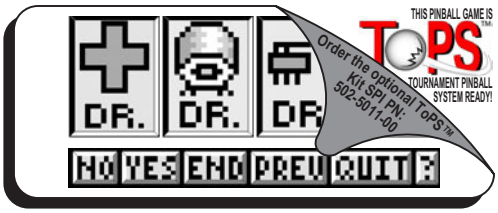
Find-It-In-Front: Dr. Pinball Section

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

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

STERN
PINBALL, INC.



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

Your Parts Sales & Technical Support Team

Susan White
Parts
Sales
MANAGER

Chas Siddiqi
Technical
Support
ENGINEER

Joe Blackwell
DIRECTOR,
Parts Sales &
Technical Support

Patty Schraps
Parts
Stockroom
MANAGER

J. Alfer
Technical Support
Documentation
ADMINISTRATOR

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

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

Printed in the U.S.A.
10-2002 ~ Print Copy: ①

SPI PN:
780-5078-01

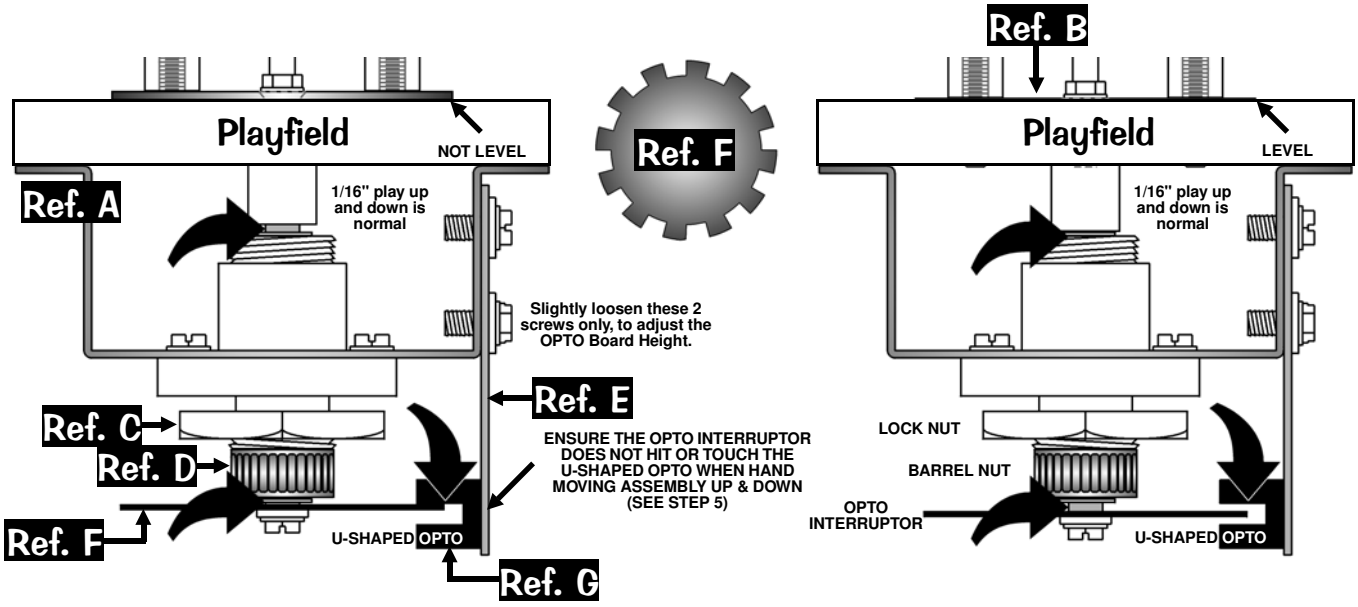
For Proper Operation of RollerCoaster Tycoon™ Pinball, four (4) Pinballs must be installed!

STERN PINBALL, INC.

Spinning Wheel Height & OPTO Adjustment Procedure:

For more views and parts of this assembly, *see the* **Blue Pages**, *Section* **4**, *Chapter* **2**, ***Drawings...***, ***Page 90***.

With the Main Housing Bracket (**Ref. A**) secured under the playfield, the Spinning Wheel *(Scrambled Eggs)* needs to be *level-to-just-slightly-above* the Playfield in the *resting position* (**Ref. B**). To achieve this, perform the following Steps. **Step 1.** Back off the Lock Nut (**Ref. C**). **Step 2.** Loosen or tighten the Silver Barrel Flange Nut from the Adjusting Screw Assembly (**Ref. D**), until the Spinning Wheel is level (**Ref. B**). **Step 3.** Hand-tighten the Lock Nut, then recheck Level. ***Note:*** *There is some "play" of 1/16": view the large arrows in the Left and Right figures below.* **Step 4.** If level is now ok, using a channel lock plier, give the Lock Nut an additional ***s l i g h t*** turn to lock the Lock Nut in place *(needs to be slightly tighter than "Hand-Tight" to prevent the Lock Nut from loosening due to game vibration).* ***DO NOT OVER-TIGHTEN.*** **Step 5.** You will need to ensure the OPTO Board (**Ref. E**) is in the correct position. To do this, slightly loosen the 2 screws securing the OPTO Board to the Main Bracket. Move the **Wheel Assembly** up and down ensuring the OPTO Interruptor (**Ref. F**) does not *hit or touch* the Black U-Shaped OPTO on the board (**Ref. G**). *Tighten board.*



After alignment is complete, go to **SWITCH TEST** (via PORTALS™) and *test Switch* ***20***.
Review Section ***3***, *Chapter* ***2***, ***GO TO DIAGNOSTICS MENU (GO TO SWITCH MENU)***, ***Page 16***.

ToPS™ TOURNAMENT PINBALL SYSTEM

New to Portals! The TOURNAMENT MENU!
Read over Section ***3***, *Chapter* ***7***, *Pages* ***53-57***.

ToPS™ TOURNAMENT PINBALL SYSTEM

An Optional Tournament Kit is required for this ToPS™ Ready Pinball Game.
You can now easily set-up, start and end Tournaments for cash prizes!

New to our Pinball Games?

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

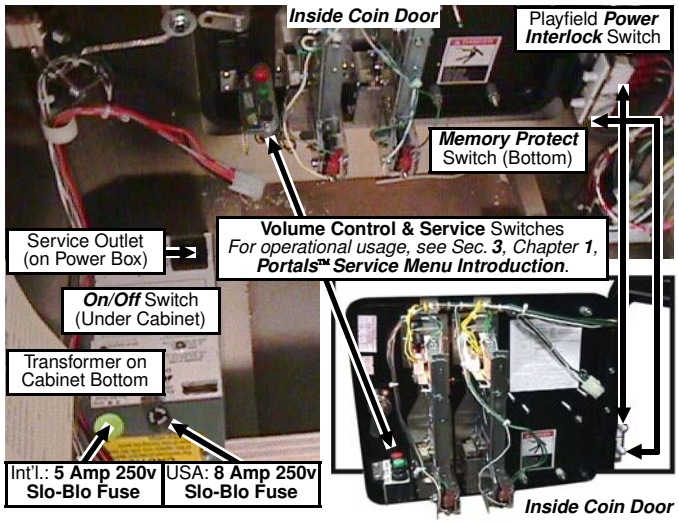
Backbox PCB Fuses, ROMs, Bridges, Relays, P/F & Cabinet Fuses, Cab. Switches

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

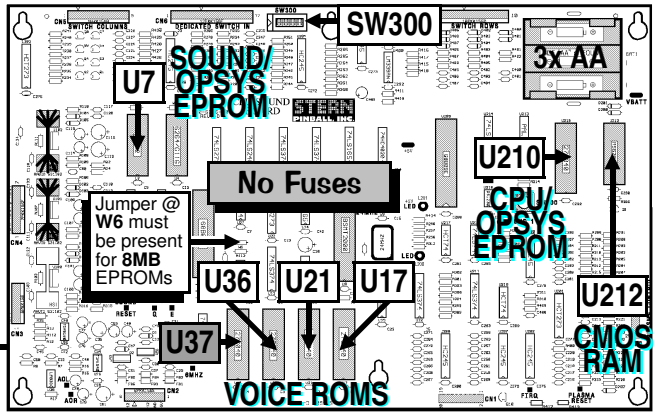
QUICK REFERENCE FUSE CHART

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	3A 250v S.B.	50v DC	Magnet
F21	3A 250v S.B.	50v DC	Coils
F22	8A 250v S.B.	18v DC	Controlled Lamps
F23	4A 250v S.B.	5v DC	Logic
F24	5A 250v S.B.	6.3v AC	G.I. Lamps (BRN-WHT to WHT-BRN)
F25	5A 250v S.B.	6.3v AC	G.I. Lamps (YEL to WHT-YEL)
F26	5A 250v S.B.	6.3v AC	G.I. Lamps (GRN to WHT-GRN)
F27	5A 250v S.B.	6.3v AC	G.I. Lamps (VIO to WHT-VIO)
F28	3A 250v S.B.	24v AC	**Not Used / Spare**
Cabinet Fuses			
LOC:	**SERVICE (AC) OUTLET BOX (Cabinet Bottom)**		
n/a	8A 250v S.B.	115v AC	Main Fuse Line (Domestic or USA)
n/a	5A 250v S.B.	220v AC	Main Fuse Line (International)
Playfield (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	Upr. Rt. Flip. (GRY-YEL⇆RED-YEL)
n/a	3A 250v S.B.	50v DC	Upr. Lt. Flip. (GRY-YEL⇆RED-YEL)

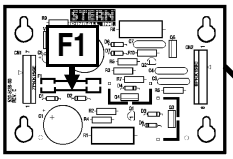
*For locations & more information on fuses, see Sec. **5**, Chapter **2**.*



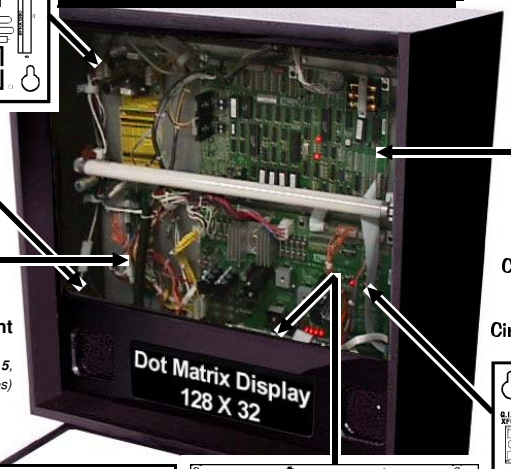
ROM TYPE on BD	LOCATION	SIZE	PART NUMBER
CPU Sound	U7	512K	965-0375-78
CPU Game	U210	1 MB	965-0374-78
CPU Voice ROM 1	U17	8 MB	965-0377-78
CPU Voice ROM 2	U21	8 MB	965-0378-78
CPU Voice ROM 3	U36	8 MB	965-0379-78
CPU Voice ROM 4	U37	8 MB	Not Used
DISPLAY Controller	U5	4 MB	965-0376-78



CPU / Sound Board ▲



◀ Display Power Supply Bd.



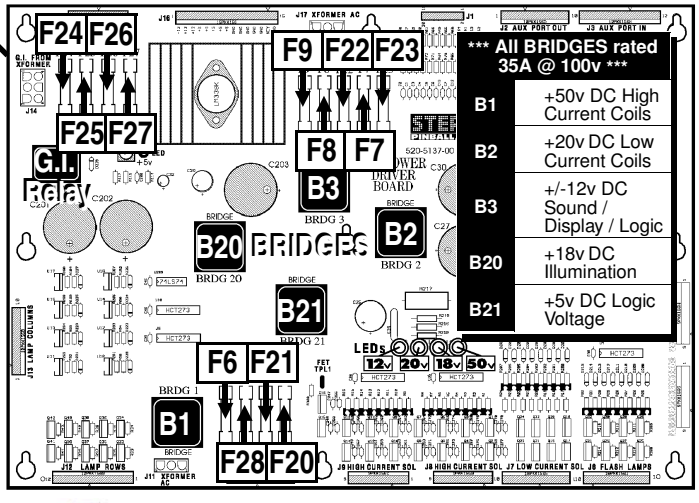
Solenoid Expander Board ‡

Tournament Interface Board ‡

‡ **UK or Tournament GAMES ONLY**
*For more info., see Section **5**, Chp. **4**, **PCBs** (Yellow Pages)*

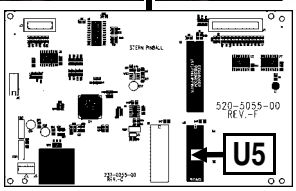
For Schematics and/or Component Parts on PC Boards shown on this page, review Section 5, Chapter 4, Printed Circuit Boards (The Yellow Pages).

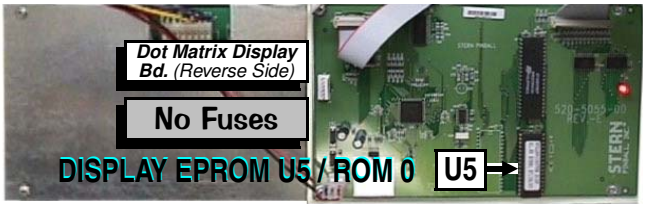
I/O Power Driver Board ▼



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 - ❿**) 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**.

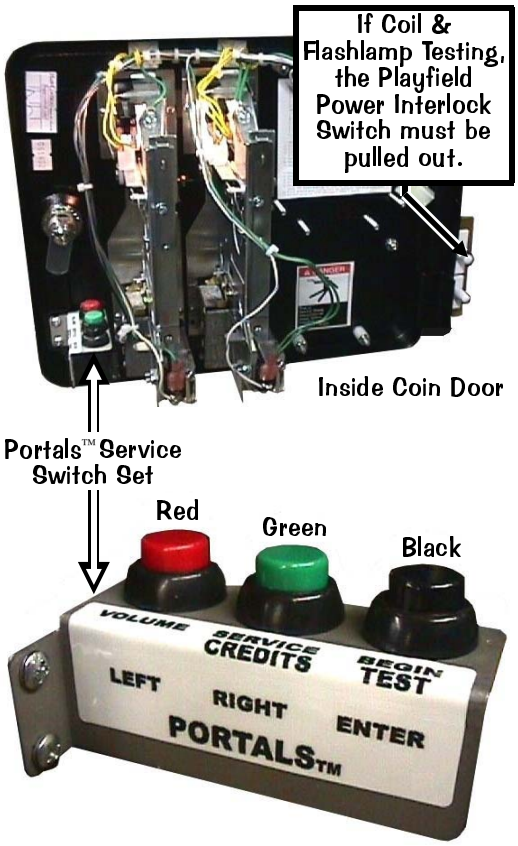
How It Works

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**.

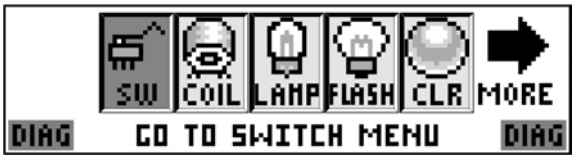
Step 3: Select or activate the *Icons* by pushing the **Black "ENTER" Button**.



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.

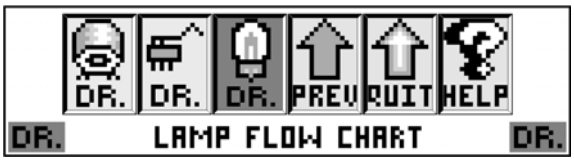
In our **Portals™ Service Menu**, selecting the "DR." *Icon* will bring the operator/technician into **DR. PINBALL** (**Flow Chart Menus**), the "on-screen" diagnostic aide. This is a feature that will allow you to utilize the power of the micro-processor assisting in troubleshooting a problem with the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



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
```

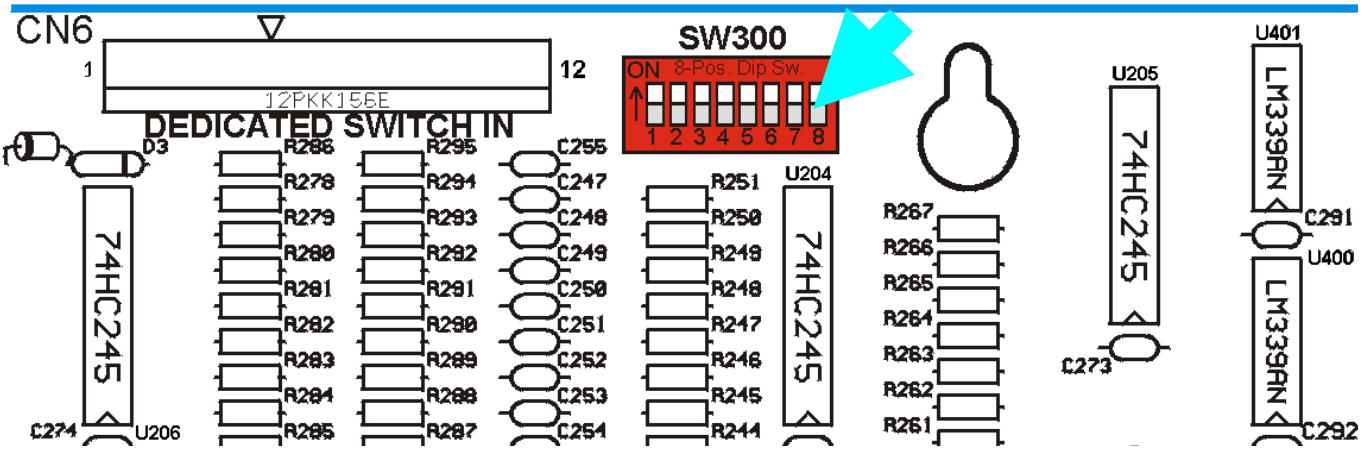
This ***display*** is shown momentarily during **Game Mode** or **Power-Up** to alert the operator of a coil malfunction *(coil doesn't energize or coil fires a multiple number of times)*. **OPERATOR ALERT!** works by monitoring any *switch activated coil* that has the potential to trap a ball when disabled *(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** & will indicate the *following display warning:*

```
PLEASE CHECK
TECH REPORT
PORTALS->DIAG->TECH
```

If this ***display flashes*** *(along with an audible sound)*, the game has detected faulty switches and/or missing pinballs. To check, enter the **Portals™Service Menu System**, select the **"DIAG"** *Icon (**GO TO DIAGNOSTICS MENU**)* from the **MAIN MENU** and select the **"TECH"** *Icon (more details in Section **3**, Chapter **2**, **GO TO DIAGNOSTICS MENU**).*

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

D iode O n T erminal S trip :

Column (Drive) / Row (Return)	1: Q1 GRN-BRN CN5-P1	2: Q2 GRN-RED CN5-P3	3: Q3 GRN-ORG CN5-P4	4: Q4 GRN-YEL CN5-P5	5: Q5 GRN-BLK CN5-P6	6: Q6 GRN-BLU CN5-P7	7: Q7 GRN-VIO CN5-P8	8: Q8 GRN-GRY CN5-P9
1: U400 WHT-BRN CN7-P9	LEFT BUTTON (UK ONLY) on Cabinet side 1	NOT USED 9	(**R**) &D STANDUP on Brckt. Below 17	LEFT TOP LANE (**A**) on Brckt. Below 25	LEFT RAMP RETURN on Asm. Above 33	NOT USED 41	LEFT BUMPER on Asm. Below 49	LEFT OUTLANE on Brckt. Below 57
2: U400 WHT-RED CN7-P8	4TH COIN SLOT on Coin Door 2	NOT USED 10	R (**&**) D STANDUP on Brckt. Below 18	MIDDLE TOP LANE (**B**) on Brckt. Below 26	CENTER RAMP MADE on Asm. Above 34	LOCKUP **1** (TOP) on Brckt. Below 42	RIGHT BUMPER on Asm. Below 50	LEFT RETURN LANE on Brckt. Below 58
3: U400 WHT-ORG CN7-P7	6TH COIN SLOT on Coin Door 3	4-BALL TROUGH #1 (LEFT) on Asm. Below 11	R& (**D**) STANDUP on Brckt. Below 19	RIGHT TOP LANE (**C**) on Brckt. Below 27	RIGHT RAMP MADE on Asm. Above 35	LOCKUP **2** (BOTTOM) on Brckt. Below 43	BOTTOM BUMPER on Asm. Below 51	LEFT SLINGSHOT on Asm. Below 59
4: U400 WHT-YEL CN7-P6	RIGHT COIN SLOT on Coin Door 4	4-BALL TROUGH #2 on Asm. Below 12	WHEEL OPTO on Asm. Below 20	DUMMY LEFT on Brckt. Below 28	GHOST DOWN on Asm. Above 36	(**E**) AT STANDUP on Brckt. Below 44	ROCKET on Asm. Below 52 DOTS	RIGHT OUTLANE on Brckt. Below 60
5: U401 WHT-GRN CN7-P5	CENTER COIN SLOT / DBA on Coin Door 5	4-BALL TROUGH #3 on Asm. Below 13	MINI FLIPPER FEED on Brckt. Below 21	DUMMY RIGHT on Brckt. Below 29	RIGHT ORBIT on Brckt. Below 37	E (**A**) T STANDUP on Brckt. Below 45	TOURNAMENT BUTTON Cabinet Front 53	RIGHT RETURN LANE on Brckt. Below 61
6: U401 WHT-BLU CN7-P3	LEFT COIN SLOT on Coin Door 6	4-BALL TROUGH VUK OPTO on Asm. Below 14	MINI FLIPPER STANDUP on Brckt. Below 22	DROP BANK LEFT on Asm. Below 30 DOTS	SWEEPER OPTO on Brckt. Below 38	EA (**T**) STANDUP on Brckt. Below 46	START BUTTON Cabinet Front 54	RIGHT SLINGSHOT on Asm. Below 62
7: U401 WHT-VIO CN7-P2	5TH COIN SLOT on Coin Door 7	4-BALL STACKING OPTO on Asm. Below 15	CHICAGO LOOP on Asm. Above 23	DROP BANK MIDDLE on Asm. Below 31 DOTS	SWEEPER DROP on Asm. Below 39 DOTS	KIOSK SCOOP on Asm. Below 47	NOT USED 55	NOT USED 63
8: U401 WHT-GRY CN7-P1	RIGHT BUTTON (UK ONLY) on Cabinet side 8	SHOOTER LANE on Brckt. Below 16	LEFT ORBIT on Brckt. Above 24	DROP BANK RIGHT on Asm. Below 32 DOTS	GHOST STANDUP on Brckt. Below 40	KIOSK TUNNEL on Asm. Below 48	PLUMB BOB TILT Inside Cabinet 56	NOT USED 64

GND / IC U206 INPUTS	Ground BLK CN6-P1, -P11
1: U206 GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON in Cabinet side DS-1
2: U206 GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke) in Cabinet side DS-2
3: U206 GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON in Cabinet side DS-3
4: U206 GRY-YEL CN6-P6	#4 RIGHT FLIPPER E.O.S. (End-of-Stroke) in Cabinet side DS-4
5: U206 GRY-GRN CN6-P7	#5 UPR. RT. FLIPPER BUTTON in Cabinet side DS-5
6: U206 GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (In Test: LEFT) on Coin Door DS-6
7: U206 GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) on Coin Door DS-7
8: U206 GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) on Coin Door DS-8

In LAMP MENU also select:

TEST ALL LAMPS, ROW & COLUMN LAMP TESTS

LAMP MATRIX GRID

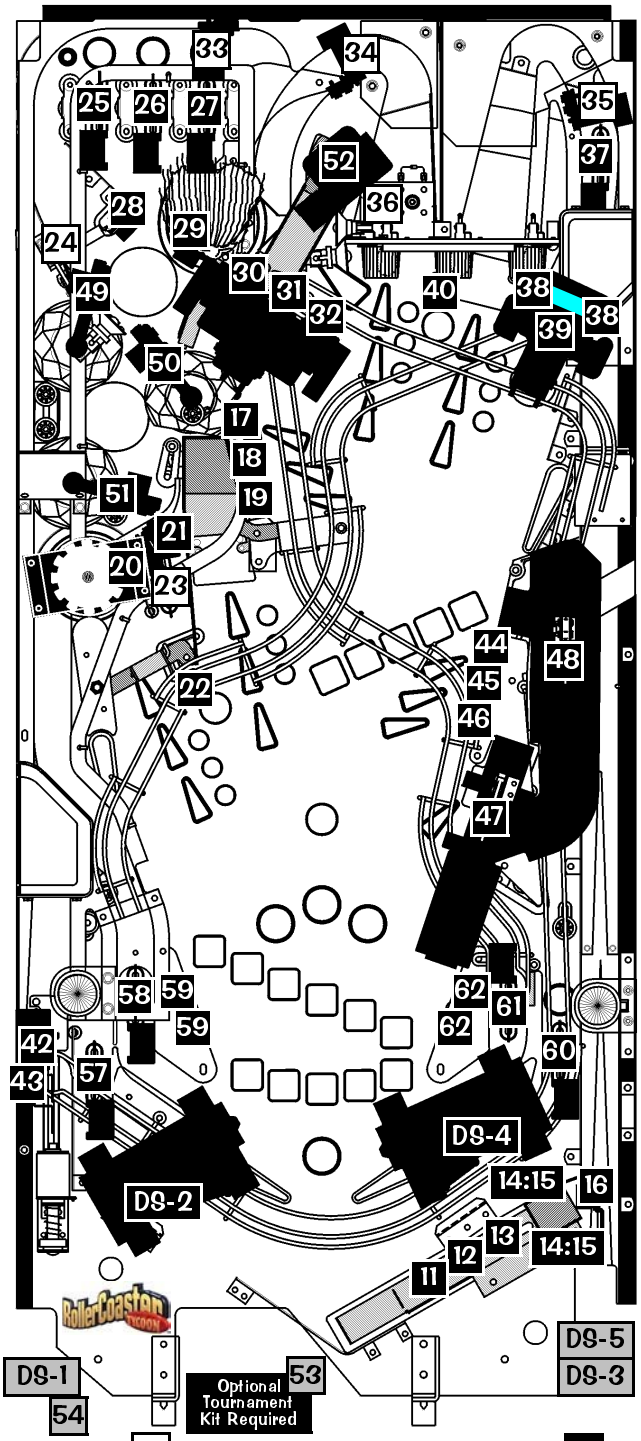
D iode O n T erminal S trip :

Column (18v) / Row (GND)	1: U17 YEL-BRN J13-P9	2: U16 YEL-RED J13-P8	3: U15 YEL-ORG J13-P7	4: U14 YEL-BLK J13-P6	5: U13 YEL-GRN J13-P5	6: U12 YEL-BLU J13-P4	7: U11 YEL-VIO J13-P3	8: U10 YEL-GRY J13-P1
1: Q33 RED-BRN J12-P1	2X BONUS #555 Bulb 1	3X BONUS #555 Bulb 2	4X BONUS #555 Bulb 3	5X BONUS #555 Bulb 4	5X+ LITE EXTRA #555 Bulb 5	DUNK THE DUMMY #555 Bulb 6	SPIN AND BUMP #555 Bulb 7	RIGHT OUTLANE #555 Bulb 8
2: Q34 RED-BLK J12-P2	LEFT OUTLANE #555 Bulb 9	SUPER DUNK #555 Bulb 10	POWER RIDE #555 Bulb 11	TOSS YOUR COOKIES #555 Bulb 12	DANCING DIGITS #555 Bulb 13	LOCK **1** #555 Bulb 14	MULTIBALL #555 Bulb 15	LOCK **2** #555 Bulb 16
3: Q35 RED-ORG J12-P3	LITE MAP #555 Bulb 17	WHEEL JACKPOT #555 Bulb 18	2X SPIN #555 Bulb 19	WHEEL RED #555 Bulb 20	WHEEL YELLOW #555 Bulb 21	WHEEL GREEN #555 Bulb 22	SHOOT AGAIN #555 Bulb 23	MAP #555 Bulb 24
4: Q36 RED-YEL J12-P4	SNACK STAND "?" #555 Bulb 25	FRIES STAND #555 Bulb 26	COTTON CANDY #555 Bulb 27	BURGER STAND #555 Bulb 28	DRINK STAND #555 Bulb 29	(**E**) AT #555 Bulb 30	E (**A**) T #555 Bulb 31	EA (**T**) #555 Bulb 32
5: Q37 RED-GRN J12-P5	LITE SPIN #555 Bulb 33	CHICAGO LOOP LOCK #555 Bulb 34	CHICAGO LOOP JACKPOT #555 Bulb 35	LOOP POWER RIDE #555 Bulb 36	CHICAGO LOOP GREEN #555 Bulb 37	CHICAGO LOOP YELLOW #555 Bulb 38	CHICAGO LOOP RED #555 Bulb 39	PARK TYCOON #555 Bulb 40
6: Q38 RED-BLU J12-P6	EXTRA BALL #555 Bulb 41	FLYING_TURNS JACKPOT #555 Bulb 42	MULTIBALL START #555 Bulb 43	FLYING TURNS GREEN #44 Bulb 44	FLYING TURNS YELLOW #44 Bulb 45	FLYING TURNS RED #44 Bulb 46	PUKE #555 Bulb 47	START FUN (on Ramp Sign) #44 Bulb 48
7: Q39 RED-VIO J12-P8	LITE FUN #555 Bulb 49	GHOST JACKPOT #555 Bulb 50	GHOST POWER RIDE #555 Bulb 51	SUPER JACKPOT #555 Bulb 52	GHOST GREEN #555 Bulb 53	GHOST YELLOW #555 Bulb 54	GHOST RED #555 Bulb 55	GHOST STANDUP #555 Bulb 56
8: Q40 RED-GRY J12-P9	LEFT BUMPER #555 Bulb 57 DOTS	RIGHT BUMPER #555 Bulb 58 DOTS	BOTTOM BUMPER #555 Bulb 59 DOTS	ADD RIDE #44 Bulb 60	(**R**) &D #555 Bulb 61	R (**&**) D #555 Bulb 62	R& (**D**) #555 Bulb 63	START BUTTON #555 Bulb 64
9: Q41 RED-WHT J12-P10	BACK PANEL **1** (LEFT) #44 Bulb 65	BACK PANEL **2** #44 Bulb 66	BACK PANEL **3** #44 Bulb 67	BACK PANEL **4** #44 Bulb 68	BACK PANEL **5** #44 Bulb 69	LEFT TOP LANE (**A**) #555 Bulb 70	MIDDLE TOP LANE (**B**) #555 Bulb 71	RIGHT TOP LANE (**C**) #555 Bulb 72
10: Q42 RED J12-P11	BACK PANEL **6** #44 Bulb 73	BACK PANEL **7** #44 Bulb 74	BACK PANEL **8** #44 Bulb 75	BACK PANEL **9** #44 Bulb 76	BACK PANEL **10** (RIGHT) #44 Bulb 77	TROLL LIT X2 #44 Bulb 78	5000 W/FLASHING #44 Bulb 79	TOURNAMENT BUTTON #555 Bulb 80

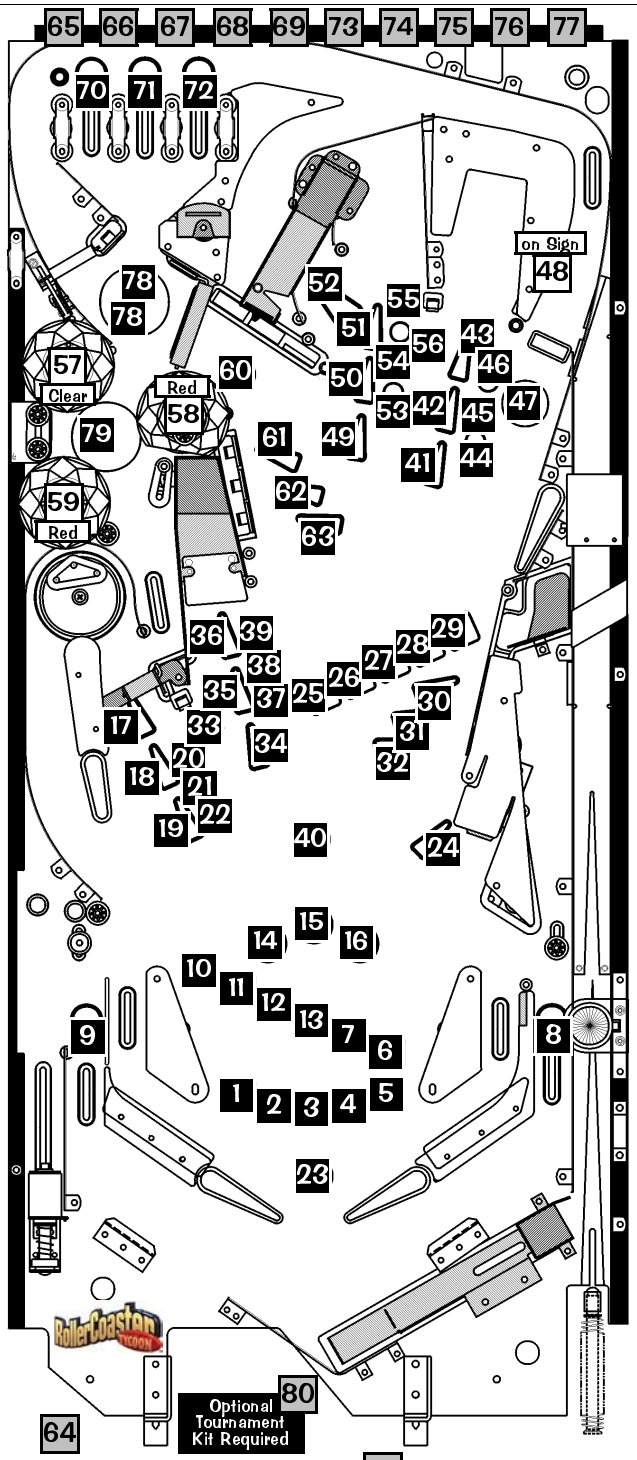
RollerCoaster TYCOON™

Find-It-In-Front:
Dr. Pinball

SWITCH MATRIX GRID LOCATIONS

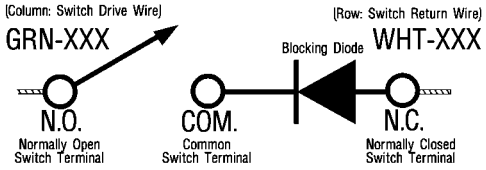


LAMP MATRIX GRID LOCATIONS

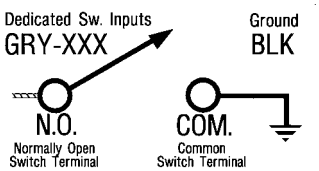


Legend Note: ☐ = Switches/Lamps mounted above P/F. ■ = Switches/Lamps mounted below the P/F. ▩ = ...mounted on Cabinet.

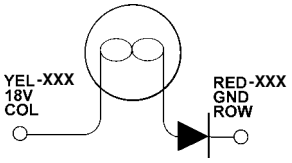
TYPICAL SWITCH SCHEMATIC



DEDICATED SWITCH SCHEMATIC



TYPICAL LAMP SCHEMATIC



Note: *All 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	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BRN-BLK	J8-P1	26-1200 090-5044-00T
#2	AUTO LAUNCH	Q2		YEL-VIO	J10-P4/5	50v DC	BRN-RED	J8-P3	24-940 090-5036-00T
#3	LOCKUP	Q3		YEL-VIO	J10-P4/5	50v DC	BRN-ORG	J8-P4	23-800 090-5001-00B
#4	1 BANK RESET	Q4		YEL-VIO	J10-P4/5	50v DC	BRN-YEL	J8-P5	27-1500 090-5004-00B
#5	1 BANK TRIP	Q5		YEL-VIO	J10-P4/5	50v DC	BRN-GRN	J8-P6	32-1250 515-6916-01
#6	3 BANK TRIP	Q6		YEL-VIO	J10-P4/5	50v DC	BRN-BLU	J8-P7	32-1250 515-6916-01
#7	ROCKET VUK	Q7		YEL-VIO	J10-P4/5	50v DC	BRN-VIO	J8-P8	24-940 090-5036-00T
Note Early Production Games: **Q7** should be **26-1200** if the top of the Rocket Bracket @ Yellow Wire Ramp ***does not have*** a **Wire Gate**. *See Sec. 4, Chp. 2, ...Assemblies..., VUK for details.*									
#8	KIOSK SCOOP	Q8		YEL-VIO	J10-P4/5	50v DC	BRN-GRY	J8-P9	23-800 090-5001-00T

High Current Coils Group 2		Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#9	LEFT BUMPER	Q9	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BLU-BRN	J9-P1	26-1200 090-5044-00T
#10	RIGHT BUMPER	Q10		YEL-VIO	J10-P4/5	50v DC	BLU-RED	J9-P2	26-1200 090-5044-00T
#11	BOTTOM BUMPER	Q11		YEL-VIO	J10-P4/5	50v DC	BLU-ORG	J9-P4	26-1200 090-5044-00T
#12	3 BANK RESET	Q12		YEL-VIO	J10-P4/5	50v DC	BLU-YEL	J9-P5	24-940 090-5036-00B
#13	TOP LEFT MINI-FLIPPER	Q13		GRY-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	BLU-GRN	J9-P6	25-1400 090-5067-00T
#14	TOP RIGHT FLIPPER	Q14		BLU-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	BLU-BLK	J9-P7	25-1600 090-5068-00T
#15	LEFT FLIPPER (50v RED/YEL)	Q15		GRY-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	ORG-GRY	J9-P8	22-1080 090-5032-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16		BLU-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	ORG-VIO	J9-P9	22-1080 090-5032-00T

Low Current Coils Group 1		Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#17	LEFT SLINGSHOT	Q17	▲ I/O Power Driver ▼	BRN	J7-P1	20v DC	VIO-BRN	J7-P2	23-800 090-5001-00T
#18	RIGHT SLINGSHOT	Q18		BRN	J7-P1	20v DC	VIO-RED	J7-P3	23-800 090-5001-00T
#19	GHOST RELEASE TRIP	Q19		BRN	J7-P1	20v DC	VIO-ORG	J7-P4	32-1250 515-6916-01
#20	UP POST (BALL DEFLECTOR)	Q20		BRN	J7-P1	20v DC	VIO-YEL	J7-P6	26-1200 090-5044-00T
#21	FLASH: LOCKUP	Q21		ORG	J6-P10	20v DC	VIO-GRN	J7-P7	#906 Bulb 165-5004-00
#22	FLASH: SHOOTER	Q22		ORG	J6-P10	20v DC	VIO-BLU	J7-P8	#906 Bulb 165-5004-00
#23	FLASH: KIOSK	Q23		ORG	J6-P10	20v DC	VIO-BLK	J7-P9	#89 Bulb 165-5000-89
#24	OPTIONAL COIN METER	Q24		RED	J16-P7	5v DC	VIO-GRY	J7-P10	Meter 5v 091-5000-00

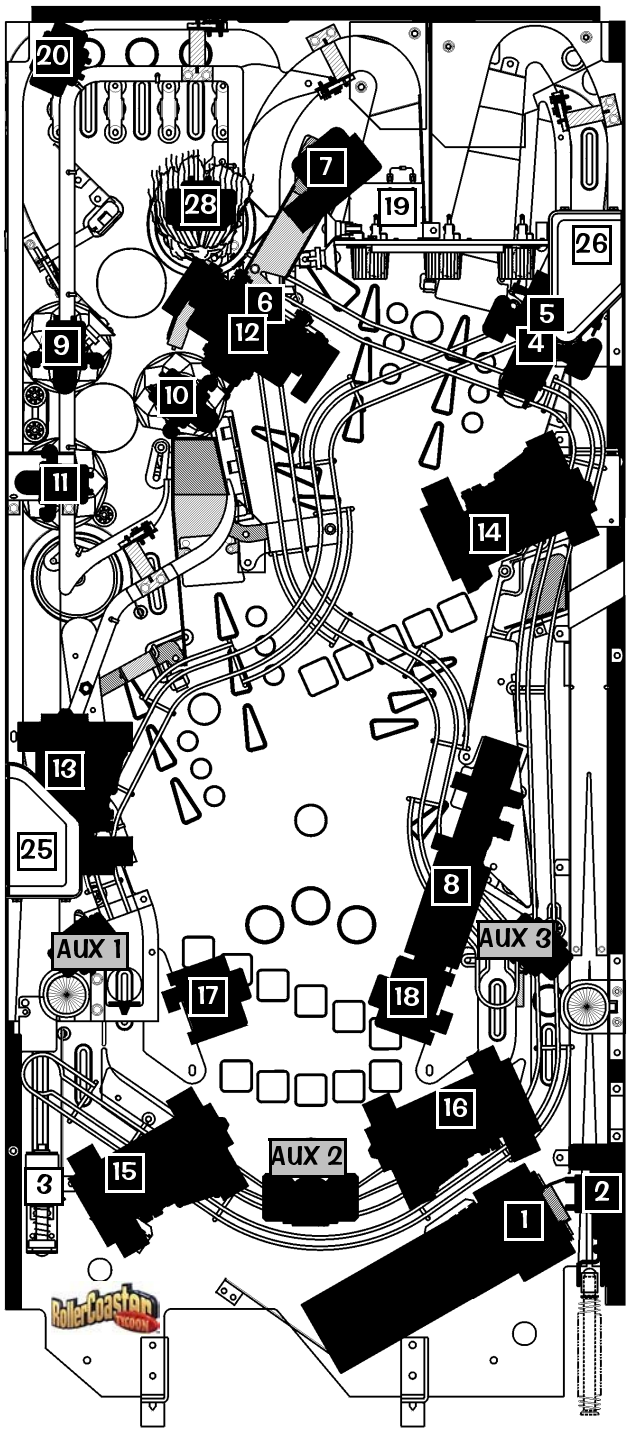
Diode **O**n **T**erminal **S**trip (if noted)

Low Current Coils Group 2		Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#25	LEFT DIVERTER	Q25	▲ I/O Power Driver ▼	BRN	J7-P1	20v DC	BLK-BRN	J6-P1	32-1800 090-5031-00
#26	RIGHT DIVERTER	Q26		BRN	J7-P1	20v DC	BLK-RED	J6-P2	32-1800 090-5031-00
#27	FLASH: BUMPERS	Q27		ORG	J6-P10	20v DC	BLK-ORG	J6-P3	#89 Bulb 165-5000-89
#28	DUMMY	Q28		BRN	J7-P1	20v DC	BLK-YEL	J6-P4	23-800 090-5001-00T
#29	FLASH: SIGN RIGHT	Q29		ORG	J6-P10	20v DC	BLK-GRN	J6-P5	#906 Bulb 165-5000-89
#30	FLASH: SIGN MIDDLE	Q30		ORG	J6-P10	20v DC	BLK-BLU	J6-P6	#906 Bulb 165-5000-89
#31	FLASH: SIGN LEFT	Q31		ORG	J6-P10	20v DC	BLK-VIO	J6-P7	#906 Bulb 165-5000-89
#32	FLASH: MIDDLE LEFT	Q32		ORG	J6-P10	20v DC	BLK-GRY	J6-P8	#89 Bulb 165-5000-89

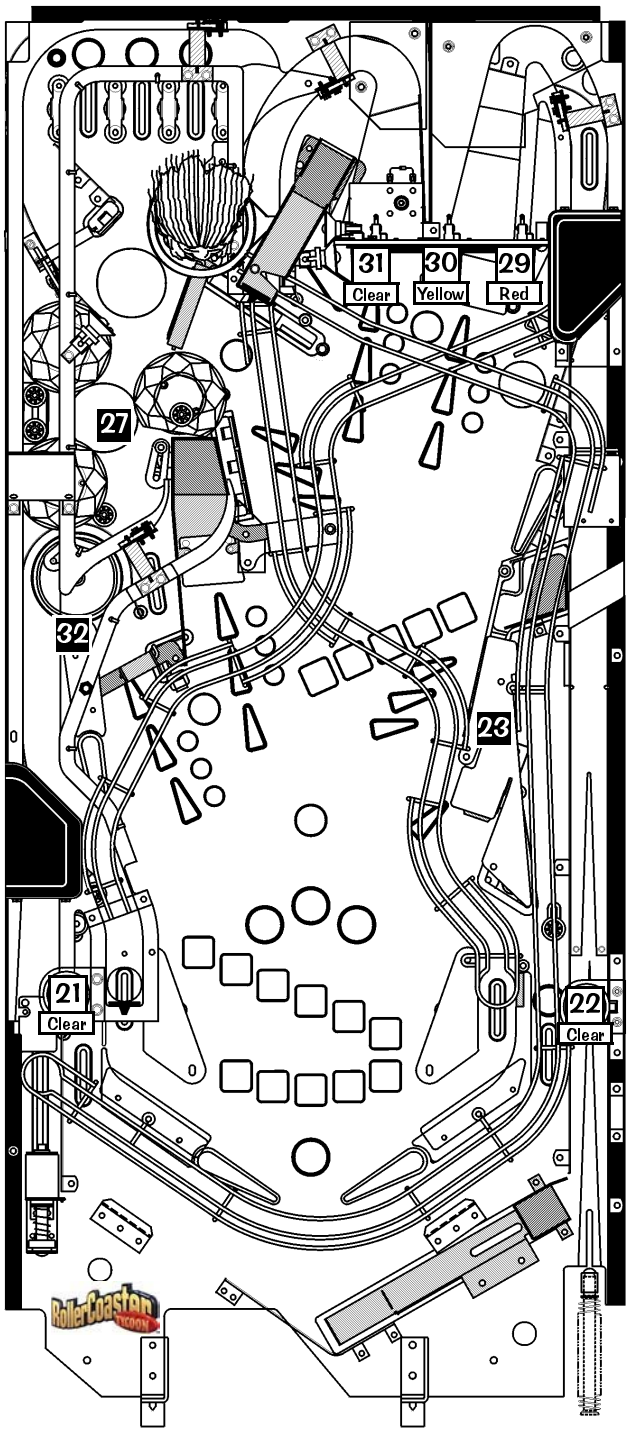
Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: Q21-Q23, Q27, Q29-Q32)

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

COIL LOCATIONS

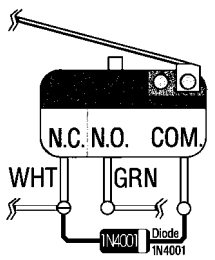


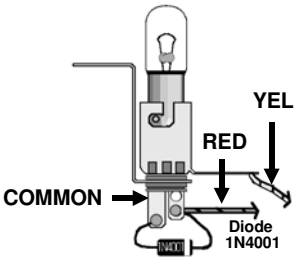
FLASH LAMP LOCATIONS

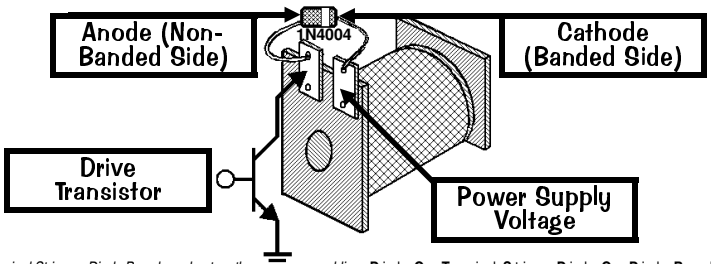


Legend Note: = Coils/Flashers mounted above P/F. = Coils/Flashers mounted below the P/F. = ...mounted in/on Cabinet.

TYPICAL SWITCH, LAMP & COIL WIRING

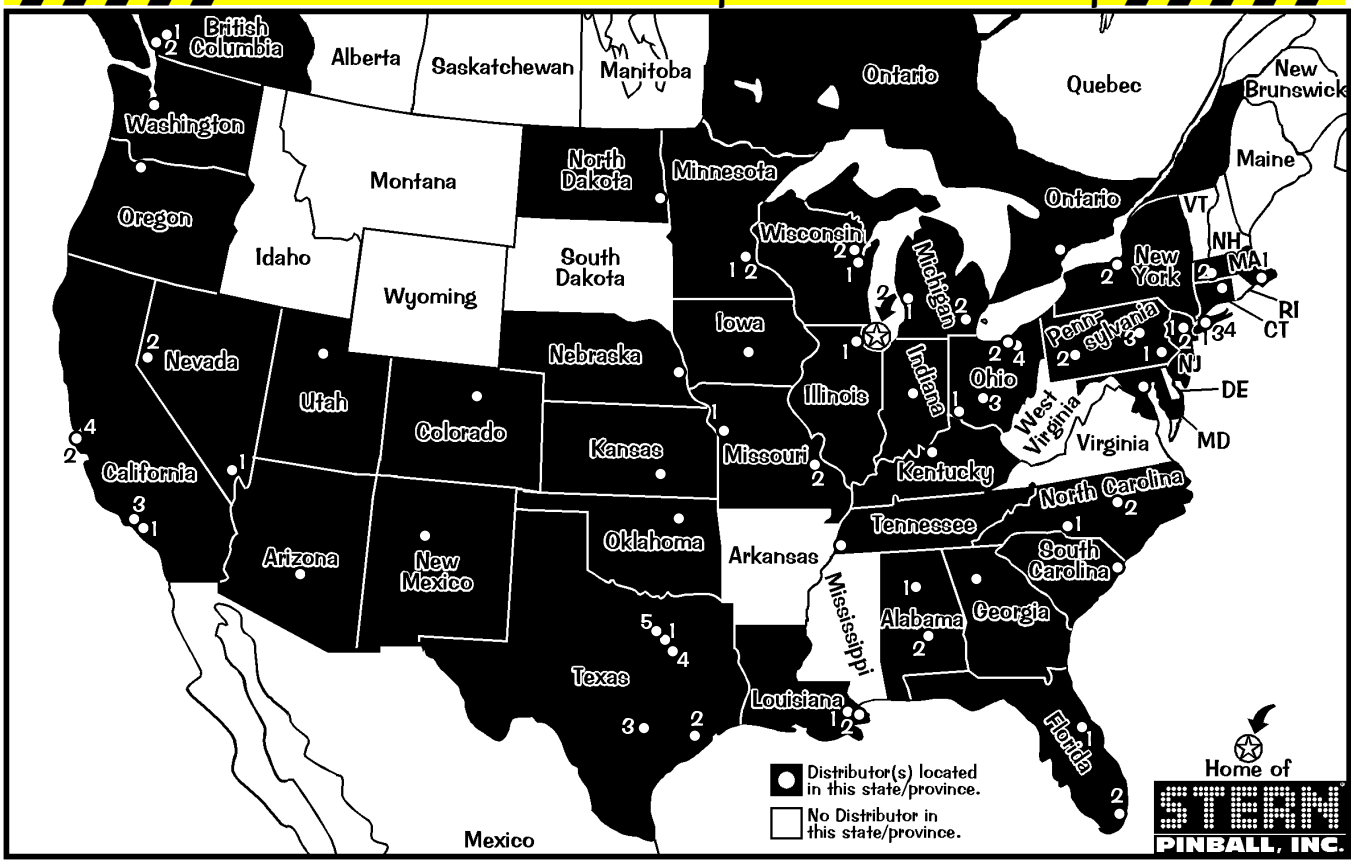




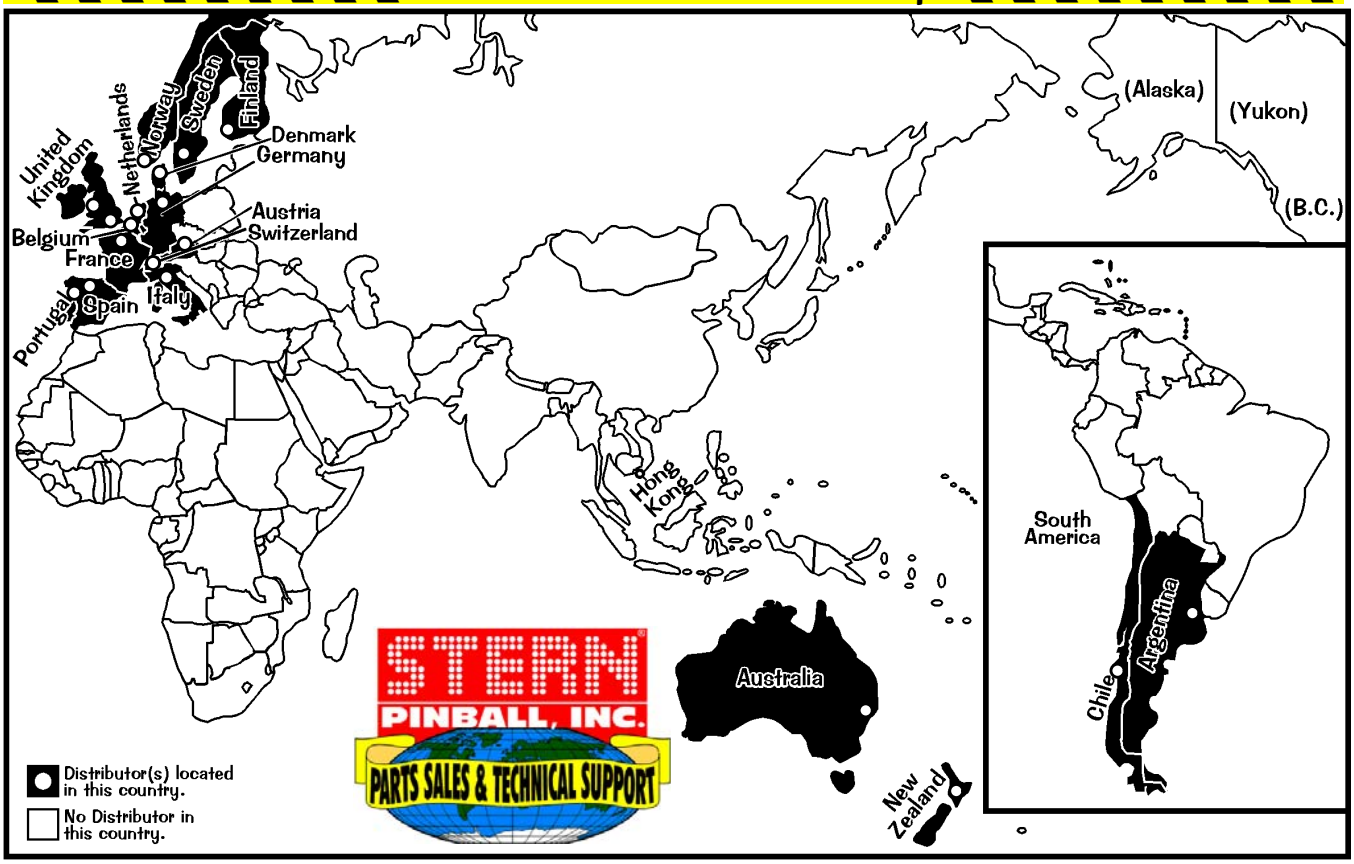


Note: *All Switch, Lamp & Coil assemblies require diodes. Some diodes are* ***located under the playfield*** *on Terminal Strips* ***or*** *Diode Boards and not on the assemblies.* **D**iode **O**n **T**erminal **S**trip ***or*** **D**iode **O**n **D**iode **B**oard.

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)
1-847-439-9400

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

World Wide Distributing
Chicago (2)
773-384-2300

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

Moss Distributing
Des Moines
1-515-266-6422

INDIANA
Atlas Distributing
Indianapolis
1-317-786-6892

Shaffer Distributing
Indianapolis
1-317-899-2530

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

KENTUCKY
Atlas Distributing
Louisville
1-502-966-5266

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

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

MARYLAND
Betson Enterprises
Baltimore
1-410-646-4100

Weiner Distributing
Baltimore
1-410-525-2600

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

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

MICHIGAN
Atlas Distributing
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

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

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

Deith Distributing
Roslyn Heights (4)
1-516-621-1234

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

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

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

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

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

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

OKLAHOMA
Galaxy Distributing
Tulsa
1-918-835-1166

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
Green Coin
Mrytle Beach
1-843-626-1900

TENNESSEE
Brady Distributing
Memphis
1-901-345-7811

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

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

H.A. Franz, & Co.
Houston (2)
1-713-523-7366
San Antonio (3)
1-210-226-6322

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

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

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

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

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

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

AUSTRALIA
Amusement Mach. Dist.
Matraville
[61] 2931-66000

AUSTRIA
TAB
Ansfelden
[43] 72-297-8660

Parts & Service Only:

R. Rupp
Kaindorf, Austria
[43] 3452-86105

BELGIUM
Namusco
Brussels
[32] 2414-4596

CHILE
Cuinsa
Santiago
[56] 2641-8520

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

FINLAND
Pelika Ray-Oy
Espoo
[35] (0) 5892-90452-99

FRANCE
Avranches Automatic
Ducey
[33] 2338-96162

SFA
Paris
[33] 1532-68082

GERMANY
Bergmann Automaten
Hamburg
[49] 4101/30 24-0

HONG KONG
Topfull Amusement Mach.
Kowloon
[85] 2278-10456

ITALY (RSM)
Tecnoplay S.A.
San Marino
[39] 5499-00361

NETHERLANDS
JVH Gaming Products
Tilburg
[31] 13-595-3200

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

Parts & Service Only:

Amco Machine Supplies
Auckland, New Zealand
[64] 9846-7606

NORWAY
Vendcomatic
Oslo
[47] 2291-8383

PORTUGAL
Jacinto & Martins, S.A.
Belas
[35] 1214-325624/38

SPAIN
Comercial Cocomatic
Madrid
[34] 9167-16980

SWEDEN
Bjuvia Fritid AB
Bjuv
[46] 4238-6900

SWITZERLAND
Novomat, A.G.
Harkingen
[41] 6238-88961

UNITED KINGDOM
Electrocoin
London, England
[44] 2089-652055

Parts & Service Only:

Electrocoin Aftersales
Cardiff, S. Wales
[44] (0) 2920 343888

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**

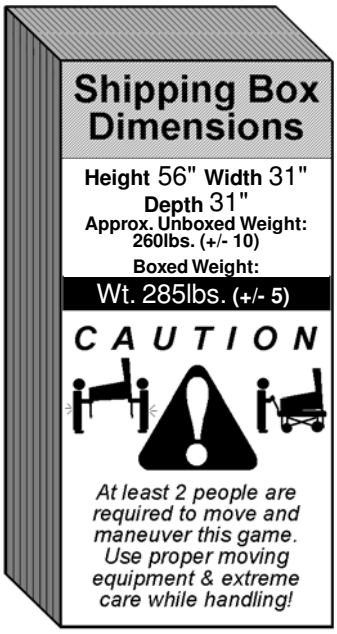
TRANSPORTATION

BEFORE TRANSPORTING

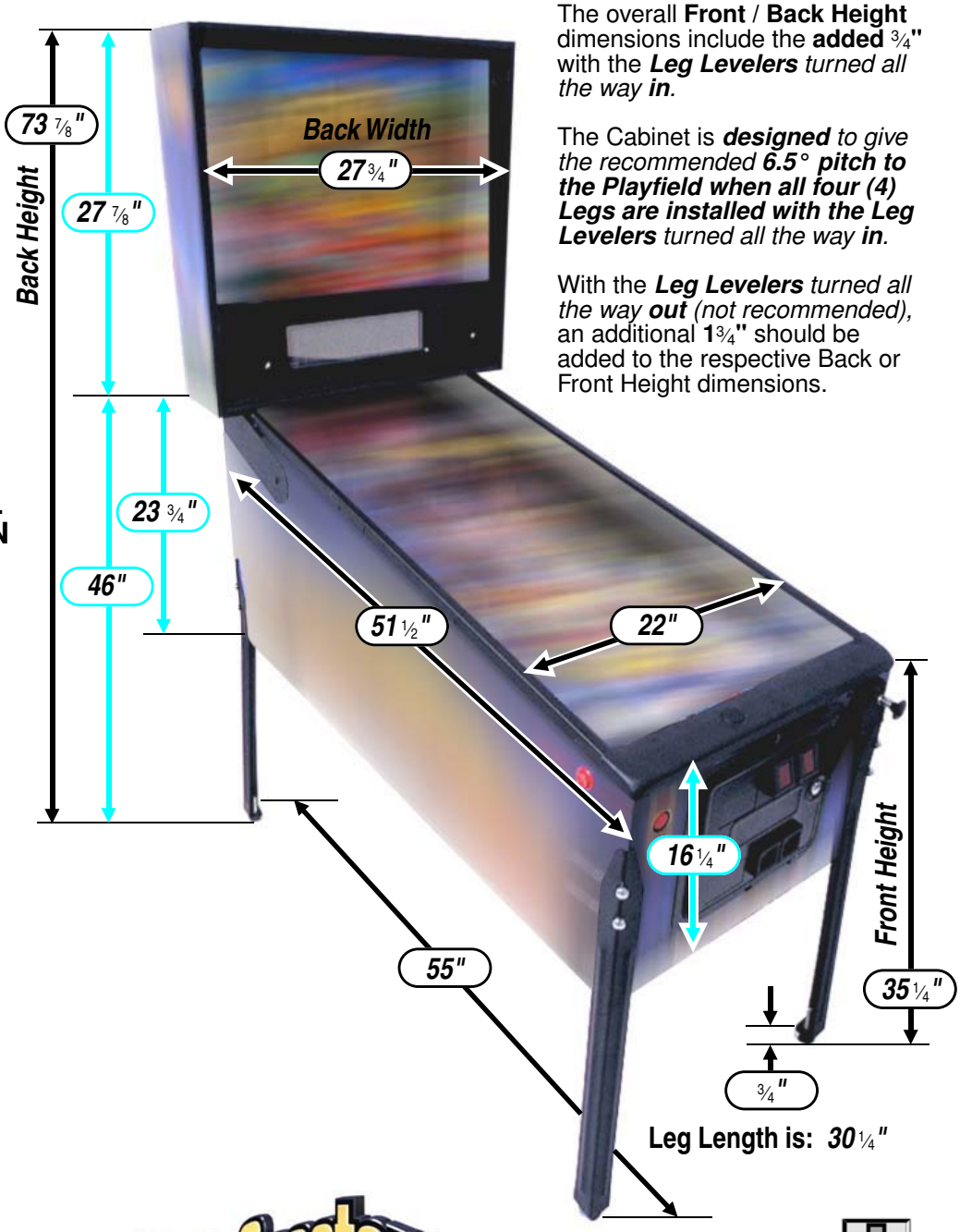
To reduce the possibility of damage, observe **ALL** precautions whenever transporting the game.

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 !



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 1/4"***

RollerCoaster TYCOON™

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

After Set-Up

Pinball Game Set-Up Procedures

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

With the Back Glass Removed:

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

With the Playfield Glass Removed:

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

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

4. Raise the playfield and support it, by lifting the **Prop Rod** *(located on the left, inside the cabinet).* The end of the Prop Rod should be placed into the hole under playfield. See the illustration **"Easy Access Service System - 3 Positions"** *on Page 4.*

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

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

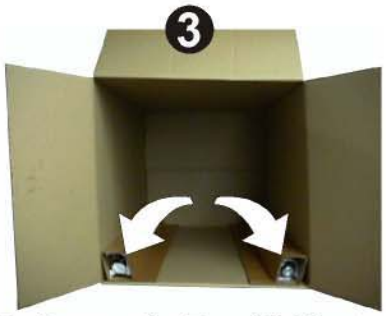
Open up the Printable Version in both 8-1/2 X 11 & 11 X 17.

Pinball Game Set-Up Future Reference

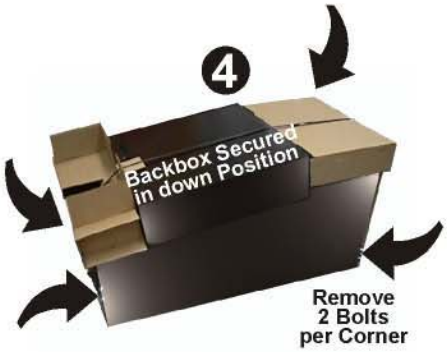
CAUTION: At least 2 people are required to move and maneuver game.
Use proper moving equipment & extreme care while handling. Pinball game is 260lbs (+/- 10).
Refer to Game Manual for further Game Set-Up Procedures (Sec. 1, Chp. 1) and other important information!
TOOLS REQUIRED: 5/8" Socket Wrench &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

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

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



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



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

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

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

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

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

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

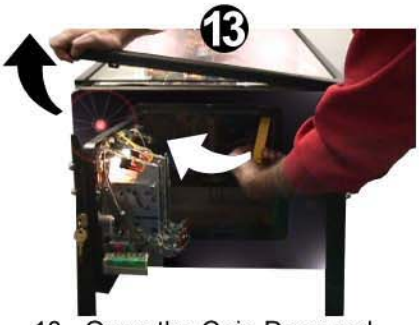
Pinball Game Set-Up Future Reference Continued

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

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

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

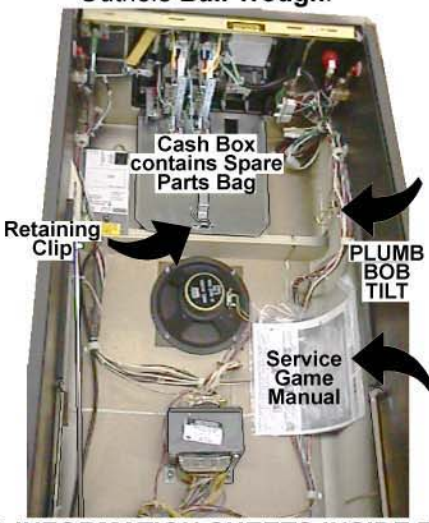
NOTE: KEYS are tied to the **Shooter Rod*** *(if equipped)* or taped to the **Playfield Glass** *(if equipped with Auto Plunger Button). Remove keys. One (1) set of keys opens the Coin Door, the other set is used to unlock the* ***Back Glass*** *to gain access to the White Star Board System.*



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

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

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

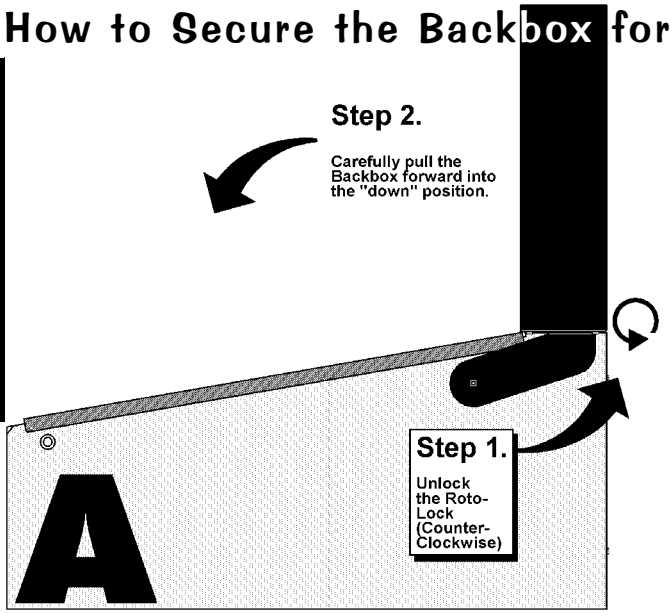


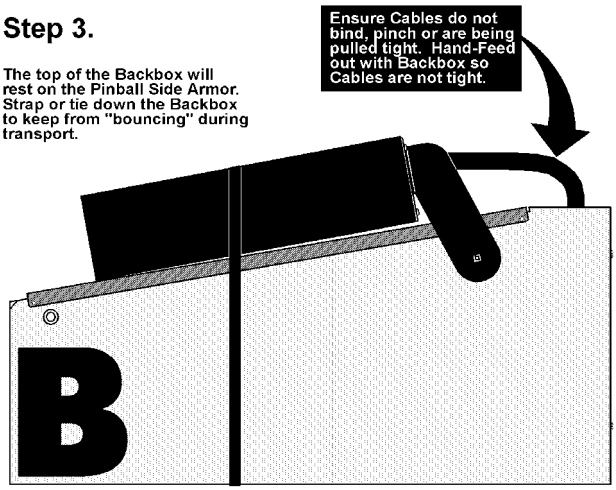
Remove the **PINBALL GAME MANUAL** *(stapled to side of the left wall of the cabinet). Review Section 1, Chapter 1, which describes how to lift the playfield to access the Plumb Bob Tilt Assembly.* The manual gives you all the important information you need to prepare for final set-up and other important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

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

How to Secure the Backbox for Transporting

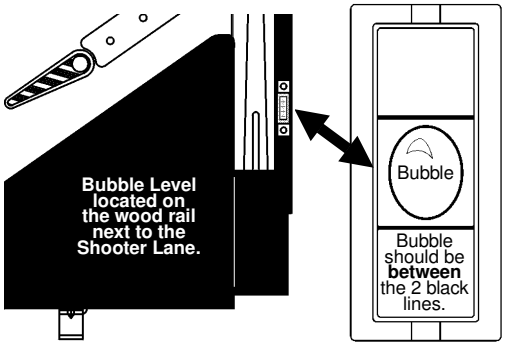
*For more Backbox details & part numbers, see Section **4**, Chapter **1**, **Backbox Assembly**, Pages 60-61.*





Leg Leveler Adjustment

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

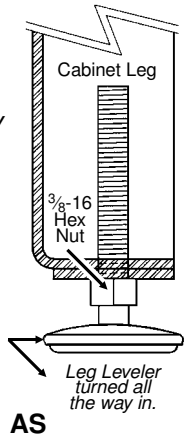


Start adjustment with the leg levelers *turned all the way in.*

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.



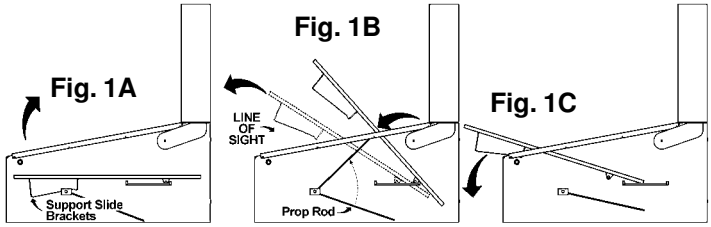
YOUR PLAYFIELD PITCH IS NOW AT 6.5° AS REQUIRED FOR PROPER GAME PLAY!

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

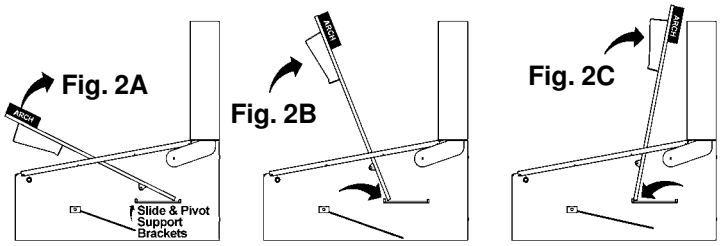
Easy Access Service System - 3 Positions

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

Positions 1 & 2
When lifted high enough, the ***Playfield Support Slide Brackets*** (**Fig. 1A**) can be seen & can clear the cabinet front. At this time, pull the playfield toward the front of the cabinet, checking that the mechanical components clear the cabinet front, then rest the playfield on the ***Playfield Support Slide Brackets*** at the front channel of cabinet (**Fig. 1C**); Or, the ***Prop Rod*** (located on the right inside of cabinet) can be used by positioning the ***Prop Rod*** end into the receiving playfield hole (**Fig. 1B**).



Position 3
With the playfield at rest, hold the sides & pull toward the front of the cabinet (approx. 6" to 8"), until resistance is felt from ***Edge Slide Brackets*** stopping against the ***Slide & Pivot Support Brackets*** located on either side of the cabinet (**Fig. 2A**). At this time, swivel the playfield toward the Backbox, then rest on the top edge (**Fig. 2B & 2C**).



Game Operation & Features

Start of Game Features

Starting a Normal Game

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

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

Starting Team Play (Doubles!)

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

Starting League Play

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

Starting Tournament Play with ToPS

This Pinball Game is **ToPS™ (Tournament Pinball System) Ready**. ***Optional Tournament equipment & hardware (sold separately) is required.*** Unlike a *"Normal Game"*, the Tournament Game is started by depressing the **Tournament Start Button** *(located on the Front Molding, if installed).* If adequate credit(s) are posted **and** a ***Tournament is started*** via **Portals™** *(select the "TOUR" Icon in the Main Menu)*, the **Tournament Start Button** will flash. *Any adjustments or installs changed will not be in affect. Starting a Tournament Game defaults to preprogrammed Tournament Rules (e.g. No Extra Balls, Specials or Bonus Credits are awarded); however, starting a Normal Game after a Tournament Game will then revert back to any unique adjustments or installs performed previously.* **During** and **End of Game Features** operate in the same manner *(differences in adjustment defaults are present). Review Section **3**, Chp. **7**, **GO TO TOURNAMENT MENU**, for more info!*

During Game Features

Feature Mode & Combination Shots

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

Multiball

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

Replay Feature

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

End of Game Features

Game Endings

When all player(s) have played all balls (including any Extra Balls), the game ends. If power is interrupted during the course of a game, it will end that game (***see Starting a Normal Game***). Closure of the Plumb Bob Tilt Switch according to the number of tilts set, **Adj. 09, Tilt Warnings** (Default = **01**) or prolonged closure, will end the current Ball-In-Play. Closure of the Slam Tilt Switch on the Coin Door ends the current game(s).

Match Feature

At the end of each ball, earned bonuses are collected. At the end of the last ball of a game (including any extra balls, if applicable), earned bonuses are collected, then the system produces a random 2-digit number (a multiple of 10; 00 to 90). Matching the last 2 digits of the player's score with this number awards a credit. In **Adj. 07, Match Percentage** (Default = **8%**) can be changed from 0-10%. Changing the percentage to **0% displays** the *"Match Animation"* at the end of the game, however, will never match nor award anything. Changing this adjustment to **OFF** will **not display** the *"Match Animation"* nor award anything.

Entering Initials/Name

If player achieved a new *High Score* in a game or achieved a *Special Feature (if given)* the player may enter 3 Initials. In **Adj. 24, High Score Initials** (Default = **3 Initials**) can also be changed to **10-Letter Name**. Use the **Flipper Buttons** to choose a letter or character as seen on the Dot Display. Hitting the **Start Button** locks in the letter or character and proceeds to the next letter. The game then proceeds into the ***Game-Over Mode*** and then to the ***Attract Mode***.

Note: ***Adj. 26, Custom Message*** *(Default = **ON**) can be displayed during the Attract Mode; enter letters in the same fashion.*

*For more details on Adjustments, see Sec. **3**, Chp. **4**.*

Continued Next Page.

Auto Percentaging

This game is equipped with Auto Percentaging, **Adj. 01, Replays: Fixed/Auto** (Default = **12%**, adjustable). The *Replay Percent* is automatically adjusted or you can set a *Fixed Replay Score*. Four levels may be selected. Adjustments allow awarding of a "CREDIT" (or your setting) as each level is exceeded. This can be adjusted with, **Adj. 03, Replay Award** (Default = **CREDIT**). With the ***Autopercentage Feature***, if the actual replay percentage is higher or lower than that desired, the game will automatically adjust for the new recommended percentage score(s). You may choose to make a different "score-to-beat" adjustment; this is done by utilizing **Adj. 02, Replay Levels**. *For more details with **Adjustments**, see Section **3**, Chapter **4**, **GO TO ADJUSTMENTS MENU**; also, see see Section **3**, Chapter **5**, **GO TO INSTALLS MENU** for further customization of your Pinball Game.*

Instruction Card

Below is a **COPY** of the Game Instruction Card (SPI Nº: 755-5178-00 USA) which is included with every game. If your card is lost or damaged, simply **COPY** this page and *cut out* the Instruction Card as a *temporary replacement* until a *new card is ordered.*

(***Hint:*** **COPY & CUT** along the dotted line and fold in the center to keep the "COPY" sturdy.)

COPY & CUT

RollerCoaster TYCOON™

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

FOLD HERE

OBJECT: Turn on rides & get as many **Guests** into the amusement park as possible.

TURN ON RIDES: Change the flashing **Red Light** to **Yellow** then **Green** by shooting at that ride.

MULTIBALL: Turning on rides lites **Lock**. **Lock 2 Balls** by shooting at the **Left Ramp** (Chicago Loop). Then shoot for the **Right Ramp** (Flying Turns) to start Multiball.

JACKPOT: In Multiball, shoot at the **Flashing Arrows**. These are the rides you have **already opened**.

SUPER JACKPOT: After **completing all Jackpots**, shoot the **Rocket Roller Coaster** for Super Jackpot.

EXTRA BALL: Complete all **Food Stands** or put the specified **number of Guests** in your amusement park for an **Extra Ball**.

START FUN: When Start Fun is lit, shoot to hit the **Maintenance Man** in the back of the head. Follow the directions on the **Dot Matrix Display** for that mode.

PARK TYCOON: When all modes are completed, **Park Tycoon** will lite.

HINT: Put as many **Guests** in your park as possible!

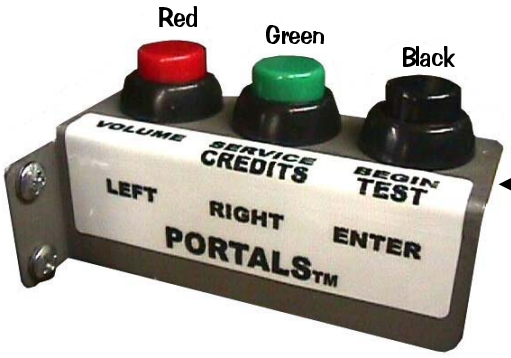
RollerCoaster TYCOON™

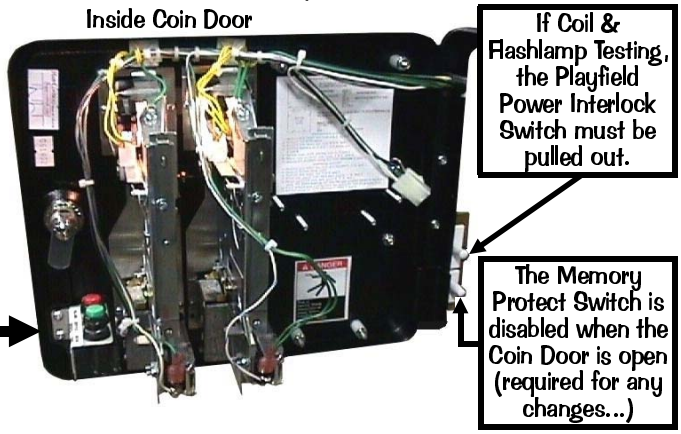
SPI PART Nº: 755-5178-00 USA

Section 3
Service Menu System
Table of Contents

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***.





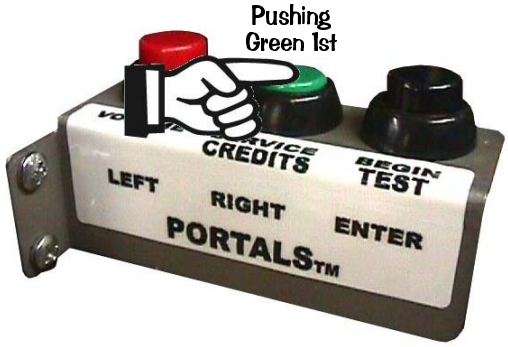
To access any of these ***three (3) functions*** you must first open the **Coin Door** (see pictorial above) with the Game in the ***Attract Mode*** *(not already in any Function or Menu stated below).*

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.*

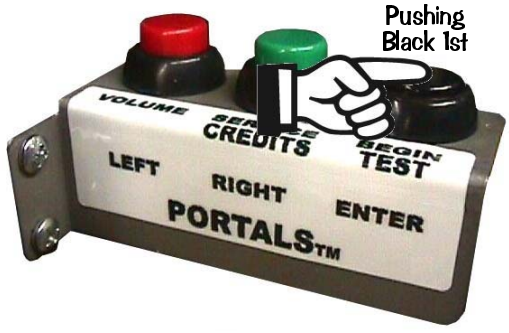
Set between **0** and **31**; **15** is the *Factory Default*. Once your adjustments are made, this menu will ***automatically exit*** a few seconds after the last button depression.



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. 11**, **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 25***, ***Free Play****, is set to* ***YES****. The Service Credits are limited to the Credit Limit in addition to any paid credits present in the game (e.g. If the Credit Limit is 30, and there are 8 paid credits present, only 22 Service Credits can be applied.).*



Function 3, Portals™ Service Menu

Pushing the ***Black Button*** ***(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!***

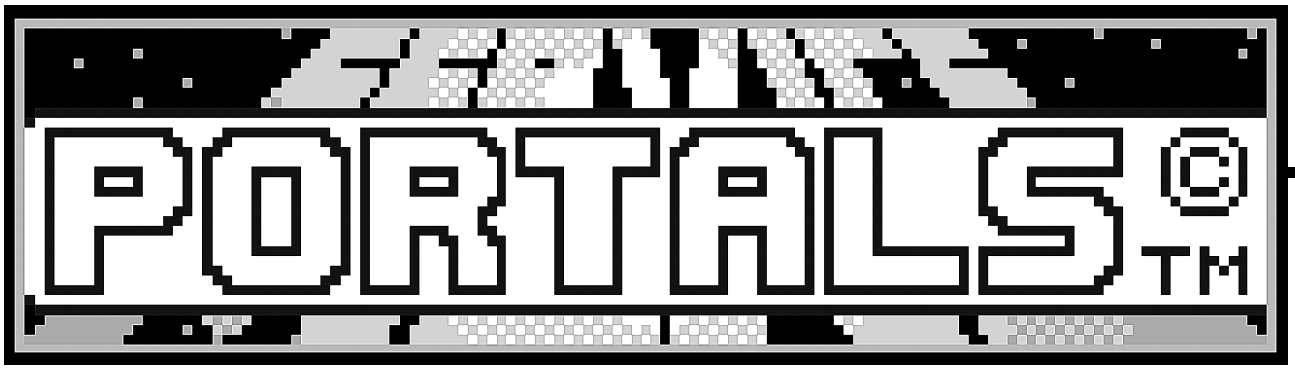
Portals™ Service Menu Introduction

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 previous and 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. After Power-Up, push down the **Black "BEGIN TEST" Button** to begin. Looking at the display you will momentarily see "**Service Menu**" with a *satellite flying from right to left pulling a banner* "**Portals©TM**" followed by the **MAIN MENU**:



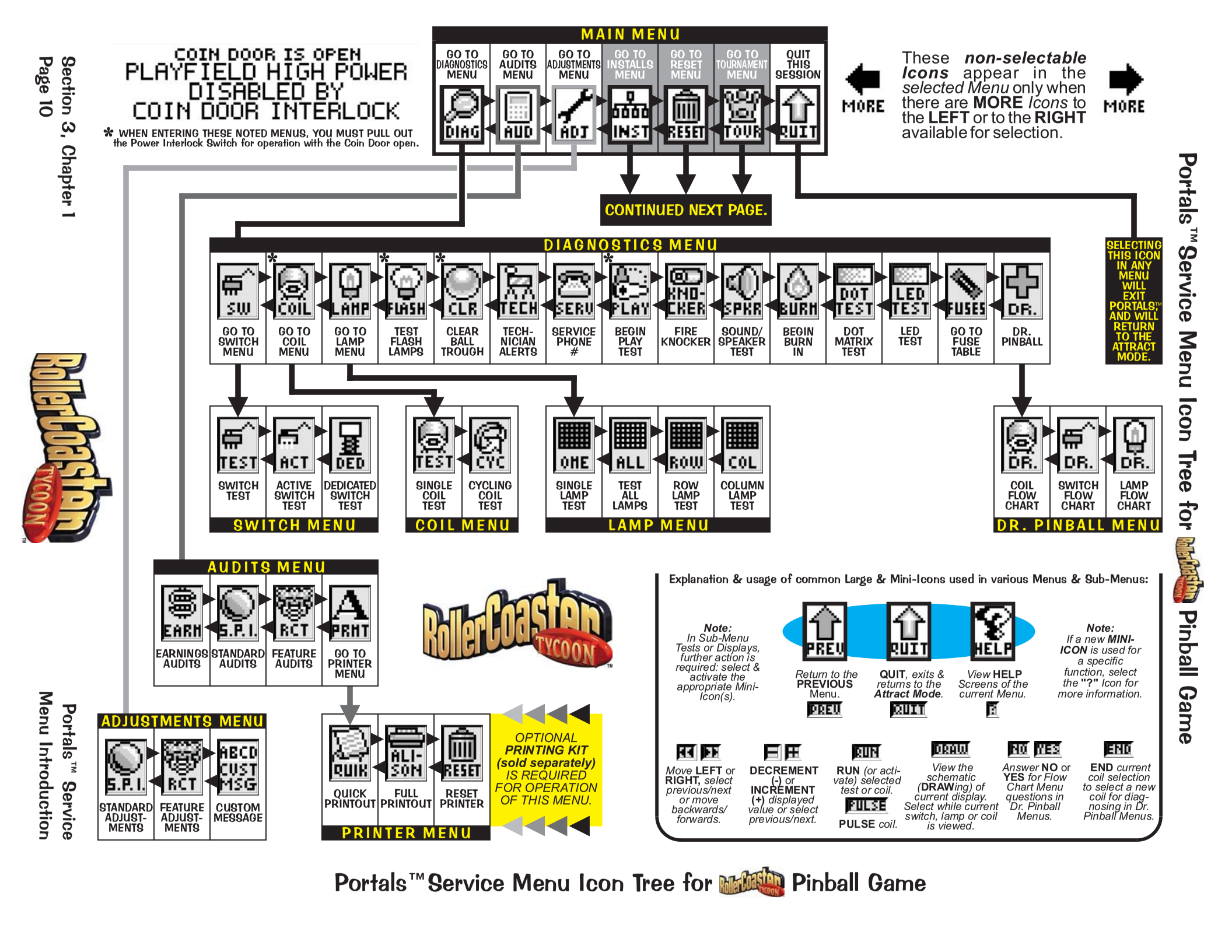
Use the **Red "LEFT" & Green "RIGHT" Buttons** (or **Left** & **Right Flipper Buttons**) to move the selected ***Icon*** left or right, and the **Black "ENTER" Button** (or **Start Button**) to activate the selected ***Icon***. The use of the Service Switch Set (**Red**, **Green**, & **Black Buttons**)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

The **MAIN MENU** now appears with the "DIAG" *Icon* (**GO TO 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. The "HELP" *Icon* & "?" *Mini-Icon* provide explanation of **ICON** usage in the Menu where the "HELP" *Icon* or "?" *Mini-Icon* was selected. View **QUIT THIS SESSION** (**Exiting the Portals™ Service Menu**) at the end of this chapter *(reference Section **3**, Chapter **1**, **Portals™ Service Menu Introduction**).*

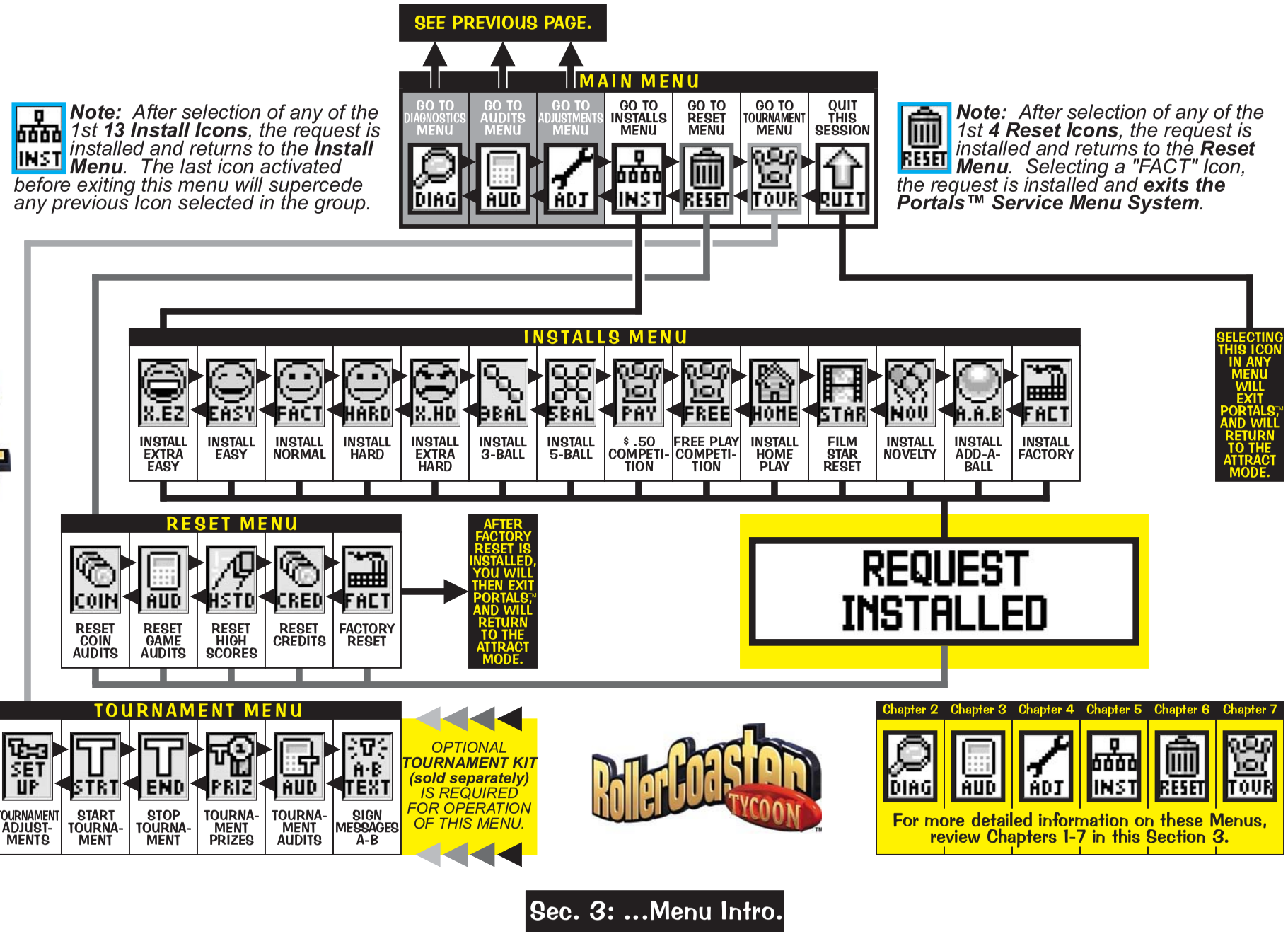
The **chapters** in this **section**, which coincide with the **MAIN MENU**, will also provide more detailed information. ***Use both the manual and the display to help customize, troubleshoot and/or diagnose faults, if any.***



Portals™ Service Menu Icon Tree for RollerCoaster Tycoon Pinball Game

Portals™ Service Menu Icon Tree for RollerCoaster Tycoon Pinball Game

Portals™ Service Menu Icon Tree for RollerCoaster Tycoon Pinball Game Continued



Portals™ Service Menu Icon Tree for RollerCoaster Tycoon Pinball Game Continued

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, and Sub-Menu 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 on Button Usage, select & *activate* the "HELP" *Icon* or "?" *Mini-Icons.*

EXPLANATION & USAGE OF COMMON LARGE & MINI-ICONS USED IN VARIOUS MENUS & SUB-MENUS:

These ***non-selectable Icons*** appear in the *selected Menu* only when there are **MORE** Icons to the **LEFT** or to the **RIGHT** available for selection.

Select and activate to return to the **PREVIOUS** Menu.

Select and activate to **QUIT**, *exits & returns to the* ***Attract Mode***.

Select and activate to view **HELP** *Screens of the current Menu*.*

Select and activate to:

Move **LEFT** or **RIGHT,** *select previous / next or move backwards / forwards.*

DECREMENT (-) or **INCREMENT (+)** *displayed value or select previous / next.*

RUN *(or activate) selected test or coil*

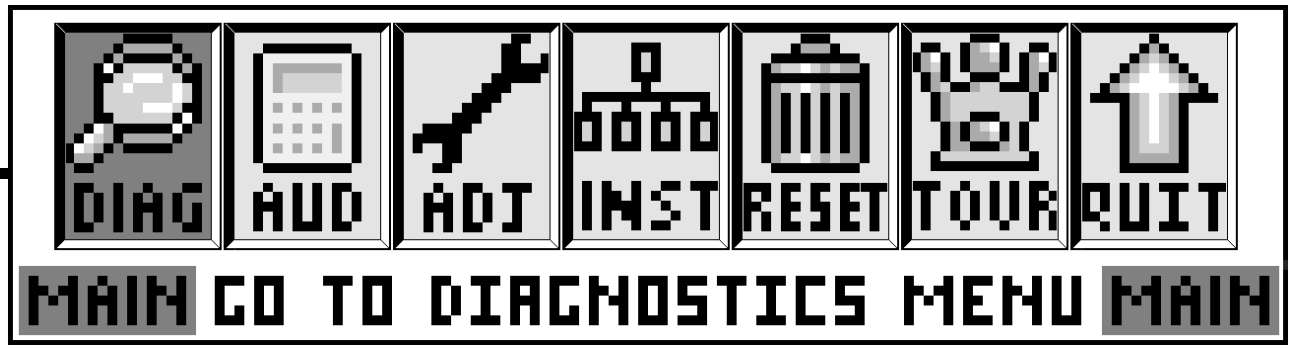
PULSE *coil.*

*View the schematic (***DRAW****ing) of current display. Select while current switch, lamp or coil is viewed.*

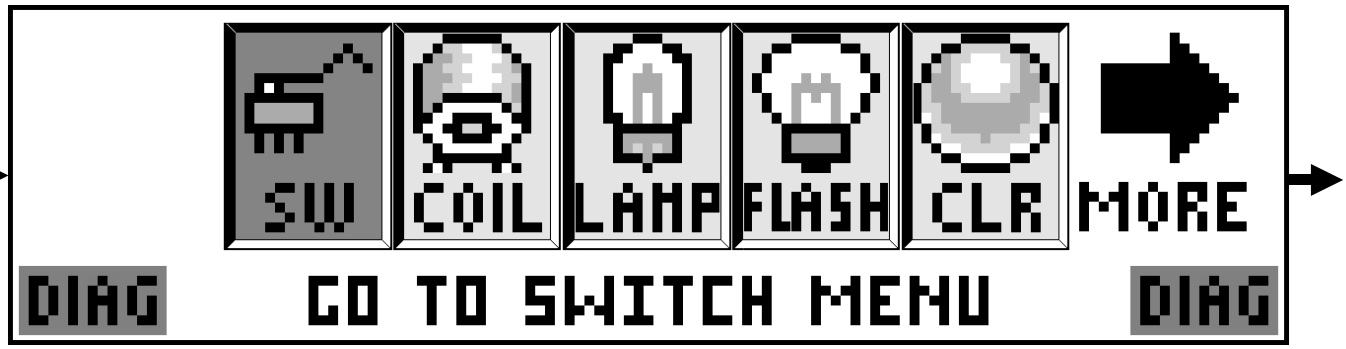
**** Help Note: An explanation of each Mini-Icon at that menu level will cycle continuously. To exit a display where no Mini-Icons are available for selection, pressing any button will exit the display.***

Example:

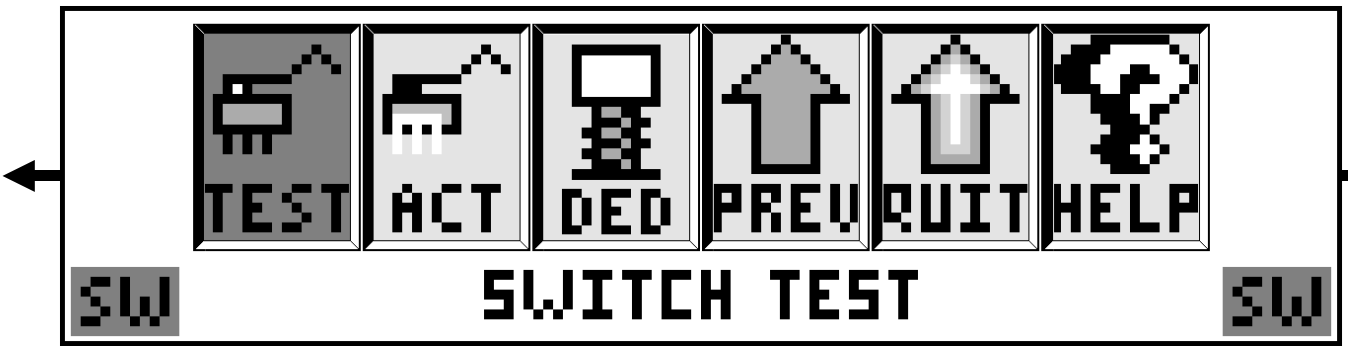
After entering **Portals™**, the **MAIN MENU** now appears with the **"DIAG"** *Icon* (**GO TO DIAGNOSTICS MENU**) flashing:



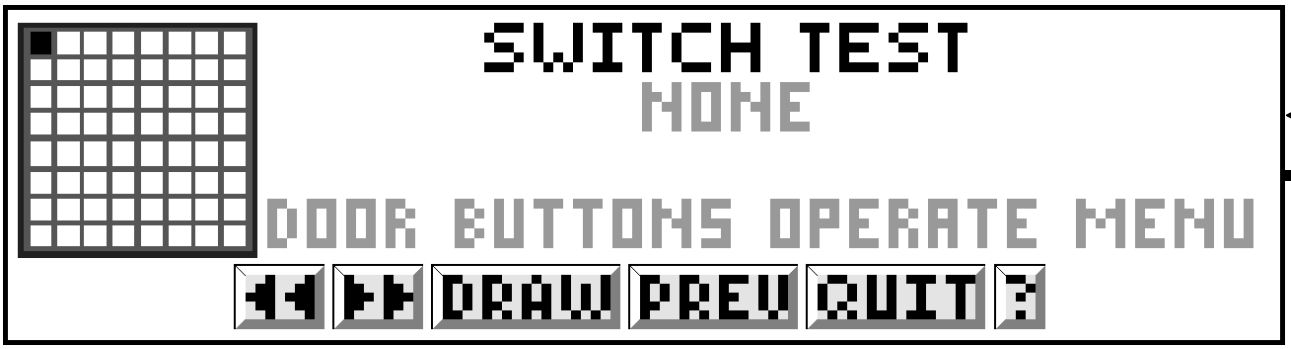
Press the **Black "ENTER" Button** to *activate* this **ICON**. The **DIAGNOSTICS MENU** now appears with the "SW" *Icon* (**GO TO SWITCH MENU**) flashing:



Press the **Black Button** to *activate* this **ICON**. The **SWITCH TEST MENU** now appears with the "TEST" *Icon* (**SWITCH TEST**) flashing:

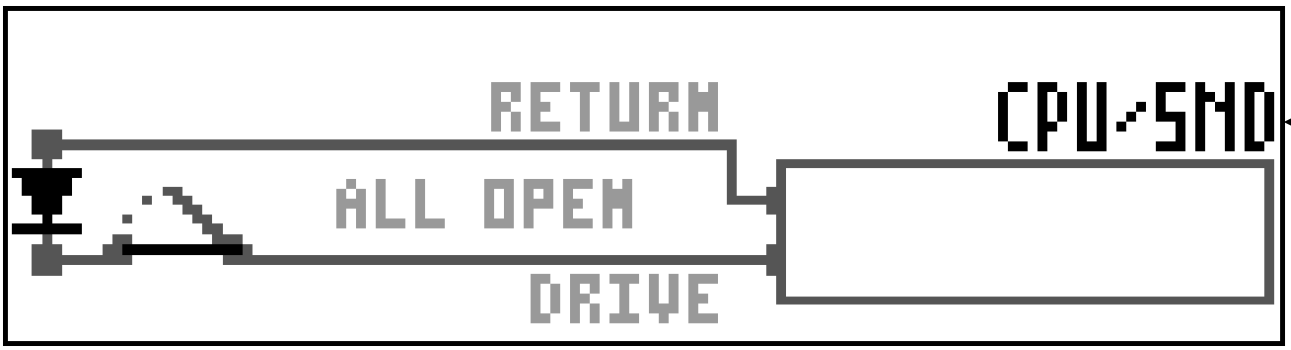


Press the **Black "ENTER" Button** to *activate* this icon. The **Switch Test Display** now appears.



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.



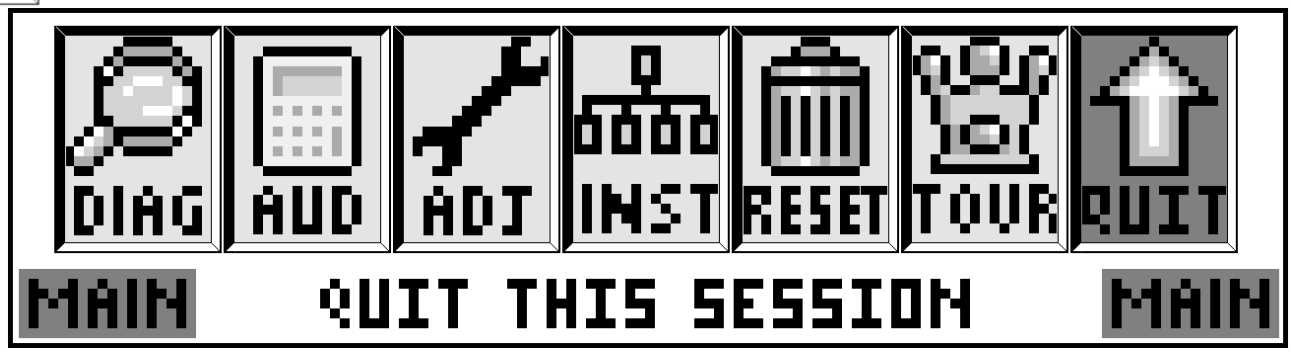
To ***exit any display where there are no Mini-Icons*** *(Schematics or Help Displays)*, ***press any button*** to return to the previous Menu.

While in **Switch Test** or **Active Switch Test**, the **Flipper & Start Buttons** are deactivated (because they can be part of these tests). 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 "<<" or ">>" *Mini-Icon* is *activated*, the display will go to (slip between) the previous tests *(Active & Dedicated Switch Tests).* Use either the **Red** or **Green Button** to select the "PREV" *Mini-Icon.* Press the **Black "ENTER" Button** to return to **Switch Test Menu**. To exit out of this Sub-Menu, select and *activate* the "PREV" *Icon* in the Menu. The **DIAGNOSTICS MENU** now appears with the "SW" *Icon* (**GO TO SWITCH MENU**) flashing. Go through other ***Diagnostics*** selections or exit.

To exit the **Portals™ Service Menu**, select & *activate* the "QUIT" *Icon (see the next page).*

QUIT THIS SESSION (Exiting the Portals™ Service Menu)

In the **MAIN MENU** and in all **SUB-MENUS**, if the "QUIT" *Icon* or "QUIT" *Mini-Icon* is selected and *activated*, the **Portals™ Service Menu Session** will be exited and returned to the ***Attract Mode***.



The game will go into the same *Power-Up Routine* as if turning on the game. Upon **Power-Up**, the CPU Game Code & Display Code versions with Check-Sums are shown, followed by the Location ID & Game ID Numbers and Alerts, if any *(see Section **3**, Chapter **2**, **GO TO DIAGNOSTICS MENU**, **Technician Alerts**).*

The below **Problem** / **Solution Table** was designed to answer some common problems frequently asked.

Problem / Solution Table

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/Sound Board, Connector **CN6**. • Check CPU/Sound Board for possible failure.
All Service Buttons (**Red, Green** and **Black**) appear nonfunctional.	• Check the Service Switches wiring harness for poor or no connection and/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 Switches wiring harness for poor or no connection and/or broken wires.
The **Display** "blanks out."	• Check the Dot Matrix Display for loose wiring harness for poor or no connection and/or broken wires. • Check **F1** (3/4A Fuse) on the Display Power Supply Board. Refer to Sec. **5**, Chp. **4**, **SCHEMATICS & TROUBLESHOOTING**.
Icons *"scroll"* along continuously in the **MAIN MENU**.	• Check for a stuck switch on the **Green Button**. • If the Service Switch Set and/or the Coin Door was replaced, ensure the Locking Mechanism on the **Green Button** was 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. Refer to Section **3**, Chapter **2**, **GO TO DIAGNOSTICS MENU**, **Switch Test**.
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. Refer Section **3**, Chapter **3**, **GO TO PRINTER MENU**.
Some *Icons* appear non-functional in the **GAME SPECIFIC MENU** under the **DIAGNOSTICS MENU**.	• If there is no other test under this Menu, the "<<" & ">>" *Mini-Icons* will appear not to function. The remaining *Icons* should function as normal. ***Note:*** *If there is no "Go To (Game Name) Test(s), the "GAME NAME" Icon will not invoke another display.*
The display returns to the **ATTRACT MODE** exiting the Service Session after a **FACTORY RESET**.	• This is normal. After a **FACTORY RESET**, the Service Session is automatically exited. Refer to Sec. **3**, Chp. **6**, **GO TO RESET MENU**, **Factory Reset**.
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 the start of this Chapter).*
In **ADJUSTMENTS MENU**, with the Coin Door **CLOSED**, adjustments are not getting changed as desired (using the **Flipper** & **Start Buttons**).	• 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 "LEFT"** to decrease / decrement (-) or **Green "RIGHT" Button** to increase / increment (+) the volume.
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.

Go To Diagnostics Menu

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)*. 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 Name' Tests**) may be used for troubleshooting. All *Icons* and there usages are explained throughout this chapter in order.

Important: *Upon* ***Power-up****, opening the* ***Coin Door*** *or exiting* ***Portals****™, watch the* ***Display*** *for any* ***Alerts.***

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 Sec.* ***5****, Chp.* ***4****,* ***PCBs****).*

This ***flashing display*** is shown immediately upon opening the **Coin Door** as a reminder that **20v/50v DC** power to the playfield is **disabled**. All electro-mechanical devices *(such as Coils)* ***cannot be tested*** with the switch pushed in. **PULL OUT** the **Power Interlock Switch** ***ONLY*** if you're in a ***Testing Menu*** requiring power. See ***Access & Use*** in Chapter **1** of this Section for the location of this switch. *Closing the* ***Coin Door*** *will automatically reset this switch.*

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 *(more details in this Chapter,* ***Technician Alerts****,* ***Pages 24-25****).*

If this ***display flashes*** *(along with an audible sound),* the game has detected faulty switches and/or missing pinballs. To check, enter the **Portals™ Service Menu System**, select the **"DIAG"** *Icon* (**GO TO DIAGNOSTICS MENU**) from the **MAIN MENU** and select the **"TECH"** *Icon (more details in this Chapter,* ***Technician Alerts****,* ***Pages 24-25****).*

⚠ **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**, then select the "CLR" *Icon* to enter the **CLEAR BALL TROUGH MENU**. Select the "RUN" *Mini-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 Name' Tests***. **PULL OUT** the **Power Interlock Switch** for operation.

EXPLANATION & USAGE OF COMMON LARGE & MINI-ICONS USED IN VARIOUS MENUS & SUB-MENUS:

These ***non-selectable Icons*** appear in the *selected Menu* only when there are **MORE** Icons to the **LEFT** or to the **RIGHT** available for selection.

Select and activate to return to the **PREVIOUS** Menu.

Select and activate to **QUIT**, *exits & returns to the* ***Attract Mode****.*

Select and activate to view **HELP** *Screens of the current Menu*.*

Select and activate to:

Move **LEFT** or **RIGHT,** *select previous / next or move backwards / forwards.*

DECREMENT (-) or **INCREMENT (+)** *displayed value or select previous / next.*

RUN *(or activate) selected test or coil*
PULSE *coil.*

*View the schematic (***DRAW****ing) of current display. Select while current switch, lamp or coil is viewed.*

**** Help Note: An explanation of each Mini-Icon at that menu level will cycle continuously. To exit a display where no Mini-Icons are available for selection, pressing any button will exit the display.***

GO TO DIAGNOSTICS MENU

After entering **Portals™**, the **MAIN MENU** now appears. To initiate, from the **MAIN MENU**, select the "DIAG" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** (the **Flipper Buttons** operates in the same manner) and press the **Black "ENTER" Button** (the **Start Button** operates in the same manner). The **DIAGNOSTICS MENU** appears. Continue through this chapter for the explanation & usage of the *Icons* in the **DIAGNOSTICS MENU**. ***Usage Note:*** *Only in Switch & Active Switch Tests, the* ***Flipper & Start Buttons cannot be used*** *as the alternate navigation buttons as they are a part of these tests.* After exiting these tests, the **Left** & **Right Flipper** and **Start Buttons** can once again be used. Continue through this chapter for the explanation & usage of the *Icons* in the **DIAGNOSTICS MENU**.

Go To Switch Menu

To initiate, from the **DIAGNOSTICS MENU**, select the "SW" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** 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** possible switches. The **SWITCH TEST MENU** consists of three (3) parts: **Switch Test**, **Active Switches** & **Dedicated Switch Test**. ***Reminder:*** *The **Flipper & Start Buttons** (part of Switch Tests) cannot be used as **navigation buttons** during these test(s)*

Switch Test

To initiate, from the **SWITCH MENU**, select the "TEST" *Icon* with either the **Red** or **Green Buttons** & press the **Black Button**. In **Switch Test**, close each switch and observe the display. The display will describe the switch in the Switch Matrix, which includes the switch name, Return (Row) Wire, Drive (Column) Wire and the "Pin-Outs" from the **CPU/Sound Board**. When the switch is closed, the information if displayed momentarily. To view the schematic for the switch selected, press either the **Red** or **Green Button** to select the "DRAW" *Mini-Icon*. Press the **Black Button** to *activate* this *Mini-Icon*; do so while the switch is momentarily closed. To return to **Switch Test**, press the **Black Button** again.

Active Switch Test

To initiate, from the **SWITCH MENU**, select the "ACT" *Icon* with either the **Red** or **Green Buttons** & press the **Black Button**. If still in a previous test, select the "PREV" *Mini-Icon* to return to **SWITCH MENU** or select either of the "<<" or ">>" *Mini-Icons* to move through the tests. In **Active Switch Test**, if any switches are stuck closed *(or made from the presence of a pinball),* the display sequences through the Switch Names, Return (Row) Wire, Drive (Column) Wire, Drive Transistor, Part Number 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.).* In **Dedicated Switch Test**, the display will describe the switch which includes the Switch Name, Return (Row) Wire, Drive (Column) Wire, Part Number and the "Pin-Outs" from the **CPU/Sound Board**.

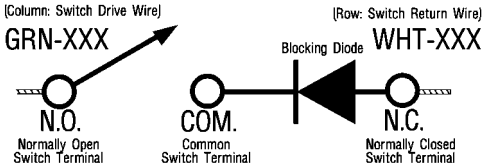
SWITCH MATRIX GRID & DEDICATED SWITCHES

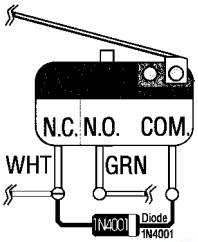
D iode O n T erminal S trip :

Row (Return) \ Column (Drive)	1: Q1 GRN-BRN CN5-P1	2: Q2 GRN-RED CN5-P3	3: Q3 GRN-ORG CN5-P4	4: Q4 GRN-YEL CN5-P5	5: Q5 GRN-BLK CN5-P6	6: Q6 GRN-BLU CN5-P7	7: Q7 GRN-VIO CN5-P8	8: Q8 GRN-GRY CN5-P9
1: U400 WHT-BRN CN7-P9	LEFT BUTTON (UK ONLY) on Cabinet side 1	NOT USED 9	(R) &D STANDUP on Brckt. Below 17	LEFT TOP LANE (A) on Brckt. Below 25	LEFT RAMP RETURN on Asm. Above 33	NOT USED 41	LEFT BUMPER on Asm. Below 49	LEFT OUTLANE on Brckt. Below 57
2: U400 WHT-RED CN7-P8	4TH COIN SLOT on Coin Door 2	NOT USED 10	R (&) D STANDUP on Brckt. Below 18	MIDDLE TOP LANE (B) on Brckt. Below 26	CENTER RAMP MADE on Asm. Above 34	LOCKUP 1 (TOP) on Brckt. Below 42	RIGHT BUMPER on Asm. Below 50	LEFT RETURN LANE on Brckt. Below 58
3: U400 WHT-ORG CN7-P7	6TH COIN SLOT on Coin Door 3	4-BALL TROUGH #1 (LEFT) on Asm. Below 11	R& (D) STANDUP on Brckt. Below 19	RIGHT TOP LANE (C) on Brckt. Below 27	RIGHT RAMP MADE on Asm. Above 35	LOCKUP 2 (BOTTOM) on Brckt. Below 43	BOTTOM BUMPER on Asm. Below 51	LEFT SLINGSHOT on Asm. Below 59
4: U400 WHT-YEL CN7-P6	RIGHT COIN SLOT on Coin Door 4	4-BALL TROUGH #2 on Asm. Below 12	WHEEL OPTO on Asm. Below 20	DUMMY LEFT on Brckt. Below 28	GHOST DOWN on Asm. Above 36	(E) AT STANDUP on Brckt. Below 44	ROCKET on Asm. Below DOTS 52	RIGHT OUTLANE on Brckt. Below 60
5: U401 WHT-GRN CN7-P5	CENTER COIN SLOT / DBA on Coin Door 5	4-BALL TROUGH #3 on Asm. Below 13	MINI FLIPPER FEED on Brckt. Below 21	DUMMY RIGHT on Brckt. Below 29	RIGHT ORBIT on Brckt. Below 37	E (A) T STANDUP on Brckt. Below 45	TOURNAMENT BUTTON Cabinet Front 53	RIGHT RETURN LANE on Brckt. Below 61
6: U401 WHT-BLU CN7-P3	LEFT COIN SLOT on Coin Door 6	4-BALL TROUGH VUK OPTO on Asm. Below 14	MINI FLIPPER STANDUP on Brckt. Below 22	DROP BANK LEFT on Asm. Below DOTS 30	SWEEPER OPTO on Brckt. Below 38	EA (T) STANDUP on Brckt. Below 46	START BUTTON Cabinet Front 54	RIGHT SLINGSHOT on Asm. Below 62
7: U401 WHT-VIO CN7-P2	5TH COIN SLOT on Coin Door 7	4-BALL STACKING OPTO on Asm. Below 15	CHICAGO LOOP on Asm. Above 23	DROP BANK MIDDLE on Asm. Below DOTS 31	SWEEPER DROP on Asm. Below DOTS 39	KIOSK SCOOP on Asm. Below 47	NOT USED 55	NOT USED 63
8: U401 WHT-GRY CN7-P1	RIGHT BUTTON (UK ONLY) on Cabinet side 8	SHOOTER LANE on Brckt. Below 16	LEFT ORBIT on Brckt. Above 24	DROP BANK RIGHT on Asm. Below DOTS 32	GHOST STANDUP on Brckt. Below 40	KIOSK TUNNEL on Asm. Below 48	PLUMB BOB TILT Inside Cabinet 56	NOT USED 64

IC U206 INPUTS \ GND	Ground BLK CN6-P1, -P11
1: U206 GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON in Cabinet side D9-1
2: U206 GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke) in Cabinet side D9-2
3: U206 GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON in Cabinet side D9-3
4: U206 GRY-YEL CN6-P6	#4 RIGHT FLIPPER E.O.S. (End-of-Stroke) in Cabinet side D9-4
5: U206 GRY-GRN CN6-P7	#5 UPR. RT. FLIPPER BUTTON in Cabinet side D9-5
6: U206 GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (In Test: LEFT) on Coin Door D9-6
7: U206 GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) on Coin Door D9-7
8: U206 GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) on Coin Door D9-8

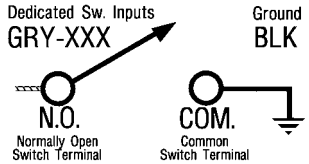
Typical Switch Schematic & Wiring



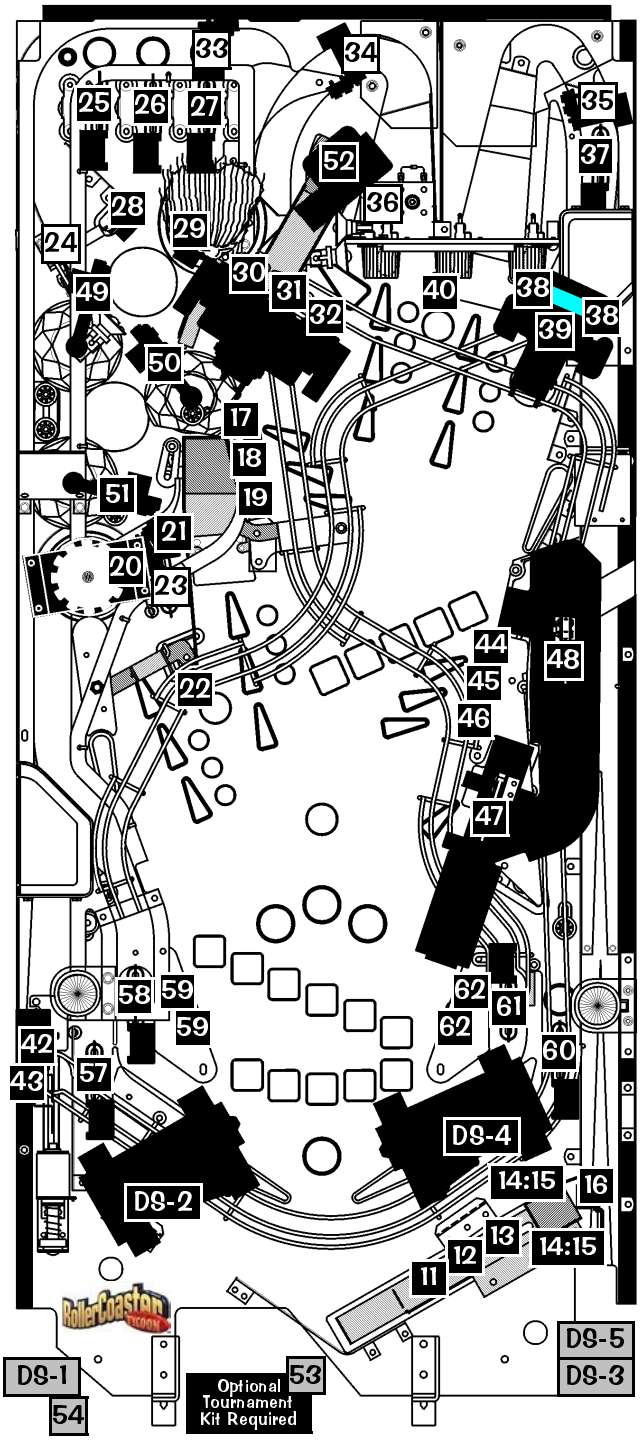


Note:
*All Switch, Lamp & Coil assemblies require diodes. Some diodes are **located under the playfield** on Terminal Strips **or** Diode Boards and not on the assemblies.*
Diode **O**n **T**erminal **S**trip
or
Diode **O**n **D**iode **B**oard

Dedicated Switch Schem.



Switch Matrix Grid Descriptions with Part Numbers and Locations



Legend Note:

= Switches mounted above Playfield (P/F).

= ... mounted below P/F. = ... in/on Cabinet.

DOTS: Diode **O**n **T**erminal **S**trip *or* **DODB**: **D**iode **O**n **D**iode **B**oard.
Note 1: Sw. 14 / Sw. 15 have both REC/TRANS on same board.
Note 2: For more details, see Sec. 4, Chp. 1, Playfield - Gen. Parts...
Note 3: Switch sold only with Bracket and/or Target.
Note 4: Switch Only. For entire Button Assembly, see Sec. 4, Chp. 1, Cabinet - General Parts & Switches.
Note 5: Switch located in/on Cabinet.
Note 6: Future Use.
Note 7: UK Only.
Note 8: See Appendix I, Stand-Up Targets, for pictorial views.

Sw. №	Col. №	Row №	See Notes:	Switch Matrix Description		Part №
				Note: *The ¥ Coin Switch (for Japan) is 180-5091-00*		
1	1	1	5, 7	LEFT BUTTON (UK ONLY)		180-5160-00
2	1	2	5	4TH COIN SLOT		180-5024-00
3	1	3	5, 6	*6TH COIN SLOT*		*(Future Use)*
4	1	4	5	RIGHT COIN SLOT		180-5024-00
5	1	5	5	CENTER COIN SLOT / DBA		
6	1	6	5	LEFT COIN SLOT		
7	1	7	5, 6	*5TH COIN SLOT*		*(Future Use)*
8	1	8	5, 7	RIGHT BUTTON (UK ONLY)		180-5160-00
9	2	1		NOT USED		
10	2	2		NOT USED		
11	2	3		4-BALL TROUGH #1 (LEFT)		180-5119-02
12	2	4		4-BALL TROUGH #2		
13	2	5		4-BALL TROUGH #3		
14	2	6		4-BALL TROUGH VUK OPTO	BOT TRANS: BOT REC:	515-5173-00 515-5174-00
15	2	7		4-BALL STACKING OPTO	TOP TRANS: TOP REC:	515-5173-00 515-5174-00
16	2	8		SHOOTER LANE		180-5157-00
17	3	1	3, 8	(**R**) &D STANDUP	Sq. Yellow Target	515-5162-06
18	3	2	3, 8	R (**&**) D STANDUP	Sq. Yellow Target	
19	3	3	3, 8	R& (**D**) STANDUP	Sq. Yellow Target	
20	3	4	1	WHEEL OPTO		520-5222-00
21	3	5	2, 3	MINI FLIPPER FEED	on Rt. Mount R/O	500-6227-02
22	3	6	3, 8	MINI FLIPPER STANDUP	Nar. Yel. Trgt.	515-5967-06
23	3	7		CHICAGO LOOP	on Gate	180-5190-28
24	3	8		LEFT ORBIT	on Gate	180-5087-00
25	4	1	2, 3	LEFT TOP LANE (**A**)	on Rt. Mount R/O	500-6227-02
26	4	2	2, 3	MIDDLE TOP LANE (**B**)	on Rt. Mnt. R/O	
27	4	3	2, 3	RIGHT TOP LANE (**C**)	on Rt. Mnt. R/O	
28	4	4	3, 8	DUMMY LEFT	Square Blue Target	515-5162-05
29	4	5	3, 8	DUMMY RIGHT	Square Red Target	515-5162-02
30	4	6	DOTS	DROP BANK LEFT		180-5158-00
31	4	7	DOTS	DROP BANK MIDDLE		
32	4	8	DOTS	DROP BANK RIGHT		
33	5	1		LEFT RAMP RETURN	on Gate	180-5190-28
34	5	2		CENTER RAMP MADE	on Gate	
35	5	3		RIGHT RAMP MADE	on Gate	
36	5	4		GHOST DOWN	on Gate	180-5119-00
37	5	5	2, 3	RIGHT ORBIT	on Rt. Mount R/O	500-6227-02
38	5	6		SWEEPER OPTO VUK OPTO	TRANS: REC:	520-5082-00 520-5083-01
39	5	7	DOTS	SWEEPER DROP		180-5158-00
40	5	8		GHOST STANDUP	Narrow Yel. Target	515-5967-06
41	6	1		NOT USED		
42	6	2		LOCKUP 1 (TOP)		180-5179-00
43	6	3		LOCKUP 2 (BOTTOM)		180-5180-00
44	6	4	3, 8	(**E**) AT STANDUP	Sq. White Target	515-5162-08
45	6	5	3, 8	E (**A**) T STANDUP	Sq. White Target	
46	6	6	3, 8	EA (**T**) STANDUP	Sq. White Target	
47	6	7		KIOSK SCOOP		180-5183-00
48	6	8		KIOSK TUNNEL		
49	7	4		LEFT BUMPER		180-5015-03
50	7	2		RIGHT BUMPER		
51	7	3		BOTTOM BUMPER		
52	7	4	DOTS	ROCKET	on VUK	180-5116-01
53	7	5	4, 5	TOURNAMENT BUTTON	Switch Only	180-5174-00
54	7	6	4, 5	START BUTTON	Switch Only	
55	7	7		NOT USED		
56	7	8	5	PLUMB BOB TILT	HANGER CONTACT	535-5319-00 535-7563-01
57	8	1	2, 3	LEFT OUTLANE	on Lt. Mount R/O	500-6227-01
58	8	2	2, 3	LEFT RETURN LANE	on Lt. Mount R/O	
59	8	3	2	LEFT SLINGSHOT	Leaf Sw. X2	180-5054-00
60	8	4	2, 3	RIGHT OUTLANE	on Lt. Mount R/O	500-6227-01
61	8	5	2, 3	RIGHT RETURN LANE	on Lt. Mount R/O	
62	8	6	2	RIGHT SLINGSHOT	Leaf Sw. X2	180-5054-00
63	8	7		NOT USED		
64	8	8		NOT USED		

Go To Coil Menu

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

PULL OUT the Power Interlock Switch for operation with the Coin Door open.

Important: *For more on troubleshooting & diagnosing, see Section **5**, Chapter **4**, **Printed Circuit Boards**.*

Single Coil Test

To initiate, from the **COIL MENU**, select the "TEST" *Icon* with either the **Red** or **Green Buttons** and press the **Black Button**. Ensure the **Power Interlock Switch** is pulled out. Select either the "-" or "+" *Mini-Icons*. Start with the "+" *Mini-Icon* to start the manual **Single Coil Test** from #1 *(the test runs through all Coils and Flash Lamps #1-#32 & Optional UK Only Auxiliary Positions AUX 1-3).* Press the **Black Button** on the "+" *Mini-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 and 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" *Mini-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.

Cycling Coil Test

To initiate, from the **COIL MENU**, select the "CYC" *Icon* with either the **Red** or **Green Buttons** and press the **Black Button**. If still in a previous test, select the "PREV" *Mini-Icon* to return to **COIL MENU** or select either of the "<<" or ">>" *Mini-Icons* to 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 in the Backbox *(if Coils are used).* The display indicates **CYCLING COILS**.

Coil & Flash Lamp Descriptions

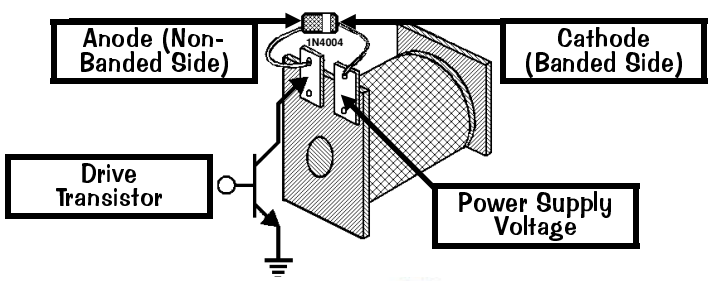
#	Type	Coil / Flash Lamp Descriptions
1	Coil	TROUGH UP-KICKER (VUK) (26-1200)
2	Coil	AUTO LAUNCH (24-940)
3	Coil	LOCKUP (23-800)
4	Coil	1 BANK RESET (27-1500)
5	Coil	1 BANK TRIP (32-1250)
6	Coil	3 BANK TRIP (32-1250)
7	Coil	ROCKET VUK (24-940; ***Early Production*** 26-1200)
8	Coil	KIOSK SCOOP (23-800)
9	Coil	LEFT BUMPER (26-1200)
10	Coil	RIGHT BUMPER (26-1200)
11	Coil	BOTTOM BUMPER (26-1200)
12	Coil	3 BANK RESET (24-940)
13	Coil	TOP LEFT MINI-FLIPPER (25-1400)
14	Coil	TOP RIGHT FLIPPER (25-1600)
15	Coil	LEFT FLIPPER [50V RED/YEL] (22-1080)
16	Coil	RIGHT FLIPPER [50V RED/YEL] (22-1080)

#	Type	Coil / Flash Lamp Descriptions
17	Coil	LEFT SLINGSHOT (23-800)
18	Coil	RIGHT SLINGSHOT (23-800)
19	Coil	GHOST RELEASE TRIP (32-1250)
20	Coil	UP POST (26-1200)
21	Flash	FLASH: LOCKUP (#906 Bulb)
22	Flash	FLASH: SHOOTER (#906 Bulb)
23	Flash	FLASH: KIOSK (#89 Bulb)
24	Coil	(OPTIONAL COIN METER)
25	Coil	LEFT DIVERTER (32-1800)
26	Coil	RIGHT DIVERTER (32-1800)
27	Flash	FLASH: BUMPERS (#89 Bulb)
28	Coil	DUMMY (23-800)
29	Flash	FLASH: SIGN RIGHT (#906 Bulb)
30	Flash	FLASH: SIGN MIDDLE (#906 Bulb)
31	Flash	FLASH: SIGN LEFT (#906 Bulb)
32	Flash	FLASH: MIDDLE LEFT (#89 Bulb)

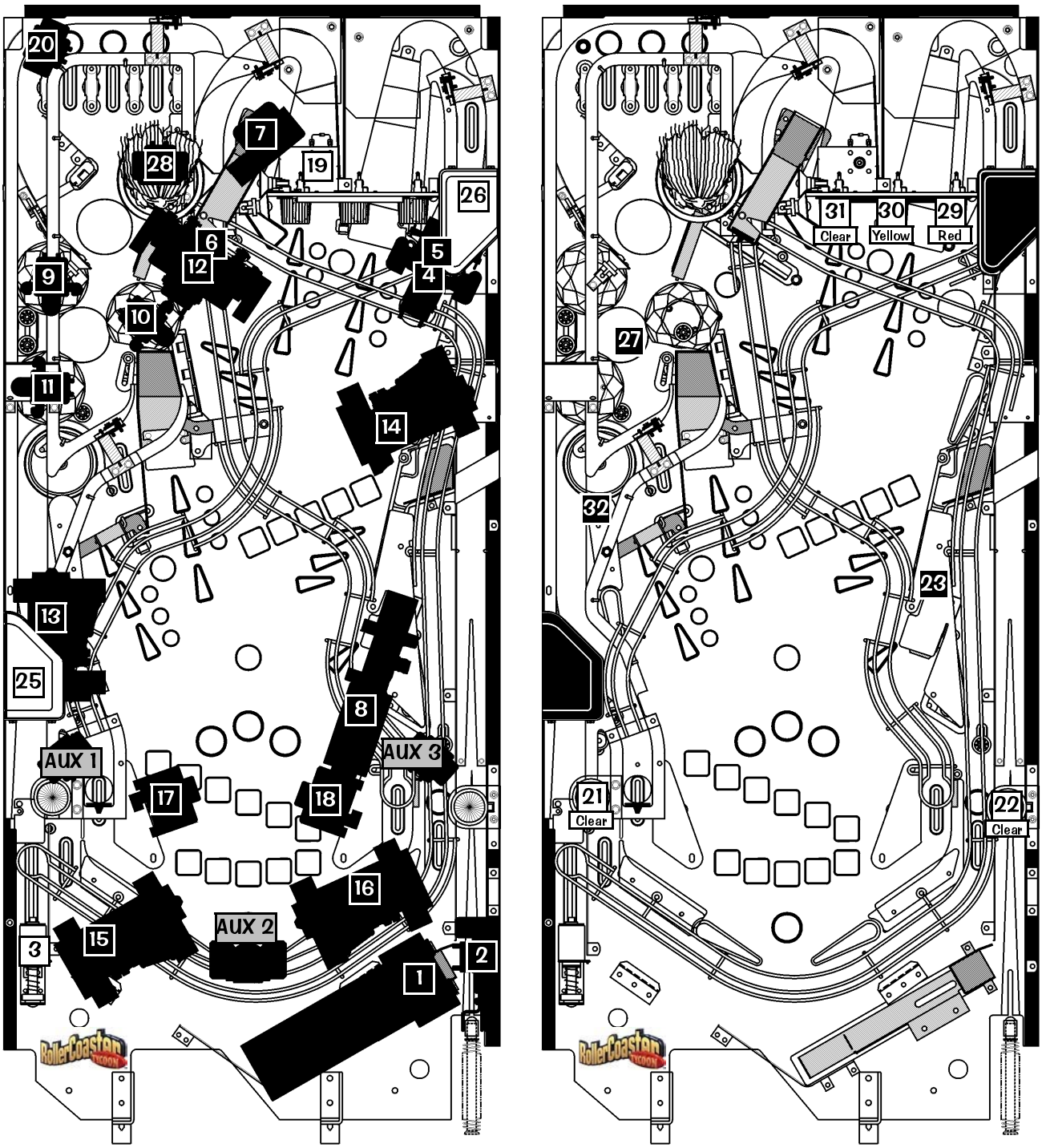
See the next three (3) pages for the **Coil & Flash Lamp Location Maps** (corresponds to above tables), **Coils Detailed Chart Table** & the **Backbox I/O Power Driver Board Detailed Wiring Diagram**.

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

Typical Coil Wiring



Coil & Flash Lamp Locations



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

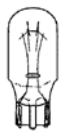
Legend Note:

☐ = Coils and Flash Lamps mounted above playfield.

■ = Coils and Flash Lamps mounted below playfield.

The following Bulb Types are used for Flash Lamps:

#89 Bulb
(Bayonet)
165-5000-89



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

The following Coil is optional:

24

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

Aux. 1 Aux. 2 Aux. 3

All Coil Positions are used.

In COIL MENU also select:

CYCLING COIL TEST

COILS DETAILED CHART TABLE

	High Current Coils Group 1	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BRN-BLK	J8-P1	26-1200 090-5044-00T
#2	AUTO LAUNCH	Q2		YEL-VIO	J10-P4/5	50v DC	BRN-RED	J8-P3	24-940 090-5036-00T
#3	LOCKUP	Q3		YEL-VIO	J10-P4/5	50v DC	BRN-ORG	J8-P4	23-800 090-5001-00B
#4	1 BANK RESET	Q4		YEL-VIO	J10-P4/5	50v DC	BRN-YEL	J8-P5	27-1500 090-5004-00B
#5	1 BANK TRIP	Q5		YEL-VIO	J10-P4/5	50v DC	BRN-GRN	J8-P6	32-1250 515-6916-01
#6	3 BANK TRIP	Q6		YEL-VIO	J10-P4/5	50v DC	BRN-BLU	J8-P7	32-1250 515-6916-01
#7	ROCKET VUK	Q7		YEL-VIO	J10-P4/5	50v DC	BRN-VIO	J8-P8	24-940 090-5036-00T
	Note Early Production Games: **Q7** should be **26-1200** if the top of the Rocket Bracket @ Yellow Wire Ramp ***does not have*** a **Wire Gate**. *See Sec. **4**, Chp. **2**, **...Assemblies...**, **VUK** for details.*								
#8	KIOSK SCOOP	Q8		YEL-VIO	J10-P4/5	50v DC	BRN-GRY	J8-P9	23-800 090-5001-00T

	High Current Coils Group 2	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#9	LEFT BUMPER	Q9	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BLU-BRN	J9-P1	26-1200 090-5044-00T
#10	RIGHT BUMPER	Q10		YEL-VIO	J10-P4/5	50v DC	BLU-RED	J9-P2	26-1200 090-5044-00T
#11	BOTTOM BUMPER	Q11		YEL-VIO	J10-P4/5	50v DC	BLU-ORG	J9-P4	26-1200 090-5044-00T
#12	3 BANK RESET	Q12		YEL-VIO	J10-P4/5	50v DC	BLU-YEL	J9-P5	24-940 090-5036-00B
#13	TOP LEFT MINI-FLIPPER	Q13		GRY-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	BLU-GRN	J9-P6	25-1400 090-5067-00T
#14	TOP RIGHT FLIPPER	Q14		BLU-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	BLU-BLK	J9-P7	25-1600 090-5068-00T
#15	LEFT FLIPPER (50v RED/YEL)	Q15		GRY-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	ORG-GRY	J9-P8	22-1080 090-5032-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16		BLU-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	ORG-VIO	J9-P9	22-1080 090-5032-00T

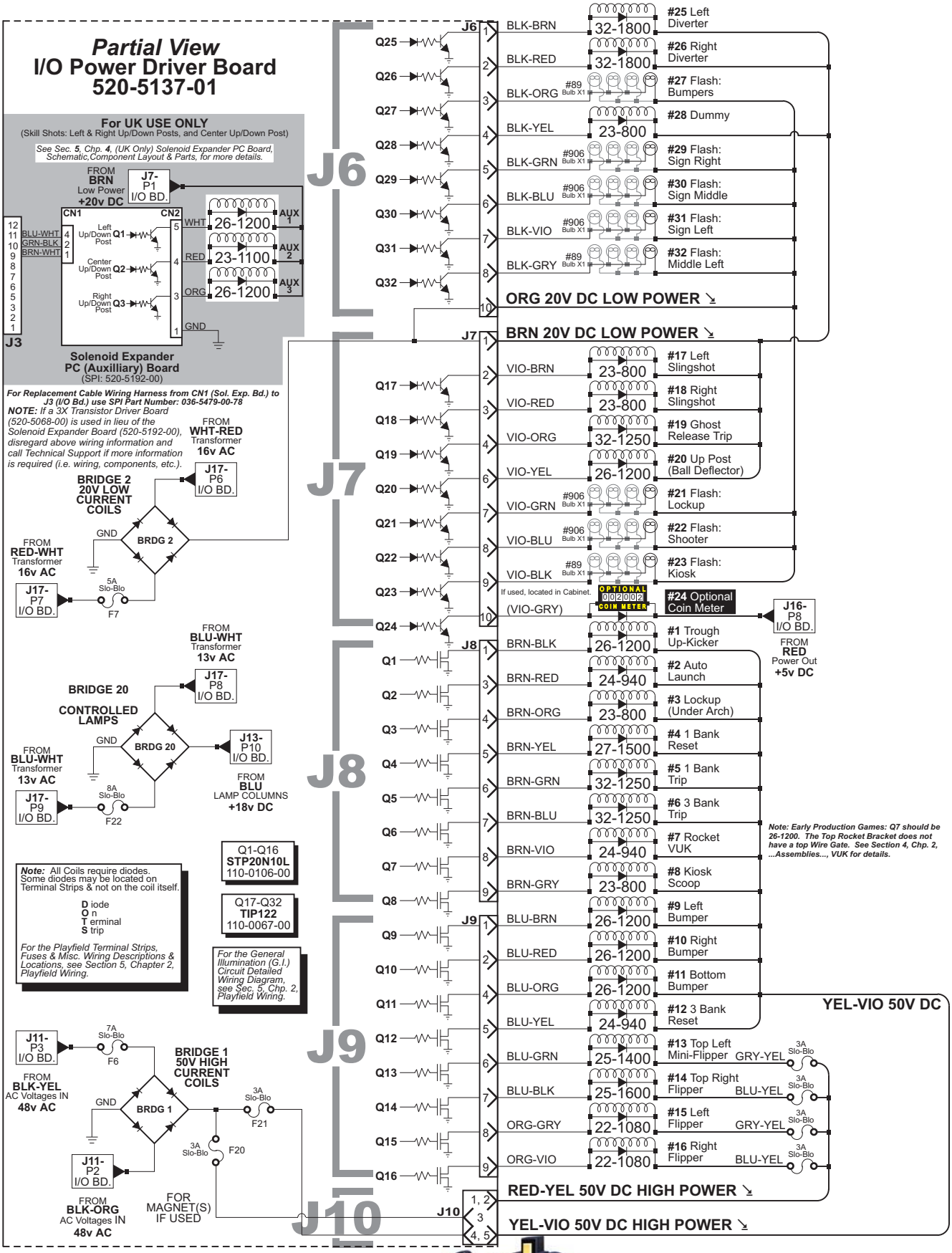
	Low Current Coils Group 1	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#17	LEFT SLINGSHOT	Q17	▲ I/O Power Driver ▼	BRN	J7-P1	20v DC	VIO-BRN	J7-P2	23-800 090-5001-00T
#18	RIGHT SLINGSHOT	Q18		BRN	J7-P1	20v DC	VIO-RED	J7-P3	23-800 090-5001-00T
#19	GHOST RELEASE TRIP	Q19		BRN	J7-P1	20v DC	VIO-ORG	J7-P4	32-1250 515-6916-01
#20	UP POST (BALL DEFLECTOR)	Q20		BRN	J7-P1	20v DC	VIO-YEL	J7-P6	26-1200 090-5044-00T
#21	FLASH: LOCKUP	Q21		ORG	J6-P10	20v DC	VIO-GRN	J7-P7	#906 Bulb 165-5004-00
#22	FLASH: SHOOTER	Q22		ORG	J6-P10	20v DC	VIO-BLU	J7-P8	#906 Bulb 165-5004-00
#23	FLASH: KIOSK	Q23		ORG	J6-P10	20v DC	VIO-BLK	J7-P9	#89 Bulb 165-5000-89
#24	OPTIONAL COIN METER	Q24		RED	J16-P7	5v DC	VIO-GRY	J7-P10	Meter 5v 091-5000-00

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

	Low Current Coils Group 2	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#25	LEFT DIVERTER	Q25	▲ I/O Power Driver ▼	BRN	J7-P1	20v DC	BLK-BRN	J6-P1	32-1800 090-5031-00
#26	RIGHT DIVERTER	Q26		BRN	J7-P1	20v DC	BLK-RED	J6-P2	32-1800 090-5031-00
#27	FLASH: BUMPERS	Q27		ORG	J6-P10	20v DC	BLK-ORG	J6-P3	#89 Bulb 165-5000-89
#28	DUMMY	Q28		BRN	J7-P1	20v DC	BLK-YEL	J6-P4	23-800 090-5001-00T
#29	FLASH: SIGN RIGHT	Q29		ORG	J6-P10	20v DC	BLK-GRN	J6-P5	#906 Bulb 165-5000-89
#30	FLASH: SIGN MIDDLE	Q30		ORG	J6-P10	20v DC	BLK-BLU	J6-P6	#906 Bulb 165-5000-89
#31	FLASH: SIGN LEFT	Q31		ORG	J6-P10	20v DC	BLK-VIO	J6-P7	#906 Bulb 165-5000-89
#32	FLASH: MIDDLE LEFT	Q32		ORG	J6-P10	20v DC	BLK-GRY	J6-P8	#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: Q21-Q23, Q27, Q29-Q32)

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


Partial View
I/O Power Driver Board
520-5137-01
For UK USE ONLY
(Skill Shots: Left & Right Up/Down Posts, and Center Up/Down Post)
See Sec. 5, Chp. 4, (UK Only) Solenoid Expander PC Board, Schematic,Component Layout & Parts, for more details.
FROM BRN Low Power +20v DC
J7- P1 I/O BD.
CN1
CN2
BLU-WHT
GRN-BLK
BRN-WHT
Left Up/Down Post Q1
Center Up/Down Post Q2
Right Up/Down Post Q3
WHT
RED
ORG
GND
26-1200
23-1100
26-1200
AUX 1
AUX 2
AUX 3
J3
Solenoid Expander PC (Auxilliary) Board
(SPI: 520-5192-00)
For Replacement Cable Wiring Harness from CN1 (Sol. Exp. Bd.) to J3 (I/O Bd.) use SPI Part Number: 036-5479-00-78
NOTE: If a 3X Transistor Driver Board (520-5068-00) is used in lieu of the Solenoid Expander Board (520-5192-00), disregard above wiring information and call Technical Support if more information is required (i.e. wiring, components, etc.).
FROM WHT-RED Transformer 16v AC
J17- P6 I/O BD.
BRIDGE 2 20V LOW CURRENT COILS
GND
BRDG 2
FROM RED-WHT Transformer 16v AC
J17- P7 I/O BD.
5A Slo-Blo
F7
FROM BLU-WHT Transformer 13v AC
J17- P8 I/O BD.
BRIDGE 20 CONTROLLED LAMPS
GND
BRDG 20
J13- P10 I/O BD.
FROM BLU-WHT Transformer 13v AC
J17- P9 I/O BD.
8A Slo-Blo
F22
FROM BLU LAMP COLUMNS +18v DC
Note: All Coils require diodes. Some diodes may be located on Terminal Strips & not on the coil itself.
Diode On Terminal Strip
For the Playfield Terminal Strips, Fuses & Misc. Wiring Descriptions & Locations, see Section 5, Chapter 2, Playfield Wiring.
Q1-Q16 STP20N10L 110-0106-00
Q17-Q32 TIP122 110-0067-00
For the General Illumination (G.I.) Circuit Detailed Wiring Diagram, see Sec. 5, Chp. 2, Playfield Wiring.
J11- P3 I/O BD.
7A Slo-Blo
F6
FROM BLK-YEL AC Voltages IN 48v AC
BRIDGE 1 50V HIGH CURRENT COILS
GND
BRDG 1
3A Slo-Blo
F21
3A Slo-Blo
F20
J11- P2 I/O BD.
FROM BLK-ORG AC Voltages IN 48v AC
FOR MAGNET(S) IF USED
J6
J7
J8
J9
J10
Q25
Q26
Q27
Q28
Q29
Q30
Q31
Q32
Q17
Q18
Q19
Q20
Q21
Q22
Q23
Q24
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
BLK-BRN
BLK-RED
BLK-ORG
BLK-YEL
BLK-GRN
BLK-BLU
BLK-VIO
BLK-GRY
#25 Left Diverter
#26 Right Diverter
#27 Flash: Bumpers
#28 Dummy
#29 Flash: Sign Right
#30 Flash: Sign Middle
#31 Flash: Sign Left
#32 Flash: Middle Left
32-1800
32-1800
#89 Bulb X1
23-800
#906 Bulb X1
ORG 20V DC LOW POWER
BRN 20V DC LOW POWER
VIO-BRN
VIO-RED
VIO-ORG
VIO-YEL
VIO-GRN
VIO-BLU
VIO-BLK
#17 Left Slingshot
#18 Right Slingshot
#19 Ghost Release Trip
#20 Up Post (Ball Deflector)
#21 Flash: Lockup
#22 Flash: Shooter
#23 Flash: Kiosk
23-800
32-1250
26-1200
If used, located in Cabinet.
OPTIONAL COIN METER
#24 Optional Coin Meter
(VIO-GRY)
J16- P8 I/O BD.
FROM RED Power Out +5v DC
BRN-BLK
BRN-RED
BRN-ORG
BRN-YEL
BRN-GRN
BRN-BLU
BRN-VIO
BRN-GRY
#1 Trough Up-Kicker
#2 Auto Launch
#3 Lockup (Under Arch)
#4 1 Bank Reset
#5 1 Bank Trip
#6 3 Bank Trip
#7 Rocket VUK
#8 Kiosk Scoop
26-1200
24-940
23-800
27-1500
32-1250
32-1250
24-940
23-800
Note: Early Production Games: Q7 should be 26-1200. The Top Rocket Bracket does not have a top Wire Gate. See Section 4, Chp. 2, ...Assemblies..., VUK for details.
BLU-BRN
BLU-RED
BLU-ORG
BLU-YEL
BLU-GRN
BLU-BLK
ORG-GRY
ORG-VIO
#9 Left Bumper
#10 Right Bumper
#11 Bottom Bumper
#12 3 Bank Reset
#13 Top Left Mini-Flipper
#14 Top Right Flipper
#15 Left Flipper
#16 Right Flipper
26-1200
26-1200
26-1200
24-940
25-1400
25-1600
22-1080
22-1080
GRY-YEL
BLU-YEL
GRY-YEL
BLU-YEL
3A Slo-Blo
YEL-VIO 50V DC
RED-YEL 50V DC HIGH POWER
YEL-VIO 50V DC HIGH POWER
1, 2
3
4, 5

Go To Lamp Menu

To initiate, from the **DIAGNOSTICS MENU**, select the "LAMP" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** 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** & **Column Lamp Test**.

Single Lamp Test

To initiate, from the **LAMP MENU**, select the "ONE" *Icon* with either the **Red** or **Green Buttons** and press the **Black Button**. Select either the "-" or "+" *Mini-Icons*. Start with the "+" *Mini-Icon* to start the manual **Single Lamp Test** from Column 1, Row 1, Lamp 1. Press the **Black Button** on the "+" *Mini-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" *Mini-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 the **Red** or **Green Buttons** and press the **Black Button**. If still in **Single Lamp Test** *(or any 1 of the 4 tests)*, select the "PREV" *Mini-Icon* to return to **LAMP MENU** or select either of the "<<" or ">>" *Mini-Icons* to 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 the **Red** or **Green Buttons** and press the **Black Button**. If still in a previous test, select the "PREV" *Mini-Icon* to return to **LAMP MENU** or select either of the "<<" or ">>" *Mini-Icons* to 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

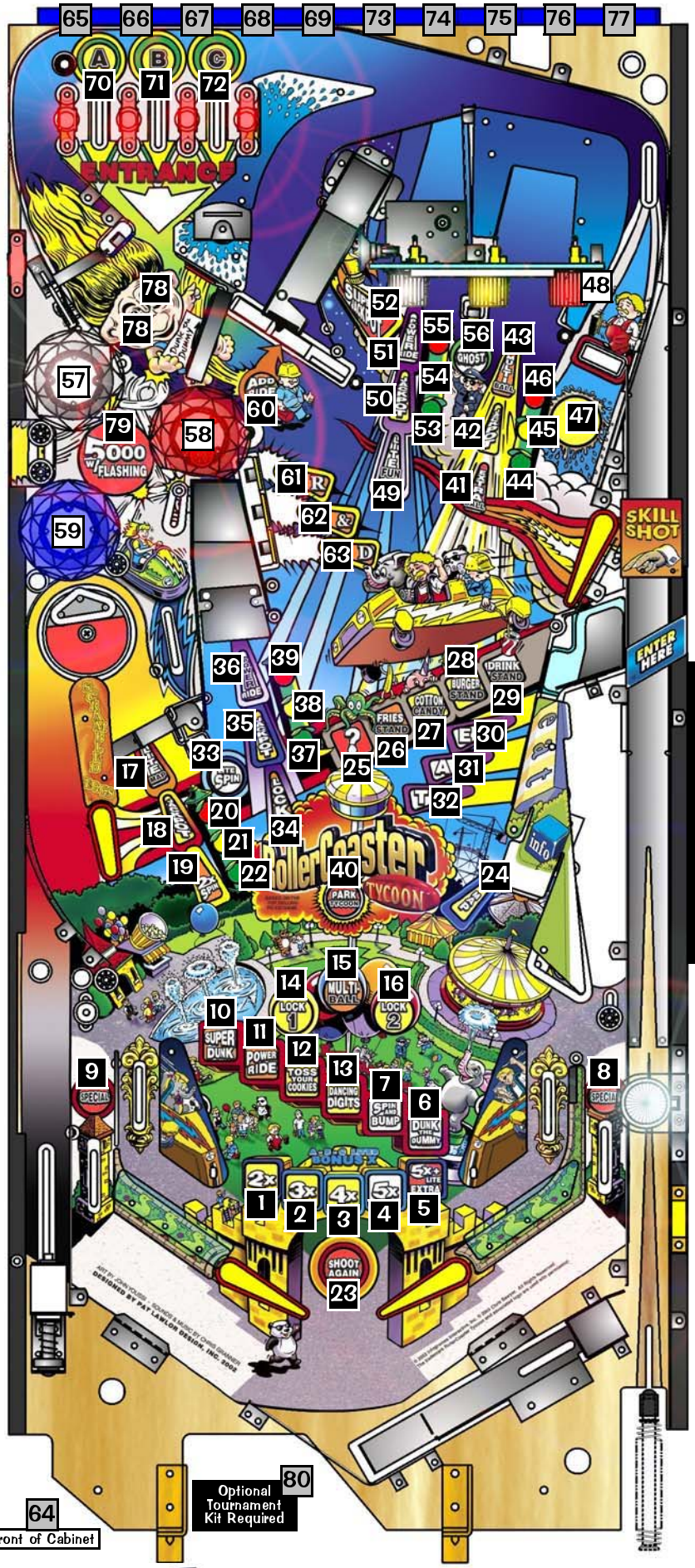
D iode **O** n **T** erminal **S** trip :

Row (GND) \ Column (18v)	1: U17 YEL-BRN J13-P9	2: U16 YEL-RED J13-P8	3: U15 YEL-ORG J13-P7	4: U14 YEL-BLK J13-P6	5: U13 YEL-GRN J13-P5	6: U12 YEL-BLU J13-P4	7: U11 YEL-VIO J13-P3	8: U10 YEL-GRY J13-P1
1: Q33 RED-BRN J12-P1	2X BONUS #555 Bulb 1	3X BONUS #555 Bulb 2	4X BONUS #555 Bulb 3	5X BONUS #555 Bulb 4	5X+ LITE EXTRA #555 Bulb 5	DUNK THE DUMMY #555 Bulb 6	SPIN AND BUMP #555 Bulb 7	RIGHT OUTLANE #555 Bulb 8
2: Q34 RED-BLK J12-P2	LEFT OUTLANE #555 Bulb 9	SUPER DUNK #555 Bulb 10	POWER RIDE #555 Bulb 11	TOSS YOUR COOKIES #555 Bulb 12	DANCING DIGITS #555 Bulb 13	LOCK **1** #555 Bulb 14	MULTIBALL #555 Bulb 15	LOCK **2** #555 Bulb 16
3: Q35 RED-ORG J12-P3	LITE MAP #555 Bulb 17	WHEEL JACKPOT #555 Bulb 18	2X SPIN #555 Bulb 19	WHEEL RED #555 Bulb 20	WHEEL YELLOW #555 Bulb 21	WHEEL GREEN #555 Bulb 22	SHOOT AGAIN #555 Bulb 23	MAP #555 Bulb 24
4: Q36 RED-YEL J12-P4	SNACK STAND "?" #555 Bulb 25	FRIES STAND #555 Bulb 26	COTTON CANDY #555 Bulb 27	BURGER STAND #555 Bulb 28	DRINK STAND #555 Bulb 29	(**E**) AT #555 Bulb 30	E (**A**) T #555 Bulb 31	EA (**T**) #555 Bulb 32
5: Q37 RED-GRN J12-P5	LITE SPIN #555 Bulb 33	CHICAGO LOOP LOCK #555 Bulb 34	CHICAGO LOOP JACKPOT #555 Bulb 35	LOOP POWER RIDE #555 Bulb 36	CHICAGO LOOP GREEN #555 Bulb 37	CHICAGO LOOP YELLOW #555 Bulb 38	CHICAGO LOOP RED #555 Bulb 39	PARK TYCOON #555 Bulb 40
6: Q38 RED-BLU J12-P6	EXTRA BALL #555 Bulb 41	FLYING_TURNS JACKPOT #555 Bulb 42	MULTIBALL START #555 Bulb 43	FLYING TURNS GREEN #44 Bulb 44	FLYING TURNS YELLOW #44 Bulb 45	FLYING TURNS RED #44 Bulb 46	PUKE #555 Bulb 47	START FUN (on Ramp Sign) #44 Bulb 48
7: Q39 RED-VIO J12-P8	LITE FUN #555 Bulb 49	GHOST JACKPOT #555 Bulb 50	GHOST POWER RIDE #555 Bulb 51	SUPER JACKPOT #555 Bulb 52	GHOST GREEN #555 Bulb 53	GHOST YELLOW #555 Bulb 54	GHOST RED #555 Bulb 55	GHOST STANDUP #555 Bulb 56
8: Q40 RED-GRY J12-P9	LEFT BUMPER #555 Bulb 57	RIGHT BUMPER #555 Bulb 58	BOTTOM BUMPER #555 Bulb 59	ADD RIDE #44 Bulb 60	(**R**) &D #555 Bulb 61	R (**&**) D #555 Bulb 62	R& (**D**) #555 Bulb 63	START BUTTON #555 Bulb 64
9: Q41 RED-WHT J12-P10	BACK PANEL **1** (LEFT) #44 Bulb 65	BACK PANEL **2** #44 Bulb 66	BACK PANEL **3** #44 Bulb 67	BACK PANEL **4** #44 Bulb 68	BACK PANEL **5** #44 Bulb 69	LEFT TOP LANE (**A**) #555 Bulb 70	MIDDLE TOP LANE (**B**) #555 Bulb 71	RIGHT TOP LANE (**C**) #555 Bulb 72
10: Q42 RED J12-P11	BACK PANEL **6** #44 Bulb 73	BACK PANEL **7** #44 Bulb 74	BACK PANEL **8** #44 Bulb 75	BACK PANEL **9** #44 Bulb 76	BACK PANEL **10** (RIGHT) #44 Bulb 77	TROLL LIT X2 #44 Bulb 78	5000 W/FLASHING #44 Bulb 79	TOURNAMENT BUTTON #555 Bulb 80

Lamp Matrix Grid Locations

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

Ramps are Not Shown for clarity.



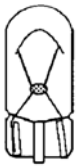
Legend Note:

☐ = Lamps mounted above Playfield.

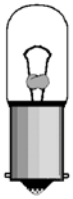
■ = Lamps mounted below Playfield.

▒ = Lamps mounted in/on Cabinet.

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

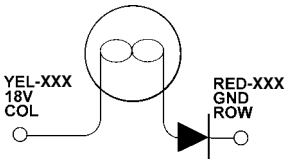


#555 Bulb (Wedge)
165-5002-00

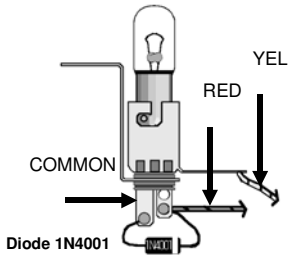


#44 Bulb (Bayonet)
165-5000-44

Typical Lamp Schematic



Typical Lamp Wiring



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

Test Flash Lamps

PULL OUT the Power Interlock Switch for operation with the Coin Door open.

To initiate, from the **DIAGNOSTICS MENU**, select the "FLASH" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. After selecting this *Icon* the display will indicate **CYCLING FLASHERS**. The Flash Lamps will cycle continuously until the test is exited. This test allows the technician to easily spot any burned-out bulbs and replace them. Flashers tested are Flash Lamps in Positions: **Q1-Q32** and in this game Flash Lamp(s) are in Position(s): **Q21-Q23, Q27, Q29-Q32**

Clear Ball Trough

PULL OUT the Power Interlock Switch for operation with the Coin Door open.

To initiate, from the **DIAGNOSTICS MENU**, select the "CLR" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. This Menu 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" *Mini-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**.

⚠ **CAUTION:** *Continuous use of above test may overheat the Trough Up-Kicker Coil.* ⚠

Technician Alerts

To initiate, from the **DIAGNOSTICS MENU**, select the "TECH" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. This Menu is provided to show any switch problems and/or missing pinballs. After selecting this *Icon*, the display will indicate *any or all* of the following categories: **POSSIBLY BROKEN SWITCH**, **CHECK SWITCHES** or **HYPER-SENSITIVE SWITCH** (Sw. #16, Shooter Lane, is used as an example). If more than one switch is reported, the Switch Number and Name will cycle within the category, and then will cycle the categories. To return to the **DIAGNOSTICS MENU**, select & *activate* the "PREV" *Mini-Icon.*

Switch Detection

During game play, activation of switches and operation of coils with associated switches are monitored. In programming, every switch is given a minimum & maximum value based on the game. The switches are monitored every 5 minutes of game play with a "sliding window" of 15 minutes. If a switch is determined to be faulty, game play is compensated. Switches noted as **POSSIBLY BROKEN SWITCH** should be checked, then adjusted or replaced. ***Important:*** *A switch reported as "possibly broken" may actually be an unused switch due to* ***lack of usage*** *and* ***not because they're broken.*** *This can happen, if a switch is located in a "hard" shot position, and the players are not making the shot. Game programming will still compensate for this unplayed switch.* Switches noted as **CHECK SWITCHES** are determined to be stuck closed or open depending on switch usage. Free up the switch actuator; adjust or replace if necessary. Switches noted as **HYPERSENSTIVE SWITCH** means just that, the switch should be readjusted or replace if necessary.

Determination of switch usage can be check in **Audits** *(review Section* ***3****, Chapter* ***3****,* ***GO TO AUDITS MENU****).* Find the associated Audit with the switch in question and check usage; compare it to commonly used switches for comparison. After any switch is checked and repaired or replaced, it's suggested to test the switch in the **PLAY TEST MENU** *(see the* ***next page****)* or **Single Coil Test** *(reviewed earlier in this chapter,* ***Page 18****)* where the associated coil to the switch can be tested as well. After correcting the problem, the switch will still be reported until the game is played and the switch is again monitored as specified above. *Only you can determine if a switch getting reported is bad or if the switch is currently not getting actuated during game play.*

Coils ***are not reported*** in **Technician Alerts**, however, if a faulty switch is the culprit, the switch will then be reported. 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** as **CHECK SWITCHES**. The display alert **PLEASE CHECK TECH REPORT** will be shown.

Technicians Alerts continued on the next page.

Continued

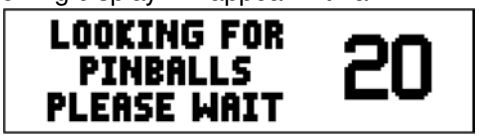
Technician Alerts Continued

While in **Technician Alerts** Menu, if the following is displayed, the game has detected 1 or more pinball(s) missing and has compensated for the lost pinball(s) to provide normal game play

Important: *Determine where the pinball is!* ***Do not add pinball(s)*** *until it is determined the pinball(s) are indeed missing and not just stuck. If pinball(s) are added, and if the original stuck pinball has freed itself, the pinball game will not operate properly with the extra pinball(s). When the pinball is recovered, the above display will not appear the next time* ***Technician Alerts*** *is visited (a game must be played for the pinball to be determined as found).*

Pinball Detection

During game play, a ball can get trapped or stuck. If after approximately 15 seconds of inactivity or "no scoring," **Ball Search** is started. ***Note:*** *If the pinball is in the Plunger Lane or "held" on the flipper, no* ***Ball Search*** *will be performed.* The game will perform one **Ball Search** in an attempt to "find" or free-up the pinball. If the game does not see a switch closure (indicating the pinball has not been found), the following display will appear with a count-down timer of 20 seconds, during which **Ball Search** will continue until the timer runs out *(this feature will not happen if the game is in Competition Mode; Ball Search will continue until the pinball is found, unstuck and/or replaced manually).* The display will momentarily acknowledge the missing pinball(s). The game will provide another pinball into play and will compensate for the lost pinball. Game play will appear normal. ***Note:*** *This detection and compensation will happen with every pinball, if each suffers the same fate of a ball trap. If* ***all*** *balls get trapped, the game cannot be played or started until the situation is rectified.*



Until any missing pinball is returned to play, the game upon ***Power-up****, opening the* ***Coin Door*** *or exiting* ***Portals™****, will continue to momentarily display the following (along with an audible sound):*

Service Phone

To initiate, from the **DIAGNOSTICS MENU**, select the "SERV" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. After selecting this *Icon* the display will indicate a phone number to call if technical assistance is required *(In USA Code: 1-800-KICKERS).*

Begin Play Test

To initiate, from the **DIAGNOSTICS MENU**, select the "PLAY" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** 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 the LED Test Sign function, select the **"LED TEST"** *Icon* in the **DIAGNOSTICS MENU**.

PULL OUT the Power Interlock Switch for operation with the Coin Door open.

Fire Knocker

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

Sound / Speaker Test

To initiate, from the **DIAGNOSTICS MENU**, select the "SPKR" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** 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 "+" *Mini-Icons* and press the **Black "ENTER" Button** to *activate* the first test. Repeat to visually see & hear all tests. Select the "RUN" *Mini-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 on the next page.

Continued

Sound / Speaker Test Continued

Speaker Phase Testing

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

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

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

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

Note: *For ROM Locations, see Page* DR. ❶. ***For ROM Usage (Summary Table) see Page*** DR. ❸ ***in the "Find-It-In-Front: Dr. Pinball Section". Voice ROMs (U17, U21, U36 & U37) which are 8MB must have a Jumper at W6 on the CPU/Sound Board to function properly.***

Begin Burn In

To initiate, from the **DIAGNOSTICS MENU**, select the "BURN" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** 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. ***Note:*** *To reset Burn-In minutes to* ***00*** *see Section* ***3****, Chapter* ***6****,* ***GO TO RESET MENU****,* ***Factory Reset****.* ***Caution:*** *Performing a Factory Reset will reset all other information as well.*

Dot Matrix Test

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

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

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

Dot Matrix Display Explained

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

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

LED Test

To initiate, from the **DIAGNOSTICS MENU**, select the "LED TEST" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. The **LED TEST MENU** appears with the "+" *Mini-Icon* flashing. This test is provided to allow a method of testing the triple 5X7 Mini Dot Display on the **"The Flying Ghosts" and "Flying Turns" Ramp Enter Sign**. Upon entering the **LED Test Menu**, the Main Display & Mini-Dot Display will be blank. Select and *activate* either of the "-" or "+" *Mini-Icons* to change any of the **six (6) Mini Dot Display Tests** *(as shown below).* As each test menu appears, the name of the test appears in the Main Display with the corresponding test demonstrated on the **"The Flying Ghosts" and "Flying Turns" Ramp Enter Sign**. *The **LED Test** will cycle continuously until the next or previous test is chosen, or if the menu is exited.* The first **three (3)** of the **six (6) LED Tests** are:

Select and *activate* the "+" *Mini-Icon* to enter next test:

1:

Select and *activate* the "-" *Mini-Icon* to enter previous test.

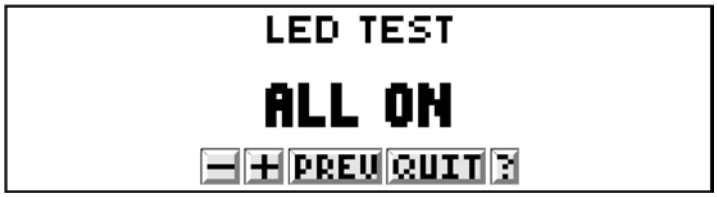
Select and *activate* the "+" *Mini-Icon* to enter next test:

2:

Select and *activate* the "-" *Mini-Icon* to enter previous test.

Select and *activate* the "+" *Mini-Icon* to enter next test:

3:



Select and *activate* the "-" *Mini-Icon* to enter previous test.

Note: *For more details on the Dot Display (5X7) x3 PC Board, see Section **5**, Chapter **4**, **Printed Circuit Boards (PCBS)**, Pages **140-141**, ...Schematic, Component Layout & Parts.*

LED Test (next 3 LED Tests) continued on the next page.

LED Test Continued

To initiate, from the **DIAGNOSTICS MENU**, select the "LED TEST" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. The **LED TEST MENU** appears with the "+" *Mini-Icon* flashing. This test is provided to allow a method of testing the triple 5X7 Mini Dot Display on the **"The Flying Ghosts" and "Flying Turns" Ramp Enter Sign**. Upon entering the **LED Test Menu**, the Main Display & Mini-Dot Display will be blank. Select and *activate* either of the "-" or "+" *Mini-Icons* to change any of the **six (6) Mini Dot Display Tests** *(as shown below).* As each test menu appears, the name of the test appears in the Main Display with the corresponding test demonstrated on the **"The Flying Ghosts" and "Flying Turns" Ramp Enter Sign**. *The **LED Test** will cycle continuously until the next or previous test is chosen, or if the menu is exited.* The next **three (3)** of the **six (6) LED Tests** are:

Select and *activate* the "+" *Mini-Icon* to enter next test:

4:

Select and *activate* the "-" *Mini-Icon* to enter previous test.

Select and *activate* the "+" *Mini-Icon* to enter next test:

5:

Select and *activate* the "-" *Mini-Icon* to enter previous test.

Select and *activate* the "+" *Mini-Icon* to enter next test:

6:

Select and *activate* the "-" *Mini-Icon* to enter previous test.

Select the "PREV" *Mini-Icon* to return to the **DIAGNOSTICS MENU** or select "QUIT" *Mini-Icon* to exit **Portals™**.

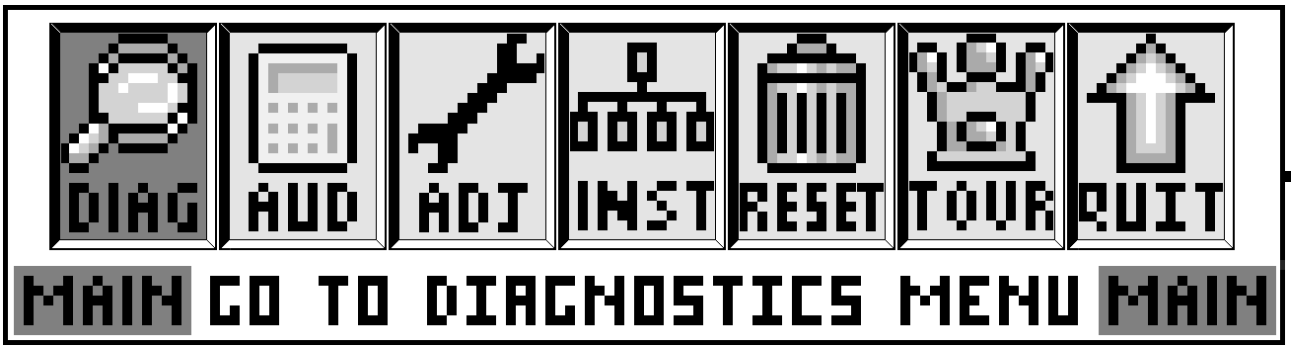
Note: *For more details on the Dot Display (5X7) x3 PC Board, see Section **5**, Chapter **4**, **Printed Circuit Boards (PCBS)**,Pages **140-141**, ...Schematic, Component Layout & Parts.*

Go To Fuse Table

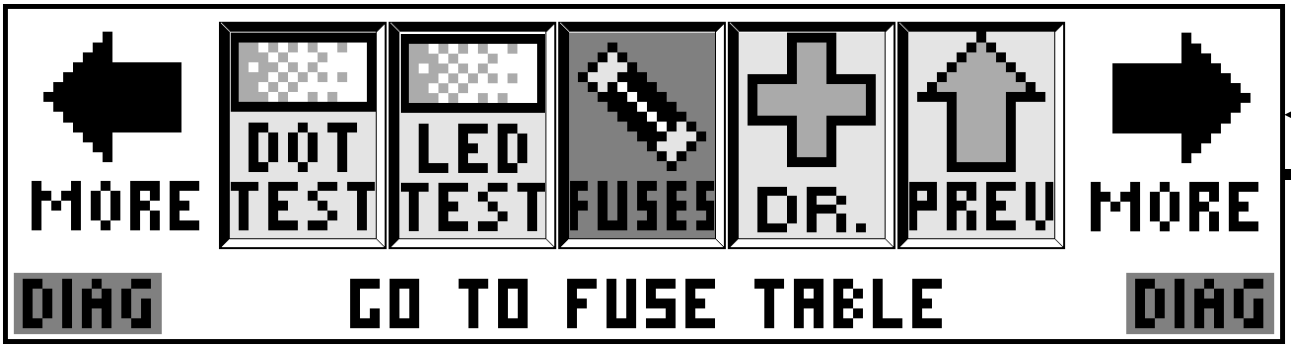
To initiate, from the **DIAGNOSTICS MENU**, select the "FUSES" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. The **FUSE TABLE MENU** now appears. This provides the technician with the current **Fuse Table** for this game *(also noted on decal in the Backbox).*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 requiring an additional fuse, such as magnets)*. For the complete **Fuse List** in the *Quick Reference Fuse Chart & Pictorials*, *see the next page or Page* DR. ❶ *(front of this manual).*

Example:

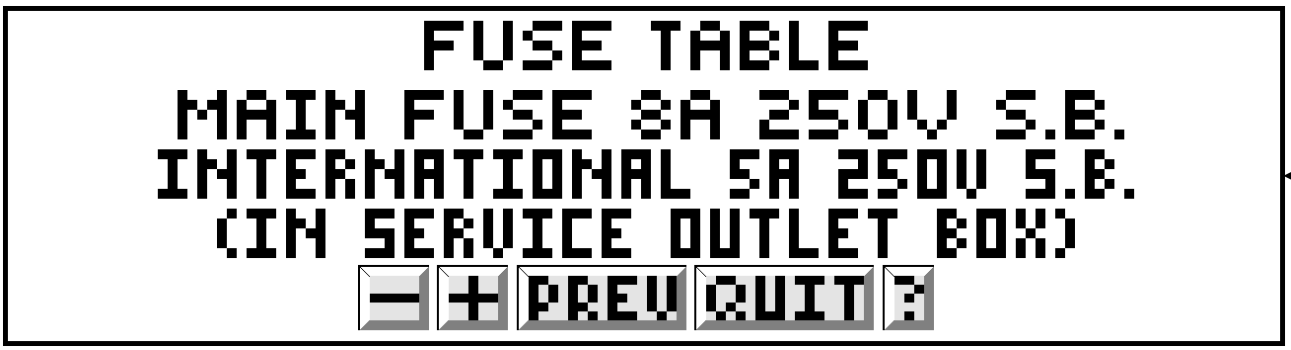
After entering **Portals**™, the **MAIN MENU** now appears with the "DIAG" *Icon* (**GO TO DIAGNOSTICS MENU**) flashing:



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 "FUSES" *Icon* (**GO TO FUSE TABLE**) is flashing:



Press the **Black Button** to *activate* this **ICON**. The **FUSE TABLE** now appears.



Select and *activate* the "+" *Mini-Icon* to view the next fuse in the group. Continue to select either the "+" or "-" *Mini-Icons* to view each fuse one at a time. The display will describe the fuse identification number (e.g. Main, F1, F6, F7, etc.), rating of fuse (e.g. 5A 250v S.B. - i.e. 5 Amp, 250 volt, Slo-Blo), location of fuse (i.e. Backbox: Board Name located on; or Cabinet: Under the playfield or in Service Outlet), 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 by selecting & *activating* the "PREV" or "QUIT" *Mini-Icons*.

Go To Fuse Table continued on the next page.

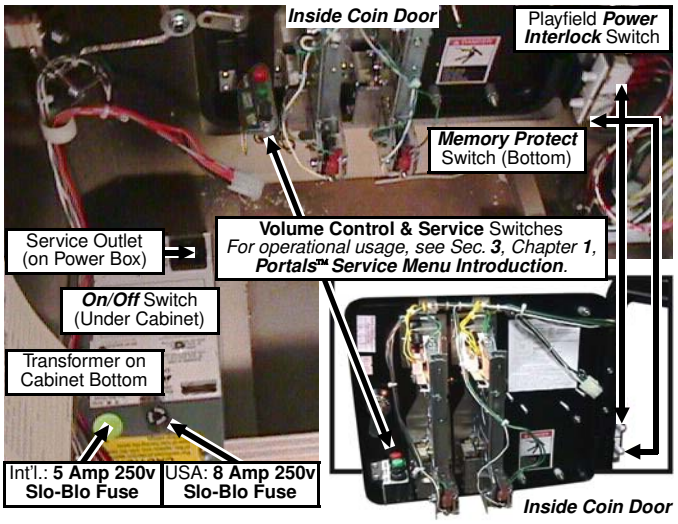
Backbox PCB Fuses, ROMs, Bridges, Relays, P/F & Cabinet Fuses, Cab. Switches

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

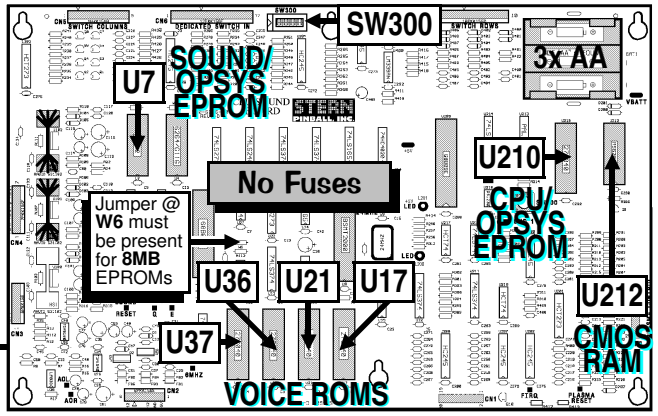
QUICK REFERENCE FUSE CHART

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	3A 250v S.B.	50v DC	Magnet
F21	3A 250v S.B.	50v DC	Coils
F22	8A 250v S.B.	18v DC	Controlled Lamps
F23	4A 250v S.B.	5v DC	Logic
F24	5A 250v S.B.	6.3v AC	G.I. Lamps (BRN-WHT to WHT-BRN)
F25	5A 250v S.B.	6.3v AC	G.I. Lamps (YEL to WHT-YEL)
F26	5A 250v S.B.	6.3v AC	G.I. Lamps (GRN to WHT-GRN)
F27	5A 250v S.B.	6.3v AC	G.I. Lamps (VIO to WHT-VIO)
F28	3A 250v S.B.	24v AC	**Not Used / Spare**
Cabinet Fuses			
LOC:	**SERVICE (AC) OUTLET BOX (Cabinet Bottom)**		
n/a	8A 250v S.B.	115v AC	Main Fuse Line (Domestic or USA)
n/a	5A 250v S.B.	220v AC	Main Fuse Line (International)
Playfield (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	Upr. Rt. Flip. (BLU-YEL⇆RED-YEL)
n/a	3A 250v S.B.	50v DC	Upr. Lt. Flip. (GRY-YEL⇆RED-YEL)

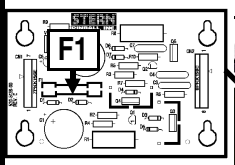
*For locations & more information on fuses, see Sec. **5**, Chapter **2**.*



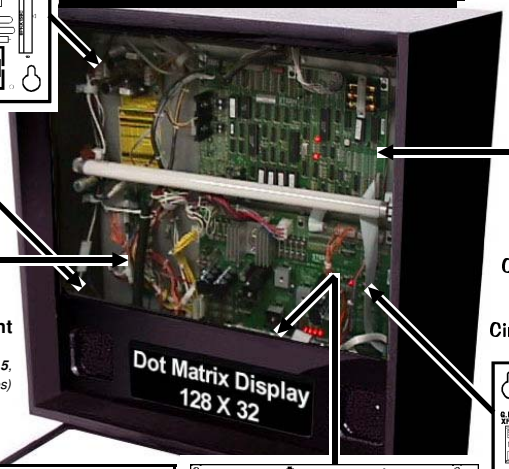
ROM TYPE on BD	LOCATION	SIZE	PART NUMBER
CPU Sound	U7	512K	965-0375-78
CPU Game	U210	1 MB	965-0374-78
CPU Voice ROM 1	U17	8 MB	965-0377-78
CPU Voice ROM 2	U21	8 MB	965-0378-78
CPU Voice ROM 3	U36	8 MB	965-0379-78
CPU Voice ROM 4	U37	8 MB	Not Used
DISPLAY Controller	U5	4 MB	965-0376-78



CPU / Sound Board ▶



◀ Display Power Supply Bd.



Solenoid Expander Board ‡

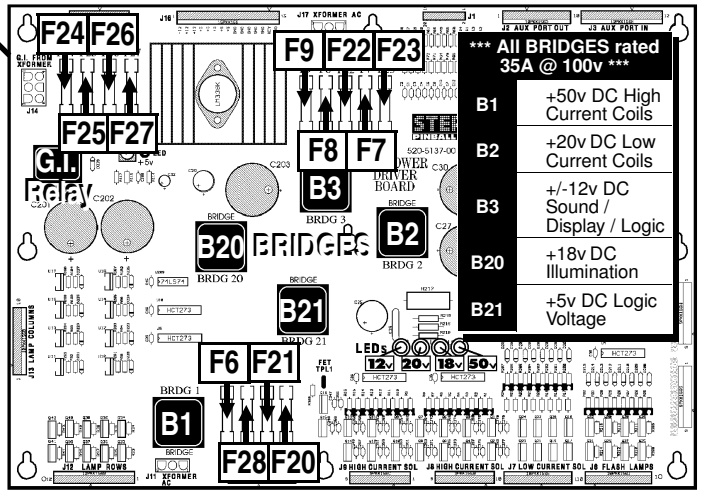
Tournament Interface Board ‡

‡ **UK or Tournament GAMES ONLY**

*For more info., see Section **5**, Chp. **4**, **PCBs** (Yellow Pages)*

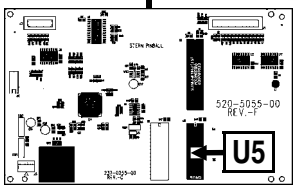
For Schematics and/or Component Parts on PC Boards shown on this page, review Section 5, Chapter 4, Printed Circuit Boards (The Yellow Pages).

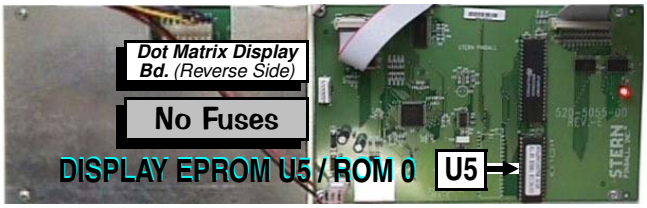
I/O Power Driver Board ▼



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.





Dr. Pinball

To initiate, from the **DIAGNOSTICS MENU**, select the Cross "DR." *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** 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 (3) *Icons:* Coil "DR.", Switch "DR." and Lamp "DR." *Icons.* 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. *Dr. Pinball* will now display 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* displays a question or requests a procedure, *Dr. Pinball* 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 the **Red** or **Green Buttons** to "SELECT" a *Mini-Icon* and the **Black Button** to "ACTIVATE or ENTER" your selection.

Coil Flow Chart

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

The following are the *Mini-Icons* with explanations for the **DR. PINBALL** Sub-Menus:

Select and *activate* either the "-" or "+" *Mini-Icons* to diagnose a Coil, Lamp or Switch. Select and *activate* the "RUN" *Mini-Icon* to test selected item. The "PREV" *Mini-Icon* allows you to go back to previous question. Select the "QUIT" *Mini-Icon* to exit **Portals**™ completely. Select the "?" *Mini-Icon* (Help) to see directions on button usage.

Select and *activate* either the "NO or "YES" *Mini-Icons* to answer a question given. Select and *activate* the "END" *Mini-Icon* to change to a new item to test. The "PREV" *Mini-Icon* allows you to go back to previous question. Select the "QUIT" *Mini-Icon* to exit **Portals**™ completely. Select the "?" *Mini-Icon* (Help) to see directions on button usage.

After a diagnosis is given, select and *activate* the "END" *Mini-Icon* to change to a new item to test. The "PREV" *Mini-Icon* allows you to go back to previous display. Select the "QUIT" *Mini-Icon* to exit **Portals**™ completely. Select the "?" *Mini-Icon* (Help) to see directions on button usage.

In **COIL FLOW CHART MENU**, select and *activate* the "PULSE" *Mini-Icon* to pulse the coil selected. Select and *activate* the "END" *Mini-Icon* to change to a new item to test. The "PREV" *Mini-Icon* allows you to go back to previous question. Select the "QUIT" *Mini-Icon* to exit **Portals**™ completely. Select the "?" *Mini-Icon* (Help) to see directions on button usage.

STARTING METER Reading : | STARTING METER Date (MM/DD/YR) : | AUDITOR'S NAME : | CURRENT VOLUME SETTING:

CURRENT METER Reading : | AUDIT Date (MM/DD/YR) : | CPU Version : | DISPLAY Version : | GAME LOCATION NAME :

EARNINGS & STANDARD AUDIT TABLES

EARNINGS AUDITS
01-14 =
Audit definitions follow in this Chapter.

TOTAL PAID CREDITS	AVERAGE GAME TIME	COINS THRU CENTER SLOT	COINS THRU 6TH SLOT	METER CLICKS
01:	04:	07:	10:	13:
FREE GAME PERCENTAGE	**COINS THRU LEFT SLOT**	**COINS THRU 4TH SLOT**	**TOTAL COINS**	**SOFTWARE METER**
02:	05:	08:	11:	14:
AVERAGE BALL TIME	**COINS THRU RIGHT SLOT**	**COINS THRU 5TH SLOT**	**TOTAL EARNINGS**	
03:	06:	09:	12:	

STANDARD AUDITS
15-81 =
Audit definitions follow in this Chapter.
To track Feature & Tournament Audits, see Pages 36 or 54.

TOTAL BALLS PLAYED	3M - 4M SCORES	20M+ SCORES	PROPRIETARY	3.5 - 4 MINUTE GAMES
15:	30:	45:	60:	75:
TOTAL EXTRA BALLS	**4M - 5M SCORES**	**AVERAGE SCORES**	**PROPRIETARY**	**4 - 5 MINUTE GAMES**
16:	31:	46:	61:	76:
EXTRA BALL PERCENT	**5M - 5.5M SCORES**	**SERVICE CREDITS**	**PROPRIETARY**	**5 - 6 MINUTE GAMES**
17:	32:	47:	62:	77:
REPLAY 1 AWARDS	**5.5M - 6M SCORES**	**BALL SEARCH STARTED**	**PROPRIETARY**	**6 - 8 MINUTE GAMES**
18:	33:	48:	63:	78:
REPLAY 2+ AWARDS	**6M - 6.5M SCORES**	**LOST BALL FEEDS**	**BASE REPLAY**	**8 - 10 MINUTE GAMES**
19:	34:	49:	64:	79:
TOTAL REPLAYS	**6.5M - 7M SCORES**	**LOST BALL GAME STARTS**	**LEFT FLIPPER USED**	**10 -15 MINUTE GAMES**
20:	35:	50:	65:	80:
REPLAY PERCENT	**7M - 7.5M SCORES**	**LEFT DRAINS**	**RIGHT FLIPPER USED**	**15+ MINUTE GAMES**
21:	36:	51:	66:	81:
TOTAL SPECIALS	**7.5M - 8M SCORES**	**CENTER DRAINS**	**PROPRIETARY**	
22:	37:	52:	67:	
SPECIAL PERCENT	**8M - 8.5M SCORES**	**RIGHT DRAINS**	**PROPRIETARY**	
23:	38:	53:	68:	
TOTAL MATCHES	**8.5M - 9M SCORES**	**TILTS**	**0 - 1 MINUTE GAMES**	
24:	39:	54:	69:	
HIGH SCORE AWARDS	**9M - 9.5M SCORES**	**TOTAL BALLS SAVED**	**1 - 1.5 MINUTE GAMES**	
25:	40:	55:	70:	
HIGH SCORE PERCENT	**9.5M - 10M SCORES**	**PROPRIETARY**	**1.5 - 2 MINUTE GAMES**	
26:	41:	56:	71:	
TOTAL FREE PLAYS	**10M - 12M SCORES**	**PROPRIETARY**	**2 - 2.5 MINUTE GAMES**	
27:	42:	57:	72:	
TOTAL PLAYS	**12M - 15M SCORES**	**PROPRIETARY**	**2.5 - 3 MINUTE GAMES**	
28:	43:	58:	73:	
0 - 3M SCORES	**15M - 20M SCORES**	**PROPRIETARY**	**3 - 3.5 MINUTE GAMES**	
29:	44:	59:	74:	

Go To Audits Menu

Overview

The **Portals™ Service Menu System** provides **139** Audits for accounting purposes and for evaluation of *Game Programming*. The Audits are divided into 3 groups: • **Earnings Audits** (Audits **01-14**), • **Standard Audits** (Audits **15-81**) and • **Feature Audits (Programming Use Only)** (Audits **82-139**). *For details on **Tournament Audits**, see Section **3**, Chapter **7**, **GO TO TOURNAMENT MENU**.* Audits which are named **Proprietary** are also for ***Future Expansion*** or ***Programming***. Game code may get upgraded during production; compare all Audits in the display with the manual and make any corrections to the Audit Table *(previous page),* as necessary. Audits are subject to change (with or without notice). To view Audits in the display, enter the **Portals™ Service Menu System**. *For how to **RESET** Audits, see Section **3**, Chapter **6**, **GO TO RESET MENU**.*

EXPLANATION & USAGE OF COMMON LARGE & MINI-ICONS USED IN VARIOUS MENUS & SUB-MENUS:

These ***non-selectable Icons*** appear in the *selected Menu* only when there are **MORE** Icons to the **LEFT** or to the **RIGHT** available for selection.

Select and activate to return to the **PREVIOUS** Menu.

Select and activate to **QUIT**, *exits & returns to the* ***Attract Mode***.

Select and activate to view **HELP** *Screens of the current Menu*.*

Select and activate to:

Move **LEFT** or **RIGHT**, *select previous / next or move backwards / forwards.*

**** Help Note:** An explanation of each Mini-Icon at that menu level will cycle continuously. To exit a display where no Mini-Icons are available for selection, pressing any button will exit the display.*

GO TO AUDITS MENU

After entering **Portals™**, the **MAIN MENU** now appears. Select the "AUD" *Icon* in the **MAIN MENU** with either the **Red "LEFT"** or **Green "RIGHT" Buttons** (the **Flipper Buttons** operates in the same manner) and press the **Black "ENTER" Button** (the **Start Button** operates in the same manner). The **AUDITS MENU** appears. Continue through this chapter for the explanation & usage of the *Icons* in the **AUDITS MENU**.

Earnings Audits (01-14)

To initiate, from the **AUDITS MENU**, select the "EARN" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Select and *activate* either of the ">>" *Mini-Icons* to view the next or previous Audit in this group. The display will describe the **Audit Number**, **Audit Name** and the **Current Audit Total** (Value). The current Audit will remain in the display until the next Audit is viewed or when this Menu is exited.

Aud. Nº	Audit Name	Audit Definition
01	**TOTAL PAID CREDITS**	Provides the total number of paid credits.
02	**FREE GAME PERCENTAGE**	Provides the percentage total by dividing Audit **27**, **TOTAL FREE PLAYS**, by Audit **28**, **TOTAL PLAYS**.
03	**AVERAGE BALL TIME**	In seconds, the average ball time is derived from the total play time divided by Audit **15**, **TOTAL BALLS PLAYED**.
04	**AVERAGE GAME TIME**	The average game time is expressed in minutes and seconds (0:00).
05	**COINS THRU LEFT SLOT**	Provides the total number of times Coin Mech. Switch 06 was closed.
06	**COINS THRU RIGHT SLOT**	Provides the total number of times Coin Mech. Switch 04 was closed.
07	**COINS THRU CENTER SLOT**	Provides the total number of times Coin Mech. Switch 05 was closed.
08	**COINS THRU 4TH SLOT**	Provides the total number of times Coin Mech. Switch 02 was closed.
09	**COINS THRU 5TH SLOT**	Provides the total number of times Coin Mech. Switch 07 was closed.
10	**COINS THRU 6TH SLOT**	Provides the total number of times Coin Mech. Switch 03 was closed.
11	**TOTAL COINS**	Provides the total amount of coins registered through all the slots.
12	**TOTAL EARNINGS**	The total cash value accumulated since the last Factory Reset occurred. *See Sec. **3**, Chp. **6**, **GO TO RESET MENU**, **Reset Coin Audits**.*
13	**METER CLICKS**	Provides the total number of money clicks accumulated. *Based on the country's lowest coin denomination used for the game credit.*
14	**SOFTWARE METER**	Provides the continuing total of Meter Clicks. *This audit cannot be reset; the display shows the constant addition of Meter Clicks.*

Standard Audits (15-81)

To initiate, from the **AUDITS MENU**, select the "S.P.I." *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Select and *activate* either of the ">>" *Mini-Icons* to view the next or previous Audit in this group. The display will describe the **Audit Number**, **Audit Name** and the **Current Audit Total** (Value). The current Audit will remain in the display until the next Audit is viewed or when this Menu is exited.

Aud. Nº	Audit Name	Audit Definition
15	**TOTAL BALLS PLAYED**	Provides the total number of *Regular* and *Extra Balls.*
16	**TOTAL EXTRA BALLS**	Provides the total number of *Extra Balls* awarded.
17	**EXTRA BALLS PERCENT**	Provides the percentage total by dividing Audit **16**, **TOTAL EXTRA BALLS**, by Audit **28**, **TOTAL PLAYS**.
18	**REPLAY 1 AWARDS**	Provides the total *Awards (Credits, Extra Balls or Scores)* for Level 1.
19	**REPLAY 2+ AWARDS**	Provides the total *Awards (Credits, Extra Balls or Scores)* for Level 2 or higher.
20	**TOTAL REPLAYS**	Provides the total *Awards (Credits, Extra Balls or Scores)* for exceeding replay score levels.
21	**REPLAY PERCENT**	Provides the percentage total from dividing Audit **20**, **TOTAL REPLAYS**, by Audit **28**, **TOTAL PLAYS**. The percentage reflects replay total awards for exceeding replay score levels.
22	**TOTAL SPECIALS**	Provides the total *Awards (Credits, Extra Balls, or Scores)* for making *Specials.*
23	**SPECIAL PERCENT**	Provides the percentage total by dividing Audit **22**, **TOTAL SPECIALS**, by Audit **28**, **TOTAL PLAYS**.
24	**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 **07**, **MATCH PERCENTAGE**, if enabled. *See Section **3**, Chapter **4**, **GO TO ADJUSTMENTS MENU**, **Standard Adjustments**.*
25	**HIGH SCORE AWARDS**	Provides the total *Awards (Credits, Extra Balls, or Scores)* for exceeding the High-Score-To-Date scores.
26	**HIGH SCORE PERCENT**	Provides the percentage total by dividing Audit **25**, **HIGH SCORE AWARDS**, by Audit **28**, **TOTAL PLAYS**.
27	**TOTAL FREE PLAYS**	Provides the total *Free Credits* for *Replays, High-Score-To-Date, Specials and Match.*
28	**TOTAL PLAYS**	This total is derived by adding the sum of Audit **01**, **TOTAL PAID CREDITS**, and Audit **27**, **TOTAL FREE PLAYS**. *(Note that Free Credits are not recorded in the Audit until they are actually used.)*
29	**0 - 3M SCORES**	Provides the total number of games the Player's final score was between **0** and **2,999,990** points.
30	**3M - 4M SCORES**	... and between **3,000,000** and **3,999,990** points.
31	**4M - 5M SCORES**	... and between **4,000,000** and **4,999,990** points.
32	**5M - 5.5M SCORES**	... and between **5,000,000** and **5,499,990** points.
33	**5.5M - 6M SCORES**	... and between **5,500,000** and **5,999,990** points.
34	**6M - 6.5M SCORES**	... and between **6,000,000** and **6,499,990** points.
35	**6.5M - 7M SCORES**	... and between **6,500,000** and **6,999,990** points.
36	**7M - 7.5M SCORES**	... and between **7,000,000** and **7,499,990** points.
37	**7.5M - 8M SCORES**	... and between **7,500,000** and **7,999,990** points.
38	**8M - 8.5M SCORES**	... and between **8,000,000** and **8,499,990** points.
39	**8.5M - 9M SCORES**	... and between **8,500,000** and **8,999,990** points.
40	**9M - 9.5M SCORES**	... and between **9,000,000** and **9,499,990** points.
41	**9.5M - 10M SCORES**	... and between **9,500,000** and **9,999,990** points.
42	**10M - 12M SCORES**	... and between **10,000,000** and **11,999,990** points.
43	**12M - 15M SCORES**	... and between **12,000,000** and **14,999,990** points.
44	**15M - 20M SCORES**	... and between **15,000,000** and **19,999,990** points.

Standard Audits 45-81 continued on the next page.

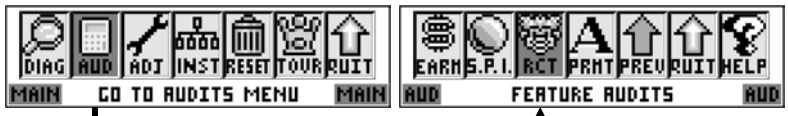
	Audit Name	Audit Definition
45	**20M+ SCORES**	Provides the total number of games the Player's final score was **20,000,000** points and over.
46	**AVERAGE SCORES**	This total is derived from adding the *Final Score* of each game to a table and dividing this sum by Audit **28**, **TOTAL PLAYS**.
47	**SERVICE CREDITS**	Provides the total number of times the **Portals™ Green Button** (Dedicated Switch 7) was pushed in **Attract Mode**. *Note: For how to receive Service Credits, see Sec. **3**, Chp. **1**, **Service Switch Set Access & Use**. For how to delete Service (and Paid Credits), see Section **3**, Chapter **6**, **GO TO RESET MENU**, **Reset Credits**.*
48	**BALL SEARCH STARTED**	Provides the total number of times the game performed a *Ball Search*.
49	**LOST BALL FEEDS**	Provides the total number of times the game added a pinball to play when it could not find a pinball after *Ball Search*. *See Sec. **3**, Chp. **2**, **GO TO DIAGNOSTICS MENU**, **Technicians Alert** [Pinball Detection].*
50	**LOST BALL GAME STARTS**	Provides the total number of times the game started with a pinball missing from the ball trough at the start of a game. *See Sec. **3**, Chp. **2**, **GO TO DIAGNOSTICS MENU**, **Technicians Alert** [Pinball Detection].*
51	**LEFT DRAINS**	Provides the total number of times Rollover Switch 57 was closed.
52	**CENTER DRAINS**	Provides the total number of times the pinball had drained when the last switch closed was not Switch 57 or Switch 60.
53	**RIGHT DRAINS**	Provides the total number of times Rollover Switch 60 was closed.
54	**TILTS**	Provides the total number of times Contact Switch 56 was closed.
55	**TOTAL BALLS SAVED**	Provides the total number of times this feature was used *(this feature can be turned ON or OFF, see Adj. **35**, **FREEZE TIME** in Section **3**, Chp. **4**, **GO TO ADJUSTMENTS MENU, Standard Adjustments**).* This feature is enabled at the start of each pinball and is disabled as soon as a predetermined number of switches are "closed" ***or*** the allocated time has expired.
56-63	**PROPRIETARY**	Proprietary Audits are used for ***Future Expansion*** or ***Programming***.
64	**BASE REPLAY**	Provides the current base *Replay Level Score*.
65	**LEFT FLIPPER USED**	Provides the total number of times the **Left Flipper Button** (Dedicated Switch 1) was pushed in **Game Mode**.
66	**RIGHT FLIPPER USED**	Provides the total number of times the **Right Flipper Button** (Dedicated Switch 3) was pushed in **Game Mode**.
67-68	**PROPRIETARY**	Proprietary Audits are used for ***Future Expansion*** or ***Programming***.
69	**0 - 1 MINUTE GAMES**	Provides the total number of games the total game time was between **0:00** and **1:00** minute.
70	**1 - 1.5 MINUTE GAMES**	... and between **1:00** and **1:30** minutes.
71	**1.5 - 2 MINUTE GAMES**	... and between **1:30** and **2:00** minutes.
72	**2 - 2.5 MINUTE GAMES**	... and between **2:00** and **2:30** minutes.
73	**2.5 - 3 MINUTE GAMES**	... and between **2:30** and **3:00** minutes.
74	**3 - 3.5 MINUTE GAMES**	... and between **3:00** and **3:30** minutes.
75	**3.5 - 4 MINUTE GAMES**	... and between **3:30** and **4:00** minutes.
76	**4 - 5 MINUTE GAMES**	... and between **4:00** and **5:00** minutes.
77	**5 - 6 MINUTE GAMES**	... and between **5:00** and **6:00** minutes.
78	**6 - 8 MINUTE GAMES**	... and between **6:00** and **8:00** minutes.
79	**8 - 10 MINUTE GAMES**	... and between **8:00** and **10:00** minutes.
80	**10 - 15 MINUTE GAMES**	... and between **10:00** and **15:00** minutes.
81	**15+ MINUTE GAMES**	Provides the total number of games the total game time was **15:00** and over.

Comments or Notes:

Feature Audits (82-139)

To initiate, from the **AUDITS MENU**, select the "RCT" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Select and *activate* either of the ">>" *Mini-Icons* to view the next or previous Audit in this group. The display will describe the **Audit Number**, **Audit Name** and the **Current Audit Total** (Value). The current Audit will remain in the display until the next Audit is viewed or when this Menu is exited. **Audits Definition: Programming Use Only.** *The proprietary information provides the total number of times a feature was started, awarded, lit, played and/or completed (awarded); also, the total number of Switch Closures during certain modes or features are tracked (a predetermined single/multiple variations of switch closures are used to determine the lighting and/or completion of the feature stated).*

FEATURE AUDIT TABLE



FEATURE AUDITS 82-139 ✍ = ✎

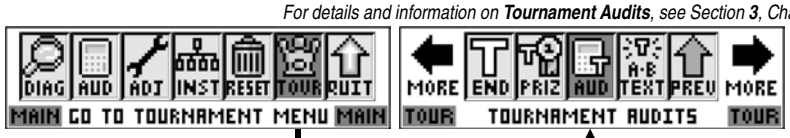
*** PROGRAMMING USE ONLY ***

UNLABELED BOXES ARE FOR FUTURE EXPANSION.

LEFT ORBITS	KIOSK ADVANCE GHOST	JACKPOTS	POWER RIDE START	PARK TYCOON JACKPOTS
82:	95:	108:	121:	134:
RIGHT ORBITS	KIOSK BOO TIME	SUPER JACKPOTS	POWER RIDE AWARDS	PARK TYCOON 1X SUPER
83:	96:	109:	122:	135:
LEFT RAMPS	KIOSK AWARD STAND	MB STARTED	DANCE DIGITS START	PARK TYCOON 2X SUPER
84:	97:	110:	123:	136:
CENTER RAMPS	KIOSK POPS AT MAX	2+ MB STARTED	DANCE DIGITS AWARDS	PARK TYCOON 3X SUPER
85:	98:	111:	124:	137:
RIGHT RAMPS	KIOSK LOCK LIT	TOSS COOKIES START	DANCE DIGITS COMPLETE	PARK TYCOON 4X SUPER
86:	99:	112:	125:	138:
ROCKET RAMPS	KIOSK QUICK MULTIBALL	TOSS COOKIES COMPLETE	BOO TIME START	GUEST EB LEVEL
87:	100:	113:	126:	139:
KIOSK AWARDS GIVEN	KIOSK ADD GUESTS	DUNK DUMMY START	BOO TIME AWARDS	
88:	101:	114:	127:	
KIOSK EB LIT	KIOSK BONUS X	DUNK DUMMY AWARDS	FOOD STANDS BUILT	
89:	102:	115:	128:	
KIOSK RANDOM POINTS	KIOSK QUICK JACKPOT	SPIN BUMP START	FOOD STANDS ?	
90:	103:	116:	129:	
KIOSK SPECIAL LIT	KIOSK AWARD BONUS	SPIN BUMP AWARDS	R&D COMPLETED	
91:	104:	117:	130:	
KIOSK CONST. START	KIOSK LIGHT FUN MODE	SUPER DUNK START	BONUS X EB LIT	
92:	105:	118:	131:	
KIOSK ADVANCE RIDE	KIOSK START FUN MODE	SUPER DUNK MB START	PARK TYCOON LIT	
93:	106:	119:	132:	
KIOSK SPINNER LIT	KIOSK BOO INCREASED	SUPER DUNK MB AWARDS	PARK TYCOON STARTED	
94:	107:	120:	133:	

TOURNAMENT AUDIT TABLE

*For details and information on **Tournament Audits**, see Section **3**, Chapter **7**, **GO TO TOURNAMENT MENU.***



TOURNAMENT AUDITS 140-151 ✍ = ✎

TOURNAMENT START DATE : 0 TOURNAMENT END DATE : 0

TOTAL PLAYS	TOTAL TOUR. EARNINGS	ACCUM. TOTAL PLAYS	ACCUM. TOUR EARNINGS	
140:	143:	146:	149:	
TOURNAMENT PLAYS	JACKPOT	ACCUM. TOUR. PLAYS	ACCUM. JACKPOT	
141:	144:	147:	150:	
TOTAL GAME EARNINGS	NET EARNINGS	ACCUM. EARNINGS	# TOURNAMENTS	
142:	145:	148:	151:	

Go To Printer Menu (OPTIONAL USE ONLY)

Operational Usage Note: *The use of the following Sub-Menus are* ***OPTIONAL*** and provided as a *convenience only.* ***No special equipment or unique software (mentioned below) was included with your Pinball Game.*** To initiate, from the **AUDITS MENU**, select the "PRNT" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The **PRINTER MENU** appears. A **Printer Interface Board**, **"Hand-Held" Printer** & the **Alison Interface Program** are required for proper operation of these Sub-Menus. *Entering the menus & selecting/activating the Icons without the equipment mentioned, will not affect the Pinball Game nor the operation of the* ***Portals™ Service Menu System*** *in any way.* For information or details on the required equipment in this Menu, call or eMail Technical Support *(contact info on the back cover).*

Quick Printout

To initiate, from the **PRINTER MENU**, select the "QUIK" *Icon* with either the **Red** or **Green Button** and press the **Black Button**. Select either the "-" or "+" *Mini-Icon* and press the **Black Button** to start the printout. Per the display instruction, the **Start Button** can also be pressed to start the printout. Only the **Earnings Audits** can be retrieved and/or printed for further processing.

Full Printout

To initiate, from the **PRINTER MENU**, select the "ALISON" *Icon* with either the **Red** or **Green Button** and press the **Black Button**. Select either the "-" or "+" *Mini-Icon* and press the **Black Button** to start the download. Per the display instruction, the **Start Button** can also be pressed to start the download. All **Earnings**, **Standard** & **Feature Audits** can be retrieved and/or printed for further processing.

Reset Printer

To initiate, from the **PRINTER MENU**, select the "RESET" *Icon* with either the **Red** or **Green Button** and press the **Black Button**. Select either the "-" or "+" *Mini-Icon* and press the **Black Button** to clear the "Nº of copies printed" count total appearing in the display. ***Operational Usage Note:*** *Activating the "QUIK" Icon (in the previous Quick Printout)* ***without*** *the special equipment and unique software, will still provide a "count total" in this Reset Printer Menu, which does not affect the operation of the* ***Portals™ Service Menu System*** *in any way.* Activating this "RESET" *Icon* will reset the "count total" in the display to **00**.

AUDIT ABBREVIATIONS USED IN THIS CHAPTER:

ACCUM.: Accumulative	**COMP.:** Completed	**EB:** Extra Ball	**M:** Million
MB *or* **MBALL:** Multiball	**MAX:** Maximum	**TOUR.:** Tournament	**X:** Multiplier (Bonus)

For how to RESET Audits, see Section 3, Chapter 6, GO TO RESET MENU.

PRINT or COPY PAGE 8 ONTO THE REVERSE SIDE OF THIS PAGE ONLY IF YOU'RE NOT PLANNING ON FAXING.

STARTING METER Reading :

STARTING METER Date (MM/DD/YR) : 0

AUDITOR'S NAME :

CURRENT VOLUME SETTING:

CURRENT METER Reading :

AUDIT Date (MM/DD/YR) : 0

CPU Version : . .

DISPLAY Version : . .

GAME LOCATION NAME :

EARNINGS & STANDARD AUDIT TABLES

EARNINGS AUDITS 01-14 ✍ = ✎

TOTAL PAID CREDITS	AVERAGE GAME TIME	COINS THRU CENTER SLOT	COINS THRU 6TH SLOT	METER CLICKS
01:	04:	07:	10:	13:
FREE GAME PERCENTAGE	**COINS THRU LEFT SLOT**	**COINS THRU 4TH SLOT**	**TOTAL COINS**	**SOFTWARE METER**
02:	05:	08:	11:	14:
AVERAGE BALL TIME	**COINS THRU RIGHT SLOT**	**COINS THRU 5TH SLOT**	**TOTAL EARNINGS**	
03:	06:	09:	12:	

STANDARD AUDITS 15-81 ✍ = ✎

TOTAL BALLS PLAYED	3M - 4M SCORES	20M+ SCORES	PROPRIETARY	3.5 - 4 MINUTE GAMES
15:	30:	45:	60:	75:
TOTAL EXTRA BALLS	**4M - 5M SCORES**	**AVERAGE SCORES**	**PROPRIETARY**	**4 - 5 MINUTE GAMES**
16:	31:	46:	61:	76:
EXTRA BALL PERCENT	**5M - 5.5M SCORES**	**SERVICE CREDITS**	**PROPRIETARY**	**5 - 6 MINUTE GAMES**
17:	32:	47:	62:	77:
REPLAY 1 AWARDS	**5.5M - 6M SCORES**	**BALL SEARCH STARTED**	**PROPRIETARY**	**6 - 8 MINUTE GAMES**
18:	33:	48:	63:	78:
REPLAY 2+ AWARDS	**6M - 6.5M SCORES**	**LOST BALL FEEDS**	**BASE REPLAY**	**8 - 10 MINUTE GAMES**
19:	34:	49:	64:	79:
TOTAL REPLAYS	**6.5M - 7M SCORES**	**LOST BALL GAME STARTS**	**LEFT FLIPPER USED**	**10 -15 MINUTE GAMES**
20:	35:	50:	65:	80:
REPLAY PERCENT	**7M - 7.5M SCORES**	**LEFT DRAINS**	**RIGHT FLIPPER USED**	**15+ MINUTE GAMES**
21:	36:	51:	66:	81:
TOTAL SPECIALS	**7.5M - 8M SCORES**	**CENTER DRAINS**	**PROPRIETARY**	
22:	37:	52:	67:	
SPECIAL PERCENT	**8M - 8.5M SCORES**	**RIGHT DRAINS**	**PROPRIETARY**	
23:	38:	53:	68:	
TOTAL MATCHES	**8.5M - 9M SCORES**	**TILTS**	**0 - 1 MINUTE GAMES**	
24:	39:	54:	69:	
HIGH SCORE AWARDS	**9M - 9.5M SCORES**	**TOTAL BALLS SAVED**	**1 - 1.5 MINUTE GAMES**	
25:	40:	55:	70:	
HIGH SCORE PERCENT	**9.5M - 10M SCORES**	**PROPRIETARY**	**1.5 - 2 MINUTE GAMES**	
26:	41:	56:	71:	
TOTAL FREE PLAYS	**10M - 12M SCORES**	**PROPRIETARY**	**2 - 2.5 MINUTE GAMES**	
27:	42:	57:	72:	
TOTAL PLAYS	**12M - 15M SCORES**	**PROPRIETARY**	**2.5 - 3 MINUTE GAMES**	
28:	43:	58:	73:	
0 - 3M SCORES	**15M - 20M SCORES**	**PROPRIETARY**	**3 - 3.5 MINUTE GAMES**	
29:	44:	59:	74:	

RollerCoaster Tycoon™

Roller Coaster Tycoon Pinball Comments or Notes:

FEATURE AUDIT TABLE

FEATURE AUDITS 82-139 = ✎

*** PROGRAMMING USE ONLY ***

UNLABELED BOXES ARE FOR FUTURE EXPANSION.

LEFT ORBITS	KIOSK ADVANCE GHOST	JACKPOTS	POWER RIDE START	PARK TYCOON JACKPOTS
82:	95:	108:	121:	134:
RIGHT ORBITS	KIOSK BOO TIME	SUPER JACKPOTS	POWER RIDE AWARDS	PARK TYCOON 1X SUPER
83:	96:	109:	122:	135:
LEFT RAMPS	KIOSK AWARD STAND	MB STARTED	DANCE DIGITS START	PARK TYCOON 2X SUPER
84:	97:	110:	123:	136:
CENTER RAMPS	KIOSK POPS AT MAX	2+ MB STARTED	DANCE DIGITS AWARDS	PARK TYCOON 3X SUPER
85:	98:	111:	124:	137:
RIGHT RAMPS	KIOSK LOCK LIT	TOSS COOKIES START	DANCE DIGITS COMPLETE	PARK TYCOON 4X SUPER
86:	99:	112:	125:	138:
ROCKET RAMPS	KIOSK QUICK MULTIBALL	TOSS COOKIES COMPLETE	BOO TIME START	GUEST EB LEVEL
87:	100:	113:	126:	139:
KIOSK AWARDS GIVEN	KIOSK ADD GUESTS	DUNK DUMMY START	BOO TIME AWARDS	
88:	101:	114:	127:	
KIOSK EB LIT	KIOSK BONUS X	DUNK DUMMY AWARDS	FOOD STANDS BUILT	
89:	102:	115:	128:	
KIOSK RANDOM POINTS	KIOSK QUICK JACKPOT	SPIN BUMP START	FOOD STANDS ?	
90:	103:	116:	129:	
KIOSK SPECIAL LIT	KIOSK AWARD BONUS	SPIN BUMP AWARDS	R&D COMPLETED	
91:	104:	117:	130:	
KIOSK CONST. START	KIOSK LIGHT FUN MODE	SUPER DUNK START	BONUS X EB LIT	
92:	105:	118:	131:	
KIOSK ADVANCE RIDE	KIOSK START FUN MODE	SUPER DUNK MB START	PARK TYCOON LIT	
93:	106:	119:	132:	
KIOSK SPINNER LIT	KIOSK BOO INCREASED	SUPER DUNK MB AWARDS	PARK TYCOON STARTED	
94:	107:	120:	133:	

TOURNAMENT AUDIT TABLE

*For details and information on **Tournament Audits**, see Section **3**, Chapter **7**, **GO TO TOURNAMENT MENU.***

TOURNAMENT AUDITS 140-151 = ✎

TOURNAMENT START DATE : 0 TOURNAMENT END DATE : 0

TOTAL PLAYS	TOTAL TOUR. EARNINGS	ACCUM. TOTAL PLAYS	ACCUM. TOUR EARNINGS	
140:	143:	146:	149:	
TOURNAMENT PLAYS	JACKPOT	ACCUM. TOUR. PLAYS	ACCUM. JACKPOT	
141:	144:	147:	150:	
TOTAL GAME EARNINGS	NET EARNINGS	ACCUM. EARNINGS	# TOURNAMENTS	
142:	145:	148:	151:	

STANDARD & FEATURE ADJUSTMENT TABLES

STANDARD ADJUSTMENTS 01-45 ✍ = ✎

	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
01	REPLAYS: FIXED/AUTO ‡	... 12% ...	
02	REPLAY LEVELS ‡	1	
03	REPLAY AWARD	CREDIT	
04	FREE GAME LIMIT	05	
05	EXTRA BALL LIMIT	09	
06	GAME PRICING ‡	USA 5	
07	MATCH PERCENTAGE	8%	
08	BALLS PER GAME	03	
09	TILT WARNINGS	01	
10	REPLAY BOOST	YES	
11	CREDIT LIMIT	30	
12	ALLOW HIGH SCORES	YES	
13	HIGH SCORE #1 AWARDS	01	
14	HIGH SCORE #2 AWARDS	00	
15	HIGH SCORE #3 AWARDS	00	
16	HIGH SCORE #4 AWARDS	00	
17	HIGH SCORE #5 AWARDS	00	
18	DEFAULT HIGH SCORE #1	50,000,000	
19	DEFAULT HIGH SCORE #2	40,000,000	
20	DEFAULT HIGH SCORE #3	30,000,000	
21	DEFAULT HIGH SCORE #4	20,000,000	
22	DEFAULT HIGH SCORE #5	10,000,000	
23	HSTD RESET COUNT	2,000	
24	HIGH SCORE INITIALS	3 INITIALS	
25	FREE PLAY	NO	
26	CUSTOM MESSAGE	ON	
27	FLASH LAMP POWER	NORMAL	
28	COIL PULSE POWER	NORMAL	
29	KNOCKER VOLUME	NORMAL	
30	GAME RESTART	YES	
31	EXTRA BALL PERCENTAGE	20%	
32	SPECIAL PERCENTAGE	2%	
33	BILL VALIDATOR	NO	
34	BKGRND MUSIC VOLUME	01	
35	FREEZE TIME	AUTO	
36	UK POST SAVE ENABLED †	NO	
37	TIMED PLUNGER	OFF	
38	FLIPPER BALL LAUNCH	DISABLED	
39	COINDOOR BALL SAVER	NO	
40	COMPETITION MODE	NO	
41	CONSOLATION BALL	YES	
42	PROPRIETARY		
43	PROPRIETARY		
44	LOCATION ID	01	
45	GAME ID	00	

‡ Adj. 01, 02 & 06 have a "Drop-Down" Table for further customization. † Adj. 38 is utilized only for the UK (UK Dip Sw. Option Setting 2).
Note: *If **Game & Display ROMs** other than USA are installed, along with the proper Dip Switch Settings, different Defaults will appear. If changes are made (or your Defaults are not USA), enter them with pencil in the **YOUR SETTING** spaces provided for reference.*

Shortcut to Standard Adjustment 26.

FEATURE ADJUSTMENTS 46-62 ✍ = ✎

	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
46	STARTING SNACK LEVEL	00	
47	EXTRA BALL MEMORY	ON	
48	SPECIAL MEMORY	ON	
49	AUTO NEXT RIDE	YES	
50	SPOT GHOST LETTERS	02	
51	START GUEST COUNT	10	
52	BONUS X MEMORY	NO	
53	RIDE START LIGHTS	01	
54	R&D DIFFICULTY	MODERATE	
55	FAST BONUS COUNTDOWN	NO	
56	GUESTS FOR EB	80	
57	MODES AT GAME START	03	
58	SNACK BAR SKILL	YES	
59	EAT DIFFICULTY	MODERATE	
60	POPS LIT AT BALL START	01	
61	MODE LIT AT BALL START	MODERATE	
62	SPOT ABC LETTERS	00	

Go To Adjustments Menu

Overview

The **Portals™ Service Menu System** provides **62** Adjustments to vary Game Functions to customize for your particular needs. The Adjustments are divided into 2 groups: • **Standard Adjustments** (**01-45**) and • **Feature Adjustments** (**46-62**). Adjustments which are named **Proprietary** are also for ***Future Expansion*** or ***Programming***. Game code may get upgraded during production; compare all Adjustments in the display with the manual and make any corrections to the Adjustment Table *(previous page),* as necessary. Adjustments are subject to change *(with or without notice)*. To view Adjustments in the display, enter the **Portals™ Service Menu System**. When a change is made and then the next / previous Adjustment is selected *(or the Sub-Menu is exited)*, the display will momentarily flash **REQUEST INSTALLED**. *For **further customization** of **Game Play Difficulty** or **Game Play Type** or how to **RESET ONLY** the **Adjustments**, see Sec. **3**, Chp. **5**, **GO TO INSTALLS MENU**.*

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

EXPLANATION & USAGE OF COMMON LARGE & MINI-ICONS USED IN VARIOUS MENUS & SUB-MENUS:

These ***non-selectable Icons*** appear in the *selected Menu* only when there are **MORE** Icons to the **LEFT** or to the **RIGHT** available for selection.

Select and activate to return to the **PREVIOUS** Menu.

Select and activate to **QUIT**, *exits & returns to the* ***Attract Mode***.

Select and activate to view **HELP** *Screens of the current Menu*.*

Select and activate to:

Move **LEFT** or **RIGHT,** *select previous / next or move backwards / forwards.*

DECREMENT (-) or **INCREMENT (+)** *displayed value or select previous / next.*

**** Help Note:** An explanation of each Mini-Icon at that menu level will cycle continuously. To exit a display where no Mini-Icons are available for selection, pressing any button will exit the display.*

GO TO ADJUSTMENTS MENU

After entering **Portals™**, the **MAIN MENU** now appears. Select the "ADJ" *Icon* in the **MAIN MENU** with either the **Red "LEFT"** or **Green "RIGHT" Buttons** (the **Flipper Buttons** operates in the same manner) and press the **Black "ENTER" Button** (the **Start Button** operates in the same manner). The **ADJUSTMENTS MENU** appears. Continue through this chapter for the explanation & usage of the *Icons* in the **ADJUSTMENTS MENU**.

Standard Adjustments (01-45)

To initiate, from the **ADJUSTMENTS MENU**, select the "S.P.I." *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Select and *activate* either of the ">>" *Mini-Icons* to view the next or previous Adjustment in this group. Select and *activate* either of the "-" or "+" *Mini-Icons* to change the setting, if desired *(the Default Setting is noted in the definitions below)*. The display will describe the **Adjustment Number**, **Adjustment Name** and the **Current Adjustment Setting**. The current Adjustment will remain in the display until the next Adjustment is view or when this Menu is exited.

Adj. Nº	Adjustment Name	Adjustment Definition
01	**REPLAYS: FIXED / AUTO**	Set between **01% - 50%** and **FIXED** (0%) for Replay Levels. Default is **12%**. Four levels may be selected. Adjustments allow awarding of a credit or an extra ball as each level is exceeded. With the ***Autopercentage Feature***, if the actual replay percentage is higher or lower than that desired, the game will automatically adjust for the new recommended percentage score(s).
02	**REPLAY LEVELS**	Set between **1 - 4** or **NONE** for the number of replay levels to be active. Default is **1**. 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.
03	**REPLAY AWARD**	Set to **CREDIT**, **EXTRA BALL**, **NONE** or **SPECIAL**. Default is **CREDIT**.
04	**FREE GAME LIMIT**	Set between **01 - 09** or **NO FREE GAMES**. Default is **05**. Set the maximum number of *Free Games* that may be accumulated per game.
05	**EXTRA BALL LIMIT**	Set between **01 - 09** or **NO EXTRA BALLS**. Default is **09**. Set the maximum number of *Extra Balls* that may be accumulated per game.

Standard Adjustment 06 continued on the next page.

Adjustment Name	Adjustment Definition
06 GAME PRICING	There are two (2) methods available for *Coin Switch Programming*: **Standard** & **Custom**. Set between **USA 1** thru **EURO 12** or **CUSTOM**. *USA Factory Default Setting* is **USA 5**.

The Dip Switch Settings for the Country, which ***must be changed*** *on the CPU/Sound Board for correct operation*. For a **Standard** Selection (USA or International): Select & *activate* either of the "-" or "+" *Mini-Icons* to move backward or forward in the Display; With your choice appearing in the display, select & *activate* the ">>" *Mini-Icon* (to advance to **Adj. 7**) to "lock-in" change *(display will momentarily flash **REQUEST INSTALLED**).*

If **CUSTOM** is selected *(appears in display)*, after selecting & *activating* any *Mini-Icon (except for "-" or "+"),* the display will momentarily flash **REQUEST INSTALLED** with the display "**LEFT COIN: 0 PULSE**" appearing. Use the "<<" or ">>" *Mini-Icons* to ***select*** the next choice *(see Table Examples below)* and the "-" or "+" *Mini-Icons* to ***customize*** the PULSES, CREDITS & CLICKS from **0** to **99**.

The prescribed number of **PULSES** required for **1 CREDIT** must be set according to the ***Pricing Scheme*** *desired*. Some simple calculations are required to get the proper set-up. After customizing, ***test*** *the set-up* with appropriate Coins or Bills and adjust, if necessary. ***Note:*** *Clicks can be changed if an optional Coin Meter is installed.*

LEFT	CENTER	RIGHT	4TH
25¢	$1.00	25¢	Not Used
Coin Mechanisms Used			

Example 1

1 /50¢	2 /75¢	3/ $1.00
Pricing Scheme Desired		

LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:	ONE CREDIT:	BONUS 1:	BONUS 2:	BONUS 1:	BONUS 2:	LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:
3	12	3	1	4	0	0	0	0	1	4	1	1
PULSES	PULSES	PULSES	PULSE	PULSES	PULSES	PULSES	CREDITS	CREDITS	CLICK	CLICKS	CLICK	CLICK

In **Example 1**, note the **LEFT** (and **RIGHT**) **COIN: 3 PULSES** and **ONE CREDIT: 4 PULSES**. Since every Coin inserted produces 3 Pulses and every Credit requires 4 Pulses, 2 Coins (50¢) will produce 6 Pulses (4 Pulses for the 1st Credit + 2 Pulses remains in "escrow"). The third Coin (75¢) provides another 3 Pulses for a total of 5 Pulses (4 Pulses for the 2nd Credit + 1 Pulse remains in "escrow"). The fourth Coin ($1.00) provides another 3 Pulses for a total of 4 Pulses (4 Pulses for the 3rd Credit + 0 Pulses remain). The **CENTER COIN: 12 PULSES** is set this way, because the Center Coin has a Bill Validator; every $1 Bill inserted produces 12 Pulses or 3 Credits.

LEFT	CENTER	RIGHT	4TH
25¢	$1.00	25¢	Not Used
Coin Mechanisms Used			

Example 2

1 /50¢	2 /75¢	7/ $2.00
Pricing Scheme Desired		

LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:	ONE CREDIT:	BONUS 1:	BONUS 2:	BONUS 1:	BONUS 2:	LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:
3	12	3	1	4	**24**	0	**1**	0	1	4	1	1
PULSES	PULSES	PULSES	PULSE	PULSES	PULSES	PULSES	CREDIT	CREDITS	CLICK	CLICKS	CLICK	CLICK

In **Example 2**, *similar to Example 1,* however, **BONUS CREDITS** are implemented. In addition to receiving 3 plays for every $1.00, the player is awarded an extra Credit for every 2nd dollar inserted before game start.

LEFT	CENTER	RIGHT	4TH
25¢	$1.00	25¢	Not Used
Coin Mechanisms Used			

Example 3

1 /25¢	6/ $1.00	13/ $2.00
Pricing Scheme Desired		

LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:	ONE CREDIT:	BONUS 1:	BONUS 2:	BONUS 1:	BONUS 2:	LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:
5	20	5	0	4	20	**40**	**1**	0	1	4	1	1
PULSES	PULSES	PULSES	PULSES	PULSES	PULSES	PULSES	CREDIT	CREDITS	CLICK	CLICKS	CLICK	CLICK

In **Example 3**, a ***Pricing Scheme*** for a cheaper game is shown. An extra Pulse is put in escrow for every 25¢, thus at 4X 25¢ inserted, another Credit is given, and the **BONUS 1: 20 PULSES** threshold is also met, so 6/ $1.00 is achieved. **BONUS 2: 40 PULSES** is set, so when this threshold is met with $2.00, 13 Credits are produced.

LEFT	CENTER	RIGHT	4TH
10p	50p	£1	20p
Coin Mechanisms Used			

Example 4

1 /30p	2 /50p	5 /£1
Pricing Scheme Desired		

LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:	ONE CREDIT:	BONUS 1:	BONUS 2:	BONUS 1:	BONUS 2:	LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:
1	6	15	2	3	0	0	0	0	1	4	1	1
PULSE	PULSES	PULSES	PULSES	PULSES	PULSES	PULSES	CREDITS	CREDITS	CLICK	CLICKS	CLICK	CLICK

In **Example 4**, a ***Pricing Scheme*** using a different currency (British Sterling) is shown to provide another way coins (or tokens) can be utilized to custom tailor to your own needs.

WARNING: Changes made in any Adjustments will be lost after a FACTORY RESET or removal of the CPU/Sound Board Batteries.

The **USA Standard Pricing Select Table** *(shown below)* and the **International Standard Pricing Select Table** *(shown next page)*, details the following: **1. Dip Switch** (Sw. 300) Setting ***required*** on the CPU/Sound Board. **2. Country Setting Option(s) 3. Coin Mechanisms:** Money values which are typically used in the Left, Center, Right and 4th Coin Slot Switches. **4. Pricing Scheme:** Number of plays or credits for the price amount shown.

USA Standard Pricing Select Table

CPU/SOUND BOARD DIP SWITCH 300 SETTING	COUNTRY SETTING OPTION(S)	COIN MECHANISMS (SWITCHES) COINS THRU ... SLOT: LEFT	CENTER	RIGHT	4TH	PRICING SCHEME Number of Plays (Credits) for Price Amount Shown See "Appendix J" for Coin Cards Examples & Info!			Requires SPI Coin Card(s) Part Number
Pos. 1 2 3 4 5 6 7 8									
ON	USA 1					1 /$.25			755-5400-01
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼	USA 2					1 /$.50	2 /$.75	3 /$1.00	755-5400-02
Note: *The Country Setting Option for USA noted with "«" & "»" denotes the Factory Default Setting (subject to change).*	USA 3					1 /$.50			755-5400-02
	USA 4					1 /$.50	*For USA Defaults 6 & 7 use:*		755-5400-02
	USA 5 »	$.25	$1.00	$.25		» 1 /$.50	5 /$2.00	**755-5400-02**	755-5400-00
	USA 6					1 /$.50	2 /'4 X 25¢'	3 /$1.00 Bill	◀ Used to promote the Bill Validator.
	USA 7					1 /$.50	4 /$1.50	6 /$2.00	
	USA 8					1 /$.50	3 /$1.00		755-5400-00

International Standard Pricing Scheme Table

CPU/SOUND BOARD DIP SWITCH 300 SETTING	COUNTRY SETTING OPTION(S)	COIN MECHANISMS (SWITCHES) COINS THRU ... SLOT: LEFT	CENTER	RIGHT	4TH	PRICING SCHEME Number of Plays (Credits) for Price Amount Shown See "Appendix J" for Coin Cards Examples & Info!			Requires SPI Coin Card(s) Part Number
Pos. 1 2 3 4 5 6 7 8	For different Euro Pricing Scheme (other than below default), go to Adjustment 06 and scroll through Euro 1-12 for new setting (see end of table Euro 1-12).								
ON ▲	Austria	€.50	€1.00	€2.00		1 /€1.00	2 /€1.50	3 /€2.00	755-5401-09
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	**Euro 9**								
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▲ ▲	**Australia 1** «	20¢	$A1	$A2		» 1 /$A1	3 /$A2		755-5406-00 (Side 1)
OFF ▼ ▼ ▼ ▼ ▼	Australia 2					1 /$A1			
Pos. 1 2 3 4 5 6 7 8	For different Euro Pricing Scheme (other than below default), go to Adjustment 06 and scroll through Euro 1-12 for new setting (see end of table Euro 1-12).								
ON ▲	Belgium	€.50	€1.00	€2.00		1 /€.50			755-5401-01
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	**Euro 1**								
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▲	**Canada**	Can$.25	Can$.25	Can$1	Can$2	1 /50¢	2 /75¢	3/ Can$1	755-5400-00 *or -01 or -02*
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼									
Pos. 1 2 3 4 5 6 7 8									
ON ▲	**Denmark 1** «	1 DKr	5 DKr	10 DKr	20 DKr	» 1 /3 DKr	2 /5 DKr		755-5402-00 (2-Sided)
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	Denmark 2					1 /2 DKr	3 /5 DKr	7 /10 DKr	
Pos. 1 2 3 4 5 6 7 8	For different Euro Pricing Scheme (other than below default), go to Adjustment 06 and scroll through Euro 1-12 for new setting (see end of table Euro 1-12).								
ON ▲ ▲	Finland	€.50	€1.00	€2.00		1 /€1.00	3 /€2.00		755-5401-08
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	**Euro 8**								
Pos. 1 2 3 4 5 6 7 8	For different Euro Pricing Scheme (other than below default), go to Adjustment 06 and scroll through Euro 1-12 for new setting (see end of table Euro 1-12).								
ON ▲ ▲	France	€.50	€1.00	€2.00		1 /€1.00	3 /€2.00	7 /€3.00	755-5401-10
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	**Euro 10**								
Pos. 1 2 3 4 5 6 7 8	*Germany: For different Euro Pricing Scheme (other than below settings), go to Adjustment 06 and scroll to Custom for this Unique Coin Door & Mech.*								
ON ▲ ▲ ▲	Germany 1					1 /€.50			755-5401-01
OFF ▼ ▼ ▼ ▼ ▼	**Germany 2** «	€.50	€1.00	€2.00		» 1 /€.50	5 /€2.00		755-5401-02
	Germany 3					1 /€.50	6 /€2.00		755-5401-04
Pos. 1 2 3 4 5 6 7 8	For different Euro Pricing Scheme (other than below default), go to Adjustment 06 and scroll through Euro 1-12 for new setting (see end of table Euro 1-12).								
ON ▲ ▲ ▲ ▲	Greece	€.50	€1.00	€2.00		2 /€.50			755-5401-06
OFF ▼ ▼ ▼ ▼	**Euro 6**								
Pos. 1 2 3 4 5 6 7 8	*Italy: For different Euro Pricing Scheme (other than below settings), go to Adjustment 06 and scroll to Custom for this Unique Coin Door & Mech.*								
ON ▲	**Italy 1** «	€.50		€.50		» 1 /€.50			755-5401-01 &
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	Italy 2					1 /€.50	3 /€2.00		755-5401-08
Pos. 1 2 3 4 5 6 7 8	For different Euro Pricing Scheme (other than below default), go to Adjustment 06 and scroll through Euro 1-12 for new setting (see end of table Euro 1-12).								
ON ▲	Netherlands	€.50	€1.00	€2.00		1 /€.50	3 /€1.00		755-5401-03
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	**Euro 3**								
Pos. 1 2 3 4 5 6 7 8									
ON ▲	**New Zealand 1** «	$NZ1		$NZ2		» 1 /$NZ1			755-5406-00 (Side 2)
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	New Zealand 2					1 /$NZ1	3 /$NZ2		
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▲	**Norway 1** «	10 NKr	5 NKr	20 NKr		» 1 /5 NKr			755-5403-00 (2-Sided)
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	Norway 2					1 /10 NKr	3 /20 NKr		
Pos. 1 2 3 4 5 6 7 8	*Portugal: For different Euro Pricing Scheme (other than below settings), go to Adjustment 06 and scroll to Custom for this Unique Coin Door & Mech.*								
ON ▲	**Portugal**	€.50		€.50		1 /€.50			755-5401-01
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼									
Pos. 1 2 3 4 5 6 7 8	For different Euro Pricing Scheme (other than below default), go to Adjustment 06 and scroll through Euro 1-12 for new setting (see end of table Euro 1-12).								
ON ▲	Spain	€.50	€1.00	€2.00		1 /€.50	3 /€1.00		755-5401-03
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	**Euro 3**								
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▲ ▲	**Sweden 1** «	1 SKr	5 SKr	10 SKr		» 1 /10 SKr	2 /15 SKr	3 /20 SKr	755-5404-00 (2-Sided)
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	Sweden 2					1 /5 SKr			
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▲	**Switzerland 1** «	1 SwF	2 SwF	5 SwF		» 1 /1 SwF	6 /5 SwF		755-5405-00 (2-Sided)
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	Switzerland 2					1 /1 SwF	3 /2 SwF	9 /5 SwF	

Pos. 1 2 3 4 5 6 7 8		LEFT	CENTER	RIGHT	4TH	5TH	UK also utilizes the 5th Coin Slot Switch (not available with Custom Pricing).			
ON ▲ ▲ ▲	UK 1	10p	50p	£1	20p	£2	3 /£1	7 /£2		755-5407-00
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	UK 2						4 /£1			755-5407-01*
	UK 3						1 /50p	5 /£2		755-5407-01
	UK 4						1 /30p	4 /£1		755-5407-01*
	UK 5 «						» 1 /£1	3 /£2		755-5407-00
	UK 6						3 /£2		*use blank side	755-5407-01*

Note: *The Country Setting Option above noted with "«" & "»" denotes the Factory Default Setting (subject to change).*

Pos. 1 2 3 4 5 6 7 8	Alternate Settings	LEFT	CENTER	RIGHT	4TH				
ON S E E A B O V E	**Euro 1**	€.50	€1.00	€2.00		1 /€.50			755-5401-01
OFF S E T T I N G S	**Euro 2**					1 /€.50	5 /€2.00		755-5401-02
	Euro 3					1 /€.50	3 /€1.00		755-5401-03
	Euro 4					1 /€.50	6 /€2.00		755-5401-04
	Euro 5				*optional* €.20 *optional*	1 /€.50	3 /€1.00	7 /€2.00	755-5401-05
	Euro 6					2 /€.50			755-5401-06
	Euro 7					1 /€1.00	5 /€4.00		755-5401-07
	Euro 8					1 /€1.00	3 /€2.00		755-5401-08
	Euro 9					1 /€1.00	2 /€1.50	3 /€2.00	755-5401-09
	Euro 10					1 /€1.00	3 /€2.00	7 /€3.00	755-5401-10
	Euro 11					1 /€1.00	4 /€2.00		755-5401-11
	Euro 12					2 /€1.00	9 /€4.00		755-5401-12

Euro 1-12 are alternate settings for above countries using the Euro:

If choosing an alternate Euro Setting other than your Country's Default, please remember to use your above noted Country Dip Switch Setting.

Standard Adj. 07-26 continued on the next page.

	Adjustment Name	Adjustment Definition
07	**MATCH PERCENTAGE**	Set between **0% - 10%** or **OFF**. Default is **8%**. At **0**% the match display occurs at the end of the game but never awards a credit.
08	**BALLS PER GAME**	Set between **02 - 05**. Default is **03**. Set the number of balls per game.
09	**TILT WARNINGS**	Set to **00**, **01** or **03**. Default is **01**. Set the number of plumb bob tilt switch closures before the ball in play is tilted.
10	**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)*.
11	**CREDIT LIMIT**	Set between **04 - 50**. Default is **30**. Set the maximum credits allowed.
12	**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. 03, Replay Award**)*. Set to **NO** to disable this feature. There are 5 High Scores that will allow the player to enter their initials *(or name)* *(see **Adj. 24, High Score Initials**)*.
13	**HIGH SCORE #1 AWARDS**	Set between **00 - 05**. Default is **01**. Set the number of awards, awarded for exceeding Level 1 *(the highest of the five (5) Levels)*.
14	**HIGH SCORE #2 AWARDS**	Set between **00 - 03**. Default is **00**. Set the number of awards, awarded for exceeding Level 2.
15	**HIGH SCORE #3 AWARDS**	Set between **00 - 02**. Default is **00**. Set the number of awards, awarded for exceeding Level 3.
16	**HIGH SCORE #4 AWARDS**	Set between **00 - 01**. Default is **00**. Set the number of awards, awarded for exceeding Level 4.
17	**HIGH SCORE #5 AWARDS**	Set between **00 - 01**. Default is **00**. Set the number of awards, awarded for exceeding Level 5.
18	**DEFAULT HIGH SCORE #1**	Set between **1,000,000 - 9,999,000,000** or **00** *(increments of 1M)*. Default is **50,000,000**. Set the desired ***High Score Level*** to which Level 1 may be achieved *(not affected by **Adj. 23, HSTD Reset Count**)*.
19	**DEFAULT HIGH SCORE #2**	Set between **1,000,000 - 9,999,000,000** or **00** *(increments of 1M)*. Default is **40,000,000**. Set the desired ***High Score Level*** to which Level 2 may be achieved *(not affected by **Adj. 23, HSTD Reset Count**)*.
20	**DEFAULT HIGH SCORE #3**	Set between **1,000,000 - 9,999,000,000** or **00** *(increments of 1M)*. Default is **30,000,000**. Set the desired ***High Score Level*** to which Level 3 may be achieved *(not affected by **Adj. 23, HSTD Reset Count**)*.
21	**DEFAULT HIGH SCORE #4**	Set between **1,000,000 - 9,999,000,000** or **00** *(increments of 1M)*. Default is **20,000,000**. Set the desired ***High Score Level*** to which Level 4 may be achieved *(not affected by **Adj. 23, HSTD Reset Count**)*.
22	**DEFAULT HIGH SCORE #5**	Set between **1,000,000 - 9,999,000,000** or **00** *(increments of 1M)*. Default is **10,000,000**. Set the desired ***High Score Level*** to which Level 5 may be achieved *(not affected by **Adj. 23, HSTD Reset Count**)*.
23	**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)*. Set the number of games between "automatic resets of high score levels" to "backup settings" and "ball time average" adjustments. Set to **OFF** for "no reset or adjustment".
24	**HIGH SCORE INITIALS**	Set to **3 INITIALS** or **10 LETTER**. Default is **3 INITIALS**. When set to **3 INITIALS**, the player is allowed only 3 initials to input. When set to **10 LETTER NAME**, the player is allowed to enter 10 initials to input.
25	**FREE PLAY**	Set to **YES** or **NO**. Default is **NO**. When set to **YES**, no coins are required for *Game Play*.
26	**CUSTOM MESSAGE** *View the Custom Message Shortcut summary (end of this chapter) for how to enter text or symbols.*	Set to **ON, CHANGE** or **OFF**. Default is **ON**. When set to **CHANGE**, a new message can be set or the old one can be edited *(select the "+" Mini-Icon to change settings until "CHANGE" appears in the display, then select the ">>" Mini-Icon to access.)*. This adjustment can be accessed in two (2) ways by either selecting the "S.P.I." *Icon* and advancing to this Adjustment, **or** can be directly accessed by selecting the "ABCD CUST MSG" *Icon* in the **ADJUSTMENTS MENU**.

Standard Adjustments 27-39 continued on the next page.

	Adjustment Name	Adjustment Definition
27	**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.
28	**COIL PULSE POWER**	Set to **NORMAL, HARD** or **SOFT**. Default is **NORMAL**. When set to **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. This adj. is provided to compensate for *Low Line* or *High Line voltage* conditions where the solenoids (coils) appear to *kicking too weak or too hard*. Adjust as required.
29	**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.
30	**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.*
31	**EXTRA BALL PERCENTAGE**	Set between **0% - 50%**. Default is **20%**. This adjustment allows the operator to adjust how frequently the ***Extra Ball Feature*** is made available to the player.
32	**SPECIAL PERCENTAGE**	Set between **0% - 5%**. Default is **2%**. This adjustment allows the operator to adjust how frequently the ***Special Feature*** is made available to the player.
33	**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*."
34	**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.
35	**FREEZE TIME (BALL SAVE)**	Set to **OFF**, **0:01-0:15** or **AUTO**. Default is **AUTO**. When set to **OFF** this feature is unavailable. Set between **0:01** through **0:15** *(single increments)* for the ball to be sent back into play if the time set is not met *(per ball).* Set to **AUTO** to automatically adjust the Freeze Timer based on the average ball time.
36	**UK POST SAVE ENABLED**	**UK Only Dip Switch Must Be Set** 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 differently; Non-UK Games cannot adjust this setting.)*
37	**TIMED PLUNGER**	Set to **OFF** or **0:15 - 1:00**. Default is **OFF**. When set to **0:15** to **1:00**, the plunger will "Autoplunge" the ball *(at the time set)* when the ball is at the beginning of play, awaiting the skill shot by the player.
38	**FLIPPER BALL LAUNCH**	Set to **DISABLED**, **LEFT FLIPPER**, **RIGHT FLIPPER**, **EITHER FLIPPER** or **BOTH FLIPPERS**. Default is **DISABLED**. This feature allows the player to operate the *Auto Ball Launch* with the **FLIPPER BUTTON(S)** depending on which setting is chosen.
39	**COINDOOR BALL SAVER**	Set to **YES** or **NO**. Default is **NO**. When set to **NO**, this feature is not available. When set to **YES**, this feature allows the **Coin Door** to be opened during game play; the ball will drain but the game will be placed "on hold". When the **Coin Door** is closed, the pinball will return to the Shooter Lane, and the game will resume.

Standard Adjustments 40-45 continued on the next page.

Standard Adjustments Continued.

Adjustment Name		Adjustment Definition
40	**COMPETITION MODE**	Set to **YES** or **NO**. Default is **NO**. When set to **NO**, this feature is not available. If an **Install** of either **$.50** or **Free Play Competition** was made *(changing the default to **YES**)*, and was changed back to **NO**, the **COMPETITION MODE** will be turned **OFF** *(see Sec. **3**, Chp. **5**, **GO TO INSTALLS MENU**, **$. 50** or **Free Play Competition**)*. Set to **YES**, this feature is available *(required for Competition Modes)*; this feature will equalize random game features and global score values during multi-player games.
41	**CONSOLATION BALL**	Set to **YES** or **NO**. Default is **YES**. When set to **YES**, the ***EXTRA BALL*** *(Playfield Light Insert)* will be lit on the last ball in play, if certain programming criteria is met.
42-43	**PROPRIETARY**	Proprietary Adjustments are used for ***Future Expansion*** or ***Programming***.
44	**LOCATION ID**	Set between **00** to **9999**. Default is **00**. This adjustment allows the operator to assign a location identification number to the audit print-out sheet. *(Will not be affected by Factory Reset.)*
45	**GAME ID**	Set between **00** to **9999**. Default is **00**. This adjustment allows the operator to assign a game identification number to the audit print-out sheet. *(Will not be affected by Factory Reset.)*

Feature Adjustments (46-62)

To initiate, from the **ADJUSTMENTS MENU**, select the "RCT" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Select and *activate* either of the ">>" *Mini-Icon*s to view the next or previous Adjustment in this group. Select and *activate* either of the "-" or "+" *Mini-Icons* to change the setting, if desired *(the Default Setting is noted in the definitions below)*. The display will describe the **Adjustment Number**, **Adjustment Name** and the **Current Adjustment Setting**. The current Adjustment will remain in the display until the next Adjustment is view or when this Menu is exited.

Adj. №	Adjustment Name	Adjustment Definition
46	**STARTING SNACK LEVEL**	Set between **00** - **04**. Default is **00**. Set the maximum number of "Snack Bars Lit" at game start.
47	**EXTRA BALL MEMORY**	Set to **ON** or **OFF**. Default is **ON**. When set to **ON**, this feature bonus (Extra Ball Lit) will be retained in memory from ball-to-ball for the same player. When set to **OFF**, this feature will go out at the end of each ball.
48	**SPECIAL MEMORY**	Set to **ON** or **OFF**. Default is **ON**. When set to **ON**, this feature bonus (Special Lit) will be retained in memory from ball-to-ball for the same player. When set to **OFF**, this feature will go out at the end of each ball.
49	**AUTO NEXT RIDE**	Set to **YES** or **NO**. Default is **YES**. When set to **YES**, the feature "next ride" will automatically start construction after a "ball lock" is made. Set to **NO** to disable this feature.
50	**SPOT GHOST LETTERS**	Set between **00** - **04**. Default is **02**. Set the maximum number of "GHOST Letters Lit" at game start.
51	**START GUEST COUNT**	Set between **01** - **99**. Default is **10**. Set the starting number of "Guests" (in hundreds) at game start.
52	**BONUS X MEMORY**	Set to **YES** or **NO**. Default is **NO**. When set to **YES** this feature "Multiplier Lamps Lit" are reset at ball start. Set to **NO** to disable this feature.
53	**RIDE START LIGHTS**	Set between **00** - **03**. Default is **01**. Set the maximum number of Red, Yellow & Green Lights to be lit when a ride activates (starts).
54	**R&D DIFFICULTY**	Set to **EXEASY, EASY, MODERATE, HARD** or **EXHARD**. Default is **MODERATE**. Determines how this Feature is started and played.
55	**FAST BONUS COUNTDOWN**	Set to **YES** or **NO**. Default is **NO**. When set to **NO**, thIs feature is not available. When set to **YES**, this feature is available.

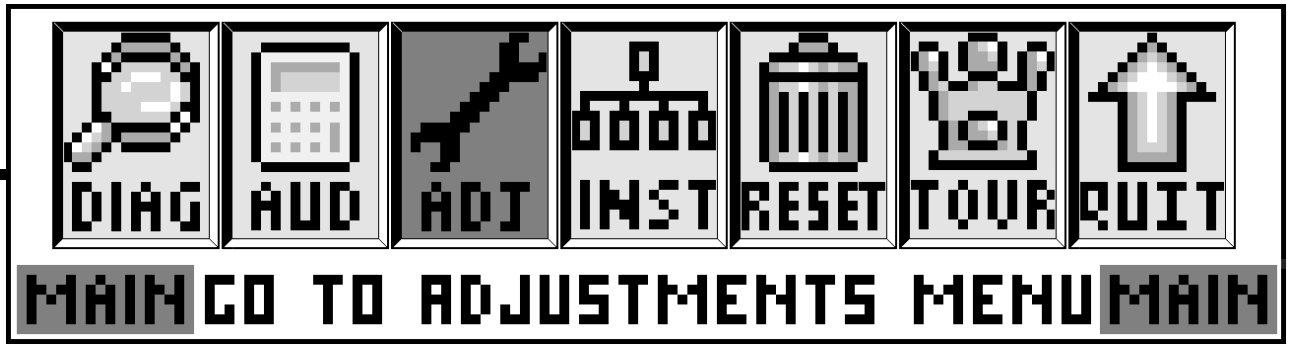
Feature Adjustments 56-62 continued on the next page.

	Adjustment Name	Adjustment Definition
56	**GUESTS FOR EB (EXTRA BALL)**	Set between **05** - **99**. Default is **80**. Set the maximum number of "hundreds of guests required" to light the Extra Ball Feature. ***Note:*** *This value will be modified automatically by the game software to make the number of actual Extra Balls given by the game. Match the desired percentage set in* ***Adj. 31, Extra Ball Percentage****.*
57	**MODES AT GAME START**	Set between **01** - **04**. Default is **03**. Set the starting number of "FUN Modes" at game start.
58	**SNACK BAR SKILL**	Set to **YES** or **NO**. Default is **YES**. When set to **YES**, the feature "Award a Snack Bar" will given if the Skill Shot is made at ball start. Set to **NO** to disable this feature.
59	**EAT DIFFICULTY**	Set to **EXEASY, EASY, MODERATE, HARD** or **EXHARD**. Default is **MODERATE**. Determines how this Feature "Spell E-A-T Targets" is started and played.
60	**POPS LIT AT BALL START**	Set between **00** - **03**. Default is **01**. Set the starting number of "Pop Bumpers Lit Solid (not blinking)" at ball start.
61	**MODE LIT AT BALL START**	Set to **EXEASY, EASY, MODERATE, HARD** or **EXHARD**. Default is **MODERATE**. Determines how this Feature "Fun Mode" is started and played.
62	**SPOT ABC LETTERS**	Set between **00** - **02**. Default is **00**. Set the starting number of "ABC Top Lanes Lit Solid (not blinking)" at ball start.

For further customization of Game Play Difficulty or Game Play Type or how to RESET ONLY the Adjustments, see Section 3, Chapter 5, GO TO INSTALLS MENU.

Custom Message

To go directly to ***Adjustment 26, Custom Message,*** from the **ADJUSTMENT MENU**, select the "CUST MSG" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** 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.



For further customization of Game Play Difficulty or Game Play Type or how to RESET ONLY the Adjustments, see Section 3, Chapter 5, GO TO INSTALLS MENU.

Go To Installs Menu

Overview

The **Portals™ Service Menu System** provides **14 Installs** to vary **Game Play Difficulty** or **Game Play Type** and **Install Factory**.

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

For **detailed customization** or to check current **Adjustments Defaults** *(either changed by YOU in the Adjustments Menu or by this* **Installs** *Menu or for Factory Default Settings), see Section **3**, Chapter **4**, **GO TO ADJUSTMENTS MENU**. **Important: Before preceding***, write down any *previously changed Adjustment Defaults.* After completing one or more of the **Installs** in this Chapter, go back to the **ADJUSTMENTS MENU** to see which **Standard and/or Feature Adjustments** have changed *(Feature Adjustment and/or settings are subject to change during production, and may differ than what is described in the tables below each Install explanation).* If the settings are not to your liking, perform one of the following:

1.: Manually change the **Standard & Feature Adjustments** Settings *(perform task in the Adjustments Menu).*

or

2.: Install Factory to reset all of the **Standard & Feature Adjustments** back to the *Factory Default Settings*, (*see the end of this chapter).*

Multiple **Installs can be set** to vary game play; however, for **Installs** that have *one or more* Adjustments in common, the ***last*** "Install" selected & *activated*, will **supersede** any previously changed Adjustment(s) from any prior **Installs**.

For example, if you want a **5-BALL Game** *set to* **EXTRA EASY**: Select and *activate* the "5BAL" *Icon* first (which will typically change any ***Feature*** Difficulty Adjustments to **HARD**), then select & *activate* the "X.EZ" *Icon* to **change back** the Difficulty Adjustments to **EXTRA EASY**. However, if the "X.EZ" *Icon* was selected & *activated* first, then the "5BAL" *Icon* was selected & *activated*, the game will be set to a **5-BALL Game** *set to* **HARD**.

EXPLANATION & USAGE OF COMMON LARGE ICONS USED IN THIS MENU:

These ***non-selectable Icons*** appear in the *selected Menu* only when there are **MORE** Icons to the **LEFT** or to the **RIGHT** available for selection.

Select and activate to return to the **PREVIOUS** Menu.

Select and activate to **QUIT**, *exits & returns to the* ***Attract Mode***.

Select and activate to view **HELP** *Screens of the current Menu*.*

⚠ WARNING: ⚠
Selection & activation of the "Install Factory" Icon, will change all Adjustments & Installs to the Factory Default!

**** Help Note: An explanation of each Icon at that menu level will cycle continuously. To exit a display where no Icons are available for selection, pressing any button will exit the display.***

GO TO INSTALLS MENU

After entering **Portals™**, the **MAIN MENU** now appears. Select the "INST" *Icon* in the **MAIN MENU** with either the **Red "LEFT"** or **Green "RIGHT" Buttons** (the **Flipper Buttons** operates in the same manner) and press the **Black "ENTER" Button** (the **Start Button** operates in the same manner). The **INSTALLS MENU** appears. Continue through this chapter for the explanation & usage of the *Icons* in the **INSTALLS MENU**.

Install Extra Easy

To initiate, from the **INSTALLS MENU**, select the "X.EZ" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. **Game Play Difficulty** is set to **EXTRA EASY. "REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "X.EZ" *Icon* flashing.

STANDARD ADJUSTMENT(S) NEW SETTINGS:		
NONE		

FEATURE ADJUSTMENTS NEW SETTINGS*:		
54, 59, 61	... DIFFICULTY	EXTRA EASY

** Feature Adjustments and/or settings are subject to change.*

Install Easy

To initiate, from the **INSTALLS MENU**, select the "EASY" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. **Game Play Difficulty** is set to **EASY**. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "EASY" *Icon* flashing.

STANDARD ADJUSTMENT(S) NEW SETTINGS:		
NONE		

FEATURE ADJUSTMENTS NEW SETTINGS*:		
54, 59, 61	... DIFFICULTY	EASY

** Feature Adjustments and/or settings are subject to change.*

Install Normal

To initiate, from the **INSTALLS MENU**, select the "FACT" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. **Game Play Difficulty** is set to **MODERATE**. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "FACT" *Icon* flashing.

STANDARD ADJUSTMENT(S) NEW SETTINGS:		
NONE		

FEATURE ADJUSTMENTS NEW SETTINGS*:		
54, 59, 61	... DIFFICULTY	MODERATE

** Feature Adjustments and/or settings are subject to change.*

Install Hard

To initiate, from the **INSTALLS MENU**, select the "HARD" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. **Game Play Difficulty** is set to **HARD**. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "HARD" *Icon* flashing.

STANDARD ADJUSTMENT(S) NEW SETTINGS:		
NONE		

FEATURE ADJUSTMENTS NEW SETTINGS*:		
54, 59, 61	... DIFFICULTY	HARD

** Feature Adjustments and/or settings are subject to change.*

Install Extra Hard

To initiate, from the **INSTALLS MENU**, select the "X.HD" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. **Game Play Difficulty** is set to **EXTRA HARD**. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "X.HD" *Icon* flashing.

STANDARD ADJUSTMENT(S) NEW SETTINGS:		
NONE		

FEATURE ADJUSTMENTS NEW SETTINGS*:		
54, 59, 61	... DIFFICULTY	EXTRA HARD

** Feature Adjustments and/or settings are subject to change.*

Install 3-Ball

To initiate, from the **INSTALLS MENU**, select the "3BAL" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. **Game Play Type** is set to **3-BALL PLAY**. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "3BAL" *Icon* flashing.

STANDARD ADJUSTMENT(S) NEW SETTINGS:		
08	BALLS PER GAME	03

FEATURE ADJUSTMENTS NEW SETTINGS*:		
54, 59, 61	... DIFFICULTY	MODERATE

** Feature Adjustments and/or settings are subject to change.*

Install 5-Ball

To initiate, from the **INSTALLS MENU**, select the "5BAL" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. **Game Play Type** is set to **5-BALL PLAY**. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "5BAL" *Icon* flashing.

STANDARD ADJUSTMENT(S) NEW SETTINGS:

08	BALLS PER GAME	05

FEATURE ADJUSTMENTS NEW SETTINGS*:

54, 59, 61	... DIFFICULTY	HARD

** Feature Adjustments and/or settings are subject to change.*

$ .50 Competition (a.k.a. IFPA)

To initiate, from the **INSTALLS MENU**, select the "PAY" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. **Game Play Type** is set to **TOURNAMENT PAY MODE**. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "PAY" *Icon* flashing.

STANDARD ADJUSTMENT(S) NEW SETTINGS:

06	GAME PRICING	USA 5
09	TILT WARNINGS	02
25	FREE PLAY	NO
30	GAME RESTART	NO
39 *(Note 1)*	COINDOOR BALL SAVER	(YES) *(Note 1)*
40 *(Note 2)*	COMPETITION MODE	YES *(Note 2)*

FEATURE ADJUSTMENTS NEW SETTINGS:

NONE		

*Note 1: Adjustment 39 Default **will not change**; Installing $ .50 Competition will override this Adjustment regardless of the setting.*
Note 2: If Adjustment 40 is changed back to NO after this Install, the Competition Mode Install will be canceled (turned off).

If Competition Mode was set, it is suggested to "Install Factory" to restore all Adjustments (Factory Default); then to recustomize, if desired.

Free Play Competition (a.k.a. EXPO or PAPA)

To initiate, from the **INSTALLS MENU**, select the "FREE" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. **Game Play Type** is set to **TOURNAMENT FREE MODE**. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "FREE" *Icon* flashing.

STANDARD ADJUSTMENT(S) NEW SETTINGS:

09	TILT WARNINGS	02
25	FREE PLAY	YES
30	GAME RESTART	NO
39 *(Note 1)*	COINDOOR BALL SAVER	(YES) *(Note 1)*
40 *(Note 2)*	COMPETITION MODE	YES *(Note 2)*

FEATURE ADJUSTMENTS NEW SETTINGS:

NONE		

*Note 1: Adjustment 39 Default **will not change**; Installing $ .50 Competition will override this Adjustment regardless of the setting.*
Note 2: If Adjustment 40 is changed back to NO after this Install, the Competition Mode Install will be canceled (turned off).

If Competition Mode was set, it is suggested to "Install Factory" to restore all Adjustments (Factory Default); then to recustomize, if desired.

Install Home Play

To initiate, from the **INSTALLS MENU**, select the "HOME" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. **Game Play Type** is set to **NORMAL HOME PLAY**. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "HOME" *Icon* flashing.

STANDARD ADJUSTMENT(S) NEW SETTINGS:

05	EXTRA BALL LIMIT	09
07	MATCH PERCENTAGE	10%
25	FREE PLAY	YES
31	EXTRA BALL PERCENTAGE	30%
39	COINDOOR BALL SAVER	YES

FEATURE ADJUSTMENTS NEW SETTINGS:

NONE		

Film Star Reset

To initiate, from the **INSTALLS MENU**, select the "STAR" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. **Game Play Type** is set to **EASY HOME PLAY**. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "STAR" *Icon* flashing.

STANDARD ADJUSTMENT(S) NEW SETTINGS:

05	EXTRA BALL LIMIT	09
25	FREE PLAY	YES
39	COINDOOR BALL SAVER	YES

FEATURE ADJUSTMENTS NEW SETTINGS*:

54, 59, 61	... DIFFICULTY	EASY

** Feature Adjustment and/or settings are subject to change.*

Install Novelty

This setting is recommended where ***local laws restrict certain game features***.

To initiate, from the **INSTALLS MENU**, select the "NOV" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. **Game Play Type** is set to **RESTRICTED PLAY**. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "NOV" *Icon* flashing.

STANDARD ADJUSTMENT(S) NEW SETTINGS:

01	REPLAYS: FIXED/AUTO	FIXED (0%)
02	REPLAY LEVELS	NONE
03	REPLAY AWARD	NONE
04	FREE GAME LIMIT	NO FREE GAMES
05	EXTRA BALL LIMIT	NO EXTRA BALLS
07	MATCH PERCENTAGE	OFF
10	REPLAY BOOST	NO
13-17	HIGH SCORE ... AWARDS	00

FEATURE ADJUSTMENTS NEW SETTINGS:

NONE		

Install Add-A-Ball

This setting is recommended where ***local laws restrict certain game features***.

To initiate, from the **INSTALLS MENU**, select the "A.A.B" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. **Game Play Type** is set to **RESTRICTED PLAY**. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "A.A.B" *Icon* flashing.

STANDARD ADJUSTMENT(S) NEW SETTINGS:

03	REPLAY AWARD	EXTRA BALL
04	FREE GAME LIMIT	NO FREE GAMES
05	EXTRA BALL LIMIT	09
07	MATCH PERCENTAGE	OFF
13-17	HIGH SCORE ... AWARDS	00

FEATURE ADJUSTMENTS NEW SETTINGS:

NONE		

Install Factory (ONLY affects all Adjustments/Installs)

To initiate, from the **INSTALLS MENU**, select the "FACT" *Icon* with either the **Red "LT"** or **Green "RT" Buttons** and press the **Black "ENT" Button**. ⚠ All **Installs** will be reset to the *Factory Default Settings*. **"REQUEST INSTALLED"** is indicated and the **Service Menu** is exited, returning to the ***Attract Mode***.

STANDARD ADJUSTMENT(S) NEW SETTINGS:

01-45	**ALL STANDARD ADJ.**	**FACTORY DEFAULTS**

FEATURE ADJUSTMENTS NEW SETTINGS*:

54, 59, 61	**ALL FEATURE ADJ.**	**FACTORY DEFAULTS**

If Competition Mode was set, it is suggested to "Install Factory" to restore all Adjustments (Factory Default); then to recustomize, if desired.

For how to RESET Audits (also can RESET High Scores, Credits or Reset All Adjustments) see Section 3, Chapter 6, GO TO RESET MENU.

Go To Reset Menu

Overview

The **Portals™ Service Menu System** provides five (5) functions to reset **Coin & Game Audits**, **High Scores**, **Credits** *or to reset* **ALL AUDITS, ADJUSTMENTS & INSTALLS** back to the ***Factory Default Settings***.

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

EXPLANATION & USAGE OF COMMON LARGE ICONS USED IN THIS MENU:

These ***non-selectable Icons*** *appear in the selected Menu only when there are* **MORE** Icons to the **LEFT** or to the **RIGHT** available for selection.

Select and activate to return to the **PREVIOUS** Menu.

Select and activate to **QUIT**, *exits & returns to the* ***Attract Mode***.

Select and activate to view **HELP** *Screens of the current Menu*.*

⚠ WARNING: ⚠
As soon as any Reset Icon is selected & activated, the information associated with the Reset Icon, is lost!

**** Help Note:** An explanation of each Icon at that menu level will cycle continuously. To exit a display where no Icons are available for selection, pressing any button will exit the display.*

GO TO RESET MENU

After entering **Portals™**, the **MAIN MENU** now appears. Select the "RESET" *Icon* in the **MAIN MENU** with either the **Red "LEFT"** or **Green "RIGHT" Buttons** (the **Flipper Buttons** operates in the same manner) and press the **Black "ENTER" Button** (the **Start Button** operates in the same manner). The **RESET MENU** appears. Continue below for the explanation & usage of the *Icons* in the **RESET MENU**.

Reset Coin Audits

To initiate, from the **RESET MENU**, select the "COIN" *Icon* with either the **Red** or **Green Buttons** and press the **Black Button**. ⚠ **ONLY** the **Coin Audits (05-13)** will be reset to zero (0), *Factory Default Settings.* **"REQUEST INSTALLED"** is indicated and returns to the **RESET MENU** with the "COIN" *Icon* flashing.

Reset Game Audits

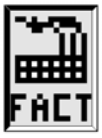
To initiate, from the **RESET MENU**, select the "AUD" *Icon* with either the **Red** or **Green Buttons** and press the **Black Button**. ⚠ **ONLY** the **Game Audits (01-04** and **15-Last Audit)** will be reset to zero (0), *Factory Default Settings.* ***Note: Coin Audits (05-13)*** *&* ***Software Meter Audit (14)*** *will not be reset.* **"REQUEST INSTALLED"** is indicated and returns to the **RESET MENU** with the "AUD" *Icon* flashing.
Tournament Note: *Tourn. Audits* ***can only be reset*** *if a new Tournament is started or a* ***Factory Reset*** *is done.*

Reset High Scores

To initiate, from the **RESET MENU**, select the "HSTD" *Icon* with either the **Red** or **Green Buttons** and press the **Black Button**. ⚠ **ONLY** the **High Scores** will be reset to the current values. ***Note:*** *If these five (5) adjustments were not personally changed by you, the Factory Default Settings will be used (see Section* ***3****, Chapter* ***4, GO TO ADJUSTMENTS MENU, Standard Adjustments*** ***18-22****).* **"REQUEST INSTALLED"** is indicated and returns to the **RESET MENU** with the "HSTD" *Icon* flashing.

Reset Credits

To initiate, from the **RESET MENU**, select the "CRED" *Icon* with either the **Red** or **Green Buttons** and press the **Black Button**. ⚠ All **Credits** will be reset to zero (0), *Factory Default Settings.* **"REQUEST INSTALLED"** is indicated and returns to the **RESET MENU** with the "CRED" *Icon* flashing.

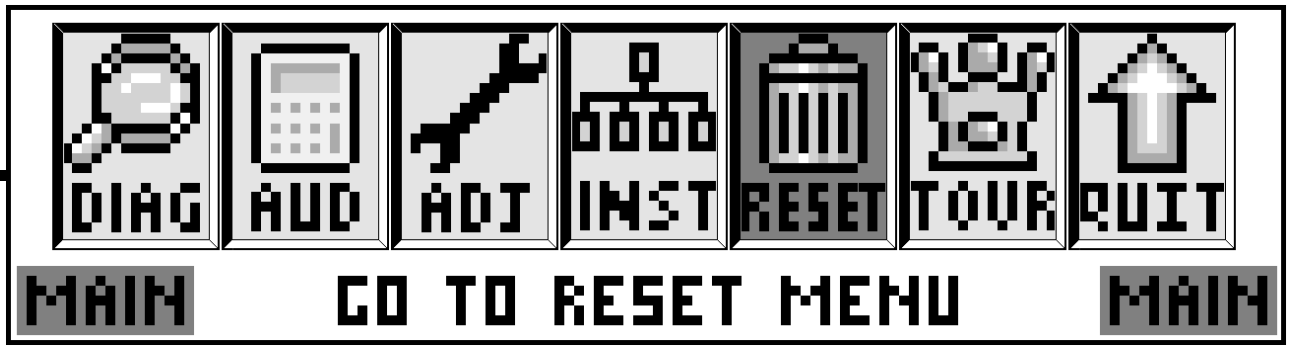


Factory Reset

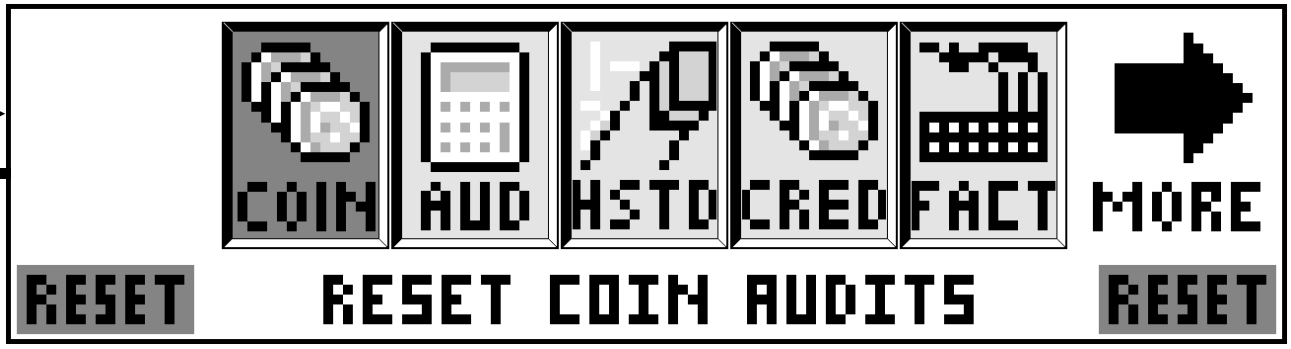
To initiate, from the **RESET MENU**, select the "FACT" *Icon* with either the **Red** or **Green Buttons** and press the **Black Button**. ⚠ All **Audits** *(except for Audit* ***14, Software Meter****)*, **Adjustments**, **Installs**, **Tournament Audits** and all **Tournament Adjustments** *(including Sign Messages A-B)*, will be reset to the *Factory Default Settings.* ***Note:*** *To* ***RESET ONLY*** *the ADJUSTMENTS & INSTALLS (leaving all the Regular Audits alone), see Section* ***3****, Chapter* ***5, GO TO INSTALLS MENU, Install Factory****.* **"REQUEST INSTALLED"** is indicated and the **Service Menu** is exited, returning to the ***Attract Mode***.

Example:

After entering **Portals™**, the **MAIN MENU** now appears. Use the **Red "LEFT"** or **Green "RIGHT" Buttons** to select the "RESET" *Icon* (**GO TO RESET MENU**).



Press the **Black "ENTER" Button** to *activate* this **ICON**. The **RESET MENU** now appears with the "COIN" *Icon* (**RESET COIN AUDITS**) flashing:

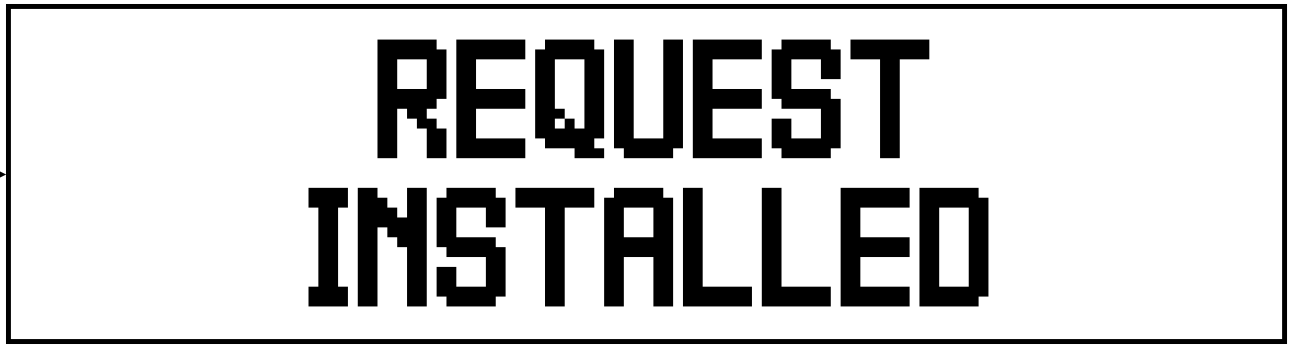


From the **RESET MENU**, select any of the *Icons* ("COIN", "AUD", "HSTD", "CRED") with either the **Red** or **Green Buttons** and press the **Black Button** to *activate* the **ICON** chosen. After the **ICON** is selected & *activated*, **"REQUEST INSTALLED"** is indicated and is returned to the **RESET MENU** with the previously selected *Icon* flashing.

Important:

AT THIS TIME, ***DO NOT*** PRESS THE **START BUTTON** OR **BLACK BUTTON** AFTER SELECTING ANY OF THE FIVE (5) ICONS UNLESS THIS IS WHAT IS DESIRED. ***THE INFORMATION ASSOCIATED WITH THE RESET ICON WILL BE LOST!*** *PLEASE READ THE PREVIOUS PAGE* FOR EXACTLY WHAT WILL HAPPEN IF ANY OF THESE FIVE (5) ICONS ARE *SELECTED & ACTIVATED.*

*Before performing any **RESET**, write down your **last Audit Totals** (see Section **3**, Chapter **3**, **GO TO AUDITS MENU**) and any **personalized Adjustment changes** you may have made (see Section **3**, Chapter **4**, **GO TO ADJUSTMENTS MENU**).*



If the "FACT" *Icon* is select and *activated*, "**REQUEST INSTALLED"** is indicated and the **Service Menu** is exited, returning to the ***Attract Mode***. *See the previous page for explanation & usage of the Icons in the **RESET MENU**.*

Go To Tournament Menu

Overview

Tournament Operation Note:

The use of the *Tournament Equipment* and/or running a Tournament is **OPTIONAL** and to be used solely in the discretion of the owner.

It is the sole responsibility of the operator to ensure that this product is used in conformity with all applicable laws. Stern Pinball, Inc.® disclaims any such responsibility.

Due to continuing product innovation, information in this chapter is subject to change without notice.

The **Portals™ Service Menu System** provides 6 Steps necessary to **SET-UP**, **START**, **MONITOR** and **END** Pinball Tournaments on your *Tournament Pinball System Ready Pinball Game.* ***OPTIONAL EQUIPMENT & HARDWARE (SOLD SEPARATELY) ARE REQUIRED FOR PROPER OPERATION AND USE OF THIS MENU.***

Game code may get upgraded during production; compare all Tournament Adjustments & Audits in the display with the manual and make any corrections to the Tournament Adjustments and/or Audits Tables *(next page),* as necessary. Tournament Adjustments & Audits are subject to change *(with or without notice)*. To view Tournament Adjustments & Audits in the display, enter the **Portals™ Service Menu System**. When any change is made and then the next / previous item is selected *(or the Sub-Menu is exited)*, the display will momentarily flash **REQUEST INSTALLED**. *For details on* ***Earnings, Standard & Feature Audits****, see Section* ***3****, Chapter* ***3****,* ***GO TO AUDITS MENU****. For details on* ***Standard & Feature Adjustments****, see Section* ***3****, Chapter* ***4****,* ***GO TO ADJUSTMENTS MENU****.*

For more details on the equipment & hardware required, Installation and Set-up, read the **ToPS™ Tournament Pinball System Kit Installation Manual** *(SPI Part Number: 780-6011-00)* provided in the ***Optional Tournament Kit*** *(SPI Part Number: 502-5011-00),* not included with this *ToPS™ Ready Pinball Game.*

The equipment & hardware consists of: **Electronic 7 X 80 Multi-Color Dot Display** (*secured above the Backbox*), **Tournament Serial Interface (TSI) Board** *(secured in the Backbox)*, **Tournament Button + Lamp** (*secured onto the Front Molding)* and all necessary wiring, hardware and documentation *(which also provides suggestions and Tips for ToPS™).*

To order, contact your local Distributor *(view Pages* ***DR.*** ❽ *&* ❾ *in the* ***Find-It-In-Front: Dr. Pinball****).* You can also call Technical Support or visit our website *(details on the back cover of this manual).*

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

EXPLANATION & USAGE OF COMMON LARGE & MINI-ICONS USED IN VARIOUS MENUS & SUB-MENUS:

These ***non-selectable Icons*** appear in the *selected Menu* only when there are **MORE** Icons to the **LEFT** or to the **RIGHT** available for selection.

Select and activate to return to the **PREVIOUS** Menu.

Select and activate to **QUIT**, *exits & returns to the* ***Attract Mode****.*

Select and activate to view **HELP** *Screens of the current Menu*.*

Select and activate to:

Move **LEFT** or **RIGHT,** *select previous / next or move backwards / forwards.*

DECREMENT (-) or **INCREMENT (+)** *displayed value or select previous / next.*

**** Help Note: An explanation of each Mini-Icon at that menu level will cycle continuously. To exit a display where no Mini-Icons are available for selection, pressing any button will exit the display.***

GO TO TOURNAMENT MENU (OPTIONAL USE ONLY)

After entering **Portals™**, the **MAIN MENU** now appears. Select the "TOUR" *Icon* in the **MAIN MENU** with either the **Red "LEFT"** or **Green "RIGHT" Buttons** (the **Flipper Buttons** operates in the same manner) and press the **Black "ENTER" Button** (the **Start Button** operates in the same manner). The **TOURNAMENT MENU** appears. Continue through this chapter for the explanation & usage of the *Icons* in the **TOURNAMENT MENU**.

Tournament Adjustment & Audit Tables on the next page.

TOURNAMENT ADJUSTMENT TABLES

TOURNAMENT ADJUSTMENTS 67-75 ✍ = ✎

	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
67	CREDITS PER PLAY	02	
68	JACKPOT BASE	$20.00	
69	JACKPOT INCREMENT	$00.50	
70	JACKPOT MAX.	$2,500.00	
71	START DATE	JANUARY 1	
72	END DATE	FEBRUARY 1	
73	# OF PRIZES	03	
74	PRIZE TYPE	CASH	
75	SHOW PLAYER'S CASH	YES	

Note: *The above adjustments must be set just before selecting and activating the "STRT" Icon (**START TOURNAMENT**).*
See the following pages for explanation and more details.

SIGN MESSAGES A-B (ADJUSTMENTS 76-77) ✍ = ✎

	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
76	LOCATION MESSAGE	ON	
77	PRIZE MESSAGE	ON	

STARTING METER Reading :

STARTING METER Date (MM/DD/YR) :

AUDITOR'S NAME :

CURRENT VOLUME SETTING:

CURRENT METER Reading :

AUDIT Date (MM/DD/YR) :

CPU Version :

DISPLAY Version :

GAME LOCATION NAME :

See Adj. 71 & 72 above >>

TOURNAMENT START DATE :

TOURNAMENT END DATE :

TOURNAMENT AUDIT TABLE

TOURNAMENT AUDITS 140-151 ✍ = ✎

Audit definitions follow in this Chapter.

TOTAL PLAYS 140:	TOTAL TOUR. EARNINGS 143:	ACCUM. TOTAL PLAYS 146:	ACCUM. TOUR EARNINGS 149:
TOURNAMENT PLAYS 141:	JACKPOT 144:	ACCUM. TOUR. PLAYS 147:	ACCUM. JACKPOT 150:
TOTAL GAME EARNINGS 142:	NET EARNINGS 145:	ACCUM. EARNINGS 148:	# TOURNAMENTS 151:

Tournament Adjustments (67-75)

To initiate, from the **TOURNAMENT MENU**, select the "SET UP" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Select and *activate* either of the ">>" *Mini-Icons* to view the next or previous Tournament Adjustment in this group. Select and *activate* either of the "-" or "+" *Mini-Icons* to change the setting, if desired *(the Default Setting is noted in the definitions below)*. The display will describe the **Tournament Adjustment Number**, **Tournament Adjustment Name** and the **Current Tournament Adjustment Setting**. The current Tournament Adjustment will remain in the display until the next Tournament Adjustment is viewed or when this Menu is exited.

IMPORTANT FOR TOURNAMENT USERS: *Select the settings carefully.* For **Tips for ToPS™** *(different Tournament Sample Set-Ups, etc.),* view the **ToPS™Tournament Pinball System Kit Installation Manual** *(SPI Part Number: 780-6011-00)* provided in the ***Optional Tournament Kit*** *(SPI Part Number: 502-5011-00).* Before allowing players to begin after you've started a Tournament, double-check the **Normal Mono-Color Dot Display** and **Top Multi-Color Dot (Beta Brite®) Display** to ensure everything you want is displayed correctly. Once a Tournament is started, no adjustments can be made until you end the Tournament *(by selecting the "END" Icon).* Allowing players to qualify, then ending a Tournament prematurely to make corrections will affect the outcome of the Tournament. *View the **ToPS™** Manual for more details.*

Adj. Nº	Tournament Adjustment Name	Tournament Adjustment Definition
67	**CREDITS PER PLAY**	Set between **01 - 10**. Default is **02**. Set the maximum number of *Credits* that may be accumulated per game.
68	**JACKPOT BASE**	Set between **$00.00 - $999,999.00** *(increments of $1).* Default is **$20.00**. Set the initial *Prize Pool Amount* to be offered for the Tournament. ***Note:*** *The displays will present the words "**PRIZE POOL**" in lieu of the word "JACKPOT".*
69	**JACKPOT INCREMENT**	Set between **$00.00 - $999,999.99** *(increments of 1¢).* Default is **$00.50**. Set the *Prize Pool Increment* which will increase the *Prize Pool Amount* with each Tournament Game played.
70	**JACKPOT MAX.**	Set between **$00.00 - $999,999.00** *(increments of $1).* Default is **$2,500.00**. Set the maximum cap to be placed on the *Prize Pool* during a Tournament. ***Note:*** *The displays will present the words "**PRIZE POOL**" in lieu of "JACKPOT".*
71	**START DATE**	Set between **JANUARY** through **DECEMBER**. Default is **JANUARY**. After the month desired is set, a **valid day** must be set. To **Start a Tournament**, go back to the **TOURNAMENT MENU** and select the "STRT" *Icon (see the next page).*
72	**END DATE**	Set to **JANUARY** through **DECEMBER**. Default is **FEBRUARY**. After the month desired is set, a **valid day** must be set. To end **End a Tournament**, go back to the **TOURNAMENT MENU** and select the "END" *Icon (see the next page).*
73	**# OF PRIZES**	Set between **01 - 05**. Default is **03**. Set the maximum number of *Prize Positions* to be awarded during a Tournament. Selections *(cannot be changed)* are as follows: Set to **01**, the Tournament Winner is awarded **100%** of the Prize Pool. Set to **02**, the 1st & 2nd place winners are awarded **70%** / **30%**, respectively. Set to **03**, the 1st, 2nd & 3rd place winners are awarded **50%** / **30%** / **20%**, respectively. Set to **04**, the 1st, 2nd, 3rd & 4th place winners are awarded **50%** / **25%** / **15%** / **10%**, respectively. Set to **05**, the 1st, 2nd, 3rd, 4th & 5th place winners are awarded **50%** / **20%** / **15%** / **10%** / **5%**, respectively.
74	**PRIZE TYPE**	Set to **CASH**, **POINTS**, **TICKETS** or **OTHER**. Default is **CASH**. ***This adjustment determines how the Prize Pool is to be represented in the Attract Mode on both the Normal and top Beta-Brite® Displays.*** Select **CASH** for the displays to represent the Prize Pool amount *(based on Jackpot Base and Max.)* in ***$Dollars***. Select **POINTS** for the displays to represent the Prize Pool amount in ***Points***. Select **TICKETS** for the display to represent the Prize Pool amount in ***Tickets***. Select **OTHER** ***NOT TO*** represent the Prize Pool amount *(if prize(s) to be awarded are not Cash, Points or Tickets).*
75	**SHOW PLAYER'S CASH**	Set to **YES** or **NO**. Default is **YES**. When set to **YES**, both the **Beta-Brite® Multi-Color Dot Display** and the **Normal Mono-Color Display** exhibit the Cash amount in the ***Attract Mode***.

Start Tournament (select only after Set-Up is completed)

To initiate, from the **TOURNAMENT MENU**, select the "STRT" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. The **"START TOURNAMENT?" MENU** appears with the "NO" *Mini-Icon* flashing.

If ***Set-Up (Tournament Adjustments)*** *was not completed* ***OR*** the ***Tournament Audits were not recorded from the prior Tournament***, exit this Menu by activating the "NO" *Mini-Icon*. If ***Set-Up*** *was completed and the* ***Tournament Audits*** *were recorded,* select and activate the "YES" *Mini-Icon.* The Pinball Game is set to **Tournament Ready Mode** *(the* ***Flashing Tournament Button*** *must be depressed for a Tournament Game after the proper credit is inserted).* **"REQUEST INSTALLED"** is indicated and returns to the **TOURNAMENT MENU** with the "STRT" *Icon* flashing. ***Note:*** *If the "STRT" Icon appears to be non-functioning, it is because a Tournament is in progress. The Tournament must first be stopped (select and activate the "END" Icon in the* ***TOURNAMENT MENU****).*

Stop Tournament (select only after a Tournament is started)

To initiate, from the **TOURNAMENT MENU**, select the "END" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. The **"END TOURNAMENT?" MENU** appears with the "NO" *Mini-Icon* flashing. If the ***Tournament*** *was not completed*, exit this Menu by activating the "NO" *Mini-Icon*. If the ***Tournament*** *was completed (the End Date set has passed)*, select and activate the "YES" *Mini-Icon. The Pinball Game is taken out of* **Tournament Ready Mode** *(to readjust any Tournament Adjustments, the Tournament must be "stopped").* **"REQUEST INSTALLED"** is indicated and returns to the **TOURNAMENT MENU** with the "END" *Icon* flashing. ***Record your Tournament Audits at this time as they will be reset (except for the "Accumulative Audits) if another Tournament is started!***

Tournament Prizes

To initiate, from the **TOURNAMENT MENU**, select the "PRIZ" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Select and *activate* either of the ">>" *Mini-Icons* to view the next or previous Leader in this group. The display will describe the **Leader Placement (1st, 2nd, 3rd, 4th & 5th)**, **Leader Name**, **4-Digit Pin-Code**, and **Prize Pool** portion for the *Current and Previous Tournaments.* The current Leader *(and related information)* will remain in the display until the next Leader is chosen or when the Sub-Menu is exited.

Tournament Audits (140-151)

To initiate, from the **TOURNAMENT MENU**, select the "AUD" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Select and *activate* either of the ">>" *Mini-Icons* to view the next or previous Tournament Audit in this group. The display will describe the **Tournament Audit Number**, **Tournament Audit Name** and the **Current Tournament Audit Total** (Value). The current Tournament Audit will remain in the display until the next Tournament Audit is viewed or when this Menu is exited.

IMPORTANT FOR TOURNAMENT USERS: ***>>>> A L L*** *of the Tournament Audits* ***140-151 are RESET O N L Y if a Factory Reset is done*** *(see Section* ***3****, Chapter* ***6****,* ***GO TO RESET MENU****).* ***>>>> Tournament Audits 140-145 are RESET ONLY if a new Tournament is started.*** ***>>>> Tournament Audits 146-151*** *are* ***NOT RESET****, they're accumulative (totals accumulate since the first Tournament was played).* **if no Factory Reset is done.*

Aud. №	Tournament Audit Name	Tournament Audit Definition
140	**TOTAL PLAYS**	Provides the total number of *Regular* and *Tournament Games* played while a *Tournament is active (in progress).* This total is derived by adding Tournament Audit **141**, **TOURNAMENT PLAYS,** with ***Regular Plays.***
141	**TOURNAMENT PLAYS**	Provides the total number of *Tournament Games* played while a *Tournament is active (in progress).*
142	**TOTAL GAME EARNINGS**	Provides the total Gross Earnings *accepted,* while a *Tournament is active (in progress).*
143	**TOTAL TOUR. EARNINGS**	Provides the total Tournament Earnings *(Audit* ***142*** *less Regular Game Earnings)* while a *Tournament is active (in progress).*

Tournament Audits 144-151 continued on the next page.

Tournament Audits Continued.

	Tournament Audit Name	Tournament Audit Definition
144	**JACKPOT (PRIZE POOL TOTAL)**	Provides the total Prize Pool *(Jackpot)* Amount to be paid out while a *Tournament is active (in progress).*
145	**NET EARNINGS**	Provides the total Net Earnings *(Gross Earnings less Prize Pool)* while a *Tournament is active (in progress).*
	The following Tournament Audits WILL NOT BE RESET if a new Tournament is started. ALL AUDITS can be reset if a Factory Reset is done!	
146	**ACCUM. TOTAL PLAYS**	Provides the accumulative total amount of *Regular & Tournament Games* played since the first Tournament was played.
147	**ACCUM. TOUR. PLAYS**	Provides the accumulative total amount of *Tournament Games* played since the first Tournament was played.
148	**ACCUM. EARNINGS**	Provides the total Gross Earnings *accepted,* since the first Tournament was played.
149	**ACCUM. TOUR EARNINGS**	Provides the accumulative total Tournament Game Earnings since the first Tournament was played.
150	**ACCUM. JACKPOT**	Provides the accumulative total of Prize Pool (Jackpot) Amounts paid out since the first Tournament was played.
151	**#TOURNAMENTS**	Provides the number of Tournaments *(not individual Tournament Games)* since the first Tournament was played.

Sign Messages A-B (Tournie Adj. 76-77)

To initiate, from the **TOURNAMENT MENU**, select the "A-B TEXT" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Select and *activate* either of the ">>" *Mini-Icon*s to view the next or previous Tournament Adjustment in this group. Select and *activate* either of the "-" or "+" *Mini-Icons* to change the setting, if desired *(the Default Setting is noted in the definitions below)*. The display will describe the **Tournament Adjustment Number**, **Tournament Adjustment Name** and the **Current Tournament Adjustment Setting**. The current Tournament Adjustment will remain in the display until the next Tournament Adjustment is viewed or when this Menu is exited.

Adj. №	Tournament Adjustment Name	Tournament Adjustment Definition
76	**LOCATION MESSAGE**	Set to **ON, CHANGE** or **OFF**. Default is **ON**. When set to **CHANGE**, a new message can be set or the old one can be edited *(select the "+" Mini-Icon to change settings until "CHANGE" appears in the display, then select the ">>" Mini-Icon to access.).* At the top left corner of the Display, the letter **A** is indicated *(blinking)* in the first available position. 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.
77	**PRIZE MESSAGE**	

The ***DEFAULT LOCATION MESSAGE*** is:

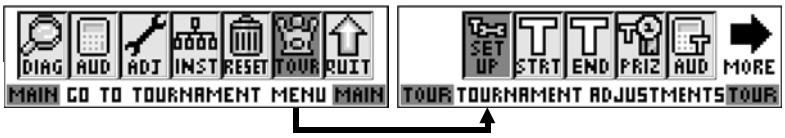
STERN PINBALL PROUDLY PRESENTS...

The ***DEFAULT PRIZE MESSAGE*** is:

YOU CAN BE THE NEXT BIG WINNER!

IMPORTANT FOR TOURNAMENT USERS:
2 additional messages can be added by using the **Beta Brite® Remote**. More details in the **ToPS™ Tournament Pinball System Kit Installation Manual** *(SPI Part Number: 780-6011-00)* provided in the ***Optional Tournament Kit*** *(SPI Part Number: 502-5011-00).*


Yellow Wire Ramp via Rocket Lift Tube
Troll Shake Up & Down
Mini-Dot Display on Ramp Entrance Sign
Ball Diverter to Red Wire Ramp or Skill
Chicago Loop Ramp onto Lt. Plastic Ramp
Red Wire Ramp via Flying Turns Enter
Ball Diverter to Lock or Return Lanes
Blue Wire Ramp via Flying Ghosts Enter
Skill Shot Entrance into Under Trough
Exit Scoop from the Under Trough
Ball Lock Lane
RollerCoaster TYCOON
PRESS & HOLD FLIPPER BUTTON FOR INFO
SUPER VALUE
$2.00=1 x5



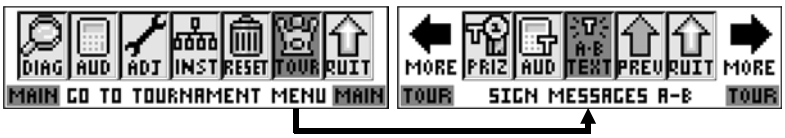
TOURNAMENT ADJUSTMENT TABLES

TOURNAMENT ADJUSTMENTS 01-10 ✍ = ✎

Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
01	CREDITS PER PLAY	02	
02	JACKPOT BASE	$20.00	
03	JACKPOT INCREMENT	$00.50	
04	JACKPOT MAX.	$2,500.00	
05	CURRENT DATE/TIME	JANUARY...	

Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
06	START DATE	JANUARY 1	
07	END DATE	FEBRUARY 1	
08	# OF PRIZES	03	
09	PRIZE TYPE	CASH	
10	SHOW PLAYER'S CASH	YES	

Note: *The above adjustments must be set just before selecting and activating the "STRT" Icon (**START TOURNAMENT**). See the following pages for explanation and more details.*



SIGN MESSAGES A-B (ADJUSTMENTS 11-12) ✍ = ✎

Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
11	LOCATION MESSAGE	ON	

Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
12	PRIZE MESSAGE	ON	

Sec. 3: Tournament ...

STARTING METER Reading :

STARTING METER Date (MM/DD/YR) : 0

AUDITOR'S NAME :

CURRENT VOLUME SETTING: ▶ ▶ ▶

CURRENT METER Reading :

AUDIT Date (MM/DD/YR) : 0

CPU Version : .

DISPLAY Version : .

GAME LOCATION NAME :

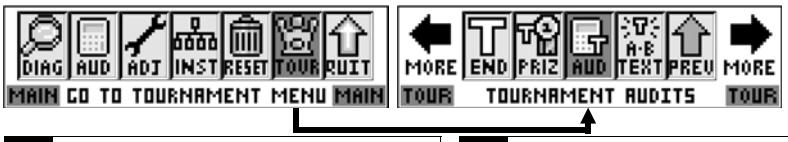
Copy this page for Field Audit Tracking Performance

See Adj. 06 & 07 above >>

TOURNAMENT START DATE : 0

TOURNAMENT END DATE : 0

TOURNAMENT AUDIT TABLE



TOURNAMENT AUDITS 01-12 ✍ = ✎

Audit definitions follow in this Chapter.

01	TOTAL PLAYS
02	TOURNAMENT PLAYS
03	TOTAL GAME EARNINGS
04	TOTAL TOUR. EARNINGS
05	JACKPOT

06	NET EARNINGS
07	ACCUM. TOTAL PLAYS
08	ACCUM. TOUR. PLAYS
09	ACCUM. EARNINGS
10	ACCUM. TOUR EARNINGS

11	ACCUM. JACKPOT
12	# TOURNAMENTS

Tournament Adjustments (01-10)

To initiate, from the **TOURNAMENT MENU**, select the "SET UP" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Select and *activate* either of the ">>" *Mini-Icon*s to view the next or previous Tournament Adjustment in this group. Select and *activate* either of the "-" or "+" *Mini-Icons* to change the setting, if desired *(the Default Setting is noted in the definitions below)*. The display will describe the **Tournament Adjustment Number**, **Tournament Adjustment Name** and the **Current Tournament Adjustment Setting**. The current Tournament Adjustment will remain in the display until the next Tournament Adjustment is viewed or when this Menu is exited.

IMPORTANT FOR TOURNAMENT USERS: *Select the settings carefully.* For **Tips for ToPS™** *(different Tournament Sample Set-Ups, etc.),* view the **ToPS™Tournament Pinball System Kit Installation Manual** *(SPI Part Number: 780-6011-00)* provided in the ***Optional Tournament Kit*** *(SPI Part Number: 502-5011-00).* Before allowing players to begin after you've started a Tournament, double-check the **Normal Mono-Color Dot Display** and **Top Multi-Color Dot (Beta Brite®) Display** to ensure everything you want is displayed correctly. Once a Tournament is started, no adjustments can be made until you end the Tournament *(by selecting the "END" Icon).* Allowing players to qualify, then ending a Tournament prematurely to make corrections will affect the outcome of the Tournament. *View the **ToPS™** Manual for more details.*

WARNING: Changes made in any Adjustments will be lost after a FACTORY RESET or removal of the CPU/Sound Board Batteries.

Nr.	TOURNAMENT ADJUSTMENT NAME: Definition
01	**CREDITS PER PLAY:** Set between **01 - 10**. Default is **02**. Set the maximum number of *Credits* that may be accumulated per game.
02	**JACKPOT BASE:** Set between **$00.00 - $999,999.00** *(increments of $1).* Default is **$20.00**. Set the initial *Prize Pool Amount* to be offered for the Tournament. ***Note:*** *The displays will present the words "**PRIZE POOL**" in lieu of the word "JACKPOT".*
03	**JACKPOT INCREMENT:** Set between **$00.00 - $999,999.99** *(increments of 1¢).* Default is **$00.50**. Set the *Prize Pool Increment* which will increase the *Prize Pool Amount* with each Tournament Game played.
04	**JACKPOT MAX.:** Set between **$00.00 - $999,999.00** *(increments of $1).* Default is **$2,500.00**. Set the maximum cap to be placed on the *Prize Pool* during a Tournament. ***Note:*** *The displays will present the words "**PRIZE POOL**" in lieu of "JACKPOT".*
05	**CURRENT DATE/TIME:** Set the current date and time. After setting the Start and End Dates in Tournament Adjustments 6 & 7, the Tournament will then start automatically*. **Requires the TIMEKEEPER™ IC (included in the kit) installed in Location U212 on the CPU/Sound Board.*
06	**START DATE:** Set between **JANUARY** through **DECEMBER**. Default is **JANUARY**. After the month desired is set, a **valid day** must be set. To **Start a Tournament**, go back to the **TOURNAMENT MENU** and select the "STRT" *Icon (see the next page).*
07	**END DATE:** Set between **JANUARY** through **DECEMBER**. Default is **FEBRUARY**. After the month desired is set, a **valid day** must be set. To **End a Tournament**, go back to the **TOURNAMENT MENU** and select the "END" *Icon (see the next page).*
08	**# OF PRIZES:** Set between **01 - 05**. Default is **03**. Set the maximum number of *Prize Positions* to be awarded during a Tournament. Selections *(cannot be changed)* are as follows: Set to **01**, the Tournament Winner is awarded **100%** of the Prize Pool. Set to **02**, the 1st & 2nd place winners are awarded **70%** / **30%**, respectively. Set to **03**, the 1st, 2nd & 3rd place winners are awarded **50%** / **30%** / **20%**, respectively. Set to **04**, the 1st, 2nd, 3rd & 4th place winners are awarded **50%** / **25%** / **15%** / **10%**, respectively. Set to **05**, the 1st, 2nd, 3rd, 4th & 5th place winners are awarded **50%** / **20%** / **15%** / **10%** / **5%**, respectively.
09	**AWARD TYPE:** Set to **CASH**, **POINTS**, **TICKET**, **NONE** or **PRIZE**. Default is **CASH**. ***This adjustment determines how the Prize Pool is to be represented in the Attract Mode on both the Normal and top Beta-Brite® Displays.*** Select **CASH** for the displays to represent the Prize Pool amount *(based on Jackpot Base and Max.)* in ***$Dollars***. Select **POINTS** for the displays to represent the Prize Pool amount in ***Points***. Select **TICKET** for the display to represent the Prize Pool amount in ***Tickets***. Select **NONE** ***NOT TO*** represent the Prize Pool amount *(if prize(s) to be awarded are not Cash, Points or Tickets).* Select **PRIZE**, if applicable.
10	**SHOW PLAYER'S CASH:** Set to **YES** or **NO**. Default is **YES**. When set to **YES**, both the **Beta-Brite® Multi-Color Dot Display** and the **Normal Mono-Color Display** exhibit the Cash amount in the ***Attract Mode***.

Start Tournament (select only after Set-Up is completed)

To initiate, from the **TOURNAMENT MENU**, select the "STRT" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. The **"START TOURNAMENT?" MENU** appears with the "NO" *Mini-Icon* flashing.

If ***Set-Up (Tournament Adjustments)*** *was not completed* ***OR*** the ***Tournament Audits were not recorded from the prior Tournament***, exit this Menu by activating the "NO" *Mini-Icon*. If ***Set-Up*** *was completed and the* ***Tournament Audits*** *were recorded,* select and activate the "YES" *Mini-Icon.* The Pinball Game is set to **Tournament Ready Mode** *(the* ***Flashing Tournament Button*** *must be depressed for a Tournament Game after the proper credit is inserted).* **"REQUEST INSTALLED"** is indicated and returns to the **TOURNAMENT MENU** with the "STRT" *Icon* flashing. ***Note:*** *If the "STRT" Icon appears to be non-functioning, it is because a Tournament is in progress. The Tournament must first be stopped (select and activate the "END" Icon in the* ***TOURNAMENT MENU****).*

Stop Tournament (select only after a Tournament is started)

To initiate, from the **TOURNAMENT MENU**, select the "END" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. The **"END TOURNAMENT?" MENU** appears with the "NO" *Mini-Icon* flashing. If the ***Tournament*** *was not completed*, exit this Menu by activating the "NO" *Mini-Icon*. If the ***Tournament*** *was completed (the End Date set has passed)*, select and activate the "YES" *Mini-Icon. The Pinball Game is taken out of* **Tournament Ready Mode** *(to readjust any Tournament Adjustments, the Tournament must be "stopped").* **"REQUEST INSTALLED"** is indicated and returns to the **TOURNAMENT MENU** with the "END" *Icon* flashing. ***Record your Tournament Audits at this time as they will be reset (except for the "Accumulative Audits) if another Tournament is started!***

Tournament Prizes

To initiate, from the **TOURNAMENT MENU**, select the "PRIZ" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Select and *activate* either of the ">>" *Mini-Icons* to view the next or previous Leader in this group. The display will describe the **Leader Placement (1st, 2nd, 3rd, 4th & 5th)**, **Leader Name**, **4-Digit Pin-Code**, and **Prize Pool** portion for the *Current and Previous Tournaments.* The current Leader *(and related information)* will remain in the display until the next Leader is chosen or when the Sub-Menu is exited.

Tournament Audits (01-12)

To initiate, from the **TOURNAMENT MENU**, select the "AUD" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Select and *activate* either of the ">>" *Mini-Icons* to view the next or previous Tournament Audit in this group. The display will describe the **Tournament Audit Number**, **Tournament Audit Name** and the **Current Tournament Audit Total** (Value). The current Tournament Audit will remain in the display until the next Tournament Audit is viewed or when this Menu is exited.

IMPORTANT FOR TOURNAMENT USERS: ***>>>> A L L*** *of the Tournament Audits* ***01-12 are RESET O N L Y if a Factory Reset is done*** *(see Section* ***3****, Chapter* ***6****,* ***GO TO RESET MENU****).* ***>>>> Tournament Audits 01-06 are RESET ONLY if a new Tournament is started****.* ***>>>> Tournament Audits 07-12*** *are* ***NOT RESET****, they're accumulative (totals accumulate since the first Tournament was played).* **if no Factory Reset is done.*

Nr.	TOURNAMENT AUDIT NAME: Definition
01	**TOTAL PLAYS:** Provides the total number of *Regular* and *Tournament Games* played while a *Tournament is active (in progress).* This total is derived by adding Tournament Audit **02**, **TOURNAMENT PLAYS,** with ***Regular Plays.***
02	**TOURNAMENT PLAYS:** Provides the total number of *Tournament Games* played while a *Tournament is active (in progress).*
03	**TOTAL GAME EARNINGS:** Provides the total Gross Earnings *accepted,* while a *Tournament is active (in progress).*
04	**TOTAL TOUR. EARNINGS:** Provides the total Tournament Earnings *(Audit* ***03*** *less Regular Game Earnings)* while a *Tournament is active (in progress).*
05	**JACKPOT (PRIZE POOL TOTAL):** Provides the total Prize Pool *(Jackpot)* Amount to be paid out while a *Tournament is active (in progress).*
06	**NET EARNINGS:** Provides the total Net Earnings *(Gross Earnings less Prize Pool)* while a *Tournament is active (in progress).*

Tournament Audits 07-12 continued on the next page.

TOURNAMENT AUDIT NAME: Definition

The following Tournament Audits WILL NOT BE RESET if a new Tournament is started. ALL AUDITS can be reset if a Factory Reset is done!

07	**ACCUM. TOTAL PLAYS:** Provides the accumulative total amount of *Regular & Tournament Games* played since the first Tournament was played.
08	**ACCUM. TOUR. PLAYS:** Provides the accumulative total amount of *Tournament Games* played since the first Tournament was played.
09	**ACCUM. EARNINGS:** Provides the total Gross Earnings *accepted,* since the first Tournament was played.
10	**ACCUM. TOUR EARNINGS:** Provides the accumulative total Tournament Game Earnings since the first Tournament was played.
11	**ACCUM. JACKPOT:** Provides the accumulative total of Prize Pool *(Jackpot)* Amounts paid out since the first Tournament was played.
12	**# TOURNAMENTS:** Provides the number of Tournaments *(not individual Tournament Games)* since the first Tournament was played.

Sign Messages A-B (Tournie Adj. 11-12)

To initiate, from the **TOURNAMENT MENU**, select the "A-B TEXT" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Select and *activate* either of the ">>" *Mini-Icon*s to view the next or previous Tournament Adjustment in this group. Select and *activate* either of the "-" or "+" *Mini-Icons* to change the setting, if desired *(the Default Setting is noted in the definitions below)*. The display will describe the **Tournament Adjustment Number**, **Tournament Adjustment Name** and the **Current Tournament Adjustment Setting**. The current Tournament Adjustment will remain in the display until the next Tournament Adjustment is viewed or when this Menu is exited.

Nr.	TOURNAMENT ADJUSTMENT NAME: Definition
11	**LOCATION MESSAGE:** Set to **ON, CHANGE** or **OFF**. Default is **ON**. When set to **CHANGE**, a new message can be set or the old one can be edited *(select the "+" Mini-Icon to change settings until "CHANGE" appears in the display, then select the ">>" Mini-Icon to access.).* At the top left corner of the Display, the letter **A** is indicated *(blinking)* in the first available position. 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.
12	**PRIZE MESSAGE:** Set to **ON, CHANGE** or **OFF**. Default is **ON**. *Procedure identical to Tournament Adjustment* ***11, Location Message****.*

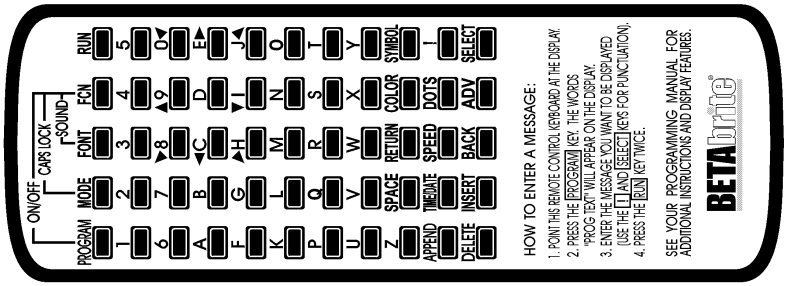
The ***DEFAULT LOCATION MESSAGE*** is:

STERN PINBALL PROUDLY PRESENTS...

The ***DEFAULT PRIZE MESSAGE*** is:

YOU CAN BE THE NEXT BIG WINNER!

IMPORTANT FOR TOURNAMENT USERS:
2 additional messages can be added by using the **Beta Brite® Remote**. *See the next pages for* ***Tips for ToPS™*** *on* ***Text Messaging!***



Parts Identification & Location (The Pink Pages)

Overview

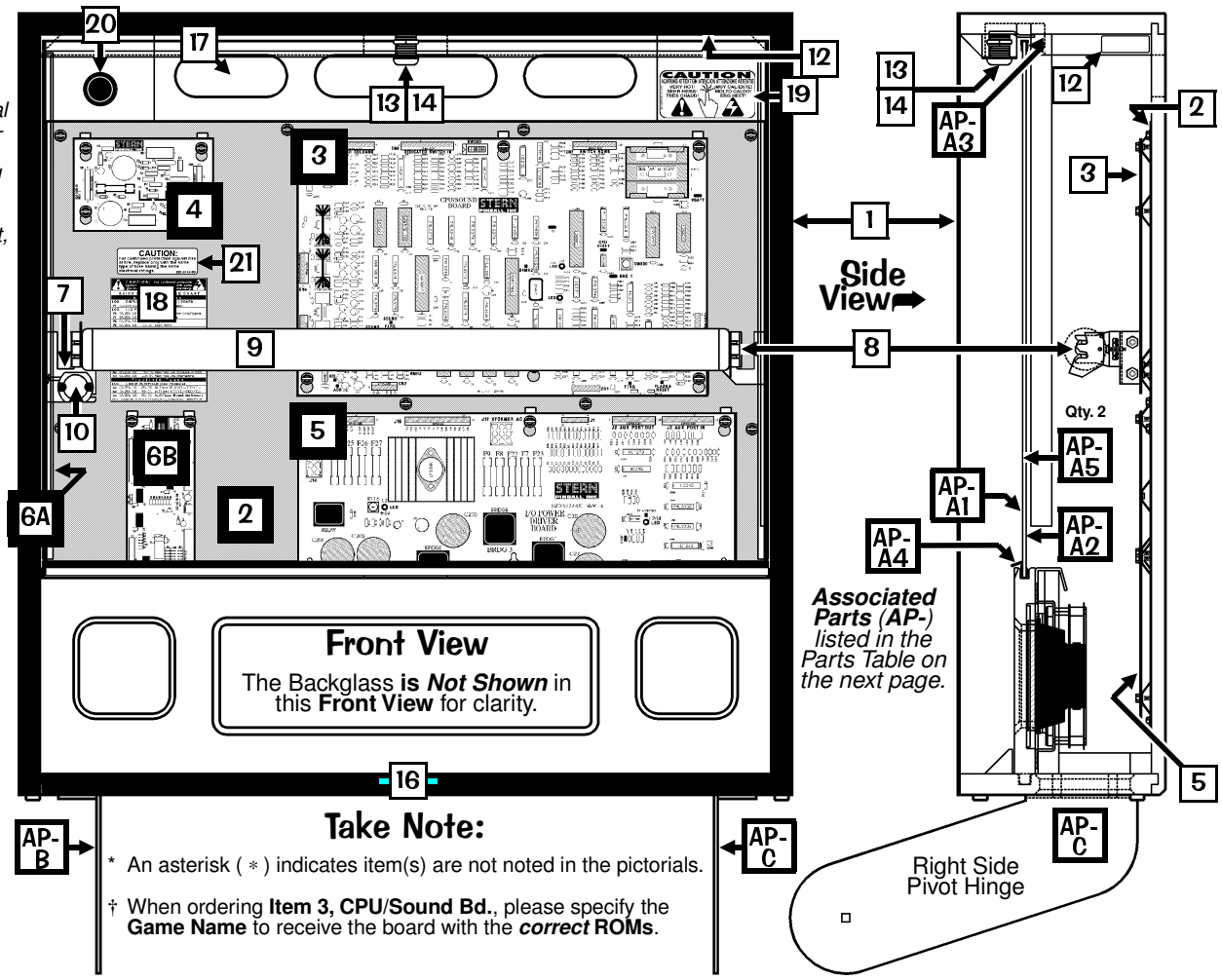
This section provides the Part Nºs and locations of all the components in this pinball machine. The parts are arranged in three groups: **BACKBOX**, **CABINET** & **PLAYFIELD**. Generic parts which may change as production continues (quantity and/or size) are listed together. Quantities greater than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

Backbox Assembly, 505-6002-78-78 (Items 1-28)

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

‡ **Item 20, Button Hole Plug (Black)** *is the optional ToPS™ Access Hole; if removing for the Optional ToPS™ Kit, save with the game.*

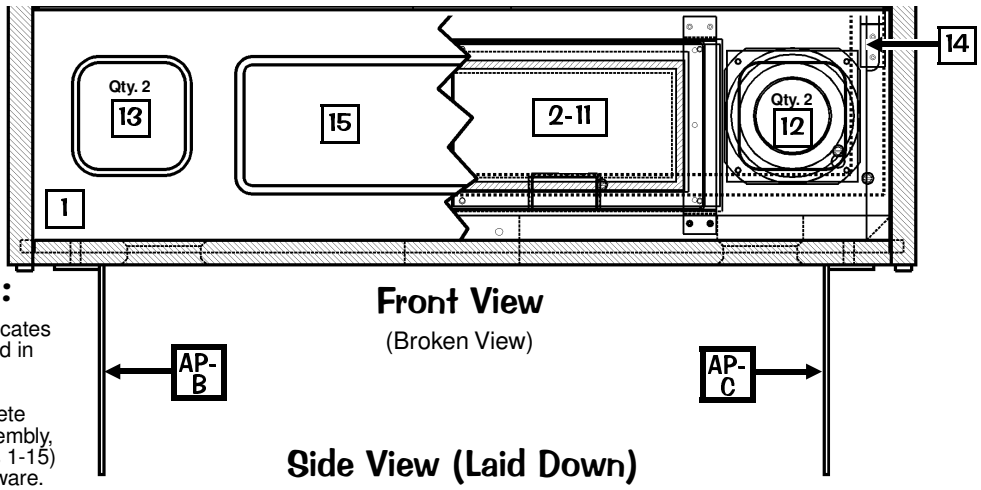


№	BACKBOX PART NAME	QTY.	SPI PART №
1	Backbox RollerCoaster Tycoon™	1	525-5558-78
	Item 1 Note: *Black Textured T-Molding is installed and cannot be ordered separately.*		
2	PCB Metal Mounting Plate	1	535-5809-14
	Item 2 is secured to Item 1 by: #8 X 1/2" HWH AB (Zinc) (Qty. 13) (234-5101-00) **and** #10 Washer 7/32" I.D. X .5" O.D. X 1/16" Thick (Qty. 4) (242-5003-00)		
3 †	CPU/Sound Board (Mono) FCC-FEB98	1	520-5136-16
4	Display Power Supply Board	1	520-5138-00
5	I/O Power Driver Board	1	520-5137-01
	Items 3, 4 & 5 are secured to Item 2 by: #8-32 X 3/8" HWH MS (Qty. 19) (237-5903-00)		
6A	3X Trans. Drvr. Bd. **(UK/Special Apps.Only)**		520-5068-00
6B	Tournament Serial Interface (TSI) Bd. **ToPS™**		520-5220-00
	Item 6A is required for UK Games *to support Auxiliary assemblies listed under the Coil Matrix of Q1-Q32; also used for* ***Special Applications*** *such as Ticket / Coin Dispensers used in conjunction with* ***Item 6B ToPS™ Tournament Serial Board.***		
7	Fluorescent Light Bracket Assy. Left	1	515-6545-00
	ORDERING ABOVE (ITEM 7) SUB-ASSY. PART № WILL INCLUDE:		
7A	Fluorescent Light Bracket Left	1	535-7739-00
7B	Lamp Holder (Self-Locking)	1	077-5214-00
7C	#6-32 X 5/8" PPH MS (Sems) Zinc	1	232-5203-00
7D	Starter Base (with Leads)	1	077-5213-00
7E	#4-40 X 1/2" PPH MS (Sems) Zinc	2	237-5813-00
	Ordering Note: If **515-6545-00** *is unavailable,* order the individual part(s) actually required.		
8	Fluorescent Light Bracket Assy. Right	1	515-6545-01
	ORDERING ABOVE (ITEM 8) SUB-ASSY. PART № WILL INCLUDE:		
8A	Fluorescent Light Bracket Right	1	535-7739-01
8B-8C	Identical to Items 7B-7C above.		See 7B-7C
	Items 7 & 8 are secured by: #10-24 X 1-1/4" Carriage Bolt Sq. Neck (Qty. 2/per) (231-5012-00), #10-24 Keps Nut (Qty. 2/per) (240-5207-00) **and** 3/4" X 3" Reinforced Strapping Tape (Qty. 1, Sold in 12" Lengths only) (626-5040-00)		
	Ordering Note: If **515-6545-01** *is unavailable,* order the individual part(s) actually required.		
9	Fluorescent Tube 24" (F18T8CW)	1	165-5061-00

№	BACKBOX PART NAME	QTY.	SPI PART №
10*	Ground Strap (5") (by Item 12)	1	600-5006-05
11	Starter - Fluorescent (FS2 Light)	1	165-5011-01
12	Ballast **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*
	Ballast Mounting Plate	1	535-8657-00
	Item 12 is secured to Item 1 by: #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5102-04)		
13	Lock Mounting Plate (2001)	1	535-8128-01
14	Camlock/Key **(N23078A•CAM•2K•SF2400)**	1	355-5018-02
	Items 13-14 are secured by: #8 X 5/8" TP Torx T20 (Qty. 4) (237-5947-00)		
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	820-6152-01
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
24*	Ribbon Cable, 26-Pin (40")	1	036-5001-40
25*	1/4" Clamp (Double)	3	040-5000-23
26*	1/2" Clamp (Single)	1	040-5000-06
27*	3/4" Clamp (Single)	2	040-5000-08
28*	1" Clamp (Single)	6	040-5000-09
	Items 25-28 are secured to Item 1 by: #8 X 1/2" HWH AB (Zinc) (Qty. 13) (234-5101-00)		

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

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



Front View
(Broken View)

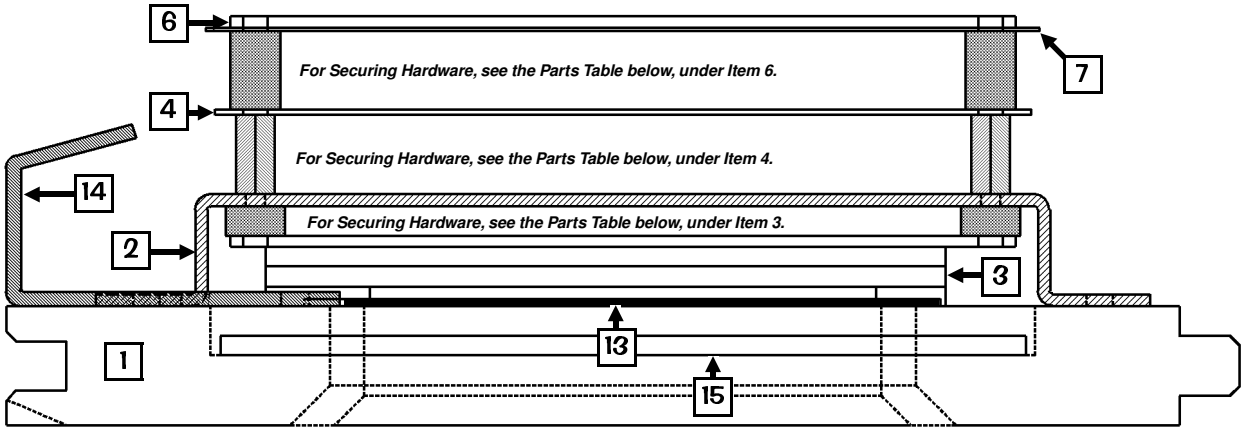
Take Note:

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

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

Side View (Laid Down)

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



№	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 (Black w/no Artwork)	2	535-8081-01
14	Speaker Panel Hook Bracket	2	535-7009-02
	Items 12, 13 & 14 are secured by: #8 X 3/4" HWH AB (Zinc) (**Items 12/13:** Qty. 4/per; **Item 14:** Qty. 2/per) (234-5103-00)		

№	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)		

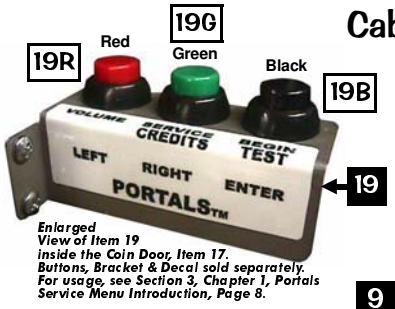
The Associated Parts AP-A thru AP-C are also noted in the Backbox Assembly drawings on the previous page.

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

№	ASSOC. BACKBOX PART NAME	QTY.	SPI PART №
AP-A	Backglass Assembly (Game № 78)	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	**Game Name Film Art (#78)**	1	830-5278-00
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	Pivot Hinge Left	1	535-7999-00
AP-C	Pivot Hinge Right	1	535-7999-01
	Items AP-B & AP-C are secured to Backbox by: 1/4"-20 X 1-1/4" C.B. Sq. Neck (Qty. 4) (231-5003-00), 1/4"-20 Flange Nut (Qty. 4) (240-5300-00) **and** Fend Washer 1/4" I.D. X 1" O.D. (Qty. 1) (242-5009-00) **Items AP-B & AP-C are secured to Cabinet by:** 1/4"-20 X 7/8" Carriage Bolt Sq. Neck (Qty. 2) (231-5014-00), Hinge Spacer (Qty. 2) (530-5099-00), Washer 1/4" I.D. X 7/8" O.D. X 1/8" Yellow (Qty. 1/per) (242-5016-01), Fend Washer 1/4" I.D. X 1" O.D. (Qty. 1/per) (242-5009-00) **and** 1/4"-20 Flange Nut (Qty. 1/per) (240-5300-00)		

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.*

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.

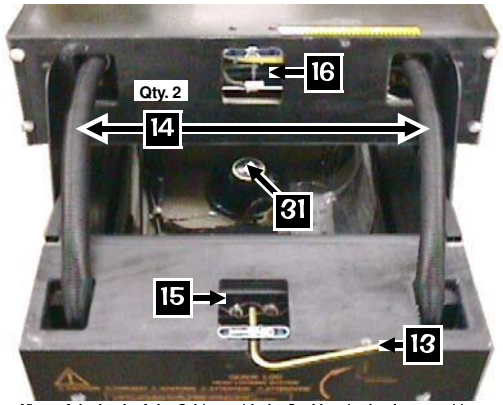
Take Note:

‡ **Item 11, Button Hole Plug (Blk)** is the Optional Tournie Button Access Hole. *If removing for the Optional Tournament Button, save with the game.*

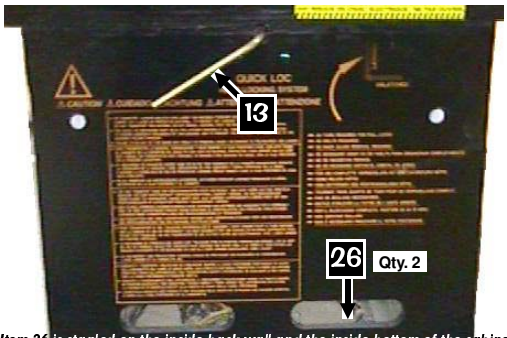
For Backbox Parts see the previous two pages.

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

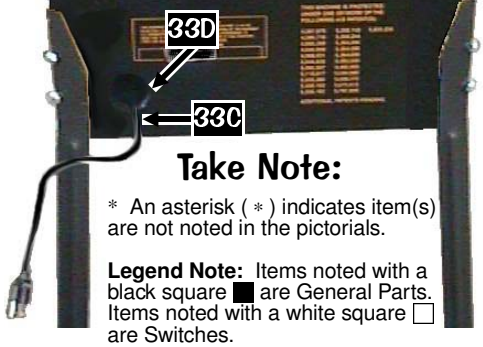
View of the Coin Door Open, Item 17.



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:

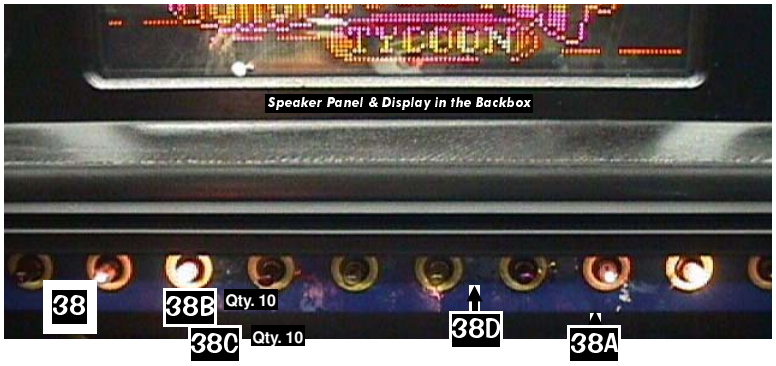
* An asterisk (*) indicates item(s) are not noted in the pictorials.

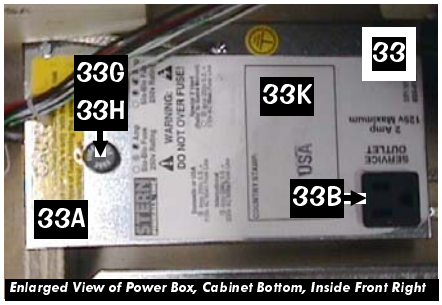
Legend Note: Items noted with a black square ■ are General Parts. Items noted with a white square □ are Switches.

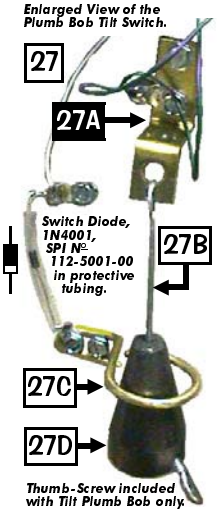
Nº	CABINET PART NAME	QTY.	SPI PART Nº
1	RCT Screened Cabinet (No Parts)	1	525-6000-78
2	Black Leg & Leveler Assembly	4	500-5921-50
	Item 2 is secured by: Leg Bolt Back Plate (535-5703-00) **and** Leg Bolt 3/8" X 16 X 2-1/2" Hex 5/8" Hd. (2/per) (231-5001-01) *To order just a Leg Leveler (3/8" - 16 X 3") use SPI Nº: 500-5017-00. A Leg "without" a Leg Leveler is not available.*		
3	Start Button (Red) + Lamp Assembly	1	500-6388-02
	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	Ball Shooter (Plunger) Assembly	1	500-6146-00-04
	Item 5 is secured by: Support Plate (Qty. 1) (535-5027-00), #10-32 X 3/8" SHWH (Serr) Swage (Qty. 3) (237-5985-00) **and** #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5002-00). **FOR A BREAKDOWN OF PARTS SEE:** ***Sec. 4, Chp. 2, Drawings for ... Assemblies...***		
6	Flipper Button (Red) Assembly	2	500-5026-32
	Item 6 is secured by: Pal Nut for Flipper Button (Metal) (Qty. 2) (240-5003-01) **and is fitted with:** O-Ring 11/32" X 7/32" X 1/16" (Qty. 1/per) (545-5850-00) **Item 6 *DOES NOT* include the Switch. FOR SWITCHES ONLY *see Items 23A/B on the Next Page.***		
7	Rear Glass Channel 20-3/8" Length	1	545-5038-00
8	Plastic Channel 42-5/8" Lg. (Left/Rt.)	2	545-5017-00
9	Side Armor "with holes" (Left & Right)	2	535-7297-02
	Item 9 is secured by: Pem Stud 1/4 X 1" FH (Qty. 2/per) (237-6116-01), 1/4-20 Flange Nut (Qty. 2/per) (240-5300-00) **and** #8 X 5/8" T20 Tamper Proof (Qty. 2/per) (237-5947-00)		
10	Front Molding - Black	1	500-5757-02-00
	Item 10 requires: Self-Adhesive Foam Rubber 3/8" X 3/16" X 20-3/8" (626-5001-00).		
11‡	Button Hole Plug (Blk) **(Happ #52-6214-00)**	1	500-6566-00
12*	P/F Glass (Tmprd.) 21" X 43" X 3/16"	1	660-5001-00

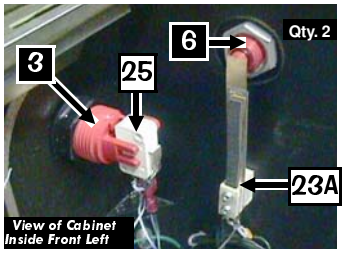
Nº	CABINET PART NAME	QTY.	SPI PART Nº
13	Hex Key Allen Wrench 5/16"	1	777-0001-00
14	Corrugated Tubing Black **1¼"ø X 2.6' Lg.**	2	605-5008-00
	Above Item 14 covers the Cables Wiring Harnesses going into the Backbox from the Cab.		
15	#1 Roto Lock Male (R2-0055-02)	1	355-5006-01
	Item 15 is secured by: #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 Nº.*		
18	Coin Door Switch (USA)	2	180-5024-00
	FYI: Coin Door Switch (¥ Japan)	0	180-5091-00
19	Bracket for above 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 63.		
20	Dual Switch Assembly	1	500-5808-00
	ORDERING ABOVE (ITEM 20) ASSEMBLY PART Nº WILL INCLUDE:		
20A	Mounting Bracket	1	535-6958-00
20B	Playfield Power Interlock Sw. (Top)	1	180-5136-00
20C	Memory Protect Switch (Bottom)	1	180-5000-01
	Item 20 is secured to Cabinet by: #8 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00)		

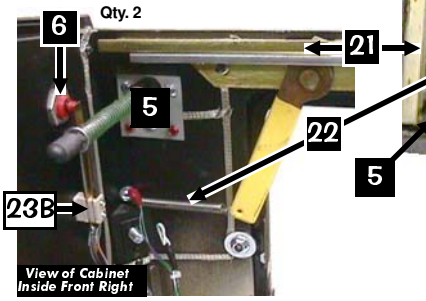
Parts Table & Views continue on the next page.

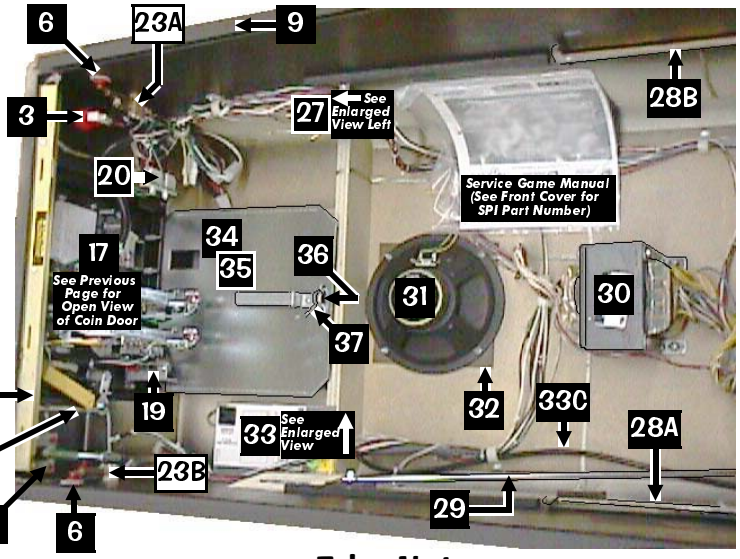












Take Note:

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

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

Parts Table & Views continue on the previous page.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
21	Front Molding Lockdown Assembly	1	500-6509-00
	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 for Lower Left**	1	180-5160-00
23B	Flipper Sw. **- X2 Stack for Lower/Upper Right**	1	180-5164-00
24*	Foam Strip (2 on 23A; 1 on 23B)	3	626-5042-00
25	Start Button Switch **(ONLY)**	1	180-5174-00
26	Grills 2-1/2" X 18" (on Back & Bottom)	2	545-5072-02
27	Cabinet Plumb Bob Tilt Switch	1	*See Parts Below*
	ORDER ONLY INDIVIDUAL PART(S) NEEDED:		
27A	Bracket for Hanger Wire	1	535-5221-00
27B	Hanger Wire	1	535-5319-00
27C	Contact Wire Form	1	535-7563-01
27D	Plumb Bob Weight (includes Thumb-Screw)	1	535-5029-00
	Items 27A & 27C are secured by: #8 X 1/2" 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	1	535-7553-00
	Item 29 is secured by: #10-24 X 1-3/4" Carriage Bolt Sq. Neck (Qty. 1) (231-5022-00), Washer #10 7/32" ID X .5" OD X 1/16" Thk (Qty. 1) (242-5003-00) **and** #10-24 Nylon Stop Nut (Qty. 1) (240-5206-00)		
30	Transformer 5.7v AC (with Ballast Winding)	1	010-5012-01
	Item 30 is secured by: 1/4"-20 X 5/8" PPH MS (Zinc) (Qty. 4) (237-5854-00) **and** 1/4" Split Lock Washer (Qty. 4) (244-5000-00)		
31	Speaker 8" ø Rd. 8010 4Ω	1	031-5007-00
32	Speaker Grill 7" X 7"	1	545-5072-03
	Items 31 & 32 are secured by: #6-32 X 1-1/4" Fin Shank Screw (Qty. 4) (237-5883-00) **and** #6-32 Keps Nut (Qty. 4) (240-5008-00)		
33	Power Input Box Sub-Assy.	1	515-5360-07
	ORDERING ABOVE (ITEM 33) SUB-ASSY. PART № WILL INCLUDE:		
33A	Power Box (Plain)	1	535-5932-00
33B	Service Outlet (for USA)	1	180-5008-01
33C	Line Cord 10' ROJ 3" Max.	1	034-5000-10
33D	Recessed Cup for Line Cord	1	545-5122-00
33E*	Line Filter	1	150-5000-00
33F*	Varistor TNR159211KM	1	150-5001-00
33G	Fuse 8 Amp 250v Slo-Blo (Domestic)	1	200-5000-05
33H	Fuse Holder	1	205-5001-00
33I*	On/Off Switch Bracket	1	535-8318-00
33J	On/Off Rocker Sw. (Arcolectric C1350AB)	1	180-5001-01
33K	Power Box Decal	1	820-6123-03
34	Cash Box Plastic Bottom	1	545-5090-00
35	Cash Box Cover (Validator)	1	535-5013-03
36	Cash Box Lock Bracket (wire)	1	535-7562-00
37	Large Hair-Pin Clip	1	535-7772-00
38	Cabinet Light Bd. Assy. RollerCoaster	1	500-6413-78
	ORDERING ABOVE (ITEM 38) ASSEMBLY PART № WILL INCLUDE:		
38A	Cabinet Light Board Plain (Generic)	1	525-5570-00
38B	3-Lug Staple Down Socket	10	077-5001-00
38C	#44 Bulb (Red) -02 x4, (Yel.) -06 x3	7	165-5053-**02**/ **-06**
	#44 Bulb (Clear)	3	165-5000-44
38D	Decal "-10" of RCT™ Decal Set		*from* **820-6315-XX**
	Note: *Individual Decals from a Decal Set cannot be ordered separately.*		
	Item 38B is secured to Item 38A by: Staple (5/16") (Qty. 3/per) (631-5000-00) **Item 38 is secured to the Cabinet by:** #8-32 X 1½" HWH MS (Ser) Zinc (Qty. 2) (237-5946-00) **and** #8 Washer (Qty. 2) (242-5005-00)		

Ordering Note: If 500-6413-78 *is unavailable,* order the individual part(s) actually required.

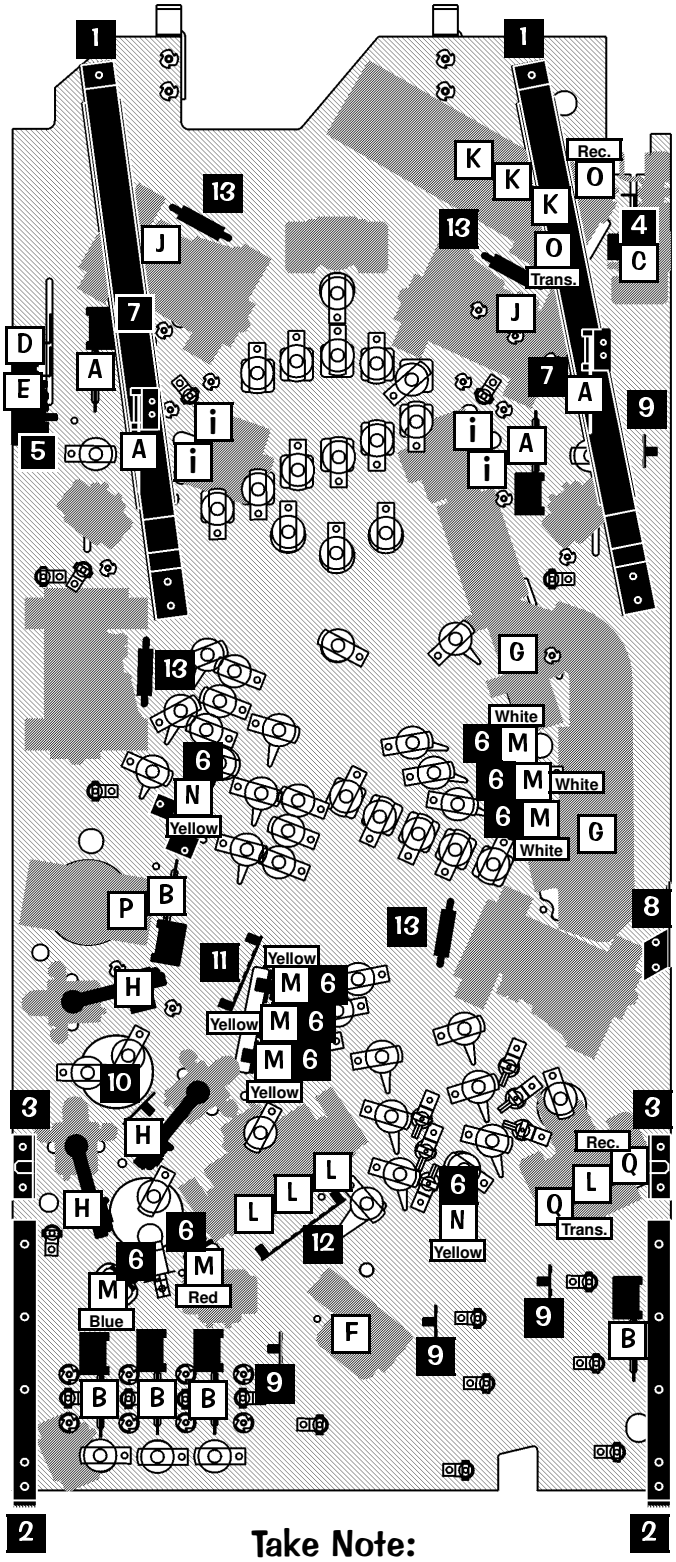
Playfield - General Parts ■ & Switches □ (Below)

№	BELOW PLAYFIELD PART NAME	QTY.	SPI PART №
1	Playfield Support Slide Bracket	2	535-6862-02
	Item 1 is secured by: #8 X 1/2" 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	500-5329-03
4	Switch Bracket **(Shooter Lane)**	1	535-6173-00
	Item 4 is secured by: #6 X 1/2" HWH AB (Zinc) Red (Qty. 2/per) (234-5001-02)		
5	Sw. (3-Ball) Bracket **(Lock 2-Ball Lane)**	1	535-8842-00
	Item 5 is secured by: #8 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00)		
6	Switch Back Plate **(Stand-Up Target)**	10	535-6452-00
	Target (Stand-Up) Bracket	10	535-6896-00
	Item 6 requires: Foam Pad (Qty. 1/per) (626-5029-00) on Target Bracket.		
7	Insulation Fiche Paper **(under Lwr. Flips)**	2	545-5721-00
8	Gate Bracket Assy. **(see next page)**	1	500-6591-00
	Item 8 is secured by: #8-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1) (232-5301-00) **and** #8-32 X 1.38" Hex Spacer (Qty. 1) (254-5031-06)		
9	Diode Terminal Strip 2-Lug (810) Isolated	5	055-5203-00
	Note: Item 9 (Qty. 1) is located in the Cabinet on the Coin Door.		
10	Diode Terminal Strip 3-Lug (813) Isolated	1	055-5204-03
11	Diode Terminal Strip 5-Lug (824) Isolated	1	055-5204-05
12	Diode Terminal Strip 7-Lug Isolated	1	055-5204-07
	Items 10-12 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****...*		
13	3A 250v Slo-Blo Fuse	4	200-5000-08
	Fuse Clip Holder (Socket)	4	205-5000-01
	Item 13 is secured by: #6 X 1/2" PPH AB (Qty. 1/per) (237-5805-00) ***Note:*** *Item 13, 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).*		
14*	Diode Terminal Strip/Fuse Decals A-G	1	820-6221-78
	Note: *For Decal Descriptions & Locations, see Sec.* ***5****, Chp.* ***2****,* ***Playfield Wiring****,* ***Page 105****.*		
15*	#8 Solder Lug	**0**	055-5140-08
	However, Item 15 (Qty. 4) is located in the Cabinet on the Coin Door & Power Box.		

№	BELOW SWITCHES PART NAME	QTY.	SPI PART №
A	Micro Sw. Roll-Over Left Brkt. Assy.	4	500-6227-01
B	Micro Sw. Roll-Over Right Brkt. Assy.	5	500-6227-02
	Items A & B are secured by: #8 X 1/2" HWH AB (Zinc) (Qty. 2/per) (234-5101-00)		
C	Micro Switch **(at Shooter Lane)**	1	180-5157-00
D	Micro Sw. **(Lg. Bend Wire Actuator-Ball Lock)**	1	180-5180-00
E	Micro Sw. **(Sm. Bend Wire Actuator-Ball Lock)**	1	180-5179-00
F	Micro Sw.**(Heavy Duty "Y" Flat Actuator-VUK)**	1	180-5116-01
G	Micro Switch **(on Scoop / on Undertrough)**	2	180-5183-00
	Items C-G require a Switch Body Protect Plate (535-6539-00) which is secured by: #2-56 X 1/2" HWH Serr (Qty. 2) (237-5937-02) **and** #2-56 Hex Nut (Qty. 2) (240-5301-00).		
H	Micro Switch **(on Pop Bumpers)**	3	180-5015-03
i	Stack (Blade) Switch **(on Slingshots)**	4	180-5054-00
J	EOS Switch Flipper **(on Flippers)**	2	180-5149-00
K	Micro Sw. **(Roller Actuator, Lite Force 4-Ball)**	3	180-5119-02
L	Micro Switch **(on 1- & 3- Bank Drop Targets)**	4	180-5158-00
	Note: *For how Items F-L are secured or for a better view, see Section* ***4****, Chapter* ***2****,* ***Drawings for Major Assemblies & Ramps****, on the individual assemblies noted in descr..*		
M	Switch & Target Assy. Square ***(see Note)***	8	515-5162-**XX**
	Item M *come in various colors, replace* ***XX*** *with the following* ***2-Digit Numbers****:* ***-02 Red (Qty. 1), -05 Blue (Qty. 1), -06 Yellow (Qty. 3)*** *and* ***-08 White (Qty. 3)***		
N	Switch & Target Assy. Narrow (Yel)	2	515-5967-06
	Items M & N are secured by: #8 X 1/2" HWH AB (Zinc) (Qty. 2/per) (234-5101-00) ***Items M & N:*** *For better view(s) or entire assembly, see* ***Appendix I****,* ***Pg. I1*** *(end of manual).*		

№	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)**	1	520-5174-00
P	1-Position OPTO PCB **(Wheel-Spin)**	1	520-5222-00
Q	Long Hop OPTO TRANS Bd. **(on Brkt.)**	1	520-5082-00
	Long Hop OPTO REC Board **(on Brkt.)**	1	520-5083-01

Note: *For more details on Items O-Q and a break-down of parts, see Section* ***5****, Chapter* ***4****,* ***Printed Circuit Boards****,* ***Pages 109-11 (O)****,* ***Page 142 (P)*** *and* ***Page 143 (Q)****.*

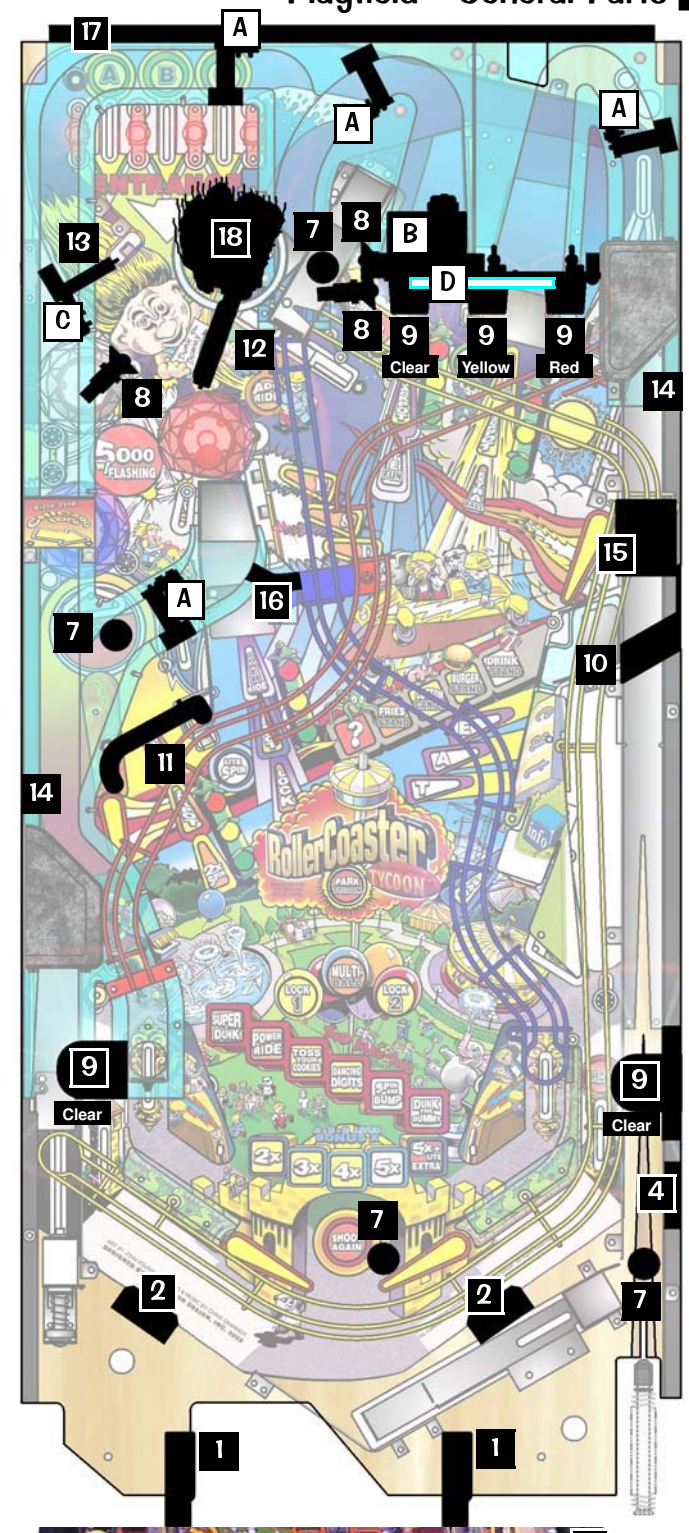


Take Note:

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

1. For Sockets & Bulbs (drawings & part numbers) see Pgs. 68-70.
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, and/or Misc. PC Boards.

Playfield - General Parts ■ & Switches □ (Above)



See Appendix J at the back of this manual for all current Cards (USA, Canada, Euro & International) available through your distributor or download via our website.

№	ABOVE PLAYFIELD PART NAME	QTY.	SPI PART №
PF	P/F Screened **w/** Inserts & **NO** Parts	1	830-5178-00
	P/F Complete **w/** Inserts & **ALL** Parts	1	505-6004-**78-78**
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) **no Forks + Kick Hole**	1	535-8392-03
	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 67****.*		
4	Level Assembly	1	515-7214-00
	For Individual Items use : .882" 8MM **Vial Mtg. Flange** (545-6027-00), **Level** .8mm Empire #0224 (545-6001-01) or **Level Bracket** (535-9010-00). **Flange secured by:** #6-32 X 1/4" PPH MS (no Sems) Zinc (Qty. 1) (237-5500-00) **and** #6-32 Keps Nut (Qty. 1) (240-5008-00) **Item 4 is secured to the wood rail by:** #6 X 1/2" HWH AB Zinc Red (Qty. 2) (234-5001-02)		
5	Instruction Card (USA) RollerCoaster	1	755-5178-00
	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.* ***Spanish*** *755-5178-****02****;* ***German*** *755-5178-****03****;* ***Italian*** *755-5178-****04****;* ***French*** *755-5178-****05****.*		
6A	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.*		
6B	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.*		
7	Pinball (Steel) 1 1/16" ø	4	260-5000-00
8	Light Reflector (Silver Color Plastic)	3	545-5409-01
9	Mini-Mars Lite Cover **(Snap-In)** ***(see Note)***	5	550-5030-**XX**
	Item 9 *come in various colors, replace* ***XX*** *with the following* ***2-Digit Numbers****:* ***-01 Clear (Qty. 3), -02 Red (Qty. 1)*** *and* ***-06 Yellow (Qty. 1)****. For* ***Light Socket & Bulbs****, see Sec.* ***4****, Chp.* ***1****,* ***Playfield - Wedge Base Bulbs and Sockets (Actual Size)****,* ***Page 74****.*		
10	Flap Gate Bracket (Right) Assembly	1	500-6591-00
	Includes: **Bracket for Flap Gate Right** (535-9166-00)**, Flap for Gate** (535-8979-00)**, Hinge Pin for Flap** (535-8982-00) **and Nylon Washer .065" ID .179" OD .078"** (242-5069-00) **Item 10 is secured under the playfield by:** #8 X 1/2" HWH AB (Zc.) (Qty. 2) (234-5101-00)		
11	Ball Gate Mounting Brckt. **(by Spin-Disk)**	1	535-9179-00
	Wire Gate (for above)	1	535-9180-00
12	Ball Gate Mounting Bracket **(by Troll)**	1	535-9173-00
	Wire Gate (for above)	1	535-9174-00
13	Roll-Under Gate & Switch **(Left Orbit)**	1	515-6490-08
	For Individual Items use : **Roll-Under Switch Mounting Bracket** (535-8529-01)**, Wire Gate** (535-8530-01) **and Micro Switch** (180-5087-00).		
14	Ramp Mounting Bracket	2	515-6508-00
	Item 14 is secured by: #6 X 1/2" PTH A (Zinc) (Qty. 2/per) (237-5809-00)		
15	Bracket, Sign Mounting	1	535-9181-00
	Item 15 is riveted to Screened Plastic -07 by: Rivet, 1/8" ø X 1/4" Lg. (Qty. 2) (249-5003-00) **and** #6 Riveting Lock Washer (Qty. 1/per) (246-5000-00) **and secured to Metal Rail by:** #8-32 Nylon Stop Nut (Qty. 1/per) (240-5102-00)		
16	Bracket, Ramp Sprt. **(prevents Ball Trap)**	1	535-9202-00
	Item 16 is secured onto a Single Groove Jewel Post (Clear) (550-5034-01) by: #6-32 X 1-3/4" PPH MS (Zinc) (237-5511-00)		
17	Back Panel Blue Wood (No Parts)	1	525-5613-00
	Item 17 is secured under the playfield by: Bracket (Qty. 2) (535-8964-00) **and** #8 X 1/2" HWH AB (Zc.) (Qty. 4/per) (234-5101-00)		
18	Troll Figurine **(Random Hair Color)**	1	880-5061-00

№	ABOVE SWITCHES PART NAME	QTY.	SPI PART №
A	Micro Switch **(X3 Left Ramp; X1 Right Ramp)**	4	180-5190-28
B	Micro Sw. **(Rllr. Actr., Reg. Force-Latch Gate)**	1	180-5119-00
	Note: *Item C can be replaced with* ***180-5119-02*** *if* ***-00*** *is no longer available.*		
	Items A & B require a Switch Body Protect Plate (Qty. 1/ea.) (535-6539-00) **which is secured by:** #2-56 X 1/2" HWH (Qty. 2) (237-5937-02) **&** #2-56 Hx Nt (Qty. 2) (240-5301-00).		
C	Micro Switch **(on Exit Gate)**	1	180-5087-00

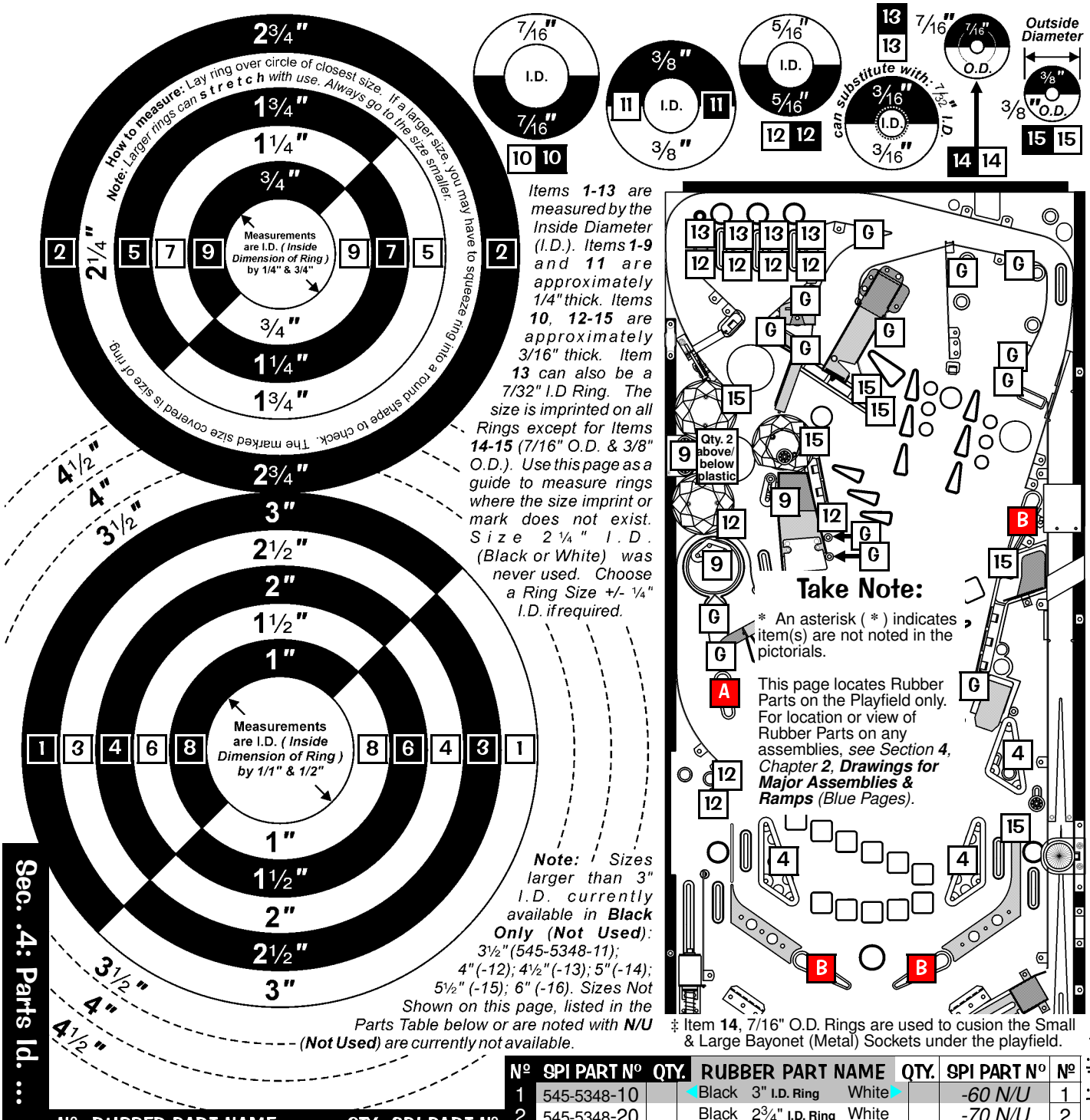
№	ABOVE MISC. PCB PART NAME	QTY.	SPI PART №
D	Dot Display x3 PCB **(Ramp Enter Sign)**	1	520-5221-00

Note: *For more details on Item D and a break-down of parts, see Section* ***5****, Chapter* ***4****,* ***Printed Circuit Boards****,* ***Pages 140-141****.*

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.® Tech. Support, 1-800-542-5377 or 1-708-345-7700.
2. **Legend Note:** Items noted with a black sq. ■ are General Parts. Items noted with a wht. sq. □ are Switches and Misc. PCB Boards.

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.*

***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.*

‡ Item **14**, 7/16" O.D. Rings are used to cusion the Small & Large Bayonet (Metal) Sockets under the playfield.

№	RUBBER PART NAME	QTY.	SPI PART №
A	Small Flipper **BLACK** Ring		545-5207-00
	Sm. Flipper **RED (Soft Duro)** Ring	1	545-5207-**22**
B	Large Flipper **BLK (50 Duro)** Ring		545-5277-00
	Lg. Flipper **RED (Soft Duro)** Ring	3	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)**	8	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)**		545-5308-00
	Bumper **WHITE (Post Sleeve, Tall)**	7	545-5308-**08**
H*	O-Ring 11/32" x 07/32" x 1/16" **(on Flipper Button)**	2	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		◀Black 2½" **I.D. Ring** White▶		545-5348-59	3
4	545-5348-08		Black 2" **I.D. Ring** White▶	3	545-5348-58	4
5	545-5348-21		◀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		Black 1" **I.D. Ring** White		*-55 N/U*	8
9	545-5348-04		◀Black ¾" **I.D. Ring** White▶	4	545-5348-54	9
10	545-5348-18		Black 7/16" **I.D. Ring** White		*-68 N/U*	10
11	545-5348-03		◀Black ⅜" **I.D. Ring** White▶		*-53 N/U*	11
12	545-5348-02		Black 5/16" **I.D. Ring** White▶	8	545-5348-52	12
13	545-5348-01		◀Black 3/16" **I.D. Ring** White▶	4	545-5348-51	13
14‡	545-5348-17	34	◀Black 7/16" **O.D. Ring** White		*-67 N/U*	14
15	545-5348-19		◀Black ⅜" **O.D. Ring** White▶	6	545-5348-69	15

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

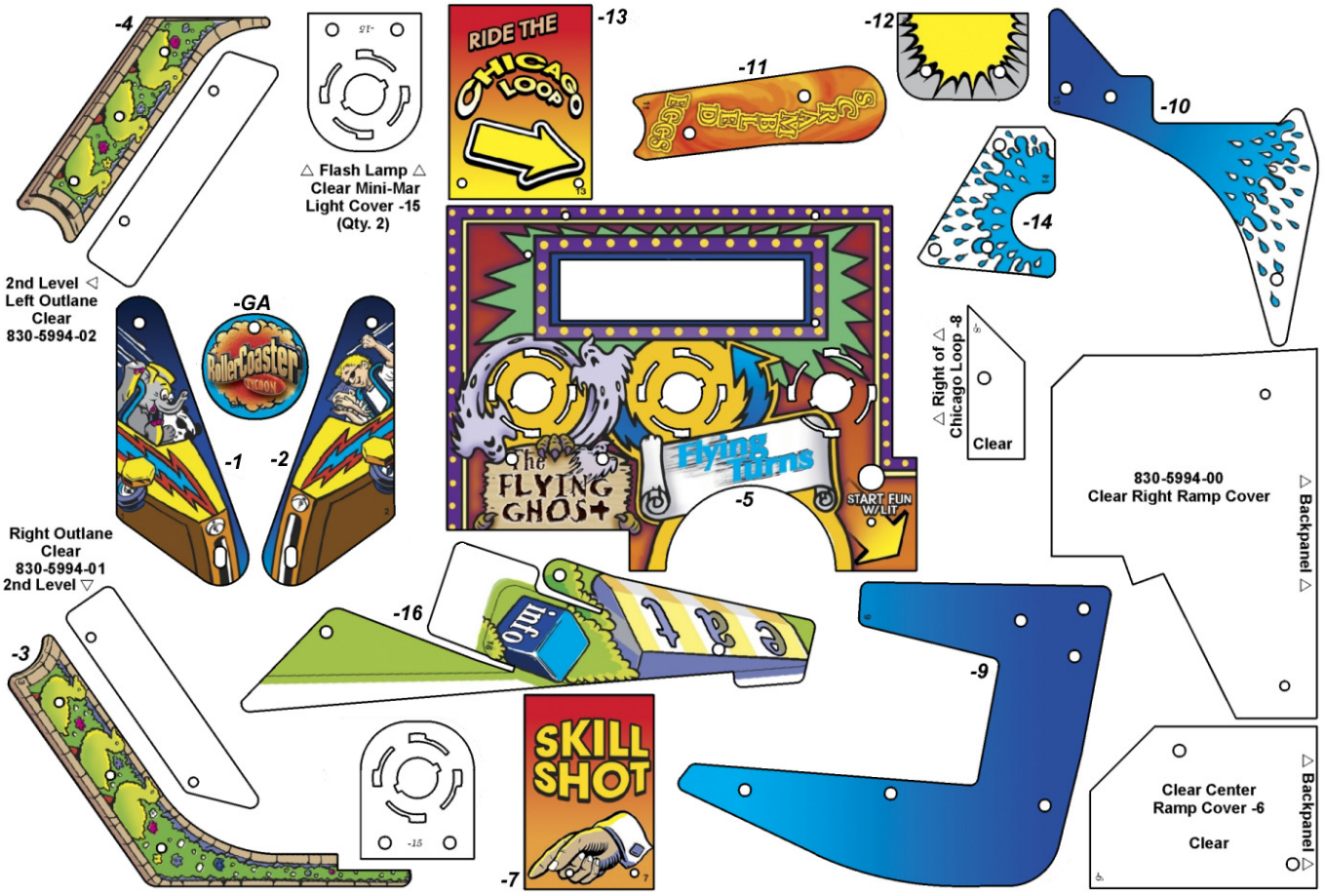
Playfield - Plastics (Screened & Clear) & Decals

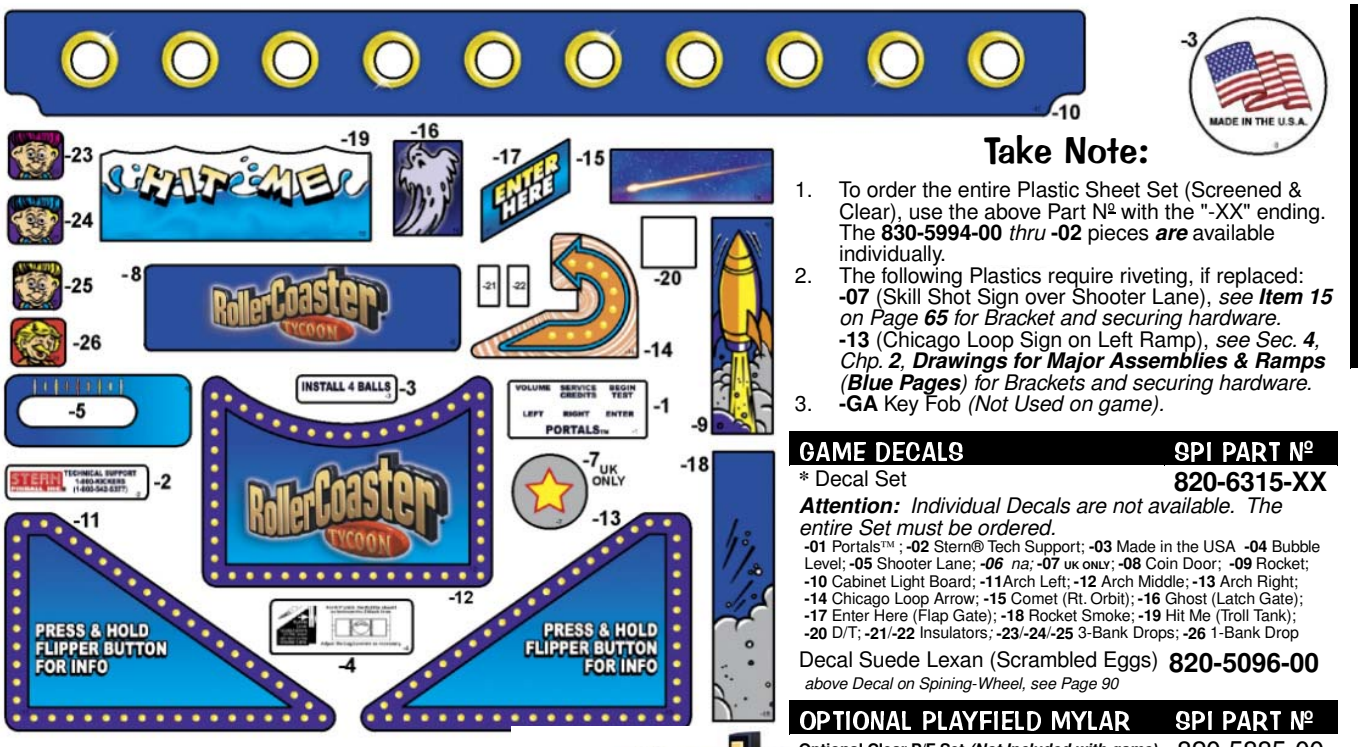
GAME PLASTICS PART NAME		SPI PART №
Screened Plastic Set **-01** thru **-16** *(Plus the Giveaway: **-GA**)* This set includes Clear Pieces: **-6**, **-8** and **-15** (Qty. 2)	1	**830-5993-XX**

Attention: *In this set, the individual Plastic Pieces are not available. The entire Plastic Sheet Set must be ordered.*

GAME PLASTICS PART NAME		SPI PART №
Clear Plastic (Right Ramp Cover)	1	**830-5994-00**
Clear Plastic (2nd Level Rt. Outlane)	1	**830-5994-01**
Clear Plastic (2nd Level Lt. Outlane)	1	**830-5994-02**

Attention: *These 3 Clear Plastic Pieces **are available** individually.*





Take Note:

1. To order the entire Plastic Sheet Set (Screened & Clear), use the above Part № with the "-XX" ending. The **830-5994-00** *thru* **-02** pieces ***are*** available individually.
2. The following Plastics require riveting, if replaced: **-07** (Skill Shot Sign over Shooter Lane), *see **Item 15** on Page **65** for Bracket and securing hardware.* **-13** (Chicago Loop Sign on Left Ramp), *see Sec. **4**, Chp. **2**, **Drawings for Major Assemblies & Ramps** (**Blue Pages**) for Brackets and securing hardware.*
3. **-GA** Key Fob *(Not Used on game).*

GAME DECALS	SPI PART №
* Decal Set	**820-6315-XX**

Attention: *Individual Decals are not available. The entire Set must be ordered.*

-01 Portals™ ; **-02** Stern® Tech Support; **-03** Made in the USA **-04** Bubble Level; **-05** Shooter Lane; ***-06*** *na;* **-07** UK ONLY; **-08** Coin Door; **-09** Rocket; **-10** Cabinet Light Board; **-11**Arch Left; **-12** Arch Middle; **-13** Arch Right; **-14** Chicago Loop Arrow; **-15** Comet (Rt. Orbit); **-16** Ghost (Latch Gate); **-17** Enter Here (Flap Gate); **-18** Rocket Smoke; **-19** Hit Me (Troll Tank); **-20** D/T; **-21**/**-22** Insulators; **-23**/**-24**/**-25** 3-Bank Drops; **-26** 1-Bank Drop

Decal Suede Lexan (Scrambled Eggs) **820-5096-00**

above Decal on Spining-Wheel, see Page 90

OPTIONAL PLAYFIELD MYLAR	SPI PART №
Optional Clear P/F Set ***(Not Included with game)***	820-5885-00

For an outline view, see the next page.

Playfield - Rails ■, Wire Forms & Ball Guides □ and Misc. Ramp(s) ■ †

№	WOOD RAIL PART NAME	QTY.	SPI PART №
1	Wood (Black) Rail **(Left Side Playfield)**	1	525-5614-00
2	Wood (Black) Rail **(Right Side Playfield)**	1	525-5614-01

Items 1 & 2 are secured by: #6 X 1-1/4" PFH A (Zinc) (Qty. 5/per) (237-5804-00)

№	METAL RAIL PART NAME	QTY.	SPI PART №
3	Metal Rail (**Center Drain under Arch**)	1	535-8393-00
4	Metal Rail (**Shooter Lane Right Wall**)	1	535-9145-00
5	Metal Rail (**Shooter Lane Right Wall**)	1	535-9147-00
6	Metal Rail (**Shooter Lane Left Wall**)	1	535-9148-00
7	Metal Rail (**Full Top Orbit**)	1	535-9149-00
8	Metal Rail (**Right Orbit & VUK**)	1	535-9150-00
9	Metal Rail (**Right of Top Lanes**)	1	535-9151-00
10	Metal Rail (**Under Top Lanes, Right**)	1	535-9152-00
11	Metal Rail (**Under Top Lanes, Left**)	1	535-9153-00
12	Metal Rail (**Behind Stand-Up by Mini-Flipper**)	1	535-9154-00
13	Metal Rail (**Under Buty. -11 Scrambled Eggs**)	1	535-9155-00
14	Metal Rail (**Behind Spin-Wheel/Mid. Rt. P/F**)	1	535-9156-00
15	Metal Rail (**Between Cntr./Right Ramp Enter**)	1	535-9162-00
16	Metal Rail (**Behind Upper Right Flipper**)	1	535-9163-00

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

17	Metal Rail (**Shield by Scoop Hole**)	1	535-9186-00

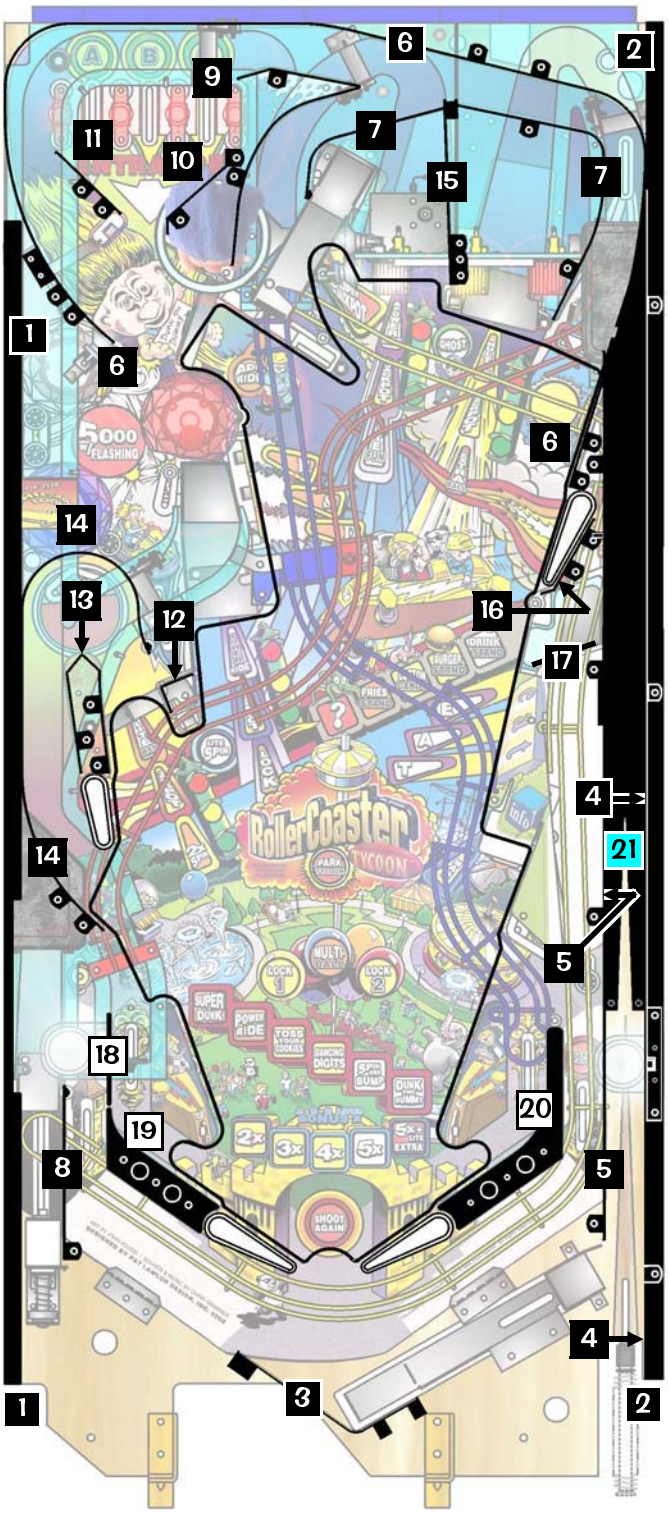
Item 17 is secured at Tab by: #8-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1) (232-5301-00)

№	WIRE FORM PART NAME	QTY.	SPI PART №
18	Ball Guide Rail - 2-1/4"	1	535-5356-05

Item 18 is secured by the ends tapped into the playfield. Take care if removing.

№	METAL BALL GUIDE PART NAME	QTY.	SPI PART №
19	Metal Ball Guide (**Left Flipper Return Lane**)	1	535-9157-00
20	Metal Ball Guide (**Right Flipr. Return Lane**)	1	535-9158-00

Items 19-20 are secured by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2/per) (232-5201-00)

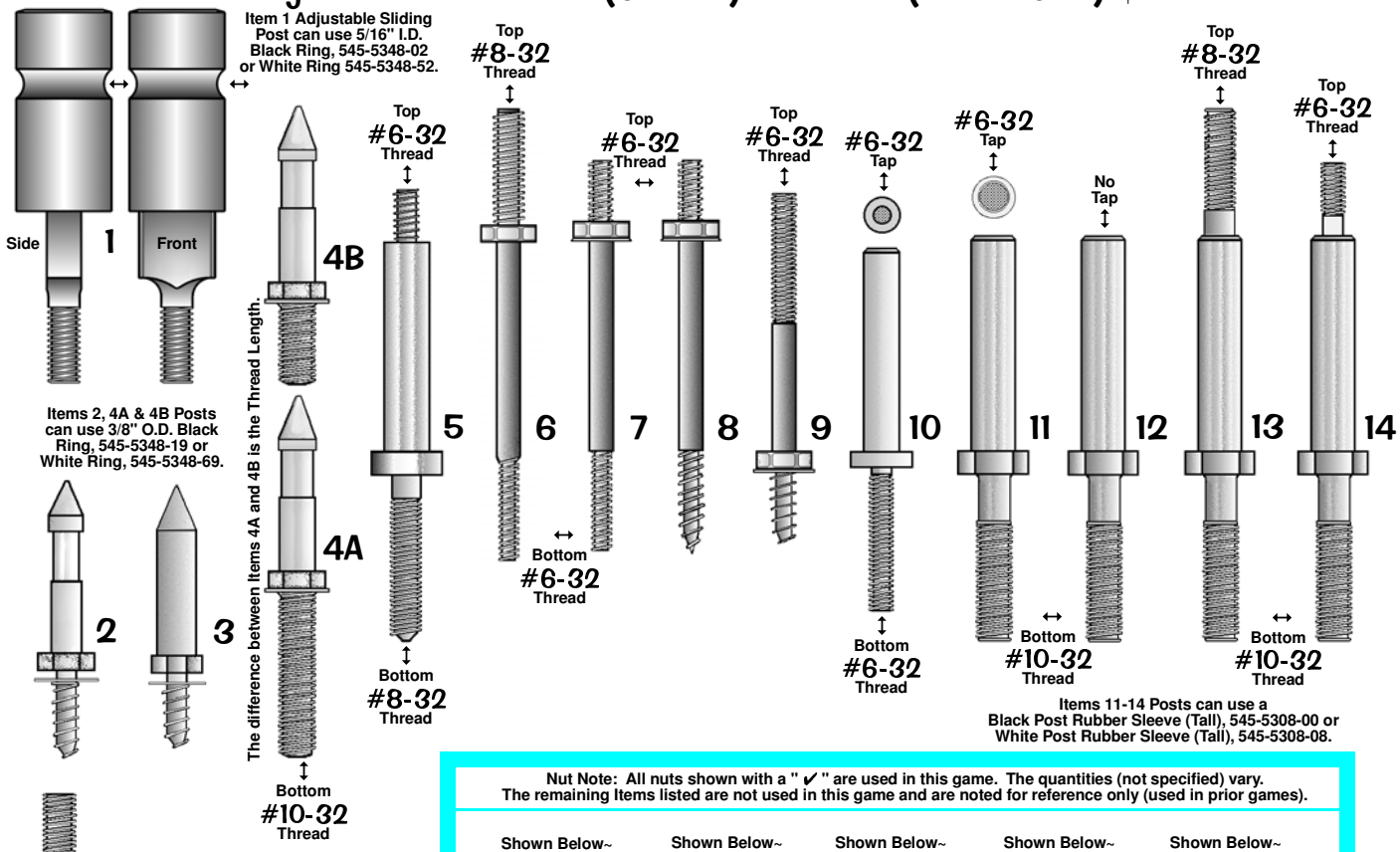


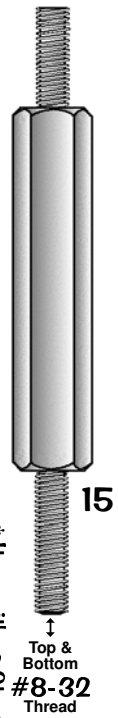
№	MISC. RAMP PART NAME	QTY.	SPI PART №
21	Metal Ramp (**Shooter Lane**)	1	535-9146-00

Item 21 is secured at Flap by: #4 X 5/8" PFH Black (Qty. 2) (237-5833-00)

*All other Ramps, see Sec. **4**, Chp. **2**, **Drawings for Major Assemblies & Ramps** (Blue Pages).*

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



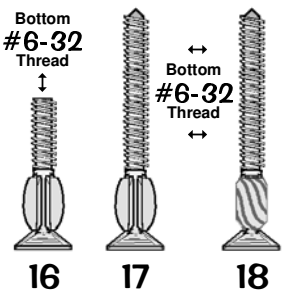


Item 16 is typically used to hold Hex Spacers onto the Playfield Top.

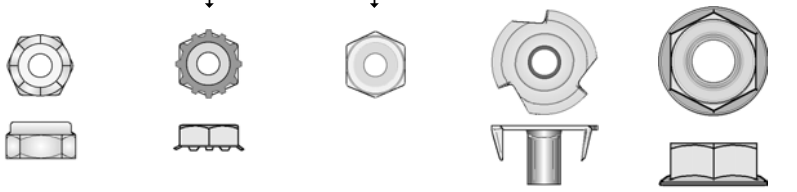
Item 17 is typically used to hold the bottom Cabinet Speaker (used with #6-32 Nylon Stop Nut, 240-5005-00).

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

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



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



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

Top & Side Views

Nylon Stop Nuts *Not Shown:*

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

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

Bottom & Side Views

KEPS Nuts *Not Shown:*

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

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

Top View

Hex Nuts *Not Shown:*

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

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

Bottom & Side Views

T-Nuts *Not Shown:*

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

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

Top & Side Views

Miscellaneous Nuts *Not Shown:*

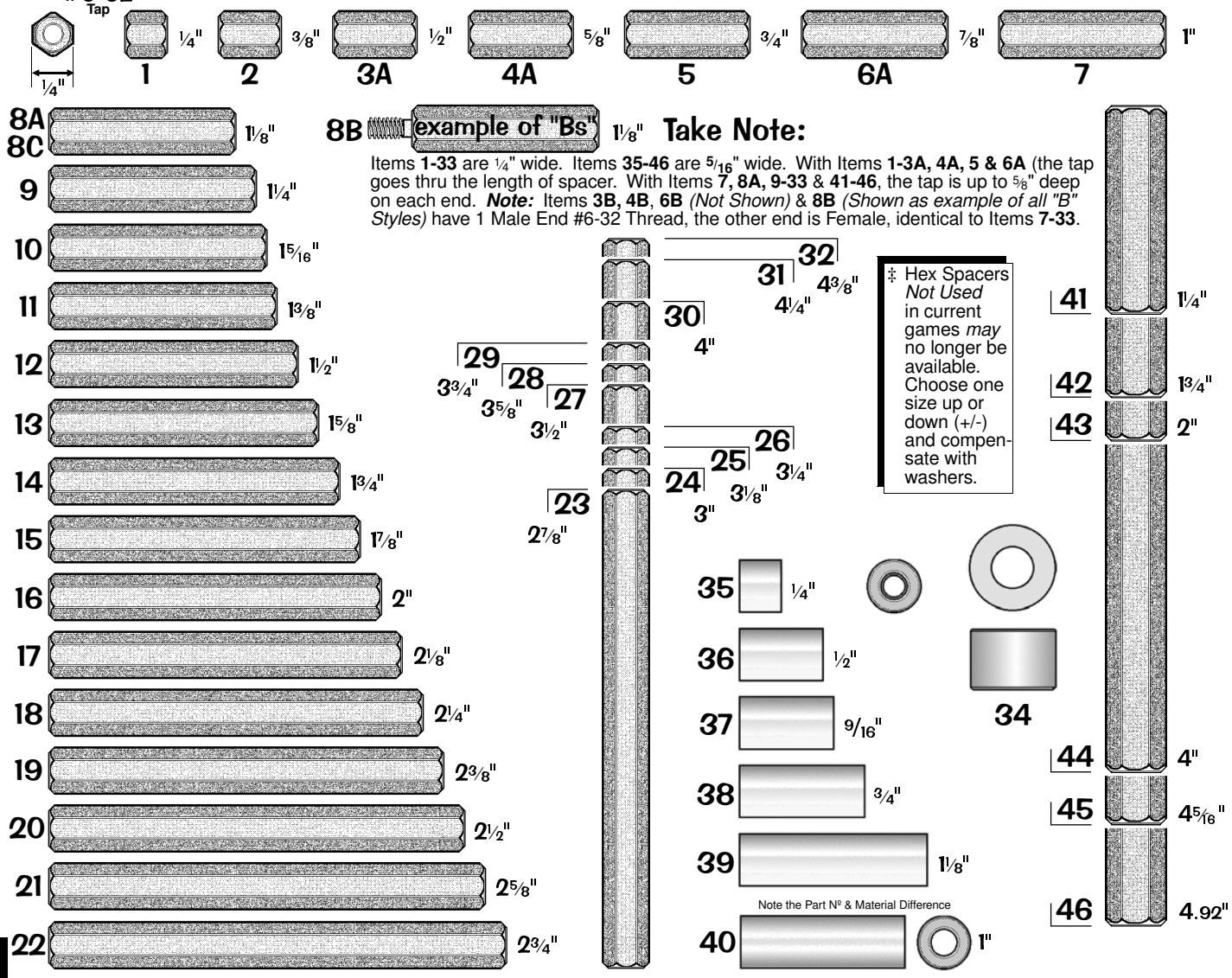
- Plastic Pal Nut (on Flipper Buttons): 240-5003-00
- Metal Pal Nut (on Flipper Buttons): 240-5003-01 ✔
- #6-32 Wing Nut: 240-5001-00
- #8-32 Wing Nut: 240-5100-00
- 1/4"-20 Wing Nut: 240-5302-00
- 1/4"-20 Toggle Wing: 240-5324-00

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



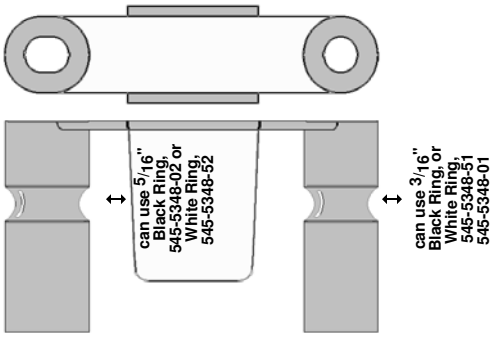
Nº	METAL SPACER NAME	QTY.	SPI PART Nº
1	1/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-00
2	3/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-12
3A	1/2" X 1/4" Hex Spacer #6-32 Tap	5	254-5008-03
3B	Same as 3A but with Male End #6-32	--	254-5024-03
4A	5/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-02
4B*	Same as 4A but with Male End #6-32		254-5024-02
5	3/4" X 1/4" Hex Spacer #6-32 Tap	5	254-5008-04
6A	7/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-05
6B*	Same as 6A but with Male End #6-32		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	3	254-5008-17
8B	Same as 8A but with #8-32 Tap	1	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	1	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	3	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		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		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

Nº	METAL SPACER NAME	QTY.	SPI PART Nº
22	2 3/4" X 1/4" Hex Spacer #6-32 Tap	1	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		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		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		254-5014-03
36	1/2" X 5/16" X .144" I.D. Spacer Tap	2	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		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

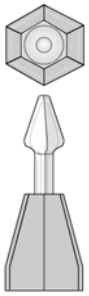
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

Playfield - Plastic Posts and Spacers (Actual Size) †

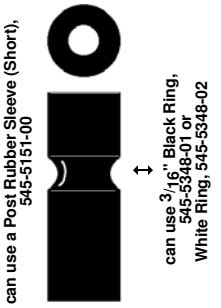
1** *Various Colors*



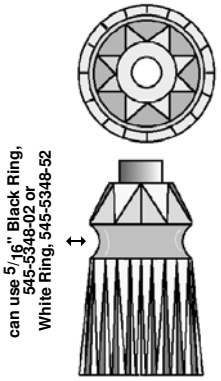
2** *Various Colors*



3** *Limited Colors*



4** *Various Colors*



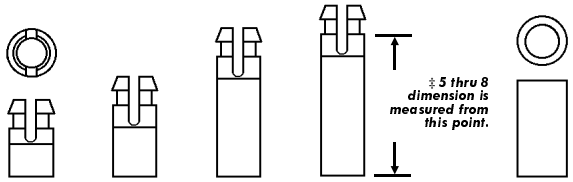
Items 3-4 Posts used in pairs can use 3/4" through 3" Rubber Rings, (See Rubber Parts for Part Nºs).

Take Note:

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

** Items **1, 2 & 4** come in various colors (may not be available in every color). Item **3** is currently only available in the color(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.*

5 ‡ 6 ‡ 7 ‡ 8 ‡ 9



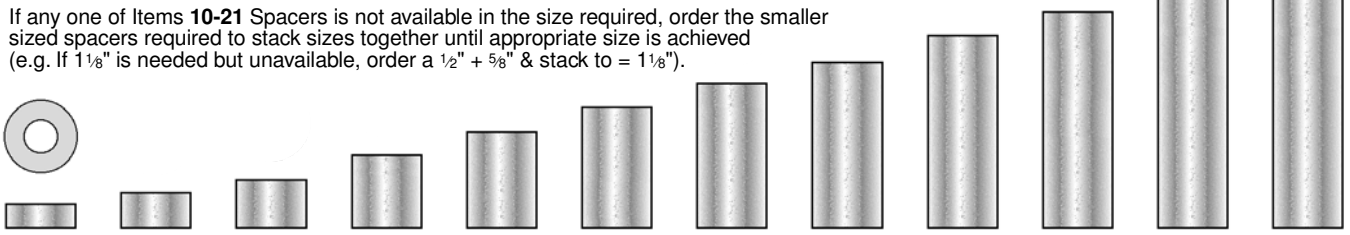
1/4" 3/8" 5/8" 3/4" 1/2"

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

10 11 12 13 14 15 16 17 18 19 20 21

Take Note:

If any one of Items **10-21** Spacers is not available in the size required, order the smaller sized spacers required to stack sizes together until appropriate size is achieved (e.g. If 1 1/8" is needed but unavailable, order a 1/2" + 5/8" & stack to = 1 1/8").



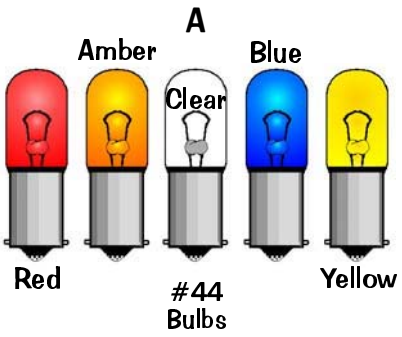
1/8" 3/16" 1/4" 3/8" 1/2" 5/8" 3/4" 7/8" 1" 1 1/8" 1 1/4" 1 1/2"

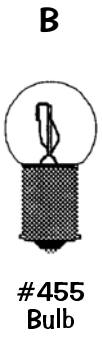
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

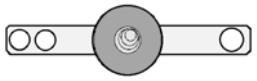
Nº	PLASTIC POST/SPACER NAME	QTY.	SPI PART Nº
1**	Top Lane Mini-Light Hood (Red)	5	550-5061-02
	Item 1 typically secured by: #6-32 X 1-3/4" PPH MS (Zinc) (Qty. 2/per) (237-5511-00) **and** Washer 9/64" X 5/16" OD X 1/32" (Qty. 2/per) (242-5017-00)		
2**	Mini-Jewel Post Clear	1	550-5052-01
	Item 2 typically secured by: #6 X 3/8" HWH AB (Zinc) (Qty. 1/per) (234-5000-00)		
3**	1 1/16" Single Groove Post (Clear)	12	550-5059-01
4**	*Single* Groove Jewel Post **(Clear & Red)**	10/1	550-5034-01/-02
	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		254-5007-01
7 ‡	5/8" Slf. Rtn. Spacer White		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

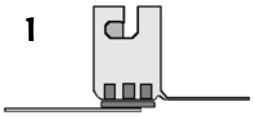
Nº	PLASTIC POST/SPACER NAME	QTY.	SPI PART Nº
10	1/8" X 3/8" Spacer Gray		254-5000-19
11	3/16" X 3/8" Spacer Gray (4 for Dot Display)	4	254-5000-18
12	1/4" X 3/8" Spacer Gray	4	254-5000-02
13	3/8" X 3/8" Spacer Gray	8	254-5000-12
14	1/2" X 3/8" Spacer Gray		254-5000-01
15	5/8" X 3/8" Spacer Gray	6	254-5000-14
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		254-5000-04
19	1 1/8" X 3/8" Spacer Natural **(-06 for Gray)**	7	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

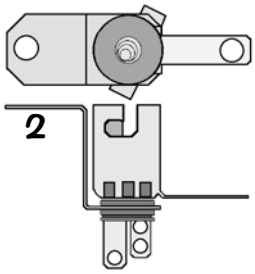
Playfield - Small Bayonet Type Bulbs and Sockets (Actual Size) †

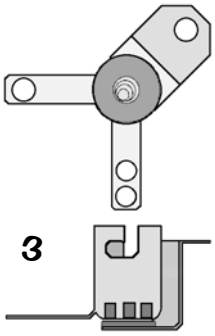


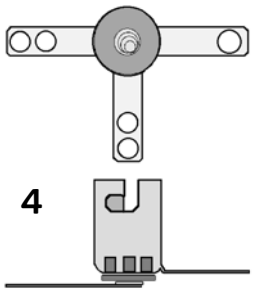


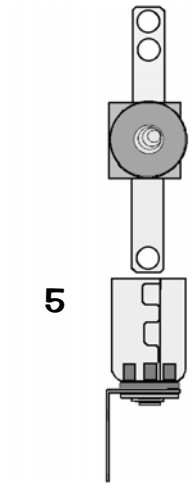


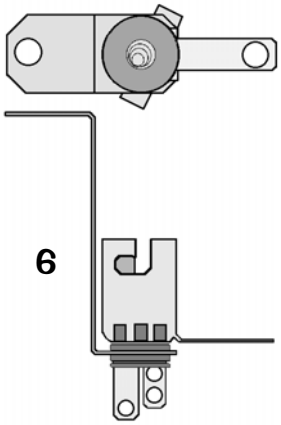


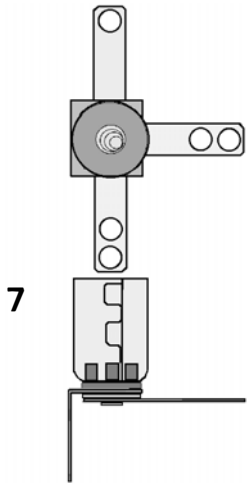


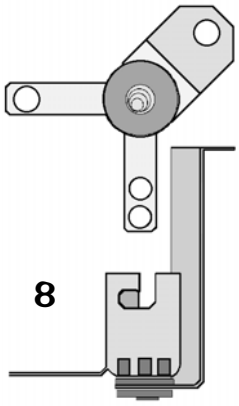


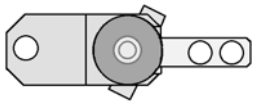


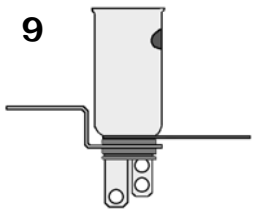


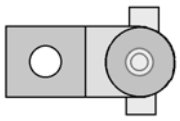


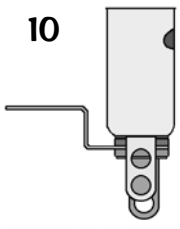


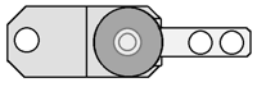


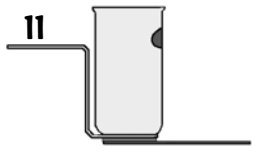


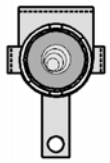


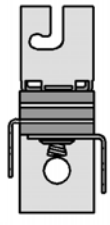








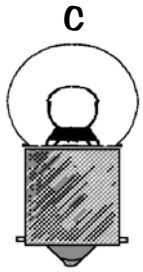




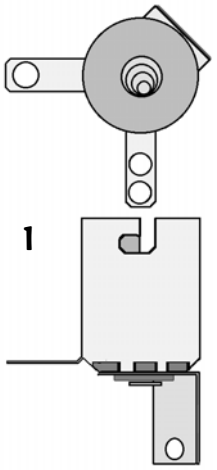
№	SMALL BULB & SOCKET NAME	QTY.	SPI PART №
A	#44 Bulb (Clear)	39	165-5000-44
A	#44 Bulb (Red)	4	165-5053-02
A	#44 Bulb (Amber)		165-5053-03
A	#44 Bulb (Blue)		165-5053-05
A	#44 Bulb (Yellow)	7	165-5053-06
B	#455 Twinkle Bulb		165-5003-00
1	2-Lug Staple Down Socket	3	077-5000-00
2	3-Lug Stand-Up Short Socket		077-5008-00
3	2-Lug Stand-Up Short Socket		077-5002-00
4	3-Lug Staple Down Socket	10	077-5001-00
5	2-Lug Laydown Socket		077-5003-00
6	3-Lug Stand-Up Long Socket	7	077-5009-00
7	3-Lug Laydown Socket (3 Lugs Flat)	4	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)	20	077-5031-00
11	1-Lug Stand-Up Long Shell Socket		077-5012-00
12	3-Lug Laydown Socket (2 Lugs Bent)		077-5032-00

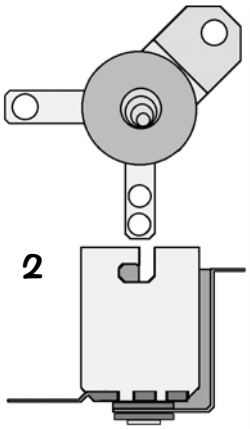
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

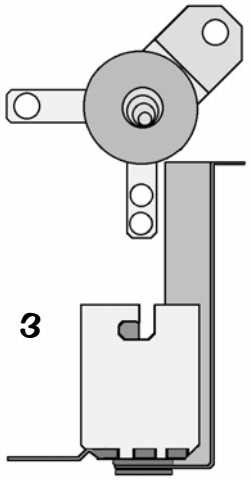
Playfield - Large Bayonet Type Bulb and Sockets (Actual Size) †

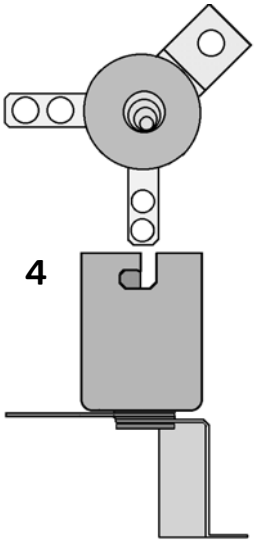


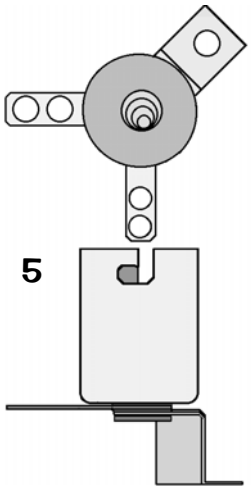
#89
Bulb

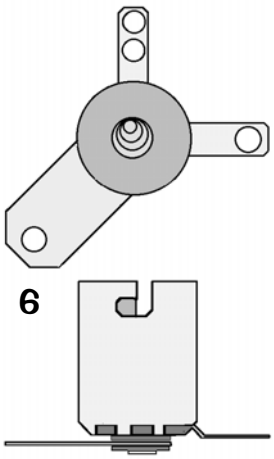










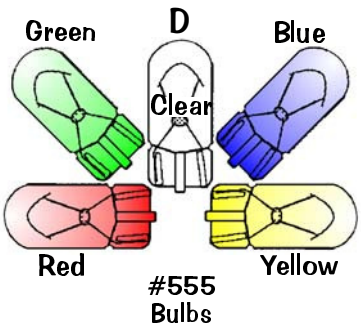


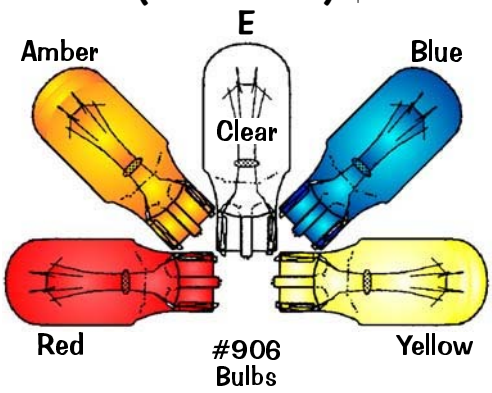
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

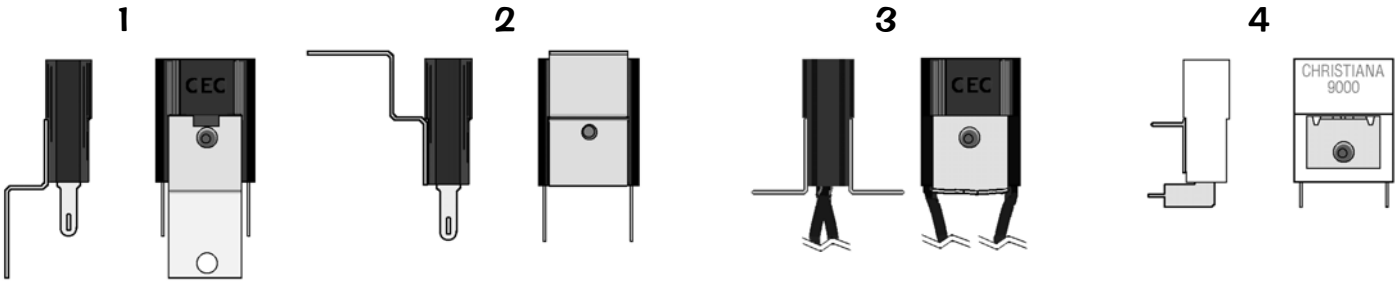
№	LARGE BULB & SOCKET NAME	QTY.	SPI PART №
C	#89 Bulb	3	165-5000-89
1	Laydown Standard Socket	1	077-5100-00
2	2-Lug Stand-Up Short Socket	2	077-5101-00
3	2-Lug Stand-Up Long Socket		077-5102-00

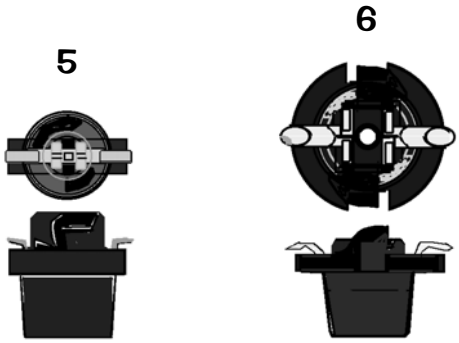
№	LARGE BULB & SOCKET NAME	QTY.	SPI PART №
4	Stand-Up Socket Rev. Short		077-5103-00
5	2-Lug Stand-Up Small Socket		077-5106-00
6	Straight Leg Socket		077-5107-00

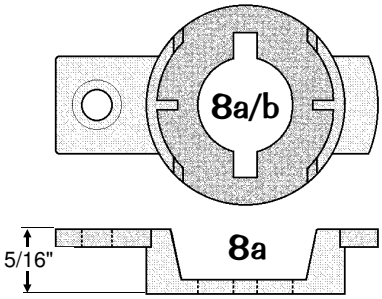
Playfield - Wedge Base Bulbs and Sockets (Actual Size) †







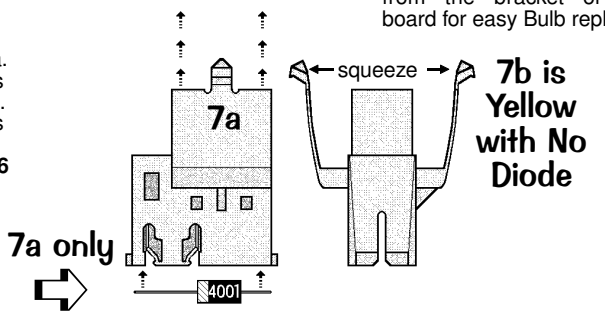




Take Special Note

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)	64	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)	2	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

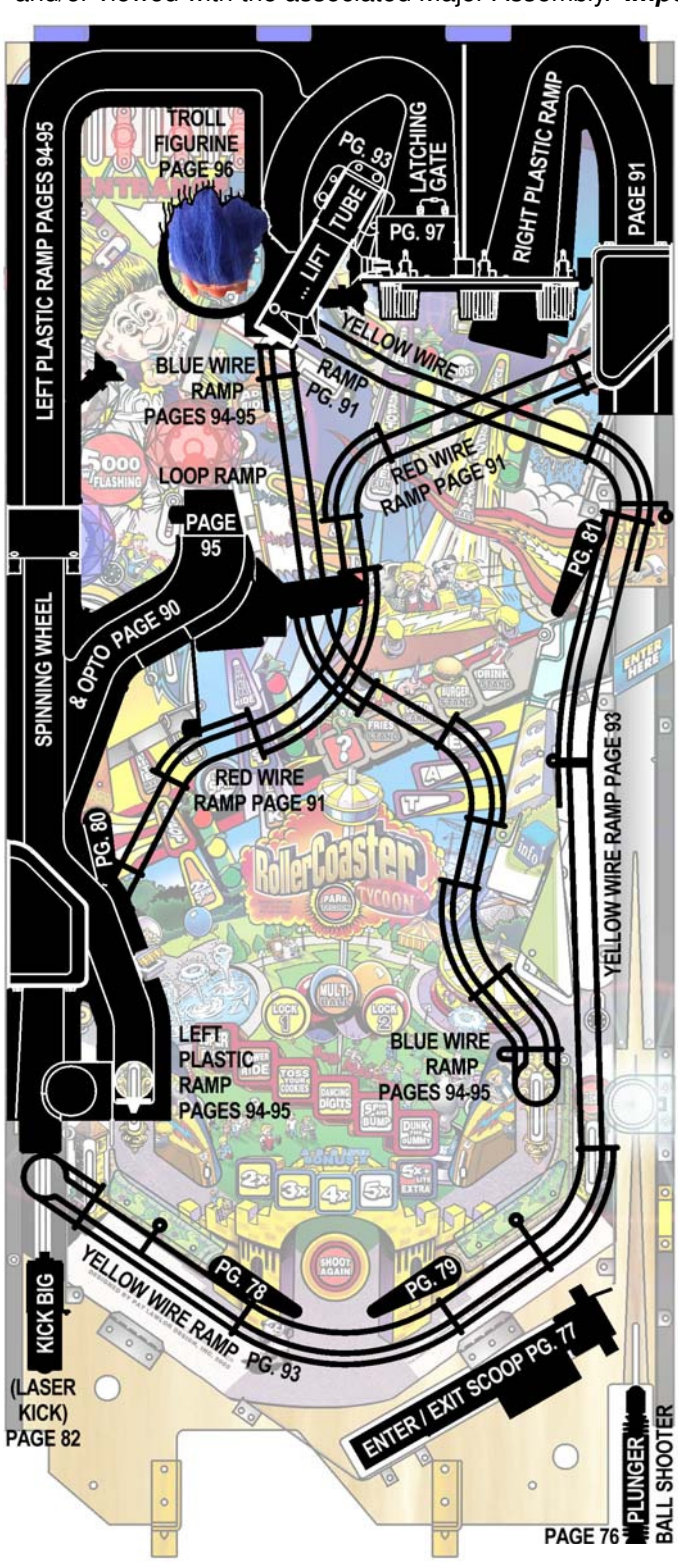
№	WEDGE BULB & SOCKET NAME	QTY.	SPI PART №
1	#555 Wedge Base Socket (Laydown)	3	077-5026-01
2	#555 Wedge Base Socket (Offset)		077-5029-00
3	#555 W.B. Socket (for Pop Bumper)	3	077-5206-00
4	#555 W.B. Socket (Solder Type)		077-5207-00
5	#555 Wedge Base Socket (Twist)		077-5007-00
6	#906 Wedge Base Socket (Twist)		077-5016-00
7a	#555 IDC Snap-On Socket	55	077-5216-00
7b	#555 IDC Snap-On Socket ***No Diode***	5	077-5216-**01**
8a	5/16" Ht. Snap-On Socket Bracket	55	545-5760-18
8b*	19/32" Ht. Snap-On Socket Bracket		545-5760-19
9*	Clear Plastic Socket Mtg. Bd. (x/per)		*Not Required*

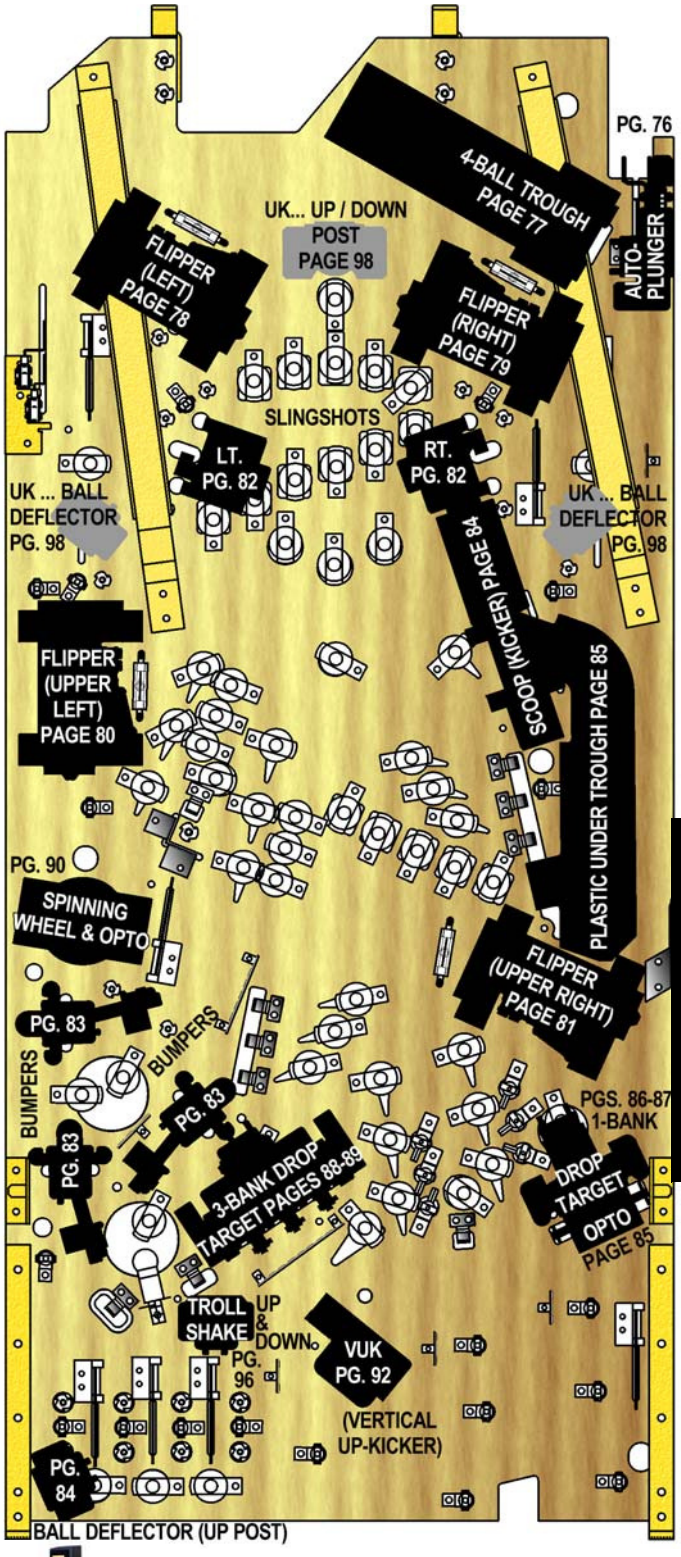
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

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.

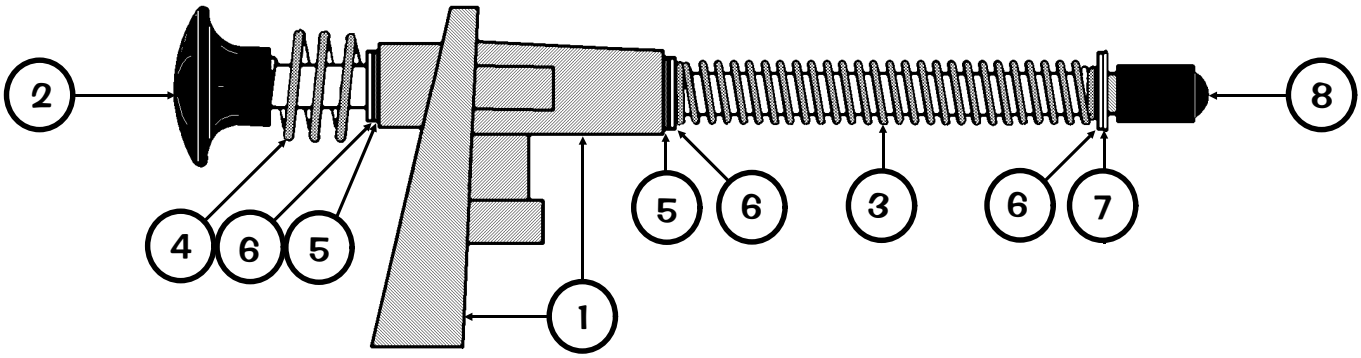




Ball Shooter (Plunger) Assembly, 500-6146-00-04 (Items 1-8)

Manually launch the ball into play.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Housing (Shooter Assembly)	1	535-5067-02
	Item 1 is secured to the Cabinet by: Support Plate (Qty. 1) (535-5027-00), #10-32 X 1/2" PPH (Sems) Zinc TF (Qty. 3) (237-6033-00), #10 Split Lock Washer (Qty. 3) (234-5003-00) **and** #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5002-00)		
2	Rod Assembly (w/Black Knob)	1	515-6557-00
3	Comp. (Return) Spring (GRN, .035" ø)	1	266-5001-04
4	Compression Spring (Short Plunger)	1	266-5010-00
5	Bushing, 3/8" I.D. (Oilite)	2	280-5010-00
6	Washer, 3/8" I.D. X 5/8" O.D. X 1/16"	3	242-5014-00
7	Retaining Ring, 3/8" ø Shaft	1	270-5012-00
8	Plunger Tip (Black 50 Duro)	1	545-5276-00

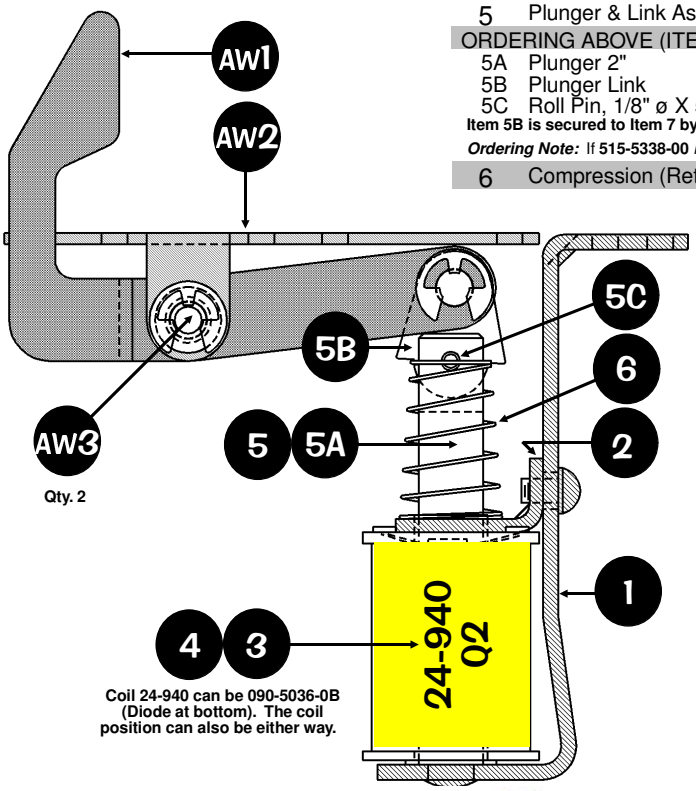


Autoplunger Arm Weld Assembly, 500-6091-00 (Items AW1-AW3)
Autoplunger Coil Assembly, 500-6092-02 (Items 7-9)

Automatically launches the ball into play.

№	... ARM WELD PART NAME	QTY.	SPI PART №
AW1	Arm Weld Assembly	1	515-6526-00
	Item AW1 is secured to Item AW2 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)		
AW2	Autoplunger Fulcrum	1	535-7697-00
AW3	Nyliner, 1/4" (Thomson #4l1-FF)	2	545-5423-00

№	'PLUNGER COIL PART NAME	QTY.	SPI PART №
1	Autoplunger Coil Bracket Assembly	1	515-6527-00
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 9) (234-5101-00)		
2	Coil Retainer Bracket	1	535-5203-03
	Item 2 is secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)		
3	Coil, 24-940	1	090-5036-00T
	ORDERING ABOVE (ITEM 3) COIL PART № 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 № WILL INCLUDE:		
5A	Plunger 2"	1	530-5025-01
5B	Plunger Link	1	545-5293-00
5C	Roll Pin, 1/8" ø X 5/8" Lg.	1	251-5008-00
	Item 5B is secured to Item 7 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)		
	Ordering Note: If **515-5338-00** *is unavailable*, order the individual part(s) actually required.		
6	Compression (Return) Spring	1	266-5020-00



4-Ball Trough Assembly, 500-6318-14 (Items 1-13)
and Associated Parts: See Parts Table below.

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

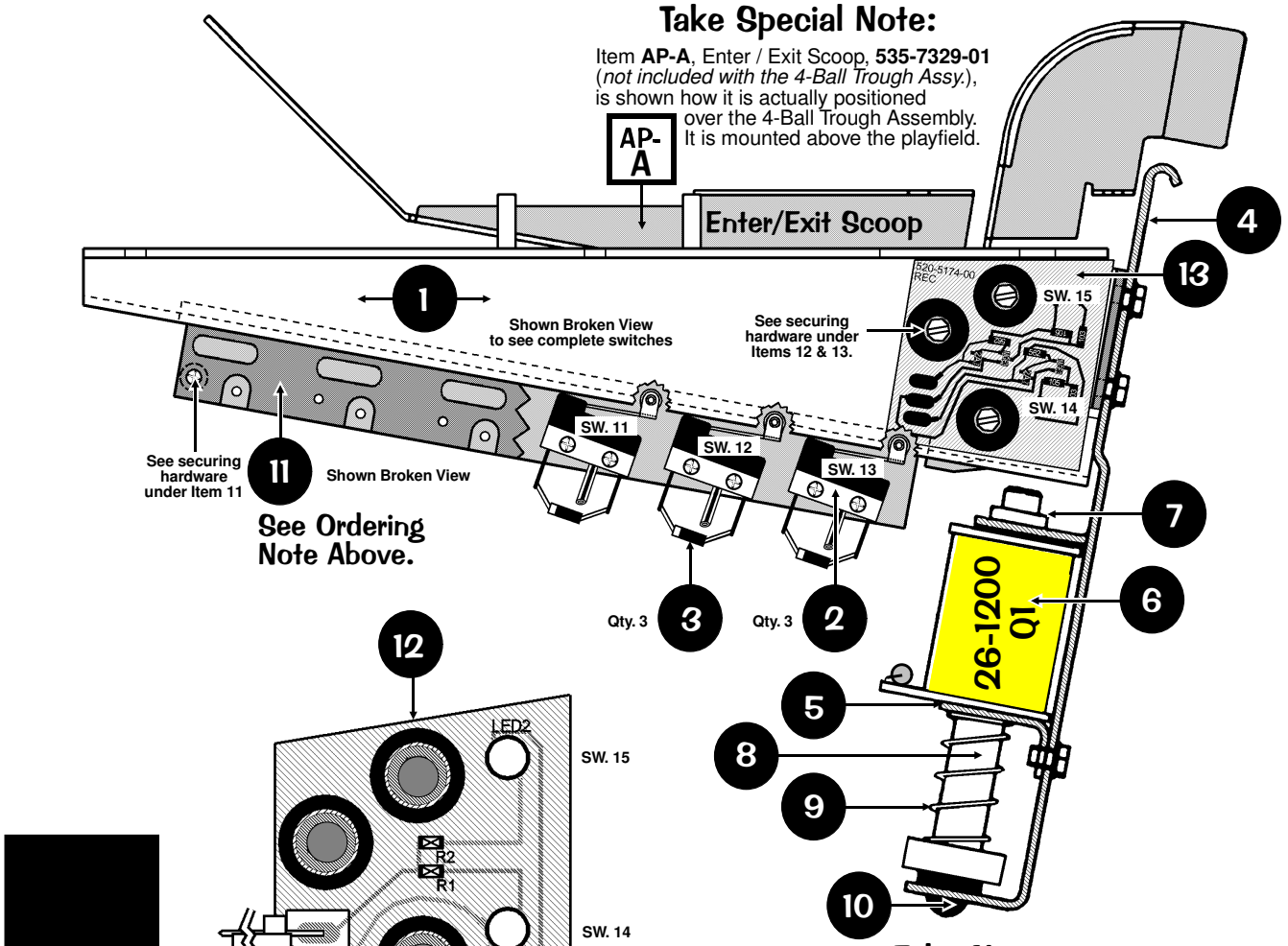
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Ball Trough Outhole Mounting Bracket	1	515-6580-01
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 6) (234-5101-00)		
2	Micro Switch **(Roller Actuator, Lite-Force)**	3	180-5119-02
	Item 2 is secured to Item 1 by: #2-56 X 1/2" HWH (Sr) 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*	0	535-7801-00
	Item 11 is secured to Item 1 by: 1/4" X 5/16" X .144" I.D. Spacer Tap. (Qty. 1) (254-5014-03) **and** #2-56 X 1/2" HWH (Ser) UNS #4HD TR3 BO (Qty. 4) (237-5937-02)		
12	Dual OPTO TRANS Board Assembly	1	515-0173-00
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: Yellow Flipper Bat & Shaft Assy., 515-5133-06-06 (Item AP-A)

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
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 № 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 № 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)		

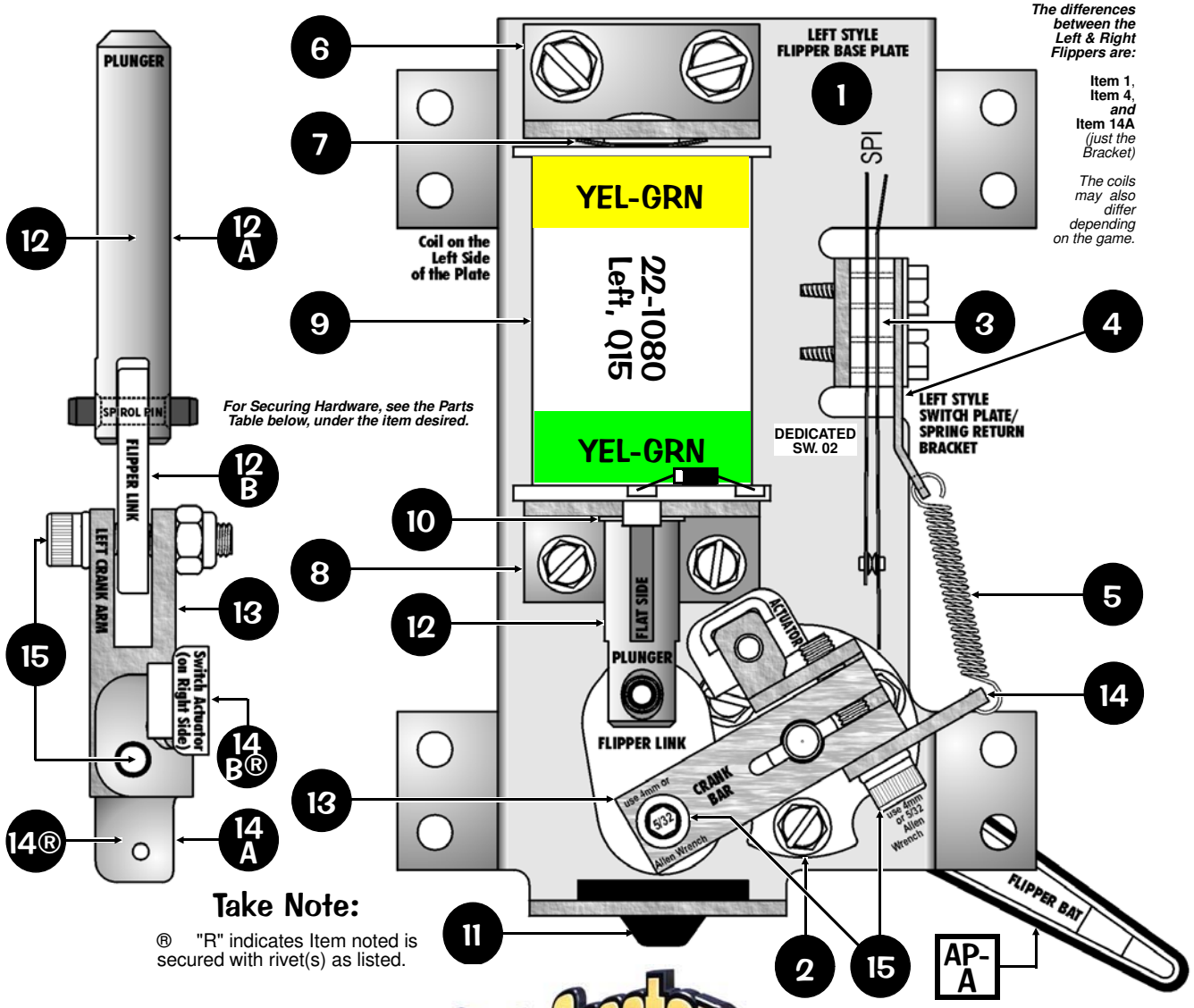
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
13*	Crank Bar	1	530-5070-02
	Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)		
14*	® Switch Actuator (**LEFT**) Sub-Assy.	1	515-7257-**01**
	ORDERING ABOVE (ITEM 14) SUB-ASSY. PART № WILL INCLUDE:		
14A	Actuator & Spring Bracket (**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.

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



The differences between the Left & Right Flippers are:

Item 1, Item 4, *and* Item 14A *(just the Bracket)*

The coils may also differ depending on the game.

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, 500-6543-02 (Items 1-15)
and Associated Part: Yellow Flipper Bat & Shaft Assy., 515-5133-06-06 (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, 22-1080 (YEL-GRN) (Right)	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 (**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**		

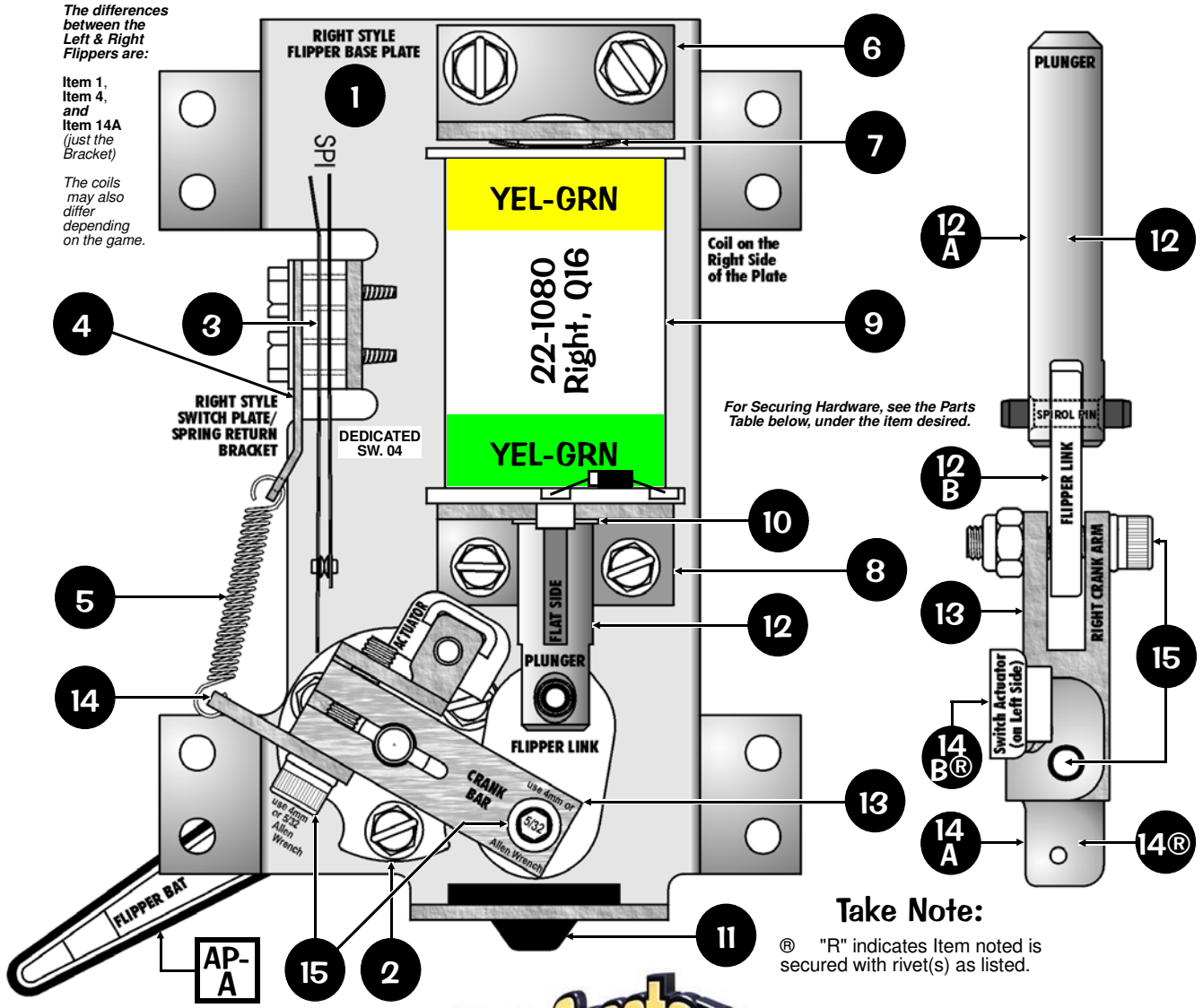
Flipper Rebuild Parts for Easier Installation, $ave $:

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	**YELLOW** Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-5133-06-06
	Large Flipper **RED** Rubber Ring	1	545-5277-22

* 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.

Flipper (Upper Left) Assembly, 500-6543-37 (Items 1-15)
and Associated Part: Yellow Mini-Flipper Bat & Shaft Assy., 515-6275-06 (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	1/4" X 3/8" Spacer Gray	2	254-5000-02
	Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Sw. (Ser.) Zc. (Qty. 1/per) (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, 25-1400 (RED) (Upper Left)	1	090-5067-00T
	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)		

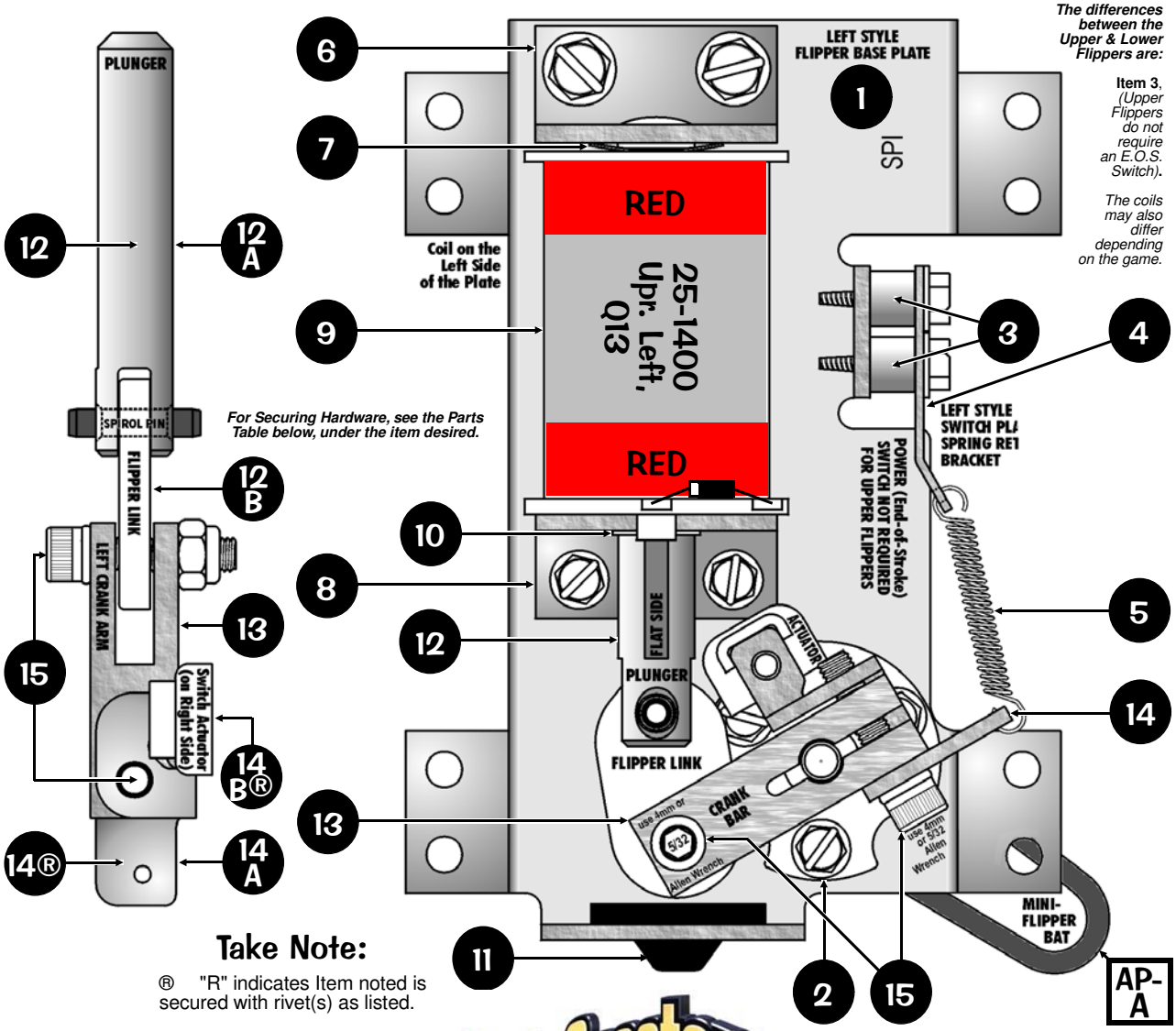
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
13*	Crank Bar	1	530-5070-02
	Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)		
14*	® Switch Actuator (**LEFT**) Sub-Assy.	1	515-7257-**01**
	ORDERING ABOVE (ITEM 14) SUB-ASSY. PART Nº WILL INCLUDE:		
14A	Actuator & Spring Bracket (**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	**YEL.** Mini-Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-6275-06
	Small Flipper **RED** Rubber Ring	1	545-5207-22



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 (Upper Right) Assembly, 500-6543-28 (Items 1-15)
and Associated Part: Yellow Flipper Bat & Shaft Assy., 515-5133-06-06 (Item AP-A)

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
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	1/4" X 3/8" Spacer Gray	2	254-5000-02
	Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Sw. (Ser.) Zc. (Qty. 1/per) (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, 25-1600 (WHT) (Upper Right)	1	090-5068-00T
	ORDERING ABOVE (ITEM 9) COIL PART № WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
10*	Coil Sleeve	1	545-5388-00
11	Deflector Pad (Bumper)	1	545-5428-00
12*	Flipper Plunger & Link Sub-Assy.	1	515-6304-03
	ORDERING ABOVE (ITEM 12) SUB-ASSY. PART № 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 № 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**		

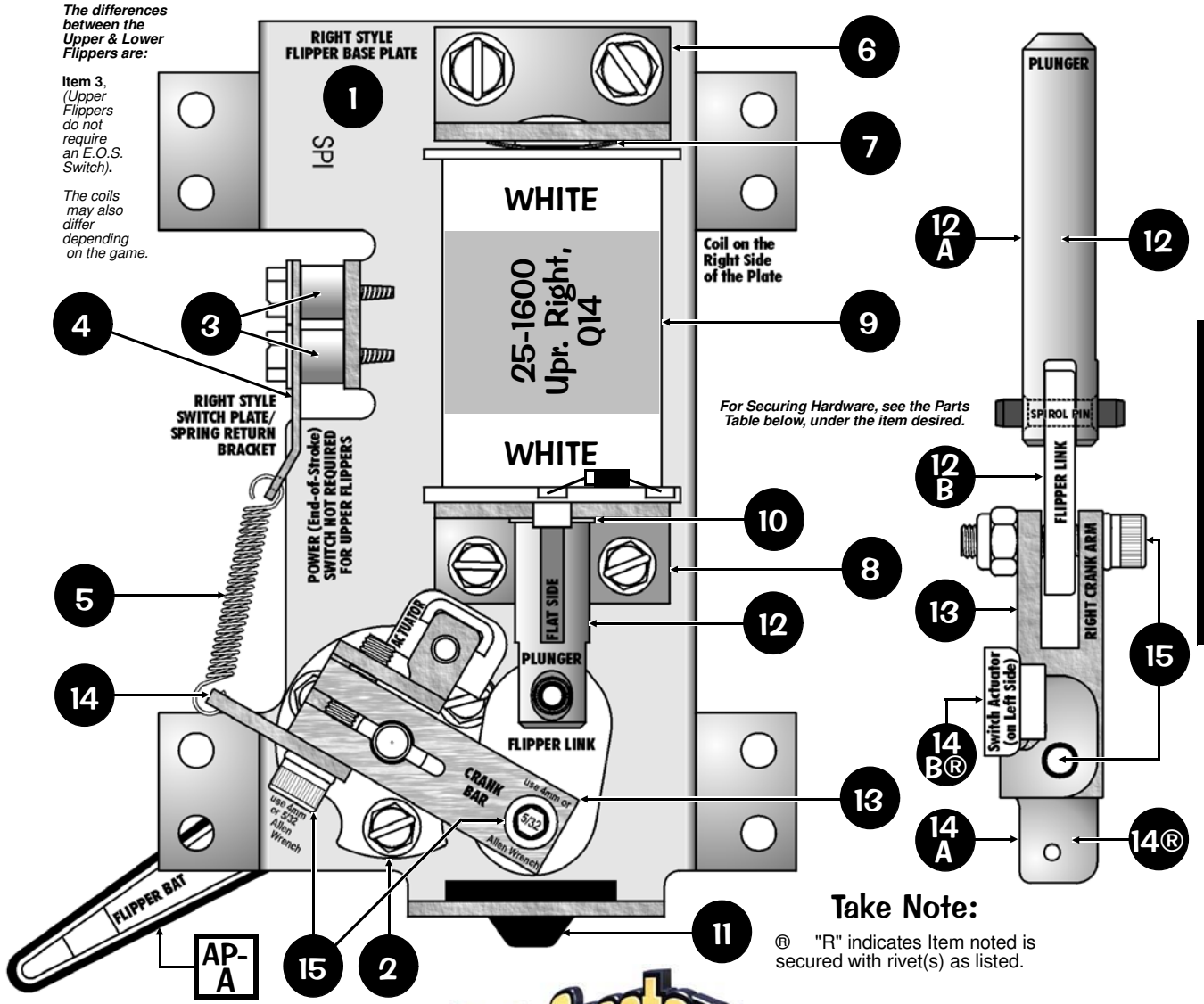
Flipper Rebuild Parts for Easier Installation, $ave $:

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.

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

* 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.

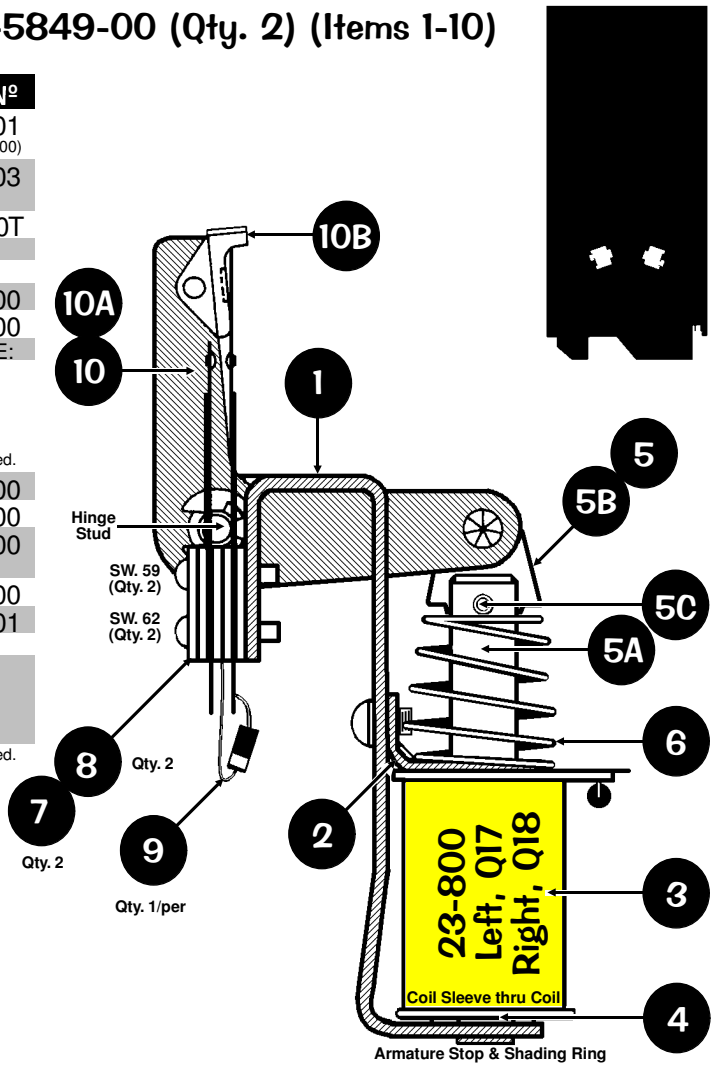
Slingshot Assemblies, 500-5849-00 (Qty. 2) (Items 1-10)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Slingshot Bracket Assembly	1	515-5339-01
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 3) (234-5101-00)		
2	Coil Retaining Bracket	1	535-5203-03
	Item 2 is secured to Item 1 by: #8-32 X 3/8" PPH MS (Sems) (Qty. 2) (232-5301-00)		
3	Coil, 23-800	1	090-5001-00T
	ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
4	Coil Sleeve	1	545-5031-00
5	Plunger & Link Assembly	1	515-5338-00
	ORDERING ABOVE (ITEM 5) SUB-ASSY. PART Nº WILL INCLUDE:		
5A	Plunger 2" Lg.	1	530-5025-01
5B	Plunger Link	1	545-5293-00
5C	Roll Pin 1/8" ø x 5/8" Lg.	1	251-5008-00
	Item 5B is secured to Item 10A by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)		
	Ordering Note: If **515-5338-00** *is unavailable*, order the individual part(s) actually required.		
6	Compression (Return) Spring	1	266-5020-00
7	Slingshot Stack (Blade) Switch	2	180-5054-00
8	Switch Body Protect Plate	2	535-5045-00
	Items 7 & 8 are secured to Item 1 by: #6-32 X 5/8" HWH Swage (Qty. 4) (237-5976-04)		
9	Switch Diode, 1N4001	2	112-5001-00
10®	Riveted Arm & Tip Assembly	1	515-5340-01
	ORDERING ABOVE ® RIVETED ASSY. PART Nº WILL INCLUDE:		
10A	Arm	1	515-5341-01
10B®	Kicker Tip *(secured to 1A by 1C)*	1	545-5216-01
10C*	Rivet, 1/8" ø x 1/4" Lg.	1	249-5003-00
	Item 10A is secured to Item 1 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)		
	Ordering Note: If **515-5340-01** *is unavailable*, order the individual part(s) actually required.		

Take Note:

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

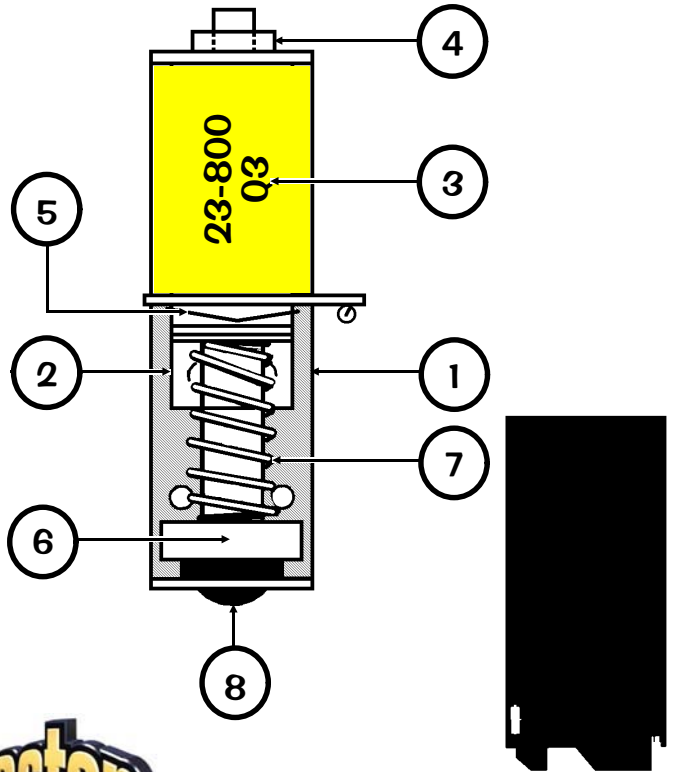
® "R" indicates Item noted is secured with rivet(s) as listed.

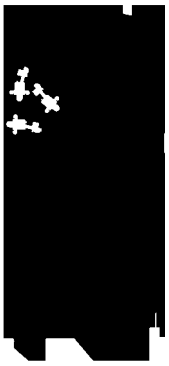


Kick Big (Laser Kick) Assembly, 500-5862-02 (Items 1-8)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Mounting Bracket (Frame)	1	535-6730-00
	Item 1 is secured above the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 3) (234-5101-00)		
2	Coil Retaining Bracket	1	535-5203-03
	Item 2 is secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) (Qty. 2) (232-5300-00)		
3	Coil, 23-800	1	090-5001-00B
	ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at bottom)	1	112-5003-00
4	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
5	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
6	Plunger Assembly	1	515-5000-02
7	Compression (Return) Spring	1	266-5020-00
8	Rubber Bumper (Grommet)	1	545-5105-00

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

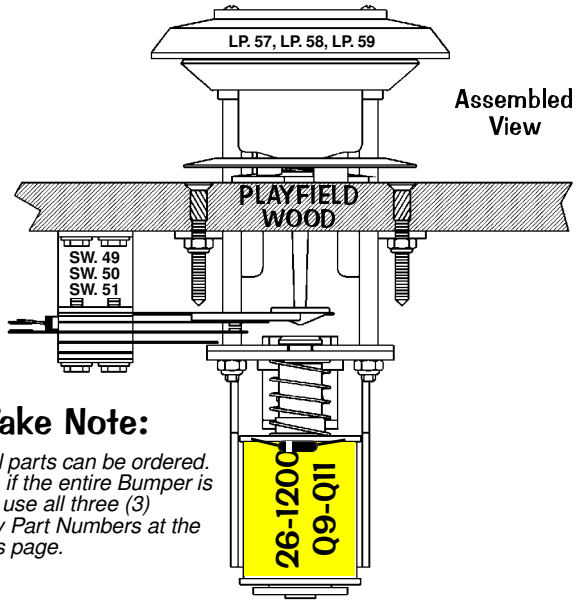




Bumper Top Assemblies, 515-6459-01 (Qty. 3) (Items 1-7), Bumper Bottom Assy., 515-6459-04 (Qty. 3) (Items 8-15), Bumper Switch Assy., 515-6459-03 (Qty. 3) (Items 16-20)

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

Exploded View



Assembled View

Take Note:

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

№	BUMPER TOP PART NAME	QTY.	SPI PART №
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

№	BUMPER BOTTOM PART NAME	QTY.	SPI PART №
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 № 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)		

№	BUMPER SWITCH PART NAME	QTY.	SPI PART №
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	Spoon Switch Actuator	1	545-5610-01
18	Bumper Stack (Blade) Switch	1	180-5015-03
19	Switch Body Protect Plate	1	535-7344-00
	Items 18 & 19 are secured by: #6-32 X 3/4" HWH Swage (Serr) Zc. (Qty. 2) (237-5976-05)		
20	Switch Diode, 1N4001	1	112-5001-00

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

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

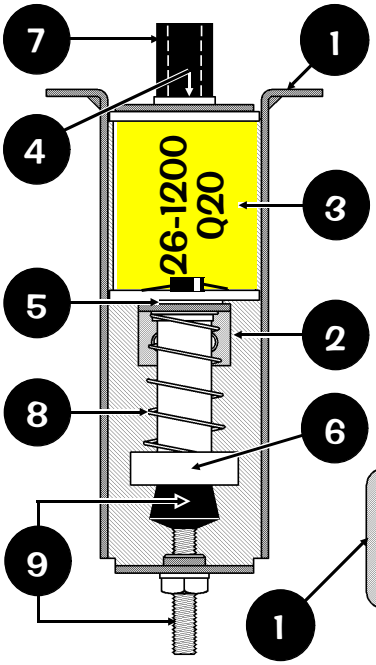
№	ASSOCIATED PART NAME	QTY.	SPI PART №
	Bumper Cap (CLEAR)	1	550-5057-01
AP-A	Bumper Cap (BLUE)	1	550-5057-05
	Bumper Cap (RED-***ALTERED/CUT***)	1	**550-5078-02**
	Item AP-A is secured to Item 4 by: #4 X 3/4" PRH (Zinc) T-25 (Qty. 2/per) (237-5873-00)		

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

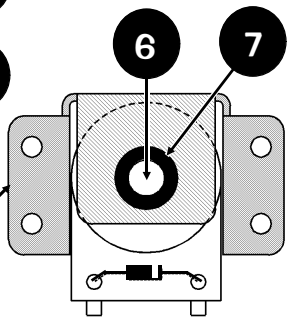
Stops the ball in the Left Orbit.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Ball Deflector Coil Mounting Bracket	1	535-6857-02
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5101-00)		
2	Coil Retaining Bracket	1	535-5203-03
	Item 2 is secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) (Qty. 2) (232-5300-00)		
3	Coil, 26-1200	1	090-5044-00T
	ORDERING ABOVE (ITEM 3) COIL PART № WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
4	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
5	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
6	Solid Plunger Assembly (Tapered Top)	1	515-7089-00
7	Post Black Rubber (Sleeve Tall)	1	545-5308-00
8	Compression (Relay) Spring	1	266-5022-01
9	#10-32 Adj. Spindle Stop w/Rubber Tip	1	280-5014-00
	Item 9 is secured by: #10-32 Keps Nut (Qty. 1) (240-5208-00)		

Ordering Note: If **500-6433-00** *is unavailable*, order the individual part(s) actually required or try **500-5788-XX** and change it's Solid Plunger with above Solid Plunger (**515-7089-00**) and **ORDER** the Post Rubber Sleeve (**545-5308-00**) to add to the tip. The Rubber Sleeve is not included with the Solid Plunger. ***PERIODICALLY CHECK THIS RUBBER FOR WEAR.***



Top View

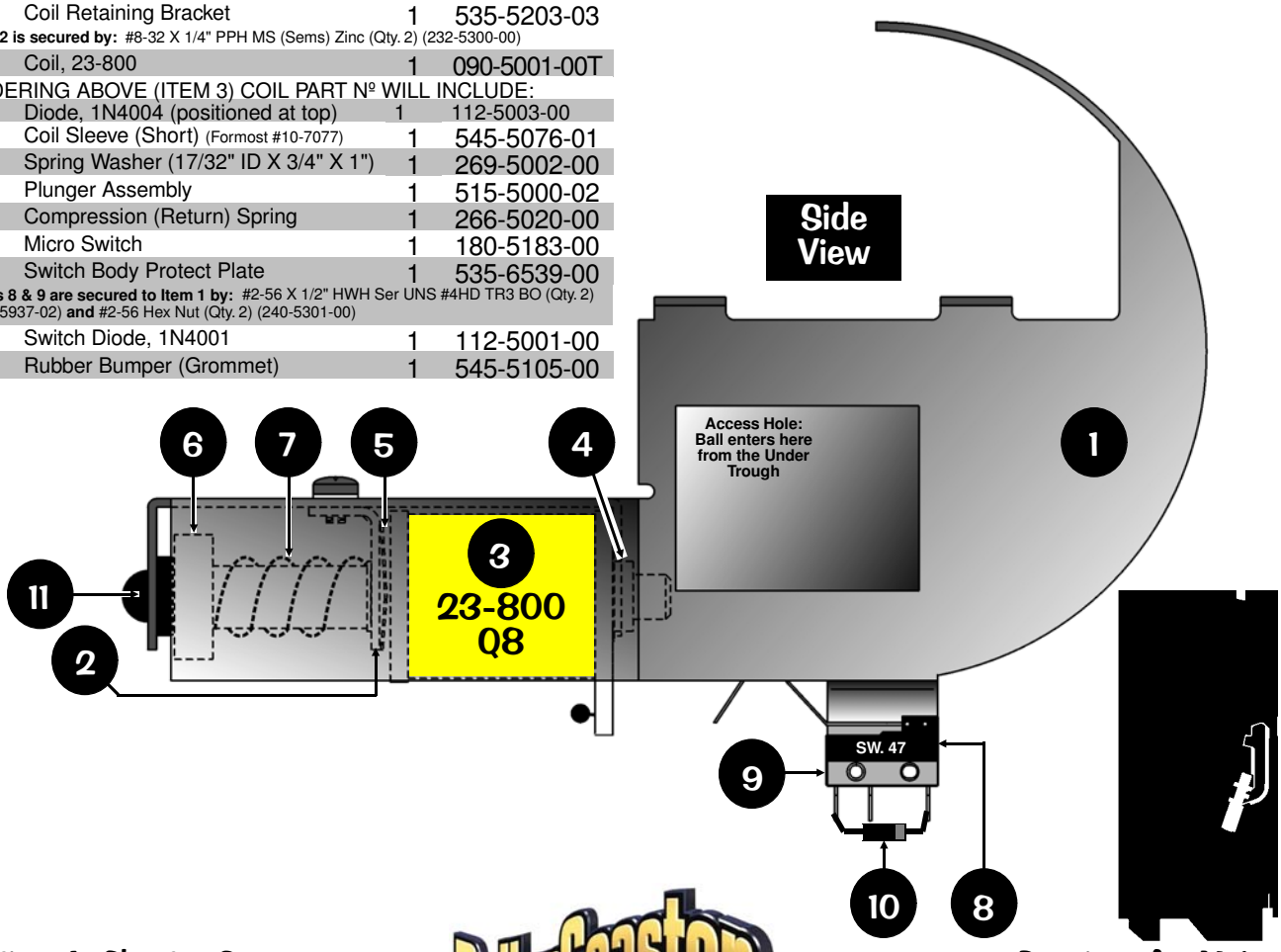


Scoop (Kicker) Assembly, 500-6585-00 (Items 1-11)

Ball is kicked back into play via the Under Trough (Next Page).

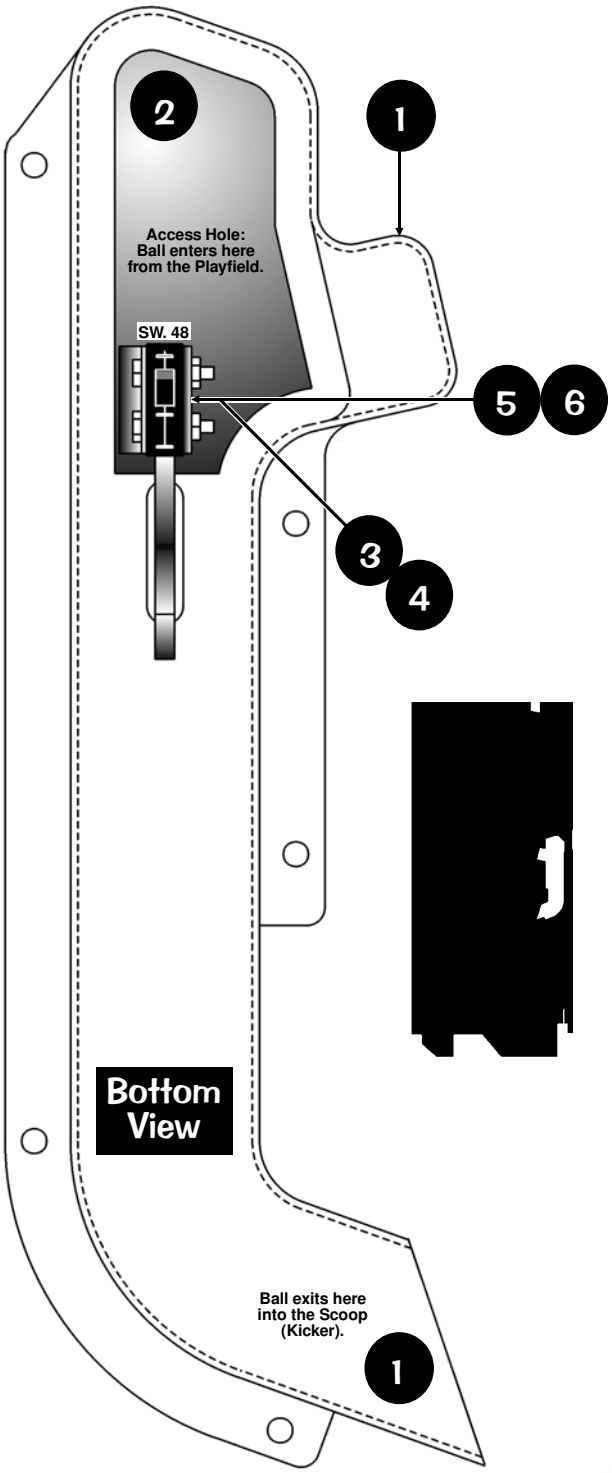
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Scoop Weldment Mounting Assy.	1	515-7165-02
	Item 1 is secured under the P/F by: #8-32 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5101-00)		
2	Coil Retaining Bracket	1	535-5203-03
	Item 2 is secured by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)		
3	Coil, 23-800	1	090-5001-00T
	ORDERING ABOVE (ITEM 3) COIL PART № WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
4	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
5	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
6	Plunger Assembly	1	515-5000-02
7	Compression (Return) Spring	1	266-5020-00
8	Micro Switch	1	180-5183-00
9	Switch Body Protect Plate	1	535-6539-00
	Items 8 & 9 are secured to Item 1 by: #2-56 X 1/2" HWH Ser UNS #4HD TR3 BO (Qty. 2) (237-5937-02) **and** #2-56 Hex Nut (Qty. 2) (240-5301-00)		
10	Switch Diode, 1N4001	1	112-5001-00
11	Rubber Bumper (Grommet)	1	545-5105-00

Side View



Plastic Under Trough Individual Parts Only (Items 1-6)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Plastic Under Trough (Plain No Parts)	1	545-6057-00
	Item 1 is secured under the P/F by: #8 X 1/2" HWH AB (Zinc) (Qty. 5) (234-5101-00)		
2	Impact Plate	1	535-9185-00
3	Switch Bracket	1	535-6173-02
	Items 2 & 3 are secured by: #8-32 X 1/4" PFH 82 Undercut (Zinc) (Qty. 2) (237-6030-02)		
4	Micro Switch **(Happ # 95-1128-00)**	1	180-5183-00
5	Switch Body Protect Plate	1	535-6539-00
	Items 4 & 5 are secured by: #2-56 X 1/2" HWH Ser UNS #4HD TR3 BO (Qty. 2) (237-5937-02) **and** #2-56 Hex Nut (Qty. 2) (240-5301-00)		
6	Switch Diode, 1N4001	1	112-5001-00



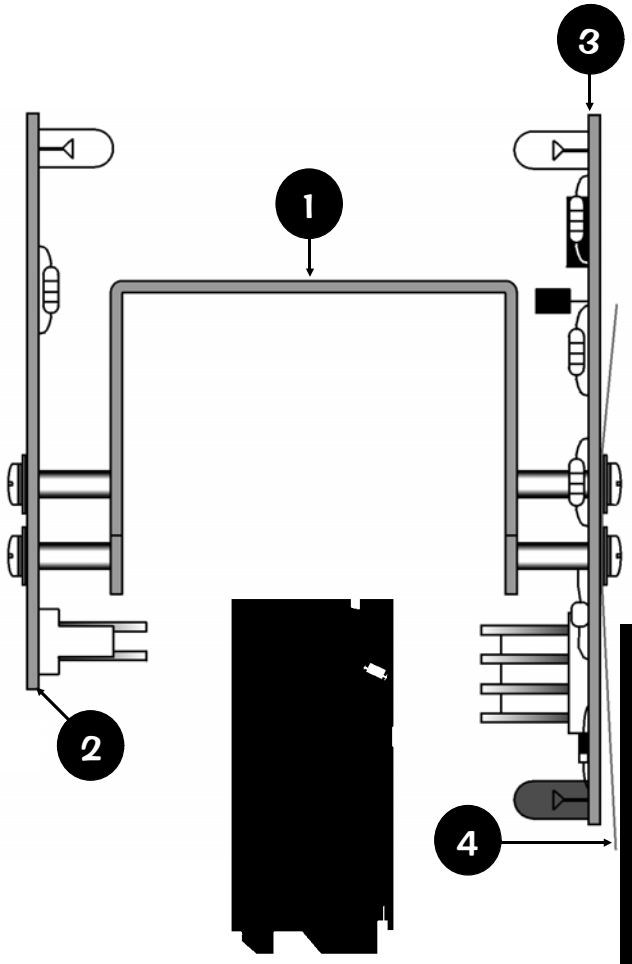
OPTO (Bracket & Pem) Individual Parts Only (Items 1-4)

Detects Ball in the Right Orbit Lane behind the 1-Bank Drop Target (next page).

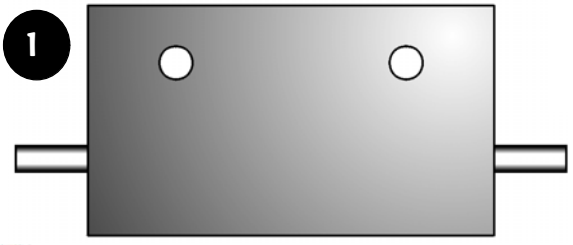
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	OPTO Mounting Bracket (with Pems)	1	535-9176-00
	Item 1 is secured under the P/F by: #8-32 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00)		
2	OPTO Transmitter (TRANS) Board	1	520-5082-00
3	OPTO Receiver (REC) Board	1	520-5083-01
	Items 2 & 3 are secured to Item 1 by: #4-40 X 1/2" PPH MS (Sems) Zinc (Qty. 2/per) (237-5813-00) **and** #4 Washer (Qty. 2/per) (242-5002-00)		
4	Insulation Fiche Paper (on Item 3)	1	545-6064-00

Take Note:

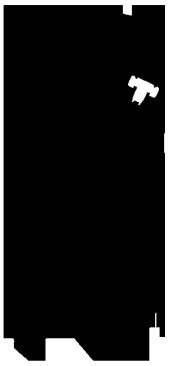
For a break-down of parts of **Items 2 & 3**, **OPTO Boards** (**520-5082-00 & 520-5083-01**), *see Section **5**, Chapter **4**, **Playfield Switch OPTO "Long-Hop" Boards Component Layout & Parts, Page 143.***



Top View of above Bracket Only (Item 1)



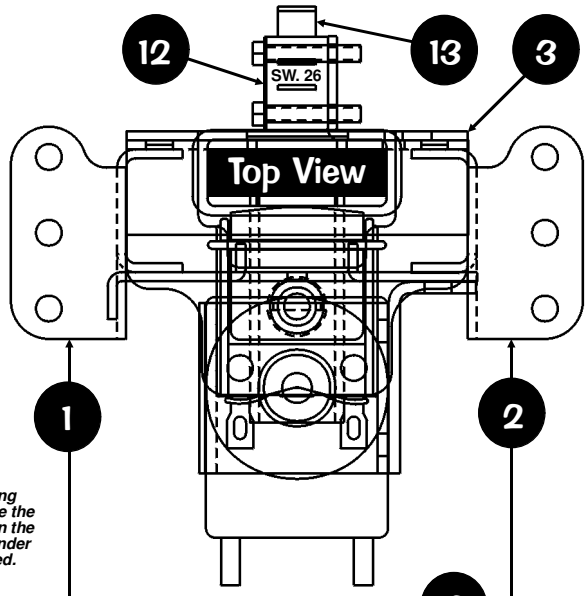
1-Bank Drop Target Assembly, 500-6440-01 (Items 1-22‡)

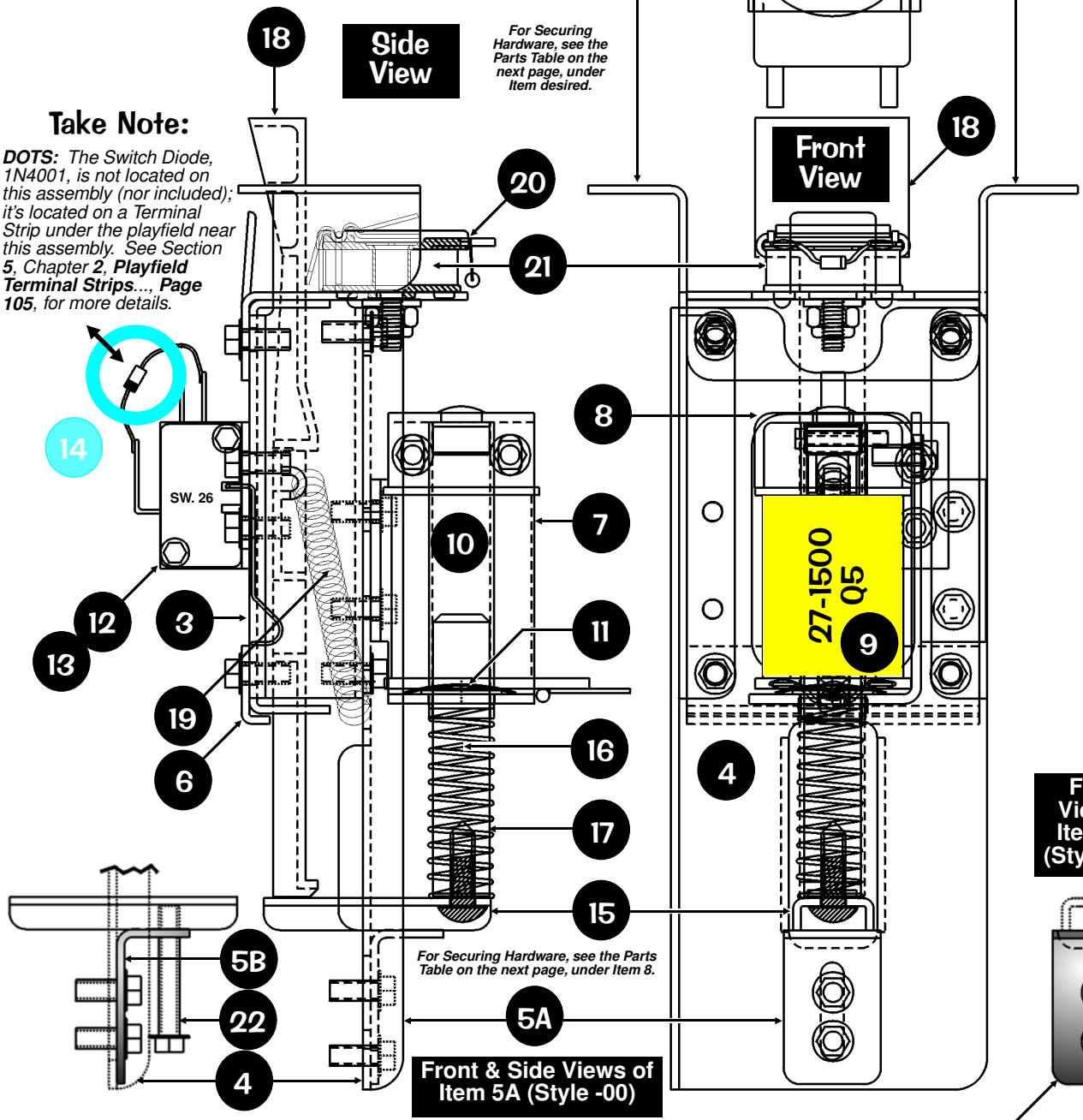


Different Views, Parts Table & Target Height Adjustment Procedure on the next page.

Items **5A** & **5B**, Height Adjustment Bracket, 535-7709-**00** (-**01**), come in two (2) different styles. Your game may have either one. View below and on the next page, Target Height Adjustment Procedure, to determine which style bracket is installed.

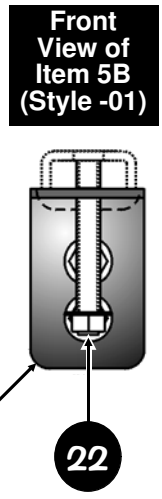
If reordering to replace Item ***5A***, *order Item* ***5B*** *(535-7709-**01**) along with Item **22**, Height Adjustment Screw. Item **5B** fits in the same holes in Item **4**, Support Bracket.*





Take Note:

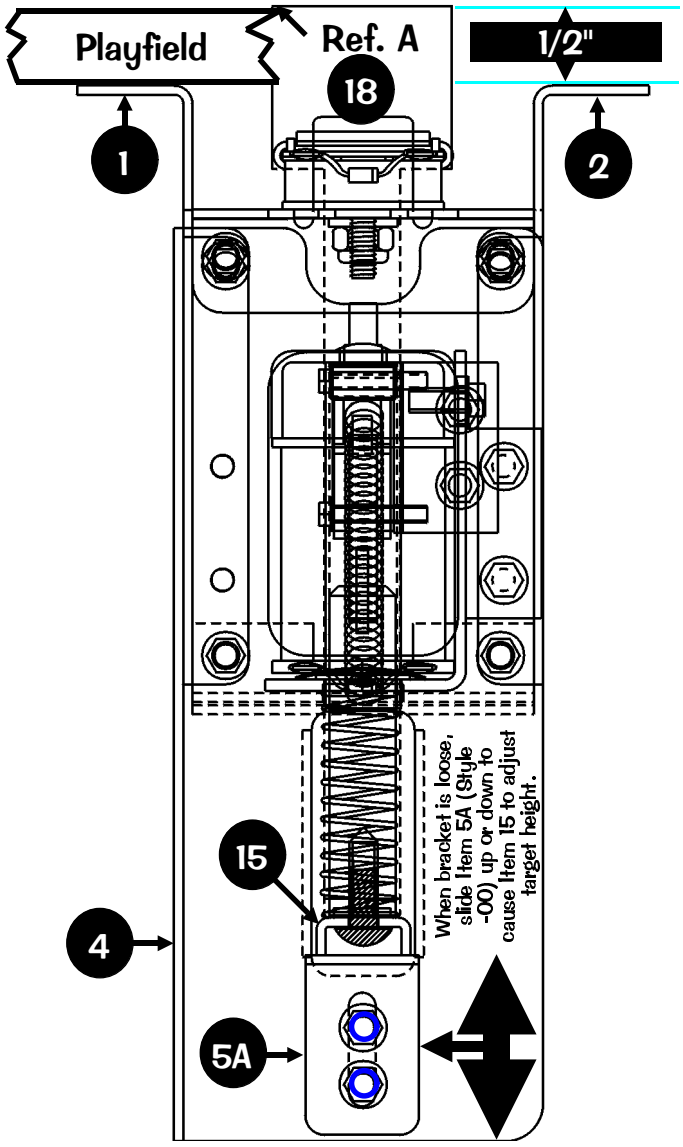
DOTS: *The Switch Diode, 1N4001, is not located on this assembly (nor included); it's located on a Terminal Strip under the playfield near this assembly. See Section **5**, Chapter **2**, **Playfield Terminal Strips**..., **Page 105**, for more details.*



If Item 5A Bracket (-00) is installed, the Securing Hardware must be loosened to Adjust the Target Height by moving Item 15 up or down. If Item 5B Bracket (-01) is installed, Item 22, Height Adjustment Screw, is required to move Item 15 up or down (it's secured through the top of Item 5B Bracket (Style -01). See Target Height Adjustment Procedure on the next page for more details.

1-Bank Drop Target Assembly (500-6440-01) (Items 1-22‡) Continued

Different Views on the previous page.



№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Bracket, Drop Target (Left Side)	1	535-8746-00
2	Bracket, Drop Target (Right Side)	1	535-8746-01
	Items 1 & 2 are secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 3/per) (234-5101-00)		
3	Back Plate (1-Bank Drop Target)	1	535-7713-00
4	Bracket, Support (1-Bank D/T)	1	535-7712-00
5A	Bracket, Height Adjustment **Style -00**	1	535-7709-**00**
or 5B	Bracket, Height Adjustment **Style -01**	1	535-7709-**01**
6	Bracket, Target Retainer (1-Bank D/T)	1	535-7728-00
7	Bracket, Coil Housing	1	535-7707-00
8	Bracket Cap, Coil Housing	1	515-6533-00
	Items 1-3, 5X, 7-8 are secured to Item 4 by: #8-32 X 3/8" HWH Sw. (Qty. 16) (237-5975-00)		
9	Coil, 27-1500	1	090-5004-00B
	ORDERING ABOVE (ITEM 9) COIL PART № WILL INCLUDE:		
—	Diode, 1N4004 (positioned at bottom)	1	112-5003-00
10	Coil Sleeve	1	545-5709-00
11	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
	*To order **Items 7-11** assembled with securing hardware, use SPI №: **515-6535-01**.*		
12	Bracket, Switch (1-Bank D/T)	1	535-7710-00
13	Switch (D/T)	1	180-5158-00
	Item 13 is secured to Item 12 by: #4-40 X 5/8" HWH TF (Qty. 2) (237-5945-00)		
14	Switch Diode, 1N4001 *See "Take Note" prev. page.*		112-5001-00
15	Bracket, Target Lift (1-Bank D/T)	1	535-7706-01
16	Plunger (Drive Coil)	1	530-5410-00
	Item 16 is secured to Item 15 by: #10-32 X 3/8" PPH (Sems) (Qty. 1) (232-5401-00)		
	*To order **Items 15-16** assembled with securing hardware, use SPI №: **515-6537-00**.*		
17	Compression (Return) Spring	1	266-5020-00
18	Drop Target White (Rollover)	1	545-5533-01
	***Note:** Individual Decal Not Available. The entire decal sheet must be ordered for replacement. See Sec. **4**, Chp. **1**, **Parts Identication & Location**, **Game Decals**, Page **67**.*		
19	Spring, Target Reset	1	265-5003-00
20	Bracket, Trip Coil Mounting	1	535-8745-00
21	Coil, 32-1250 (Mini.) Assembly	1	515-6916-01
	Ordering above Item 21 Coil Part Number will include: *Diode, 1N4004 (**112-5003-00**), Actuator Flap Plate (**535-8597-00**) **and** Retainer Clip (**530-5550-00**).*		
	Item 21 is secured to Item 20 by: #8-32 Nylon Stop Nut (Qty. 1) (240-5102-00)		
22‡	Height Adj. Screw (#8-32 X 1" HWH)	1	237-6003-00
	‡ **Item 22** is only required if **Item 5B** (Style 2) Bracket is installed *(otherwise Not Used)*.		

***Ordering Note:** If **500-6440-01** is unavailable, order the individual part(s) actually required Item **5**, Height Adjustment Bracket may differ slightly, see "Take Special Note" explanation.*
Also, ensure the diode on the switch is desoldered and wired correctly as original.

Target Height Adjustment Procedure:

With the Drop Target (Rollover) (**Item 18**) in the ***D O W N P O S I T I O N***, adjust the height of the Target so the top is *just slightly over* 1/2" above the feet of the Left & Right Side Brackets (**Items 1 & 2**) as shown above *(see **Ref. A**)*. ***Keep in Mind:*** This adjustment procedure should have the **TOP SIDE** of the Drop Target "flush to slightly above" the *playfield surface* after reinstalling the assembly to the underside of the Playfield *(see **Ref. A** above)*. This will ensure a **BALL TRAP** is ***n o t c r e a t e d*** where the ball can rest in the target hole above the playfield.

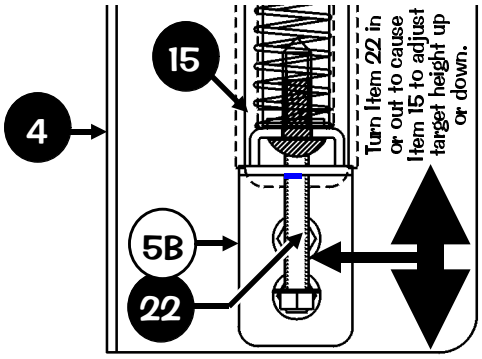
If you have the 5A Bracket (Style -00):

Step 1. Loosen the **securing hardware** for the Height Adjustment Brkt. (**Item 5A**) attached to the Support Brkt. (**Item 4**). ***Hint:*** *After loosening the screws, hand-tighten just enough so the* Adjustment Bracket only moves with your touch.

Step 2. Slide Height Adjustment Bracket either **UP** or **DOWN** causing the Target Lift Bracket (**Item 15**) to raise or lower the Drop Target to the desired height.

Step 3. Tighten the **securing hardware** for the Height Adjustment Bracket enough so it will not move. *Do Not Over Tighten. Apply **Blue** Loc-Tite.*

If you have the 5B Bracket (Style -01):



5B Bracket (Style -01) Only: **Step 1.** Using a 1/4" Nut Driver, loosen or tighten *(turn in or out)* Height Adjustment Screw (**Item 22**) through Height Adjustment Bracket (**Item 5B**) to raise or lower the Target Lift Bracket (**Item 15**) causing the Drop Target to reach desired height as stated above. **Step 2.** *Apply **Blue** Loc-Tite.*

3-Bank Drop Target Assembly, 500-6577-13-78 (Items 1-21)

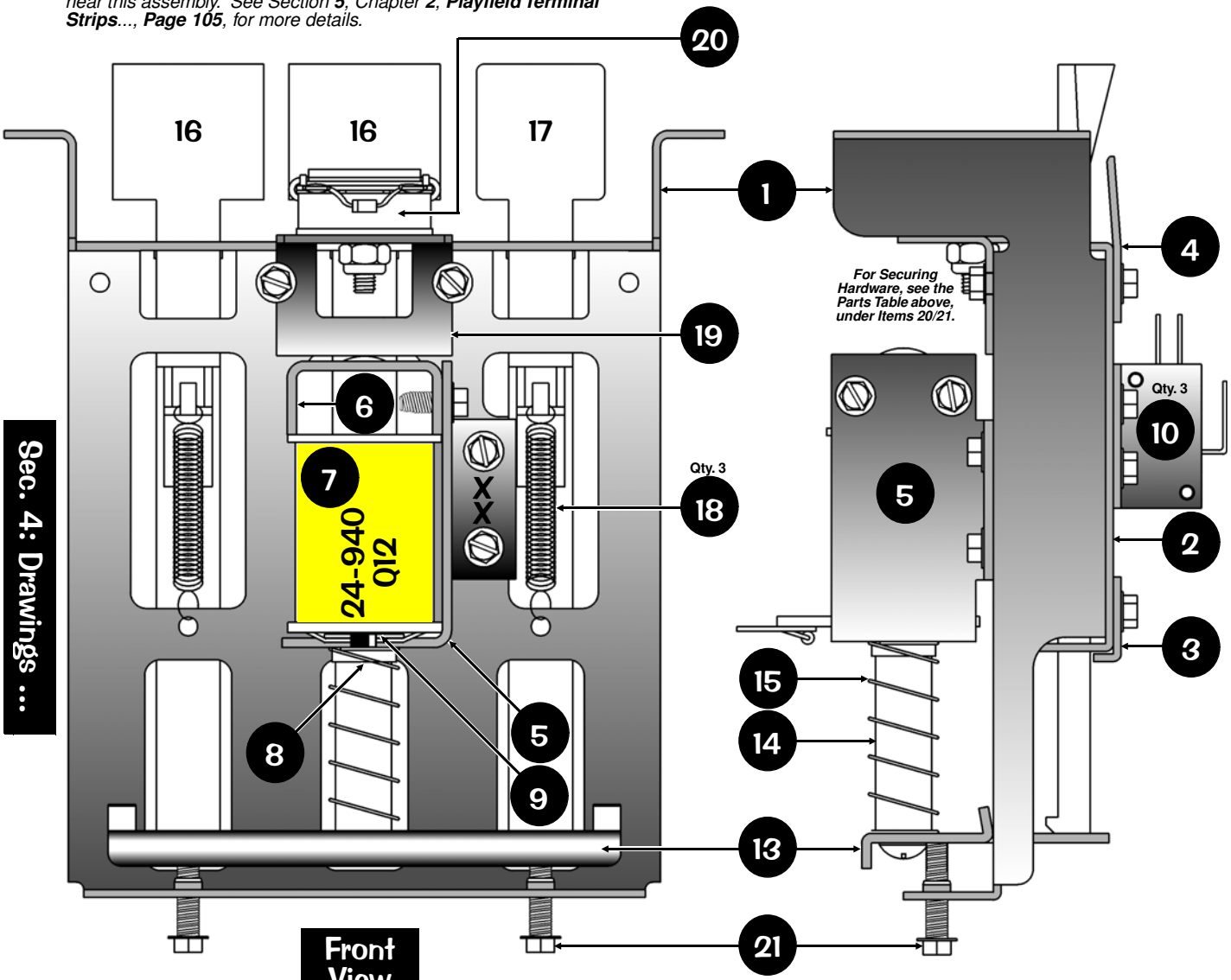
Different Views, Target Height Adjustment & Drop Target Removal Procedures on the next page.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Bracket, Main Housing	1	535-9126-03
	Item 1 is secured below the P/F by: #8 X 1/2" HWH AB (Zinc) (Qty. 6) (234-5101-00)		
2	Back Plate (3-Bank Drop Target)	1	535-9127-03
3	Bracket, Target Retainer (3-Bank D/T)	1	535-9129-03
4	Bracket, Target Back Stop	1	535-9131-03
5	Bracket, Coil Housing	1	535-7707-00
6	Bracket Cap, Coil Housing	1	515-6533-00
7	Coil, 24-940	1	090-5036-00B
	ORDERING ABOVE (ITEM 7) COIL PART № WILL INCLUDE:		
—	Diode, 1N4004 (positioned at bottom)	1	112-5003-00
8	Coil Sleeve	1	545-5709-00
9	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
	To order ***Items 5-9*** *assembled with securing hardware, use SPI №:* ***515-6535-03***.		
10	Bracket, Switch **(Universal X-Bank D/T)**	3	535-7710-00
11	Switch (Drop Target)	3	180-5158-00
	Item 11 is secured to Item 10 by: #4-40 X 5/8" HWH TF (Qty. 2) (237-5945-00)		

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
12	Switch Diode, 1N4001 *See "Take Note" below.*		112-5001-00
13	Bracket, Target Lift (3-Bank D/T)	1	535-9128-03
14	Plunger (Drive Coil)	1	530-5410-00
	Item 14 is secured to Item 13 by: #10-32 X 3/8" PPH (Sems) (Qty. 1) (232-5401-00)		
	To order ***Items 13-14*** *assembled with securing hardware, use SPI №:* ***515-7246-00***.		
15	Compression (Return) Spring	1	266-5020-00
16	Drop Target White (Rollover)	2	545-5533-01
17	Drop Target White (Normal)	1	545-5048-01
	Note: *Individual Decals Not Available. The entire decal sheet must be ordered for replacement. See Sec.* ***4****, Chp.* ***1****,* ***Parts Identication & Location****,* ***Game Decals****, Page* ***67****.*		
18	Spring, Target Reset	3	265-5003-00
19	Bracket, Trip Coil Mounting	1	535-9130-00
20	Coil, 32-1250 (Mini.) Assembly	1	515-6916-01
	Ordering above Item 20 Coil Part Number will include: *Diode, 1N4004 (****112-5003-00****), Actuator Flap Plate (****535-8597-00****) and Retainer Clip (****530-5550-00****).*		
	Item 20 is secured to Item 19 by: #8-32 Nylon Stop Nut (Qty. 1) (240-5102-00)		
21	Height Adj. Screw (#8-32 X 3/4" HWH)	2	237-6010-00
	Items 3, 4, 5, 6, 10 & 19 are secured by: #8-32 X 3/8" HWH Swg. (Qty. 2) (237-5975-00)		
	Ordering Note: *If* ***500-6577-13*** *is unavailable,* order the individual part(s) actually required.		

Take Note:

DOTS: *The Switch Diodes, 1N4001, are not located on this assembly (nor included); theyre located on a Terminal Strip under the playfield near this assembly. See Section* ***5****, Chapter* ***2****,* ***Playfield Terminal Strips****..., Page* ***105****, for more details.*



Front View

For Securing Hardware, see the Parts Table above, under Item 21.

Right Side View

Sec. 4: Drawings ...

3-Bank Drop Target Assembly, 500-6577-13-78 (Items 1-21) Continued

Different Views & Parts Table on the previous page.

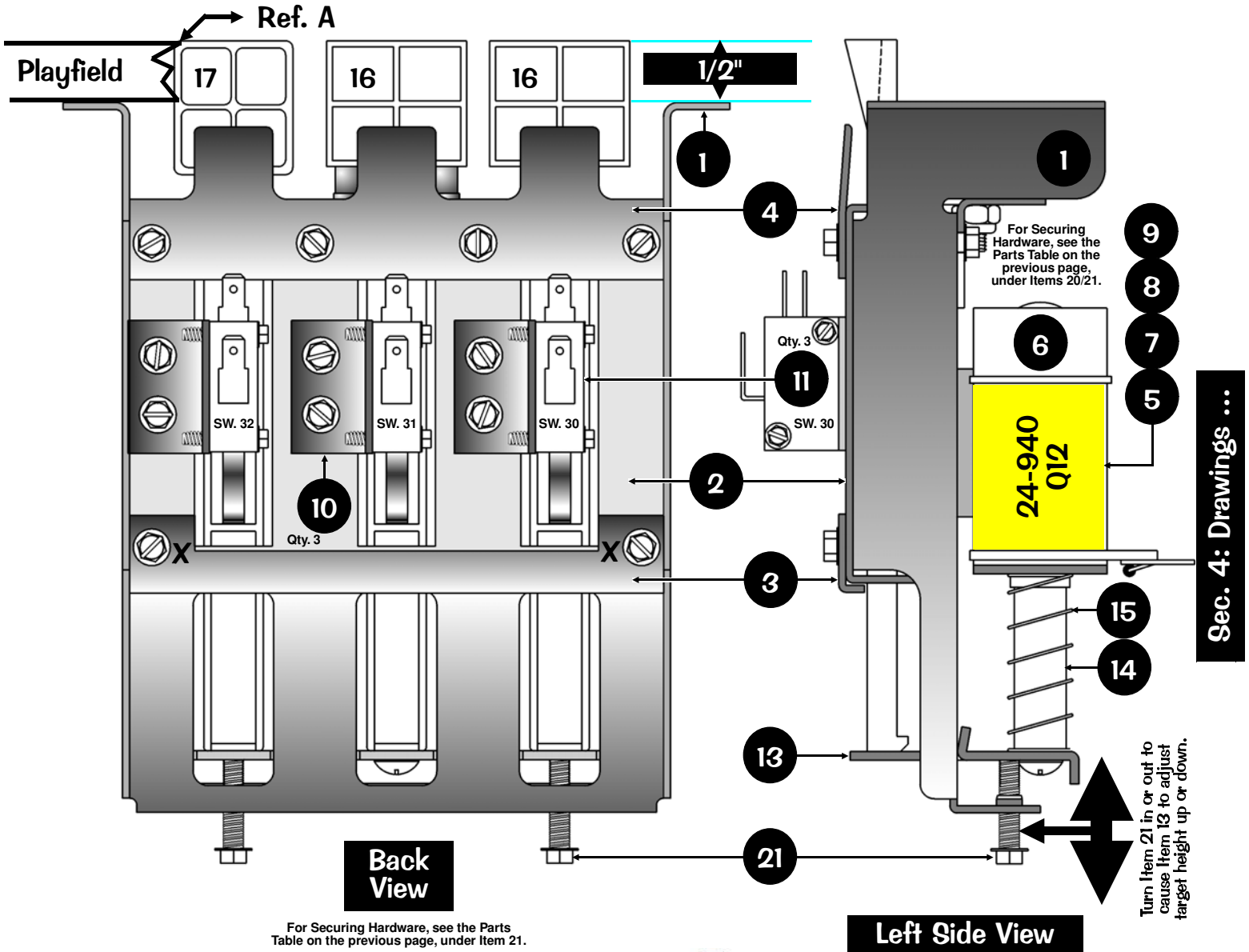
Target Height Adjustment Procedure:

With the Drop Targets (Rollover) (**Item 16**) and the Drop Target (Normal) (**Item 17**) in the ***D O W N P O S I T I O N***, adjust the height of the Target so the top is *just slightly* over 1/2" above the feet of the Main Housing Bracket (**Item 1**) as shown below *(see **Ref. A**)*. ***Keep in Mind:*** This adjustment procedure should have the **TOP SIDE** of the Drop Targets "flush to slightly above" the *playfield surface* after reinstalling the assembly to the underside of the Playfield *(see **Ref. A** above).* This will ensure a **BALL TRAP** is ***n o t c r e a t e d*** where the ball can rest in the target hole above the playfield.

Step 1. Using a 1/4" Nut Driver, loosen or tighten *(turn in or out)* the Height Adjustment Screws (**Item 21**) through the Target Lift Bracket (**Item 13**) to raise or lower the Drop Targets to reach desired height as stated above *(using 1/4 turns between each screw to keep Targets even).* **Step 2.** *Apply **Blue** Loc-Tite.*

Drop Target Removal Procedure:

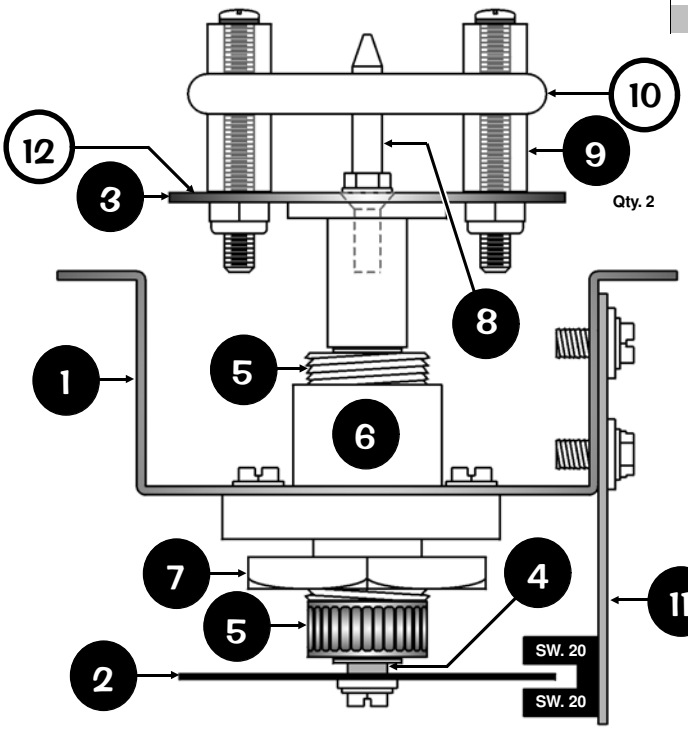
Although it is possible to remove the Drop Targets with the Assembly secured to the playfield, it would be easier to remove the assembly. The #8-32 X 3/8" Screws to be removed are marked by an "**X**" in the **Front** and **Back Views**. **Step 1.** Remove the Target Retainer Bracket (**Item 3**, *see* **Back View** *below*). **Step 2.** Turn assembly around and remove the Target Reset Spring (**Item 18**) with pointed-nose pliers. ***Note:*** *If replacing the middle Target, it may be necessary to remove the Coil Housing Bracket (**Item 5**) to access the Spring.* **Step 3.** Replace Target & Decal *(see note under **Item 17**, previous page)* and reassemble. **Step 4.** Recheck the Target Height Adjustment and adjust as necessary per above procedure.

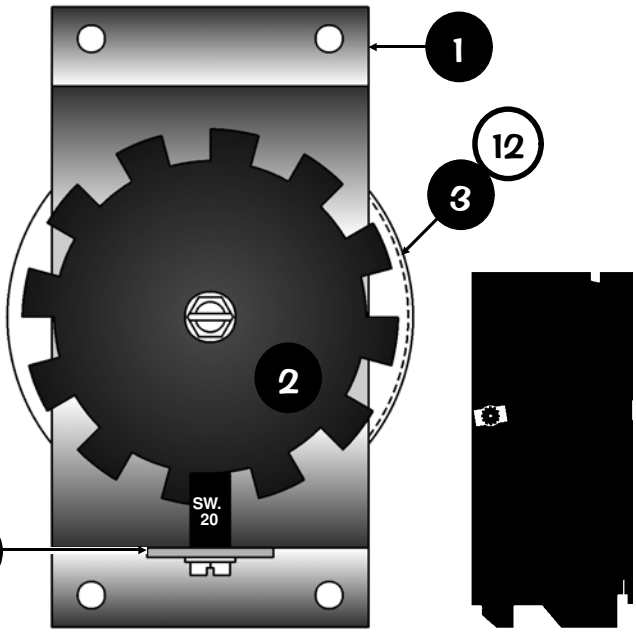


Spinning Wheel (Scrambled Eggs) & OPTO Assembly, 500-6568-00 (Items 1-12)

Detects Ball on the "Scrambled Eggs" Wheel (with any wheel movement).

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Bracket, Main House	1	535-9113-00
	Item 1 is secured below the P/F by: #8 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5101-00)		
2	OPTO Interrupter ***(Black Metal w/Teeth)***	1	535-9114-00
	Item 2 is secured to Item 4 by: #8-32 X 3/8" HWH Swg. (Ser.) Zinc (Qty. 1) (237-5975-00) **and** #8 Washer (Qty. 1) (242-5005-00)		
3	Spinning Wheel (Disk)	1	535-9115-00
	Item 3 is secured to Item 4 by: #8-32 X 3/8" PFH 82 Undercut (Zinc) (Qty. 1) (240-5203-00)		
4	Shaft (1/4" ø)	1	530-5615-00
5	Adjusting Screw Assembly	1	515-7261-00
	Ordering above Item 5 will include: *Adjusting Screw* (***530-5617-00***) *and Bearing-Bronze Flange* (***283-5002-00***)		
6	Gland (Nylon Bushing)	1	530-5616-00
	Item 6 is secured to Item 1 by: #8-32 X 3/8" HWH Swg. (Ser.) Zinc (Qty. 3) (237-5975-00)		
7	Lock Nut 3/4"-16 **CRFTCH-G102-110-18**	1	530-5628-00
8	Mini-Post MS / #10-32 Bot. **.4" Thread**	1	530-5005-01
	Item 8 is secured to Item 3 by: #10-32 Nylon Stop Nut (Qty. 1) (240-5203-00)		
9	$1^{1}/_{16}$" Single Groove Post (Clear)	2	550-5059-01
	Item 9 is secured to Item 3 by: #6-32 X 1-1/2" PPH MS (Zinc) (Qty. 1/per) (237-5510-00) **and** #6-32 Nylon Stop Nut (Qty. 1/per) (240-5005-00)		
10	3/4" I.D. Ring White	1	545-5348-54
11	1-Position U-Shaped OPTO PC Board	1	520-5222-00
	Item 11 is secured to Item 1 by: #8-32 X 3/8" HWH Swg. (Ser.) Zinc (Qty. 2) (237-5975-00)		
12	Decal Suede Lexan (Scrambled Eggs)	1	820-5096-00

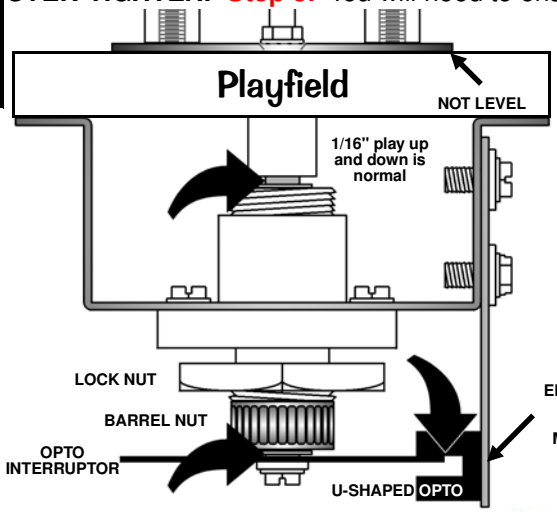




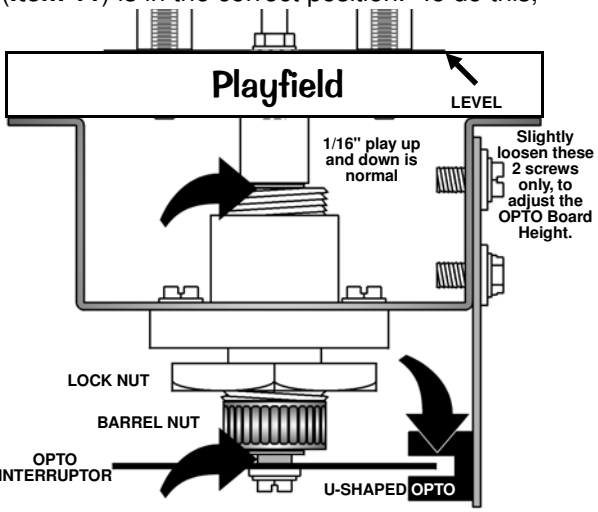
For Securing Hardware, see the Parts Table above, under Item desired.

Spinning Wheel Height & OPTO Adjustment Procedure:

With the Main Housing Bracket (**Item 1**) secured under the playfield, the Spinning Wheel (**Item 3**) needs to be *level-to-just-slightly-above* the Playfield in the *resting position.* To achieve this, perform the following Steps. **Step 1.** Back off the Lock Nut (**Item 7**). **Step 2.** Loosen or tighten the Silver Barrel Flange Nut from the Adjusting Screw Assembly (**Item 5**), until the Spinning Wheel is level. **Step 3.** Hand-tighten the Lock Nut, then recheck Level. ***Note:*** *There is some "play" of 1/16": view the arrows in the Left and Right figures below.* **Step 4.** If level is now ok, using a channel lock plier, give the Lock Nut an additional ***s l i g h t*** turn to lock the Lock Nut in place *(needs to be slightly tighter than "Hand-Tight" to prevent the Lock Nut from loosening due to game vibration).* ***DO NOT OVER-TIGHTEN.*** **Step 5.** You will need to ensure the OPTO Board (**Item 11**) is in the correct position. To do this, slightly loosen the 2 screws securing the OPTO Board to the Main Bracket. Move the **Wheel Assembly** up and down ensuring the OPTO Interruptor (**Item 2**) does not *hit or touch* the Black U-Shaped OPTO on the board. Tighten board.



ENSURE THE OPTO INTERRUPTOR DOES NOT HIT OR TOUCH THE U-SHAPED OPTO WHEN HAND MOVING ASSEMBLY UP & DOWN (SEE STEP 5)



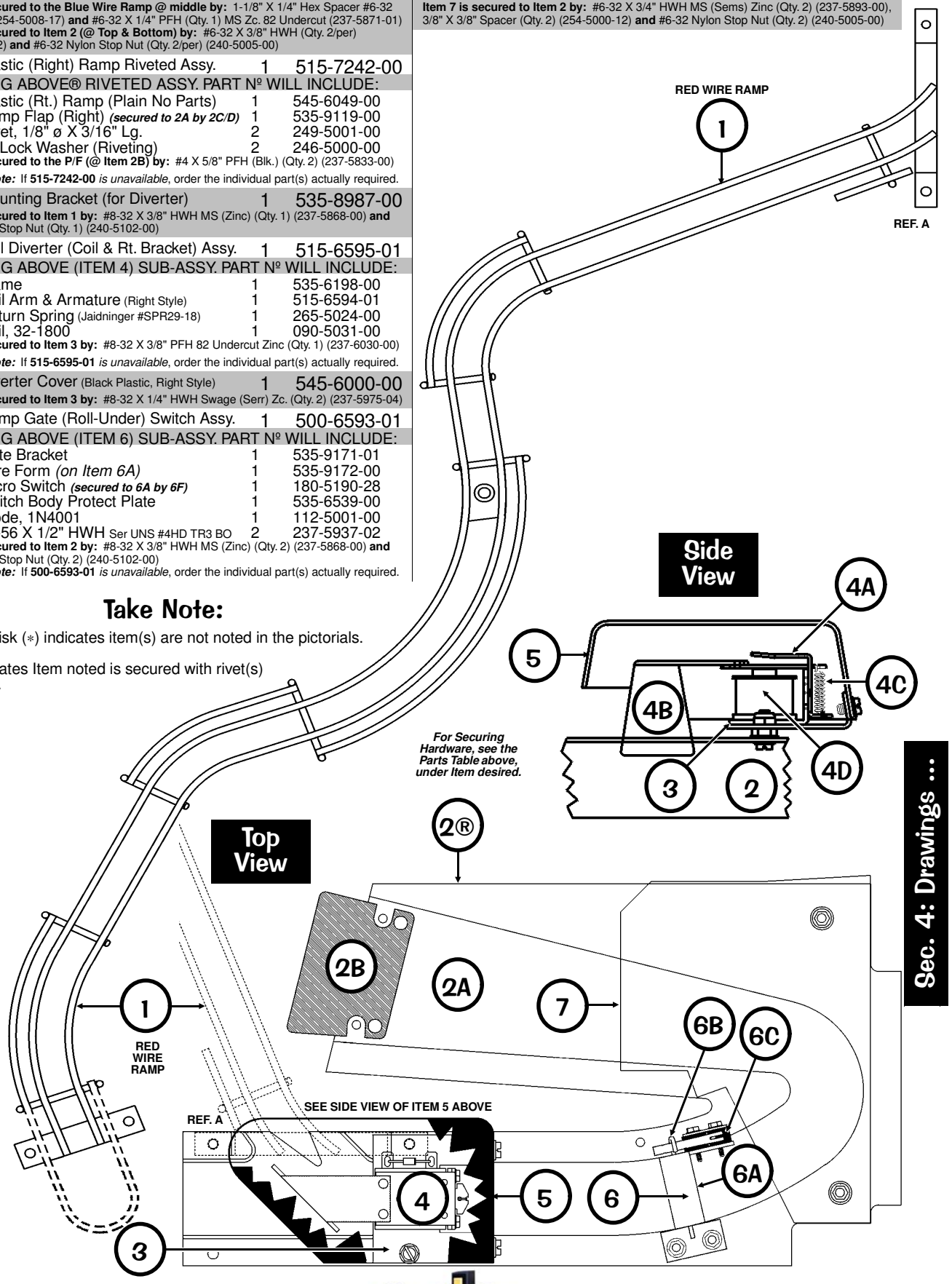
Red Wire Ramp and Right Plastic Ramp Individual Parts Only (Items 1-7)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Red Wire Ramp	1	535-9123-00
	Item 1 is secured to the Blue Wire Ramp @ middle by: 1-1/8" X 1/4" Hex Spacer #6-32 tap (Qty. 1) (254-5008-17) **and** #6-32 X 1/4" PFH (Qty. 1) MS Zc. 82 Undercut (237-5871-01) **Item 1 is secured to Item 2 (@ Top & Bottom) by:** #6-32 X 3/8" HWH (Qty. 2/per) (237-5976-02) **and** #6-32 Nylon Stop Nut (Qty. 2/per) (240-5005-00)		
2®	Plastic (Right) Ramp Riveted Assy.	1	515-7242-00
	ORDERING ABOVE® RIVETED ASSY. PART Nº WILL INCLUDE:		
2A	Plastic (Rt.) Ramp (Plain No Parts)	1	545-6049-00
2B	Ramp Flap (Right) ***(secured to 2A by 2C/D)***	1	535-9119-00
2C*	Rivet, 1/8" ø X 3/16" Lg.	2	249-5001-00
2D*	#6 Lock Washer (Riveting)	2	246-5000-00
	Item 2 is secured to the P/F (@ Item 2B) by: #4 X 5/8" PFH (Blk.) (Qty. 2) (237-5833-00)		
	Ordering Note: If **515-7242-00** *is unavailable*, order the individual part(s) actually required.		
3	Mounting Bracket (for Diverter)	1	535-8987-00
	Item 3 is secured to Item 1 by: #8-32 X 3/8" HWH MS (Zinc) (Qty. 1) (237-5868-00) **and** #8-32 Nylon Stop Nut (Qty. 1) (240-5102-00)		
4	Ball Diverter (Coil & Rt. Bracket) Assy.	1	515-6595-01
	ORDERING ABOVE (ITEM 4) SUB-ASSY. PART Nº WILL INCLUDE:		
4A	Frame	1	535-6198-00
4B	Coil Arm & Armature (Right Style)	1	515-6594-01
4C	Return Spring (Jaidninger #SPR29-18)	1	265-5024-00
4D	Coil, 32-1800	1	090-5031-00
	Item 4 is secured to Item 3 by: #8-32 X 3/8" PFH 82 Undercut Zinc (Qty. 1) (237-6030-00)		
	Ordering Note: If **515-6595-01** *is unavailable*, order the individual part(s) actually required.		
5	Diverter Cover (Black Plastic, Right Style)	1	545-6000-00
	Item 5 is secured to Item 3 by: #8-32 X 1/4" HWH Swage (Serr) Zc. (Qty. 2) (237-5975-04)		
6	Ramp Gate (Roll-Under) Switch Assy.	1	500-6593-01
	ORDERING ABOVE (ITEM 6) SUB-ASSY. PART Nº WILL INCLUDE:		
6A	Gate Bracket	1	535-9171-01
6B	Wire Form *(on Item 6A)*	1	535-9172-00
6C	Micro Switch ***(secured to 6A by 6F)***	1	180-5190-28
6D*	Switch Body Protect Plate	1	535-6539-00
6E*	Diode, 1N4001	1	112-5001-00
6F*	#2-56 X 1/2" HWH Ser UNS #4HD TR3 BO	2	237-5937-02
	Item 6 is secured to Item 2 by: #8-32 X 3/8" HWH MS (Zinc) (Qty. 2) (237-5868-00) **and** #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00)		
	Ordering Note: If **500-6593-01** *is unavailable*, order the individual part(s) actually required.		
7	Clear Plastic (Butyrate) (Right Cover)	1	830-5994-00
	Item 7 is secured to Item 2 by: #6-32 X 3/4" HWH MS (Sems) Zinc (Qty. 2) (237-5893-00), 3/8" X 3/8" Spacer (Qty. 2) (254-5000-12) **and** #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00)		

Take Note:

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

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

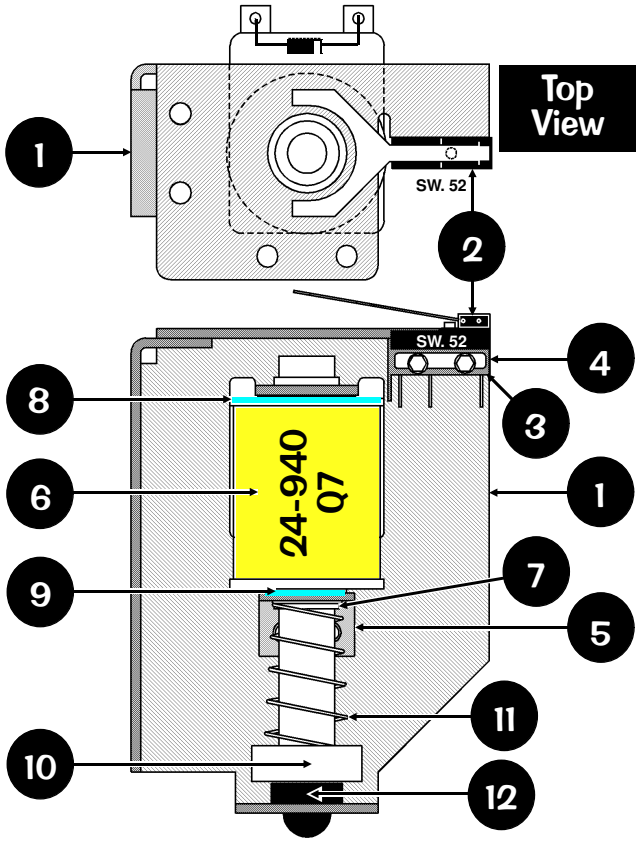


VUK (Vertical Up-Kicker, Right Style) Assembly, 500-6290-11 (Items 1-12)

Launches ball into the Rocket Scoop (next page).

Use this VUK (Coil) if the Rocket Lift Tube *has* a Top Gate.
See the Next Page for more details.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	VUK Coil Mounting Bracket (Left Style)	1	535-8296-00
	Item 1 is secured under the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 3) (234-5101-00)		
2	Micro Sw. **(Heavy Duty "Y" Flat Actuator)**	1	180-5116-01
3	Switch Lug Insulator (Fiche Paper)	1	545-5759-00
4	Switch Body Protect Plate	1	535-6539-00
	Items 2-4 are secured by: #2-56 X 1/2" HWH MS (Serr) Zc TF 3/16" (Qty. 2) (237-5937-02)		
5	Coil Retaining Bracket	1	535-5203-03
	Item 5 is secured by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)		
6	Coil, **24-940** ***(See Note Above)***	1	090-5036-00T
	ORDERING ABOVE (ITEM 6) COIL PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
7	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
8	Coil Lug Insulator (Fiche Paper)	1	545-5431-00
9	Spring Washer, 17/32" ID X 3/4" X 1"	1	269-5002-00
10	Plunger Assembly	1	515-5941-01
11	Compression (Relay) Spring	1	266-5020-00
12	Rubber Bumper (Grommet)	1	545-5105-00



Take Note:

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

DOTS: *The Switch Diode, 1N4001, is not located on either VUK Assembly (nor included); it's located on a Terminal Strip under the playfield near this assembly. See Section* ***5****, Chapter* ***2****,* ***Playfield Terminal Strips****.., Page* ***105****, for more details.*

VUK (Vertical Up-Kicker, Right Style) Assembly (500-6290-01) (Items 1-12)

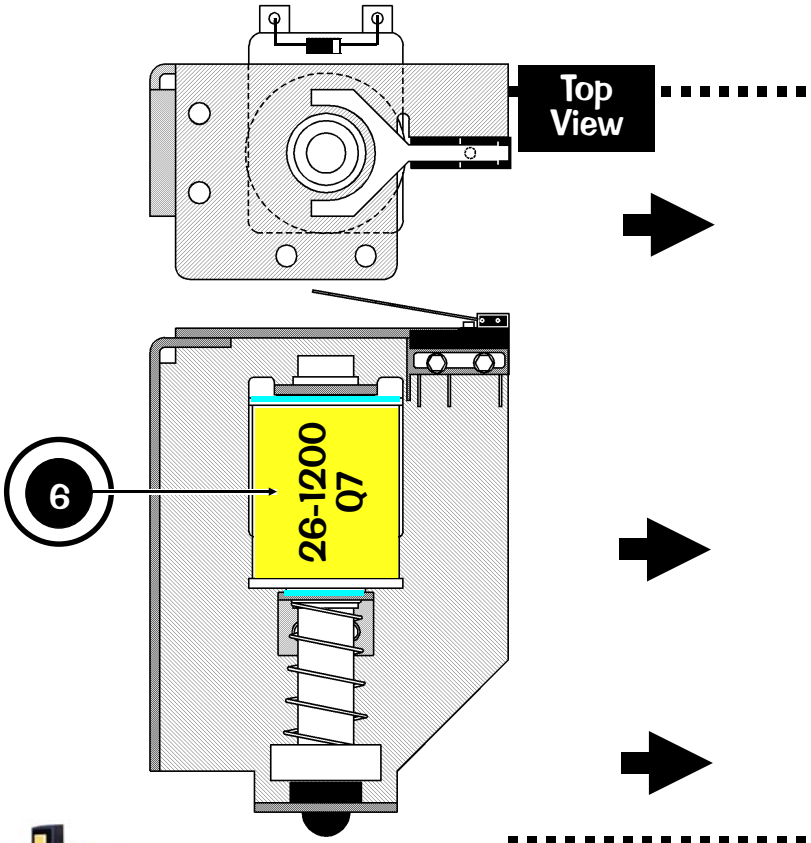
Launches ball into the Rocket Scoop (next page).

Early Production Games

Use this VUK (Coil) if the Rocket Lift Tube does not have a Top Gate.
See the Next Page for more details.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
	Items 1-5 identical to above Items 1-5.		
6	Coil, **26-1200** ***(See Note Above)***	1	090-5044-00T
	ORDERING ABOVE (ITEM 6) COIL PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00

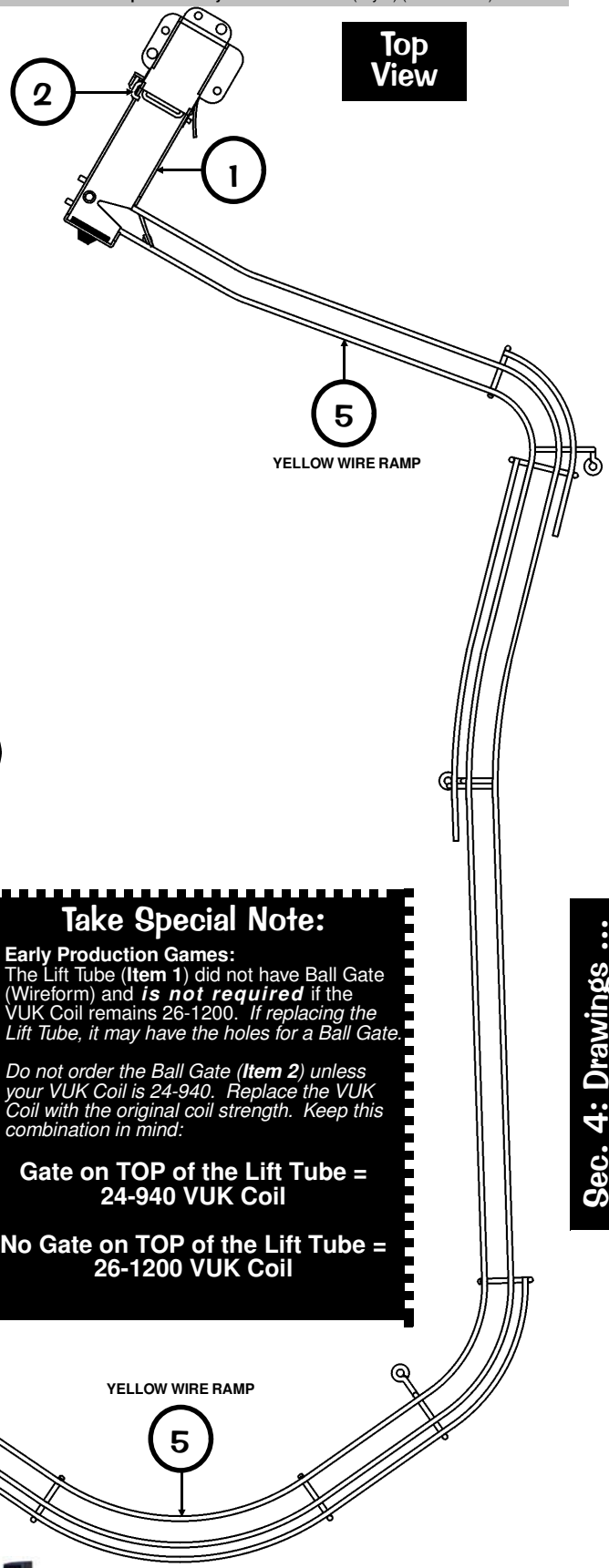
Items 7-12 identical to above Items 7-12.



Rocket Lift Tube and Yellow Wire Ramp Individual Parts Only (Items 1-5)

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Rocket Lift Tube	1	535-9164-00
	Item 1 is secured below the P/F by: #8-32 Nylon Stop Nut (Qty. 3) (240-5102-00)		
	Note: *Individual Decals Not Available. The entire decal sheet must be ordered for replacement. See Sec.* ***4****, Chp.* ***1****,* ***Parts Identication & Location****,* ***Game Decals****, Page* ***67****.*		
2	Ball Gate (Top) ***(See Note Below)***	1	535-9204-00
3	Ball Gate Bracket (Bottom)	1	535-9182-00
	Ball Gate (for Bottom Bracket)	1	535-9183-00
	Item 3 Bracket is secured by: #8-32 Nylon Stop Nut (Qty. 1) (240-5102-00)		

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
4	Deflector Pad (Bumper)	2	545-5428-00
5	Yellow Wire Ramp	1	535-9125-00
	Item 5 secured at the top of Item 1 by: #6-32 X 3/8" PFH (Qty. 1) (237-5850-00)		



Blue Wire Ramp, Left Plastic Ramp & Loop Ramp, Individual Parts Only (Items 1-23)

Continuing Views and Parts Table (8-23) on the next page.

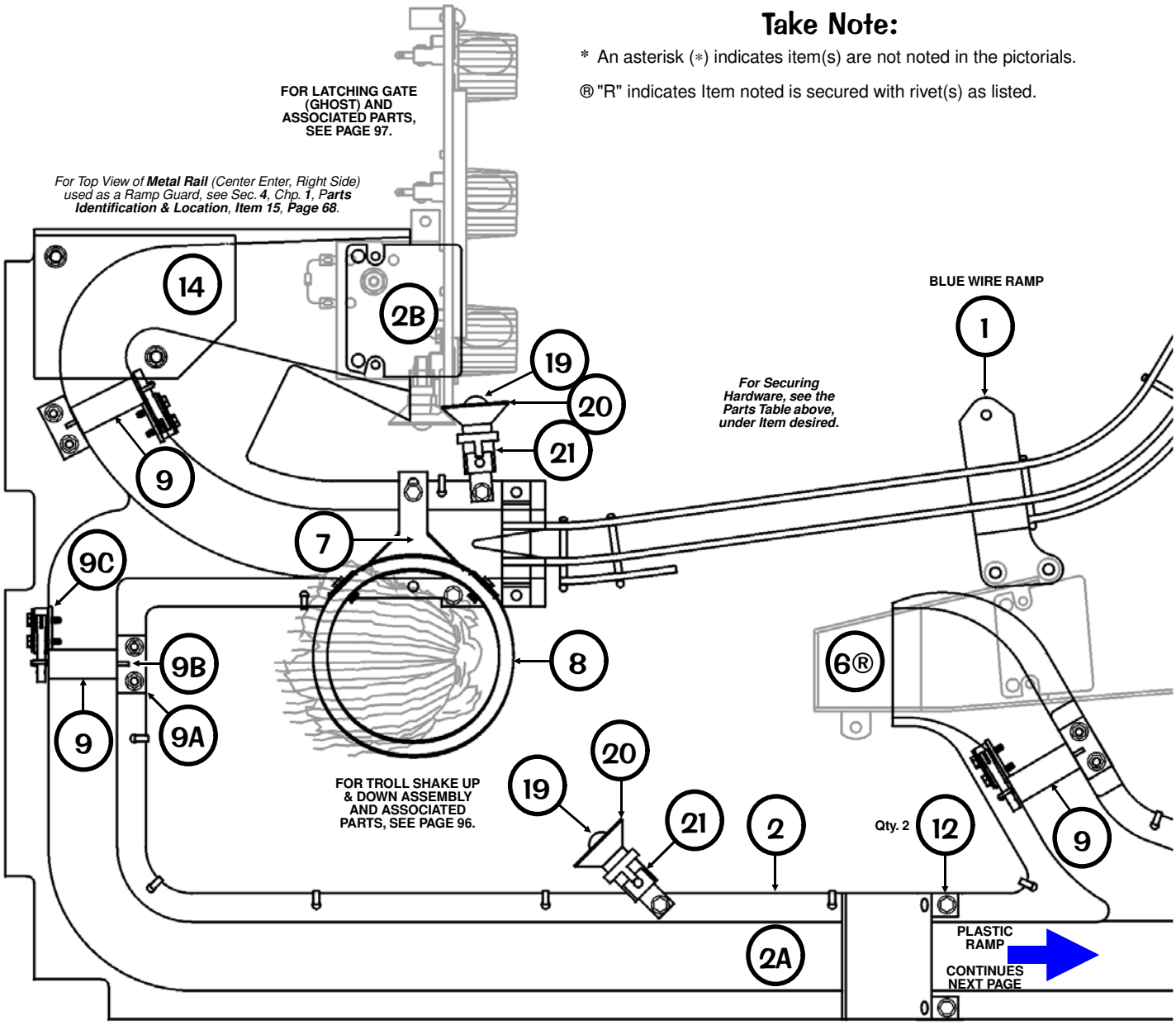
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Blue Wire Ramp	1	535-9124-00
	Item 1 is secured to Item 2 (@ Top) by: #6-32 X 3/8" HWH (Qty. 2) (237-5976-02) **and** #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00) **Item 1 is secured to Item 2 (@ Slingshot) by:** #6-32 X 3/8" HWH (Qty. 1) (237-5976-02) **and** #6-32 Nylon Stop Nut (Qty. 1) (240-5005-00) **On Item 1 @ middle (Ball Trap Prevention):** 3/8" X 3/8" Spacer Gray (Qty. 1) (254-5000-12) **and** #6-32 Nylon Stop Nut (Qty. 1) (240-5005-00)		
2®	Plastic (Left) Ramp Riveted Assy.	1	515-7243-00
	ORDERING ABOVE® RIVETED ASSY. PART Nº WILL INCLUDE:		
2A	Plastic (Left) Ramp (Plain No Parts)	1	545-6050-00
2B	Ramp Flap (Top) ***(secured to 2A by 2D/E)***	1	535-9120-00
2C	Ramp Flap (Bot.) ***(secured to 2A by 2D/E)***	1	535-9139-00
2D*	Rivet, 1/8" ø X 3/16" Lg.	2	249-5001-00
2E*	#6 Lock Washer (Riveting)	2	246-5000-00
	Item 2 is secured to the P/F (@ Items 2B/C) by: #4 X 5/8" PFH (Blk.) (Qty. 2/per) (237-5833-00).		
	Ordering Note: If **515-7243-00** *is unavailable*, order the individual part(s) actually required.		
3	Mounting Bracket (for Diverter)	1	535-8987-00
	Item 3 is secured to Item 1 by: #8-32 X 3/8" HWH MS (Zinc) (Qty. 1) (237-5868-00) **and** #8-32 Nylon Stop Nut (Qty. 1) (240-5102-00)		

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
4	Ball Diverter (Coil & Lt. Bracket) Assy.	1	515-7288-00
	ORDERING ABOVE (ITEM 4) SUB-ASSY. PART Nº WILL INCLUDE:		
4A	Frame	1	535-6198-00
4B	Coil Arm & Armature (Left Style)	1	515-7287-00
4C	Return Spring (Jaidninger #SPR29-18)	1	265-5024-00
4D	Coil, 32-1800	1	090-5031-00
	Item 4 is secured to Item 3 by: #8-32 X 3/8" PFH 82 Undercut Zinc (Qty. 1) (237-6030-00)		
	Ordering Note: If **515-7288-00** *is unavailable*, order the individual part(s) actually required.		
5	Diverter Cover (Black Plastic, Left Style)	1	545-6059-00
	Item 5 is secured to Item 3 by: #8-32 X 1/4" HWH Swage (Serr) Zc. (Qty. 2) (237-5975-04)		
6®	Loop (Metal) Ramp Assembly	1	500-6571-00
	ORDERING ABOVE® RIVETED ASSY. PART Nº WILL INCLUDE:		
6A	Steel Ramp (Plain No Parts)	1	535-9122-00
6B	Ramp Flap (Loop) ***(secured to 5A by 5C/D)***	1	535-9121-00
6C*	Rivet, 1/8" ø X 3/16" Lg.	2	249-5001-00
6D*	#6 Lock Washer (Riveting)	2	246-5000-00
	Item 2 is secured to the P/F (@ Item 6B) by: #4 X 5/8" PFH (Blk.) (Qty. 2) (237-5833-00)		
	Ordering Note: If **500-6571-00** *is unavailable*, order the individual part(s) actually required.		
7	Troll Tank Support Bracket	1	535-9175-00
	Item 7 is secured to Item 2 by: #8-32 X 3/8" HWH MS (Zinc) (Qty. 1) (237-5868-00) **and** #8-32 Nylon Stop Nut (Qty. 1) (240-5102-00)		

Take Note:

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

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



Left Plastic, Blue Wire & Loop Ramps Individual Parts Only Continued (Items 1-23)

Continuing Views and Parts Table (1-7) on the previous page.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
8	Clear Troll Acrylic Tank	1	545-6058-00
	Item 8 is secured to Item 7 by: #8-32 X 3/8" HWH Swg. (Serr) Zinc (Qty. 2) (237-5975-00)		
	Note: *Individual Decal Not Available. The entire decal sheet must be ordered for replacement. See Sec.* ***4****, Chp.* ***1, Parts Identication & Location****,* ***Game Decals****, Page* ***67****.*		
9	Ramp Gate (Roll-Under) Switch Assy.	3	500-6593-01
	ORDERING ABOVE (ITEM 6) SUB-ASSY. PART Nº WILL INCLUDE:		
9A	Gate Bracket	1	535-9171-01
9B	Wire Form *(on Item 6A)*	1	535-9172-00
9C	Micro Switch ***(secured to 6A by 6F)***	1	180-5190-28
9D*	Switch Body Protect Plate	1	535-6539-00
9E*	Diode, 1N4001	1	112-5001-00
9F*	#2-56 X 1/2" HWH Ser UNS #4HD TR3 BO	2	237-5937-02
	Item 9 is secured to Item 2 by: #8-32 X 3/8" HWH MS (Zinc) (Qty. 2) (237-5868-00) **and** #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00)		
	Ordering Note: If **500-6593-01** *is unavailable*, order the individual part(s) actually required.		
10	Deflector Pad (Rubber Bumper)	1	545-5428-00
11	Impact Plate *(with Pem Stud)*	1	535-9203-00
	Item 11 is secured to Item 2 by: #6-32 Nylon Stop Nut (Qty. 1) (240-5005-00) **and** #6 Washer (Qty. 1) (242-5001-00)		
12®	Bracket (Ride the...), Sign Mounting	2	535-8941-02
	Item 12 is secured to Item 2 by: #8-32 X 3/8" HWH MS (Zinc) (Qty. 1/per) (237-5868-00) **and** #8-32 Nylon Stop Nut (Qty. 1/per) (240-5102-00)		

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
13®	Screened Plastic (Butyrate) -13	1	*from* **830-5993-XX**
	Item 13 is secured to Item 12 by: Rivet, 1/8" ø X 3/16" Lg. (Qty. 1/per) (249-5001-00) **and** #6 Lock Washer (Riveting) (Qty. 1/per) (246-5000-00)		
14	Clear Plastic (Butyrate) (Lt. Cvr.) -6	1	*from* **830-5993-XX**
15	Clear Plastic (Butyrate) -15	1	*from* **830-5993-XX**
	Items 14 & 15 are secured to Item 2 by: #6-32 X 3/4" HWH MS (Sems) Zinc (Qty. 2/per) (237-5893-00), 3/8" X 3/8" Spacer (Qty. 2) (254-5000-12) **and** #6-32 Nylon Stop Nut (Qty. 2/per) (240-5005-00)		
	Special Ordering note on Items 13-15: *The individual piece may not be available in which case the entire sheet must be ordered. See "Availability Note" below.*		
16	#555 IDC Snap-On Socket ***No Diode***	1	077-5216-**01**
17	#906 Wedge Base Bulb (Clear)	1	165-5004-00
18	Mini-Mars Lite Cover (Clear)	1	550-5030-01
19	#555 Wedge Base Socket (Laydown)	2	077-5026-01
20	Light Reflector (Silver Plastic)	2	545-5409-01
21	#555 Wedge Base Bulb (Clear)	2	165-5002-00
	Items 19-21 are secured to Item 2 by: #6-32 X 3/8" HWH Swage (Ser) Zinc (Qty. 1/per) (237-5976-02) **and** #6-32 Nylon Stop Nut (Qty. 1/per) (240-5005-00)		
22	Mini-Jewel Post Clear	1	550-5052-01
	Item 22 is secured to Item 2 by: #6 X 3/8" HWH AB (Zinc) (Qty. 1) (234-5000-00)		
23*	Cable Ties	11	040-5001-01

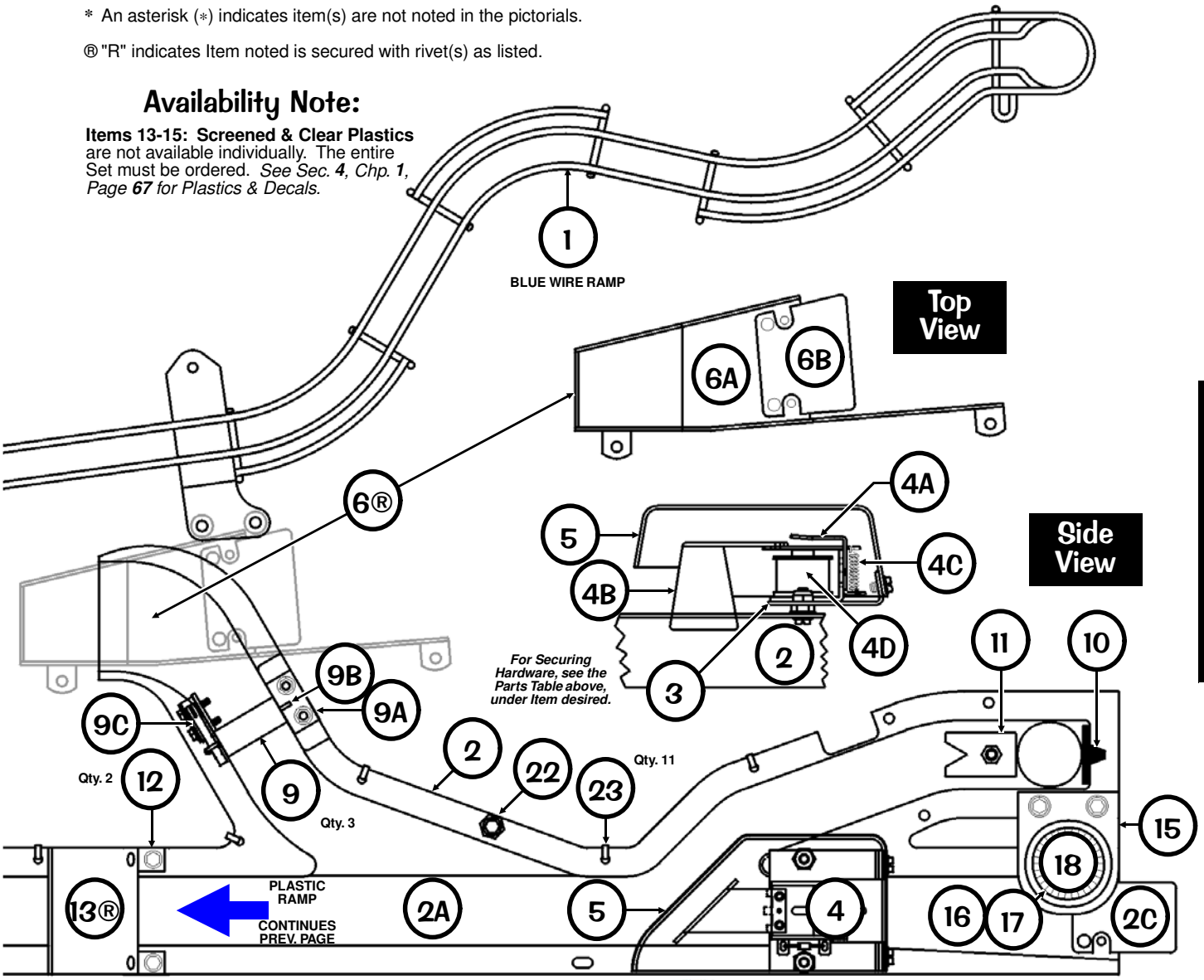
Take Note:

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

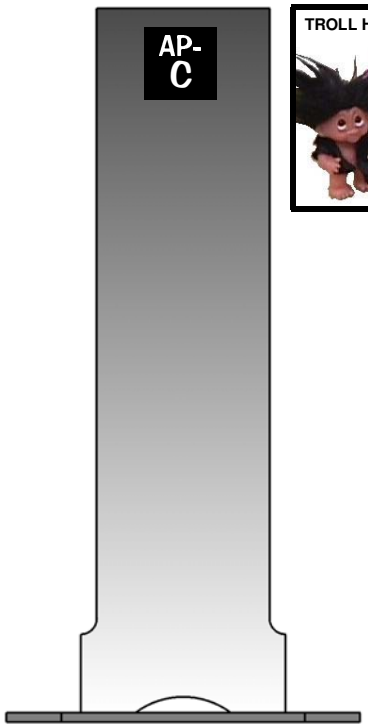
® "R" indicates Item noted is secured with rivet(s) as listed.

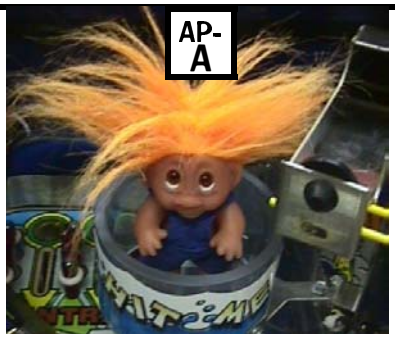
Availability Note:

Items 13-15: Screened & Clear Plastics are not available individually. The entire Set must be ordered. *See Sec.* ***4****, Chp.* ***1****, Page* ***67*** *for Plastics & Decals.*

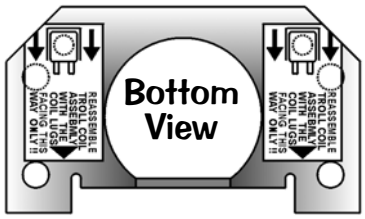


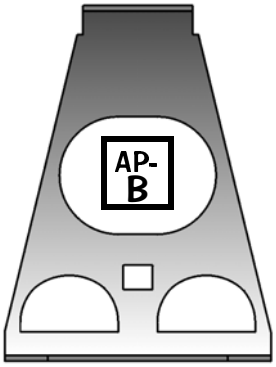
Troll Shake Up & Down Assembly, 500-6586-00 (Items 1-8)
and Assoc. Parts: Troll Figurine, Troll Mounting & Guide Brackets (Items AP-A, AP-B & AP-C)



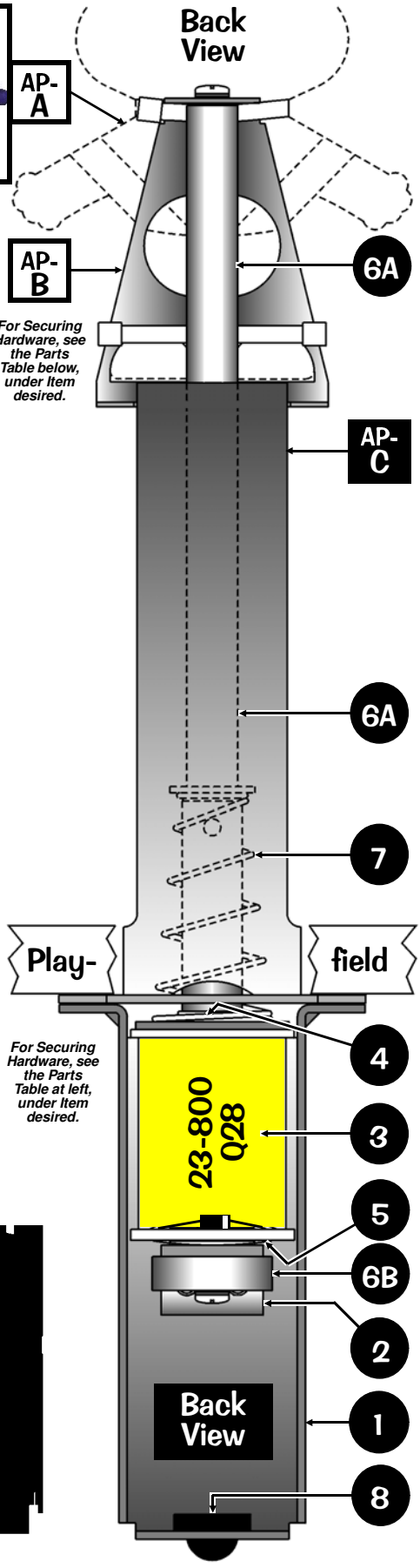


FOR TROLL TANK & BRACKET SEE PREVIOUS PAGES.





Decals **"REASSEMBLE TROLL COIL ASSEMBLY WITH THE COIL LUGS FACING THIS WAY ONLY !!"** (Qty. 2) (820-6319-78) should be kept on the Troll Guide Bracket (**Item AP-C**) as shown in the this "Bottom View," to remind the technician to reinstall the ***Troll Shake Up & Down Assembly*** with the *open side of Item 1* and *Coil Lugs* facing the rear of the Cabinet.



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Coil Mounting Bracket	1	535-6857-03
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5101-00)		
2	Coil Retaining Bracket	1	535-5203-03
	Item 2 is secured by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)		
3	Coil, 23-800	1	090-5001-00T
	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
6A	Solid Plunger Assembly	1	515-7256-00
6B	Plunger Stop (Shaft Head)	1	530-5627-00
	Item 6B is secured Item 6A by: #8-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1) (232-5301-00)		
7	Compression (Relay) Spring	1	266-5022-01
8	Rubber Bumper (Grommet)	1	545-5105-00
	Item 8 is secured by: #10-32 Keps Nut (Qty. 1) (240-5208-00)		

Ordering Note: If **500-6586-00** *is unavailable*, order the individual part(s) actually required.

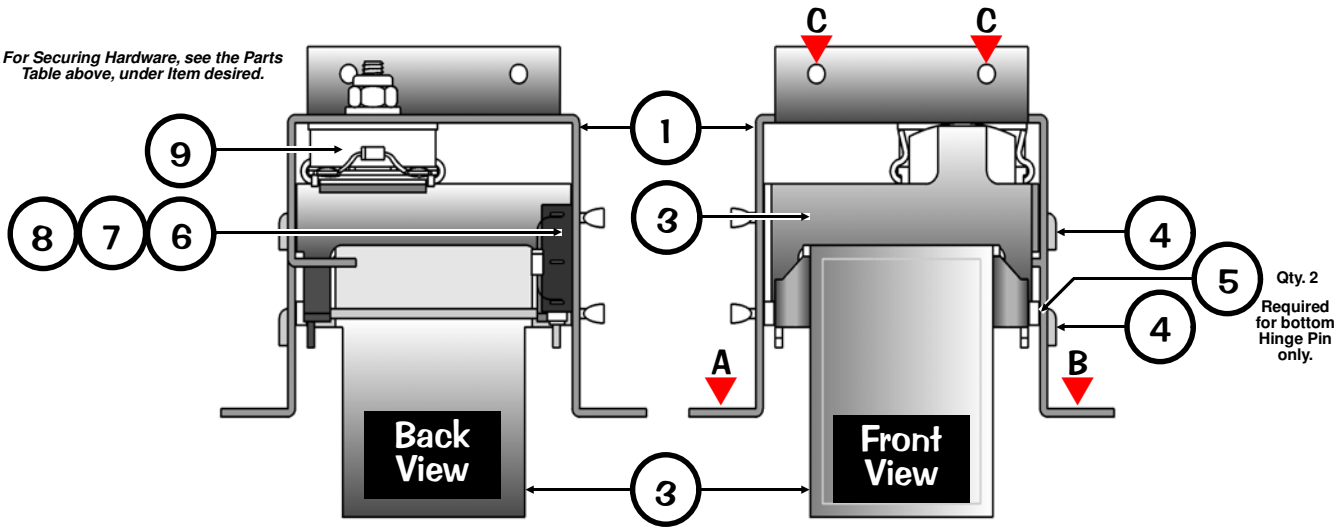
ASSOCIATED PARTS (BELOW) ARE NOT INCLUDED WITH THE ABOVE ASSY.

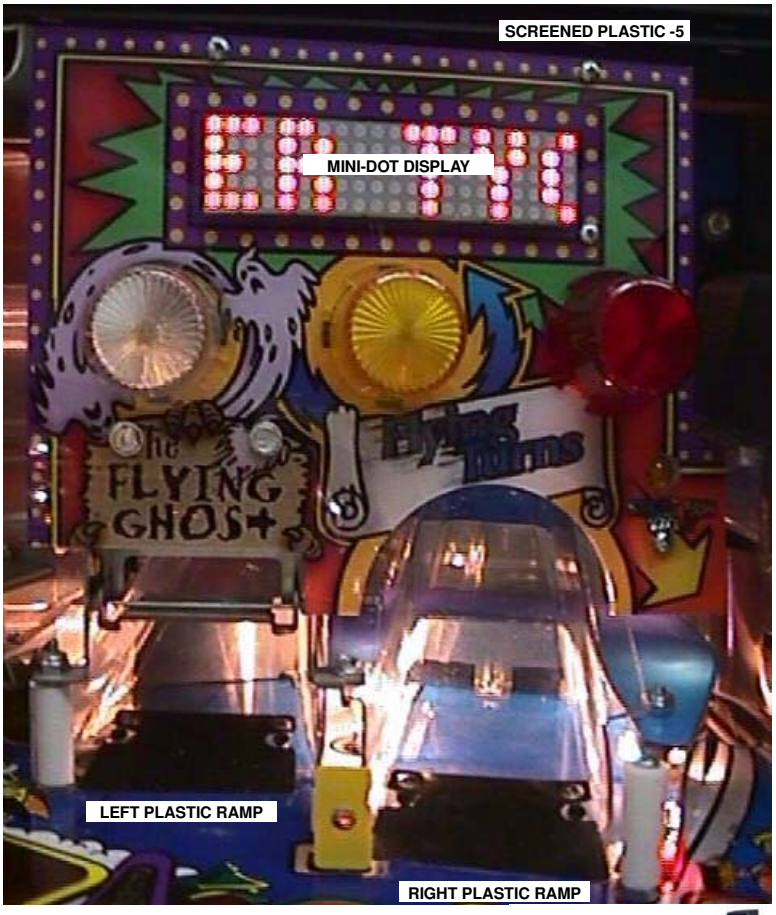
Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
AP-A	Troll Figurine **(See Notes on Trolls Above)**	1	880-5061-00
	Item AP-A is secured AP-B @ Neck by: Cable Tie, 5-1/2" PLT 1.5M-XMR (Qty. 1) (040-5001-06) **and @ Feet by:** Cable Tie, 4" PLT1MXMR (Qty. 2) (040-5001-01)		
AP-B	Troll Support Bracket	1	535-9160-00
	Item AP-B is secured @ Top by: #8-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1) (232-5301-00)		
AP-C	Troll Guide Bracket	1	535-9161-00
	Item AP-C is secured under the P/F by: The same securing hardware for **Item 1** above.		

Latching Gate Assembly, 500-6590-00 (Items 1-9)
Ramp Entrance Target Switch (Ghost Latch) located behind Screened Plastic -5 (Not Included).

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Bracket, Main Housing	1	535-9167-00
	Item 1 is secured on the Left Plastic Ramp @ Ref. A *(See Drawing)* on Post by: #6-32 Nylon Stop Nut (Qty. 1) (240-5005-00) **and** **@ Ref. B *by:*** #6-32 X 3/8" HWH Swage (Ser) Zc. (Qty. 1) (237-5976-02) **and** **@ Ref. C on Plastic Sign -5 by:** #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2) (232-5201-00)		
2	Latch	1	535-9168-00
3	Gate	1	535-9169-00
4	Hinge Pin	2	535-9170-00
5	Nylon Washer **.065" ID X .179" OD X .078"**	2	242-5069-00
6	Micro Switch **(Roller Actuator)**	1	180-5119-00
7	Switch Body Protect Plate	1	535-6539-00
	Items 6-7 are secured by: #2-56 X 1/2" HWH MS (Serr) Zc TF 3/16" (Qty. 2) (237-5937-02)		
8	Switch Diode, 1N4001	1	112-5001-00
9	Coil, 32-1250 (Mini.) Assembly	1	515-6916-01
	Ordering above Item 9 Coil Part Number will include: *Diode, 1N4004 (**112-5003-00**), Actuator Flap Plate (**535-8597-00**) and Retainer Clip (**530-5550-00**).* **Item 9 is secured to Item 1 by:** #8-32 Nylon Stop Nut (Qty. 1) (240-5102-00) **and** #8 Flat Washer (Qty. 1) (242-5005-00)		

Note: *Individual Decals Not Available. The entire decal sheet must be ordered for replacement. See Sec. **4**, Chp. **2, Parts Identication & Location**, **Game Decals**, Page **67**.*
Decal -21 & -22 used as Insulators (1 required on the underside of the Trip Plate of Item 9).





Take Note:

For **Targets** or other **miscellaneous items** *not on assemblies* listed in the **Blue Pages**, *see Section **4**, Chapter **1**, **Parts ID & Location, Playfield - General Parts Below**, Page **64**.*

For more details on Targets, see the end of this manual, ***Appendix I**, **Stand-Up Targets**, Pg. **1**.*

For **Mini-Mars Lite Covers**, **Mini-Dot Matrix Display** or other **miscellaneous items** *not on assemblies* listed in the **Blue Pages**, *see Section **4**, Chapter **1**, **Parts ID & Location, Playfield - General Parts Above**, Page **65**.*

Yellow Pages:
*For more details on the **Mini-Dot Matrix Display**, see Section **5**, Chapter **4**, **PCBs**, Pages **140-141**.*

Pink Pages:
For **Plastics & Decals**, *see Sec. **4**, Chp. **1**, **Page 67**.*

For **Posts & Spacers**, *see Sec. **4**, Chp. **1**, **Pages 69-71**.*

For **Sockets & Bulbs**, *see Sec. **4**, Chp. **1**, **Pages 72-74**.*

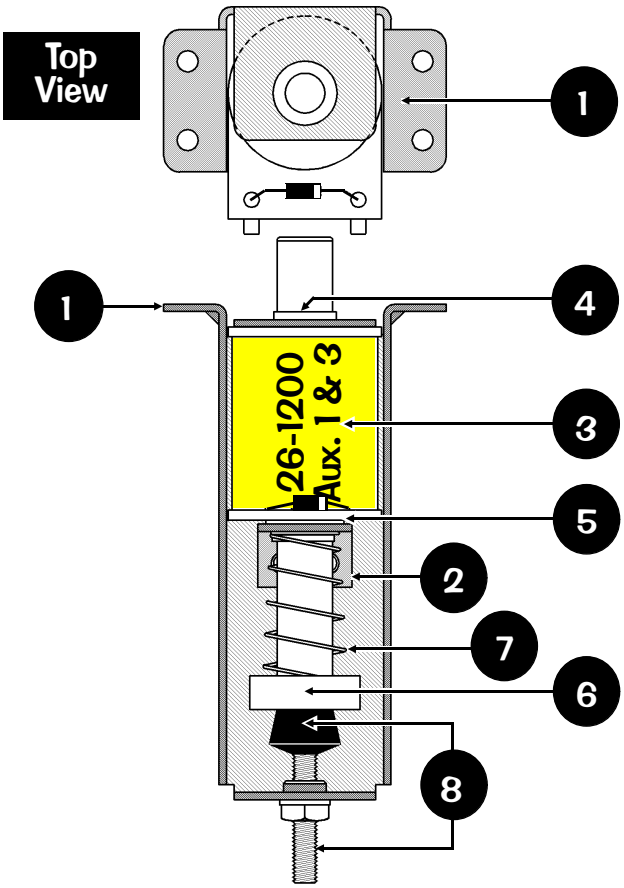
Blue Pages:
For **Ramps**, *see **Pages 91-95** earlier in this chapter.*

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.

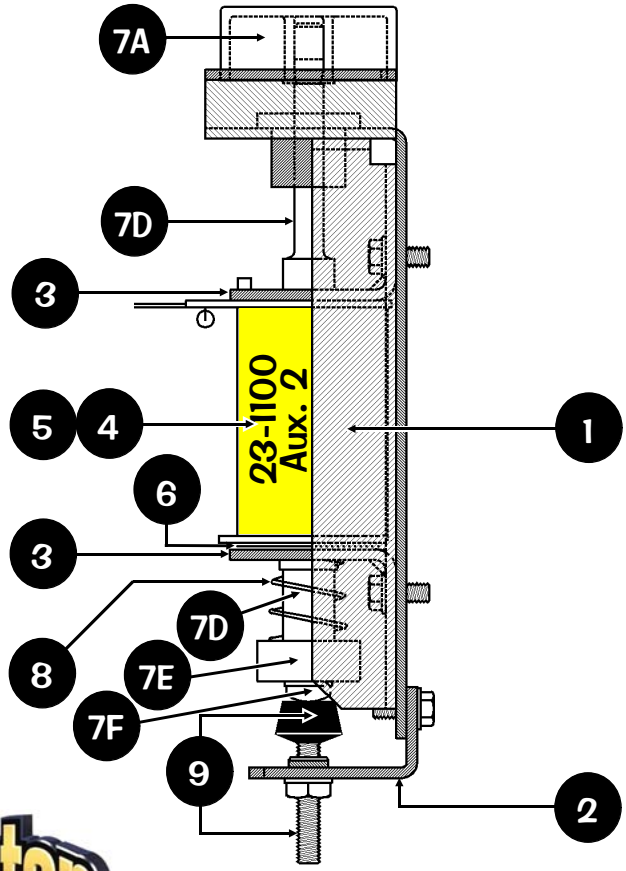


UK ONLY OPTIONAL

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.

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 hardrive 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.

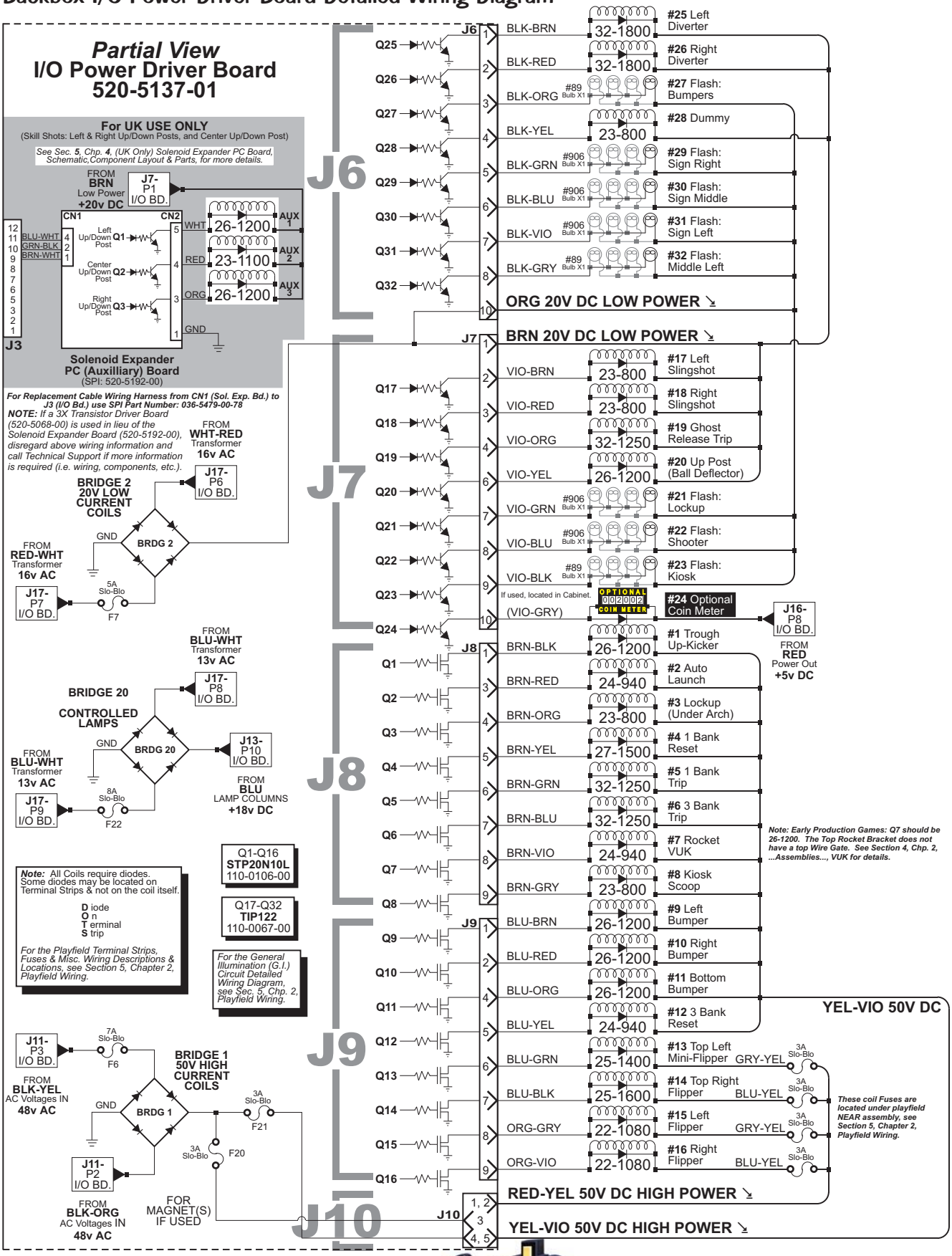
Use the below ***Coils Detailed Chart Table*** in conjunction with *Sec. **5**, Chp. **1**, Backbox I/O Power Driver Board Detailed Wiring Diagram (I/O Board Connectors J6, J7, J8 & J9) and Backbox Board Layout Wiring Diagram:*

COILS DETAILED CHART TABLE

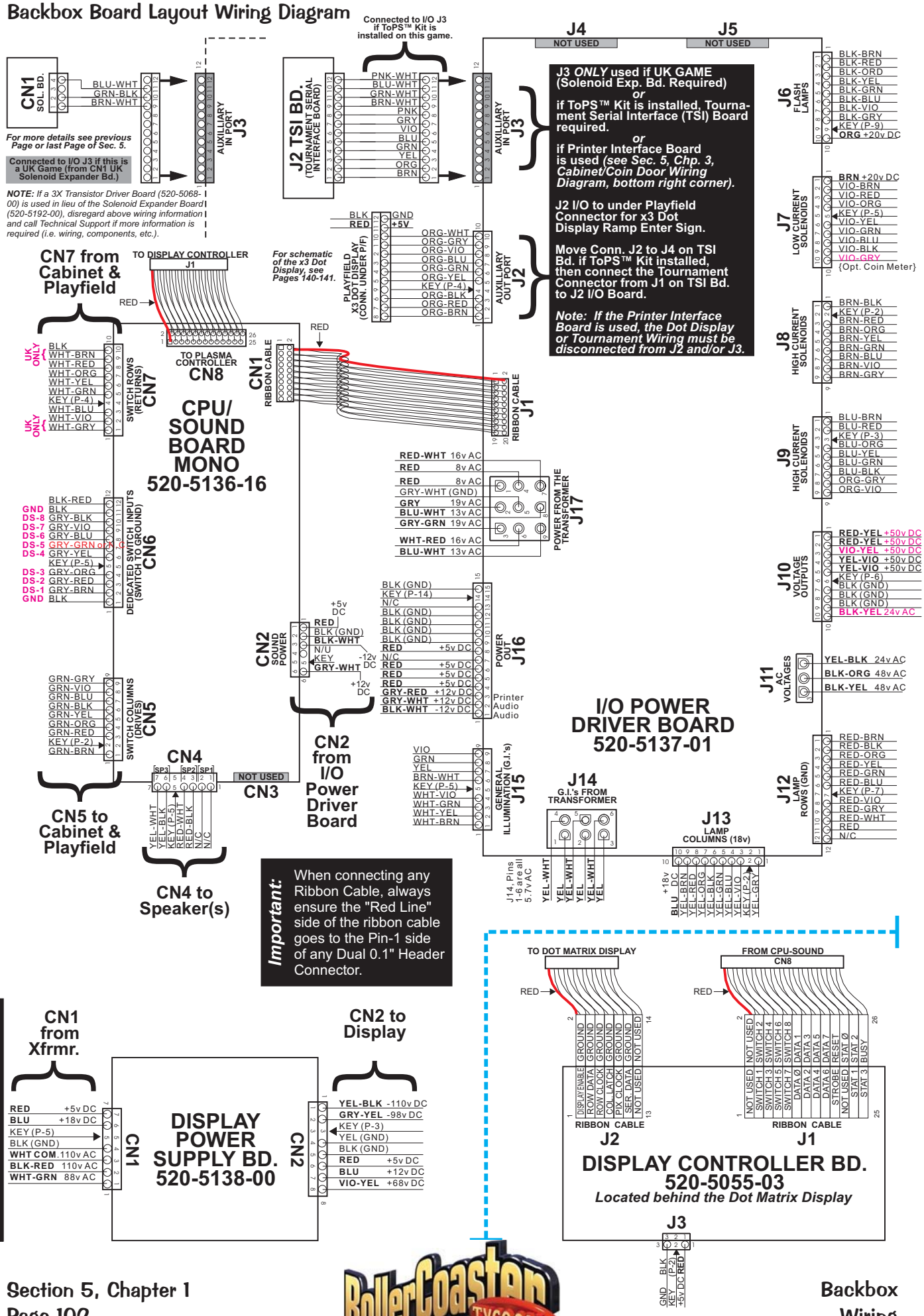
	High Current Coils Group 1	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BRN-BLK	J8-P1	26-1200 090-5044-00T
#2	AUTO LAUNCH	Q2		YEL-VIO	J10-P4/5	50v DC	BRN-RED	J8-P3	24-940 090-5036-00T
#3	LOCKUP	Q3		YEL-VIO	J10-P4/5	50v DC	BRN-ORG	J8-P4	23-800 090-5001-00B
#4	1 BANK RESET	Q4		YEL-VIO	J10-P4/5	50v DC	BRN-YEL	J8-P5	27-1500 090-5004-00B
#5	1 BANK TRIP	Q5		YEL-VIO	J10-P4/5	50v DC	BRN-GRN	J8-P6	32-1250 515-6916-01
#6	3 BANK TRIP	Q6		YEL-VIO	J10-P4/5	50v DC	BRN-BLU	J8-P7	32-1250 515-6916-01
#7	ROCKET VUK	Q7		YEL-VIO	J10-P4/5	50v DC	BRN-VIO	J8-P8	24-940 090-5036-00T
	Note Early Production Games: **Q7** should be **26-1200** if the top of the Rocket Bracket @ Yellow Wire Ramp ***does not have*** a **Wire Gate**. *See Sec. **4**, Chp. **2**, **...Assemblies..., VUK** for details.*								
#8	KIOSK SCOOP	Q8		YEL-VIO	J10-P4/5	50v DC	BRN-GRY	J8-P9	23-800 090-5001-00T
	High Current Coils Group 2	**Drive Transistor**	**Driver Ouput Board**	**Power Line Color**	**Power Line Connection**	**Power Voltage**	**Drive Transistor Control Line Color**	**D.T. Control Line Connect**	**Coil GA-Turn or Bulb Type**
#9	LEFT BUMPER	Q9	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BLU-BRN	J9-P1	26-1200 090-5044-00T
#10	RIGHT BUMPER	Q10		YEL-VIO	J10-P4/5	50v DC	BLU-RED	J9-P2	26-1200 090-5044-00T
#11	BOTTOM BUMPER	Q11		YEL-VIO	J10-P4/5	50v DC	BLU-ORG	J9-P4	26-1200 090-5044-00T
#12	3 BANK RESET	Q12		YEL-VIO	J10-P4/5	50v DC	BLU-YEL	J9-P5	24-940 090-5036-00B
#13	TOP LEFT MINI-FLIPPER	Q13		GRY-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	BLU-GRN	J9-P6	25-1400 090-5067-00T
#14	TOP RIGHT FLIPPER	Q14		BLU-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	BLU-BLK	J9-P7	25-1600 090-5068-00T
#15	LEFT FLIPPER (50v RED/YEL)	Q15		GRY-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	ORG-GRY	J9-P8	22-1080 090-5032-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16		BLU-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	ORG-VIO	J9-P9	22-1080 090-5032-00T
	Low Current Coils Group 1	**Drive Transistor**	**Driver Ouput Board**	**Power Line Color**	**Power Line Connection**	**Power Voltage**	**Drive Transistor Control Line Color**	**D.T. Control Line Connect**	**Coil GA-Turn or Bulb Type**
#17	LEFT SLINGSHOT	Q17	▲ I/O Power Driver ▼	BRN	J7-P1	20v DC	VIO-BRN	J7-P2	23-800 090-5001-00T
#18	RIGHT SLINGSHOT	Q18		BRN	J7-P1	20v DC	VIO-RED	J7-P3	23-800 090-5001-00T
#19	GHOST RELEASE TRIP	Q19		BRN	J7-P1	20v DC	VIO-ORG	J7-P4	32-1250 515-6916-01
#20	UP POST (BALL DEFLECTOR)	Q20		BRN	J7-P1	20v DC	VIO-YEL	J7-P6	26-1200 090-5044-00T
#21	FLASH: LOCKUP	Q21		ORG	J6-P10	20v DC	VIO-GRN	J7-P7	#906 Bulb 165-5004-00
#22	FLASH: SHOOTER	Q22		ORG	J6-P10	20v DC	VIO-BLU	J7-P8	#906 Bulb 165-5004-00
#23	FLASH: KIOSK	Q23		ORG	J6-P10	20v DC	VIO-BLK	J7-P9	#89 Bulb 165-5000-89
#24	OPTIONAL COIN METER	Q24		RED	J16-P7	5v DC	VIO-GRY	J7-P10	Meter 5v 091-5000-00
	Diode **O**n **T**erminal **S**trip (if noted)								
	Low Current Coils Group 2	**Drive Transistor**	**Driver Ouput Board**	**Power Line Color**	**Power Line Connection**	**Power Voltage**	**Drive Transistor Control Line Color**	**D.T. Control Line Connect**	**Coil GA-Turn or Bulb Type**
#25	LEFT DIVERTER	Q25	▲ I/O Power Driver ▼	BRN	J7-P1	20v DC	BLK-BRN	J6-P1	32-1800 090-5031-00
#26	RIGHT DIVERTER	Q26		BRN	J7-P1	20v DC	BLK-RED	J6-P2	32-1800 090-5031-00
#27	FLASH: BUMPERS	Q27		ORG	J6-P10	20v DC	BLK-ORG	J6-P3	#89 Bulb 165-5000-89
#28	DUMMY	Q28		BRN	J7-P1	20v DC	BLK-YEL	J6-P4	23-800 090-5001-00T
#29	FLASH: SIGN RIGHT	Q29		ORG	J6-P10	20v DC	BLK-GRN	J6-P5	#906 Bulb 165-5000-89
#30	FLASH: SIGN MIDDLE	Q30		ORG	J6-P10	20v DC	BLK-BLU	J6-P6	#906 Bulb 165-5000-89
#31	FLASH: SIGN LEFT	Q31		ORG	J6-P10	20v DC	BLK-VIO	J6-P7	#906 Bulb 165-5000-89
#32	FLASH: MIDDLE LEFT	Q32		ORG	J6-P10	20v DC	BLK-GRY	J6-P8	#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: Q21-Q23, Q27, Q29-Q32)								
	Auxiliary (UK ONLY)	**Drive Transistor**	**Driver Ouput Board**	**Power Line Color**	**Power Line Connection**	**Power Voltage**	**Drive Transistor Control Line Color**	**D.T. Control Line Connect**	**Coil GA-Turn**
	AUX 1: LEFT UP/DOWN POST	Q1	Solenoid Expander Auxiliary	BRN	J7-P1	20v DC	WHT	CN2-P5	26-1200 090-5044-00T
	AUX 2: CENTER UP/DOWN POST	Q2		BRN	J7-P1	20v DC	RED	CN2-P4	23-1100 090-5030-00T
	AUX 3: RIGHT UP/DOWN POST	Q3		BRN	J7-P1	20v DC	ORG	CN2-P3	26-1200 090-5044-00T

Backbox Wiring

Backbox I/O Power Driver Board Detailed Wiring Diagram

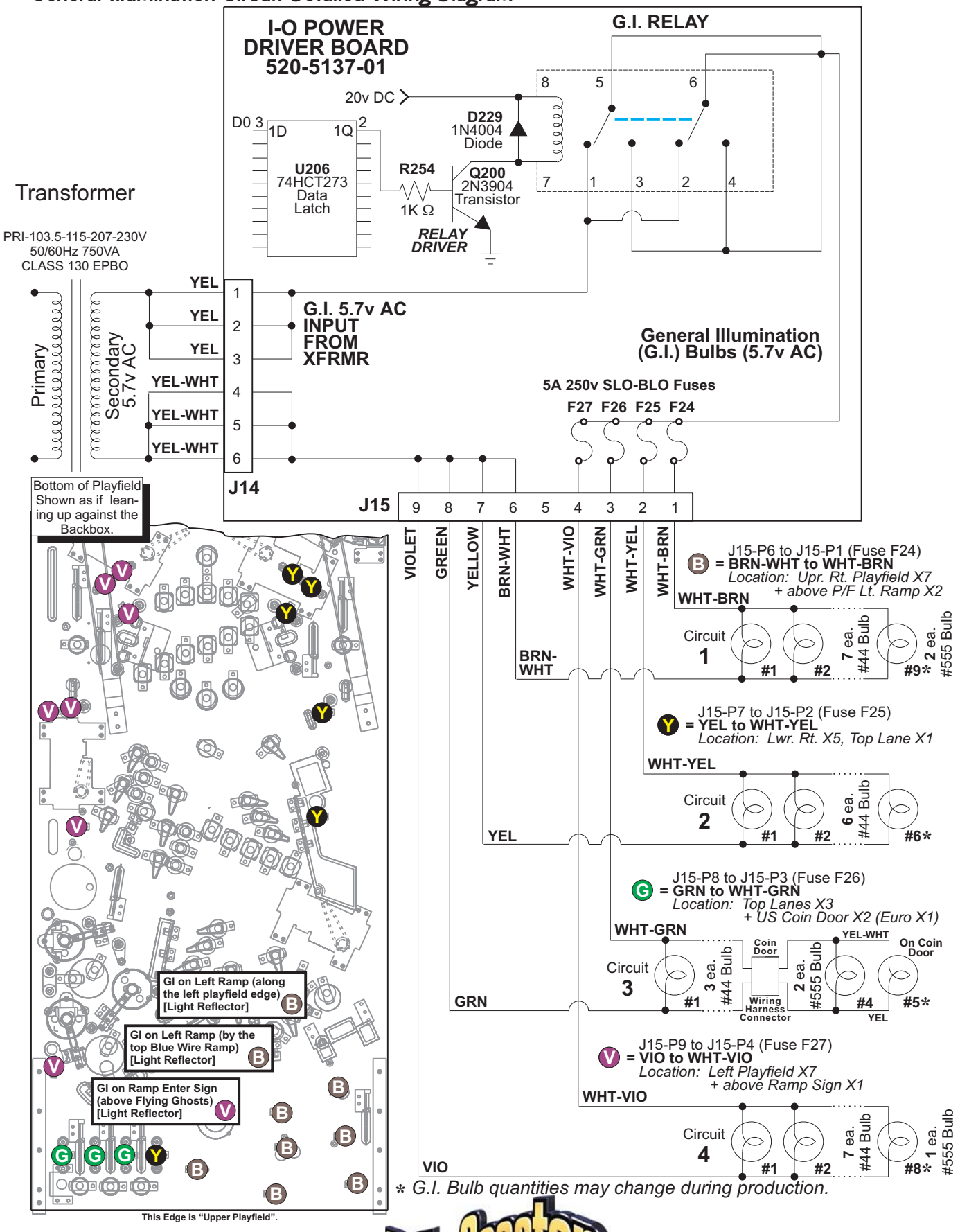


Backbox Board Layout Wiring Diagram



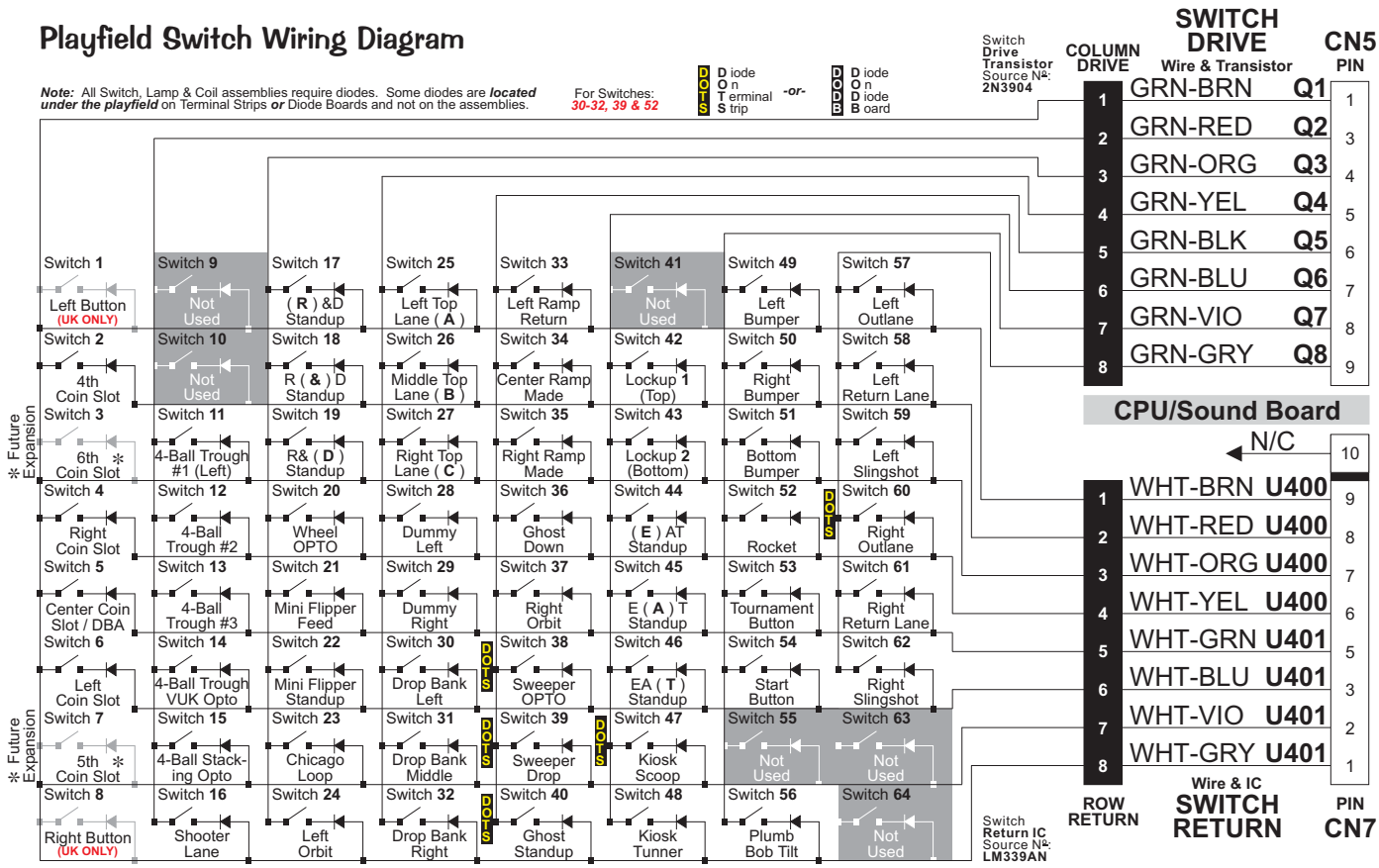
Playfield Wiring

General Illumination Circuit Detailed Wiring Diagram

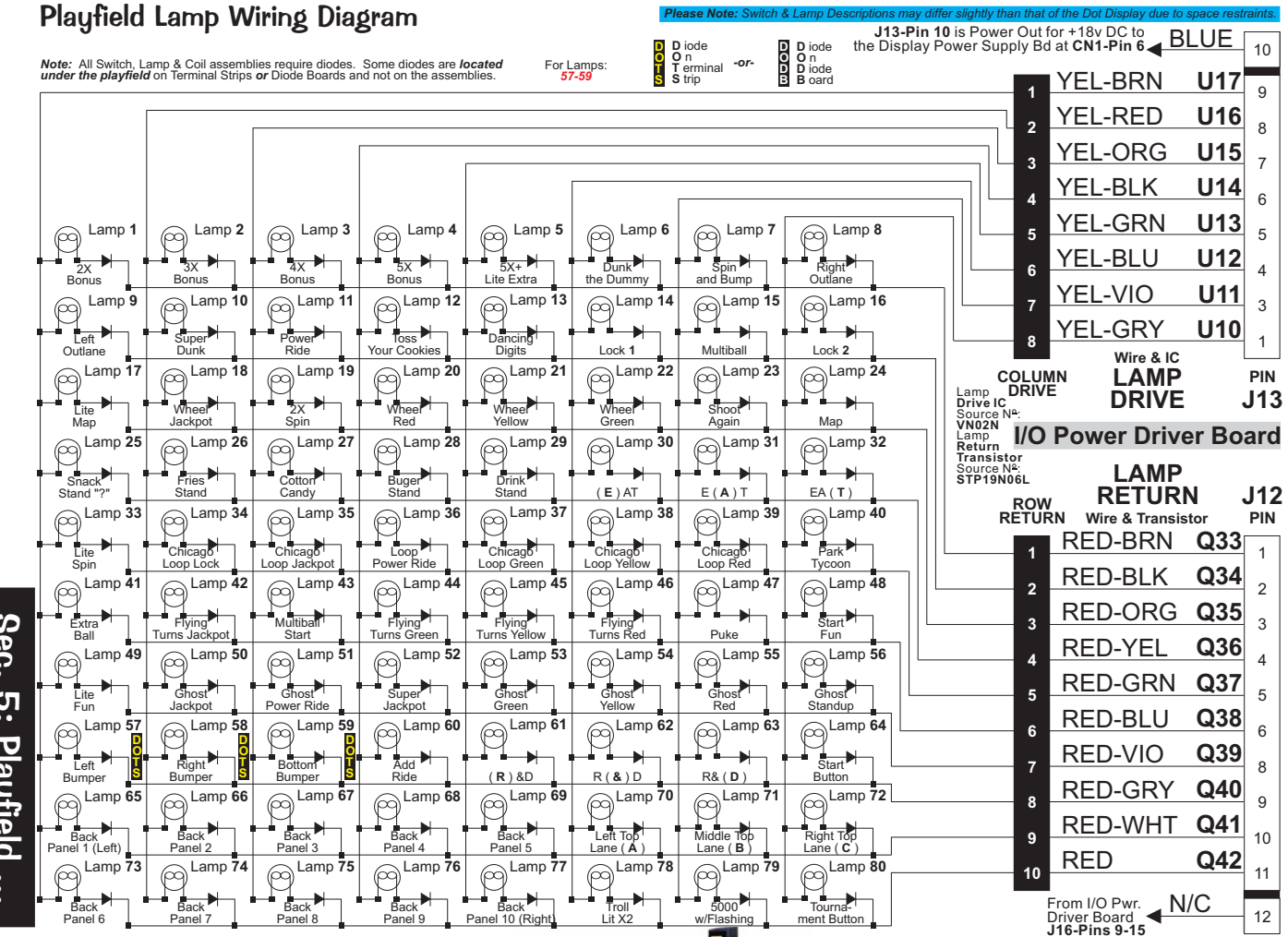


* G.I. Bulb quantities may change during production.

Playfield Switch Wiring Diagram

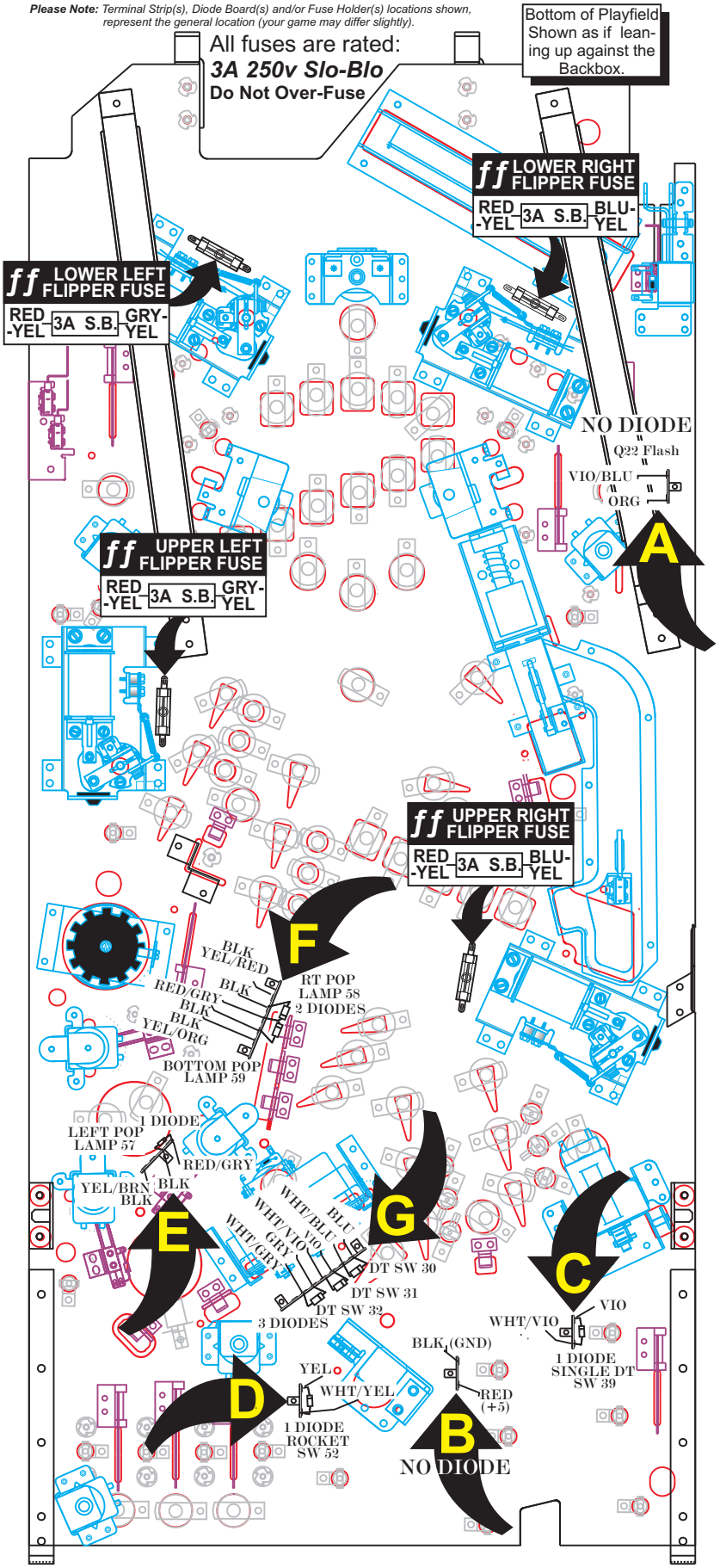


Playfield Lamp Wiring Diagram



Playfield Terminal Strips, Fuses & Misc. Wiring Descriptions & Locations

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



Explanation:

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. The Switch and Lamp Matrix Grids also note which Switch or Lamp has a diode on a Terminal Strip *(noted by **"DOTS"** meaning: "**D**iode **O**n **T**erminal **S**trip") or on a Diode Board (noted by **"DODB"** meaning: "**D**iode **O**n **D**iode **B**oard").*

A RollerCoaster Tycoon
Coil: **Q22** Flash: Shooter.....

Terminal Strip	
Q22 Flash	VIO-BLU
	NO DIODE REQUIRED (JUMPER)
	ORG

B RollerCoaster Tycoon
Switch: **20** Wheel OPTO.....

Terminal Strip	
Switch 20	(GND) BLK
	NO DIODE REQUIRED (JUMPER)
	RED (+5V)

C RollerCoaster Tycoon
Switch: **39** 1-Bank Drop Target.....

Terminal Strip	
Switch 39	WHT-VIO
	VIO to GRN-BLK

D RollerCoaster Tycoon
Switch: **52** Rocket (Vertical Up-Kicker.....

Terminal Strip	
Switch 52	WHT-YEL
	YEL to GRN-VIO

E RollerCoaster Tycoon
Lamp: **57** Left Bumper.....

Terminal Strip	
Lamp 57	RED-GRY
	BLK
	YEL-BRN & BLK

F RollerCoaster Tycoon
Lamps: **58** Right & **59** Bottom Bumpers.....

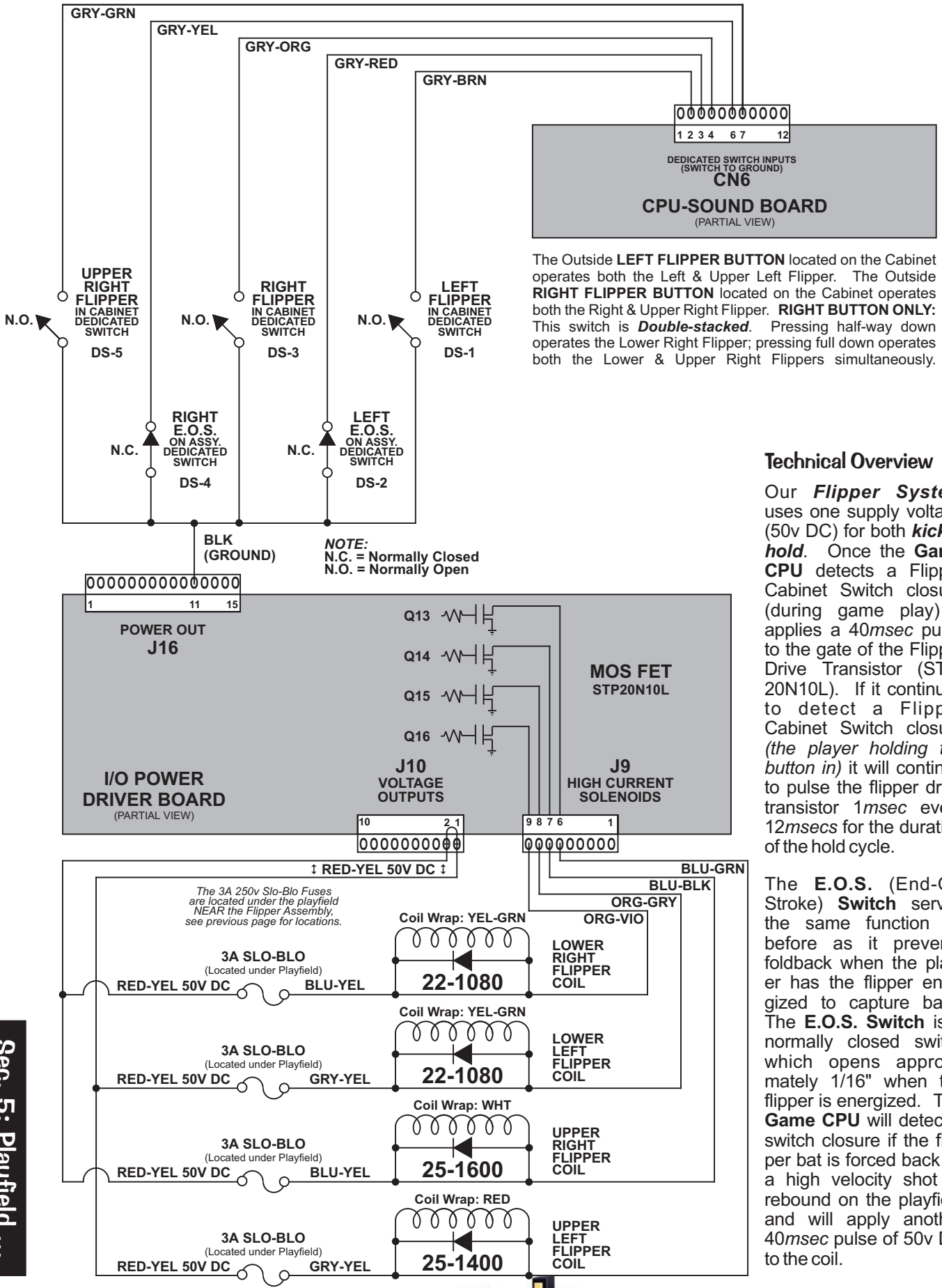
Terminal Strip	
59 Lamps 58	YEL-RED & BLK
	BLK
	RED-GRY
	BLK
	YEL-ORG & BLK

G RollerCoaster Tycoon Switches: D/T= Drop Target
30 D/T Bottom.....
31 D/T Middle.....
32 D/T Right.....

Terminal Strip	
Sw. 30	BLU to GRN-YEL
	WHT-BLU
Sw. 31	VIO to GRN-YEL
	WHT-VIO
Sw. 32	GRY to GRN-YEL
	WHT-GRY
	N.C.

See the Pink Pages, Playfield - General Parts (Below) (Page 60) for Terminal Strips, Diodes, Fuses and Fuse Holders Part Numbers.

4- Flipper Circuit Wiring Diagram



The Outside **LEFT FLIPPER BUTTON** located on the Cabinet operates both the Left & Upper Left Flipper. The Outside **RIGHT FLIPPER BUTTON** located on the Cabinet operates both the Right & Upper Right Flipper. **RIGHT BUTTON ONLY:** This switch is ***Double-stacked***. Pressing half-way down operates the Lower Right Flipper; pressing full down operates both the Lower & Upper Right Flippers simultaneously.

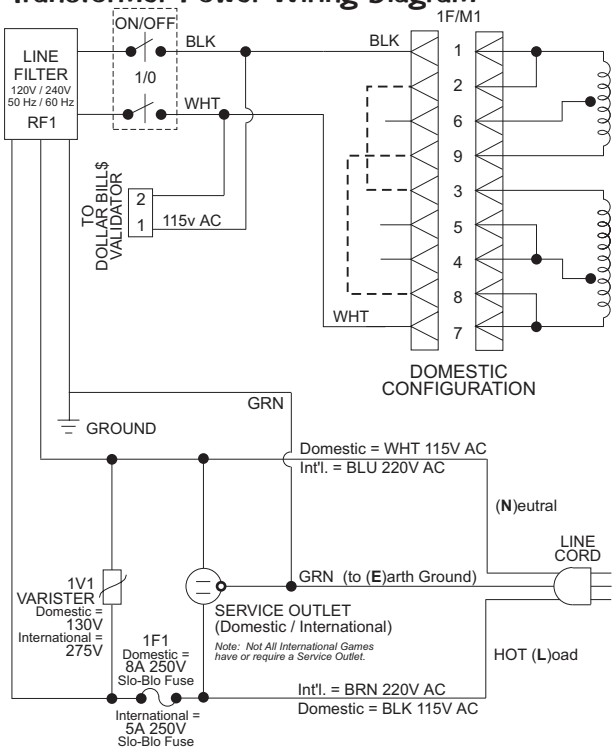
Technical Overview

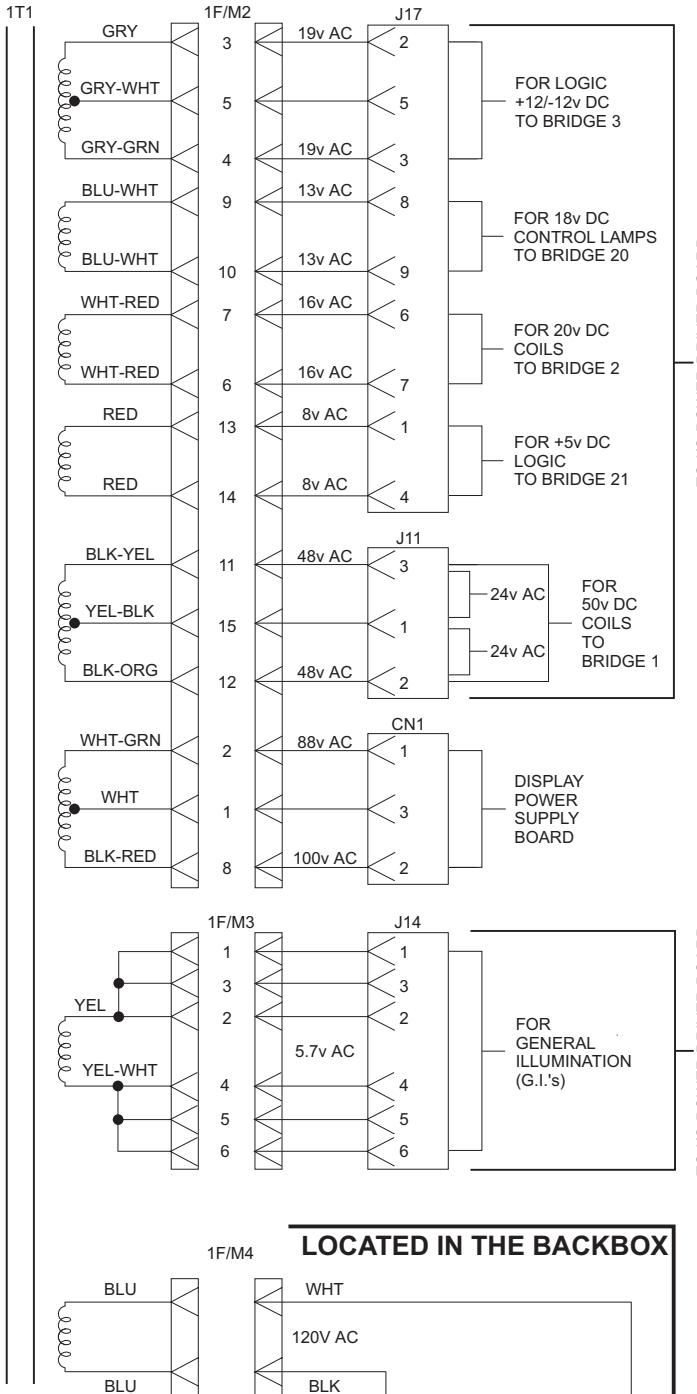
Our ***Flipper System*** uses one supply voltage (50v DC) for both ***kick*** & ***hold***. Once the **Game CPU** detects a Flipper Cabinet Switch closure (during game play) it applies a 40*msec* pulse to the gate of the Flipper Drive Transistor (STP-20N10L). If it continues to detect a Flipper Cabinet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

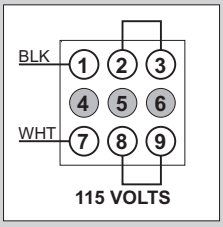
Cabinet Wiring

Transformer Power Wiring Diagram





JUMPERS FOR VOLTAGE VARIATION

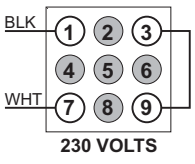


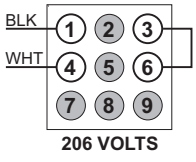
< < <
CONFIGURATON FOR DOMESTIC 115V
< < <

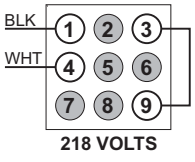
CONFIGURATION OF 220V OR LOWER LINE VOLTAGES FOR INTERNATIONAL USE

EXPORT/ HIGH LINE VOLTAGE
230/218/206 VOLTS

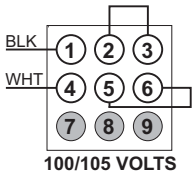
1F1= 5A 250V SLO BLO
1V1= 275V VARISTOR





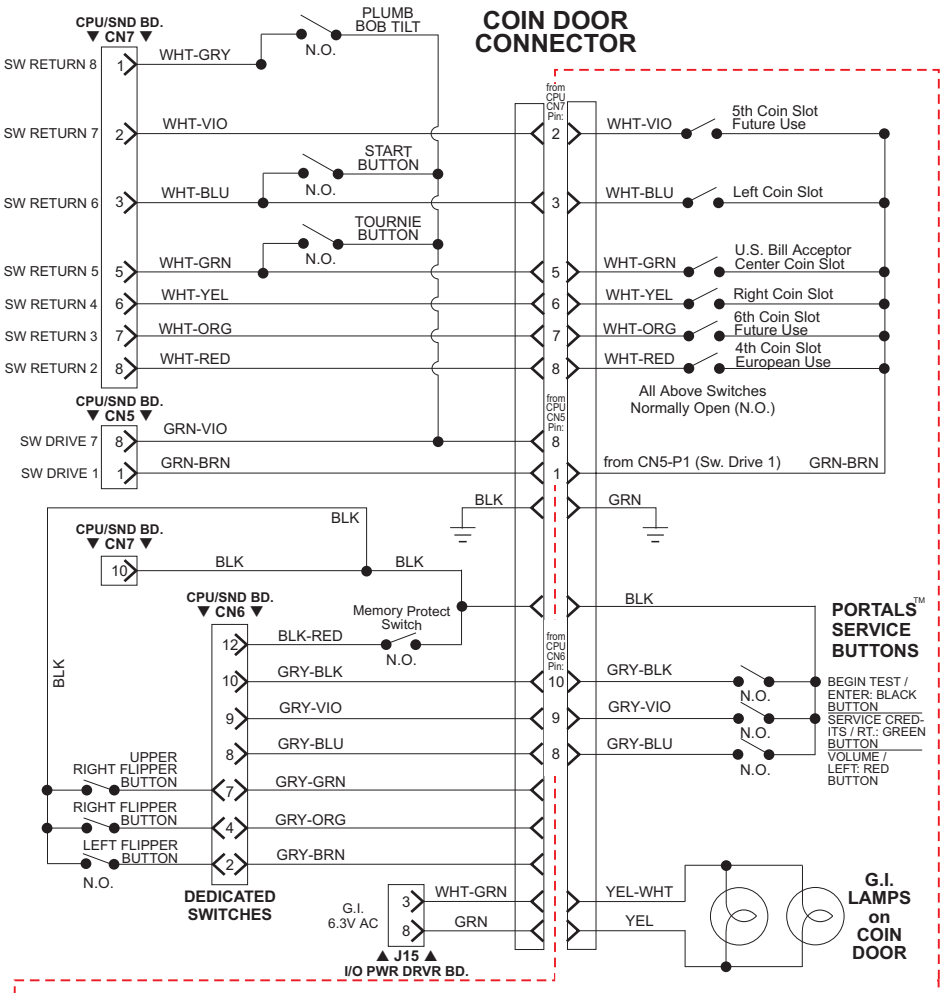


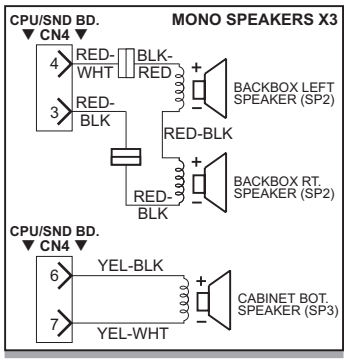
1F1= 8A SLO BLO
1V1= 130V VARISTOR

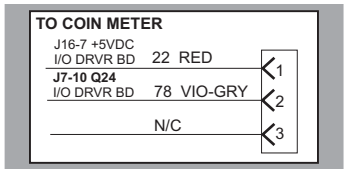


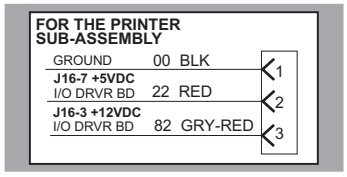
< < <
CONFIGURATON FOR JAPAN or LOW LINE VOLTAGE
< < <

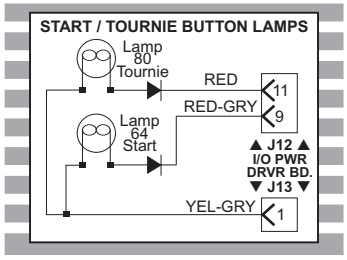
Cabinet / Coin Door Wiring Diagram



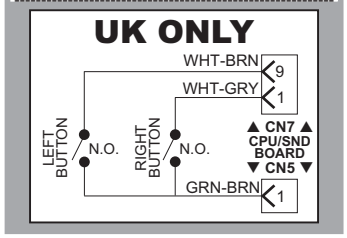


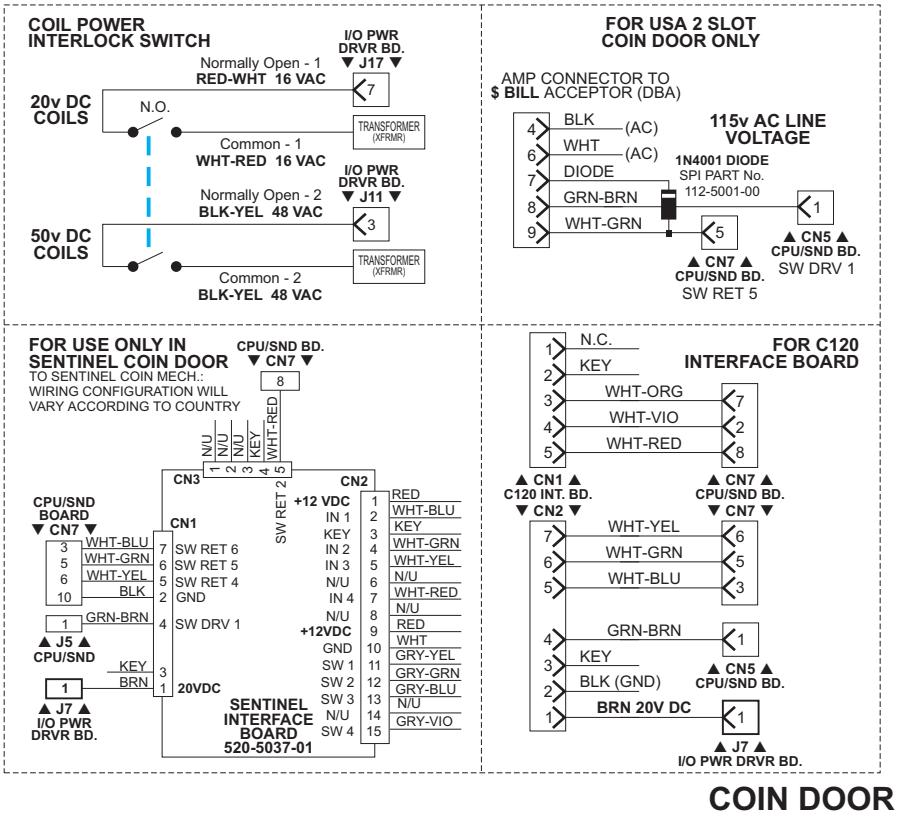






UK ONLY: 2 Extra Cabinet Buttons for the Post Save™ Feature are used. The Left Button operates the Left Outlane Ball Deflector. The Right Button operates the Right Outlane Ball Deflector. Both buttons pushed together operate the Center Up/Down Post. Both buttons are located under the Flipper Buttons.

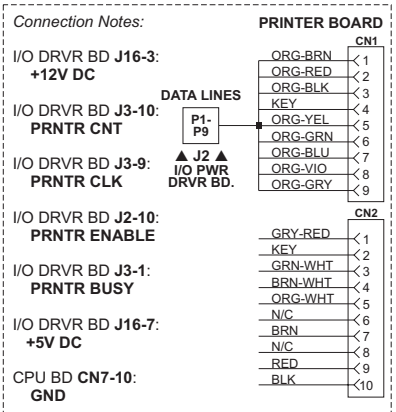




COIN DOOR

PRINTER INTERFACE OPTIONAL

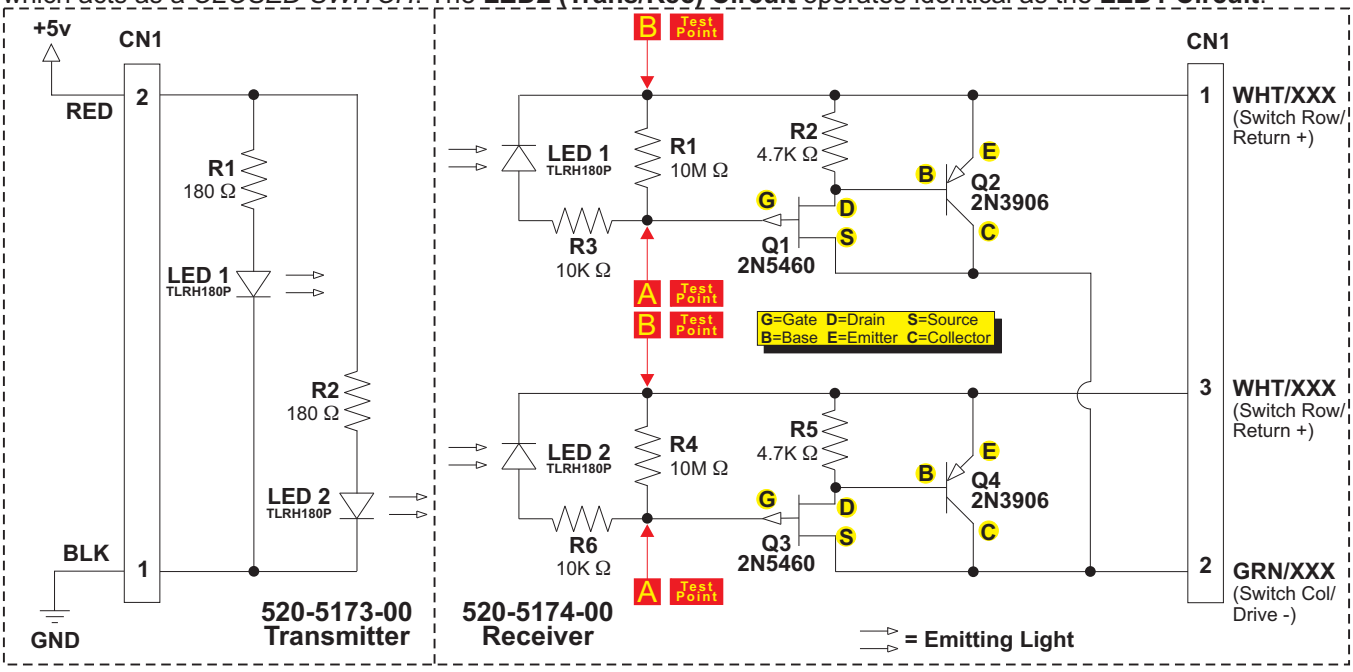
Cable Wiring Harness SPI Part Nº:
036-5408-00
RS-232 Printer Interface Board SPI Part Nº:
520-5069-00



Printed Circuit Boards (PCBs)

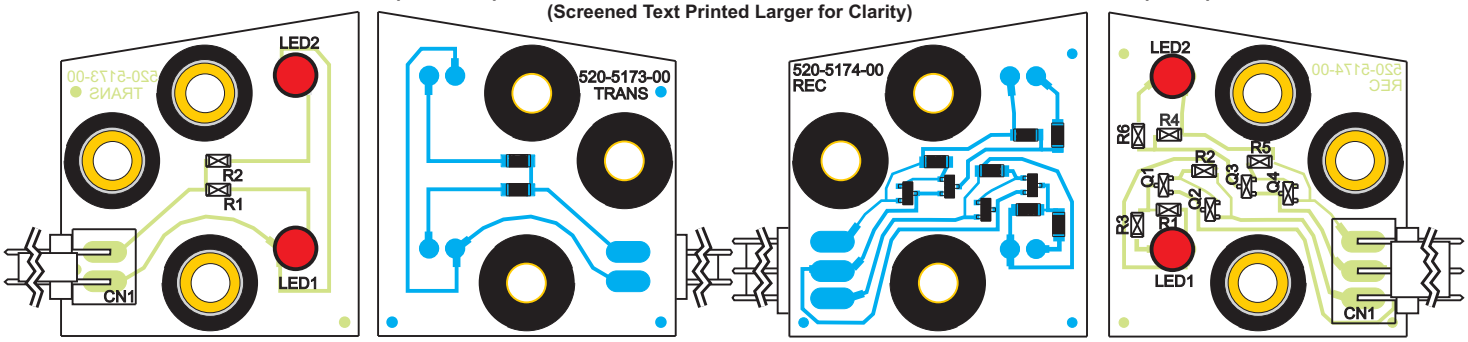
Trough Up-Kicker Dual OPTO Boards Theory of Operation & Schematic

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 (Screened Text Printed Larger for Clarity) — 520-5174-00 (REC)



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	DESCRIPTION
A	**1**	**515-0173-00**	**Dual-OPTO Trans. Bd. Assy.**	**PCB Assy.** (with all **Items 1-5**)
—	**1**	**520-5173-00**	**Dual-OPTO Trans. Board**	**PCB Assy.** (with Items **1-3** only)
01	1	045-5111-02	CN1	2X, .156" Rt. Angle (26-60-5020) Conn.
02	**2**	**165-5052-00**	**LED1, LED2**	**LED TLRH180P** (**Ultra Bright Red**)
03	2	121-5067-00	R1, R2	180 Ω 1/8W Chip Res. (CRCW)
04	3	530-5308-02	n/a	OPTO PCB Brass Tube Spacer
05	3	545-5518-00	n/a	OPTO PCB Rubber Grommet
B	**1**	**515-0174-00**	**Dual-OPTO Rec. Bd. Assy.**	**PCB Assy.** (with all **Items 1-9**)
—	**1**	**520-5174-00**	**Dual-OPTO Rec. Board**	**PCB Assy.** (with **Items 1-7** only)
01	1	045-5111-03	CN1	3X, .156" Rt. Angle (26-60-5030) Conn.
02	**2**	**165-5052-00**	**LED 1, LED 2**	**LED TLRH180P** (**Ultra Bright Red**)
03	2	110-5006-00	Q1, Q3	2N5460, Transistor (P-FET SOT-23)
04	2	110-0086-00	Q2, Q4	**2N3906**, Transistor
05	2	121-5082-00	R1, R4	10M Ω 1/8W Chip Res. (CRCW)
06	2	121-5083-00	R2, R5	4.7K Ω 1/8W Chip Res. (CRCW)
07	2	121-5011-00	R3, R6	10K Ω 1/8W Chip Res. (CRCW)
08	3	530-5308-02	n/a	OPTO PCB Brass Tube Spacer
09	3	545-5518-00	n/a	OPTO PCB Rubber Grommet

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

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 previous page, 520-5174-00 Receiver Side). It should read approximately 0.8 - 1.2v DC. The **LED2 Circuit** operates the same.

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

2. Oscilloscope Test (indicates normal operating condition):

Fig. A

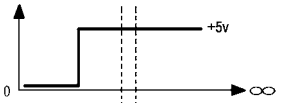
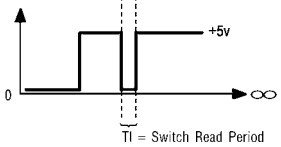


Fig. B



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

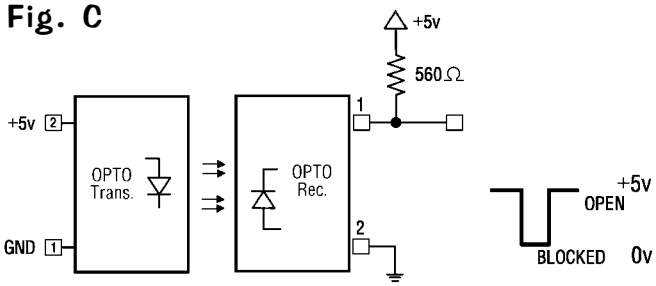
B. **CLOSED OPTO** (Light Blocked) = *SWITCH CLOSED*. Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (see Schematic). The Scope should display a **PULSE STREAM** indicating **Q2** has switched "On" as shown in **Fig. B**, Wave Form Diagram. This is your Switch Drive Pulse.

3. Bench Test (See Fig. C):

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

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

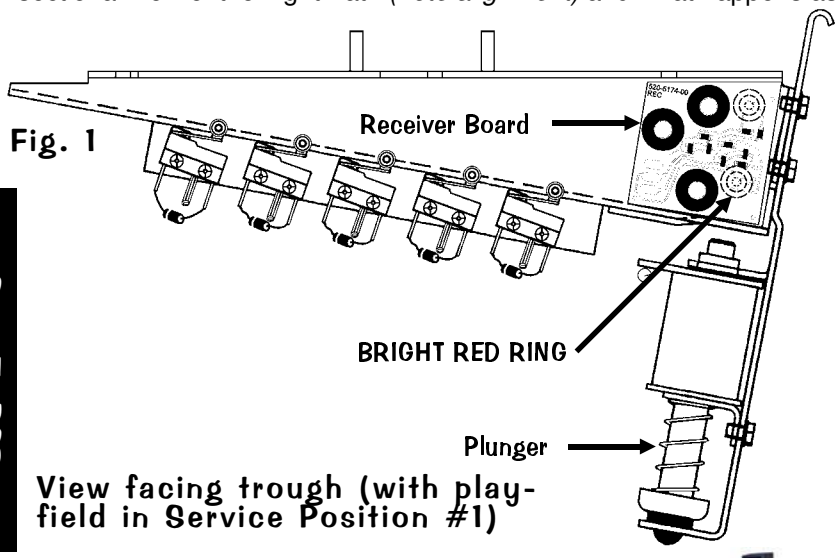
Fig. C



Trough Dual OPTO Boards Alignment / Test for LED1

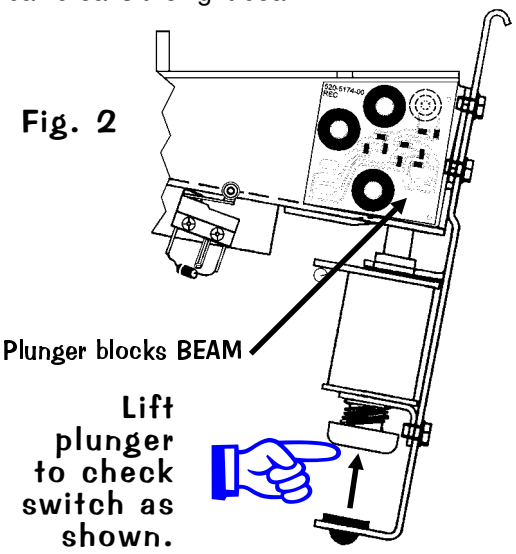
When a working **OPTO** is installed and connected in a game, the transmitter should light (LED1 lower & LED2 upper) when the power is switched on. With the playfield in **Service Position #1** *(playfield lifted up in the half-way position resting on the Prop Rod or edge slide support brackets)* and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

Fig. 1

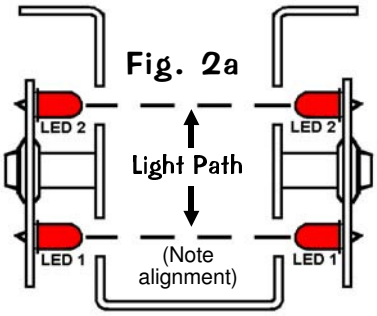


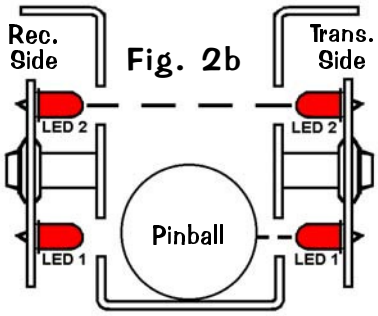
View facing trough (with play-field in Service Position #1)

Fig. 2



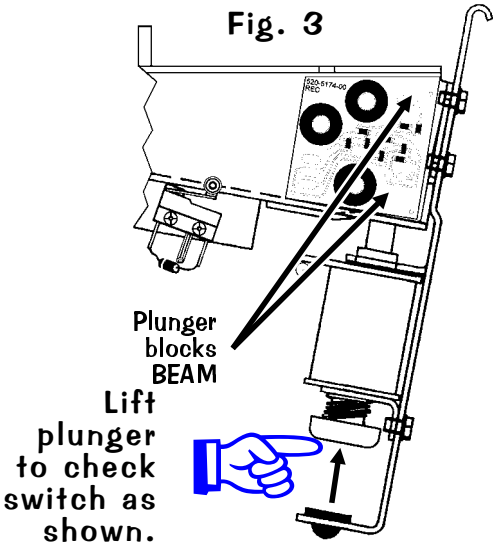
Sectional view from right (Fig. 2a & 2b)

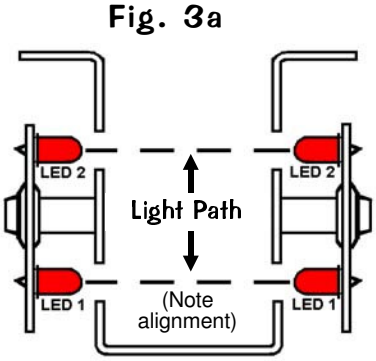


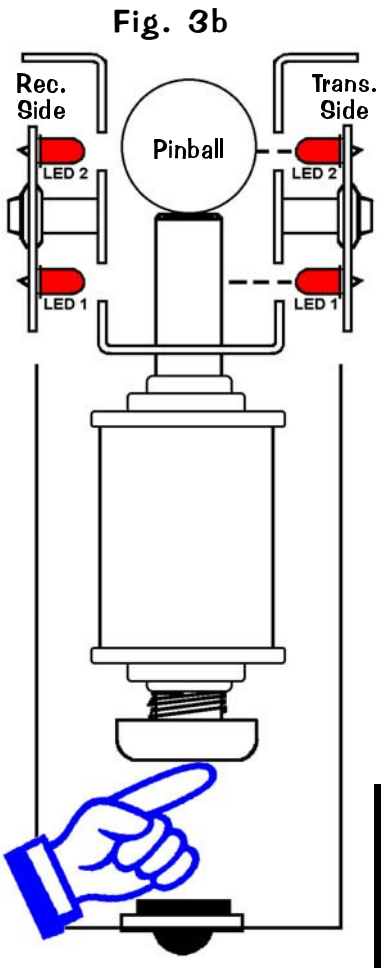


Trough Dual OPTO Boards Alignment / Test for LED2

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







I M P O R T A N T

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

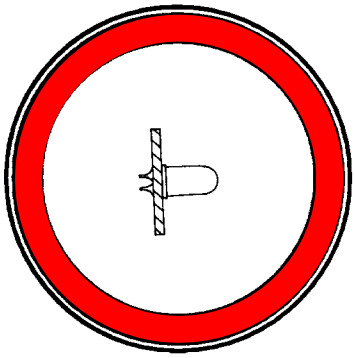


Fig. 4a
Correct Position

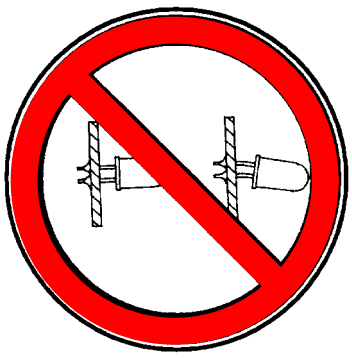
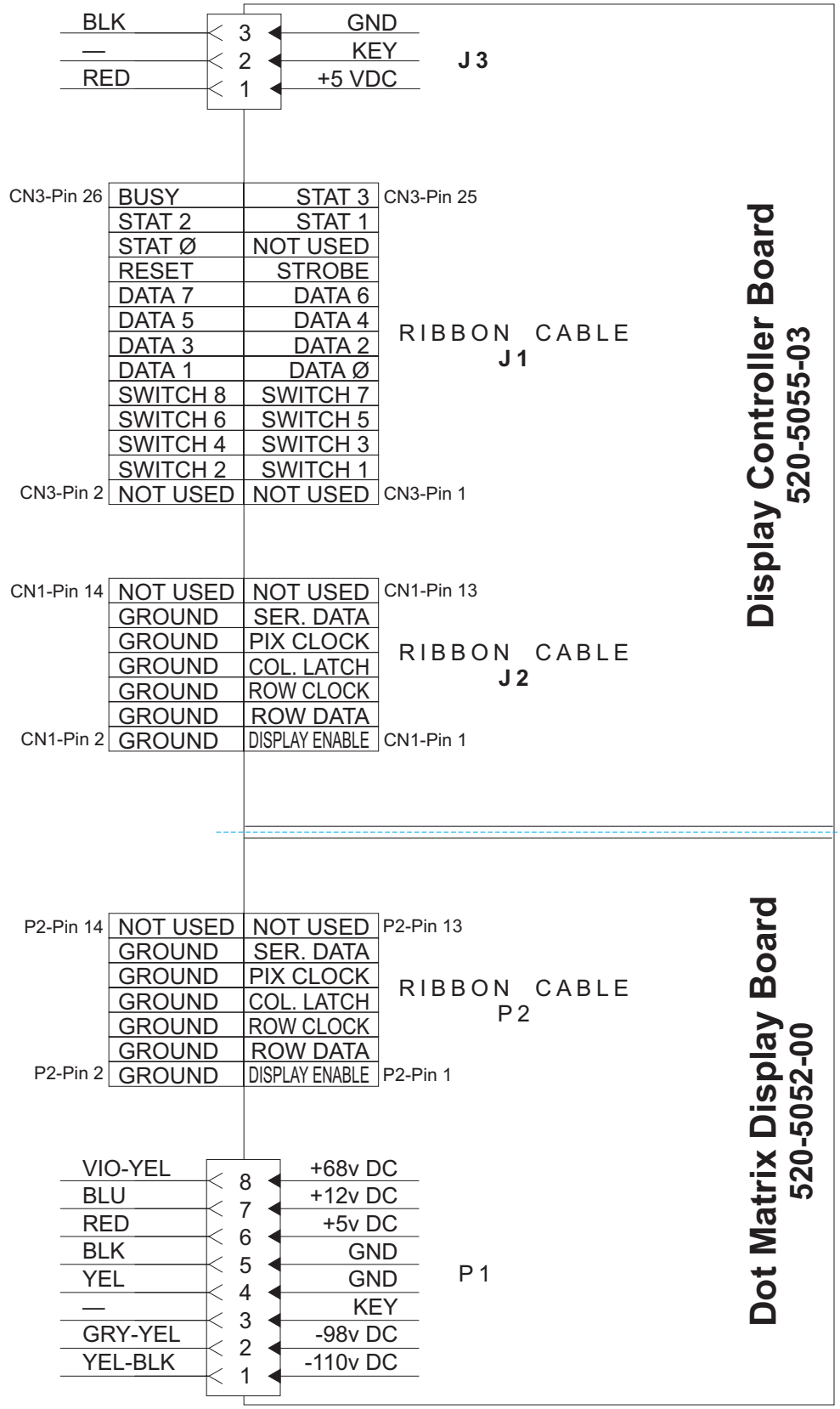
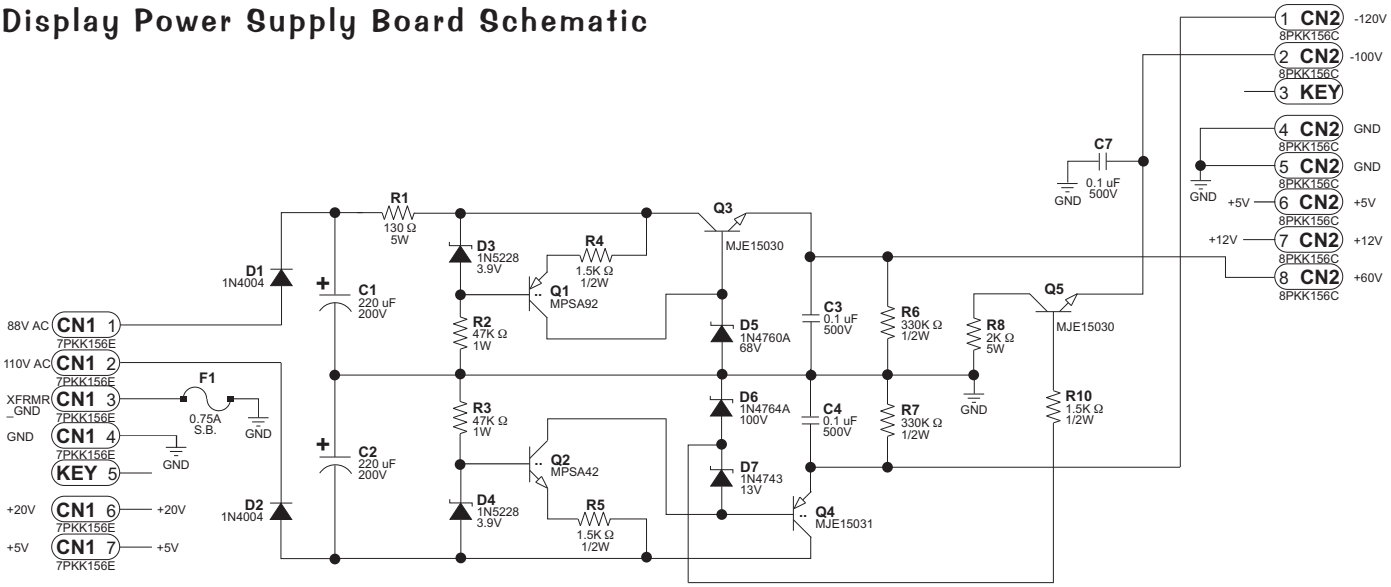


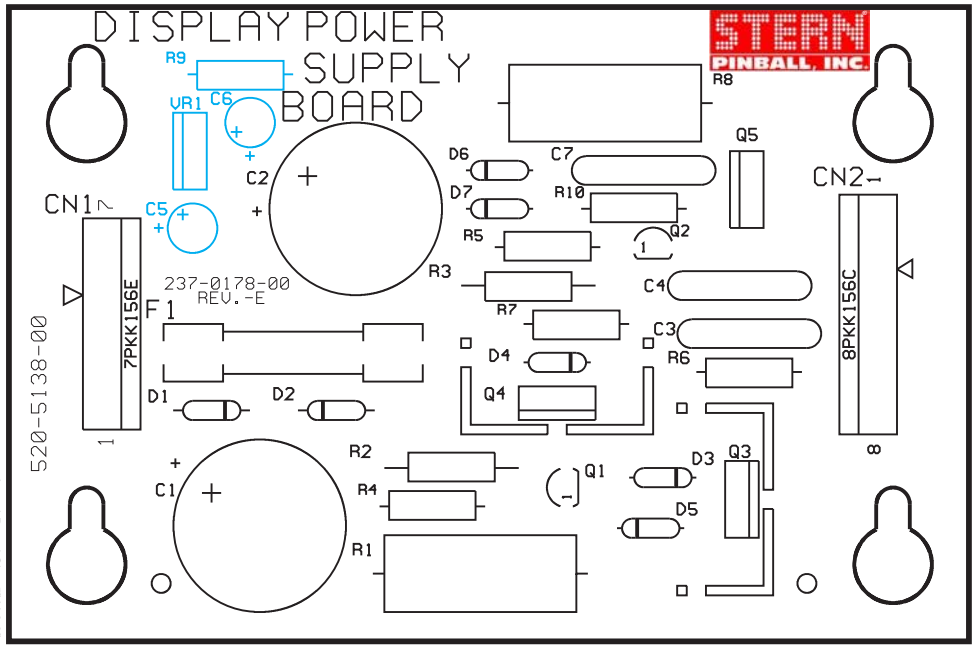
Fig. 4b
Incorrect Position


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

Display Power Supply Board Schematic

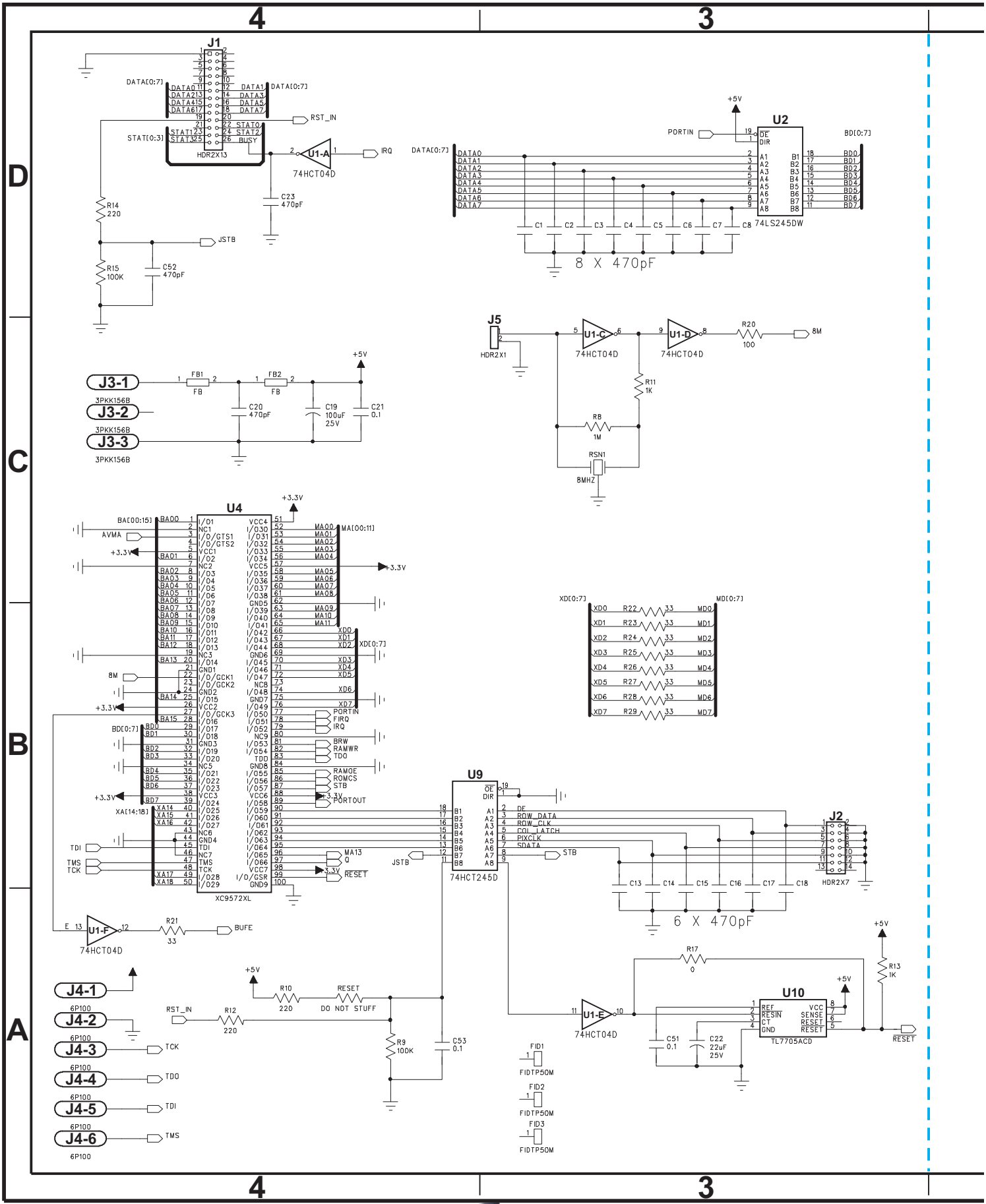


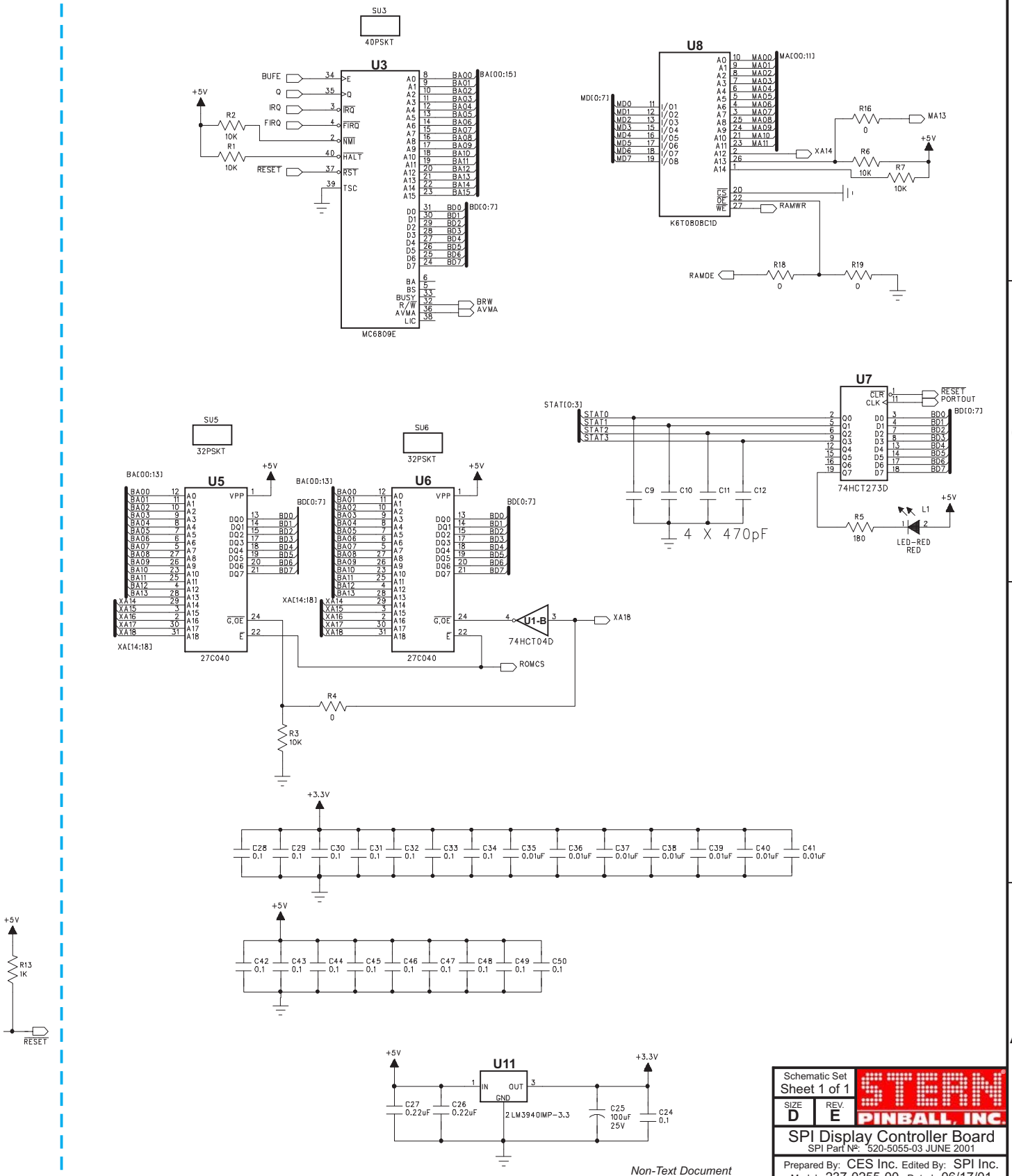
Display Power Supply Board Component Layout & Parts



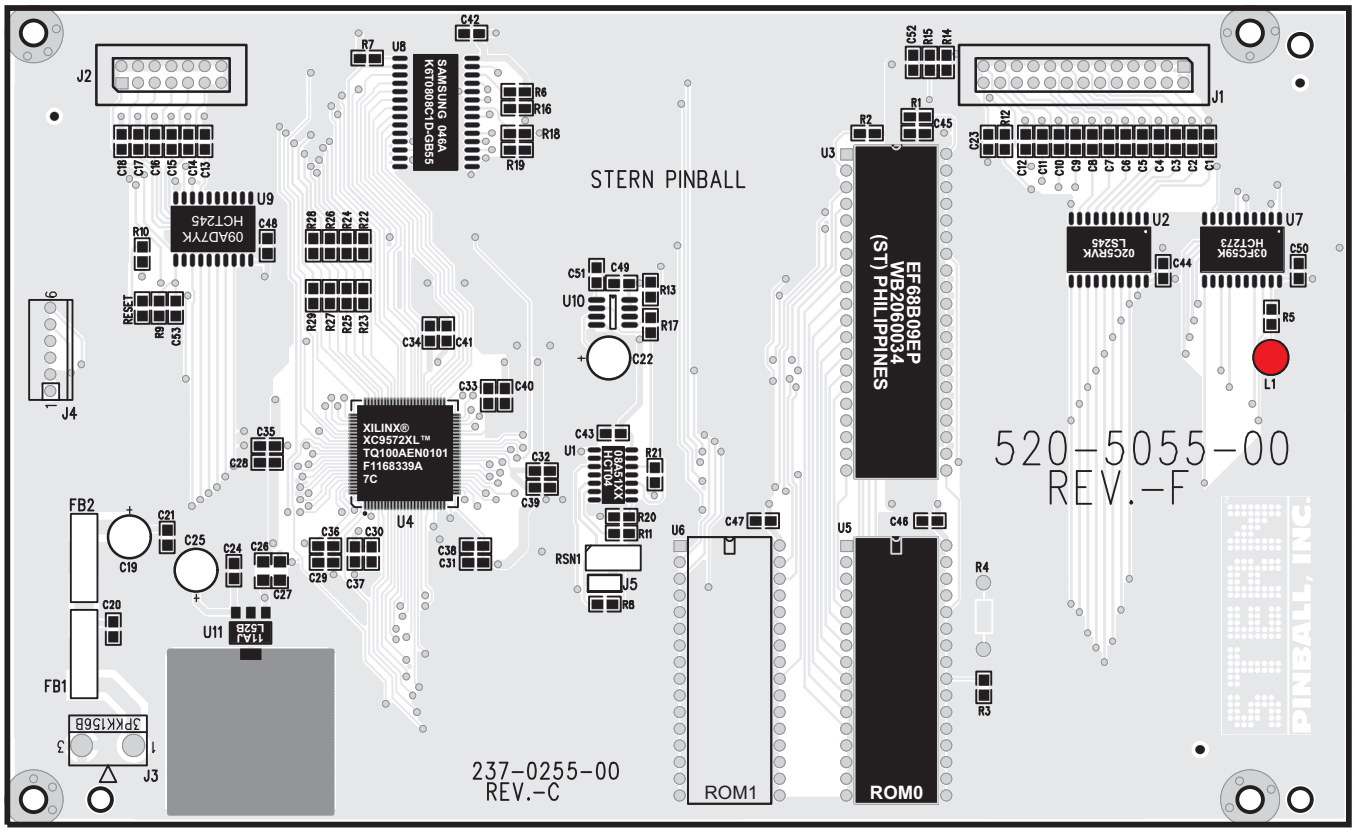
Actual Board Size 5" X 3.3"

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
C23
470pF
R14
220
JSTB
R15
100K
C52
470pF
U2
PORTIN
BD[0:7]
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]
PORTIN
FIRQ
IRQ
BRW
RAMWR
TDO
RAMOE
ROMCS
STB
PORTOUT
XA[14:18]
TDI
TMS
TCK
MA13
RESET
U9
74HCT245D
JSTB
STB
J2
HDR2X7
DF
ROW_DATA
ROW_CLK
COL_LATCH
PIXCLK
SDATA
6 X 470pF
MD[0:7]
R22
R23
R24
R25
R26
R27
R28
R29
33
U1-F
74HCT04D
R21
33
BUFE
J4-1
J4-2
J4-3
J4-4
J4-5
J4-6
6P100
TCK
TDO
TDI
TMS
R10
220
RESET
DO NOT STUFF
R12
220
R9
100K
C53
0.1
U1-E
74HCT04D
R17
0
U10
TL7705ACD
C51
0.1
C22
22uF
25V
R13
1K
FID1
FID2
FID3
FIDTP50M


SU3
40PSKT
U3
MC6809E
U8
K6T0808C1D
U7
74HCT273D
SU5
32PSKT
U5
27C040
SU6
32PSKT
U6
27C040
U1-B
74HCT04D
4 X 470pF
LED-RED
RESET
PORTOUT
RAMWR
ROMCS
U11
2LM3940IMP-3.3
Schematic Set
Sheet 1 of 1
SIZE D
REV. E
STERN PINBALL, INC.
SPI Display Controller Board
SPI Part №: 520-5055-03 JUNE 2001
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0255-00 Dated: 06/17/01
Non-Text Document

Display Controller Board Component Layout & Parts



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
1	2 (See Pg. DR. ③ Table)		U5 (ROM0) (U6 (ROM1): NS)	4MB ROM 27C040 (M27C401-100)
2	2	077-5217-00	U5 (U6: NS)	32-Pin, IC Dip Socket
3	1	045-5015-03	J3	3-Pin, PKK156B Connector
4A	1	100-0189-01	U3	MC6809E
4B	1		U3	40-Pin, Socket
5	1		J4	6-Pin (6P100)
6	1		U1	74HCT04D (74LS04)
7	1	If part is required, call Technical Support (see back of cover).	U9	74HCT245D
8	1		U7	74HCT273D
9	1		U2	74LS245DW
10	1		RSN1	8MHZRSN (8Mhz) Crystal
11	7		C35-C39, C40, C41	0.01uF, 50v Cap.103-0805-X7R
12	20		C21, C24, C28-C32, C33, C34, C42, C43, C44, C45, C46 C47, C48, C49, C50, C53 (C51: NS)	0.1, 50v Cap. 104-0805
13	2		C26, C27	0.22uF, 50v Cap. 224-1206-Z5U
14	21		C1-C12, C13-C18, C20, C23, C52	470pF, 50v Cap. 471-0805
15	2	n/a	FB1, FB2	Ferrite Bead, FB0370
16	3		FID1-3	FIDTP50M
17	1	n/a	(J5: NS)	HDR2X1
18	1		J2	7-Pin, Dual Row .1" Hdr. Conn HDR2X7
19	1		J1	13-Pin, Dual row .1" Hdr. Conn HDR2X13
20	1	100-5045-00	U8	K6T0808C1D-GB55, Int. Samsung 046A
21	**1**	**165-5099-00**	**L1**	**LED T1-3/4 DIFFUSER RED**
22	1		U11	LM3940IMP-3.3
23	4		R16-R18 (R19: NS)	0Ω 1/10W Resistor 0805
24	1	n/a	RESET	DO NOT STUFF
25	1	n/a	(R4: NS)	RES0E1/4W5CF, 0
26	1		R20	100Ω 1/10W Resistor 0805
27	2	If part is required, call Technical Support (see back of cover).	R9, R15	100KΩ 1/10W Resistor 0805
28	5		R1, R2, R3, R7 (R6: NS)	10KΩ 1/10W Resistor 0805
29	1		R5	180Ω 1/10W Resistor 0805
30	2		R11, R13	1KΩ 1/10W Resistor 0805
31	1		R8	1MΩ 1/10W Resistor 0805
32	3		R10, R12, R14	220Ω 1/10W Resistor 0805
33	9		R21, R22-R29	33Ω 1/10W Resistor 0805
34	2	125-5015-00	C19, C25	100uF, 25v TCap.
35	1	n/a	(C22: NS)	22uF, 25v TCap.
36	1	n/a	(U10: NS)	TL7705ACD
37	1	100-5044-00	U4	XC9572XL, Int. Xilinx®

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.

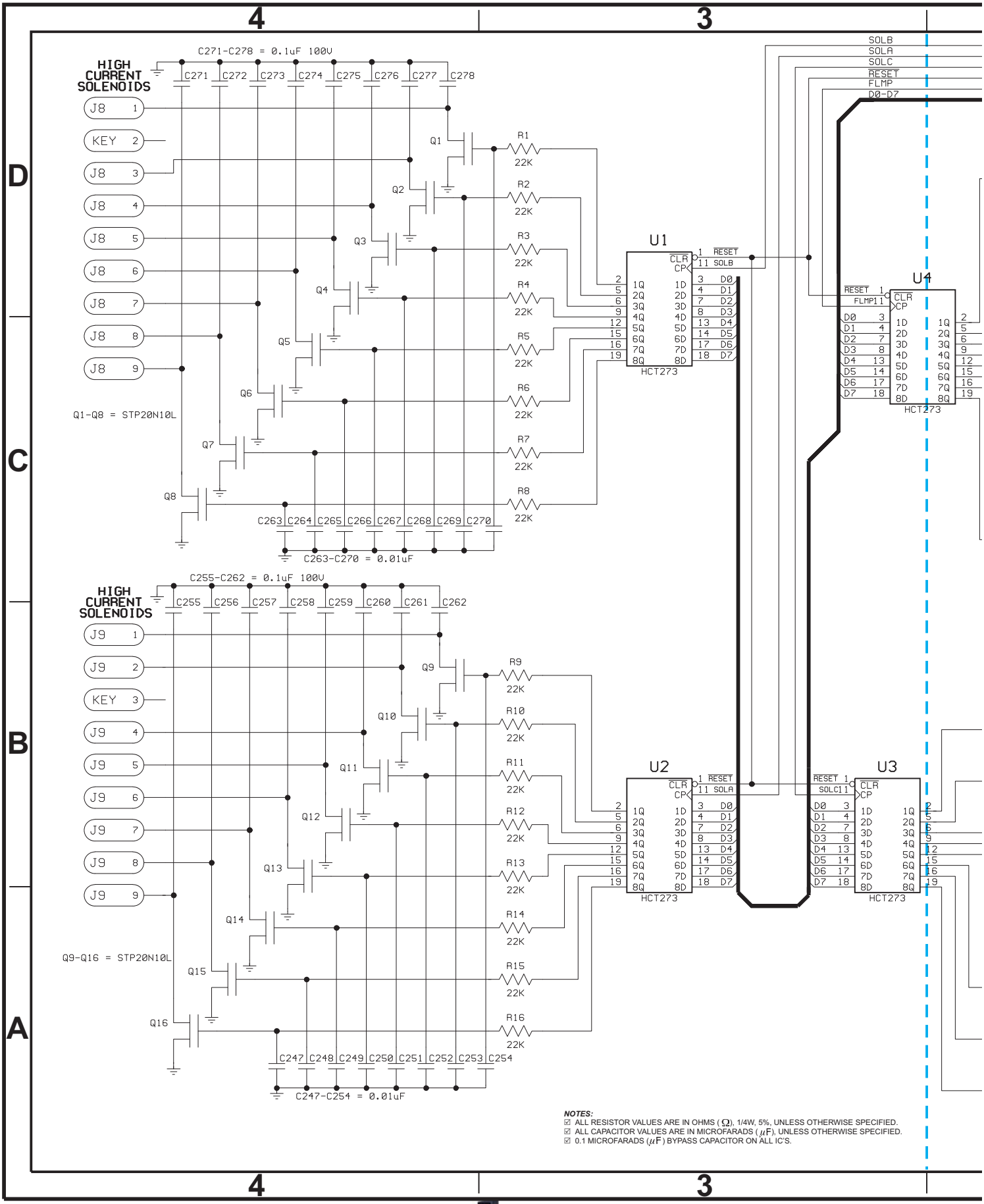
Solenoid (Coil) Drivers & Flash Lamps:
J8 & **J9** are high side drivers for driving solenoids and other heavy loads. Each connector has its own buffer driving 8 drivers. **J8** & **J9** consist of **MOSFET Drivers 20N10L** which can easily & safely be tested by clipping one end of a clip-lead to test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

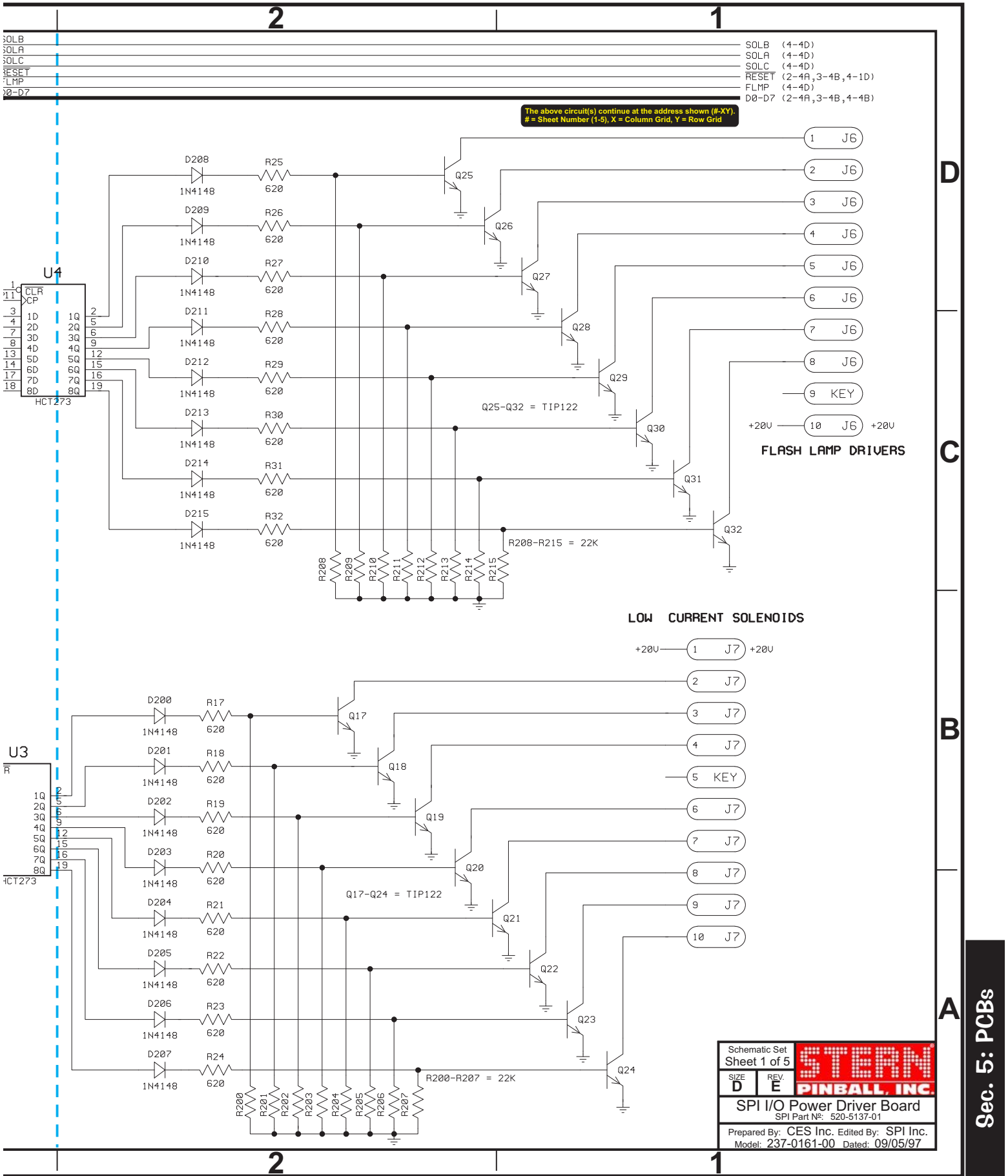
Auxiliary In & Out:
J2-8 CMOS Outputs sometimes used for a printer interface.
J3-8 CMOS Inputs general purpose inputs.

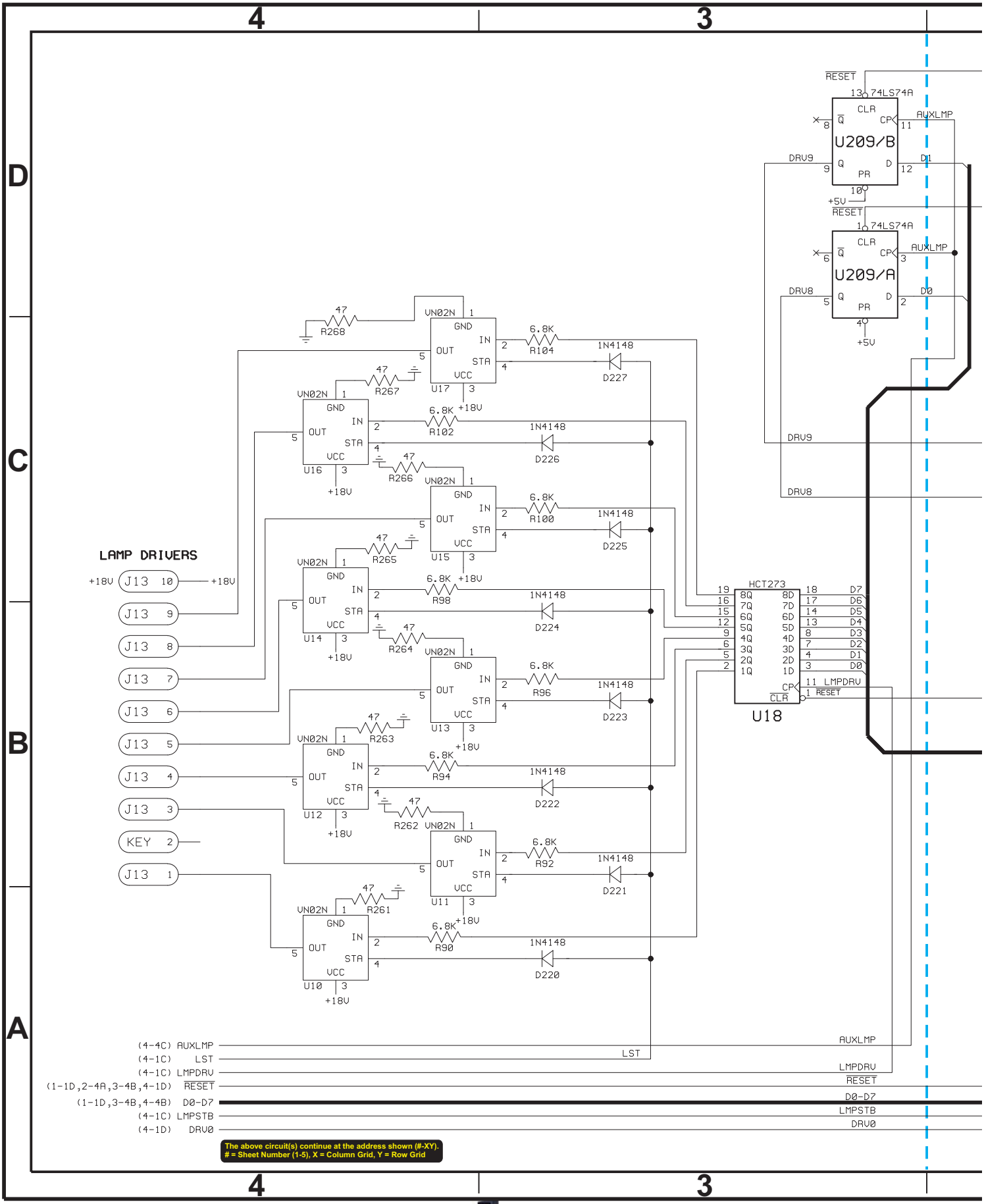
Lamp Matrix:
J12 has 10 low side drivers for the lamp strobes which consist of **19N06L MOSFETS**. Only one lamp strobe should be low at any time. Again the scanning of the lamp strobes keeps the **I/O** from resetting. **J13** has 8 high side drivers with each having a status indicator. All the status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

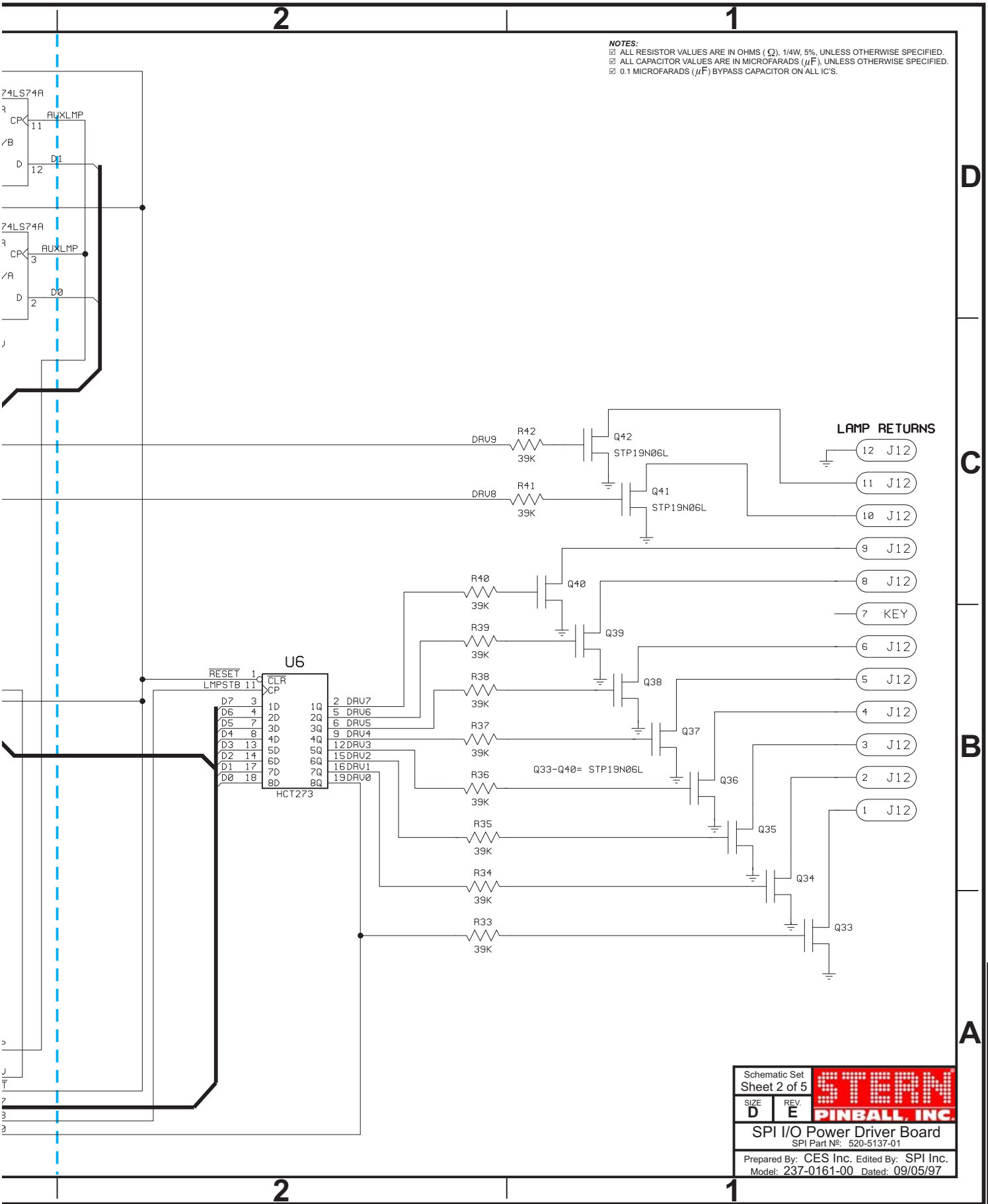
General Illumination (G.I.) Lights:
J15 has 6v AC switched on & off by a relay on the **I/O Board**. The relay is controlled by **Q200** which supplies power to the 24v coil winding to activate the relay. There are 4 taps on **J15** each fused at 5A for this 6v AC source.

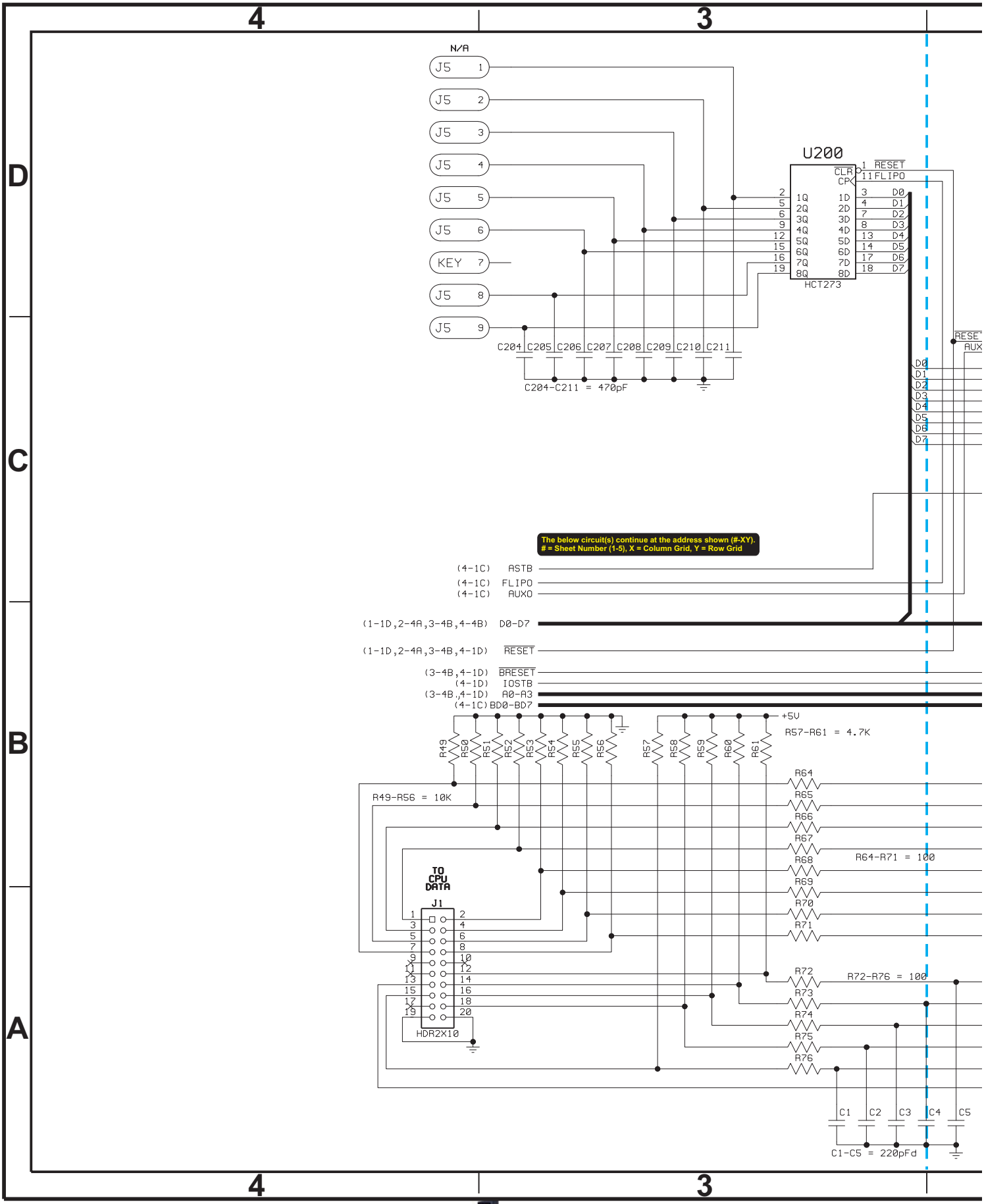


NOTES:
- ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
- ☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
- ☑ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.


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
J6
KEY
+20V
FLASH LAMP DRIVERS
LOW CURRENT SOLENOIDS
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

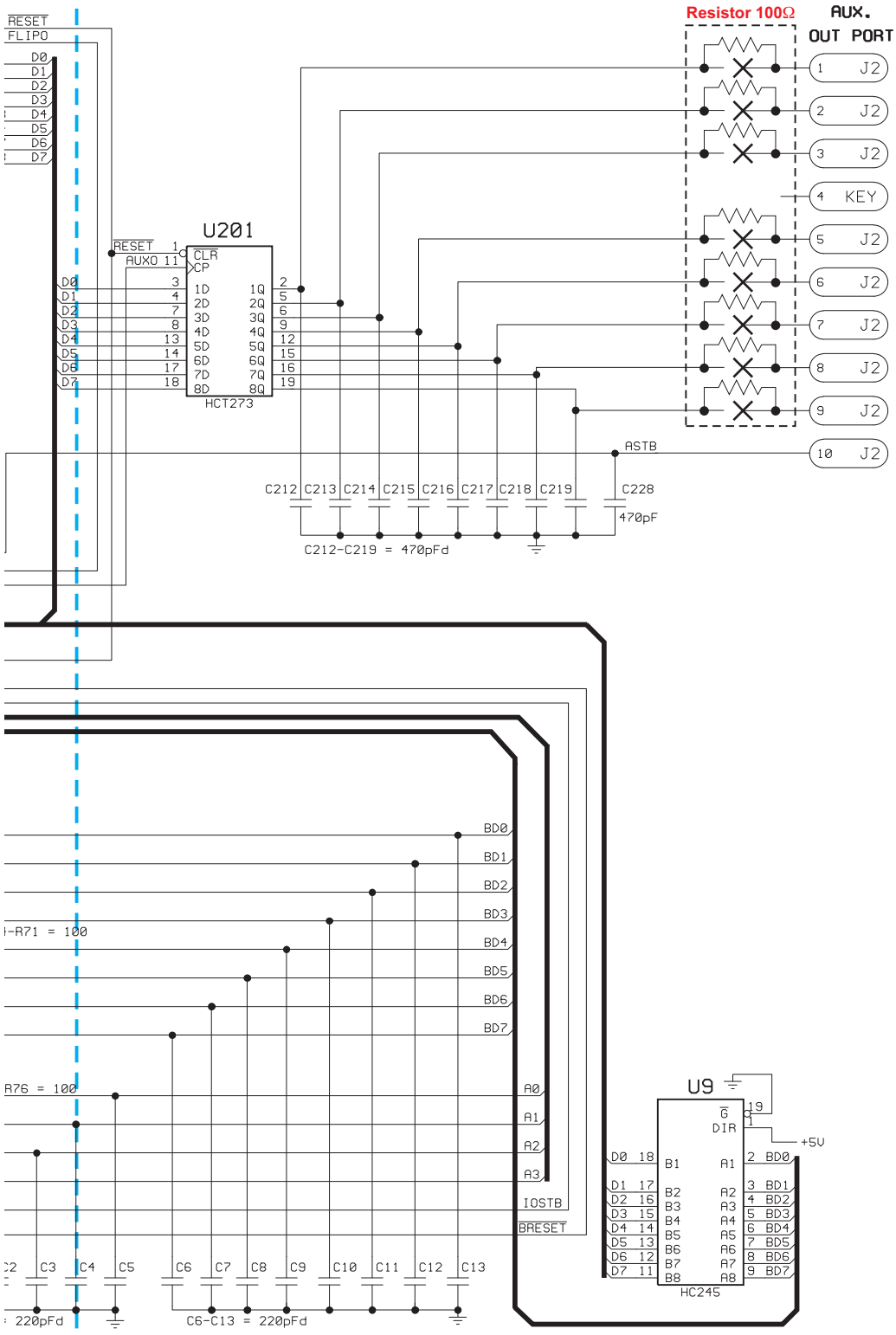

4
3
D
C
B
A
LAMP DRIVERS
+18V
J13 10
J13 9
J13 8
J13 7
J13 6
J13 5
J13 4
J13 3
KEY 2
J13 1
R268
R267
R266
R265
R264
R263
R262
R261
47
6.8K
R104
R102
R100
R98
R96
R94
R92
R90
1N4148
D227
D226
D225
D224
D223
D222
D221
D220
UN02N
GND
IN
OUT
STA
VCC
U17
U16
U15
U14
U13
U12
U11
U10
HCT273
U18
74LS74A
U209/B
U209/A
CLR
PR
RESET
AUXLMP
DRV9
DRV8
D1
D0
D7
D6
D5
D4
D3
D2
LMPDRV
(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
DRV7
DRV6
DRV5
DRV4
DRV3
DRV2
DRV1
DRV0
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
J12
KEY
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
1 RESET
11 FLIPO
1Q 2Q 3Q 4Q 5Q 6Q 7Q 8Q
1D 2D 3D 4D 5D 6D 7D 8D
D0 D1 D2 D3 D4 D5 D6 D7
HCT273
C204 C205 C206 C207 C208 C209 C210 C211
C204-C211 = 470pF
RESE
AUX
The below circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
(4-1C) ASTB
(4-1C) FLIPO
(4-1C) AUXO
(1-1D,2-4A,3-4B,4-4B) D0-D7
(1-1D,2-4A,3-4B,4-1D) RESET
(3-4B,4-1D) BRESET
(4-1D) IOSTB
(3-4B,4-1D) A0-A3
(4-1C) BD0-BD7
+5V
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
TO CPU DATA
J1
HDR2X10
R72 R73 R74 R75 R76
R72-R76 = 100
C1 C2 C3 C4 C5
C1-C5 = 220pFd

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

DATE	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

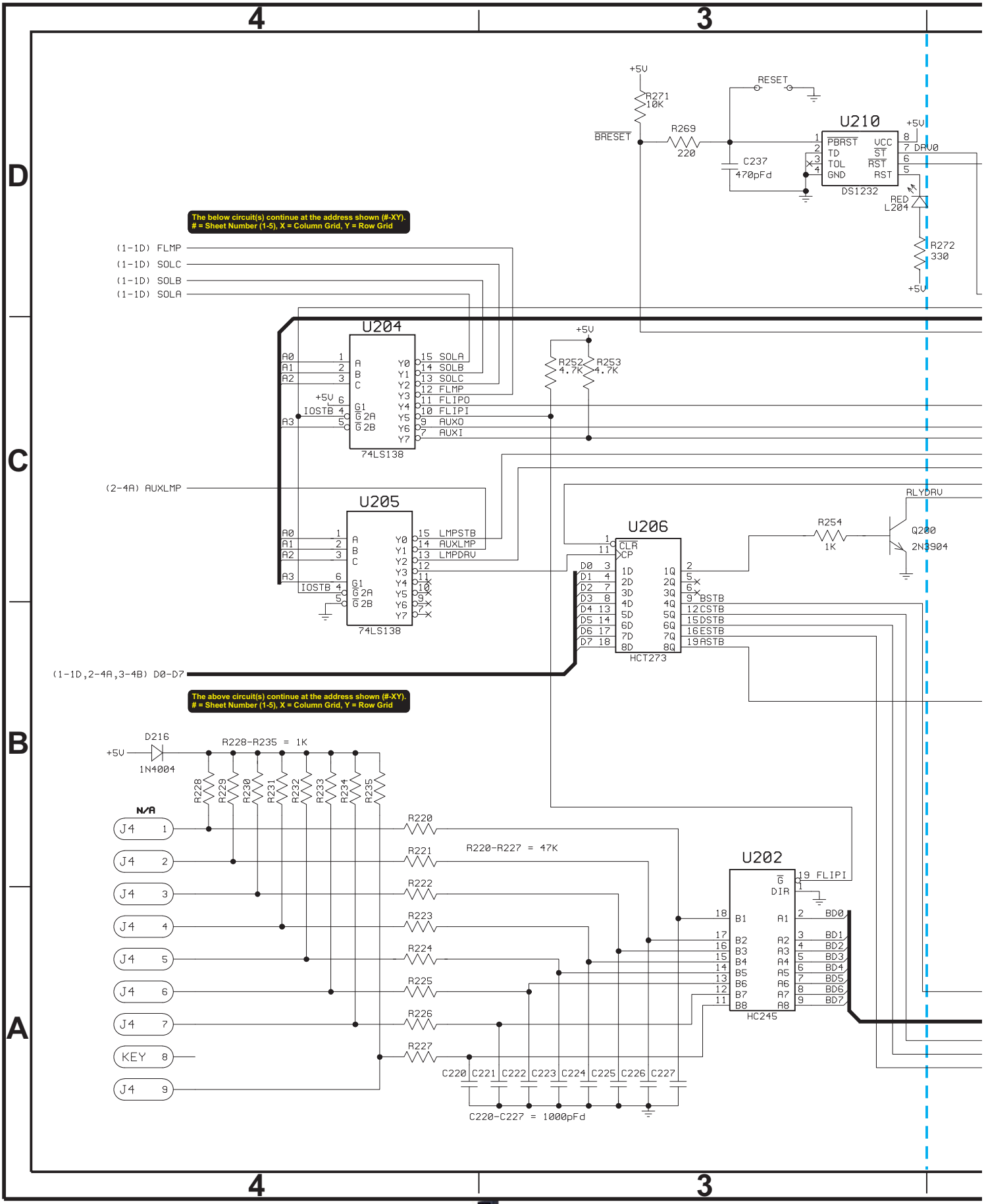


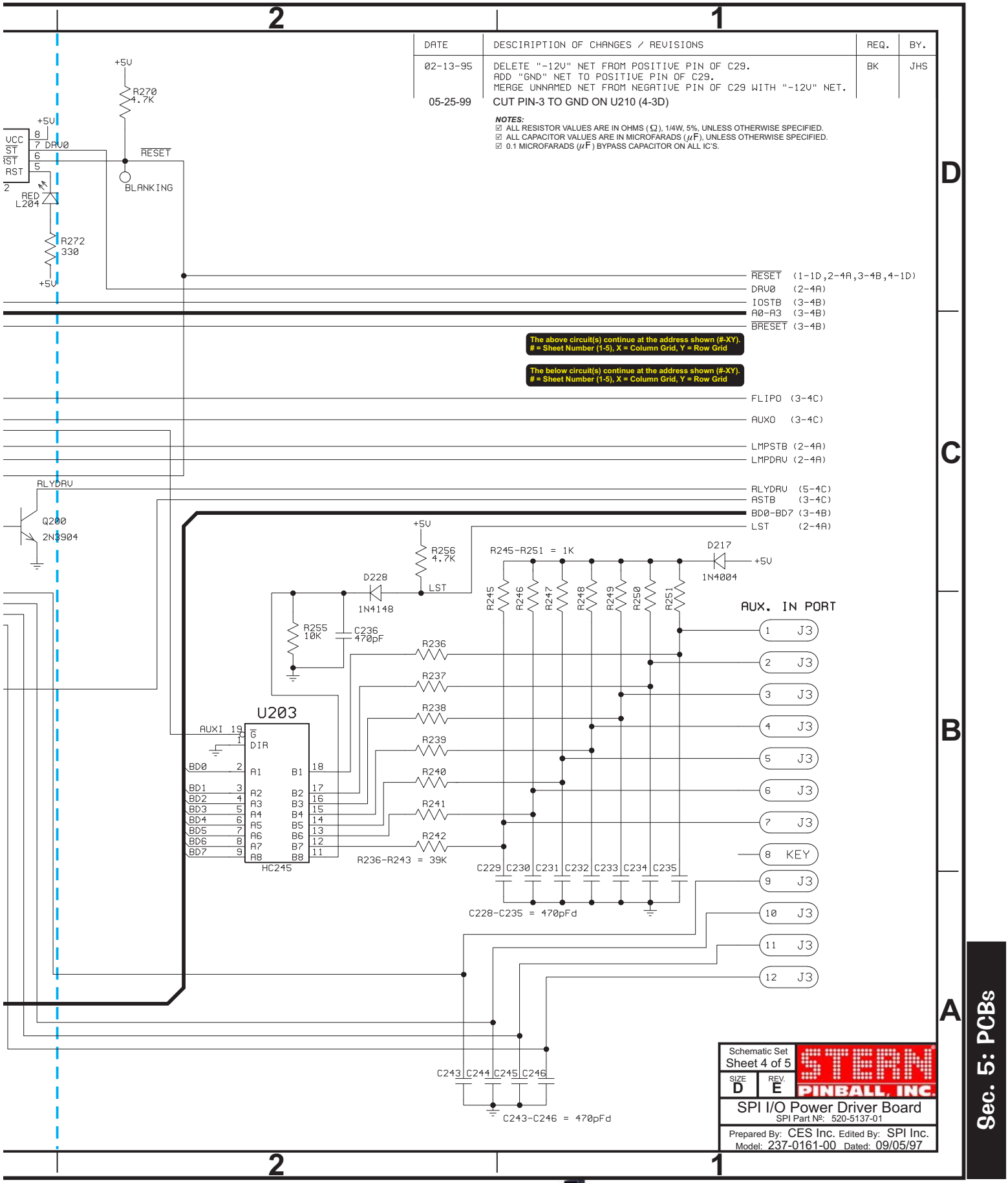
Schematic Set	Sheet 3 of 5
SIZE	D
REV.	E

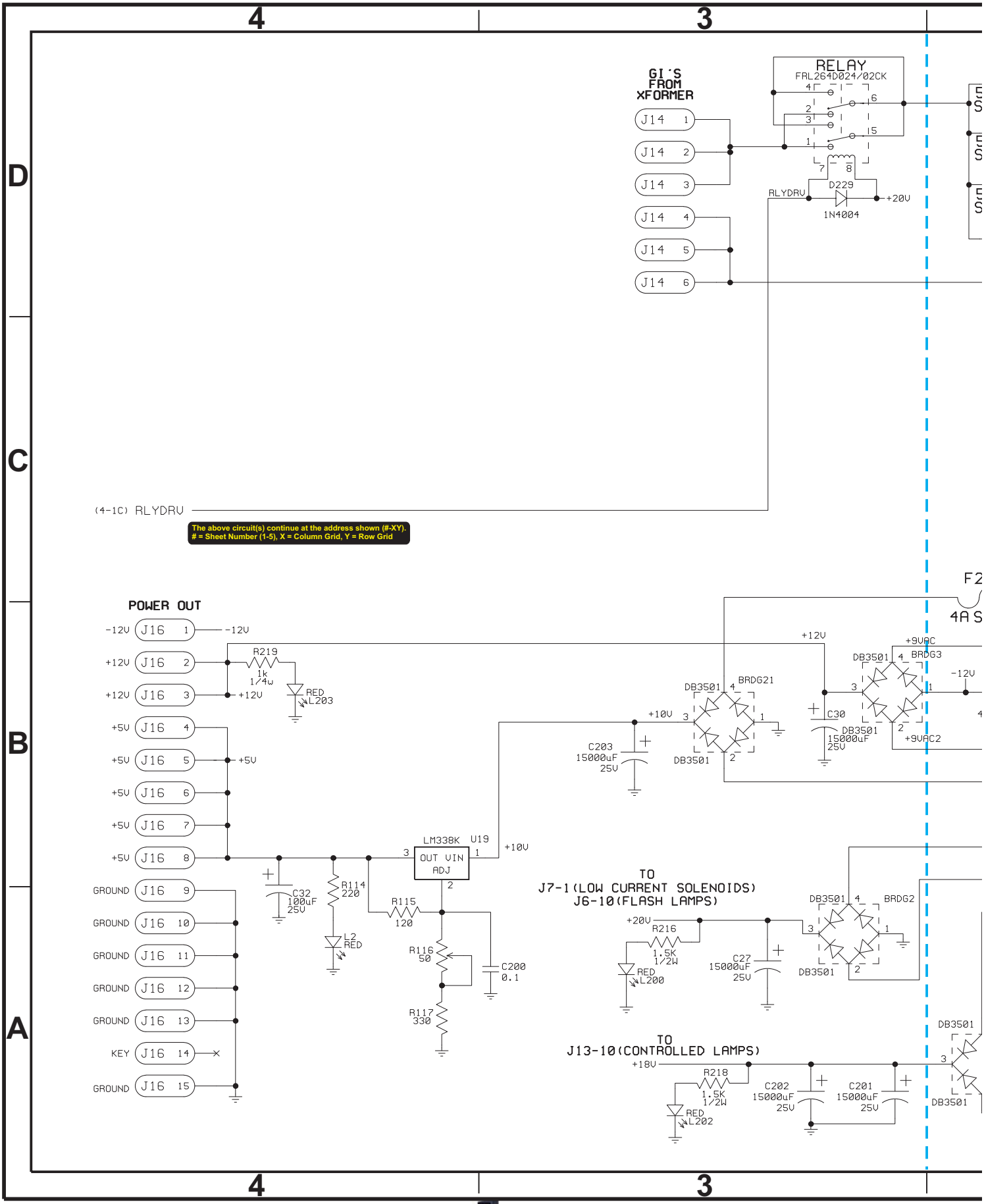
STERN PINBALL, INC.

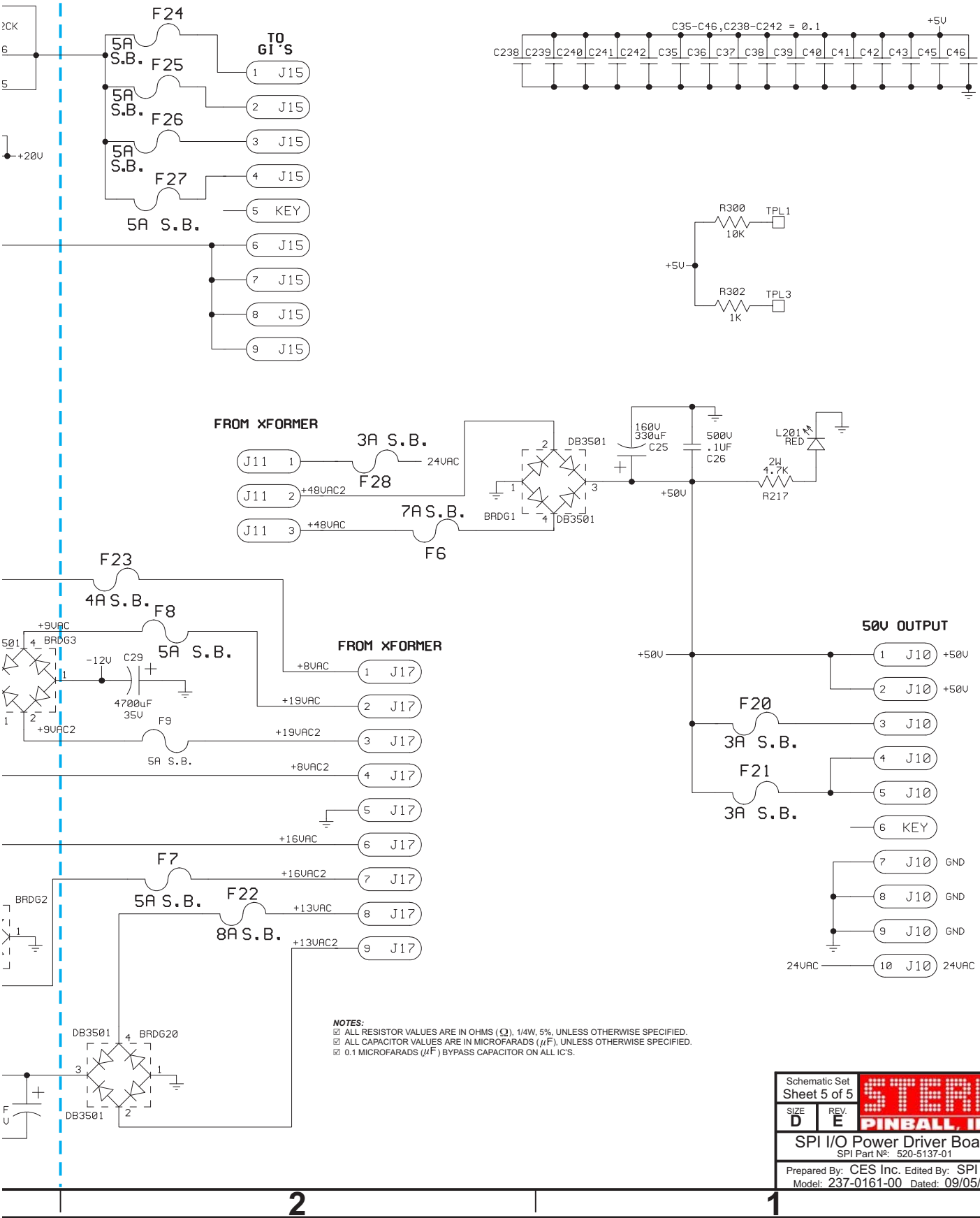
SPI I/O Power Driver Board
SPI Part Nº: 520-5137-01

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
RLYDRV
R254
1K
Q200
2N3904
(1-1D,2-4A,3-4B) D0-D7
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
D216
+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


2
1
D
C
B
A
DATE
DESCRIPTION OF CHANGES / REVISIONS
REQ.
BY.
02-13-95
DELETE "-12V" NET FROM POSITIVE PIN OF C29.
ADD "GND" NET TO POSITIVE PIN OF C29.
MERGE UNNAMED NET FROM NEGATIVE PIN OF C29 WITH "-12V" NET.
BK
JHS
05-25-99
CUT PIN-3 TO GND ON U210 (4-3D)
NOTES:
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.
+5V
R270
4.7K
RESET
BLANKING
RED
L204
R272
330
RESET (1-1D,2-4A,3-4B,4-1D)
DRV0 (2-4A)
IOSTB (3-4B)
A0-A3 (3-4B)
BRESET (3-4B)
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
The below circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
FLIP0 (3-4C)
AUX0 (3-4C)
LMPSTB (2-4A)
LMPDRV (2-4A)
RLYDRV
Q200
2N3904
RLYDRV (5-4C)
ASTB (3-4C)
BD0-BD7 (3-4B)
LST (2-4A)
R256
4.7K
D228
1N4148
R255
10K
C236
470pF
R245-R251 = 1K
D217
1N4004
R245
R246
R247
R248
R249
R250
R251
AUX. IN PORT
U203
HC245
AUXI
DIR
BD0
BD1
BD2
BD3
BD4
BD5
BD6
BD7
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
J3
KEY
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
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
F2
4A S



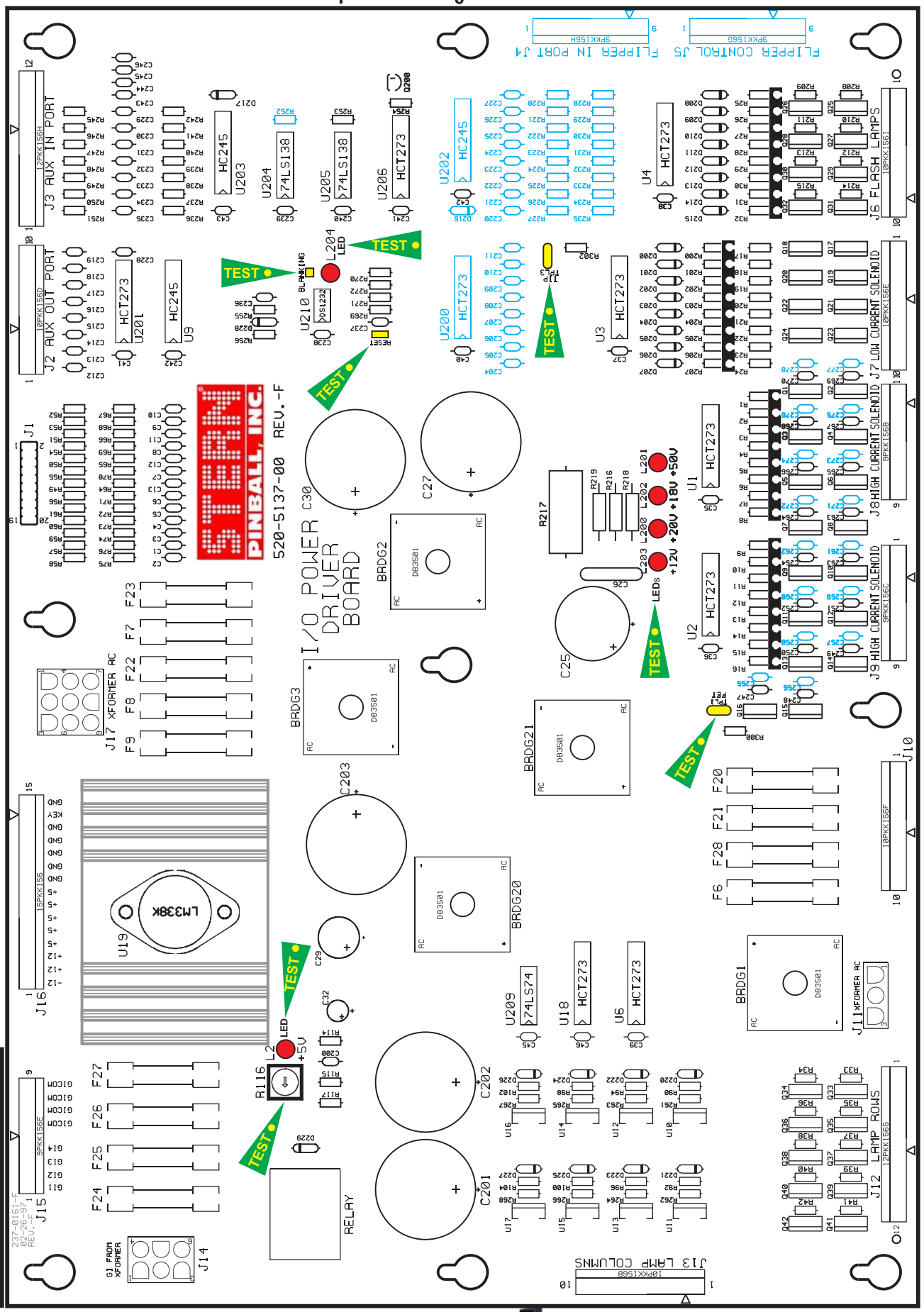
NOTES:
- ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
- ☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
- ☑ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.

Schematic Set	Sheet 5 of 5
SIZE D	REV. E

STERN PINBALL, INC.

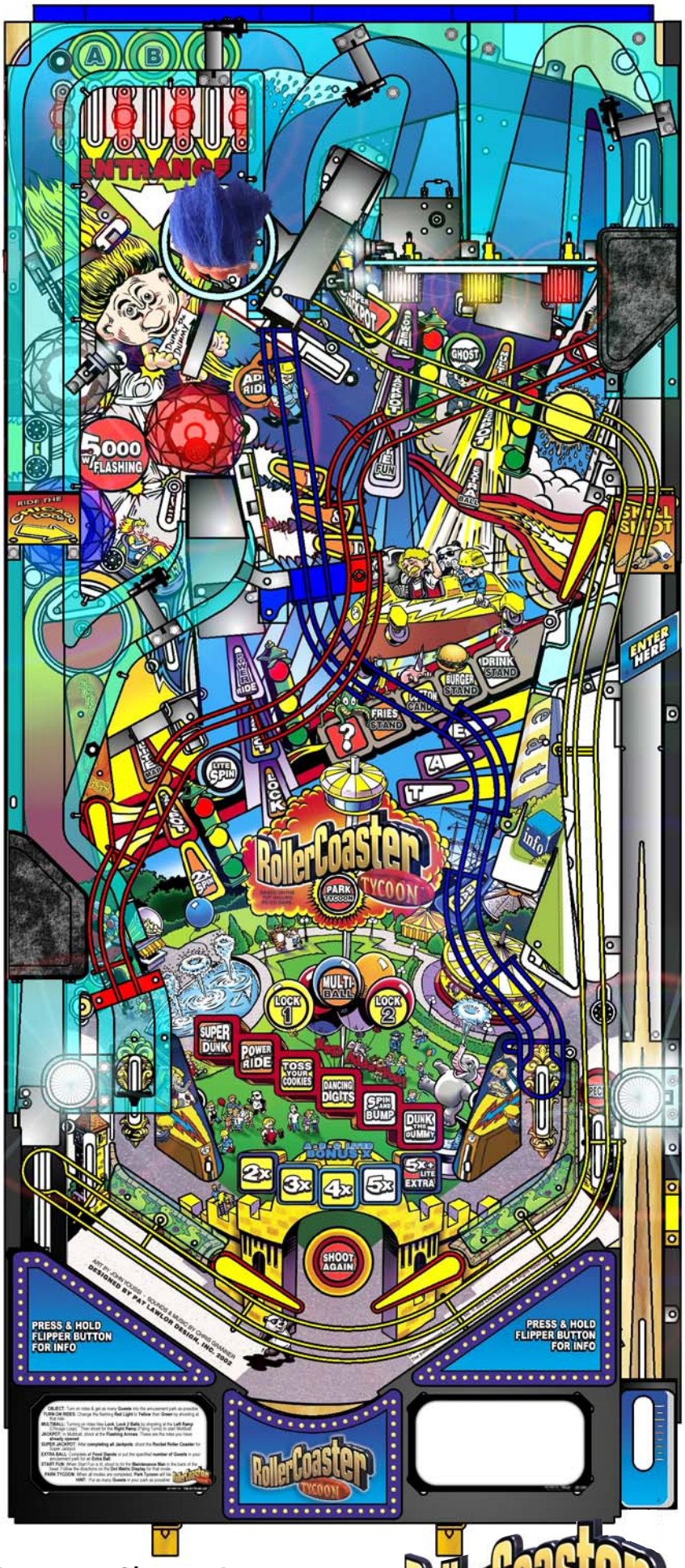
SPI I/O Power Driver Board
SPI Part №: 520-5137-01

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
520-5137-00 REV.-F
I/O POWER DRIVER BOARD
PINBALL, INC.
Actual Board Size 15.698" X 11"

I/O Power Driver Board Parts

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	**1**	**520-5137-01**	**I/O Power Driver Board**	**Complete PCB Assembly**
01	5	112-5000-00	BRDG1, BRDG2, BRDG3, BRDG20, BRDG21	DB3501
02	13	125-5030-00	C1, C2, C3>C6, C7, C8, C9>C10, C11, C12	220pF, (221), Cap.
03	1	125-5033-00	C25	100uF, 150v, Radial Lytic Cap.
04	1	125-5035-00	C26	.1UF, 500v, Ceramic Disk Cap.
05	5	125-5036-00	C27, C30, C201, C202, C203	15000uF, 25v, Radial Lytic Cap.
06	1	125-5034-00	C29	4700uF, 35v, Radial Lytic Cap.
07	1	125-5032-00	C32	100uF, 25v, Radial Lytic Cap.
08	17	125-5031-00	C35, C36, C37, C38, C39, C40, C41, C42, C43, C45, C46, C200, C238, C239, C240, C241, C242	0.1uF, (104), Cap.
09	22	125-5028-00	C212>C219, C228>C237, C243>C246 (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	3	200-5000-08	F21, F20, F28	3A 250v S.B. Fuse
19	1	200-5000-05	F22	8A 250v S.B. Fuse
20	1	200-5000-06	F23	4A 250v S.B. Fuse
21	1	045-5015-01	J1	20-Pin, 0.1 Dual Row Header
22	1	045-5014-01	J2 (Key Pin-4), J6 (Key Pin-9), J7 (Key Pin-5) J10 (Key Pin-6), J13 (Key Pin-2)	10PKK156
23	1	045-5015-00	J3 (Key Pin-8)	12PKK156
	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	1K Ω 1/4W Res.
49	0	n/a	(R220>R227: NS)	
50	9	121-5009-00	R245>R251, R254, R302 (R228>R235: NS)	1K Ω 1/4W Res.
51	8	121-5032-00	R261, R262, R263, R264, R265, R266, R267, R268	47 Ω 1/4W Res.
52	1	190-5002-00	RELAY	FRL264D024/02CK Relay
53	2	n/a	TPL1, TPL3	*Test Point Wire (24ga.) Loops*
54	8	100-5012-00	U1, U2, U3, U4, U6, U18, U201, U206 (U200: NS)	74HCT273
55	1	110-0058-00	U9	74LS245
56	1	100-5023-00	U210	DS1232
57	8	110-0089-00	U10, U11, U12, U13, U14, U15, U16, U17	VN02N
58	1	100-0356-00	U19	LM338K
59	1	n/a	U19	Heatsink (5v Reg.)
60	1	100-0338-00	U203 (U202: NS)	74HC245
61	2	100-0148-00	U204, U205	74LS138
62	1	100-0037-00	U209	74LS74
63	1	n/a	BLANKING, RESET	*Test Points*


A
B
C
ENTRANCE
5000
FLASHING
GHOST
DRINK STAND
BURGER STAND
FRIES STAND
ENTER HERE
LITE SPIN
RollerCoaster TYCOON
PARK TYCOON
MULTI-BALL
LOCK 1
LOCK 2
SUPER DUNK
POWER RIDE
TOSS YOUR COOKIES
DANCING DIGITS
SPIN AND BUMP
DUNK THE GUMMY
2x
3x
4x
5x
5x LITE EXTRA
SHOOT AGAIN
PRESS & HOLD FLIPPER BUTTON FOR INFO
PRESS & HOLD FLIPPER BUTTON FOR INFO
DESIGNED BY PAT LAWLOR DESIGN, INC. 2005
RollerCoaster TYCOON

Your Notes

CPU Section:
The **CPU** is a **68B09E** (**U209**) with up to 8 MBytes of **CPU** *Code Space* (**U210**). The **CPU** code is bank selected by the use of **U211** and each bank consists of 16 KBytes. 8 KBytes of **RAM** (**U212**) is available to the **CPU**. The RAM is battery backed and has a write protected area. Battery back up is accomplished by **3-AA Cells** (**BAT1**) which have a **TEST POINT VBATT** to check the battery voltage status. The write protected area consists of 512 Bytes used for storing game settings. This section of **RAM** can only be written to when the coin door is open. The Coin Door switch comes into the **CPU** on **CN6-12** and is fed into the address decoding **PAL U213**. When this memory protect signal is low writes to the protected **RAM** area are prohibited. Address decoding for the system is accomplished by one **PAL U213** and one 1-of-8 decoder **U214**.

A watchdog is used to monitor the **CPU** and the 5v supply. If the 5v supply is below 4.75 the watchdog will hold the **CPU**/**Sound Board** & **I/O Board** in *reset*. The watchdog must be fed at a rate of ***250ms*** or faster. The signal used to feed the watchdog comes from the EPROM Bank select signal used to load **U211**. The **CPU** has a timer interrupt used as a heartbeat for the system this signal comes from counter **U2**. The clock for this counter is the **CPU Q CLOCK**. Clearing the timer interrupt is done by reading the ***DIP Switch***. The timer interrupt can be observed at **TEST POINT FIRQ**. In normal operation **"FIRQ"** should be toggling at a rate of *976Hz*.

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

Switches:
The Switch Matrix consists of eight (8) **2N3904** Transistors(**Q1-Q8**) which pull one of 8 strobes 'low' to *activate* a Single Column of switches. The *Switch Return Signals* are fed into **CN7** [SWITCH ROWS] and are highly filtered and compared to a 2.5v *reference voltage*. The *Switch Return Voltage* must be below 2.5v to make a *Valid Switch Closure*. If *false switches* are appearing, check that none of the **2N3904** Transistors are permanently pulling the *strobe line low*. Only one strobe from **CN5** [SWITCH COLUMNS] should be *low at any time*. **CN6** [DEDICATED SWITCH IN] is a *Dedicated Bank of Input Switches*. Switches connected to **CN6** are connected to ground instead of a strobe and may be read at any time.

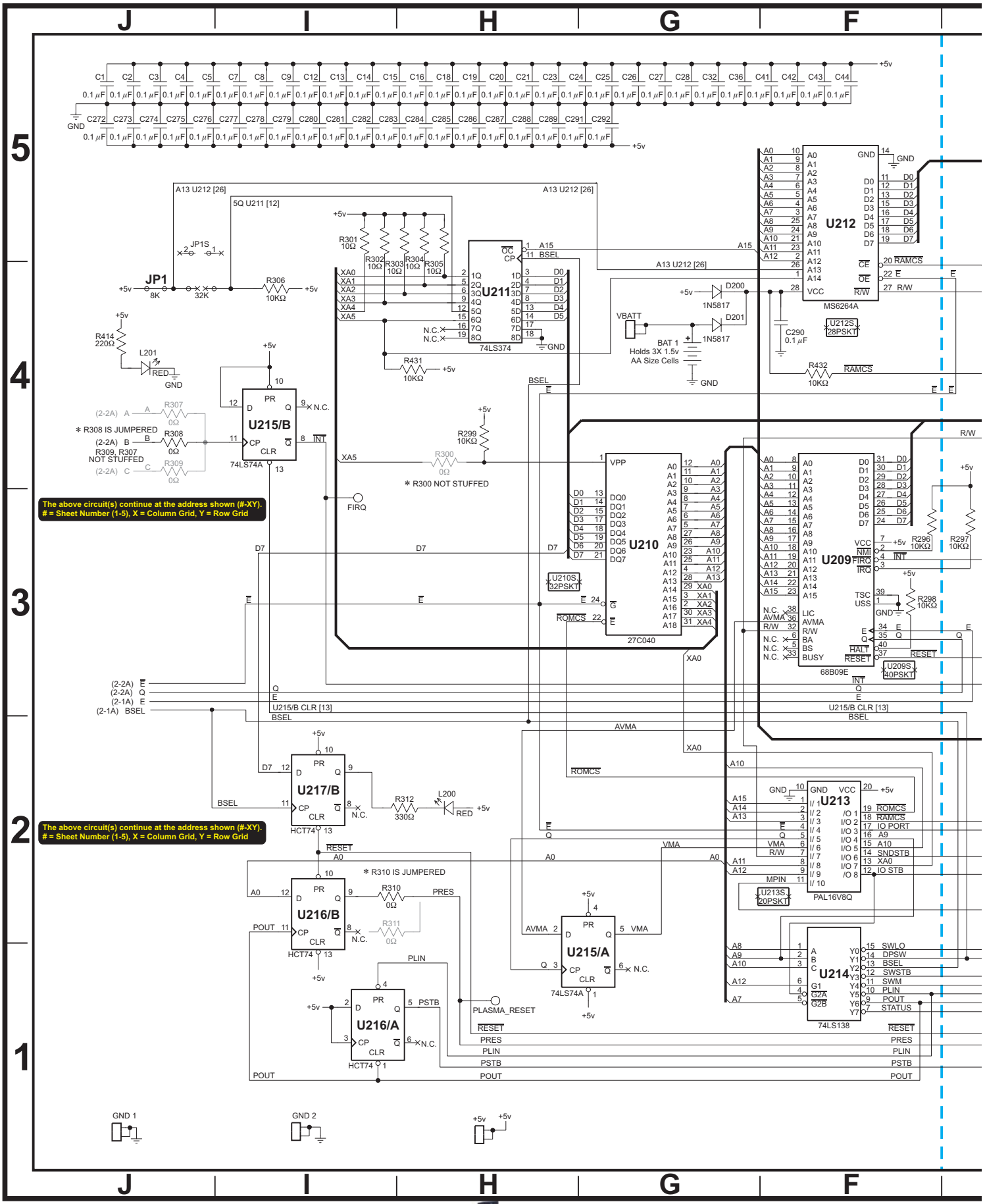
Plasma Interface:
The data path for communication to and from the **Plasma Controller Board** is 8 bits wide. There are separate *Input* and *Output Busses*. The *Input Bus* from the Plasma Controller to the **CPU**/**Sound Board** comes in on **CN8** [PLASMA CONTROL]-**Pins 3-10** and is fed into **U200** for input to the **CPU**'s *Data Bus*. Data going out to the controller comes from the **CPU**'s *Data Bus* through **U201** and onto **CN8-Pins 11-18**. Status back from the Plasma Controller comes in on **CN8-Pins 22-26** and is fed into **U202** for input to the **CPU**'s *Data Bus*. Two control signals that go out to the Plasma Controller are **PRES** [PLASMA RESET] and **CN8-Pin 19** [**PSTB** - *Plasma Strobe*]. The Plasma Reset is software controllable through **U216**/**B** and also has a test point "Plasma Reset". The *Plasma Strobe Signal* to the controller is generated from **U216**/**A** and is *used to latch data* into the Plasma Controller.

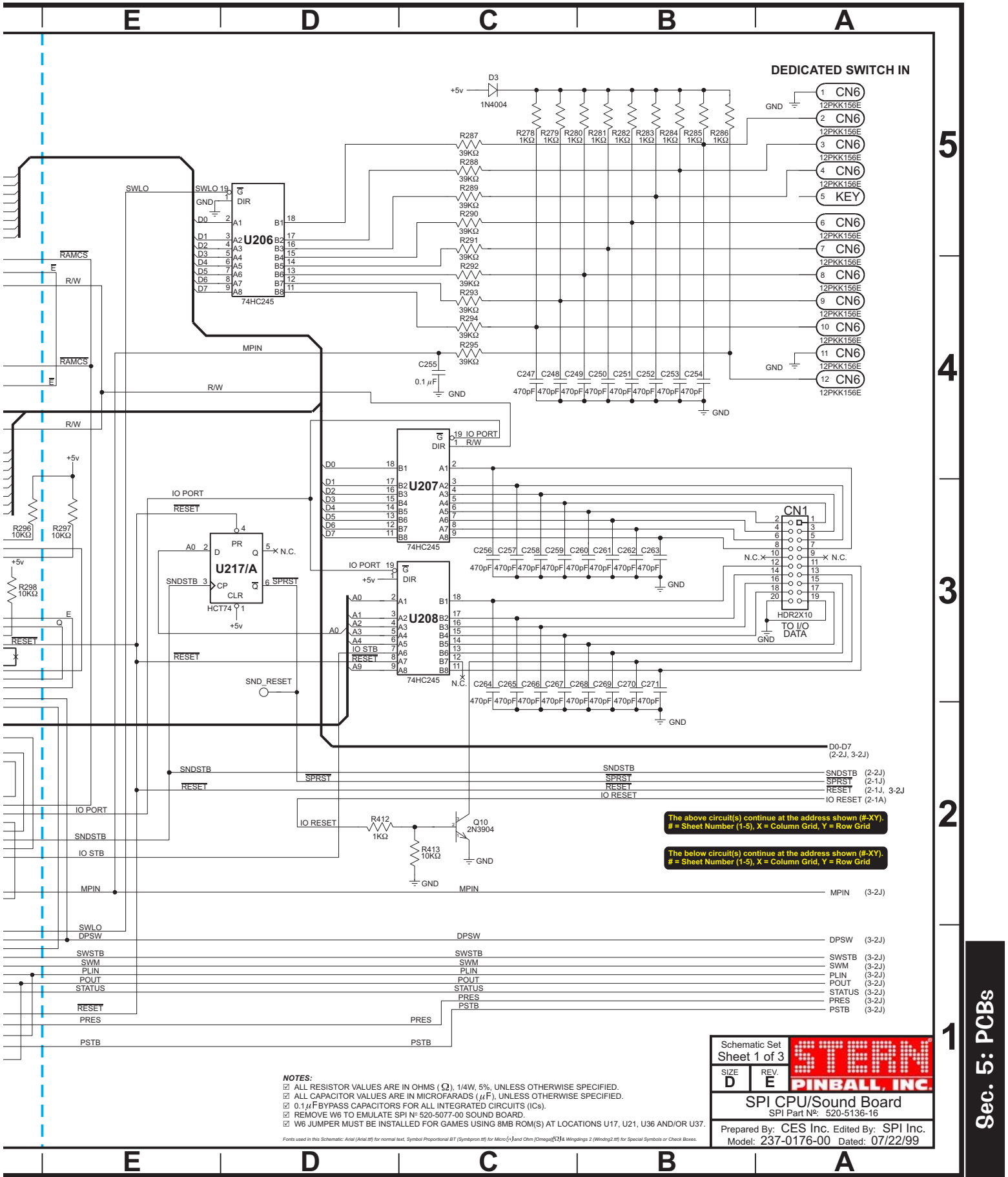
Sound Section:
The audio section consists of a **BSMT SOUND CHIP U9** Sound (Voice) EPROMs (**U17 U21 U36 U37**) **68B09E U6** and Sound Code **EPROM U7**. The **BSMT** latches sound EPROM addresses in **U13** & **U12** for output to the Sound EPROMs. Sound Data from the EPROMs is read through **U19** to the **BSMT**. The EPROMs are bank selected by **U22**. When the **BSMT** has sound data to be played out to the speakers it loads 16 bits into a 16 bit shift register made up of **U24** & **U23**. The data stream from the shift register is serially shifted into a stereo 16 bit *Digital to Analog Converter* (**DAC, U26**). When the system is operating properly the ws (word select) input of the **DAC** will be toggling. The ws input is used to latch the right and left channel sound data into the **DAC**. If the ws line is not oscillating no analog signal will come out of the **DAC**. The **DAC** outputs are a controlled current source. These outputs are converted to a voltage by an operational amplifier **U30** to form the analog signal. **TEST POINTS AOR** and **AOL** are the outputs of the operational amplifier. These outputs are then fed directly into the power amplifiers (**TDA2030A**) or optionally into an analog volume control chip **U35** for a potentiometer volume control. The analog section has its own +5v & -5v derived from **VR1** & **VR2**. These separate supply voltages are for the **DAC U26** Operational Amplifier **U30** and analog volume control **U35**.

Sound calls are made from the **CPU's 68B09E U209** to the sound section by latching data into **U5**. The sound section's **CPU 68BO9E (U6)** reads in this data and handles the interfacing to the **BSMT**.

Other Test Points:
E & **Q** - The **CPU** signals for both **68B09E** processors. Should be at 2Mhz with **Q** leading **E** by ***500 nsec***.
24Mhz - The oscillator used for the **BSMT** & derivation of **E** & **Q**.
SND-FIRQ - The sound sections **CPU Interupt**.
6Mhz - This clock is generated internally on the **BSMT** and is used for shifting the data samples into th **DAC**.

W6 Jumper - This jumper must be installed for games that use **8MB** Sound EPROMs (**U17 U21 U36 U37**). For games which use **4MB** Sound EPROMs this jumper is not installed but will operate on boards with **W6** installed.


J
I
H
G
F
5
4
3
2
1
U212
MS6264A
U211
74LS374
U210
27C040
U209
68B09E
U215/B
74LS74A
U217/B
HCT74
U216/B
U216/A
U215/A
U213
PAL16V8Q
U214
74LS138
JP1
JP1S
R306 10KΩ
R414 220Ω
L201
RED
R307 0Ω
R308 0Ω
R309 0Ω
R310 0Ω
R311 0Ω
R312 330Ω
L200
R296 10KΩ
R297 10KΩ
R298 10KΩ
R299 10KΩ
R300 0Ω
R301 10Ω
R302 10Ω
R303 10Ω
R304 10Ω
R305 10Ω
R431 10KΩ
R432 10KΩ
D200 1N5817
D201 1N5817
BAT 1
Holds 3X 1.5v
AA Size Cells
C290 0.1 µF
U212S 28PSKT
U210S 32PSKT
U209S 40PSKT
U213S 20PSKT
* R308 IS JUMPERED
R309, R307 NOT STUFFED
* R300 NOT STUFFED
* R310 IS JUMPERED
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
A13 U212 [26]
5Q U211 [12]
U215/B CLR [13]
BSEL
AVMA
ROMCS
RESET
PRES
PLIN
PSTB
POUT
PLASMA_RESET
FIRQ
R/W
GND 1
GND 2



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

NOTES:

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

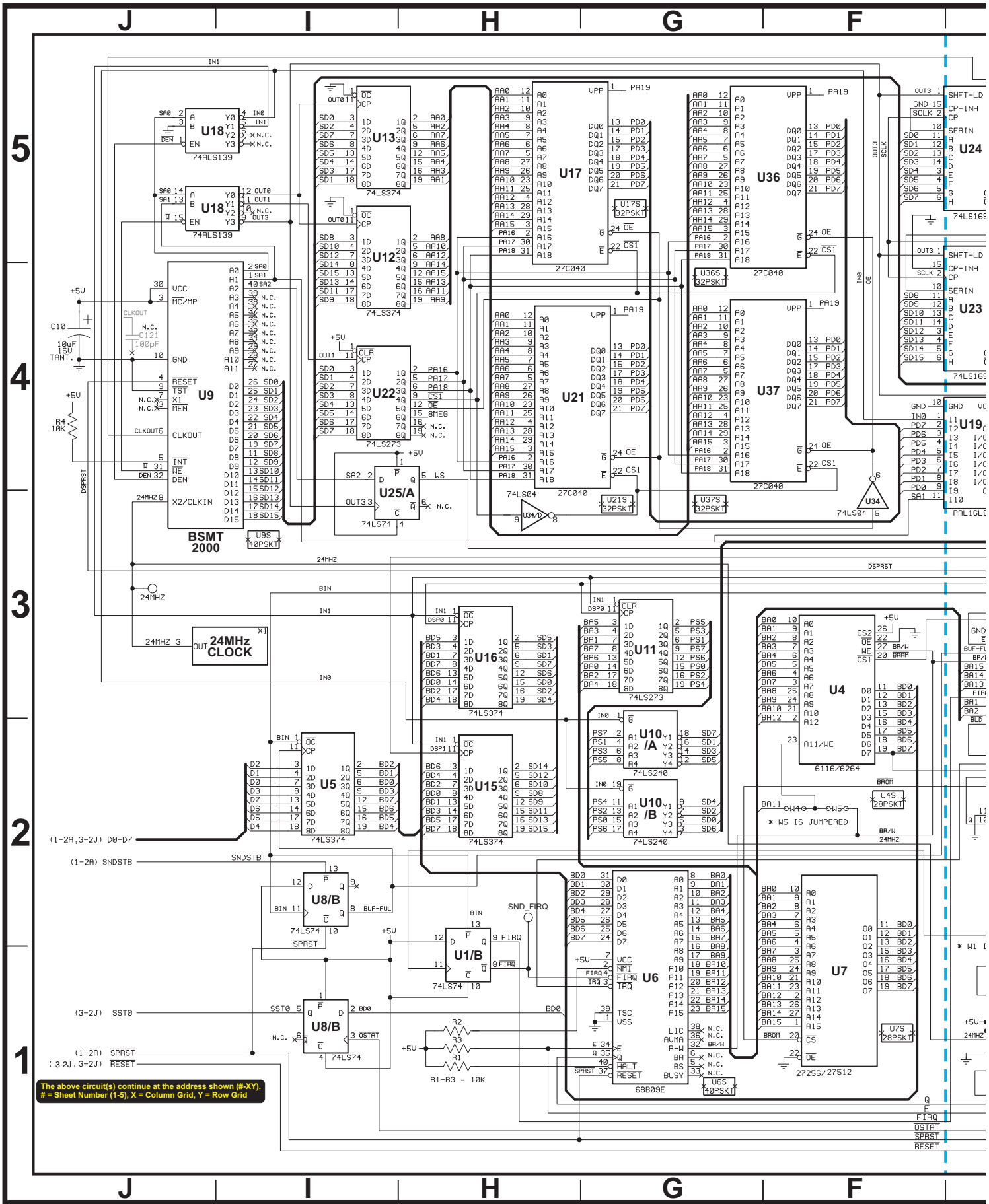
Fonts used in this Schematic: Arial (Arial.ttf) for normal text, Symbol Proportional BT (Symbpron.ttf) for Micro (μ) and Ohm (Omega) (Ω) & Wingdings 2 (Windng2.ttf) for Special Symbols or Check Boxes.

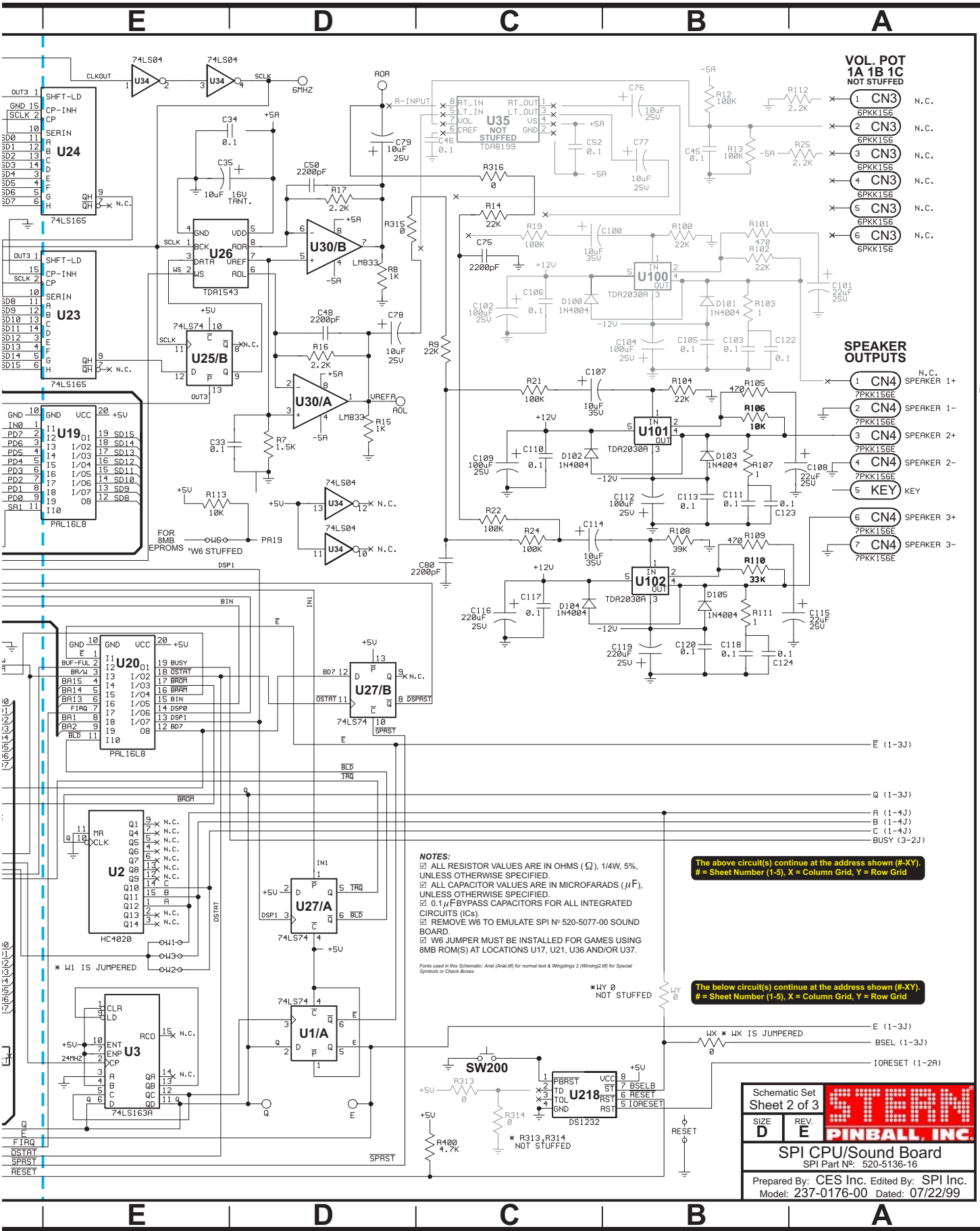
Schematic Set	Sheet 1 of 3
SIZE	D
REV.	E

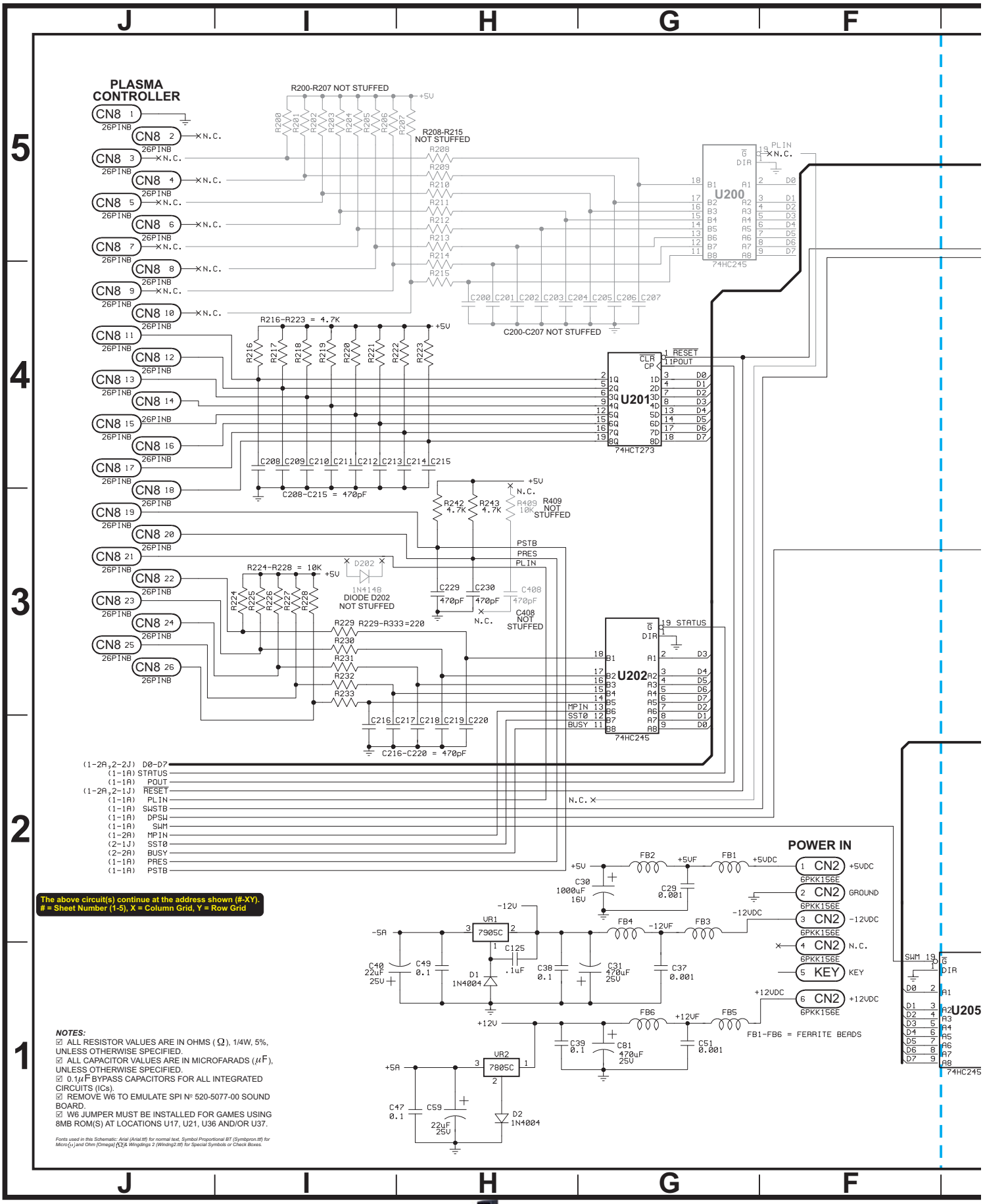
STERN PINBALL, INC.

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

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


J
I
H
G
F
5
4
3
2
1
U18
74ALS139
U13
74LS374
U12
74LS374
U17
27C040
U36
27C040
U24
74LS165
U23
74LS165
U19
PAL16L8
U9
BSMT 2000
U22
74LS273
U25/A
74LS74
U21
27C040
U37
27C040
U34
74LS04
U16
74LS374
U11
74LS273
U10 /A
74LS240
U10 /B
74LS240
U4
6116/6264
U5
74LS374
U15
74LS374
U8/B
74LS74
U1/B
74LS74
U6
68B09E
U7
27256/27512
24MHZ CLOCK
IN1
IN0
BIN
24MHZ
DSPRST
SNDSTB
SND_FIRQ
FIRQ
SPRST
RESET
SST0
BD0
BUF-FUL
(1-2A,3-2J) D0-D7
(1-2A) SNDSTB
(3-2J) SST0
(1-2A) SPRST
(3-2J) RESET
R1-R3 = 10K
* W5 IS JUMPERED
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid

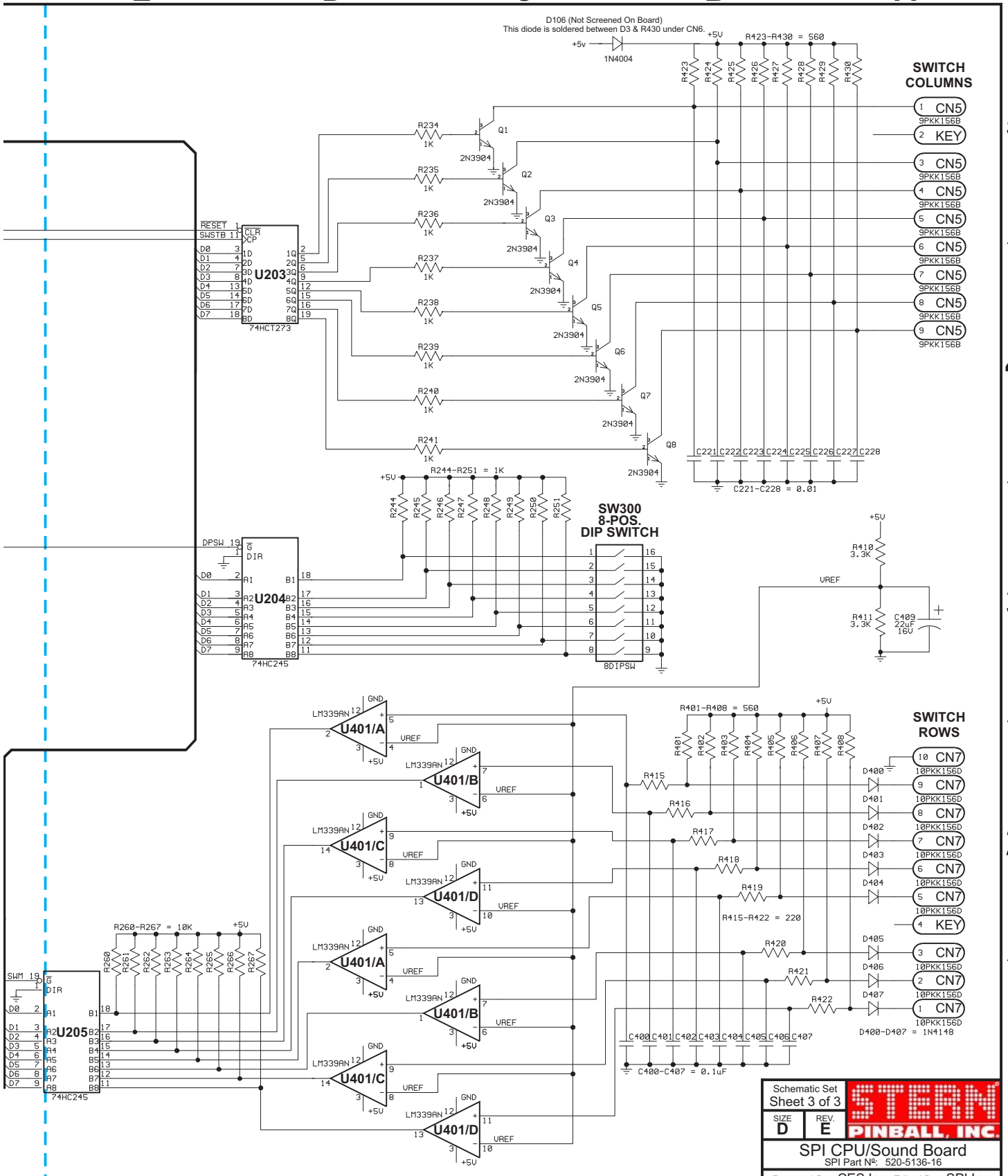

VOL. POT
1A 1B 1C
NOT STUFFED
SPEAKER OUTPUTS
U35 NOT STUFFED TDA8199
U24
U23
U26 TDA1543
U30/B
U30/A
U25/B
U19 PAL16L8
U20 PAL16L8
U27/B
U27/A
U1/A
U2 HC4020
U3 74LS163A
U100 TDA2030A
U101 TDA2030A
U102 TDA2030A
U218 DS1232
SW200
NOTES:
☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).
☑ REMOVE W6 TO EMULATE SPI Nº 520-5077-00 SOUND BOARD.
☑ W6 JUMPER MUST BE INSTALLED FOR GAMES USING 8MB ROM(S) AT LOCATIONS U17, U21, U36 AND/OR U37.
The above circuit(s) continue at the address shown (#-XY). # = Sheet Number (1-5), X = Column Grid, Y = Row Grid
The below circuit(s) continue at the address shown (#-XY). # = Sheet Number (1-5), X = Column Grid, Y = Row Grid
Schematic Set Sheet 2 of 3
SIZE D REV. E
STERN PINBALL, INC.
SPI CPU/Sound Board
SPI Part №: 520-5136-16
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0176-00 Dated: 07/22/99



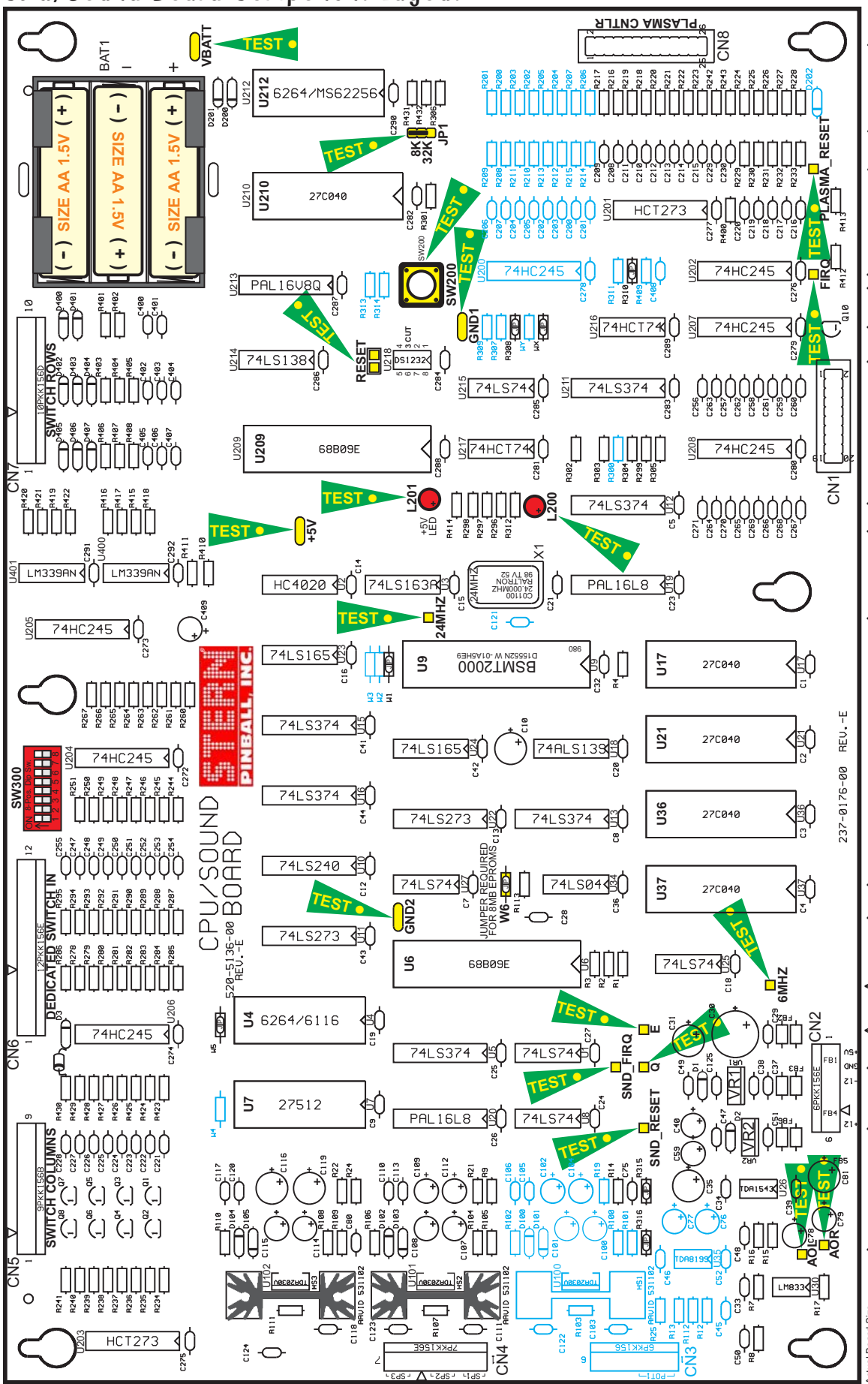
NOTES:

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

Fonts used in this Schematic: Arial (Arial.ttf) for normal text, Symbol Proportional BT (Symbpron.ttf) for Micro(μ) and Ohm (Omega) (Ω) & Wingdings 2 (Windng2.ttf) for Special Symbols or Check Boxes.

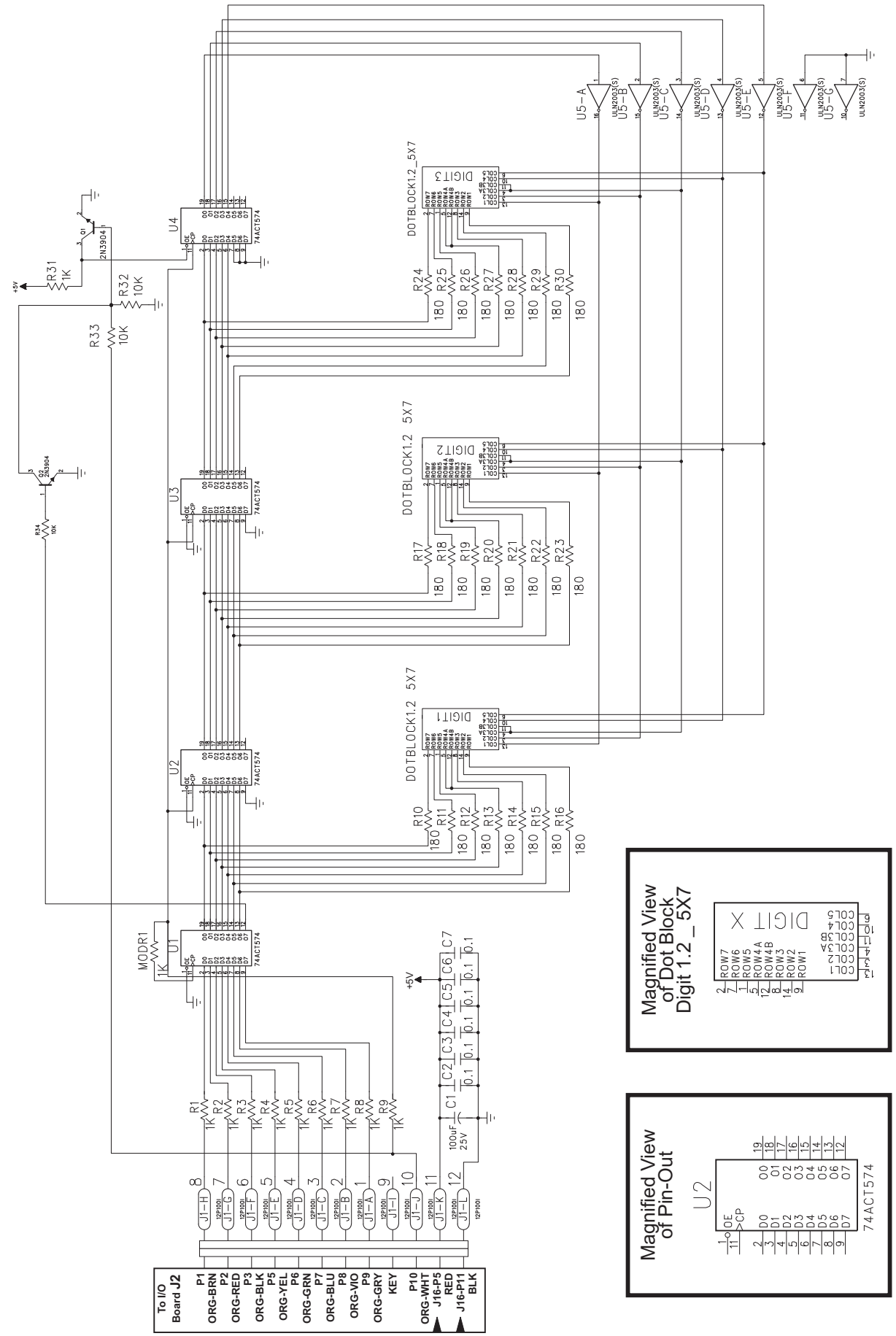

D106 (Not Screened On Board)
This diode is soldered between D3 & R430 under CN6.
1N4004
R423-R430 = 560
SWITCH COLUMNS
CN5 9PKK156B
KEY
U203 74HCT273
Q1 2N3904
Q2 2N3904
Q3 2N3904
Q4 2N3904
Q5 2N3904
Q6 2N3904
Q7 2N3904
Q8 2N3904
C221-C228 = 0.01
R244-R251 = 1K
SW300 8-POS. DIP SWITCH
8DIPSW
U204 74HC245
R410 3.3K
R411 3.3K
C409 22uF 16V
VREF
U401/A LM339AN
U401/B LM339AN
U401/C LM339AN
U401/D LM339AN
R401-R408 = 560
SWITCH ROWS
CN7 10PKK156D
R415-R422 = 220
D400-D407 = 1N4148
C400-C407 = 0.1uF
R260-R267 = 10K
U205 74HC245
Schematic Set Sheet 3 of 3
SIZE D
REV. E
STERN PINBALL, INC.
SPI CPU/Sound Board
SPI Part №: 520-5136-16
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0176-00 Dated: 07/22/99

CPU/Sound Board Component Layout

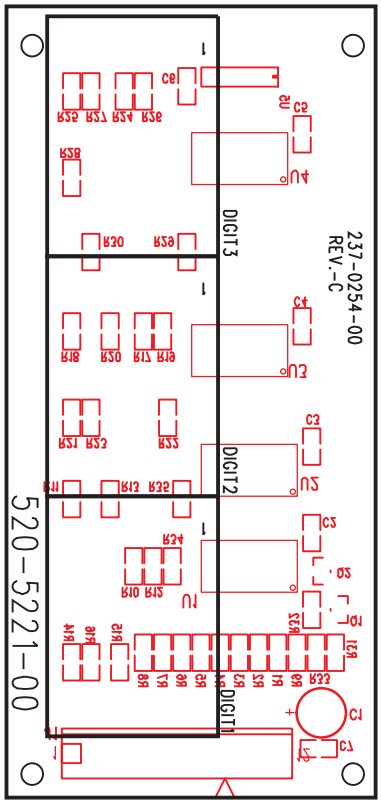


CPU/Sound Board Parts

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	**1**	**520-5136-16**	**CPU/Sound Board Mono (FCC FEB98)**	**Complete PCB Assembly**
01	1	545-5685-00	BAT1 HOLDER *(Always replace all 3, Size AA 1.5v Cells, with new ones, when required)*	
02	79	125-5031-00	C1, C2, C3, C4, C5, C7, C8, C9, C12, C13, C14, C15, C16, C18, C19, C20, C21, C23, C24, C25, C26, C28, C32, C33, C34, C36, C38, C39, C41, C42, C43, C44, C47, C49, C110, C111, C113, C117, C118, C120, C123, C124, C125, C255, C272, C273, C274, C275, C276, C277, C279, C280, C281, C282, C283, C284, C285, C286, C287, C288, C289, C290, C291, C292, C400>C401, C402>C404, C405>C407 (C45, C46, C52, C103, C105, C106, C122: NS)	0.1uF, (104), Axial Cer. Cap.
03	2	125-5017-00	C10, C35	10uF, 16v, Radial Tant. Cap.
04	3	125-5043-00	C29, C37, C51	0.001uF, (102), Cap.
05	1	125-5037-00	C30	1000uF, 16v, Radial Lytic Cap.
06	2	125-5019-00	C31, C81	470uF, 25v, Radial Lytic Cap.
07	4	125-5020-00	C40, C59, C108, C115 (C76, C77, C101: NS)	22uF, 25v, Radial Lytic Cap.
08	4	125-5039-00	C48, C50, C75, C80	0.0022uF, (222), Cap.
09	6	125-5017-00	C78, C79, C107, C114 (C100: NS)	10uF, 25v-35v, Radial Lytic Cap.
10	2	125-5015-00	C109, C112 (C102, C104: NS)	100uF, 25v, Rad. Ltc. Cap.
11	2	125-5012-00	C116, C119	220uF, 25v, Radial Lytic Cap.
12	0	125-5038-00	(C121: NS)	100pF, (101), Cap.
13	44	125-5028-00	C208>C215, C216>C220, C229, C230, C247>C254, C256>C263, C264>C271 (C200>C207: NS)	470pF, (471), Cer. Cap.
14	8	125-5029-00	C221>C228 (C408: NS)	0.01uF, (103), 100v Cap.
15	1	125-5014-00	C409	22uF, 16v, Radial Lytic Cap.
16	1	045-5015-01	CN1	20-Pin, 0.1 HEADER
17	1	045-5015-06	CN2 (Key Pin-5) (CN3: NS)	6PKK156
18	1	045-5015-07	CN4 (Key Pin-5)	7PKK156
19	1	045-5013-00	CN5 (Key Pin-2)	9PKK156
20	1	045-5015-00	CN6 (Key Pin-5)	12PKK156
21	1	045-5014-01	CN7 (Key Pin-4)	10PKK156
22	1	045-5015-26	CN8 x2	26-Pin, 0.1 HEADER
23	7	112-5003-00	D1, D2, D3, D102, D103, D104, D105 (D100, D101: NS)	1N4004, Diode
24	2	112-5008-00	D200, D201	1N5817, Diode
25	8	112-0054-00	D400, D401, D402>D404, D405>D407 (D202: NS)	1N4148, Diode
26	6	n/a	(FB1)-FB2, FB3-(FB4), (FB5)-FB6	Ferrite Bead *(if required, call Tech Support)*
27	**1**	**165-5099-00**	**L200, L201**	**LED T1-3/4 DIFFUSER LED**
28	10	110-0069-00	Q1>Q8, Q10 (Q9 Not Used)	2N3904, Transistor
29	36	121-5011-00	R1>R3, R4, R106, R113, R224>R228, R244>R251, R260>R267, R296>R298, R299, R301, R302>R305, R306, R413, R431>R432 (R200>R207, R409: NS)	10K Ω 1/4W Res.
30	1	121-5018-00	R7	1.5K Ω 1/4W Res.
31	5	121-5023-00	R9, R14, R104, (R100, R102: NS)	22K Ω 1/4W Res.
32	20	121-5009-00	R15, R8, R234>R241, R278>R286, R412	1K Ω 1/4W Res.
33	2	121-5043-00	R16, R17 (R25, R112: NS)	2.2K Ω 1/4W Res.
34	3	121-5051-00	R21, R22, R24 (R12, R13, R19: NS)	100K Ω 1/4W Res.
35	2	121-5046-01	R105, R109 (R101: NS)	470 Ω 1/4W Res.
36	2	121-5013-00	R107, R111 (R103: NS)	1M Ω 1/4W Res.
37	9	121-5045-00	R108, R287>R294	39K Ω Res.
38	11	121-5021-00	R216>R223, R242, R243, R400	4.7K Ω 1/4W Res.
39	15	121-5033-00	R229>R233, R295, R414, R415>R422 (R208>R215: NS)	220 Ω 1/4W Res.
40	5	n/a	R308, R310, R315>R316, WX (R300,R307,R309,R311,R313>R314,WY:NS)	0Ω *Jumper Wire (24ga.)*
41	1	121-5036-00	R312	330 Ω 1/4W Res.
42	16	121-5047-00	R401>R402, R403>R405, R406>R408, R423>R430	560 Ω 1/4W Res.
43	2	121-5048-00	R410, R411	3.3K Ω 1/4W Res.
44	1	n/a	SW200	B3F4000
45	1	181-5002-00	SW300	8-Pin, Dip Switch
46	5	100-0037-00	U1, U8, U25, U27, U215	74LS74
47	1	100-0249-00	U2	74HC4020
48	1	100-0049-00	U3	74LS163
49	1	105-0052-05	U4	6116 RAM
50	3	077-5208-00	U4, U7, U212	28-Pin, IC Dip Socket
51	6	100-0064-00	U5, U12, U13, U15, U16, U211	74LS374
52	1	100-0189-01	U6, U209	68B09E
53	3	077-5209-00	U6, U9, U209	40-Pin, IC Socket
54	1	(See Pg. DR, ❶ Table)	U7	27512 EPROM
55	**1**	**105-0116-00**	**U9**	**BSMT2000**
56	1	100-0149-00	U10	74LS240
57	5	(See Pg. DR, ❶ Table)	U17, U21, U36, U37, U210	27C040 EPROM
58	5	077-5217-00	U17, U21, U36, U37, U210	32-Pin, IC Socket
59	1	100-0043-00	U18	74ALS139
60	**1**	**965-0136-00**	**U19 - YELLOW DOT**	**PAL16L8 (Programmed) YELLOW DOT**
61	**1**	**965-0137-00**	**U20 - WHITE DOT**	**PAL16L8 (Programmed) WHITE DOT**
62	2	100-0022-00	U22, U11	74LS273
63	2	100-5008-00	U23, U24	74LS165
64	1	100-5018-00	U26	TDA1543
65	1	100-0375-00	U30	LM833
66	1	100-0027-00	U34	74LS04
67	0	100-5016-00	(U35: NS)	TDA1899
68	2	100-5016-20	U101, U102 (U100 : NS)	TDA2030A
69	3	535-5000-10	U101 (HS2), U102 (HS3) (U100 (HS1): NS)	AAVID 531102 (Heat Sink)
70	2	100-5012-00	U201, U203	74HCT273
71	6	100-0338-00	U202, U204, U205, U206, U207, U208 (U200: NS)	74HC245
72	**1**	**105-5046-00**	**U212**	**MS6264A**
73	**1**	**965-6504-00**	**U213- BLUE DOT**	**PAL16L8 (Programmed) BLUE DOT**
74	1	100-0148-00	U214	74LS138
75	2	100-5015-00	U216, U217	HCT74
76	1	100-5023-00	U218	DS1232
77	2	100-0377-00	U400, U401	LM339AN
78	4	n/a	VBATT, +5v, GND1, GND2	*Test Point Wire (24ga.) Loops*
79	1	124-5002-00	VR1	LM7905CT **-5v** Regulator
80	1	124-5001-00	VR2	LM7805CT **+5v** Regulator
81	6	n/a	W1, W5, **W6* (*for 8MB EPROMs)** (W2-W3, W4: NS)	0Ω *Jumper Wire (24ga.)*
82	1	140-0011-00	X1	24Mhz
83	12	n/a	AOR, AOL, SND_RESET, SND_FIRQ, Q, E, 6Mhz, 24Mhz, FIRQ, PLASMA_RESET, RESET (X2)	*Test Points*
84	1	**(call Tech. Support)**	R110 *(New Rev. Change Feb 02)*	33K Ω 1/4W Res.

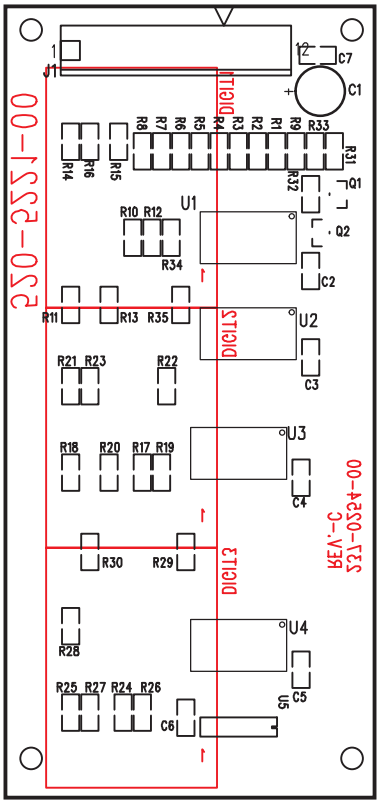

To I/O Board J2
P1
ORG-BRN
P2
ORG-RED
P3
ORG-BLK
P5
ORG-YEL
P6
ORG-GRN
P7
ORG-BLU
P8
ORG-VIO
P9
ORG-GRY
KEY
P10
ORG-WHT
J16-P5
RED
J16-P11
BLK
U1
U2
U3
U4
74ACT574
DOTBLOCK1.2_5X7
DIGIT1
DIGIT2
DIGIT3
ULN2003(5)
U5-A
U5-B
U5-C
U5-D
U5-E
U5-F
U5-G
2N3904
Q1
Q2
MODR1
+5V
100uF 25V
Magnified View of Dot Block Digit 1.2 _ 5X7
Magnified View of Pin-Out

Dot Display (5X7) x3 PC Bd. (... Ramp Enter Sign) Component Layout & Parts

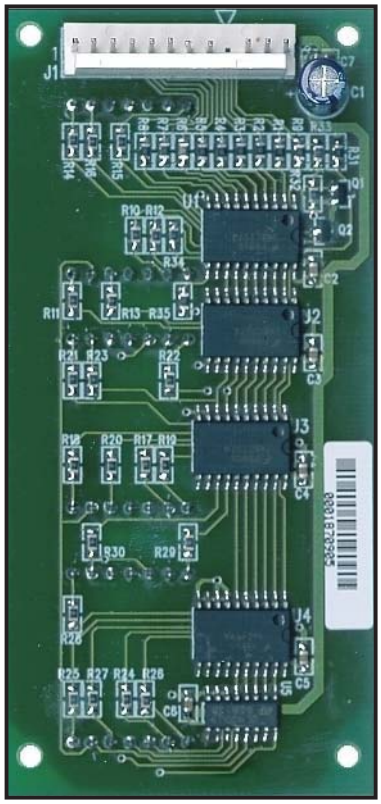


Front (Dot Block) Side

*Note: To test this Dot Display Board via **Portals™**, see Section **3**, Chapter **2**, **GO TO DIAGNOSTICS MENU, LED Test**, **Pages 27-28**.*



Component / Solder Side



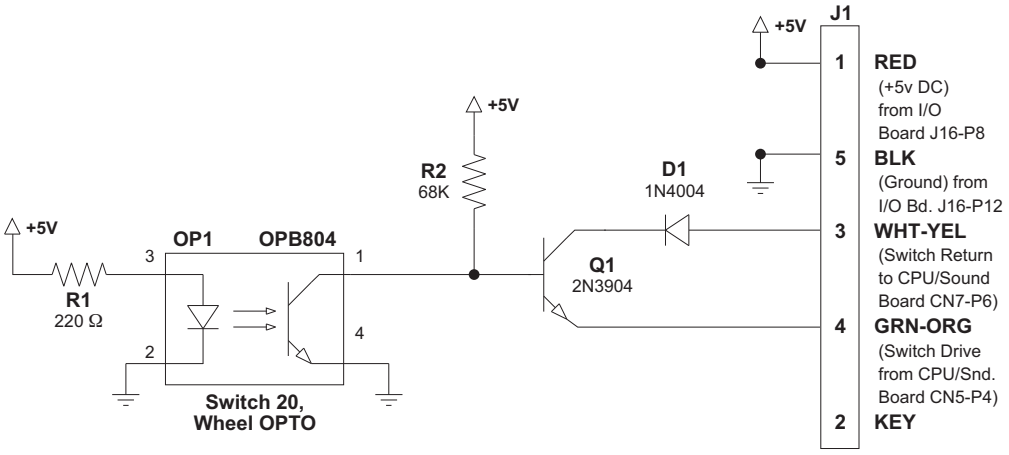
Component / Solder Side

Note: The Dot Display x3 PC Board is shown how it is used in this game. The Screend Plastic (Butyrate) is not included with this PC Bd. Assembly. For Screened Plastic -5, see the Pink Pages (Pg. 67).

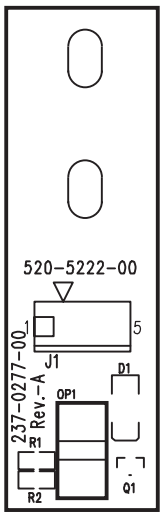
ITEM	QTY	PART NUMBER	REF-DESIGNATOR		DESCRIPTION
--	1	**520-5221-00**	**Dot Display (5X7) x3 PC Board**		**PCB Assembly**
1	1	045-5107-12	J1		Connector, 12-Pin .1" Header.
2	2	112-5017-00	Q1, Q2	(Manex №: 211-0003589)	2N3904S 40V 0.2A
3	4	100-5036-00	U1, U2, U3, U4	(Manex №: 221-0006048)	74ACT574
4	6	100-5039-00	C2-C7	(Manex №: 121-0004238)	Cap. 104-0805 0.1 50V
5	3	100-5040-00	DIGIT1, DIGIT2, DIGIT3	(Manex №: 430-0006059)	Dot Block 1.2: 5X7 GMA8875C
6	3	121-5084-00	R32-R34	(Manex №: 101-0001827)	10KΩ 1/10W 0805 Res.
7	10	121-5088-00	R1-R9, R31	(Manex №: 101-0001905)	1KΩ 1/10W 0805 Res.
8	21	121-5086-00	R10-R30	(Manex №: 101-0001897)	180Ω 1/10W 0805 Res.
9	1	100-5037-00	C1	(Manex №: 131-0003773)	100uF 25V T. Cap.
10	1	100-5038-00	U5	(Manex №: 225-0005340)	ULN2003(S)
11	1	121-5089-00	MOD1	(Manex №: 105-0002703)	1KΩ 1/8W 5CF Res.
12	1	036-5463-08-78	n/a		Wiring Harness (incl. Item 1 above)
13	1	545-6066-00	n/a		Insulator Fiche Paper

1-Position OPTO PC Board (Wheel-Spin) Theory of Operation & Schematic

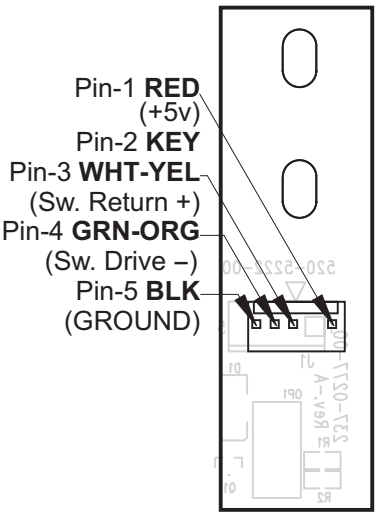
The **OPTO Printed Circuit Board** (SPI Part №: 520-5222-00) used in the ***Wheel-Spin Assembly***, is an ordinary Photo-Interrupter designed to signal **Switch #20** (**OP1**) back to the **CPU/ Sound Board** (Switch Matrix Grid). The slotted OPTO (U-Shaped), location **OP1** contains a small infrared **LED** that beams light across the slot to an **NPN Phototransistor.** This causes the **Phototransistor** to *conduct* and *pull down the voltage* at the base of **Q1** (2N3904 Transistor) to **.3v** *or less.* **Q1** (transistor) requires the Base Emitter Drop Voltage (**.7v**) **plus** the Switch Drive Drop (**.1v**) to *conduct,* and since **.3v** *is less* than this **.8v**, **Q1** stays off when the *Switch Matrix Strobe* (on Pin-4 of J1) polls it. If the "Black Spinning Metal Toothed" Wheel breaks the beam in the **OPTO Slot**, the **NPN Phototransistor** *stays off*, and the *base voltage* on the 2N3904 Transistor is **pulled to .8v** during the *Switch Strobe* through the **68KΩ 1/10W Pull-Up Resistor** (this base voltage will be higher when the switch is not being polled). With the **.8v** applied to the base, **Q1** conducts through **D1**. This Diode (1N4004) prevents certain kinds of *Matrix-Related leakages* which show up as a "Phantom Switch" that completes the corners of a square in the Matrix.



1-Position OPTO PC Board (Wheel-Spin) Component Layout & Parts



For the **OPTO Adjustment Procedure** & how this PCB is used on the Spinning Wheel (Scrambled Eggs), *review Section **4**, Chapter **2**, **(Blue Pages) Drawings for Major Assemblies & Ramps**, **Page 90**.*

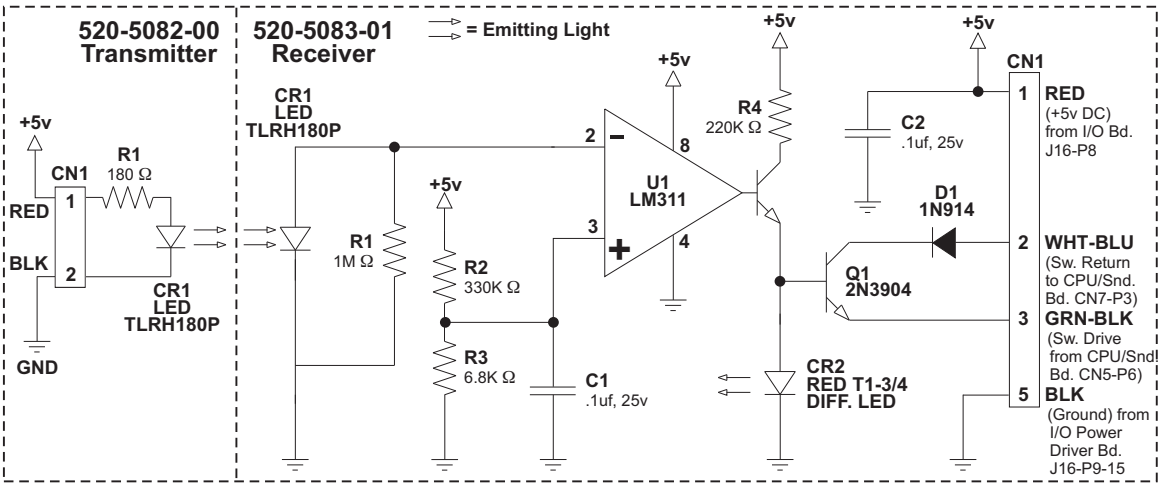


Component / Solder Side **Back Side**

Note: *In this game, this OPTO Board is used as a Playfield Detection Switch for the "Wheel Spin" Assembly. See the Switch Matrix Grid (Pgs. 16-17 or 104). PCB is used for Switch 20, (GRN-ORG, WHT-YEL).*

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
--	**1**	**520-5222-00**	**1-Position U-Shaped OPTO PC Board**	**PCB Assembly**
1	1	045-5107-05	J1	Connector, 5-Pin .1" Header.
1	2	121-5093-00	R2	68K, 1/10W SMT Resistor, 0805 case
2	1	121-5092-00	R3	220Ω, 1/10W SMT Resistor, 0805 case
3	1	112-5020-00	D1	DL4004 400v 1.0A SMT **SM4004TR, GL41G-30-T30, GL41G SMT** Diode or eqv.
4	1	110-5010-00	Q1	NPN Trans, Small Sig, 40V .2A SOT-23 case, Motorola MMBT3904LT or eqv.
5	1	165-5036-00	OP1	Slotted OPTO, OPTEK OPB804 or eqv.

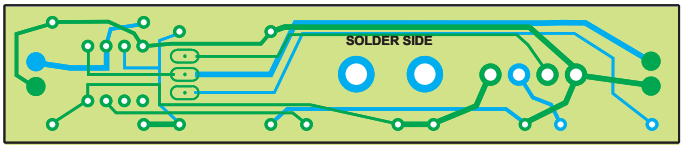
Playfield Switch OPTO "Long-Hop" Boards Theory of Operation & Schematic



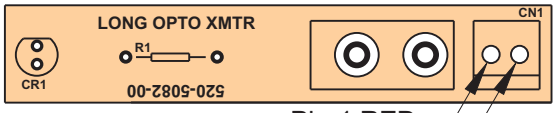
The light falling on **LED** (**CR1**) generates a voltage which is applied to the input (Pin-2) of the **LM311 Comparator** (**U1**). **R1** bleeds off excess charge. At about a volt input from **LED** (**CR1**) the **Comparator** (**U1**) *trips & drives* either **Q1** *(during switch line strobes)* 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)



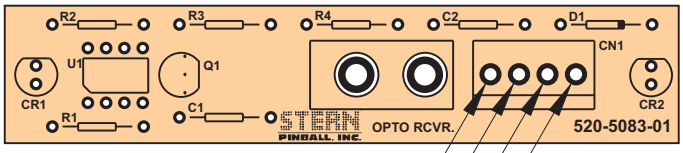
Solder Side (Green) **520-5083-01 (REC)**



Component Side (Beige)

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

Pin-2 **BLK** (GROUND)



Component Side (Beige)

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

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

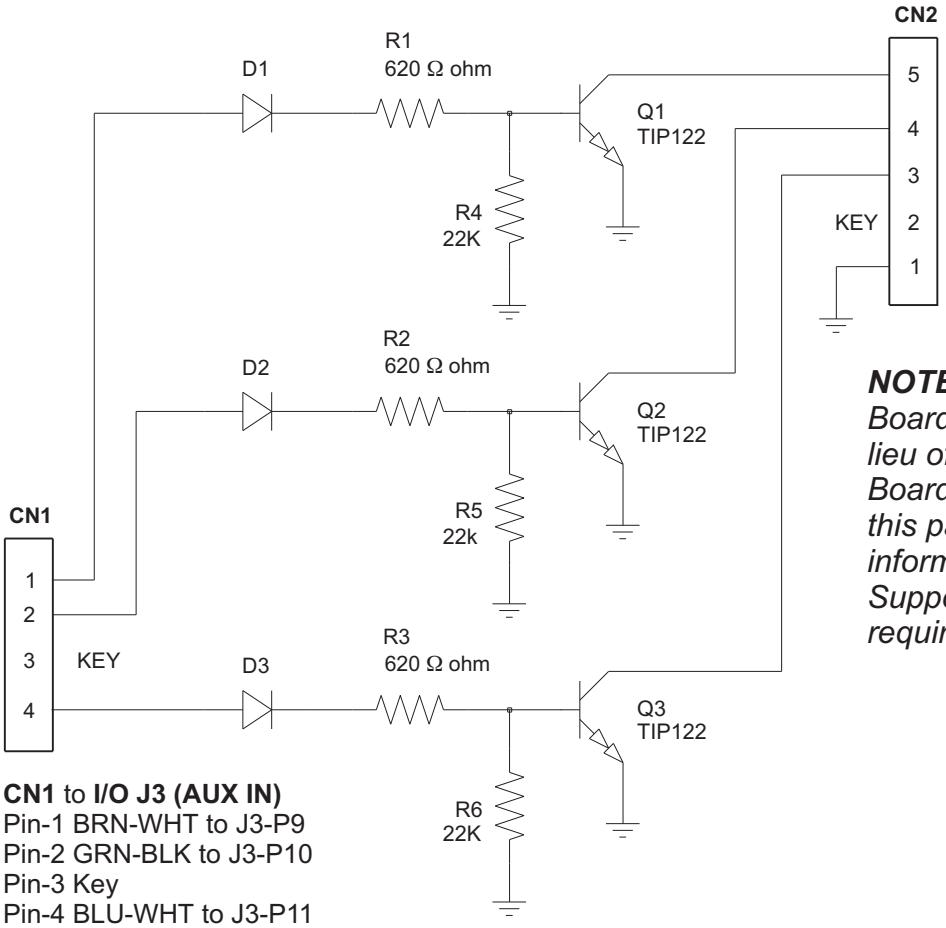
Pin-3 **GRN-BLK** (Sw. Drive –)

Pin-4 **BLK** (GROUND)

Note: *In this game, this Combo OPTO Board is used as a P/F Detection Switch behind the 1-Bank Drop Target. See the Switch Matrix Grid (Pgs. 16-17 or 104). PCBs are used for Switch 38, (GRN-BLK, WHT-BLU).*

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.

(UK Only) Solenoid Expander PC Board Schematic



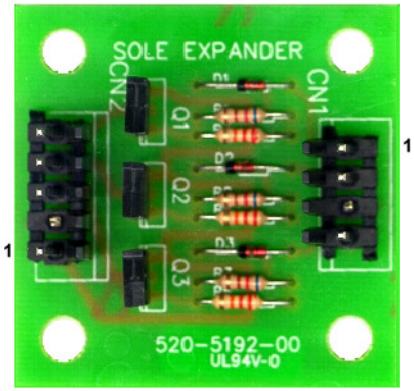
CN2 to Coils to **I/O J7-P1 20v BRN**

Pin-1 GND
Pin-2 Key
Pin-3 ORG
Right Up/Down Post (Aux. 3)
Pin-4 RED
Center Up/Down Post (Aux. 2)
Pin-5 WHT
Left Up/Down Post (Aux. 1)

NOTE: *If a 3X Transistor Driver Board (520-5068-00) is used in lieu of the Solenoid Expander Board (520-5192-00), disregard this page (wiring & board information) and call Technical Support if more information is required.*

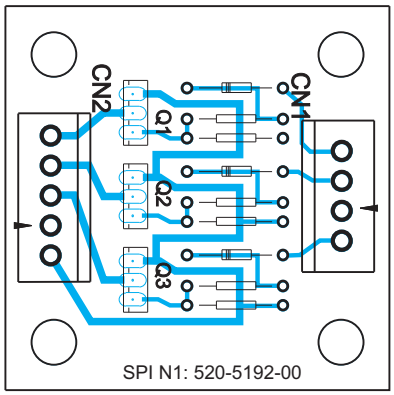
CN1 to **I/O J3 (AUX IN)**
Pin-1 BRN-WHT to J3-P9
Pin-2 GRN-BLK to J3-P10
Pin-3 Key
Pin-4 BLU-WHT to J3-P11

Component Side

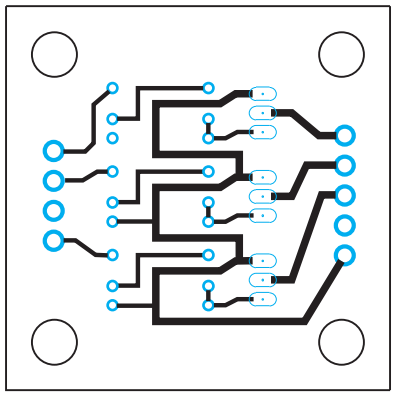


(UK Only) Solenoid Exp. PCB Component Layout & Parts

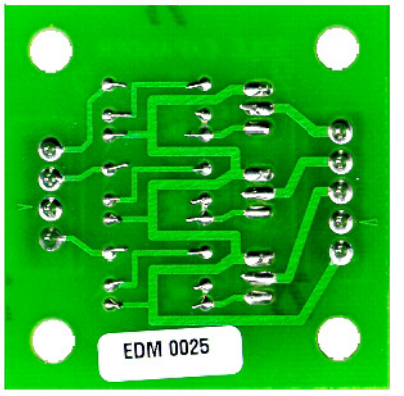
Component Side



Solder Side

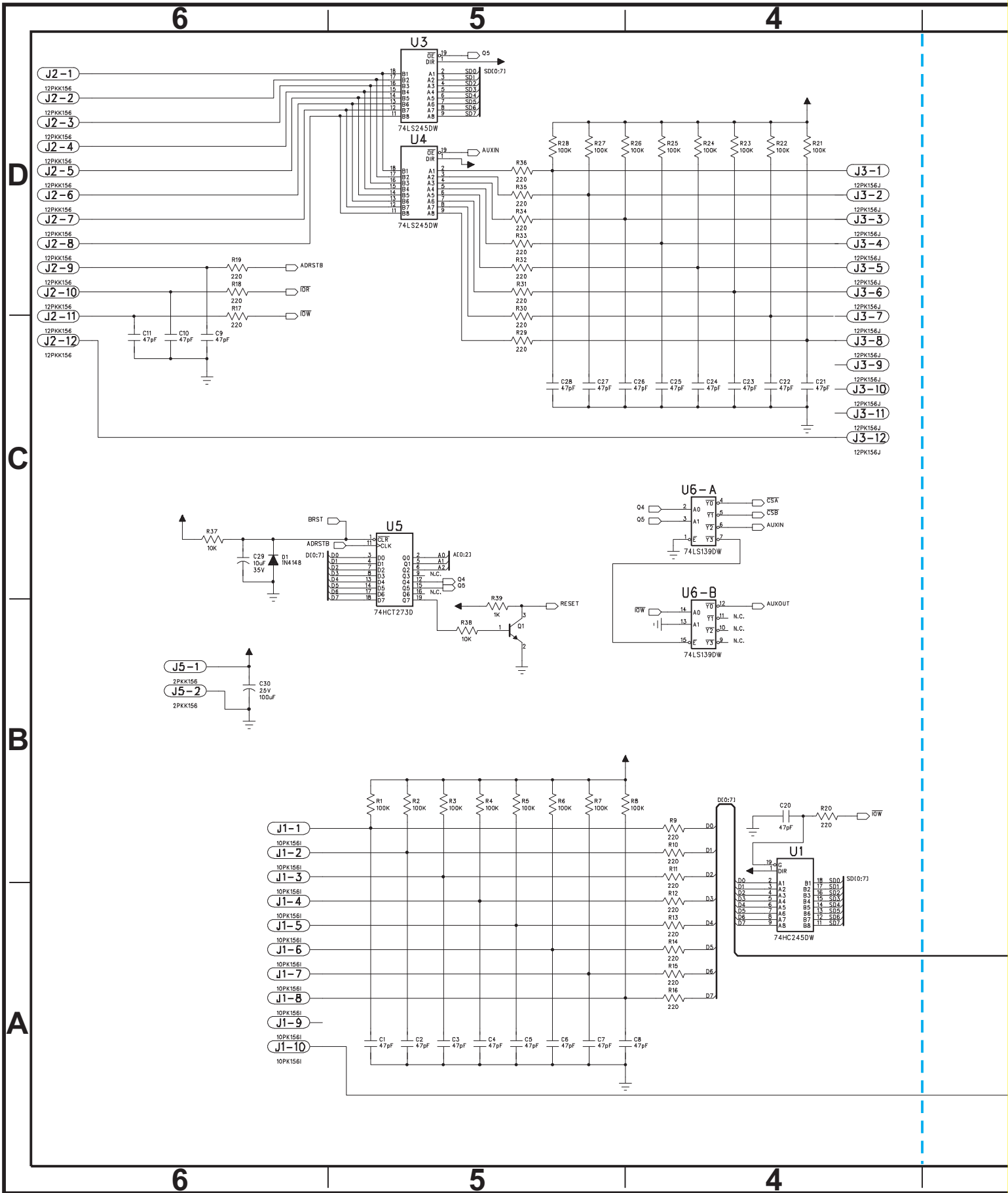


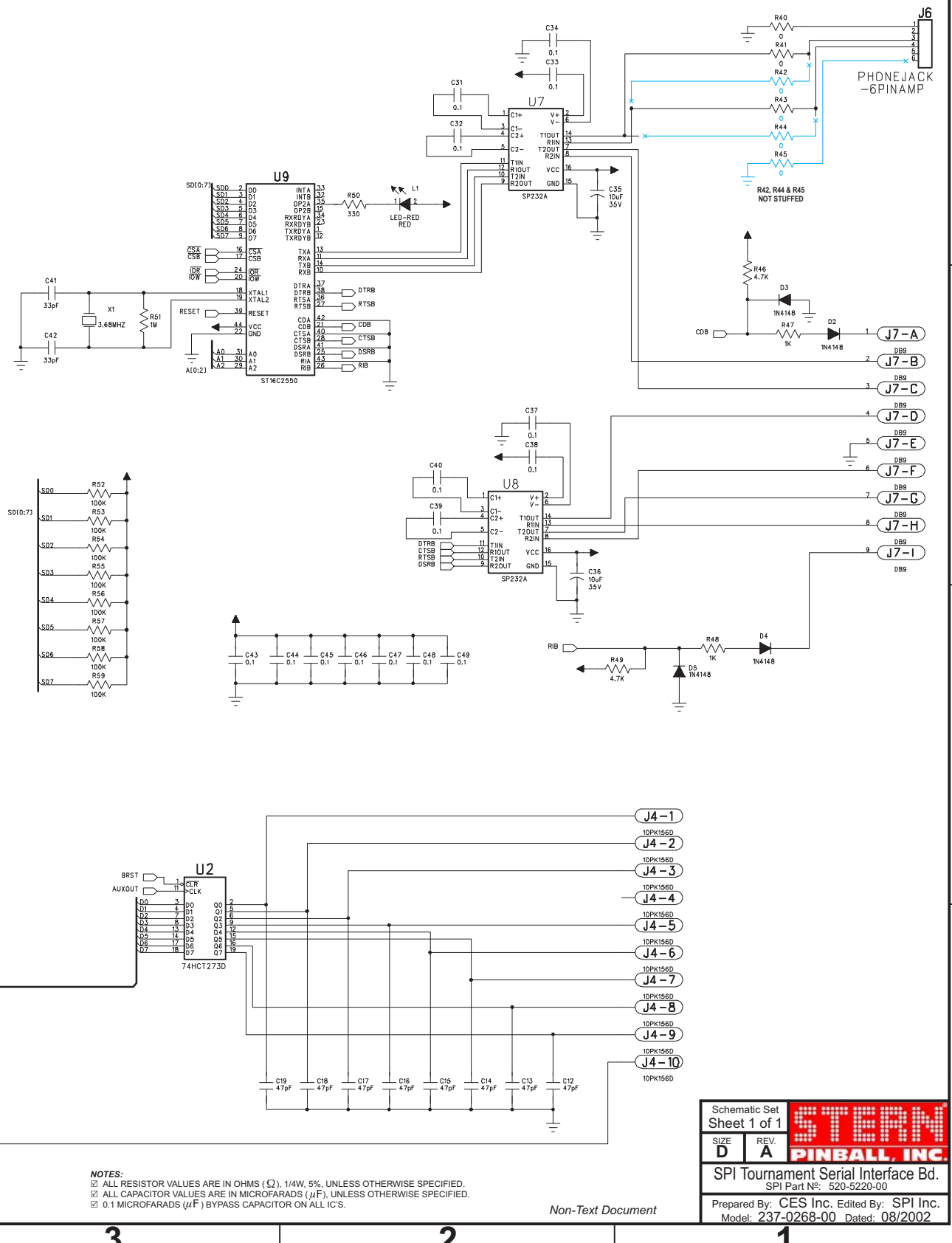
Solder Side



ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
—	1	520-5192-00	Solenoid Expander PC Board	**Complete PCB Assembly**
1	1		CN1	Connector, 4X .156”
2	1		CN2	Connector, 5X .156”
3	3	112-5014-00	D1, D2, D3	1N914, Signal Diode
4	3	121-5003-00	R1, R2, R3	620Ω 1/4W CF Resistor
5	3	121-5042-00	R4, R5, R6	22KΩ 1/4W CF Resistor
6	3	110-0067-00	Q1, Q2, Q3	Tip122 (NPN Darl. Transistor)
7	1	036-5479-00-76	Not Shown	UK Post Cable Wiring Harness

Order the Optional ToPS™ (Tournament Pinball System) Kit!
Call Technical Support at 1-800-542-5377 for more information


6
5
4
D
C
B
A
U3
74LS245DW
U4
74LS245DW
U5
74HCT273D
U6-A
74LS139DW
U6-B
74LS139DW
U1
74HC245DW
J2-1
J2-2
J2-3
J2-4
J2-5
J2-6
J2-7
J2-8
J2-9
J2-10
J2-11
J2-12
J3-1
J3-2
J3-3
J3-4
J3-5
J3-6
J3-7
J3-8
J3-9
J3-10
J3-11
J3-12
J5-1
J5-2
J1-1
J1-2
J1-3
J1-4
J1-5
J1-6
J1-7
J1-8
J1-9
J1-10
SD[0:7]
AUXIN
ADRSTB
BRST
RESET
AUXOUT
D[0:7]
A[0:2]



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.

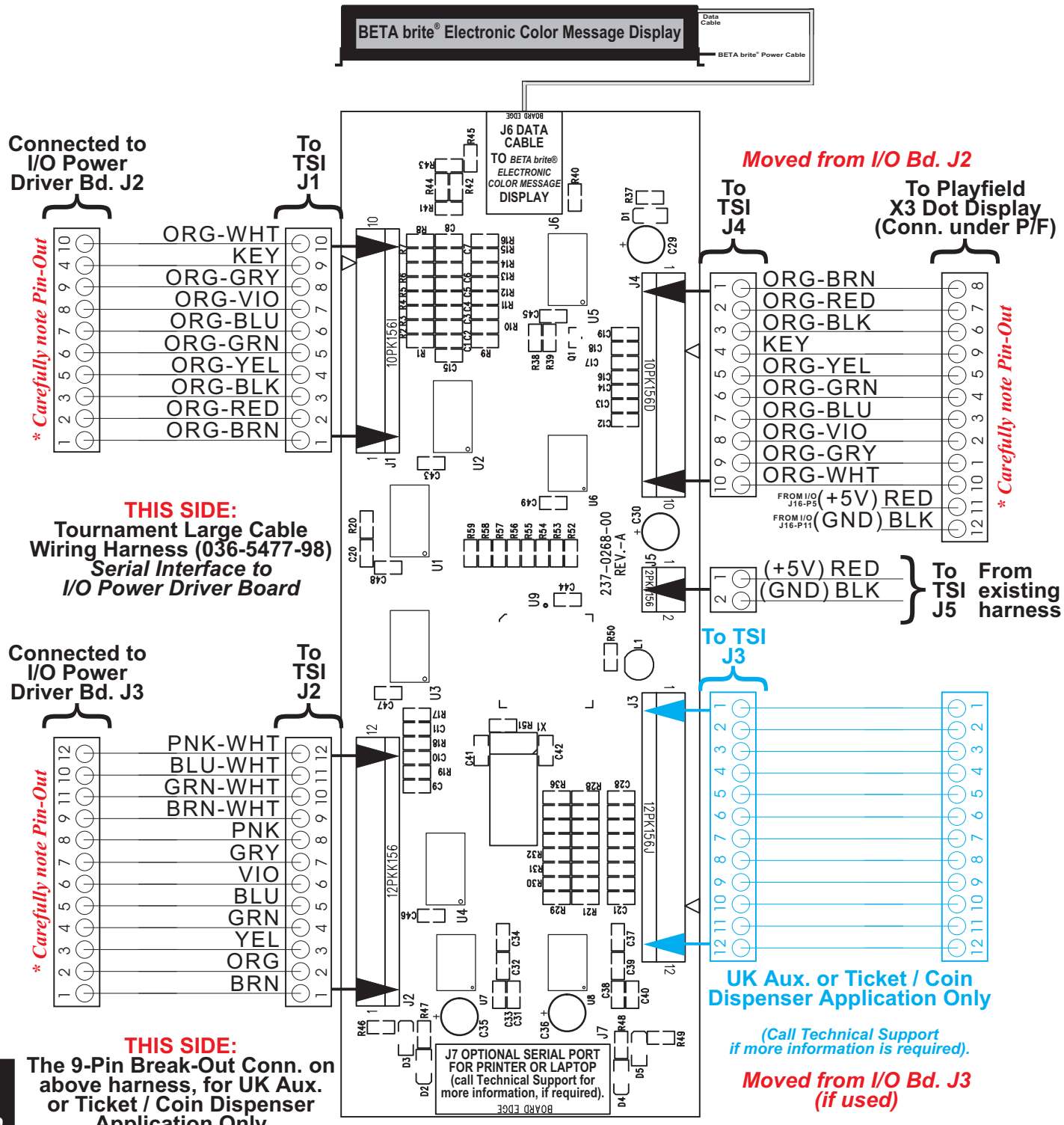
Non-Text Document

Schematic Set	Sheet 1 of 1
SIZE	D
REV.	A

STERN PINBALL, INC.

SPI Tournament Serial Interface Bd.
SPI Part №: 520-5220-00

Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0268-00 Dated: 08/2002



ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
--	1	520-5220-00	Tournament Serial Interface (TSI) Board	PCB Assembly

Appendixes A through J

Appendix
Table of Contents

Appendixes A-J
Table of Contents

APPENDIX A

Pinball Game Firmware Table

EPROM	Chip Size	Program Part №	USA Ver.	Bd. Loc.	Raw Part №
Laser War					
CPU	(256K)	965-0004-00	LWAR.C5	C5	960-5007-00
Sound (Old)	(256K)	965-0005-00		J5	960-5007-00
Sound (Old)	(256K)	965-0006-00		J6	960-5007-00
Sound (Old)	(256K)	965-0007-00		J7	960-5007-00
			- OR -		
Sound	(256K)	965-0008-00		7F	960-5007-00
Sound 1	(512K)	965-0009-00		6F	960-7001-02
Sound 2	(512K)	965-0010-00		4F	960-7001-02
Secret Service					
CPU	(256K)	965-0011-00	A4-6	B5	960-5007-00
CPU	(256K)	965-0012-00	A4-6	C5	960-5007-00
Voice 1	(512K)	965-0014-00		6F	960-7001-02
Voice 2	(512K)	965-0015-00		4F	960-7001-02
Sound	(256K)	965-0013-00		7F	960-5007-00
Torpedo Alley					
CPU	(256K)	965-0016-00	A2-1	B5	960-5007-00
CPU	(256K)	965-0017-00	A2-1	C5	960-5007-00
Voice 1	(512K)	965-0019-00		6F	960-7001-02
Voice 2	(512K)	965-0020-00		4F	960-7001-02
Sound	(256K)	965-0018-00		7F	960-5007-00
Time Machine					
CPU	(128K)	965-0021-00	A2-4	B5	960-5006-00
CPU	(256K)	965-0022-00	A2-4	C5	960-5007-00
Voice 1	(512K)	965-0024-00		6F	960-7001-02
Voice 2	(512K)	965-0025-00		4F	960-7001-02
Sound	(256K)	965-0023-00		7F	960-5007-00
Playboy 35th Anniversary					
CPU	(256K)	965-0046-00	A2-4	B5	960-5007-00
CPU	(256K)	965-0047-00	A2-4	C5	960-5007-00
Voice 1	(512K)	965-0049-00		6F	960-7001-02
Voice 2	(512K)	965-0050-00		4F	960-7001-02
Sound	(256K)	965-0048-00		7F	960-5007-00
ABC Monday Night Football					
CPU	(128K)	965-0031-00	A2-7	B5	960-5006-00
CPU	(256K)	965-0032-00	A2-7	C5	960-5007-00
Voice 1	(512K)	965-0034-00		6F	960-7001-02
Voice 2	(512K)	965-0035-00		4F	960-7001-02
Sound	(256K)	965-0033-00		7F	960-5007-00
Robocop					
CPU	(256K)	965-0036-00	A3-4	B5	960-5007-00
CPU	(256K)	965-0037-00	A3-4	C5	960-5007-00
Voice 1	(512K)	965-0039-00		6F	960-7001-02
Voice 2	(512K)	965-0040-00		4F	960-7001-02
Sound	(256K)	965-0038-00		7F	960-5007-00
Phantom of the Opera					
CPU	(128K)	965-0026-00	A3-2	B5	960-5006-00
CPU	(256K)	965-0027-00	A3-2	C5	960-5007-00
Voice 1	(512K)	965-0029-00		6F	960-7001-02
Voice 2	(512K)	965-0030-00		4F	960-7001-02
Sound	(256K)	965-0028-00		7F	960-5007-00
Back to the Future					
CPU	(256K)	965-0041-00	A2-0	B5	960-5007-00
CPU	(256K)	965-0042-00	A2-0	C5	960-5007-00
Voice 1	(512K)	965-0044-00		6F	960-7001-02
Voice 2	(512K)	965-0045-00		4F	960-7001-02
Sound	(256K)	965-0043-00		7F	960-5007-00
The Simpsons					
CPU	(128K)	965-0051-00	A2-7	B5	960-5006-00
CPU	(256K)	965-0052-00	A2-7	C5	960-5007-00
Voice 1	(512K)	965-0054-00		6F	960-7001-02
Voice 2	(512K)	965-0055-00		4F	960-7001-02
Sound	(256K)	965-0053-00		7F	960-5007-00
Checkpoint					
CPU	(128K)	965-0056-00	A1-7	B5	960-5006-00
CPU	(256K)	965-0134-00	A1-7	C5	960-5007-00
Voice 1	(1M)	965-0057-00		F7	960-5009-00
Voice 2	(1M)	965-0058-00		F5	960-5009-00
Sound	(256K)	965-0059-00		F4	960-5007-00
Display	(512K)	965-0060-00	CP80	U8	960-7001-02
Teenage Mutant Ninja Turtles					
CPU	(128K)	965-0061-00	A1.04	B5	960-5006-00
CPU	(256K)	965-0062-00	A1.04	C5	960-5007-00
Voice 1	(1M)	965-0063-00		F5/6	960-5009-00
Voice 2	(1M)	965-0064-00		F4/5	960-5009-00
Sound	(256K)	965-0065-00		F7	960-5007-00
Display	(512K)	965-0066-00	A1.04	U8	960-7001-02
Batman					
CPU	(128K)	965-0067-00	A1.06	B5	960-5006-00
CPU	(256K)	965-0135-00	A1.06	C5	960-5007-00
Voice 1	(2M)	965-0068-00		U17	960-5010-00
Voice 2	(1M)	965-0069-00		U21	960-5009-00
Sound	(256K)	965-0070-00		U7	960-5007-00
Display	(1M)	965-0071-00	A1.06	U8	960-5009-00
Star Trek 25th Anniversary					
CPU	(512K)	965-0072-00	A2.01	C5	960-7001-02
Voice 1	(2M)	965-0073-00		U17	960-5010-00
Voice 2	(2M)	965-0074-00		U21	960-5010-00
Sound	(256K)	965-0075-00		U7	960-5007-00
Display	(1M)	965-0076-00	A1.09	U8	960-5009-00
Hook					
CPU	(512K)	965-0077-00	A4.08	C5	960-7001-02
Voice 1	(2M)	965-0078-00		U17	960-5010-00
Voice 2	(2M)	965-0079-00		U21	960-5010-00
Sound	(256K)	965-0080-00		U7	960-5007-00
Display	(1M)	965-0081-00	A4.01	U8	960-5009-00
Lethal Weapon 3					
CPU	(512K)	965-0082-00	A2.08	C5	960-7001-02
Voice 1	(2M)	965-0083-00		U17	960-5010-00
Voice 2	(2M)	965-0084-00		U21	960-5010-00
Sound	(256K)	965-0085-00		U7	960-5007-00
Display	(2M)	965-0086-00	A2.06	ROM 0	960-5010-00
Display	(2M)	965-0087-00	A2.06	ROM 1	960-5010-00
	(Used on Display PCB 520-5055-00)				
			-OR-		
Display	(4M)	965-0087-04	A2.06	ROM 0	960-5015-00
	(Used on Display PCB 520-5055-01)				
Star Wars					
CPU	(512K)	965-0119-00	A1.03	C5	960-7001-02
Voice 0	(4M)	965-0132-00		U17	960-5015-00
Voice 1	(2M)	965-0133-00		U21	960-5010-00
Sound	(256K)	965-0131-00		U7	960-5007-00
Display	(2M)	965-0120-00	A1.04	ROM 0	960-5010-00
Display	(2M)	965-0121-00	A1.04	ROM 1	960-5010-00
	(Used on Display PCB 520-5055-00)				
			-OR-		
Display	(4M)	965-0122-00	A1.05	ROM 0	960-5015-00
	(Used on Display PCB 520-5055-01)				
Rocky & Bullwinkle & Friends					
CPU	(512K)	965-0138-00	A1.30	C5	960-7001-02
Voice 0	(4M)	965-0139-00		U17	960-5015-00
Voice 1	(2M)	965-0140-00		U21	960-5010-00
Sound	(256K)	965-0141-00		U7	960-5007-00
Display	(4M)	965-0142-00	A1.30	ROM 0	960-5015-00
Jurassic Park					
CPU	(512K)	965-0143-00	A5.13	C5	960-7001-02
Voice 0	(4M)	965-0144-00		U17	960-5015-00
Voice 1	(2M)	965-0145-00		U21	960-5010-00
Sound	(256K)	965-0146-00		U7	960-5007-00
Display	(4M)	965-0147-00	A5.10	ROM 0	960-5015-00
Last Action Hero					
CPU	(512K)	965-0148-00	A1.12	C5	960-7001-02
Voice 0	(4M)	965-0149-00		U17	960-5015-00
Voice 1	(2M)	965-0150-00		U21	960-5010-00
Sound	(256K)	965-0151-00		U7	960-5007-00
Display	(4M)	965-0152-00	A1.06	ROM 0	960-5015-00
Tales from the Crypt					
CPU	(512K)	965-0157-00	A3.03	C5	960-7001-02
Voice 0	(4M)	965-0158-00		U17	960-5015-00
Voice 1	(2M)	965-0159-00		U21	960-5010-00
Sound	(256K)	965-0160-00		U7	960-5007-00
Display	(4M)	965-0161-00	A3.01	ROM 0	960-5015-00
The Who's Tommy					
CPU	(512K)	965-0162-00	A4.00	C5	960-7001-02
Voice 1	(4M)	965-0165-00		U17	960-5015-00
Voice 2	(4M)	965-0166-00		U21	960-5015-00
Voice 3	(4M)	965-0167-00		U36	960-5015-00
Voice 4	(4M)	965-0168-00		U37	960-5015-00
Sound	(512K)	965-0164-00		U7	960-7001-02
Display	(4M)	965-0163-00	A4.00	ROM 0	960-5015-00
WWF Royal Rumble					
CPU	(512K)	965-0169-00	A1.06	C5	960-7001-02
Voice 1	(4M)	965-0172-00		U17	960-5015-00
Voice 2	(4M)	965-0173-00		U21	960-5015-00
Voice 3	(4M)	965-0174-00		U36	960-5015-00
Sound	(512K)	965-0171-00		U7	960-7001-02
Display	(4M)	965-0170-00	A1.02	ROM 0	960-5015-00
Guns N' Roses					
CPU	(512K)	965-0175-00	A3.00	C5	960-7001-02
Voice 1	(4M)	965-0178-00		U17	960-5015-00
Voice 2	(4M)	965-0179-00		U21	960-5015-00
Voice 3	(4M)	965-0180-00		U36	960-5015-00
Voice 4	(4M)	965-0181-00		U37	960-5015-00
Sound	(512K)	965-0177-00		U7	960-7001-02
Display	(4M)	965-0176-00	A3.00	ROM 0	960-5015-00
Maverick *					
CPU	(512K)	965-0182-00	A4.04	C5	960-7001-02
Voice 1	(4M)	965-0186-00		U17	960-5015-00
Voice 2	(4M)	965-0187-00		U21	960-5015-00
Voice 3	(4M)	965-0187-01		U36	960-5015-00
Sound	(512K)	965-0185-00		U7	960-7001-02
Display*	(4M)	965-0183-00	A4.01	ROM 0	960-5015-00
Display*	(4M)	965-0184-00	A4.01	ROM 3	960-5015-00
Mary Shelley's Frankenstein *					
CPU	(512K)	965-0188-00	A1.03	C5	960-7001-02
Voice 1	(4M)	965-0192-00		U17	960-5015-00
Voice 2	(4M)	965-0193-00		U21	960-5015-00
Voice 3	(4M)	965-0194-00		U36	960-5015-00
Sound	(512K)	965-0191-00		U7	960-7001-02
Display*	(4M)	965-0189-00	A1.03	ROM 0	960-5015-00
Display*	(4M)	965-0190-00	A1.03	ROM 3	960-5015-00
Baywatch *		(CPU Board 520-5003-04)			
CPU	(512K)	965-0195-00	A4.00	C5	960-7001-02
Voice 1	(4M)	965-0196-00		U17	960-5015-00
Voice 2	(4M)	965-0197-00		U21	960-5015-00
Sound	(512K)	965-0199-00		U7	960-7001-02
Display*	(4M)	965-0200-00	A4.00	ROM 0	960-5015-00
Display*	(4M)	965-0201-00	A4.00	ROM 3	960-5015-00
Batman Forever *		(CPU Board 520-5003-04)			
CPU	(512K)	965-0202-00	A3.02	C5	960-7001-02
Voice 1	(4M)	965-0203-00		U17	960-5015-00
Voice 2	(4M)	965-0204-00		U21	960-5015-00
Sound	(512K)	965-0205-00		U7	960-7001-02
Display*	(4M)	965-0206-00	A3.00	ROM 0	960-5015-00
Display*	(4M)	965-0207-00	A3.00	ROM 3	960-5015-00

* ***Note:*** *Display* ***EPROMS (4M)*** *for* ***Maverick*** *thru* ***Batman Forever*** *require an access time of* ***120 Nsec*** *or faster.*

APPENDIX A

Pinball Game Firmware (for White Star Board System) Table

ROM	Chip Size	Program Part №	USA Ver. & Check Sum	Bd. Loc.	Raw Part №
Apollo 13 (Note 1)					
Game ROM	(1M)	965-0208-00	A5.01 | $09FF	U210	960-5009-00
Sound	(512K)	965-0212-00		U7	960-7001-02
Display	(4M)	965-0213-00	A5.00 | $B92B	ROM 0	960-5015-01
Voice 1	(4M)	965-0209-00		U17	n/a (masked)
Voice 2	(4M)	965-0210-00		U21	n/a (masked)
Voice 3	(4M)	965-0211-00		U36	n/a (masked)
Golden Eye (Note 1)					
Game ROM	(1M)	965-0214-42	A4.04 | $3FFF	U210	960-5009-00
Sound	(512K)	965-0217-42		U7	960-7001-02
Display	(4M)	965-0218-42	A4.00 | $E6ED	ROM 0	960-5015-01
Voice 1	(4M)	965-0215-42		U17	n/a (masked)
Voice 2	(4M)	965-0216-42		U21	n/a (masked)
Twister (Note 2)					
Game ROM	(1M)	965-0219-41	A4.05 | $E9FF	U210	960-5009-00
Sound	(512K)	965-0221-41		U7	960-7001-02
Display	(4M)	965-0222-41	A4.01 | $FD01	ROM 0	960-5015-01
Voice 1	(4M)	965-0220-41		U17	960-5015-01
Voice 2	(4M)	965-0223-41		U21	960-5015-01
ID4: Independence Day (Note 2)					
Game ROM	(1M)	965-0224-45	A2.02 | $9CFF	U210	960-5009-00
Sound	(512K)	965-0227-45		U7	960-7001-02
Display	(4M)	965-0228-45	A2.00 | $ABF7	ROM 0	960-5015-01
Voice 1	(4M)	965-0225-45		U17	960-5015-01
Voice 2	(4M)	965-0226-45		U21	960-5015-01
Space Jam (Note 2)					
Game ROM	(1M)	965-0229-43	A3.00 | $E6FF	U210	960-5009-00
Sound	(512K)	965-0233-43		U7	960-7001-02
Display	(4M)	965-0234-43	A3.00 | $0057	ROM 0	960-5015-01
Voice 1	(4M)	965-0230-43		U17	960-5015-01
Voice 2	(4M)	965-0231-43		U21	960-5015-01
Voice 3	(4M)	965-0232-43		U36	960-5015-01
The Star Wars Trilogy - Special Edition (S.E.) (Note 2)					
Game ROM	(1M)	965-0235-56	A4.03 | $5EFF	U210	960-5009-00
Sound	(512K)	965-0238-56		U7	960-7001-02
Display	(4M)	965-0239-56	A4.00 | $8817	ROM 0	960-5015-01
Voice 1	(4M)	965-0236-56		U17	960-5015-01
Voice 2	(4M)	965-0237-56		U21	960-5015-01
The Lost World: Jurassic Park (Note 2)					
Game ROM	(1M)	965-0240-53	A2.02 | $C8FF	U210	960-5009-00
Sound	(512K)	965-0243-53		U7	960-7001-02
Display	(4M)	965-0244-53	A2.01 | $7F46	ROM 0	960-5015-01
Voice 1	(4M)	965-0241-53		U17	960-5015-01
Voice 2	(4M)	965-0242-53		U21	960-5015-01
The X-Files (Note 2)					
Game ROM	(1M)	965-0245-46	A3.03 | $A2FF	U210	960-5009-00
Sound	(512K)	965-0248-46		U7	960-7001-02
Display	(4M)	965-0249-46	A3.00 | $66D0	ROM 0	960-5015-01
Voice 1	(4M)	965-0246-46		U17	960-5015-01
Voice 2	(4M)	965-0247-46		U21	960-5015-01
Starship Troopers (Note 3)					
Game ROM	(1M)	965-0250-59	A2.01 | $85FF	U210	960-5009-00
Sound	(512K)	965-0253-59		U7	960-7001-02
Display	(4M)	965-0254-59	A2.00 | $E77B	ROM 0	960-5015-01
Voice 1	(4M)	965-0251-59		U17	960-5015-01
Voice 2	(4M)	965-0252-59		U21	960-5015-01
Voice 3	(4M)	965-0255-59		U36	960-5015-01
Viper Night Drivin' (Note 4)					
Game ROM	(1M)	965-0266-35	A2.01 | $C5FF	U210	960-5009-00
Sound	(512K)	965-0271-35		U7	960-7001-02
Display	(4M)	965-0272-35	A2.01 | $C17D	ROM 0	960-5015-01
Voice 1	(4M)	965-0267-35		U17	960-5015-01
Voice 2	(4M)	965-0268-35		U21	960-5015-01
Voice 3	(4M)	965-0269-35		U36	960-5015-01
Voice 4	(4M)	965-0270-35		U37	960-5015-01
Lost In Space (Note 4)					
Game ROM	(1M)	965-0282-60	A1.01 | $B2FF	U210	960-5009-00
Sound	(512K)	965-0287-60		U7	960-7001-02
Display	(4M)	965-0288-60	A1.02 | $32AB	ROM 0	960-5015-01
Voice 1	(4M)	965-0283-60		U17	960-5015-01
Voice 2	(4M)	965-0284-60		U21	960-5015-01
Voice 3	(4M)	965-0285-60		U36	960-5015-01
Voice 4	(4M)	965-0286-60		U37	960-5015-01
Godzilla (Note 4)					
Game ROM	(1M)	965-0289-40	A2.05| $B1FF	U210	960-5009-00
Sound	(512K)	965-0294-40		U7	960-7001-02
Display	(4M)	965-0295-40	A2.00 | $C929	ROM 0	960-5015-01
Voice 1	(4M)	965-0290-40		U17	960-5015-01
Voice 2	(4M)	965-0291-40		U21	960-5015-01
Voice 3	(4M)	965-0292-40		U36	960-5015-01
Voice 4	(4M)	965-0293-40		U37	960-5015-01
South Park (Notes 4, 5)					
Game ROM	(1M)	965-0301-71	A1.03 | $58FF	U210	960-5009-00
Sound	(512K)	965-0306-71		U7	960-7001-02
Display	(4M)	965-0307-71	A1.01 | $166F	ROM 0	960-5015-01
Voice 1	(8M)	965-0302-71		U17	960-5016-00
Voice 2	(8M)	965-0303-71		U21	960-5016-00
Voice 3	(8M)	965-0304-71		U36	960-5016-00
Voice 4	(8M)	965-0305-71		U37	960-5016-00
Harley-Davidson® (Notes 4, 5, 6)					
Game ROM	(1M)	965-0319-67	A1.03 | $3EFF	U210	960-5009-00
Sound	(512K)	965-0320-67		U7	960-7001-02
Display	(4M)	965-0321-67	A1.04 | $FC7C	ROM 0	960-5015-01
Voice 1	(8M)	965-0322-67	look for	U17	960-5016-00
Voice 2	(8M)	965-0323-67	updated code	U21	960-5016-00
Voice 3	(8M)	965-0324-67	in late 2002	U36	960-5016-00
Voice 4	(4M)	965-0325-67	for new HDs.	U37	960-5015-01
Striker Xtreme (Notes 4, 5)					
Game ROM	(1M)	965-0326-68	A1.02 | $E4FF	U210	960-5009-00
Sound	(512K)	965-0327-68		U7	960-7001-02
Display	(4M)	965-0328-68	A1.03 | $1957	ROM 0	960-5015-01
Voice 1	(8M)	965-0329-68		U17	960-5016-00
Voice 2	(8M)	965-0330-68		U21	960-5016-00
Voice 3	(8M)	965-0331-68		U36	960-5016-00
Voice 4	(8M)	965-0332-68		U37	960-5016-00
NFL (Notes 4, 5)					
Game ROM	(1M)	965-0339-73	A1.00 | $D2FF	U210	960-5009-00
Sound	(512K)	965-0340-73		U7	960-7001-02
Display	(4M)	965-0341-73	A1.01 | $845A	ROM 0	960-5015-01
Voice 1	(8M)	965-0342-73	*not on website:*	U17	960-5016-00
Voice 2	(8M)	965-0343-73	code through	U21	960-5016-00
Voice 3	(8M)	965-0344-73	Distributor	U36	960-5016-00
Voice 4	(8M)	965-0345-73	only.	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		U7	960-7001-02
Display	(4M)	965-0335-72	A2.01 | $6C33	ROM 0	960-5015-01
Voice 1	(8M)	965-0336-72		U17	960-5016-00
Voice 2	(8M)	965-0337-72		U21	960-5016-00
Voice 3	(8M)	965-0338-72		U36	960-5016-00
High Roller Casino (Notes 4, 5)					
Game ROM	(1M)	965-0346-65	A3.00 | $90FF	U210	960-5009-00
Sound	(512K)	965-0347-65		U7	960-7001-02
Display	(4M)	965-0348-65	A3.00 | $74B3	ROM 0	960-5015-01
Voice 1	(8M)	965-0349-65		U17	960-5016-00
Voice 2	(8M)	965-0350-65		U21	960-5016-00
Voice 3	(8M)	965-0351-65		U36	960-5016-00
Voice 4	(8M)	965-0352-65		U37	960-5016-00
Austin Powers™ (Notes 4, 5)					
Game ROM	(1M)	965-0353-74	A3.02 | $5DFF	U210	960-5009-00
Sound	(512K)	965-0354-74		U7	960-7001-02
Display	(4M)	965-00355-74	A3.00 | $6A34	ROM 0	960-5015-01
Voice 1	(8M)	965-0356-74		U17	960-5016-00
Voice 2	(8M)	965-0357-74		U21	960-5016-00
Voice 3	(8M)	965-0358-74		U36	960-5016-00
Voice 4	(8M)	965-0359-74		U37	960-5016-00
Monopoly® (Notes 4, 5)					
Game ROM	(1M)	965-0360-75	A3.03 | $5EFF	U210	960-5009-00
Sound	(512K)	965-0361-75		U7	960-7001-02
Display	(4M)	965-0362-75	A3.01 | $A381	ROM 0	960-5015-01
Voice 1	(8M)	965-0363-75		U17	960-5016-00
Voice 2	(8M)	965-0364-75		U21	960-5016-00
Voice 3	(8M)	965-0365-75		U36	960-5016-00
Voice 4	(8M)	965-0366-76		U37	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		U7	960-7001-02
Display	(4M)	965-0369-76	A5.00 | $A5FF	ROM 0	960-5015-01
Voice 1	(8M)	965-0370-76		U17	960-5016-00
Voice 2	(8M)	965-0371-76		U21	960-5016-00
Voice 3	(8M)	965-0372-76		U36	960-5016-00
Voice 4	(8M)	965-0373-76		U37	960-5016-00
RollerCoaster Tycoon™ (Notes 4, 5, 7)					
Sound	(512K)	965-0374-78		U7	960-7001-02
Game ROM	(1M)	965-0375-78	A7.01 | $40FF	U210	960-5009-00
Voice 1	(8M)	965-0377-78		U17	960-5016-00
Voice 2	(8M)	965-0378-78		U21	960-5016-00
Voice 3	(8M)	965-0379-78		U36	960-5016-00
Voice 4	(8M)	965-0380-78		U37	960-5016-00
Display	(4M)	965-0376-78	A7.00 | $8E23	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. Check our website (see back cover) for current versions or other info. Raw Part numbers are identical to the Harley-Davidson® original.
7. **ToPS™ (Tournament Pinball System) READY!**

Game Revisions can be updated after the Production Run. This Table is accurate as of the printing of this manual. If any changes occurred, the next game manual will include the updated information. The version stated is USA. If there is a question of as to the latest Code Revision & Check Sum call our Technical Support Department, 1-800-542-5377 or 1-708-345-7700 (Select Option 1). Visit our website www.SternPinball.com where code can be downloaded (an EPROM Burner is required).

APPENDIX B

Semi-Conductors / Integrated Circuits (I.C.) / Relays Cross-Reference Table

Table №	Type	Source Number	STERN™ PINBALL	N T E®	E C G®	Radio Shack®	R C A®
	RECTIFICATION, BLOCKING, DAMPENING DIODES AND/OR LIGHT EMITTING DIODES (LEDs)						
1	Diode	1N4001	112-5001-00	NTE552	ECG552	- — - — -	SK9000
	Diode	1N4004	112-5003-00	NTE116	ECG116	276-1103	SK3312
	Diode	1N5401	112-0056-00	NTE5801	ECG5801	276-1143	SK9004
	Diode	1N5404	112-5004-00	NTE5804	ECG5804	276-1144	SK9007
	Diode	T6A10L	112-5006-01	NTE5812	ECG5812	- — - — -	- — - — -
	Diode	FR302	112-5009-00	NTE588	ECG588	- — - — -	SK5014
	Diode, Signal	1N914	112-5014-00	- — - — -	- — - — -	- — - — -	- — - — -
	LED	**MT5000UR** or **TLRH180P** (T1-3/4 GaAlAs)	165-5052-00 *(old SPI Part №: 165-5100-00)*	- — - — -	- — - — -	276-066B	- — - — -
	ZENER DIODES						
2	Diode	1N4742A 12v	112-0061-00	NTE142A	ECG142A	276-563	SK12V
	Diode	1N4760B 68v	112-0062-00B	NTE5092A	ECG5092A	- — - — -	SK68V
	Diode	1N4764A 100v	112-0049-00A	NTE5096A	ECG5096A	- — - — -	SK100V
	Diode	1N5228 3.9v	112-0053-00	NTE5007A	ECG5007A	- — - — -	SK3A9
	Diode	1N5234B 6.2v	112-0047-00B	NTE5013A	ECG5013A	276-561	SK6A2
	Diode	1N5379 110v	112-0072-00	NTE5157	ECG5157	- — - — -	SK110X
	Diode	1N6267A 6.8v	112-5011-00	NTE4902	ECG4902	- — - — -	- — - — -
	Diode	1N4752A 33v	112-5010-00A	NTE147A	ECG147A	- — - — -	SK33V
	Diode	1N4736 6.8v 1w	112-5007-00	NTE5071A	ECG5071A	- — - — -	- — - — -
	TRANSISTORS - TYPE FET, NPN, PNP AND/OR SCR						
3	FET Trans.	STP20N10L	110-0106-00	NTE2987	ECG2987	- — - — -	- — - — -
	FET Trans.	STP19N06L	110-0088-00	NTE2985	ECG2985	- — - — -	- — - — -
	FET Trans.	VN02N	110-0089-00	- — - — -	- — - — -	- — - — -	- — - — -
	NPN Trans.	2N4401	110-0073-00	NTE85	ECG85	276-2009	SK3124A
	NPN Trans.	2N6427	110-0070-00	NTE48	ECG48	- — - — -	SK4906
	NPN Trans.	MJE340	110-0071-00	NTE157	ECG157	- — - — -	SK3747
	NPN Trans.	MPSA42	110-0082-00	NTE287	ECG287	- — - — -	SK3232
	NPN Trans.	2N3904	110-0069-00	NTE123AP	ECG123AP	276-2009	- — - — -
	NPN Trans.	TIP122	110-0067-00	NTE261	ECG261	276-2068	SK3896
	NPN Trans.	MJE15030	110-0101-00	NTE375	ECG375	- — - — -	SK9118
	PNP Trans.	2N5401	110-0078-00	NTE288	ECG288	- — - — -	SK3434
	PNP Trans.	MJE15031	110-0103-00	NTE292	ECG292	- — - — -	SK3441
	PNP Trans.	MJE350	110-0072-00	NTE374	ECG374	- — - — -	SK9042
	PNP Trans.	MPSA92	110-0100-00	NTE288	ECG278	- — - — -	SK3434
	PNP Trans.	TIP42	110-0068-00	NTE332	ECG332	- — - — -	SK9236
	PNP Trans.	TIP32C	110-0081-00	NTE292	ECG292	- — - — -	SK3441
	PNP Trans.	TIP36C	110-0077-00	NTE393	ECG393	- — - — -	SK3961
	SCR Trans.	2N5060	110-0074-00	NTE5400	ECG5400	276-1067	SK3950
	SCR Trans.	SCR2800B	110-0083-00	NTE5461-8	ECG5461-8	- — - — -	- — - — -
	BRIDGE RECTIFIERS (BR)			**Comments:**			
4	BR (Present)	DB3501 or CM3501	112-5000-00	For White Star I/O Bds., BR = 35 Amp @ 100v P.I.V.			
	RELAYS			**Comments:**			
5	Relay	FRL-264 D024/02CK	190-5002-00	For PPB, Power Supply, & White Star I/O Boards, Relay = 24v DC 10 Amp DPDT			
	Relay	FRL-264 D006/04CV	190-5001-00	For CPU Boards, Relay = 6v DC 5 Amp 4 Pole DT			

APPENDIX C

Game Mfg. Date, Manual Part Nº & CPU Jumper Table†

Game Name	Game Mfg. Date and Manual PNº	CPU Ver.	EPROM Position	Jumpers Installed (*see Note)	Jumpers Removed (*see Note)
1. Laser War	MAY 87 780-5001-00	1	5C	J4 J6a J7a	J5 J6 J7b
		2	5B, 5C	J4 J5a J6a	J5 J5b J6b
2. Secret Service	MAR 88 780-5002-00	2	5B, 5C	J4	J5
3. Torpedo Alley	AUG 88 780-5003-00	2	5B, 5C	J4	J5
4. Time Machine	DEC 88 780-5004-00	2	5B, 5C	J4	J5
5. Playboy 35th Anniversary	MAY 89 780-5005-00	2	5B, 5C	J4	J5
6. ABC Monday Night Football	SEP 89 780-5007-00	2	5B, 5C	J4	J5
7. Robocop	NOV 89 780-5006-00	2	5B, 5C	J4	J5
8. Phantom of the Opera	JAN 90 780-5008-00	2	5B, 5C	J4	J5
9. Back to the Future	JUN 90 780-5009-00	3	5B, 5C	J4	J5
10. The Simpsons	SEP 90 780-5012-00	3	5B, 5C	J4	J5
11. Checkpoint	FEB 91 780-5010-00	3	5B, 5C	J4	J5
12. Teenage Mutant Ninja Turtles	MAY 91 780-5017-00	3	5B, 5C	J4	J5
13. Batman	JUL 91 780-5011-00	3	5B, 5C	J4	J5
14. Star Trek 25th Anniversary	OCT 91 780-5014-00	3	5C	J5	J4
15. Hook	JAN 92 780-5019-00	3	5C	J5	J4
16. Lethal Weapon 3	JUN 92 780-5026-00	3	5C	J5	J4
17. Star Wars	OCT 92 780-5024-00	3	5C	J5	J4
18. Rocky & Bullwinkle & Friends	FEB 93 780-5022-00	3	5C	J5	J4
19. Jurassic Park	APR 93 780-5020-00	3	5C	J5	J4
20. Last Action Hero	AUG 93 780-5027-00	3	5C	J5	J4
21. Tales from the Crypt	NOV 93 780-5018-00	3	5C	J5	J4
22. The Who's Tommy	FEB 94 780-5028-00	3	5C	J5	J4
23. WWF Royal Rumble	MAY 94 780-5023-00	3	5C	J5	J4
24. Guns-N'-Roses	JUL 94 780-5029-00	3	5C	J5	J4
25. Maverick	SEP 94 780-5031-00	3	5C	J5	J4
26. Mary Shelley's Frankenstein	DEC 94 780-5036-00	3	5C	J5	J4
27. Baywatch	MAR 95 780-5033-00	3	5C	J5	J4
28. Batman Forever	JUL 95 780-5038-00	3	5C	J5	J4
29. Apollo 13 (A13)	NOV 95 780-5044-00	—	U210	n / a	n / a
30. Golden Eye	FEB 96 780-5042-00	—	U210	n / a	n / a
31. Twister	APR 96 780-5041-00	—	U210	n / a	n / a
32. ID4: Independence Day	JUL 96 780-5045-00	—	U210	n / a	n / a
33. Space Jam	OCT 96 780-5043-00	—	U210	n / a	n / a
34. The Star Wars Trilogy - S.E.	FEB 97 780-5056-00	—	U210	n / a	n / a
35. The Lost World: J.P.	JUN 97 780-5053-00	—	U210	n / a	n / a
36. The X-Files	AUG 97 780-5046-00	—	U210	n / a	n / a
37. Starship Troopers	NOV 97 780-5059-00	—	U210	n / a	n / a
38. Viper Night Drivin'	FEB 98 780-5035-00	—	U210	n / a	n / a
39. Lost In Space	JUN 98 780-5060-00	—	U210	n / a	n / a
40. Godzilla	SEP 98 780-5040-00	—	U210	n / a	n / a
41. South Park	JAN 99 780-5071-00	—	U17 U21 U36 U37	W6 CPU/Snd.	n / a
42a. Harley-Davidson®	AUG 99 780-5067-01	—	U17 U21 U36 U37	W6 CPU/Snd.	n / a
42b. **Harley-Davidson® 2nd Ed.**	SEP 02 780-5067-10	—	U17 U21 U36 U37	W6 CPU/Snd.	n / a
43a. Striker Xtreme	MAR 00 780-5068-01	—	U17 U21 U36 U37	W6 CPU/Snd.	n/a
43b. NFL	OCT 00 780-5073-00	—	U17 U21 U36 U37	W6 CPU/Snd.	n/a
44. Sharkey's Shootout	OCT 00 780-5072-01	—	U17 U21 U36	W6 CPU/Snd.	n/a
45. High Roller Casino	JAN 01 780-5065-00	—	U17 U21 U36 U37	W6 CPU/Snd.	n/a
46. Austin Powers™	MAY 01 780-5074-00	—	U17 U21 U36 U37	W6 CPU/Snd.	n/a
47. Monopoly®	SEP 01 780-5075-00	—	U17 U21 U36 U37	W6 CPU/Snd.	n/a
48. Playboy	FEB 02 780-5076-00	—	U17 U21 U36 U37	W6 CPU/Snd.	n/a
49. RollerCoaster Tycoon™	AUG 02 780-5078-00	—	U17 U21 U36 U37	W6 CPU/Snd.	n/a

† Additional Information for Installed / Removed Jumpers (List 1-28 only):

Board Combinations with **ROM** at Location **5C** (Game 1, Ver1) **Installed** J1b, J3, J4, J6a, **J7a** & J8 **Removed** J1a, J2, J5, **J6** & **J7b**

Board Combinations w/ **ROM** at Locations **5B**, **5C** (Game 1, Ver2) **Installed** J1b, J3, J4, **J5a, J6a, J7b** & J8 **Removed** J1a, J2, J5, **J5b, J6b,** & **J7a**

Board Combinations w/ **ROM** at Locations **5B**, **5C** (Games 2-12, Ver2/3) **Installed** J1b, J3, **J4**, **J5b**, **J6b,** J7b & J8 **Removed** J1a, J2, **J5, J5a, J6a** & J7a

Board Combinations with **ROM** at Locations **5C** (Games 14-28, Ver3) **Installed** J1b, J3, **J5,** J5b, J6b, J7b & J8 **Removed** J1a, J2, **J4,** J5a, J6a & J7a

* Version 1 has a 2K RAM which is a 24-pin IC in Position 5D; Versions 2 & 3 have a 8K RAM which is a 28-PIN IC in Position 5D.

APPENDIX D
Board Type Table

Game Name	Flipper	Sound	Power Supply	Display X-Digit
• Laser War	2-Flipper **Board Not Required**	***initial:*** 520-5002-00 ***replaced with:*** 520-5002-02 *520-5002-01 was not used.*	520-5000-00	Master: 520-5004-00 plus: 520-5005-00 (Qty. 2): 7 Digit Alpha/Numeric 520-5006-00 (Qty. 2): 7 Digit Numeric 520-5007-00 (Qty. 1): 4 Digit Numeric
• Secret Service • Torpedo Alley	3-Flipper **Board Not Required**	520-5002-02		520-5014-01 7 Digit Alpha/Numeric Combined
• Time Machine	2-Flipper **Board Not Required**			
• Playboy 35th Anniversary * • ABC Monday Night Football * • *Robocop* • *Phantom of the Opera* • *Back to the Future*	520-5033-00 2-Flipper *(*only for 100 games of Playboy 35th Anniv. & ABC Mon. Night Football)*			520-5030-00 16 Digit Alpha/Numeric Combined
• The Simpsons		520-5002-**03**		

Game Name	Flipper	Sound	Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Apllication
• Checkpoint • Teenage Mutant Ninja Turtles	520-5033-00 2-Flipper	520-5002-03	520-5047-00	520-5042-00 128 X 16				
• Batman • Star Trek 25th Anniv. • Hook		520-5050-01						
• Lethal Weapon 3			520-5047-01	520-5052-00 128 X 32	520-5055-00			
• Star Wars • Rocky & Bull-winkle & Friends		520-5050-02						
• Jurassic Park	520-5076-00 3-Flipper		520-5047-02					
• Last Action Hero	520-5070-00 2-Flipper	520-5050-03						
• Tales from the Crypt	520-5076-00 3-Flipper				520-5055-01			
• The Who's Tommy		520-5077-00						
• WWF Royal Rumble	**520-5070 / 5080 -00** 4-Flipper (2X2)							
• Guns N' Roses	520-5076-00 3-Flipper							
• Maverick		520-5050-03	520-5047-03	520-5075-00 192 X 64	520-5092-01	520-5102-00 Single OPTO	520-5103-00 Single OPTO	Paddle Boat Wheel Enter
• Mary Shelley's Frankenstein	520-5076-00 3-Flipper	520-5077-00						
• Baywatch	**520-5070 / 5080 -00** 4-Flipper (2X2)	520-5126-02				520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker
• Batman Forever	520-5076-00 3-Flipper					520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker

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

GAMES HEREON USE THE WHITE STAR BOARD SYSTEM™ *(with the addition of the I/O Power Driver Board):*

Game Name	Flipper	I/O Power Driver	CPU/Sound Stereo	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Apllication
Apollo 13	520-5080-00 2-Flipper	520-5137-00	520-5136-00	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker
	Miscellaneous PC Boards:	Light Boards 520-5130-01, -04 & -05 Magnet Interface, 7-Segment Display & Light Bd. 520-5130-06 Magnet Driver Board 520-5130-02 Switch Membrane Board 520-5130-03				Relay Board 520-5010-00			
Golden Eye	520-5080-00 2-Flipper	520-5137-00	520-5136-00	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker
	Miscellaneous PC Boards:	Light Boards 520-5128-05 through -08		Mag. Processor X2 Driver Bd. 520-5143-00		Relay Board 520-5010-00			

GAMES HEREON USE THE WHITE STAR BOARD SYSTEM™ *(with the deletion of the Flipper Board):*

Game Name	I/O Power Driver	CPU/Sound Mono	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO 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	
	MiscellaneousPC 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	
	MiscellaneousPC 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	

Table continued on the next page.

APPENDIX D

Board Type Table

Game Name	I/O Power Driver	CPU/Sound Mono	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Application	Misc OPTO & App.
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
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Shaker Mtr. Bd. 520-5065-00						
The X-Files	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	520-5155-00 3-Pos. Motor Sensor on File Cab. Motor
	Miscellaneous PC Boards:					520-5082-00 Long Hop OPTO	520-5083-00 Long Hop OPTO	File Cabinet Enter	
Starship Troopers	520-5137-01	520-5136-15	520-5138-00	520-5052-00 128 X 32	520-5055-02	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	4X 7-Segment Display Board 520-5166-00				520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	L/R Orbit Lane Enter	
Viper Night Drivin'	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00				520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Jump Ramp	
Lost In Space	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00							
Godzilla	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Shaker Mtr. Bd. 520-5065-00							
South Park	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:					520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Kenny Under Trough Enter	
Harley-Davidson®	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00	Shaker Mtr. Bd. /520-5065-00	Diode Board 520-5146-00		520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Motorcycle Enter	
Striker Xtreme (NFL)	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5155-00 3-Pos. Motor Sensor on Goalie Motor
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Relay Board 520-5010-00	Diode Board 520-5146-00	for **UK ONLY> Solenoid Expander Bd. 520-5192-00**	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Goalie Under-Trough Enter	
Sharkey's Shootout	520-5137-64	520-5136-64	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5194-00 4-Pos. Motor Sensor on ?-Ball Motor
	Miscellaneous PC Boards:	Relay Board 520-5010-00	Sol. Exp. Bd. 520-5192-00						
High Roller Casino	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5194-00 4-Pos. Motor Sensor on Roulette Wheel Motor
						520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Ball Lock under Roulette	
	Miscellaneous PC Boards:	Dot Display (5X7) in Slot Mach. 520-5197-00			for **UK ONLY> Solenoid Expander Bd. 520-5192-00**	520-5196-00 3-Pos. OPTO	520-5195-00 3-Pos. OPTO	Up/Dn Ramp in Slot Mach.	
Austin Powers™	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5212-00 **Pulse-Stretcher OPTO on Spini-Me**
	Miscellaneous PC Boards:	Relay Bd. (X3) 520-5010-00			for **UK ONLY> Solenoid Expander Bd. 520-5192-00**	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	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	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	
Playboy	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	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	520-5173-00 Dual OPTO	520-5174-00 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	

† ***Note:*** To order Game Specific CPU/ Sound Board please specify Game Name.

APPENDIX E

Generic Coil Cross-Reference Guide † ‡

STANDARD COILS						FLIPPER COILS			
GA-TURNS	Res. (Ω)	SPI PART Nº	GA-TURNS	Res. (Ω)	SPI PART Nº	GAUGE-TURNS	Res. (Ω)	COLOR	SPI PART Nº
20-400	1.0 Ω	090-5021-00	**24-940 †**	5.5 Ω	090-5036-00T	**21-900 †**	*not available*	RED	090-5020-10T
22-500	1.7 Ω	090-5017-00			090-5036-00B	**22-750**/30-2600 ‡	2.6 / 92.0 Ω	N/A	090-5011-00
22-600	2.2 Ω	090-5023-00	**25-1240**	9.3 Ω	090-5034-00	**22-900 †**	3.4 Ω	YEL	090-5020-20T
23-700	3.1 Ω	090-5022-00	**26-1200 †**	10.3 Ω	090-5044-00T	**22-1080 †**	4.3 Ω	YEL/GRN	090-5032-00T
23-750	3.4 Ω	090-5019-00			090-5044-00B				090-5032-00B
23-800 †	3.6 Ω	090-5001-00T	**27-1300**	14.2 Ω	090-5003-00	**23-620**/30-2600 ‡	2.4 / 75.0 Ω	N/A	090-5006-00
		090-5001-00B	**27-1400**	14.7 Ω	090-5015-00	**23-700**/30-2600 ‡	3.0 / 83.5 Ω	N/A	090-5013-00
23-840	4.0 Ω	090-5005-00	**27-1500**	16.3 Ω	090-5004-00T	**23-800**/30-2600 ‡	2.8 / 90.5 Ω	N/A	090-5012-00
23-1200	7.1 Ω	090-5008-00			090-5004-00B	**23-900**	3.8 Ω	GRN	090-5020-30
23½-765	3.6 Ω	090-5037-03	**28-1050**	11.5 Ω	090-5046-00	**23-1100**	5.1 Ω	ORG	090-5030-00
24-900	5.0 Ω	090-5002-00	**29-2000**	33.6 Ω	090-5016-00	**23-1500**	4.4 Ω	BLU	090-5062-00T
						24-1570	9.5 Ω	N/A	090-5025-00
						25-1800	13.8 Ω	BLU/GRN	090-5041-00

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

† Coil Part Nºs ending with a "T" signifies the Diode is on the top of the lug; ...ending with a "B" signifies the Diode is on the bottom of the lug.

‡ These coils are dual-wound. ***Also Note:*** All Coil Part Nºs listed ***Do Not Include*** Coil Sleeves (must be ordered separately).

MAGNET COILS w/12" leads			TRIP COILS (Miniature)						LUGLESS COILS	
GA-TURNS	Res. (Ω)	SPI PART Nº	GA-TURNS	Res. (Ω)	SPI PART Nº	GA-TURNS	Res. (Ω)	SPI PART Nº	GA-TURNS	Res. (Ω)
22-650	4.3 Ω	090-5042-01	**29-1000**	15.2 Ω	090-5059-00	**33-1590**	59 Ω	515-6916-00	SPI PART Nº	
24-780	8 Ω	090-5061-00	**31-1500**	52.0 Ω	090-5054-00	**32-1250**	35 Ω	515-6916-**01**	**23-800**	3.6 Ω
20½-480	2.9 Ω	090-5064-02	**32-1800**	50.2 Ω	090-5031-00	Note: 33-1590 WHT & 32-1250 YEL			090-5053-00	

Flipper Coil Table ‡ ††

GAME NAME	Nº of Flippers	LOWER FLIPPERS SPI Nº / GAUGE-TURNS / Color		UPPER FLIPPERS SPI Nº / GAUGE-TURNS / Color	
		LEFT	RIGHT	LEFT	RIGHT
Laser War ‡	**2**	090-5011-00 **22-750 / 30-2600**	SAME	Not Used	Not Used
Secret Service ‡	**3**	090-5006-00 **23-620 / 30-2600**	SAME	Not Used	090-5006-00 **23-620 / 30-2600**
Torpedo Alley ‡	**3**	090-5011-00 **22-750 / 30-2600**	090-5013-00 **23-700 / 30-2600**	Not Used	090-5012-00 **23-800 / 30-2600**
Time Machine ‡	**2**	090-5011-00 **22-750 / 30-2600**	SAME	Not Used	Not Used

‡ These coils are dual-wound.

Playboy 35th Anniversary ††	**2**	090-5020-02 **22-900 -YEL-**	SAME	Not Used	Not Used
ABC Monday Night Football ††	**2**	090-5020-02 **22-900 -YEL-**	SAME	Not Used	Not Used

†† A very small % of these games used a 090-5020-20 coil which used a proto-type Solid State Flipper System. The two types of coils both are 22-900 coils; the only difference being the addition of the 1N5404 Diode on the (-02) coils which was used in the Deger Design.

Robocop	**2**	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
Phantom of the Opera	**2**	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
Back to the Future	**2**	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
The Simpsons	**2**	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
Checkpoint	**2**	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
Teenage Mutant Ninja Turtles	**2**	090-5020-30 **23-900 -GRN-**	SAME	Not Used	Not Used
Batman	**2**	090-5020-30 **23-900 -GRN-**	SAME	Not Used	Not Used
Star Trek 25th Anniversary	**2**	090-5020-30 **23-900 -GRN-**	SAME	Not Used	Not Used
Hook	**2**	090-5030-00 **23-1100 -ORG-**	090-5020-30 **23-900 -GRN-**	Not Used	Not Used
Lethal Weapon 3	**2**	090-5030-00 **23-1100 -ORG-**	SAME	Not Used	Not Used
Star Wars	**2**	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used

Table continued on the next page.

APPENDIX E

Flipper Coil Table †

GAME NAME	Nº of Flippers	LOWER FLIPPERS		UPPER FLIPPERS	
		SPI Nº / GAUGE-TURNS / Color		SPI Nº / GAUGE-TURNS / Color	
		LEFT	RIGHT	LEFT	RIGHT
Rocky & Bullwinkle & Friends	2	090-5020-30 **23-900 -GRN-**	SAME	Not Used	Not Used
Jurassic Park	3	090-5020-30 **23-900 -GRN-**	SAME	Not Used	090-5030-00 **23-1100 -ORG-**
Last Action Hero	2	090-5020-30 **23-900 -GRN-**	SAME	Not Used	Not Used
Tales from the Crypt	3	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	090-5041-00 **25-1800 -BLU-GRN-**
The Who's Tommy	3	090-5020-30 **23-900 -GRN-**	SAME	090-5041-00 **25-1800 -BLU-GRN-**	Not Used
WWF Royal Rumble	4	090-5032-00 **22-1080 -YEL-GRN-**	SAME	090-5041-00 **25-1800 -BLU-GRN-**	SAME
Guns N' Roses	3	090-5032-00 **22-1080 -YEL-GRN-**	SAME	090-5030-00 **23-1100 -ORG-**	Not Used
Maverick	3	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	090-5032-00 **22-1080 -YEL-GRN-**
Mary Shelley's Frankenstein	3	090-5030-00 **23-1100 -ORG-**	SAME	Not Used	090-5030-00 **23-1100 -ORG-**
Baywatch	4	090-5030-00 **23-1100 -ORG-**	090-5020-30 **23-900 -GRN-**	090-5025-00 **24-1570 -N/A-**	090-5030-00 **23-1100 -ORG-**
Batman Forever	3	090-5032-00 **22-1080 -YEL-GRN-**	090-5020-20 **22-900 -YEL-**	Not Used	090-5020-30 **23-900 -GRN-**
Apollo 13	2	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
Golden Eye	2	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
Twister	2	090-5020-20 **22-900 -YEL-**	090-5032-00 **22-1080 -YEL-GRN-**	Not Used	Not Used
ID4: Independence Day	3	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	090-5020-30 **23-900 -GRN-**
Space Jam †	2	090-5032-00T **22-1080 -YEL-GRN-**	090-5020-20T **22-900 -YEL-**	Not Used	Not Used
The Star Wars Trilogy - Special Edition †	2	090-5032-00T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
The Lost World: Jurassic Park †	2	090-5032-00T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
The X-Files †	2	090-5032-00T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
Starship Troopers †	3	090-5030-00T **23-1100 -ORG-**	SAME	Not Used	090-5032-00T **22-1080 -YEL-GRN-**
Viper Night Drivin' †	2	090-5030-00T **23-1100 -ORG-**	SAME	Not Used	Not Used
Lost In Space †	2	090-5030-00T **23-1100 -ORG-**	090-5032-00T **22-1080 -YEL-GRN-**	Not Used	Not Used
Godzilla †	2	090-5032-00T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
South Park †	2	090-5030-00T **23-1100 -ORG-**	SAME	Not Used	Not Used
Harley-Davidson® †	2	090-5032-00T **22-1080 -YEL-GRN-**	090-5030-00T **23-1100 -ORG-**	Not Used	Not Used
Striker Xtreme (NFL) †	3	090-5032-00T **22-1080 -YEL-GRN-**	090-5030-00T **23-1100 -ORG-**	090-5030-00T **23-1100 -ORG-**	Not Used
Sharkey's Shootout †	3	090-5030-00T **23-1100 -ORG-**	090-5030-00T **23-1100 -ORG-**	090-5030-00T **23-1100 -ORG-**	Not Used
High Roller Casino †	2	090-5020-20T **22-900 -YEL-**	090-5032-00T **23-1080 -YEL-GRN-**	Not Used	Not Used
Austin Powers™ †	2	090-5020-30 **23-900 -GRN-**	090-5030-00T **23-1100 -ORG-**	Not Used	Not Used
Monopoly® †	3	090-5032-00T **22-1080 -YEL-GRN-**	090-5032-00T 22-1080 -YEL-GRN-	Not Used	090-5062-00T 23-1500 -BLU-
Playboy †	2	090-5030-00T **23-1100 -ORG-**	090-5030-00T **23-1100 -ORG-**	Not Used	Not Used
RollerCoaster Tycoon™ †	4	090-5032-00T **22-1080 -YEL-GRN-**	SAME	090-5067-00T 25-1400 -RED-	090-5068-00T **25-1600 -WHT-**

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

APPENDIX F

Motor Specification Table

The following table only list games that used motors. *Part Numbers starting with "515-" will include the Wiring Harness & Connector.*

Game Name	Function	Specifications	Part №
ABC Monday Night Football	Goal Post Up/Down Movement	Motor 24v A.C. 60 RPM CW	515-5222-00
Phantom of the Opera	Organ Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Checkpoint	Mag Wheel (in Backbox)	Motor D.C. (KEN)	041-5005-00
	Shaker	Johnson Motor (Vibrator)	041-5002-00
Teenage Mutant Ninja Turtles	Spinning Pizza Ball Deflector	Gear Motor 24v A.C. 325 RPM CW	515-5397-00
Batman	Bar Target Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Star Trek 25th Anniversary	Swinging Target	Bowman Motor 24v 22½ RPM	515-5534-00
	Transporter F/X	Gear Motor 24v A.C. 3½ RPM	500-5421-00
	Cooling Fan (for Transporter F/X)	4½" Motor 12v	041-5014-00
Lethal Weapon 3	Spinning Light	Motor 2½ v A.C. 4000 RPM CCW	041-5017-00
Star Wars	Bar Target Up/Down Movement	Bowman Motor 24v 60hz 3W 11 RPM CCW	515-5256-00
	R2D2 Robot Left/Right Movement	Bowman Motor 24v A.C. 22½ RPM CW	515-5571-00
	Death Star Rotation	Bowman "G" Motor 24v A.C. 60Hz 6 RPM CW	515-5570-00
Rocky & Bullwinkle & Friends	Nell Log "Cutting Blade" Forward/Back Movement	Autotrol Model E Motor 24v 60hz 4W 3 RPM CCW	041-5023-00
Jurassic Park	T-Rex Left/Right Movement	Multi Motor 5v D.C.	041-5025-00
	T-Rex Up/Down Movement	Bowman Motor 24v 11 RPM CW	041-5026-00
	Shaker	Johnson Motor (Vibrator)	041-5002-00
Last Action Hero	Crane Left/Right Movement	Multi Products Motor 12v D.C. #3312 OSC	041-5027-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Tales from the Crypt	Tombstone Up/Down Movement	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
The Who's Tommy	Mirror Up/Down Movement	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
	Flipper Blinders	Servo Motor (94102)	041-5032-00
	Spinning Airplane Propellers	Motor D.C.	041-5033-00
WWF Royal Rumble	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Maverick, The Movie	Turning Paddle Wheel	Motor 24v A.C. 10 RPM	041-5036-00
Mary Shelley's Frankenstein	Creature Head Left/Right Movement	Servo Motor (94102)	041-5032-00
Batman Forever	Cannon Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CCW	515-6383-00
Apollo 13	Rocket Up/Down Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CCW	515-6383-00
	Moon Unit Rotational Orbit	Multi Products Motor 24v A.C. 50/60Hz 3W 6 RPM CCW	515-6487-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Golden Eye	Satellite Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CW	515-6528-00

Table continued on the next page.

APPENDIX F

Motor Specification Table

The following table only list games that used motors. *Part Numbers starting with "515-" will include the Wiring Harness & Connector.*

Game Name	Function	Specifications	Part №
Twister	Spinning Disc with Magnet	Multi Products Motor 24v A.C. (041-5026-00) 50/60Hz 3W 325 RPM CCW	515-6347-00
	Backbox Fan (Tornado Wind)	Multi Products Motor 24v A.C. (041-5052-00) 50/60Hz 3W 3600 RPM CW	515-6531-00
ID4: Independence Day	Alien Head Open/Close Movement	Servo Motor (94322)	041-5045-00
The Star Wars Trilogy - S.E.	X-Wing Left/Right Movement	Bowman Motor 24v A.C. (041-5058-00) 60Hz 3W 10 RPM CCW	515-6383-01
The Lost World: J.P.	Snagger & Center Link Lift Up/Down Movement	Multi Products Motor 20v D.C. (041-5059-03) 9 RPM Non-Directional	515-6715-03
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
The X-Files	X-File Cabinet Lift Up/Down Movement	Multi Products Motor 20v D.C. 9 RPM CCW	041-5057-00
Starship Troopers	Warrior Bug Forward/Reverse Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12v D.C. 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not incl.) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 **Requires 7" Shaft:** 530-5503-00
Lost In Space	Spinning Disc with Magnet	Multi Products Motor 24v A.C. (041-5046-00) 50/60Hz 3W 325 RPM CCW	515-6347-00
Godzilla	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW ‡	041-5029-**01**
Harley-Davidson®	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW ‡	041-5029-**01**
	Motorcycle Lift Up/Down Movement	Autotrol 24v A.C. (041-5072-02) 20 RPM CCW	515-7025-00
Striker Xtreme (NFL)	Goalie (Linebacker) Left to Right Movement	Multi #3590 12v D.C. (041-5075-00) 60 RPM	515-7071-00
Sharkey's Shootout	Mystery Ball Rotating Movement	Hankscraft Motor Model-E 24v A.C. (041-5076-00) 50/60Hz 3W 20 RPM CW	515-7095-00
High Roller Casino	Roulette Wheel Rotating Movement	Multi Products Motor 20V D.C. (041-5078-00) 17 RPM CCW	515-7153-00
	Up/Dn. Ramp in Slot Mach. Lift Up/Down Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12v D.C. 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not incl.) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 **Requires Shaft 4¼":** 530-5503-01
Austin Powers™	Time Machine Rotating Movement	Multi Products Motor 24v A.C. (041-5079-00) 50/60Hz 20RPM CCW	515-7141-00
	Laser Beam Left to Right Directional	Autotrol Motor 24V A.C. (041-5081-00) 50/60Hz 4W 10RPM Bi-Directional	515-7171-00
	Dr. Evil Target Lift Up/Down Movement	Hankscraft Motor Model-E 24v A.C. (041-5030-00) 50/60Hz 6RPM CCW	515-5900-00
Monopoly®	Mini-Flipper (Waterworks) Rotating Movement	Multi Prod. Motor & Gear Box #7000 EX00159A 20v D.C. 50/60Hz 85RPM CC/CCW	041-5083-00
Playboy	Triangular Billboard Rotating Movement	Autotrol Motor (BD511 150-1387) 24v A.C. 50/60Hz 12RPM Bi-Directional	041-5086-02
	Centerfold Mechanism Open/Close Movement	Multi Products (3680) Motor 12v DC 10/12 RPM CC/CCW	041-5075-04
	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 **Requires 7" Shaft:** 530-5503-00

No motors were used on the following games: Laser War, Secret Service, Torpedo Alley, Time Machine, Playboy 35th Anniversary, Robocop, Back to the Future, The Simpsons, Hook, Guns N' Roses, Baywatch, Space Jam, Viper Night Drivin', South Park and RollerCoaster Tycoon.

‡ ***Please Note:*** *"-01" Shaker Motor is* ***Not Compatible*** *with old Shaker Motor 041-5029-**00** (Shaker Motor Assy. 515-5893-00). THIS NEW MOTOR CAN ONLY BE USED IN NEW SHAKER MOTOR ASSY. 515-5893-**01**.*

APPENDIX G

Part Number Prefix Classification Codes

I. Electrical Source, Energy & Signal Converters
- 010- Transformers
- 031- Speakers
- 090- Solenoids (Coils)

II. Conductors, Connectors & Insulators
- 034- Line Cords
- 036- Cable and Harness Assemblies
- 041- Motors
- 045- Connectors (All Types)
- 077- Lamp Sockets

III. Circuits & Circuit Elements
- 100- ICs
- 110- Transistors
- 112- Diodes
- 121- Resistors
- 123- Resistors (Variable & Adjustable)
- 124- Regulators & Bridge Rectifiers
- 125- CAPS
- 140- Crystals
- 165- Light Bulbs
- 180- Switches
- 190- Relays

IV. Bolts, Screws, Nuts & Washers
- 231- Bolts
- 232- Screws (Pan Head)
- 234- Screws (HWH)
- 237- Screws (Misc.)
- 240- Nuts (Misc.)
- 242- Washers (Flat, Round)
- 244- Washers (Split Lock)
- 246- Washers (Lockers, External Tooth)

V. Mechanical Components
- 249- Rivets
- 251- Pins (Dowel)
- 254- Stand-Offs, Spacers and Shims
- 260- Steel Ball
- 265- Springs (Extension)
- 266- Springs (Compression)
- 269- Springs (Washers - Belleville, Wave)
- 280- Grommets and Bushing

VI. Handles, Locks, Catches & Latches, Keys & Hinges
- 355- Handles, Locks, Catches & Latches and Keys
- 390- Hinges

VII. Fabricated Parts (In-House Assemblies)
- 500- End Product (Systems and Models)
- 515- Sub-Assemblies
- 520- Printed Circuit Boards (PCBs)
- 522- Display Glass
- 525- Wood Parts
- 530- Screw Machined Parts
- 535- Fabricated Parts
- 545- Molded (Extruded) Plastic/Rubber Parts
- 550- Molded (Inserts)

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

IX. Miscellaneous
- 705- Packing & Shipping Items
- 820- Decals and Labels (Sets & Misc.)
- 830- Butyrate (Plastic Pieces)
- 900- Game Posters
- 960- EPROM (Raw Part)
- 965- EPROM (Programmed Part)

APPENDIX H

Playfield Inserts (Plastic Light Covers)

Patterns: **STARBURST**  **STIPPLE** 	**STARBURST CIRCULAR** 5/8" ø **550-5000-XX**	**STARBURST CIRCULAR** 3/4" ø **550-5001-XX**	**STARBURST CIRCULAR** 1" ø **550-5002-XX**	**STARBURST CIRCULAR** 1-3/16" ø **550-5003-XX**	**STARBURST CIRCULAR** 1-1/2" ø **550-5004-XX**
STARBURST CIRCULAR 2-1/4" ø **550-5005-XX**	**STARBURST CIRCULAR** 2-3/4" ø **550-5006-XX**	**PLAIN CIRCULAR** 3/4" ø **550-5007-XX**	**PLAIN CIRCULAR** 1" ø **550-5008-XX**	**PLAIN CIRCULAR** 1-3/16" ø **550-5009-XX**	**PLAIN CIRCULAR** 1-1/2" ø **550-5010-XX**
PLAIN CIRCULAR 2-1/4" ø **550-5011-XX**	**PLAIN CIRCULAR** 2-3/4" ø **550-5012-XX**	**STIPPLE CIRCULAR** 1" ø **550-5048-XX**	**STIPPLE 1" SQUARE** 1" **550-5019-XX**	**ROLLOVER BUTTON BASE** **550-5026-XX**	**WHITE STAR** *(only in white)* **545-5015-00**
STIPPLE RECTANGULAR 1-1/2" X 3/4" **550-5018-XX**	**STIPPLE RECTANGULAR** 1-5/8" 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.*

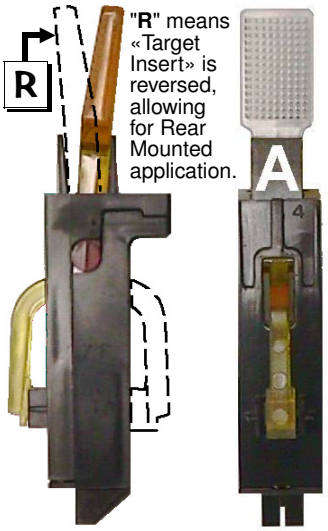
Instructions: Parts which may come in various colors (i.e. targets, some posts, playfield inserts, etc.) end in a 2-digit Nº which correspond to the color of that part. The "**-XX**" in Part Nºs which may come in various colors should be replaced with the desired 2-Digit Nº. corresponding to the color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

PLASTIC PART COLOR CHART

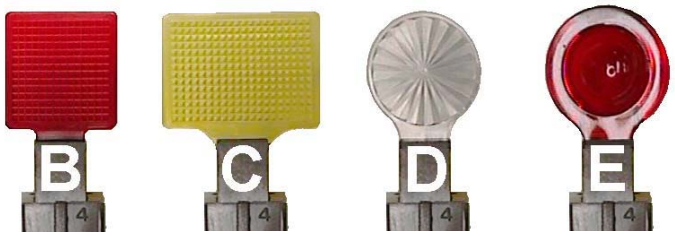
Nº	Color	Nº	Color	Nº	Color	Nº	Color	Nº	Color	Nº	Color
-00	**Black** or Solid Clear	**-03**	Amber	**-06**	Yellow	**-09**	Purple	**-12**	Fluor. Blue	**-15**	Luminescent
-01	Clear	**-04**	Green	**-07**	Orange	**-10**	Fluor. Orange	**-13**	Teal Green	**-16**	Gold
-02	Red	**-05**	Blue	**-08**	White	**-11**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

APPENDIX I

Stand-Up Targets



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



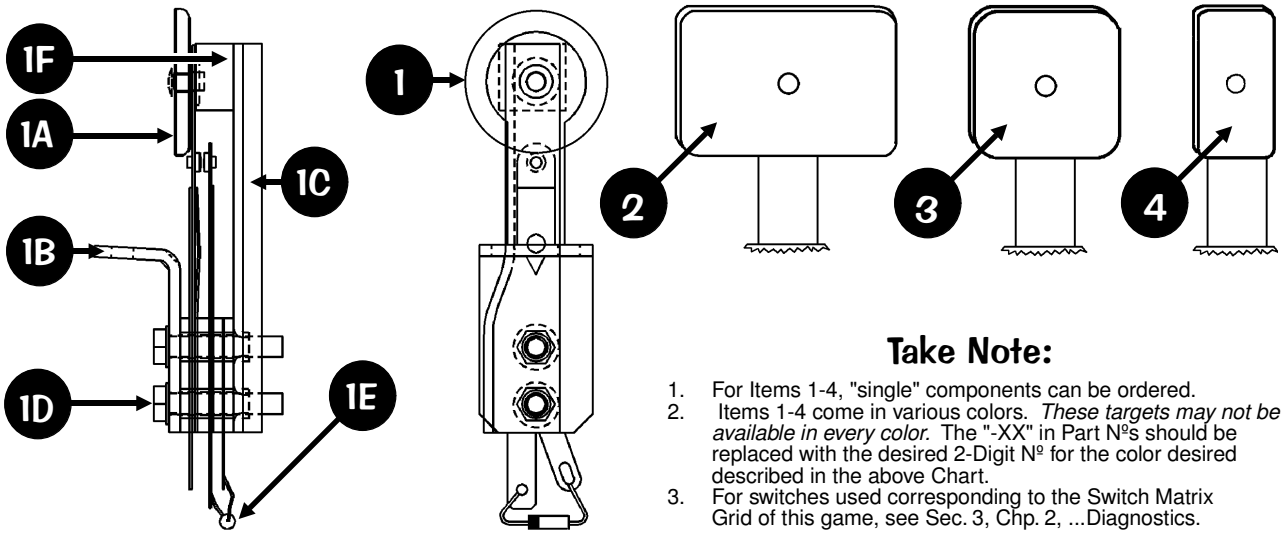
Take Note:

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.

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

Nº	STAND-UP TARGET NAME	SPI PART Nº	Nº	STAND-UP TARGET NAME	SPI PART Nº
A	Modular Stand-Up Target Narrow Assy.	500-6138-XX	D	Modular Stand-Up Target Round Assy.	500-6075-XX
	Stand-Up Target Narrow (Insert)	545-6138-XX		Stand-Up Target Round (Insert)	545-6075-XX
B	Modular Stand-Up Target Square Assy.	500-6139-XX	E	Mod. Stand-Up Target 1" Spherical Assy.	500-6189-XX
	Stand-Up Target Square (Insert)	545-6139-XX		Stand-Up Target 1" Spherical (Insert)	545-6189-XX
C	Modular Stand-Up Target Rectangle Assy.	500-6228-XX			
	Stand-Up Target Rectangle (Insert)	545-6228-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. Items 2B-F are identical to 1B-F	515-6027-XX 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 Items 3B-F are identical to 1B-F	515-5162-XX Same as 1B-F

‡ ***Note:*** Item **3A**, is a riveted Sub-Assy. which includes the following items for reference: **A1**— Stack Switch Radius End (180-5133-00), **A2**— Washer 5/16" (242-5017-00), **A3**— Rivet 1/8" ø X 3/16" (249-5001-00) **and A4**— 1" Square Target (545-5470-XX).

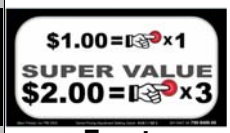
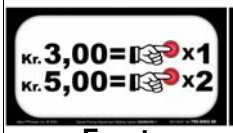
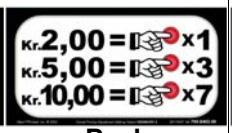
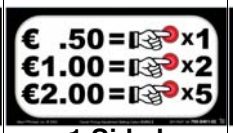
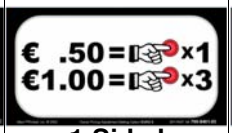
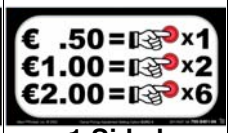
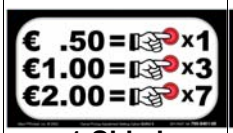
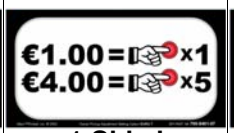
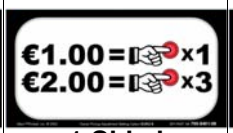
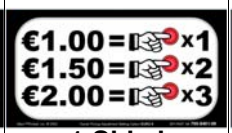
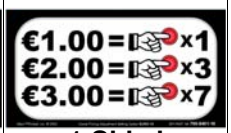
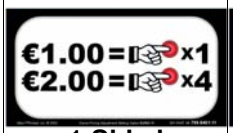
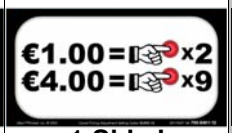
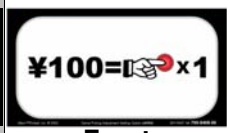
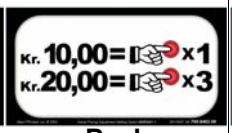
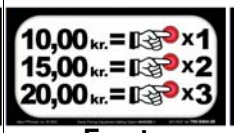
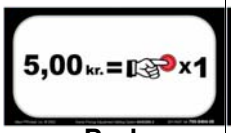
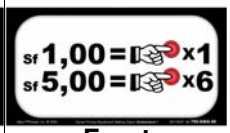
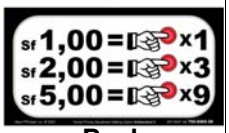
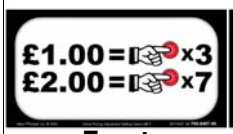
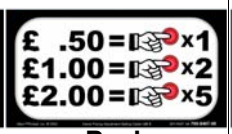
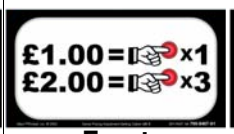
4	Narrow Stand-Up Target Assy.	500-5857-XX
ORDERING ABOVE (ITEM 4) ASSY. PART Nº WILL INCLUDE:		
4A‡	Sw. & Target Assy. Narrow Items 4B-F are identical to 1B-F	515-5967-XX Same as 1B-F

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

APPENDIX J

Coin Cards (USA & International Pricing Defaults)

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**
					
Front 755-5400-03 *‡	Back 755-5400-03 *‡	Front 755-5400-04 *‡	Back 755-5400-04 *†‡	Front 755-5406-00	Back 755-5406-00
DENMARK 1	**DENMARK 2**	**EURO 1**	**EURO 2**	**EURO 3**	**EURO 4**
					
Front 755-5402-00	Back 755-5402-00	1-Sided 755-5401-01	1-Sided 755-5401-02	1-Sided 755-5401-03	1-Sided 755-5401-04
EURO 5	**EURO 6**	**EURO 7**	**EURO 8**	**EURO 9**	**EURO 10**
					
1-Sided 755-5401-05	1-Sided 755-5401-06	1-Sided 755-5401-07	1-Sided 755-5401-08	1-Sided 755-5401-09	1-Sided 755-5401-10
EURO 11	**EURO 12**	**ToPS™EURO Custom *‡**	**ToPS™EURO Custom *†‡**	**JAPAN**	**JAPAN Custom †**
					
1-Sided 755-5401-11	1-Sided 755-5401-12	Front 755-5401-20 *‡	Back 755-5401-20 *†‡	Front 755-5408-00	Back 755-5408-00 †
NORWAY 1	**NORWAY 2**	**SWEDEN 1**	**SWEDEN 2**	**SWITZERLAND 1**	**SWITZERLAND 2**
					
Front 755-5403-00	Back 755-5403-00	Front 755-5404-00	Back 755-5404-00	Front 755-5405-00	Back 755-5405-00
UK 1	**UK 3**	**UK 5**	**UK Custom †**	**ToPS™UK Custom *‡**	**ToPS™UK Custom *†‡**
					
Front 755-5407-00	Back 755-5407-00	Front 755-5407-01	Back 755-5407-01 †	Front 755-5407-02 *‡	Back 755-5407-02 *†‡

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

† ***Any International can use the back side of these noted Coin Cards for Custom Pricing.***

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

Parts Order Checklist Notes

Date Ordered	Part Nº	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

ToPS™ Tournament Pinball System

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).

STERN PINBALL, INC.® LIMITED WARRANTY

STERN PINBALL, INC.®, ("SELLER") WARRANTS ONLY TO THE INITIAL PURCHASER OF ITS PRODUCTS THAT THE ITEMS LISTED BELOW ARE FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP UNDER NORMAL USE AND SERVICE FOR THE WARRANTY PERIOD SPECIFIED:

PRINTED CIRCUIT BOARDS (GAME LOGIC):	2 MONTHS
DOT MATRIX DISPLAY BOARDS:	9 MONTHS

NO OTHER PARTS OF SELLER'S PRODUCT ARE WARRANTED.

WARRANTY PERIODS ARE EFFECTIVE FROM THE INITIAL DATE OF SHIPMENT FROM SELLER TO ITS AUTHORIZED DISTRIBUTORS.

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CAUTIONS, WARNINGS & NOTICES

Caution

FOR SAFETY AND RELIABILITY, SUBSTITUTE PARTS AND EQUIPMENT MODIFICATIONS ARE NOT RECOMMENDED (AND MAY VOID ANY WARRANTIES). USE OF NON-STERN PINBALL INC.® PARTS OR MODIFICATIONS OF GAME CIRCUITRY, MAY ADVERSELY AFFECT GAME PLAY, OR MAY CAUSE INJURIES. TRANSPORT PINBALL GAMES WITH HINGED BACKBOX IN THE DOWN POSITION ONLY! ALWAYS TAKE GREAT CARE WHEN SERVICING ANY GAME. ALWAYS READ THE SERVICE MANUAL BEFORE REPLACING OR SERVICING COMPONENTS. SUBSTITUTIONS OF PARTS OR EQUIPMENT MODIFICATIONS MAY VOID FCC TYPE ACCEPTANCE.

Always Disconnect The Line Voltage Before Servicing. Some Parts May Still Hold Current When Unplugged.

Warning

THIS EQUIPMENT GENERATES, USES, AND CAN RADIATE RADIO FREQUENCY ENERGY, AND IF NOT INSTALLED AND USED IN ACCORDANCE WITH THE INSTRUCTIONS MANUAL, MAY CAUSE INTERFERENCE TO RADIO COMMUNICATIONS. IT HAS BEEN TESTED AND FOUND TO COMPLY WITH THE LIMITS FOR A CLASS A COMPUTING DEVICE PURSUANT TO SUBPART J OF PART 15 OF FCC RULES, WHICH ARE DESIGNED TO PROVIDE REASONABLE PROTECTION AGAINST SUCH INTERFERENCE WHEN OPERATED IN A COMMERCIAL ENVIRONMENT. OPERATION OF THIS EQUIPMENT IN A RESIDENTIAL AREA IS LIKELY TO CAUSE INTERFERENCE IN WHICH CASE THE USER AT HIS OWN EXPENSE WILL BE REQUIRED TO TAKE WHATEVER MEASURES MAY BE REQUIRED TO CORRECT THE INTERFERENCE.

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 Terminal Strip:

Column (Drive) / Row (Return)	1: Q1 GRN-BRN CN5-P1	2: Q2 GRN-RED CN5-P3	3: Q3 GRN-ORG CN5-P4	4: Q4 GRN-YEL CN5-P5	5: Q5 GRN-BLK CN5-P6	6: Q6 GRN-BLU CN5-P7	7: Q7 GRN-VIO CN5-P8	8: Q8 GRN-GRY CN5-P9
1: U400 WHT-BRN CN7-P9	LEFT BUTTON (UK ONLY) on Cabinet side 1	NOT USED 9	(R) &D STANDUP on Brckt. Below 17	LEFT TOP LANE (A) on Brckt. Below 25	LEFT RAMP RETURN on Asm. Above 33	NOT USED 41	LEFT BUMPER on Asm. Below 49	LEFT OUTLANE on Brckt. Below 57
2: U400 WHT-RED CN7-P8	4TH COIN SLOT on Coin Door 2	NOT USED 10	R (&) D STANDUP on Brckt. Below 18	MIDDLE TOP LANE (B) on Brckt. Below 26	CENTER RAMP MADE on Asm. Above 34	LOCKUP 1 (TOP) on Brckt. Below 42	RIGHT BUMPER on Asm. Below 50	LEFT RETURN LANE on Brckt. Below 58
3: U400 WHT-ORG CN7-P7	6TH COIN SLOT on Coin Door 3	4-BALL TROUGH #1 (LEFT) on Asm. Below 11	R& (D) STANDUP on Brckt. Below 19	RIGHT TOP LANE (C) on Brckt. Below 27	RIGHT RAMP MADE on Asm. Above 35	LOCKUP 2 (BOTTOM) on Brckt. Below 43	BOTTOM BUMPER on Asm. Below 51	LEFT SLINGSHOT on Asm. Below 59
4: U400 WHT-YEL CN7-P6	RIGHT COIN SLOT on Coin Door 4	4-BALL TROUGH #2 on Asm. Below 12	WHEEL OPTO on Asm. Below 20	DUMMY LEFT on Brckt. Below 28	GHOST DOWN on Asm. Above 36	(E) AT STANDUP on Brckt. Below 44	ROCKET on Asm. Below 52 DOTS	RIGHT OUTLANE on Brckt. Below 60
5: U401 WHT-GRN CN7-P5	CENTER COIN SLOT / DBA on Coin Door 5	4-BALL TROUGH #3 on Asm. Below 13	MINI FLIPPER FEED on Brckt. Below 21	DUMMY RIGHT on Brckt. Below 29	RIGHT ORBIT on Brckt. Below 37	E (A) T STANDUP on Brckt. Below 45	TOURNAMENT BUTTON Cabinet Front 53	RIGHT RETURN LANE on Brckt. Below 61
6: U401 WHT-BLU CN7-P3	LEFT COIN SLOT on Coin Door 6	4-BALL TROUGH VUK OPTO on Asm. Below 14	MINI FLIPPER STANDUP on Brckt. Below 22	DROP BANK LEFT on Asm. Below 30 DOTS	SWEEPER OPTO on Brckt. Below 38	EA (T) STANDUP on Brckt. Below 46	START BUTTON Cabinet Front 54	RIGHT SLINGSHOT on Asm. Below 62
7: U401 WHT-VIO CN7-P2	5TH COIN SLOT on Coin Door 7	4-BALL STACKING OPTO on Asm. Below 15	CHICAGO LOOP on Asm. Above 23	DROP BANK MIDDLE on Asm. Below 31 DOTS	SWEEPER DROP on Asm. Below 39 DOTS	KIOSK SCOOP on Asm. Below 47	NOT USED 55	NOT USED 63
8: U401 WHT-GRY CN7-P1	RIGHT BUTTON (UK ONLY) on Cabinet side 8	SHOOTER LANE on Brckt. Below 16	LEFT ORBIT on Brckt. Above 24	DROP BANK RIGHT on Asm. Below 32 DOTS	GHOST STANDUP on Brckt. Below 40	KIOSK TUNNEL on Asm. Below 48	PLUMB BOB TILT Inside Cabinet 56	NOT USED 64

GND / IC U206 INPUTS	Ground BLK CN6-P1, -P11
1: U206 GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON in Cabinet side DS-1
2: U206 GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke) in Cabinet side DS-2
3: U206 GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON in Cabinet side DS-3
4: U206 GRY-YEL CN6-P6	#4 RIGHT FLIPPER E.O.S. (End-of-Stroke) in Cabinet side DS-4
5: U206 GRY-GRN CN6-P7	#5 UPR. RIGHT FLIPPER BUTTON in Cabinet side DS-5
6: U206 GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (In Test: LEFT) on Coin Door DS-6
7: U206 GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) on Coin Door DS-7
8: U206 GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) on Coin Door DS-8

In LAMP MENU also select:

TEST ALL LAMPS, ROW & COLUMN LAMP TESTS

LAMP MATRIX GRID

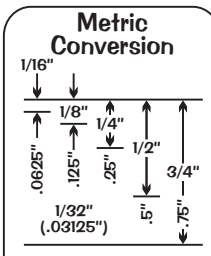
Diode On Terminal Strip:

Column (18v) / Row (GND)	1: U17 YEL-BRN J13-P9	2: U16 YEL-RED J13-P8	3: U15 YEL-ORG J13-P7	4: U14 YEL-BLK J13-P6	5: U13 YEL-GRN J13-P5	6: U12 YEL-BLU J13-P4	7: U11 YEL-VIO J13-P3	8: U10 YEL-GRY J13-P1
1: Q33 RED-BRN J12-P1	2X BONUS #555 Bulb 1	3X BONUS #555 Bulb 2	4X BONUS #555 Bulb 3	5X BONUS #555 Bulb 4	5X+ LITE EXTRA #555 Bulb 5	DUNK THE DUMMY #555 Bulb 6	SPIN AND BUMP #555 Bulb 7	RIGHT SPECIAL #555 Bulb 8
2: Q34 RED-BLK J12-P2	LEFT SPECIAL #555 Bulb 9	SUPER DUNK #555 Bulb 10	POWER RIDE #555 Bulb 11	TOSS YOUR COOKIES #555 Bulb 12	DANCING DIGITS #555 Bulb 13	LOCK 1 #555 Bulb 14	MULTIBALL #555 Bulb 15	LOCK 2 #555 Bulb 16
3: Q35 RED-ORG J12-P3	LITE MAP #555 Bulb 17	WHEEL JACKPOT #555 Bulb 18	2X SPIN #555 Bulb 19	WHEEL RED #555 Bulb 20	WHEEL YELLOW #555 Bulb 21	WHEEL GREEN #555 Bulb 22	SHOOT AGAIN #555 Bulb 23	MAP #555 Bulb 24
4: Q36 RED-YEL J12-P4	SNACK STAND "?" #555 Bulb 25	FRIES STAND #555 Bulb 26	COTTON CANDY #555 Bulb 27	BURGER STAND #555 Bulb 28	DRINK STAND #555 Bulb 29	(E)AT #555 Bulb 30	E(A)T #555 Bulb 31	EA(T) #555 Bulb 32
5: Q37 RED-GRN J12-P5	LITE SPIN #555 Bulb 33	CHICAGO LOOP LOCK #555 Bulb 34	CHICAGO LOOP JACKPOT #555 Bulb 35	LOOP POWER RIDE #555 Bulb 36	CHICAGO LOOP GREEN #555 Bulb 37	CHICAGO LOOP YELLOW #555 Bulb 38	CHICAGO LOOP RED #555 Bulb 39	PARK TYCOON #555 Bulb 40
6: Q38 RED-BLU J12-P6	EXTRA BALL #555 Bulb 41	MULTIBALL START #555 Bulb 42	FLYING TURNS JACKPOT #555 Bulb 43	FLYING TURNS GREEN #44 Bulb 44	FLYING TURNS YELLOW #44 Bulb 45	FLYING TURNS RED #44 Bulb 46	PUKE #555 Bulb 47	START FUN (on Ramp Sign) #44 Bulb 48
7: Q39 RED-VIO J12-P8	LITE FUN #555 Bulb 49	GHOST JACKPOT #555 Bulb 50	GHOST POWER RIDE #555 Bulb 51	SUPER JACKPOT #555 Bulb 52	GHOST GREEN #555 Bulb 53	GHOST YELLOW #555 Bulb 54	GHOST RED #555 Bulb 55	GHOST STANDUP #555 Bulb 56
8: Q40 RED-GRY J12-P9	LEFT BUMPER #555 Bulb 57 DOTS	RIGHT BUMPER #555 Bulb 58 DOTS	BOTTOM BUMPER #555 Bulb 59 DOTS	ADD RIDE #44 Bulb 60	(R)&D #555 Bulb 61	R(&)D #555 Bulb 62	R&(D) #555 Bulb 63	START BUTTON #555 Bulb 64
9: Q41 RED-WHT J12-P10	BACK PANEL 1 (LEFT) #44 Bulb 65	BACK PANEL 2 #44 Bulb 66	BACK PANEL 3 #44 Bulb 67	BACK PANEL 4 #44 Bulb 68	BACK PANEL 5 #44 Bulb 69	TOP LANE A #555 Bulb 70	TOP LANE B #555 Bulb 71	TOP LANE C #555 Bulb 72
10: Q42 RED J12-P11	BACK PANEL 6 #44 Bulb 73	BACK PANEL 7 #44 Bulb 74	BACK PANEL 8 #44 Bulb 75	BACK PANEL 9 #44 Bulb 76	BACK PANEL 10 (RIGHT) #44 Bulb 77	TROLL LIT X2 #44 Bulb 78	5000 W/FLASHING #44 Bulb 79	TOURNAMENT BUTTON #555 Bulb 80

RollerCoaster Tycoon™

▼ U.S. ▼
Customary
Inch Ruler

Metric Conversion



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

- For metric, multiply inch value by metric value, e.g. 5" X 2.54cm = 12.7cm or 127mm.
- For US, multiply metric value by inch value, e.g. 13cm X .3937" = 5.1181"

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