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

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

Find the answers to your questions here...
If you still need help, give us a call!

STERN PINBALL, INC.

DR. DR. DR. DR.

NO YES END PREV QUIT ?

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

Joe Blackwell
DIRECTOR,
Parts Sales &
Technical Support

Patty Schraps
Parts Sales
MANAGER

Dorothy Brown
Parts Sales
REPRESENTATIVE

Your Parts Sales & Technical Support Team

Chas Siddiqi
Technical Support
ENGINEER

Patrick Powers
Technical Support
ENGINEER

J. Alfer
Technical Support
Documentation
ADMINISTRATOR

Please call us at 1-800-542-5377 or
1-708-345-7700 for Technical Support.

1-800-KICKERS

Visit us at our Web Site www.SternPinball.com.

SPI Part Number
780-5087-00

Harley-Davidson Specific (Motorcycle Test)

To initiate, from the **DIAGNOSTICS MENU**, select the "H-D" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button** (the **START Button** operates in the same manner). (New to our **Portals™ Service Menu**? Review Section 3, Chapter 1)

This will bring up the **HARLEY-DAVIDSON SPECIFIC MENU**. Similiar to "BEGIN PLAY TEST," this menu is used to test and adjust Game Specific Features. The feature in this game is **MOTORCYCLE TEST**.

Important: The **Power Interlock Switch** must be pulled out for this Test to Function.

This test is provided to allow the technician a simple method of removing the balls from the trough, to test the functionality of the trough (correct operation of the Kick-Out Coil & the Switch Membrane) and Motor Operation. After selecting the "H-D" *Icon* the display will indicate the position of the Motorcycle (***Motor Up, Switch 35***, and ***Motor Down, Switch 36***). *The position will be highlighted in the box.* The next line will indicate if any switch closures are present over the Switch Membrane in the Kick-Out Trough (***Sw. 44 (bottom)*** through ***Sw. 41 (top)***).

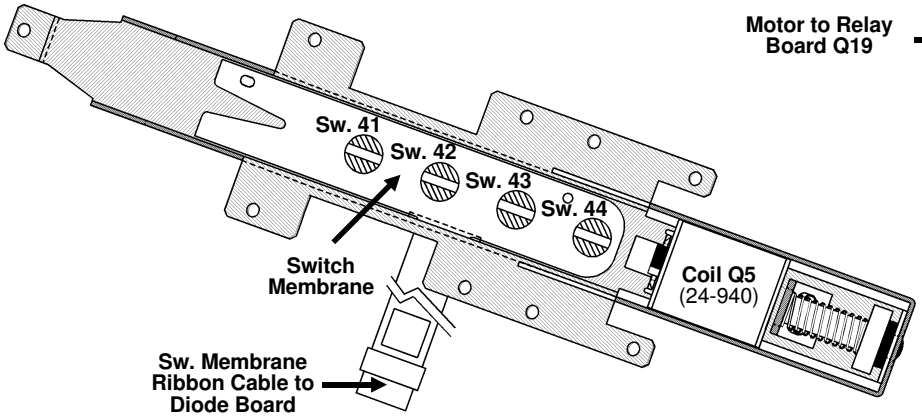
Motor Up/Down Test Procedure:

Select the "RUN" *Icon* to automatically bring the Motor & Trough from the **DOWN** or **UP** position to the opposite position. Select the "PULSE" *Icon* to move the motor slowly **UP and/or DOWN** one pulse at a time. This test allows you to operate the Motor on this mechanism which is controlled by a **Relay** driven by **Q19** on the I/O Power Driver Board for the purpose of troubleshooting.

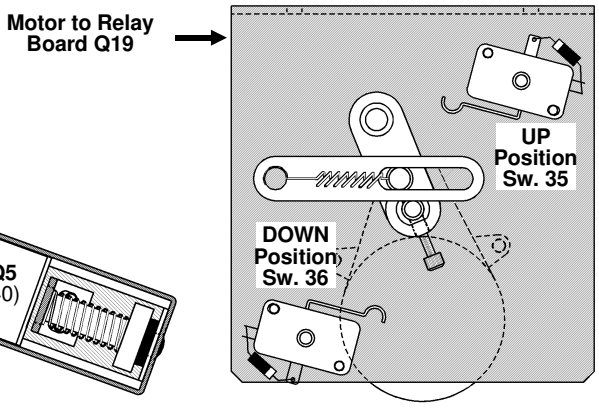
Switch & Ball Eject Test Procedure:

Hand-Roll 1 ball at a time into the trough (with the Motorcycle in the **UP** position). Watch the display and note that each box is high-lighted from left to right as the balls are inserted. *This test indicates proper Switch Membrane function* (***Switch 44*** is the first ball in (bottom) and ***Switch 41*** being the last (4th) ball in (top). To eject the balls and to test the **Motorcycle Ball Launch** (**Coil Q5**), press the **"AUTO LAUNCH" Button** (Cabinet Front Right Side). The 4 boxes should become unhighlighted indicating "no balls are in the trough".

Kick-Out Trough Assembly, 500-6397-00-67



Lift (Motor) Assembly, 500-6396-00-67



You may wish to activate the "RUN" *Icon* to bring the Motorcycle back into the **DOWN** position. If exiting **Portals™** without doing so, the Motorcycle will automatically return to the **DOWN** position upon Game Reset.

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.

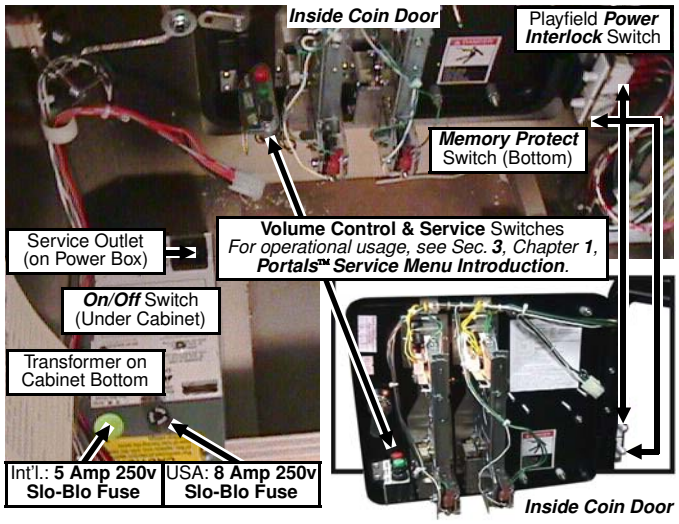
Backbox PCB Fuses, ROMs, Bridges, Relays, P/F & Cabinet Fuses, Cab. Switches

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

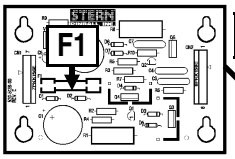
QUICK REFERENCE FUSE CHART

Backbox Fuses			
LOC:	**DISPLAY POWER SUPPLY (P.S.) BOARD**		
F1	¾A 250v S.B.	90v DC	High Voltage Display
LOC:	**I / O POWER DRIVER BOARD**		
F6	7A 250v S.B.	50v DC	Primary High Power Coils/Flippers
F7	5A 250v S.B.	20v DC	Low Power Coils
F8	5A 250v S.B.	12v DC	Logic Power
F9	5A 250v S.B.	12v DC	Logic Power
F20	4A 250v S.B.	50v DC	Magnet(s)
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)
LOC:	**SHAKER MOTOR BD. (Cabinet, Rt. Side Front)**		
F2	2½A 250v S.B.	12v DC	Shaker Motor
F3	2½A 250v S.B.	12v DC	Shaker Motor
Playfield (P/F) 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	Magnet (Top Orbit) (VIO-YEL⇆BLK)

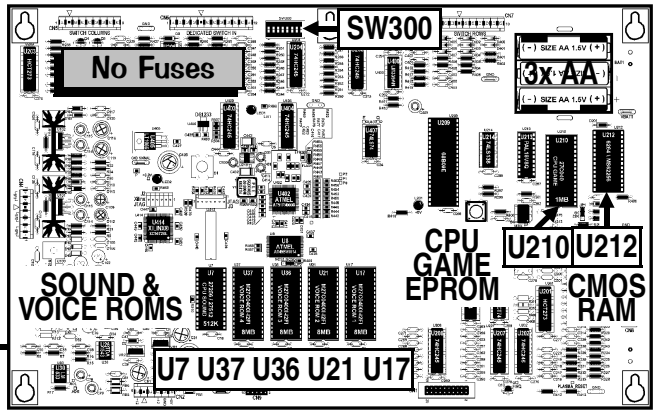
*For locations & more information on fuses, see Sec. **5**, Chapter **2**.*



ROM TYPE on BD	LOCATION	SIZE	PART NUMBER
CPU Sound	U7	512K	965-0320-87
CPU Game	U210	1 MB	965-0319-87
CPU Voice ROM 1	U17	8 MB	965-0322-87
CPU Voice ROM 2	U21	8 MB	965-0323-87
CPU Voice ROM 3	U36	8 MB	965-0324-87
CPU Voice ROM 4	U37	8 MB	965-0325-87
DISPLAY Controller	U5	4 MB	965-0321-87



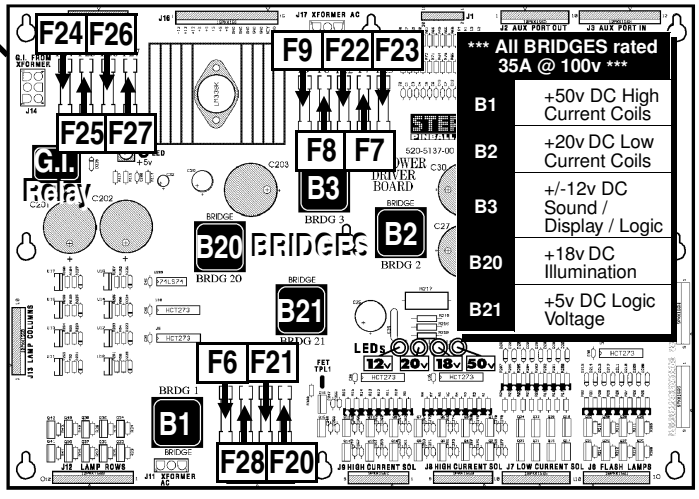
◀ Display Power Supply Bd.



For Schematics and/or Component Parts on PC Boards shown on this page, review Section 5, Chapter 4, Printed Circuit Boards (The Yellow Pages).

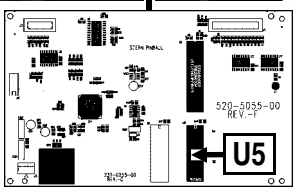
CPU/Sound Bd. II w/ATMEL ▲

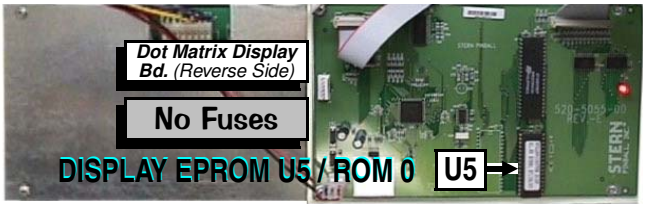
I/O Power Driver Board ▼



Display Controller Bd. ▶

The Display Controller has the Display EPROM (Location: U5 / ROM 0). This board is located behind the 128 X 32 Dot Matrix Display Board.





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

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

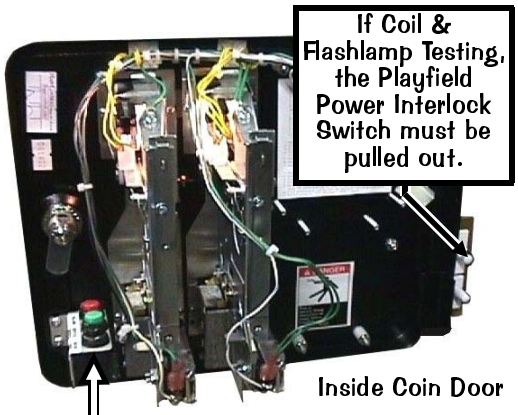
How It Works

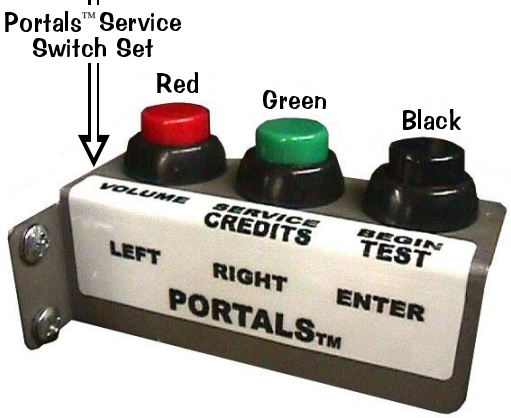
First, the operator / technician must enter the ***Service Menu Mode*** *(for a complete description of the* ***Portals™ Service Menu*** *and* ***ICONS Read!*** *Section* ***3****, Chapter* ***1****).* To get into the ***Service Menu Mode***, power-up the game *(if not already)* and open the **Coin Door**.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

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

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

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

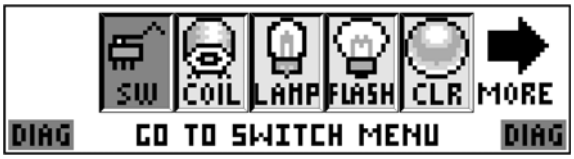




While in the **Portals™ Service Menu**, the **Start Button** can be used in lieu of the **Black Button**; the **Left** & **Right Flipper Buttons** can be used in lieu of the **Red** & **Green Buttons**. However, in *Switch* or *Active Switch Tests* ***only*** the **Red** & **Green Buttons** can be used.

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

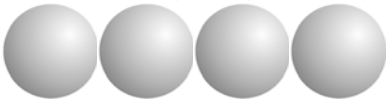
After entering **Portals™**, the **MAIN MENU** now appears with the "DIAG" *Icon* (**GO TO DIAGNOSTICS MENU**) flashing; press the **Black "ENTER" Button** to *activate* this **ICON**. The **DIAGNOSTICS MENU** now appears with the "SW" *Icon* (**GO TO SWITCH MENU**) flashing; use the **Red "LEFT"** or **Green "RIGHT" Buttons**, until the "DR." *Icon* (**DR. PINBALL**) is flashing:



Press the **Black "ENTER" Button** to *activate* this **ICON**. The **DR. PINBALL MENU** (**Flow Chart Menus**) now appears with the COIL "DR." *Icon* flashing. Three (3) *Icons,* Coil "DR.", Switch "DR." and Lamp "DR." are available for selection. Selecting a particular *Icon* 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. After selection, *Dr. Pinball* will now display a question or a procedure to follow such as "Does the lamp turn on?" or "Check bridge rectifier BR-20, if short replace." When *Dr. Pinball* displays a question or requests a procedure, *Dr. Pinball* will expect a response such as "NO" or "YES". You the operator/technician must respond by using the **Red** or **Green Buttons** to "SELECT" a *Mini-Icon* and the **Black Button** to "ACTIVATE or ENTER" your selection.

For Mini-Icons explanations & details, see the end of Section ***3****, Chapter* ***2****,* ***GO TO DIAGNOSTICS MENU****,* ***Dr. Pinball****.*

For proper operation of this HARLEY-DAVIDSON® Pinball,



FOUR (4) PINBALLS MUST BE INSTALLED!

DIAGNOSTIC AIDS

OPEN THE DOOR

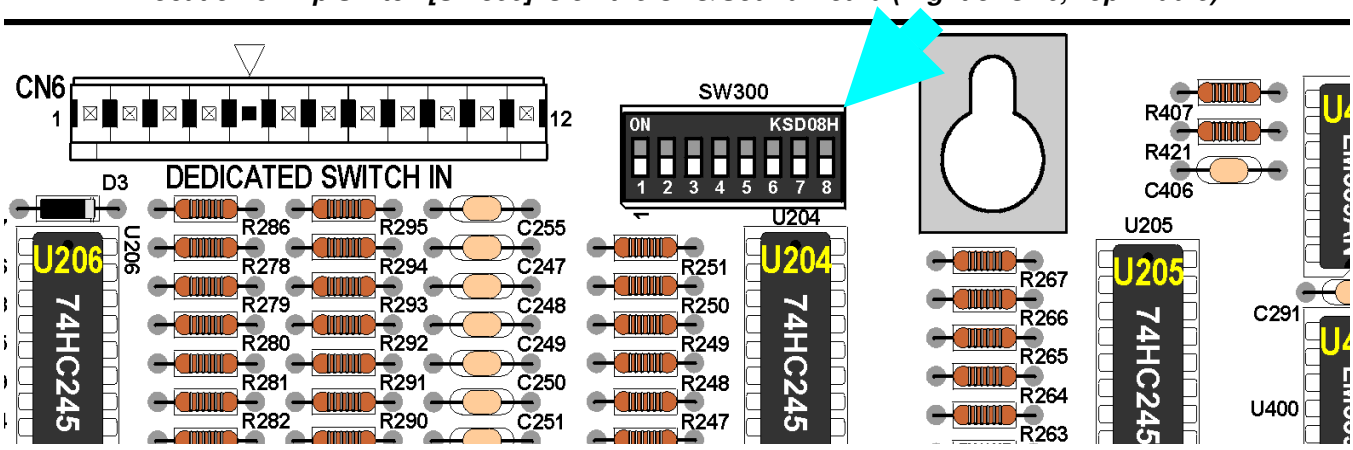
If this ***display flashes***, the game is indicating that **CMOS RAM** memory *(CPU Loc. **U212**)* has been corrupted. This is caused be either failure in memory *(e.g. batteries are dead and/or faulty **RAM**)* or upon installation of updated version of game code. Opening the **Coin Door** will initiate a *Factory Restore (Reset)*, by opening the ***Memory Protect Switch***. Check battery voltage at **VBATT Test Point** on the **CPU/Sound Bd.** *(more details in Section **5**, Chapter **4**, **PCBs**).*

OPERATOR ALERT!
#2 AUTO LAUNCH
COIL MALFUNCTION

This ***display*** is shown momentarily during **Game Mode** or **Power-Up** to alert the operator of a coil malfunction *(coil doesn't energize or coil fires a multiple number of times)*. **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.)*. This alert can also appear if a switch associated with a coil *(e.g. #16 Shooter Lane & #2 Auto Launch)* is stuck closed *(caused by a switch jam or stuck ball)*; the **CPU/Sound Board** will activate the coil approximately ten times and if the switch remains closed, the game will report this switch in **Technician Alerts**.

CPU DIP SWITCH SETTINGS

Location of Dip Switch [SW300] is on the CPU/Sound Board (Right of CN6, Top Middle)



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

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

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

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

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

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

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
Spain	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	▼		▼		▼	▼	▼	▼

In SWITCH MENU also select:

ACTIVE and DEDICATED SWITCH TESTS

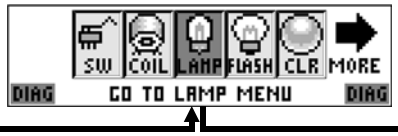
SWITCH MATRIX GRID & DEDICATED SWITCHES

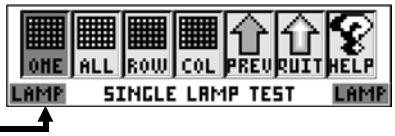
Diode On Terminal Strip :

Row (Return) \ Column (Drive)	1: Q1 NOT USED GRN-BRN CN5-P1	2: Q2 NOT USED GRN-RED CN5-P3	3: Q3 NOT USED GRN-ORG CN5-P4	4: Q4 NOT USED GRN-YEL CN5-P5	5: Q5 NOT USED GRN-BLK CN5-P6	6: Q6 NOT USED GRN-BLU CN5-P7	7: Q7 NOT USED GRN-VIO CN5-P8	8: Q8 NOT USED GRN-GRY CN5-P9
1: U400 NOT USED WHT-BRN CN7-P9	LEFT BUTTON (UK ONLY) on Cabinet side 1	NOT USED 9	LT 4-BANK D/T (L) IVE Under P/F 17	RIGHT RAMP ENTER Above P/F 25	LEFT ORBIT Under P/F 33	M-CYCLE TROUGH #4 (TOP) Under P/F 41	LEFT TURBO BUMPER Under P/F 49	LEFT OUTLANE Under P/F 57
2: U400 NOT USED WHT-RED CN7-P8	4TH COIN SLOT On Coin Door 2	NOT USED 10	LT 4-BANK D/T L (I) VE Under P/F 18	RIGHT RAMP EXIT Above P/F 26	RIGHT ORBIT Under P/F 34	M-CYCLE TROUGH #3 Under P/F 42	RIGHT TURBO BUMPER Under P/F 50	LEFT RETURN LANE Under P/F 58
3: U400 NOT USED WHT-ORG CN7-P7	6TH COIN SLOT On Coin Door 3	4-BALL TROUGH #1 (LEFT) 11	LT 4-BANK D/T LI (V) E Under P/F 19	RIGHT RAMP MID Above P/F 27	MOTOR UP Under P/F 35	M-CYCLE TROUGH #2 Under P/F 43	BOTTOM TURBO BUMPER Under P/F 51	LEFT SLINGSHOT Under P/F 59
4: U400 NOT USED WHT-YEL CN7-P6	RIGHT COIN SLOT On Coin Door 4	4-BALL TROUGH #2 Under P/F 12	LT 4-BANK D/T LIV (E) Under P/F 20	SPINNER Above P/F 28	MOTOR DOWN Under P/F 36	M-CYCLE TROUGH #1 (BOT) Under P/F 44	TOP TURBO BUMPER Under P/F 52	RIGHT OUTLANE Under P/F 60
5: U401 NOT USED WHT-GRN CN7-P5	CENTER COIN SLOT / DBA On Coin Door 5	4-BALL TROUGH #3 Under P/F 13	RT 4-BANK D/T (R) IDE Under P/F 21	S-U TRGT LT (M-CYCLE) Under P/F 29	OPTO Under P/F 37	SUPER VUK Under P/F 45	LAUNCH BUTTON Cabinet Front 53	RIGHT RETURN LANE Under P/F 61
6: U401 NOT USED WHT-BLU CN7-P3	LEFT COIN SLOT On Coin Door 6	4-BALL TROUGH VUK OPTO Under P/F 14	RT 4-BANK D/T R (I) DE Under P/F 22	S-U TRGT RT (M-CYCLE) Under P/F 30	NOT USED 38	BALL EJECT (SCOOP) Under P/F 46	START BUTTON Cabinet Front 54	RIGHT SLINGSHOT Under P/F 62
7: U401 NOT USED WHT-VIO CN7-P2	5TH COIN SLOT On Coin Door 7	4-BALL STACKING OPTO Under P/F 15	RT 4-BANK D/T RI (D) E Under P/F 23	S-U TRGT LT (RT RAMP) Under P/F 31	NOT USED 39	NOT USED 47	SLAM TILT On Coin Door 55	NOT USED 63
8: U401 NOT USED WHT-GRY CN7-P1	RIGHT BUTTON (SKILL) on Cabinet side 8	SHOOTER LANE Under P/F 16	RT 4-BANK D/T RID (E) Under P/F 24	S-U TRGT RT (RT RAMP) Under P/F 32	NOT USED 40	BEHIND TOP VUK Under P/F 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 DB-1
2: U206 GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke) in Cabinet side DB-2
3: U206 GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON in Cabinet side DB-3
4: U206 GRY-YEL CN6-P6	#4 RIGHT FLIPPER E.O.S. (End-of-Stroke) in Cabinet side DB-4
5: U206 NOT USED GRY-GRN CN6-P7	#5 NOT USED DB-5
6: U206 GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (In Test: LEFT) on Coin Door DB-6
7: U206 GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) on Coin Door DB-7
8: U206 GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) on Coin Door DB-8

Diode On Diode Board :





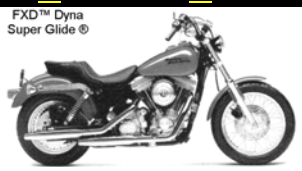
In LAMP MENU also select:

TEST ALL LAMPS, ROW & COLUMN LAMP TESTS

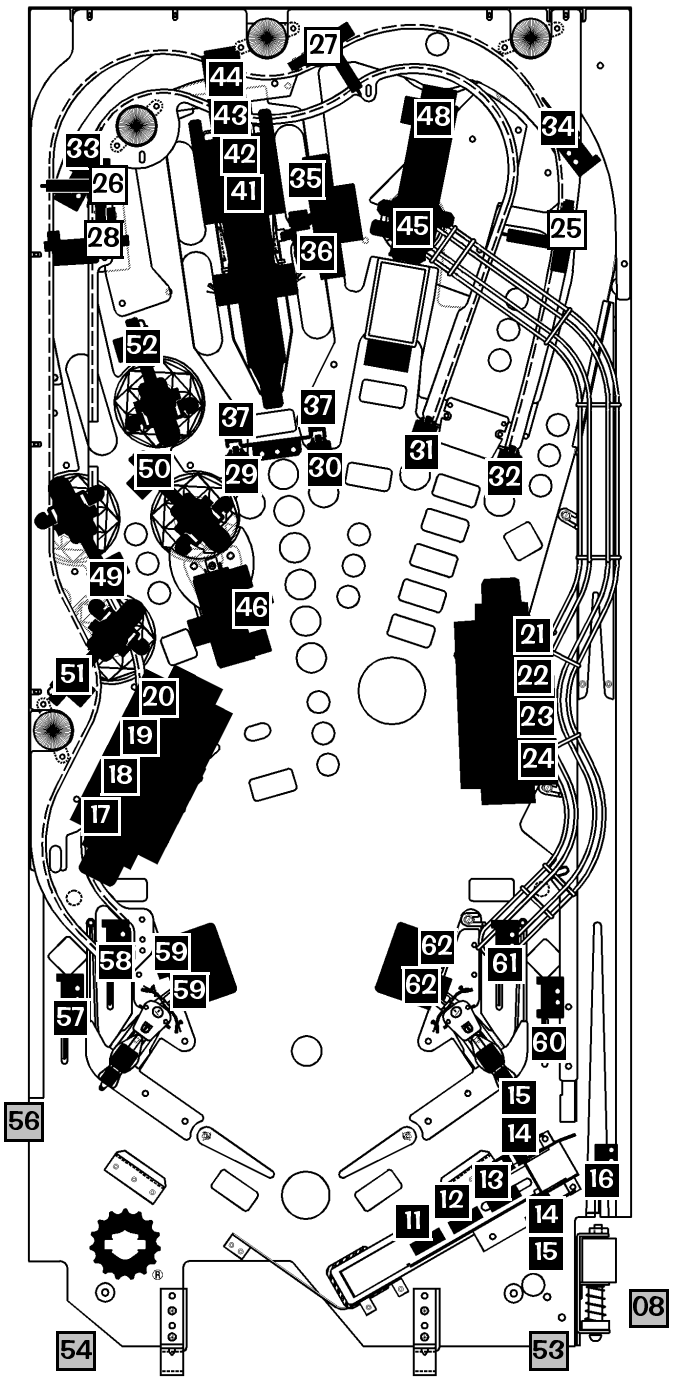
LAMP MATRIX GRID

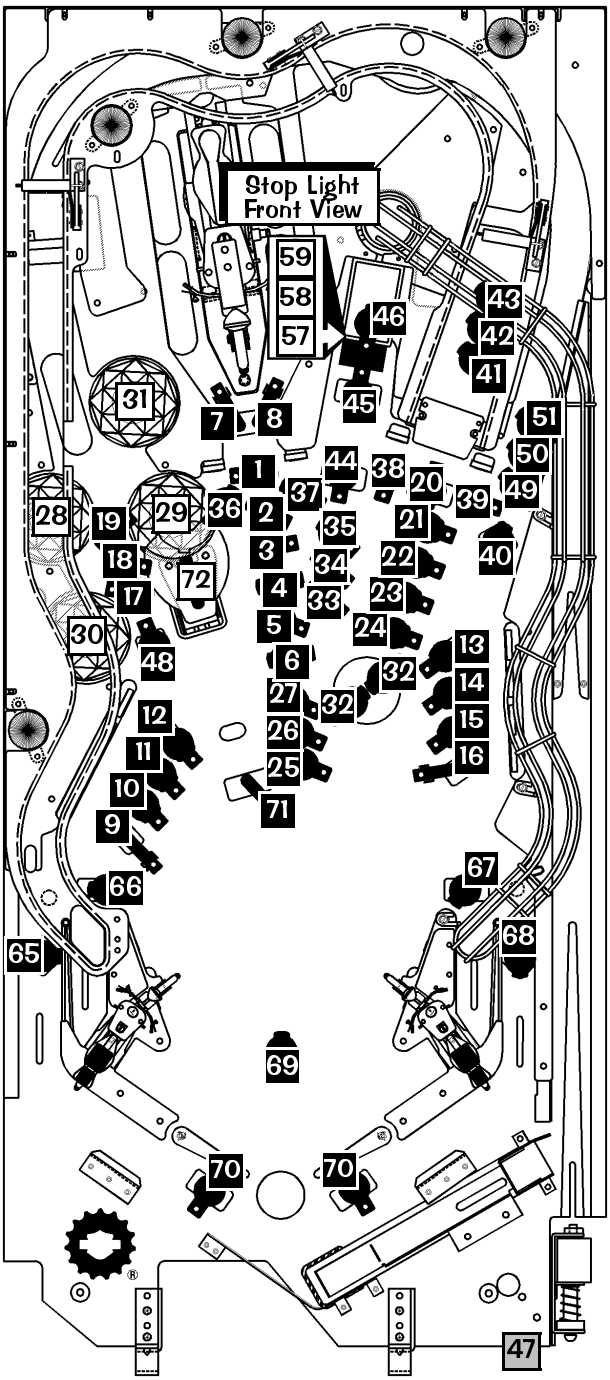
Diode On Terminal Strip :

Row (GND) \ Column (18v)	1: U17 NOT USED YEL-BRN J13-P9	2: U16 NOT USED YEL-RED J13-P8	3: U15 NOT USED YEL-ORG J13-P7	4: U14 NOT USED YEL-BLK J13-P6	5: U13 NOT USED YEL-GRN J13-P5	6: U12 NOT USED YEL-BLU J13-P4	7: U11 NOT USED YEL-VIO J13-P3	8: U10 NOT USED YEL-GRY J13-P1
1: Q33 NOT USED RED-BRN J12-P1	(H) ARLEY #555 Bulb 1	H (A) RLEY #555 Bulb 2	HA (R) LEY #555 Bulb 3	HAR (L) EY #555 Bulb 4	HARL (E) Y #555 Bulb 5	HARLE (Y) #555 Bulb 6	SUPER JACK-POT (RED) #44 Bulb 7	SUPER JACK-POT (GRN) #44 Bulb 8
2: Q34 NOT USED RED-BLK J12-P2	(L) IVE #44 Bulb 9	L (I) VE #555 Bulb 10	LI (V) E #555 Bulb 11	LIV (E) #555 Bulb 12	(R) IDE #555 Bulb 13	R (I) DE #555 Bulb 14	RI (D) E #555 Bulb 15	RID (E) #44 Bulb 16
3: Q35 NOT USED RED-ORG J12-P3	LT ORBIT GRN LIGHT #555 Bulb 17	LT ORBIT YEL LIGHT #555 Bulb 18	LT ORBIT RED LIGHT #555 Bulb 19	1ST GEAR #555 Bulb 20	2ND GEAR #555 Bulb 21	3RD GEAR #555 Bulb 22	4TH GEAR #555 Bulb 23	5TH GEAR #555 Bulb 24
4: Q36 NOT USED RED-YEL J12-P4	M-CYCLE GRN LIGHT #555 Bulb 25	M-CYCLE YEL LIGHT #555 Bulb 26	M-CYCLE RED LIGHT #555 Bulb 27	LEFT TURBO BUMPER DB-9 #555 Bulb 28	RT TURBO BUMPER DB-9 #555 Bulb 29	BOT TURBO BUMPER DB-9 #555 Bulb 30	TOP TURBO BUMPER DB-8 #555 Bulb 31	SPEEDO-METER X2 #555 Bulb 32
5: Q37 NOT USED RED-GRN J12-P5	SUPER VUK GRN LIGHT #555 Bulb 33	SUPER VUK YEL LIGHT #555 Bulb 34	SUPER VUK RED LIGHT #555 Bulb 35	BIKE S-U TARGET (LT) #555 Bulb 36	BIKE S-U TARGET (RT) #555 Bulb 37	RAMP S-U TARGET (LT) #555 Bulb 38	RAMP S-U TARGET (RT) #555 Bulb 39	SLIPPERY WHEN WET #555 Bulb 40
6: Q38 NOT USED RED-BLU J12-P6	RT RAMP GRN LIGHT #555 Bulb 41	RT RAMP YEL LIGHT #555 Bulb 42	RT RAMP RED LIGHT #555 Bulb 43	PATCH #555 Bulb 44	BIKERS BACK #555 Bulb 45	RED LIGHT MULTIBALL #555 Bulb 46	AUTO LAUNCH #555 Bulb 47	LITE MYST-ERY RIDER #555 Bulb 48
7: Q39 NOT USED RED-VIO J12-P8	RT ORBIT GRN LIGHT #555 Bulb 49	RT ORBIT YEL LIGHT #555 Bulb 50	RT ORBIT RED LIGHT #555 Bulb 51	NOT USED 52	NOT USED 53	NOT USED 54	NOT USED 55	NOT USED 56
8: Q40 NOT USED RED-GRY J12-P9	STOP LIGHT GRN LIGHT #44 Bulb 57	STOP LIGHT YEL LIGHT #44 Bulb 58	STOP LIGHT RED LIGHT #44 Bulb 59	NOT USED 60	NOT USED 61	NOT USED 62	NOT USED 63	NOT USED 64
9: Q41 NOT USED RED-WHT J12-P10	2 XTRA BALLS LT OUTLANE #555 Bulb 65	ADVANCE GEAR LT RETURN #555 Bulb 66	LITE MYSTERY... RT RETURN #555 Bulb 67	2 XTRA BALLS RT OUTLANE #555 Bulb 68	M-CYCLE HEADLIGHT #555 Bulb 69	RIDE AGAIN X2 #555 Bulb 70	MYSTERY RIDER #44 Bulb 71	NEXT CITY #44 Bulb 72
10: Q42 NOT USED RED J12-P11	NOT USED 73	NOT USED 74	NOT USED 75	NOT USED 76	NOT USED 77	NOT USED 78	NOT USED 79	NOT USED 80



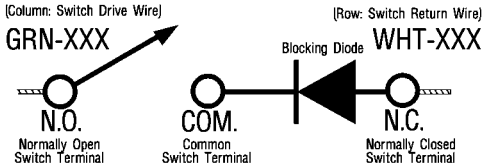
SWITCH MATRIX GRID LOCATIONS	LAMP MATRIX GRID LOCATIONS

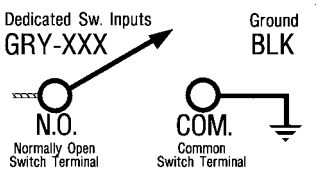


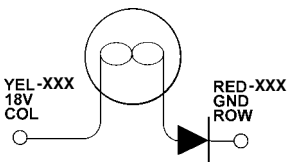


Legend Note: ☐ = Switches/Lamps mounted above P/F. ■ = Switches/Lamps mounted below the P/F. ■ = ...mounted in/on Cabinet.

TYPICAL SWITCH SCHEMATIC	DEDICATED SWITCH SCHEMATIC	TYPICAL LAMP SCHEMATIC







Note: *All Switch, Lamp & Coil assemblies require diodes. Some diodes are* ***located under the playfield*** *on Terminal Strips* ***or*** *Diode Boards and not on the assemblies.* **D**iode **O**n **T**erminal **S**trip ***or*** **D**iode **O**n **D**iode **B**oard

In COIL MENU also select:

CYCLING COIL TEST

COILS DETAILED CHART TABLE

High Current Coils Group 1		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	I/O Pwr. Drvr.	BRN-BLK	J8-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#2	AUTO LAUNCH	Q2	I/O Pwr. Drvr.	BRN-RED	J8-P3	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00T
#3	SUPER VUK	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#4	POWER SCOOP/KICK BIG	Q4	I/O Pwr. Drvr.	BRN-YEL	J8-P5	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#5	MOTORCYCLE BALL LAUNCH	Q5	I/O Pwr. Drvr.	BRN-GRN	J8-P6	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00B
#6	LEFT 4-BANK DROP TARGET	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	YEL-VIO	J10-P4/5	50v DC	23-700 090-5022-00T
#7	RIGHT 4-BANK DROP TARGET	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	YEL-VIO	J10-P4/5	50v DC	23-700 090-5022-00T
#8	EUROPEAN TOKEN DISPENSER	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	YEL-VIO	J10-P4/5	50v DC	DL4SS 515-6076-01

High Current Coils Group 2		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn
#9	LEFT TURBO BUMPER	Q9	I/O Pwr. Drvr.	BLU-BRN	J9-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#10	RIGHT TURBO BUMPER	Q10	I/O Pwr. Drvr.	BLU-RED	J9-P2	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#11	BOTTOM TURBO BUMPER	Q11	I/O Pwr. Drvr.	BLU-ORG	J9-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#12	TOP TURBO BUMPER	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#13	SHAKER MOTOR	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	RED-WHT	J17-P7	16v AC 12v DC	Motor Only 041-5029-01
#14	MAGNET	Q14	I/O Pwr. Drvr.	BLU-BLK	J9-P7	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#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	23-1100 090-5030-00T

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 GA/Turn or Meter #
#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	MOTOR RELAY	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	BRN	J7-P1	20v DC	Relay Bd. 520-5010-00
#20	FLASH: SCOOP X1	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#21	LT OUTLANE (UK ONLY)	Q21	I/O Pwr. Drvr.	VIO-GRN	J7-P7	BRN	J7-P1	20v DC	28-1050 090-5046-00
#22	RT OUTLANE (UK ONLY)	Q22	I/O Pwr. Drvr.	VIO-BLU	J7-P8	BRN	J7-P1	20v DC	28-1050 090-5046-00
#23	UP/DOWN POST (SKILL)	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	BRN	J7-P1	20v DC	23-1100 090-5030-00T
#24	OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v DC	Meter 5v 091-5000-00

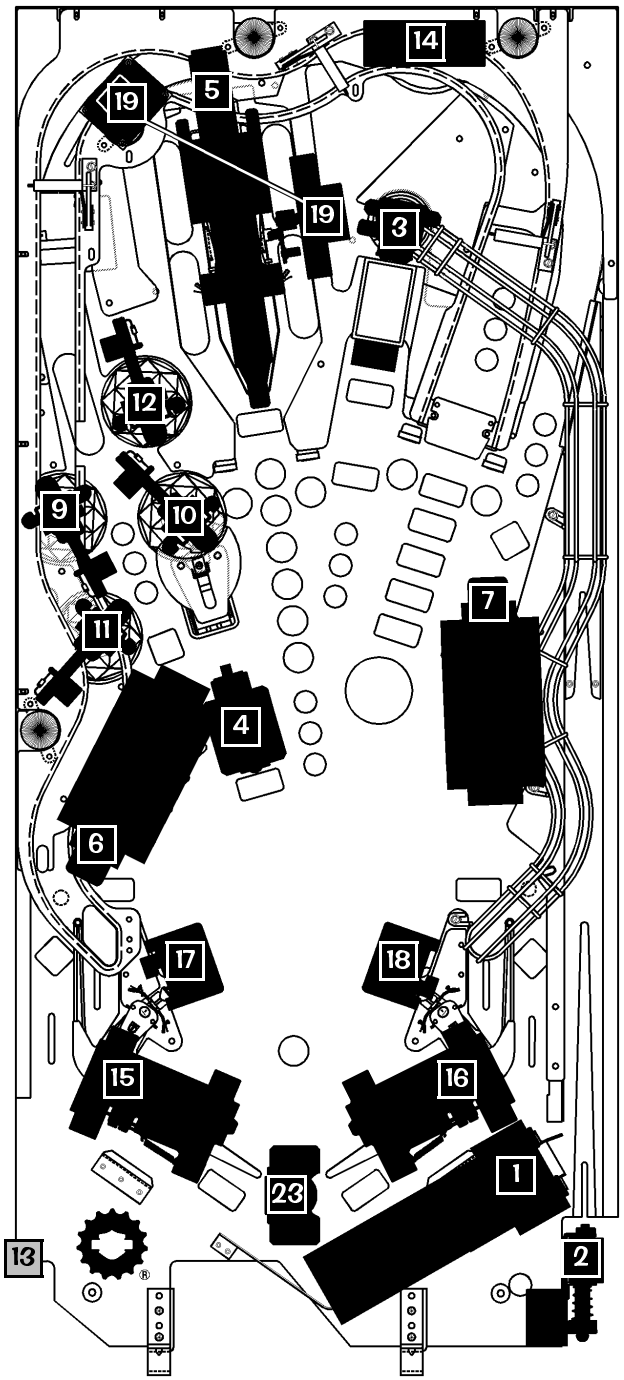
Diode **O**n **T**erminal **S**trip (if noted)

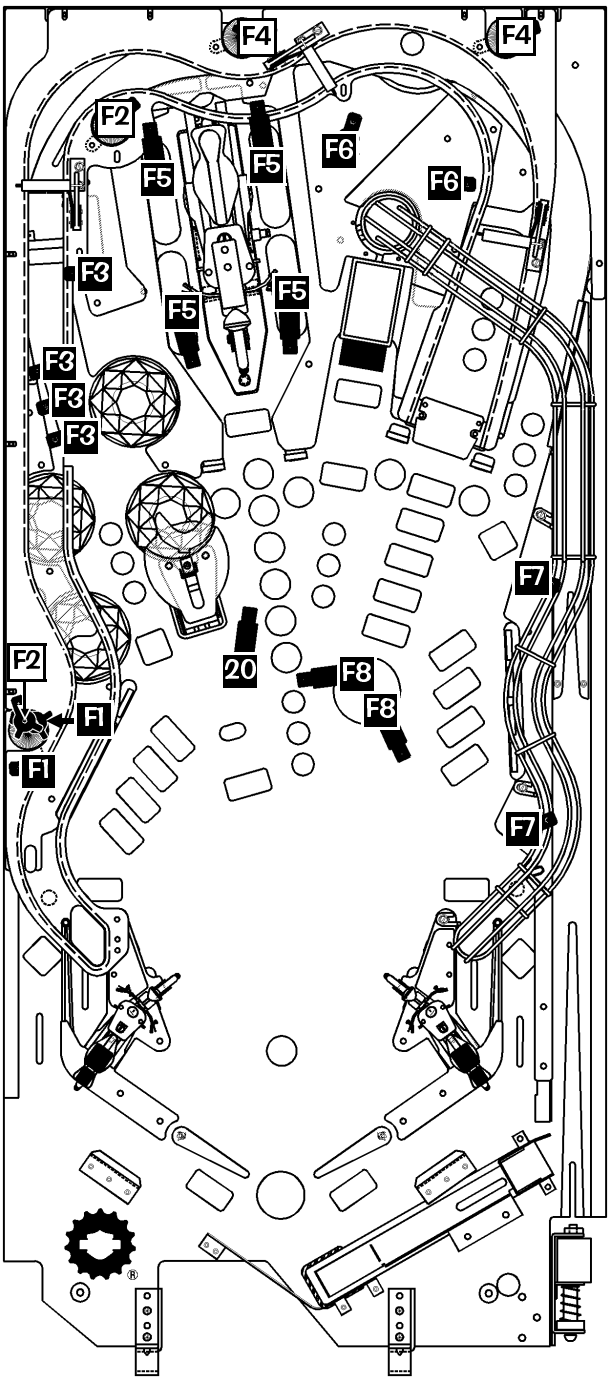
Flash Lamps (FLASH)		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Bulb Type
#F1	FLASH: LEFT DROP TARGET X2	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F2	FLASH: RAMP LEFT X2	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F3	FLASH: TURBO BUMPER X4	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F4	FLASH: RAMP TOP X2	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F5	FLASH: MOTORCYCLE X4	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F6	FLASH: SUPER VUK X2	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F7	FLASH: RT. DROP TARGET X2	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F8	FLASH: SPEEDOMETER X2	Q32	I/O Pwr. Drvr.	BLK-GRY	J6-P8	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89

Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: Q20 & Q25-Q32)

Find-It-In-Front: Dr. Pinball

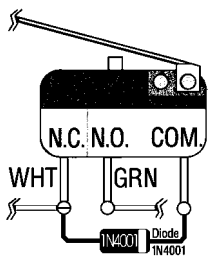
COIL LOCATIONS	FLASH LAMP LOCATIONS

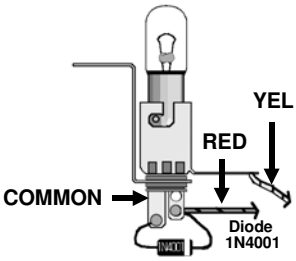


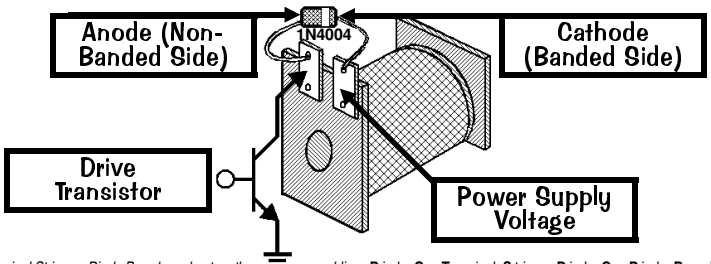


Legend Note: = Coils/Flashers mounted above P/F. = Coils/Flashers mounted below the P/F. = ...mounted in/on Cabinet.

TYPICAL SWITCH, LAMP & COIL WIRING

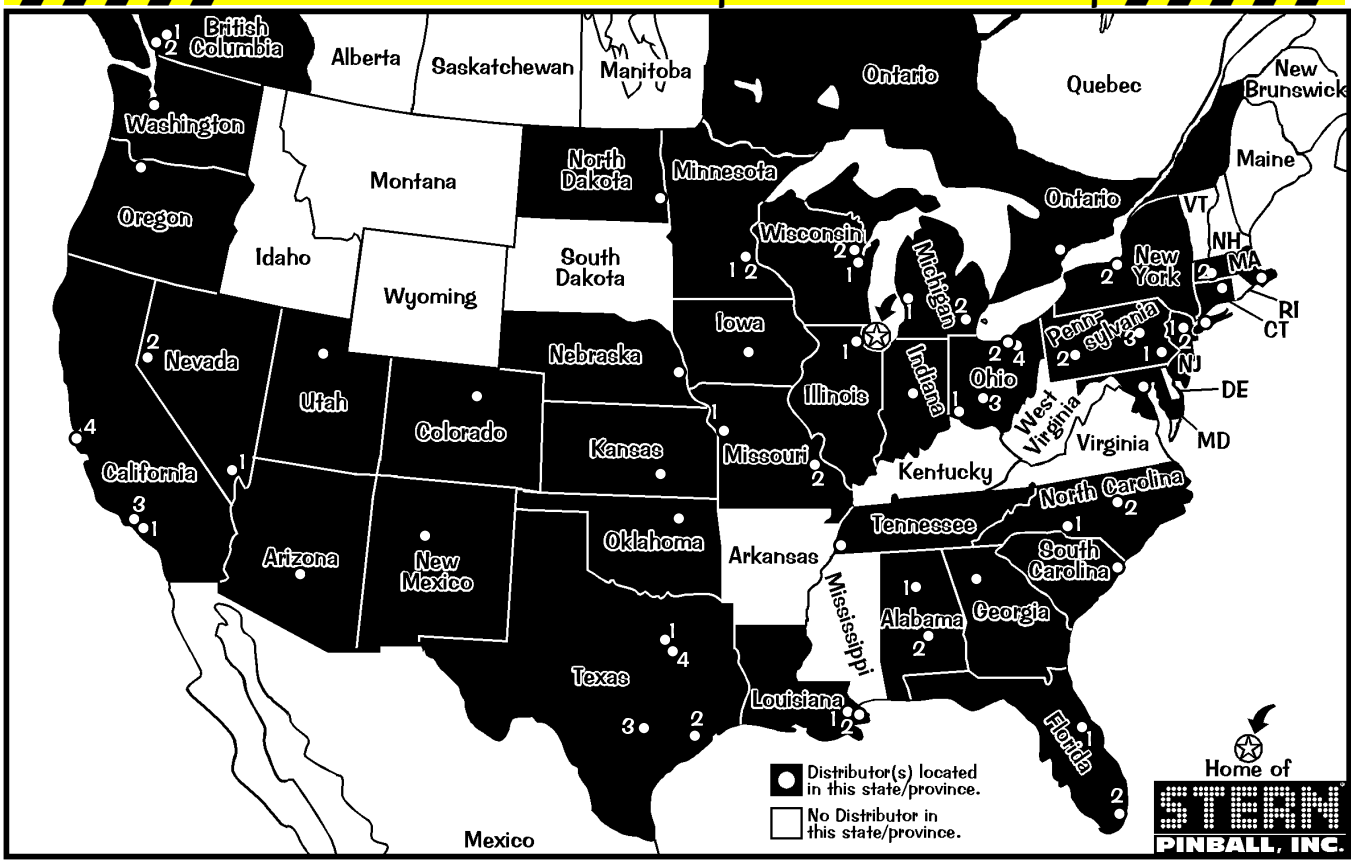




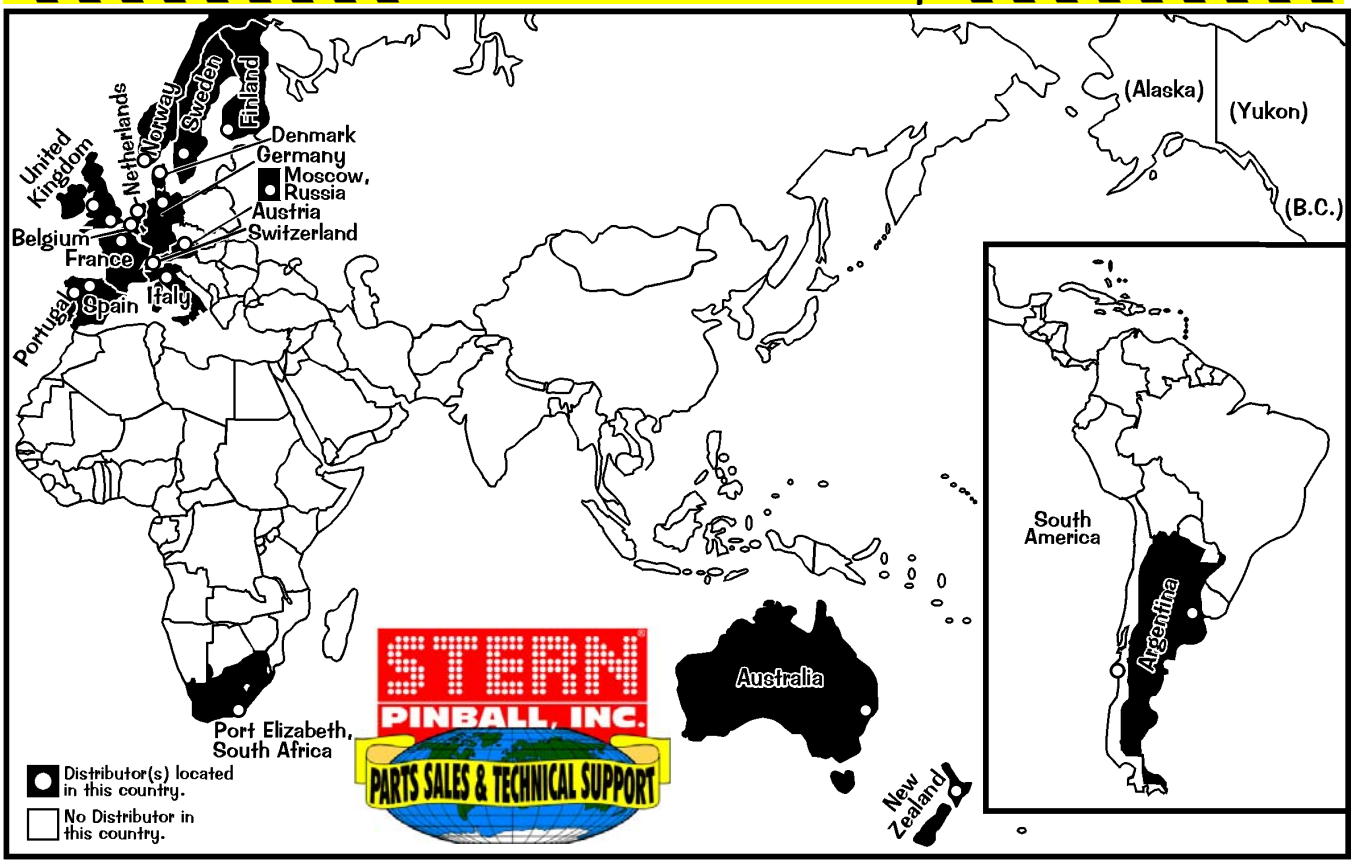


Note: *All Switch, Lamp & Coil assemblies require diodes. Some diodes are* ***located under the playfield*** *on Terminal Strips* ***or*** *Diode Boards and not on the assemblies.* **D**iode **O**n **T**erminal **S**trip ***or*** **D**iode **O**n **D**iode **B**oard.

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
Betson West
Phoenix
1-480-380-8857

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
TDM Distributing
Williamantic
1-860-423-1403

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

Brady Distributing
Miami [Miramar] (2)
1-954-874-1100
Orlando (1)
1-407-872-1666

GEORGIA
Greater Southern Dist.
Smyrna
1-770-803-3040

ILLINOIS
American Vending
Elk Grove Village
1-847-439-9400

Atlas Dist. International
Elk Grove Village
1-847-952-7500

World Wide Distributing
Elk Grove Village
847-434-0400

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

Moss Distributing
Des Moines
1-515-266-6422

INDIANA
Atlas Dist. International
Indianapolis
1-317-786-6892

Shaffer Distributing
Indianapolis
1-317-899-2530

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

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

Parts & Service Only:

New Orleans Novelty
New Orleans (2)
1-504-888-3500

MARYLAND
Betson Enterprises
Baltimore
1-410-646-4100

Parts & Service Only:

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 Dist. International
Wyoming (1)
1-616-241-1472

Cleveland Coin Machine
Livonia (2)
1-734-432-1040

MINNESOTA
Lieberman Music
Minneapolis (1)
1-952-887-5299

Moss Distributing
Richfield (2)
1-612-798-8030

MISSOURI
Greater America Dist.
Kansas City (1)
1-816-531-4300

Moss Distributing
Kansas City (1)
1-816-231-6600

Shaffer Distributing
St. Louis (2)
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

Jack Guarnieri Service Co., Inc. (Pinballsales.com)
Lakewood (2)
1-732-364-9900

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

NEW YORK
Betson Enterprises
New Hyde Park (2)
1-516-354-4647
Syracuse (3)
1-315-437-2400

Parts & Service Only:

Bay Coin
Richmond Hill (1)
1-718-291-5757

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 Dist. International
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

OREGON
Betson West
Portland
1-503-772-4567

Mountain Coin
Portland
1-503-234-5491

Specialty Coin Products
Portland
1-503-786-9200
Toll-Free
1-800-987-4946

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

Cleveland Coin Machine
Pittsburgh (2)
1-412-920-1300

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

SOUTH CAROLINA
Parts & Service Only:

Green Coin
Mrytle Beach
1-843-626-1900

TENNESSEE
Brady Distributing
Memphis
1-901-345-7811

Parts & Service Only:

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

TEXAS
Amusement Distributors
San Antonio (3)
1-210-225-3844

Betson Texas
Dallas (1)
1-214-638-4900

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

Discount Arcade Games
Crowley (1)
1-817-297-0440

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

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

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

WASHINGTON
Mountain Coin
Seattle
1-206-682-5700

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

Lieberman/Viking Vend.
Menomonee Falls (2)
1-262-703-4168

CANADA

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

BRITISH COLUMBIA
Parts & Service Only:

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

Parts & Service Only:

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

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
South Company
Mar Del Plata
[54] 2234-95-5532

AUSTRALIA
Amusement Mach. Dist.
Matraville
[61] 2931-6-6000

AUSTRIA
Parts & Service Only:

R. Rupp
Leibnitz
[43] 3452-8-6105

Parts & Service Only:

TAB
Ansfelden
[43] 7229-7-8040

BELGIUM
NAMUSCO
Brussels
[32] 2414-4596

Belgium Continued
Parts & Service Only:

Splin S.A.
Liege
[32] 4362-7677

DENMARK
JK Automater A/S
Thisted
[45] 9792-0925

ENGLAND
see UNITED KINGDOM

FINLAND
Pelika net Oy
Vantaa
[35] 8 (0) 9-290-450

FRANCE
Avranches Automatic
Ducey
[33] 2338-9-6162

SFA
Paris
[33] 1532-6-8080

GERMANY
ADP Gauselmann
Espelkamp
[49] 5741-27-3384

Bergmann Int'l Gaming
Rellingen
[49] 4101-3-0240
Witten
[49] 2302-28-2540

MEXIM
Espelkamp
[49] 5772-4-9422

HOLLAND
see THE NETHERLANDS

ITALY (RSM)
Tecnoplay S.A.
San Marino
[39] 5499-0-1508

THE NETHERLANDS
JVH Gaming Products
Tilburg
[31] 1359-5-3200

NEW ZEALAND
Coin Cascade Ltd.
Christchuch
[64] 3338-1411

Parts & Service Only:

Amco Machine Supplies
Auckland
[64] 9846-7606

NORWAY
Vendcomatic
Oslo
[47] 2291-8383

PORTUGAL
Jacinto & Martins, S.A.
Belas
[35] 1214-32-5624 *or*
[35] 1214-32-5638

RUSSIA
O.D.A. Game Machines
Moscow
[095] 219-2949 *or*
[095] 219-8917

SOUTH AFRICA
K & W Amusements
Port Elizabeth
[27] 4148-4-3344 *or*
[27] 4148-4-2940

SPAIN
Comercial Cocamatic
Coslada (Madrid)
[34] 9167-1-6980

Parts & Service Only:

Sente, S.A.
Madrid
[34] 9154-1-7112

SWEDEN
Bjuvia Fritid AB
Bjuv
[46] 4238-6900

SWITZERLAND
Novomat, A.G.
Harkingen
[41] 6238-8-8961

UNITED KINGDOM
Electrocoin
London, England
[44] 2089-65-2055

Parts & Service Only:

Electrocoin Aftersales
Cardiff, S. Glamorgan
[44] 2920-45-0345

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 use 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 use 2x 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 use 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****, and* ***How to Secure the Backbox for Transporting****.* Remove the legs and secure the game within the transporting vehicle.

SAVE AND RETAIN ALL PRINTED INFORMATION INSIDE THE CABINET !

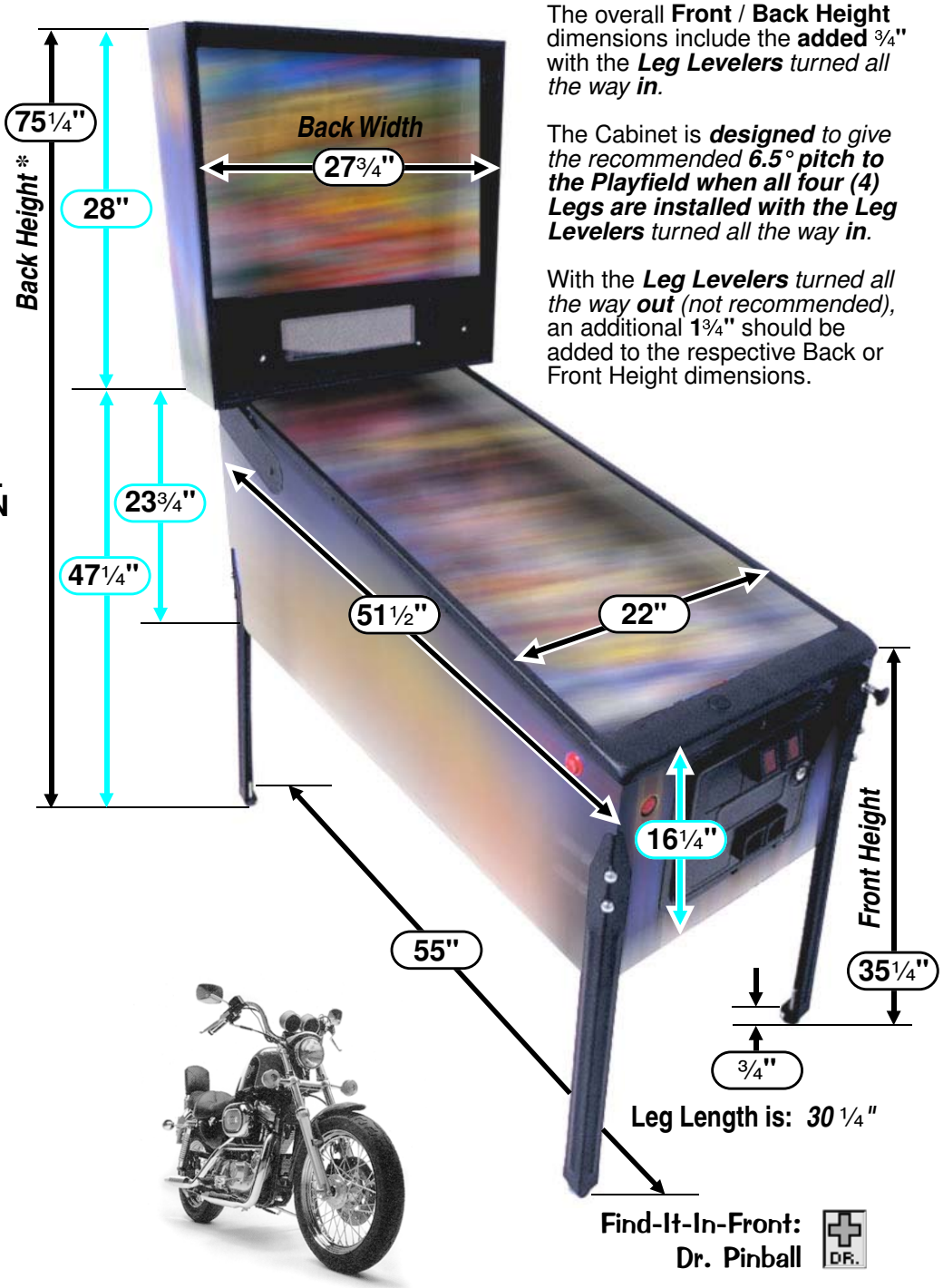
Shipping Box Dimensions

Height 56" **Width** 31"
Depth 31"
Approx. Unboxed Weight: 270lbs. (+/- 10)
Boxed Weight:
Wt. 290lbs. **(+/- 5)**

C A U T I O N

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

GAME DIMENSIONS



The overall **Front** / **Back Height** dimensions include the **added** ¾" with the ***Leg Levelers*** *turned all the way* ***in****.*

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*** *(not recommended),* an additional **1¾"** should be added to the respective Back or Front Height dimensions.

Leg Length is: ***30*** ¼"

Find-It-In-Front:
Dr. Pinball

STERN PINBALL, INC.

Pinball Game Service Manual General Table of Contents

See Sections 3 & 5, Table Of Contents, for details of that Section and it's Chapters.

Section 4, Chapter 1, Parts Identification & Location (The Pink Pages) Continued on the Next Page

Portals™ Service Menu Introduction

Section 3
Table of Contents

Table of Contents

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

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

COILS DETAILED CHART TABLE

	High Current Coils Group 1	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	I/O Pwr. Drvr.	BRN-BLK	J8-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#2	AUTO LAUNCH	Q2	I/O Pwr. Drvr.	BRN-RED	J8-P3	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00T
#3	SUPER VUK	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#4	POWER SCOOP/KICK BIG	Q4	I/O Pwr. Drvr.	BRN-YEL	J8-P5	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#5	MOTORCYCLE BALL LAUNCH	Q5	I/O Pwr. Drvr.	BRN-GRN	J8-P6	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00B
#6	LEFT 4-BANK DROP TARGET	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	YEL-VIO	J10-P4/5	50v DC	23-700 090-5022-00T
#7	RIGHT 4-BANK DROP TARGET	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	YEL-VIO	J10-P4/5	50v DC	23-700 090-5022-00T
#8	EUROPEAN TOKEN DISPENSER	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	YEL-VIO	J10-P4/5	50v DC	DL4SS 515-6076-01

	High Current Coils Group 2	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn
#9	LEFT TURBO BUMPER	Q9	I/O Pwr. Drvr.	BLU-BRN	J9-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#10	RIGHT TURBO BUMPER	Q10	I/O Pwr. Drvr.	BLU-RED	J9-P2	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#11	BOTTOM TURBO BUMPER	Q11	I/O Pwr. Drvr.	BLU-ORG	J9-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#12	TOP TURBO BUMPER	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#13	SHAKER MOTOR	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	RED-WHT	J17-P7	16v AC 12v DC	Motor Only 041-5029-01
#14	MAGNET	Q14	I/O Pwr. Drvr.	BLU-BLK	J9-P7	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#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	23-1100 090-5030-00T

	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 GA/Turn or Meter #
#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	MOTOR RELAY	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	BRN	J7-P1	20v DC	Relay Bd. 520-5010-00
#20	FLASH: SCOOP X1	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#21	LT OUTLANE (UK ONLY)	Q21	I/O Pwr. Drvr.	VIO-GRN	J7-P7	BRN	J7-P1	20v DC	28-1050 090-5046-00
#22	RT OUTLANE (UK ONLY)	Q22	I/O Pwr. Drvr.	VIO-BLU	J7-P8	BRN	J7-P1	20v DC	28-1050 090-5046-00
#23	UP/DOWN POST (SKILL)	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	BRN	J7-P1	20v DC	23-1100 090-5030-00T
#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)

	Flash Lamps (FLASH)	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	Bulb Type
#F1	FLASH: LEFT DROP TARGET X2	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F2	FLASH: RAMP LEFT X2	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F3	FLASH: TURBO BUMPER X4	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F4	FLASH: RAMP TOP X2	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F5	FLASH: MOTORCYCLE X4	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F6	FLASH: SUPER VUK X2	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F7	FLASH: RT. DROP TARGET X2	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F8	FLASH: SPEEDOMETER X2	Q32	I/O Pwr. Drvr.	BLK-GRY	J6-P8	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89

Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: Q20 & Q25-Q32)

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. Remove all shipping tie downs, shipping blocks, packing foam, etc., if present. ***READ ALL PRINTED INFORMATION!*** Shipping Instructions and/or Decals describe warnings, cautions, and/or important information specific to the game. **SAVE ALL IN CABINET!**

If pinballs were already installed into the Ball Trough *(under the arch)*, remove them before performing the following step. ******Pinballs can fall out and away from the playfield ******

3. Raise the playfield and rest it against the Backbox. See the illustration **"Easy Access Service System - 2 Positions"** *on Page 4.*

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

5. Make sure the proper amount of pinballs are installed *(Amount of balls are always specified on decal attached to the lock down assembly and at the top of the inside cover).*

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.* Start with the Leg Levelers turned all the way in (1.25" from floor to bottom of leg), depending on the condition of the floor, adjust the Leg Levelers as required until the **game pitch is 6.5°**, determined by the Bubble Level.

USE THE BUBBLE LEVEL ON THE WOOD RAIL (LOWER RIGHT) TO DETERMINE IF LEVEL IS ACHIEVED. 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 Name Test**" Menus to test components on the game).*

8. If desired, adjust **Game Pricing, Standard and/or Custom** *(see Section **3**, Chapter **4**, **GO TO ADJUSTMENTS MENU** and Section **3**, Chapter **5**, **GO TO INSTALLS MENU** to adjust **Game Difficulty**, **3-** or **5-Ball Play**, **Home** or **Tournament Settings**, **Novelty**, **Add-A-Ball**, etc.).*

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

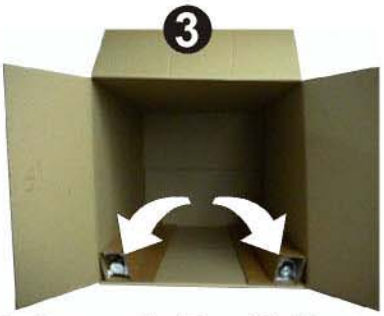
Open up the Printable Version in both 8-1/2 X 11 & 11 X 17.

Pinball Game Set-Up Future Reference

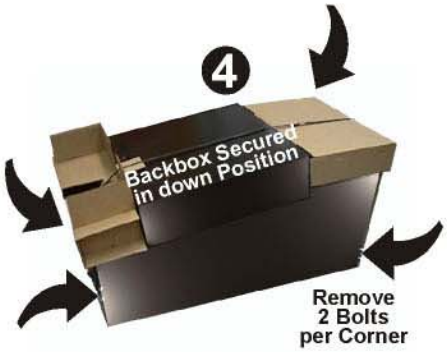
CAUTION: At least 2 people are required to move and maneuver game.
Use proper moving equipment & extreme care while handling. Pinball game is 260lbs (+/- 10).
Refer to Game Manual for further Game Set-Up Procedures (Sec. 1, Chp. 1) and other important information!
TOOLS REQUIRED: 5/8" Socket Wrench &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

1. Before unpacking 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).*

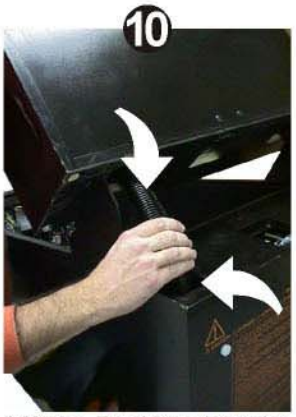
6. Install **FRONT LEGS** using the bolts removed from ***Step 4***. *Secure tightly.* ***Take care not to scratch the Black Finish on any of the Legs.***

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

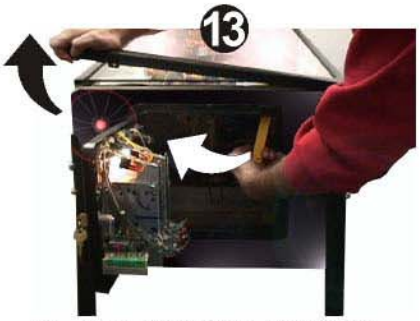


10. Lift the Backbox into the **UPRIGHT POSITION** *(Ensure the cables do not get pinched).*

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.

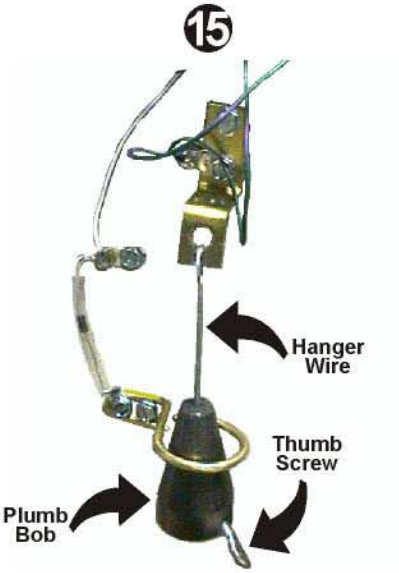
12. The next step you will remove the **PLAYFIELD GLASS** & **BACK GLASS** to access the inside of the cabinet & Backbox.

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.*

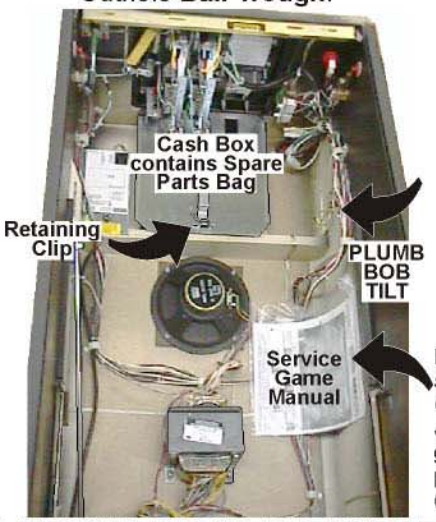


13. Open the Coin Door and pull the **YELLOW HANDLE** to the **LEFT** and at the same time pull up on the **FRONT TOP MOLDING** and remove. The **GLASS** can now be pulled out towards you and removed. ***TAKE CARE*** *while moving; set glass on a safe surface.*

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.

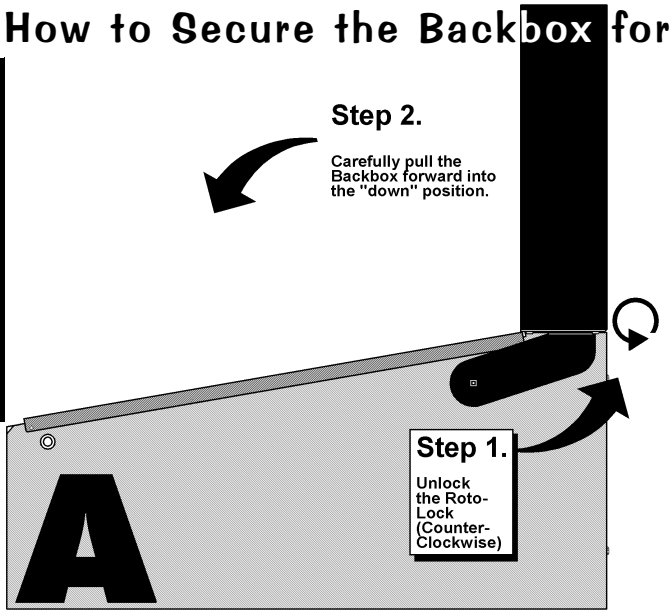


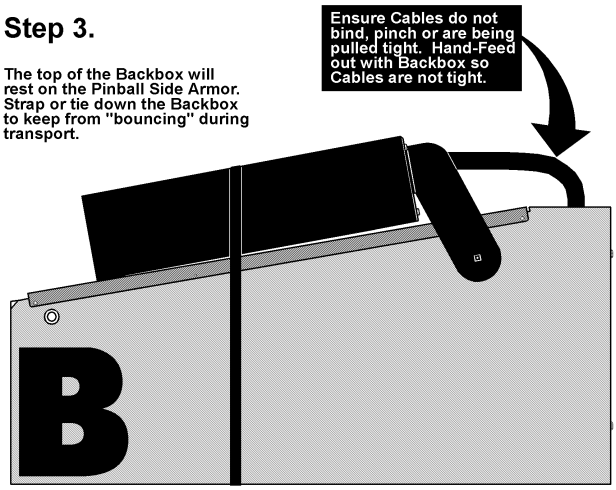
Remove the **PINBALL GAME MANUAL** *(stapled to side of the left wall of the cabinet). Review Section 1, Chapter 1, which describes how to lift the playfield to access the Plumb Bob Tilt Assembly.* The manual gives you all the important information you need to prepare for final set-up and other important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

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

How to Secure the Backbox for Transporting

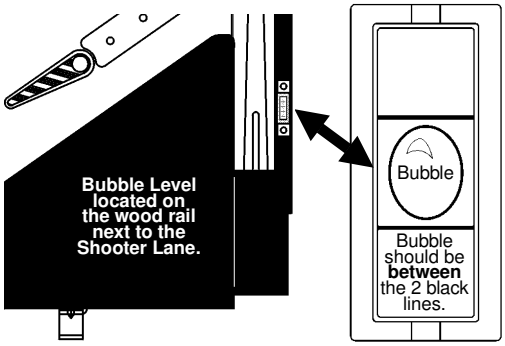
*For more Backbox details & part numbers, see Section **4**, Chapter **1**, **Backbox Assembly**, Pages 60-61.*





Leg Leveler Adjustment

Attach the four (4) Leg Assemblies to cabinet corners with the eight (8) leg bolts provided .

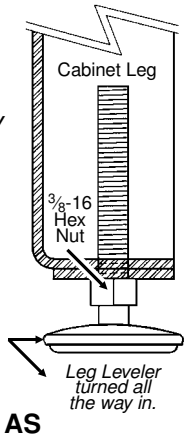


Start adjustment with the leg levelers *turned all the way in*.

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.



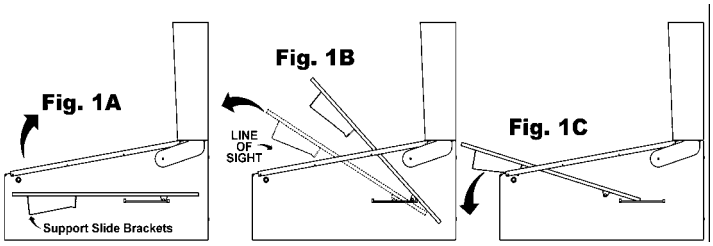
YOUR PLAYFIELD PITCH IS NOW AT 6.5° AS REQUIRED FOR PROPER GAME PLAY!

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

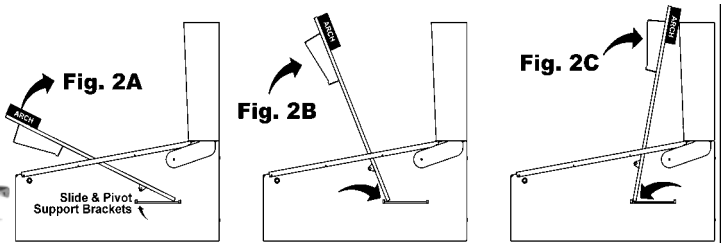
Easy Access Service System - 2 Positions

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

Position 1
When lifted high enough, the ***Playfield Support Slide Brackets*** (**Fig. 1A**) can be seen and can clear the cabinet front (**Fig. 1B**). 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**);



Position 2
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 6 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 ½ 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/Tournament 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. *Features subject to change.*

Starting Pinball Wizard Play

After credit is posted, while holding in the **RIGHT FLIPPER BUTTON**, press the **START BUTTON**. Pinball Wizard Play has now begun. The same as League/Tournament Play, but ooooooh! so much gosh darn harder! *Feature subject to change.*

During Game Features

Feature Mode & Combination Shots

Features are lit on the playfield and started by completing certain play shots (e.g. completion of target banks, orbit(s), ramp(s) and/or any combination of the shots). Combination shots (combos) are a series of shots completed in many different variations. These combinations vary per game. For feature modes & combos certain points or awards are given after completion. *Feature subject to change.*

Multiball

Multiball is started after completion of certain Feature Modes or may be a mode itself depending on game rules/play. Multiball may vary with the amount of balls used in Multiball depending on game style. Typically, if Multiball play was short, a "restart" option is given. Watch the Display for instructions on the restart.

Replay Feature

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

Video Mode

The video modes ***may*** require the player to "*play on-screen*". The interactive video play ***may*** require the player to use the flipper buttons to play the mode. *Feature subject to change.*

End of Game Features

Game Endings

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

Match Feature

At the end of each ball, earned bonuses are collected. At the end of the last ball of a game (including any extra balls, if applicable), earned bonuses are collected, then the system produces a random 2-digit number (a multiple of 10; 00 to 90). Matching the last 2 digits of the player's score with this number awards a credit. In Adj. 11, Match Percentage (Default=**7%**, adjustable) can be changed from 0-10%. Changing the percentage to **0%** displays the "Match Animation" at the end of the game, however, will never match (to award a credit). Changing this adjustment to **OFF** will not display the "Match Animation" nor award a credit.

Continued Next Page.

End of Game Features Continued

Entering Initials

If player achieved a new high score in any of the 3 categories (Regular, Novice or Wizard), the player may enter his/her initials. To enter your initials, use the Left & Right Flipper Buttons to choose letter or character as seen on the Dot Display. Hitting the Start Button locks in the letter or character and proceeds to the next letter. The game then proceeds into the *Game-Over Mode* and then to the *Attract Mode*. *(**Note:** A custom message (adjustable) can be displayed during the **Attract Mode**; enter letters in the same fashion.)*

Manual Percentaging

This game is equipped with a Manual Percentage Adjustment. As with our previous games, you can either set operator adjustments for a replay percent or you can set a fixed replay score. See Section 3, Chapter 4, Go To Adjustments Menu, Adjustments 1 & 2. If you set operator adjustments for a particular replay percent, the game will compute a recommended score to keep the game at that replay percentage. If a change is recommended and the game coin door is opened, the display will indicate if the replay is too high or low and make a sound to alert the operator. By pressing the Start Button, the score to beat will be changed to a more appropriate level. If you close the Coin Door or enter the **Portals™ Service Menu**, no score change will be made. You may choose to ignore the recommended change; for example, you may not think last week's players were the usual crowd. Just close the door and the message will disappear without altering the existing level. Or you may choose to make a different score to beat adjustment; this is done by utilizing Adj. 2, Replay Levels.

Instruction Card

Below is a **COPY** of the game instruction card 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.* (***Suggestion:*** **COPY & CUT** along the dotted line and fold in the center to keep the "COPY" sturdy.)

COPY & CUT

HARLEY-DAVIDSON®
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For more detailed game rules, visit our website @ www.SternPinball.com and click on the " Harley-Davidson 3rd Edition " or "Game Archive" Pop Bumper Link.

FOLD HERE

Click on card to open the Instruction Card for printing.

SKILL SHOT Use flippers to change *Displayed Award*. Shoot ball to collect.

HARLEY MULTIBALL Shoot **Motorcycle** to spell ***H-A-R-L-E-Y***. Completing letters opens **Motorcycle** to ***Lock Balls***. *Locking 4 Balls* begins ***Harley Multiball***. During ***Harley Multiball***, shoot **Motorcycle** for ***H-A-R-L-E-Y Jackpots,*** then shoot open **Motorcycle** for ***Super Jackpot***.

SPEEDOMETER MULTIBALL Shoot **Ramp** to advance **Gears** towards ***Speedometer Multiball***. During this feature, you need to get up-to-speed to collect ***Jackpots***. ***Hint: Watch the Display!***

RED LIGHT MULTIBALL Shooting *any shot* changes the corresponding ***Traffic Signal***. Completing all ***Red Lights*** qualify **Big Traffic Signal** for ***Red Light Multiball***. During ***Red Light Multiball***, Playfield ***Green & Yellow Lights*** collect ***Jackpot***. Completing all Playfield ***Red Lights*** qualifies **Big Traffic Signal** for ***SUPER JACKPOT***.

MILES All shots *add miles* and advance player toward *Next City*. Each *city gives an Award* as indicated in the **Display**. Getting to *Milwaukee starts the Final Mode*.

MYSTERY RIDER *Random Award*. This feature may *give player a consolation award* on **Last Ball**.

VIDEO MODE Completing the *Harley Logo Sequence* lights **Big Traffic Signal** for ***Video Mode***.

FASTEST RAMP SHOT *This shot is timed*. Faster shots award more ***Miles***. Exceeding the fastest time awards ***Enter Initials***.

PATCH When entering a ***New City***, the ***Big Traffic Signal*** shot awards a ***Patch*** for that city *(sewn onto Jacket)*. Collecting ***Patches*** advances final mode *Jackpot Awards*.

EXTRA BALL *Mystery Rider*, *Patches*, or *Consolation* may award or light ***Extra Ball***.

SPECIAL *Consolation* or *Features* may award ***Special***.

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FEATURES AUTHENTIC HARLEY-DAVIDSON® ENGINE SOUND™

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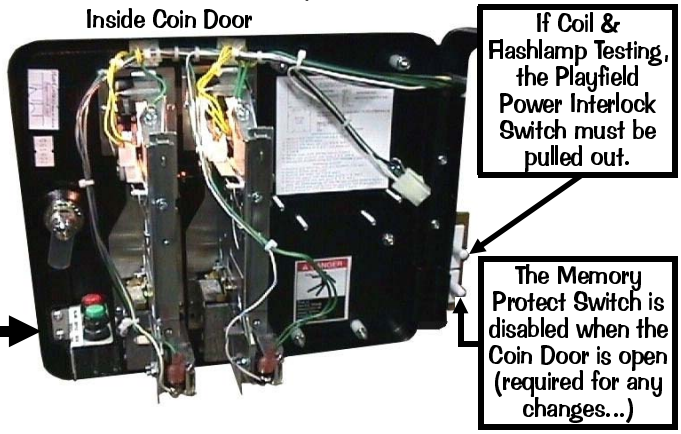
Service Switch Set (Red, Green & Black Buttons) Access & Use

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***.



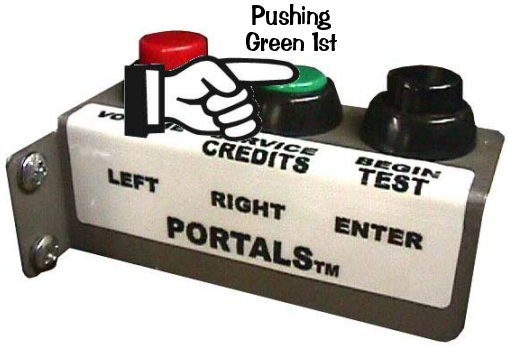
To access any of these ***three (3) functions*** you must first open the **Coin Door** (see pictorial above) with the Game in the ***Attract Mode*** *(not already in any Function or Menu stated below).*

Function 1, Volume Menu

Pushing the ***Red Button*** ***(VOLUME / LEFT)*** 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.

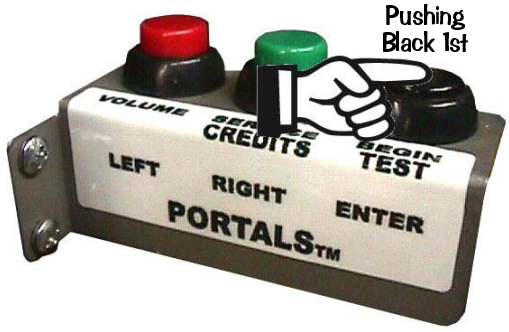


Function 2, Service Credits Menu

Pushing the ***Green Button*** ***(SERVICE CREDITS / RIGHT)*** first, adds ***Service Credits*** *(will not affect your audits as "paid" credits).* This is useful for the technician to test games in regular play without affecting the game audits. Each depression adds **1 credit**; up to **50 credits** can be applied. **Adj. 15**, **Credit Limit**, determines this, however, it can be changed from 04-50; *for details see Chapter **4** of this Section **3***. 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.).*

open Adjustments



Function 3, Portals™ Service Menu

Pushing the ***Black Button*** ***(BEGIN TEST / ENTER)*** first, enters the ***Portals™ Service Menu***. Once in, navigate through all menus 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!***

back to Page 8

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.

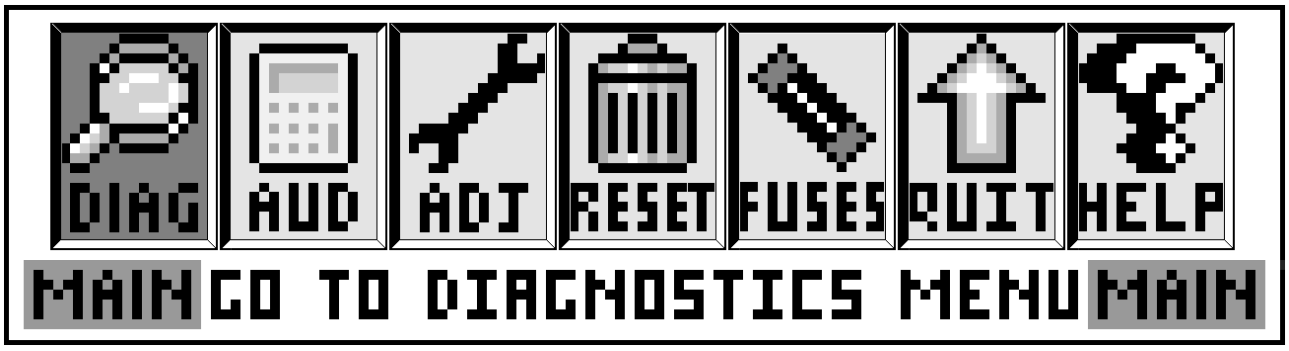
How to Use This Section

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©™**" 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*.

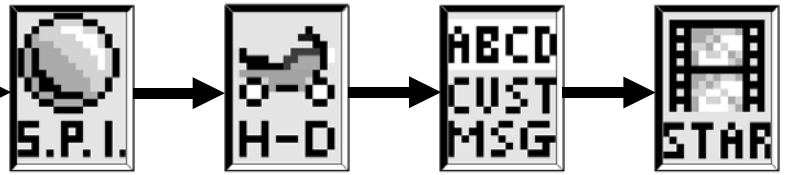
The **chapters** in this **section**, which coincide with the **MAIN MENU**, will also provide more detailed information. ***Use both the manual and the display to help customize, troubleshoot and/or diagnose faults, if any.***

Portals™ Service Menu Icon Tree for HARLEY-DAVIDSON

MAIN MENU

- **GO TO DIAGNOSTICS MENU**
- **GO TO AUDITS MENU**
- **GO TO ADJUSTMENTS MENU**
- **GO TO RESET MENU**
- **GO TO FUSES LIST** → GAME FUSES LISTING. Reference current Game Manual, Sec. 3, Chapter 6.
- **QUIT THIS SESSION** → Exits Back to Attract Mode
- **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.

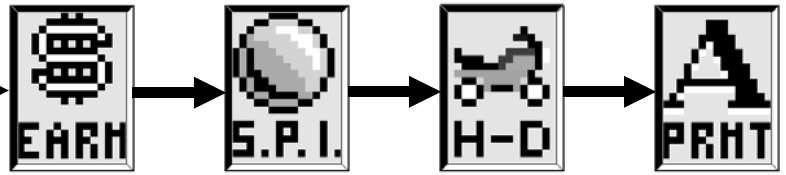


- **S.P.I. ADJUSTMENTS** → 1st Adjustment of Game Generic Group
- **HARLEY-DAVIDSON ADJUSTMENTS** → 1st Adjustment of Game Specific Group
- **CUSTOM MESSAGE** → Direct Access to Adjustment 34, Custom Message
- **FILM STAR RESET** → REQUEST INSTALLED (Back to Attract Mode)

Go To Reset Menu
RESET MENU
Reference current Game Manual, Sec. 3, Chapter 5.

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

Go To Audits Menu
AUDITS MENU
Reference current Game Manual, Sec. 3, Chapter 3.

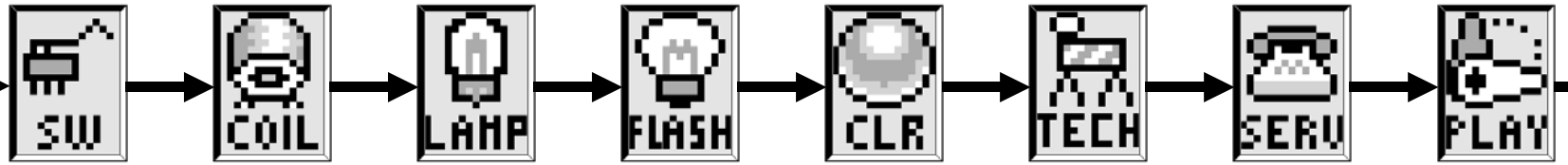


- **EARNINGS AUDITS** → 1st Audit of Game Earnings Group
- **S.P.I. AUDITS** → 1st Audit of Game Generic Group
- **HARLEY-DAVIDSON AUDITS** → 1st Audit of Game Specific Group
- **GO TO PRINTER MENU**

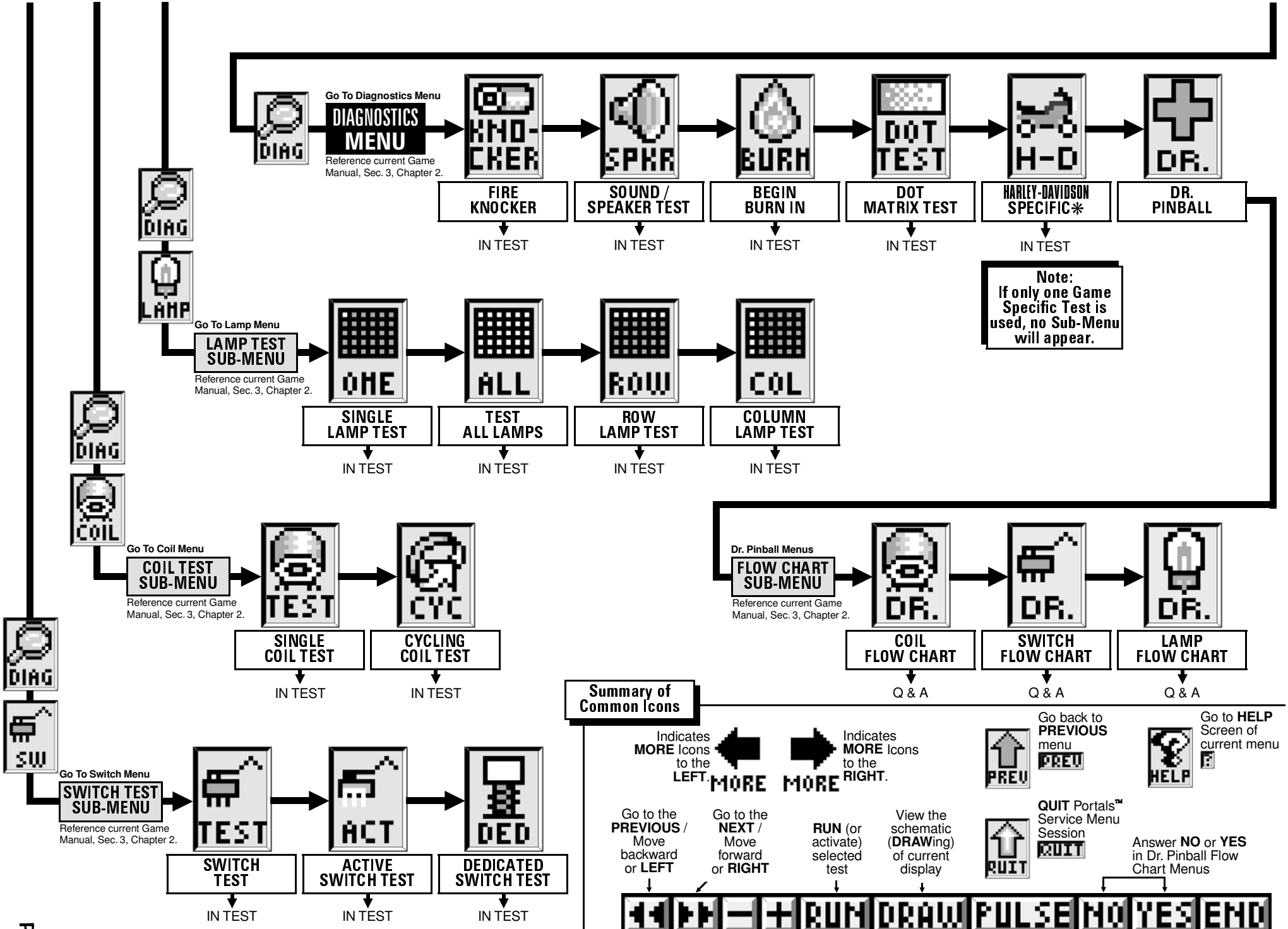
Go To Audits Menu
PRINTER SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 3.

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

Go To Diagnostics Menu
DIAGNOSTICS MENU
Reference current Game Manual, Sec. 3, Chapter 2.



- **GO TO SWITCH MENU**
- **GO TO COIL MENU**
- **GO TO LAMP MENU**
- **TEST FLASH LAMPS** → IN TEST
- **CLEAR BALL TROUGH** → IN TEST
- **TECHNICIAN ALERT** → PLAYFIELD STATUS
- **SERVICE PHONE #** → 1-800-KICKERS (USA Setting)
- **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
H-D
DR.
FIRE KNOCKER
SOUND / SPEAKER TEST
BEGIN BURN IN
DOT MATRIX TEST
HARLEY-DAVIDSON SPECIFIC*
DR. PINBALL
IN TEST
Note: If only one Game Specific Test is used, no Sub-Menu will appear.
LAMP
Go To Lamp Menu
LAMP TEST SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 2.
ONE
ALL
ROW
COL
SINGLE LAMP TEST
TEST ALL LAMPS
ROW LAMP TEST
COLUMN LAMP 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
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
Summary of Common Icons
Indicates MORE Icons to the LEFT.
MORE
Indicates MORE Icons to the RIGHT.
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*.

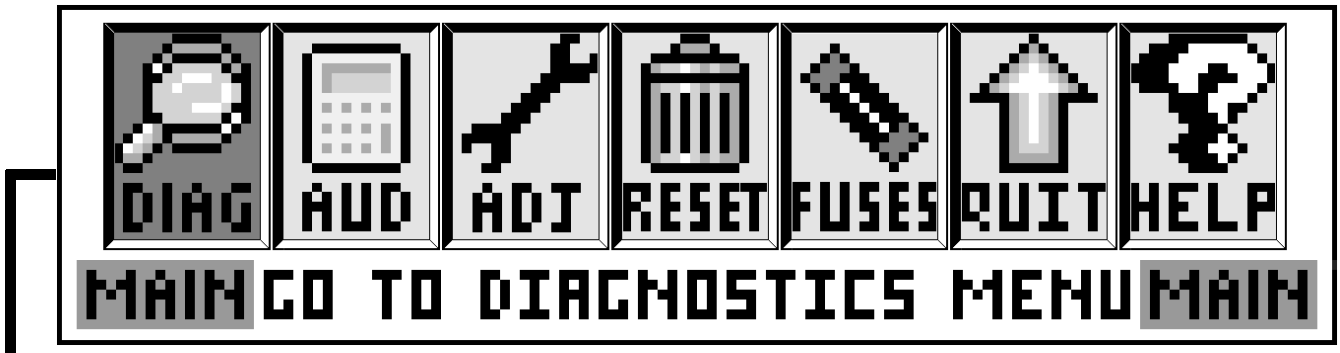
Important Note:

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.***

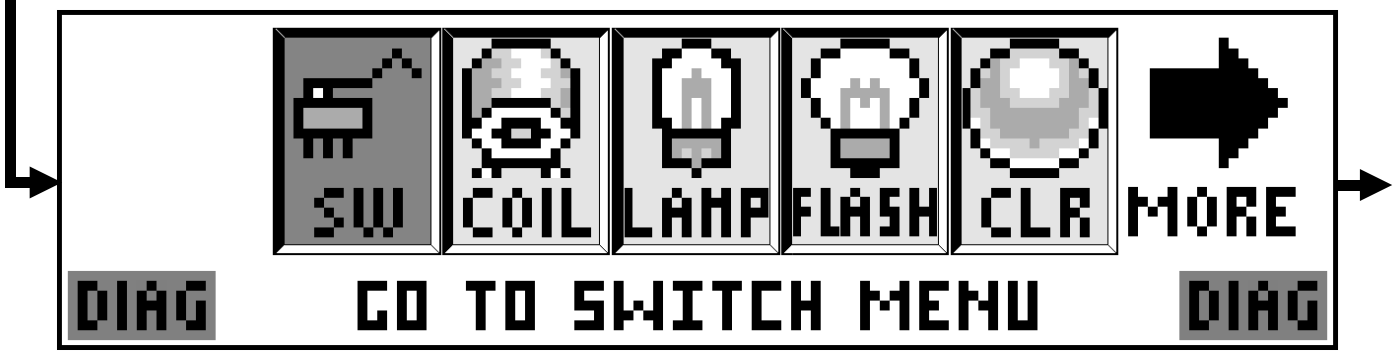
Selecting & activating the "QUIT" *Icon* from any display will exit the *Service Session.*

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**).

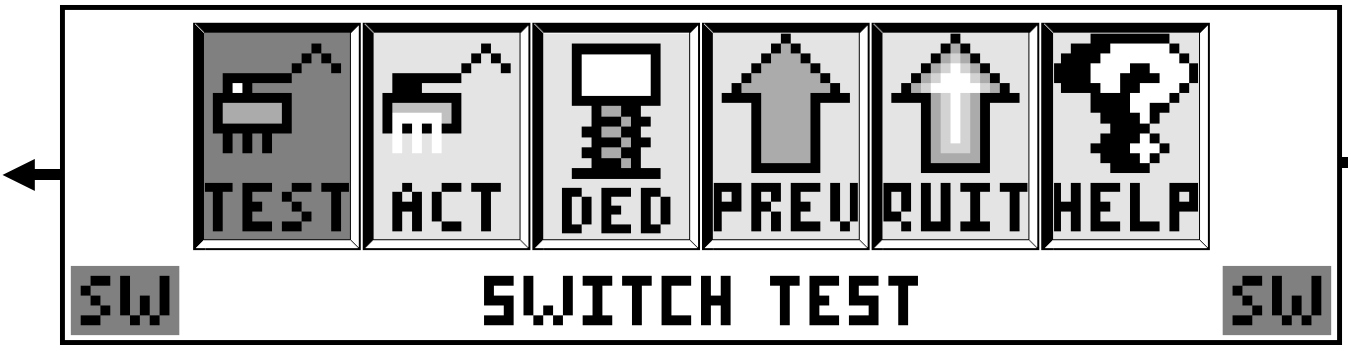


Press the **Black "ENTER" Button** to activate this **ICON**. This will bring up the **DIAGNOSTICS MENU**.

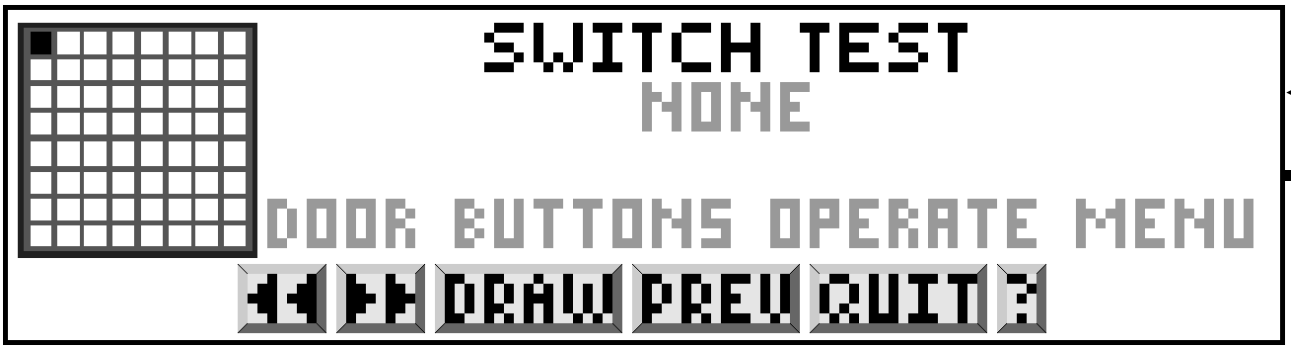


The **DIAGNOSTICS MENU** now appears with the "SW" *Icon* (**GO TO SWITCH MENU**) flashing. Press the **Black Button** to *activate* this icon. This will bring up the **SWITCH TEST MENU**.

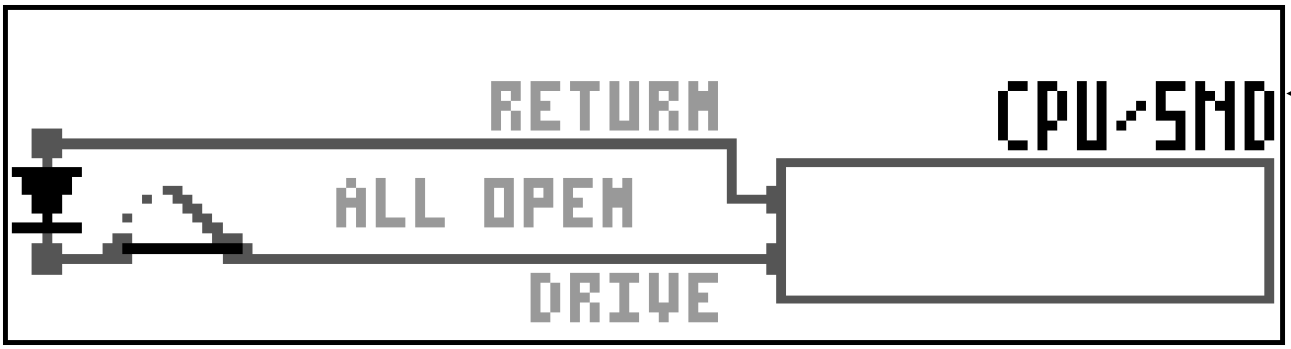
The **SWITCH TEST MENU** now appears with the "TEST" *Icon* (**SWITCH TEST**) flashing:
Press the **Black "ENTER" Button** to *activate* this icon. This will bring up the **Switch Test Display**.



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.



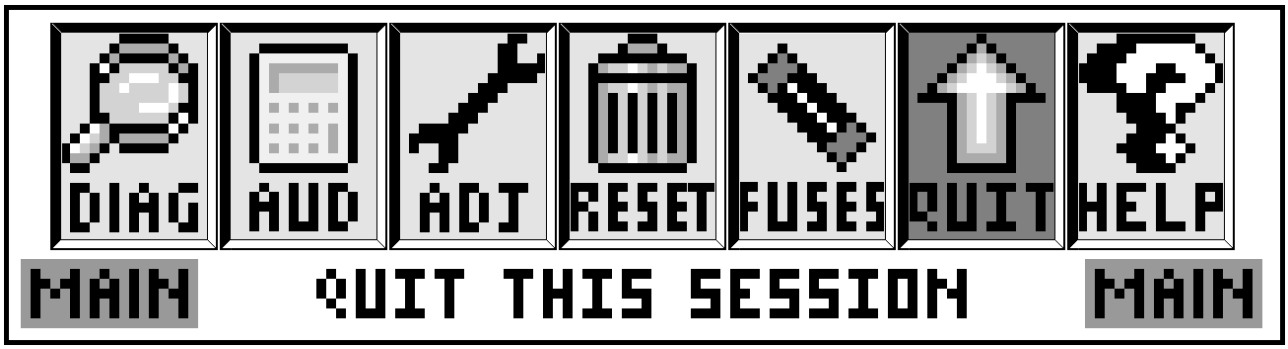
While in Switch or Active Switch Tests, the **Flipper & Start Buttons** are deactivated. Use the **Red "LEFT," Green "RIGHT"** and/or **Black "ENTER" Buttons** to select and activate the "**MINI-ICONS**" at the bottom of the display. In Switch Test, if the "Left Arrow" or "Right Arrow" *Mini-Icon* is 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.

Your Notes

Go To Diagnostics Menu

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

Overview

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

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

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

GO TO DIAGNOSTICS MENU

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

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

Important Notes:

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

Selecting & activating the "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 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*** & ***Harley-Davidson Specific*** Menu's, ***the*** **Power Interlock Switch** (inside Coin Door) must be pulled out. (See ***Access & Use*** in Chapter 1 of this section for the location.)

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

Go To Switch Menu

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

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

Switch Test

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

Active Switch Test

To initiate, from the **SWITCH MENU**, select the "ACT" *Icon* with either **Red** or **Green Button** & press the **Black Button**. If still in a previous test, select the "PREV" *Icon* to return to Switch Menu or selecting either of the "ARROW" *Icons* will move through the tests. If any switches are stuck closed (or made from the presence of a pinball), the display sequences through the Switch Names, Return (Row) Wire, Drive 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

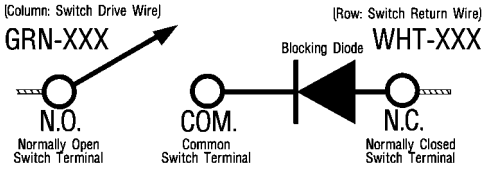
Diode **O**n **T**erminal **S**trip :

Row (Return) \ Column (Drive)	1: Q1 NOT USED GRN-BRN CN5-P1	2: Q2 NOT USED GRN-RED CN5-P3	3: Q3 NOT USED GRN-ORG CN5-P4	4: Q4 NOT USED GRN-YEL CN5-P5	5: Q5 NOT USED GRN-BLK CN5-P6	6: Q6 NOT USED GRN-BLU CN5-P7	7: Q7 NOT USED GRN-VIO CN5-P8	8: Q8 NOT USED GRN-GRY CN5-P9
1: U400 NOT USED WHT-BRN CN7-P9	LEFT BUTTON (UK ONLY) on Cabinet side 1	NOT USED 9	LT 4-BANK D/T (L) IVE Under P/F 17	RIGHT RAMP ENTER Above P/F 25	LEFT ORBIT Under P/F 33	M-CYCLE TROUGH #4 (TOP) Under P/F 41	LEFT TURBO BUMPER Under P/F 49	LEFT OUTLANE Under P/F 57
2: U400 NOT USED WHT-RED CN7-P8	4TH COIN SLOT On Coin Door 2	NOT USED 10	LT 4-BANK D/T L (I) VE Under P/F 18	RIGHT RAMP EXIT Above P/F 26	RIGHT ORBIT Under P/F 34	M-CYCLE TROUGH #3 Under P/F 42	RIGHT TURBO BUMPER Under P/F 50	LEFT RETURN LANE Under P/F 58
3: U400 NOT USED WHT-ORG CN7-P7	6TH COIN SLOT On Coin Door 3	4-BALL TROUGH #1 (LEFT) 11	LT 4-BANK D/T LI (V) E Under P/F 19	RIGHT RAMP MID Above P/F 27	MOTOR UP Under P/F 35	M-CYCLE TROUGH #2 Under P/F 43	BOTTOM TURBO BUMPER Under P/F 51	LEFT SLINGSHOT Under P/F 59
4: U400 NOT USED WHT-YEL CN7-P6	RIGHT COIN SLOT On Coin Door 4	4-BALL TROUGH #2 Under P/F 12	LT 4-BANK D/T LIV (E) Under P/F 20	SPINNER Above P/F 28	MOTOR DOWN Under P/F 36	M-CYCLE TROUGH #1 (BOT) Under P/F 44	TOP TURBO BUMPER Under P/F 52	RIGHT OUTLANE Under P/F 60
5: U401 NOT USED WHT-GRN CN7-P5	CENTER COIN SLOT / DBA On Coin Door 5	4-BALL TROUGH #3 Under P/F 13	RT 4-BANK D/T (R) IDE Under P/F 21	S-U TRGT LT (M-CYCLE) Under P/F 29	OPTO Under P/F 37	SUPER VUK Under P/F 45	LAUNCH BUTTON Cabinet Front 53	RIGHT RETURN LANE Under P/F 61
6: U401 NOT USED WHT-BLU CN7-P3	LEFT COIN SLOT On Coin Door 6	4-BALL TROUGH VUK OPTO Under P/F 14	RT 4-BANK D/T R (I) DE Under P/F 22	S-U TRGT RT (M-CYCLE) Under P/F 30	NOT USED 38	BALL EJECT (SCOOP) Under P/F 46	START BUTTON Cabinet Front 54	RIGHT SLINGSHOT Under P/F 62
7: U401 NOT USED WHT-VIO CN7-P2	5TH COIN SLOT On Coin Door 7	4-BALL STACKING OPTO Under P/F 15	RT 4-BANK D/T RI (D) E Under P/F 23	S-U TRGT LT (RT RAMP) Under P/F 31	NOT USED 39	NOT USED 47	SLAM TILT On Coin Door 55	NOT USED 63
8: U401 NOT USED WHT-GRY CN7-P1	RIGHT BUTTON (SKILL) on Cabinet side 8	SHOOTER LANE Under P/F 16	RT 4-BANK D/T RID (E) Under P/F 24	S-U TRGT RT (RT RAMP) Under P/F 32	NOT USED 40	BEHIND TOP VUK Under P/F 48	PLUMB BOB TILT Inside Cabinet 56	NOT USED 64

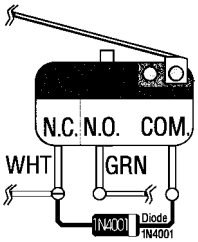
Diode **O**n **D**iode **B**oard :

IC U206 INPUTS \ GND	Ground BLK CN6-P1, -P11
1: U206 GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON in Cabinet side D8-1
2: U206 GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke) in Cabinet side D8-2
3: U206 GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON in Cabinet side D8-3
4: U206 GRY-YEL CN6-P6	#4 RIGHT FLIPPER E.O.S. (End-of-Stroke) in Cabinet side D8-4
5: U206 NOT USED GRY-GRN CN6-P7	NOT USED D8-5
6: U206 GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (In Test: LEFT) on Coin Door D8-6
7: U206 GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) on Coin Door D8-7
8: U206 GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) on Coin Door D8-8

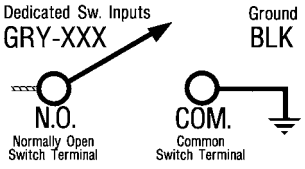
Typical Switch Schematic & Wiring



Note:
All Switches require diodes. Some diodes are located on Terminal Strips (under playfield) & not on the switch itself.
Diode **O**n **T**erminal **S**trip

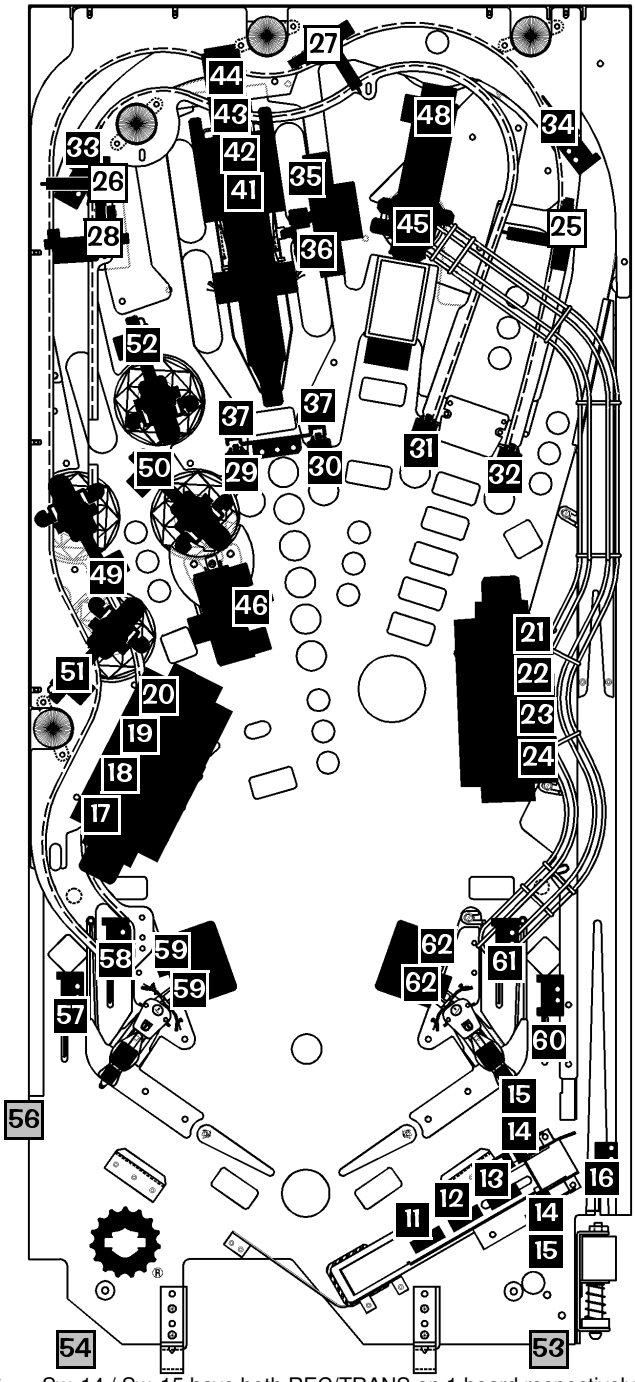


Dedicated Switch Schem.



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. 14 / Sw. 15 have both REC/TRANS on 1 board respectively. Sw. 37 has both REC/TRANS on the same board.

DOTS: Diode **O**n **T**erminal **S**trip, or **DODB**: **D**iode **O**n **D**iode **B**oard

Legend Note:

☐ = Switches mounted above playfield.

■ = Switches mounted below playfield.

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

2 4 5 6 54 55 56

The following switches are not used:

9 10 38 39 40 47 63 64

Switches for Up/Down Post: (8)

Sw. Nº	Col. Nº	Row Nº	See Note:	Switch Matrix Description	Part Nº
				Note: The ¥ Coin Switch (for Japan) is 180-5091-00	
1	1	1		LEFT BUTTON (UK ONLY)	180-5160-00
2*	1	2		4TH COIN SLOT	180-5024-00
3*	1	3		*6TH COIN SLOT*	*(Future Use)*
4*	1	4		RIGHT COIN SLOT	180-5024-00
5*	1	5		CENTER COIN SLOT / DBA	
6*	1	6		LEFT COIN SLOT	
7*	1	7		*5TH COIN SLOT*	*(Future Use)*
8	1	8		RIGHT BUTTON (SKILL)	180-5160-00
9	2	1		NOT USED	
10	2	2		NOT USED	
11	2	3		4-BALL TROUGH #1 (LEFT)	180-5119-00
12	2	4		4-BALL TROUGH #2	
13	2	5		4-BALL TROUGH #3	
14‡	2	6		4-BALL TROUGH VUK OPTO — BOT TRANS: / BOT REC:	520-5173-00 / 520-5174-00
15‡	2	7		4-BALL STACKING OPTO — TOP TRANS: / TOP REC:	520-5173-00 / 520-5174-00
16	2	8		SHOOTER LANE	180-5100-01
17	3	1		LT 4-BANK D/T (L) IVE	180-5104-00
18	3	2		LT 4-BANK D/T L (I) VE	
19	3	3		LT 4-BANK D/T LI (V) E	
20	3	4		LT 4-BANK D/T LIV (E)	
21	3	5		RT 4-BANK D/T (R) IDE	
22	3	6		RT 4-BANK D/T R (I) DE	
23	3	7		RT 4-BANK D/T RI (D) E	
24	3	8		RT 4-BANK D/T RID (E)	
25	4	1		RIGHT RAMP ENTER (Switch Gate)	180-5087-00
26	4	2		RIGHT RAMP EXIT (Switch Gate)	
27	4	3		RIGHT RAMP MID (Switch Gate)	
28	4	4		SPINNER	180-5010-04
29	4	5		S-U TRGT LT (M-CYLE) (Nar. Trgt. Red)	500-6138-02
30	4	6		S-U TRGT RT (M-CYLE) (Nar. Trgt. Red)	
31	4	7		S-U TRGT LT (RT RAMP) (Nar. Trgt. Red)	
32	4	8		S-U TRGT RT (RT RAMP) (Nar. Trgt. Red)	
33	5	1		LEFT ORBIT (Lt. Mount Roll-Over Lite Sw.)	500-6227-03
34	5	2		RIGHT ORBIT (Rt. Mount Roll-Over Lite Sw.)	500-6227-04
35	5	3		MOTOR UP	180-5052-00
36	5	4		MOTOR DOWN	
37‡	5	5		OPTO — TRANS / REC	180-5082-00 / 180-5083-01
38	5	6		NOT USED	
39	5	7		NOT USED	
40	5	8		NOT USED	
41	6	1	DODB	M-CYCLE TROUGH #4 (TOP)	(1) 4-Position Membrane Switch: 181-5001-00
42	6	2	DODB	M-CYCLE TROUGH #3	
43	6	3	DODB	M-CYCLE TROUGH #2	
44	6	4	DODB	M-CYCLE TROUGH #1 (BOT)	
45	6	5	DOTS	SUPER VUK	180-5052-00
46	6	6	DOTS	BALL EJECT (Power Scoop / Kick Big)	180-5057-00
47	6	7		NOT USED	
48	6	8		BEHIND TOP VUK (Metal Under-Trough)	180-5057-00
49	7	4		LEFT TURBO BUMPER	180-5015-03
50	7	2		RIGHT TURBO BUMPER	
51	7	3		BOTTOM TURBO BUMPER	
52	7	4		TOP TURBO BUMPER	
53	7	5		LAUNCH BUTTON (Yel.)	500-6121-06
54*	7	6		START BUTTON (Red)	500-6090-02
55*	7	7		SLAM TILT (On Coin Door)	180-5022-00
56*	7	8		PLUMB BOB TILT — HANGER / CONTACT	535-5319-00 / 535-7563-01
57	8	1		LEFT OUTLANE (Rt. Mount Roll-Over Sw.)	500-6227-02
58	8	2		LEFT RETURN LANE (Rt. Mnt. R-O Sw.)	
59	8	3		LEFT SLINGSHOT (Double-Switch)	180-5054-00
60	8	4		RIGHT OUTLANE (Rt. Mount R-O Sw.)	500-6227-02
61	8	5		RT RETURN LANE (Rt. Mount R-O Sw.)	
62	8	6		RIGHT SLINGSHOT (Double-Switch)	180-5054-00
63	8	7		NOT USED	
64	8	8		NOT USED	

Go To Coil Menu

From the **DIAGNOSTICS MENU**, select the "COIL" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The coils are listed in groups. Coils 01-16 are typically High Current Coils (although Low Current Coils may be used in positions 01-07). Coils 17-24 are typically Low Current Coils. The remaining positions (F1-F8) are typically for Flash Lamps (although they may be used any positions 01-24, read **Single Coil Test**). ***Important:*** The **Power Interlock Switch** must be pulled out.

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 Coils 1-24 and Flash Lamps F1-F8; *Note: Some Flash Lamps are used in Coil Positions; this game: #20*). 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.

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.

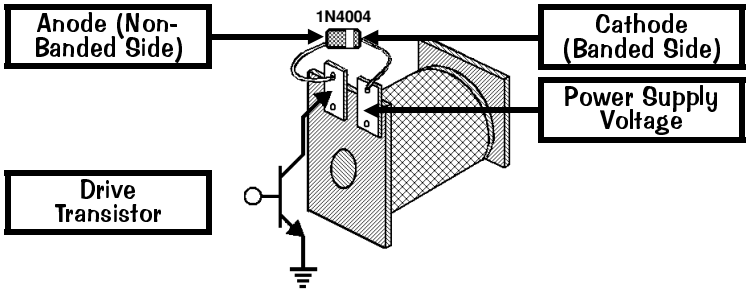
Coil & Flash Lamp Descriptions

Type	Coil / Flash Lamp Descriptions
COIL 1	TROUGH UP-KICKER (VUK) (26-1200)
COIL 2	AUTO LAUNCH (50V) (24-940)
COIL 3	SUPER VUK (23-800)
COIL 4	POWER SCOOP/KICK BIG (23-800)
COIL 5	MOTORCYCLE BALL LAUNCH (24-940)
COIL 6	LEFT 4-BANK DROP TARGET (23-700)
COIL 7	RIGHT 4-BANK DROP TARGET (23-700)
COIL 8	(EUROPEAN TOKEN DISPENSER)
COIL 9	LEFT TURBO BUMPER (26-1200)
COIL 10	RIGHT TURBO BUMPER (26-1200)
COIL 11	BOTTOM TURBO BUMPER (26-1200)
COIL 12	TOP TURBO BUMPER (26-1200)
COIL 13	SHAKER MOTOR (041-5029-01)
COIL 14	MAGNET (22-650)
COIL 15	LEFT FLIPPER [50V RED/YEL] (22-1080)
COIL 16	RIGHT FLIPPER [50V RED/YEL] (23-1100)

Type	Coil / Flash Lamp Descriptions
COIL 17	LEFT SLINGSHOT (23-800)
COIL 18	RIGHT SLINGSHOT (23-800)
COIL 19	MOTOR RELAY (BD.) (520-5010-00)
COIL 20	FLASH: SCOOP X2 (#89 Bulb)
COIL 21	LT OUTLANE (UK ONLY) (28-1050)
COIL 22	RT OUTLANE (UK ONLY) (28-1050)
COIL 23	UP/DOWN POST (SKILL) (23-1100)
COIL 24	(OPTIONAL COIN METER)
#F1	FLASH: LEFT DROP TARGET X2
#F2	FLASH: RAMP LEFT X2
#F3	FLASH: TURBO BUMPER X4
#F4	FLASH: RAMP TOP X2
#F5	FLASH: MOTORCYCLE X4
#F6	FLASH: SUPER VUK X2
#F7	FLASH: RT DROP TARGET X2
#F8	FLASH: SPEEDOMETER X2

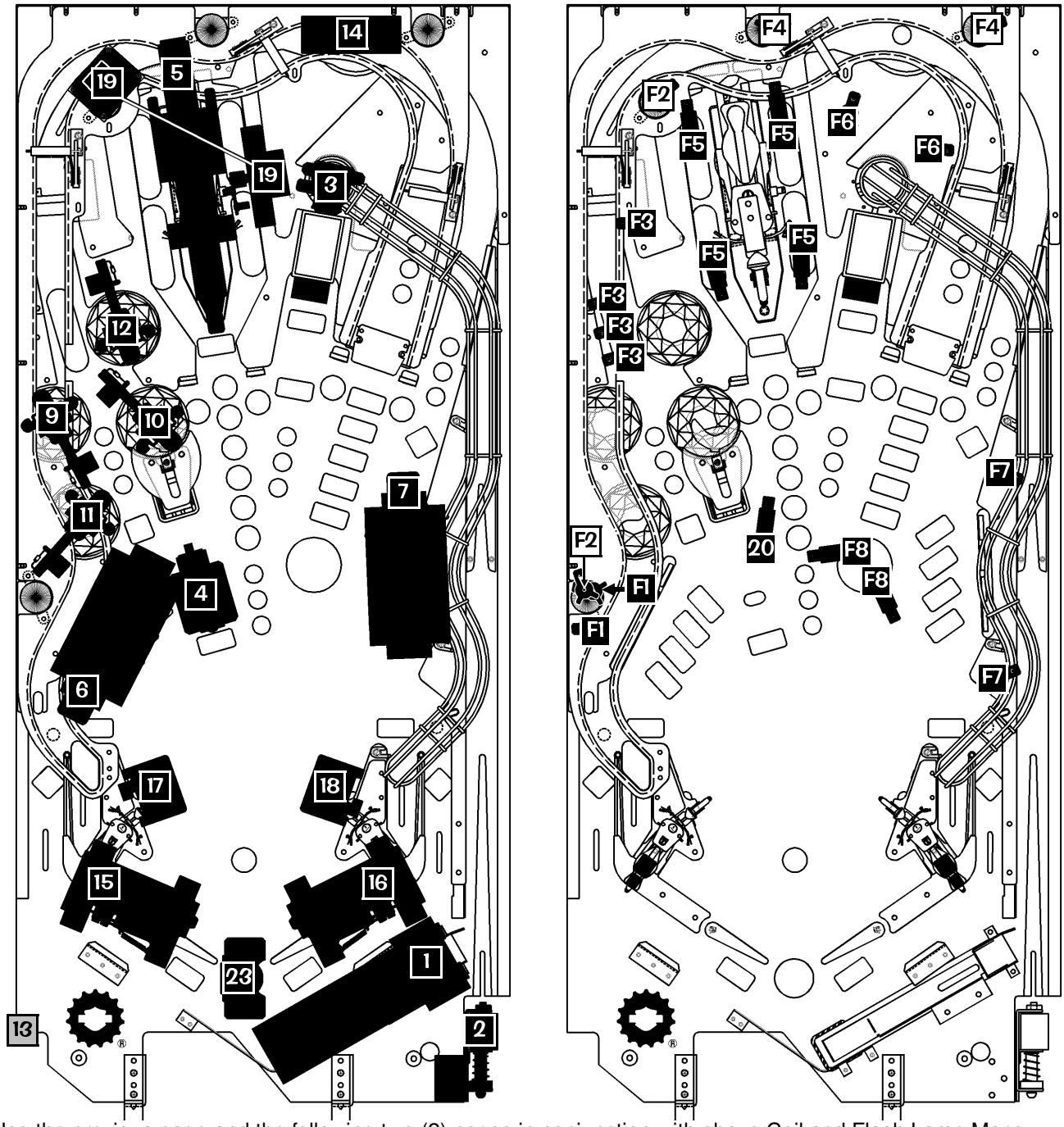
See the next three (3) pages for the **Coil & Flash Lamp Location Maps** (corresponds to above tables), **Coils Detailed Chart Table** & the **Backbox I/O Power Driver Board Detailed Wiring Diagram**.

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 Coils are optional for ***UK Only:***

21 22

The following Coils are Optional:

08 24

The following Bulb Type is used for Flash Lamps:

#89 Bulb
(Bayonet)
165-5000-89

From the Main Menu in Portals™
GO TO DIAGNOSTICS MENU

From the Diagnostics Menu
GO TO COIL MENU

From the Coil Menu
GO TO COIL TEST

From the Coil Menu
GO TO CYCLING COILS

COILS DETAILED CHART TABLE

High Current Coils Group 1		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	I/O Pwr. Drvr.	BRN-BLK	J8-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#2	AUTO LAUNCH	Q2	I/O Pwr. Drvr.	BRN-RED	J8-P3	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00T
#3	SUPER VUK	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#4	POWER SCOOP/KICK BIG	Q4	I/O Pwr. Drvr.	BRN-YEL	J8-P5	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#5	MOTORCYCLE BALL LAUNCH	Q5	I/O Pwr. Drvr.	BRN-GRN	J8-P6	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00B
#6	LEFT 4-BANK DROP TARGET	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	YEL-VIO	J10-P4/5	50v DC	23-700 090-5022-00T
#7	RIGHT 4-BANK DROP TARGET	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	YEL-VIO	J10-P4/5	50v DC	23-700 090-5022-00T
#8	EUROPEAN TOKEN DISPENSER	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	YEL-VIO	J10-P4/5	50v DC	DL4SS 515-6076-01

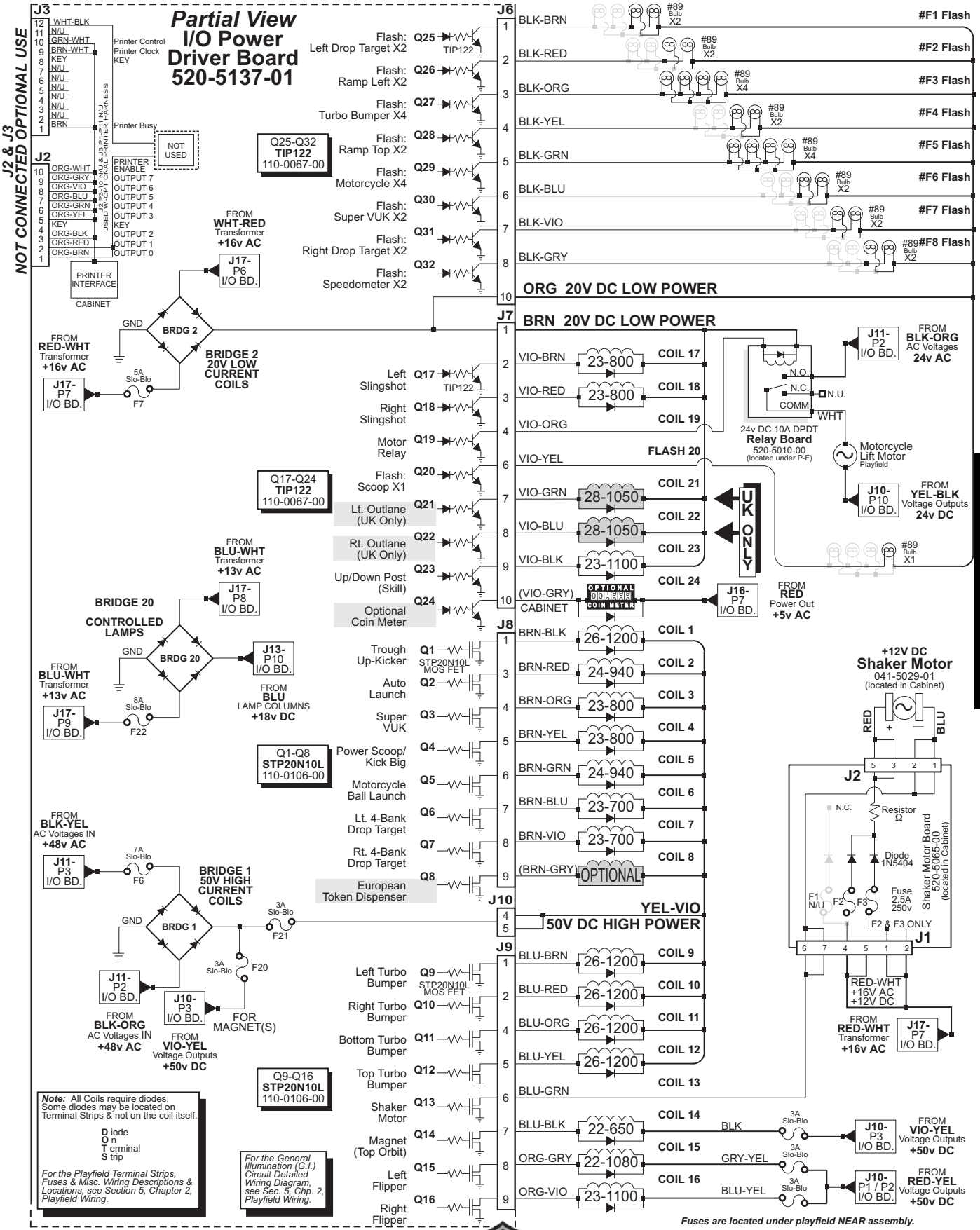
High Current Coils Group 2		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn
#9	LEFT TURBO BUMPER	Q9	I/O Pwr. Drvr.	BLU-BRN	J9-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#10	RIGHT TURBO BUMPER	Q10	I/O Pwr. Drvr.	BLU-RED	J9-P2	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#11	BOTTOM TURBO BUMPER	Q11	I/O Pwr. Drvr.	BLU-ORG	J9-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#12	TOP TURBO BUMPER	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#13	SHAKER MOTOR	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	RED-WHT	J17-P7	16v AC 12v DC	Motor Only 041-5029-01
#14	MAGNET	Q14	I/O Pwr. Drvr.	BLU-BLK	J9-P7	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#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	23-1100 090-5030-00T

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 GA/Turn or Meter #
#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	MOTOR RELAY	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	BRN	J7-P1	20v DC	Relay Bd. 520-5010-00
#20	FLASH: SCOOP X1	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#21	LT OUTLANE (UK ONLY)	Q21	I/O Pwr. Drvr.	VIO-GRN	J7-P7	BRN	J7-P1	20v DC	28-1050 090-5046-00
#22	RT OUTLANE (UK ONLY)	Q22	I/O Pwr. Drvr.	VIO-BLU	J7-P8	BRN	J7-P1	20v DC	28-1050 090-5046-00
#23	UP/DOWN POST (SKILL)	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	BRN	J7-P1	20v DC	23-1100 090-5030-00T
#24	OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v DC	Meter 5v 091-5000-00

Diode **O**n **T**erminal **S**trip (if noted)

Flash Lamps (FLASH)		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	Bulb Type
#F1	FLASH: LEFT DROP TARGET X2	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F2	FLASH: RAMP LEFT X2	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F3	FLASH: TURBO BUMPER X4	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F4	FLASH: RAMP TOP X2	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F5	FLASH: MOTORCYCLE X4	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F6	FLASH: SUPER VUK X2	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F7	FLASH: RT. DROP TARGET X2	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F8	FLASH: SPEEDOMETER X2	Q32	I/O Pwr. Drvr.	BLK-GRY	J6-P8	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89

Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: Q20 & Q25-Q32)


Partial View
I/O Power
Driver Board
520-5137-01
J2 & J3
NOT CONNECTED OPTIONAL USE
J3
J2
PRINTER INTERFACE
CABINET
Printer Control
Printer Clock
KEY
Printer Busy
NOT USED
PRINTER ENABLE
OUTPUT 7
OUTPUT 6
OUTPUT 5
OUTPUT 4
OUTPUT 3
KEY
OUTPUT 2
OUTPUT 1
OUTPUT 0
J1 & J3 P1-P1 N/U USED W/OPTIONAL PRINTER HARNESS
J6
J7
J8
J9
J10
Flash: Left Drop Target X2 Q25
Flash: Ramp Left X2 Q26
Flash: Turbo Bumper X4 Q27
Flash: Ramp Top X2 Q28
Flash: Motorcycle X4 Q29
Flash: Super VUK X2 Q30
Flash: Right Drop Target X2 Q31
Flash: Speedometer X2 Q32
Q25-Q32 TIP122 110-0067-00
TIP122
BLK-BRN
BLK-RED
BLK-ORG
BLK-YEL
BLK-GRN
BLK-BLU
BLK-VIO
BLK-GRY
#89 Bulb X2
#89 Bulb X4
#89 Bulb X1
#F1 Flash
#F2 Flash
#F3 Flash
#F4 Flash
#F5 Flash
#F6 Flash
#F7 Flash
#F8 Flash
ORG 20V DC LOW POWER
BRN 20V DC LOW POWER
FROM WHT-RED Transformer +16v AC
J17- P6 I/O BD.
GND
BRDG 2
BRIDGE 2 20V LOW CURRENT COILS
FROM RED-WHT Transformer +16v AC
J17- P7 I/O BD.
5A Slo-Blo
F7
Left Slingshot Q17
Right Slingshot Q18
Motor Relay Q19
Flash: Scoop X1 Q20
Lt. Outlane (UK Only) Q21
Rt. Outlane (UK Only) Q22
Up/Down Post (Skill) Q23
Optional Coin Meter Q24
Q17-Q24 TIP122 110-0067-00
VIO-BRN
VIO-RED
VIO-ORG
VIO-YEL
VIO-GRN
VIO-BLU
VIO-BLK
(VIO-GRY)
23-800
28-1050
23-1100
COIL 17
COIL 18
COIL 19
FLASH 20
COIL 21
COIL 22
COIL 23
COIL 24
OPTIONAL COIN METER
CABINET
J16- P7 I/O BD.
FROM RED Power Out +5v AC
UK ONLY
N.O.
N.C.
COMM
N.U.
WHT
24v DC 10A DPDT Relay Board 520-5010-00 (located under P-F)
J11- P2 I/O BD.
FROM BLK-ORG AC Voltages 24v AC
Motorcycle Lift Motor Playfield
J10- P10 I/O BD.
FROM YEL-BLK Voltage Outputs 24v DC
FROM BLU-WHT Transformer +13v AC
J17- P8 I/O BD.
BRIDGE 20 CONTROLLED LAMPS
GND
BRDG 20
J13- P10 I/O BD.
FROM BLU LAMP COLUMNS +18v DC
FROM BLU-WHT Transformer +13v AC
J17- P9 I/O BD.
8A Slo-Blo
F22
Trough Up-Kicker Q1
Auto Launch Q2
Super VUK Q3
Power Scoop/ Kick Big Q4
Motorcycle Ball Launch Q5
Lt. 4-Bank Drop Target Q6
Rt. 4-Bank Drop Target Q7
European Token Dispenser Q8
Q1-Q8 STP20N10L 110-0106-00
STP20N10L MOS FET
BRN-BLK
BRN-RED
BRN-ORG
BRN-YEL
BRN-GRN
BRN-BLU
BRN-VIO
(BRN-GRY)
26-1200
24-940
23-800
23-700
OPTIONAL
COIL 1
COIL 2
COIL 3
COIL 4
COIL 5
COIL 6
COIL 7
COIL 8
YEL-VIO
50V DC HIGH POWER
FROM BLK-YEL AC Voltages IN +48v AC
J11- P3 I/O BD.
7A Slo-Blo
F6
BRIDGE 1 50V HIGH CURRENT COILS
GND
BRDG 1
3A Slo-Blo
F21
F20
J11- P2 I/O BD.
J10- P3 I/O BD.
FROM BLK-ORG AC Voltages IN +48v AC
FROM VIO-YEL Voltage Outputs +50v DC
FOR MAGNET(S)
Left Turbo Bumper Q9
Right Turbo Bumper Q10
Bottom Turbo Bumper Q11
Top Turbo Bumper Q12
Shaker Motor Q13
Magnet (Top Orbit) Q14
Left Flipper Q15
Right Flipper Q16
Q9-Q16 STP20N10L 110-0106-00
BLU-BRN
BLU-RED
BLU-ORG
BLU-YEL
BLU-GRN
BLU-BLK
ORG-GRY
ORG-VIO
26-1200
22-650
22-1080
23-1100
COIL 9
COIL 10
COIL 11
COIL 12
COIL 13
COIL 14
COIL 15
COIL 16
BLK
GRY-YEL
BLU-YEL
3A Slo-Blo
J10- P3 I/O BD.
J10- P1 / P2 I/O BD.
FROM VIO-YEL Voltage Outputs +50v DC
FROM RED-YEL Voltage Outputs +50v DC
+12V DC Shaker Motor 041-5029-01 (located in Cabinet)
RED
BLU
J2
J1
N.C.
Resistor Ω
Diode 1N5404
Fuse 2.5A 250v
F1 N/U
F2
F3
F2 & F3 ONLY
Shaker Motor Board 520-5065-00 (located in Cabinet)
RED-WHT +16V AC +12V DC
FROM RED-WHT Transformer +16v AC
J17- P7 I/O BD.
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.
For the General Illumination (G.I.) Circuit Detailed Wiring Diagram, see Sec. 5, Chp. 2, Playfield Wiring.
Fuses are located under playfield NEAR assembly.

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 **Single Lamp Test** from Column 1, Row 1, Lamp 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.

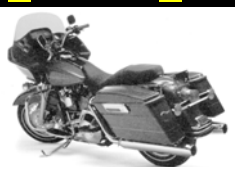
Row & Column Lamp Tests

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

D iode O n T erminal S trip :

Row (GND) \ Column (18v)	1: U17 NOT USED YEL-BRN J13-P9	2: U16 NOT USED YEL-RED J13-P8	3: U15 NOT USED YEL-ORG J13-P7	4: U14 NOT USED YEL-BLK J13-P6	5: U13 NOT USED YEL-GRN J13-P5	6: U12 NOT USED YEL-BLU J13-P4	7: U11 NOT USED YEL-VIO J13-P3	8: U10 NOT USED YEL-GRY J13-P1
1: Q33 NOT USED RED-BRN J12-P1	(H) ARLEY #555 Bulb 1	H (A) RLEY #555 Bulb 2	HA (R) LEY #555 Bulb 3	HAR (L) EY #555 Bulb 4	HARL (E) Y #555 Bulb 5	HARLE (Y) #555 Bulb 6	SUPER JACK-POT (RED) #44 Bulb 7	SUPER JACK-POT (GRN) #44 Bulb 8
2: Q34 NOT USED RED-BLK J12-P2	(L) IVE #44 Bulb 9	L (I) VE #555 Bulb 10	LI (V) E #555 Bulb 11	LIV (E) #555 Bulb 12	(R) IDE #555 Bulb 13	R (I) DE #555 Bulb 14	RI (D) E #555 Bulb 15	RID (E) #44 Bulb 16
3: Q35 NOT USED RED-ORG J12-P3	LT ORBIT GRN LIGHT #555 Bulb 17	LT ORBIT YEL LIGHT #555 Bulb 18	LT ORBIT RED LIGHT #555 Bulb 19	1ST GEAR #555 Bulb 20	2ND GEAR #555 Bulb 21	3RD GEAR #555 Bulb 22	4TH GEAR #555 Bulb 23	5TH GEAR #555 Bulb 24
4: Q36 NOT USED RED-YEL J12-P4	M-CYCLE GRN LIGHT #555 Bulb 25	M-CYCLE YEL LIGHT #555 Bulb 26	M-CYCLE RED LIGHT #555 Bulb 27	LEFT TURBO BUMPER DIODE #555 Bulb 28	RT TURBO BUMPER DIODE #555 Bulb 29	BOT TURBO BUMPER DIODE #555 Bulb 30	TOP TURBO BUMPER DIODE #555 Bulb 31	SPEEDO-METER X2 #555 Bulb 32
5: Q37 NOT USED RED-GRN J12-P5	SUPER VUK GRN LIGHT #555 Bulb 33	SUPER VUK YEL LIGHT #555 Bulb 34	SUPER VUK RED LIGHT #555 Bulb 35	BIKE S-U TARGET (LT) #555 Bulb 36	BIKE S-U TARGET (RT) #555 Bulb 37	RAMP S-U TARGET (LT) #555 Bulb 38	RAMP S-U TARGET (RT) #555 Bulb 39	SLIPPERY WHEN WET #555 Bulb 40
6: Q38 NOT USED RED-BLU J12-P6	RT RAMP GRN LIGHT #555 Bulb 41	RT RAMP YEL LIGHT #555 Bulb 42	RT RAMP RED LIGHT #555 Bulb 43	PATCH #555 Bulb 44	BIKERS BACK #555 Bulb 45	RED LIGHT MULTIBALL #555 Bulb 46	AUTO LAUNCH #555 Bulb 47	LITE MYST-ERY RIDER #555 Bulb 48
7: Q39 NOT USED RED-VIO J12-P8	RT ORBIT GRN LIGHT #555 Bulb 49	RT ORBIT YEL LIGHT #555 Bulb 50	RT ORBIT RED LIGHT #555 Bulb 51	NOT USED 52	NOT USED 53	NOT USED 54	NOT USED 55	NOT USED 56
8: Q40 NOT USED RED-GRY J12-P9	STOP LIGHT GRN LIGHT #44 Bulb 57	STOP LIGHT YEL LIGHT #44 Bulb 58	STOP LIGHT RED LIGHT #44 Bulb 59	NOT USED 60	NOT USED 61	NOT USED 62	NOT USED 63	NOT USED 64
9: Q41 NOT USED RED-WHT J12-P10	2 XTRA BALLS LT OUTLANE #555 Bulb 65	ADVANCE GEAR LT RETURN #555 Bulb 66	LITE MYSTERY... RT RETURN #555 Bulb 67	2 XTRA BALLS RT OUTLANE #555 Bulb 68	M-CYCLE HEADLIGHT #555 Bulb 69	RIDE AGAIN X2 #555 Bulb 70	MYSTERY RIDER #44 Bulb 71	NEXT CITY #44 Bulb 72
10: Q42 NOT USED RED J12-P11	NOT USED 73	NOT USED 74	NOT USED 75	NOT USED 76	NOT USED 77	NOT USED 78	NOT USED 79	NOT USED 80



Lamp Matrix Grid Locations

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

Legend Note:

☐ = Lamps mounted above playfield.

■ = Lamps mounted below playfield.

The following Lamps are not used:

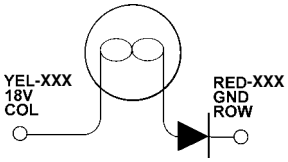
52 - 56 | 60 - 64 | 73 - 80

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

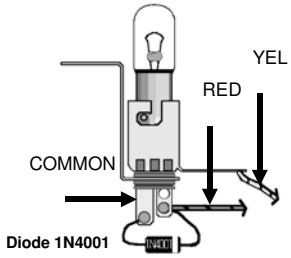
#555 Bulb (Wedge)
165-5002-00

#44 Bulb (Bayonet)
165-5000-44

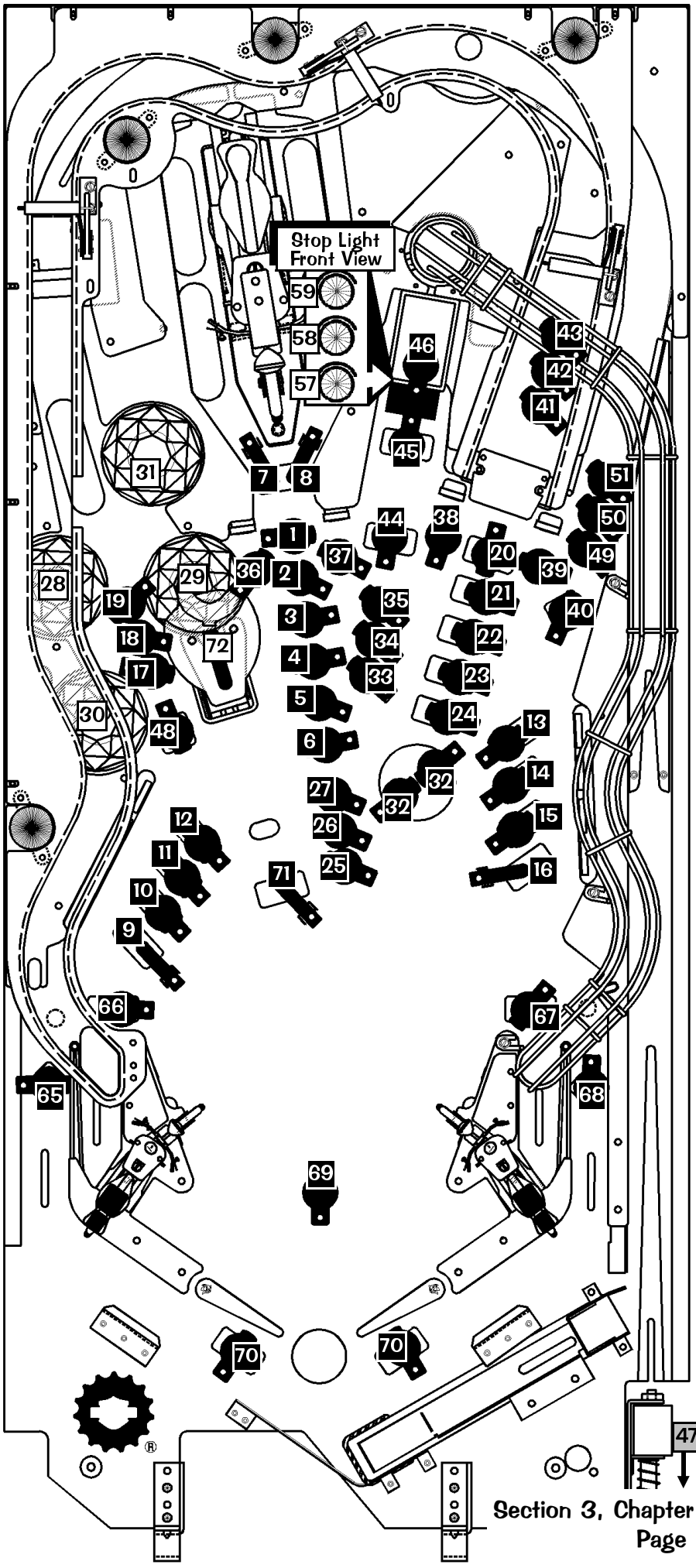
Typical Lamp Schematic



Typical Lamp Wiring



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



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: **Q25-Q32 (F1-F8)** and in this game Flash Lamp(s) are also in Position(s): **Q20**.

Important: The **Power Interlock Switch** must be pulled out for this Test to Function.

Clear Ball Trough

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

Technician Alert

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

Service Phone

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

Begin Play Test

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

Fire Knocker

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

Sound / Speaker Test

From the **DIAGNOSTICS MENU**, select the "SPKR" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The BSMT 2000 Sound System produces true digital stereo sound from Backbox & Cabinet Speakers or *"Mono"* on the Cabinet Speaker (when used by itself). After selecting this *Icon*, select the "-" or "+" *Icons* and press the **Black "ENTER" Button** to activate the first test. Repeat to visually see & hear all tests. Select the "RUN" *Icon* to activate the test chosen without moving to the next test. ***Note:*** *During Sound Tests, the display shows the speaker identification and the corresponding sound(s). The sound functions allow verification that both channels are functioning properly & that the speaker connections are correct.*

Sound / Speaker Test Continued Next Page

Speaker Phase Testing

Continued

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

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

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

Auto / Manual Tests	Sounds Produced
Speaker Test	**Tone**
Sound/OPSYS EPROM (Loc. U7)	**Level 1-3+ (Music Test)**
Voice ROMs: 1 (U17) 2 (U21) 3 (U36) & 4 (U37)	**Speech Pattern 1-4+**

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 and 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.
6. Illuminates all dots at 30%, 70% & 100% brightness.

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

Dot Matrix Display Explained

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

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

Harley-Davidson Specific (Motorcycle Test)

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

This will bring up the **HARLEY-DAVIDSON SPECIFIC MENU**. Similiar to "BEGIN PLAY TEST," this menu is used to test and adjust Game Specific Features. The feature in this game is **MOTORCYCLE TEST**.

Important: The **Power Interlock Switch** must be pulled out for this Test to Function.

This test is provided to allow the technician a simple method of removing the balls from the trough, to test the functionality of the trough (correct operation of the Kick-Out Coil & the Switch Membrane) and Motor Operation. After selecting the "H-D" *Icon* the display will indicate the position of the Motorcycle (***Motor Up, Switch 35***, and ***Motor Down, Switch 36***). *The position will be highlighted in the box.* The next line will indicate if any switch closures are present over the Switch Membrane in the Kick-Out Trough (***Sw. 44 (bottom)*** through ***Sw. 41 (top)***).

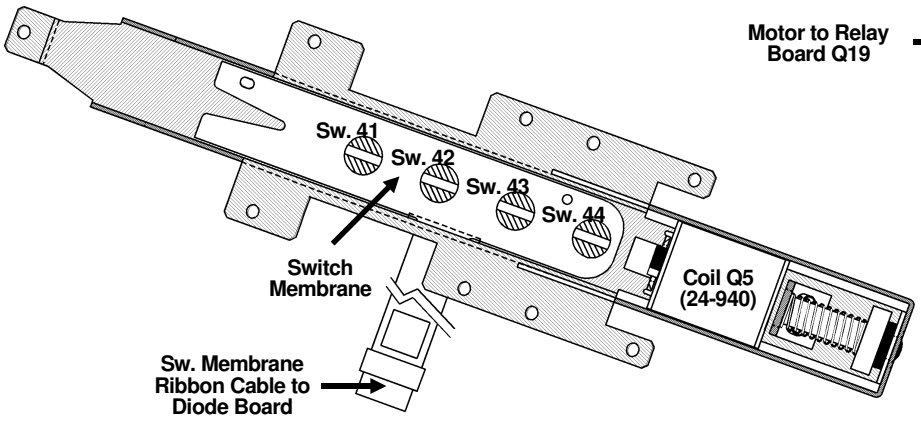
Motor Up/Down Test Procedure:

Select the "RUN" *Icon* to automatically bring the Motor & Trough from the **DOWN** or **UP** position to the opposite position. Select the "PULSE" *Icon* to move the motor slowly **UP and/or DOWN** one pulse at a time. This test allows you to operate the Motor on this mechanism which is controlled by a **Relay** driven by **Q19** on the I/O Power Driver Board for the purpose of troubleshooting.

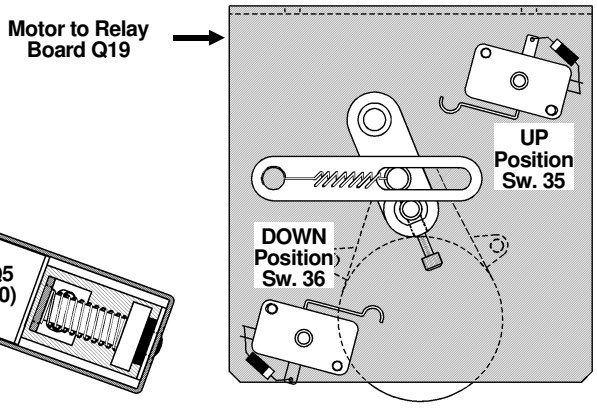
Switch & Ball Eject Test Procedure:

Hand-Roll 1 ball at a time into the trough (with the Motorcycle in the **UP** position). Watch the display and note that each box is high-lighted from left to right as the balls are inserted. *This test indicates proper Switch Membrane function* (***Switch 44*** is the first ball in (bottom) and ***Switch 41*** being the last (4th) ball in (top). To eject the balls and to test the **Motorcycle Ball Launch** (**Coil Q5**), press the **"AUTO LAUNCH" Button** (Cabinet Front Right Side). The 4 boxes should become unhighlighted indicating "no balls are in the trough".

Kick-Out Trough Assembly, 500-6397-00-67



Lift (Motor) Assembly, 500-6396-00-67



You may wish to activate the "RUN" *Icon* to bring the Motorcycle back into the **DOWN** position. If exiting **Portals**™ without doing so, the Motorcycle will automatically return to the **DOWN** position upon Game Reset.

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 question is being asked on the Display. Select "YES" or "NO" to answer 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.

HARLEY-DAVIDSON

GAME AUDIT TABLE

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

STERN PINBALL, INC.

Earnings Audits 1-12

EARN

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

S.P.I. Audits 13-55

S.P.I.

	Audit Name	Fill-In		Audit Name	Fill-In		Audit Name	Fill-In
13	TOTAL BALLS PLAYED		28	20M—49.9M SCORES		43		
14	TOTAL EXTRA BALLS		29	50M—69.9M SCORES		44		
15	EXTRA BALL PERCENT		30	70M—99.9M SCORES		45		
16	REPLAY 1 AWARDS		31	100M—129.9M SCORES		46		
17	REPLAY 2+ AWARDS		32	130M+ SCORES		47		
18	TOTAL REPLAYS		33	AVERAGE SCORES		48		
19	REPLAY PERCENT		34	SERVICE CREDITS		49		
20	TOTAL SPECIALS		35	BALL SEARCH STARTED		50		
21	SPECIAL PERCENT		36	LOST BALL FEEDS		51		
22	TOTAL MATCHES		37	LOST BALL GAME STARTS		52	LEFT FLIPPER USED	
23	HIGH SCORE AWARDS		38	LEFT DRAINS		53	RIGHT FLIPPER USED	
24	HIGH SCORE PERCENT		39	CENTER DRAINS		54	USA 8 BONUS USED	
25	TOTAL FREE PLAYS		40	RIGHT DRAINS		55		
26	TOTAL PLAYS		41	SLAM TILTS				
27	0—19.9M SCORES		42	TOTAL BALLS SAVED				

Harley-Davidson Audits 56-99 (All Audits Subject to Change)

H-D

	Audit Name	Fill-In		Audit Name	Fill-In		Audit Name	Fill-In
56	LEFT ORBITS		72	MBALL RESTARTED		88	NEXT CITY COMPLETED	
57	RIGHT ORBITS		73	MBALL JACKPOTS		89	CITIES AWARDED	
58	RIGHT RAMP SHOTS		74	SUPER JACKPOTS LIT		90	SPEED POPS	
59	HARLEY OPTO SHOTS		75	SUPER JACKPOTS		91	MYSTERY LIT	
60	LEFT SCOOP SHOTS		76	REDLITE MBALL STARTED		92	MYSTERY AWARDED	
61	SUPER VUK SHOTS		77	REDLITE JACKPOT		93	PATCH LIT	
62	POP BUMPER HITS		78	REDLITE SUPER JPOT		94	PATCHES COLLECTED	
63	STAND-UP TARGETS HIT		79	SPEEDOMETER MBALL		95	MILW. MBALL STARTED	
64	LIVE TARGETS HIT		80	SPEEDOMETER JACKPOT		96	MILWAUKEE COMPLETED	
65	LIVE TARGETS COMP.		81	SKILL AWARD 1		97		
66	RIDE TARGETS HIT		82	SKILL AWARD 2		98		
67	RIDE TARGETS COMP.		83	SKILL AWARD 3		99		
68	HARLEY MBALL READY		84	SKILL AWARD 4			***CPU Version:***	
69	HARLEY MBALL STARTED		85	VIDEO MODE STARTED			***Display Version:***	
70	2+ MBALL STARTS		86	VIDEO MODE COMPLETED			***Date Audited:***	
71	MBALL RESTART LIT		87	NEXT CITY LIT			***Audited By:***	

Location:

Go To Audits Menu

Overview

The **Portals™ Service Menu System** provides **99** Audit Functions for accounting purposes and for evaluation of *Game Difficulty Adjustments*. The Audit Functions are divided into 3 groups: 1st— **Earnings (Coin) Audits**, are the first 12 most-used Audits; 2nd— **S.P.I. Audits**, are the Game Play Generic Audits **13-55**; 3rd— **Harley- Davidson Audits**, are the Game Play Specific Audits 56-99; Audits left open (blank space in gray, e.g. Audits 43-51, 54 & 55, 97-99) 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. Copy page to fill-in important audit information as required.

GO TO AUDITS MENU

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

Important Notes:

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

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

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

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

Earnings Audits (1-12)

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

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

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

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

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

S.P.I.Audits Continued.

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

Harley-Davidson Audits (56-99) (Subject to Change)

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

Au. Nº	Audit Name	Audit Definition
Au. 56	Left Orbits	Provides the total number of times this feature was completed. †
Au. 57	Right Orbits	Provides the total number of times this feature was completed. †
Au. 58	Right Ramp Shots	Provides the total number of times this feature was completed. †
Au. 59	Harley OPTO Shots	Provides the total number of times OPTO Switch 37 was closed.
Au. 60	Left Scoop Shots	Provides the total number of times Scoop Switch 46 was closed.
Au. 61	Super VUK Shots	Provides the total number of times SVUK Switch 45 was closed.
Au. 62	Pop Bumper Hits	Provides the total number of times this feature was completed. †
Au. 63	Stand-Up Targets Hit	Provides the total number of times Stand-Up Switches 29-32 were closed.
Au. 64	Live Targets Hit	Provides the total number of times Left 4-Bank Switches 17-20 were closed.
Au. 65	Live Targets Completed	Provides the total number of times this feature was completed. †
Au. 66	Ride Targets Hit	Provides the total number of times Right 4-Bank Switches 21-24 were closed.
Au. 67	Ride Targets Completed	Provides the total number of times this feature was completed. †
Au. 68	Harley MBall Ready	Provides the total number of times this feature was ready (lit) awaiting Multiball. † ‡
Au. 69	Harley MBall Started	Provides the total number of times Harley Multiball was played. †
Au. 70	2+ MBall Starts	Provides the total number of times Multiball was played more than once by a single player in one game. †
Au. 71	MBall Restart Lit	Provides the total number of times Multiball was played and no Jackpots were collected. ‡

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

Audit Name		Audit Definition
Au. 72	MBall Restarted	Provides the total number of times Multiball was restarted after Multiball Restart was lit. ‡
Au. 73	MBall Jackpots	Provides the total number of times this feature was awarded. †
Au. 74	Super Jackpots Lit	Provides the total number of times this feature was lit. ‡
Au. 75	Super Jackpots	Provides the total number of times this feature was awarded. †
Au. 76	Redlite MBall Started	Provides the total number of times Redlite Multiball was played. †
Au. 77	Redlite Jackpot	Provides the total number of times this feature was awarded. †
Au. 78	Redlite Super Jackpot	Provides the total number of times this feature was awarded. †
Au. 79	Speedometer MBall	Provides the total number of times Speedometer Multiball was played. †
Au. 80	Speedometer Jackpot	Provides the total number of times this feature was awarded. †
Au. 81	Skill Award 1	Provides the total number of times this feature was awarded. †
Au. 82	Skill Award 2	Provides the total number of times this feature was awarded. †
Au. 83	Skill Award 3	Provides the total number of times this feature was awarded. †
Au. 84	Skill Award 4	Provides the total number of times this feature was awarded. †
Au. 85	Video Mode Started	Provides the total number of times this feature was started. †
Au. 86	Video Mode Completed	Provides the total number of times this feature was completed. †
Au. 87	Next City Lit	Provides the total number of times this feature was lit. ‡
Au. 88	Next City Completed	Provides the total number of times this feature was completed. †
Au. 89	Cities Awarded	Provides the total number of times this feature was awarded. †
Au. 90	Speed Pops	Provides the total number of times this feature (Super Pops) was started. †
Au. 91	Mystery Lit	Provides the total number of times this feature was lit. ‡
Au. 92	Mystery Awarded	Provides the total number of times this feature was awarded. †
Au. 93	Patch Lit	Provides the total number of times this feature was lit. ‡
Au. 94	Patches Collected	Provides the total number of times this feature was awarded. †
Au. 95	Milwaukee MBall Started	Provides the total number of times Milwaukee Multiball was played. †
Au. 96	Milwaukee Completed	Provides the total number of times this feature was completed. †
Au. 97-Au. 99		At time of printing, these audits are ***Not Used***, allowing for ***Future Expansion***, if any.

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

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

Au.

Au.

Au.

Au.

Au.

Au.

Au.

Au.

Au.

Go To Printer Menu

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

☞ Special equipment is required for this Sub-Menu

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

Quick Printout (Printer Interface)

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

Full Printout (Alison Interface Program)

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

GAME ADJUSTMENT TABLE

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

S.P.I. Adjustments 1-48

	Adjustment Name	USA Default	Your Setting		Adjustment Name	USA Default	Your Setting
1	REPLAYS: FIXED/AUTO ‡	...10%...		25	DEFAULT HIGH SCORE #5	300,000,000	
2	REPLAY LEVELS ‡	1 ...		26	DEFAULT HIGH SCORE #6	275,000,000	
3	REPLAY AWARD	CREDIT		27	DEFAULT HIGH SCORE #7	250,000,000	
4	FREE GAME LIMIT	05		28	DEFAULT HIGH SCORE #8	225,000,000	
5	EXTRA BALL LIMIT	03		29	DEFAULT HIGH SCORE #9	200,000,000	
6	GAME DIFFICULTY ‡	MODERATE		30	DEFAULT HIGH SCORE #10	175,000,000	
7	GAME PRICING ‡	USA8		31	HSTD RESET COUNT	2,000	
8	RESET COIN AUDITS	NO		32	HIGH SCORE INITIALS	3 Initials	
9	RESET GAME AUDITS	NO		33	FREE PLAY	NO	
10	RESET HIGH SCORES	NO		34	CUSTOM MESSAGE	ON	
11	MATCH PERCENTAGE	9%		35	ATTRACT MODE MUSIC	ON	
12	BALLS PER GAME	03		36	FLASH LAMP POWER	NORMAL	
13	TILT WARNINGS	01		37	COIL PULSE POWER	NORMAL	
14	REPLAY BOOST	YES		38	KNOCKER VOLUME	NORMAL	
15	CREDIT LIMIT	30		39	MINIMUM GAME TIME	OFF	
16	ALLOW HIGH SCORES	YES		40	BKGRND MUSIC VOLUME	01	
17	HIGH SCORE #1 AWARDS	01		41	GAME RESTART	YES	
18	HIGH SCORE #2 AWARDS	00		42	EXTRA BALL PERCENTAGE	25%	
19	HIGH SCORE #3 AWARDS	00		43	BILL VALIDATOR	NO	
20	HIGH SCORE #4 AWARDS	00		44	TOURNAMENT MODE	NONE	
21	DEFAULT HIGH SCORE #1	400,000,000		45	EURO. TOKEN DISP.	OFF	
22	DEFAULT HIGH SCORE #2	375,000,000		46	SPECIAL MEMORY	YES	
23	DEFAULT HIGH SCORE #3	350,000,000		47	LOCATION ID	00	
24	DEFAULT HIGH SCORE #4	325,000,000		48	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.*

Harley-Davidson Adjustments 49-55

	Adjustment Name	USA Default	Your Setting		Adjustment Name	USA Default	Your Setting
49	EXTRA BALL MEMORY	ON		53	UK POST SAVE ENABLED	NO	
50	HARLEY MBALL RESTART	MODERATE		54	UK COIN MECH. TYPE	CURRENT:	
51	HARLEY MBALL CRITERION	MODERATE		ADJ. (53) CAN ONLY BE ADJUSTED IF THE GAME HAS THE UK EPROM INSTALLED (UK ONLY). ADJ. (54) CAN ONLY BE ADJUSTED IF USING UK DIP SWITCH OPTION SETTING 2.			
52	MOTORCYCLE ENABLED	YES		55	SPEEDOMETER CRITERION	MODERATE	

Go To Adjustments Menu

Overview

The **Portals™ Service Menu System** provides 55 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: 1st— **S.P.I. Adjustments**, are the Game Play Generic Adjustments (1-48); 2nd— **Harley-Davidson Adjustments**, are the Game Play Specific Adjustments (49-55); 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 Section 3, Chapter 1, Portals™ Service Menu Introduction).* 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**.

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 "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 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 (1-48)

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

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

Adjustment Name	Adjustment Definition

Adj. 6 Game Difficulty

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

Adjustments which change when set to:	Extra Easy	Easy	Moderate	Hard	Extra Hard
(49) Extra Ball Memory	ON	ON	ON	ON	OFF
(50) Harley MBall Restart	EXTRA EASY	EASY	MODERATE	HARD	EXTRA HARD
(51) Harley MBall Criterion	EXTRA EASY	EASY	MODERATE	HARD	EXTRA HARD
(55) Speedometer Criterion	EXTRA EASY	EASY	MODERATE	HARD	EXTRA HARD

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

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

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

Adj.	*Adjustment* Name	*Setting*	*Adj.*	*Adjustment Name*	*Setting*
1	Replays: Fixed/Manual	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/Manual	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 **USA8** *(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.

Go To
Adjustments Menu

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 Switch Pulses Required 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¢ 1/25¢ 5/$1.00 1/25¢ 6/$1.00	01 01 05	04 04 20	01 01 05	00 00 00	01 01 04	02 04 20	00 00 00	01 01 01
5*SCH*	10*SCH*	10*SCH*	N/U	1/10 S 1/10 S 4/30 S	01 04	02 08	02 08	00 00	02 06	00 00	00 00	00 00
10*p*	50*p*	£1	20*p*	1/30*p* 2/50*p* 5/£1 1/50*p* 3/£1 1/30*p* 4/£1	01 01 01	06 05 05	15 15 12	02 02 02	03 05 03	00 00 00	00 00 00	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)			
	USA1	25¢	$1.00	25¢		1 /25¢			
	USA2	25¢	$1.00	25¢		1 /50¢	2 /75¢	3 /$1.00	
	USA3	25¢	$1.00	25¢		1 /50¢			
Pos. 1 2 3 4 5 6 7 8	USA4	25¢		25¢		1 /50¢			
ON	USA5	25¢	$1.00	25¢		1 /50¢	5 /$2.00		
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼	USA6	25¢	$1.00	25¢		1 /50¢	2 /'4 X 25¢'	3 /$1.00 Bill ← Used to promote the Bill Validator	
	USA7	25¢	$1.00	25¢		1 /50¢	4 /$1.50	6 /$2.00	
	USA8 (Default)	25¢	$1.00	25¢		1 /50¢	3 /$1.00		

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)			
		Please Note: for all USA Settings, see previous page (bottom).							
Pos. 1 2 3 4 5 6 7 8 / ON / OFF ▲ ▼ ▼ ▼ ▼ ▼ ▼ ▼	Austria †	5S	10S	10S		1 /10S	2 /15S	3 /20S	
Pos. 1 2 3 4 5 6 7 8 / ON	Australia 1 ‡	20¢	$A 1	$A 2		1 /$A 1	3 /$A 2		
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼	Australia 2 ‡	20¢	$A 1	$A 2		1 /$A 1			
Pos. 1 2 3 4 5 6 7 8 / ON ▲ / OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼	Belgium †	5 BF	20 BF	50 BF		1 /20 BF	3 /50 BF		
		This country uses unique Tokens and/or Debit Cards *only* (pricing varies).							
Pos. 1 2 3 4 5 6 7 8 / ON ▲ ▲ / OFF ▼ ▼ ▼ ▼ ▼ ▼	Brazil †	1 'coin'	4 'coins'	1 'coin'		1 /'2 coins'			
Pos. 1 2 3 4 5 6 7 8 / ON ▲ ▲ / OFF ▼ ▼ ▼ ▼ ▼ ▼	Canada †	25¢	25¢	Can$ 1		1 /50¢	2 /75¢	3/ Can$ 1	
Pos. 1 2 3 4 5 6 7 8 / ON / OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼	Denmark 1 ‡	1 DKr	5 DKr	10 DKr	20 DKr	1 /3 DKr	2 /5 DKr		
	Denmark 2 ‡	1 DKr	5 DKr	10 DKr	20 DKr	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		
	France 1 †	1 Fr	5Fr	10 Fr	20 Fr	1 /3 Fr	2 /5 Fr	5 /10 Fr	11 /20 Fr
Pos. 1 2 3 4 5 6 7 8 / ON ▲ ▲ / OFF ▼	France 2	1 Fr	5 Fr	10 Fr	20 Fr	1 /5 Fr	3 /10 Fr	7 /20 Fr	
	France 3	1 Fr	5 Fr	10 Fr	20 Fr	1 /3 Fr	2 /5 Fr	4 /10 Fr	9 /20 Fr
	Germany 1	1 DM	2 DM	5 DM		1 /1 DM	6/'1 X 5 DM'		
Pos. 1 2 3 4 5 6 7 8 / ON ▲ ▲ ▲ / OFF ▼	Germany 2	1 DM	2 DM	5 DM		1 /2 DM	2 /3 DM	3 /4 DM	4 /5 DM
	Germany 3 †	1 DM	2 DM	5 DM		1 /2 DM	2 /3 DM	3 /4 DM	5 /5 DM
	Germany 4	1 DM	2 DM	5 DM		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	500 Lit		500 Lit		1 /1000 Lit	3 /2000 Lit		
Pos. 1 2 3 4 5 6 7 8 / ON ▲ / OFF ▼ ▼	Japan 1 †			100¥		1 /100¥			
	Japan 2			100¥		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.		
Pos. 1 2 3 4 5 6 7 8 / ON ▲ / OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼	Netherlands 2 †	1 Fls.	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 ‡	$NZ 1		$NZ 2		1 /$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	10 NKr	5 NKr	20 NKr		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 SKr	5 SKr	10 SKr		1 /5 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 SwF	2 SwF	5 SwF		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	10p	50p	£1	20p	4 /£1	8 /£2		
Dip Switch Setting for New 50p / £2:	UK 3	10p	50p	£1	20p	1 /50p	2 /£1	5 /£2	
Pos. 1 2 3 4 5 6 7 8 / ON ▲ ▲ ▲ / OFF ▼ ▼ ▼ ▼ ▼	UK 4	10p	50p	£1	20p	1 /30p	2 /60p	3 /90p	4 /£1
	UK 5	10p	50p	£1	20p	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	10p	50p	£1	20p	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 **9%**. At **0**% the match display occurs at the end of the game but never awards a credit.
Adj. 12	**Balls Per Game**	Set between **02 - 05**. Default is **03**. Adjusts the number of balls per game.
Adj. 13	**Tilt Warnings**	Set to **00**, **01** or **03**. Default is **01**. Adjusts the number of plumb bob tilt switch closures before the ball in play is tilted.
Adj. 14	**Replay Boost**	Set to **YES** or **NO**. Default is **YES**. When set to **YES**, exceeding a replay will set a temporary replay level for each time a replay level is surpassed. This new level will equal the previous replay level (when the replay was awarded) plus 50M for each following game, until the replays have all been played (then the previous level is resumed).
Adj. 15	**Credit Limit**	Set between **04 - 50**. Default is **30**. Adjusts the maximum number of credits that may be posted.
Adj. 16	**Allow High Scores**	Set to **YES** or **NO**. Default is **YES**. When set to **YES** if a player exceeds any 1 of the 4 High Scores, the player may receive an award (depending on Adj. 3, Replay Award). Set to **NO** to disable this feature. There are 10 High Scores that will allow the player to enter their initials (or name) (See Adj. 32, Initials), however, only the top 4 can receive an award if this adjustment is enabled.
Adj. 17	**High Score #1 Awards**	Set between **00 - 05**. Default is **01**. Adjusts the number of awards awarded for exceeding Level 1 *(the highest of the four (4) Levels).*
Adj. 18	**High Score #2 Awards**	Set between **00 - 03**. Default is **00**. Adjusts the number of awards awarded for exceeding Level 2.
Adj. 19	**High Score #3 Awards**	Set between **00 - 02**. Default is **00**. Adjusts the number of awards awarded for exceeding Level 3.
Adj. 20	**High Score #4 Awards**	Set between **00 - 01**. Default is **00**. Adjusts the number of awards awarded for exceeding Level 4.
Adj. 21	**Default High Score #1**	Set between **1,000,000 - 9,999,000,000** or **00** *(increments of 1M).* Default is **400,000,000**. Adjusts the desired ***High Score Level*** to which Level 1 may be achieved (not affected by **Adj. 31**).
Adj. 22	**Default High Score #2**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **375,000,000**. Adjusts the desired ***High Score Level*** to which Level 2 may be achieved (not affected by **Adj. 31**).
Adj. 23	**Default High Score #3**	Set between **1,000,000 - 9,999,000,000***0* or **00** *(increments of 1M).* Default is **350,000,000**. Adjusts the desired ***High Score Level*** to which Level 3 may be achieved (not affected by **Adj. 31**).
Adj. 24	**Default High Score #4**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **325,000,000**. Adjusts the desired ***High Score Level*** to which Level 4 may be achieved (not affected by **Adj. 31**).
Adj. 25	**Default High Score #5**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **300,000,000**. Adjusts the desired ***High Score Level*** to which Level 5 may be achieved (not affected by **Adj. 31**).
Adj. 26	**Default High Score #6**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **275,000,000**. Adjusts the desired ***High Score Level*** to which Level 6 may be achieved (not affected by **Adj. 31**).
Adj. 27	**Default High Score #7**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **250,000,000**. Adjusts the desired ***High Score Level*** to which Level 7 may be achieved (not affected by **Adj. 31**).

Adjustment Name		Adjustment Definition
Adj. 28	**Default High Score #8**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **225,000,000**. Adjusts the desired ***High Score Level*** to which Level 8 may be achieved (not affected by **Adj. 31**).
Adj. 29	**Default High Score #9**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **200,000,000**. Adjusts the desired ***High Score Level*** to which Level 9 may be achieved (not affected by **Adj. 31**).
Adj. 30	**Default High Score #10**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **175,000,000**. Adjusts the desired ***High Score Level*** to which Level 10 may be achieved (not affected by **Adj. 31**).
Adj. 31	**HSTD Reset Count**	Set between **100 - 9,900** or **OFF** *(increments of 100)*. Default is **2,000**. **HSTD** (**H**igh **S**core **T**o **D**ate). Adjusts the number of games between automatic resets of high score levels to backup settings and ball time averager adjustments. Set to **OFF** for "no reset or adjustment".
Adj. 32	**High Score Initials**	Set to **3 INITIALS** or **10 LETTER**. Default is **3 INITIALS**. When set to **3 INITIALS**, player is allowed only 3 initials to input. When set to **10 LETTER NAME**, player is allowed to enter 10 initials to input.
Adj. 33	**Free Play**	Set to **YES** or **NO**. Default is **NO**. When set to **YES**, no coins are required for *Game Play.*
Adj. 34	**Custom Message**	Set to **ON, CHANGE** or **OFF**. Default is **ON**. When set to **CHANGE** *(select the "+" Icon to change settings until "CHANGE" appears in the display, then select the ">>" Icon to access.) This adjustment can be accessed in two (2) ways by either selecting the "SEGA" Icon* and advancing to this **Adjustment 34**, or can be directly accessed by selecting the "ABCD CUST MSG" *Icon* in the **ADJUSTMENTS MENU**. ABCD CUST MSG View the definition at the end of this chapter under the **Custom Message** entry for the operation explanation.
Adj. 35	**Attract Mode Music**	Set to **ON** or **OFF**. Default is **ON**. When set to **ON**, attraction music / sounds are played between games.
Adj. 36	**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. 37	**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. 38	**Knocker Volume**	Set to **NORMAL, LOW** or **OFF**. Default is **NORMAL**. When set to **LOW**, the volume is decreased 50%. When set to **OFF**, no sound is heard when the "knocker" is sounded.
Adj. 39	**Minimum Game Time**	Set between **0:01** - **14:59** or **OFF** for minimum game time. Default is **OFF**. If the last ball in play drains prior to what the game time is set for, another ball will be served into the Shooter Lane and Normal Play will continue. Subsequent balls will continue to do be served into the shooter lane if the last ball still drains prior to and up until minimum game time is satisfied.
Adj. 40	**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. 41	**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. 42	**Extra Ball Percentage**	Set between **0% - 50%**. This adjustment allows the operator to adjust how frequently the ***Extra Ball Feature*** is made available to the player.

Adjustment Name		Adjustment Definition
Adj. 43	**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. 44	**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. 45	**Euro. Token Disp.**	Set to **ON** or **OFF**. Default is **OFF**. When set to **ON**, the operator can enable the **BRN/BRN-GRY Wires** *(out of the Main Cabinet Cable Harness, by bottom speaker)* to drive an external device (e.g. European Token Dispenser) without the game giving a replay. (Ref. **Coil #8** or **Q8**.)
Adj. 46	**Special Memory**	Set to **YES** or **NO**. Default is **YES**. When set to **YES**, the lit 'Special' light will be retained in memory from ball to ball for the same player. When set to **NO**, the lit 'Special' light will go out at the end of each ball.
Adj. 47	**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. 48	**Game ID**	Set between **00** to **9999**. Default is **00**. This adjustment allows the operator to assign a game identification number to the audit print-out sheet. *(Will not be affected by Factory Reset.)*

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

Harley-Davidson Adjustments (49-55)

From the **ADJUSTMENTS MENU**, select the "H-D" *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. 49	**Extra Ball Memory**	Set to **ON** or **OFF**. Default is **ON**. When set to **ON**, the lit 'Extra Ball' light will be retained in memory from ball-to-ball for the same player. When set to **OFF**, the lit 'Extra Ball' light will go out at the end of each ball.
Adj. 50	**Harley MBall Restart**	Set to **EXEASY, EASY, MODERATE, HARD** or **EXHARD**. Default is **MODERATE**. Determines how Harley Multiball can restart.
Adj. 51	**Harley MBall Criterion**	Set to **EXEASY, EASY, MODERATE, HARD** or **EXHARD**. Default is **MODERATE**. Determines how the Harley Multiball Feature is started and played.
Adj. 52	**Motorcycle Enabled**	Set to **YES** or **NO**. Default is **YES**. When set to **YES**, the Motorcycle Assembly Coil (**Motor Relay Q19**) is operational. When set to **NO**, the **Motor Relay Q19** is disabled. Use the **NO** setting if any of the following is/are malfunctioning or is awaiting service and/or repair: Motor Assembly (Relay Board) (Q19), Motor Up and/or Down Switches (35 & 36), Switch Membrane in the Motorcycle Trough (41-44) or Motorcycle Ball Launch (Q5).

Adjustment Name		Adjustment Definition
Adj. 53	**UK Post Save Enabled**	/////// **THIS ADJUSTMENT CAN ONLY BE ADJUSTED IF THE GAME HAS THE UK EPROM INSTALLED FOR UK SETTINGS** /////// 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. 54	**UK Coin Mech. Type**	/////// **THIS ADJUSTMENT CAN ONLY BE ADJUSTED IF THE GAME HAS THE UK EPROM INSTALLED FOR UK SETTINGS and HAS THE DIP SWITCH SETTING OPTION 2 SET (2, 3 & 4 ON)** /////// Set to **CURRENT: 2 POUND AT #5** if using a Coin Control Mech 74-1129-104**U** (latest version). Set to **OLD: 2 POUND AT #6** if using older version Coin Control Mech 74-1129-104. Default is **CURRENT: 2 POUND AT #5**.
Adj. 55	**Speedometer Criterion**	Set to **EXEASY, EASY, MODERATE, HARD** or **EXHARD**. Default is **MODERATE**. Determines how the Speedometer Multiball Feature is started and played.

Custom Message

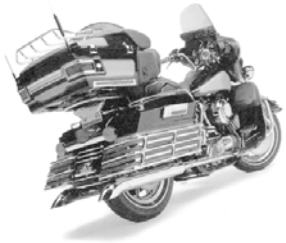
To go directly to ***Adjustment 34, Custom Message,*** from the **ADJUSTMENT MENU**, select the "CUST MSG" *Icon* either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. At the top left corner of the Display, the letter **A** is indicated (blinking) in the first available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

Film Star Reset

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

Take Note:

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



Go To Reset Menu

Overview

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

GO TO RESET MENU

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

Important Notes:

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

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

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

Reset Coin Audits

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

Reset Game Audits

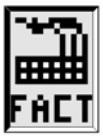
From the **RESET MENU**, select the "AUD" *Icon* with either **Red** or **Green Button** and press the **Black Button**. ⚠ All Game Audits (See **Fig. 2**) will be reset to Factory Settings. The display will indicate **REQUEST INSTALLED** and return to the **RESET MENU**. Game Audits can also be reset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

Fig. 1

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

Fig. 2

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

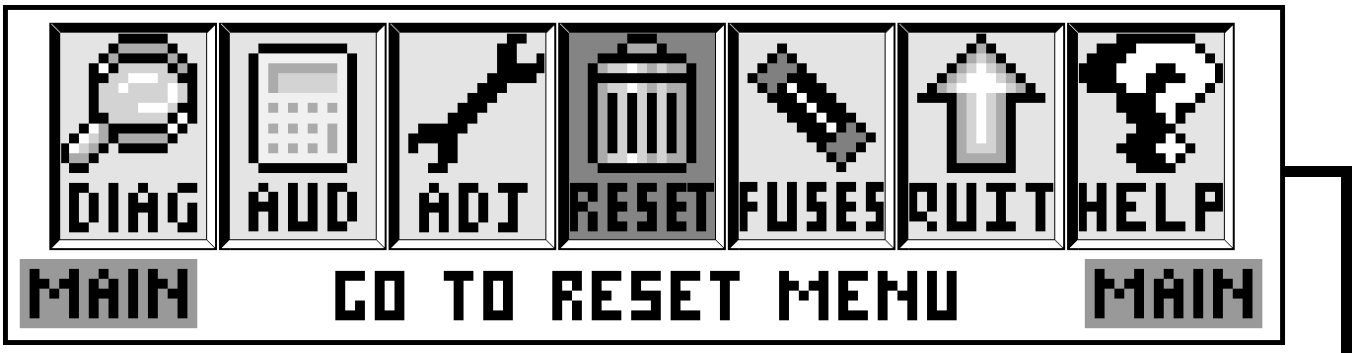


Factory Reset

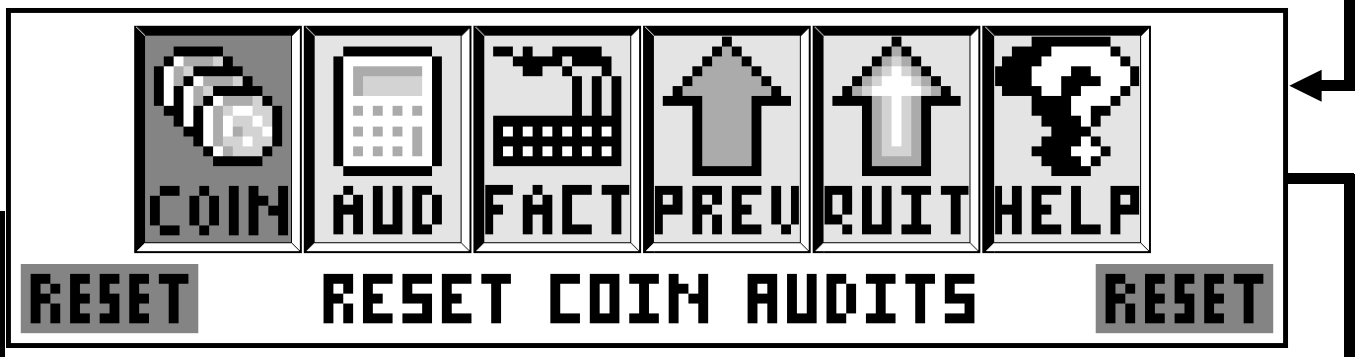
From the **RESET MENU**, select the "FACT" *Icon* with either **Red** or **Green Button** and press the **Black Button**. ⚠ All adjustments will be reset to *Factory Settings* (except for Proprietary Adjustments). The display will indicate **REQUEST INSTALLED** and exit the Service Session. See Chapter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

Example:

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



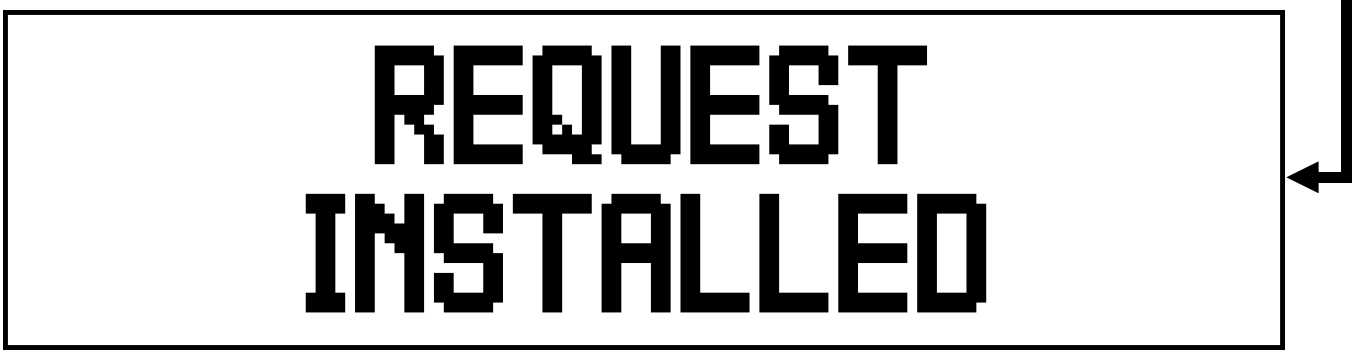
Press the **Black Button** to activate this **ICON**. This will bring up the **RESET MENU**.



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

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

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



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

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

Go To 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.

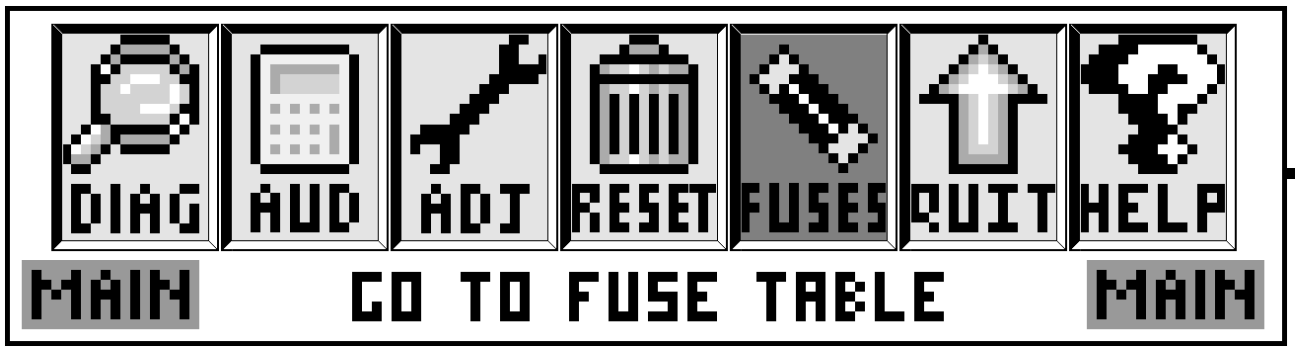
Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.

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.)

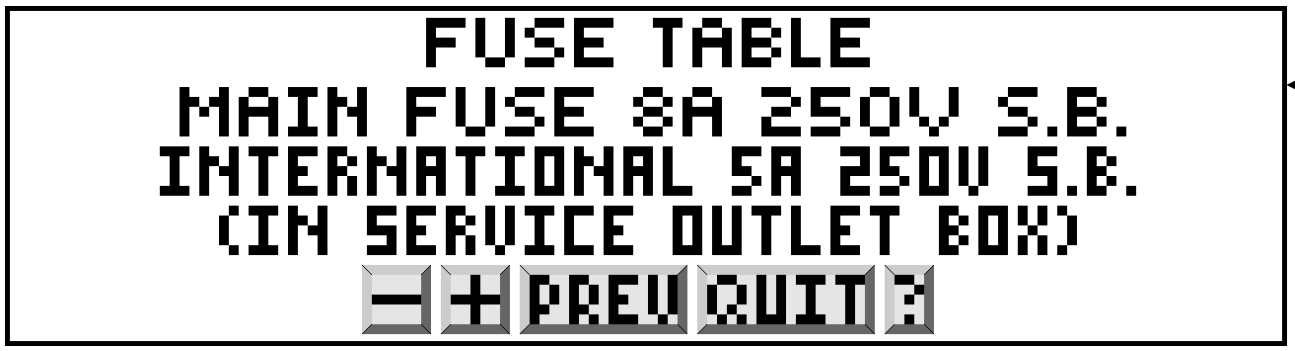
Selecting & activating the "+ " or "-" *Icons* selects the next or previous fuse in this group.

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

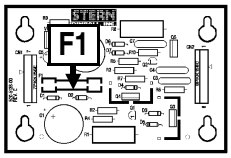
Backbox Fuses			
LOC:	**DISPLAY POWER SUPPLY (P.S.) BOARD**		
F1	¾A 250v S.B.	90v DC	High Voltage Display
LOC:	**I / O POWER DRIVER BOARD**		
F6	7A 250v S.B.	50v DC	Primary High Power Coils/Flippers
F7	5A 250v S.B.	20v DC	Low Power Coils
F8	5A 250v S.B.	12v DC	Logic Power
F9	5A 250v S.B.	12v DC	Logic Power
F20	4A 250v S.B.	50v DC	Magnet(s)
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)
LOC:	**SHAKER MOTOR BD. (Cabinet, Rt. Side Front)**		
F2	2½A 250v S.B.	12v DC	Shaker Motor
F3	2½A 250v S.B.	12v DC	Shaker Motor
Playfield (P/F) 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	Magnet (Top Orbit) (VIO-YEL⇆BLK)

*For locations & more information on fuses, see Sec. **5**, Chapter **2**.*

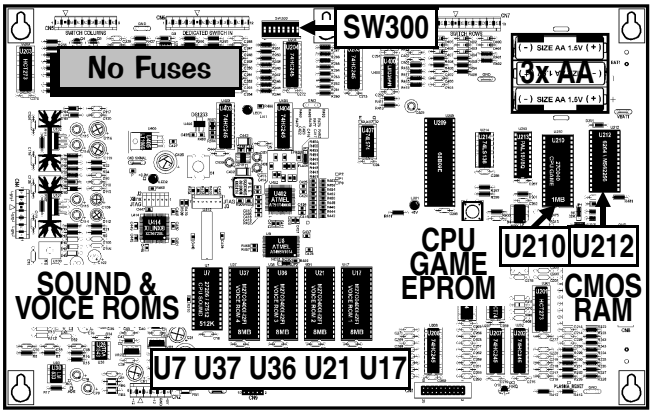
For Backbox & Cabinet General Parts, review Section 4, Chapter 1, Parts Identification & Location (The Pink Pages).
For Schematics and/or Component Parts on above Boards, review Section 5, Chapter 4, Printed Circuit Boards (The Yellow Pages).

Sec. 3: ... Fuse Table

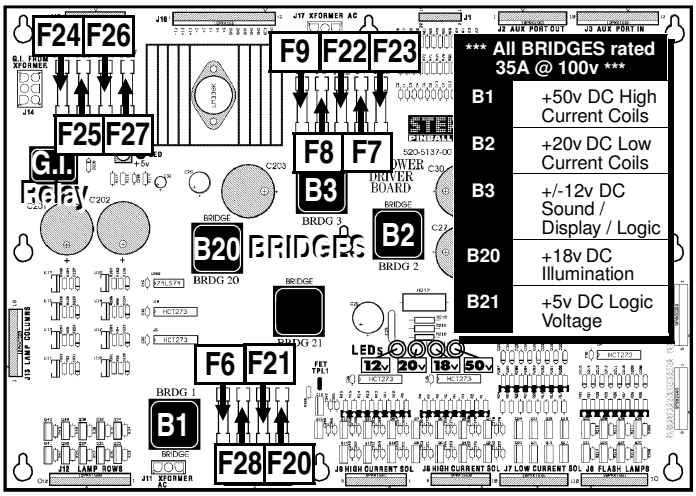
Display Power Supply Board



CPU/Sound Bd. II w/ATMEL

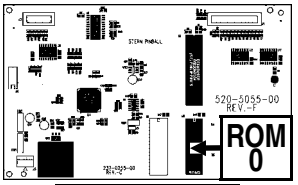


I/O Power Driver Board

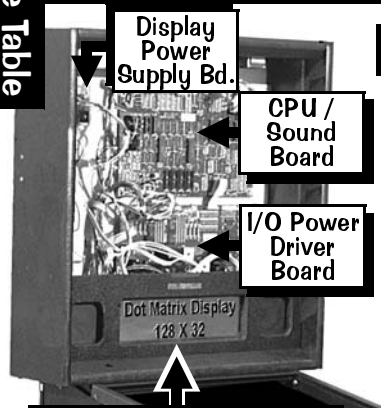


Display Controller Board

(Mounted behind the Dot Matrix Display)

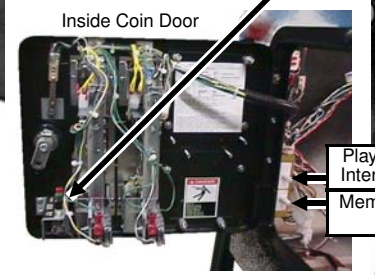


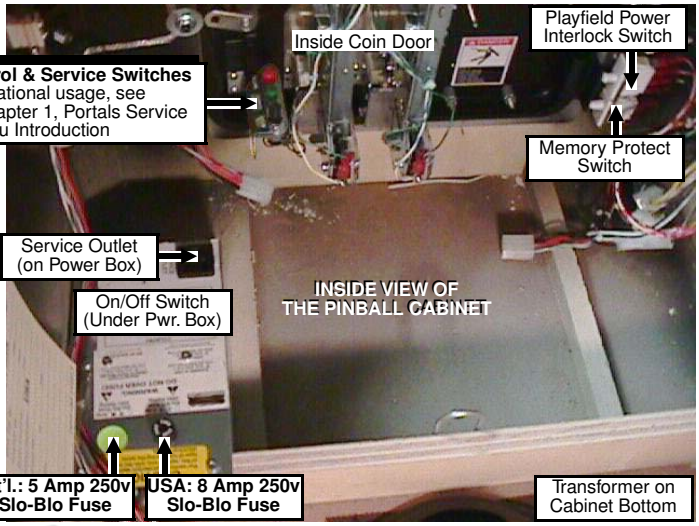
No Fuses



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

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





Go To Help Screen

Overview

The **Portals™ Service Menu System** provides help screens in each display (except if the display is in a testing mode). 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:

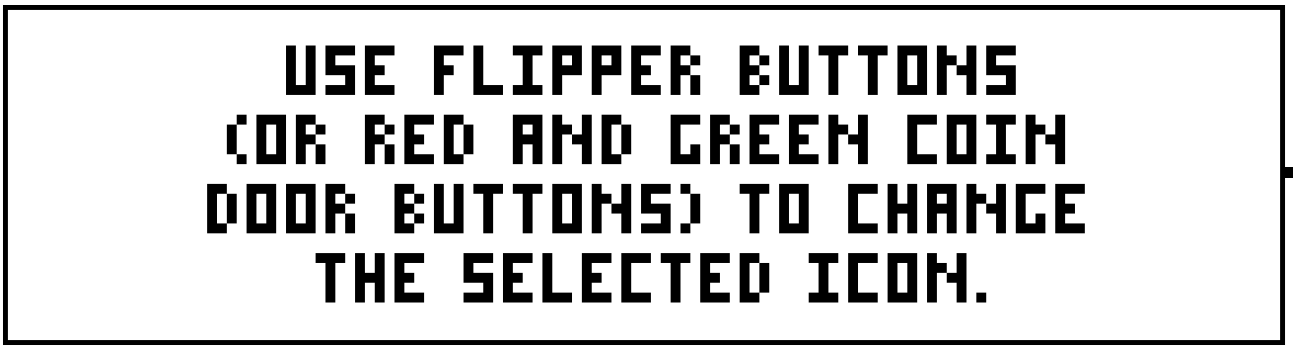
Exit any sub-menu and return to the **MAIN MENU** by selecting & activating the "PREV" *Icons*. If no *Icons* appear in the display because of a testing function or special display (e.g. "Help"), press any button to exit.

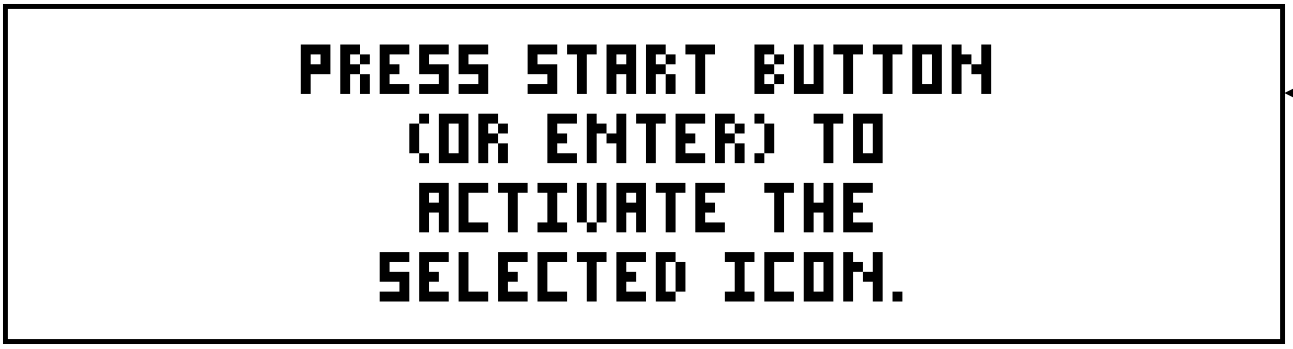
Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.

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.)

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:





Sec. 3: ...Help Screen

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.

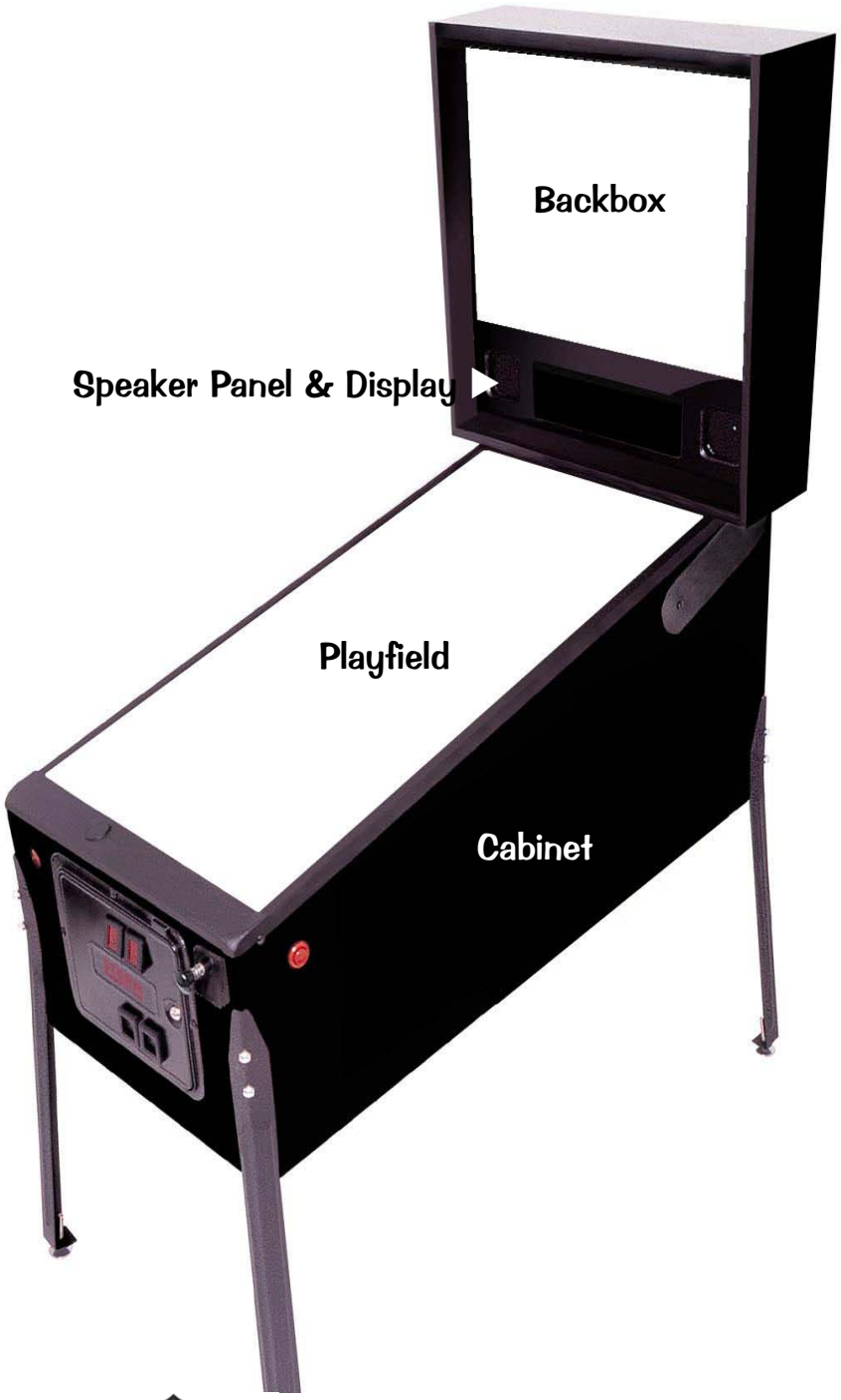
PROBLEM	SOLUTION
Will not enter the Service Mode after depressing the **Black "BEGIN TEST" Button**.	• Check the Service Switch(es) (**Red, Green & Black Buttons**) for loose connections or bad Ground. • Check the associated wiring harness to/from the CPU Board Connector CN6. • Check CPU Board, possibly 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

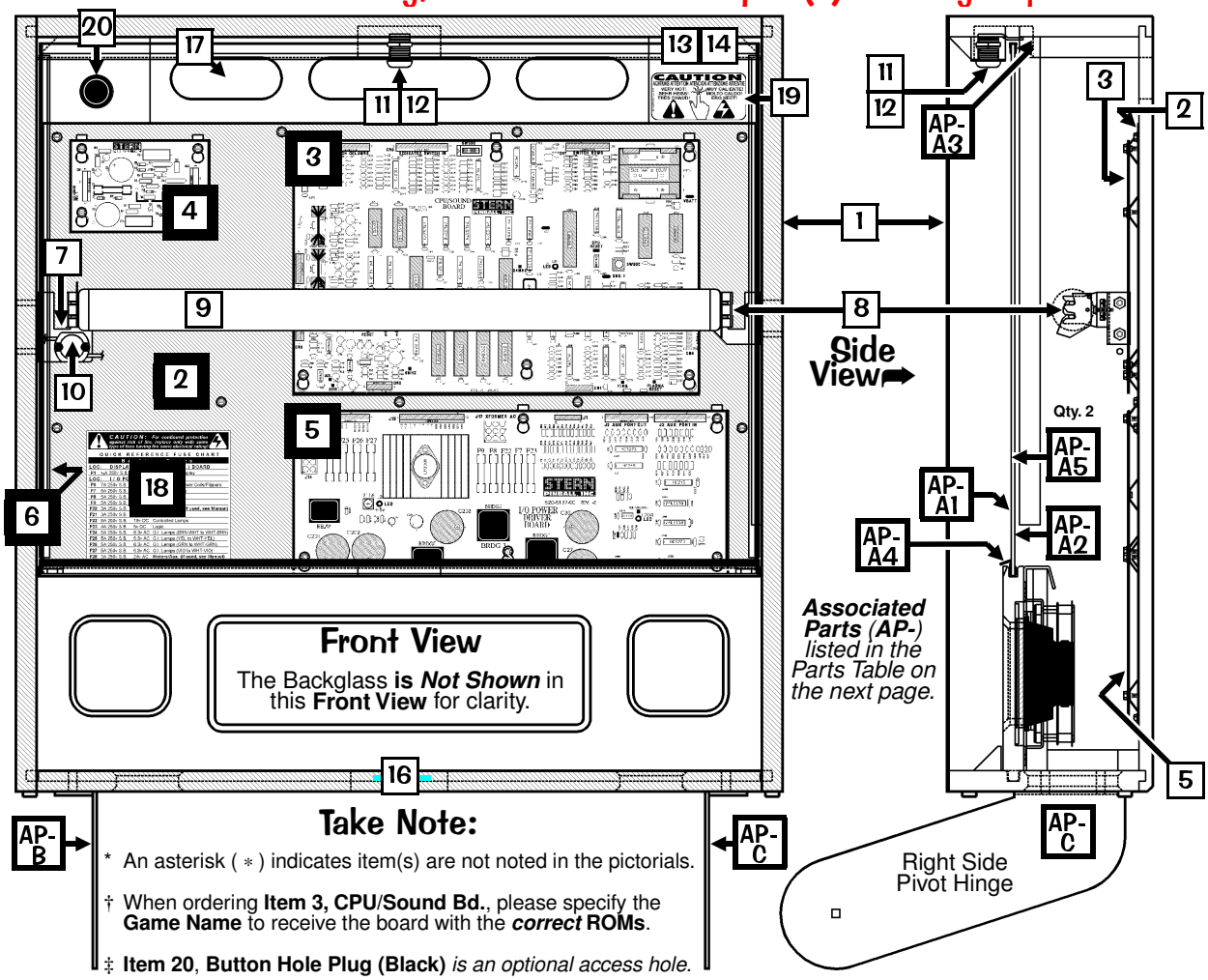
This section provides the Part Nºs and locations of all the components in this pinball machine. The parts are arranged in three groups: **BACKBOX**, **CABINET** & **PLAYFIELD**. Generic parts which may change as production continues (quantity and/or size) are listed together. Quantities greater than 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.

Section 4, Table of Contents



Harley-Davidson® Backbox Assembly, 505-6002-87-87 (Items 1-27)

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

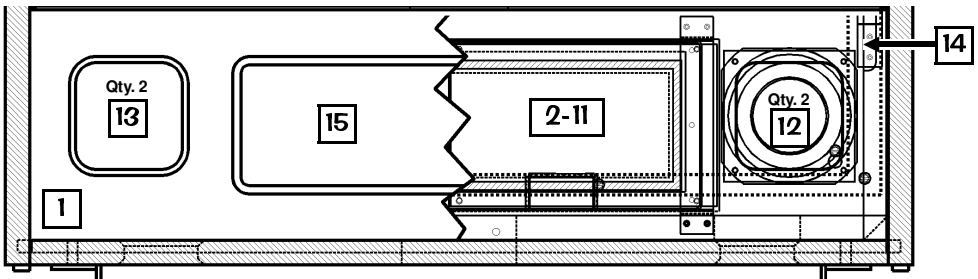


№	BACKBOX PART NAME	QTY.	SPI PART №
1	Backbox **HD3 Screened No Parts**	1	**525-5631-17-87**
	Item 1 Note: *Chrome T-Molding is installed and cannot be ordered separately.* Ist edition Black Molding (old style backbox) use : 525-5558-01		
2	PCB Metal Mounting Plate	1	535-5809-14
	Item 2 is secured to Item 1 by: #8 X 1/2" HWH 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)	1	520-5300-00
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	3X Trans. Drvr. Bd. **(UK/Special Apps. Only)**		520-5068-01
7	Fluorescent Light Bracket Assy. Left	1	515-6545-00
	For Individual Items use : Fluorescent Light Bracket Left (**535-7739-00**), Lamp Holder** (Self-Locking) (**077-5214-00**) **and** Starter Base *(with Leads)**** (**077-5213-00**).		
8	Fluorescent Light Bracket Assy. Right	1	515-6545-01
	For Individual Items use : Fluorescent Light Bracket Right (**535-7739-01**), Lamp Holder** (Self-Locking) (**077-5214-00**) **and** Starter Base *(with Leads)**** (**077-5213-00**). ** **secured by:** #6-32 X 5/8" PPH MS (Sems) Zinc (Qty. 1) (232-5203-00) *** **secured by:** #4-40 X 1/2" PPH MS (Sems) Zinc (Qty. 2) (237-5813-00)		
	Items 7 & 8 are secured to Item 1 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)		
9	Fluorescent Tube 24" (F18T8CW)	1	165-5061-00
10	Starter - Fluorescent (FS2 Light)	1	165-5011-01
11	Lock Mounting Plate	1	535-8128-01
12	Lock 5/8" Barrel, 3/4"ø, 1.5" Flat Cam	1	355-5055-00
	Items 11-12 are secured by: #8 X 5/8" TP Torx T20 (Qty. 4) (237-5947-00)		

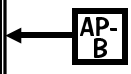
№	BACKBOX PART NAME	QTY.	SPI PART №
13	Ballast Mounting Plate	1	535-8657-00
14	Ballast *CU45Z-W 1/2" Core 120v 60 Hz 13W*	1	010-5015-00
	Ballast, EU / UK Only 5/8" Core 50/60 Hz		*010-5015-01*
	Items 13 & 14 are secured to Item 1 by: #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5102-04)		
15*	*#1 Roto Lock Male (on Cabinet)*	*1*	*355-5006-01*
16	#1 Roto Lock Female (R2-0002-02)	1	355-5006-02
	Item 16 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)		
17	Back Vent Grill 2-1/2" X 18"	1	545-5072-02
	Item 17 is secured by: Staple 5/16" (Qty. 24) (631-5000-00)		
18	Fuse Description Decal (Generic)	1	820-6152-02
19	"CAUTION - VERY HOT" Decal	1	820-6266-00
20‡	Button Hole Plug (Blk) **(Happ #52-6214-00)**	1	500-6566-00
21	Fuse Label (UL)	1	820-6143-00
22*	Backbox Date Label	1	820-5091-00
23*	Ribbon Cable, 20-Pin (4")	1	036-5000-04
	Item 23 (20-Pin) connects the *CPU/Sound Board to the I/O Power Driver Board.*		
24*	Ribbon Cable, 26-Pin (40")	1	036-5001-40
	Item 24 (26-Pin) connects *the CPU/Sound Board to the Display Controller Board.*		
25*	1/4" Clamp (Double)	2	040-5000-23
26*	1/2", 3/4" & 1" Clamp (Single)	9	040-5000-XX
	Items 25-26 are secured to Item 1 by: #8 X 1/2" HWH AB (Zinc) (Qty. 13) (234-5101-00) ***-XX Note:*** for **1/2"** use **-06** (Qty. 1); for **3/4"** use **-08** (Qty. 2); for **1"** use **-09** (Qty. 6)		
27*	Ground Strap (5") *(by Item 12)*	1	600-5006-05

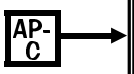
Speaker Panel Assy. for the Backbox, 515-6888-03-87 (Items 1-15) and Assoc. Parts: Backglass Assembly & Pivot Hinges (Left & Right) (Items AP-A - AP-C)

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



Front View
(Broken View)





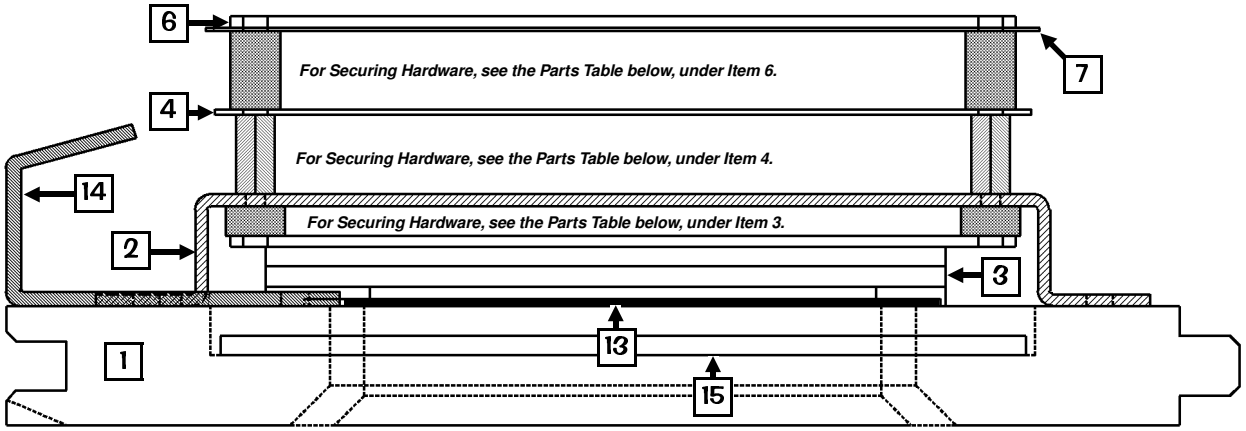
Take Note:

* 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).



№	SPEAKER PANEL PART NAME	QTY.	SPI PART №
1	Speaker Panel (Black Wood)	1	525-5515-00
2	Dot Matrix Disp. Bd. Mounting Bracket	2	535-8368-01
	Item 2 is secured to Item 1 by: #8 X 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 *(Chrome Plain)*	2	535-8081-04
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)		

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

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

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

№	ASSOC. BACKBOX PART NAME	QTY.	SPI PART №
AP-A	Backglass Assembly (Game № 67)	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	**H-D Film Art (#87)**	1	**830-5287-00**
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	626-5005-00 *(only 6" required)*
	Note: AP-A6 secures AP-A3--A5 to AP-A1		
AP-B	Chrome Pivot Hinge Left (3rd Ed.)	1	535-7999-**06**
AP-C	Chrome Pivot Hinge Right (3rd Ed.)	1	535-7999-**07**
	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 Zinc (Qty. 2) (231-5014-02), 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)		

Note: *Inside cabinet holes are covered by* ***BLACK MYLAR COVER DISCS (QTY. 2) (820-5041-00)*** *to hide securing hardware (AP-B & AP-C above) from player view.*

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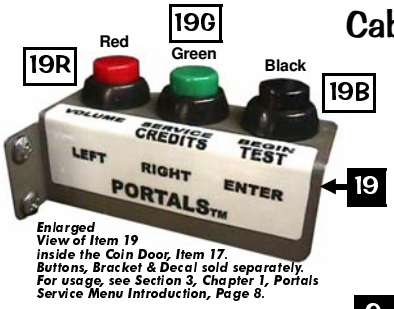
Cabinet - General Parts ■ & Switches □

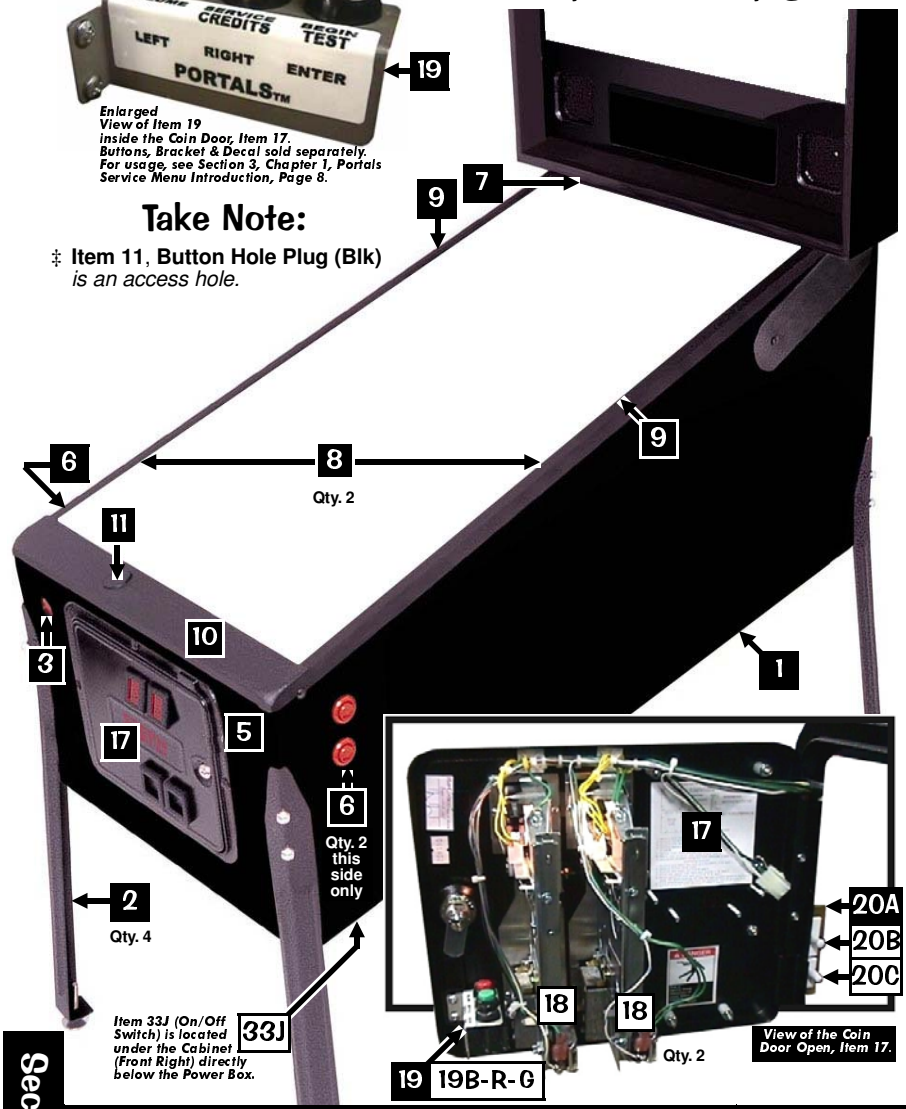


Enlarged View of Item 19 inside the Coin Door, Item 17. Buttons, Bracket & Decal sold separately. For usage, see Section 3, Chapter 1, Portals Service Menu Introduction, Page 8.

For Backbox Parts see the previous two pages.

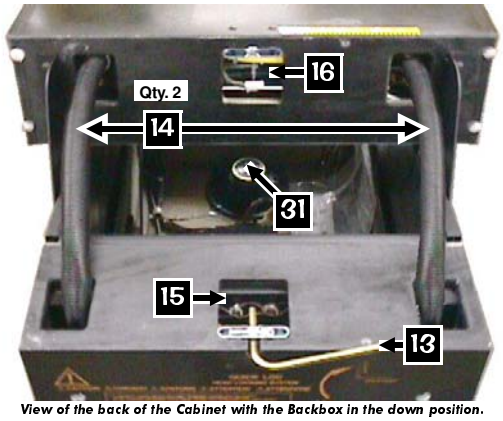
Take Note:

‡ **Item 11, Button Hole Plug (Blk)** *is an access hole.*

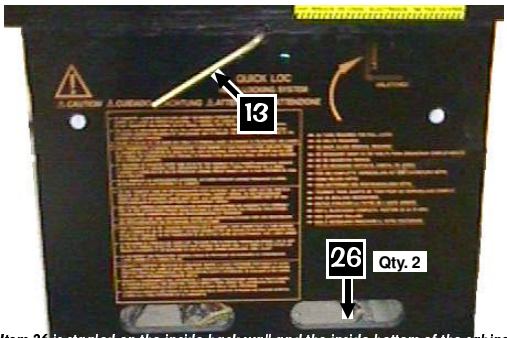


Item 33J (On/Off Switch) is located under the Cabinet (Front Right) directly below the Power Box.

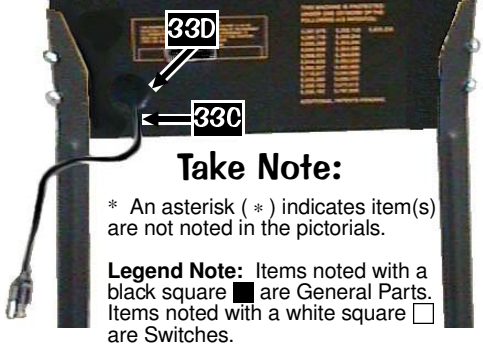
View of the Coin Door Open, Item 17.



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



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



Take Note:

* An asterisk (*) indicates 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	H-D3 Screened Cabinet (No Parts)	1	525-5395-15P-87
2	Chrome Leg & Leveler Assy. 3rd Ed.	4	500-5921-10
	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 Button Sw. Assy. (Red "Flipper" Style)	1	500-6090-02
	Item 3 includes the Switch.* FOR SWITCH ONLY *see Item 25 on the Next Page.		
4*	#555 Wedge Base Bulb (Clear)	1	165-5002-00
	Item 4 is included with Item 3, for just a replacement Bulb use the above number.		
5	Large Rd. Auto Launch Assy. Yellow	1	500-6121-06
6	Flipper Button (Red) Assy. **(Lt. X1/Rt. X2)**	3	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. (Left/Rt.)	2	545-5017-00
9	Chrome Side Armor 3rd Ed. (Lt./Rt.)	2	535-7297-05
	Item 9 is secured @ front by: Pem Stud 1/4 X 1" FH Zinc (Qty. 1/per) (237-6116-00) and 1/4-20 Flange Nut (Qty. 1/per) (240-5300-00); **@ center by:** #8 X 5/8" PPH AB Zinc (Qty. 2/per) (232-5101-00); **@ rear (backbox) by:** #10-24 X 1" Sq. Neck Carriage Bolt Zinc (Qty. 1/per) (231-5021-01) **and** #10-24 Hex Nut (Qty. 1/per) (240-5202-00)		
10	Front Molding - Chrome 3rd Ed.	1	500-5757-04
	Item 10 requires: Self-Adhesive Foam Rubber 3/8" X 3/1[illegible] X 20-3/8" (626-5001-00).		
11‡	Button Hole Plug *(Chrome)*	1	500-6566-02
12*	P/F Glass (Tmprd.) 21" X 43" X 3/16"	1	660-5001-00

№	CABINET PART NAME	QTY.	SPI PART №
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.		
15	#1 Roto Lock Male (R2-0055-02)	1	355-5006-01
	Item 15 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	*#1 Roto Lock Female (on Backbox)*	*1*	*355-5006-02*
17	Coin Door (with Validator) USA only	1	500-5018-172
	Item 17 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 №.*		
18	Coin Door Switch (USA)	2	180-5024-00
	FYI: Coin Door Switch (¥ Japan)	0	180-5091-00
19	Bracket for below Portals™ Switches	1	535-6860-03
19B	Push-Button Portals™ Switch (Black)	1	180-5192-00
19R	Push-Button Portals™ Switch (Red)	1	180-5192-02
19G	Push-Button Portals™ Switch (Green)	1	180-5192-04
	Ordering Note: Securing hardware for switches included. For Decal, see Page 55.		
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" HWH AB (Zinc) (Qty. 2) (234-5101-00)		

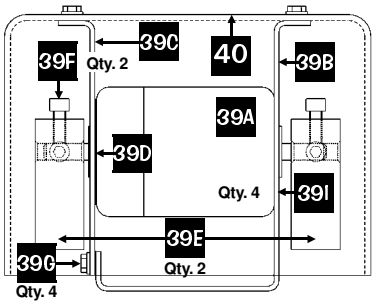
<UPDATED AFTER MANUAL PRINTING> 111804

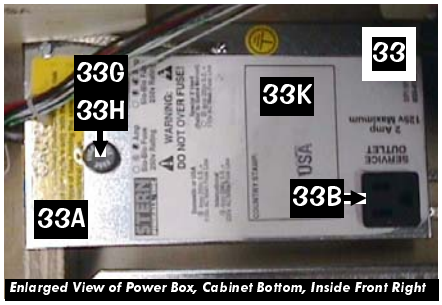
Cabinet - General Parts ■ & Switches □ Continued

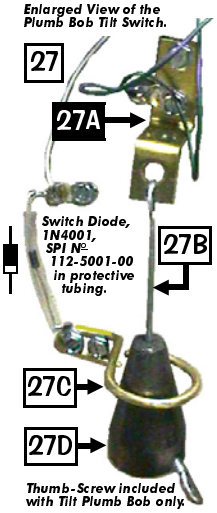
BREAKDOWN OF ITEM 39, SHAKER MOTOR ASSEMBLY:

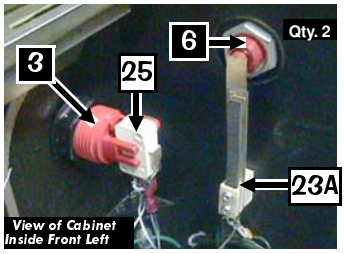
ORDERING 515-5893-01 WILL INCLUDE:

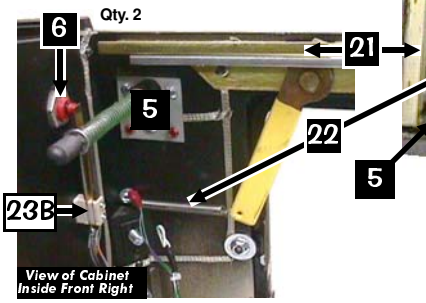
39A Shaker Motor 10.5v DC 2950 RPM CW (Qty. 1) (041-5029-**01**)
39B Shaker Motor Mounting Bracket (Qty. 1) (535-6711-**01**)
39C Shaker Motor Leg Bracket (Qty. 1) (535-6711-**02**)
39D Insulator (Qty. 1) (545-5425-00)
39E Shaker Motor Weight (Qty. 2) (535-6727-**01**)
39F #10-32 X 5/8" Lg. Soc. Set Screw (Qty. 2) (237-5911-00)
39G #8-32 X 1/4" HWH MS (Taptite) (Qty. 4) (237-5964-01)
39H* Capacitor - Tecate .1 MFD 500v (Qty. 1) (130-5000-00)
39I* M5X.8X8MM PHMS w/Patch (Qty. 4) (237-6014-00)

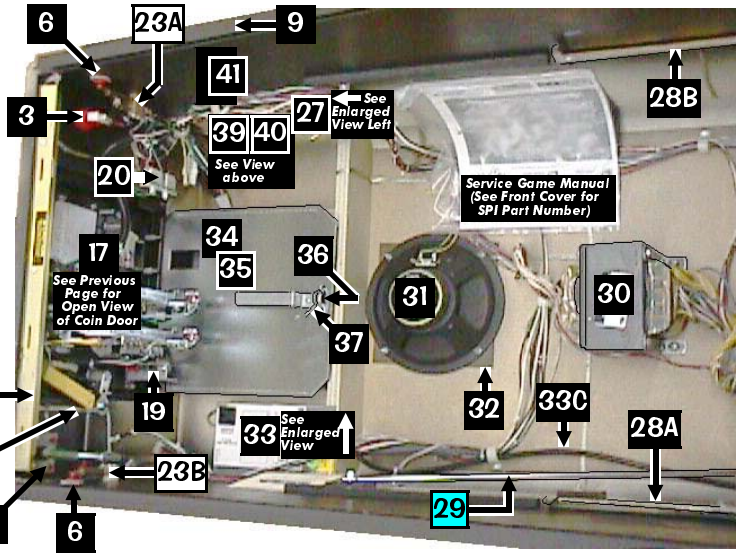












Take Note:

* 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.

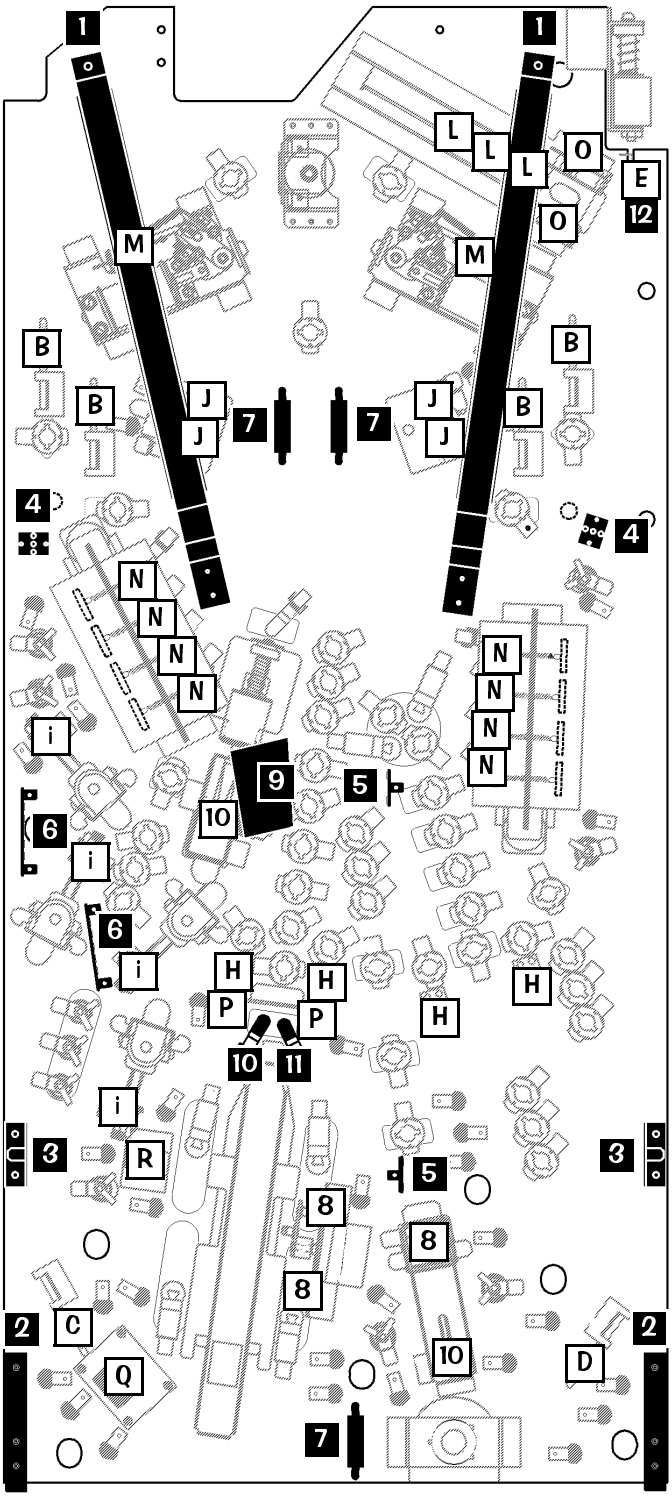
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
Parts Table & Views continue on the previous page.			
21	Front Molding Lockdown Assembly	1	500-6509-00
	Item 21 is secured by: #10-24 X 1-1/4" Carr. Bolt (Qty. 2) (231-5012-00), #10-24 Keps Nut (Qty. 2) (240-5207-00), #8 X 5/8" HWH AB Zinc (Qty. 4) (234-5102-04) **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**	3	180-5160-00
23B	Flipper Sw. **- X2 Stack for Lwr./Upr. Flipper(s)**	**0**	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" HWH 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 *(No Longer Required)*	0	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)		
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	Black Plastic Back Panel Shield	1	545-5928-00
	Item 38 is secured by: #6 X 1/2" PPH A Black (Qty. 3) (237-5805-00)		
39	Shaker Motor (Vibrator) Assy.	1	515-5893-**01**
	Item 39 secured by: #8-32 T-Nut (Qty. 4) (240-5101-00) **and** #8 X 5/8" HWH SWAGE (Ser) Zinc (Qty. 4) (237-5975-03) ***FOR A BREAKDOWN OF PARTS, SEE TABLE ABOVE.***		
40	Shaker Motor Plastic Cover Housing	1	545-5241-00
	Item 40 secured to Item 39B by: #8-32 X 3/8" HWH MS (Taptite) (Qty. 2) (237-5967-00)		
41	Shaker Motor P.C. Board	1	520-5065-00
	Item 41 secured by: 3/8" Slf. Rtn. Spacer White (Qty. 4) (254-5007-01) **and** #6 X 3/4" HWH AB (Zinc) (Qty. 4) (234-5003-00)		

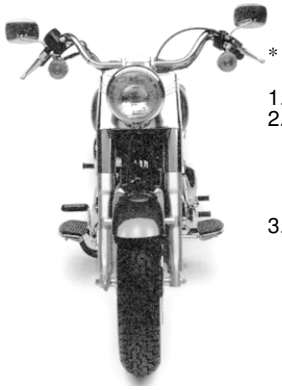
Playfield - General Parts ■ & Switches □ (Below)

№	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" HWH 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	500-5329-00
4	Outlane Adjustbale Post Plate	2	535-5091-02
	Item 4 is secured by: #6 X 1/2" HWH AB (Zinc) Red (Qty. 2/per) (234-5001-02)		
5*	Diode Terminal Strip 2-Lug (810) Isolated	2	055-5203-00
	Note: Item 5 (Qty. 1) is located in the Cabinet on the Coin Door.		
6	Diode Terminal Strip 5-Lug (824) Isolated	2	055-5204-05
	Items 5-6 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****,* ***P/F Diode Terminal Strip****...*		
7	3A 250v Slo-Blo Fuse	2	200-5000-08
	Fuse Clip Holder (Socket)	2	205-5000-01
	Item 7 is secured by: #6 X 1/2" PPH AB (Qty. 1/per) (237-5805-00) ***Note:*** *Item 7, 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).*		
8*	Solder Lug	3	055-5140-08
9	Insulator Paper	3	545-5721-00
	Item 9 Note: Qty. 2 Not Shown are hidden under each Flipper.		
10	Rubber Lite Cover Red	1	545-5014-02
11	Rubber Lite Cover Green	1	545-5014-04
12	Switch Bracket **(Shooter Lane / Eject Hole)**	2	535-6173-00
	Item 12 is secured by: #6 X 1/2" HWH AB (Zinc) Red (Qty. 2/per) (234-5001-02)		
13*	Diode Terminal Strip/Fuse Decals A-E	1	820-6221-67
	Note: *For Decal Descriptions & Locations, see Sec.* ***5****, Chp.* ***2****,* ***Playfield Wiring****.*		

№	BELOW SWITCHES PART NAME	QTY.	SPI PART №
A	Micro Sw. Roll-Over Left Brkt. Assy.	0	500-6227-01
B	Micro Sw. Roll-Over Right Brkt. Assy.	4	500-6227-02
C	Micro Sw. R-O Lt. Brkt. Lite Force	1	500-6227-03
D	Micro Sw. R-O Rt. Brkt. Lite Force	1	500-6227-04
	Items B-D are secured by: #8 X 1/2" HWH AB (Zinc) (Qty. 2/per) (234-5101-00)		
E	Micro Switch **(at Shooter Lane)**		180-5100-01
F	Micro Sw. **(on Super VUK, Up/Down Motor)**	3	180-5052-00
G	Micro Sw. **(on Scoop & U-Trough)**	2	180-5057-00
H	Modular S-U Target Narrow (Red)	4	500-6138-02
	Item H is secured by: #8 X 3/4" HWH AB (Zinc) (Qty. 2/per) (234-5103-00) ***Item H:*** *For better view(s) or entire assembly, see* ***Appendix I****,* ***Pg. I1*** *(end of manual).*		
i	Micro Switch **(on Pop Bumpers)**	4	180-5015-04
J	Stack (Blade) Switch **(on Slingshots)**	4	180-5054-00
K	Micro Switch **(Roller Actuator, Reg. Force)**	0	180-5119-00
L	Micro Sw. **(Roller Actuator, Lite Force)**	3	180-5119-02
	Note: *Item L can be replaced with* ***180-5119-00*** *if* ***-02*** *is no longer available.*		
M	EOS Switch Flipper **(on Flippers)**	2	180-5149-00
N	Micro Switch **(on Drop Target)**	8	180-5104-00
	Note: *For how Items E-G & i-N are secured or for a better view, see Section 4, Chapter 2, Drawings for Major Assemblies & Ramps,* ***on the individual assemblies noted above****.*		

№	BELOW MISC. PCB PART NAME	QTY.	SPI PART №
O	Dual OPTO TRANS Bd. **(on Ball Trough)**	1	520-5173-00
	Dual OPTO REC Board **(on Ball Trough)**		520-5174-00
P	Long Hop OPTO TRANS Board	1	520-5082-00
	Long Hop OPTO REC Board		520-5083-01
Q	Relay Board		520-5010-00
R	Diode Board		520-5146-00



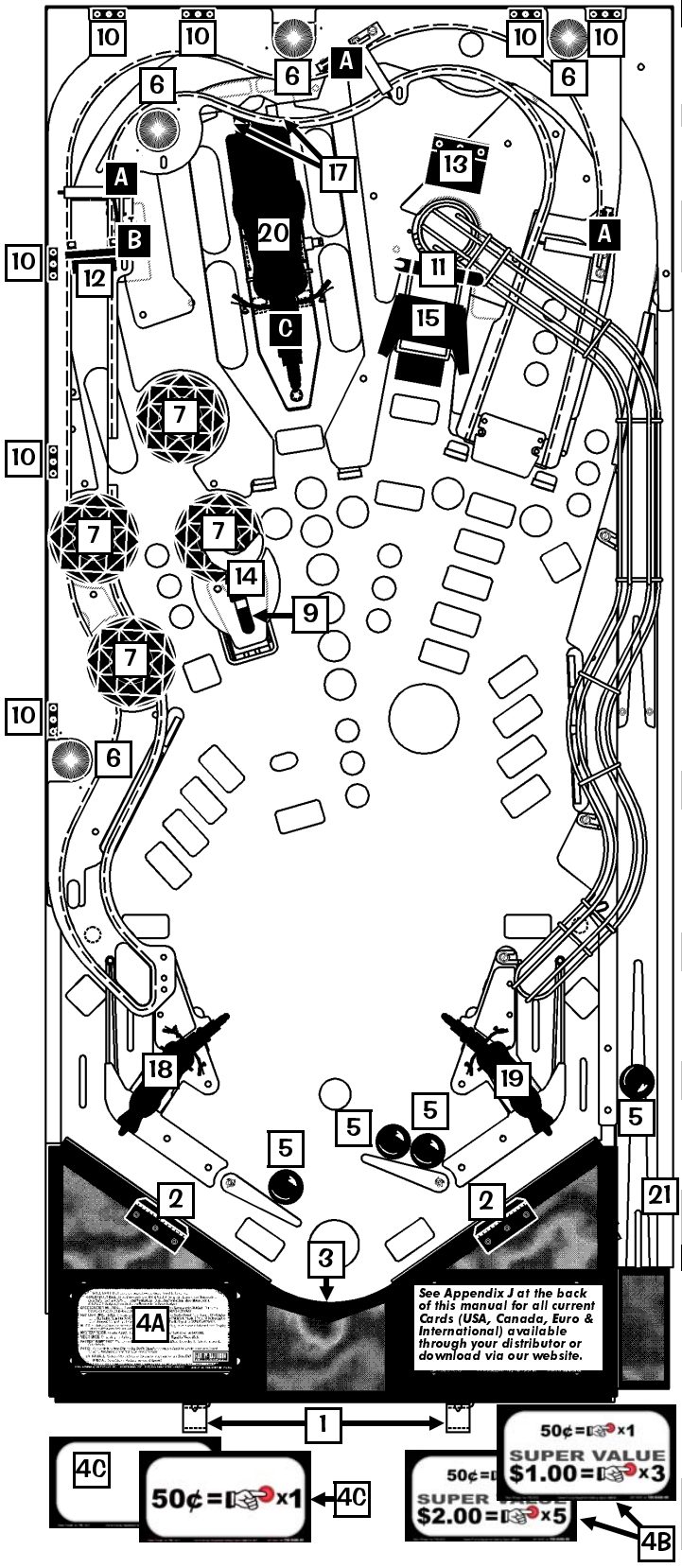


Take Note:

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

1. For Sockets & Bulbs (drawings & part numbers) see Pgs. 60-62.
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, Inc.® Technical Support, 1-800-542-5377 or 1-708-345-7700 (Opt. 1).
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)



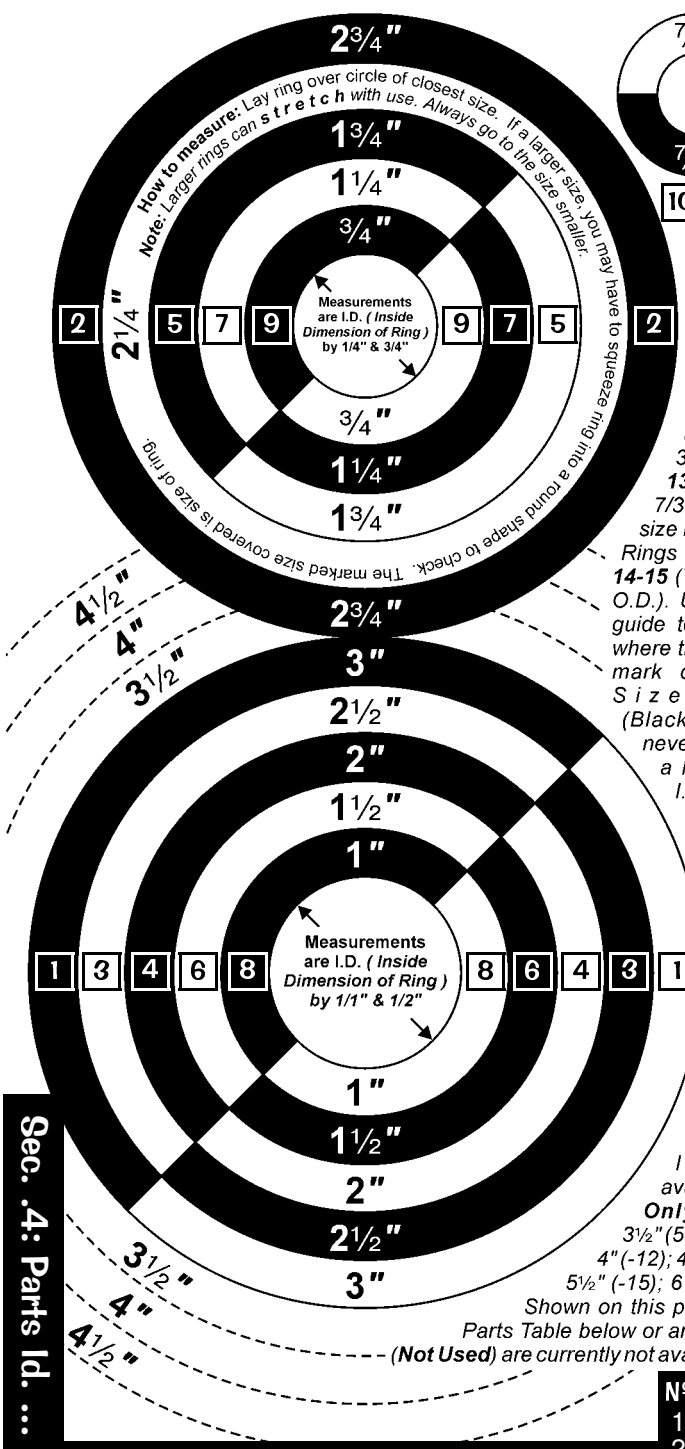
№	ABOVE PLAYFIELD PART NAME	QTY.	SPI PART №
PF	P/F Screened **w/** Inserts & **NO** Parts	1	830-5100-87
	P/F Complete **w/** Inserts & **ALL** Parts	1	**505-6004-87-87**
1	Playfield Hanger Bracket	2	535-8385-00
	Item 1 is secured to the P/F by: #8-32 X 7/8" HWH MS Zinc (Qty. 2/per) (237-5890-00)		
2	Arch Retaining (Hold-Down) Brackets	2	535-8394-00
	Item 2 is secured to the Playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 3/per) (234-5101-00)		
3	Arch (Black Metal)	1	500-6005-00
	Item 3 is secured to the playfield by Item 2 and : #10-32 X 5/16" PH FL U/C MS STL Zinc (Qty. 2) (237-6013-00). ***Usage Note:*** *When replacing the Arch,* order new replacement **Nelson Protect Strips** *(not included)* (Qty. 2) (545-5212-02). ***Note: Item 3*** *does not include Decals. For Decals, see Sec.* ***4****, Chp.* ***1****,* ***Playfield - Plastics & Decals****, Page 55.*		
4A	Instruction Card (USA) H-D 3rd Ed.	1	**755-5187-00**
	Note: *Visit* ***www.sternpinball.com*** *for a PDF copy of the Game Instruction Card which will also have any translated Instruction Cards made for this game. Find Game Link or Archives.*		
4B	Coin Card (2-Sided)	1	**755-5400-00**
	Usage Note: *Use* ***Item 6A*** *(****Back: 1 Play 50¢ - 5 Plays $2****) for Adj. 6, Game Pricing,* ***USA 5*** *Setting, or (****Front: 1 Play 50¢ - 3 Plays $1****) for Adj. 6, Game Pricing,* ***USA 8*** *Setting.*		
4C	Coin Card (2-Sided)	1	**755-5400-02**
	Usage Note: *Use* ***Item 6B*** *(****Front: 1 Play 50¢****) for Adj. 6, Game Pricing,* ***USA 2-7*** *Setting, (****Back: is Blank****) for Custom Settings.*		
	Availability: *See* ***Appendix J*** *(back of manual) for all current Coin Cards (****USA****,* ***Canada****,* ***Euro*** *& other* ***International****). If this is a non-US Game, Coin Card(s) provided will differ.*		
5	Pinball (Steel) 1 1/16" ø	4	260-5000-00
6	Mini-Mars Light Cover Red	4	550-5031-02
7	Pop (Bumper) Cap Blue	4	550-5057-05
8*	Plug-Cap (3/16") Black Plastic	1	545-5232-01
	Note: *Item 17 should plug hole if a Center Post (@ Drain) is used, then removed.*		
9	Rubber Lite Cover Red	1	545-5014-02
10	Ramp Mounting Welded Bracket	6	515-6508-00
	Item 10 is secured to the Rails by: #6 X 1/2" PTH A (Zinc) (Qty. 2/per) (237-5809-00)		
11	1-Way Gate Mounting Bracket (Lg.)	1	535-5269-06
	Wire Gate (for above)		535-8441-00
	Item 11 is secured by: #6 X 1-1/2" PPH Zinc (Qty. 2) (232-5007-00) **and** 1" X 3/8" Spacer Black (Qty. 2) (254-5000-04)		
12	Spinner Assembly	1	500-5656-00
	Item 12 is secured by: #6 X 1/2" HWH AB (Zinc) Red (Qty. 2) (234-5001-02) ***For Individual Parts Use: Spinner Bracket (Right Side Mount)*** *(Qty. 1) (535-5128-00);* ***Spinner Sub-Assy.*** *(Qty. 1) (515-5553-00);* ***Micro Switch*** *(1-1/4") (Qty. 1) (180-5010-04);* ***Switch Body Protect Plate*** *(Qty. 1) (535-6539-00)*		
13	Ball Snubber Bracket	1	535-8573-00
	Item 13 is secured to the playfield by: #8-32 X 5/8" HWH SWAGE (Ser) Zinc (Qty. 1) (237-5975-03) **and** #8 X 1/2" SHWH AB (Zinc) (Qty. 2) (234-5101-00)		
14	Mounting Bracket (for Butyrate "-35" Eagle)	1	535-8598-00
	Item 14 is secured by: #2-56 X 3/8" HWH MS (Serr) TF 3/16" HD (Qty. 4) (237-5938-01) **and** #2-56 Hex Nut (Qty. 4) (240-5301-00)		
15	Support Bracket for Butyrate "-16"	1	535-8601-00
	Note: *Item 15 is mounted under Plastic Piece (Butyrate) "-16" (830-5960-16) using existing hardware to protect the entrance way under the Stop Light Housing Assembly.*		
16*	Back Panel (H-D®)	1	525-5557-00
	Item 16 is secured to the playfield by: #6 X 3/4" HWH AB (Zinc) (Qty. 6) (234-5003-00) and #6 X 1-1/4" PFH A (Zinc) (Qty. 6) (237-5804-00)		
17	Ball Trap Stop Bracket	2	535-8744-00
	Item 17 are secured onto Spacers at the Rear Wheel of Item 20 Bike by: 3/4" X3/8" Spacer Gray, **1 on each side of wheel by:** #6 X 1-1/4" HWH Ser (Zinc) (Qty. 6) (234-5003-00) **with Item 17** (Qty. 1 on Right) **and** (Qty. 1 on Left of the 1" Spacer Black).		
	Harley-Davidson® Motorcycle Toy Models:		
18	MRVL Tailwinds 1:18 **(3rd Edition)** 31360-18 (Colors vary! Cannot choose.)	1	880-5042-02
	FLSTF™ Fat Boy® 1:18 (2nd Ed.) 31760-**J**	0	*880-5042-01*
	FXSTS™ Springer Softail 1:18 (1st Ed.)	0	*880-5042-00*
19	FLSTF™ Fat Boy® 1:18 **(3rd / 2nd Ed.)** 31760-**K**	1	880-5035-01
	GXDL™ Dyna Low Ryder 1:18 *(1st Ed.)*	0	*880-5035-00*
20	FLSTF™ Fat Boy® 1:10 **(3rd/2nd)** Blue #31606	1	880-5034-01
	FLSTS™ Hrtg. Springer® 1:10 (1st Ed.)	0	*880-5034-00*
21	Bubble Level Assembly	1	500-6815-00
	For Individual Items use : **Level** .8mm Empire #0224 (**545-5001-01**) or **Level Mount** (**545-6068-00**). **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) **Item 4 is secured to the wood rail by:** #6 X 1/2" HWH AB Zinc Red (Qty. 2) (234-5001-02)		

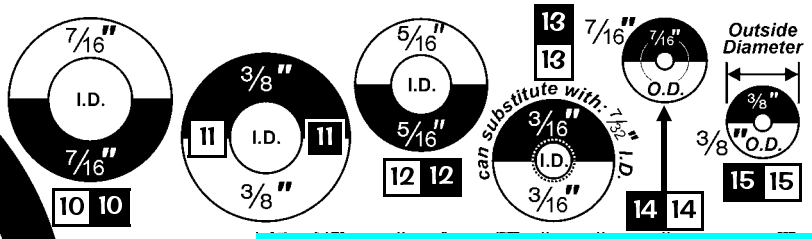
№	ABOVE SWITCHES PART NAME	QTY.	SPI PART №
A	Micro Switch (on Roll-Under Gates)	3	180-5087-00
B	Micro Switch (1-1/4") (on Spinner)	1	180-5010-04
C	4-Pos. Membrane Sw. (on Bike Trough)	1	181-5001-00

Take Note:

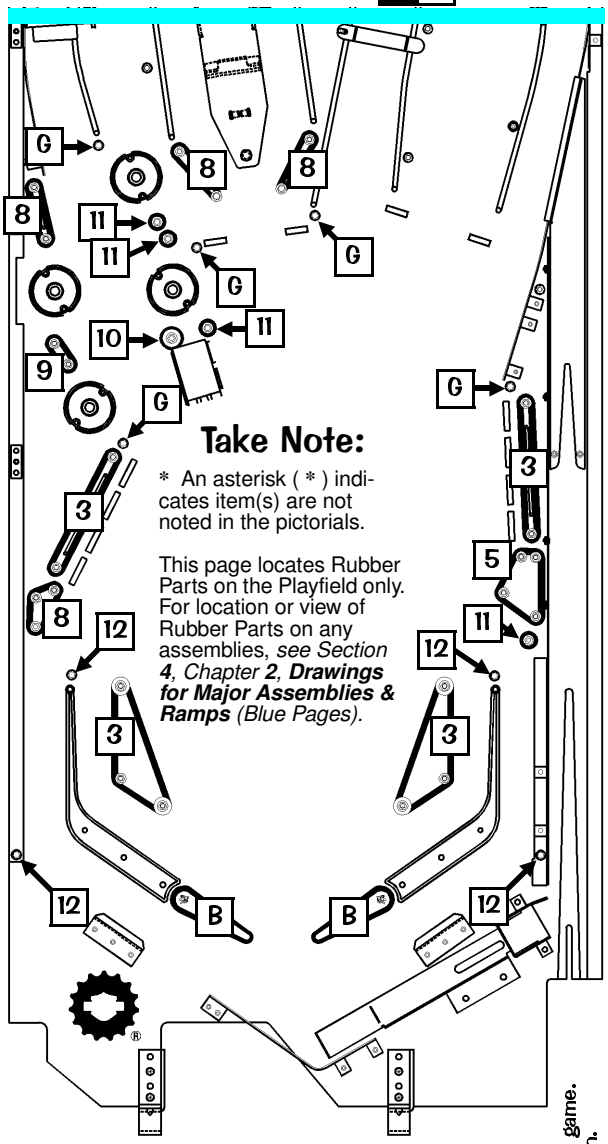
1. Some items or parts *may be included with* **or** *associated with* a Major Assembly or Ramp Assembly; **see the Blue Pages, Sec. 4, Chp. 2.** for parts required not appearing on this page. If you still cannot find the part required, Call Stern Pinball, Inc.® Technical Support, 1-800-542-5377 or 1-708-345-7700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

Playfield - Rubber Parts Red ■, Black ■ and White □ (Rings Actual Size) †





*Items **1-13** are measured by the Inside Diameter (I.D.). Items **1-9** and **11** are approximately 1/4" thick. Items **10**, **12-15** are approximately 3/16" thick. Item **13** can also be a 7/32" I.D Ring. The size is imprinted on all Rings except for Items **14-15** (7/16" O.D. & 3/8" O.D.). Use this page as a guide to measure rings where the size imprint or mark does not exist. Size 2¼" I.D. (Black or White) was never used. Choose a Ring Size +/- ¼" I.D. if required.*



Take Note:

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

This page locates Rubber Parts on the Playfield only. For location or view of Rubber Parts on any assemblies, *see Section **4**, Chapter **2**, **Drawings for Major Assemblies & Ramps** (Blue Pages).*

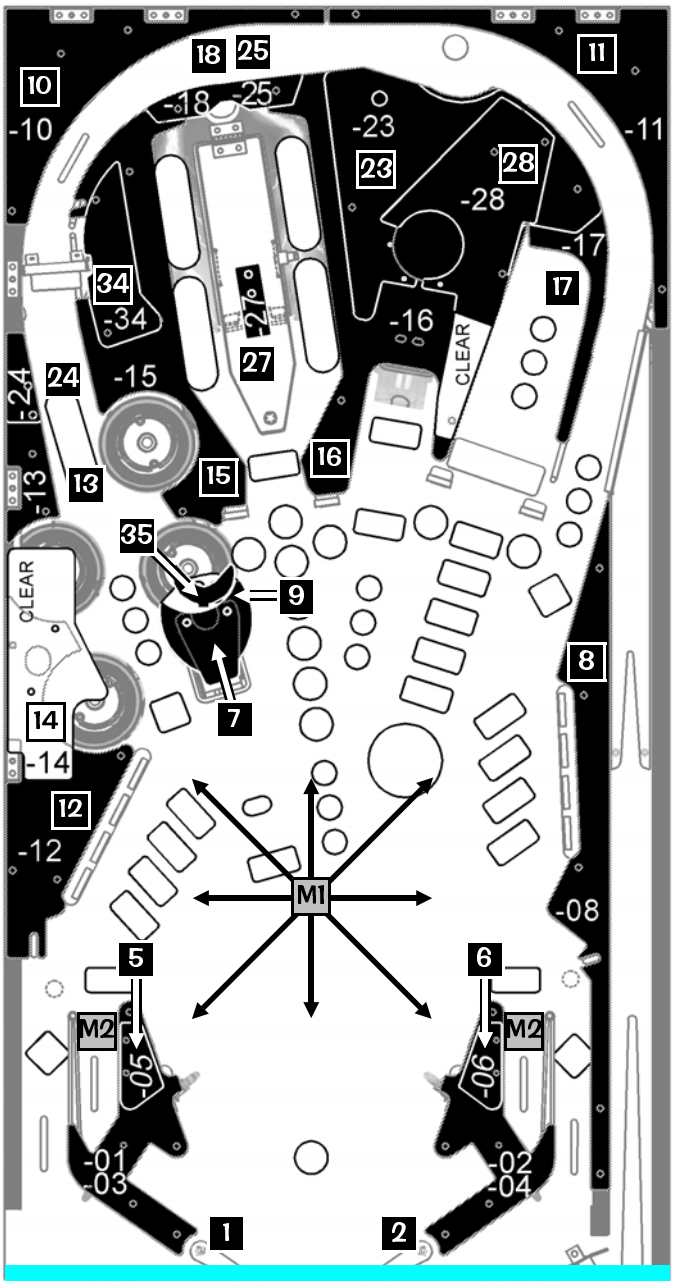
***Note:** Sizes larger than 3" I.D. currently available in **Black Only (Not Used)**: 3½"(545-5348-11); 4"(-12); 4½"(-13); 5"(-14); 5½" (-15); 6" (-16). Sizes Not Shown on this page, listed in the Parts Table below or are noted with **N/U** (**Not Used**) are currently not available.*

№	RUBBER PART NAME	QTY.	SPI PART №
A	Small Flipper **BLACK** Ring		545-5207-00
	Sm. Flipper **RED (Soft Duro)** Ring		545-5207-**22**
B	Large Flipper **BLK (50 Duro)** Ring	2	545-5277-00
	Lg. Flipper **RED (Soft Duro)** Ring		545-5277-**22**
	Optional Item B Replacements: Lg. **YELLOW (50 Duro)** Ring (**545-5277-04**) **or** Large **YELLOW (40 Duro)** Ring (**545-5277-06**)		
C*	Bumper **(Deflector Pad)**	2	545-5428-00
D*	Bumper **(Grommet) 1138 (A60)**	5	545-5105-00
E*	Bumper **(Post)**		545-5009-00
F*	Bumper (Post Sleeve, Short)		545-5151-00
G	Bumper **BLACK (Post Sleeve, Tall)**	5	545-5308-00
	Bumper **WHITE (Post Sleeve, Tall)**		545-5308-**08**
H*	O-Ring 11/32" X 07/32" X 1/16" **(on Flipper Button)**		545-5850-00

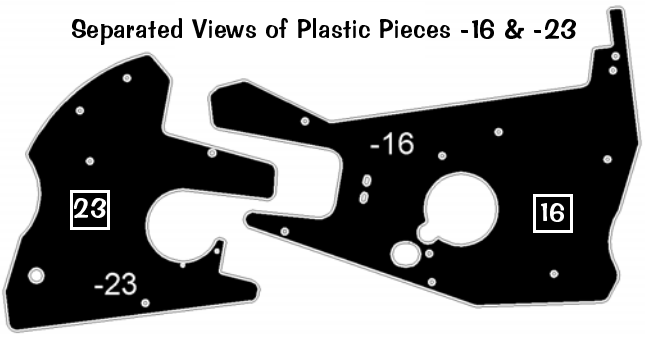
№	SPI PART №	QTY.	RUBBER PART NAME	QTY.	SPI PART №	№
1	545-5348-10		Black 3" I.D. Ring White		-60 N/U	1
2	545-5348-20		Black 2¾" I.D. Ring White		-70 N/U	2
3	545-5348-09	4	Black 2½" I.D. Ring White		545-5348-59	3
4	545-5348-08		Black 2" I.D. Ring White		545-5348-58	4
5	545-5348-21	1	Black 1¾" I.D. Ring White		-71 N/U	5
6	545-5348-07		Black 1½" I.D. Ring White		545-5348-57	6
7	545-5348-06		Black 1¼" I.D. Ring White		545-5348-56	7
8	545-5348-05	4	Black 1" I.D. Ring White		-55 N/U	8
9	545-5348-04	1	Black ¾" I.D. Ring White		545-5348-54	9
10	545-5348-18		Black 7/16" I.D. Ring White		-68 N/U	10
11	545-5348-03		Black 3/8" I.D. Ring White		-53 N/U	11
12	545-5348-02	1	Black 5/16" I.D. Ring White		545-5348-52	12
13	545-5348-01	4	Black 3/16" I.D. Ring White		545-5348-51	13
14‡	545-5348-17	4	Black 7/16" O.D. Ring White		-67 N/U	14
15	545-5348-19		Black 3/8" O.D. Ring White		545-5348-69	15

† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

Playfield - Plastics (Screened & Clear), Mylar & Decals (Not Shown)*



Separated Views of Plastic Pieces -16 & -23



Plastic Screened | Plastic Clear | Mylar

№	PLASTIC (BUTYRATE) NAME	QTY.	SPI PART №
	Plastics not available individually, the entire set must be ordered. Plastics are listed for reference only. *Note: Some pieces are © clear or p© part-clear.*	***Kit:***	***803-5000-87*** *Includes:* 830-5960-XX-87
1	Left Return & Slingshot (Screened)	1	-01-87
2	Right Return & Slingshot (Screened)	1	-02-87
3	Lt. Return & Slingshot (Spare)	1	-03-87
4	Rt. Return & Slingshot (Spare)	1	-04-87
5	Second Level (Screened) **over -01**	1	-05-87
6	Second Level (Screened) **over -02**	1	-06-87
7	Rt. Pop/Scoop (Screened)	1	-07-87
8	Right Side (Screened)	1	-08-87
9 p©	Second Level (Part-Clear) **over -07**	1	-09-87
10	Top Left Corner (Screened)	1	-10-87
11	Top Right Corner (Screened)	1	-11-87
12	Left Side Bottom (Screened)	1	-12-87
13	Left Side Top (Screened)	1	-13-87
14 ©	Second Level (Clear) **over -12**	1	-14-87
15	Left of M-Cycle Trough (Screened)	1	-15-87
16	Right of M-Cycle Trough (Screened)	1	-16-87
	Note: *If Item 16 Butyrate Plastic Piece is replaced, ensure the Support Bracket (535-8601-00) is transfered to protect the entrance way under the Stop Light Housing Assy.*		
17	Under Plastic Ramp (Screened)	1	-17-87
18	Second Level (Screened) **over -15/-16**	1	-18-87
19-20*	Key Chain (H-D® Motorcycle, Red)	1	-19-87/ -20-87
21 ©*	Top/Mid Lamp Sprt. (Clear)	1	-21-87
22 ©*	Bot. Lamp Sprt. (Clear)	1	-22-87
	Note: *Items 21 & 22 are located inside the Stop Light Housing Assembly (500-6400-00-67) which are used to support the three (3) light sockets located inside (see Page 80).*		
23	Second Level (Screened) **over -16/-17**	1	-23-87
24	Second Level (Screened) **over -13**	1	-24-87
25	Third Level (Screened) **over -18**	1	-25-87
26*	Key Chain (H-D® Motorcycle, Red)	1	-26-87
27	Ball Trap Under M-Cycle (Screened)	1	-27-87
28 p©	Third Level (Part-Clear) **over -23**	1	-28-87
30-33*	Key Chain (H-D® Motorcycle, Red)	1	-30-87~-33-87
	Note: *Key Chain Pieces -19, -20, -26, and -30 through -33 are identical.*		
35	Third Level (Screened) **over -09**	1	-35-87
	Note: *Items 29 and 34 are Not Used.*		

№	MYLAR NAME	QTY.	SPI PART №
M1	Clear Mylar - Playfield (H-D®)	1	820-5874-00
M2	Clear Mylar - Square Ball Drop	2	820-5815-00
M3*	Clear Mylar - Slings **(Not Required)**	0	820-5821-00
M4*	Black Mylar - Cover Discs **(in Cabinet)**	2	820-5041-00

№	GAME #67 DECAL NAME		SPI PART №
D1*	Kit: #87 Screened Decal Sheet Set	*Kit:*	***802-5000-87*** *Includes:* 820-6243-XX-87
	Note: Individual pieces are not available*, the entire sheet set must be ordered.*		
D2*	Diode Terminal Strip Desc. Decal (A-E)		**820-6221-67R**
D3*	**" ® "** Decal (for Cabinet H-D® Logos)		820-6257-00

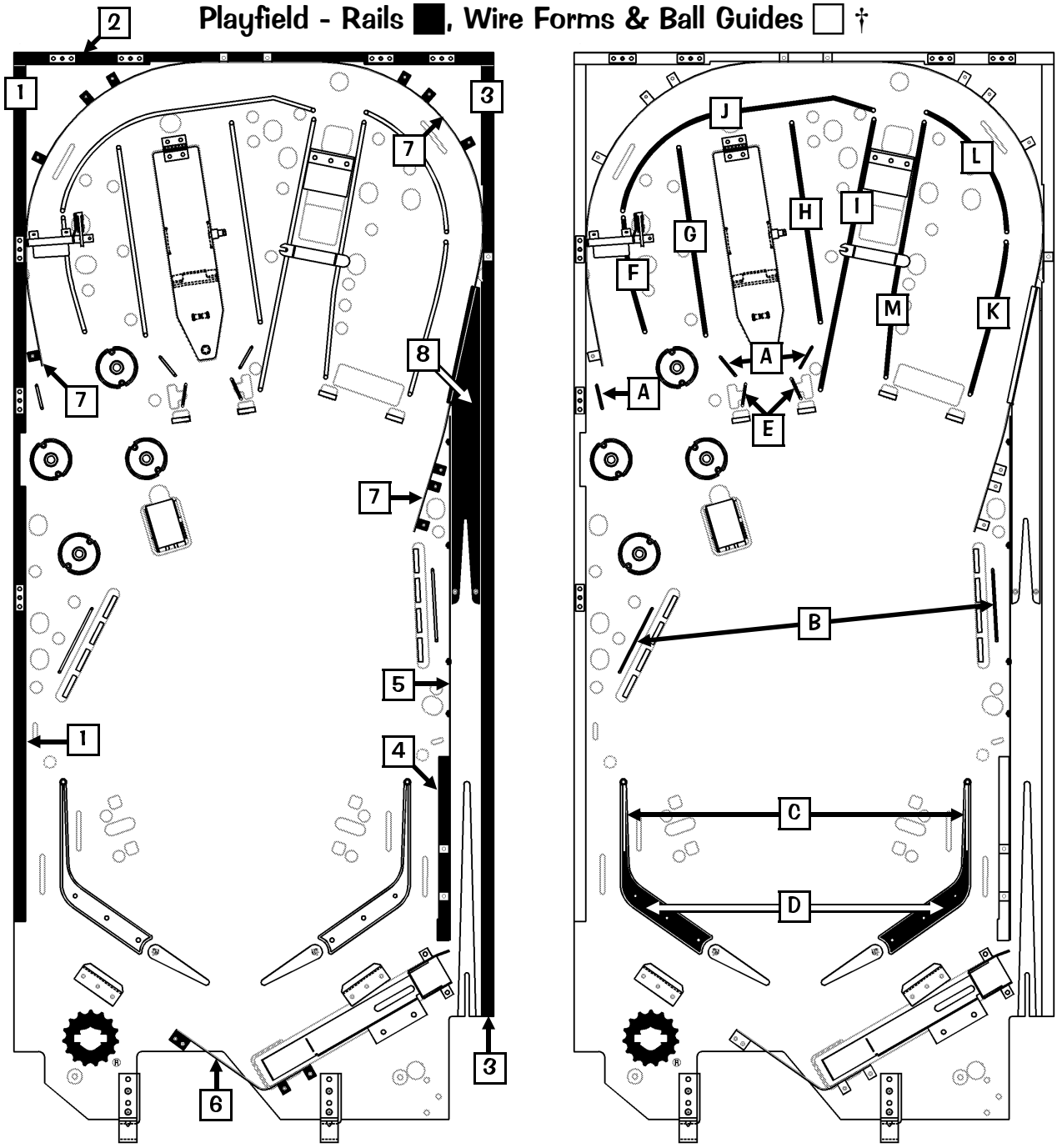
№	GENERIC DECAL NAMES	
	Power (820-6223-00)	Protective Earth (820-6224-00)
	Generic Backbox Fuse Loc. (820-6152-02)	Fuse Lable (UL) (820-6143-00)
	UL Listing LabeL (820-6141-00)	Danger Coin Door (UL) (820-6140-00)
	Power Box Decal - USA (820-6123-01)	Power Box Decal Supp. (820-6123-04)
	High Voltage Label (UL) (820-6082-01)	Suitable ...Use... (UL) (820-6001-01)
	Warning-Fingers... Shaker Motor (820-6062-00)	

Take Note:

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

1. To order the entire Plastic Sheet Set (Screened & Clear), use the Part № with the "-XX" ending. For individual pieces replace the "-XX" with appropriate last 2-Digit №. *Attention: Individual pieces may not be available.*
2. **Legend Note:** Items noted with a black square ■ are Screened; ...a white square ❒ are © Clear; ...a gray square ■ are Mylar.

Playfield - Rails ■, Wire Forms & Ball Guides □ †



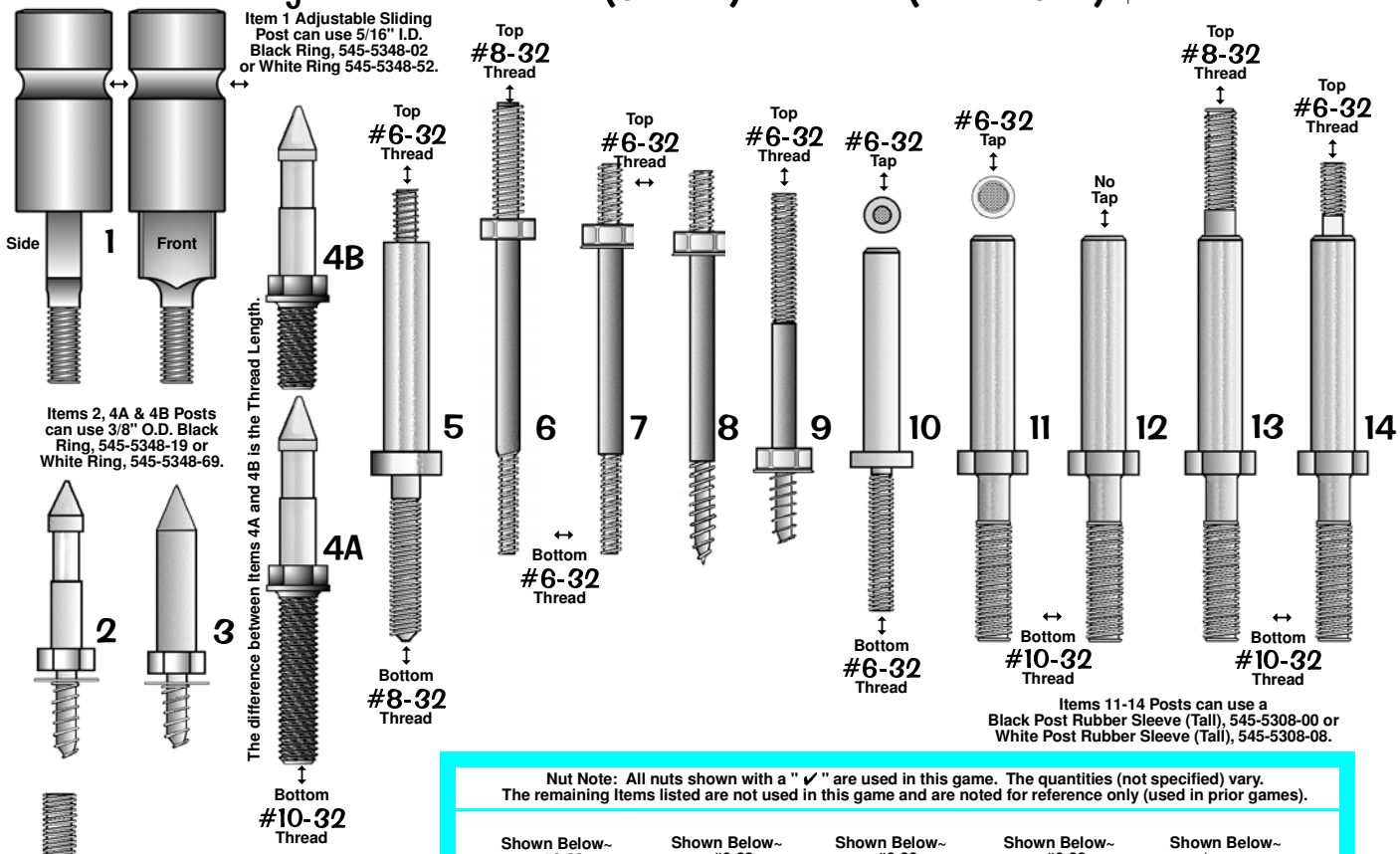
Nº	WOOD & METAL RAIL NAME	QTY.	SPI PART Nº
1	Wood Rail (Left Side)	1	525-5553-00
2	Wood Rail (Top Side)	1	525-5554-00
3	Wood Rail (Right Side)	1	525-5555-00
4	Wood Rail (Shooter Lane, Short)	1	525-5556-00
	Items 1-4 are secured by: #6 X 1-1/4" PFH A (Zinc) (Qty. 20) (237-5804-00)		
5	Metal Rail Weldment (Shooter Lane)	1	515-7018-00
6	Metal Rail (Center Drain under Arch)	1	535-8393-00
7	Metal Rail (Full Orbit) (or Loop)	1	535-8556-00
	Items 5-7 are secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 14) (234-5101-00)		
8	Metal Rail Ramp (Shooter Lane)	1	535-8145-00
	Item 8 is secured by: #4 X 1/2" PFH (Zinc) (Qty. 2) (237-5840-00)		

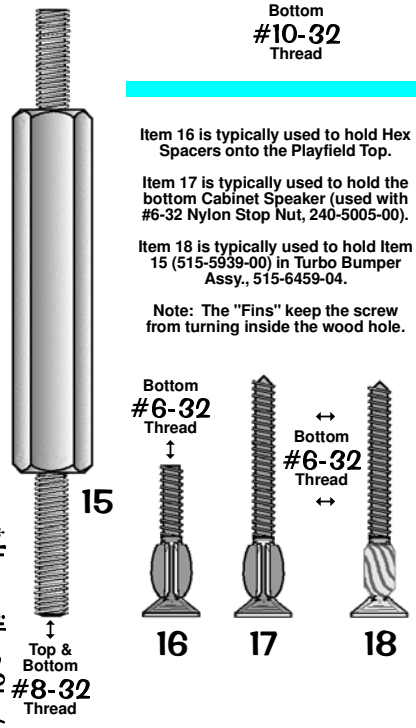
Nº	WIRE FORM (WF) NAME	QTY.	SPI PART Nº
A	Wire Form - 1"	3	535-5300-05
B	Wire Form - 3"	2	535-5300-02
C	Wire Form (over Item D)	2	535-5642-00

Nº	BALL GUIDE RAIL (BGR) NAME	QTY.	SPI PART Nº
D	Ball Guide Rail (Plastic) (Return Lane)	2	550-5037-01
E	Ball Guide Rail - 5/8"	2	535-5356-19
F	Ball Guide Rail - 4-1/2"	1	535-6492-15
G	Ball Guide Rail - 8"	1	535-6492-19
H	Ball Guide Rail - 8-1/2"	1	535-6492-20
I	Ball Guide Rail - 11.63"	1	535-6492-16
J	Ball Guide Rail (Left Orbit, Upper)	1	535-8558-00
K	Ball Guide Rail (Right Orbit, Lower)	1	535-8559-00
L	Ball Guide Rail (Right Orbit, Upper)	1	535-8560-00
M	Ball Guide Rail (Inside Upper Right)	1	535-8561-00

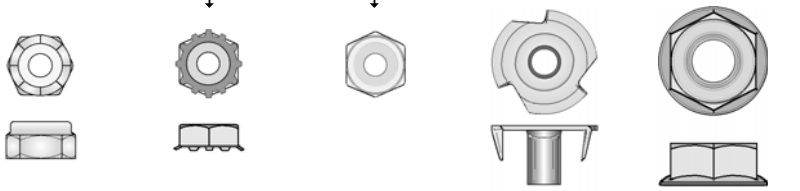
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

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





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).



Top & Side Views

Nylon Stop Nuts *Not Shown:*

- #6-32 (w/ ¼" 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

Bottom & Side Views

KEPS Nuts *Not Shown:*

- #6-32 (w/ ¼" 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

Top View

Hex Nuts *Not Shown:*

- #8-32: 240-5103-00
- #10-32: 240-5201-00
- #10-24: 240-5202-00 ✔
- #10-32 X ⅜": 240-5209-00
- ¾-16: 240-5315-00 ✔
- #2-56: 240-5301-00 ✔
- ⅞"-14: 240-5317-00

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

Top & Side Views

Miscellaneous Nuts *Not Shown:*

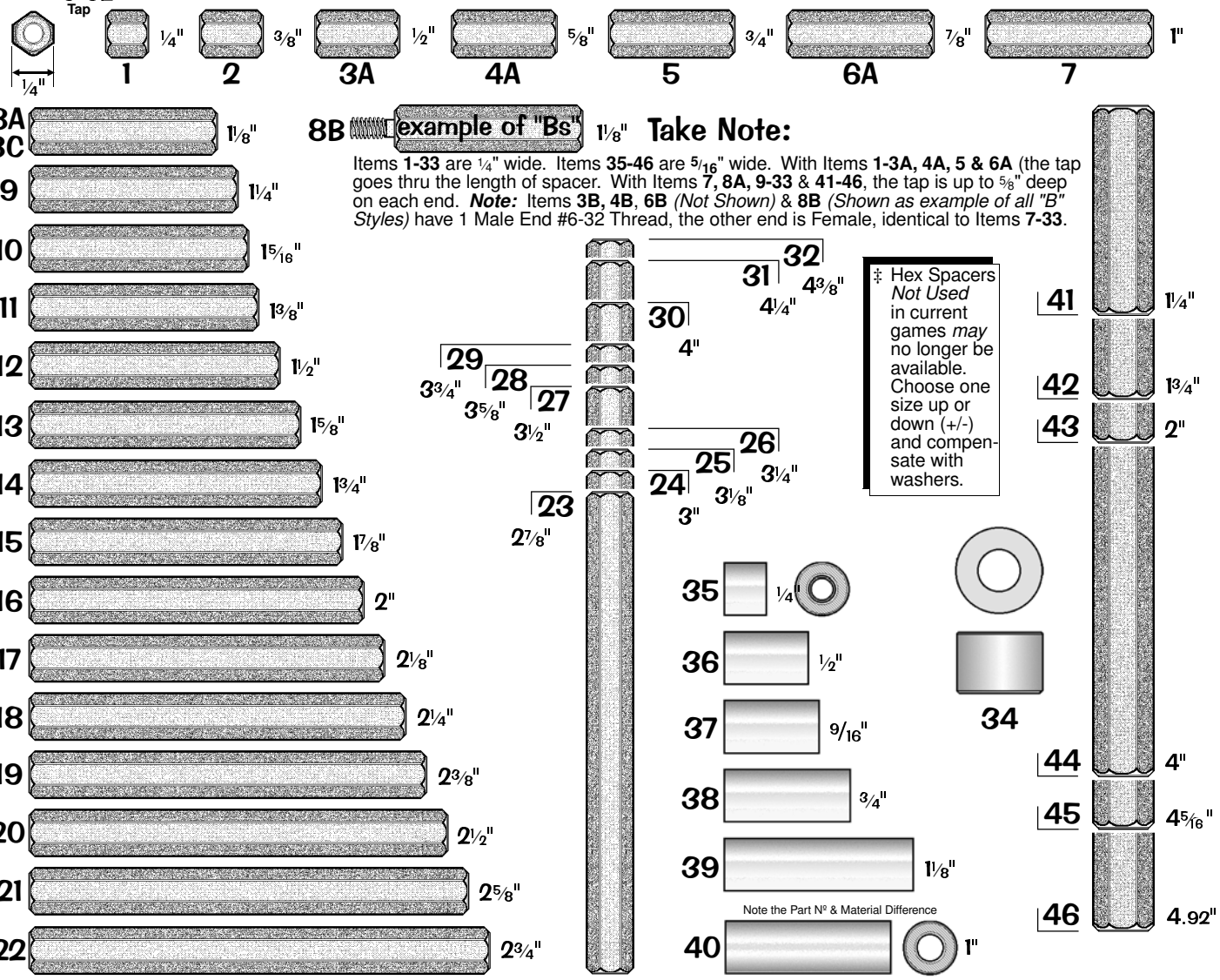
- Plastic Pal Nut (on Flipper Buttons): 240-5003-00
- Metal Pal Nut (on Flipper Buttons): 240-5003-01 ✔
- #6-32 Wing Nut: 240-5001-00
- #8-32 Wing Nut: 240-5100-00
- ¼"-20 Wing Nut: 240-5302-00
- ¼"-20 Toggle Wing: 240-5324-00

№	METAL POST NAME	QTY.	SPI PART №
1	***Adjustable*** Sliding Post **(Brass)** #8-32 Bot.		530-5621-00
2	Mini-Post Wood Screw	4	530-5004-00
3	Mini-Post Wood Screw **(no cut-away)**		530-5004-01
4A	Mini-Post MS / #10-32 Bot. **.875" Thread**	4	530-5005-00
4B	Mini-Post MS / #10-32 Bot. **.4" Thread**		530-5005-01
5	Post Fasten #6-32 Top / #8-32 Bot.		530-5007-00
6	Post Fasten #8-32 Top / #6-32 Bot.	5	530-5008-00
7	Post Fasten #6-32 Top / #6-32 Bot.	26	530-5012-02
8	Post Fstn. #6-32 Top / Wood Scr. Bot.		530-5010-02
9	Post #6-32 Top / Wood Screw Bottom		530-5263-01
10	Post #6-32 Tap / #6-32 Bottom		530-5127-00
11	Post Hex Base #6-32 Tap/#10-32 Bot.		530-5332-01
12	Post Hex Base (No Tap)/#10-32 Bot.	4	530-5332-00
13	Post Hex Base #8-32 Top/#10-32 Bot.		530-5332-02
14	Post Hex Base #6-32 Top/#10-32 Bot.		530-5332-03
15	Playfield Support #8-32 Top/Bottom		530-5285-00
16	#6-32 X 3/4" Fin Shank Screw		237-5921-02
17	#6-32 X 1¼" Fin Shank Screw	4	237-5883-00
18	#6-32 X 1**3/16**" Spirol Fin Shank Screw	12	237-5957-00

† Items with no Qty. (quantity) 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:

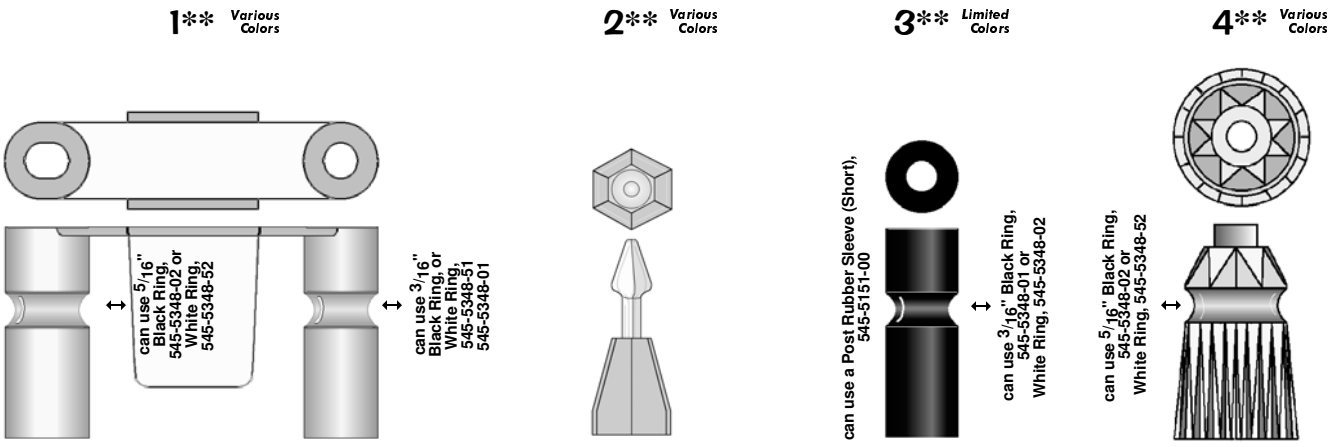
Items **1-33** are 1/4" wide. Items **35-46** are 5/16" wide. With Items **1-3A, 4A, 5 & 6A** (the tap goes thru the length of spacer. With Items **7, 8A, 9-33** & **41-46**, the tap is up to 5/8" deep on each end. ***Note:*** Items **3B, 4B**, **6B** *(Not Shown)* & **8B** *(Shown as example of all "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	1/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-00
2	3/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-12
3A	1/2" X 1/4" Hex Spacer #6-32 Tap	9	254-5008-03
3B	Same as 3A but with Male End #6-32		254-5024-03
4A	5/8" X 1/4" Hex Spacer #6-32 Tap	9	254-5008-02
4B*	Same as 4A but with Male End #6-32		254-5024-02
5	3/4" X 1/4" Hex Spacer #6-32 Tap	4	254-5008-04
6A	7/8" X 1/4" Hex Spacer #6-32 Tap	2	254-5008-05
6B*	Same as 6A but with Male End #6-32	6	254-5024-05
7	1" X 1/4" Hex Spacer #6-32 Tap		254-5008-06
8A	1 1/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-17
8B	Same as 8A but with #8-32 Tap		254-5031-06
8C	Same as 8A but with Male End #6-32		254-5024-17
9	1 1/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-11
10	1 5/16" X 1/4" Hex Spacer #6-32 Tap		254-5008-34
11 ‡	1 3/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-33
12	1 1/2" X 1/4" Hex Spacer #6-32 Tap	1	254-5008-09
13 ‡	1 5/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-13
14	1 3/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-10
15 ‡	1 7/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-20
16	2" X 1/4" Hex Spacer #6-32 Tap	2	254-5008-07
17	2 1/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-32
18	2 1/4" X 1/4" Hex Spacer #6-32 Tap	1	254-5008-18
19	2 3/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-28
20	2 1/2" X 1/4" Hex Spacer #6-32 Tap		254-5008-16
21	2 5/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-08
22	2 3/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-15
23	2 7/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-31
24	3" X 1/4" Hex Spacer #6-32 Tap	1	254-5008-14
25	3 1/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-19
26	3 1/4" X 1/4" Hex Spacer #6-32 Tap	1	254-5008-26
27	3 1/2" X 1/4" Hex Spacer #6-32 Tap		254-5008-27
28	3 5/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-25
29	3 3/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-36
30	4" X 1/4" Hex Spacer #6-32 Tap		254-5008-21
31	4 1/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-30
32	4 3/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-29
33*	5 1/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-35
34	3/8" X 1/2" Spacer (Used with Backbox)	2	530-5099-00
35	1/4" X 5/16" X .144" I.D. Spacer Tap	1	254-5014-03
36	1/2" 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		254-5014-04
38	3/4" X 5/16" X .144" I.D. Spacer Tap		254-5014-01
39	1 1/8" X 5/16" X .144" I.D. Spacer Tap		254-5014-02
40	1" X 5/16" X .144" I.D. Spacer Tap		254-5001-00
41	1 1/4" X 5/16" Hex Spacer #6-32 Tap		254-5018-09
42	1 3/4" X 5/16" Hex Spacer #6-32 Tap		254-5018-06
43	2" X 5/16" Hex Spacer #6-32 Tap		254-5018-07
44	4" X 5/16" Hex Spacer #6-32 Tap	3	254-5018-03
45	4 5/16" X 5/16" Hex Spacer #6-32 Tap		254-5018-00
46	4.92" X 5/16" Hex Spacer #6-32 Tap		254-5018-04

† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

Playfield - Plastic Posts and Spacers (Actual Size) †

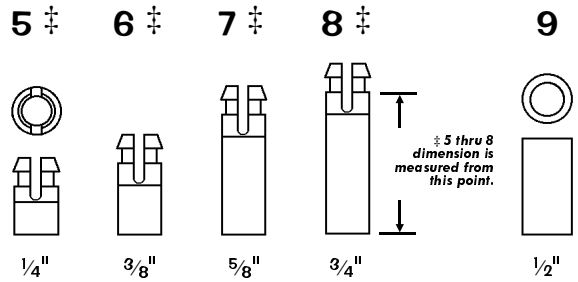


Items 3-4 Posts used in pairs can use 3/4" through 3" Rubber Rings, (See Rubber Parts for Part Nºs).

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		

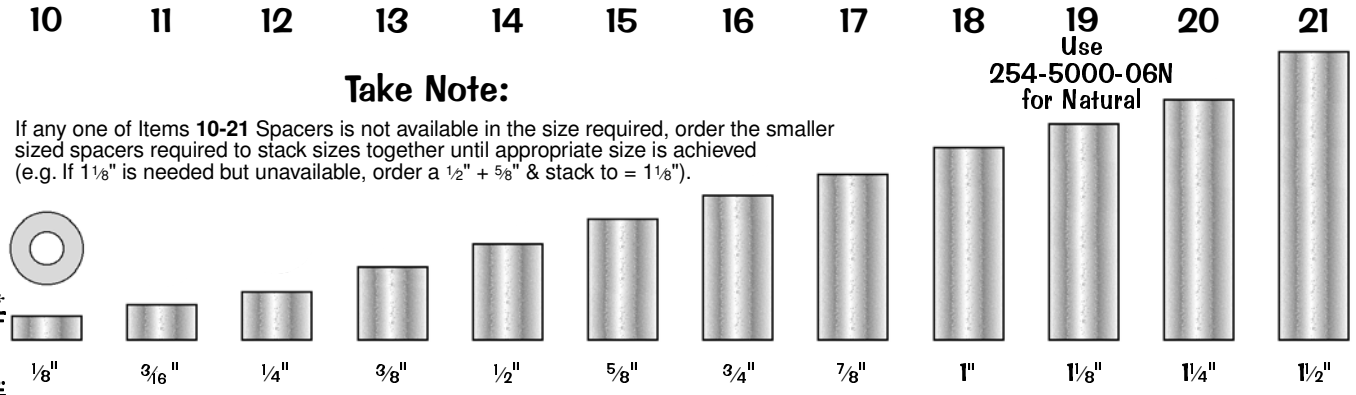
** Items **1, 2 & 4** come in various colors (may not be available in every color). Item **3** is currently only available in the color(s) stated in this game manual (other colors used in prior games may no longer be available). The "**-XX**" or last 2-Digits in Part Nºs which come in various colors,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



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

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 1 1/8" is needed but unavailable, order a 1/2" + 5/8" & stack to = 1 1/8").

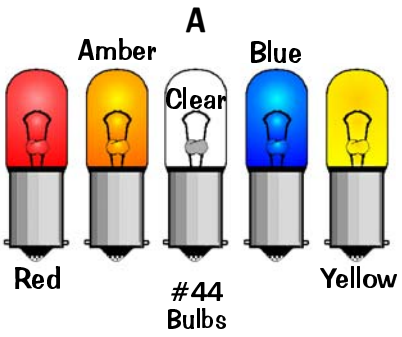


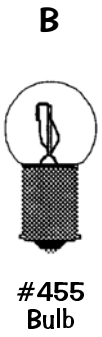
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

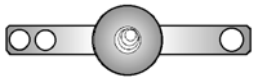
Nº	PLASTIC POST/SPACER NAME	QTY.	SPI PART Nº
1**	Top Lane Mini-Light Hood (XXX)		550-5061-XX
	Item 1 typically secured by: #6-32 X 1-3/4" PPH MS (Zinc) (Qty. 2/per) (237-5511-00) **and** Washer 9/64" X 5/16" OD X 1/32" (Qty. 2/per) (242-5017-00)		
2**	Mini-Jewel Post (Clear)	2	550-5052-01
	Item 2 typically secured by: #6 X 3/8" HWH AB (Zinc) (Qty. 1/per) (234-5000-00)		
3**	1 1/16" Single Groove Post (Black)	43	550-5059-00
4**	*Single* Groove Jewel Post (Clear)	1	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 69).		
5 ‡	1/4" Slf. Rtn. Spacer White		254-5007-02
6 ‡	3/8" Slf. Rtn. Spacer White	10	254-5007-01
7 ‡	5/8" Slf. Rtn. Spacer White	2	254-5007-00
8 ‡	3/4" Slf. Rtn. Spacer White		254-5007-03
9	1/2" X 1/4" Spacer White (Narrow)		254-5000-03

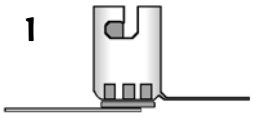
Nº	PLASTIC POST/SPACER NAME	QTY.	SPI PART Nº
10	1/8" X 3/8" Spacer Gray		254-5000-19
11	3/16" X 3/8" Spacer Gray (4 for Dot Display)	4	254-5000-18
12	1/4" X 3/8" Spacer Gray		254-5000-02
13	3/8" X 3/8" Spacer Gray	4	254-5000-12
14	1/2" X 3/8" Spacer Gray		254-5000-01
15	5/8" X 3/8" Spacer Gray		254-5000-14
16	3/4" X 3/8" Spacer Gray	3	254-5000-07
17	7/8" X 3/8" Spacer Gray		254-5000-11
18	1" X 3/8" Spacer Gray/Black	5	254-5000-04
19	1 1/8" X 3/8" Spacer Natural (-06 for Gray)		254-5000-06N
20	1 1/4" X 3/8" Spacer Gray		254-5000-05
21	1 1/2" X 3/8" Spacer Gray		254-5000-08

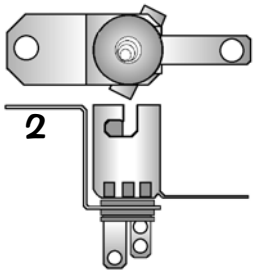
Playfield - Small Bayonet Type Bulbs and Sockets (Actual Size) †

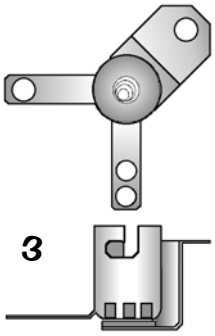


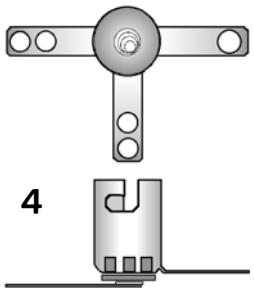


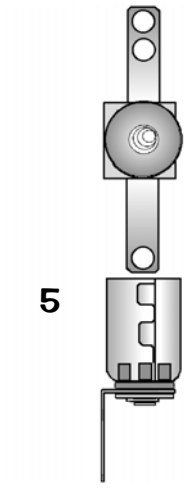


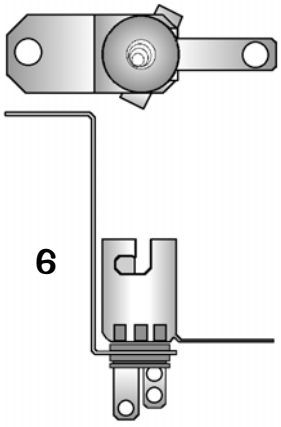


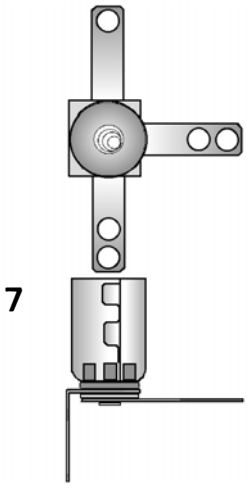


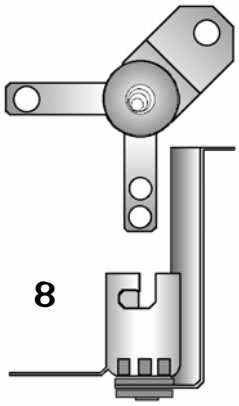


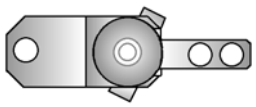


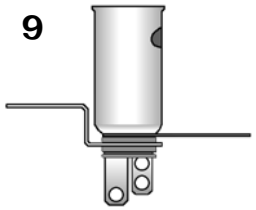


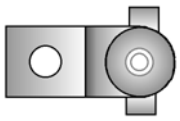


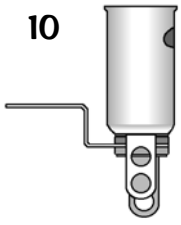


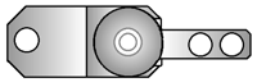


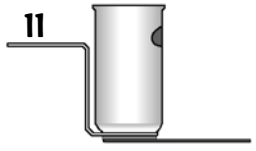


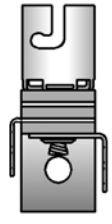










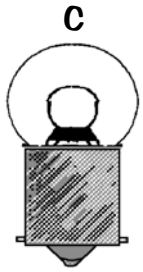


№	SMALL BULB & SOCKET NAME	QTY.	SPI PART №
A	#44 Bulb (Clear) *Heavy Filament*	47	**165-5000-44-HF**
A	#44 Bulb (Red)		165-5053-02
A	#44 Bulb (Amber)		165-5053-03
A	#44 Bulb (Blue)		165-5053-05
A	#44 Bulb (Yellow)		165-5053-06
B	#455 Twinkle Bulb		165-5003-00
1	2-Lug Staple Down Socket	4	077-5000-00
2	3-Lug Stand-Up Short Socket		077-5008-00
3	2-Lug Stand-Up Short Socket	1	077-5002-00
4	3-Lug Staple Down Socket		077-5001-00
5	2-Lug Laydown Socket		077-5003-00
6	3-Lug Stand-Up Long Socket		077-5009-00
7	3-Lug Laydown Socket (3 Lugs Flat)	5	077-5006-00
8	2-Lug Stand-Up Long Socket		077-5005-00
9	3-Lug Stand-Up Long Shell Socket		077-5013-00
10	2-Lug Stand-Up Lg. Shell Socket (Gls)	33	077-5031-00

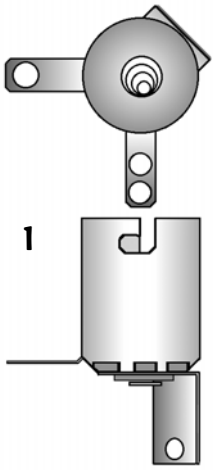
№	SMALL BULB & SOCKET NAME	QTY.	SPI PART №
11	1-Lug Stand-Up Long Shell Socket		077-5012-00
12	3-Lug Laydown Socket (2 Lugs Bent)	4	077-5032-00

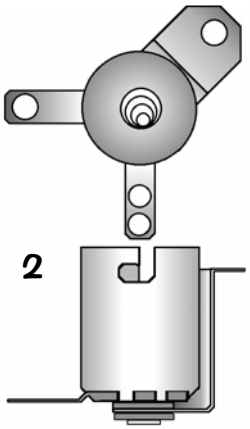
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

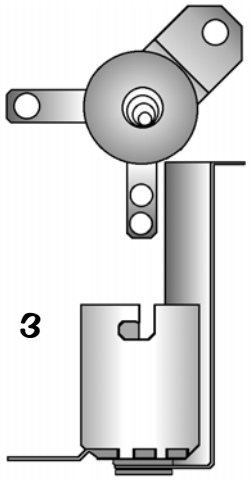
Playfield - Large Bayonet Type Bulb and Sockets (Actual Size) †

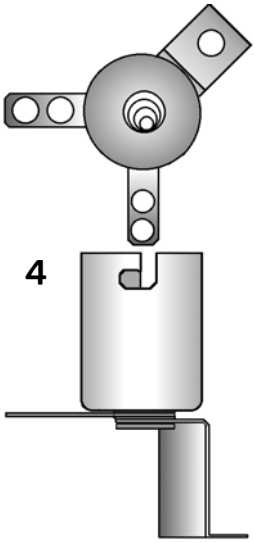


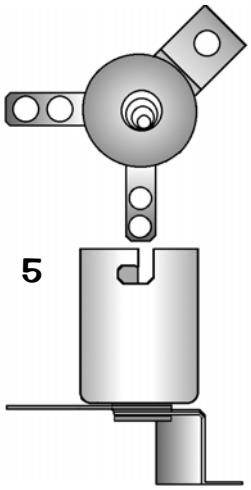
#89
Bulb

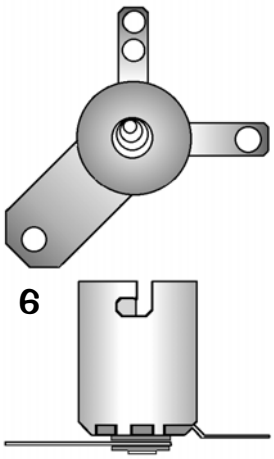








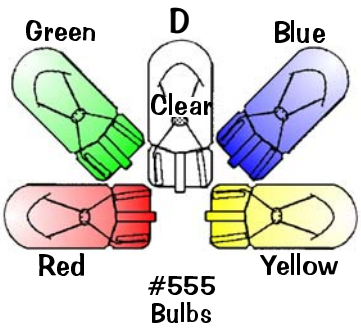


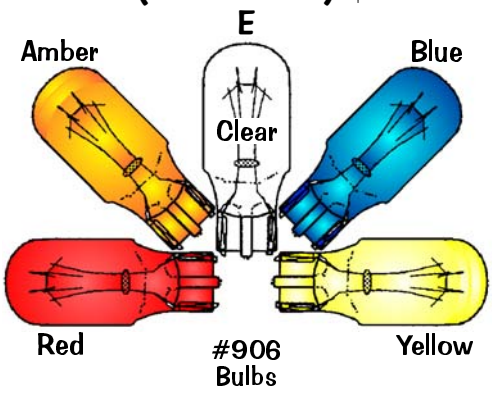


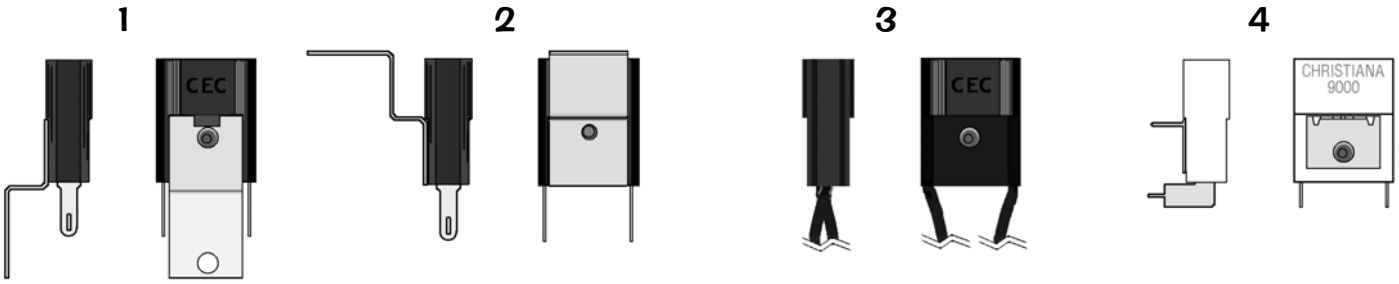
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

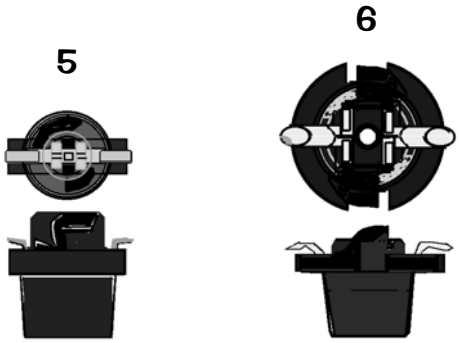
№	LARGE BULB & SOCKET NAME	QTY.	SPI PART №
C	#89 Bulb *Heavy Filament*	21	**165-5000-89-HF**
1	Laydown Standard Socket	7	077-5100-00
2	2-Lug Stand-Up Short Socket	11	077-5101-00
3	2-Lug Stand-Up Long Socket	3	077-5102-00
4	Stand-Up Socket Rev. Short		077-5103-00
5	2-Lug Stand-Up Small Socket		077-5106-00
6	Straight Leg Socket		077-5107-00

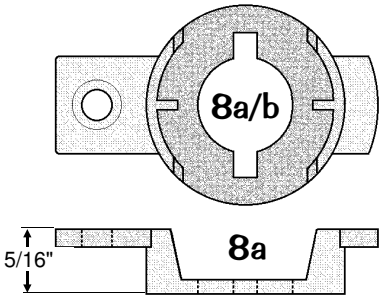
Playfield - Wedge Base Bulbs and Sockets (Actual Size) †







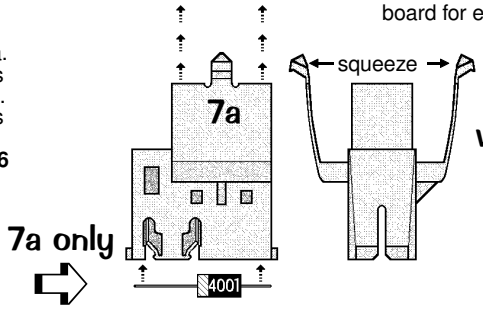




Take Special Note

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 or in a special application).*

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)	53	165-5002-00
D	#555 Wedge Base Bulb (Red)		165-5054-02
D	#555 Wedge Base Bulb (Green)		165-5054-04
D	#555 Wedge Base Bulb (Blue)		165-5054-05
D	#555 Wedge Base Bulb (Yellow)		165-5054-06
E	#906 Wedge Base Bulb (Clear)		165-5004-00
E	#906 Wedge Base Bulb (Red)		165-5004-02
E	#906 Wedge Base Bulb (Amber)		165-5004-03
E	#906 Wedge Base Bulb (Blue)		165-5004-05
E	#906 Wedge Base Bulb (Yellow)		165-5004-06

№	WEDGE BULB & SOCKET NAME	QTY.	SPI PART №
1	#555 Wedge Base Socket (Laydown)		077-5026-01
2	#555 Wedge Base Socket (Offset)		077-5029-00
3	#555 W.B. Socket (for Pop Bumper)	4	077-5206-00
4	#555 W.B. Socket (Solder Type)		077-5207-00
5	#555 Wedge Base Socket (Twist)		077-5007-00
6	#906 Wedge Base Socket (Twist)		077-5016-00
7a	#555 IDC Snap-On Socket	49	077-5216-00
7b	#555 IDC Snap-On Socket ***No Diode***		077-5216-**01**
8a	5/16" Ht. Snap-On Socket Bracket	49	545-5760-18
8b*	19/32" Ht. Snap-On Socket Bracket		545-5760-19

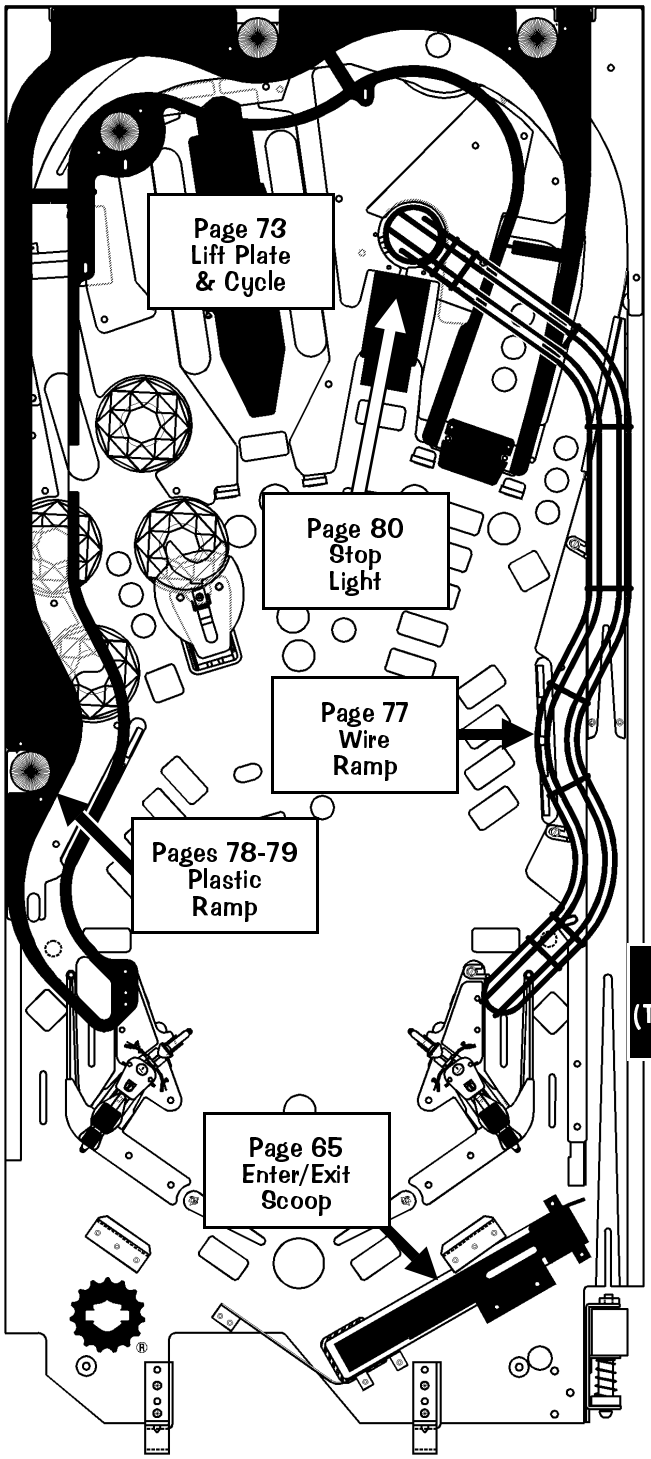
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

Drawings for Major Assemblies & Ramps (The Blue Pages)

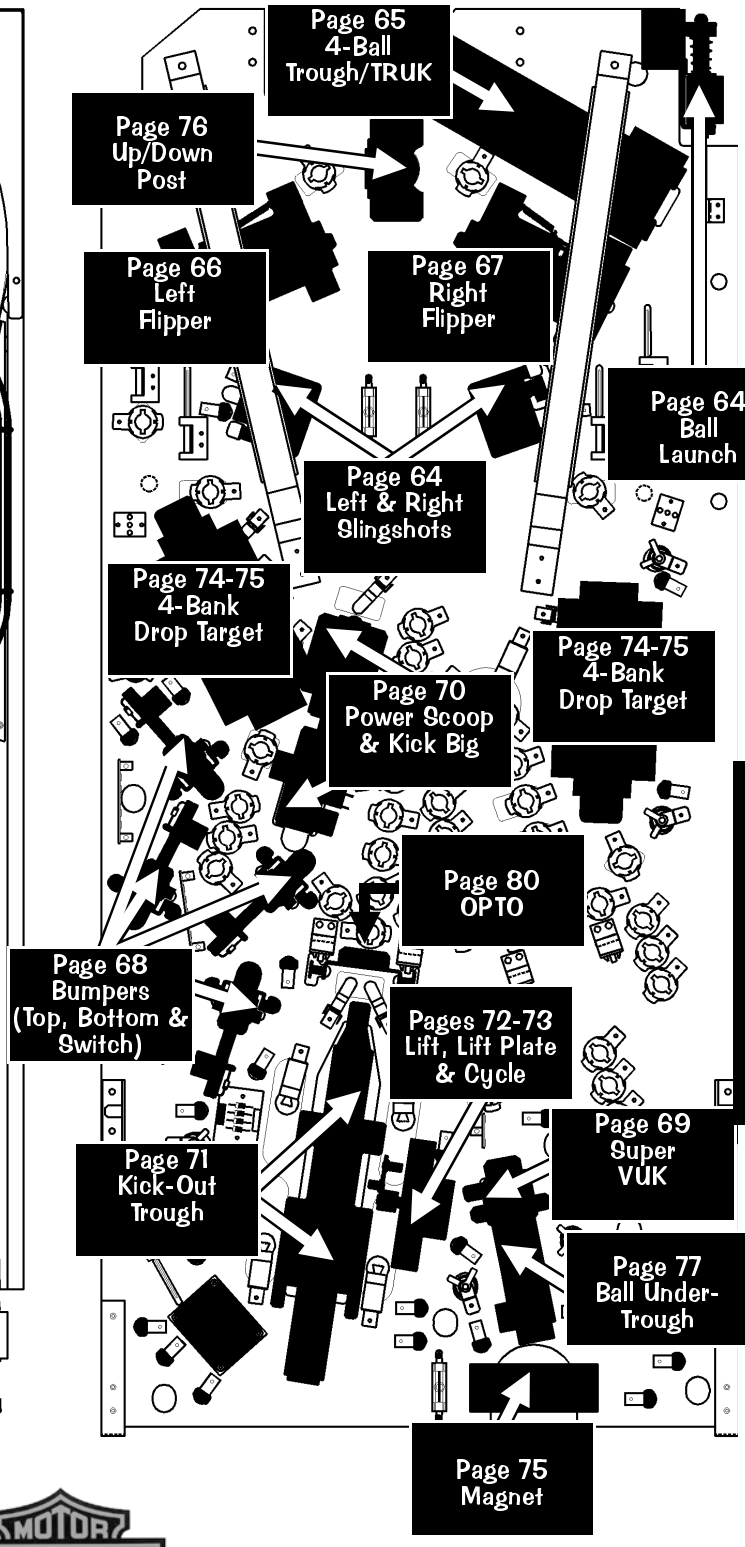
Overview

Drawings are provided for the Major Assemblies in this game with individual parts of each assembly numbered. Items noted with a white circle ○ are mounted above the playfield; items noted with a black circle ● are mounted below. All numbered parts describe the **NAME**, **QUANTITY** & **PART Nº**. **ASSOCIATED PARTS** (**AP-**) are noted and/or viewed with the associated Major Assembly. ***Important:*** Read all "**Take Note:**" items.

ASSEMBLIES MOUNTED ABOVE THE PLAYFIELD



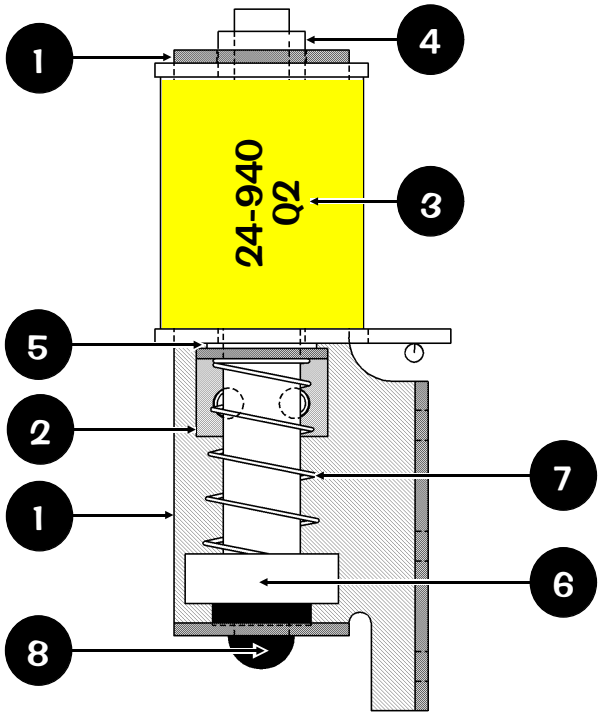
ASSEMBLIES MOUNTED BELOW THE PLAYFIELD



Ball (Auto) Launch Assembly, 500-5477-01 (Items 1-8)

Automatically launches the ball into play.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Coil Mounting Bracket	1	515-6385-00
	Item 1 is secured below the playfield by: #8-32 X 7/8" HWH MS (Zinc) (Qty. 2) (237-5890-00), #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00) **and** #8-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 1) (237-5975-03)		
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, 24-940	1	090-5036-00B
	ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at bottom)	1	112-5003-00
4	Coil Sleeve	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)	2	545-5105-00



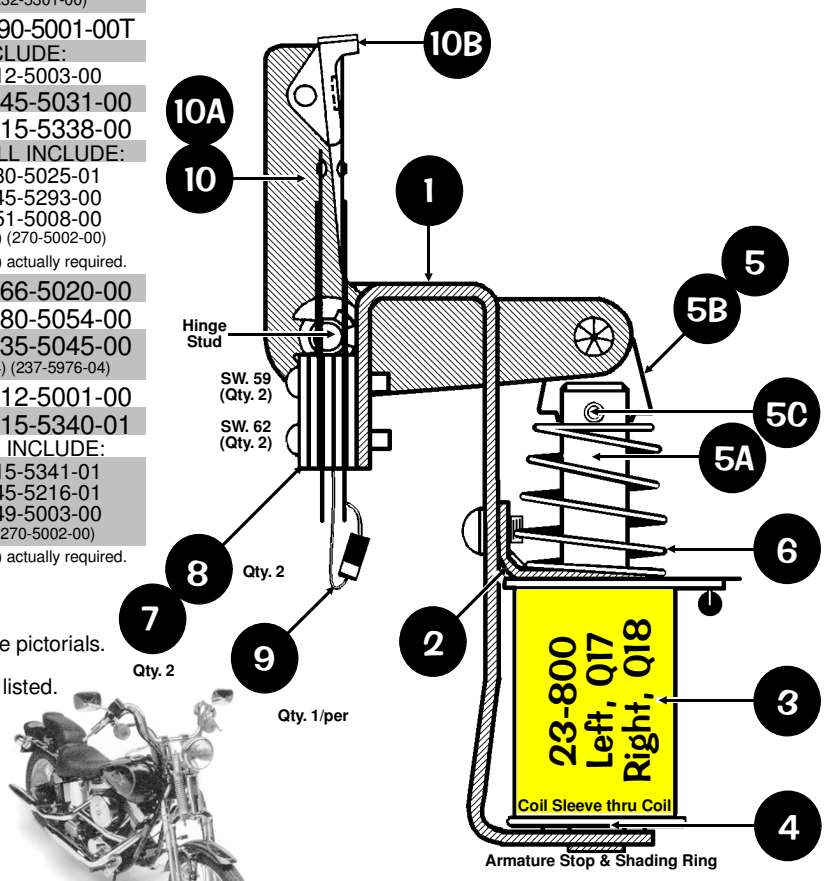
Slingshot (Left & Right) Assemblies, 500-5849-00 (Qty. 2) (Items 1-10)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Slingshot Bracket Assembly	1	515-5339-01
	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.



4-Ball Trough Assembly, 500-6318-24 (Items 1-13)
and Associated Parts: See Parts Table below.

Ordering Note: Identical to 500-6318-14 except it does require Item 11, Trough Ball Guide Plate (used only when magnets are present in the game).

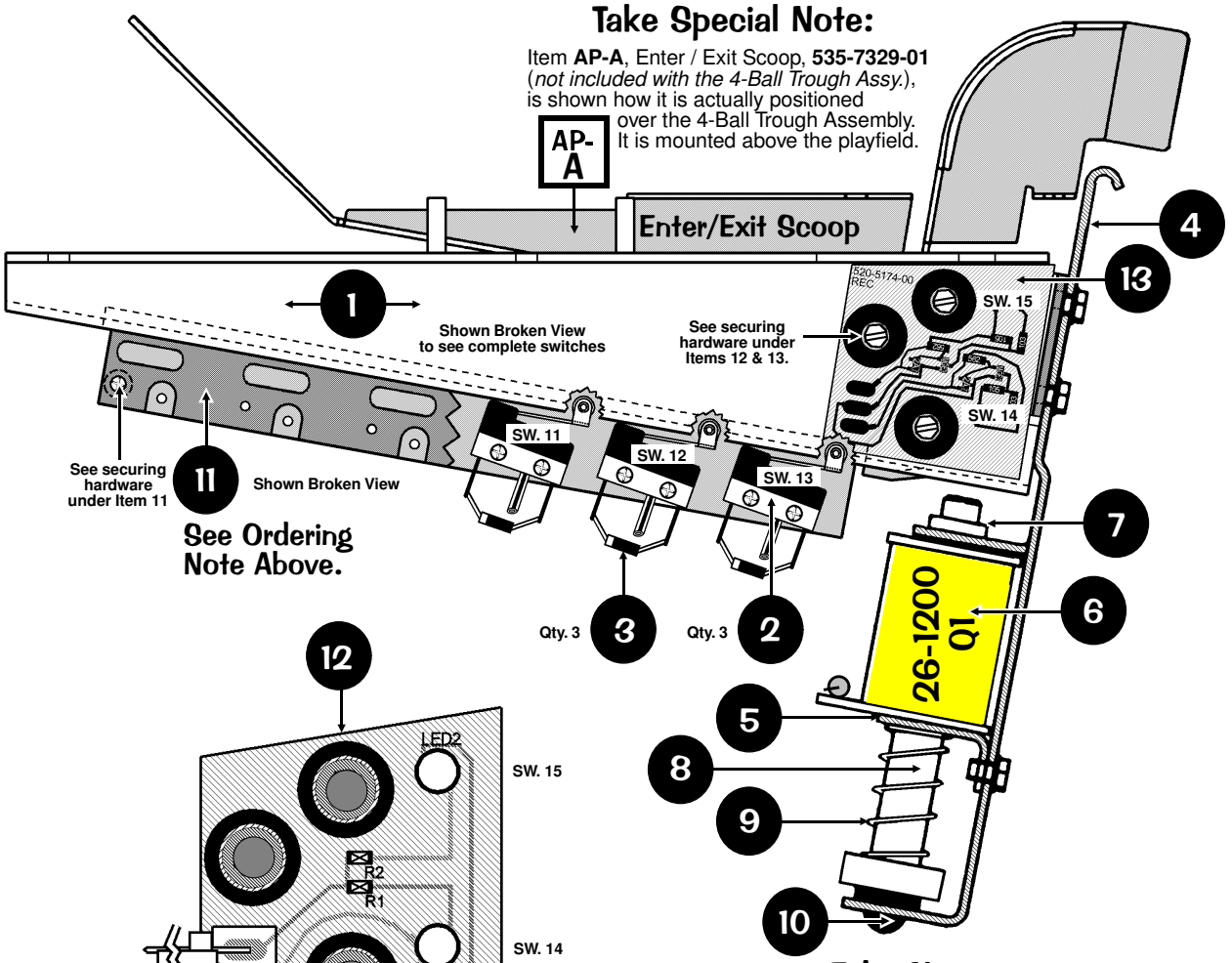
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Ball Trough Outhole Mounting Bracket	1	515-6580-01
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 6) (234-5101-00)		
2	Micro Switch **(Roller Actuator, Lite-Force)**	3	180-5119-02
	Item 2 is secured to Item 1 by: #2-56 X 1/2" HWH (Sr) 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 № 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
10	Rubber Bumper (Grommet)	1	545-5105-00
11	Trough Ball Guide Plate *Not Required*	1	535-7801-00
	Item 11 is secured to Item 1 by: 1/4" X 5/16" X .144" I.D. Spacer Tap. (Qty. 1) (254-5014-03) **and** #2-56 X 1/2" HWH (Ser) UNS #4HD TR3 BO (Qty. 4) (237-5937-02)		
12	Dual OPTO TRANS Board Assembly	1	515-0173-00
13	Dual OPTO REC Board Assembly	1	515-0174-00
	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**)		

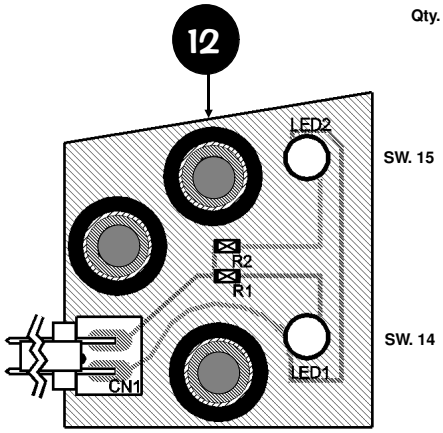
ASSOCIATED PARTS **ARE NOT INCLUDED** WITH THE ABOVE ASSEMBLY.

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

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, 515-0173-00, is mounted on the other side of the Trough Assembly, in line with Item 13, Dual OPTO REC (Receiver) Board, 515-0174-00, 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** (**515-0173-00** & **515-0174-00**), *see Section **5**, Chapter **4**, **Trough Up-Kicker Dual OPTO Boards Theory of Operation & Schematic**, **Component Layout & Parts**.*

Flipper (Left) Assembly, 500-6543-12 (Items 1-15)
and Associated Part: White Flipper Bat & Shaft Assy., 515-5133-08-06 (Item AP-A)

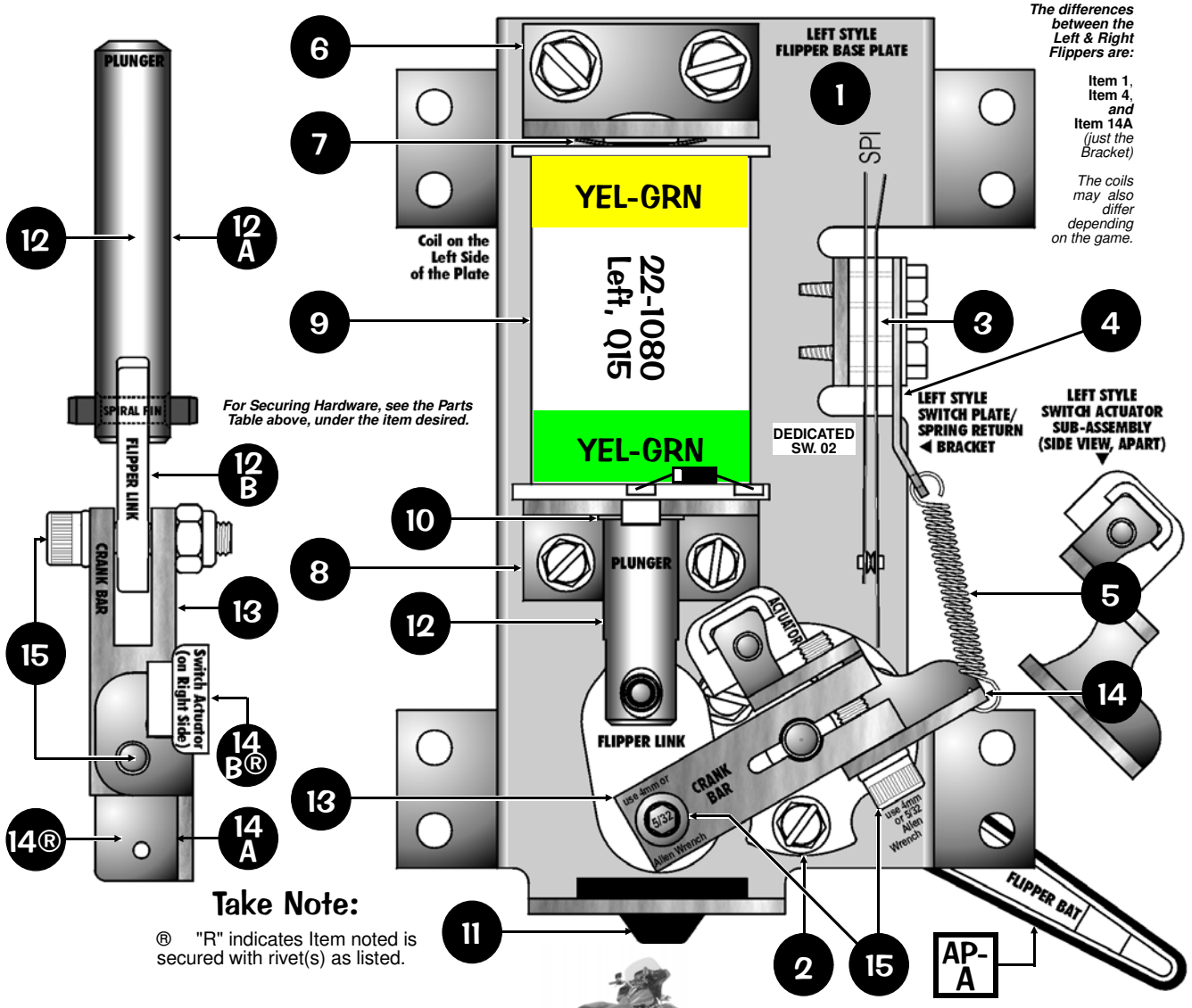
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Flipper Base Plate (**LEFT**)	1	**See FRP1**
	Item 1 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00) ***Ordering Note:*** *Use Item **FRP1**, see the end of this Parts Table.*		
2	Flipper Bat Bushing (White Plastic)	1	545-5070-00
	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	Sw. Plate/Spring Return Brkt. (**LEFT**)	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
12*	Flipper Plunger & Link Sub-Assy.	1	515-6304-03
	ORDERING ABOVE (ITEM 12) SUB-ASSY. PART Nº WILL INCLUDE:		
12A	Flipper Plunger with "Flat"	1	530-5349-01
12B	Plunger "Flipper" Link	1	545-5611-01
	Item 12B is secured to 12A by: Bushing, .16" ø ID X .281" ø OD X .187" (Qty. 1) (530-5532-00) **and** Spirol Pin ø 5/32" X 3/4" Lg. (Qty. 1) (251-5015-02)		
13*	Crank Bar	1	530-5070-02
	Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)		
14*	® Switch Actuator (**LEFT**) Sub-Assy.	1	515-7257-**01**
	ORDERING ABOVE (ITEM 14) SUB-ASSY. PART Nº WILL INCLUDE:		
14A	Actuator & Spring Bracket (**LEFT**)	1	535-9038-**01**
14B	® Switch Actuator (White Plastic)	1	545-5612-00
	Item 14B is secured to 14A by: Rivet, 1/8" ø X 1/4" Lg. (Qty. 1) (249-5003-00)		
15*	Set Screw: #10-32 X 7/8" Socket Hd.	2	237-5966-00
	Item 15 requires: #10 Split Lock Washer (Qty. 1/per) (244-5003-00) **and** #10-32 Nylon Stop Nut (Qty. 1/per) (240-5203-00) **Tool Required for Item 15: 5/32" or 4mm Allen Wrench**		

Flipper Rebuild Parts for Easier Installation, $ave $:

FRP1	**Flipper Base Plate Kit (LEFT)** *Includes Item 1 pre-threaded, with the Securing Hardware for Items 2, 3, 6 & 8.*	515-6617-**01**
FRP2	**Plunger, Link & Crank (LEFT) Assy.** *Includes above Items 12, 13, 14 and 15 and is pre-assembled.*	515-7203-**01**
FRP3	**Flipper (LEFT) Rebuild Kit** *Same as **FRP2**, but also includes above Items 6 & 10.*	500-6307-**10**

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

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



Take Note:

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

* To Order the Flipper (Left) Rebuild Kit ask for Part Nr.: 500-6307-10 (includes Items 6, 10, 12, 13, 14 & 15)

Flipper (Right) Assembly, 500-6543-04 (Items 1-15)
and Associated Part: White Flipper Bat & Shaft Assy., 515-5133-08-06 (Item AP-A)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Flipper Base Plate (**RIGHT**)	1	**See FRP1**
	Item 1 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00) ***Ordering Note:*** *Use Item **FRP1**, see the end of this Parts Table.*		
2	Flipper Bat Bushing (White Plastic)	1	545-5070-00
	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	Sw. Plate/Spring Return Brkt. (**RIGHT**)	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, 23-1100 (ORANGE) (Right)	1	090-5030-00T
	ORDERING ABOVE (ITEM 9) COIL PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
10*	Coil Sleeve	1	545-5388-00
11	Deflector Pad (Bumper)	1	545-5428-00
12*	Flipper Plunger & Link Sub-Assy.	1	515-6304-03
	ORDERING ABOVE (ITEM 12) SUB-ASSY. PART Nº WILL INCLUDE:		
12A	Flipper Plunger with "Flat"	1	530-5349-01
12B	Plunger "Flipper" Link	1	545-5611-01
	Item 12B is secured to 12A by: Bushing, .16" ø ID X .281" ø OD X .187" (Qty. 1) (530-5532-00) **and** Spirol Pin ø 5/32" X 3/4" Lg. (Qty. 1) (251-5015-02)		
13*	Crank Bar	1	530-5070-02
	Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)		
14*	® Switch Actuator (**RIGHT**) Sub-Assy.	1	515-7257-**00**
	ORDERING ABOVE (ITEM 14) SUB-ASSY. PART Nº WILL INCLUDE:		
14A	Actuator & Spring Bracket (**RIGHT**)	1	535-9038-**00**
14B	® Switch Actuator (White Plastic)	1	545-5612-00
	Item 14B is secured to 14A by: Rivet, 1/8" ø X 1/4" Lg. (Qty. 1) (249-5003-00)		
15*	Set Screw: #10-32 X 7/8" Socket Hd.	2	237-5966-00
	Item 15 requires: #10 Split Lock Washer (Qty. 1/per) (244-5003-00) **and** #10-32 Nylon Stop Nut (Qty. 1/per) (240-5203-00) **Tool Required for Item 15: 5/32" or 4mm Allen Wrench**		

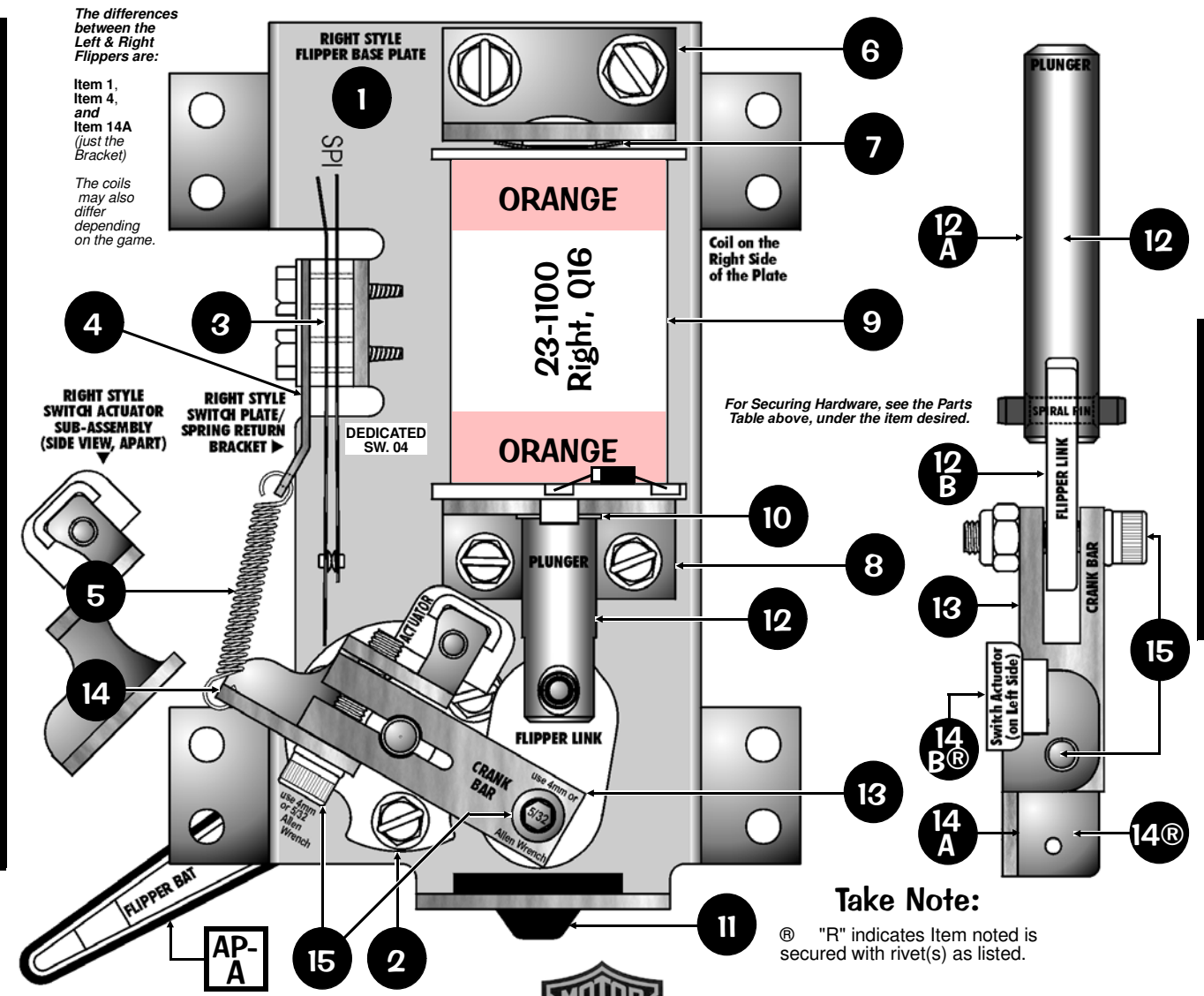
Flipper Rebuild Parts for Easier Installation, $ave $:

FRP1	**Flipper Base Plate Kit (RIGHT)** *Includes Item 1 pre-threaded, with the Securing Hardware for Items 2, 3, 6 & 8.*	515-6617-**00**
FRP2	**Plunger, Link & Crank (RIGHT) Assy.** *Includes above Items 12, 13, 14 and 15 and is pre-assembled.*	515-7203-**00**
FRP3	**Flipper (RIGHT) Rebuild Kit** *Same as **FRP2**, but also includes above Items 6 & 10.*	500-6307-**00**

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

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

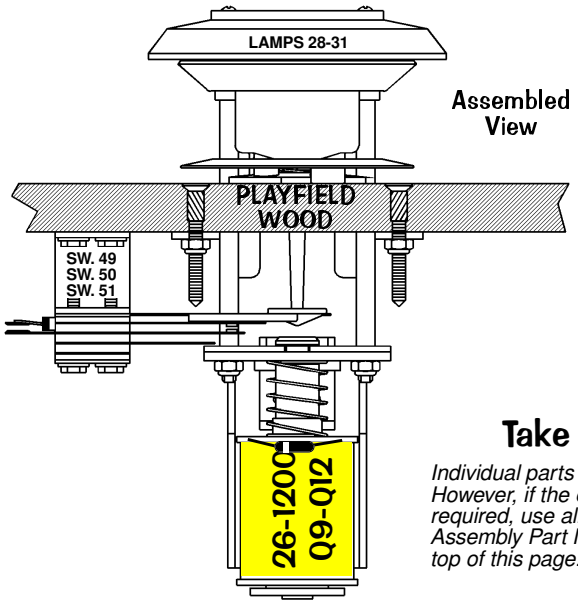
* To Order the Flipper (Right) Rebuild Kit ask for Part Nr.: 500-6307-00 (includes Items 6, 10, 12, 13, 14 & 15)



Take Note:

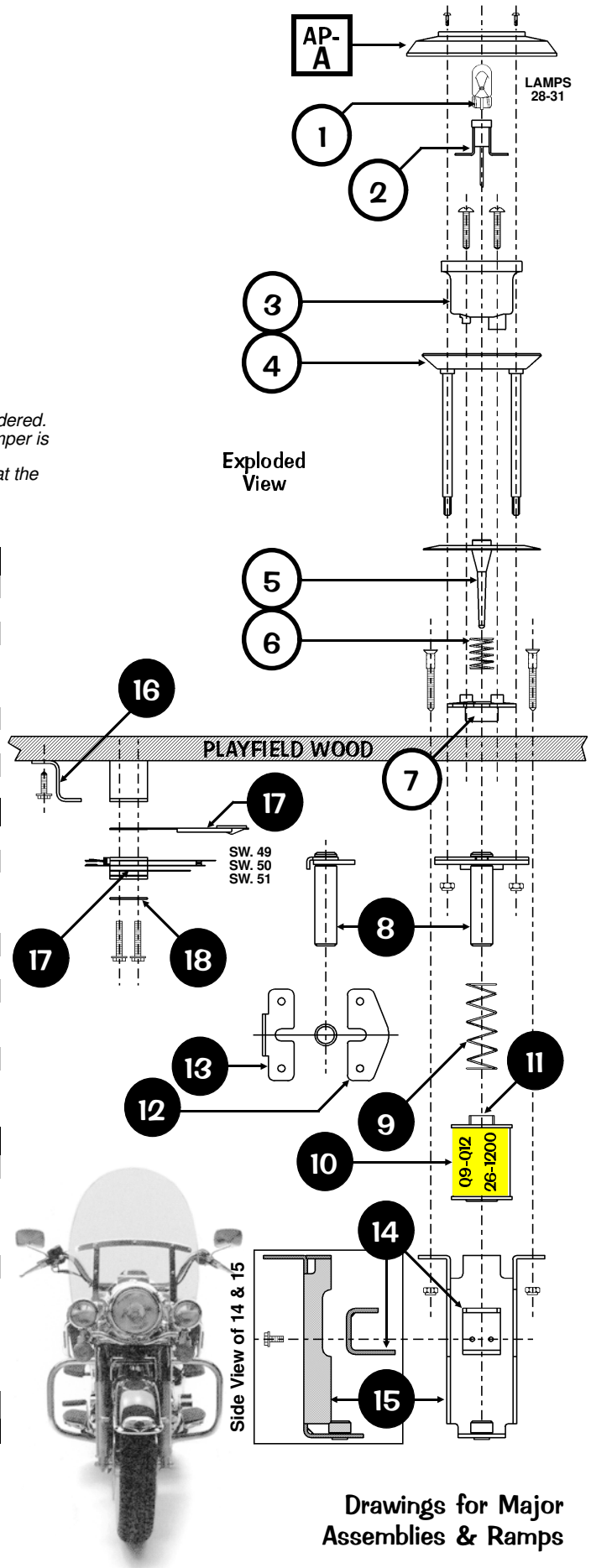
® "R" indicates Item noted is secured with rivet(s) as listed.

Bumper Top Assemblies, 515-6459-01 (Qty. 4) (Items 1-7), Bumper Bottom Assy., 515-6459-04 (Qty. 4) (Items 8-15), Bumper Switch Assy., 515-6459-09 (Qty. 4) (Items 16-20) and Associated Part(s): See Table Below (Item AP-A)



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" HWH AB (Zinc) (Qty. 2) (234-5101-00)		
17	Bumper Stack (Blade) Switch Assy.	1	180-5015-04
	Included with Item 17 : Spoon Switch Actuator (**545-5610-02**). Switch has a Diode (1N4004) (112-5003-00). *Can be replaced with (1N4001) (112-5001-00).*		
18	Switch Body Protect Plate	1	535-7344-00
	Items 17 & 18 are secured by: #6-32 X 3/4" HWH Swage (Serr) Zc. (Qty. 2) (237-5976-05)		

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)	4	550-5057-02

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

Launches the ball into the Wire Ramp.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	SVUK Mounting Weldment Bracket	1	515-6744-04
	Item 1 is secured under the P/F by: #8 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5101-00)		
2	Super VUK Switch Bracket	1	535-8144-01
	Item 2 is secured to Item 1 by: #4-40 X 5/8" MS (Serr) Zinc (Qty. 2) (237-5945-00)		
3	Micro-Switch	1	180-5052-00
	Item 3 secured to Item 2 by: #6-32 X 3/8" HWH Swage (Serr) Zinc (Qty. 2) (237-5976-02)		
4	Coil Retaining Bracket	1	535-5203-03
	Item 4 is secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) (Qty. 2) (232-5300-00)		
5	Coil, 23-800	1	090-5001-00T
	ORDERING ABOVE (ITEM 9) COIL PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
6	Coil Sleeve	1	545-5076-01
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
8	Plunger Assembly	1	515-5941-01
9	Compression (Relay) Spring	1	266-5020-00
10	Rubber Bumper (Grommet)	1	545-5105-00

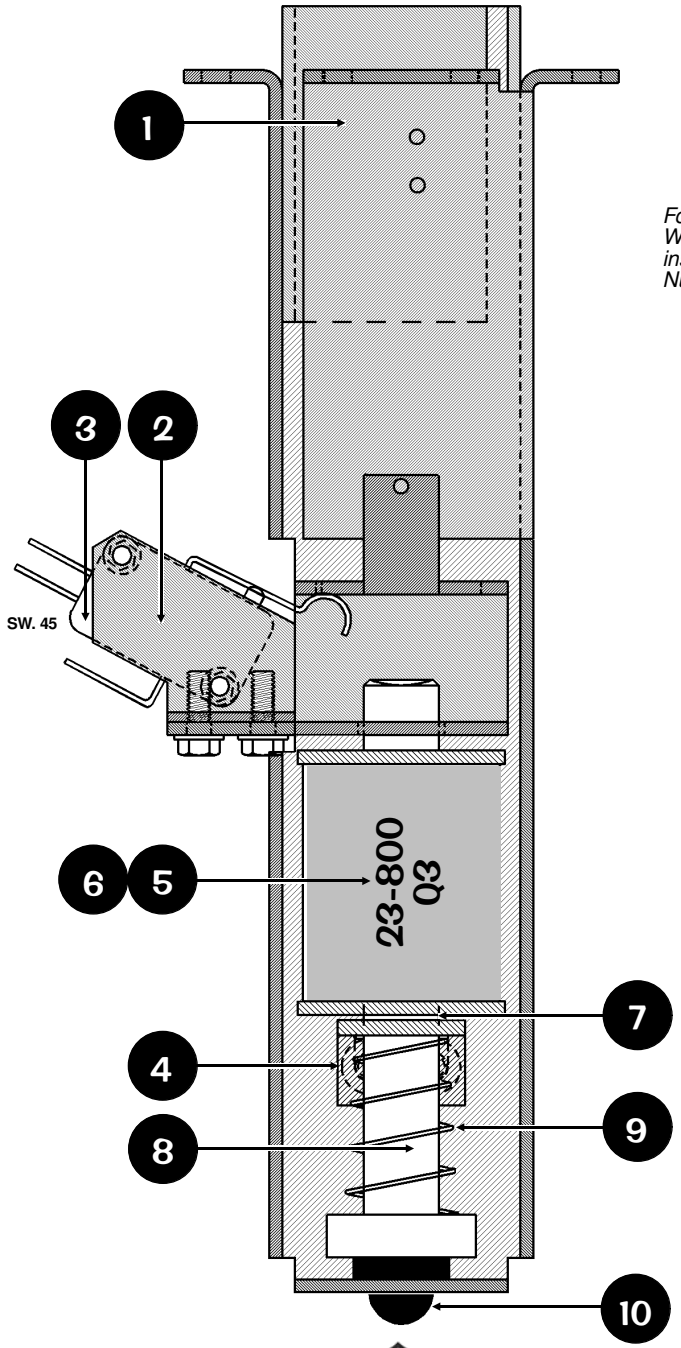
Ordering Note: If **500-6184-05** *is unavailable*, order the individual part(s) actually required.

Take Note:

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

1. Note: The Switch Diode, 1N4001, is not located on this assembly (nor included); it's located on a *Terminal Strip* under the playfield.

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



Ordering Note:

*For this assembly to come with the Cable Wiring Harness (036-5450-02-67) installed, add **-67** to the 500-6184-05 Part Number.*

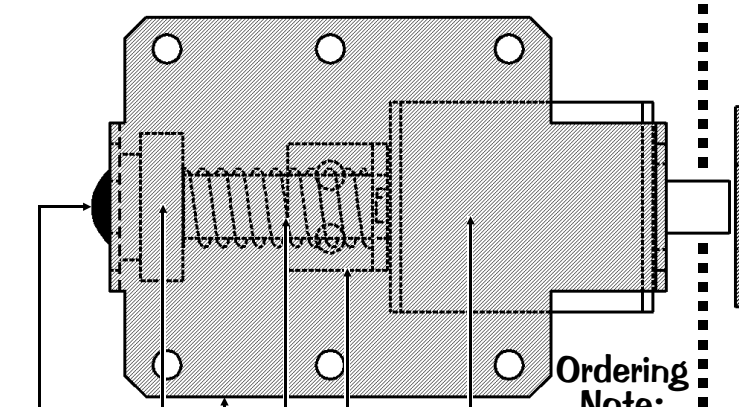
Kick-Big Assembly, 500-6398-00 (Items 1-8)

Note: This Assembly works in conjunction with the Power Scoop Assy. Shown Right.

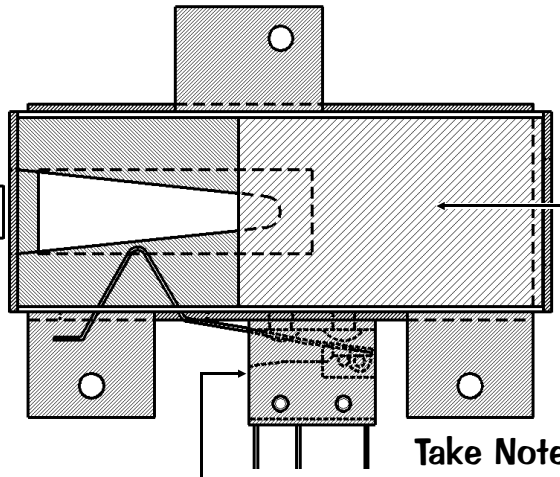
Power Scoop Assembly, 500-5809-00 (Items 9-12)

Note: This Assembly works in conjunction with the Kick-Big Assy. Shown Left.

Top View Kick Big



Top View Power Scoop



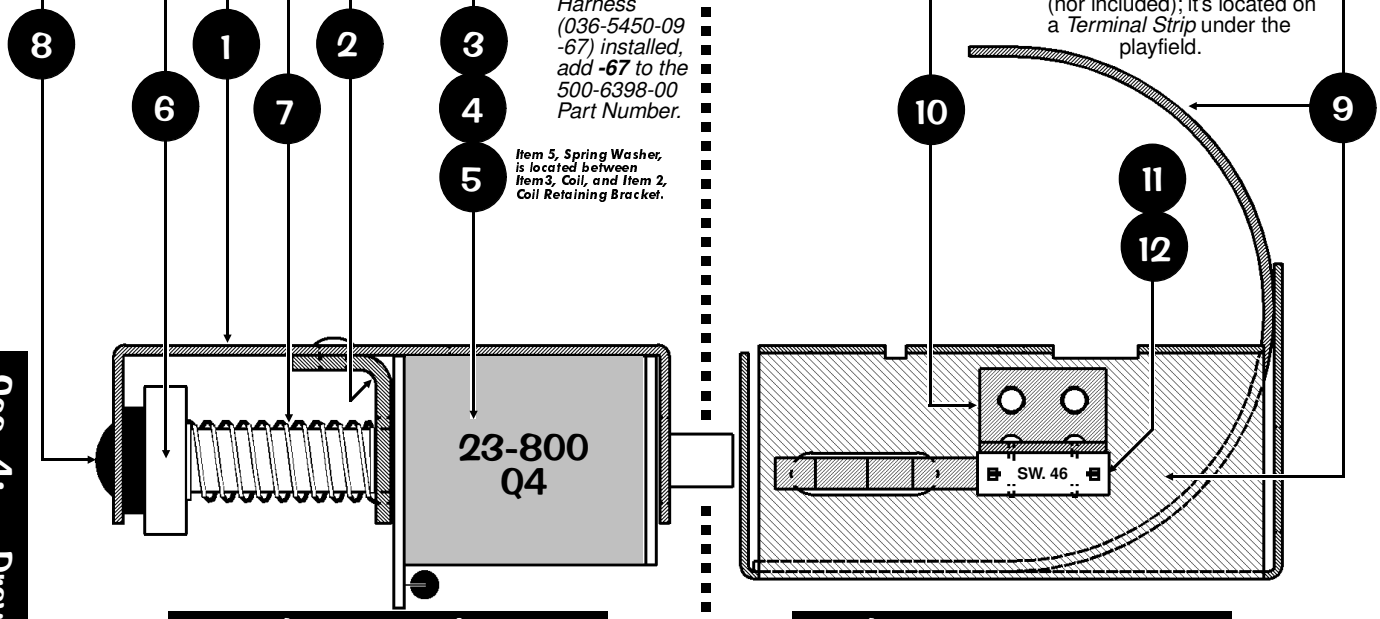
Ordering Note:

*For this assembly to come with the Cable Wiring Harness (036-5450-09 -67) installed, add **-67** to the 500-6398-00 Part Number.*

Item 5, Spring Washer, is located between Item3, Coil, and Item 2, Coil Retaining Bracket.

Take Note:

1. Note: The Sw. Diode, 1N4001, is not located on this assembly (nor included); it's located on a *Terminal Strip* under the playfield.



Side View Kick Big

Side View Power Scoop

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Kick-Big Mounting Bracket	1	535-8575-00
	Item 1 is secured under the P/F by: #6 X 1/2" HWH AB (Zinc) Red (Qty. 6) (234-5101-02)		
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, 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	545-5076-01
5	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
6	Plunger Assembly	1	515-5000-02
7	Compression (Relay) Spring	1	266-5020-00
8	Rubber Bumper (Grommet)	1	545-5105-00

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
9	Power Scoop Weldment Assembly	1	515-6022-00
	Item 9 is secured under the P/F by: #6 X 1/2" HWH AB (Zinc) Red (Qty. 3) (234-5001-02)		
10	Micro-Switch Bracket	1	535-6173-00
	Item 10 is secured to Item 9 by: #6-32 X 3/16" PPH MS (Sems) Zc. (Qty. 2) (234-5209-00)		
11	Micro Switch, High-Form	1	180-5057-00
12	Switch Body Protect Plate	1	535-6539-00
	Items 11/12 are secured to Item 10 by: #2-56 X 1/2" PPH MS (Zc.) (Qty. 2) (237-5806-00), #2 Split Lock Washer (Qty. 2) (244-5001-00) **and** #2-56 Hex Nut (Qty. 2) (240-5301-00)		

Ordering Note: *If* **500-5398-00** *or* **500-5809-00** *are unavailable*, order the individual part(s) actually required.

Kick-Out Trough Assembly, 500-6397-00 (Items 1-10)
and Associated Part: Diode Board, 520-5146-00 (Item AP-A*)

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Kick-Out Trough Weldment Bracket	1	515-7023-00
	Item 1 is secured under the playfield at the top single-hole by: #8 X 1/2" SHWH AB (Zinc) (Qty. 1) (234-5101-00) **and** Washer .187" ID X .875" OD X .048" Thk (Qty. 1) (242-5059-00) **and the front 2 holes by:** #8-32 X 3/4" HWH Swage (Serr) Zinc (Qty. 2) (237-5975-02) **and the back 6 holes by:** #4 X 1/2" PFH (Zinc) (Qty. 6) (237-5840-00)		
2	Stop Bracket	1	535-8568-00
	Item 2 secured to Item 1 by: #8-32 X 1/2" PPH MS (Sems) Zinc (Qty. 3) (232-5302-00)		
3	4-Position Membrane Switch w/cable	1	181-5001-00
4	Coil Retaining Bracket	1	535-5203-03
	Item 4 secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) (Qty. 2) (232-5300-00)		
5	Coil, 24-940	1	090-5036-00B
	ORDERING ABOVE (ITEM 5) COIL PART № WILL INCLUDE:		
—	Diode, 1N4004 (positioned at bottom)	1	112-5003-00

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
6	Coil Sleeve	1	545-5076-01
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
8	Plunger Assembly	1	515-5941-01
9	Compression (Relay) Spring	1	266-5020-00
10	Rubber Bumper (Grommet)	1	545-5105-00

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

№	ASSOCIATED PART NAME	QTY.	SPI PART №
AP-**A**	* Diode PC Board	1	520-5146-00
	Item AP-A is secured under the P/F by: #6 X 3/4" HWH AB (Zinc) (Qty. 2) (234-5003-00) **and** 3/8" Slf. Rtn. Spacer White (Qty. 2) (254-5007-01)		

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

Take Note:

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

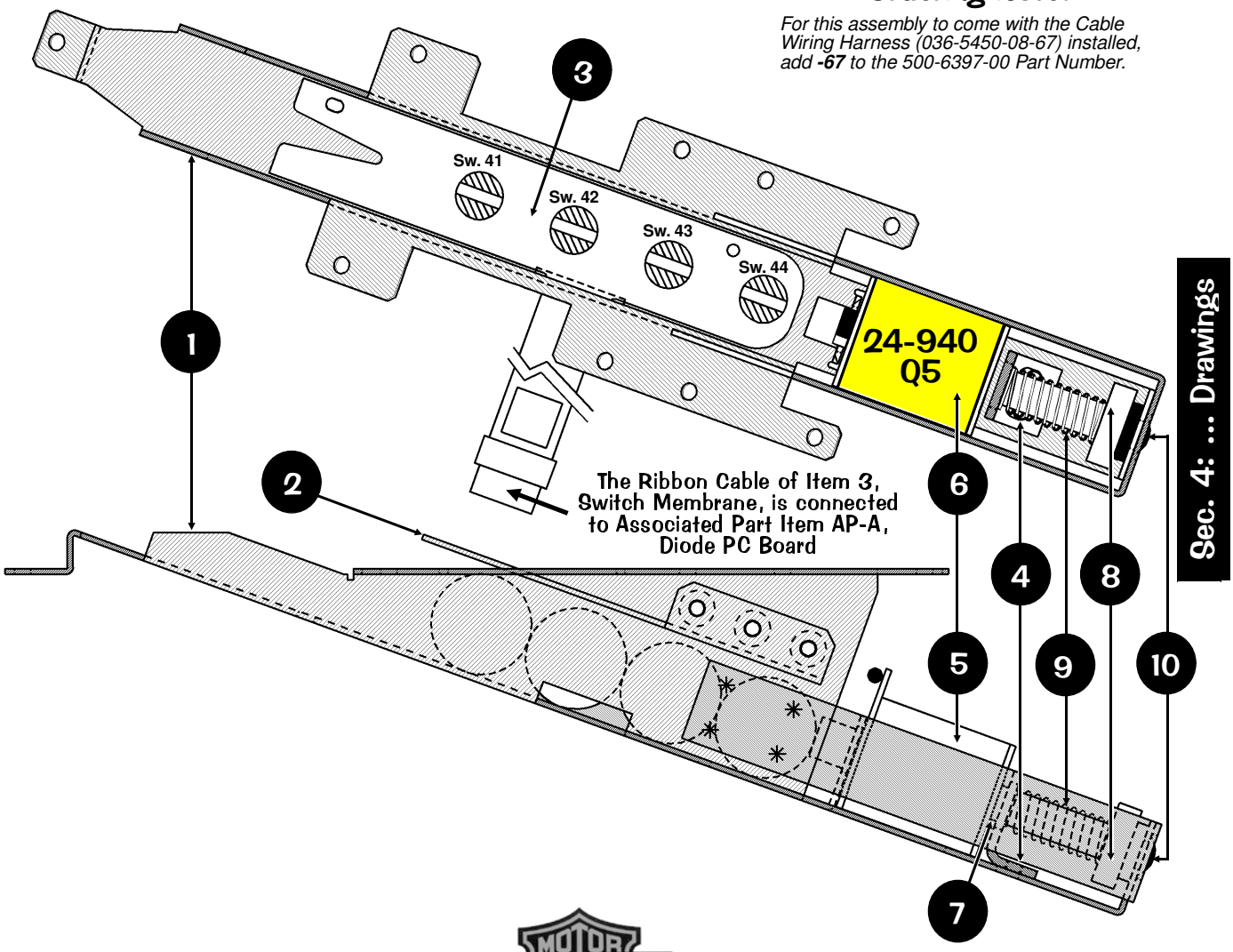
Note: *The Switch Diodes, 1N4001, are not located on this assembly; they're located on a Diode Board (Item AP-A) under the playfield.*

Tech Alert Note:

The **Switch Membrane (Item 3)** is connected to a **Diode Board (Assoc. Part Item AP-A)** which is *required to operate*. Before determining the **Switch Membrane** is malfunctioning, *check the connection* to the **Diode Board**, and the diodes on the board first. *Testing of this mechanism can be done in* ***Portals™****, reference the inside front cover or Section* ***3****, Chapter* ***2****,* ***GO TO DIAGNOSTICS MENU****,* ***Harley-Davidson Specific (Motorcycle Test)****,* ***Page 24****.*

Ordering Note:

For this assembly to come with the Cable Wiring Harness (036-5450-08-67) installed, add ***-67*** *to the 500-6397-00 Part Number.*



Lift Assembly, 500-6396-00 (Items 1-6)
and Associated Part: Relay Board, 520-5010-00 (Item AP-A*)

Note: This Assembly works in conjunction with the Lift Plate & Cycle Assy., next page.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Motor Mounting Bracket	1	535-8564-00
	Item 1 is secured under the P/F by: #8 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00)		
2	Motor & Connector Assembly	1	515-7025-00-67
	ORDERING ABOVE (ITEM 2) SUB-ASSY. PART Nº WILL INCLUDE:		
2A	Motor, Autotrol 20 RPM 24v AC CCW	1	**041-5072-02**
2B*	1 X 3, .093" Conn. Male 03-09-2032	1	045-5004-03
2C*	Capacitor, Tecate .1 MFD 500v Disc	1	130-5000-00
2D*	Neon Bulb	1	165-5021-00
	Item 2 is secured to Item 1 by: #6-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5200-00)		
	Operation Note: *Item 2C eliminates Line Noise, Item 2D is used for Spike Suppression.*		
3	Lift Cam Assembly	1	515-7021-00
	Item 3 is secured to Item 1 (Shaft) by Item 4 (next column).		

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
4	#8-32 X 3/8" Soc. Hd. Cap Scr. (Zinc)	1	237-5897-00
5	Micro-Switch	2	180-5052-00
	Item 5 is secured to Item 1 by: #4-40 X 5/8" PPH MS (Sems) Zc (Qty. 2/per) (237-5832-00)		
6	Switch Diode, 1N4001	2	112-5001-00

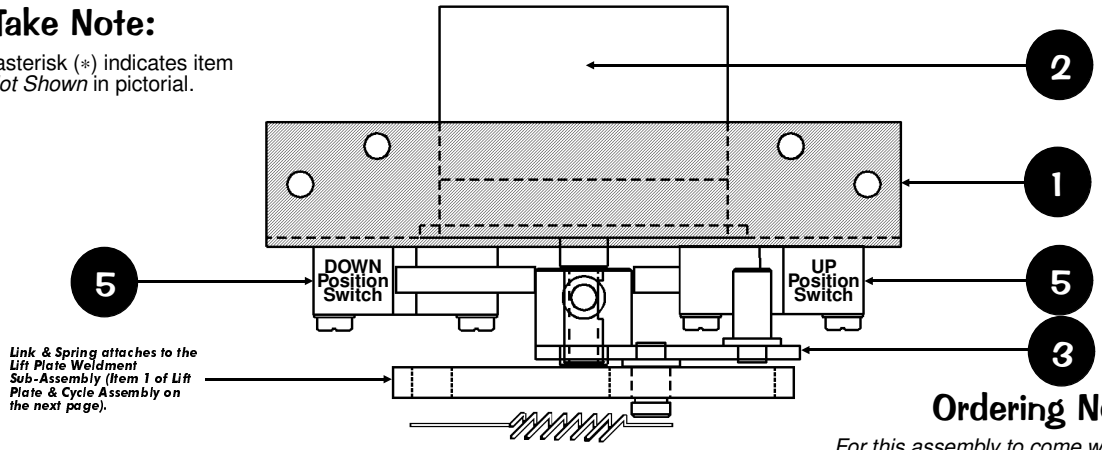
ASSOCIATED PART **IS NOT INCLUDED** WITH THE ABOVE ASSEMBLY.

Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
AP-**A**	* Relay PC Board	1	520-5010-00
	Item AP-A 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)		
	Note: For Item AP-A PC Bd. to include cable & spacers use (500-6213-00).		

Ordering Note: If **500-6396-00** *is unavailable*, order the individual part(s) actually required.

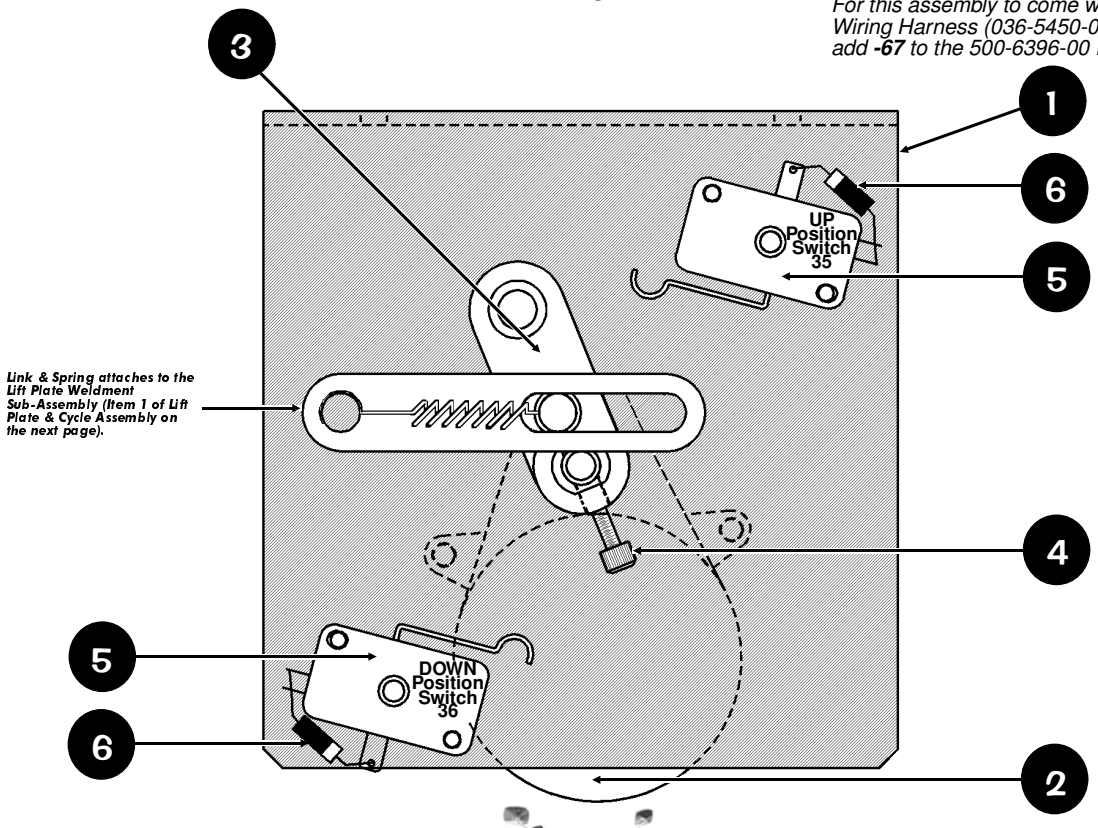
Take Note:

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



Ordering Note:

*For this assembly to come with the Cable Wiring Harness (036-5450-07-67) installed, add **-67** to the 500-6396-00 Part Number.*



Lift Plate & Cycle Assembly, 500-6362-00-67 (Items 1-6)
and Associated Parts: See Table Below (Items AP-A & AP-B)

Note: This Assembly works in conjunction with the Lift Assembly, previous page.

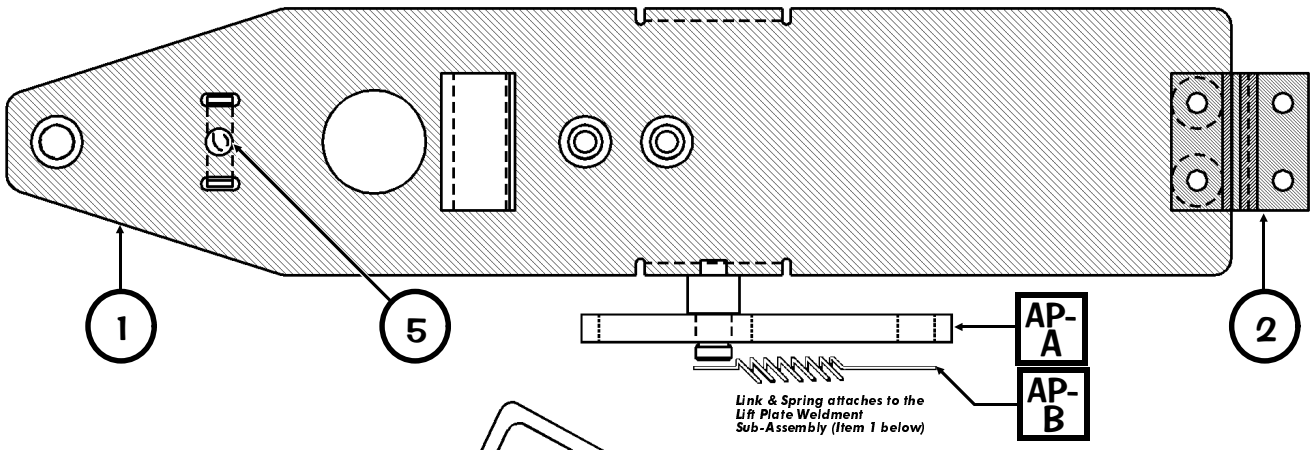
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Lift Plate Weldment Sub-Assembly	1	515-7022-00
	Item 1 is secured above the P/F @ Item 2 by: #8-32 X 5/8" PPH MS (Sems) Zc. (Qty. 2) (232-5303-00)		
2	Hinge	1	390-5044-00
	Item 2 is secured to Item 1 by: #8-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2) (232-5301-00)		
3	Rubber Sleeve **(Modified: unique to game)**	1	545-5932-00
	Item 3 is secured to Item 1 by: #6-32 X 1/4" PPH MS (Sems) Zinc (Qty. 1) (232-5200-00) **and** #6 Washer (Qty. 1) (242-5001-00)		
	Item 3 is created from a modified Post Black Rubber (Sleeve Tall) (545-5308-00)		
4	H-D® FLSTF® Fat Boy™ 1:10	1	880-5034-01
5	Clear Dot, Self-Adhesive	1	280-5012-00
6	Plastic Piece (Screened) Buty -27	1	*from 830-5960-XX*
	Item 6 secured by: #6-32 X 3/4" PPH TC MS Zinc (Qty. 2) (237-6009-00) **and** #6 Washer (Qty. 1) (242-5001-00)		

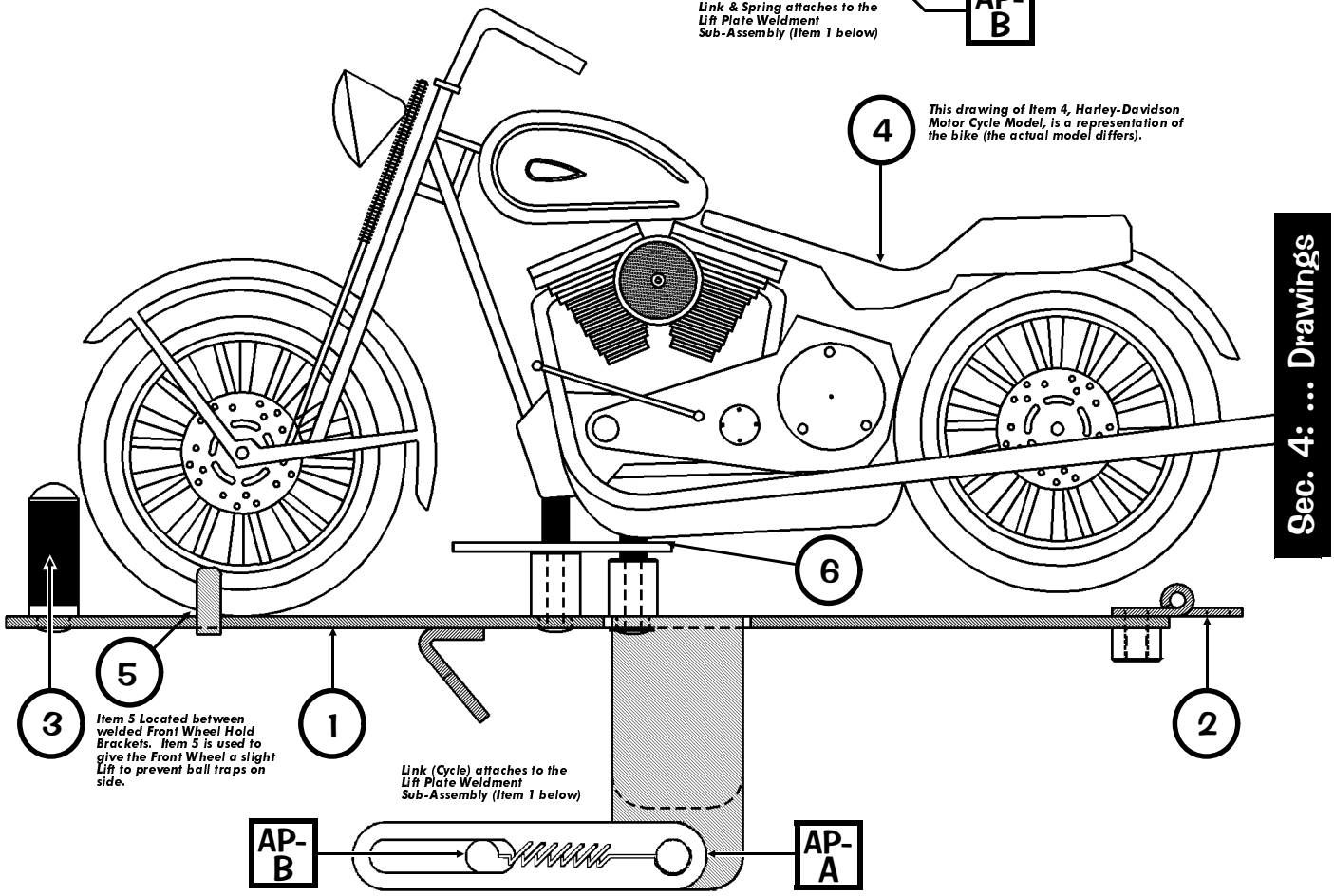
ASSOCIATED PART **IS NOT INCLUDED** WITH THE ABOVE ASSEMBLY.

№	ASSOCIATED PART NAME	QTY.	SPI PART №
AP-**A**	Link (Metal, Slotted)	1	535-8603-00
AP-**B**	Spring (works with Item 7 Link)	1	265-5017-01

Items AP-A & AP-B are secured onto the PEM Stud of the Lift Assy., 500-6396-00-67 (previous page) by: Washer 1/4" ID X 7/16" OD X 1/32" (Qty. 1) (242-5012-00) **and** Retaining Ring, 1/4" ø Shaft (Qty. 2) (270-5002-00) **and onto the PEM Stud of the Lift Plate & Cycle Assy., 500-6362-01-67 by:** Washer 1/4" ID X 7/16" OD X 1/32" (Qty. 1) (242-5012-00)

Ordering Note: If **500-6362-00** *is unavailable*, order the individual part(s) actually required.

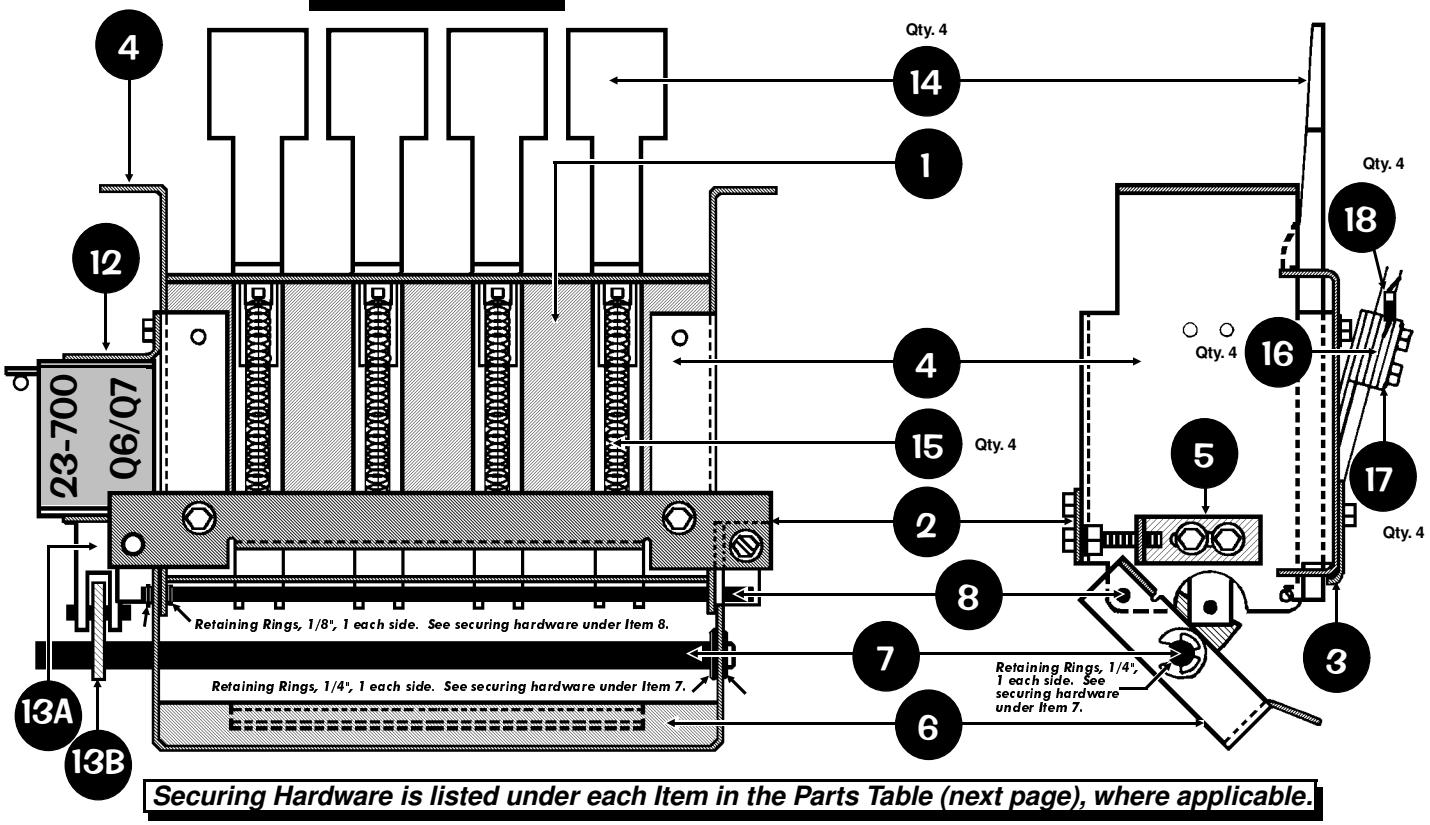




4-Bank Drop Target Assembly, 500-5799-04 (Qty. 2) (Items 1-18)

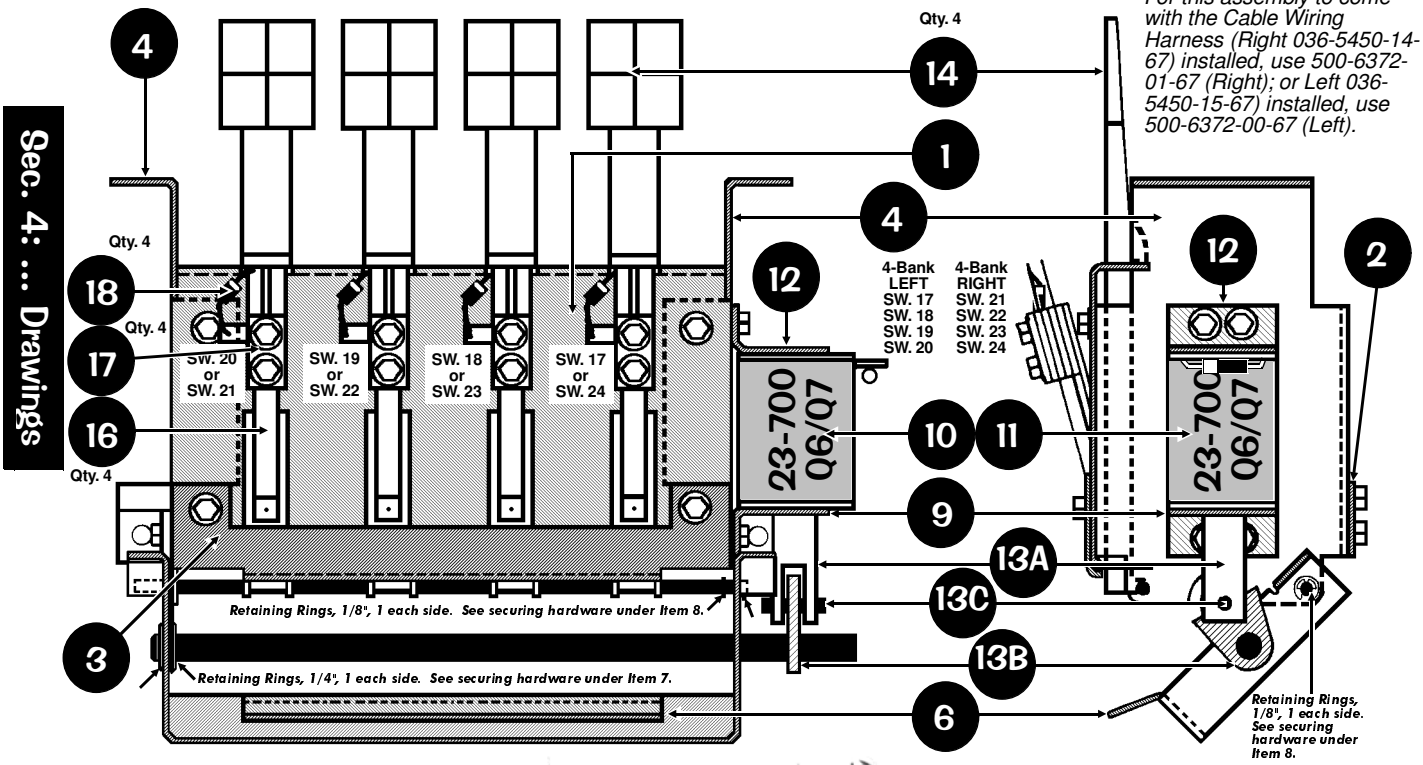
Parts Table on the next page.

Front View



Securing Hardware is listed under each Item in the Parts Table (next page), where applicable.

Back View



Ordering Note:

For this assembly to come with the Cable Wiring Harness (Right 036-5450-14-67) installed, use 500-6372-01-67 (Right); or Left 036-5450-15-67) installed, use 500-6372-00-67 (Left).

4-Bank Drop Target Assembly, 500-5799-04 (Qty. 2) (Items 1-18) Continued
Drawing for below Parts Table on previous page.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Target Frame (4-Bank)	1	535-6159-04
	Item 1 is secured under the P/F by: #8 X 1/2" SHWH AB (Zinc) (Qty. 6) (234-5101-00)		
	Item 1 is secured onto Item 4 (at top) by: #8-32 X 3/8" HWH TF Type C (Qty. 2) (237-5903-00)		
2	Mounting Bracket, D/T Springs (4-Bank)	1	535-6510-04
	Item 2 is secured onto Item 4 (at bottom) by: #8-32 X 3/8" HWH TF Type C (Qty. 2) (237-5903-00)		
3	Target Retaining Bracket (4-Bank)	1	535-5042-04
	Item 3 is secured onto Item 1 (at bottom) by: #8-32 X 3/8" HWH TF Type C (Qty. 2) (237-5903-00)		
4	End Plates (Drop Target)	2	535-6162-00
	Each Item 4 is secured by hardware for Items 1, 2 & 3.		
5	Adjustment Bracket	1	535-6508-00
	Item 5 is secured onto Item 4 (side without Coil) by: #6-32 X 3/8" SHWH MS (Zinc) TC T-23 (Qty. 2) (237-5891-00) **and is secured with a:** #8-32 X 7/8" SHWH MS (Zinc) (Qty. 1) (237-5890-00) **&** #8-32 Nylon Stop Nut (Qty. 1) (240-5102-00) **through Item 2.**		
6	Target Lift Bracket (4-Bank)	1	535-6509-04
	Item 6 is secured onto Item 4 (both sides) by Item 8, Pivot Shaft.		
7	Target Shaft (4-Bank)	1	530-5179-04
	Item 7 is secured by: Retaining Ring, 1/4" ø Shaft (Qty. 2) (270-5002-00)		
8	Pivot Shaft (4-Bank)	1	530-5180-04
	Item 8 is secured by: Retaining Ring, 1/8" ø Shaft (Qty. 2) (270-5000-00)		
9	Coil Retaining Bracket (Bottom)	1	535-6154-00
	Item 9 is secured onto Item 4 (side with Coil) by: #6-32 X 3/8" SHWH MS (Zinc) TC T-23 (Qty. 2) (237-5891-00)		
10	Coil, 23-700	1	090-5022-00T
	ORDERING ABOVE (ITEM 10) COIL PART № WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
11	Coil Sleeve	1	545-5031-00
12	Coil Stop Bracket Assy. (Top)	1	515-5088-00
	Item 12 is secured onto Item 4 (side with Coil) by: #6-32 X 3/8" SHWH MS (Zinc) TC T-23 (Qty. 2) (237-5891-00)		
13	Plunger & Link Assembly	1	515-5338-00
	ORDERING ABOVE (ITEM 13) SUB-ASSY. PART № WILL INCLUDE:		
13A	Plunger 2" Lg.	1	530-5025-01
13B	Plunger Link	1	545-5293-00
13C	Roll Pin 1/8" ø x 5/8" Lg.	1	251-5008-00
14	Drop Target (White) (Partec #4-124-1)	4	545-5048-01
15	Reset Spring for Drop Targets	4	265-5003-00
16	Leaf-Switch (Drop Target Style)	4	180-5104-00
17	Switch Protect Plate	4	535-5045-00
	Items 16 & 17 are secured on Item 1 by: #6-32 X 1/2" HWH Swage (Serr) Zinc (Qty. 2/per) (237-5976-03)		
18	Diode, 1N4001	4	112-5001-00

Ordering Note: If **500-5799-04** *is unavailable*, order the individual part(s) actually required.

Ordering Note:

For this assembly to come with the Cable Wiring Harness (Right 036-5450-14-67) installed, use 500-6372-01-67 (Right); or Left 036-5450-15-67) installed, use 500-6372-00-67 (Left).

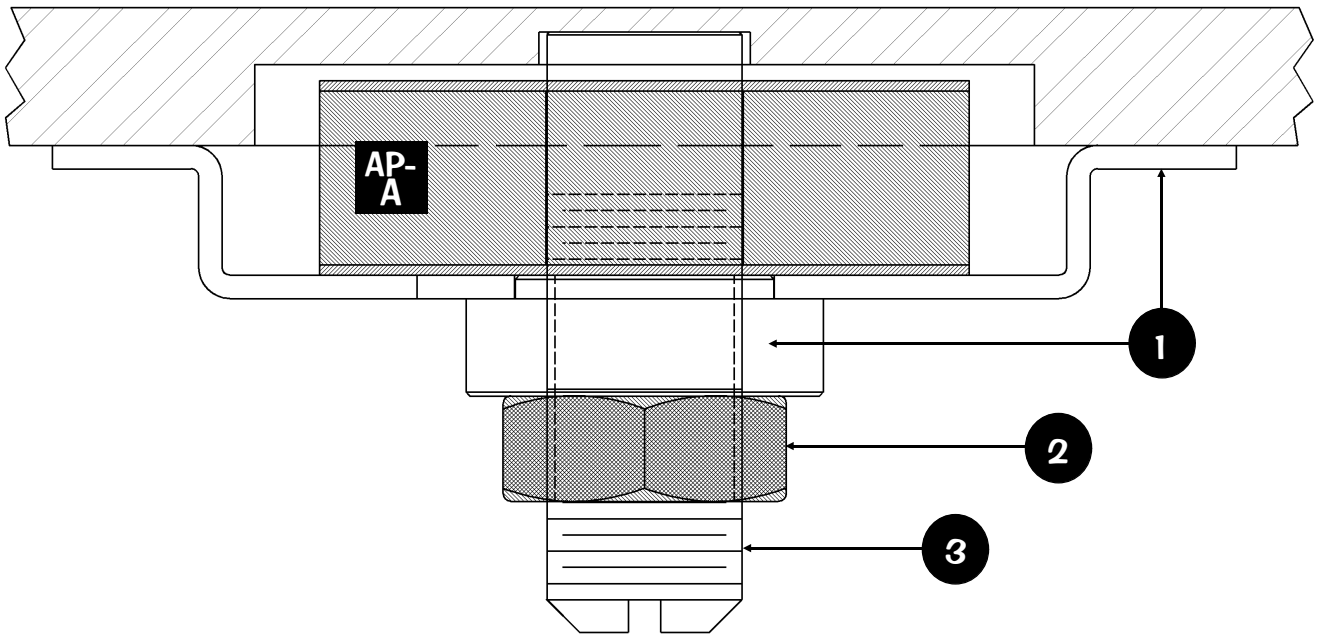
Threaded Bushing Core Assembly, 515-6142-01 (Items 1-3)
and Associated Part: Magnet Coil (22-650), 090-5042-01 (Item AP-A)

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Threaded Bushing Weld Assy. New	1	515-6141-**01**
2	Threaded Core Plug	1	530-5320-00
3	3/4"-16 Hex Nut	1	240-5315-00

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

№	ASSOCIATED PART NAME	QTY.	SPI PART №
AP-**A**	Magnet Coil, 22-650 (12" Leads) (1/per)	4	090-5042-01
	Item AP-A is secured under the P/F by: #8 X 1/2 SHWH AB (Zinc) (Qty. 4) (234-5101-00)		

Ordering Note: If **515-6142-01** *is unavailable*, order the individual part(s) actually required.

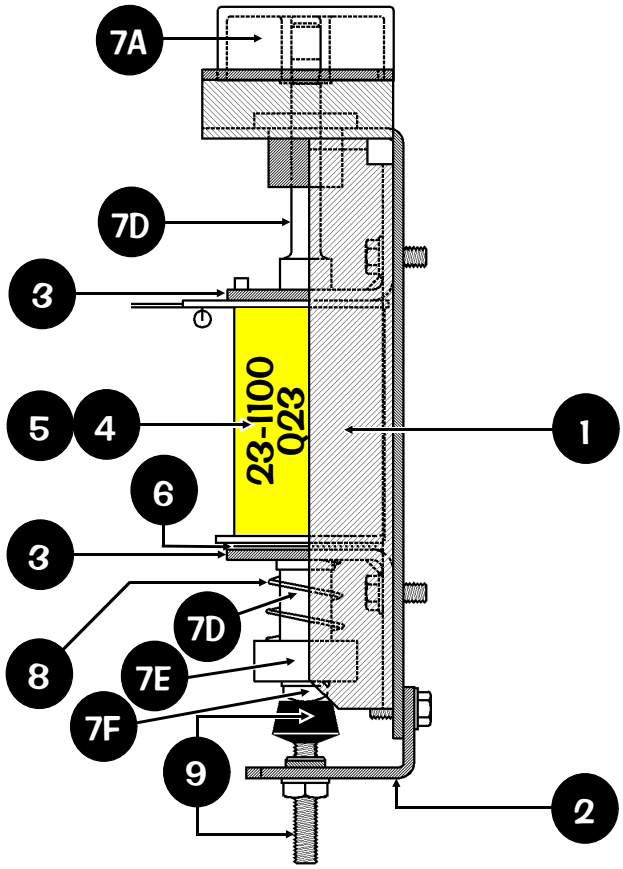


Up / Down Post Assembly, 500-6293-00 (Items 1-9)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Up/Down Post Coil Mounting Bracket	1	515-6840-00
	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 Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
5	Coil Sleeve (with extension)	1	545-5847-00
6	Spring Washer, 17/32" ID X 3/4" X 1"	1	269-5002-00
7	Plunger & Shaft Assembly	1	515-6844-00
	ORDERING ABOVE (ITEM 7) SUB-ASSY. PART Nº WILL INCLUDE:		
7A	Ball Bumper Plastic (Top) Red	1	550-5029-02
7B*	Roll Pin, 3/32" ø X 1/2" Long	1	251-5002-00
7C*	Retaining Ring, 1/4" ø Shaft	1	270-5002-00
7D	Plunger & Shaft Sub-Assembly	1	515-6841-00
7E	Plunger Head	1	530-5511-00
7F	#10-32 X 3/8" PPH MS (Sems) Zinc	1	232-5401-00
	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:

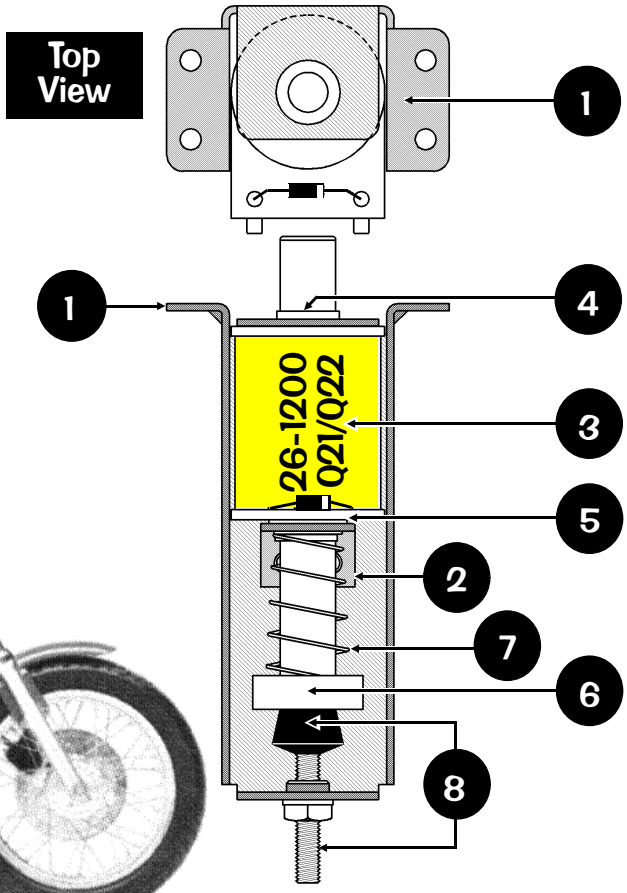
* An asterisk (*) indicates item(s) are not noted in the pictorials.



UK ONLY OPTIONAL

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

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Ball Deflector Coil Mounting Bracket	1	535-6857-02
	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 Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
4	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
5	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
6	Solid Plunger Assembly	1	515-6858-00
7	Compression (Relay) Spring	1	266-5022-01
8	#10-32 Adj. Spindle Stop w/Rubber Tip	1	280-5014-00
	Item 8 is secured by: #10-32 Keps Nut (Qty. 1) (240-5208-00)		
	Ordering Note: If **500-5788-02** *is unavailable*, order the individual part(s) actually required.		



Ball Under-Trough Assembly, 500-6401-00 (Items 1-4)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1®	Riveted Under-Trough Sub-Assy.	1	515-7020-00-67R
ORDERING ABOVE ® RIVETED ASSY. PART Nº WILL INCLUDE:			
1A	Metal Under-Trough (Plain, No Parts)	1	535-8562-00
1B	Mounting Bracket for Micro-Switch	1	535-7319-05
1C*	Rivet, 1/8" ø X 5/32" Lg.	2	249-5009-00
Item 1 is secured under the Playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5101-00)			

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
2	Micro-Switch (High Form)	1	180-5057-00
3*	Switch Body Protect Plate	1	535-6539-00
Items 2 & 3 are secured on Item 1B by: #2-56 X 1/2" HWH Ser. UNS #4HD TR3 BO (Qty. 2) (237-5937-02)			
4	Diode, 1N4001	1	112-5001-00

Ordering Note: If **500-6401-00** *is unavailable*, order the individual part(s) actually required.

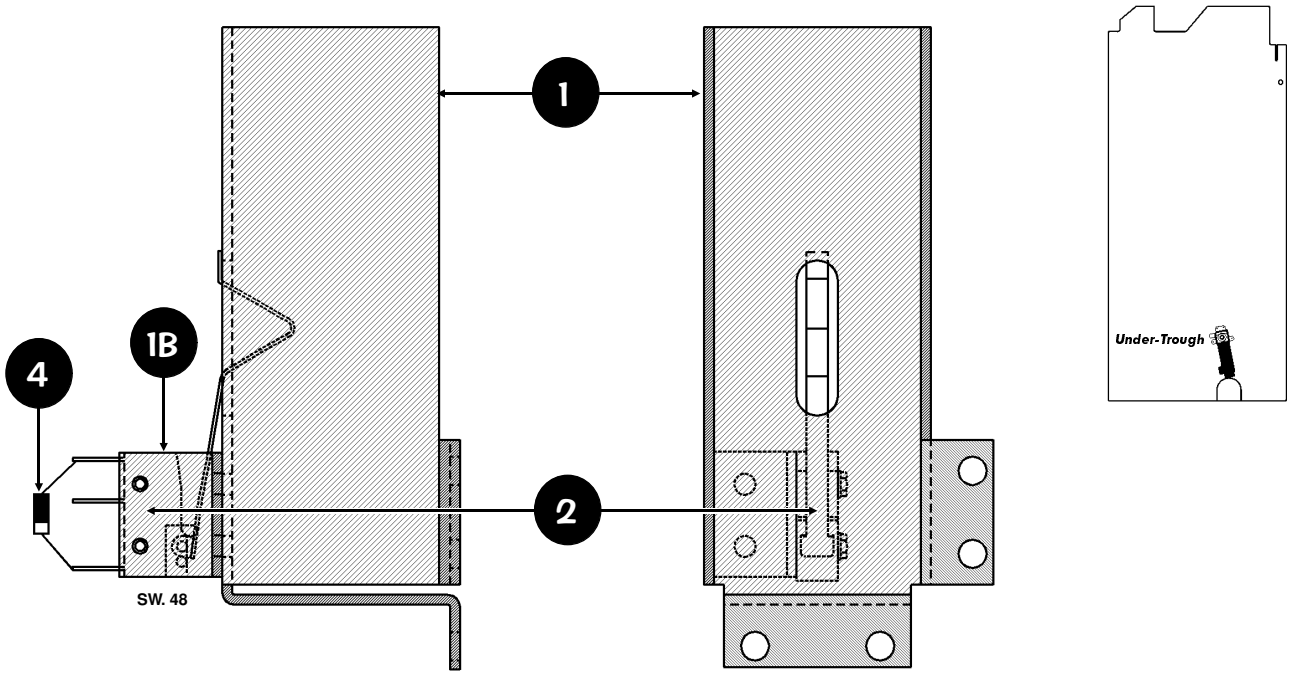
Take Note:

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

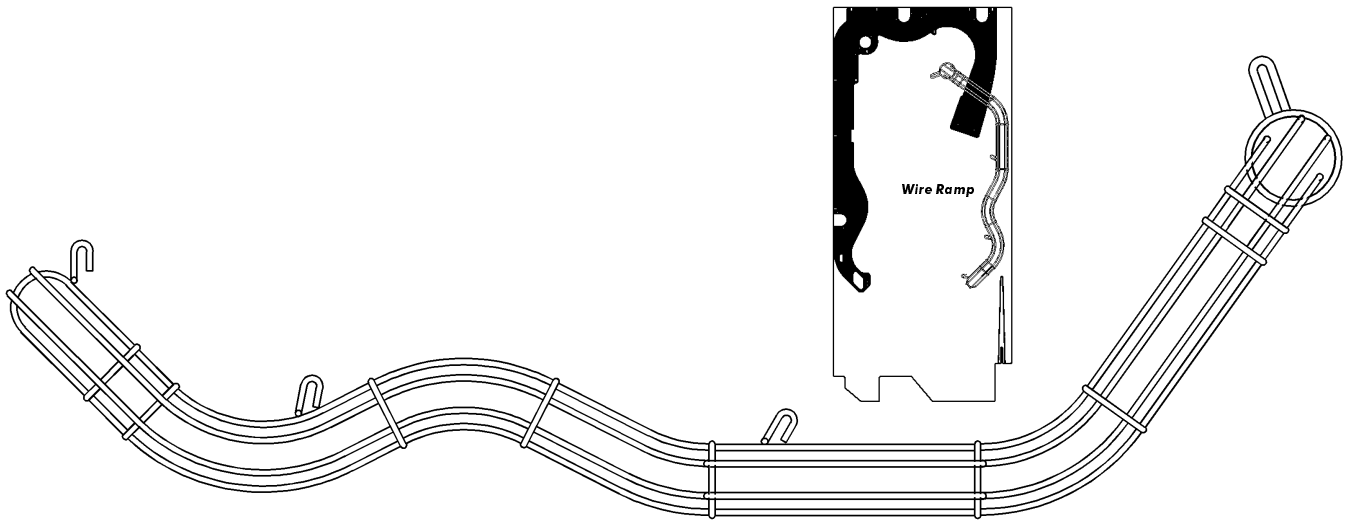
® "R" indicates item has a riveted-on part(s), if removing/adding rivets is not an option, order the entire ® Sub-Assembly. ***Please Note:*** If the ® Sub-Assembly **is not** available, call Technical Support.

Ordering Note:

*For this assembly to come with the Cable Wiring Harness (036-5450-03-67) installed, add **-67** to the 500-6401-00 Part Number.*

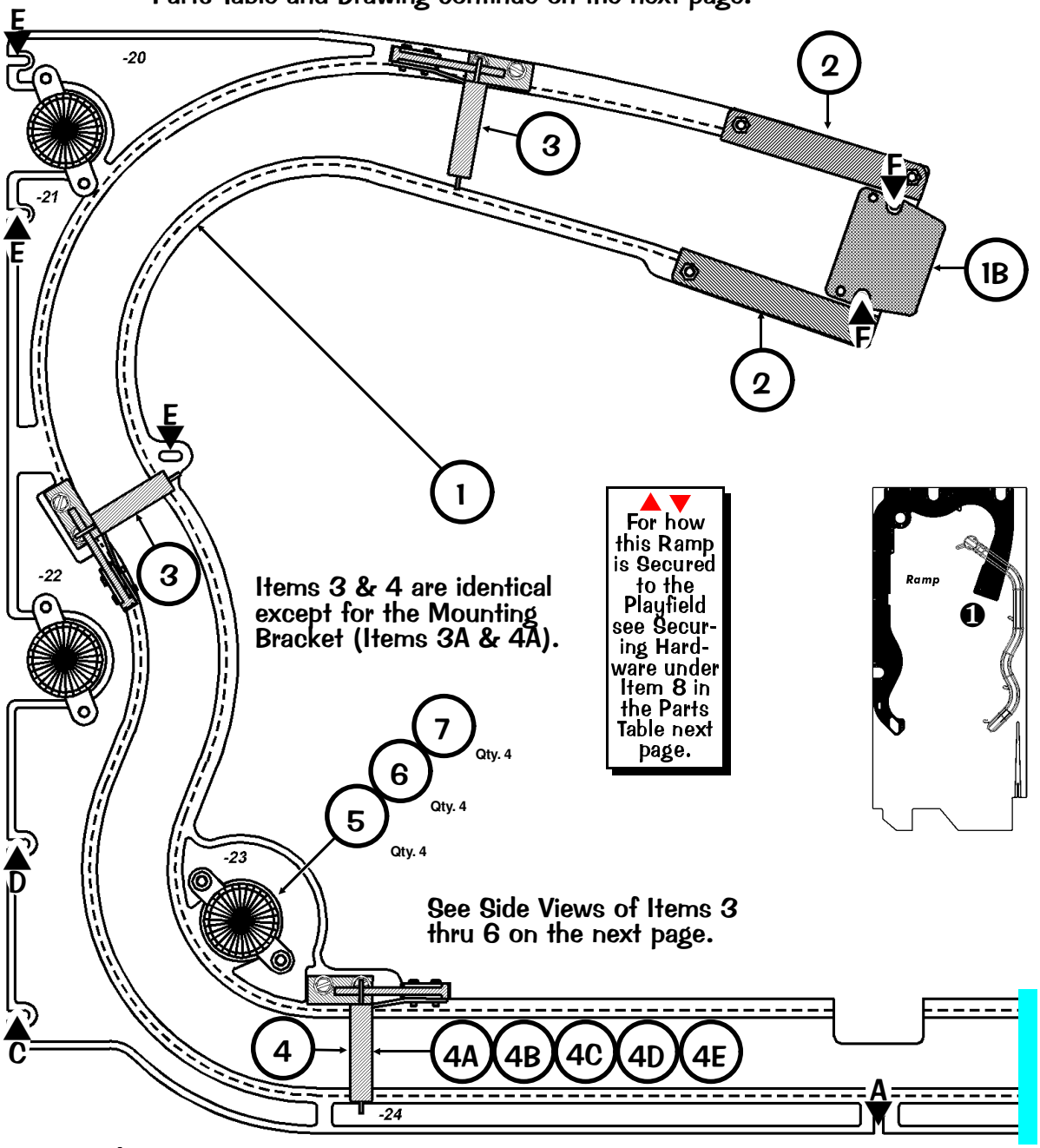


Wire Ramp Assembly (No Individual Parts), 515-7013-00



Plastic Ramp Assembly, Individual Parts Only (Items 1-8)

Parts Table and Drawing continue on the next page.



continued next page

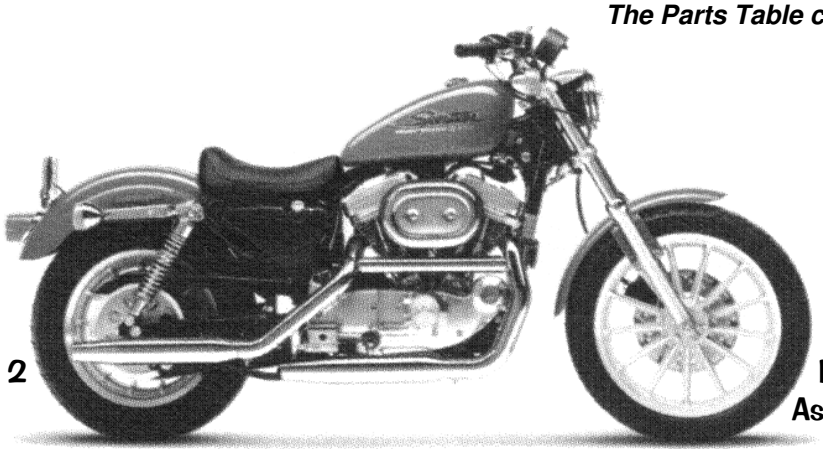
Take Note:

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

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

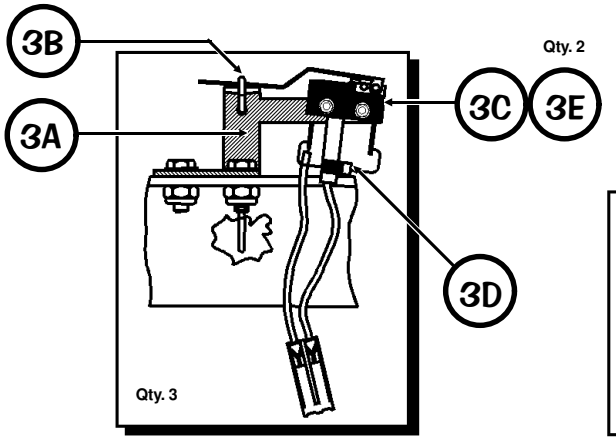
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1®	Riveted Plastic Ramp Sub-Assembly	1	515-7029-00-67R
ORDERING ABOVE ® RIVETED ASSY. PART Nº WILL INCLUDE:			
1A	Plastic Ramp (Plain, No Parts)	1	545-5931-00
1B	Ramp Flap	1	535-8576-00
1C*	#6 Lock Washer (Riveting)	2	246-5000-00
1D*	Rivet, 1/8" ø X 1/4" Lg.	2	249-5003-00

The Parts Table continues next page.

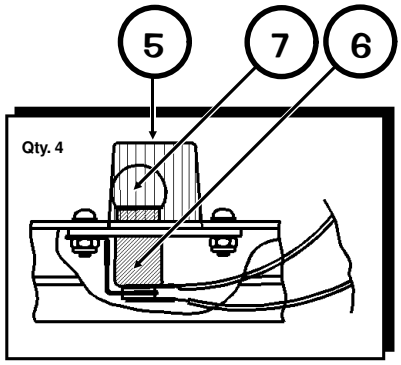


Plastic Ramp Assembly, Individual Parts Only (Items 1-8) Continued

Parts Table & Drawing start on previous page.

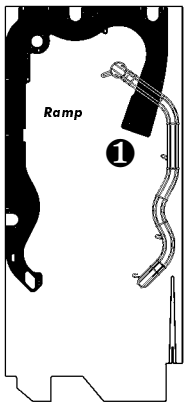


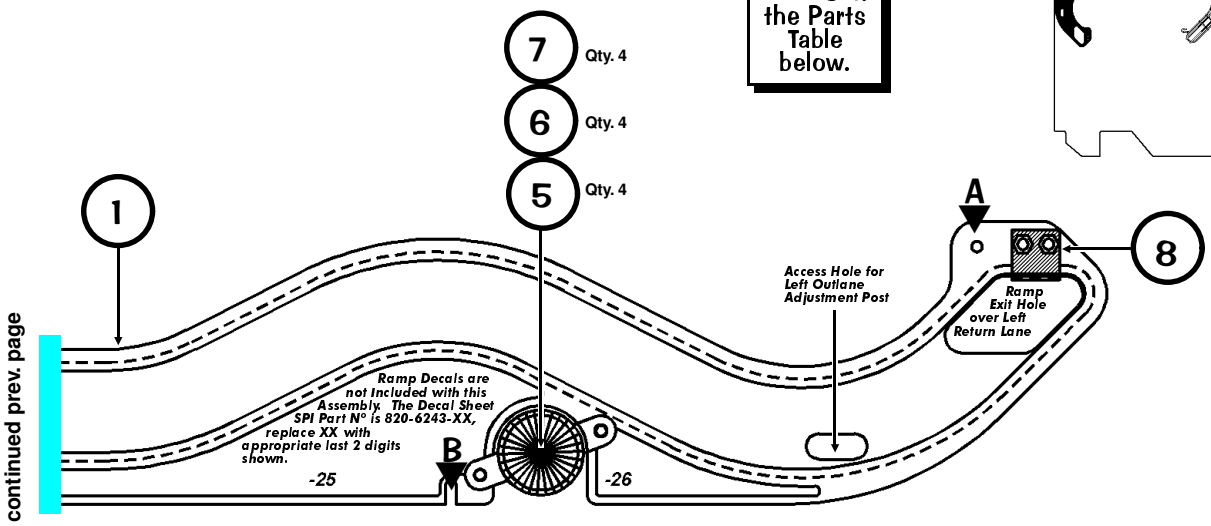
Side View of Item 3 or 4



Side View of Items 5, 6 & 7

For how this Ramp is Secured to the Playfield see Securing Hardware under Item 8 in the Parts Table below.





continued prev. page

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
2	Ramp Protector	2	535-6707-00
	Item 2 is secured to Item 1A by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2/per) (232-5201-00) **and** #6-32 Nylon Stop Nut, 1/4 Hex Body (Qty. 2/per) (240-5010-00)		
3	Gate Assembly	2	515-6556-04
	ORDERING ABOVE (ITEM 3) SUB-ASSY. PART Nº WILL INCLUDE:		
3A	Mounting Brkt. for Wire Form & Sw.	1	535-7756-01
3B	Wire Form	1	535-7755-02
3C	Micro-Switch (for Wire Gate)	1	180-5087-00
3D	Diode, 1N4001	1	112-5001-00
3E*	#2-56 X 1/2" HWH Ser. UNS #4HD TR3 BO	2	237-5937-02
4	Gate Assembly (Reverse Mounted)	1	515-6556-02
	ORDERING ABOVE (ITEM 4) SUB-ASSY. PART Nº WILL INCLUDE:		
4A	Mounting Brkt. for Wire Form & Sw.	1	535-7756-02
4B	Wire Form	1	535-7755-02
4C	Micro-Switch (for Wire Gate)	1	180-5087-00
4D	Diode, 1N4001	1	112-5001-00
4E*	#2-56 X 1/2" HWH Ser. UNS #4HD TR3 BO	2	237-5937-02
	Items 3 & 4 are secured to Item 1A by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2/per) (232-5201-00) **and** #6-32 Nylon Stop Nut (Qty. 2/per) (240-5005-00)		

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
5	Mini-Mars Light Cover (Red)	4	550-5031-02
6	Socket, 2-Lug Stand-Up Short	4	077-5101-00
7	#89 Bulb	4	165-5000-89
	Items 5, 6 & 7 are secured to Item 1A by: #6-32 X 1/2" PPH MS (Sems) Zinc (Qty. 2/per) (232-5202-00) **and** #6-32 Nylon Stop Nut (Qty. 2/per) (240-5005-00)		
8	Ramp Exit Protector	1	535-8167-01
	Item 8 is secured onto Item 1 by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2) (232-5201-00) **and** #6-32 Nylon Stop Nut 1/4 Hex Body (Qty. 2) (240-5010-00)		

Plastic Ramp Assembly is secured above the Playfield by:

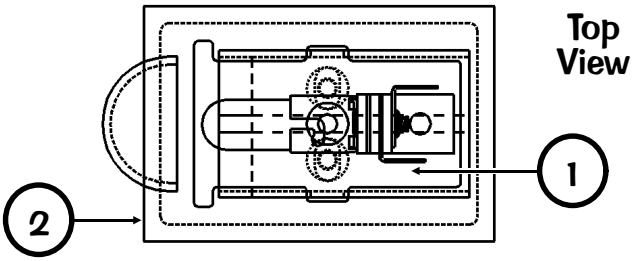
A▼ 2" X 1/4" Hex Spacer #6-32 Top (Qty. 2) (254-5008-07)
B▼ 2-1/4" X 1/4" Hex Spacer #6-32 Top (Qty. 1) (254-5008-18)
C▲ 3" X 1/4" Hex Spacer #6-32 Top (Qty. 1) (254-5008-14)
D▲ 3-1/4" X 1/4" Hex Spacer #6-32 Top (Qty. 1) (254-5008-26)
E▲▼ 4" X 5/16" Hex Spacer #6-32 Top (Qty. 3) (254-5018-03)
and on the Wood Rail sides with a Ramp Mounting Bracket (Qty. 1/per) (515-6508-00)
and at the Ramp with #6-32 X 3/8" PPH MS Sems (Zinc) (Qty. 1/per) (232-5201-00) **and** #6 Washer (Qty. 1/per) (242-5001-00)

F▲▼ at the Ramp Flap (Item 1B) with #4 X 1/2" PFH (Zinc) Black (Qty. 2) (237-5840-00)

Stop Light Assembly, 500-6400-00 (Items 1-7)
and Associated Part: Support Bracket, 535-8601-00 (Item AP-A)

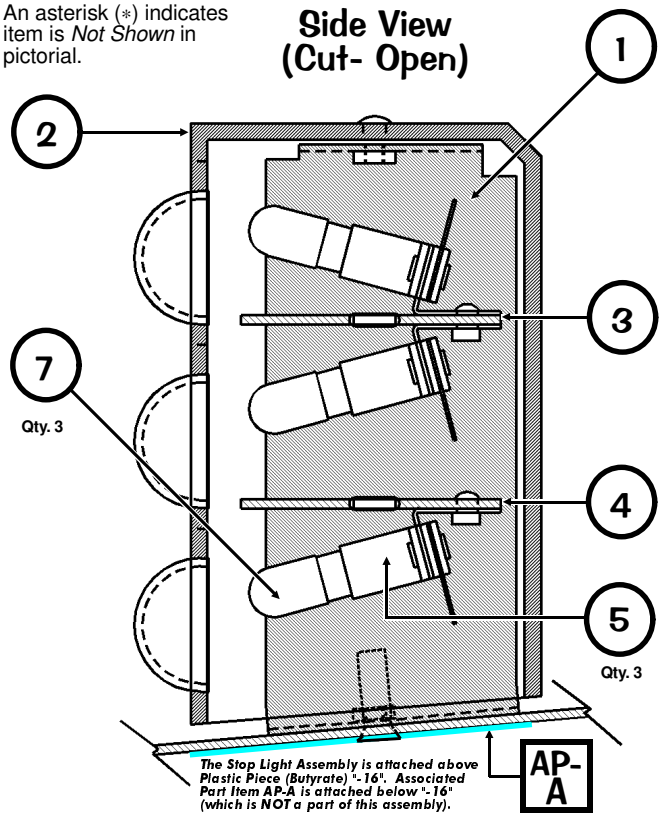
Ordering Note:

*For this assembly to come with the Cable Wiring Harness (036-5450-10-67) installed, add **-67** to the 500-6400-00 Part Number.*



Take Note:

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



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Mounting Bracket for Plastic Housing	1	535-8574-00
2	Stop Light Plastic Housing Assembly	1	515-7030-00
	ORDERING ABOVE (ITEM 2) SUB-ASSY. PART Nº WILL INCLUDE: The Light Covers (Starburst Hat Red, Orange & Green) are modified to fit this housing and are secured into each "hole" by glue. **Item 2 is secured to Item 1 at the top center by:** #6-32 X 1/2" PPH MS (Sems) Zinc (Qty. 1) (232-5202-00)		
3	Plastic Piece (-21) (Top/Mid Lamp Support)	1	830-5960-21
4	Plastic Piece (-22) (Bottom Lamp Support)	1	830-5960-22
5	Socket, 3-Lug Laydown (Formed Back)	3	077-5032-00
6*	Diode, 1N4001	3	112-5001-00
	Items 5 & 6 are secured onto Items 3 & 4 by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1/per) (232-5201-00) **and** #6-32 Nylon Stop Nut (Qty. 1/per) (240-5010-00)		
7	#44 Bulb	3	165-5000-44
	Stop Light Assembly, 500-6400-00-67 is secured on the top of Plastic Piece "-16" by: #6-32 X 1/2" FH MS (Zinc) (Qty. 2) (237-5918-00)		

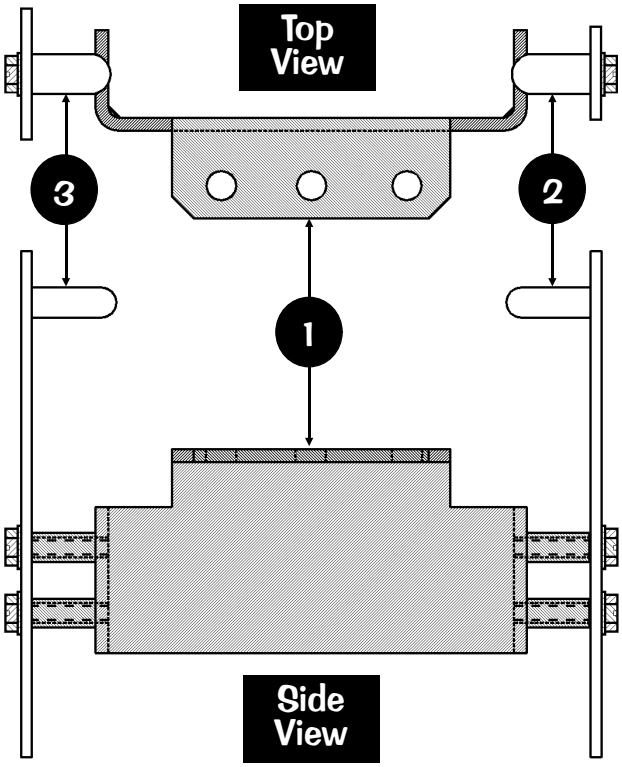
Ordering Note: If **500-6400-00** *is unavailable*, order the individual part(s) actually required.

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

Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
AP-A	* Support Bracket	1	535-8601-00
	Item AP-A is secured on the bottom of Plastic Piece "-16" by: ***The same hardware described under Item 7 above.***		

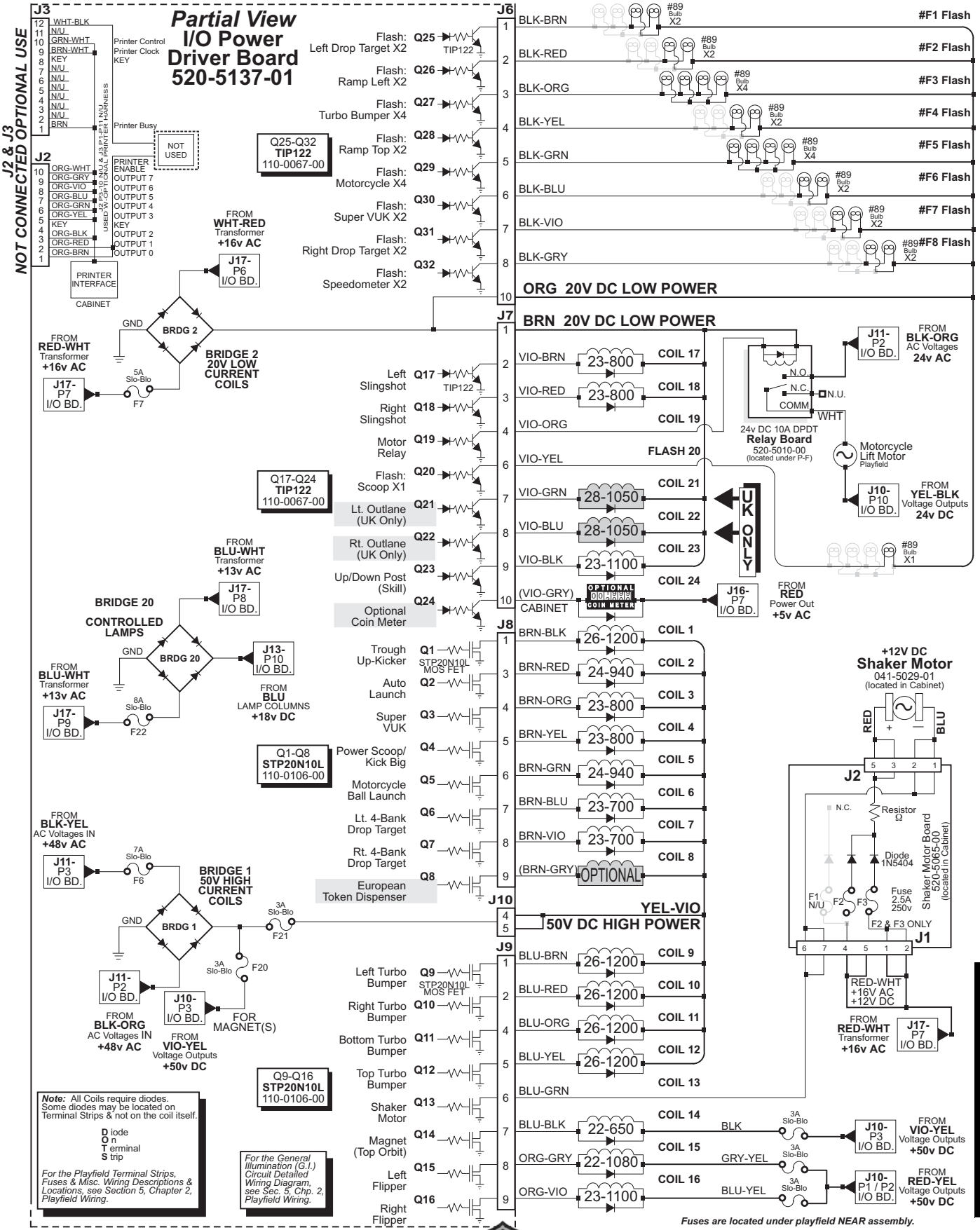
OPTO (Bracket & PEM) Individual Parts Only (Items 1-3)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	OPTO Mtng Bracket & PEM Assy.	1	515-7026-00
	Item 1 is secured below the Playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00)		
2	OPTO Transmitter (TRANS) Board	1	520-5082-00
3	OPTO Receiver (REC) Board	1	520-5083-01
	Items 2 & 3 are secured by: #4-40 X 5/8" HWH (Serr) Zinc (Qty. 2/per) (237-5945-00)		

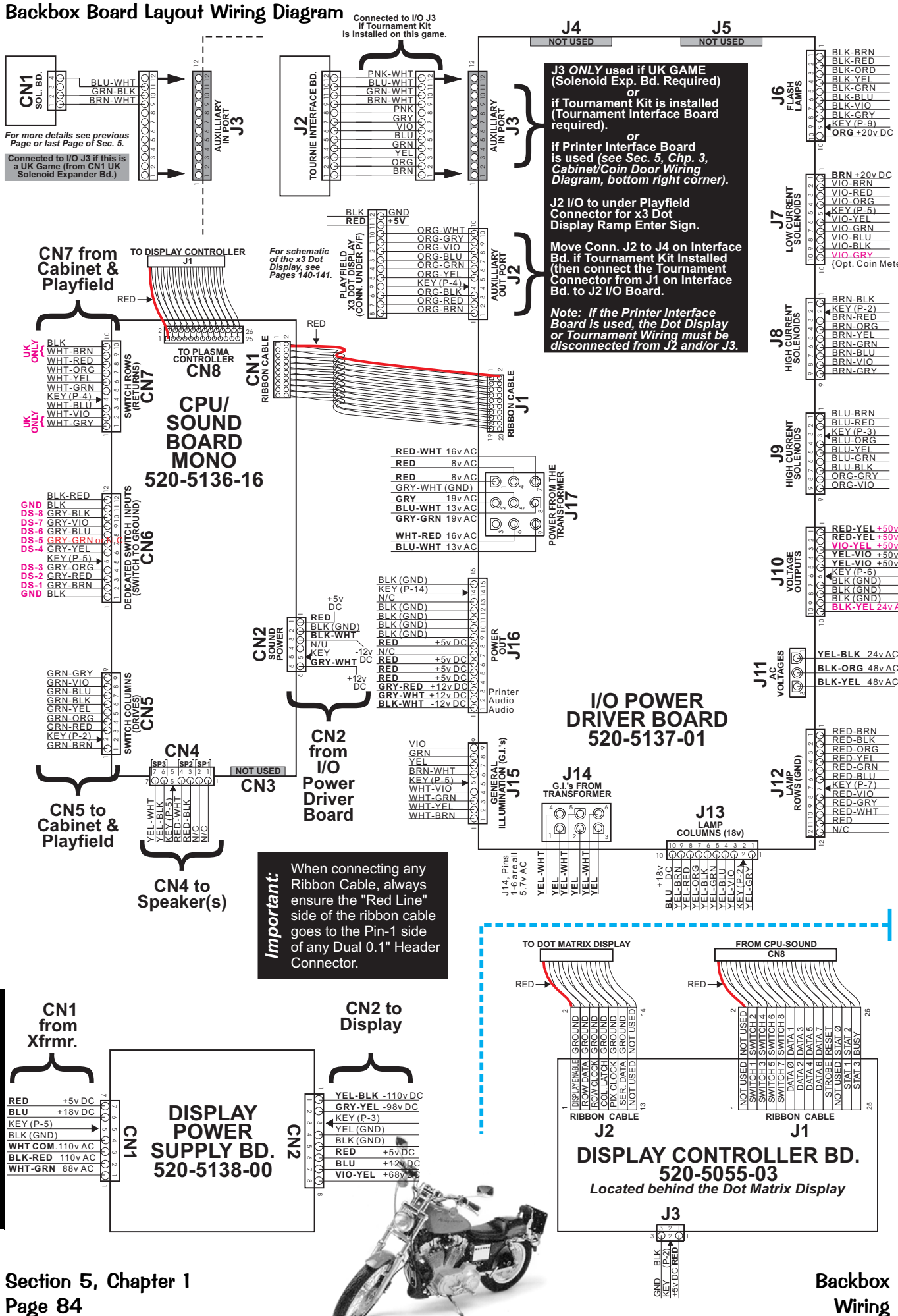


Backbox I/O Power Driver Board Detailed Wiring Diagram

Backbox Wiring



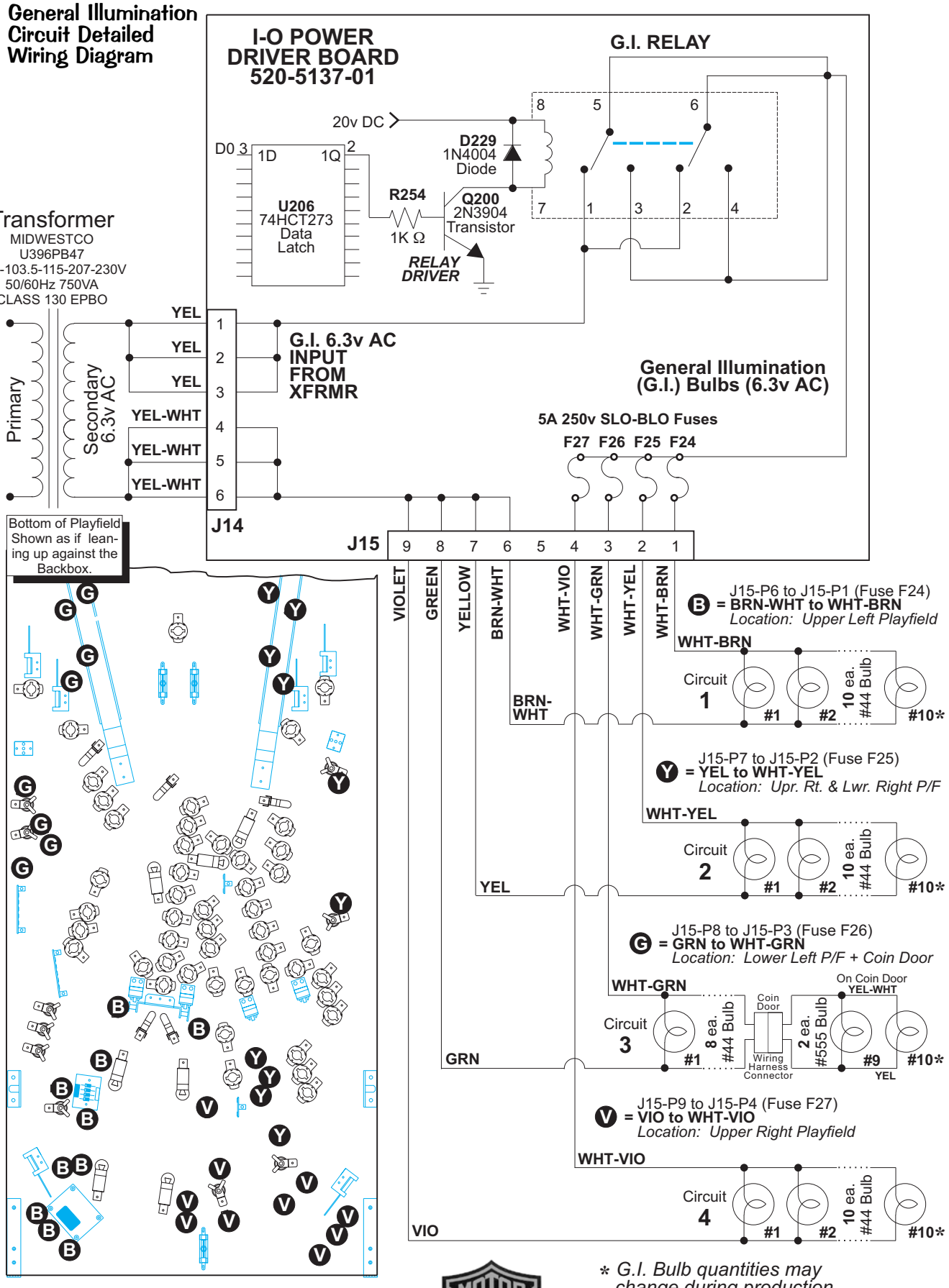
Backbox Board Layout Wiring Diagram



Sec. 5: Backbox ...

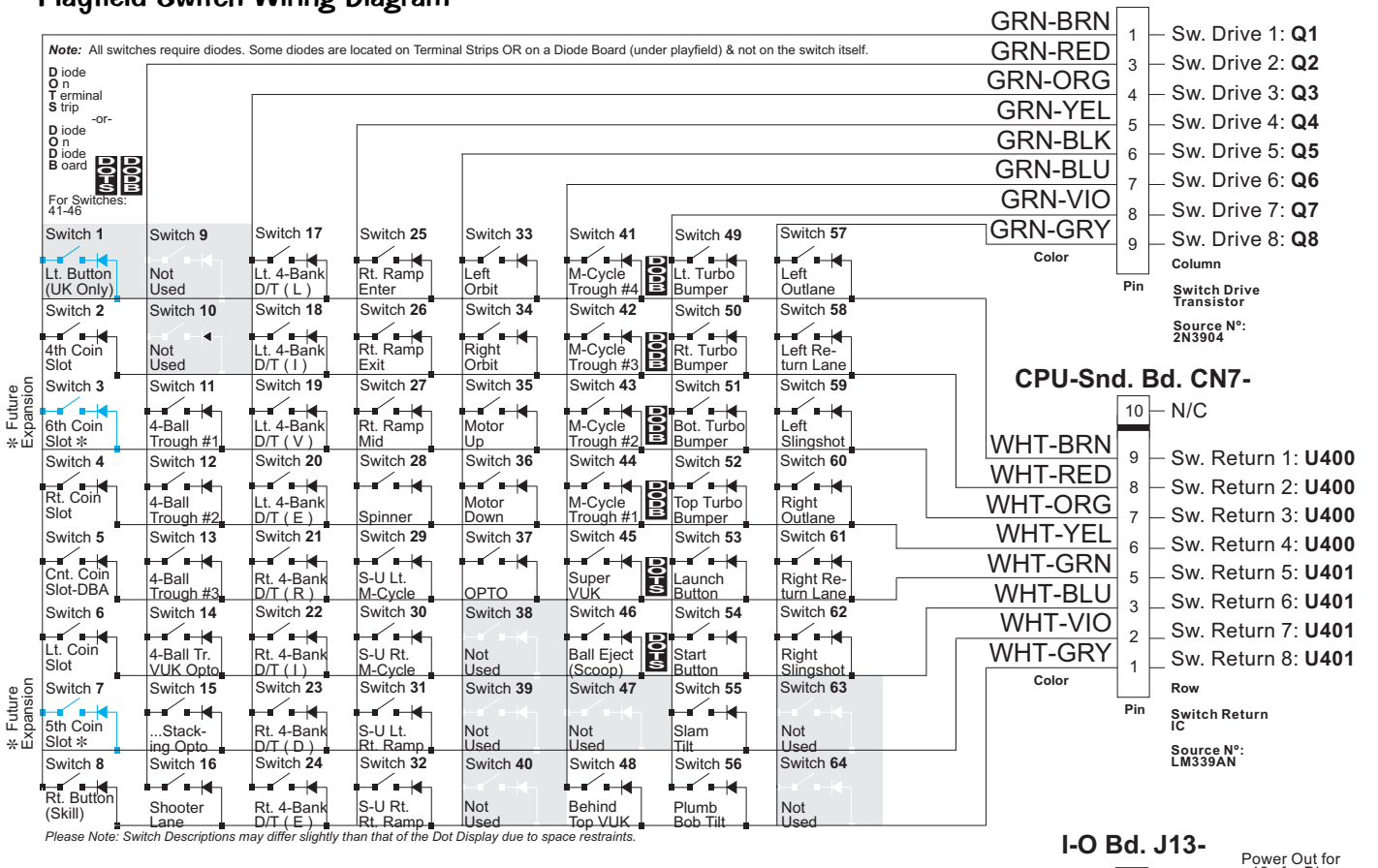
Playfield Wiring

General Illumination Circuit Detailed Wiring Diagram



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

Playfield Switch Wiring Diagram



CPU-Snd. Bd. CN5-

Color	Pin	
GRN-BRN	1	Sw. Drive 1: **Q1**
GRN-RED	3	Sw. Drive 2: **Q2**
GRN-ORG	4	Sw. Drive 3: **Q3**
GRN-YEL	5	Sw. Drive 4: **Q4**
GRN-BLK	6	Sw. Drive 5: **Q5**
GRN-BLU	7	Sw. Drive 6: **Q6**
GRN-VIO	8	Sw. Drive 7: **Q7**
GRN-GRY	9	Sw. Drive 8: **Q8**

Column

Switch Drive Transistor

Source Nº: 2N3904

CPU-Snd. Bd. CN7-

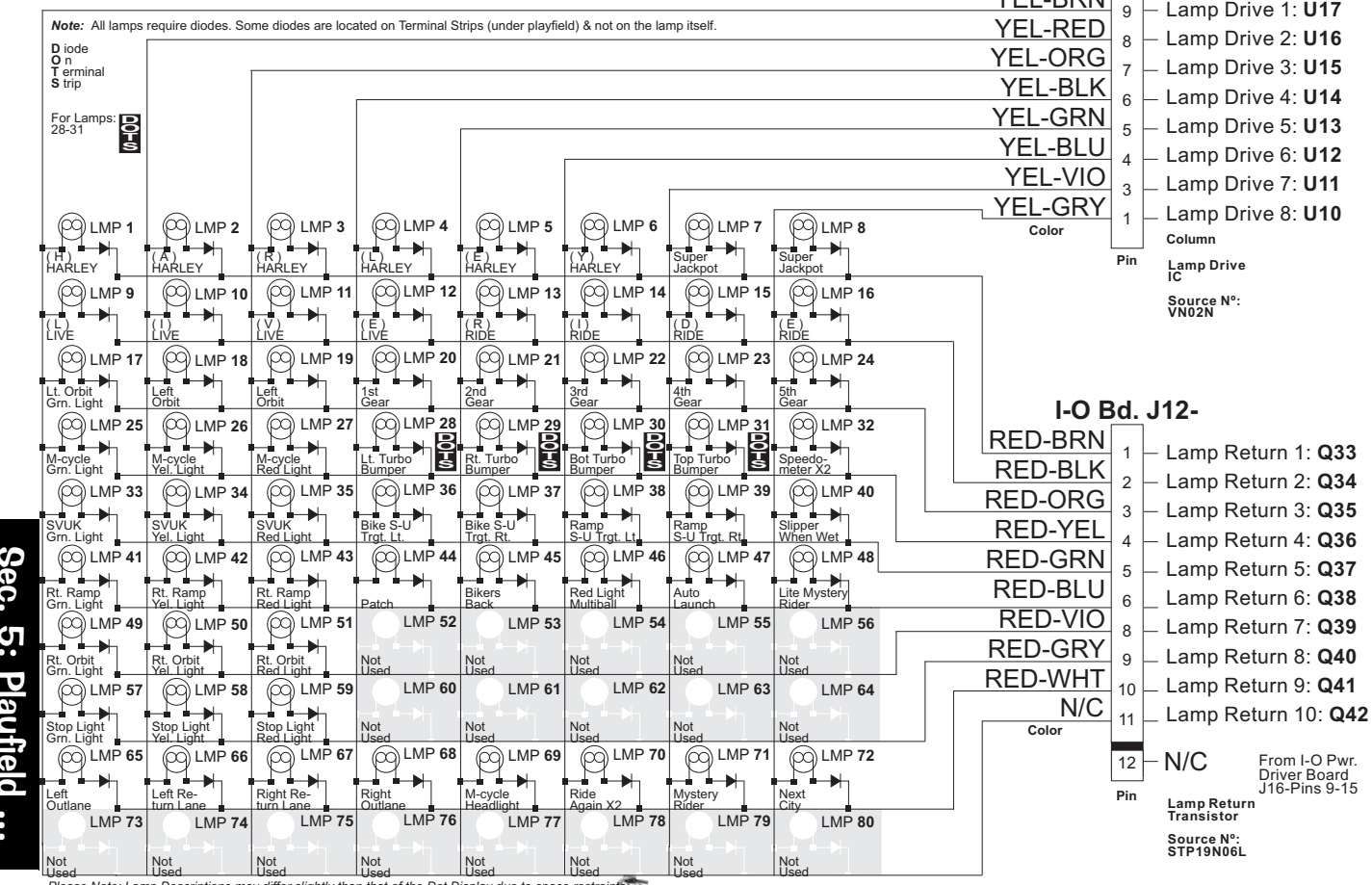
Color	Pin	
	10	N/C
WHT-BRN	9	Sw. Return 1: **U400**
WHT-RED	8	Sw. Return 2: **U400**
WHT-ORG	7	Sw. Return 3: **U400**
WHT-YEL	6	Sw. Return 4: **U400**
WHT-GRN	5	Sw. Return 5: **U401**
WHT-BLU	3	Sw. Return 6: **U401**
WHT-VIO	2	Sw. Return 7: **U401**
WHT-GRY	1	Sw. Return 8: **U401**

Row

Switch Return IC

Source Nº: LM339AN

Playfield Lamp Wiring Diagram



I-O Bd. J13-

Color	Pin	
	10	BLUE — Power Out for +18v for Disp. Pwr. Sup. Bd. CN1-Pin 6
YEL-BRN	9	Lamp Drive 1: **U17**
YEL-RED	8	Lamp Drive 2: **U16**
YEL-ORG	7	Lamp Drive 3: **U15**
YEL-BLK	6	Lamp Drive 4: **U14**
YEL-GRN	5	Lamp Drive 5: **U13**
YEL-BLU	4	Lamp Drive 6: **U12**
YEL-VIO	3	Lamp Drive 7: **U11**
YEL-GRY	1	Lamp Drive 8: **U10**

Column

Lamp Drive IC

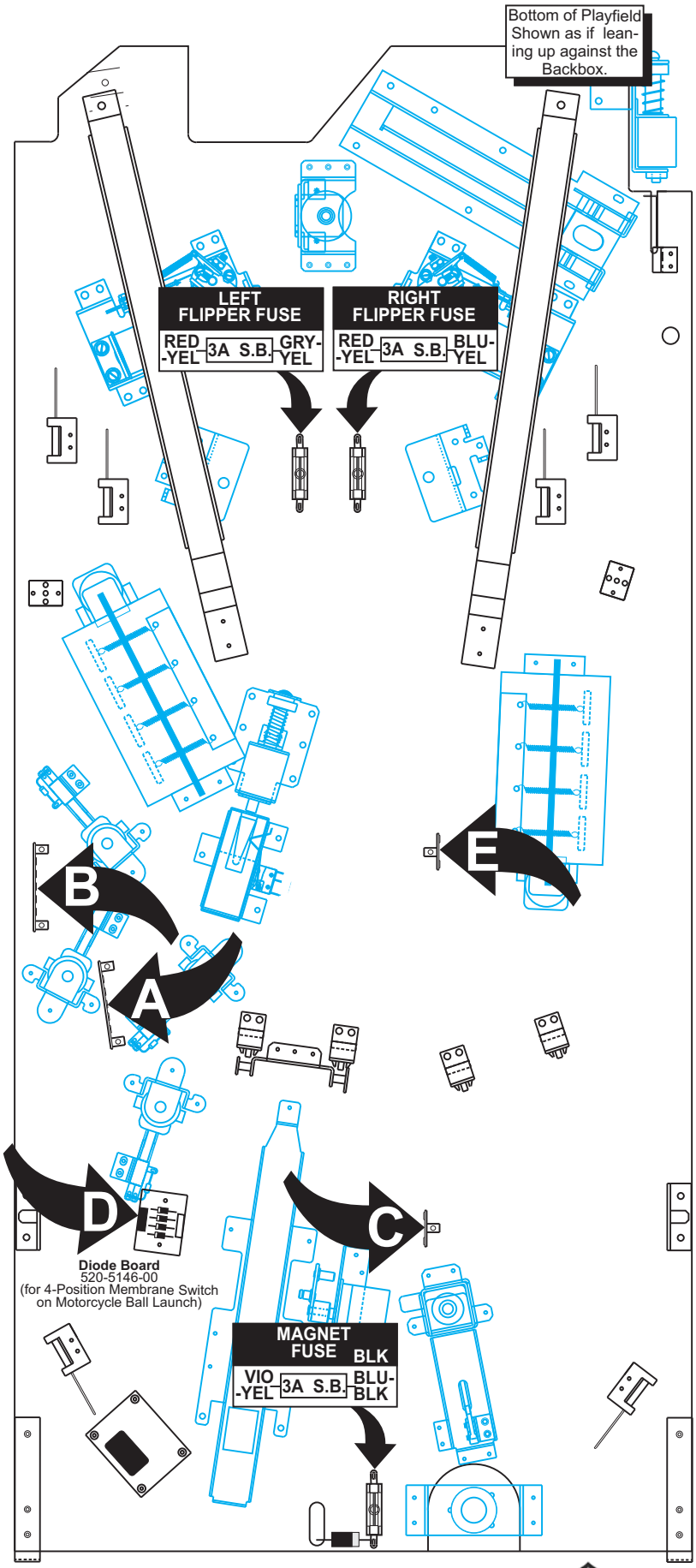
Source Nº: VN02N

I-O Bd. J12-

Color	Pin	
RED-BRN	1	Lamp Return 1: **Q33**
RED-BLK	2	Lamp Return 2: **Q34**
RED-ORG	3	Lamp Return 3: **Q35**
RED-YEL	4	Lamp Return 4: **Q36**
RED-GRN	5	Lamp Return 5: **Q37**
RED-BLU	6	Lamp Return 6: **Q38**
RED-VIO	8	Lamp Return 7: **Q39**
RED-GRY	9	Lamp Return 8: **Q40**
RED-WHT	10	Lamp Return 9: **Q41**
N/C	11	Lamp Return 10: **Q42**
	12	N/C — From I-O Pwr. Driver Board J16-Pins 9-15

Lamp Return Transistor

Source Nº: STP19N06L

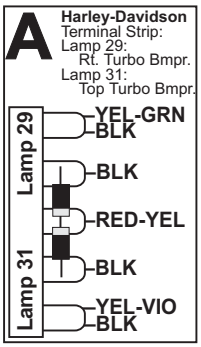


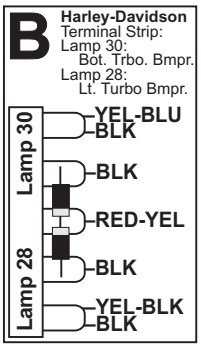
See the Pink Pages, Playfield - General Parts (Below) (Page 52) for Terminal Strips, Diodes, Fuses and Fuse Holders Part Nºs.

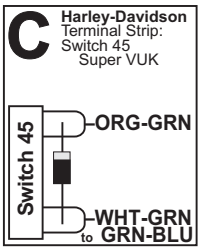
Also Note:
Terminal Strip, Diode Board & Fuse Holder locations shown, represent the general location (your game may differ slightly).

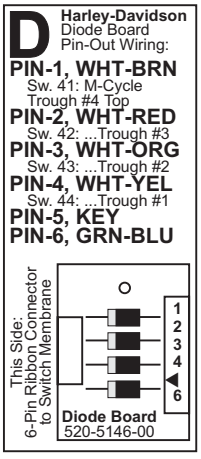
Explanation:
All switches, lamps, coils require diodes. The diodes not physically located on the switch, lamp or coil are located on Terminal Strips or Diode Bd. under the playfield. The Switch & Lamp Matrix Grids also note which switch or lamp has a diode on a Terminal Strip (noted by **"DOTS"** meaning: "Diode on Terminal Strip") or Diode Board (noted by **"DODB"** meaning: "Diode on Diode Board"). There is 1 diode located on a solder lug for the Magnet Fuse.

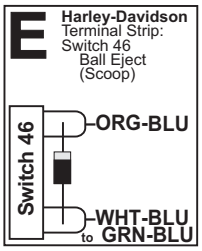
All fuses are rated:
3A 250v Slo-Blo, Do Not Over-Fuse.



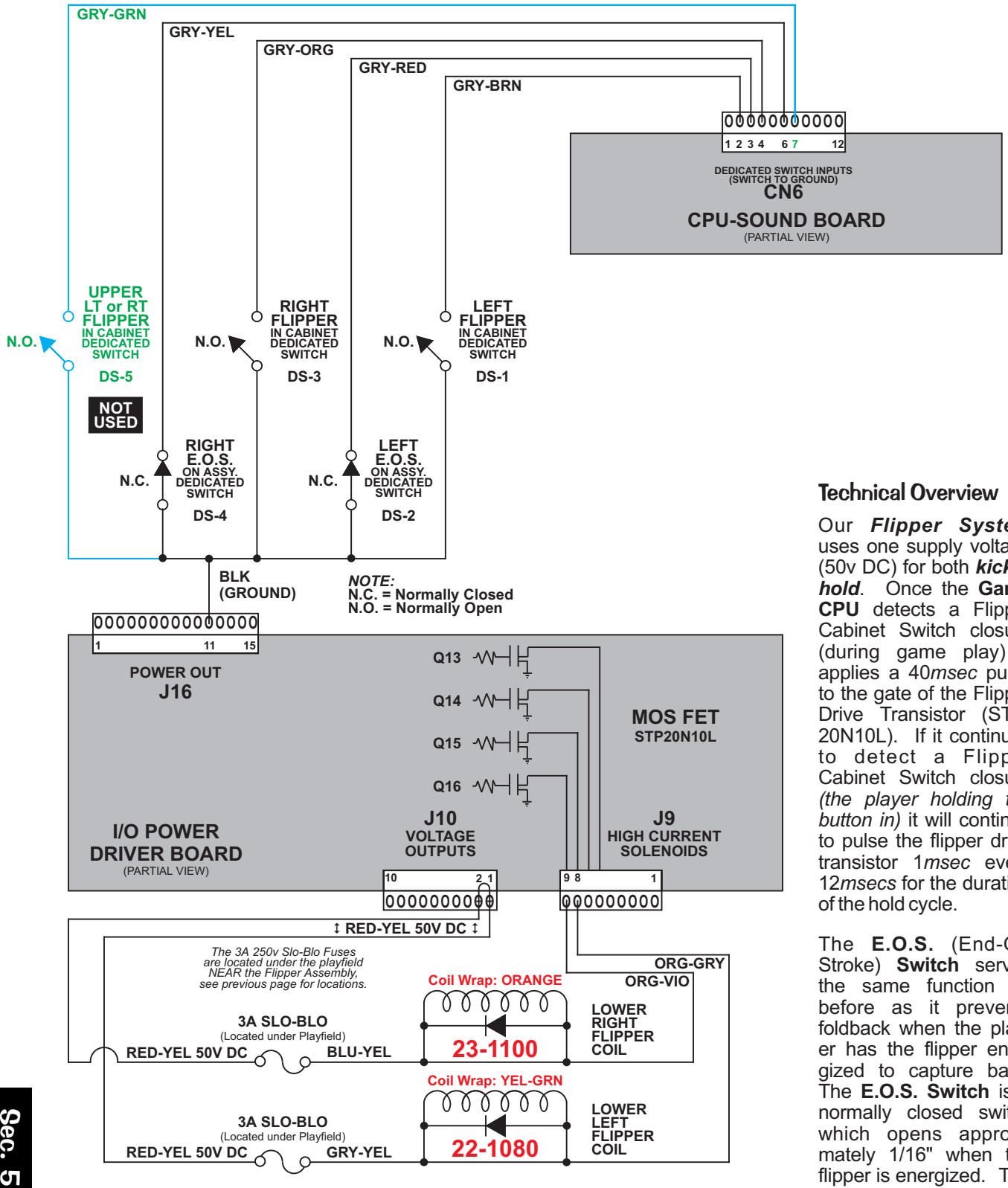








2-Flipper Circuit Wiring Diagram



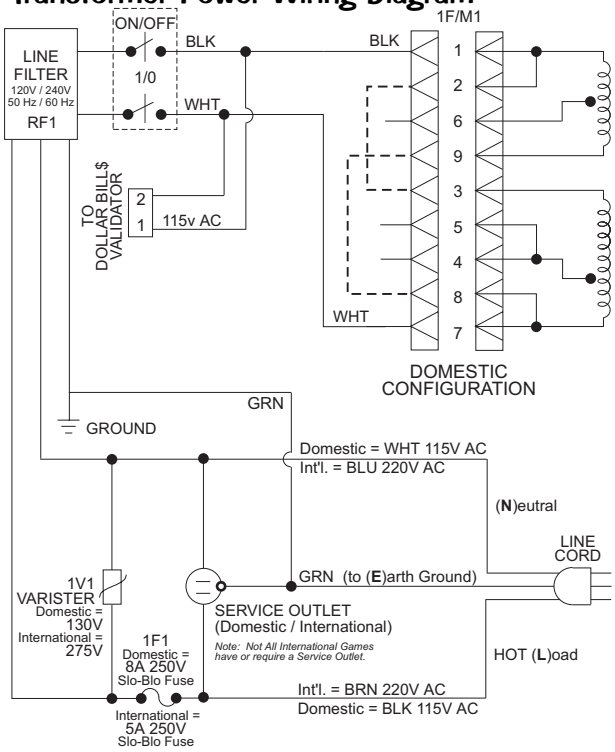
Technical Overview

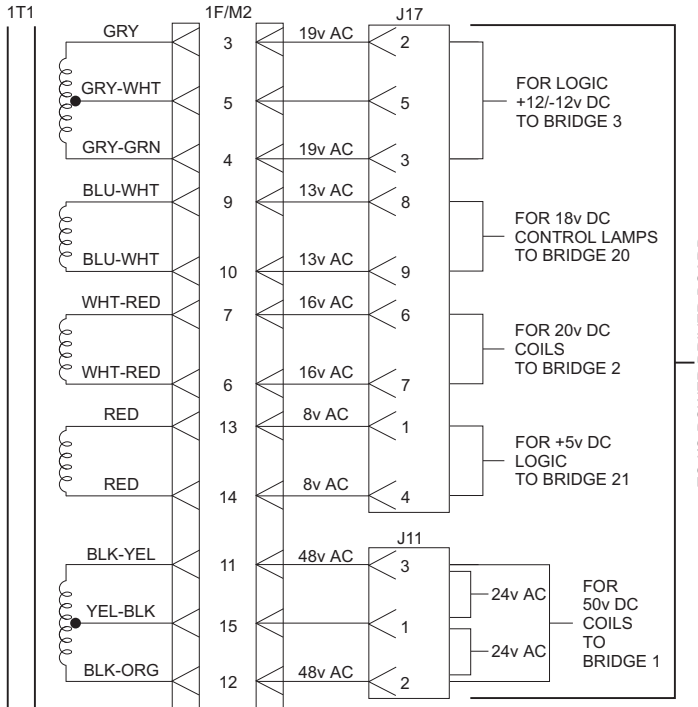
Our ***Flipper System*** uses one supply voltage (50v DC) for both ***kick*** & ***hold***. Once the **Game CPU** detects a Flipper Cabinet Switch closure (during game play) it applies a 40*msec* pulse to the gate of the Flipper Drive Transistor (STP-20N10L). If it continues to detect a Flipper Cabinet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

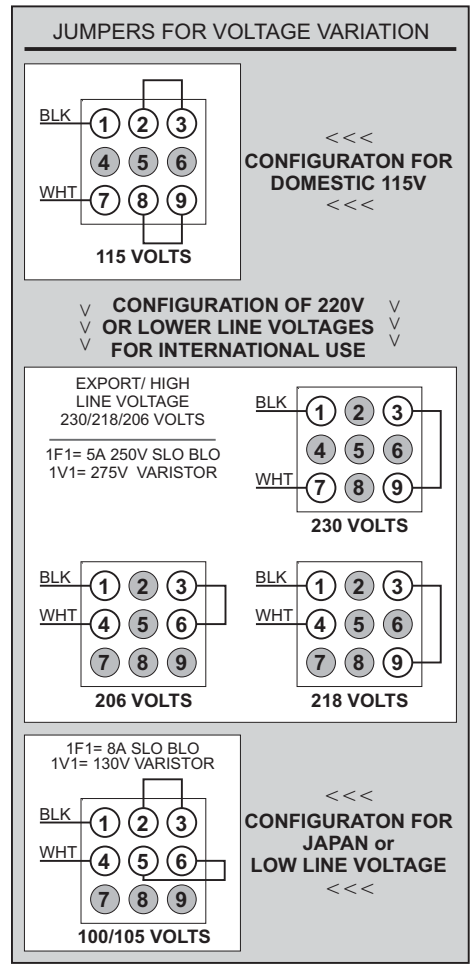
The **E.O.S.** (End-Of-Stroke) **Switch** serves the same function as before as it prevents foldback when the player has the flipper energized to capture balls. The **E.O.S. Switch** is a normally closed switch which opens approximately 1/16" when the flipper is energized. The **Game CPU** will detect 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.

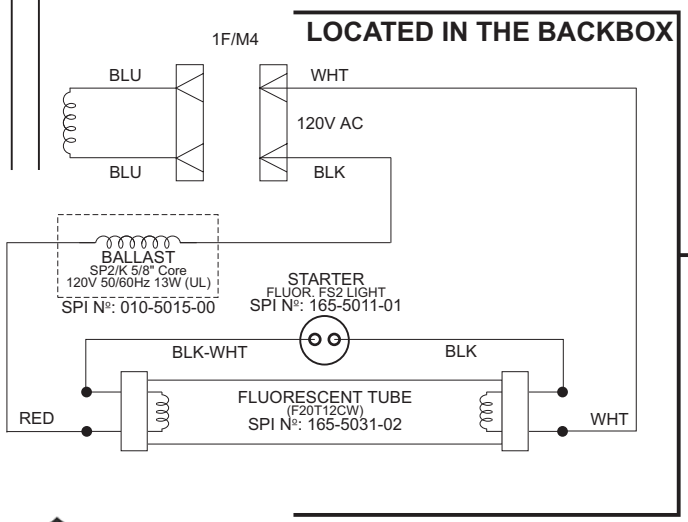
Cabinet Wiring

Transformer Power Wiring Diagram

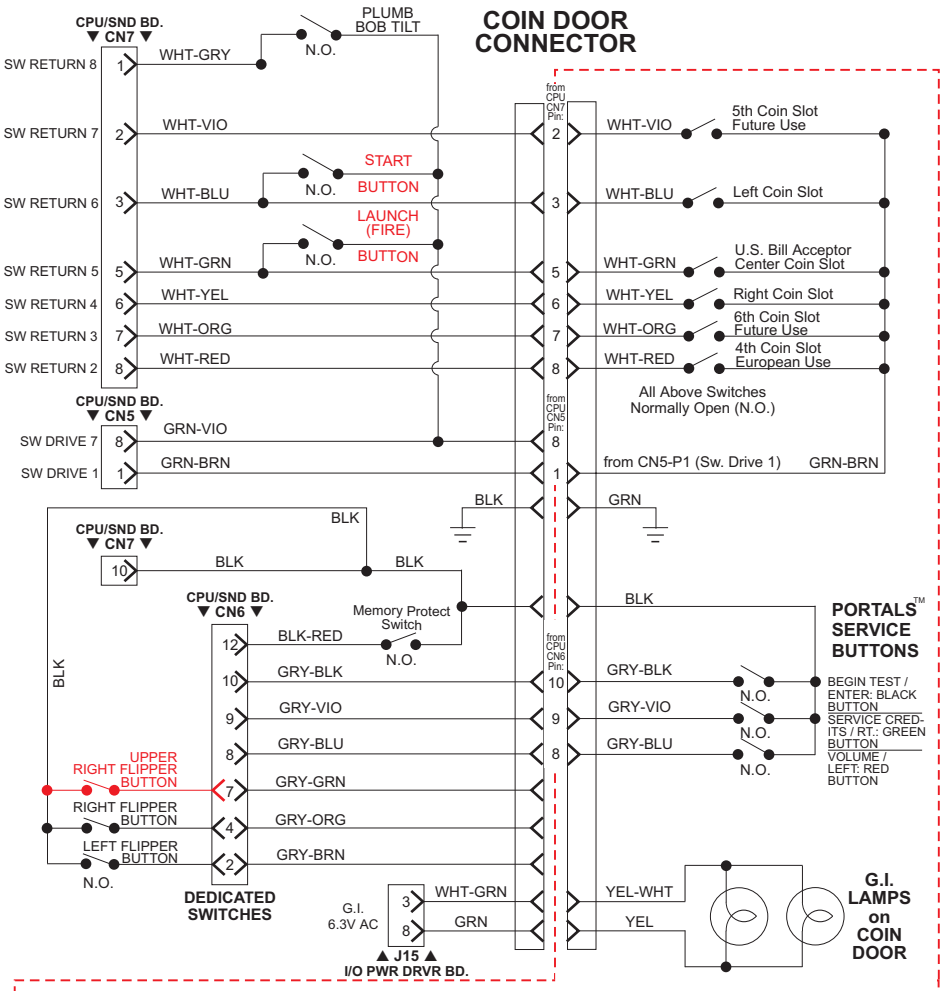


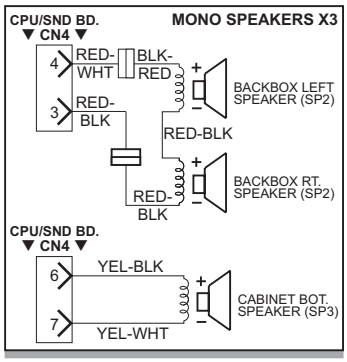


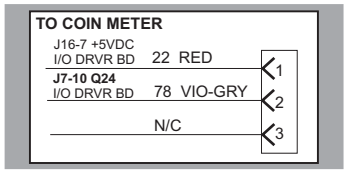


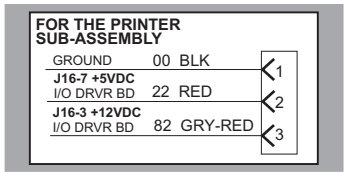


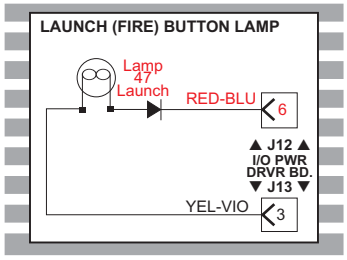
Cabinet / Coin Door Wiring Diagram





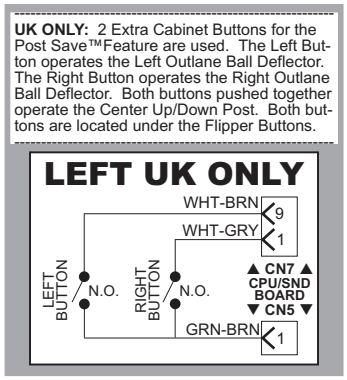


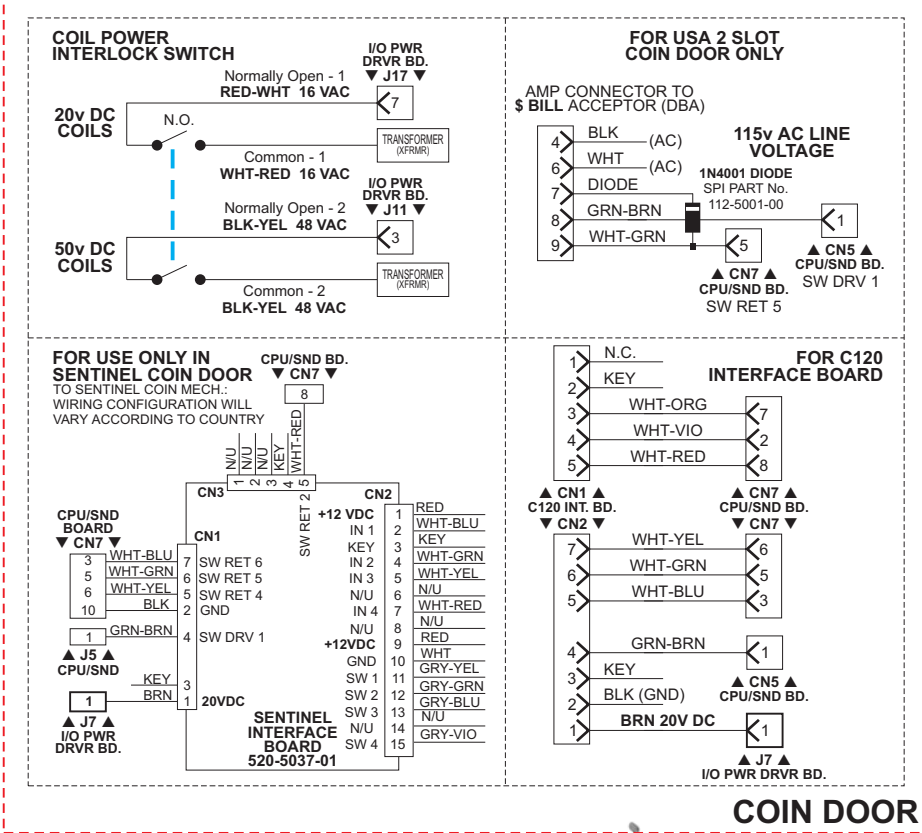




UK ONLY: 2 Extra Cabinet Buttons for the Post Save™ Feature are used. The Left Button operates the Left Outlane Ball Deflector. The Right Button operates the Right Outlane Ball Deflector. Both buttons pushed together operate the Center Up/Down Post. Both buttons are located under the Flipper Buttons.

USA ONLY: The Extra **Right** Button is used to operate the Up/Down Center Post.

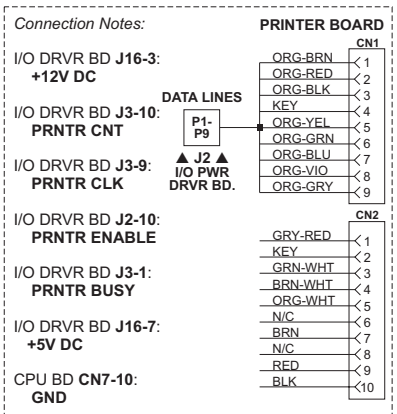




COIN DOOR

PRINTER INTERFACE OPTIONAL

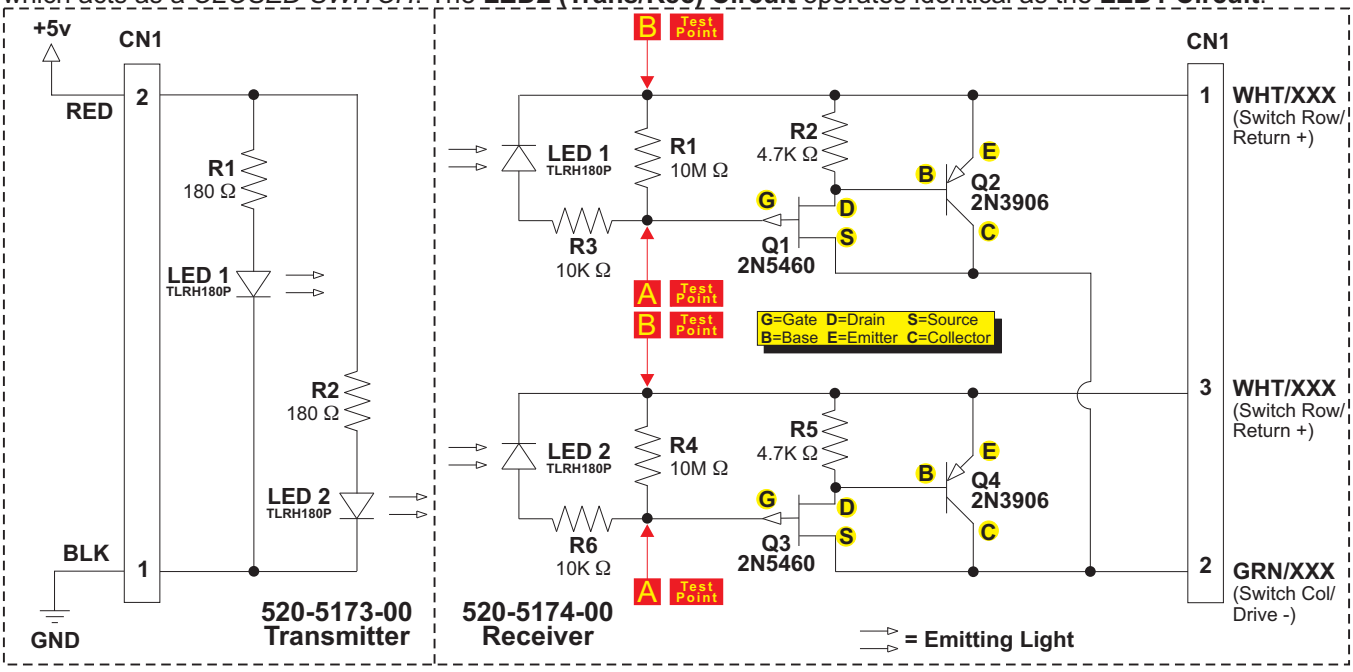
Cable Wiring Harness SPI Part Nº:
036-5408-00
RS-232 Printer Interface Board SPI Part Nº:
520-5069-00



Printed Circuit Boards (PCBs)

Trough Up-Kicker Dual OPTO Boards Theory of Operation & Schematic

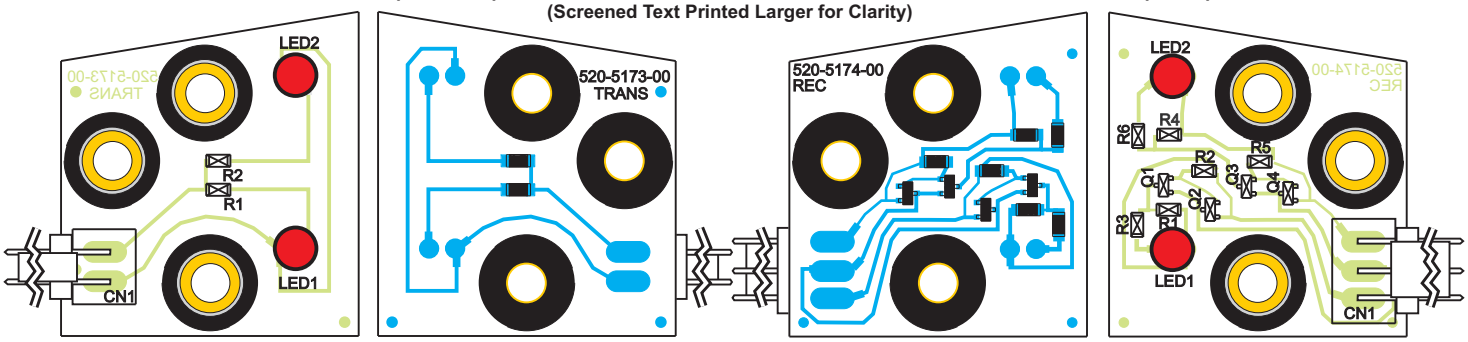
As light from the **Transmitter LED1** falls on the **Receiver LED1**, it generates a Positive Bias Voltage (0.7v to 1.5v) which is applied to the **Gate** (**G**) of **Q1 (Fet 2N5460)** turning **Q1** off. When **Q1** is held off, no current flows through **Q2**'s **(2N3906) Base** (**B**). With no *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

520-5173-00 (TRANS) Boards Actual Size 520-5174-00 (REC)

(Screened Text Printed Larger for Clarity)



Front Side (LEDs & 2-Pin Connector) | Back Side (Solder / Surface Mounts) | Back Side (Solder / Surface Mounts) | Front Side (LEDs & 3-Pin Connector)

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

Replacement Part:
LED TLRH180P
(T1-3/4 GaAlAs)
SPI Part №:
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**)
180 Ω 1/8W Chip Res. (CRCW)
OPTO PCB Brass Tube Spacer
OPTO PCB Rubber Grommet
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**)
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 PCB Brass Tube Spacer
OPTO PCB Rubber Grommet

OPTO Troubleshooting

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

A. **OPEN OPTO** (Light Falling on LED) = *SWITCH OPEN*. Place meter leads across points **A** and **B** on the **LED1 Circuit** (Refer to Schematic Drawing on previos page, 520-5174-00 Receiver Side). It should read approximately 0.8 - 1.2v DC. The **LED2 Circuit** operates the same.

B. **CLOSED OPTO** (Light Blocked) = *SWITCH CLOSED*. Place meter leads across points **A** and **B** on the **LED1 Circuit** (Refer to Schematic Drawing on previous page, 520-5174-00 Receiver Side). It should read approximately 0.0 - 0.1v DC. The **LED2 Circuit** operates the same.

2. Oscilloscope Test (indicates normal operating condition):

Fig. A

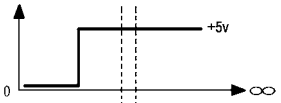
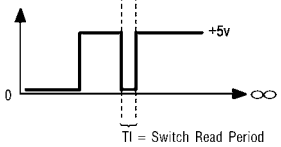


Fig. B



A. **OPEN OPTO** (Light Falling on LED) = *SWITCH OPEN*. Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (see Schematic). The Scope should display a **STEADY +5v** as shown in **Fig. A**, Wave Form Diagram.

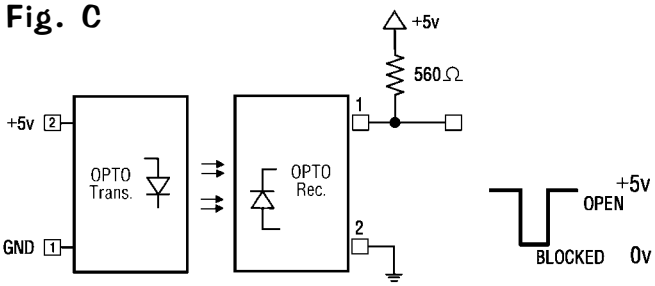
B. **CLOSED OPTO** (Light Blocked) = *SWITCH CLOSED*. Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (see Schematic). The Scope should display a **PULSE STREAM** indicating **Q2** has switched "On" as shown in **Fig. B**, Wave Form Diagram. This is your Switch Drive Pulse.

3. Bench Test (See Fig. C):

Please Note: To perform this test you must use a spare 560Ω Pull-Up Resistor, SPI Nº: 121-5047-00

Disconnect the OPTO Transmitter / Receiver Board from the circuit. Connect one side of a 560Ω Pull-Up Resistor to **Pin-1** of the OPTO Receiver Bd. and the other side of the resistor to a 5v DC source. Connect **Pin-2** to GND. Connect a +5v DC source to **Pin-1** of the Transmitter & GND to **Pin-2**. Align with the Receiver OPTO approx. 3" distance. Using your Volt-Meter or an Oscilloscope, monitor **Pin-1** while *BLOCKING* and *UNBLOCKING* the ***BEAM*** from the Trans. The output will be approx. +5v DC when the ***BEAM IS NOT BLOCKED*** and approx. 0v when the ***BEAM IS BLOCKED.***

Fig. C



Trough Dual OPTO Boards Alignment / Test for LED1

When a working **OPTO** is installed and connected in a game, the transmitter should light *(LED1 lower & LED2 upper)* when the power is switched on. With the playfield in **Service Position #1** *(playfield lifted up and resting on Playfield Support Slide Brackets)* and the game on, the LED lights should show up as a **BRIGHT RED RINGS** through the back of the Receiver Board around the **Receivers LED1 & LED2** *(See **Fig. 1**)*. Testing only **LED1:** With the game in ***Switch Test Mode***, lifting the Trough Plunger with a fingertip should block the **BEAM** and cause the Switch Position to trigger *(See **Fig. 2**)*. View **Fig. 2a** & **2b** *(on the next page)* for a sectional view of the Light Path *(note alignment)* and what happens as a ball breaks the light beam.

Fig. 1

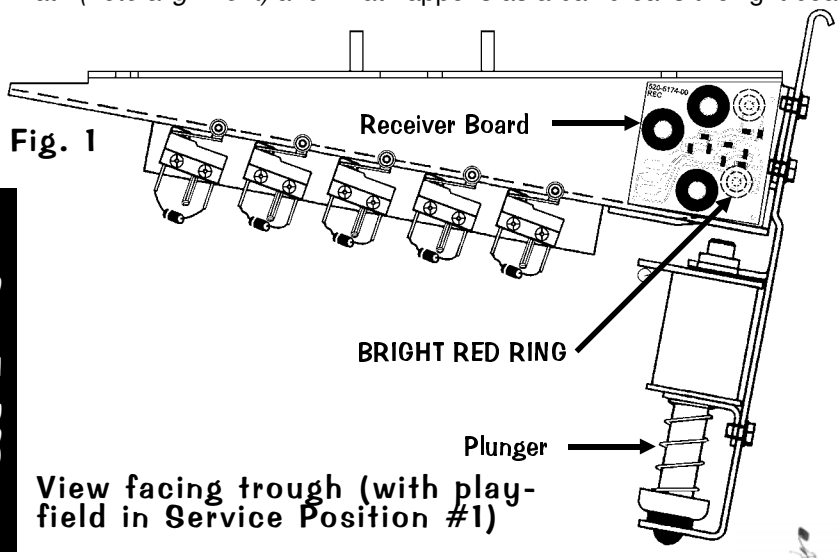
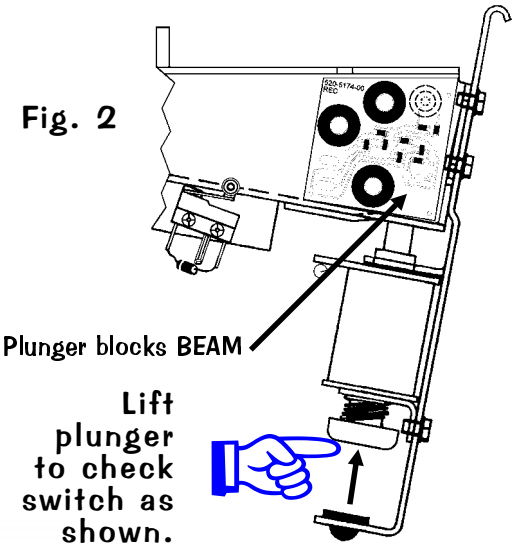
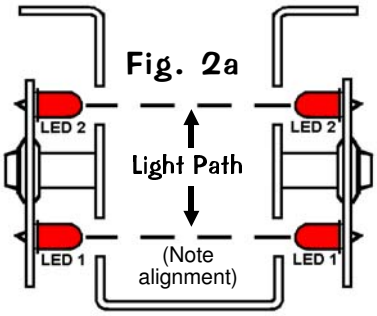
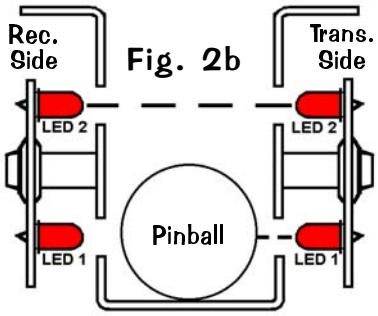


Fig. 2



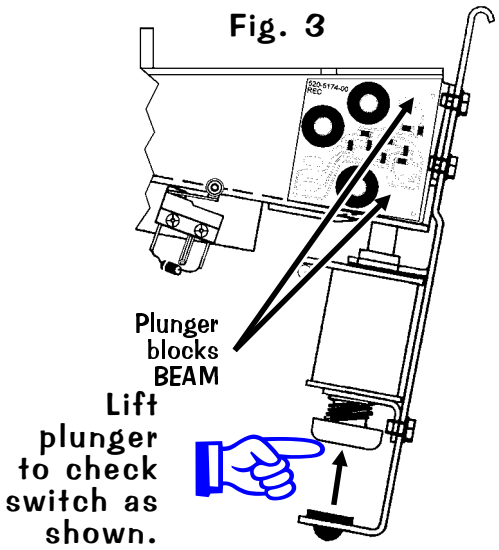
Sectional view from right (Fig. 2a & 2b)

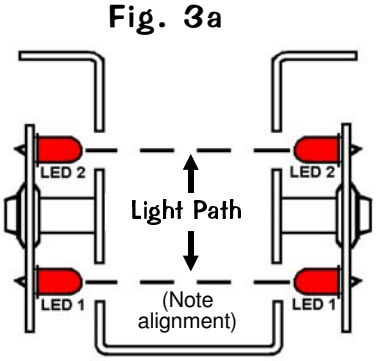


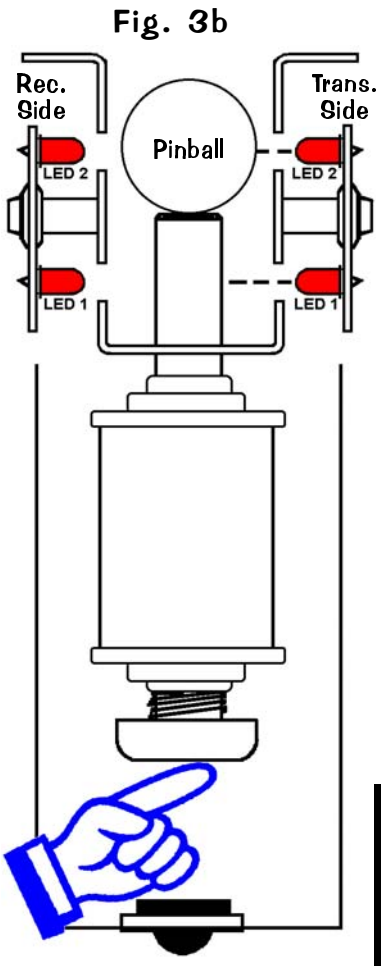


Trough Dual OPTO Boards Alignment / Test for LED2

When a working **OPTO** is installed and connected in a game, the transmitter should light *(LED1 lower & LED2 upper)* when the power is switched on. With the playfield in **Service Position #1** *(playfield lifted up and resting on Playfield Support Slide Brackets)* and the game on, the LED lights should show up as a **BRIGHT RED RINGS** through the back of the Receiver Board around the **Receivers LED1 & LED2** *(See **Fig. 1, previous page**).* Testing only **LED2:** *TO PERFORM THIS TEST, A PINBALL MUST BE IN THE BALL TROUGH.* With the game in ***Switch Test Mode***, lifting the Trough Plunger with a finger tip should block the **BEAM** on LED2 and cause the Switch Position to trigger *(See **Fig. 3**).* View **Fig. 3a** & **3b** for a sectional view of the Light Path *(note alignment)* and what happens as a "double-stacked" ball scenario breaks the light beam.







I M P O R T A N T

If replacement of ***LED*** *is required, insure that is* ***mounted correctly before and after soldering*** *(See **Fig. 4a** / **4b**).*

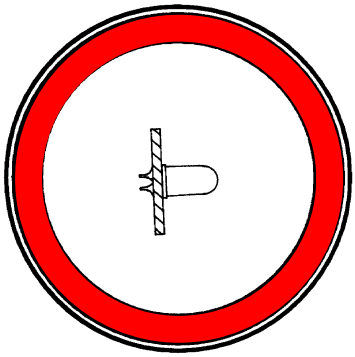


Fig. 4a
Correct Position

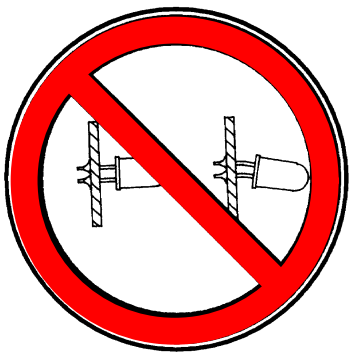
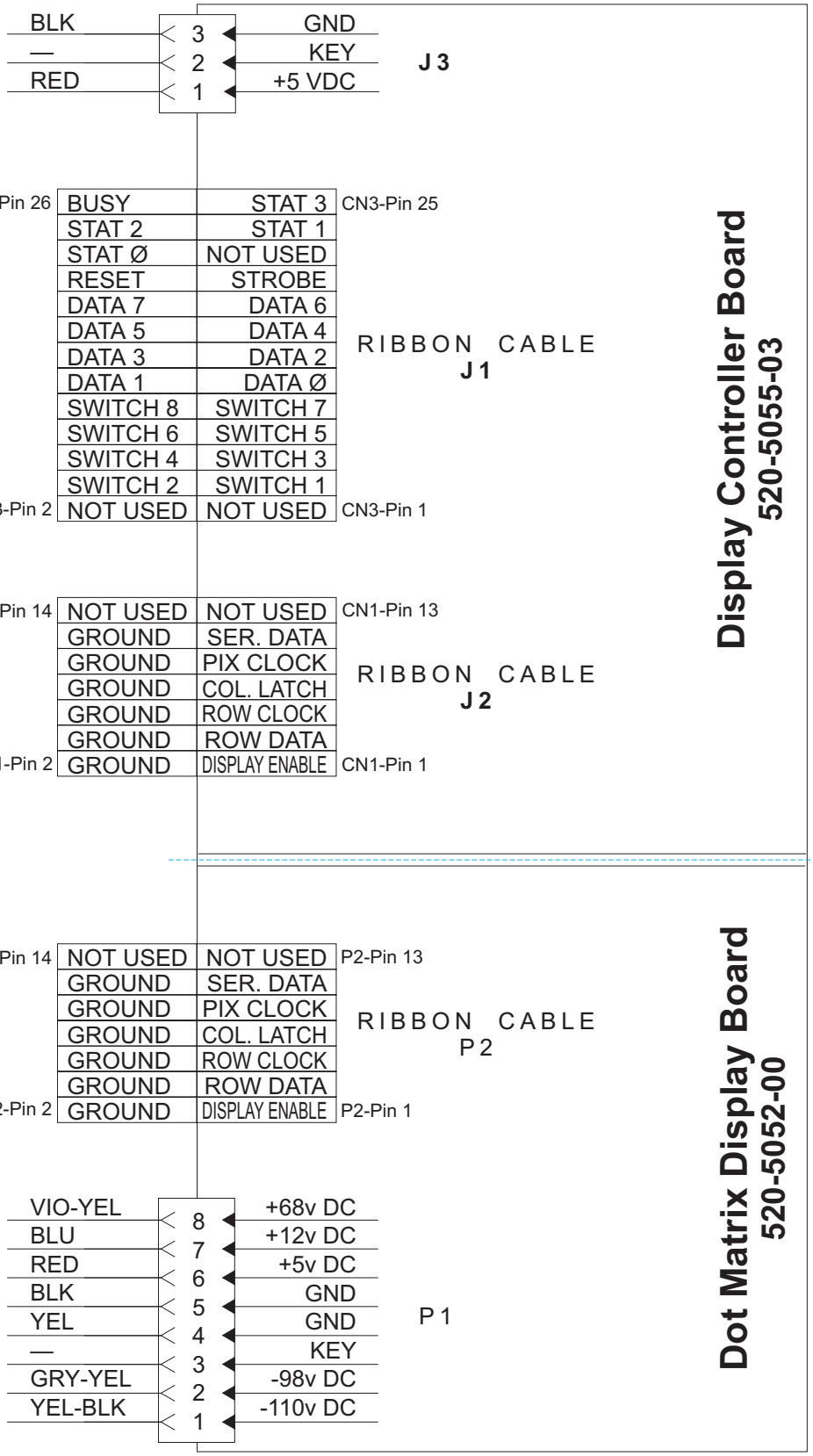


Fig. 4b
Incorrect Position

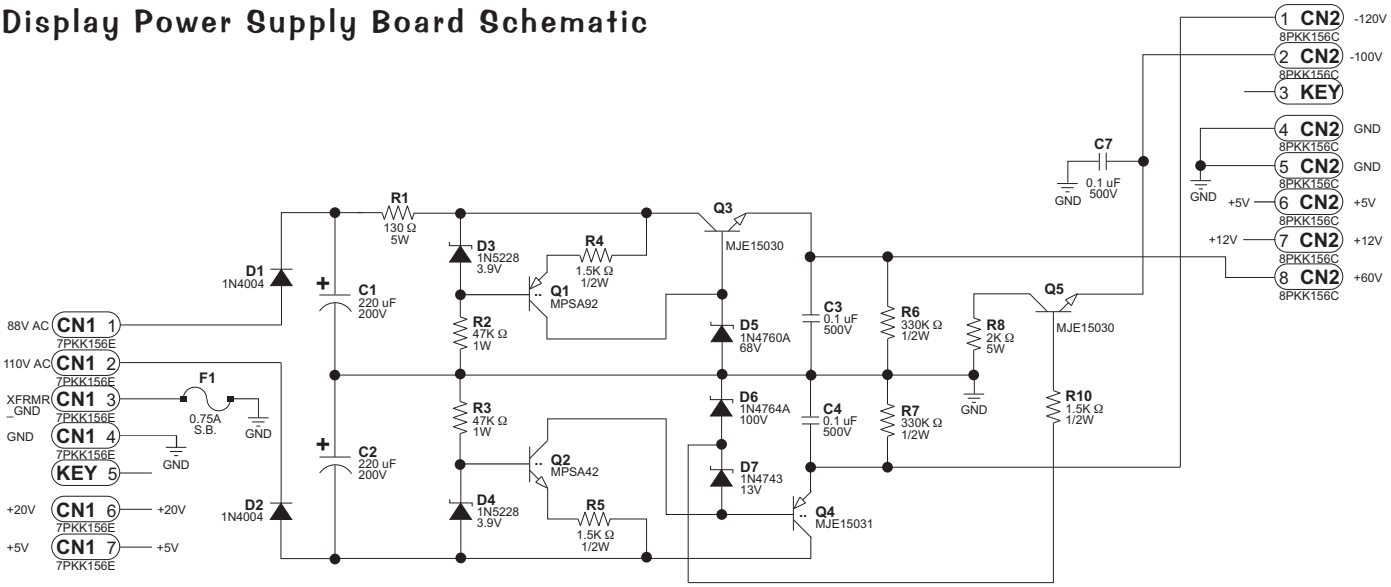


Dot Matrix Display Explained

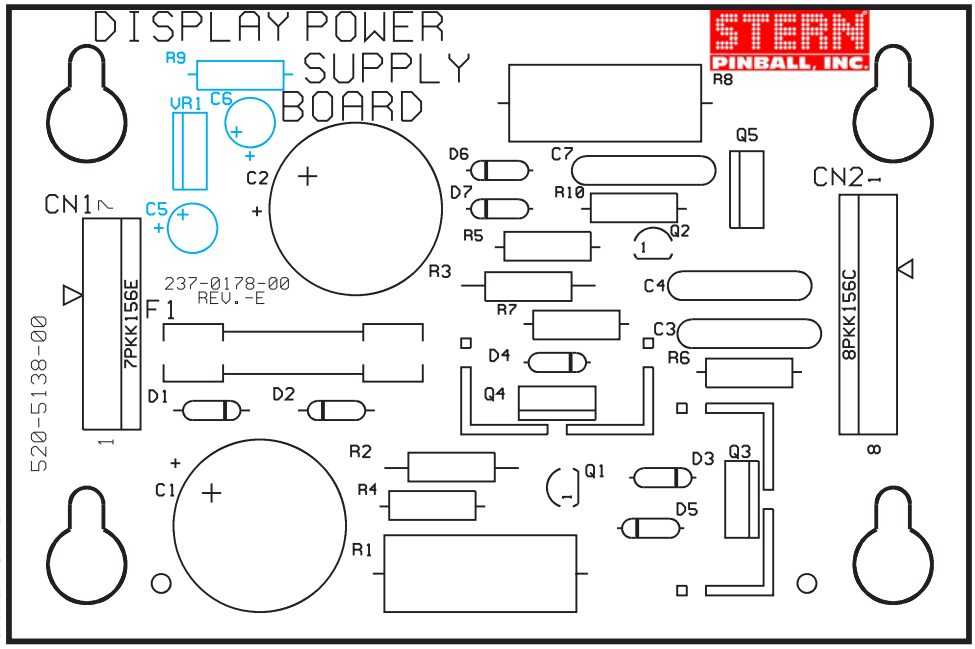
The display utilizes a Micro-Processor Control Board mounted in piggyback fashion to the Dot Matrix Display (128 X 32) Driver Board. The purpose behind this board is to provide more information to the operator as well as displaying graphics to the player.

The board is controlled by a 6809E Micro processor 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.

Display Power Supply Board Schematic

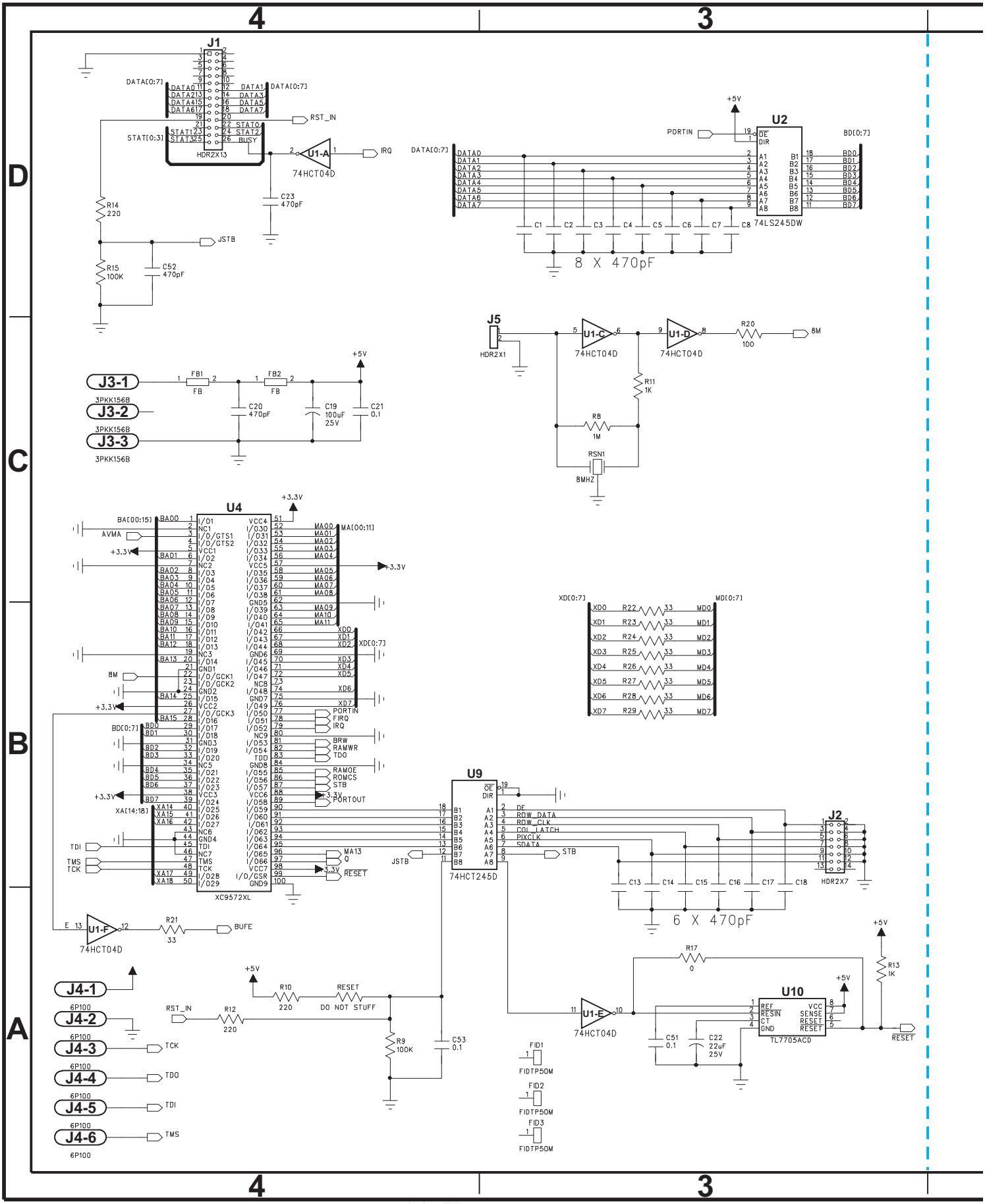


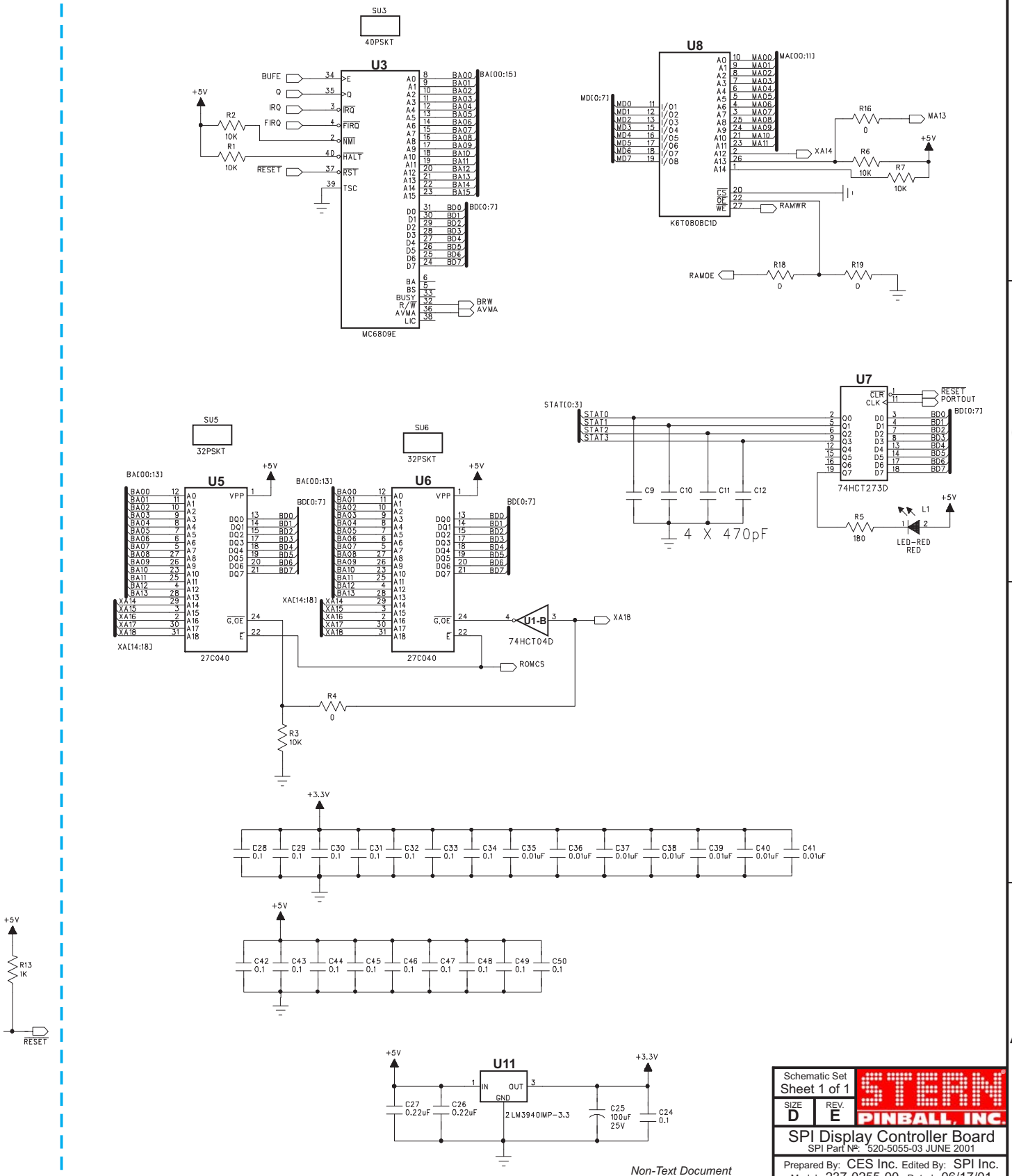
Display Power Supply Board Component Layout & Parts



Actual Board Size 5" X 3.3"

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.
03	0	125-5003-00	(C5, C6: NS)	22uF, 35v, Rad Lytic 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.
25	0	124-5003-00	(VR1: NS)	7812CT


4
3
D
C
B
A
J1
DATA[0:7]
STAT[0:3]
HDR2X13
RST_IN
IRQ
U1-A
74HCT04D
R14
220
C23
470pF
JSTB
R15
100K
C52
470pF
U2
PORTIN
74LS245DW
8 X 470pF
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
+5V
+3.3V
U4
XC9572XL
BA[00:15]
AVMA
MA[00:11]
XD[0:7]
BD[0:7]
XA[14:18]
TDI
TMS
TCK
PORTIN
FIRQ
IRQ
BRW
RAMWR
TDO
RAMOE
ROMCS
STB
PORTOUT
MA13
Q
RESET
U9
74HCT245D
JSTB
STB
J2
HDR2X7
DF
ROW_DATA
ROW_CLK
COL_LATCH
PIXCLK
SDATA
6 X 470pF
XD0 R22 33 MD0
XD1 R23 33 MD1
XD2 R24 33 MD2
XD3 R25 33 MD3
XD4 R26 33 MD4
XD5 R27 33 MD5
XD6 R28 33 MD6
XD7 R29 33 MD7
U1-F
74HCT04D
R21
33
BUFE
J4-1
J4-2
J4-3
J4-4
J4-5
J4-6
6P100
RST_IN
R12
220
R10
220
RESET
DO NOT STUFF
R9
100K
C53
0.1
FID1
FID2
FID3
FIDTP50M
R17
0
U1-E
74HCT04D
U10
TL7705ACD
REF
RESIN
CT
GND
VCC
SENSE
RESET
C51
0.1
C22
22uF
25V
R13
1K



Non-Text Document

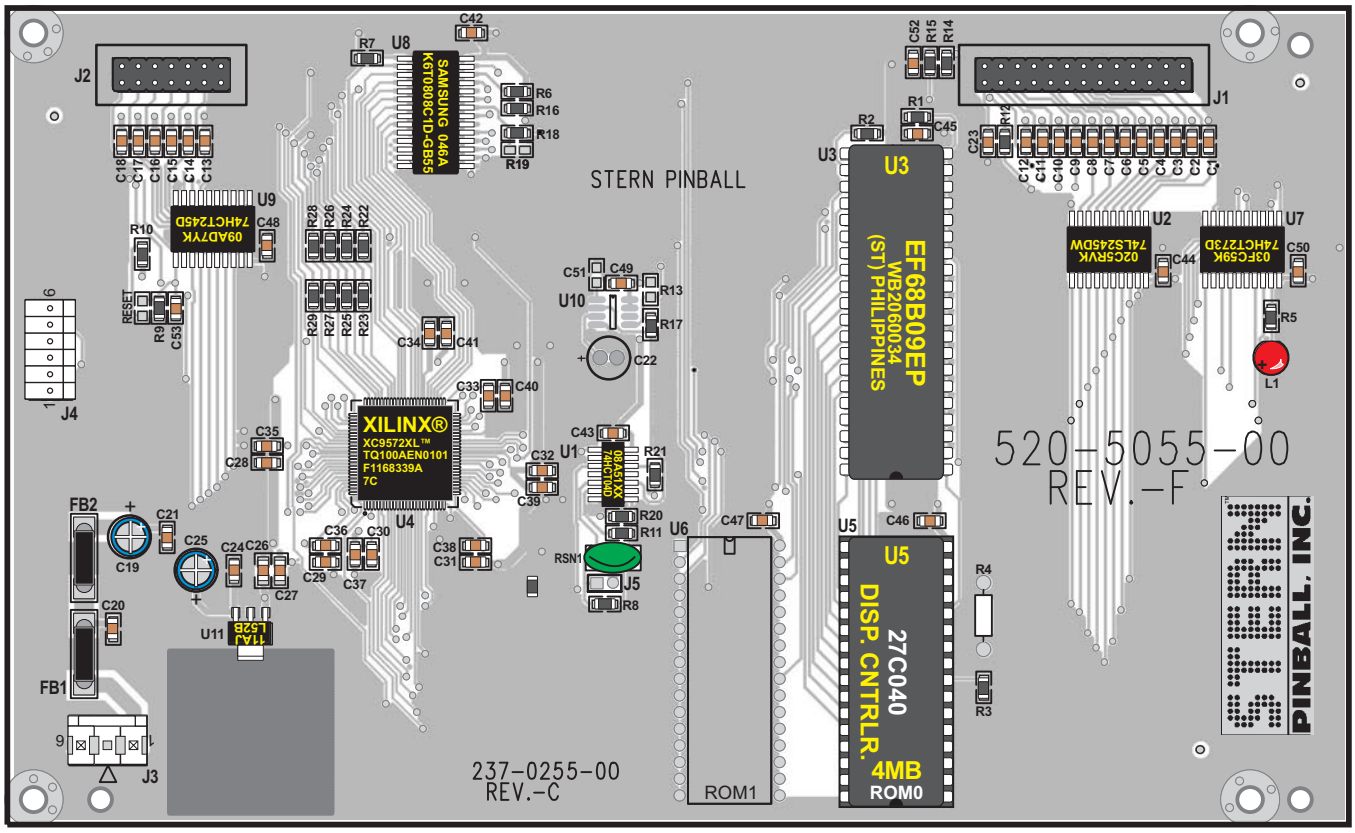
Schematic Set	Sheet 1 of 1
SIZE	D
REV.	E

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

Display Controller Board Component Layout & Parts



Actual Board Size 20.5cm X 12.5cm

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**
01	1	045-5015-26	J1	13-Pin, Dual row .1" Hdr. Conn HDR2X13
02	1	045-5015-02	J2	7-Pin, Dual Row .1" Hdr. Conn HDR2X7
03	1	045-5015-03	J3	3-Pin, PKK156B Connector
04	1		J4	6-Pin (6P100)
05	7		C35-C39, C40, C41	SMT 0.01uF, 50v Cap. 103-0805-X7R
06	20		C21, C24, C28-C32, C33, C34, C42, C43, C44, C45, C46 C47, C48, C49, C50, C53 (C51: NS)	SMT 0.1uF, 50v Cap. 104-0805
07	2		C26, C27	SMT 0.22uF, 50v Cap. 224-1206-Z5U
08	21		C1-C12, C13-C18, C20, C23, C52	SMT 470pF, 50v Cap. 471-0805
09	2		C19, C25	100uF, 25v TCap.
10	**1**	**165-5099-00**	**L1**	**LED T1-3/4 DIFFUSER RED**
11	4		R16-R18 (R19: NS)	0 Ω 1/10W Resistor 0805
12	1	n/a	RESET	*DO NOT STUFF*
13	2		R11, R13	SMT 1K Ω 1/10W Resistor 0805
14	1		R8	SMT 1M Ω 1/10W Resistor 0805
15	5		R1, R2, R3, R7 (R6: NS)	SMT 10K Ω 1/10W Resistor 0805
16	9		R21, R22-R29	SMT 33 Ω 1/10W Resistor 0805
17	1		R20	SMT 100 Ω 1/10W Resistor 0805
18	2		R9, R15	SMT 100K Ω 1/10W Resistor 0805
19	1		R5	SMT 180 Ω 1/10W Resistor 0805
20	3		R10, R12, R14	SMT 220 Ω 1/10W Resistor 0805
21	1		U1	74HCT04D (74LS04)
22	1		U2	74LS245DW
23	1	100-0189-01	U3 *(40-Pin Socket, 077-X)*	MC6809E
24	1	100-5044-00	U4	XC9572XL, Int. Xilinx®
25	2 (See Pg. **DR.** ❶ Table)		U5 (ROM0) (U6: NS) *(32-Pin, IC Dip Socket, 077-5217-00)*	4MB ROM 27C040 (M27C401-100)
26	1		U7	74HCT273D
27	1	100-5045-00	U8	K6T0808C1D-GB55, Int. Samsung 046A
28	1		U9	74HCT245D
29	1		U11	LM3940IMP-3.3
30	1		RSN1	8MHZRSN (8Mhz) Crystal
31	2	n/a	FB1, FB2	Ferrite Bead, FB0370
32	0		FID1-3	FIDTP50M

If a part is required where a part number is not provided, call Technical Support (see back of cover).

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.

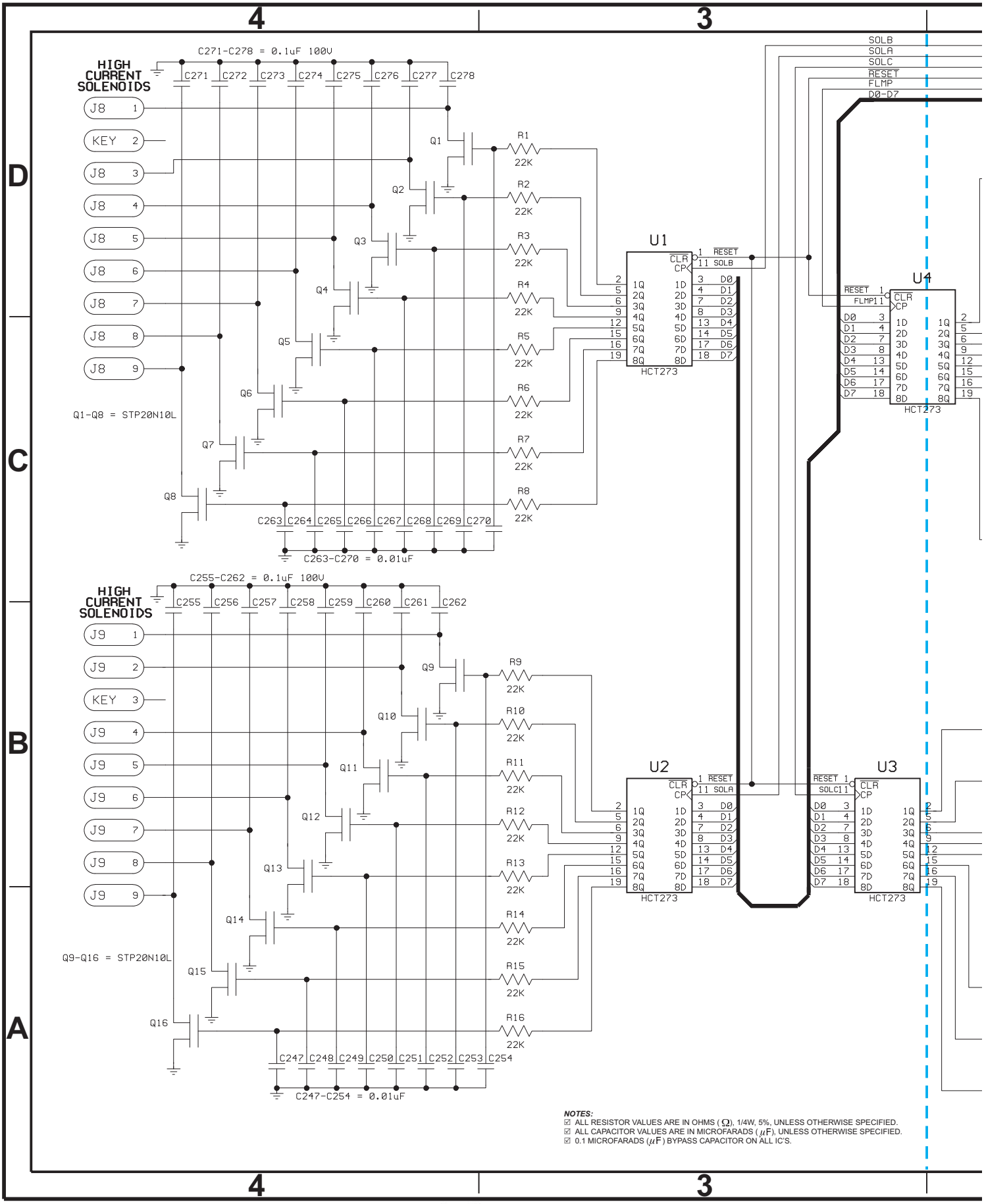
Solenoid (Coil) Drivers & Flash Lamps:
J8 & **J9** are high side drivers for driving solenoids and other heavy loads. Each connector has its own buffer driving 8 drivers. **J8** & **J9** consist of **MOSFET Drivers 20N10L** which can easily & safely be tested by clipping one end of a clip-lead to test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

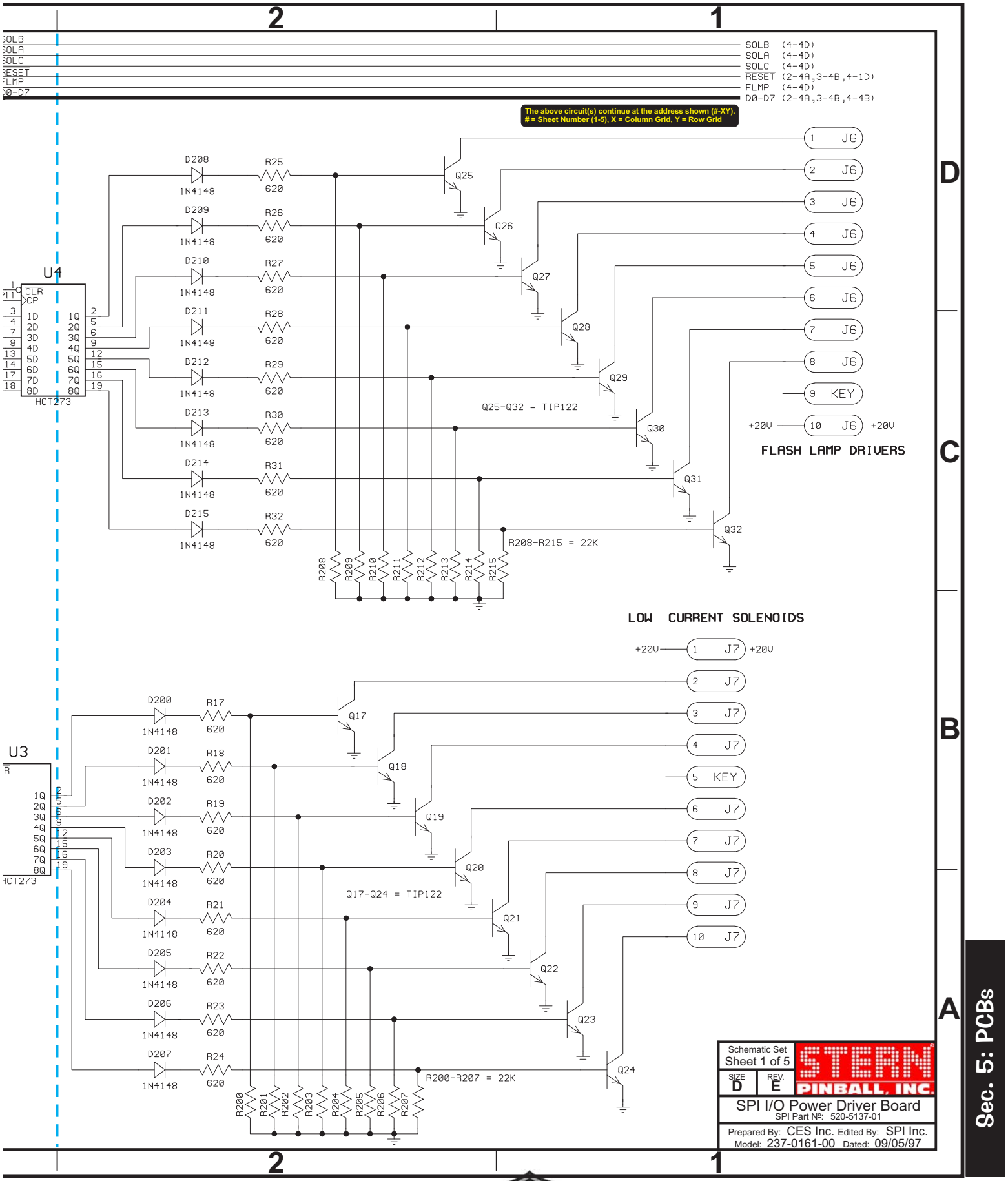
Lamp Matrix:
J12 has 10 low side drivers for the lamp strobes which consist of **19N06L MOSFETS**. Only one lamp strobe should be low at any time. Again the scanning of the lamp strobes keeps the I/O from resetting. **J13** has 8 high side drivers with each having a status indicator. All the status indicators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

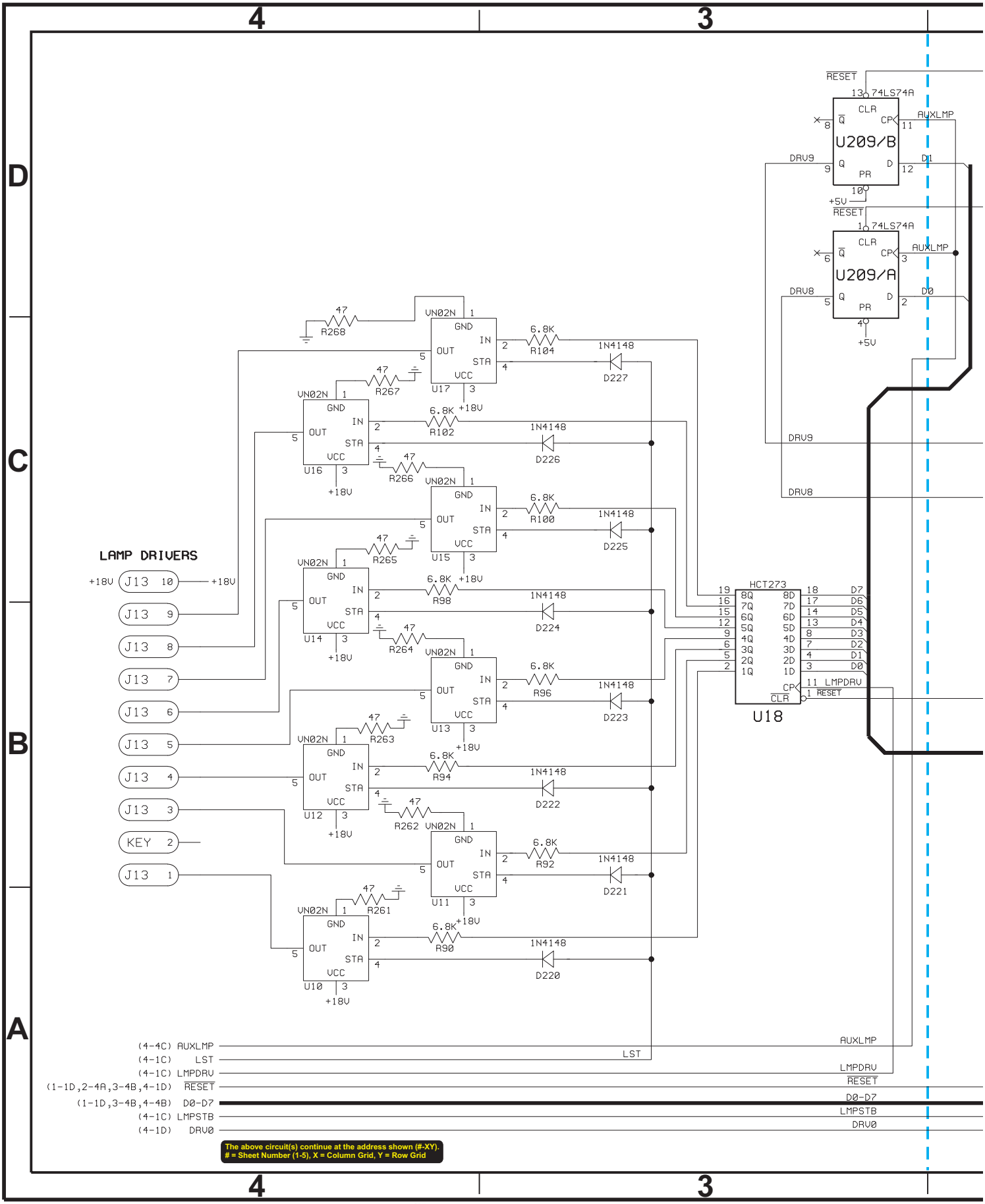
General Illumination (G.I.) Lights:
J15 has 6v AC switched on & off by a relay on the I/O Board. The relay is controlled by **Q200** which supplies power to the 24v coil winding to activate the relay. There are 4 taps on **J15** each fused at 5A for this 6v AC source.

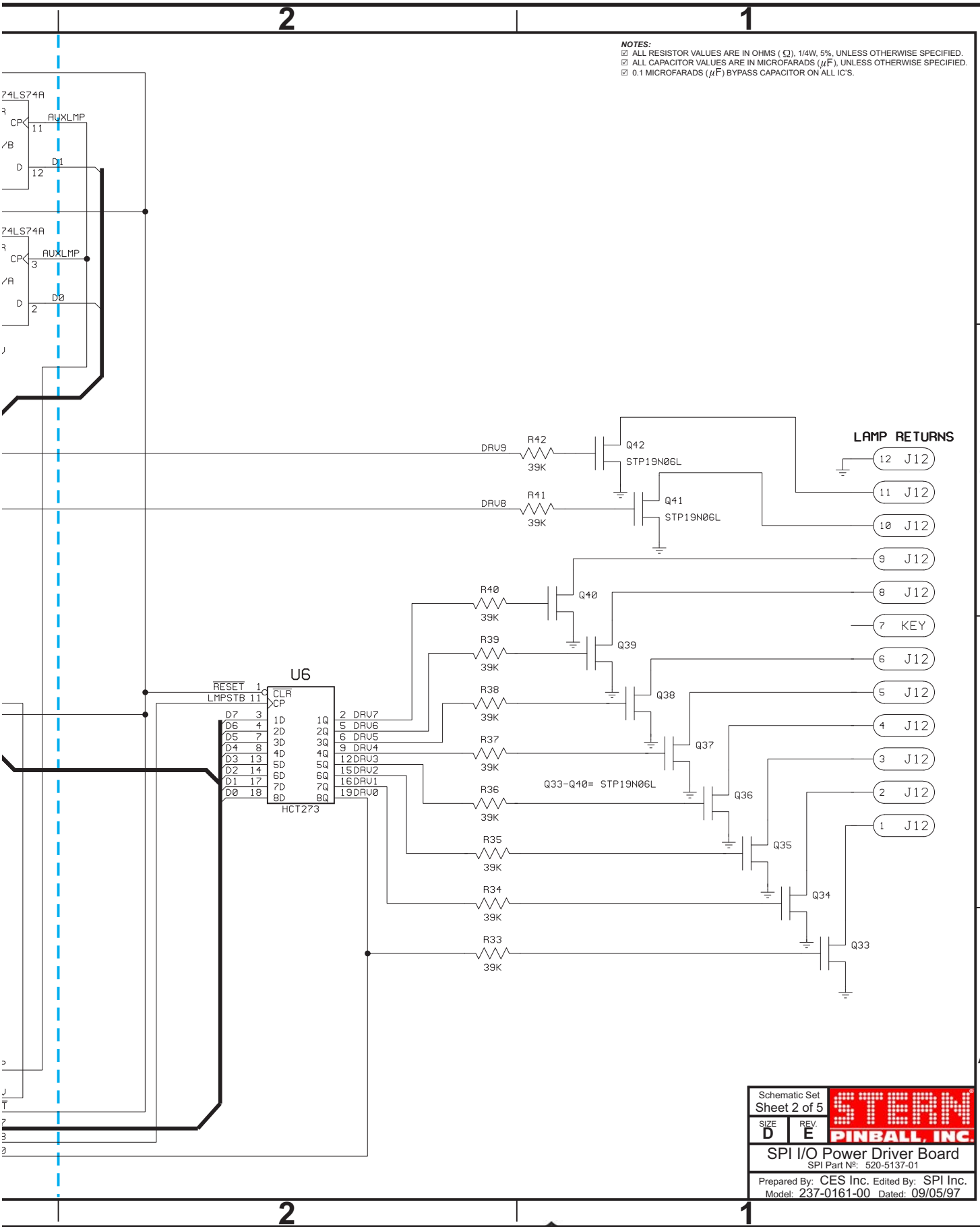


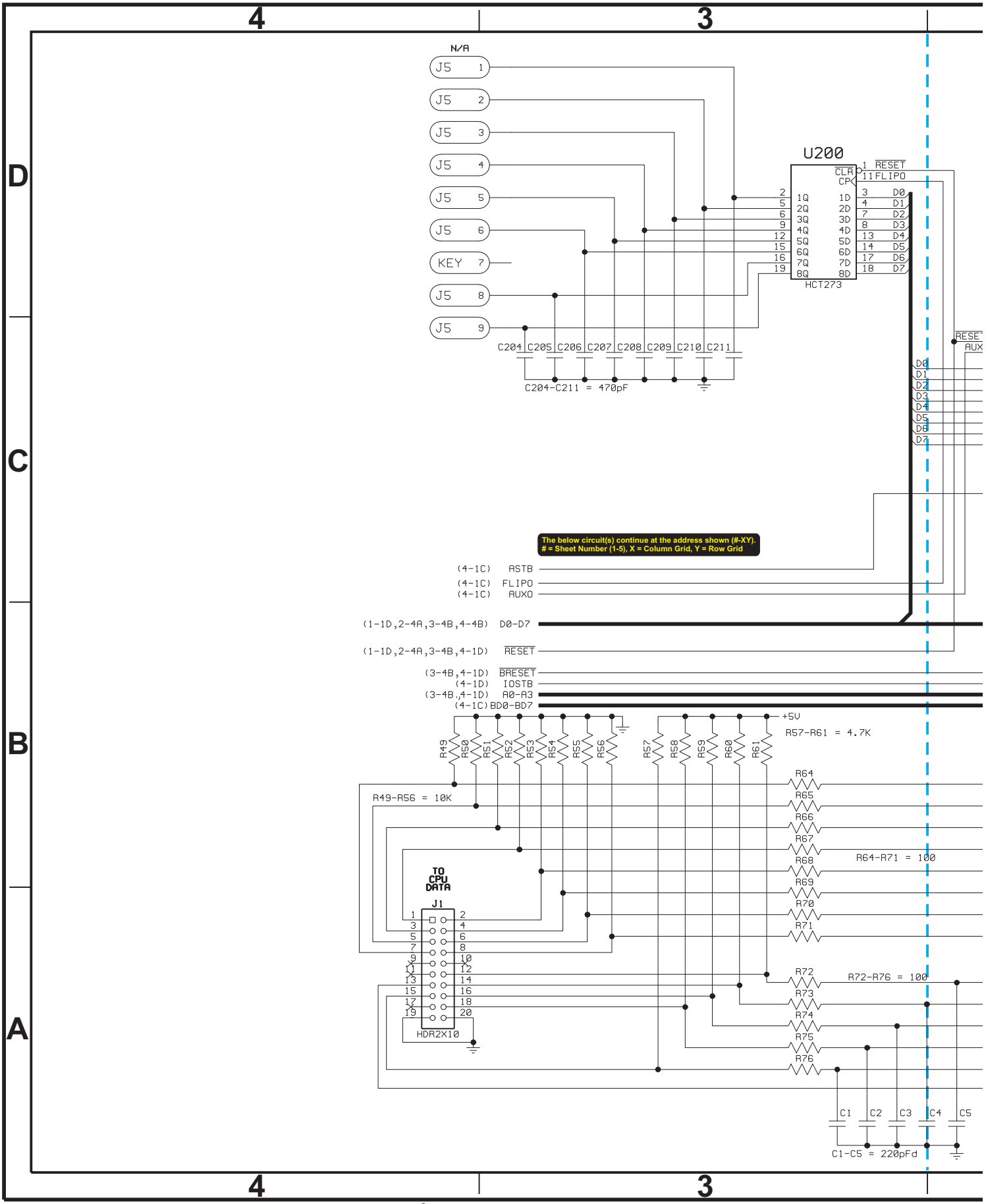
NOTES:

☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
☑ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.


SOLB (4-4D)
SOLA (4-4D)
SOLC (4-4D)
RESET (2-4A,3-4B,4-1D)
FLMP (4-4D)
D0-D7 (2-4A,3-4B,4-4B)
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
U4
HCT273
D208 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
R208 R209 R210 R211 R212 R213 R214 R215
R208-R215 = 22K
1 J6
2 J6
3 J6
4 J6
5 J6
6 J6
7 J6
8 J6
9 KEY
+20V 10 J6 +20V
FLASH LAMP DRIVERS
LOW CURRENT SOLENOIDS
+20V 1 J7 +20V
2 J7
3 J7
4 J7
5 KEY
6 J7
7 J7
8 J7
9 J7
10 J7
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 R201 R202 R203 R204 R205 R206 R207
R200-R207 = 22K
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


4
3
D
C
B
A
LAMP DRIVERS
+18V
J13 10
J13 9
J13 8
J13 7
J13 6
J13 5
J13 4
J13 3
KEY 2
J13 1
R268
R267
R266
R265
R264
R263
R262
R261
47
6.8K
R104
R102
R100
R98
R96
R94
R92
R90
UN02N
GND
IN
OUT
STA
VCC
U17
U16
U15
U14
U13
U12
U11
U10
1N4148
D227
D226
D225
D224
D223
D222
D221
D220
HCT273
U18
8D
7D
6D
5D
4D
3D
2D
1D
8Q
7Q
6Q
5Q
4Q
3Q
2Q
1Q
CP
CLR
D7
D6
D5
D4
D3
D2
D1
D0
LMPDRV
RESET
74LS74A
U209/B
U209/A
AUXLMP
DRV9
DRV8
D1
D0
(4-4C) AUXLMP
(4-1C) LST
(4-1C) LMPDRV
(1-1D,2-4A,3-4B,4-1D) RESET
(1-1D,3-4B,4-4B) D0-D7
(4-1C) LMPSTB
(4-1D) DRV0
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid


NOTES:
☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
☑ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.
74LS74A
AUXLMP
D1
D0
U6
RESET
LMPSTB
CLR
CP
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 №: 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
1Q 2Q 3Q 4Q 5Q 6Q 7Q 8Q
1D 2D 3D 4D 5D 6D 7D 8D
D0 D1 D2 D3 D4 D5 D6 D7
RESET
FLIPO
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
R49 R50 R51 R52 R53 R54 R55 R56
R57 R58 R59 R60 R61
R57-R61 = 4.7K
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:
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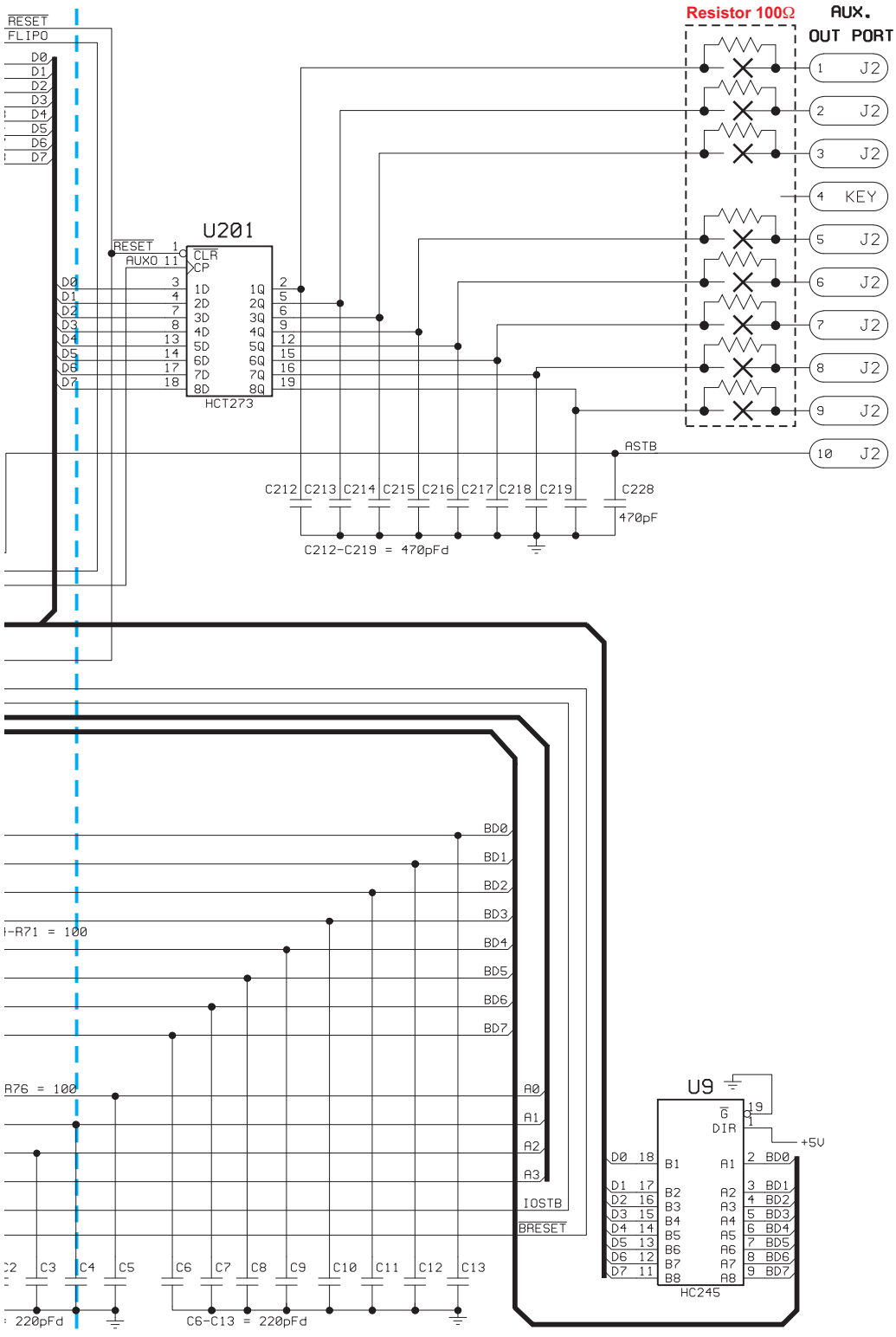
- ☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
- ☑ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.

DATE	DESCRIPTION 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 Nº: 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

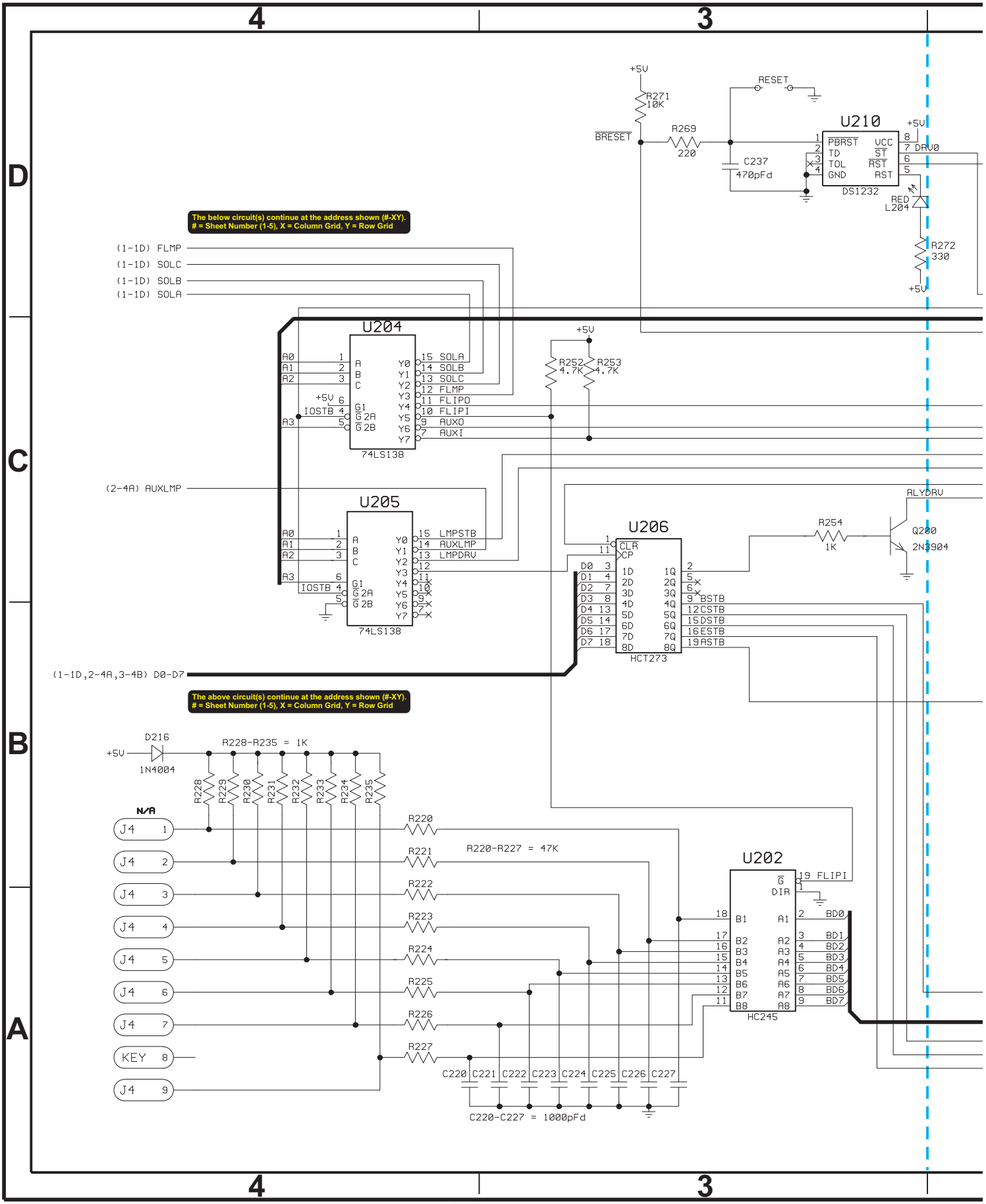


Schematic Set	Sheet 3 of 5
SIZE	D
REV.	E

STERN PINBALL, INC.

SPI I/O Power Driver Board
SPI Part 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
+5V
R271
10K
RESET
BRESET
R269
220
C237
470pFd
U210
PBRST
TD
TOL
GND
VCC
ST
RST
RST
DS1232
+5V
DRV0
RED
L204
R272
330
+5V
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
+5V
IOSTB
G1
G 2A
G 2B
Y0 SOLA
Y1 SOLB
Y2 SOLC
Y3 FLMP
Y4 FLIPO
Y5 FLIPI
Y6 AUXO
Y7 AUXI
74LS138
+5V
R252
4.7K
R253
4.7K
(2-4A) AUXLMP
U205
A0
A1
A2
A3
IOSTB
G1
G 2A
G 2B
Y0 LMPSTB
Y1 AUXLMP
Y2 LMPDRV
74LS138
U206
CLR
CP
D0
D1
D2
D3
D4
D5
D6
D7
1D
2D
3D
4D
5D
6D
7D
8D
1Q
2Q
3Q
4Q
5Q
6Q
7Q
8Q
BSTB
CSTB
DSTB
ESTB
ASTB
HCT273
R254
1K
RLYDRV
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
+5V
1N4004
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)		

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+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

FLIP0 (3-4C)
AUX0 (3-4C)
LMPSTB (2-4A)
LMPDRV (2-4A)
RLYDRV (5-4C)
ASTB (3-4C)
BD0-BD7 (3-4B)
LST (2-4A)

RLYDRV
Q200 2N3904

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

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

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

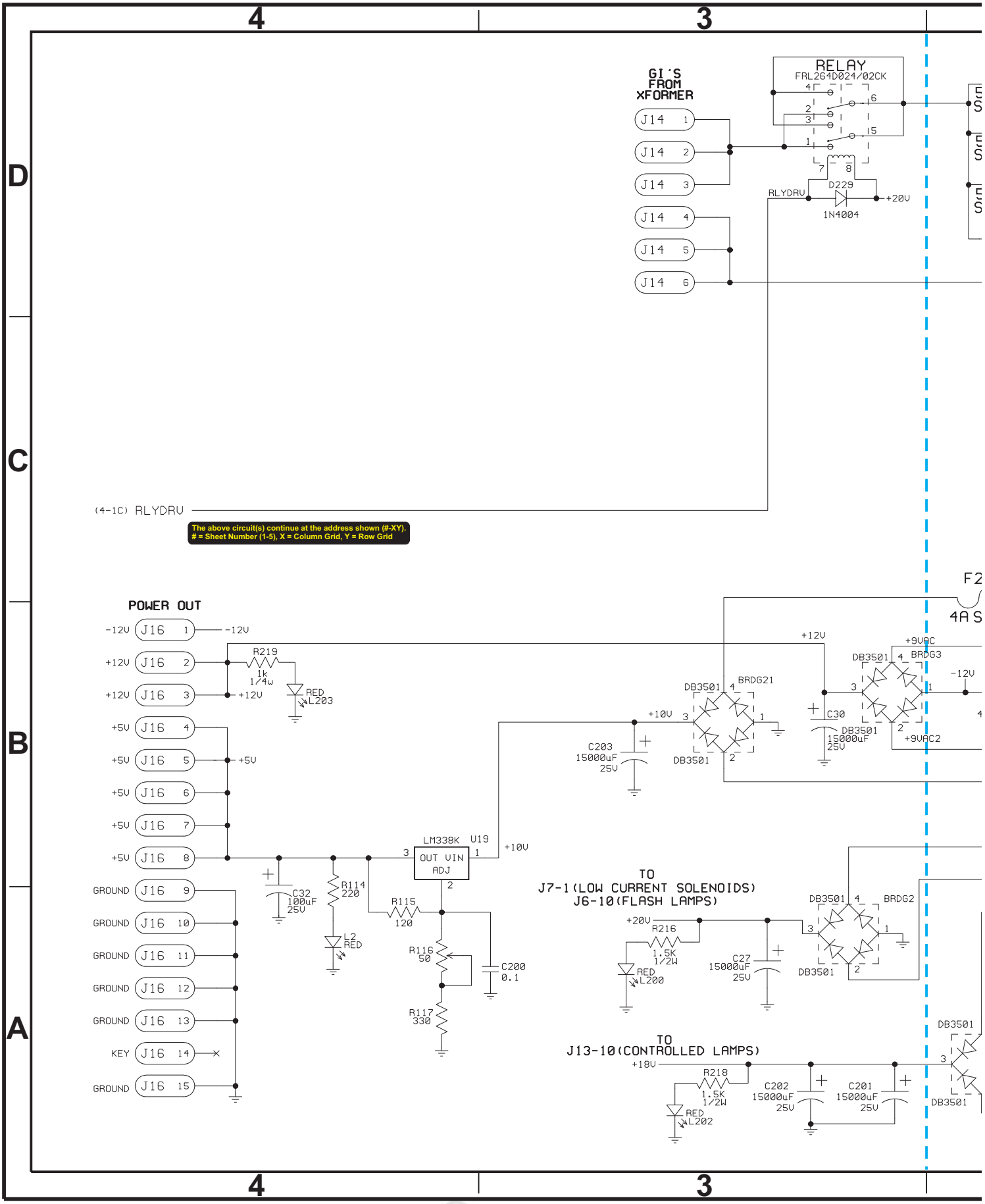
C243 C244 C245 C246
C243-C246 = 470pFd

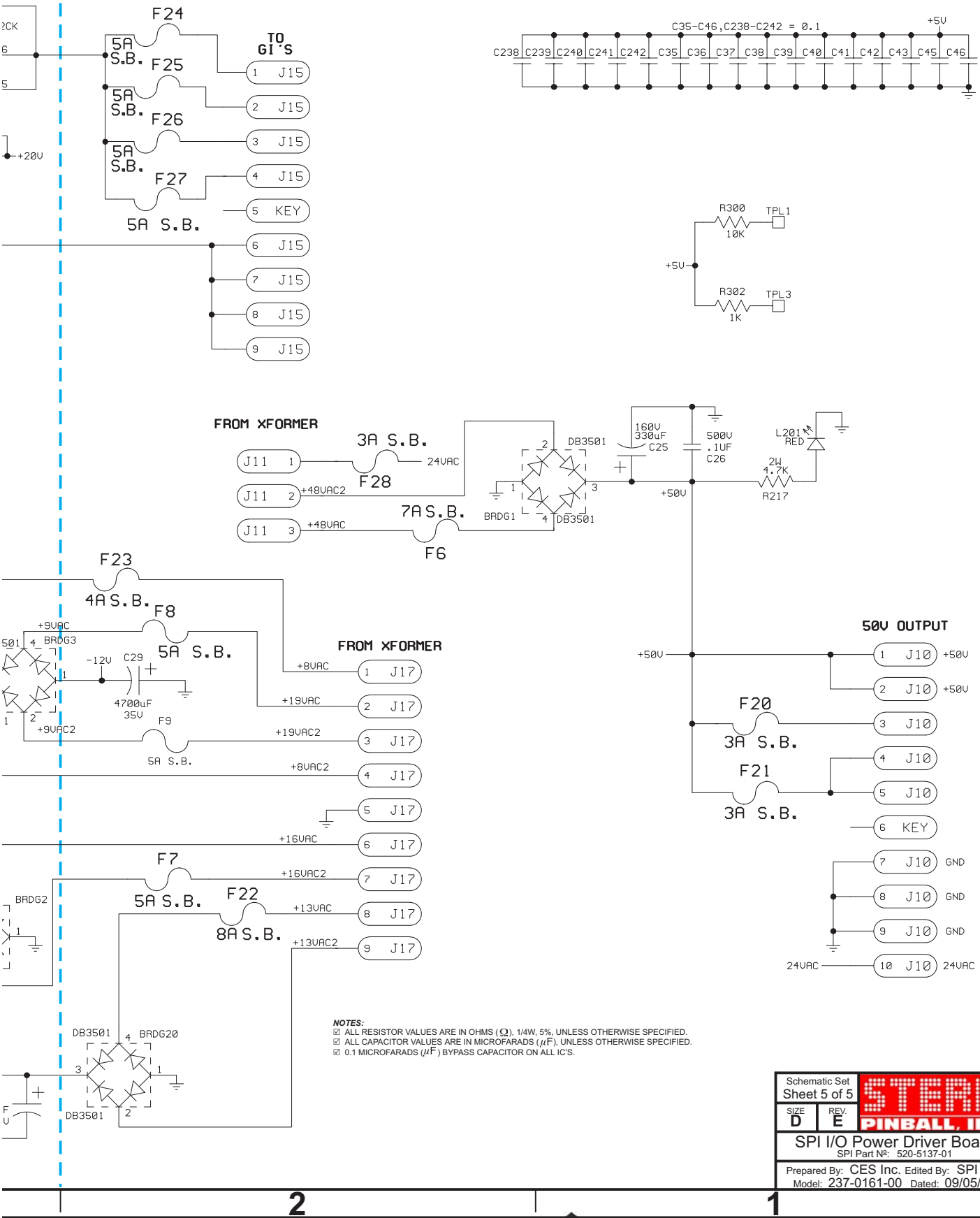
Schematic Set	
Sheet 4 of 5	
SIZE D	REV. E

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
C30
15000uF
25V
DB3501 BRDG3
+9VAC
+9VAC2
-12V
+12V
F2
4A S
TO
J7-1(LOW CURRENT SOLENOIDS)
J6-10(FLASH LAMPS)
R216
1.5K
1/2W
RED
L200
C27
15000uF
25V
DB3501 BRDG2
TO
J13-10(CONTROLLED LAMPS)
+18V
R218
1.5K
1/2W
RED
L202
C202
15000uF
25V
C201
15000uF
25V
DB3501



NOTES:

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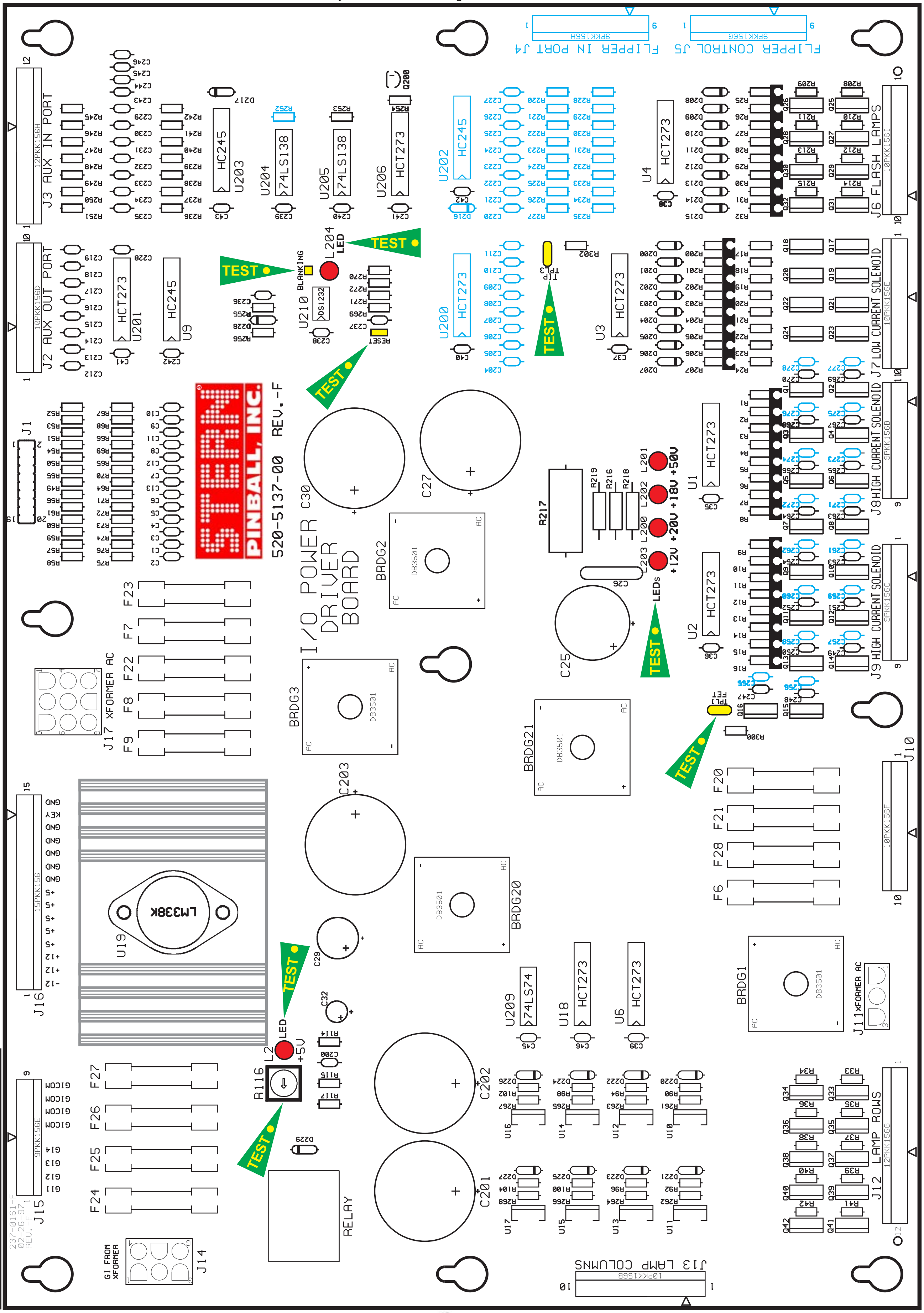
Schematic Set	Sheet 5 of 5
SIZE D	REV. E

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



Test Points:

TEST

←TIP TPL3
←BLANKING
←L204 LED
←RESET

LEDs :
←L201+50v
←L202+18v
←L200+20v
←L203+12v

←FET TPL1

LED :
←L2+5V
←R116 POT

Sec. 5: PCBs

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 Rev. G**	**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 (C204-C211: NS)	470pF, (471), Axial Cap.
10	0	n/a	(C220>C227: NS)	
11	16	125-5029-00	C247>C254, C263>C270	0.01uF, (103), 100v Cap.
12	0	125-5027-00	(C255>C262, C271>C278: NS)	0.1uF, (104), 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 (D216: NS)	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	2	200-5000-08	F21, F28	3A 250v S.B. Fuse
19	1	200-5000-05	F22	8A 250v S.B. Fuse
20	2	200-5000-06	F20, 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
	0	n/a	(J4, J5: NS)	
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 (R252: NS)	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, R245>R251, R254, R302 (R228>R235: NS)	1K Ω 1/4W Res.
49	8	121-5016-00	R261, R262, R263, R264, R265, R266, R267, R268	47 Ω 1/4W Res.
50	1	190-5002-00	RELAY	FRL264D024/02CK Relay
51	2	n/a	TPL1, TPL3	*Test Point Wire (24ga.) Loops*
52	8	100-5012-00	U1, U2, U3, U4, U6, U18, U201, U206 (U200: NS)	74HCT273
53	1	110-0058-00	U9	74LS245
54	1	100-5023-00	U210	DS1232
55	8	110-0089-00	U10, U11, U12, U13, U14, U15, U16, U17	VN02N
56	1	100-0356-00	U19	LM338K
57	1	n/a	U19	Heatsink (5v Reg.)
58	1	100-0338-00	U203 (U202: NS)	74HC245
59	2	100-0148-00	U204, U205	74LS138
60	1	100-0037-00	U209	74LS74
61	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**) Battery Pack which has a **TEST POINT (TP): 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**.

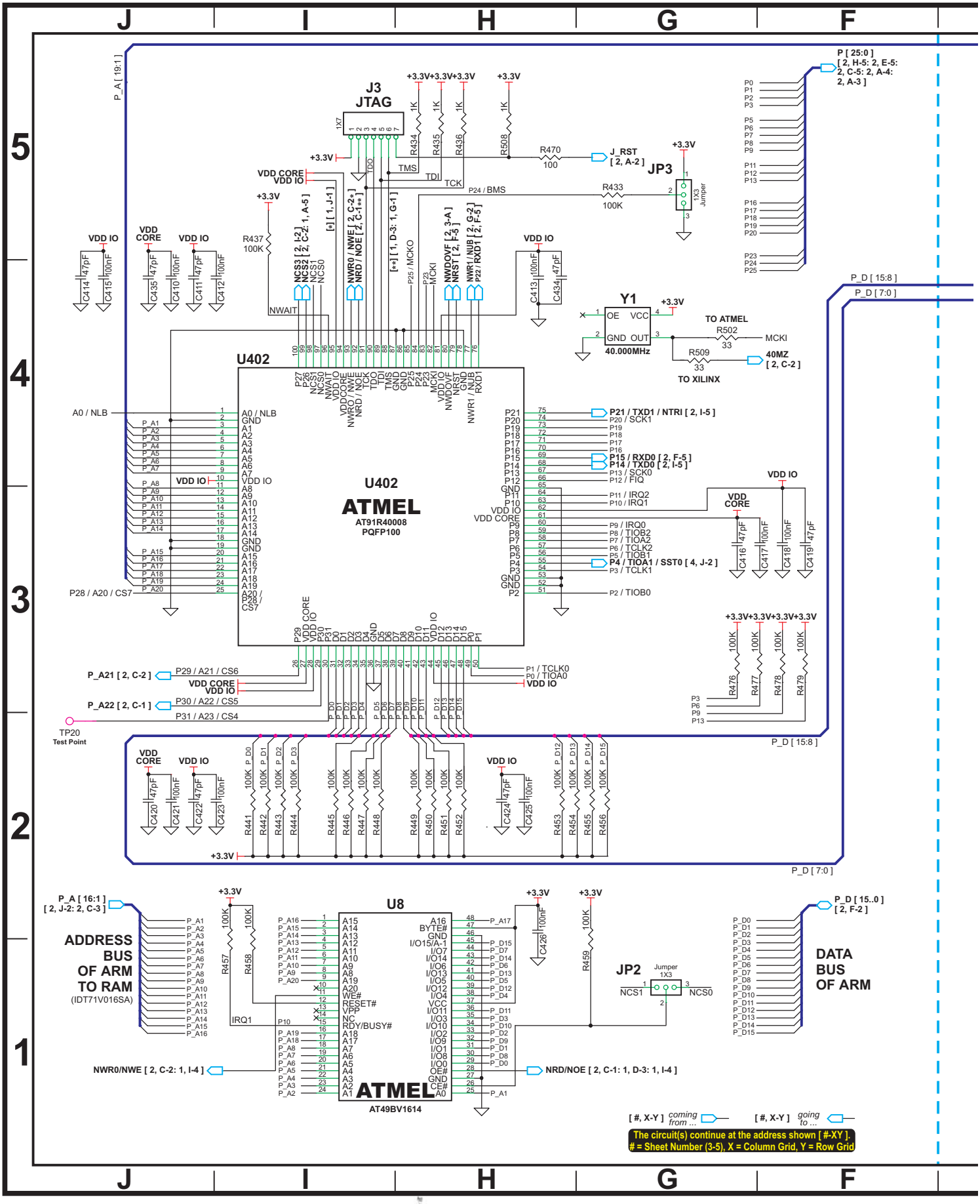
A watchdog is used to monitor the **CPU** and the 5v supply. If the 5v supply is below 4.75 the watchdog will hold the **CPU**/**Sound Board** & **I/O Board** in *reset*. The watchdog must be fed at a rate of ***250ms*** or faster. The signal used to feed the watchdog comes from the EPROM Bank select signal used to load **U211**.

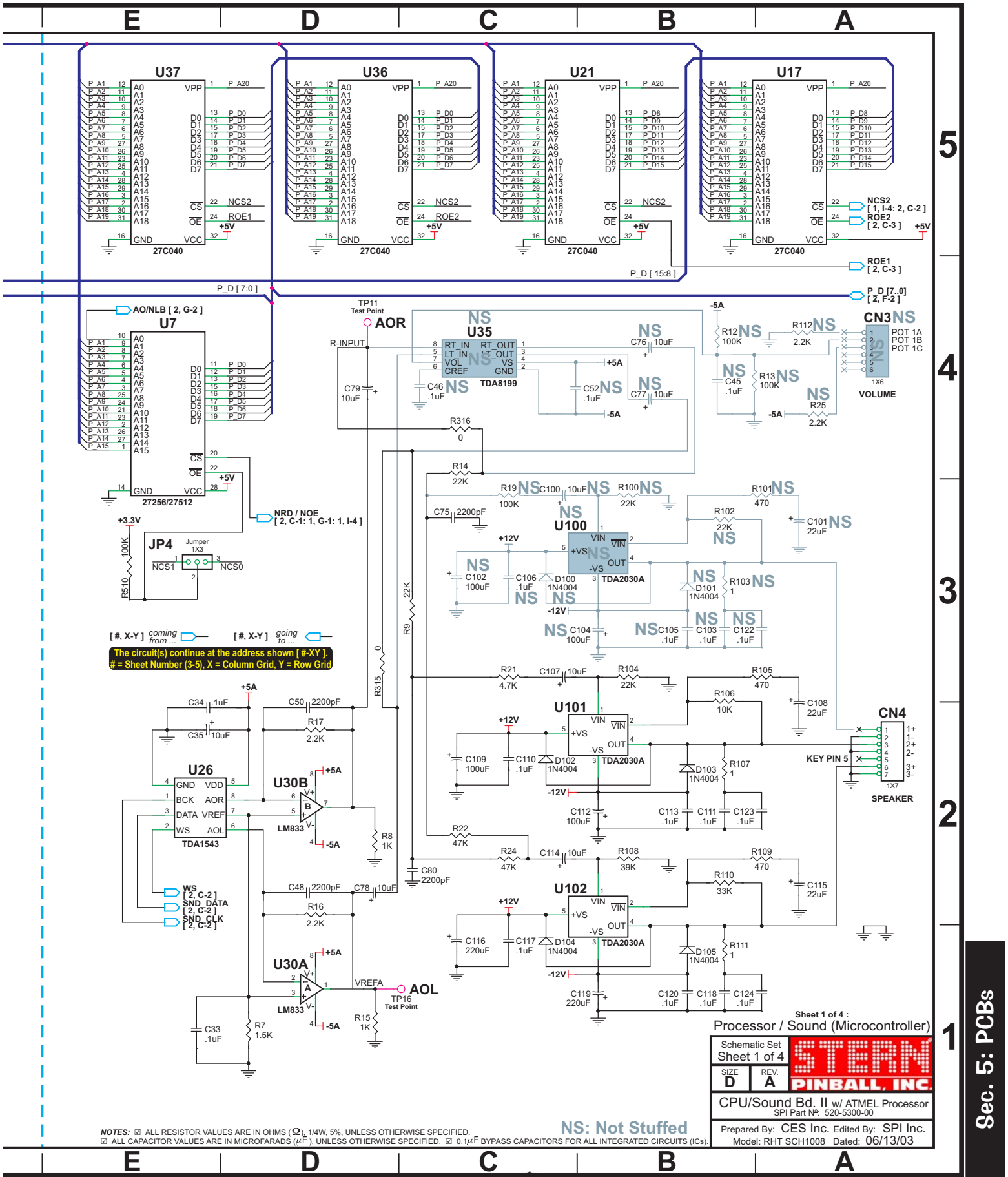
The **I/O** Interface **CN1** is buffered by two (2) **HC245** Chips (**U207 & U208**). The **CPU**'s reset line is buffered by **Q10** and fed over to the **I/O** through **CN1**. An I/*O Strobe Signal* is fed through **CN1-15** and is used to notify the **I/O** that a valid address is being sent.

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*. 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** [TP17: 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.

Other Test Points (TP):
TP 7: E & **TP5: Q** - The **CPU** signals for both **68B09E** processors. Should be at 2Mhz with **Q** leading **E** by ***500 nsec***. **TP2: P0. TP3: P1. TP4: P2. TP20:** *(near U402)***. TP8:** *(near U219)***. TP1: +3.3V.**

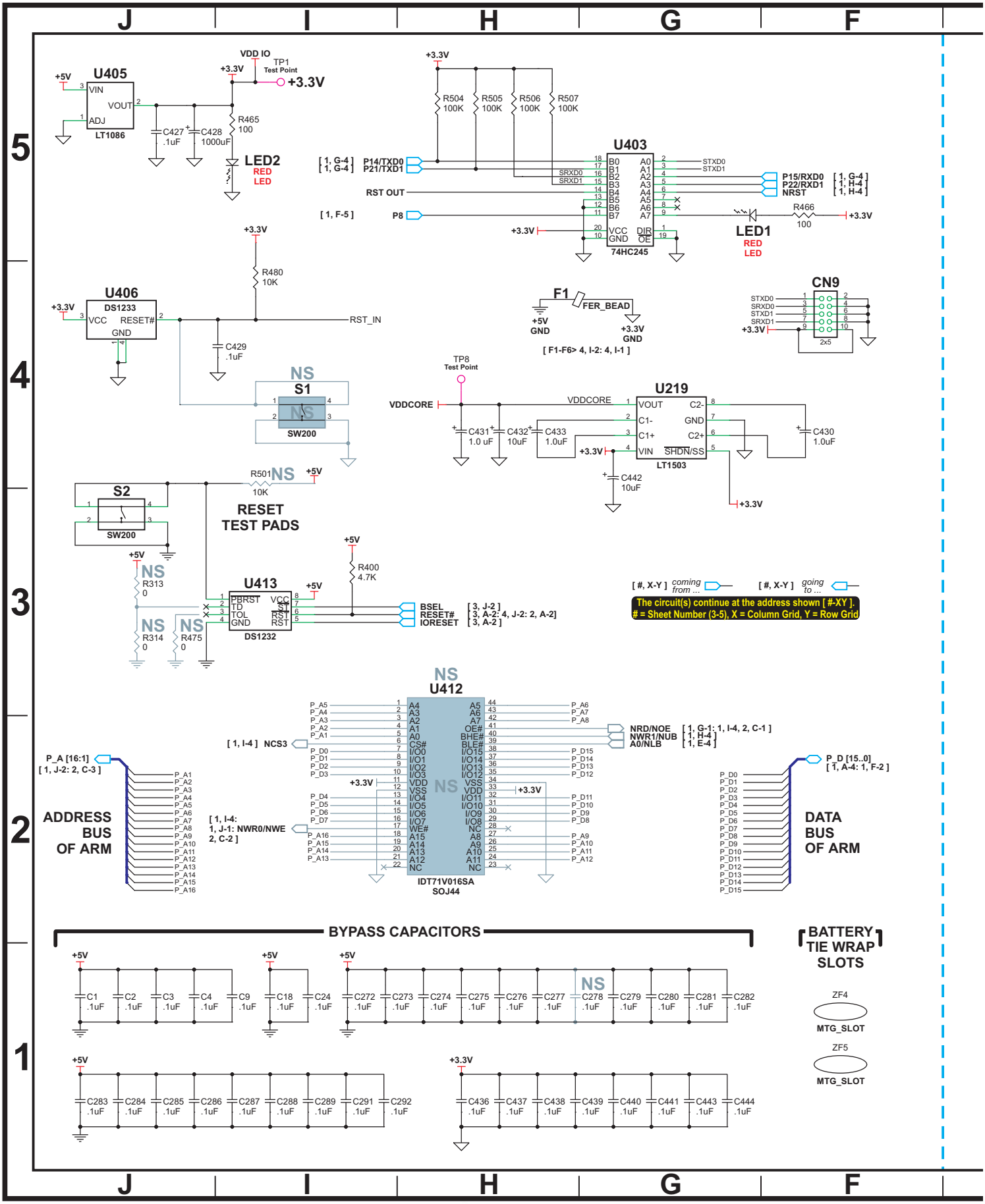

J3
JTAG
U402
ATMEL
AT91R40008
PQFP100
U8
ATMEL
AT49BV1614
Y1
40.000MHz
JP3
JP2
TO ATMEL
TO XILINX
ADDRESS BUS OF ARM TO RAM
(IDT71V016SA)
DATA BUS OF ARM
[#, X-Y] coming from ...
[#, X-Y] going to ...
The circuit(s) continue at the address shown [#-XY].
= Sheet Number (3-5), X = Column Grid, Y = Row Grid



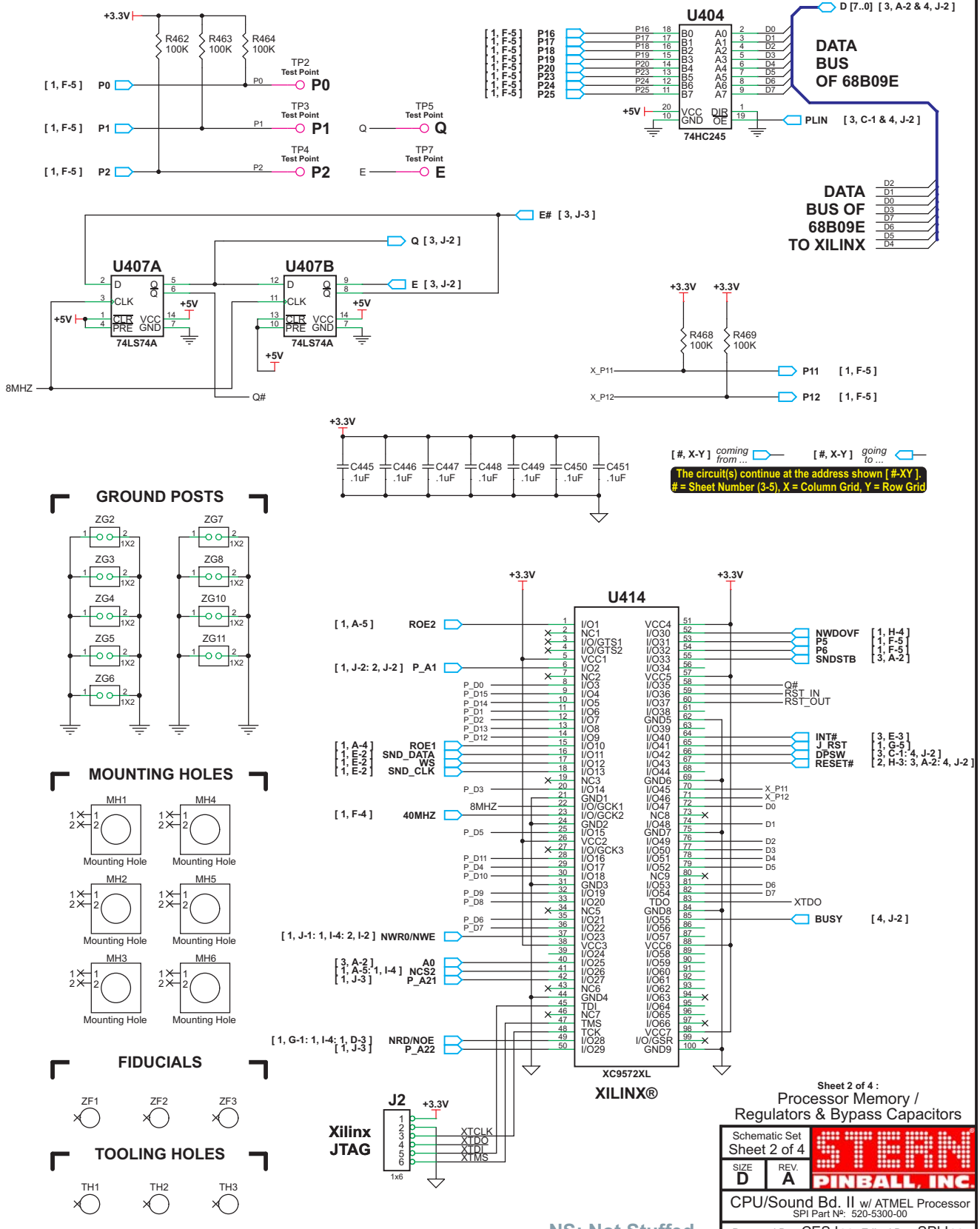
NOTES: ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED. ☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).

Sheet 1 of 4 :
Processor / Sound (Microcontroller)

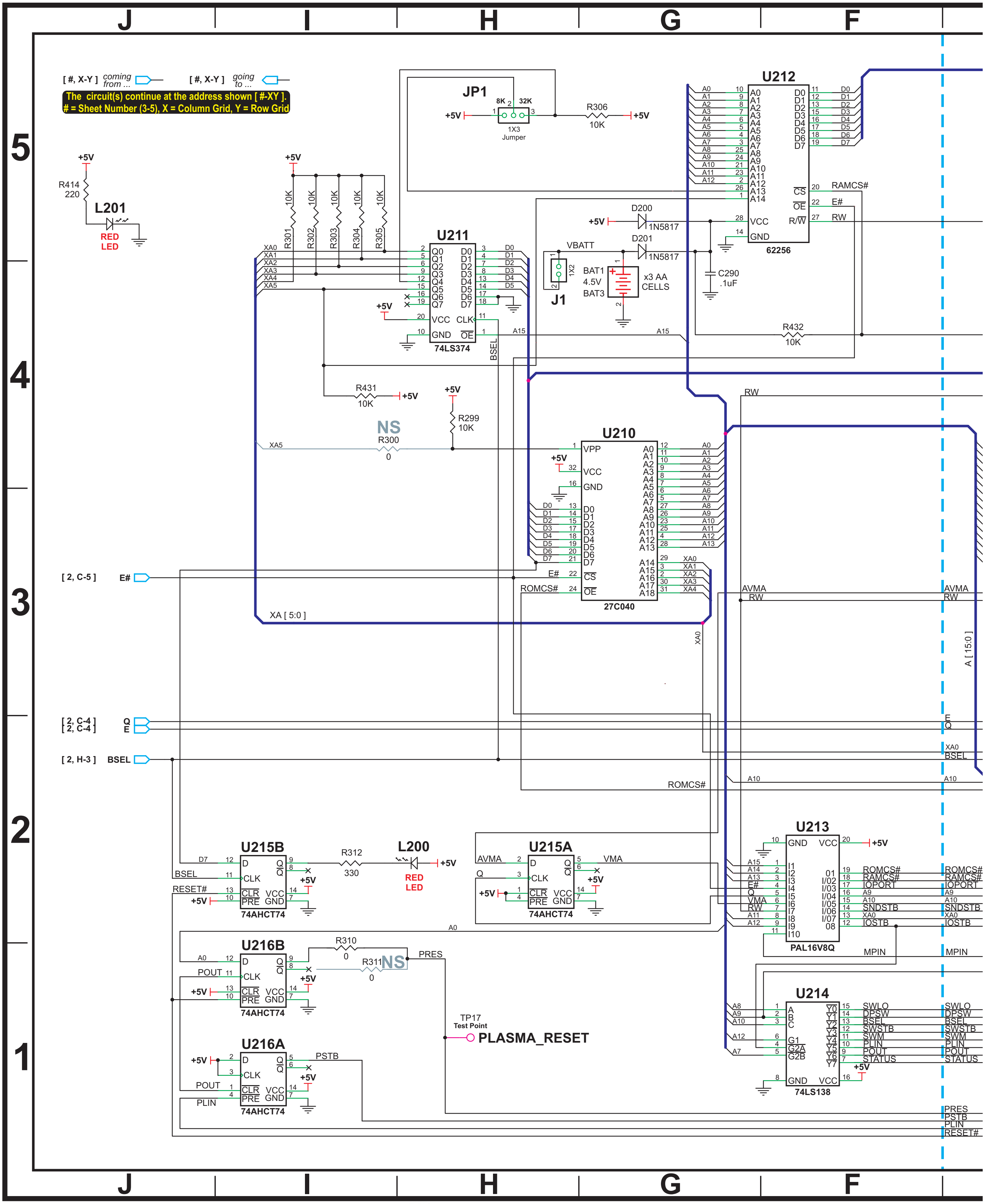
Schematic Set Sheet 1 of 4	STERN PINBALL, INC.
SIZE D / REV. A	
CPU/Sound Bd. II w/ ATMEL Processor	
SPI Part №: 520-5300-00	
Prepared By: CES Inc. Edited By: SPI Inc.	
Model: RHT SCH1008 Dated: 06/13/03	

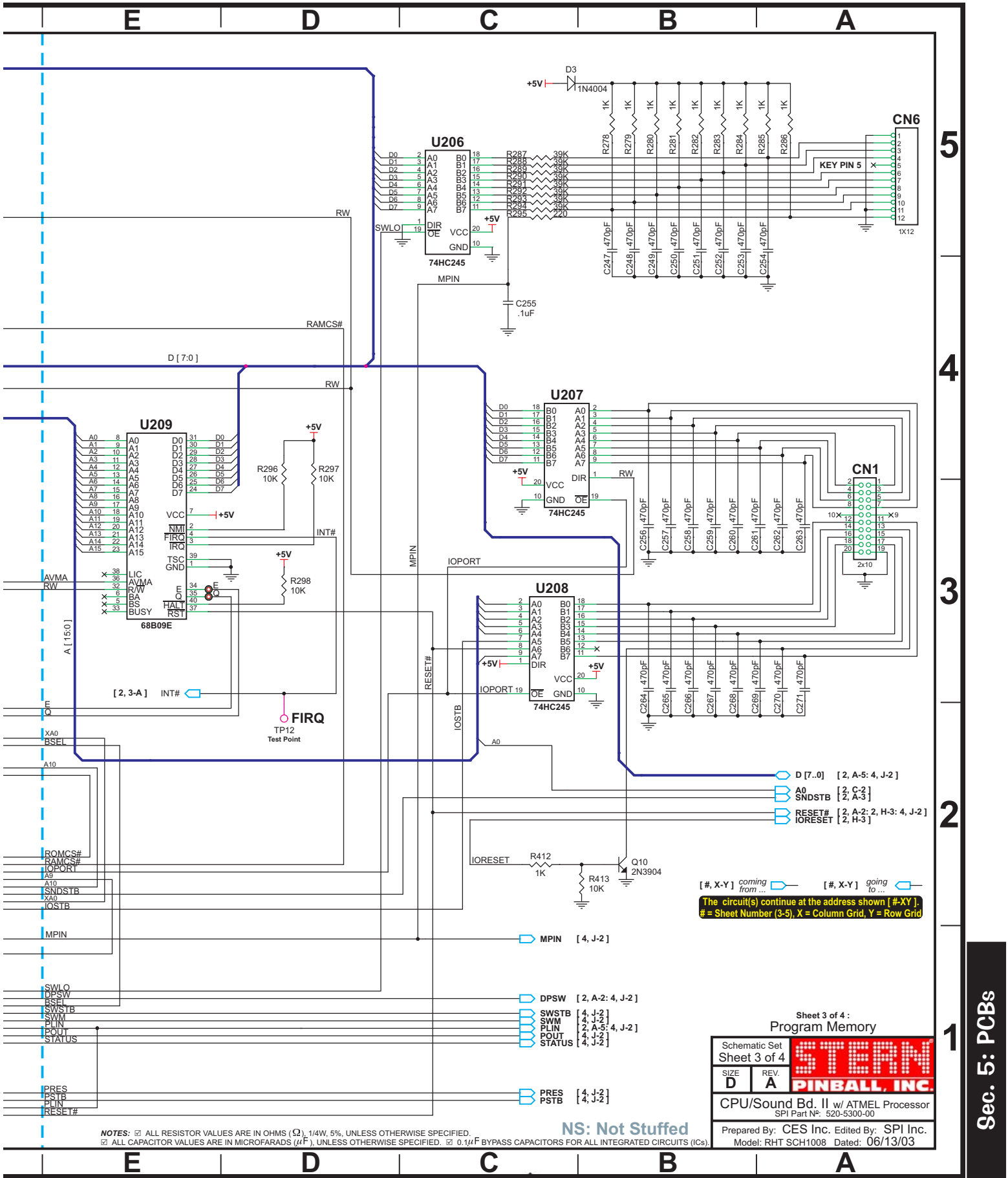

J I H G F
5
4
3
2
1
U405
LT1086
VDD IO
TP1
Test Point
+3.3V
R465
100
C427
.1uF
C428
1000uF
LED2
RED
LED
R504 100K
R505 100K
R506 100K
R507 100K
U403
74HC245
P14/TXD0
P21/TXD1
P15/RXD0
P22/RXD1
NRST
RST OUT
P8
R466
100
LED1
RED
LED
U406
DS1233
R480
10K
RST_IN
C429
.1uF
F1
FER_BEAD
CN9
2x5
S1
SW200
TP8
Test Point
VDDCORE
U219
LT1503
C431 1.0 uF
C432 10uF
C433 1.0uF
C430 1.0uF
C442 10uF
S2
SW200
R501
10K
RESET
TEST PADS
R313
0
R314
0
R475
0
U413
DS1232
R400
4.7K
BSEL
RESET#
IORESET
coming from ...
going to ...
The circuit(s) continue at the address shown [#-XY].
= Sheet Number (3-5), X = Column Grid, Y = Row Grid
U412
IDT71V016SA
SOJ44
NCS3
NWR0/NWE
NRD/NOE
NWR1/NUB
A0/NLB
P_A [16:1]
ADDRESS BUS OF ARM
P_D [15..0]
DATA BUS OF ARM
BYPASS CAPACITORS
BATTERY TIE WRAP SLOTS
ZF4
MTG_SLOT
ZF5
MTG_SLOT

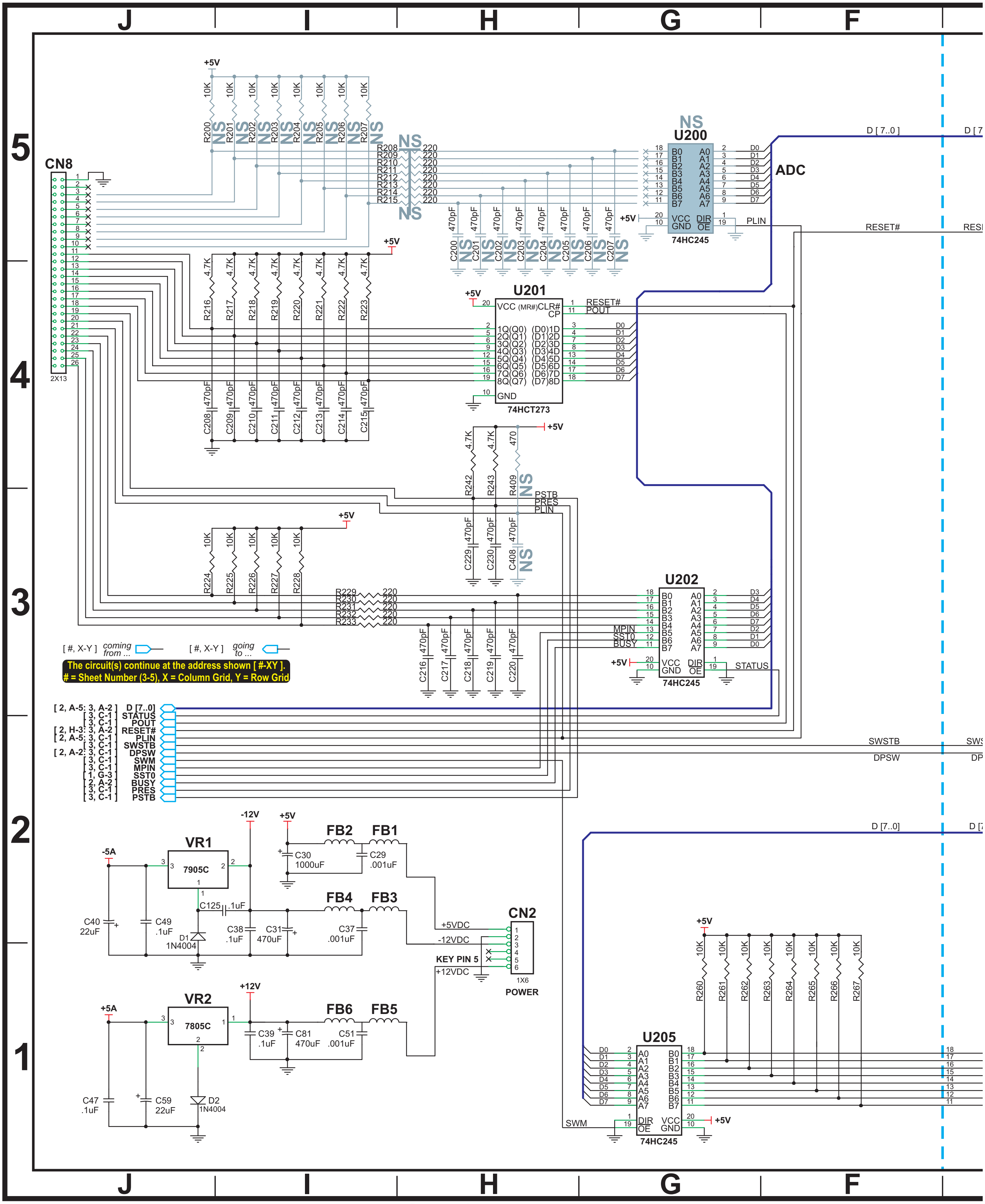
Sec. 5: PCBs

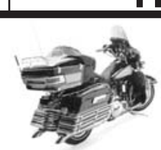


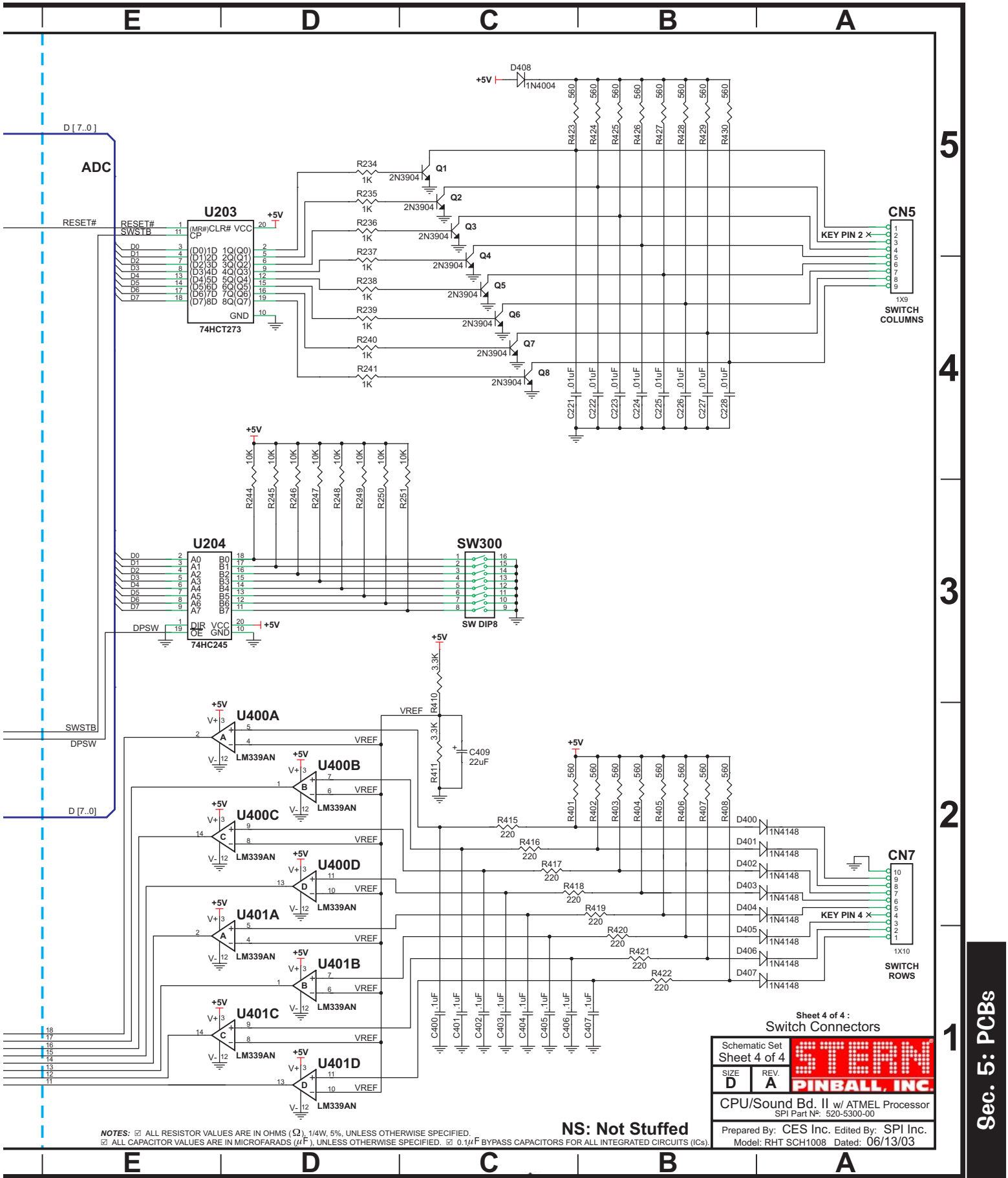
NOTES: ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED. ☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).


J
I
H
G
F
5
4
3
2
1
[#, X-Y] coming from ...
[#, X-Y] going to ...
The circuit(s) continue at the address shown [#-XY].
= Sheet Number (3-5), X = Column Grid, Y = Row Grid
JP1
8K
32K
1X3 Jumper
R306 10K
+5V
U212
62256
RAMCS#
E#
RW
R414 220
L201
RED LED
U211
74LS374
R301 R302 R303 R304 R305 10K
D200 1N5817
D201 1N5817
VBATT
BAT1 4.5V BAT3
x3 AA CELLS
J1
1X2
C290 .1uF
R432 10K
A15
BSEL
R431 10K
R299 10K
NS
R300 0
XA5
U210
27C040
ROMCS#
XA [5:0]
[2, C-5] E#
[2, C-4] Q
[2, C-4] E
[2, H-3] BSEL
AVMA
RW
A [15:0]
XA0
A10
U215B
74AHCT74
R312 330
L200
RED LED
U215A
74AHCT74
AVMA
VMA
U213
PAL16V8Q
ROMCS#
RAMCS#
IOPORT
SNDSTB
IOSTB
MPIN
U216B
74AHCT74
R310 0
R311 NS 0
PRES
POUT
TP17 Test Point
PLASMA_RESET
U216A
74AHCT74
PSTB
PLIN
RESET#
U214
74LS138
SWLO
DPSW
BSEL
SWSTB
SWM
PLIN
POUT
STATUS

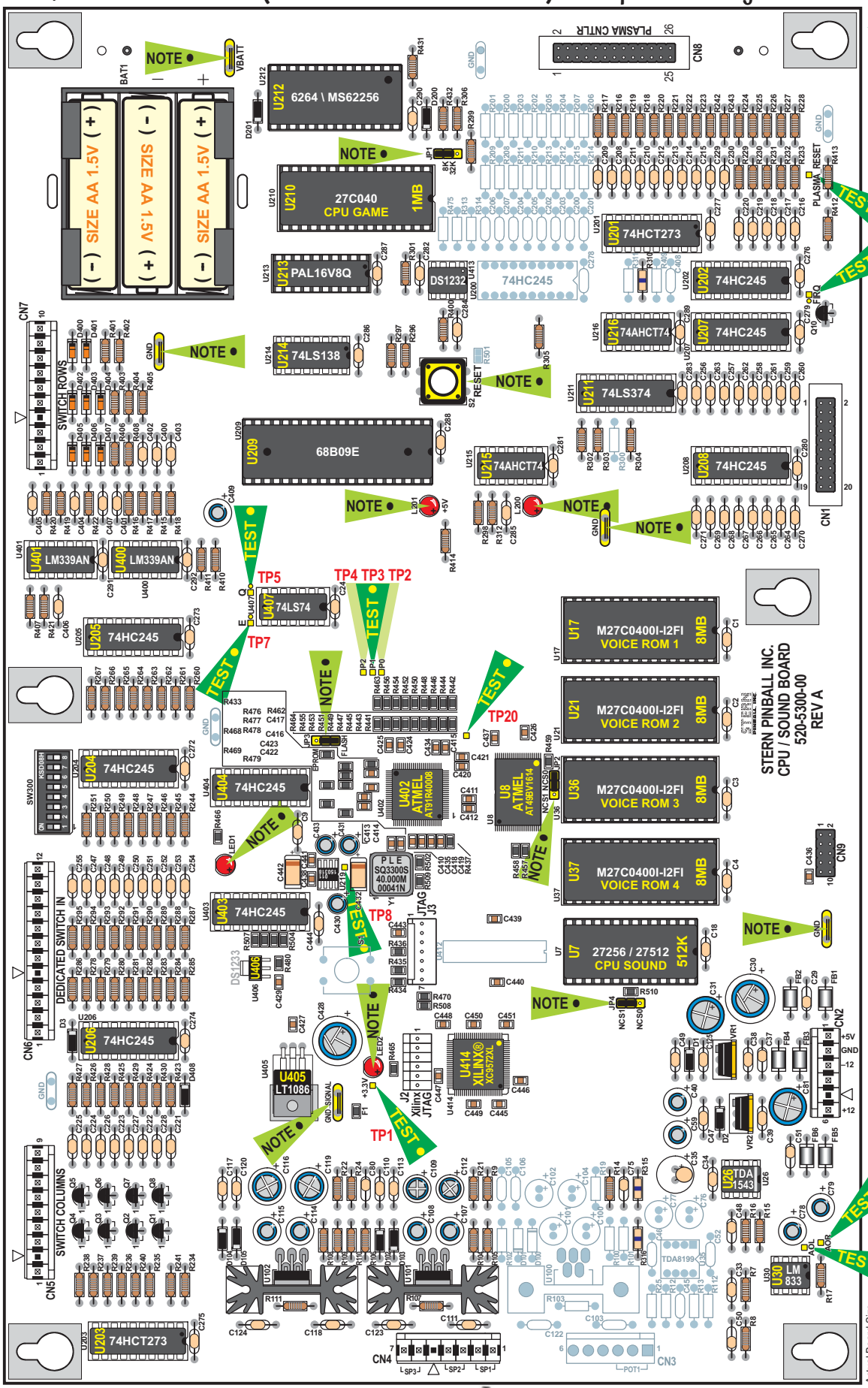

U206
74HC245
U207
74HC245
U208
74HC245
U209
68B09E
CN6
KEY PIN 5
1X12
CN1
2x10
D3
1N4004
+5V
RW
RAMCS#
D [7:0]
AVMA
A [15:0]
INT#
FIRQ
TP12
Test Point
MPIN
IOPORT
RESET#
IOSTB
IORESET
Q10
2N3904
R412
1K
R413
10K
R296
10K
R297
10K
R298
10K
C255
.1uF
ROMCS#
SNDSTB
DPSW
BSEL
SWSTB
SWM
PLIN
POUT
STATUS
PRES
PSTB
[2, 3-A]
D [7..0] [2, A-5: 4, J-2]
A0 [2, C-2]
SNDSTB [2, A-3]
RESET# [2, A-2: 2, H-3: 4, J-2]
IORESET [2, H-3]
MPIN [4, J-2]
DPSW [2, A-2: 4, J-2]
SWSTB [4, J-2]
SWM [4, J-2]
PLIN [2, A-5: 4, J-2]
POUT [4, J-2]
STATUS [4, J-2]
PRES [4, J-2]
PSTB [4, J-2]
[#, X-Y] coming from ...
[#, X-Y] going to ...
The circuit(s) continue at the address shown [#-XY].
= Sheet Number (3-5), X = Column Grid, Y = Row Grid
NS: Not Stuffed
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).
Sheet 3 of 4 :
Program Memory
Schematic Set
Sheet 3 of 4
SIZE D
REV. A
STERN PINBALL, INC.
CPU/Sound Bd. II w/ ATMEL Processor
SPI Part №: 520-5300-00
Prepared By: CES Inc. Edited By: SPI Inc.
Model: RHT SCH1008 Dated: 06/13/03


J
I
H
G
F
5
4
3
2
1
CN8
2X13
U200
74HC245
ADC
U201
74HCT273
U202
74HC245
U205
74HC245
NS
D [7..0]
RESET#
POUT
PSTB
PRES
PLIN
STATUS
SWSTB
DPSW
SWM
MPIN
SST0
BUSY
[#, X-Y] coming from ...
[#, X-Y] going to ...
The circuit(s) continue at the address shown [#-XY].
= Sheet Number (3-5), X = Column Grid, Y = Row Grid
VR1
7905C
VR2
7805C
FB1
FB2
FB3
FB4
FB5
FB6
CN2
1X6
POWER
KEY PIN 5
+5VDC
-12VDC
+12VDC
D1 1N4004
D2 1N4004
+5V
-12V
+12V
-5A
+5A




E
D
C
B
A
5
4
3
2
1
D [7..0]
ADC
RESET#
SWSTB
DPSW
U203
74HCT273
U204
74HC245
SW300
SW DIP8
CN5
KEY PIN 2
SWITCH COLUMNS
CN7
KEY PIN 4
SWITCH ROWS
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
2N3904
D408
1N4004
1N4148
U400A
U400B
U400C
U400D
U401A
U401B
U401C
U401D
LM339AN
VREF
C409
22uF
Sheet 4 of 4 :
Switch Connectors
Schematic Set
Sheet 4 of 4
SIZE
D
REV.
A
STERN PINBALL, INC.
CPU/Sound Bd. II w/ ATMEL Processor
SPI Part №: 520-5300-00
Prepared By: CES Inc. Edited By: SPI Inc.
Model: RHT SCH1008 Dated: 06/13/03
NS: Not Stuffed
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).

CPU/Sound Board II (with ATMEL Processor) Component Layout



CPU/Sound II Board (with Atmel Processor) Parts

	ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
	—	1	520-5300-00	CPU/Sound II Board (with Atmel Processor)	Complete PCB Assembly
Connectors	01	4		JP1, JP2, JP3, JP4	3-Pin Jumper & 2-Pin Cover
	02	1	045-5015-06	CN2 (Key Pin-5)	6-Pin, 6PKK156
	03	1		J2 JTAG Xilinx®	6-Pin, ## Header
	04	1	045-5015-07	CN4 (Key Pin-5)	7-Pin, 7PKK156
	05	1		J3 JTAG	7-Pin, ## Header
	06	1	045-5013-00	CN5 (Key Pin-2)	9-Pin, 9PKK156
	07	1		CN9	10-Pin, 0.1 Header
	08	1	045-5014-01	CN7 (Key Pin-4)	10-Pin, 10PKK156
	09	1	045-5015-00	CN6 (Key Pin-5)	12-Pin, 12PKK156
	10	1	045-5015-01	CN1	20-Pin, 0.1 Header
	11	1	045-5015-26	CN8	26-Pin, 0.1 Header
	12	3	125-5043-00	C29, C37, C51	0.001uF (102), Cap.
	13	4	125-5039-00	C48, C50, C75, C80	0.0022uF *or* 2200pF, (222), Cap.
	14	8	125-5029-00	C221>C228	0.01uF (103), 100v Cap.
	15	52	125-5031-00	C1>C4, C9, C18, C24, C33, C34, C38, C39, C47, C49, C110, C111, C113, C117, C118, C120, C123, C124, C125, C255, C272>C277, C279>C292, C400>C407, C444 (C45, C46, C52, C103, C105, C106, C122, C278: NS)	0.1uF (104), Axial Cer. Cap.
	16	3		C430, C431, C433 *(near U403, U404)*	1.0uF, ##v, Radial Lytic Cap.
Capacitors*	17	1	125-5017-00	C35	10uF, 16v, Radial Tant. Cap.
	18	4	125-5017-00	C78, C79, C107, C114 (C76, C77, C100: NS)	10uF, 25v-35v, Radial Lytic Cap.
	19	2	125-5015-00	C109, C112 (C102, C104: NS)	100uF, 25v, Radial Lytic Cap.
	20	1	125-5014-00	C409	22uF, 16v, Radial Lytic Cap.
	21	4	125-5020-00	C40, C59, C108, C115 (C101: NS)	22uF, 25v, Radial Lytic Cap.
	22	2	125-5012-00	C116, C119	220uF, 25v, Radial Lytic Cap.
	23	2	125-5019-00	C31, C81	470uF, 25v, Radial Lytic Cap.
	24	39	125-5028-00	C208>C215, C216>C220, C229, C230, C247>C254, C256>C263, C264>C271 (C200>C207, C408: NS)	470pF (471), Cer. Cap.
	25	2	125-5037-00	C30, C428	1000uF, 16v, Radial Lytic Cap.
	26	17		C427, C429, C436>C441, C443, C445>C451	SMT .1uF Cap.
	27	2		C432, C442 *(near U403 & U404)*	SMT 10uF Cap.
	28	9		C411, C414, C416, C419, C420, C422, C424, C434, C435	SMT 47pF Cap.
	29	10		C410, C412, C413, C415, C417, C418, C421, C423, C425, C426	SMT 100nF Cap.
Diodes & LEDs*	30	7	112-5003-00	D1>D3, D102>D105, D408 (D100, D101: NS)	1N4004, Diode
	31	2	112-5008-00	D200, D201	1N5817, Diode
	32	8	112-0054-00	D400-D407	1N4148, Diode
	33	4	165-5099-00	**LED1, LED2, L200, L201**	**LED T1-3/4 DIFFUSER LED**
	34	3	124-5064-00	R310, R315, R316 (R300, R311, R313, R314, R475: NS)	0Ω Jumper Res. (1-Stripe)
	35	2	121-5041-00	R107, R111 (R103: NS)	1 Ω 1/4W Res.
	35	20	121-5009-00	R8, R15, R234>R241, R278>R286, R412	1K Ω 1/4W Res.
	36	1	121-5018-00	R7	1.5K Ω 1/4W Res.
	37	2	121-5043-00	R16, R17 (R25, R112: NS)	2.2K Ω 1/4W Res.
	38	2	121-5048-00	R410, R411	3.3K Ω 1/4W Res.
	39	12	121-5021-00	R21, R216>R223, R242, R243, R400	4.7K Ω 1/4W Res.
Resistors / Transistors*	40	36	121-5011-00	R106, R224>R228, R244>R251,R260>R267, R296>R299, R301>R306, R413, R431, R432 (R200>R207, R501: NS)	10K Ω 1/4W Res.
	41	3	121-5023-00	R9, R14, R104 (R100, R102: NS)	22K Ω 1/4W Res.
	42	1	121-5022-04	R110	33K Ω 1/4W Res.
	43	9	121-5045-00	R108, R287>R294	39K Ω Res.
	44	2	121-5032-00	R22, R24	47K Ω 1/4W Res.
	45	15	121-5014-00	R229>R233, R295, R414>R422 (R208>R215: NS)	220 Ω 1/4W Res.
	46	1	121-5036-00	R312	330 Ω 1/4W Res.
	47	2	121-5046-01	R105, R109 (R101, R409: NS)	470 Ω 1/4W Res.
	48	16	121-5047-00	R401>R408, R423>R430	560 Ω 1/4W Res.
	49	1		F1	SMT xx Res.
	50	4		R434, R435, R436, R508	SMT 1K Ω Res.
	51	1		R480	SMT 10K Ω Res.
	52	2		R502, R509	SMT 33 Ω Res.
	53	3		R465, R466, R470	SMT 100 Ω Res.
	54	35		R433, R437, R441>R459, R462>R464, R468, R469, R476>R479, R504>R507, R510	SMT 100K Ω Res.
	55	9	110-0069-00	Q1-Q8, Q10	2N3904, Transistor
ICs / RAMs / ROMs / EPROMs	56	1		U402	**ATMEL**, AT91R40008
	57	1		U8	**ATMEL**, AT49BV1614
	58	1		U414	**XILINX®**, XC9572XL
	59	1	(See Pg. DR. ❶ Table)	U7	**512K EPROM** Sound (27512)
	60	1	(See Pg. DR. ❶ Table)	U210 *(32-Pin, IC Socket, 077-5217-00)*	**1MB EPROM** CPU Game (27C040)
	61	4	(See Pg. DR. ❶ Table)	U17, U21, U36, U37 *(32-Pin, IC Socket, 077-5217-00)*	**8MB EPROM** Voice 1-4 (M27C0400l-12Fl)
	62	1	965-6504-00	U213 (**BLUE DOT**)	**PAL16V8Q (Programmed) BLUE DOT**
	63	1	105-5046-00	U212 *(28-Pin, IC Dip Socket, 077-5208-00)*	6264/MS62256 (MS6264A) (28-Pin)
	64	1	100-0189-01	U209 *(40-Pin, IC Socket, 077-5209-00)*	68B09E (40-Pin)
	65	2	100-5015-00	U215, U216	74AHCT74 (14-Pin)
	66	8	100-0338-00	U202, U204, U205, U206, U207, U208, U403, U404 (U200: NS)	74HC245 (20-Pin)
	67	2	100-5012-00	U201, U203	74HCT273 (20-Pin)
	68	1	100-0037-00	U407	74LS74 (14-Pin)
	69	1	100-0148-00	U214	74LS138 (16-Pin)
	70	1	100-0064-00	U211	74LS374 (20-Pin)
	71	1		U406	3.3v Watchdog, DS1233 (3-Pin)
	72	1	100-5023-00	U413	5.0v Watchdog, DS1232 (8-Pin)
	73	1		U219	1.8v Volt. Regulator LT1503 (8-Pin)
	74	1		U405	3.3v Volt. Regulator LT1086 (3-Pin)
	75	1	124-5002-00	VR1	-5v Regulator, LM7905CT
	76	1	124-5001-00	VR2	+5v Regulator, LM7805CT
	77	2	100-0377-00	U400, U401	LM339AN (14-Pin)
	78	1	100-0375-00	U30	LM833 (8-Pin)
	79	1	100-5018-00	U26	TDA1543 (8-Pin)
	80	2	100-5016-20	U101, U102 (U100: NS)	TDA2030A (5-Pin)
Miscellaneous	81	1		Y1	40MHz Clock PLE SQ3300S
	82	1	181-5002-00	SW300	Dip Switch 8-Pos., (KSD08H Black)
	83		n/a	FB1>FB6	Ferrite Bead
	84		535-5000-10	HS2, HS3, (HS1: NS) *(over U101, U102)*	Heat Sink (AAVID 531102)
	85	1		S2 (Reset)	Push-Button Switch (B3F4000)
	86	1	545-5685-00	BAT1 HOLDER	***(Always replace all 3, Size AA 1.5v Cells, with new ones, when required)***

** Surface Mounts (SMT) are not listed.*

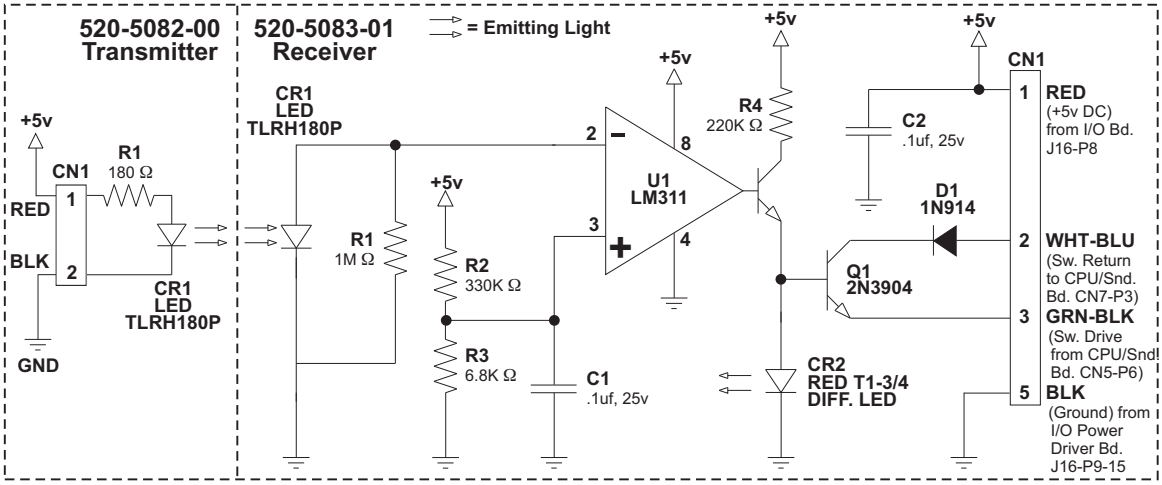
** Surface Mounts (SMT) are not listed.*

Test Point Wire (24ga.) Loops:
VBATT, GND *(near CN7)*, GND *(near CN9)*, GND *(near L200)*, GND_SIGNAL *(near U405)*

Test Point Pads:
TP1>TP5, TP7, TP8, TP11, TP12, TP16, TP17, TP20

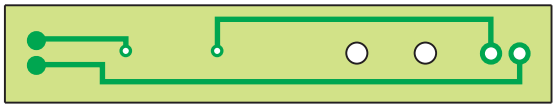
If a part is required where a part number is not provided, call Tech. Support (see back of cover).

Playfield Switch OPTO "Long-Hop" Boards Theory of Operation & Schematic



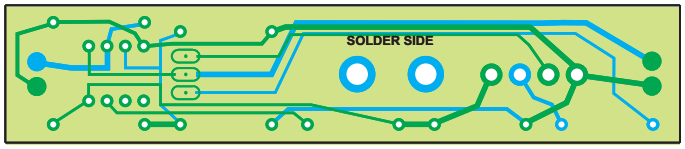
The light falling on **LED** (**CR1**) generates a voltage which is applied to the input (Pin-2) of the **LM311 Comparator** (**U1**). **R1** bleeds off excess charge. At about a volt input from **LED** (**CR1**) the **Comparator** (**U1**) *trips & drives* either **Q1** *(during switch line strobes)* or the indicator **LED** (**CR2**) *(in between strobes).* 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 give a **1v** forward bias voltage to **Q1**, which is lower than the **1.7v** drop on **LED** (**CR2**) so the current flows through the Transistor during strobes. This drives **Q1** on and *makes the switch*. If the strobe line is high, then the **1.7v** path through **LED** (**CR2**) is lower than **Q1**'s bias voltage so current flows through **LED** (**CR2**) and the indicator lights. **D1** prevents reverse bleed, **R2** and **R3** form the voltage divider for the trip point, **R4** is a current limiter for both **Q1** and **CR2**, **C1** and **C2** are general noise-filter caps.

Playfield Switch OPTO "Long-Hop" Boards Component Layout & Parts



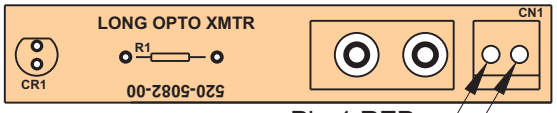
520-5082-00 (TRANS)

Solder Side (Green)



Solder Side (Green)

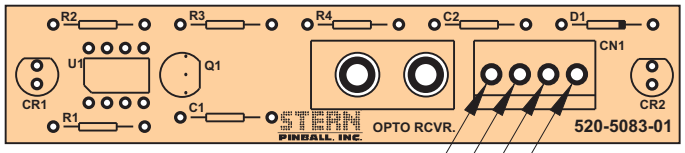
520-5083-01 (REC)



Component Side (Beige)

Pin-1 **RED** (+5v)

Pin-2 **BLK** (GROUND)



Component Side (Beige)

Pin-1 **RED** (+5v)

Pin-2 **WHT-GRN** (Sw. Return +)

Pin-3 **GRN-BLK** (Sw. Drive –)

Pin-4 **BLK** (GROUND)

Note: *In this game, this Combo OPTO Board is used as a P/F Detection Switch for the Motorcycle Enter Trough. See the Switch Matrix Grid (Pgs. 16-17 or 86). PCBs are used for Switch 37, (GRN-BLK, WHT-GRN).*

ITEM	QTY	PART NUMBER	REF-DESIGNATOR		DESCRIPTION
A	**1**	**520-5083-01**	**OPTO Receiver Board**		**Complete PCB Assembly**
1	1	165-5052-00	**CR1**		**LED TLRH180P** (**Ultra Bright Red**)
2	1	165-5099-00	**CR2**		**LED T1-3/4 RED DIFFUSER**
3	1	112-5014-00	D1		1N914, Diode
4	1	121-5013-00	R1		1M Ω 1/4W Res., 5%
5	1	121-5037-00	R2		330K Ω 1/4W Res., 5%
6	1	121-5077-00	R3		6.8K Ω 1/4W Res., 5%
7	1	121-5014-00	R4		220 Ω 1/4W Res., 5%
8	2	125-5023-00	C1, C2		.1uF, 25v, Axial Ceramic Cap.
6	1	100-5025-00	U1		LM311
7	1	110-0069-00	Q1		2N3904, Transistor
8	1	045-5200-04	CN1	(Molex 50-84-1040)	4X1, .156" Locking Straight Hdr. Conn.
B	**1**	**520-5082-00**	**OPTO Transmitter Board**		**Complete PCB Assembly**
1	1	165-5052-00	**CR1**		**LED TLRH180P** (**Ultra Bright Red**)
2	1	121-5066-00	R1		180 Ω 1/4W Res.
3	1	045-5206-02	CN1	(Molex 50-84-1020)	2X1, .156" Locking Straight Hdr. Conn.

Appendixes A through J

Table of Contents

*** Note:** *For complete Appendix Information (**Appendixes A, C, D, E & F**) for Games **Laser War** through **Batman Forever**), see any Service Game Manual between **Apollo 13** through **Ripley's Believe It or Not!** or on-line at our website www.sternpinball.com/parts.htm; also available on CD-R, 970-2003-00 (**The Simpsons™ Pinball Party**, **Terminator® 3** and **The Lord of the Rings™**).*

APPENDIX A

Pinball Game Firmware (White Star Board System Only*) Table

ROM	Chip Size	Program Part №	USA Ver. & Check Sum	Bd. Loc.	Raw Part №
*** Note:** *For complete Appendix Information for Games **Laser War** through **Batman Forever**, see any Service Game Manual between **Apollo 13** through **Ripley's Believe It or Not!** or on-line at our website www.sternpinball.com/parts.htm; also available on CD-R, 970-2003-00 (**The Simpsons™ Pinball Party**, **T3®** and **The Lord of the Rings™**).*					
Apollo 13 (Note 1)					
Game ROM	(1M)	965-0208-00	**A5.01 | $09FF**	**U210**	960-5009-00
Sound	(512K)	965-0212-00	1.00 | $5244	U7	960-7001-02
Display	(4M)	965-0213-00	**A5.00 | $B92B**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0209-00	1.00 | $7FC7	U17	n/a (masked)
Voice 2	(4M)	965-0210-00	1.00 | $8E55	U21	n/a (masked)
Voice 3	(4M)	965-0211-00	1.00 | $08EE	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	1.00 | $D615	U7	960-7001-02
Display	(4M)	965-0218-42	**A4.00 | $E6ED**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0215-42	1.00 | $3E32	U17	n/a (masked)
Voice 2	(4M)	965-0216-42	1.00 | $71F0	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	1.00 | $1FFF	U7	960-7001-02
Display	(4M)	965-0222-41	**A4.00 | $FD01**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0220-41	1.00 | $3650	U17	960-5015-01
Voice 2	(4M)	965-0223-41	1.00 | $9300	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	1.00 | $222B	U7	960-7001-02
Display	(4M)	965-0228-45	**A2.00 | $ABF7**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0225-45	1.00 | $3AE1	U17	960-5015-01
Voice 2	(4M)	965-0226-45	1.00 | $206E	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	1.00 | $F1E7	U7	960-7001-02
Display	(4M)	965-0234-43	**A3.00 | $0057**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0230-43	1.00 | $DBA8	U17	960-5015-01
Voice 2	(4M)	965-0231-43	1.00 | $DDF1	U21	960-5015-01
Voice 3	(4M)	965-0232-43	1.00 | $F32A	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	1.00 | $4A7D	U7	960-7001-02
Display	(4M)	965-0239-56	**A4.00 | $8817**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0236-56	1.00 | $E66B	U17	960-5015-01
Voice 2	(4M)	965-0237-56	1.00 | $8F54	U21	960-5015-01
The Lost World: Jurassic Park (Note 2)					
Game ROM	(1M)	965-0240-53	**A2.02 | $C8FF**	**U210**	960-5009-00
Sound	(512K)	965-0243-53	1.00 | $A35B	U7	960-7001-02
Display	(4M)	965-0244-53	**A2.01 | $7F46**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0241-53	1.00 | $1D27	U17	960-5015-01
Voice 2	(4M)	965-0242-53	1.00 | $8DA4	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	1.00 | $6648	U7	960-7001-02
Display	(4M)	965-0249-46	**A3.00 | $66D0**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0246-46	1.00 | $349D	U17	960-5015-01
Voice 2	(4M)	965-0247-46	1.00 | $629C	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	1.00 | $64B2	U7	960-7001-02
Display	(4M)	965-0254-59	**A2.00 | $E77B**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0251-59	1.00 | $152A	U17	960-5015-01
Voice 2	(4M)	965-0252-59	1.00 | $0291	U21	960-5015-01
Voice 3	(4M)	965-0255-59	1.00 | $95A7	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	1.00 | $4DF8	U7	960-7001-02
Display	(4M)	965-0272-35	**A2.01 | $C17D**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0267-35	1.00 | $8018	U17	960-5015-01
Voice 2	(4M)	965-0268-35	1.00 | $2157	U21	960-5015-01
Voice 3	(4M)	965-0269-35	1.00 | $B5A6	U36	960-5015-01
Voice 4	(4M)	965-0270-35	1.00 | $D01E	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	1.00 | $A6AF	U7	960-7001-02
Display	(4M)	965-0288-60	**A1.02 | $32AB**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0283-60	1.00 | $4391	U17	960-5015-01
Voice 2	(4M)	965-0284-60	1.00 | $8215	U21	960-5015-01
Voice 3	(4M)	965-0285-60	1.00 | $5832	U36	960-5015-01
Voice 4	(4M)	965-0286-60	1.00 | $8971	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	1.00 | $0CC8	U7	960-7001-02
Display	(4M)	965-0295-40	**A2.00 | $C929**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0290-40	1.00 | $0D75	U17	960-5015-01
Voice 2	(4M)	965-0291-40	1.00 | $CCCF	U21	960-5015-01
Voice 3	(4M)	965-0292-40	1.00 | $227F	U36	960-5015-01
Voice 4	(4M)	965-0293-40	1.00 | $DB69	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	1.00 | $1286	U7	960-7001-02
Display	(4M)	965-0307-71	**A1.01 | $166F**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0302-71	1.00 | $7BF8	U17	960-5016-00
Voice 2	(8M)	965-0303-71	1.00 | $9CCC	U21	960-5016-00
Voice 3	(8M)	965-0304-71	1.00 | $ADD9	U36	960-5016-00
Voice 4	(8M)	965-0305-71	1.00 | $6659	U37	960-5016-00
Harley-Davidson® (Notes 4, 5, 6) *Original (1999-2001)*					
Game ROM	(1M)	965-0319-67	**A1.03 | $3EFF**	**U210**	960-5009-00
Sound	(512K)	965-0320-67	1.00 | $F4FF	U7	960-7001-02
Display	(4M)	965-0321-67	**A1.04 | $FC7C**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0322-67	1.00 | $CD26	U17	960-5016-00
Voice 2	(8M)	965-0323-67	1.00 | $9396	U21	960-5016-00
Voice 3	(8M)	965-0324-67	1.00 | $FB72	U36	960-5016-00
Voice 4	(4M)	965-0325-67	1.00 | $6100	U37	960-5015-01
▶ **Harley-Davidson® (Notes 4, 5, 6, 8) *2nd Edition (2002-2003)***					
Game ROM	(1M)	965-0319-67**A**	**A1.08 | $23FF**	**U210**	960-5009-00
Display	(4M)	965-0321-67**A**	**A1.05 | $B594**	**ROM 0**	960-5015-01
▶ **Harley-Davidson® (Notes 4, 5, 6, 8) *3rd Edition (2004)***					
Game ROM	(1M)	965-0319-87	**A3.00 | $22FF**	**U210**	960-5009-00
Display	(4M)	965-0321-87	**A3.00 | $B596**	**U5**	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	1.00 | $3BCA	U7	960-7001-02
Display	(4M)	965-0328-68	**A1.03 | $1957**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0329-68	1.00 | $482A	U17	960-5016-00
Voice 2	(8M)	965-0330-68	1.00 | $7312	U21	960-5016-00
Voice 3	(8M)	965-0331-68	1.00 | $DE2F	U36	960-5016-00
Voice 4	(8M)	965-0332-68	1.00 | $C508	U37	960-5016-00
NFL (Notes 4, 5) *Not on CD-R or Website: Code through Distributor Only.*					
Game ROM	(1M)	965-0339-73	**A1.00 | $D2FF**	**U210**	960-5009-00
Sound	(512K)	965-0340-73	1.00 | $	U7	960-7001-02
Display	(4M)	965-0341-73	**A1.01 | $845A**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0342-73	1.00 | $	U17	960-5016-00
Voice 2	(8M)	965-0343-73	1.00 | $	U21	960-5016-00
Voice 3	(8M)	965-0344-73	1.00 | $	U36	960-5016-00
Voice 4	(8M)	965-0345-73	1.00 | $	U37	960-5016-00
Sharkey's Shootout (Notes 4, 5)					
Game ROM	(1M)	965-0333-72	**A2.11 | $49FF**	**U210**	960-5009-00
Sound	(512K)	965-0334-72	1.01 | $9796	U7	960-7001-02
Display	(4M)	965-0335-72	**A2.01 | $6C33**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0336-72	1.00 | $58EA	U17	960-5016-00
Voice 2	(8M)	965-0337-72	1.00 | $272B	U21	960-5016-00
Voice 3	(8M)	965-0338-72	1.00 | $41AE	U36	960-5016-00
High Roller Casino (Notes 4, 5)					
Game ROM	(1M)	965-0346-65	**A3.00 | $90FF**	**U210**	960-5009-00
Sound	(512K)	965-0347-65	1.00 | $581C	U7	960-7001-02
Display	(4M)	965-0348-65	**A3.00 | $74B3**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0349-65	1.00 | $E12D	U17	960-5016-00
Voice 2	(8M)	965-0350-65	1.00 | $38F4	U21	960-5016-00
Voice 3	(8M)	965-0351-65	1.00 | $1B54	U36	960-5016-00
Voice 4	(8M)	965-0352-65	1.00 | $D720	U37	960-5016-00
Austin Powers™ (Notes 4, 5)					
Game ROM	(1M)	965-0353-74	**A3.02 | $5DFF**	**U210**	960-5009-00
Sound	(512K)	965-0354-74	1.00 | $DA7B	U7	960-7001-02
Display	(4M)	965-0035-74	**A3.00 | $6A34**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0356-74	1.00 | $D2B9	U17	960-5016-00
Voice 2	(8M)	965-0357-74	1.00 | $9E75	U21	960-5016-00
Voice 3	(8M)	965-0358-74	1.00 | $51F3	U36	960-5016-00
Voice 4	(8M)	965-0359-74	1.00 | $0AE5	U37	960-5016-00
Monopoly® (Notes 4, 5)					
Game ROM	(1M)	965-0360-75	**A3.03 | $5EFF**	**U210**	960-5009-00
Sound	(512K)	965-0361-75	1.00 | $8C18	U7	960-7001-02
Display	(4M)	965-0362-75	**A3.01 | $A381**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0363-75	1.00 | $35E6	U17	960-5016-00
Voice 2	(8M)	965-0364-75	1.00 | $B35A	U21	960-5016-00
Voice 3	(8M)	965-0365-75	1.00 | $8A9F	U36	960-5016-00
Playboy (Notes 4, 5, 7)					
Game ROM	(1M)	965-0367-76	**A5.00 | $7DFF**	**U210**	960-5009-00
Sound	(512K)	965-0368-76	1.02 | $E7C2	U7	960-7001-02
Display	(4M)	965-0369-76	**A5.00 | $A5FF**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0370-76	1.00 | $9ABE	U17	960-5016-00
Voice 2	(8M)	965-0371-76	1.00 | $9F34	U21	960-5016-00
Voice 3	(8M)	965-0372-76	1.00 | $374B	U36	960-5016-00
Voice 4	(8M)	965-0373-76	1.00 | $237A	U37	960-5016-00
RollerCoaster Tycoon™ (Notes 4, 5, 7)					
Sound	(512K)	965-0374-78	1.00 | $F663	U7	960-7001-02
Game ROM	(1M)	965-0375-78	**A7.01| $40FF**	**U210**	960-5009-00
Voice 1	(8M)	965-0377-78	1.00 | $3C4A	U17	960-5016-00
Voice 2	(8M)	965-0378-78	1.00 | $057A	U21	960-5016-00
Voice 3	(8M)	965-0379-78	1.00 | $04D7	U36	960-5016-00
Display	(4M)	965-0376-78	**A7.00 | $8E23**	**U5** Disp. Cntrlr.	960-5015-01
The Simpsons™ Pinball Party (Notes 4, 5, 7)					
Sound	(512K)	965-0381-77	1.01 | $A7EE	U7	960-7001-02
Game ROM	(1M)	965-0382-77	**A4.00 | $4FFF**	**U210**	960-5009-00
Voice 1	(8M)	965-0383-77	1.00 | $9719	U17	960-5016-00
Voice 2	(8M)	965-0384-77	1.00 | $16ED	U21	960-5016-00
Voice 3	(8M)	965-0385-77	1.00 | $ADCE	U36	960-5016-00
Voice 4	(8M)	965-0386-77	1.00 | $E7E5	U37	960-5016-00
Display	(4M)	965-0387-77	**A4.00 | $8A03**	**U5** Disp. Cntrlr.	960-5015-01
Terminator® 3: Rise of the Machines™ (Notes 4, 5, 7)					
Sound	(512K)	965-0388-79	1.00 | $D2FD	U7	960-7001-02
Game ROM	(1M)	965-0389-79	**A4.00 | $F8FF**	**U210**	960-5009-00
Voice 1	(8M)	965-0390-79	1.00 | $1838	U17	960-5016-00
Voice 2	(8M)	965-0391-79	1.00 | $F0D5	U21	960-5016-00
Voice 3	(8M)	965-0392-79	1.00 | $89DA	U36	960-5016-00
Voice 4	(8M)	965-0393-79	1.00 | $1200	U37	960-5016-00
Display	(4M)	965-0394-79	**A4.00 | $6E49**	**U5** Disp. Cntrlr.	960-5015-01
The Lord of the Rings™ (Notes 5, 7, 8)					
Sound	(512K)	965-0401-80	1.01 | $36BC	U7	960-7001-02
Game ROM	(1M)	965-0402-80	**A8.00 | $94FF**	**U210**	960-5009-00
Voice 1	(8M)	965-0403-80	1.00 | $1792	U17	960-5016-00
Voice 2	(8M)	965-0404-80	1.00 | $67F1	U21	960-5016-00
Voice 3	(8M)	965-0405-80	1.00 | $89B6	U36	960-5016-00
Voice 4	(8M)	965-0406-80	1.00 | $EA49	U37	960-5016-00
Display	(4M)	965-0407-80	**A8.00 | $3C88**	**U5** Disp. Cntrlr.	960-5015-01

Sound & Voice 1-4 identical to above H-D® Original.

footnotes: *1 — 8 see the bottom of the next page (**A2**).*

APPENDIX A

Pinball Game Firmware (White Star Board System Only*) Table

ROM	Chip Size	Program Part Nº	USA Ver. & Check Sum	Bd. Loc.	Raw Part Nº
Ripley's Believe It or Not!® (Notes 7, 8)					
Sound	(512K)	965-0408-81	1.00 | $D93D	U7	960-7001-02
Game ROM	(1M)	965-0409-81	**A3.02** | **$45FF**	**U210**	960-5009-00
Voice 1	(8M)	965-0410-81	1.00 | $067B	U17	960-5016-00
Voice 2	(8M)	965-0411-81	1.00 | $C8B8	U21	960-5016-00
Voice 3	(8M)	965-0412-81	1.00 | $64C2	U36	960-5016-00
Voice 4	(8M)	965-0413-81	1.00 | $5341	U37	960-5016-00
Display	(4M)	965-0414-81	**A3.00** | **$DE4B**	**U5** Disp. Cntrlr.	960-5015-01
Elvis® (Notes 7, 8)					
Sound	(512K)	965-0415-84	1.00 | $8CD2	U7	960-7001-02
Game ROM	(1M)	965-0416-84	**A3.02** | **$93FF**	**U210**	960-5009-00
Voice 1	(8M)	965-0417-84	1.00 | $538D	U17	960-5016-00
Voice 2	(8M)	965-0418-84	1.00 | $8BCD	U21	960-5016-00
Voice 3	(8M)	965-0419-84	1.00 | $60F8	U36	960-5016-00
Voice 4	(8M)	965-0420-84	1.00 | $14D8	U37	960-5016-00
Display	(4M)	965-0421-84	**A3.02** | **$B719**	**U5** Disp. Cntrlr.	960-5015-01

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).
6 **Harley-Davidson® 2nd Edition:** For Game ROM, Sound & Display info (version, check sums, part numbers) call Tech Support or check our website (see back cover) for current versions or other info. Raw Part numbers are identical to the H-D® original.
7 **ToPS™ (Tournament Pinball System) READY!**
8 ROMs on **CPU/Sound Board II (with ATMEL Processor)**: **520-5300-00** & Display Cont. Bd.: 520-5055-03‡ (‡FCC 02-98)

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 Dept., 1-800-542-5377 or 1-708-345-7700 *(Select Opt. 1).*

Visit our website **www.SternPinball.com** where the latest code can be downloaded *(an EPROM Burner is required).*

Code also available on CD-R Disc 2

Please Note:

Sound & Display Files in languages other than USA (English) can be distinguised as follows:

File name ends with letter code:

```
*******A: USA
*******F: France
*******G: Germay
*******I: Italy
*******S: Spain
*******L: Spain
```

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

Production Start Date, Manual Part Nº, ROM Size & Positions and Jumper W6 Installed Note‡ (White Star Board System Only*)

	Game\ Name White Star Board System™	Production Start Date and Manual PNº	CPU/Sound Board **Sound U7 512K** CPU/Sound Board **Game U210 1MB** CPU/Sound Board **Voice ROMS:** U17	U21	U36	U37	Jumper Installed (‡ see Note)
*** Note:**	*For complete Appendix Information for Games **Laser War** through **Batman Forever**, see any Service Game Manual between **Apollo 13** through **Ripley's Believe It or Not!** or on-line at our website www.sternpinball.com/parts.htm; also available on CD-R, 970-2003-00 (**The Simpsons™ Pinball Party**, **T3®** and **The Lord of the Rings™**).*						
29	Apollo 13 (A13)	NOV 95 780-5044-00	4MB	4MB	4MB	Not Used	n / a
30	Golden Eye	FEB 96 780-5042-00	4MB	4MB	Not Used	Not Used	n / a
31	Twister	APR 96 780-5041-00	4MB	4MB	Not Used	Not Used	n / a
32	ID4: Independence Day	JUL 96 780-5045-00	4MB	4MB	Not Used	Not Used	n / a
33	Space Jam	OCT 96 780-5043-00	4MB	4MB	4MB	Not Used	n / a
34	The Star Wars Trilogy - Sp. Ed.	FEB 97 780-5056-00	4MB	4MB	Not Used	Not Used	n / a
35	The Lost World: Jurassic Park	JUN 97 780-5053-00	4MB	4MB	Not Used	Not Used	n / a
36	The X-Files	AUG 97 780-5046-00	4MB	4MB	Not Used	Not Used	n / a
37	Starship Troopers	NOV 97 780-5059-00	4MB	4MB	4MB	Not Used	n / a
38	Viper Night Drivin'	FEB 98 780-5035-00	4MB	4MB	4MB	4MB	n / a
39	Lost In Space	JUN 98 780-5060-00	4MB	4MB	4MB	4MB	n / a
40	Godzilla	SEP 98 780-5040-00	4MB	4MB	4MB	4MB	n / a
41	South Park	JAN 99 780-5071-00	8MB	8MB	8MB	8MB	W6
42 **a**	Harley-Davidson®	AUG 99 780-5067-01	8MB	8MB	8MB	8MB	W6
42 **b**	Harley-Davidson®2nd Ed.	SEP 02 780-5067-10	8MB	8MB	8MB	8MB	W6
42 **c**	Harley-Davidson® 3rd Ed.	OCT 04 780-5087-00	8MB	8MB	8MB	8MB	W6
43 **a**	Striker Xtreme	MAR 00 780-5068-01	8MB	8MB	8MB	8MB	W6
43 **b**	NFL	OCT 00 780-5073-00	8MB	8MB	8MB	8MB	W6
44	Sharkey's Shootout	JUL/OCT 00 780-5072-01	8MB	8MB	8MB	Not Used	W6
45	High Roller Casino	JAN 01 780-5065-00	8MB	8MB	8MB	8MB	W6
46	Austin Powers™	MAY 01 780-5074-00	8MB	8MB	8MB	8MB	W6
47	MONOPOLY®	SEP 01 780-5075-00	8MB	8MB	8MB	Not Used	W6
48	Playboy	FEB 02 780-5076-00	8MB	8MB	8MB	8MB	W6
49	RollerCoaster Tycoon™	AUG 02 780-5078-00	8MB	8MB	8MB	Not Used	W6
50	The Simpsons™ Pinball Party	JAN 03 780-5077-00	8MB	8MB	8MB	8MB	W6
51	T3®: Rise of the Machines™	MAY 03 780-5079-00	8MB	8MB	8MB	8MB	W6
52	The Lord of the Rings™	NOV 03 780-5080-00	8MB	8MB	8MB	8MB	
53	Ripley's Believe It or Not!®	APR 04 780-5081-00	8MB	8MB	8MB	8MB	
54	Elvis®	AUG 04 780-5084-00	8MB	8MB	8MB	8MB	

‡ *Additional Information for **Installed** Jumper (above games 41-51):*

- *Installed **W6** so 8MB ROMS can be utilized. See the **CPU/Sound Board Schematic** (Sheet 2 of 3, Address Location 3E) in the games' Service Game Manual. Game 52 - current has a new CPU/Sound Board (see Pages 131-141).*

See **Apdx. A** for more detailed information on **Pinball Game Firmware** *(ROM Name, Size, Part Numbers, USA Version & Checksum and Board Locations).*

See **Apdx. A** for more detailed information on **Pinball Game Firmware** *(ROM Name, Size, Part Numbers, USA Version & Checksum and Board Locations).*

APPENDIX D

Board Type (White Star Board System Only*) Table

Game Name	Flipper	I/O Power Driver	CPU/Sound Stereo	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Apllication
* **Note:** *For complete Appendix Info. for Games **Laser War** through **Batman Forever**, see any Service Game Manual between **Apollo 13** through **Ripley's BION!** or on-line at our website www.sternpinball.com/parts.htm; also available on CD-R, 970-2003-00 (**The Simpsons™ Pinball Party**, **T3®** and **The Lord of the Rings™**).*									
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			

GAMES HEREON NO LONGER REQUIRE THE FLIPPER BOARD WITH THE WHITE STAR BOARD SYSTEM™

Game Name	I/O Power Driver	CPU/Sound Mono	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Apllication	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 Trilolgy - 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
	MiscellaneousPC 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	515-0173-00 Dual OPTO	515-0174-00 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	515-0173-00 Dual OPTO	515-0174-00 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	515-0173-00 Dual OPTO	515-0174-00 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® 1st-3rd* Editions	520-5137-01	520-5136-16 *520-5300-00*	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 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	515-0173-00 Dual OPTO	515-0174-00 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	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5194-00 4-Pos. Motor Sensor on ?-Ball Motor
	MiscellaneousPC 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	515-0173-00 Dual OPTO	515-0174-00 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	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5212-00 **Pulse-Stretcher OPTO on Spini-Me**
	MiscellaneousPC Boards:	Relay Bd. (X3) 520-5010-00			for **UK ONLY> Solenoid Expander Bd.** 520-5192-00	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Time Machine Ramp	
Monopoly®	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	MiscellaneousPC Boards:	DC Relay Bd. 520-5066-00	Mini-Dot Display (3 by 5X7) 520-5197-00 (Electric C° Sign)		for **UK ONLY> Solenoid Expander Bd.** 520-5192-00	520-5218-00 4-Pos. OPTO	520-5210-00 4-Pos. OPTO	Bank Door	

Table continued on the next page.

APPENDIX D

Board Type (White Star Board System Only*) Table

Game Name	I/O Power Driver	CPU/Sound (old & new)	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Application	Misc OPTO & App.
Playboy	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Relay Bd. 520-5010-00		for **UK ONLY> Solenoid Expander Bd. 520-5192-00**				
RollerCoaster Tycoon™	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5222-00 1-Position Switch Detect on Wheel Spin
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Mini-Dot Display (3 by 5X7) 520-5221-00 **(Ramp Enter Sign)**		for **UK ONLY> Solenoid Expander Bd. 520-5192-00**	520-5082-00 Long Hop **OPTO**	520-5083-01 Long Hop **OPTO**	Behind 1-Bank Drop Target	
The Simpsons™ Pinball Party	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	LED Bd. 520-5219-00	Color Dot Display (4 by 5X7) 520-5225-00 **(TV Set)**		for **UK ONLY ◀◀◀ Aux. Driver Bd. 520-5068-01**				
Terminator® 3: Rise of the Machines™	520-5137-01	**520-5136-16**	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:				for **UK ONLY ◀◀◀ Aux. Driver Bd. 520-5068-01**	515-7307-00 Single OPTO	515-7308-00 Single OPTO	TXCannon Trough	
The Lord of the Rings™	520-5137-01	***New* 520-5300-00**	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	500-6746-00 (White Trans.) 500-6747-00 (Black Rec.)
	Miscellaneous PC Boards:	19-LED PCB 520-5242-00	OPTO Transmitter / Receiver Amplifier PCB 520-5239-00		for **UK ONLY ◀◀◀ Aux. Driver Bd. 520-5068-01**	515-7307-00 Single OPTO	515-7308-00 Single OPTO	Orthanc Tower Trough	
Ripley's Believe It or Not!®	520-5137-01	520-5300-00	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	500-6775-00 OPTO Trnscvr
	Miscellaneous PC Boards:	520-5236-00 X3 Dot Display	OPTO Transmitter / Receiver Amplifier PCB 520-5239-01		for **UK ONLY ◀◀◀ Aux. Driver Bd. 520-5068-01**	520-5234-00 3-Pos. OPTO	520-5234-00 3-Pos. OPTO	Vari-Target	520-5235-03 X3 Aux. Drvr
Elvis®	520-5137-01	520-5300-00	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:				for **UK ONLY ◀◀◀ Aux. Driver Bd. 520-5068-01**				

APPENDIX E

Generic Coil Cross-Reference Guide

GA-TURNS	Res. (Ω)	SPI PART Nº	COMMENTS
STANDARD COILS (TYPICAL APPLICALTIONS)			
20-400	1.0 Ω	090-5021-00	Diode Top
22-500	1.7 Ω	090-5017-00	Diode (Top)
22-600	2.2 Ω	090-5023- *use*	**-0B** Diode Bottom, **-0T** Diode Top
23-700	3.1 Ω	090-5022- *use*	**-00** Diode Bottom, **-0T** Diode Top
23-750	3.4 Ω	090-5019-00	Diode (Top)
23-800	3.6 Ω	090-5001- *use*	**-0B** Diode Bottom, **-0T** Diode Top, **-NL** *No Lugs-11" Leads*
23-840	4.0 Ω	090-5005-00	Diode (Top)
23½-765	3.6 Ω	090-5037-03	Diode Top
24-900	5.0 Ω	090-5002- *use*	**-02** Diode (Top), **-10** *No Lugs-14" Lds*
24-940	5.5 Ω	090-5036- *use*	**-0B** Diode Bottom, **-0T** Diode Top
		090-**5051**-01	*No Lugs-11" Leads*
25-1240	9.3 Ω	090-5034-**00**	Diode Bottom
26-1200	10.3 Ω	090-5044- *use*	**-0B** Diode Bottom, **-0T** Diode Top, **-NL** *No Lugs-11" Leads*
27-1300	14.2 Ω	090-5003-00	Diode (Top)
27-1400	14.7 Ω	090-5015-00	Diode Bottom
27-1500	16.3 Ω	090-5004- *use*	**-0B** Diode Bottom, **-0T** Diode Top
29-2000	33.6 Ω	090-5016-00	Diode (Top)
MAGNET COILS (LARGE, MEDIUM & MINI)			
20½-480	2.9 Ω	090-5064-02	Large *No Lugs-14" Leads* / No Core
22-650	4.3 Ω	090-5042-**00**	Large *No Lugs-6" Leads* / No Core
		090-5042-**01**	Large *No Lugs-12" Leads* / No Core
24-780	8.0 Ω	090-5061-00	Medium *No Lugs-6" Leads* / No Core
29-1000	15.2 Ω	090-5059-00	Mini w/ Magnet Core, w/Lugs + Diode
31-1500	52.0 Ω	090-5**0**54-00	Mini w/ Mag. Core, Str. Lugs + Diode
		090-5**0**55-00	Mini w/ Mag. Core, 90° Lugs + Diode

Ordering Note: *Coils typically should not come with Coil Sleeves.* ***IF A SLEEVE EXISTS****, ensure it is the correct sleeve for the application usage. For the correct Coil Sleeve, refer to the Assembly Drawing the coil exists on and order separately.*

Please Note: *Ohm values may vary +/- .03Ω* ***depending on meter calibration.***

GA-TURNS	Res. (Ω)	SPI PART Nº	COMMENTS
LARGE COILS (FLIPPERS & SPECIAL APPLICATIONS)			
21-900	Ω	090-5020-**01**	Diodes Top X2 1N4004 + 1N5404 (3-Lug) <BROWN>
		090-5020-**10**	Diode (Top), <RED>
22-750/ 30-2600	2.6 Ω 92.0 Ω	090-5011-00	**DUAL-WOUND COIL**, Diode Top X2 1N4004 (3-Lug), <>
22-900	3.45 Ω	090-5020-20T	Diode Top <YELLOW>
22-1080	4.3 Ω	090-5032- *use*	**-0B** Diode Bot., **-0T** Diode Top, **-NL** *No Lugs-X" Leads <YEL-GRN> Wrap*
23-620/ 30-2600	2.4 Ω 75.0 Ω	090-5006-00	**DUAL-WOUND COIL**, Diode Top X2 1N4004 (3-Lug), <>
23-700/ 30-2600	3.0 Ω 83.5 Ω	090-5013-00	**DUAL-WOUND COIL**, Diode (Top) <>
23-800/ 30-2600	2.8 Ω 90.5 Ω	090-5012-00	**DUAL-WOUND COIL**, Diode (Top) <>
23-900	4.05 Ω	090-5020-30	Diode Top <GREEN>
23-1100	5.1 Ω	090-5030-0T	Diode Top <ORANGE>
23-1200	7.1 Ω	090-5008-00	Diode Top <BLACK>
23-1500	4.4 Ω	090-5062-00	Diode Top <BLUE>
24-1570	9.5 Ω	090-5025-00	Diode Top <BLUE>
25-1400	Ω	090-5067-0T	Diode Top <RED>
25-1600	Ω	090-5068-0T	Diode Top <WHITE>
25-1800	13.8 Ω	090-5041-0T	Diode Top <BLUE-GREEN>
MINI-COILS (RESET / TRIP APPLICATIONS)			
27-950	Ω	090-5046-01	Diode Top, <>
28-1050	11.5 Ω	090-5046-00	Diode Top, <>
31-590	Ω	090-5010-00	Diode (Top), <>
32-1250	35.0 Ω	**515-6916-01**	with Flap & Screw, <YELLOW>
32-1800	50.2 Ω	**515-6110-00**	w/ Mounting & Armature Brackets, <>
		090-5031- *use*	**-0B** Diode Bottom, **-0T** Diode Top
33-1590	59.0 Ω	**515-6916-00**	with Brackets, <WHITE>

Flipper Coil (White Star Board System Only*) Table

		FLIPPERS		FLIPPERS no E.O.S. Switch	
		SPI Nº / GAUGE-TURNS / Color		SPI Nº / GAUGE-TURNS / Color	
		LOWER LEFT	LOWER RIGHT	UPPER LEFT	UPPER RIGHT
Apollo 13	2	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
Golden Eye	2	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
Twister	2	090-5020-20T **22-900 -YELLOW-**	090-5032-0T **22-1080 -YEL-GRN-**	Not Used	Not Used
ID4: Independence Day	3	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	090-5020-30 **23-900 -GREEN-**
Space Jam †	2	090-5032-0T **22-1080 -YEL-GRN-**	090-5020-20T **22-900 -YELLOW-**	Not Used	Not Used
The Star Wars Trilogy - Special Edition †	2	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
The Lost World: Jurassic Park †	2	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
The X-Files †	2	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
Starship Troopers †	3	090-5030-0T **23-1100 -ORANGE-**	SAME	Not Used	090-5032-0T **22-1080 -YEL-GRN-**
Viper Night Drivin' †	2	090-5030-0T **23-1100 -ORANGE-**	SAME	Not Used	Not Used
Lost In Space †	2	090-5030-0T **23-1100 -ORANGE-**	090-5032-0T **22-1080 -YEL-GRN-**	Not Used	Not Used
Godzilla †	2	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
South Park †	2	090-5030-0T **23-1100 -ORANGE-**	SAME	Not Used	Not Used

**** Note:*** *For complete Appendix Information for Games* ***Laser War*** *through* ***Batman Forever****, see any Service Game Manual between* ***Apollo 13*** *through* ***Ripley's Believe It or Not!****; or order CD-R, 970-2003-00 (****The Simpsons™ Pinball Party****,* ***Terminator® 3*** *and* ***The Lord of the Rings™****).*

Table continued on the next page.

† Coil Part Numbers ending with a "**T**" signifies the Diode is on the top of the lug *(on the coil-winding side)*; Coil Part Numbers ending with a "**B**" signifies the Diode is on the bottom of the lugs.

APPENDIX E

Flipper Coil (White Star Board System Only*) Table

GAME NAME	Nº of Flippers	FLIPPERS w/E.O.S. Switch		FLIPPERS no E.O.S. Switch	
		SPI Nº / GAUGE-TURNS / Color		SPI Nº / GAUGE-TURNS / Color	
		LOWER LEFT	LOWER RIGHT	UPPER LEFT	UPPER RIGHT
Harley-Davidson® † *and 1st through 3rd Editions*	2	090-5032-0T **22-1080 -YEL-GRN-**	090-5030-0T **23-1100 -ORANGE-**	Not Used	Not Used
Striker Xtreme (NFL) †	3	090-5032-0T **22-1080 -YEL-GRN-**	090-5030-0T **23-1100 -ORANGE-**	090-5030-0T **23-1100 -ORANGE-**	Not Used
Sharkey's Shootout †	3	090-5030-0T **23-1100 -ORANGE-**	SAME	090-5030-0T **23-1100 -ORANGE-**	Not Used
High Roller Casino †	2	090-5020-20T **22-900 -YELLOW-**	090-5032-0T **22-1080 -YEL-GRN-**	Not Used	Not Used
Austin Powers™ †	2	090-5020-30 **23-900 -GREEN-**	090-5030-0T **23-1100 -ORANGE-**	Not Used	Not Used
MONOPOLY® †	3	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	090-5062-0T **23-1500 -BLUE-**
Playboy †	2	090-5030-0T **23-1100 -ORANGE-**	SAME	Not Used	Not Used
RollerCoaster Tycoon™ †	4	090-5032-0T **22-1080 -YEL-GRN-**	SAME	090-5067-0T **25-1400 -RED-**	090-5068-0T **25-1600 -WHITE-**
The Simpsons™ Pinball Party †	6** (5 with Flipper Bats)	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	090-5030-0T **23-1100 -ORANGE-**
		** *The Homer Head Assembly is affixed to an Upr. Rt. Style Flipper (no E.O.S. Switch):*	** 090-5020-20T **22-900 -YELLOW-**	Flippers (Mini-Bats) on 2nd Level Playfield: 090-5041-00T **25-1800 -BLU-GRN-**	090-5025-00 **24-1570 -BLUE-**
Terminator® 3: Rise of the Machines™ †	2	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
The Lord of the Rings™ †	2	090-5020-20T **22-900 -YELLOW-**	SAME	Not Used	Not Used
Ripley's Believe It or Not!® †	3	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	090-5067-00T **25-1400 -RED-**
Elvis® †	4	090-5020-20T **22-900 -YELLOW-**	SAME	090-5020-30 **23-900 -GREEN-**	SAME

† Coil Part Numbers ending with a "T" signifies the Diode is on the top of the lug *(on the coil-winding side)*; Coil Part Numbers ending with a "**B**" signifies the Diode is on the bottom of the lugs.

APPENDIX F

Motor Specification (White Star Board System Only*) Table

Game Name	Function	Specifications	Part №
* **Note:** *For complete Appendix Info. for Games **Laser War** through **Batman Forever**, see any Service Game Manual between **Apollo 13** through **Ripley's** or on-line at our website www.sternpinball.com/parts.htm; also available on CD-R, 970-2003-00 (**The Simpsons™ Pinball Party**, **T3®** and **The Lord of the Rings™**).*			
Apollo 13	Rocket Up/Down Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CCW	515-6383-00 *incl. Connector*
	Moon Unit Rotational Orbit	Multi Products Motor 24v A.C. 50/60Hz 3W 6 RPM CCW	515-6487-00 *incl. Connector*
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00 *MOTOR ONLY*
Golden Eye	Satellite Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CW	515-6528-00 *incl. Connector*
Twister	Spinning Disc with Magnet	Multi Products Motor 24v A.C. (041-5026-00) 50/60Hz 3W 325 RPM CCW	515-6347-00 *incl. Connector*
	Backbox Fan (Tornado Wind)	Multi Products Motor 24v A.C. (041-5052-00) 50/60Hz 3W 3600 RPM CW	515-6531-00 *incl. Connector*
ID4: Independence Day	Alien Head Open/Close Movement	Servo Motor (94322)	041-5045-00 *MOTOR ONLY*
SPACE JAM (NO MOTOR USED)			
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 *incl. Connector*
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 *incl. Connector*
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00 *MOTOR ONLY*
The X-Files	X-File Cabinet Lift Up/Down Movement	Multi Products Motor 20v D.C. 9 RPM CCW	041-5057-00 *MOTOR ONLY*
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 *incl. Connector* **Requires 7" Shaft:** 530-5503-00
VIPER NIGHT DRIVIN' (NO MOTOR USED)			
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 *incl. Connector*
Godzilla	Shaker ‡	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW ‡	041-5029-**01** *MOTOR ONLY*
SOUTH PARK (NO MOTOR USED)			
Harley-Davidson® *1st through 3rd Editions*	Shaker ‡	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW ‡	041-5029-**01** *MOTOR ONLY*
	Motorcycle Lift Up/Down Movement	Autotrol 24v A.C. (041-5072-02) 20 RPM CCW	515-7025-00 *incl. Connector*
Striker Xtreme (NFL)	Goalie (Linebacker) Left to Right Movement	Multi #3590 12v D.C. (041-5075-00) 60 RPM	515-7071-00 *incl. Connector*
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 *incl. Connector*
High Roller Casino	Roulette Wheel Rotating Movement	Multi Products Motor 20V D.C. (041-5078-00) 17 RPM CCW	515-7153-00 *incl. Connector*
	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 *incl. Connector* **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 *incl. Connector*
	Laser Beam Left to Right Directional	Autotrol Motor 24V A.C. (041-5081-00) 50/60Hz 4W 10RPM Bi-Directional	515-7171-00 *incl. Connector*
	Dr. Evil Target Lift Up/Down Movement	Hankscraft Motor Model-E 24v A.C. (041-5030-00) 50/60Hz 6RPM CCW	515-5900-00 *incl. Connector*
Monopoly®	Mini-Flipper (Waterworks) Rotating Movement	Multi Prod. Motor & Gear Box #7000 EX00159A 20v D.C. 50/60Hz 85RPM CC/CCW	041-5083-00 *MOTOR ONLY*
Playboy	Triangular Billboard Rotating Movement	Autotrol Motor (BD511 150-1387) 24v A.C. 50/60Hz 12RPM Bi-Directional	041-5086-02 *MOTOR ONLY*
	Centerfold Mechanism Open/Close Movement	Multi Products (3680) Motor 12v DC 10/12 RPM CC/CCW	041-5075-04 *MOTOR ONLY*
	Tease Drop Screen 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 *incl. Connector* **Requires 7" Shaft:** 530-5503-00

‡ ***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**.*

Table continued on the next page.

Game Name	Function	Specifications	Part Nº
ROLLERCOASTER TYCOON™ (NO MOTOR USED)			
THE SIMPSONS™ PINBALL PARTY (NO MOTOR USED)			
Terminator® 3: Rise of the Machines™	Backbox Ball Shooter Up/Down Movement	Multi Products Motor 24V A.C. (041-5079-01) 21 RPM CW	515-7317-00 *incl. Connector*
The Lord of the Rings™	Balrog (Motor & Gate) Open/Close Movement	Multi Prod. Motor 20V D.C. Series 600B *(or equiv.)* 50/60Hz 10 RPM Bi-Directional	041-5088-01 *MOTOR ONLY*
RIPLEY'S BELIEVE IT OR NOT!® (NO MOTOR USED)			
Elvis®	Elvis™ Front/Back Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12v D.C. 10W (041-5089-00), HSI #46868-12-002	500-6809-00 *incl. Connector* **Requires 7.25" Shaft:** 530-5658-00
	▶▶▶ **OPTIONAL** ◀◀◀ Shaker	Johnson Motor (Vibrator) 10.5v D.C. (041-5029-01) 10 AMP 2950 RPM CW & Wiring Harness	515-5893-01 *incl. Connector*

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** 1-5/8" 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.*

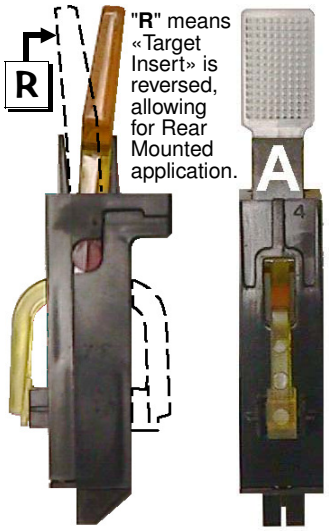
Instructions: Parts which may come in various colors (i.e. targets, some posts, playfield inserts, etc.) end in a 2-digit Nº which correspond to the color of that part. The "**-XX**" in Part Nºs which may come in various colors should be replaced with the desired 2-Digit Nº. corresponding to the color desired. *Not all colors may be available.*

PLASTIC PART COLOR CHART

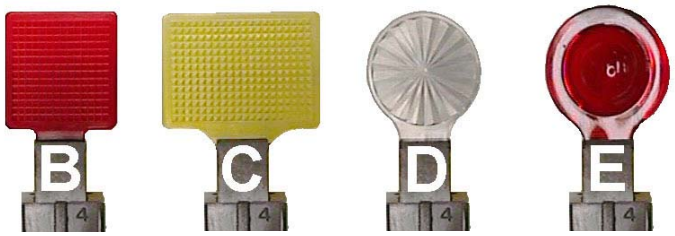
Nº	Color	Nº	Color	Nº	Color	Nº	Color	Nº	Color	Nº	Color
-00	**Black** or Solid Clear	**-03**	Amber	**-06**	Yellow	**-09**	Purple	**-12**	Fluor. Blue	**-15**	Luminescent
-01	Clear	**-04**	Green	**-07**	Orange	**-10**	Fluor. Orange	**-13**	Teal Green	**-16**	Gold
-02	Red	**-05**	Blue	**-08**	White	**-11**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

APPENDIX I

Stand-Up Targets



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



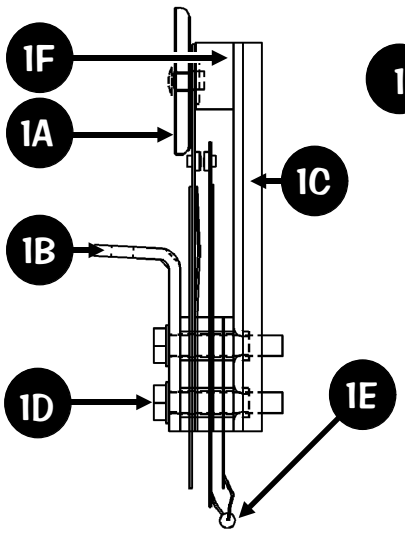
PLASTIC PART COLOR CHART	
Nº	**Color**
-00	Black
-01	Clear
-02	Red
-03	Amber
-04	Green
-05	Blue
-06	Yellow
-07	Orange
-08	White
-09	Purple
-10	Fluor. Orange
-11	Fluor. Green
-12	Fluor. Blue
-13	Teal Green
-14	Gray
-15	Luminescent
-16	Gold

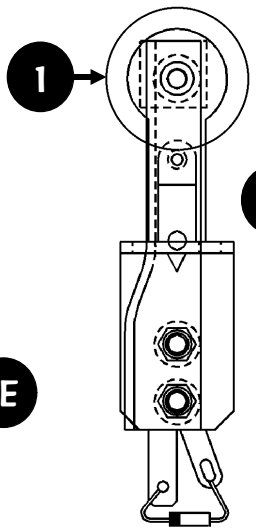
Take Note:

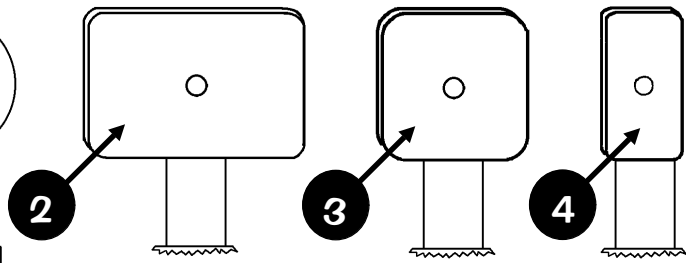
1. For **Items A-E**, for the Target Assembly use the **"500-"** SPI Nº; For the Target Assy. with Rear Mount add **"R"** to **"500-"** SPI Nº; For just the «Target Insert» use the **"545-"** SPI Nº.
2. **Items A-E** come in various colors. *These targets may not be available in every color.* The **"-XX"** 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 Assembly with the « Target Insert » « **R**eversed » simply add a **"R"** at the end of the Part Nº. See Side View picture above to compare (dashed line shows target reversed).*







Take Note:

1. For Items 1-4, "single" components can be ordered.
2. Items 1-4 come in various colors. *These targets may not be available in every color.* The "-XX" in Part Nºs should be replaced with the desired 2-Digit Nº for the color desired described in the above Chart.
3. *For switches used corresponding to the Switch Matrix Grid of this game, see Sec. **3**, Chp. **2**, **...Diagnostics**.*

Nº	STAND-UP (FLAT) TARGET NAME	SPI PART Nº
1	1" Round Stand-Up Target Assy.	500-5835-**XX**
ORDERING ABOVE (ITEM 1) ASSY. PART Nº WILL INCLUDE:		
1A‡	Switch & Target Assy. 1" Round	515-5966-**XX**
1B	Mounting Bracket	535-6896-00
1C	Switch Back Plate	535-6452-00
1D	6-32 X ¾ HWH Swage (Qty. 2)	237-5976-05
1E	Switch Diode, 1N4001	112-5001-00
1F	Foam Pad	626-5029-00

‡ ***Note:*** Item **1A**, is a riveted Sub-Assy. which includes the following items for reference:
A1— Stack Switch Radius End (180-5133-00), **A2**— Washer 5/16" (242-5017-00),
A3— Rivet 1/8" ø X 3/16" (249-5001-00) **and A4**— 1" Round Target (545-5456-XX).

2	1" X 1½" Stand-Up Rect. Target Assy.	500-5321-**XX**
ORDERING ABOVE (ITEM 2) ASSY. PART Nº WILL INCLUDE:		
2A‡	Sw. & Target Assy. 1" X 1½" Rect.	515-6027-**XX**
	Items 2B-F are identical to 1B-F	Same as 1B-F

Item 2 Table Note continued in the next column.

‡ ***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	515-5162-**XX**
	Items 3B-F are identical to 1B-F	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	515-5967-**XX**
	Items 4B-F are identical to 1B-F	Same as 1B-F

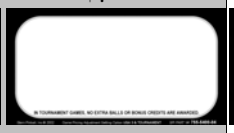
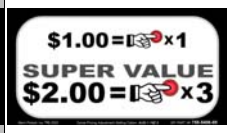
‡ ***Note:*** Item **4A**, is a riveted Sub-Assy. which includes the following items for reference:
A1— Stack Switch Square End (180-5132-00),
A2— Washer 5/16" (242-5017-00),
A3— Rivet 1/8" ø X 3/16" (249-5001-00) **and**
A4— Narrow Target (545-5210-XX).

to open Coin Card Files, insert Disc 2

APPENDIX J

Coin Cards (USA & International Pricing Defaults) ▶ For Yellow Stock add -Y to the Part Number

Sec. **3**, Chp. **4**, **Go To Adjustments Menu**, Adj. **6**, **Game Pricing**, **USA & Int'l. Standard Pricing Select Table**, summarizes *Custom* or *Standard Pricing Schemes* these Coin Cards represent.

USA 8 *or* CANADA	USA 5	USA 1* *(optional)*	USA *or* CANADA Custom *†	USA 2-7 *or* CANADA	USA *or* CANADA Custom †
					
Front 755-5400-00	Back 755-5400-00	Front 755-5400-01 *	Back 755-5400-01 *†	Front 755-5400-02	Back 755-5400-02 †
ToPS™USA *or* CANADA *‡	**ToPS™ USA *‡**	**ToPS™USA, CANADA, AUSTRALIA *or* NEW ZEALAND Custom *†‡**		**AUSTRALIA 1 *or* NEW ZEALAND 2**	**AUSTRALIA 2 *or* NEW ZEALAND 1**
					
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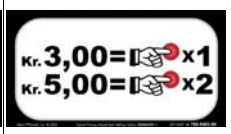
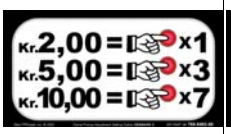
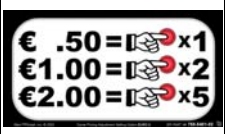
CROATIA	**CROATIA Custom †**	**DENMARK 1**	**DENMARK 2**	**EURO 1**	**EURO 2**
					
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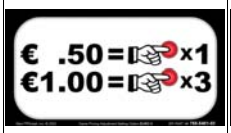
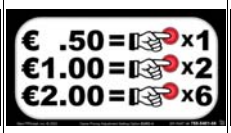
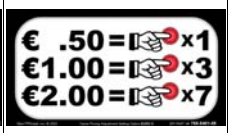
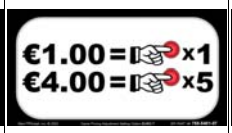
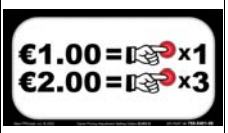
EURO 3	**EURO 4**	**EURO 5**	**EURO 6**	**EURO 7**	**EURO 8**
					
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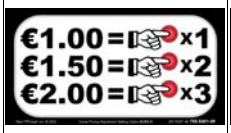
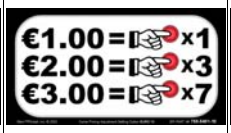
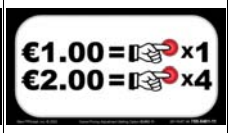
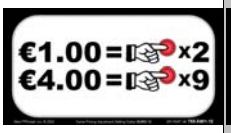
EURO 9	**EURO 10**	**EURO 11**	**EURO 12**	**ToPS™EURO Custom *‡**	**ToPS™EURO Custom *†‡**
					
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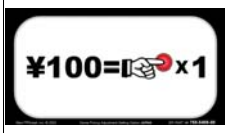	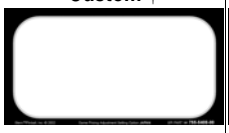		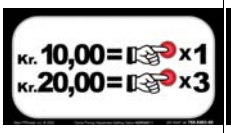	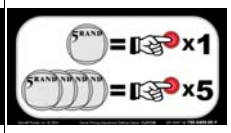	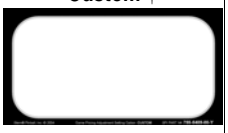
Front 755-5408-00	Back 755-5408-00 †	Front 755-5403-00	Back 755-5403-00	Front 755-5409-00	Back 755-5409-00
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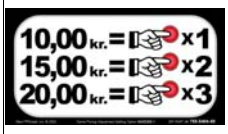
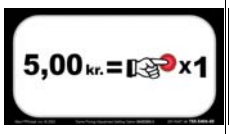
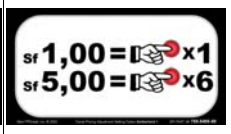
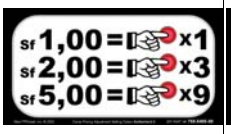
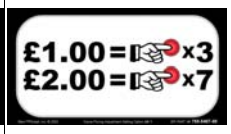
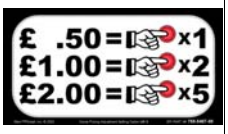
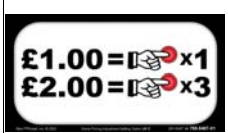
					
Front 755-5404-00	Back 755-5404-00	Front 755-5405-00	Back 755-5405-00	Front 755-5407-00	Back 755-5407-00
UK 5	**UK Custom †**	**ToPS™UK Custom *‡**	**ToPS™UK Custom *†‡**		
					
Front 755-5407-01	Back 755-5407-01 †	Front 755-5407-02 *‡	Back 755-5407-02 *†‡		

Coin Card(s) included with this Pinball game is/are determined by original shipping country destination.

* ***Optional Coin Card*** *shown is not included with this game, but is available for sale or download.*

† *Any blank back side of the Coin Cards noted, can be used for Custom Pricing.*

‡ **ToPS™ (TOURNAMENT PINBALL SYSTEM) ONLY.** *See Sec. 3, Chp. 7, **GO TO TOURNAMENT MENU.***

Note: *You can download any Coin Card (in PDF Format, Adobe® Reader v5.0+ required) from our website www.sternpinball.com/coinagecards.htm or follow link(s) for info on getting all Coin Cards on CD-R.* ***Older style Coin Cards (foreign or domestic), not on the website or no longer available through your distributor, are obsolete.***

Parts Order Checklist Notes

Date Ordered	Part №	Qty.	Description	Date Received

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 **canno**t 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).

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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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RF INTERFERENCE NOTICE, CABLE HARNESS PLACEMENTS AND GROUND STRAP ROUTING ON THIS GAME HAVE BEEN DESIGNED TO KEEP RF RADIATION AND CONDUCTION WITHIN LEVELS ACCEPTED BY THE FCC RULES. TO MAINTAIN THESE LEVELS, REPOSITION HARNESSES AND RECONNECT GROUND STRAPS TO THEIR ORIGINAL PLACEMENTS, IF THEY BECOME DISCONNECTED DURING MAINTENANCE.

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In SWITCH MENU also select:

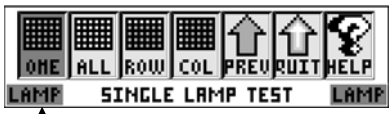
ACTIVE and DEDICATED SWITCH TESTS

SWITCH MATRIX GRID & DEDICATED SWITCHES

Diode On Diode Board :
Diode On Terminal Strip :

Column (Drive) / Row (Return)	1: Q1 NOT USED GRN-BRN CN5-P1	2: Q2 NOT USED GRN-RED CN5-P3	3: Q3 NOT USED GRN-ORG CN5-P4	4: Q4 NOT USED GRN-YEL CN5-P5	5: Q5 NOT USED GRN-BLK CN6-P6	6: Q6 NOT USED GRN-BLU CN5-P7		7: Q7 NOT USED GRN-VIO CN5-P8	8: Q8 NOT USED GRN-GRY CN5-P9
1: U400 NOT USED WHT-BRN CN7-P9	LEFT BUTTON (UK ONLY) on Cabinet side 1	NOT USED 9	LT 4-BANK D/T (L) IVE Under P/F 17	RIGHT RAMP ENTER Above P/F 25	LEFT ORBIT Under P/F 33	M-CYCLE TROUGH #4 (TOP) Under P/F	DOB 41	LEFT TURBO BUMPER Under P/F 49	LEFT OUTLANE Under P/F 57
2: U400 NOT USED WHT-RED CN7-P8	4TH COIN SLOT On Coin Door 2	NOT USED 10	LT 4-BANK D/T L (I) VE Under P/F 18	RIGHT RAMP EXIT Above P/F 26	RIGHT ORBIT Under P/F 34	M-CYCLE TROUGH #3 Under P/F	DOB 42	RIGHT TURBO BUMPER Under P/F 50	LEFT RETURN LANE Under P/F 58
3: U400 NOT USED WHT-ORG CN7-P7	6TH COIN SLOT On Coin Door 3	4-BALL TROUGH #1 (LEFT) 11	LT 4-BANK D/T LI (V) E Under P/F 19	RIGHT RAMP MID Above P/F 27	MOTOR UP Under P/F 35	M-CYCLE TROUGH #2 Under P/F	DOB 43	BOTTOM TURBO BUMPER Under P/F 51	LEFT SLINGSHOT Under P/F 59
4: U400 NOT USED WHT-YEL CN7-P6	RIGHT COIN SLOT On Coin Door 4	4-BALL TROUGH #2 Under P/F 12	LT 4-BANK D/T LIV (E) Under P/F 20	SPINNER Above P/F 28	MOTOR DOWN Under P/F 36	M-CYCLE TROUGH #1 (BOT) Under P/F	DOB 44	TOP TURBO BUMPER Under P/F 52	RIGHT OUTLANE Under P/F 60
5: U401 NOT USED WHT-GRN CN7-P5	CENTER COIN SLOT / DBA On Coin Door 5	4-BALL TROUGH #3 Under P/F 13	RT 4-BANK D/T (R) IDE Under P/F 21	S-U TRGT LT (M-CYCLE) Under P/F 29	OPTO Under P/F 37	SUPER VUK Under P/F	DOB 45	LAUNCH BUTTON Cabinet Front 53	RIGHT RETURN LANE Under P/F 61
6: U401 NOT USED WHT-BLU CN7-P3	LEFT COIN SLOT On Coin Door 6	4-BALL TROUGH VUK OPTO Under P/F 14	RT 4-BANK D/T R (I) DE Under P/F 22	S-U TRGT RT (M-CYCLE) Under P/F 30	NOT USED 38	BALL EJECT (SCOOP) Under P/F	DOB 46	START BUTTON Cabinet Front 54	RIGHT SLINGSHOT Under P/F 62
7: U401 NOT USED WHT-VIO CN7-P2	5TH COIN SLOT On Coin Door 7	4-BALL STACKING OPTO Under P/F 15	RT 4-BANK D/T RI (D) E Under P/F 23	S-U TRGT LT (RT RAMP) Under P/F 31	NOT USED 39	NOT USED 47		SLAM TILT On Coin Door 55	NOT USED 63
8: U401 NOT USED WHT-GRY CN7-P1	RIGHT BUTTON (SKILL) on Cabinet side 8	SHOOTER LANE Under P/F 16	RT 4-BANK D/T RID (E) Under P/F 24	S-U TRGT RT (RT RAMP) Under P/F 32	NOT USED 40	BEHIND TOP VUK Under P/F 48		PLUMB BOB TILT Inside Cabinet 56	NOT USED 64

IC U206 INPUTS / GND	Ground BLK CN6-P1, -P11
1: U206 GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON in Cabinet side DS-1
2: U206 GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke) in Cabinet side DS-2
3: U206 GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON in Cabinet side DS-3
4: U206 GRY-YEL CN6-P6	#4 RIGHT FLIPPER E.O.S. (End-of-Stroke) in Cabinet side DS-4
5: U206 NOT USED GRY-GRN CN6-P7	#5 NOT USED 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



In LAMP MENU also select:

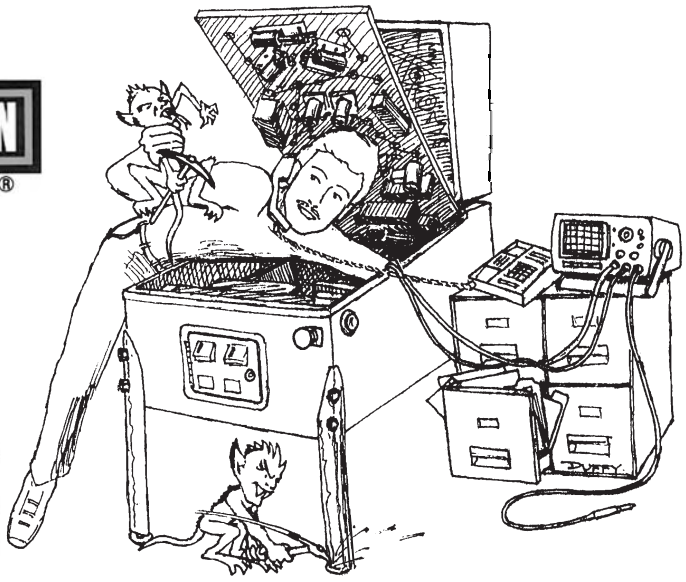
TEST ALL LAMPS, ROW & COLUMN LAMP TESTS

LAMP MATRIX GRID

Diode On Terminal Strip :

Column (18v) / Row (GND)	1: U17 NOT USED YEL-BRN J13-P9	2: U16 NOT USED YEL-RED J13-P8	3: U15 NOT USED YEL-ORG J13-P7	4: U14 NOT USED YEL-BLK J13-P6	5: U13 NOT USED YEL-GRN J13-P5	6: U12 NOT USED YEL-BLU J13-P4	7: U11 NOT USED YEL-VIO J13-P3	8: U10 NOT USED YEL-GRY J13-P1
1: Q33 NOT USED RED-BRN J12-P1	(H) ARLEY #555 Bulb 1	H (A) RLEY #555 Bulb 2	HA (R) LEY #555 Bulb 3	HAR (L) EY #555 Bulb 4	HARL (E) Y #555 Bulb 5	HARLE (Y) #555 Bulb 6	SUPER JACK-POT (RED) #44 Bulb 7	SUPER JACK-POT (GRN) #44 Bulb 8
2: Q34 NOT USED RED-BLK J12-P2	(L) IVE #44 Bulb 9	L (I) VE #555 Bulb 10	LI (V) E #555 Bulb 11	LIV (E) #555 Bulb 12	(R) IDE #555 Bulb 13	R (I) DE #555 Bulb 14	RI (D) E #555 Bulb 15	RID (E) #44 Bulb 16
3: Q35 NOT USED RED-ORG J12-P3	LT ORBIT GRN LIGHT #555 Bulb 17	LT ORBIT YEL LIGHT #555 Bulb 18	LT ORBIT RED LIGHT #555 Bulb 19	1ST GEAR #555 Bulb 20	2ND GEAR #555 Bulb 21	3RD GEAR #555 Bulb 22	4TH GEAR #555 Bulb 23	5TH GEAR #555 Bulb 24
4: Q36 NOT USED RED-YEL J12-P4	M-CYCLE GRN LIGHT #555 Bulb 25	M-CYCLE YEL LIGHT #555 Bulb 26	M-CYCLE RED LIGHT #555 Bulb 27	LEFT TURBO BUMPER DOB T9 #555 Bulb 28	RT TURBO BUMPER DOB T9 #555 Bulb 29	BOT TURBO BUMPER DOB T9 #555 Bulb 30	TOP TURBO BUMPER DOB T9 #555 Bulb 31	SPEEDO-METER X2 #555 Bulb 32
5: Q37 NOT USED RED-GRN J12-P5	SUPER VUK GRN LIGHT #555 Bulb 33	SUPER VUK YEL LIGHT #555 Bulb 34	SUPER VUK RED LIGHT #555 Bulb 35	BIKE S-U TARGET (LT) #555 Bulb 36	BIKE S-U TARGET (RT) #555 Bulb 37	RAMP S-U TARGET (LT) #555 Bulb 38	RAMP S-U TARGET (RT) #555 Bulb 39	SLIPPERY WHEN WET #555 Bulb 40
6: Q38 NOT USED RED-BLU J12-P6	RT RAMP GRN LIGHT #555 Bulb 41	RT RAMP YEL LIGHT #555 Bulb 42	RT RAMP RED LIGHT #555 Bulb 43	PATCH #555 Bulb 44	BIKERS BACK #555 Bulb 45	RED LIGHT MULTIBALL #555 Bulb 46	AUTO LAUNCH #555 Bulb 47	LITE MYST-ERY RIDER #555 Bulb 48
7: Q39 NOT USED RED-VIO J12-P8	RT ORBIT GRN LIGHT #555 Bulb 49	RT ORBIT YEL LIGHT #555 Bulb 50	RT ORBIT RED LIGHT #555 Bulb 51	NOT USED 52	NOT USED 53	NOT USED 54	NOT USED 55	NOT USED 56
8: Q40 NOT USED RED-GRY J12-P9	STOP LIGHT GRN LIGHT #44 Bulb 57	STOP LIGHT YEL LIGHT #44 Bulb 58	STOP LIGHT RED LIGHT #44 Bulb 59	NOT USED 60	NOT USED 61	NOT USED 62	NOT USED 63	NOT USED 64
9: Q41 NOT USED RED-WHT J12-P10	2 XTRA BALLS LT OUTLANE #555 Bulb 65	ADVANCE GEAR LT RETURN #555 Bulb 66	LITE MYSTERY... RT RETURN #555 Bulb 67	2 XTRA BALLS RT OUTLANE #555 Bulb 68	M-CYCLE HEADLIGHT #555 Bulb 69	RIDE AGAIN X2 #555 Bulb 70	MYSTERY RIDER #44 Bulb 71	NEXT CITY #44 Bulb 72
10: Q42 NOT USED RED J12-P11	NOT USED 73	NOT USED 74	NOT USED 75	NOT USED 76	NOT USED 77	NOT USED 78	NOT USED 79	NOT USED 80

▼ U.S. ▼
Customary
Inch Ruler



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This Game Service Manual and all other documents relating to this product, playfield components, features, rules, programming and operation are subject to change without notice (Service Bulletins, if applicable, available through our website).

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