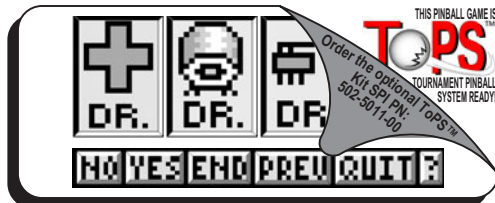


Find-It-In-Front: Dr. Pinball Section

The inside cover & the front pages
DR. ① thru DR. ⑩ covers the basics...


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



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



Your Parts Sales & Technical Support Team



Susan White
Parts
Sales
MANAGER




Patty Schraps
Parts
Stockroom
MANAGER



Joe Blackwell
DIRECTOR,
Parts Sales &
Technical Support



Chas Siddiqi
Technical
Support
ENGINEER



J. Alfer
Technical Support
Documentation
ADMINISTRATOR

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

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

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①

SPI PN#: 780-5078-01

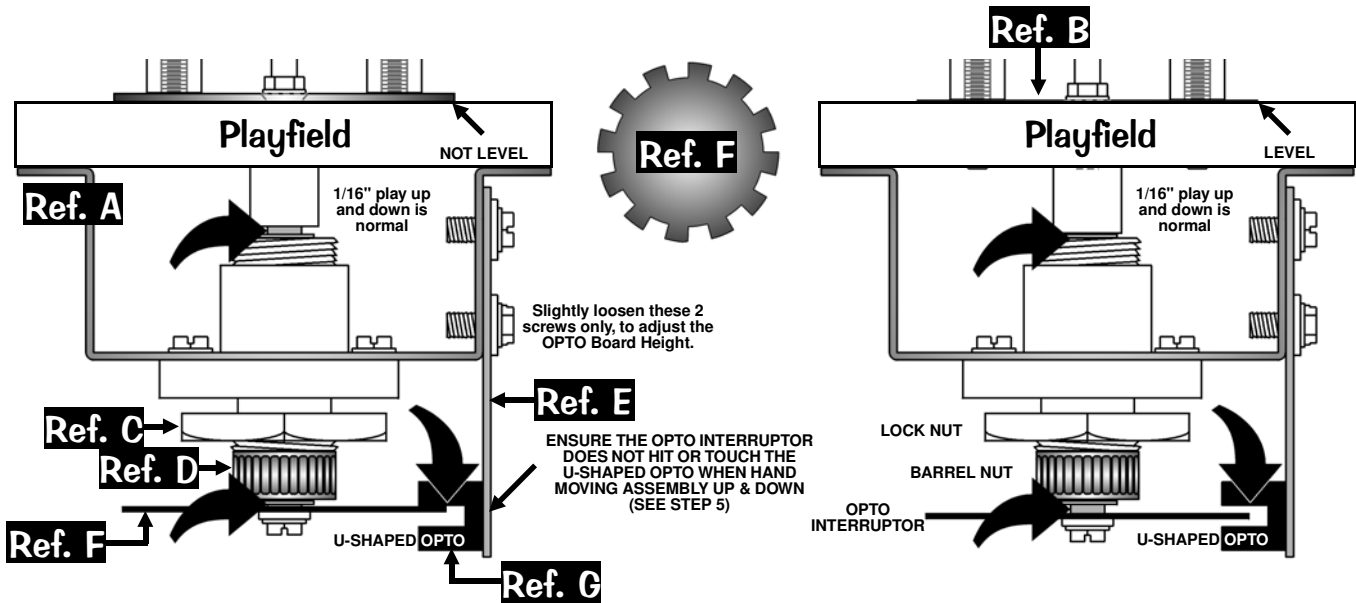
For Proper Operation of RollerCoaster Tycoon™
Pinball, four (4) Pinballs must be installed!



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

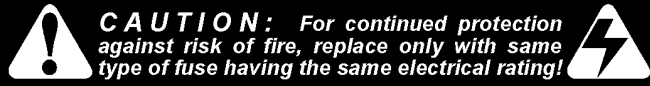
An Optional Tournament Kit is required for this ToPS™ Ready Pinball Game.
You can now easily set-up, start and end Tournaments for cash prizes!



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



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)

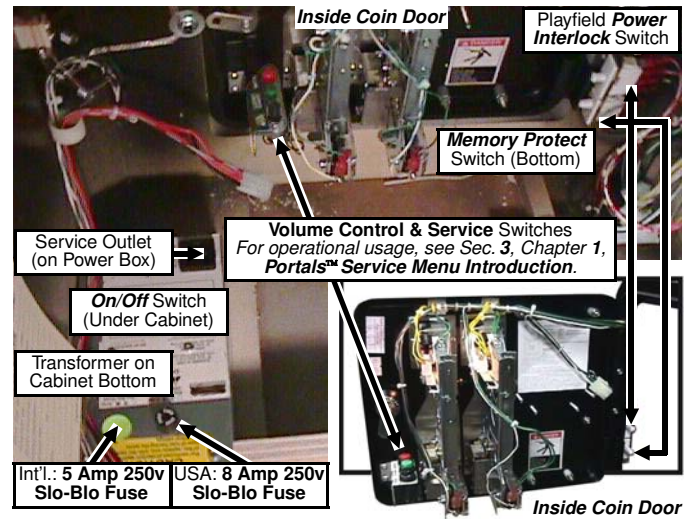
n/a	8A 250v S.B.	115v AC	Main Fuse Line (Domestic or USA)
n/a	5A 250v S.B.	220v AC	Main Fuse Line (International)

Playfield (P/F) Fuses

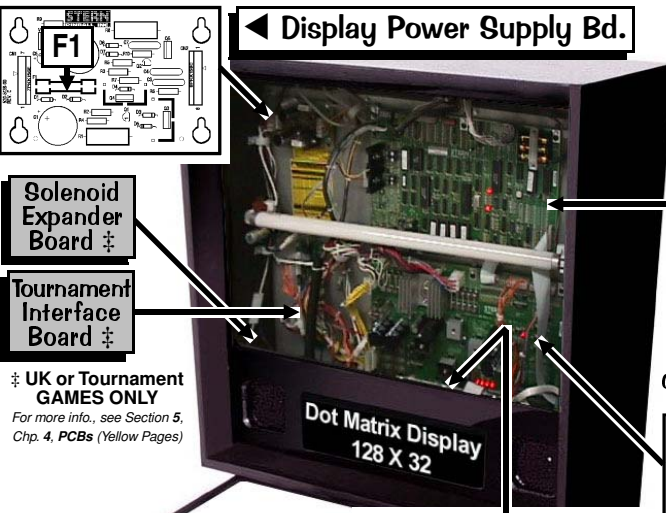
LOC: UNDER PLAYFIELD (near Flippers)

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.

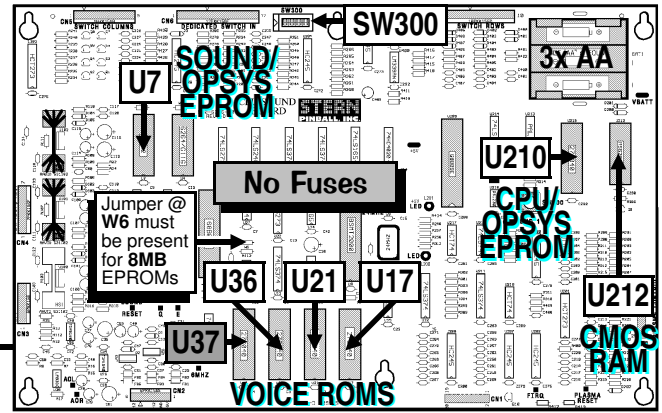
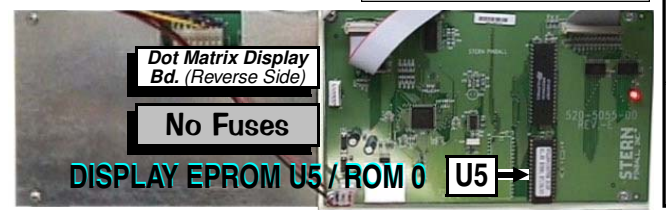


ROM TYPE on BD	LOCATION	SIZE	PART NUMBER
CPU Sound	U7	512K	965-0375-78
CPU Game	U210	1 MB	965-0374-78
CPU Voice ROM 1	U17	8 MB	965-0377-78
CPU Voice ROM 2	U21	8 MB	965-0378-78
CPU Voice ROM 3	U36	8 MB	965-0379-78
CPU Voice ROM 4	U37	8 MB	Not Used
DISPLAY Controller	U5	4 MB	965-0376-78



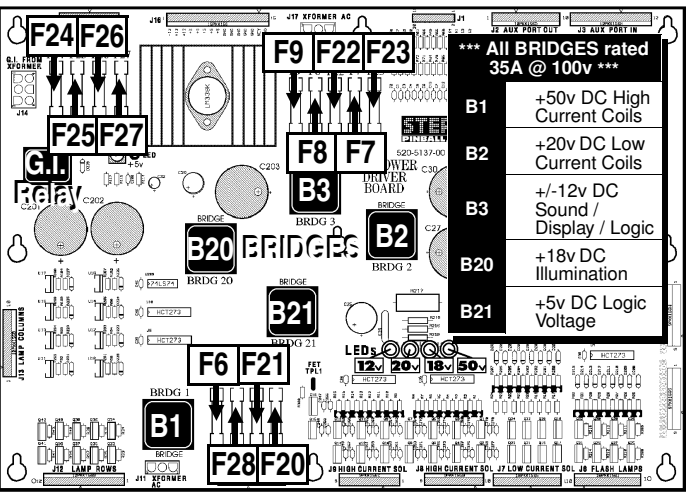
Display Controller Bd.

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



CPU / Sound Board

I/O Power Driver Board



Find-It-In-Front:
Dr. Pinball



////// 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. ① - ⑩) will assist the technician in locating important technical information needed to troubleshoot the Pinball Machine. **Dr. Pinball** is also available in a Flow Chart Help Format in the Game Display. To access, enter the **Portals™ Service Menu**.

////// How It Works ////

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

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

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



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

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



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



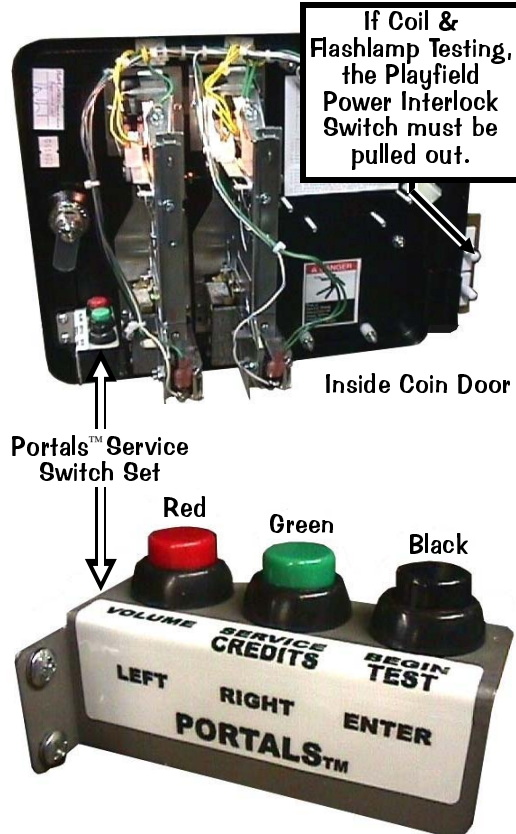
After entering **Portals™**, the **MAIN MENU** now appears with the "DIAG" *Icon* (GO TO DIAGNOSTICS MENU) flashing; press the **Black "ENTER" Button** to activate this **ICON**. The **DIAGNOSTICS MENU** now appears with the "SW" *Icon* (GO TO SWITCH MENU) flashing; use the **Red "LEFT"** or **Green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



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



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



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 by either failure in memory (*e.g. batteries are dead and/or faulty RAM*) or upon installation of updated version of game code. Opening the **Coil 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

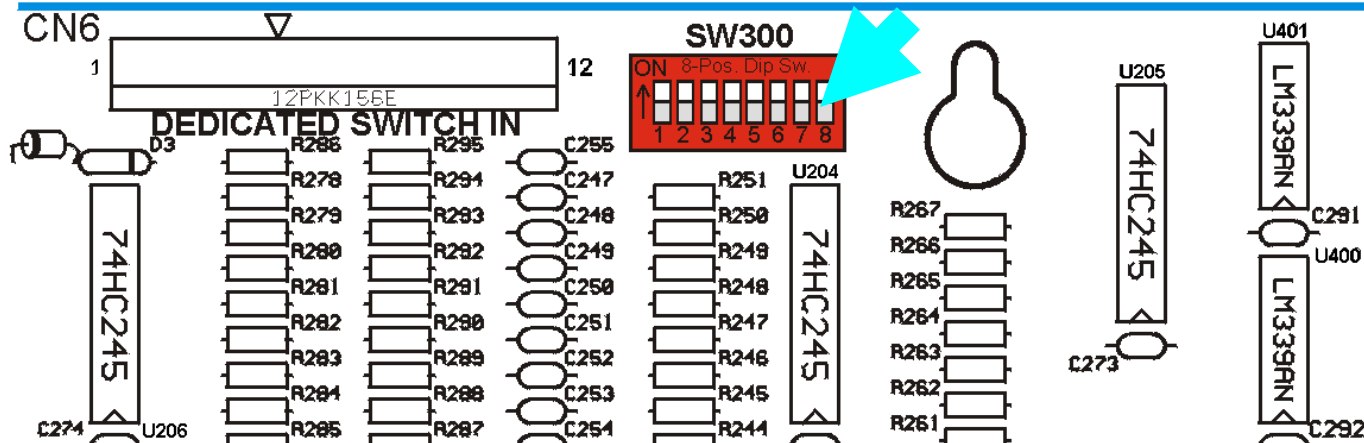
This **display** is shown momentarily during **Game Mode** or **Power-Up** to alert the operator of a coil malfunction (*coil doesn't energize or coil fires a multiple number of times*). **OPERATOR ALERT!** works by monitoring any **switch activated coil** that has the potential to trap a ball when disabled (*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	▼	▼	▼	▼	▼	▼	▼	▼
Austria	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
Australia	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
Belgium	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
Canada	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
Denmark	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
Finland	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
France	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
Germany	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
Greece	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
Italy	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
Netherlands	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
New Zealand	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
Norway	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
Portugal	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
Spain	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
Sweden	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
Switzerland	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼
UK	ON	▲	▲	▲	▲	▲	▲	▲	▲
	OFF	▼	▼	▼	▼	▼	▼	▼	▼



Find-It-In-Front:
Dr. Pinball





In SWITCH MENU also select:

ACTIVE and DEDICATED SWITCH TESTS

SWITCH MATRIX GRID & DEDICATED SWITCHES

D iode O n T ermi n a l S tri p :

Column (Drive)	1: Q1	2: Q2	3: Q3	4: Q4	5: Q5	6: Q6	7: Q7	8: Q8	0ND	Ground
Row (Return)	GRN-BRN CN5-P1	GRN-RED CN5-P3	GRN-ORG CN5-P4	GRN-YEL CN5-P5	GRN-BLK CN5-P6	GRN-BLU CN5-P7	GRN-VIO CN5-P8	GRN-GRY CN5-P9	IC U206 INPUT 8	BLK CN6-P1, -P11
1: U400	LEFT BUTTON (UK ONLY) on Cabinet side	NOT USED	(R) & D STANDUP on Brckt. Below	LEFT TOP LANE (A) on Brckt. Below	LEFT RAMP RETURN on Asm. Above	NOT USED	LEFT BUMPER on Asm. Below	LEFT OUTLANE on Brckt. Below	1: U206 GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON in Cabinet side
2: U400	4TH COIN SLOT on Coin Door	NOT USED	R (&) D STANDUP on Brckt. Below	MIDDLE TOP LANE (B) on Brckt. Below	CENTER RAMP MADE on Asm. Above	LOCKUP 1 (TOP) on Brckt. Below	RIGHT BUMPER on Asm. Below	LEFT RETURN LANE on Brckt. Below	2: U206 GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke) in Cabinet side
3: U400	6TH COIN SLOT on Coin Door	4-BALL TROUGH #1 (LEFT) on Asm. Below	R & (D) STANDUP on Brckt. Below	RIGHT TOP LANE (C) on Brckt. Below	RIGHT RAMP MADE on Asm. Above	LOCKUP 2 (BOTTOM) on Brckt. Below	BOTTOM BUMPER on Asm. Below	LEFT SLINGSHOT on Asm. Below	3: U206 GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON in Cabinet side
4: U400	RIGHT COIN SLOT on Coin Door	4-BALL TROUGH #2 on Asm. Below	WHEEL OPTO on Asm. Below	DUMMY LEFT on Brckt. Below	GHOST DOWN on Asm. Above	(E) AT STANDUP on Brckt. Below	ROCKET on Asm. Below	RIGHT OUTLANE on Brckt. Below	4: U206 GRY-YEL CN6-P6	#4 RIGHT FLIPPER E.O.S (End-of-Stroke) in Cabinet side
5: U401	CENTER COIN SLOT / DBA on Coin Door	4-BALL TROUGH #3 on Asm. Below	MINI FLIPPER FEED on Brckt. Below	DUMMY RIGHT on Brckt. Below	RIGHT ORBIT on Brckt. Below	E (A) T STANDUP on Brckt. Below	TOURNAMENT BUTTON Cabinet Front	RIGHT RETURN LANE on Brckt. Below	5: U206 GRY-GRN CN6-P7	#5 UPFR. RT. FLIPPER BUTTON in Cabinet side
6: U401	LEFT COIN SLOT on Coin Door	4-BALL TROUGH VUK OPTO on Asm. Below	MINI FLIPPER STANDUP on Brckt. Below	DROP BANK LEFT on Asm. Below	SWEeper OPTO on Brckt. Below	EA (T) STANDUP on Brckt. Below	START BUTTON Cabinet Front	RIGHT SLINGSHOT on Asm. Below	6: U206 GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (In Test: LEFT) on Coin Door
7: U401	5TH COIN SLOT on Coin Door	4-BALL STACKING OPTO on Asm. Below	CHICAGO LOOP on Asm. Above	DROP BANK MIDDLE on Asm. Below	SWEeper DROP on Asm. Below	KIOSK SCOOP on Asm. Below	NOT USED	NOT USED	7: U206 GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) on Coin Door
8: U401	RIGHT BUTTON (UK ONLY) on Cabinet side	SHOOTER LANE on Brckt. Below	LEFT ORBIT on Brckt. Above	DROP BANK RIGHT on Asm. Below	GHOST STANDUP on Brckt. Below	KIOSK TUNNEL on Asm. Below	PLUMB BOB TILT Inside Cabinet	NOT USED	8: U206 GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) on Coin Door



In LAMP MENU also select:

TEST ALL LAMPS, ROW & COLUMN LAMP TESTS

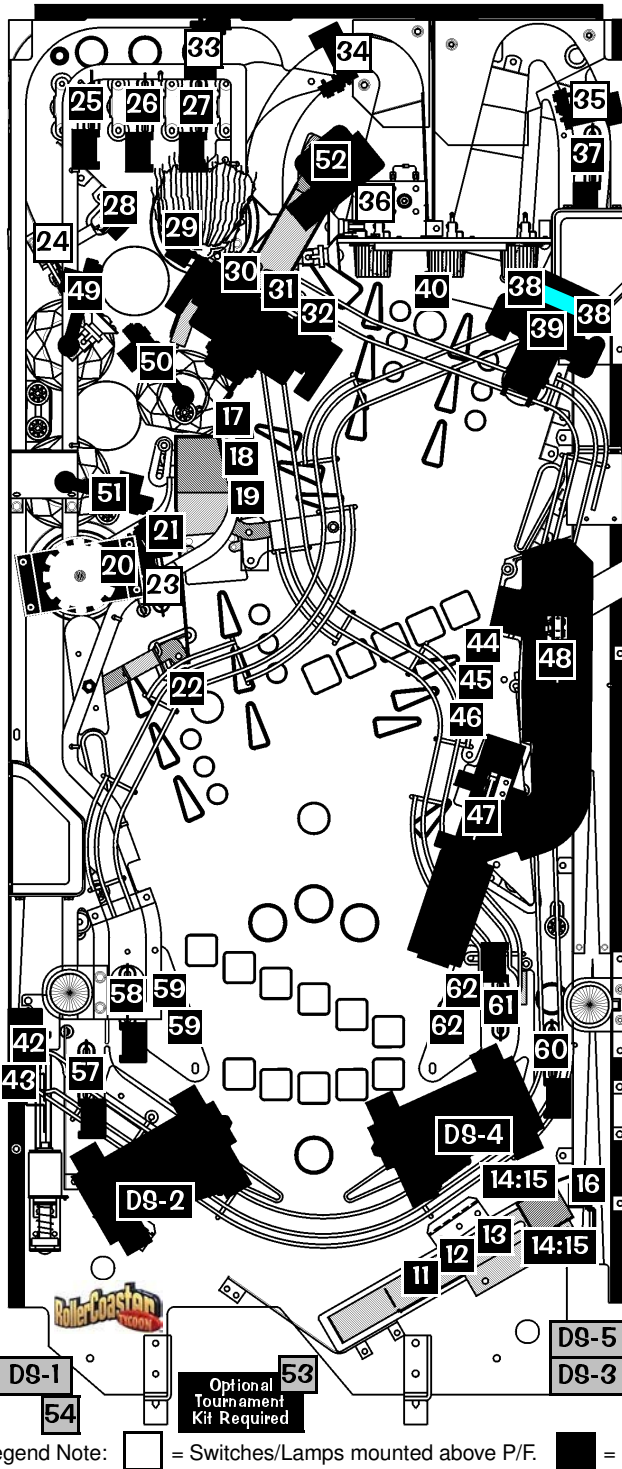
LAMP MATRIX GRID

D iode O n T ermi n a l S tri p :

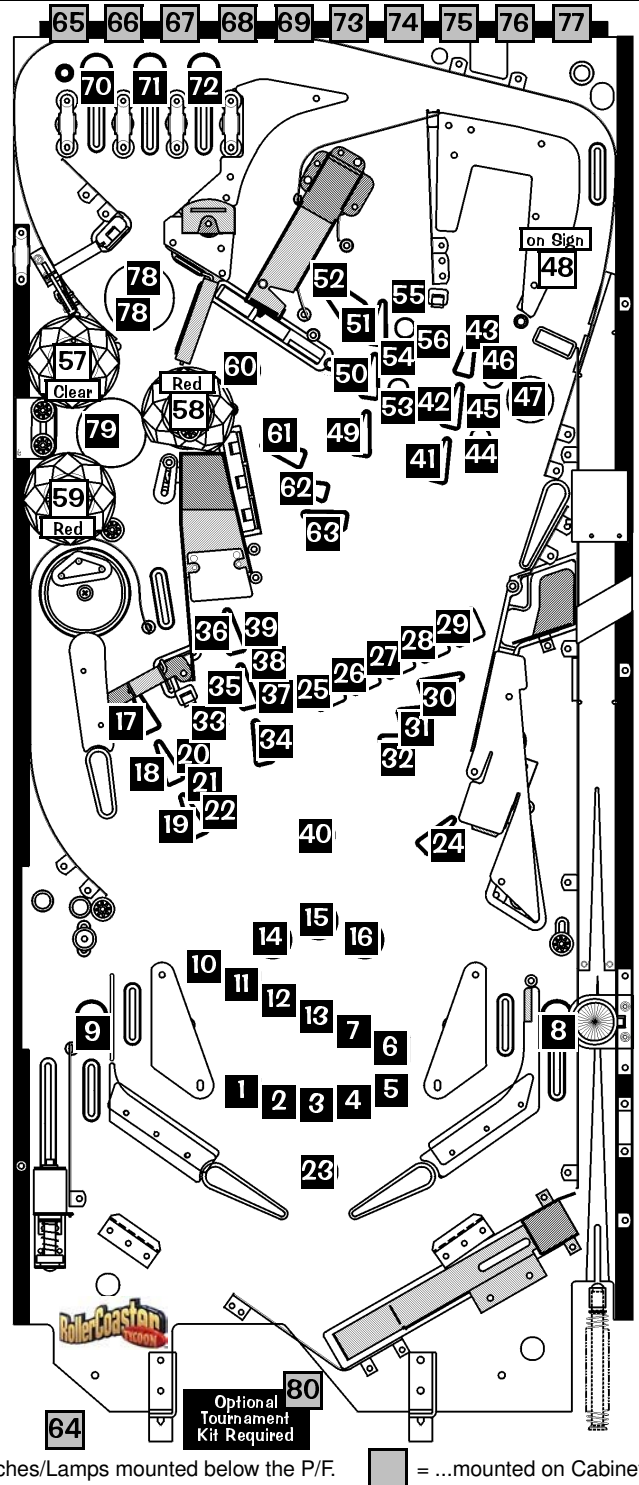
Column (18v)	1: U17	2: U16	3: U15	4: U14	5: U13	6: U12	7: U11	8: U10
Row (GND)	YEL-BRN J13-P9	YEL-RED J13-P8	YEL-ORG J13-P7	YEL-BLK J13-P6	YEL-GRN J13-P5	YEL-BLU J13-P4	YEL-VIO J13-P3	YEL-GRY J13-P1
1: Q33	2X BONUS #555 Bulb	3X BONUS #555 Bulb	4X BONUS #555 Bulb	5X BONUS #555 Bulb	5X+ LITE EXTRA #555 Bulb	DUNK THE DUMMY #555 Bulb	SPIN AND BUMP #555 Bulb	RIGHT OUTLANE #555 Bulb
2: Q34	LEFT OUTLANE #555 Bulb	SUPER DUNK #555 Bulb	POWER RIDE #555 Bulb	TOSS YOUR COOKIES #555 Bulb	DANCING DIGITS #555 Bulb	LOCK 1 #555 Bulb	MULTIBALL #555 Bulb	LOCK 2 #555 Bulb
3: Q35	LITE MAP #555 Bulb	WHEEL JACKPOT #555 Bulb	2X SPIN #555 Bulb	WHEEL RED #555 Bulb	WHEEL YELLOW #555 Bulb	WHEEL GREEN #555 Bulb	SHOOT AGAIN #555 Bulb	MAP #555 Bulb
4: Q36	SNACK STAND #555 Bulb	FRIES STAND #555 Bulb	COTTON CANDY #555 Bulb	BURGER STAND #555 Bulb	DRINK STAND #555 Bulb	(E) AT #555 Bulb	E (A) T #555 Bulb	EA (T) #555 Bulb
5: Q37	LITE SPIN #555 Bulb	CHICAGO LOOP LOCK #555 Bulb	CHICAGO LOOP JACKPOT #555 Bulb	LOOP POWER RIDE #555 Bulb	CHICAGO LOOP GREEN #555 Bulb	CHICAGO LOOP YELLOW #555 Bulb	CHICAGO LOOP RED #555 Bulb	PARK TYCOON #555 Bulb
6: Q38	EXTRA BALL #555 Bulb	FLYING_TURNS JACKPOT #555 Bulb	MULTIBALL START #555 Bulb	FLYING TURNS GREEN #44 Bulb	FLYING TURNS YELLOW #44 Bulb	FLYING TURNS RED #44 Bulb	PUKE #555 Bulb	START FUN (on Ramp Sign) #44 Bulb
7: Q39	LITE FUN #555 Bulb	GHOST JACKPOT #555 Bulb	GHOST POWER RIDE #555 Bulb	SUPER JACKPOT #555 Bulb	GHOST GREEN #555 Bulb	GHOST YELLOW #555 Bulb	GHOST RED #555 Bulb	GHOST STANDUP #555 Bulb
8: Q40	LEFT BUMPER #555 Bulb	RIGHT BUMPER #555 Bulb	BOTTOM BUMPER #555 Bulb	ADD RIDE #44 Bulb	(R) & D #555 Bulb	R (&) D #555 Bulb	R & (D) #555 Bulb	START BUTTON #555 Bulb
9: Q41	BACK PANEL 1 (LEFT) #44 Bulb	BACK PANEL 2 #44 Bulb	BACK PANEL 3 #44 Bulb	BACK PANEL 4 #44 Bulb	BACK PANEL 5 #44 Bulb	LEFT TOP LANE (A) #555 Bulb	MIDDLE TOP LANE (B) #555 Bulb	RIGHT TOP LANE (C) #555 Bulb
10: Q42	BACK PANEL 6 #44 Bulb	BACK PANEL 7 #44 Bulb	BACK PANEL 8 #44 Bulb	BACK PANEL 9 #44 Bulb	BACK PANEL 10 (RIGHT) #44 Bulb	TROLL LIT X2 #44 Bulb	5000 W/FLASHING #44 Bulb	TOURNAMENT BUTTON #555 Bulb



SWITCH MATRIX GRID LOCATIONS



LAMP MATRIX GRID LOCATIONS

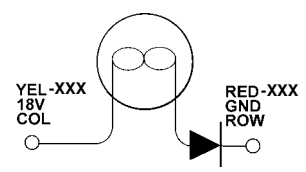
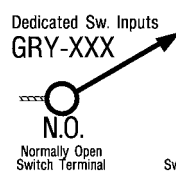
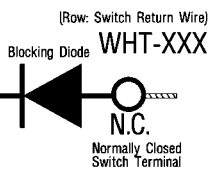
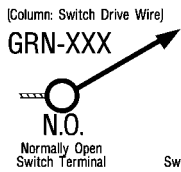


Legend Note: = Switches/Lamps mounted above P/F. = Switches/Lamps mounted below the P/F. = ...mounted on Cabinet.

TYPICAL SWITCH SCHEMATIC

DEDICATED SWITCH SCHEMATIC

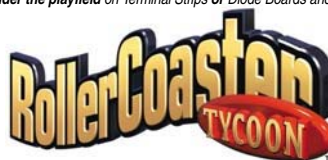
TYPICAL LAMP SCHEMATIC



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. Diode Qn Iterminal Strip or Diode Qn Diode Board



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





In COIL MENU also select:

CYCLING COIL TEST

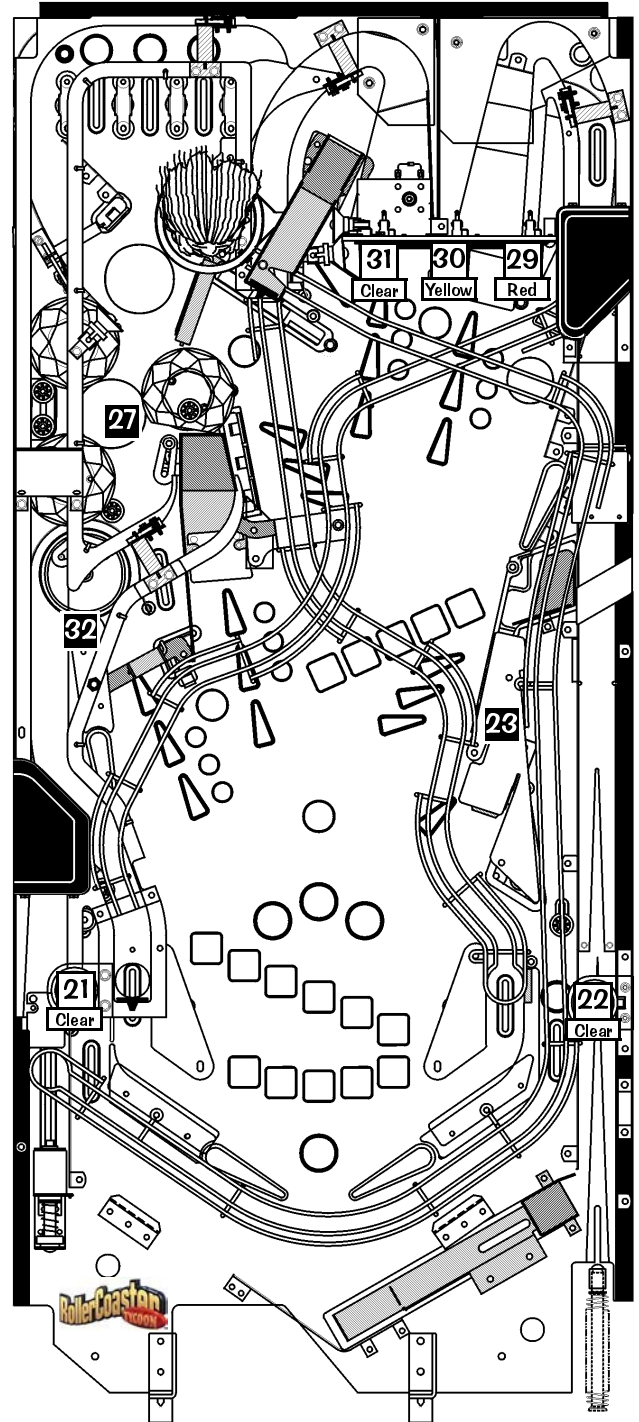
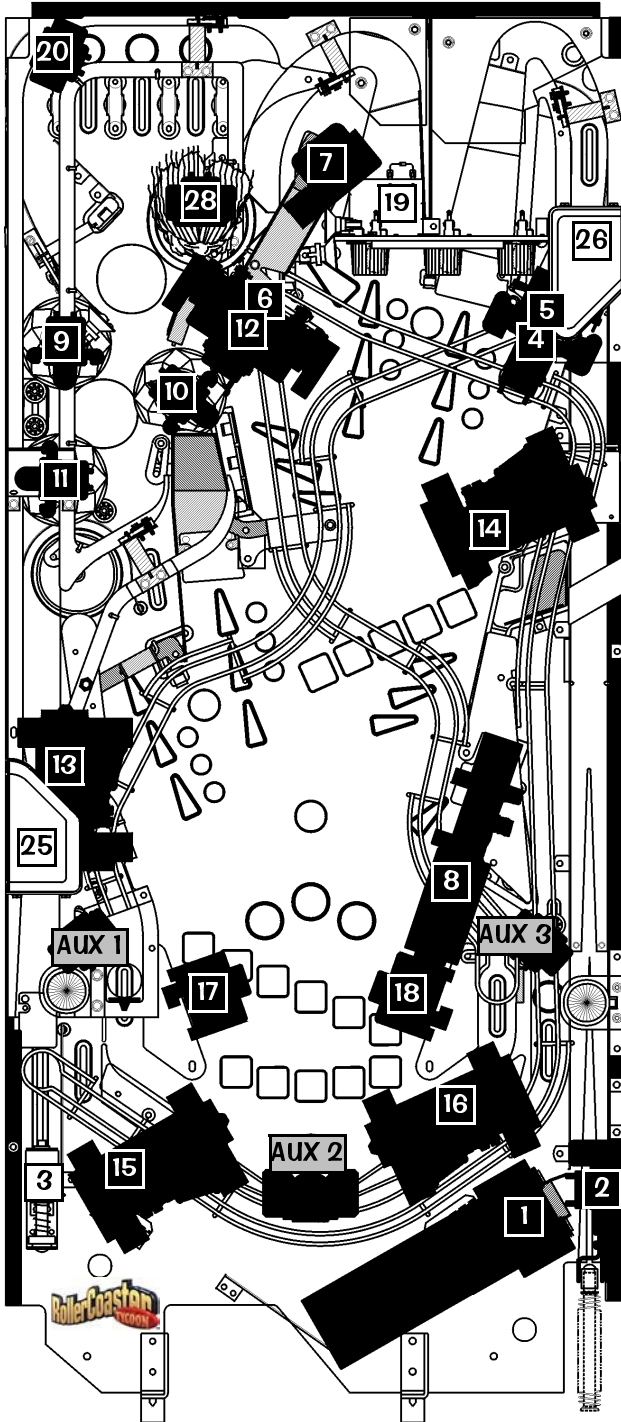
COILS DETAILED CHART TABLE

High Current Coils Group 1		Drive Transistor	Driver Output 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 Output 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 Output 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
D iode O n T ermi n al S tri p (if noted)									
Low Current Coils Group 2		Drive Transistor	Driver Output 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 Output 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



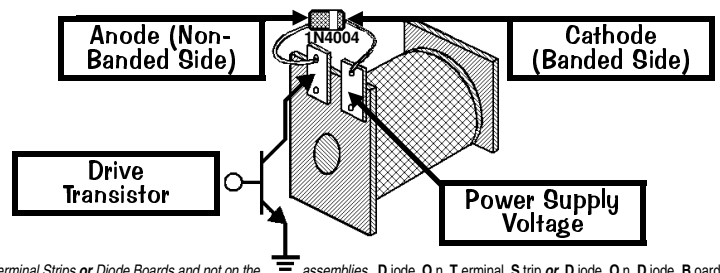
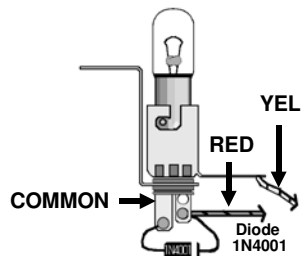
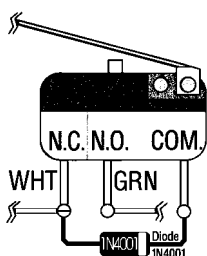
COIL LOCATIONS

FLASH LAMP LOCATIONS



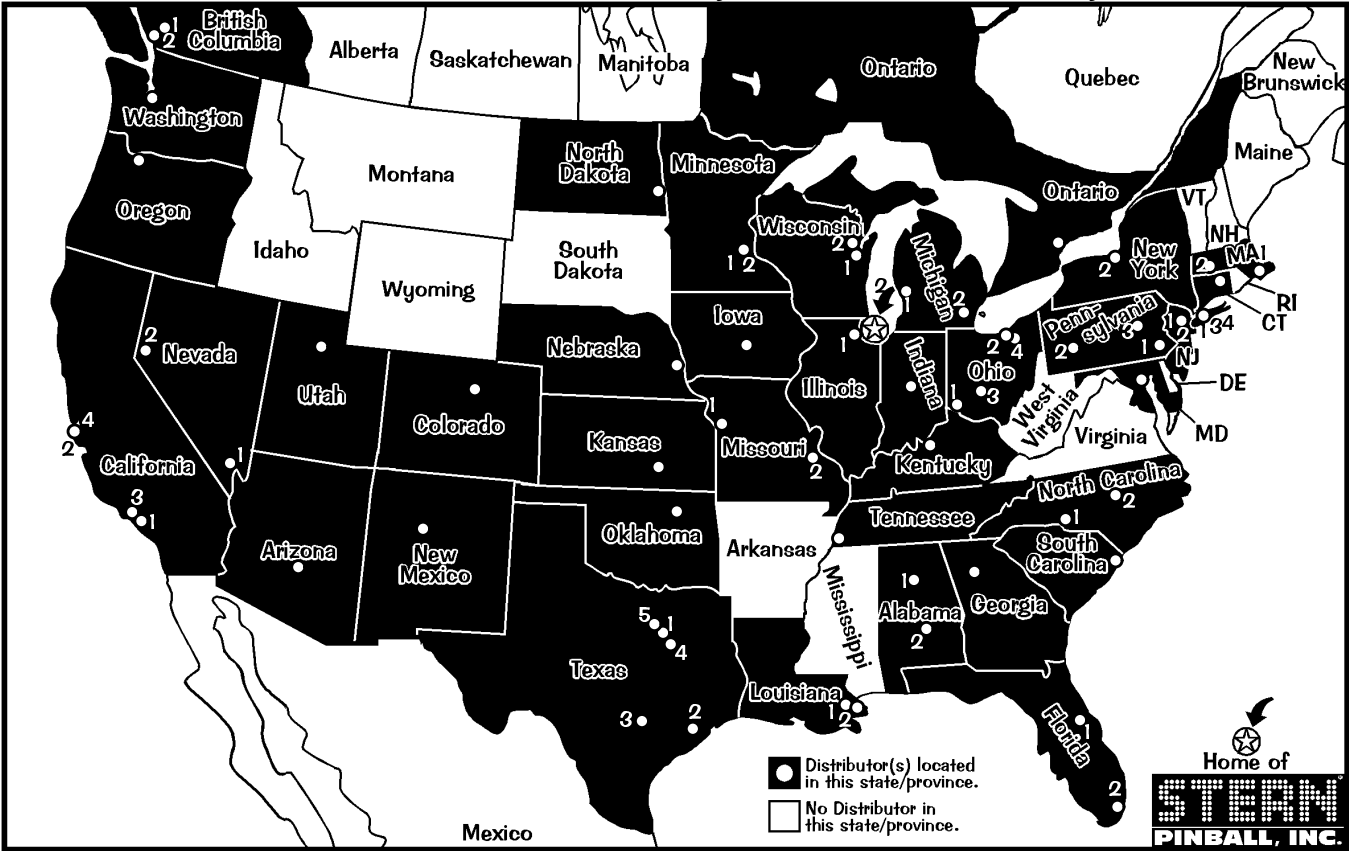
Legend Note: = Coils/Flashers mounted above P/F. = Coils/Flashers mounted below the P/F. = ...mounted in/on Cabinet.

TYPICAL SWITCH, LAMP & COIL WIRING

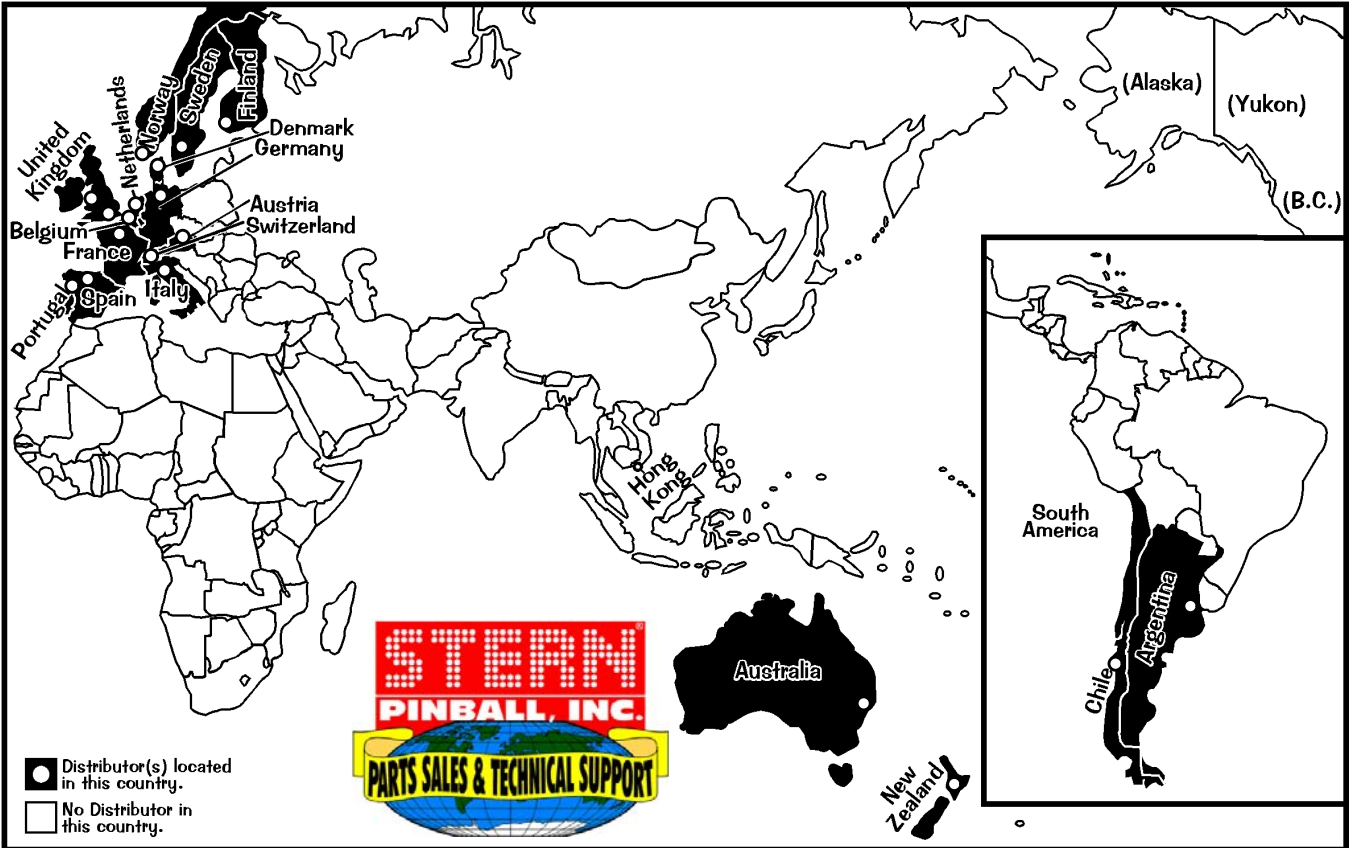


Note: All Switch, Lamp & Coil assemblies require diodes. Some diodes are located under the playfield on Terminal Strips or Diode Boards and not on the assemblies. \square Diode \square n Terminal \square trip or \square Diode \square n \square Diode \square Board.

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	IOWA	MISSOURI	OHIO	TEXAS	CANADA
Birmingham Vending Birmingham (1) 1-205-324-7526	Greater America Dist. Johnston 1-515-278-4455	Greater America Dist. Kansas City (1) 1-816-531-4300	Atlas Distributing Cincinnati (1) 1-513-851-4100	Commercial Music Dallas (1) 1-214-741-6381	ONTARIO
Franco Distributing Montgomery (2) 1-334-834-3455	Moss Distributing Des Moines 1-515-266-6422	Shaffer Distributing St. Louis (2) 1-314-645-3393	Cleveland Coin Cleveland (2) 1-216-692-0960	H.A. Franz, & Co. Houston (2) 1-713-523-7366	Starburst Coin Mach. Toronto 1-416-251-2122
ARIZONA	INDIANA	NEBRASKA	Shaffer Distributing Columbus (3) 1-614-421-6800	San Antonio (3) 1-210-226-6322	BRITISH COLUMBIA
Betsom West Phoenix 1-480-380-8857	Atlas Distributing Indianapolis 1-317-786-6892	Central Dist. Omaha 1-402-493-5600	Macedonia (4) 1-330-467-4850	Master Sales Corsicana (4) 1-903-874-4740	Parts & Service Only:
Mountain Coin Phoenix 1-602-269-7596	Shaffer Distributing Indianapolis 1-317-899-2530	Greater America Dist. Omaha 1-402-553-2812	OKLAHOMA	Southgate Amusement Houston (2) 1-713-691-7335	Can. Coin Machine Burnaby (1) 1-604-420-4008
CALIFORNIA	KANSAS	NEVADA	Galaxy Distributing Tulsa 1-918-835-1166	San Antonio (3) 1-210-225-3844	Parts & Service Only:
Betsom West Buena Park (1) 1-714-228-7500	United Dist., Inc. Wichita 1-316-263-6181	Mountain Coin Las Vegas (1) 1-702-798-0900	OREGON	Southgate/Moss Dist. Irving (5) 1-972-721-4600	Pacific Vending Vancouver (2) 1-604-324-2164
So. San Francisco (2) 1-650-952-4220	KENTUCKY	Reno Game Sales Reno (2) 1-775-829-2080	Betsom West Portland 1-503-772-4567	UTAH	
C.A. Robinson Los Angeles (3) 1-323-735-3001	Atlas Distributing Louisville 1-502-966-5266	NEW JERSEY	Mountain Coin Portland 1-503-234-5491	Mountain Coin Salt Lake City 1-801-262-5494	
San Francisco (4) 1-650-871-4280	LOUISIANA	Betsom Enterprises Carlstadt (1) 1-201-438-1300	Specialty Coin Products Portland 1-503-786-9200	Struve Distributing Salt Lake City 1-801-328-1636	
COLORADO	AMA Distributors, Inc. Metairie (1) 1-504-835-3232	Jack Guarneri Service Co., Inc. (Pinballsales.com) Lakewood (2) 1-732-364-9900	Toll-Free 1-800-987-4946	WASHINGTON	
Mountain Coin Denver 1-303-427-2133	New Orleans Novelty New Orleans (2) 1-504-888-3500	NEW MEXICO	PENNSYLVANIA	Mountain Coin Seattle 1-206-682-5700	
CONNECTICUT	MARYLAND	Mountain Coin Albuquerque 1-505-345-7706	Betsom Enterprises King Of Prussia (1) 1-610-265-1155	WISCONSIN	
TDM Distributing Williamantic 1-860-423-1403	Betsom Enterprises Baltimore 1-410-646-4100	NEW YORK	Pittsburgh (2) 1-412-331-8703	Pioneer Sales & Svc. Green Bay (1) 1-920-336-5800	
FLORIDA	Weiner Distributing Baltimore 1-410-525-2600	Bay Coin Richmond Hill (1) 1-718-291-5757	Cleveland Coin Machine Pittsburgh (2) 1-412-920-1300	Menomonee Falls (2) 1-262-781-1420	
Birmingham Vending Orlando (1) 1-407-425-1505	MASSACHUSETTS	Betsom Enterprises New Hyde Park (2) 1-516-354-4647	Roth Novelty (Superior) Wilkes-Barre (3) 1-570-824-9994	Lieberman/Viking Vend. Menomonee Falls (2) 1-262-703-4168	
Brady Distributing Miami [Miramar] (2) 1-954-874-1100	Betsom Ent. (NECO) Norwood (1) 1-781-769-9760	Syracuse (3) 1-315-437-2400	SOUTH CAROLINA		
Orlando (1) 1-407-872-1666	Geekay Sales E. Longmeadow (2) 1-413-525-2700	Deith Distributing Roslyn Heights (4) 1-516-621-1234	Green Coin Myrtle Beach 1-843-626-1900		
GEORGIA	MICHIGAN	NORTH CAROLINA	TENNESSEE		
Greater Southern Dist. Smyrna 1-770-803-3040	Atlas Distributing Wyoming (1) 1-616-241-1472	Brady Distributing Charlotte (1) 1-704-357-6284	Brady Distributing Memphis 1-901-345-7811		
ILLINOIS	Cleveland Coin Machine Livonia (2) 1-734-432-1040	Operators Distributing Archdale (2) 1-336-884-5714	Green G.A.M.E.S. Memphis 1-901-353-1000		
American Vending Elk Grove Village (1) 1-847-439-9400	MINNESOTA	NORTH DAKOTA			
Atlas Distributing Elk Grove Village (1) 1-847-952-7500	Lieberman Music Minneapolis (1) 1-952-887-5299	M.H. Associates, Inc. Fargo 1-701-282-7877			
World Wide Distributing Chicago (2) 773-384-2300	Moss Distributing Richfield (2) 1-612-798-8030				

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	BELGIUM	FRANCE	NETHERLANDS	PORTUGAL	UNITED KINGDOM
Electroport (Florenca) Mar Del Plata [54] 22-3495-5532	Namusco Brussels [32] 2414-4596	Avranches Automatic Ducey [33] 2338-96162	JVH Gaming Products Tilburg [31] 13-595-3200	Jacinto & Martins, S.A. Belas [35] 1214-325624/38	Electrocoin London, England [44] 2089-652055
AUSTRALIA	CHILE	SFA Paris [33] 1532-68082	NEW ZEALAND	SPAIN	Parts & Service Only:
Amusement Mach. Dist. Matrville [61] 2931-66000	Cuinsa Santiago [56] 2641-8520	GERMANY	Coin Cascade Ltd. Christchurch [64] 3338-1411	Comercial Cocomatic Madrid [34] 9167-16980	Electrocoin AfterSales Cardiff, S. Wales [44] (0) 2920 343888
AUSTRIA	DENMARK	Bergmann Automaten Hamburg [49] 4101/30 24-0	Parts & Service Only:	SWEDEN	
TAB Ansfelden [43] 72-297-8660	Vendomatic (Oslo, Norway) [47] 2291-8383	HONG KONG	Amco Machine Supplies Auckland, New Zealand [64] 9846-7606	Bjuvia Fritid AB Bjuv [46] 4238-6900	
Parts & Service Only:	FINLAND	Topfull Amusement Mach. Kowloon [85] 2278-10456	NORWAY	SWITZERLAND	
R. Rupp Kaindorf, Austria [43] 3452-86105	Pelika Ray-Oy Espoo [35] (0) 5892-90452-99	ITALY (RSM)	Vendomatic Oslo [47] 2291-8383	Novomat, A.G. Harkingon [41] 6238-88961	
		Tecnoplay S.A. San Marino [39] 5499-00361			



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



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	MAX OPERATION	
	CURRENT: 2.8AMP WATTAGE: 329w	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	MAX OPERATION	
	CURRENT: 1.8AMP WATTAGE: 412w	CURRENT: 5AMP 8AMP* WATTAGE: 1145w 1832w*	England & Hong Kong use an 8A Fuse.
Low Line:		95v AC - 108v AC @ 50Hz / 60Hz	
Export Japan Only use an 8AMP 250v Slo-Blo Fuse.	AVG OPERATION	MAX OPERATION	
	CURRENT: 2.6AMP WATTAGE: 264w	CURRENT: 8AMP WATTAGE: 812w	

TRANSPORTATION

GAME DIMENSIONS

BEFORE TRANSPORTING



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

Read & follow Section 1, Chapter 1, Pinball Game Set-Up Procedures, and How to Secure the Backbox for Transporting. Remove the legs and secure the game within the transporting vehicle.

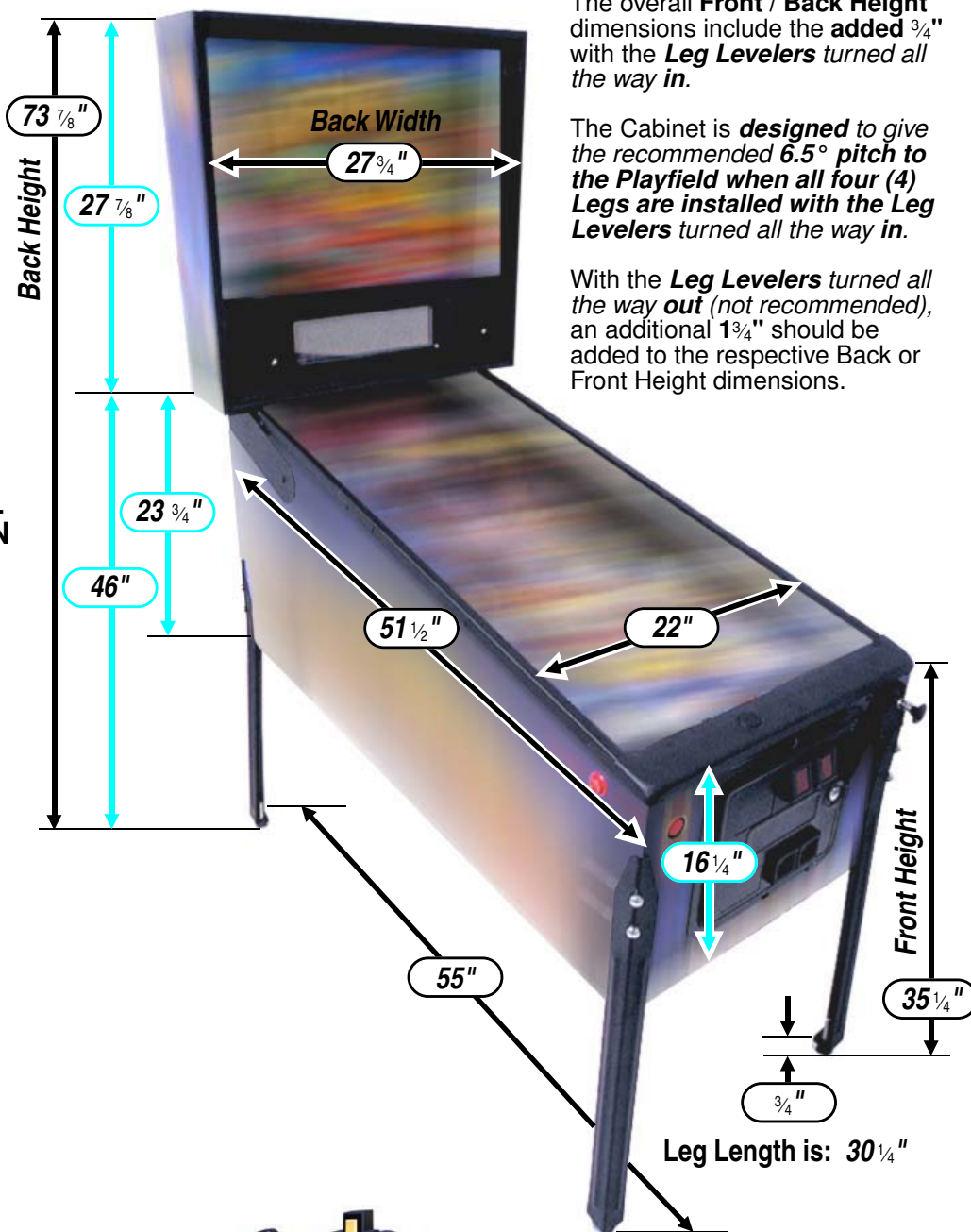
SAVE AND RETAIN ALL PRINTED INFORMATION INSIDE THE CABINET !

Shipping Box Dimensions

Height 56" Width 31"
 Depth 31"
 Approx. Unboxed Weight: 260lbs. (+/- 10)
 Boxed Weight:
Wt. 285lbs. (+/- 5)

CAUTION

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



The overall **Front / Back Height** dimensions include the **added 3/4"** 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 **1 3/4"** should be added to the respective Back or Front Height dimensions.



Find-It-In-Front:
Dr. Pinball





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After Set-Up

Pinball Game Set-Up Procedures

...after reading the Pinball Game Set-Up Instruction Sheet (SPI Part N^o 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:

- 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).
- 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."

After Set-Up

PINBALL GAME SET-UP

CAUTION: At least 2 people are required to move and maneuver game. Use proper moving equipment & extreme care while handling. Pinball game is 200lbs (+/- 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 "FRONT 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 cabinet 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 4 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 Back. 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.

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 SPIE™ 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 tied to the Playfield Glass or equipped with Auto Plunger Button). Remove keys. One (1) set of keys is in 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 downwards 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 Outsole 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 (attached to side of the left end of the cabinet). Review Section 1, Chapter 1, which describes how to tilt the playfield to access the Plumb Bob Tilt Assembly. The manual gives you all the important information you need to prepare for first setup and other important information (such as Parts, Diagnostics, Schematics and more...).

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

SPI Part N^o 755-5310-00



Pinball Game Set-Up Future Reference

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

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

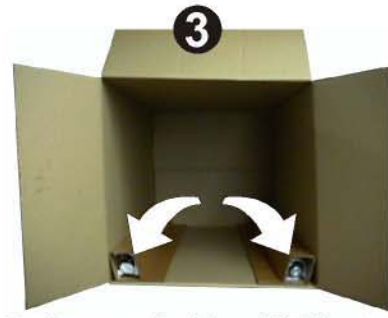
Sec. 1: After Set-Up



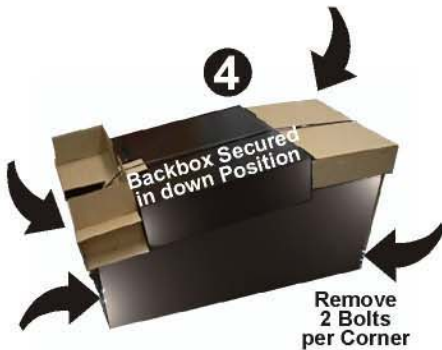
1. Before opening box, lay the box flat on its side with "TRUCK THIS SIDE ONLY" facing the floor.



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



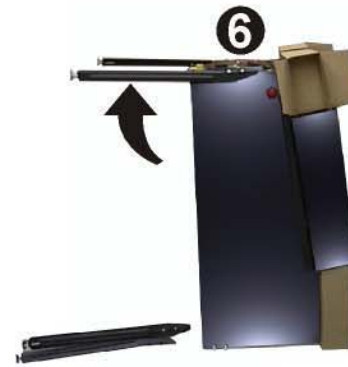
3. Remove the **Four (4) Identical Legs with Levelers** from the carton and set aside. (**SAVE!** all packing materials and information sheets related to this pinball until Set-Up is complete.)



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).

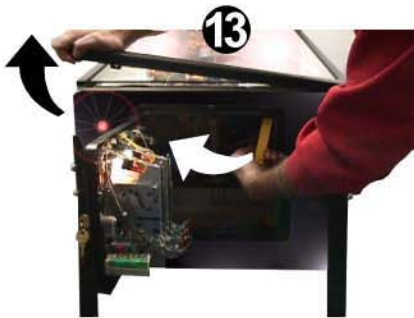


11. After the **BACKBOX** is in the **UPRIGHT POSITION**, locate the **5/16" HEX KEY**. While inserted, rotate **KEY** with a **3/4** turn until latched & locked.



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.



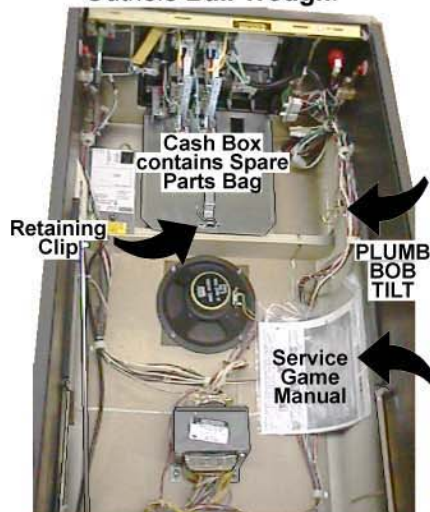
14. Through the open **Coin Door**, remove the **RETAINING RING** at the rear of the **CASH BOX** and open. Remove the **PINBALLS** & the **PLUMB BOB** from the **SPARE PARTS BAG**. (Save the other spare parts in cabinet). Install the **PINBALLS** by placing them on the playfield so they can roll into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



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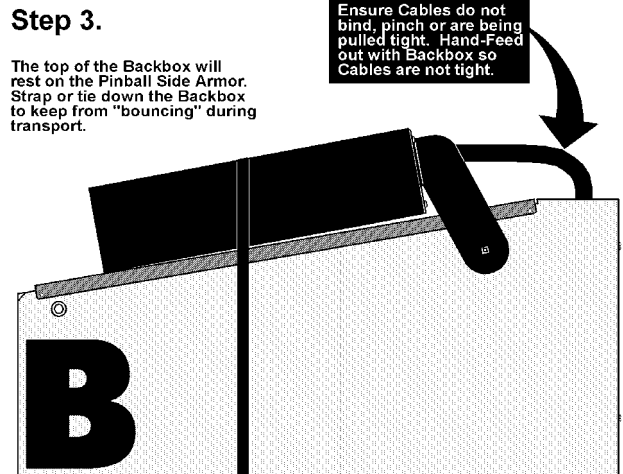
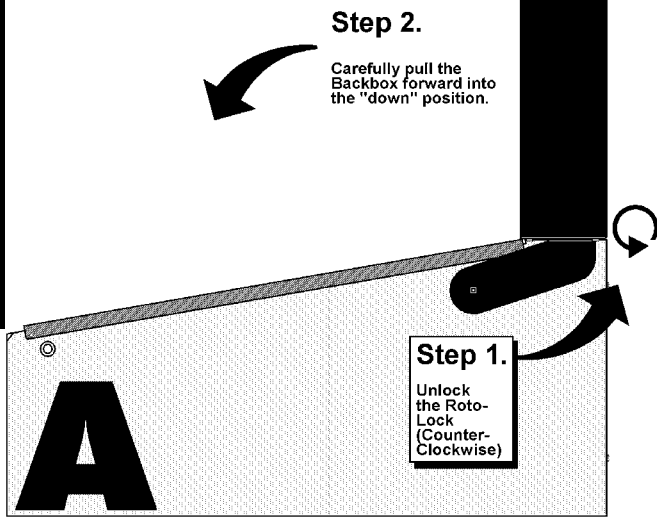
Remove the **PINBALL GAME MANUAL** (stapled to side of the left wall of the cabinet). Review **Section 1, Chapter 1**, which describes how to lift the playfield to access the **Plumb Bob Tilt Assembly**. The manual gives you all the important information you need to prepare for final set-up and other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

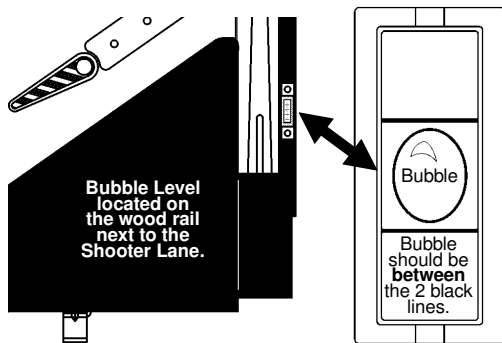
Sec. 1: After Set-Up

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 .

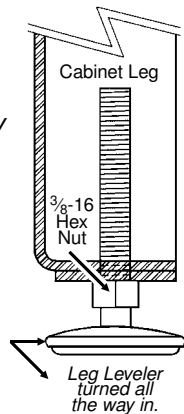


Start adjustment with the leg levelers *turned all the way in*.

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!

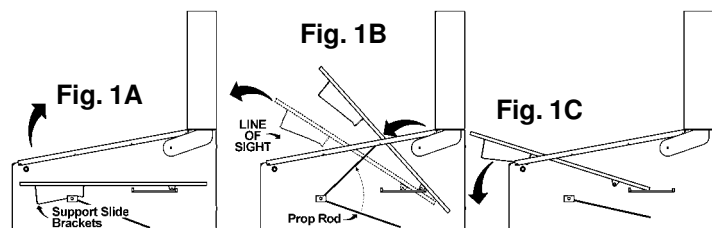
Note: For custom adjustment greater than >6.5° can be achieved by turning out the rear leg leveler(s), however, it is not recommended.

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*).

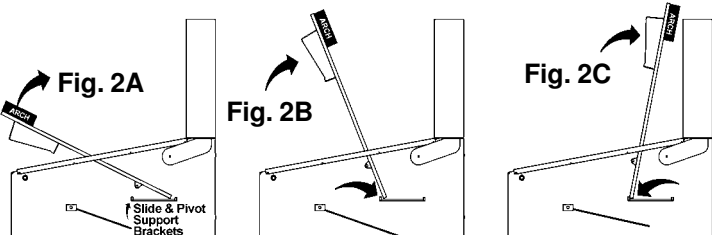
Positions 1 & 2

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

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 **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 N^o: 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



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!



SPI PART N^o: 755-5178-00 USA





Section 3 Service Menu System Table of Contents



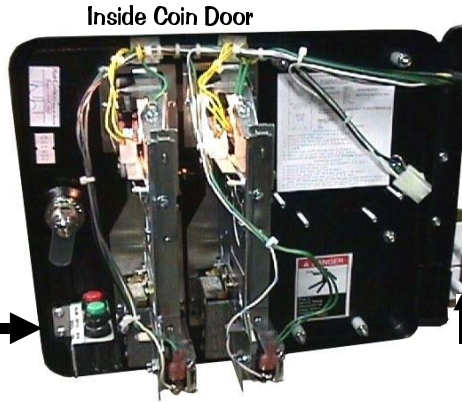
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Sec. 3: ...Menu Intro.



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**.



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

The Memory Protect Switch is disabled when the Coin Door is open (required for any changes...)

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).

Sec. 3: ...Menu Intro.

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.

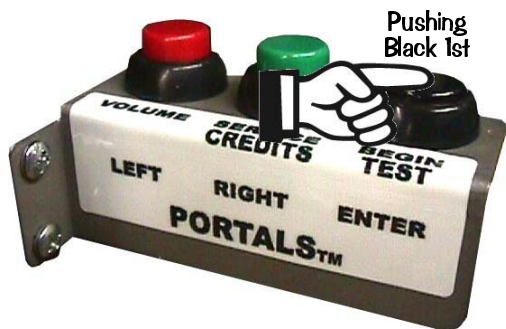
Function 2, Service Credits Menu



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!**



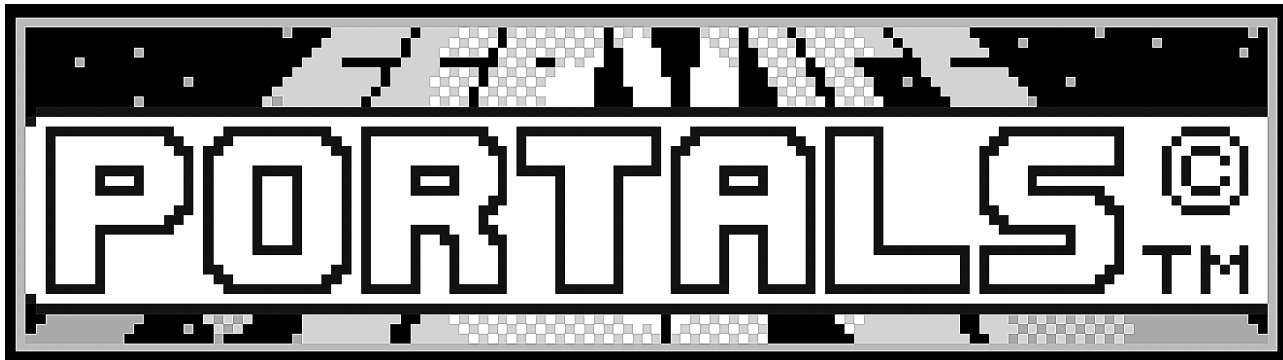
Portals™ Service Menu Introduction

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 disabled 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©™"* 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.

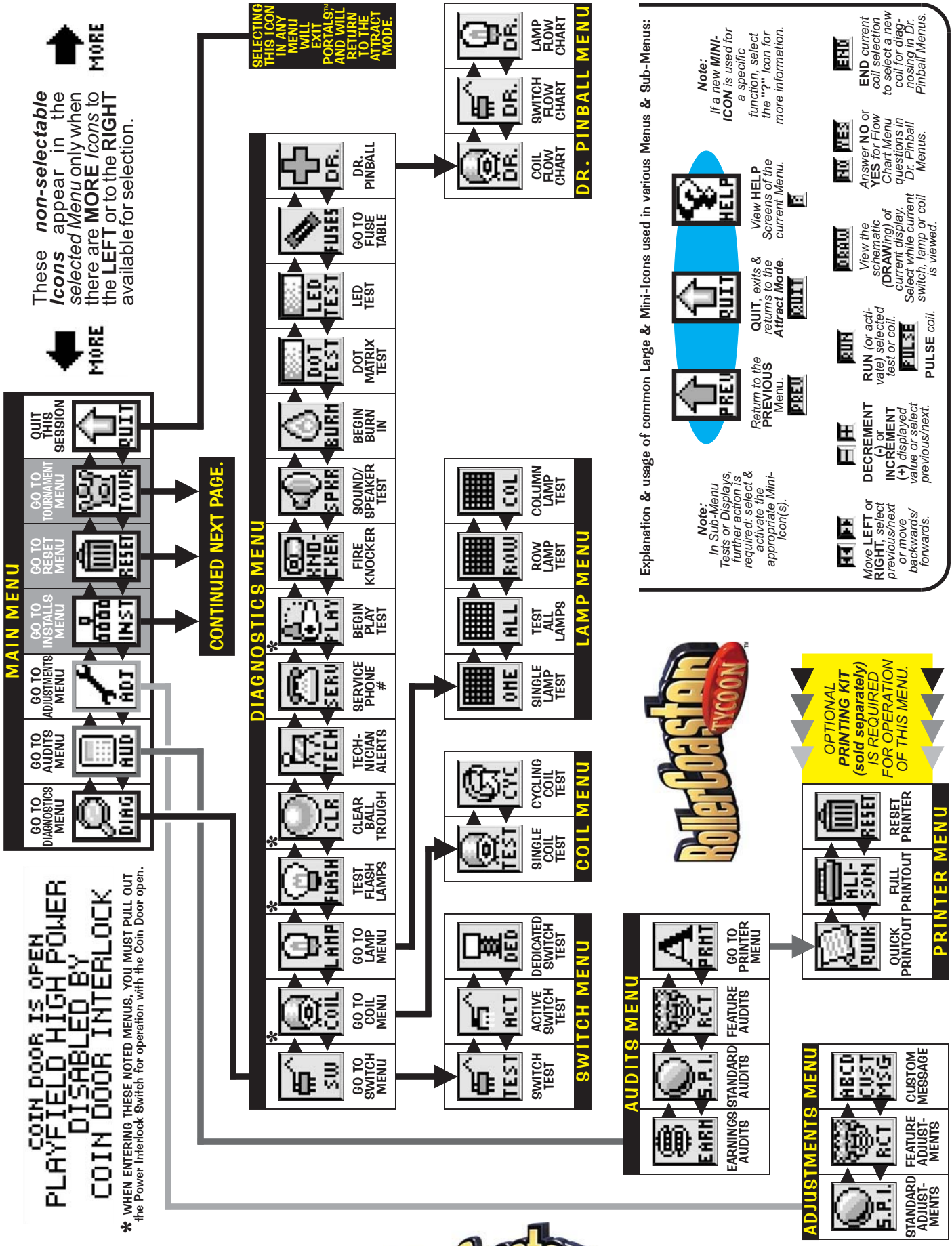
View the **Portals™ Service Menu Icon Tree** on the next pages for a complete overview of all menus used in this system. The "**HELP**" *Icon* & "**?**" *Mini-Icon* provide explanation of **ICON** usage in the Menu where the "**HELP**" *Icon* or "**?**" *Mini-Icon* was selected. View **QUIT THIS SESSION (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

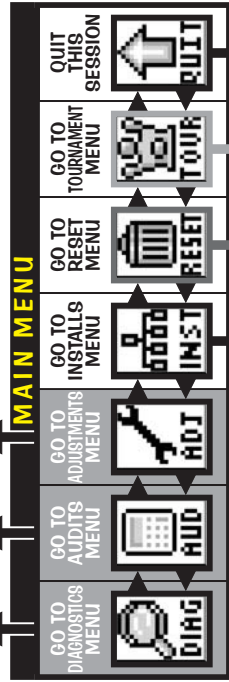
**COIN DOOR IS OPEN
PLAYFIELD HIGH POWER
DISABLED BY
COIN DOOR INTERLOCK**

* WHEN ENTERING THESE NOTED MENUS, YOU MUST PULL OUT the Power Interlock Switch for operation with the Coin Door open.



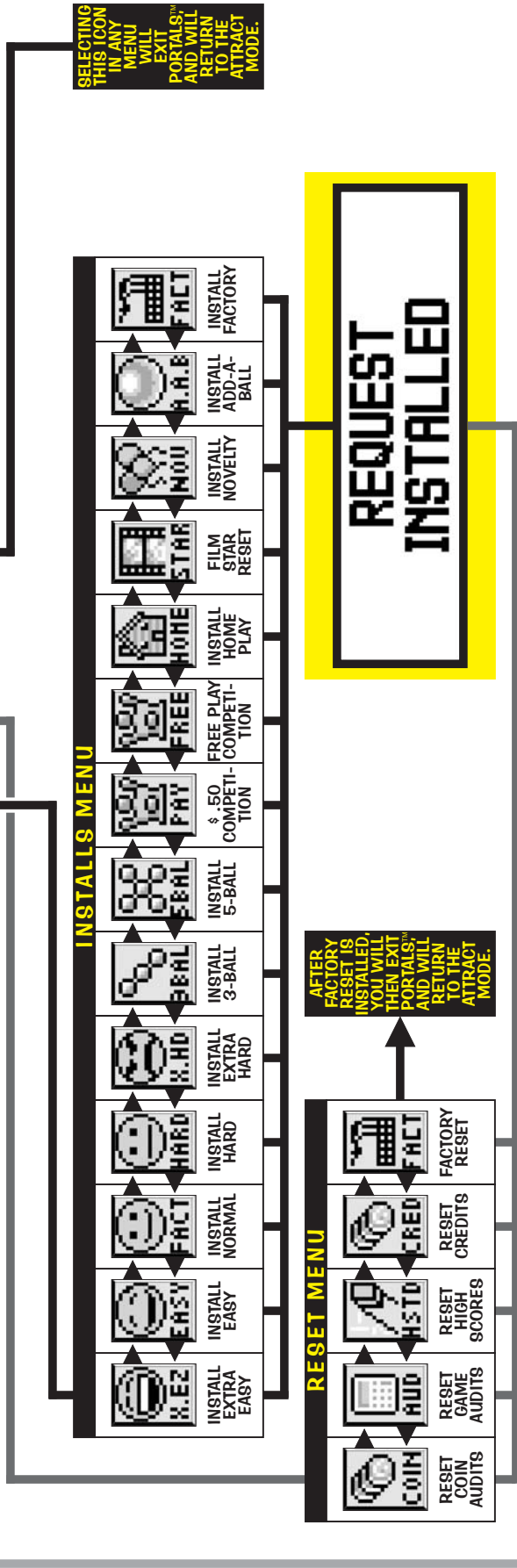
Portals™ Service Menu Icon Tree for  Pinball Game Continued

SEE PREVIOUS PAGE.



Note: After selection of any of the 1st 13 **Install Icons**, the request is installed and returns to the **Install Menu**. The last icon activated before exiting this menu will supersede any previous icon selected in the group.

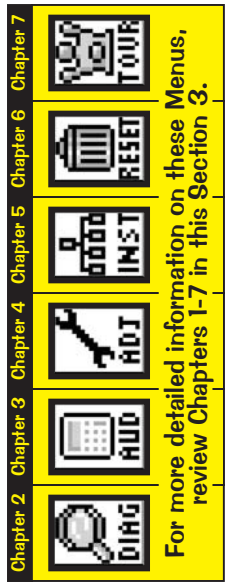
Note: After selection of any of the 1st 4 **Reset Icons**, the request is installed and returns to the **Reset Menu**. Selecting a "FACT" icon, the request is installed and exits the **Portals™ Service Menu System**.



SELECTING THIS ICON IN ANY MENU WILL EXIT PORTALS™ AND WILL RETURN TO THE ATTRACT MODE.

AFTER FACTORY IS INSTALLED, YOU WILL THEN EXIT PORTALS™ AND WILL RETURN TO THE ATTRACT MODE.

OPTIONAL TOURNAMENT KIT (sold separately) IS REQUIRED FOR OPERATION OF THIS MENU.



For more detailed information on these Menus, review Chapters 1-7 in this Section 3.



Sec. 3: ...Menu Intro.



Portals™ Service Menu Example





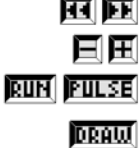


This example will demonstrate activation of *Icons* in the **DIAGNOSTICS MENU**. The example will show activation of the "SW" *Icon* (**GO TO SWITCH MENU**). In this menu, the switches can be tested individually and also all active switches can be tested. Use the same technique to access all the *Icons* 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*.



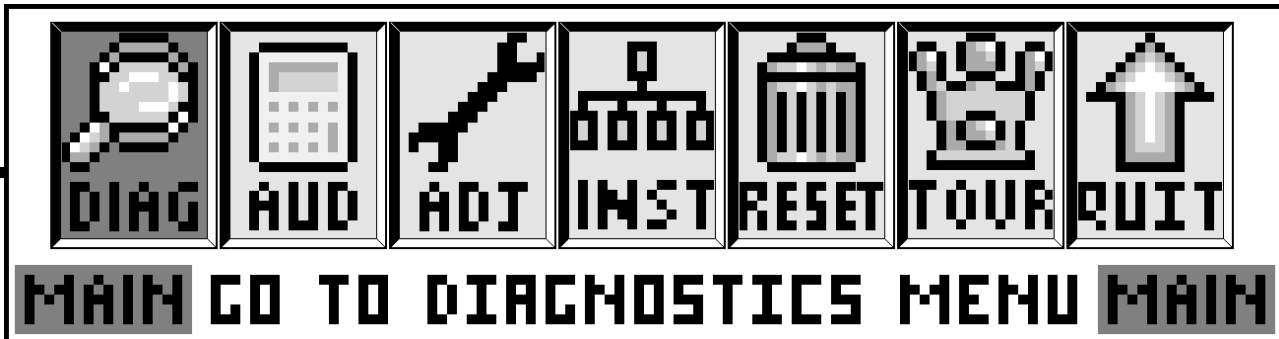
EXPLANATION & USAGE OF COMMON LARGE & MINI-ICONS USED IN VARIOUS MENUS & SUB-MENUS:

 MORE MORE	 PREV	 QUIT	 HELP	 DECREMENT (-) or INCREMENT (+) displayed value or select previous / next.	 RUN (or activate) selected test or coil PULSE coil.	 View the schematic (DRAWing) of current display. Select while current switch, lamp or coil is viewed.
<small>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.</small>	<small>Select and activate to return to the PREVIOUS Menu.</small>	<small>Select and activate to QUIT, exits & returns to the Attract Mode.</small>	<small>Select and activate to view HELP Screens of the current Menu*.</small>	<small>* 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.</small>		

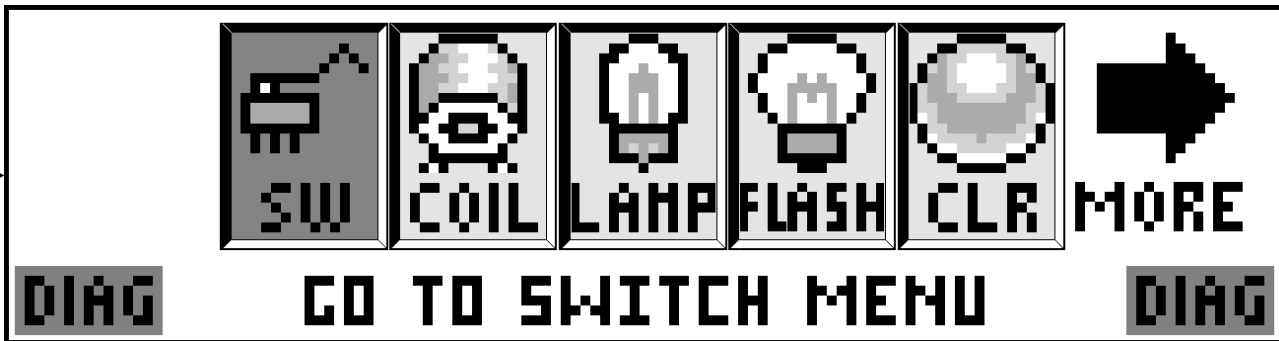
Sec. 3: ...Menu Intro.

Example:

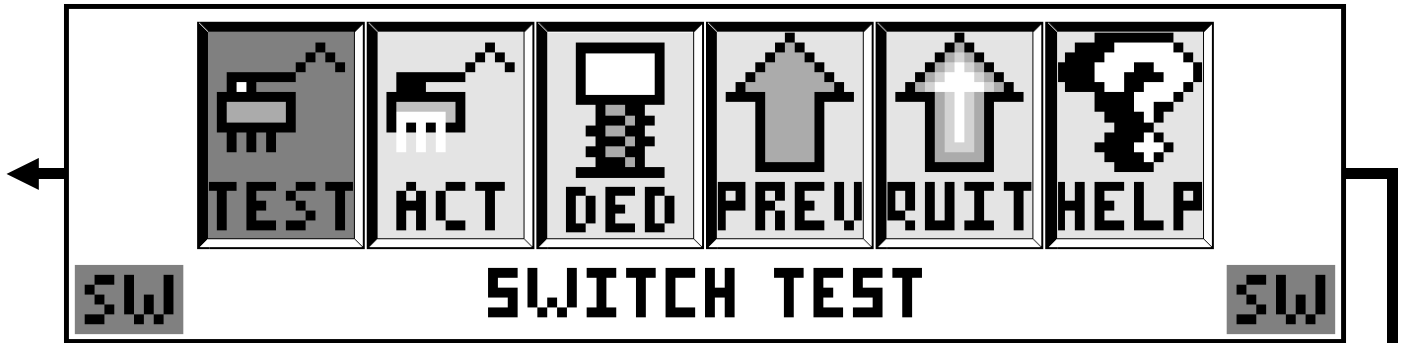
After entering **Portals™**, the **MAIN MENU** now appears with the "DIAG" *Icon* (**GO TO DIAGNOSTICS MENU**) flashing:



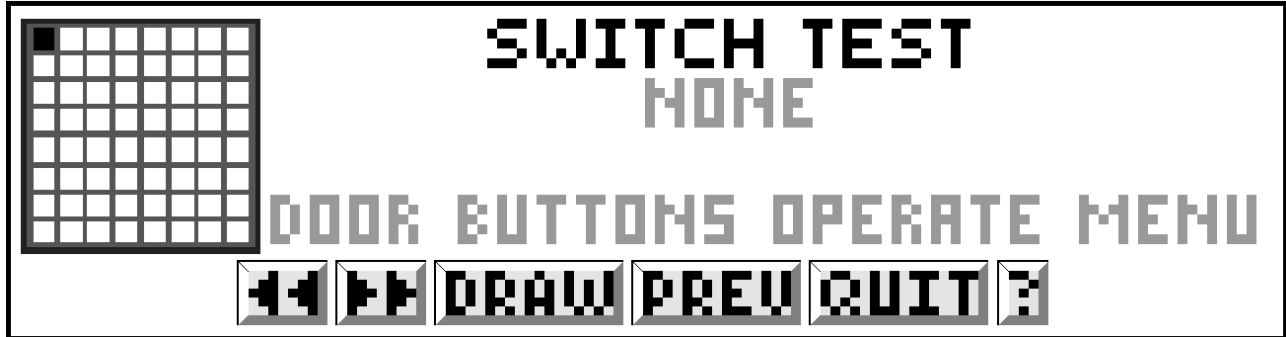
Press the **Black "ENTER" Button** to *activate* this **ICON**. The **DIAGNOSTICS MENU** now appears with the "SW" *Icon* (**GO TO SWITCH MENU**) flashing:



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

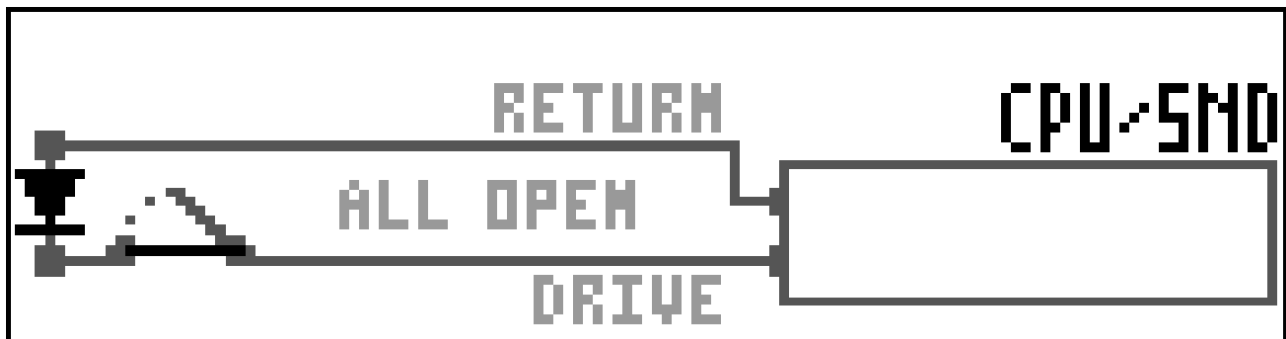


Press the **Black "ENTER" Button** to *activate* this icon. The **Switch Test Display** now appears.



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.

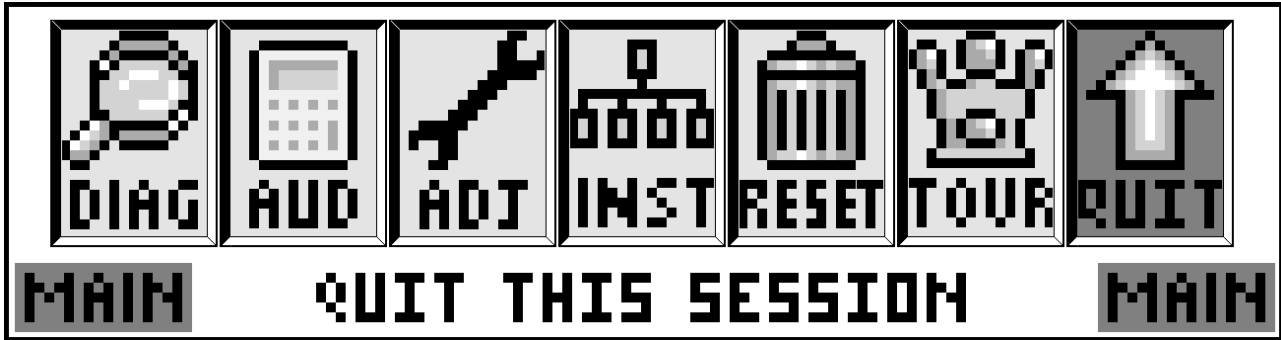
While in **Switch Test** or **Active Switch Test**, the **Flipper & Start Buttons** are deactivated (because they can be part of these tests). Use the **Red "LEFT," Green "RIGHT"** and/or **Black "ENTER" Buttons** to select and *activate* the "**MINI-ICONS**" at the bottom of the display. In **Switch 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 **Diagnos**tics 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 .	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> Check to make sure the Game is not in "Free Play." <i>If the game is set to Free Play, adding Service Credits is not required.</i> Check the Service Switches wiring harness for poor or no connection and/or broken wires.
The Display "blanks out."	<ul style="list-style-type: none"> 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 " <i>scroll</i> " along continuously in the MAIN MENU .	<ul style="list-style-type: none"> 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 <i>Icons</i> in the SWITCH TEST MENU .	<ul style="list-style-type: none"> 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 <i>Icon</i> with the Left and/or Right Flipper Buttons .	<ul style="list-style-type: none"> 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 <i>only</i> in Diagnostic's Switch & Active Switch Tests (see <i>previous Problem</i>).
Some <i>Icons</i> appear non-functional in the PRINTER MENU(S) .	<ul style="list-style-type: none"> 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 <i>Icons</i> appear non-functional in the GAME SPECIFIC MENU under the DIAGNOSTICS MENU .	<ul style="list-style-type: none"> If there is no other test under this Menu, the "<<" & ">>" Mini-Icons will appear not to function. The remaining <i>Icons</i> should function as normal. Note: <i>If there is no "Go To (Game Name) Test(s), the "GAME NAME" Icon will not invoke another display.</i>
The display returns to the ATTRACT MODE exiting the Service Session after a FACTORY RESET .	<ul style="list-style-type: none"> 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 <i>do not</i> fire after activating the "RUN" Icon .	<ul style="list-style-type: none"> 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).	<ul style="list-style-type: none"> 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 .	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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 their 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 by 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.

Sec. 3: ... Diagnostics



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

Select and activate to:

MORE MORE	PREV	QUIT	HELP	DECREMENT (-) or INCREMENT (+) displayed value or select previous / next.	RUN (or activate) selected test or coil PULSE coil.	VIEW the schematic (DRAWING) of current display. Select while current switch, lamp or coil is viewed.
<small>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.</small>	<small>Select and activate to return to the PREVIOUS Menu.</small>	<small>Select and activate to QUIT, exits & returns to the Attract Mode.</small>	<small>Select and activate to view HELP Screens of the current Menu*.</small>	<small>* 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.</small>		

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 is 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

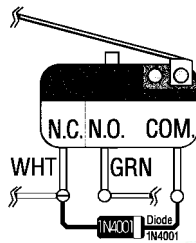
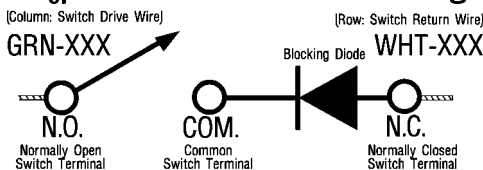
To initiate, from the **SWITCH MENU**, select the "DED" *Icon* with either **Flipper Button** & press the **Start Button** (*the Service Switches are deactivated during this test.*). In **Dedicated Switch Test**, the display will describe the switch which includes the Switch Name, Return (Row) Wire, Drive (Column) Wire, Part Number and the "Pin-Outs" from the **CPU/Sound Board**.

SWITCH MATRIX GRID & DEDICATED SWITCHES

Diode On Terminal Strip:									GND	
Column (Drive)	1: Q1	2: Q2	3: Q3	4: Q4	5: Q5	6: Q6	7: Q7	8: Q8	IC U206 INPUTS	Ground
Row (Return)	GRN-BRN CN5-P1	GRN-RED CN5-P3	GRN-ORG CN5-P4	GRN-YEL CN5-P5	GRN-BLK CN5-P6	GRN-BLU CN5-P7	GRN-VIO CN5-P8	GRN-GRY CN5-P9	1: U206	BLK CN6-P1, -P11
1: U400	LEFT BUTTON (UK ONLY) on Cabinet side	NOT USED	(R) & D STANDUP on Brckt. Below	LEFT TOP LANE (A) on Brckt. Below	LEFT RAMP RETURN on Asm. Above	NOT USED	LEFT BUMPER on Asm. Below	LEFT OUTLANE on Brckt. Below	1: U206	#1 LEFT FLIPPER BUTTON in Cabinet side
2: U400	4TH COIN SLOT on Coin Door	NOT USED	R (&) D STANDUP on Brckt. Below	MIDDLE TOP LANE (B) on Brckt. Below	CENTER RAMP MADE on Asm. Above	LOCKUP 1 (TOP) on Brckt. Below	RIGHT BUMPER on Asm. Below	LEFT RETURN LANE on Brckt. Below	2: U206	#2 LEFT FLIPPER E.O.S (End-of-Stroke) in Cabinet side
3: U400	6TH COIN SLOT on Coin Door	4-BALL TROUGH #1 (LEFT) on Asm. Below	R (&) D STANDUP on Brckt. Below	RIGHT TOP LANE (C) on Brckt. Below	RIGHT RAMP MADE on Asm. Above	LOCKUP 2 (BOTTOM) on Brckt. Below	BOTTOM BUMPER on Asm. Below	LEFT SLINGSHOT on Asm. Below	3: U206	#3 RIGHT FLIPPER BUTTON in Cabinet side
4: U400	RIGHT COIN SLOT on Coin Door	4-BALL TROUGH #2 on Asm. Below	WHEEL OPTO on Asm. Below	DUMMY LEFT on Brckt. Below	GHOST DOWN on Asm. Above	(E) AT STANDUP on Brckt. Below	ROCKET on Asm. Below	RIGHT OUTLANE on Brckt. Below	4: U206	#4 RIGHT FLIPPER E.O.S (End-of-Stroke) in Cabinet side
5: U401	CENTER COIN SLOT / DBA on Coin Door	4-BALL TROUGH #3 on Asm. Below	MINI FLIPPER FEED on Brckt. Below	DUMMY RIGHT on Brckt. Below	RIGHT ORBIT on Brckt. Below	E (A) T STANDUP on Brckt. Below	TOURNAMENT BUTTON Cabinet Front	RIGHT RETURN LANE on Brckt. Below	5: U206	#5 UPR. RT. FLIPPER BUTTON in Cabinet side
6: U401	LEFT COIN SLOT on Coin Door	4-BALL TROUGH VUK OPTO on Asm. Below	MINI FLIPPER STANDUP on Brckt. Below	DROP BANK LEFT on Asm. Below	SWEEPER OPTO on Brckt. Below	EA (T) STANDUP on Brckt. Below	START BUTTON Cabinet Front	RIGHT SLINGSHOT on Asm. Below	6: U206	#6 VOLUME (RED BUTTON) (In Test: LEFT) on Coin Door
7: U401	5TH COIN SLOT on Coin Door	4-BALL STACKING OPTO on Asm. Below	CHICAGO LOOP on Asm. Above	DROP BANK MIDDLE on Asm. Below	SWEEPER DROP on Asm. Below	KIOSK SCOOP on Asm. Below	NOT USED	NOT USED	7: U206	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) on Coin Door
8: U401	RIGHT BUTTON (UK ONLY) on Cabinet side	SHOOTER LANE on Brckt. Below	LEFT ORBIT on Brckt. Above	DROP BANK RIGHT on Asm. Below	GHOST STANDUP on Brckt. Below	KIOSK TUNNEL on Asm. Below	PLUMB BOB TILT Inside Cabinet	NOT USED	8: U206	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) on Coin Door

Sec. 3: ... Diagnostics

Typical Switch Schematic & Wiring



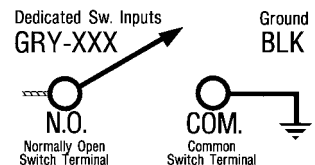
Note: All Switch, Lamp & Coil assemblies require diodes. Some diodes are located under the playfield on Terminal Strips or Diode Boards and not on the assemblies.

Diode on Terminal Strip

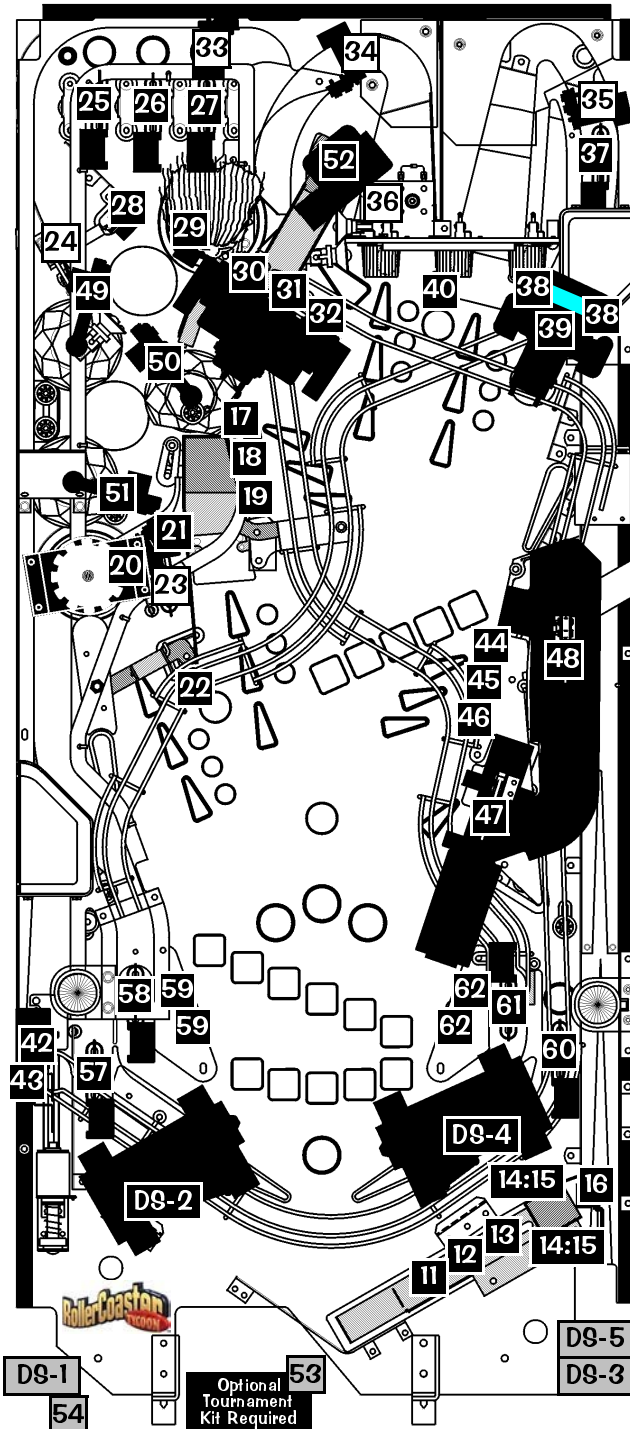
or

Diode on Diode Board

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 On Terminal Strip or **DODB:** Diode On Diode Board.

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. N ^o	Col. N ^o	Row N ^o	Sec. N ^o	Switch Matrix Description	Part N ^o
<i>Note: The ¥ Coin Switch (for Japan) is 180-5091-00</i>					
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	
5	1	5	5	CENTER COIN SLOT / DBA	180-5024-00
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)	
12	2	4		4-BALL TROUGH #2	180-5119-02
13	2	5		4-BALL TROUGH #3	
14	2	6		4-BALL TROUGH VUK OPTO	BOT TRANS: 515-5173-00 BOT REC: 515-5174-00
15	2	7		4-BALL STACKING OPTO	TOP TRANS: 515-5173-00 TOP REC: 515-5174-00
16	2	8		SHOOTER LANE	180-5157-00
17	3	1	3, 8	(R) & D STANDUP	Sq. Yellow Target
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
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	D018	DROP BANK LEFT	
31	4	7	D018	DROP BANK MIDDLE	180-5158-00
32	4	8	D018	DROP BANK RIGHT	
33	5	1		LEFT RAMP RETURN	on Gate
34	5	2		CENTER RAMP MADE	on Gate 180-5190-28
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	TRANS: 520-5082-00
				VUK OPTO	REC: 520-5083-01
39	5	7	D018	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
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	
50	7	2		RIGHT BUMPER	180-5015-03
51	7	3		BOTTOM BUMPER	
52	7	4	D018	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
61	8	5	2, 3	RIGHT RETURN LANE	on Lt. Mount R/O 500-6227-01
62	8	6	2	RIGHT SLINGSHOT	Leaf Sw. X2 180-5054-00
63	8	7		NOT USED	
64	8	8		NOT USED	

Sec. 3: ... Diagnostics



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*).

COIN DOOR IS OPEN
PLAYFIELD HIGH POWER
DISABLED BY
COIN DOOR INTERLOCK

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**.

Sec. 3: ... Diagnostics

Coil & Flash Lamp Descriptions

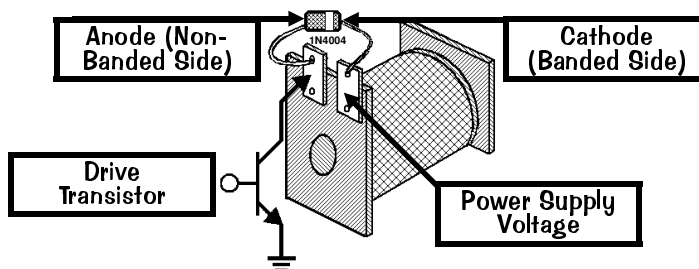
#	Type	Coil / Flash Lamp Descriptions
1	Coil	TROUGH UP-KICKER (VUK) (26-1200)
2	Coil	AUTO LAUNCH (24-940)
3	Coil	LOCKUP (23-800)
4	Coil	1 BANK RESET (27-1500)
5	Coil	1 BANK TRIP (32-1250)
6	Coil	3 BANK TRIP (32-1250)
7	Coil	ROCKET VUK (24-940; <i>Early Production</i> 26-1200)
8	Coil	KIOSK SCOOP (23-800)
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)

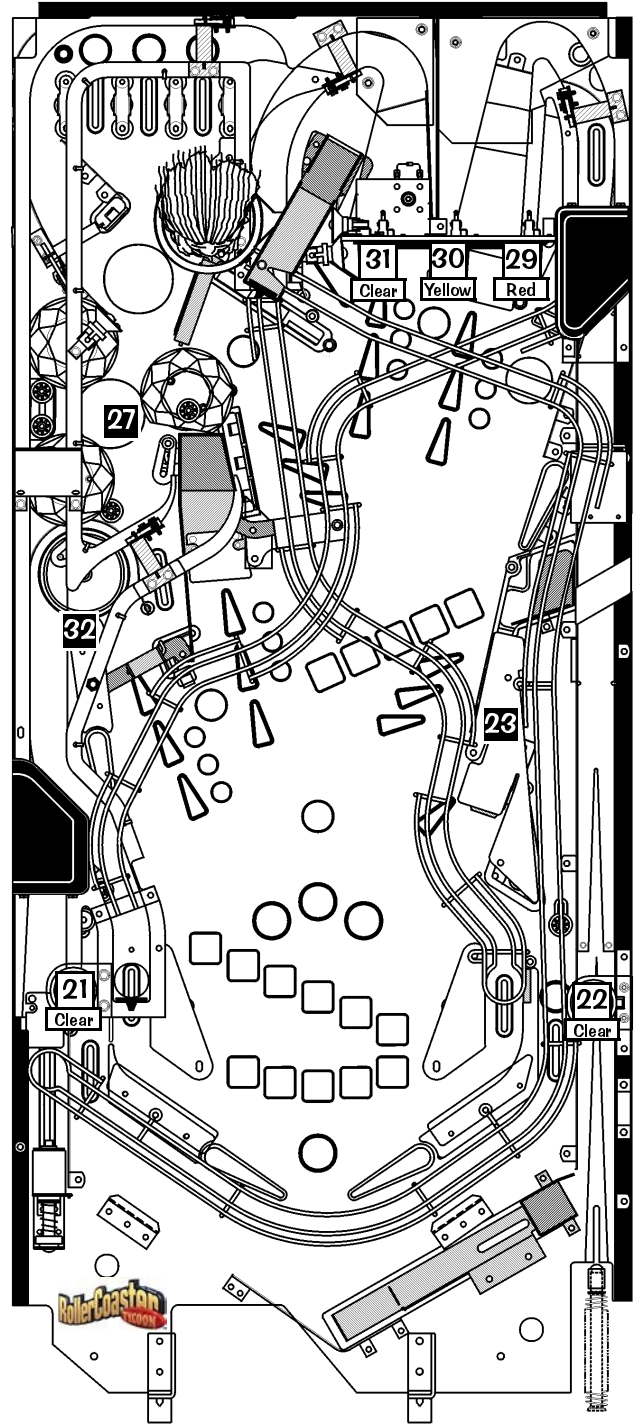
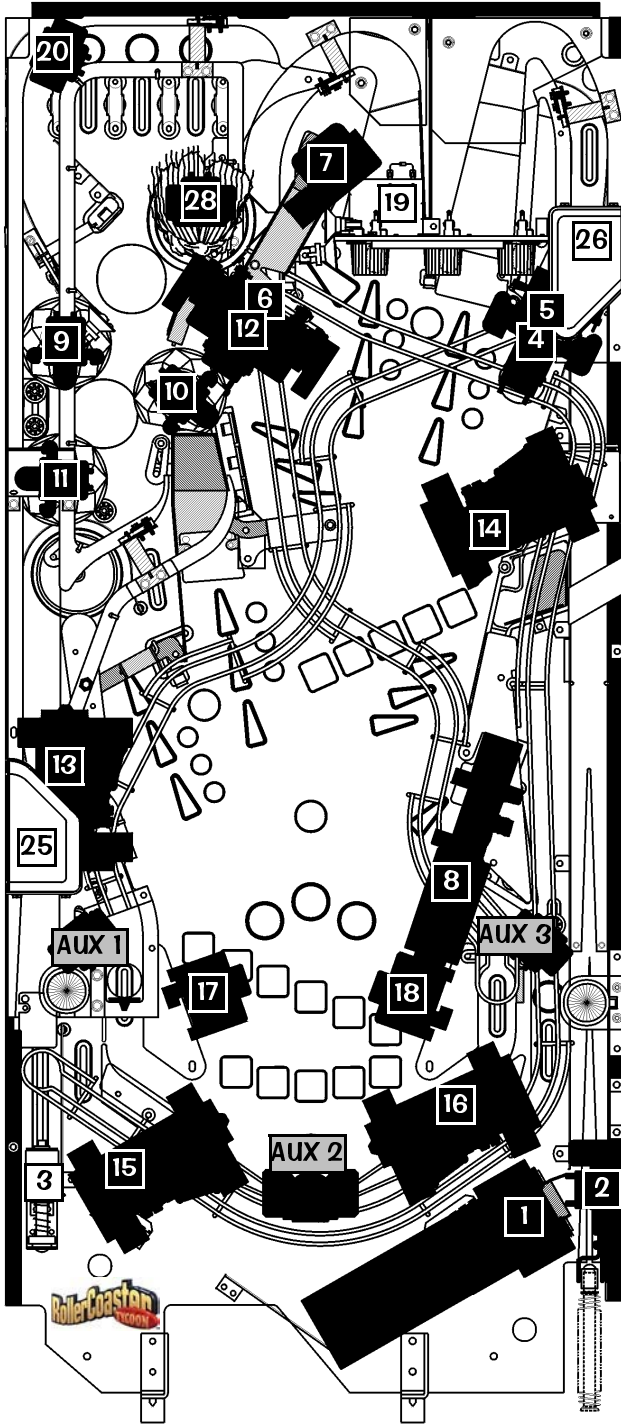
See the next three (3) pages for the **Coil & Flash Lamp Location Maps** (corresponds to above tables), **Coils Detailed Chart Table** & the **Backbox I/O Power Driver Board Detailed Wiring Diagram**.

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 Q n I ermal S trip or D iode Q n D iode B oard

Typical Coil Wiring



Coil & Flash Lamp Locations



Sec. 3: ... Diagnostics

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.

Go To
Diagnostics Menu





In COIL MENU also select:

CYCLING COIL TEST

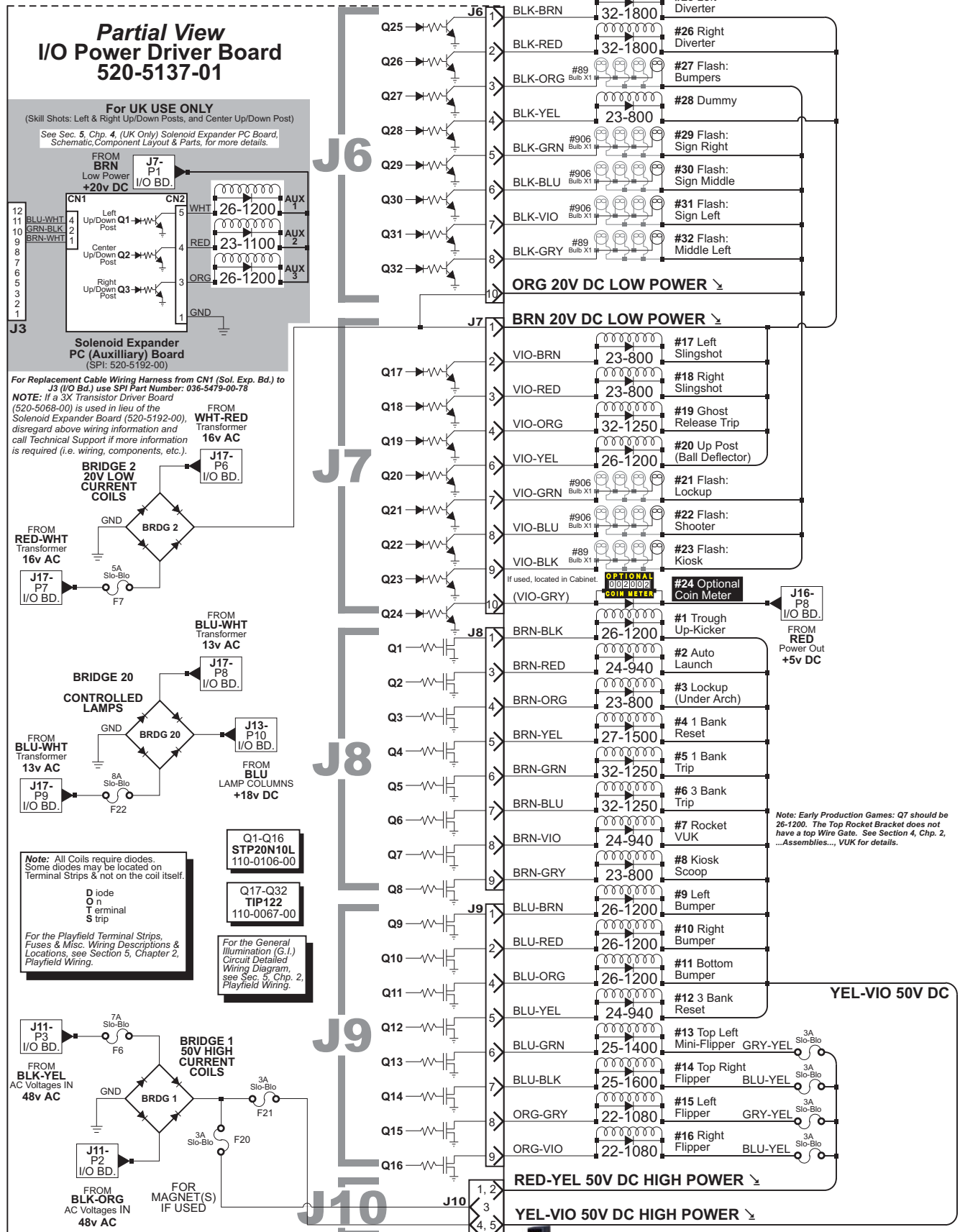
COILS DETAILED CHART TABLE

High Current Coils Group 1		Drive Transistor	Driver Output 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
<i>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.</i>									
#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 Output 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 Output 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
<i>D i o d e O n T e r m i n a l S t r i p (if noted)</i>									
Low Current Coils Group 2		Drive Transistor	Driver Output 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
<i>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)</i>									
Auxiliary (UK ONLY)		Drive Transistor	Driver Output 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

Sec. 3: ... Diagnostics



Backbox I/O Power Driver Board Detailed Wiring Diagram



Sec. 3: ... Diagnostics





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 an 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 its 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.



Sec. 3: ... Diagnostics

LAMP MATRIX GRID

D iode O n T ermal S trip :

Column (18v)	1: U17	2: U16	3: U15	4: U14	5: U13	6: U12	7: U11	8: U10
Row (GND)	YEL-BRN J13-P9	YEL-RED J13-P8	YEL-ORG J13-P7	YEL-BLK J13-P6	YEL-GRN J13-P5	YEL-BLU J13-P4	YEL-VIO J13-P3	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 N^o in the Lamp Matrix Grid on the previous page.

Ramps are Not Shown for clarity.

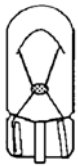
Legend Note:

□ = Lamps mounted above Playfield.

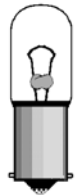
■ = Lamps mounted below Playfield.

▒ = Lamps mounted in/on Cabinet.

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

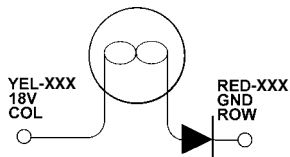


#555 Bulb (Wedge)
165-5002-00

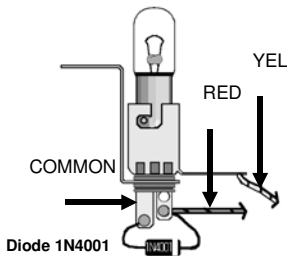


#44 Bulb (Bayonet)
165-5000-44

Typical Lamp Schematic

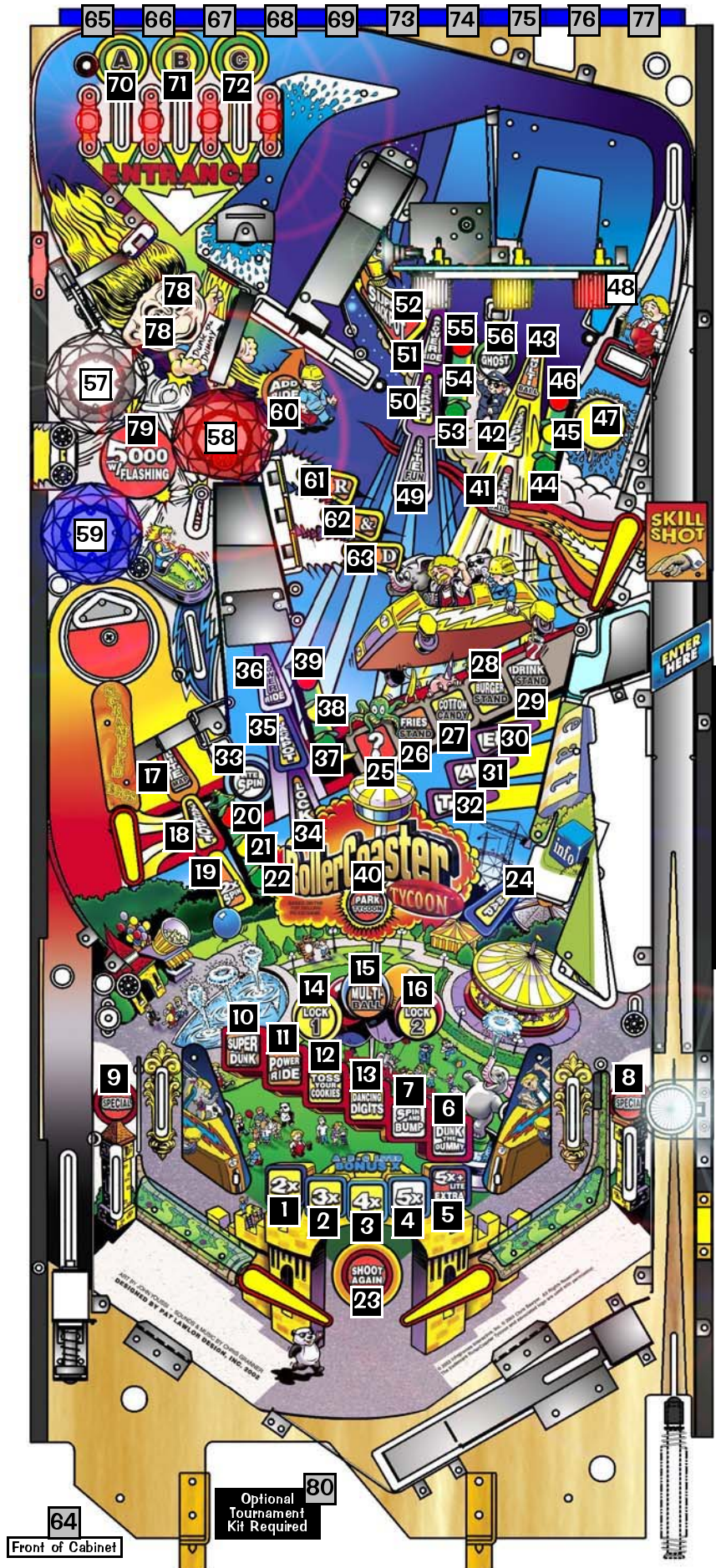


Typical Lamp Wiring



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 □ n Terminal Strip or □ diode □ n □ diode □ card



Sec. 3: ... Diagnostics

Go To
Diagnostics Menu





Test Flash Lamps

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**

COIN DOOR IS OPEN
PLAYFIELD HIGH POWER
DISABLED BY
COIN DOOR INTERLOCK

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



Clear Ball Trough

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**.

COIN DOOR IS OPEN
PLAYFIELD HIGH POWER
DISABLED BY
COIN DOOR INTERLOCK

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

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*.

PLAYFIELD STATUS
POSSIBLY BROKEN SWITCH
#02 SHOOTER LANE
PREV QUIT ?

PLAYFIELD STATUS
CHECK SWITCHES
#02 SHOOTER LANE
PREV QUIT ?

PLAYFIELD STATUS
HYPERSENSITIVE SWITCH
#02 SHOOTER LANE
PREV QUIT ?

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 **HYPERSENSITIVE 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.

OPERATOR ALERT!
#2 AUTO LAUNCH
COIL MALFUNCTION

PLEASE CHECK
TECH REPORT
PORTALS->DIAG->TECH

Technicians Alerts continued on the next page.





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

Continued



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 too 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.



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.

Sec. 3: ... Diagnostics



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.



Sec. 3: ... Diagnostics

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.



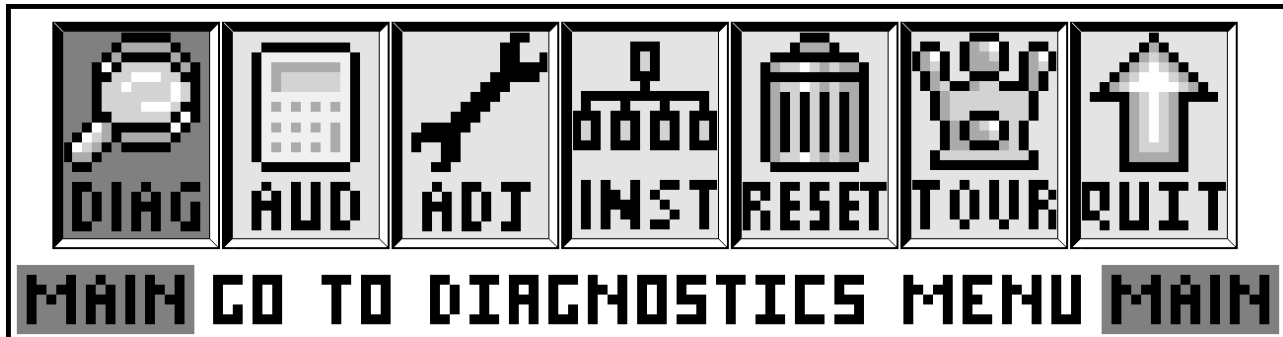


Go To Fuse Table

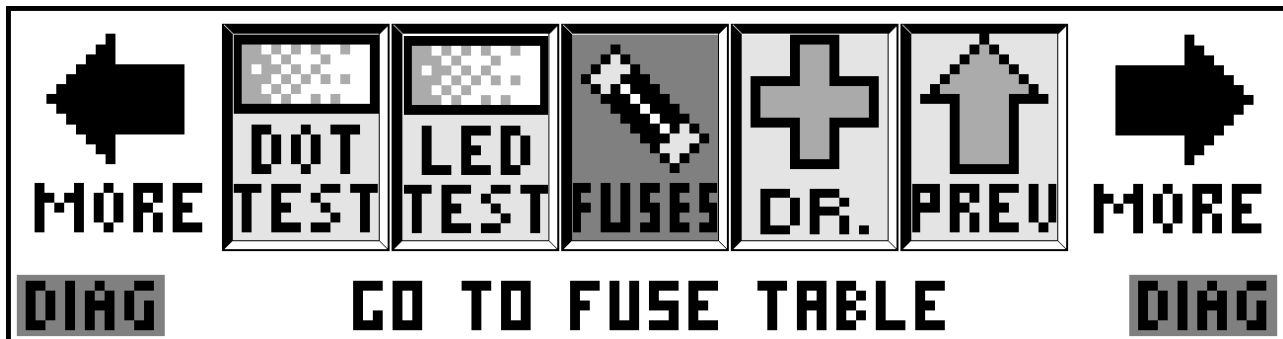
To initiate, from the **DIAGNOSTICS MENU**, select the "FUSES" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. The **FUSE TABLE MENU** now appears. This provides the technician with the current **Fuse Table** for this game (*also noted on decal 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:

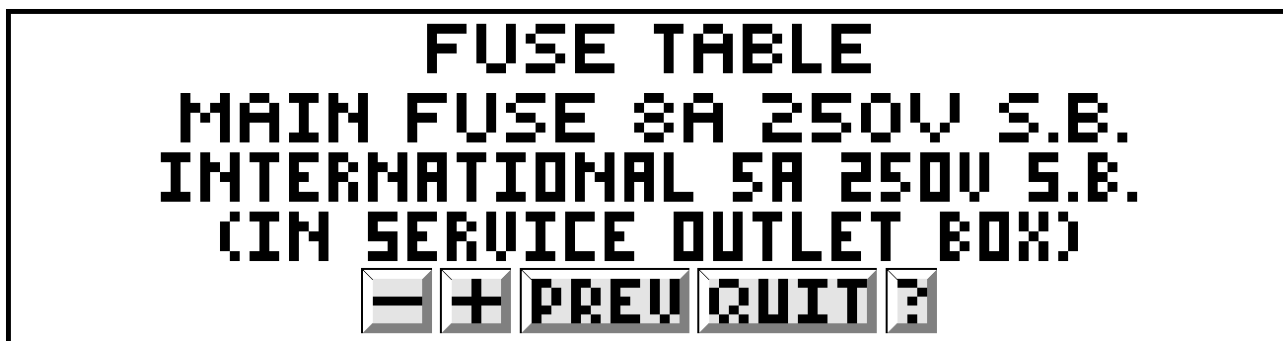
After entering **Portals™**, the **MAIN MENU** now appears with the "DIAG" *Icon* (**GO TO DIAGNOSTICS MENU**) flashing:



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:



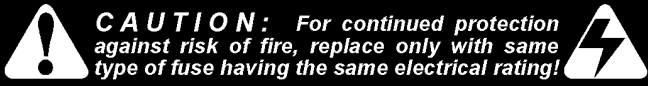
Press the **Black Button** to *activate* this **ICON**. The **FUSE TABLE** now appears.



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



QUICK REFERENCE FUSE CHART

Backbox Fuses

LOC: DISPLAY POWER SUPPLY (P.S.) BOARD

F1 3/4A 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)

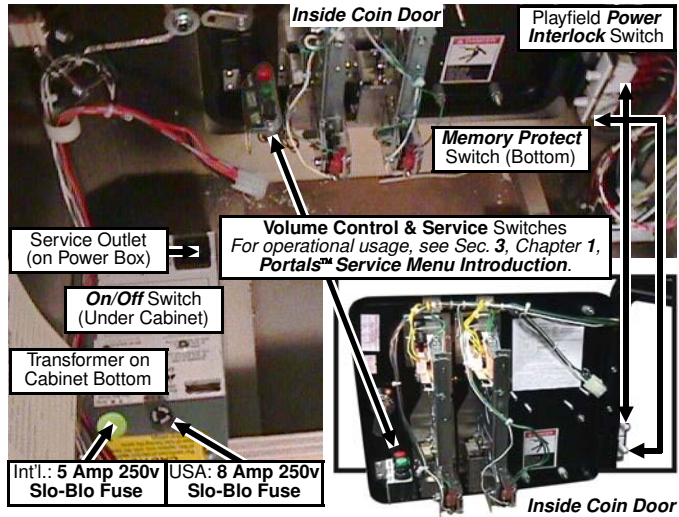
n/a 5A 250v S.B. 220v AC Main Fuse Line (International)

Playfield (P/F) Fuses

LOC: UNDER PLAYFIELD (near Flippers)

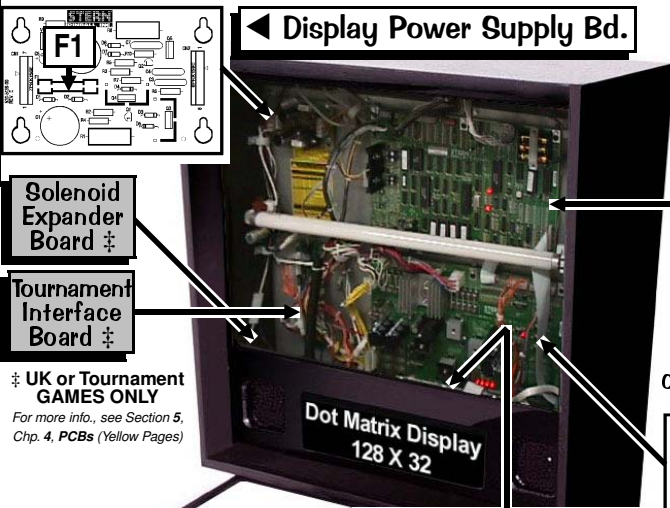
n/a	3A 250v S.B.	50v DC	Rt. Flipper (BLU-YEL ↔ RED-YEL)
n/a	3A 250v S.B.	50v DC	Lt. Flipper (GRY-YEL ↔ RED-YEL)
n/a	3A 250v S.B.	50v DC	Upr. Rt. Flip. (BLU-YEL ↔ RED-YEL)
n/a	3A 250v S.B.	50v DC	Upr. Lt. Flip. (GRY-YEL ↔ RED-YEL)

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

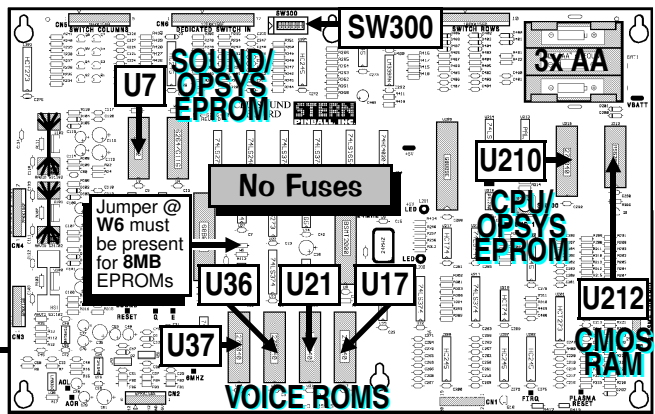


ROM TYPE on BD	LOCATION	SIZE	PART NUMBER
CPU Sound	U7	512K	965-0375-78
CPU Game	U210	1 MB	965-0374-78
CPU Voice ROM 1	U17	8 MB	965-0377-78
CPU Voice ROM 2	U21	8 MB	965-0378-78
CPU Voice ROM 3	U36	8 MB	965-0379-78
CPU Voice ROM 4	U37	8 MB	Not Used
DISPLAY Controller	U5	4 MB	965-0376-78

Sec. 3: ... Diagnostics



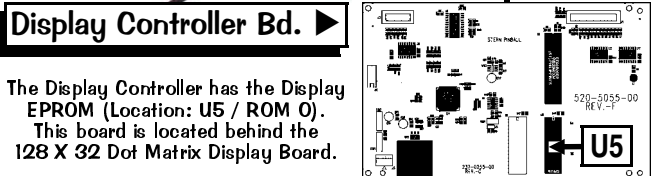
⚡ UK or Tournament GAMES ONLY
For more info., see Section 5, Chp. 4, PCBs (Yellow Pages)



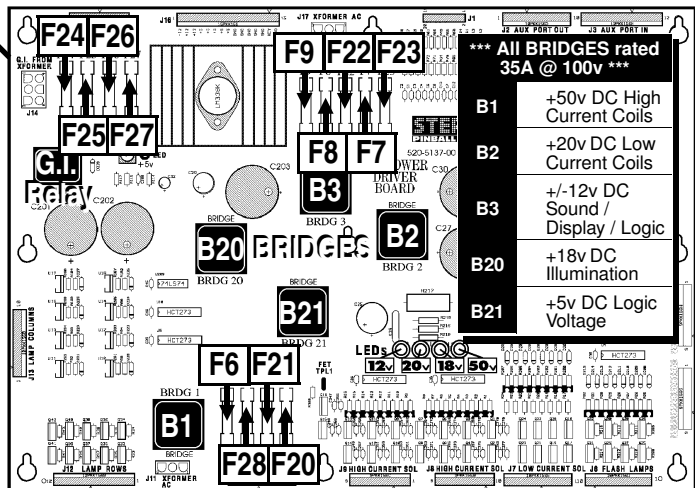
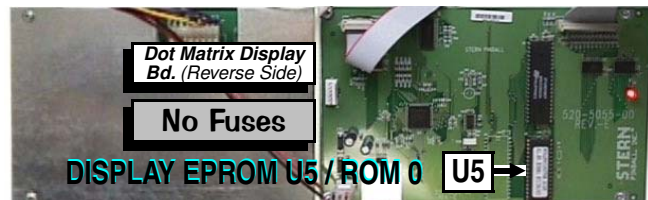
For Schematics and/or Component Parts on PC Boards shown on this page, review Section 5, Chapter 4, Printed Circuit Boards (The Yellow Pages).

CPU / Sound Board p

I/O Power Driver Board



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



*** All BRIDGES rated 35A @ 100v ***

B1	+50v DC High Current Coils
B2	+20v DC Low Current Coils
B3	+/- 12v DC Sound / Display / Logic
B20	+18v DC Illumination
B21	+5v DC Logic Voltage





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) :

					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

DIAG	AUD	ADT	INST	RESET	TOUR	QUIT	EARN	S.P.I.	RCT	PRNT	PREV	QUIT	HELP	
MAIN	GO TO AUDITS MENU	MAIN	AUD	EARNINGS AUDITS										AUD

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:	

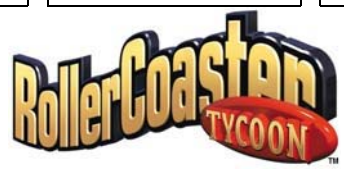
DIAG	AUD	ADT	INST	RESET	TOUR	QUIT	EARN	S.P.I.	RCT	PRNT	PREV	QUIT	HELP	
MAIN	GO TO AUDITS MENU	MAIN	AUD	STANDARD AUDITS										AUD

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*.



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. N ^o	Audit Name	Audit Definition
15	TOTAL BALLS PLAYED	Provides the total number of <i>Regular</i> and <i>Extra Balls</i> .
16	TOTAL EXTRA BALLS	Provides the total number of <i>Extra Balls</i> 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 <i>Awards (Credits, Extra Balls or Scores)</i> for Level 1.
19	REPLAY 2+ AWARDS	Provides the total <i>Awards (Credits, Extra Balls or Scores)</i> for Level 2 or higher.
20	TOTAL REPLAYS	Provides the total <i>Awards (Credits, Extra Balls or Scores)</i> 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 <i>Awards (Credits, Extra Balls, or Scores)</i> for making <i>Specials</i> .
23	SPECIAL PERCENT	Provides the percentage total by dividing Audit 22, TOTAL SPECIALS , by Audit 28, TOTAL PLAYS .
24	TOTAL MATCHES	Provides the total <i>Credits</i> awarded for matching the last two digits of the score with the <i>System-Generated Match Number</i> at the end of the game. Percentage of <i>Match Credits</i> 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 <i>Awards (Credits, Extra Balls, or Scores)</i> 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 <i>Free Credits</i> for <i>Replays, High-Score-To-Date, Specials and Match</i> .
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 <i>Free Credits</i> 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.

Sec. 3: Go To Audits

Standard Audits 45-81 continued on the next page.





Standard Audits Continued.

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 <i>Final Score</i> 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 . <i>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.</i>
48	BALL SEARCH STARTED	Provides the total number of times the game performed a <i>Ball Search</i> .
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 <i>Ball Search</i> . 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 (<i>this feature can be turned ON or OFF, see Adj. 35, FREEZE TIME in Section 3, Chp. 4, GO TO ADJUSTMENTS MENU, Standard Adjustments</i>). 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 <i>Replay Level Score</i> .
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.

Sec. 3: Go To Audits

Comments or Notes:

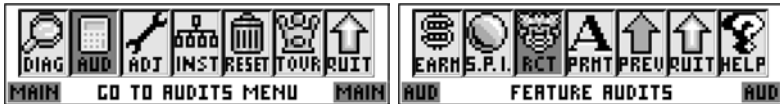




Feature Audits (82-139)

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

TOURNAMENT END DATE :

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:	





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**.

Sec. 3: Go To Audits



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) :

AUDITOR'S NAME :

CURRENT VOLUME SETTING:

CURRENT METER Reading :

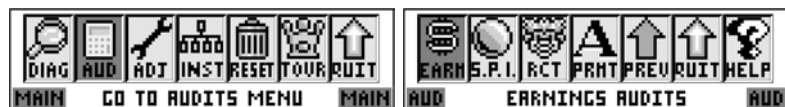
AUDIT Date (MM/DD/YR) :

CPU Version :

DISPLAY Version :

GAME LOCATION NAME :

EARNINGS & STANDARD AUDIT TABLES



EARNINGS AUDITS 01-14

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



STANDARD AUDITS 15-81

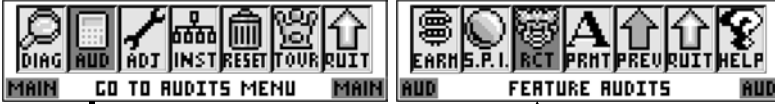
TOTAL BALLS PLAYED 15:	3M - 4M SCORES 30:	20M+ SCORES 45:	PROPRIETARY 60:	3.5 - 4 MINUTE GAMES 75:
TOTAL EXTRA BALLS 16:	4M - 5M SCORES 31:	AVERAGE SCORES 46:	PROPRIETARY 61:	4 - 5 MINUTE GAMES 76:
EXTRA BALL PERCENT 17:	5M - 5.5M SCORES 32:	SERVICE CREDITS 47:	PROPRIETARY 62:	5 - 6 MINUTE GAMES 77: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





Roller Coaster Tycoon Pinball Comments or Notes:

FEATURE AUDIT TABLE



FEATURE AUDITS

82-139 =

*** PROGRAMMING USE ONLY ***

UNLABELED BOXES ARE FOR FUTURE EXPANSION.

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

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 : TOURNAMENT END DATE :

			0						0
--	--	--	---	--	--	--	--	--	---

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





STANDARD & FEATURE ADJUSTMENT TABLES

STANDARD ADJUSTMENTS 01-45 =

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

Sec. 3: Adjustments

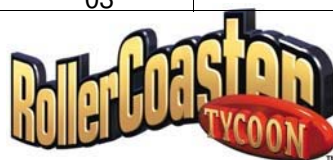
‡ Adj. 01, 02 & 06 have a "Drop-Down" Table for further customization. † Adj. 38 is utilized only for the UK (UK Dip Sw. Option Setting 2).
Note: If Game & Display ROMs other than USA are installed, along with the proper Dip Switch Settings, different Defaults will appear.
 If changes are made (or your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



FEATURE ADJUSTMENTS 46-62 =

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

Shortcut to Standard Adjustment 26.



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. N ^o	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 <i>Free Games</i> 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 <i>Extra Balls</i> that may be accumulated per game.

Standard Adjustment 06 continued on the next page.





Standard Adjustments Continued.

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	Example 1				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:
25c	\$1.00	25c	Not Used	1 /50c	2 /75c	3 /\$1.00	3	12	3	1	4	0	0	0	0	1	4	1	1	
Coin Mechanisms Used				Pricing Scheme Desired				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 (50c) will produce 6 Pulses (4 Pulses for the 1st Credit + 2 Pulses remains in "escrow"). The third Coin (75c) 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.

Sec. 3: Adjustments

LEFT	CENTER	RIGHT	4TH	Example 2				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:
25c	\$1.00	25c	Not Used	1 /50c	2 /75c	7 /\$2.00	3	12	3	1	4	24	0	1	0	1	4	1	1	
Coin Mechanisms Used				Pricing Scheme Desired				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	Example 3				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:
25c	\$1.00	25c	Not Used	1 /25c	6 /\$1.00	13 /\$2.00	5	20	5	0	4	20	40	1	0	1	4	1	1	
Coin Mechanisms Used				Pricing Scheme Desired				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 25c, thus at 4X 25c 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	Example 4				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:
10p	50p	£1	20p	1 /30p	2 /50p	5 /£1	1	6	15	2	3	0	0	0	0	1	4	1	1	
Coin Mechanisms Used				Pricing Scheme Desired				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)				PRICING SCHEME				Requires SPI Coin Card(s) Part Number
		COINS THRU ... SLOT:				Number of Plays (Credits) for Price Amount Shown See "Appendix J" for Coin Cards Examples & Info!				
Pos.		LEFT	CENTER	RIGHT	4TH					
ON	USA 1					1 /\$.25				755-5400-01
OFF	USA 2					1 /\$.50	2 /\$.75	3 /\$1.00		755-5400-02
	USA 3					1 /\$.50				755-5400-02
	USA 4					1 /\$.50				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 25c	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)					PRICING SCHEME			Requires SPI Coin Card(s) Part Number
			COINS THRU ... SLOT:					Number of Plays (Credits) for Price Amount Shown See "Appendix J" for Coin Cards Examples & Info!			
			LEFT	CENTER	RIGHT	4TH	5TH				
<i>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).</i>											
Pos. 1-8	ON	Austria Euro 9	€ .50	€ 1.00	€ 2.00			1 /€1.00	2 /€1.50	3 /€2.00	755-5401-09
Pos. 1-8	OFF										
<i>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).</i>											
Pos. 1-8	ON	Australia 1	20¢	\$A1	\$A2			1 /\$A1	3 /\$A2		755-5406-00
Pos. 1-8	OFF	Australia 2						1 /\$A1			(Side 1)
<i>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).</i>											
Pos. 1-8	ON	Belgium Euro 1	€ .50	€ 1.00	€ 2.00			1 /€ .50			755-5401-01
Pos. 1-8	OFF										
<i>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).</i>											
Pos. 1-8	ON	Canada	Can\$.25	Can\$.25	Can\$1	Can\$2		1 /50¢	2 /75¢	3 / Can\$1	755-5400-00 or -01 or -02
Pos. 1-8	OFF										
<i>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).</i>											
Pos. 1-8	ON	Denmark 1	1 DKr	5 DKr	10 DKr	20 DKr		1 /3 DKr	2 /5 DKr		755-5402-00
Pos. 1-8	OFF	Denmark 2						1 /2 DKr	3 /5 DKr	7 /10 DKr	(2-Sided)
<i>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).</i>											
Pos. 1-8	ON	Finland Euro 8	€ .50	€ 1.00	€ 2.00			1 /€1.00	3 /€2.00		755-5401-08
Pos. 1-8	OFF										
<i>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).</i>											
Pos. 1-8	ON	France Euro 10	€ .50	€ 1.00	€ 2.00			1 /€1.00	3 /€2.00	7 /€3.00	755-5401-10
Pos. 1-8	OFF										
<i>Germany: For different Euro Pricing Scheme (other than below settings), go to Adjustment 06 and scroll to Custom for this Unique Coin Door & Mech.</i>											
Pos. 1-8	ON	Germany 1	€ .50	€ 1.00	€ 2.00			1 /€ .50			755-5401-01
Pos. 1-8	OFF	Germany 2						1 /€ .50	5 /€2.00		755-5401-02
Pos. 1-8	ON	Germany 3						1 /€ .50	6 /€2.00		755-5401-04
<i>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).</i>											
Pos. 1-8	ON	Greece Euro 6	€ .50	€ 1.00	€ 2.00			2 /€ .50			755-5401-06
Pos. 1-8	OFF										
<i>Italy: For different Euro Pricing Scheme (other than below settings), go to Adjustment 06 and scroll to Custom for this Unique Coin Door & Mech.</i>											
Pos. 1-8	ON	Italy 1	€ .50		€ .50			1 /€ .50			755-5401-01 & 755-5401-08
Pos. 1-8	OFF	Italy 2						1 /€ .50	3 /€2.00		
<i>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).</i>											
Pos. 1-8	ON	Netherlands Euro 3	€ .50	€ 1.00	€ 2.00			1 /€ .50	3 /€1.00		755-5401-03
Pos. 1-8	OFF										
<i>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).</i>											
Pos. 1-8	ON	New Zealand 1	\$NZ1		\$NZ2			1 /\$NZ1			755-5406-00
Pos. 1-8	OFF	New Zealand 2						1 /\$NZ1	3 /\$NZ2		(Side 2)
<i>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).</i>											
Pos. 1-8	ON	Norway 1	10 NKr	5 NKr	20 NKr			1 /5 NKr			755-5403-00
Pos. 1-8	OFF	Norway 2						1 /10 NKr	3 /20 NKr		(2-Sided)
<i>Portugal: For different Euro Pricing Scheme (other than below settings), go to Adjustment 06 and scroll to Custom for this Unique Coin Door & Mech.</i>											
Pos. 1-8	ON	Portugal	€ .50		€ .50			1 /€ .50			755-5401-01
Pos. 1-8	OFF										
<i>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).</i>											
Pos. 1-8	ON	Spain Euro 3	€ .50	€ 1.00	€ 2.00			1 /€ .50	3 /€1.00		755-5401-03
Pos. 1-8	OFF										
<i>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).</i>											
Pos. 1-8	ON	Sweden 1	1 SKr	5 SKr	10 SKr			1 /10 SKr	2 /15 SKr	3 /20 SKr	755-5404-00
Pos. 1-8	OFF	Sweden 2						1 /5 SKr			(2-Sided)
<i>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).</i>											
Pos. 1-8	ON	Switzerland 1	1 SwF	2 SwF	5 SwF			1 /1 SwF	6 /5 SwF		755-5405-00
Pos. 1-8	OFF	Switzerland 2						1 /1 SwF	3 /2 SwF	9 /5 SwF	(2-Sided)
<i>UK also utilizes the 5th Coin Slot Switch (not available with Custom Pricing).</i>											
Pos. 1-8	ON	UK 1						3 /£1	7 /£2		755-5407-00
Pos. 1-8	OFF	UK 2						4 /£1			755-5407-01*
Pos. 1-8	ON	UK 3	10p	50p	£1	20p	£2	1 /50p	5 /£2		755-5407-01
Pos. 1-8	OFF	UK 4						1 /30p	4 /£1		755-5407-01*
Pos. 1-8	ON	UK 5						1 /£1	3 /£2		755-5407-00
Pos. 1-8	OFF	UK 6						3 /£2			755-5407-01*

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

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

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





Standard Adjustments Continued.

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 (<i>when the replay was awarded</i>) plus 50M for each following game, until the replays have all been played (<i>then the previous level is resumed</i>).
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 (<i>depending on Adj. 03, Replay Award</i>). Set to NO to disable this feature. There are 5 High Scores that will allow the player to enter their initials (<i>or name</i>) (<i>see Adj. 24, High Score Initials</i>).
13 HIGH SCORE #1 AWARDS	Set between 00 - 05 . Default is 01 . Set the number of awards, awarded for exceeding Level 1 (<i>the highest of the five (5) Levels</i>).
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 (<i>increments of 1M</i>). Default is 50,000,000 . Set the desired High Score Level to which Level 1 may be achieved (<i>not affected by Adj. 23, HSTD Reset Count</i>).
19 DEFAULT HIGH SCORE #2	Set between 1,000,000 - 9,999,000,000 or 00 (<i>increments of 1M</i>). Default is 40,000,000 . Set the desired High Score Level to which Level 2 may be achieved (<i>not affected by Adj. 23, HSTD Reset Count</i>).
20 DEFAULT HIGH SCORE #3	Set between 1,000,000 - 9,999,000,000 or 00 (<i>increments of 1M</i>). Default is 30,000,000 . Set the desired High Score Level to which Level 3 may be achieved (<i>not affected by Adj. 23, HSTD Reset Count</i>).
21 DEFAULT HIGH SCORE #4	Set between 1,000,000 - 9,999,000,000 or 00 (<i>increments of 1M</i>). Default is 20,000,000 . Set the desired High Score Level to which Level 4 may be achieved (<i>not affected by Adj. 23, HSTD Reset Count</i>).
22 DEFAULT HIGH SCORE #5	Set between 1,000,000 - 9,999,000,000 or 00 (<i>increments of 1M</i>). Default is 10,000,000 . Set the desired High Score Level to which Level 5 may be achieved (<i>not affected by Adj. 23, HSTD Reset Count</i>).
23 HSTD RESET COUNT	Set between 100 - 9,900 or OFF (<i>increments of 100</i>). Default is 2,000 . HSTD (High Score To Date) . 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 <i>Game Play</i> .
26 CUSTOM MESSAGE <i>View the Custom Message Shortcut summary (end of this chapter) for how to enter text or symbols.</i>	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 (<i>select the "+" Mini-Icon to change settings until "CHANGE" appears in the display, then select the ">>" Mini-Icon to access.</i>). This adjustment can be accessed in two (2) ways by either selecting the "S.P.I." <i>Icon</i> and advancing to this Adjustment, or can be directly accessed by selecting the "ABCD CUST MSG" <i>Icon</i> in the ADJUSTMENTS MENU .

Sec. 3: Adjustments

Standard Adjustments 27-39 continued on the next page.





Standard Adjustments Continued.

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 <i>Low Line</i> or <i>High Line voltage</i> conditions where the solenoids (coils) appear to <i>kicking too weak or too hard</i> . 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 (<i>if credits are available</i>). 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. <i>Review Section 2, Chapter 1, Game Operations & Features for details.</i>
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 <i>Game Attract Mode</i> 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 (<i>see Sec. 3, Chp. 1,...Intro</i>) this adjustment can be utilized to adjust the background music (<i>1 all the way on, 15 all the way off</i>) 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 (<i>single increments</i>) for the ball to be sent back into play if the time set is not met (<i>per ball</i>). 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 , (<i>UK Default is YES</i>). When set to YES this feature is available when lit. Set to NO to disable this feature. (<i>UK Games have Outlane/Center Post Save Devices which are accessed in differently; Non-UK Games cannot adjust this setting.</i>)
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 (<i>at the time set</i>) 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 <i>Auto Ball Launch</i> 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.

Sec. 3: Adjustments

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 (<i>changing the default to YES</i>), and was changed back to NO , the COMPETITION MODE will be turned OFF (<i>see Sec. 3, Chp. 5, GO TO INSTALLS MENU, \$. 50 or Free Play Competition</i>). Set to YES , this feature is available (<i>required for Competition Modes</i>); 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 (<i>Playfield Light Insert</i>) 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. (<i>Will not be affected by Factory Reset.</i>)
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. (<i>Will not be affected by Factory Reset.</i>)



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-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. N ^o	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.





Feature Adjustments Continued.

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. <i>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.</i>
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.



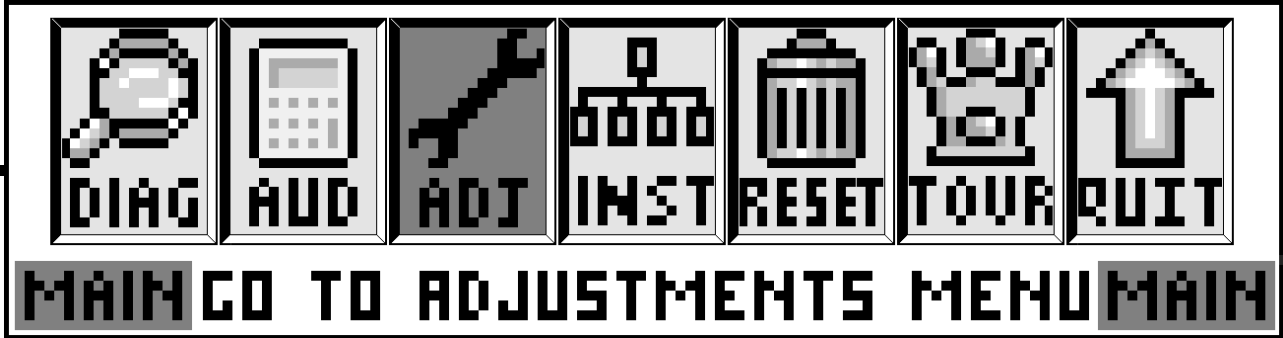
For further customization of Game Play Difficulty or Game Play Type or how to **RESET ONLY** the Adjustments, see Section 3, Chapter 5, GO TO INSTALLS MENU.





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.



Sec. 3: Adjustments



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.



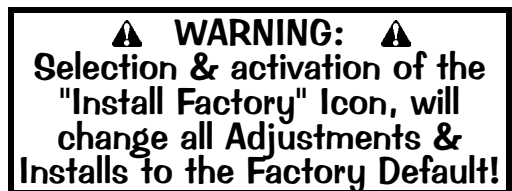
Select and **activate** to return to the **PREVIOUS** Menu.



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



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



* **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		
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FEATURE ADJUSTMENTS NEW SETTINGS*:

54, 59, 61	... DIFFICULTY	EXTRA EASY
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* *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		
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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		
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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		
------	--	--

Sec. 3: Go To Installs



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.

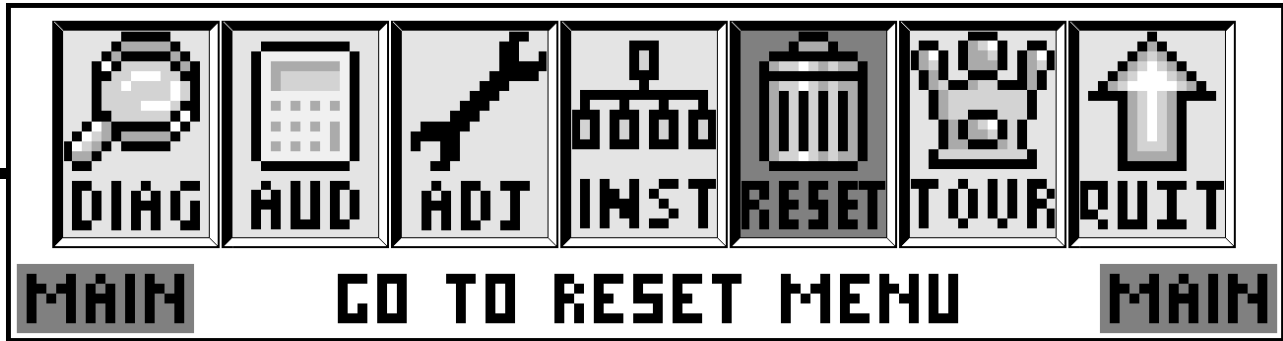


Factory Reset

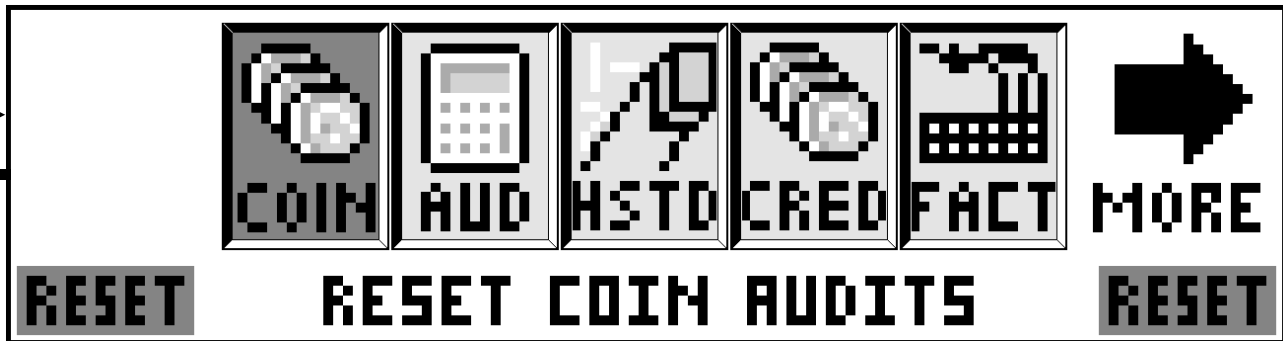
To initiate, from the **RESET MENU**, select the "**FACT**" icon with either the **Red** or **Green Buttons** and press the **Black Button**. **All Audits (except for Audit 14, Software Meter), Adjustments, Installs, Tournament Audits** and all **Tournament Adjustments (including Sign Messages A-B)**, 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**).

**REQUEST
INSTALLED**

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**.

Sec. 3: Go To Reset





Go To Tournament Menu

Overview

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: **BETAbrite™ 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. 8 & 9 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		ADJUSTMENT NAME		ADJUSTMENT NAME	
USA DEFAULT	YOUR SETTING	USA DEFAULT	YOUR SETTING	USA DEFAULT	YOUR SETTING
67	CREDITS PER PLAY 02	70	JACKPOT MAX. \$2,500.00	73	# OF PRIZES 03
68	JACKPOT BASE \$20.00	71	START DATE JANUARY 1	74	PRIZE TYPE CASH
69	JACKPOT INCREMENT \$00.50	72	END DATE FEBRUARY 1	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		ADJUSTMENT NAME	
USA DEFAULT	YOUR SETTING	USA DEFAULT	YOUR SETTING
76	LOCATION MESSAGE ON	77	PRIZE MESSAGE ON



Sec. 3: Tournament ...

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:	<input type="text"/>
TOURNAMENT PLAYS 141:	JACKPOT 144:	ACCUM. TOUR. PLAYS 147:	ACCUM. JACKPOT 150:	<input type="text"/>
TOTAL GAME EARNINGS 142:	NET EARNINGS 145:	ACCUM. EARNINGS 148:	# TOURNAMENTS 151:	<input type="text"/>

Copy this page for Field Audit Tracking Performance





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. N ^o	Tournament Adjustment Name	Tournament Adjustment Definition
67	CREDITS PER PLAY	Set between 01 - 10 . Default is 02 . Set the maximum number of <i>Credits</i> that may be accumulated per game.
68	JACKPOT BASE	Set between \$00.00 - \$999,999.00 (<i>increments of \$1</i>). Default is \$20.00 . Set the initial <i>Prize Pool Amount</i> to be offered for the Tournament. Note: <i>The displays will present the words "PRIZE POOL" in lieu of the word "JACKPOT".</i>
69	JACKPOT INCREMENT	Set between \$00.00 - \$999,999.99 (<i>increments of 1¢</i>). Default is \$00.50 . Set the <i>Prize Pool Increment</i> which will increase the <i>Prize Pool Amount</i> with each Tournament Game played.
70	JACKPOT MAX.	Set between \$00.00 - \$999,999.00 (<i>increments of \$1</i>). Default is \$2,500.00 . Set the maximum cap to be placed on the <i>Prize Pool</i> during a Tournament. Note: <i>The displays will present the words "PRIZE POOL" in lieu of "JACKPOT".</i>
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" <i>Icon</i> (<i>see the next page</i>).
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 a Tournament , go back to the TOURNAMENT MENU and select the "END" <i>Icon</i> (<i>see the next page</i>).
73	# OF PRIZES	Set between 01 - 05 . Default is 03 . Set the maximum number of <i>Prize Positions</i> to be awarded during a Tournament. Selections (<i>cannot be changed</i>) are as follows: Set to 01 , the Tournament Winner is awarded 100% of the <i>Prize Pool</i> . 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 . <i>This adjustment determines how the Prize Pool is to be represented in the Attract Mode on both the Normal and top Beta-Brite® Displays.</i>
75	SHOW PLAYER'S CASH	Select CASH for the displays to represent the <i>Prize Pool amount</i> (<i>based on Jackpot Base and Max.</i>) in \$Dollars . Select POINTS for the displays to represent the <i>Prize Pool amount</i> in Points . Select TICKETS for the display to represent the <i>Prize Pool amount</i> in Tickets . Select OTHER NOT TO represent the <i>Prize Pool amount</i> (<i>if prize(s) to be awarded are not Cash, Points or Tickets</i>).
		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 <i>Cash amount</i> 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!



Sec. 3: Tournament ...



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.



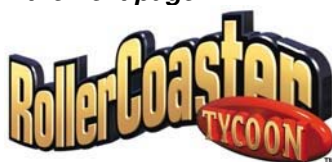
Tournament Audits (140-151)

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. N ^o	Tournament Audit Name	Tournament Audit Definition
140	TOTAL PLAYS	Provides the total number of <i>Regular</i> and <i>Tournament Games</i> played while a <i>Tournament</i> 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 <i>Tournament Games</i> played while a <i>Tournament</i> is active (in progress).
142	TOTAL GAME EARNINGS	Provides the total <i>Gross Earnings accepted</i> , while a <i>Tournament</i> is active (in progress).
143	TOTAL TOUR. EARNINGS	Provides the total <i>Tournament Earnings</i> (Audit 142 less <i>Regular Game Earnings</i>) while a <i>Tournament</i> 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 (<i>Jackpot</i>) Amount to be paid out while a <i>Tournament is active (in progress)</i> .
145	NET EARNINGS	Provides the total Net Earnings (<i>Gross Earnings less Prize Pool</i>) while a <i>Tournament is active (in progress)</i> .
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 <i>Regular & Tournament Games</i> played since the first Tournament was played.
147	ACCUM. TOUR. PLAYS	Provides the accumulative total amount of <i>Tournament Games</i> played since the first Tournament was played.
148	ACCUM. EARNINGS	Provides the total Gross Earnings <i>accepted</i> , 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 (<i>Jackpot</i>) Amounts paid out since the first Tournament was played.
151	# TOURNAMENTS	Provides the number of Tournaments (<i>not individual Tournament Games</i>) 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-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.

Adj. N ^o	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 (<i>select the "+" Mini-Icon to change settings until "CHANGE" appears in the display, then select the ">>" Mini-Icon to access.</i>). At the top left corner of the Display, the letter A is indicated (<i>blinking</i>) 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 (<i>erase</i>) 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:

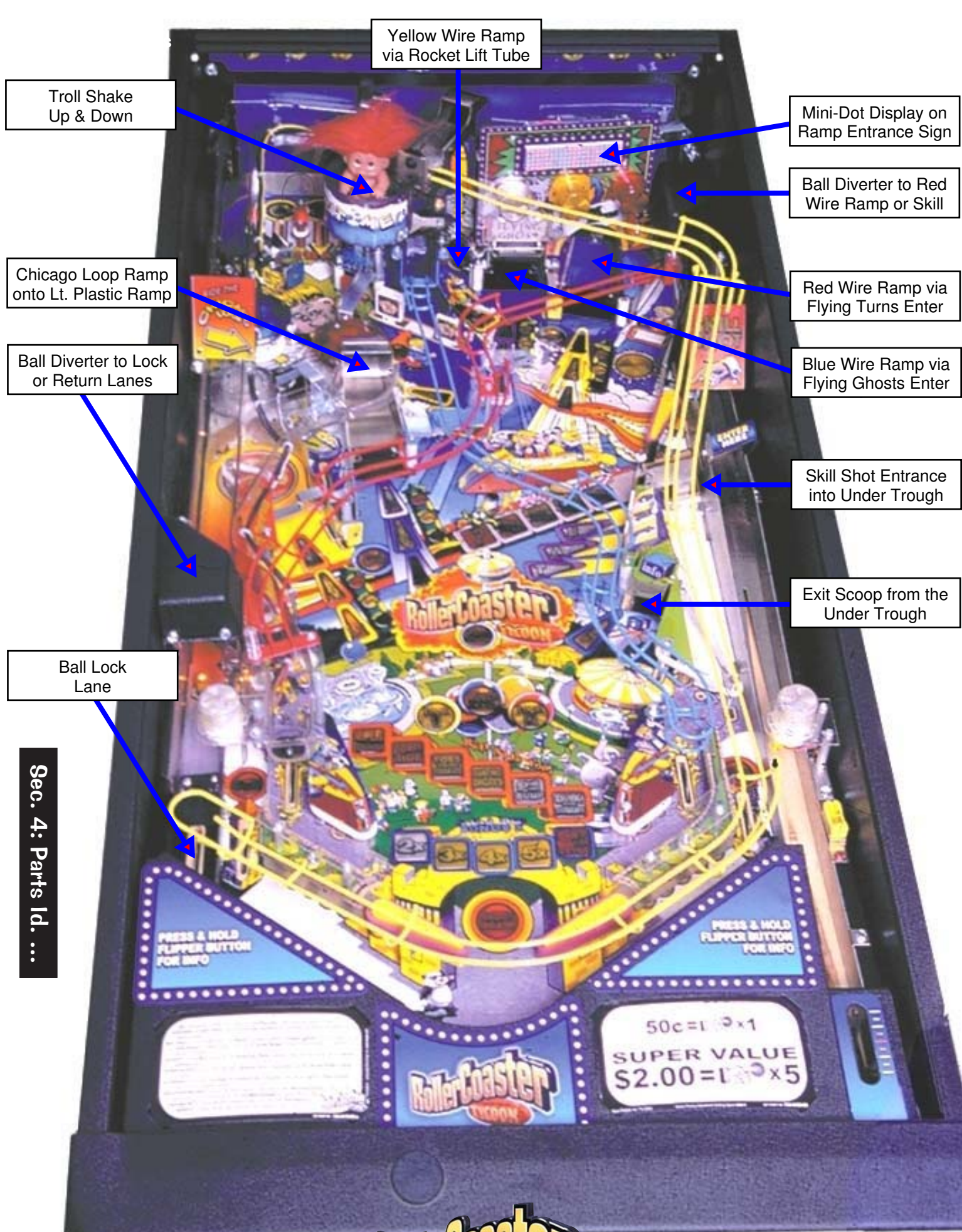
YOU CAN BE THE NEXT BIG WINNER!



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

Sec. 4: Parts Id. ...

PRESS & HOLD
FLIPPER BUTTON
FOR INFO

PRESS & HOLD
FLIPPER BUTTON
FOR INFO

50c = 1x1
SUPER VALUE
\$2.00 = 1x5





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 "START" 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) :

AUDITOR'S NAME :

CURRENT VOLUME SETTING:

CURRENT METER Reading :

AUDIT Date (MM/DD/YR) :

CPU Version :

DISPLAY Version :

GAME LOCATION NAME :

See Adj. 06 & 07 above >>

TOURNAMENT START DATE :

TOURNAMENT END DATE :

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

Copy this page for Field Audit Tracking Performance



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-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.*

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 <i>Credits</i> that may be accumulated per game.
02	JACKPOT BASE: Set between \$00.00 - \$999,999.00 (<i>increments of \$1</i>). Default is \$20.00 . Set the initial <i>Prize Pool Amount</i> to be offered for the Tournament. Note: <i>The displays will present the words "PRIZE POOL" in lieu of the word "JACKPOT".</i>
03	JACKPOT INCREMENT: Set between \$00.00 - \$999,999.99 (<i>increments of 1¢</i>). Default is \$00.50 . Set the <i>Prize Pool Increment</i> which will increase the <i>Prize Pool Amount</i> with each Tournament Game played.
04	JACKPOT MAX.: Set between \$00.00 - \$999,999.00 (<i>increments of \$1</i>). Default is \$2,500.00 . Set the maximum cap to be placed on the <i>Prize Pool</i> during a Tournament. Note: <i>The displays will present the words "PRIZE POOL" in lieu of "JACKPOT".</i>
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*. <i>*Requires the TIMEKEEPER™ IC (included in the kit) installed in Location U212 on the CPU/Sound Board.</i>
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" <i>Icon</i> (<i>see the next page</i>).
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" <i>Icon</i> (<i>see the next page</i>).
08	# OF PRIZES: Set between 01 - 05 . Default is 03 . Set the maximum number of <i>Prize Positions</i> to be awarded during a Tournament. Selections (<i>cannot be changed</i>) 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.
	AWARD TYPE: Set to CASH, POINTS, TICKET, NONE or PRIZE . Default is CASH .
09	<i>This adjustment determines how the Prize Pool is to be represented in the Attract Mode on both the Normal and top Beta-Brite® Displays.</i> Select CASH for the displays to represent the Prize Pool amount (<i>based on Jackpot Base and Max.</i>) 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 (<i>if prize(s) to be awarded are not Cash, Points or Tickets</i>). 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!



Sec. 3: Tournament ...



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.

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.

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 <i>Regular</i> and <i>Tournament Games</i> played while a <i>Tournament</i> 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 <i>Tournament Games</i> played while a <i>Tournament</i> is active (in progress).
03	TOTAL GAME EARNINGS: Provides the total <i>Gross Earnings accepted</i> , while a <i>Tournament</i> is active (in progress).
04	TOTAL TOUR. EARNINGS: Provides the total <i>Tournament Earnings (Audit 03 less Regular Game Earnings)</i> while a <i>Tournament</i> is active (in progress).
05	JACKPOT (PRIZE POOL TOTAL): Provides the total <i>Prize Pool (Jackpot)</i> Amount to be paid out while a <i>Tournament</i> is active (in progress).
06	NET EARNINGS: Provides the total <i>Net Earnings (Gross Earnings less Prize Pool)</i> while a <i>Tournament</i> is active (in progress).

Tournament Audits 07-12 continued on the next page.



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-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.

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 (<i>select the "+" Mini-Icon to change settings until "CHANGE" appears in the display, then select the ">>" Mini-Icon to access.</i>). At the top left corner of the Display, the letter A is indicated (<i>blinking</i>) in the first available position. Vary the letter(s) by operating the Left and Right Flipper Buttons (<i>or "RED" or "GREEN" Buttons</i>). 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 (<i>erase</i>) 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 . <i>Procedure identical to Tournament Adjustment 11, Location Message.</i>

Sec. 3: Tournament ...

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!**

HOW TO ENTER A MESSAGE:

1. POINT THIS REMOTE CONTROL (REAR) AT THE DISPLAY.
2. PRESS THE [PROGRAM] KEY. THE WORDS "PROG TEXT" WILL APPEAR ON THE DISPLAY.
3. ENTER THE MESSAGE YOU WANT TO BE DISPLAYED. (USE THE [L] AND [R] KEYS FOR PUNCTUATION).
4. PRESS THE [RUN] KEY TWICE.

SEE YOUR PROGRAMMING MANUAL FOR ADDITIONAL INSTRUCTIONS AND DISPLAY FEATURES.

BETA Brite

Parts Identification & Location (The Pink Pages)

Overview

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

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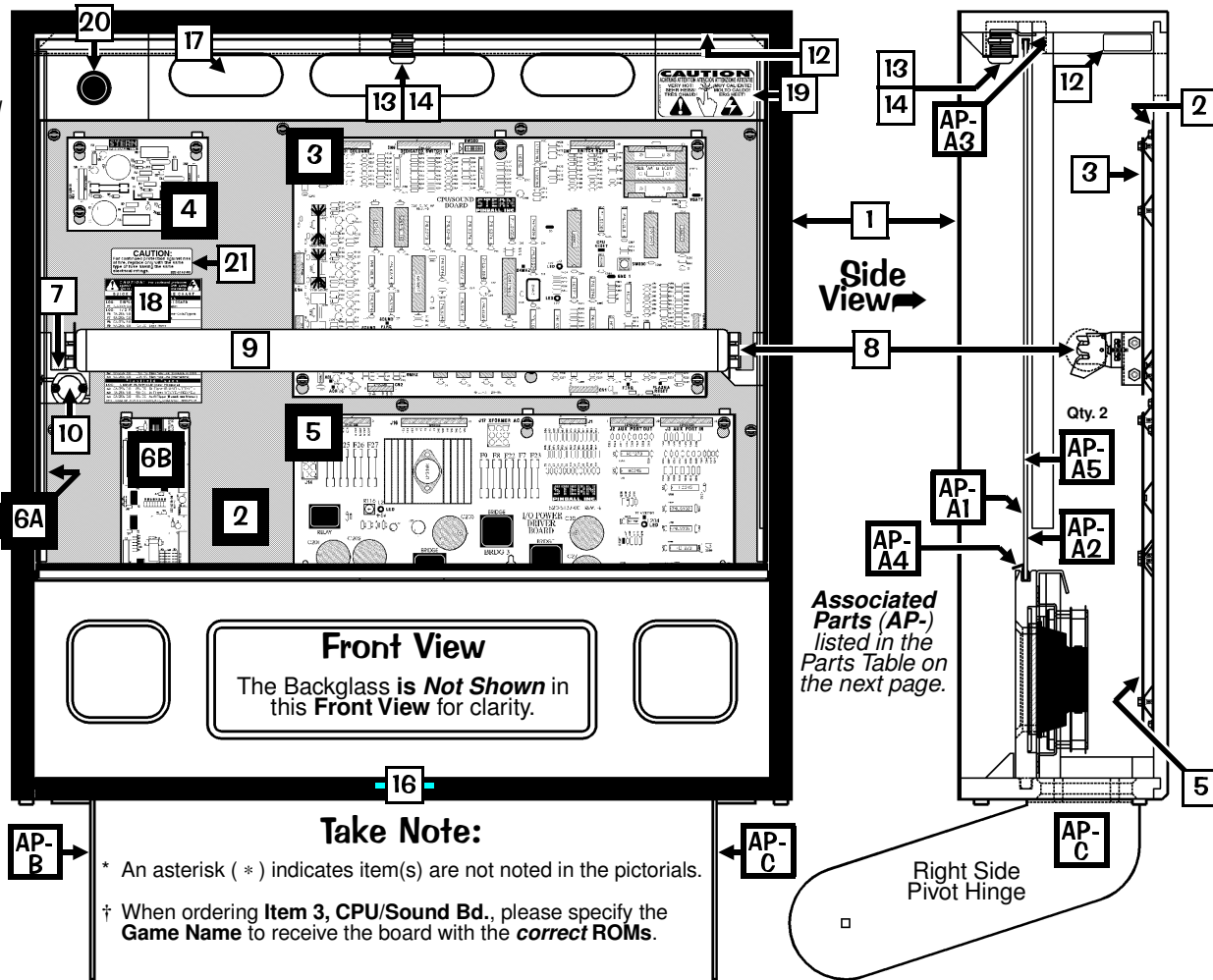




Backbox Assembly, 505-6002-78-78 (Items 1-28)

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.



Front View
The Backglass is **Not Shown** in this Front View for clarity.

Side View

Associated Parts (AP-) listed in the Parts Table on the next page.

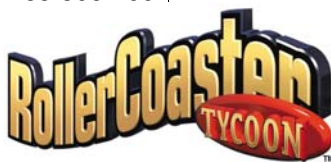
Right Side Pivot Hinge

Take Note:

- * An asterisk (*) indicates item(s) are not noted in the pictorials.
- † When ordering Item 3, CPU/Sound Bd., please specify the Game Name to receive the board with the correct ROMs.

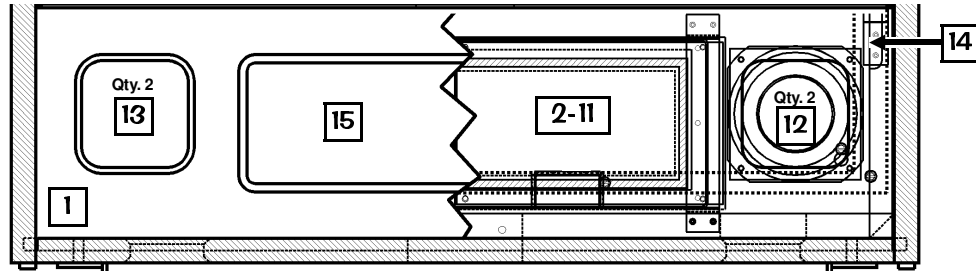
Sec. 4: Parts Id. ...

Nº	BACKBOX PART NAME	QTY.	SPI PART Nº	Nº	BACKBOX PART NAME	QTY.	SPI PART Nº
1	Backbox RollerCoaster Tycoon™	1	525-5558-78	10*	Ground Strap (5") (by Item 12)	1	600-5006-05
Item 1 Note: Black Textured T-Molding is installed and cannot be ordered separately.				11	Starter - Fluorescent (FS2 Light)	1	165-5011-01
2	PCB Metal Mounting Plate	1	535-5809-14		Ballast CU45Z-W 1/2" Core 120v 60 Hz 13W	1	010-5015-00
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)				12	Ballast, EU / UK Only 5/8" Core 50/60 Hz		010-5015-01
3 †	CPU/Sound Board (Mono) FCC-FEB98	1	520-5136-16		Ballast Mounting Plate	1	535-8657-00
4	Display Power Supply Board	1	520-5138-00	Item 12 is secured to Item 1 by: #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5102-04)			
5	I/O Power Driver Board	1	520-5137-01	13	Lock Mounting Plate (2001)	1	535-8128-01
Items 3, 4 & 5 are secured to Item 2 by: #8-32 X 3/8" HWH MS (Qty. 19) (237-5903-00)				14	Camlock/Key (N23078A•CAM•2K•SF2400)	1	355-5018-02
6A	3X Trans. Drvr. Bd. (UK/Special Apps.Only)		520-5068-00	Items 13-14 are secured by: #8 X 5/8" TP Torx T20 (Qty. 4) (237-5947-00)			
6B	Tournament Serial Interface (TSI) Bd. ToPS™		520-5220-00	15*	#1 Roto Lock Male (on Cabinet)	1	355-5006-01
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.				16	#1 Roto Lock Female (R2-0002-02)	1	355-5006-02
7	Fluorescent Light Bracket Assy. Left	1	515-6545-00	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)			
ORDERING ABOVE (ITEM 7) SUB-ASSY. PART Nº WILL INCLUDE:				17	Back Vent Grill 2-1/2" X 18"	1	545-5072-02
7A	Fluorescent Light Bracket Left	1	535-7739-00	Item 17 is secured by: Staple 5/16" (Qty. 24) (631-5000-00)			
7B	Lamp Holder (Self-Locking)	1	077-5214-00	18	Fuse Description Decal (Generic)	1	820-6152-01
7C	#6-32 X 5/8" PPH MS (Sems) Zinc	1	232-5203-00	19	"CAUTION - VERY HOT" Decal	1	820-6266-00
7D	Starter Base (with Leads)	1	077-5213-00	20 ‡	Button Hole Plug (Blk) (Happ #52-6214-00)	1	500-6566-00
7E	#4-40 X 1/2" PPH MS (Sems) Zinc	2	237-5813-00	21	Fuse Label (UL)	1	820-6143-00
Ordering Note: If 515-6545-00 is unavailable, order the individual part(s) actually required.				22*	Backbox Date Label	1	820-5091-00
8	Fluorescent Light Bracket Assy. Right	1	515-6545-01	23*	Ribbon Cable, 20-Pin (4")	1	036-5000-04
ORDERING ABOVE (ITEM 8) SUB-ASSY. PART Nº WILL INCLUDE:				24*	Ribbon Cable, 26-Pin (40")	1	036-5001-40
8A	Fluorescent Light Bracket Right	1	535-7739-01	25*	1/4" Clamp (Double)	3	040-5000-23
8B-8C	Identical to Items 7B-7C above.		See 7B-7C	26*	1/2" Clamp (Single)	1	040-5000-06
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)				27*	3/4" Clamp (Single)	2	040-5000-08
Ordering Note: If 515-6545-01 is unavailable, order the individual part(s) actually required.				28*	1" Clamp (Single)	6	040-5000-09
9	Fluorescent Tube 24" (F18T8CW)	1	165-5061-00	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.

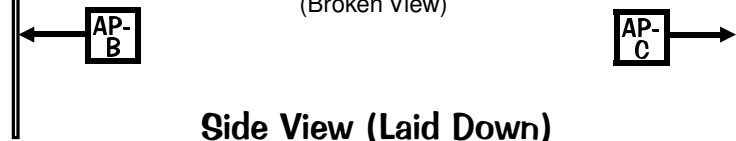


Take Note:

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

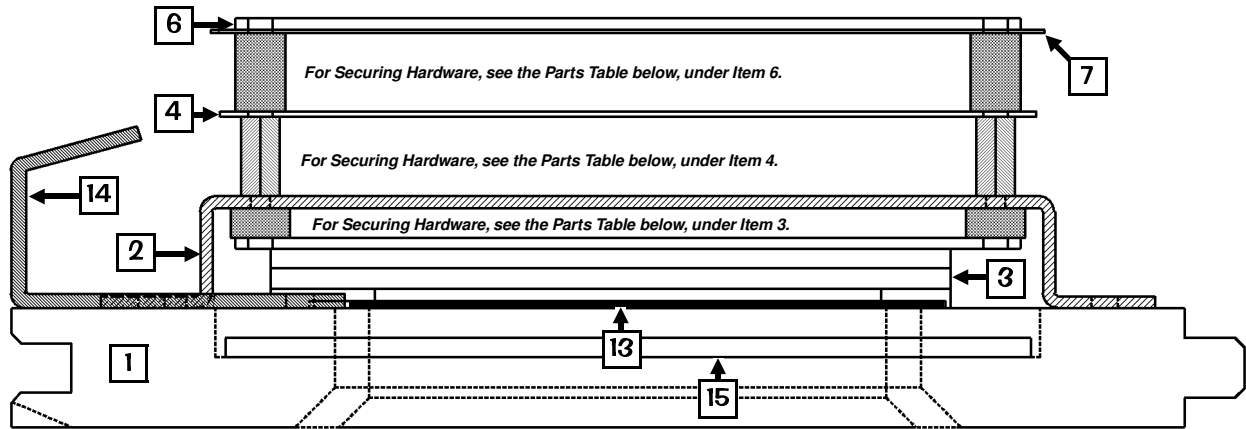
1. Ordering the complete Speaker Panel Assembly, 515-6888-03 (Items 1-15) will include all hardware.

Front View
(Broken View)



Side View (Laid Down)

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



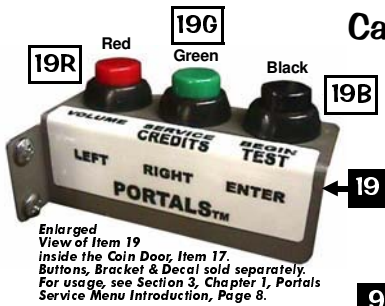
Nº	SPEAKER PANEL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Speaker Panel (Black Wood)	1	525-5515-00	15	Plastic Shield (Display Cover)	1	545-5884-00
2	Dot Matrix Disp. Bd. Mounting Bracket	2	535-8368-01	Item 15 is secured to Item 2 by: #6 X 3/8" HWH AB (Zinc) (Qty. 8) (234-5000-00)			
3	Dot Matrix Display Board 128 X 32	1	520-5052-00	The Associated Parts AP-A thru AP-C are also noted in the Backbox Assembly drawings on the previous page.			
4	Static Shield (Steel Plate)	1	535-6437-00	ASSOC. PARTS ARE NOT INCLUDED WITH BACKBOX/SPKR. PANEL ASSY'S.			
5*	Edge Protector (on Item 4)	2	545-5592-01	Nº	ASSOC. BACKBOX PART NAME	QTY.	SPI PART Nº
6	Display Controller Board FCC-FEB98	1	520-5055-03	AP-A	Backglass Assembly (Game Nº 78)	1	See Parts Below
7	RF Shield	1	820-5092-00	ORDER ONLY INDIVIDUAL PART(S) NEEDED:			
8*	Ground Strap (25") (on Items 4, 6, 12)	4	600-5006-25	AP-A1	Clear Backglass 25.906" X 19.187"	1	660-5038-02
9*	1/2" Clamp (Single) (on Item 4)	1	040-5000-06	AP-A2	Game Name Film Art (#78)	1	830-5278-00
10*	Ribbon Cable, 14-Pin	1	036-5260-00	AP-A3	Top Plastic Channel - 26"	1	545-5018-15
11*	Foam 3/16" Thk. X 1/4" X 36"	6	626-5026-00	AP-A4	Bottom Plastic Lift Channel - 26-1/16"	1	545-5021-01
12	Speaker (Shld.) 4" 8Ω MG Elec #4060SH	2	031-5004-01	AP-A5	Plastic Edging (Left/Right) - 18-1/8"	2	545-5018-14
13	Speaker Grill (Black w/no Artwork)	2	535-8081-01	AP-A6*	Tape (double-sided) (12" Length)	1	626-5005-00
14	Speaker Panel Hook Bracket	2	535-7009-02	Note: AP-A6 secures AP-A3--A5 to AP-A1 (only 6" required)			
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)				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.			

Sec. 4: Parts Id. ...



Cabinet - General Parts & Switches

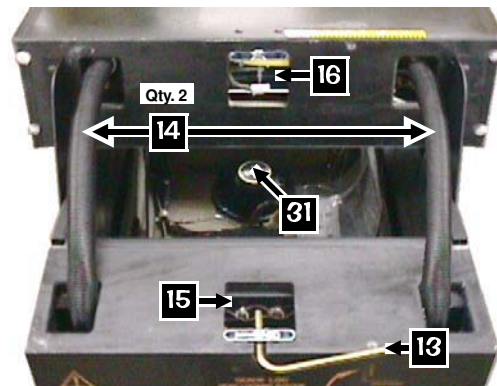
For Backbox Parts see the previous two pages.



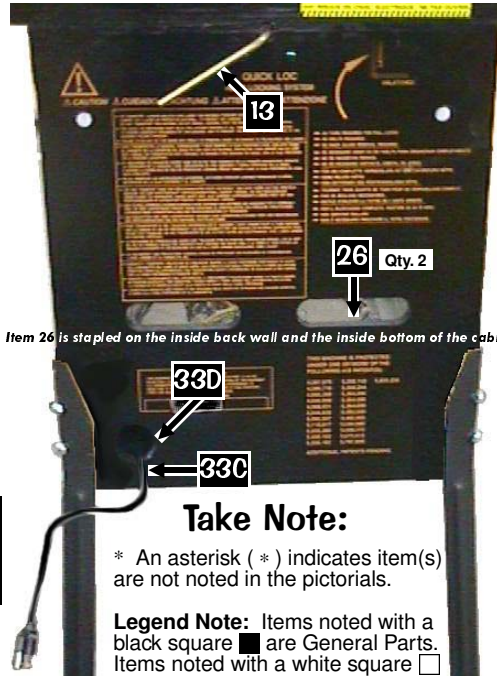
Enlarged View of Item 19 inside the Coin Door, Item 17. Buttons, Bracket & Decal sold separately. For usage, see Section 3, Chapter 1, Portals Service Menu Introduction, Page 8.

Take Note:

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



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



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

Take Note:

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

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

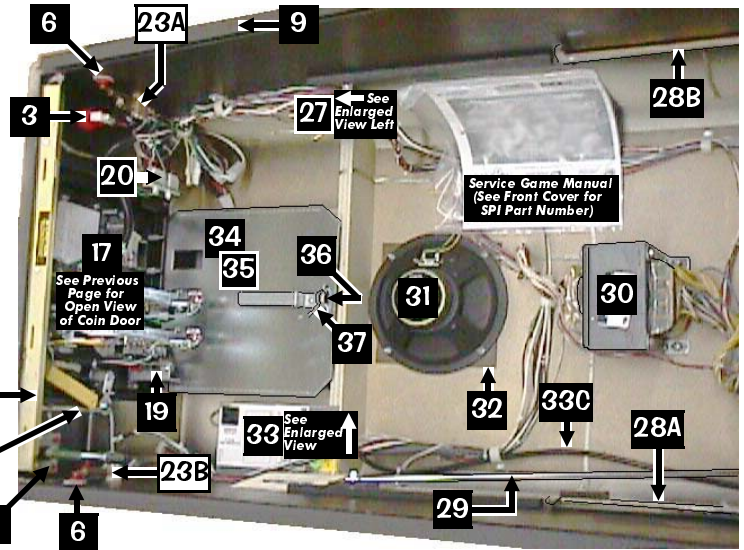
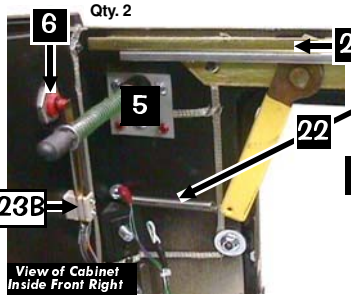
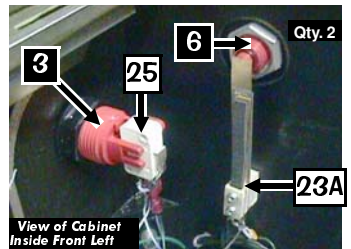
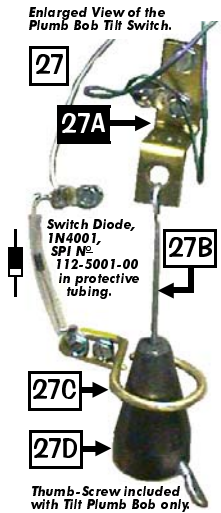
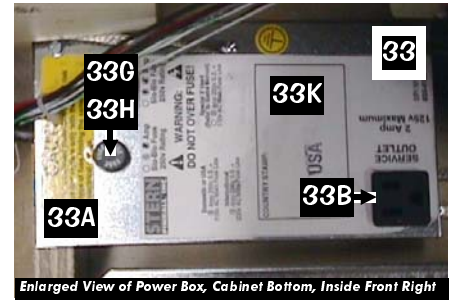
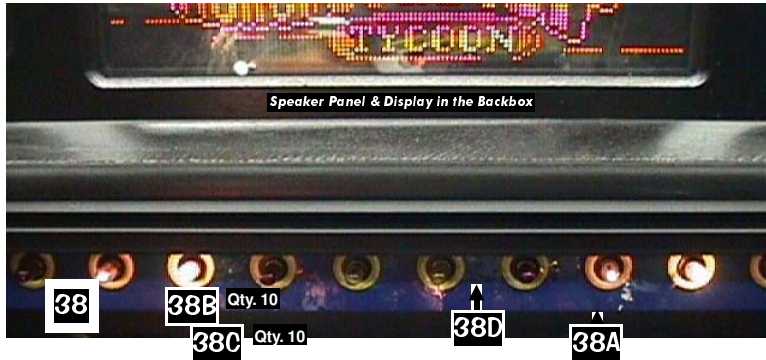
Sec. 4: Parts Id. ...

Nº	CABINET PART NAME	QTY.	SPI PART Nº	Nº	CABINET PART NAME	QTY.	SPI PART Nº
1	RCT Screened Cabinet (No Parts)	1	525-6000-78	13	Hex Key Allen Wrench 5/16"	1	777-0001-00
2	Black Leg & Leveler Assembly	4	500-5921-50	14	Corrugated Tubing Black 1 1/4"Ø X 2.6' Lg.	2	605-5008-00
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	15	#1 Roto Lock Male (R2-0055-02)	1	355-5006-01
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	16	#1 Roto Lock Female (on Backbox)	1	355-5006-02
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	17	Coin Door (with Validator) USA only	1	500-5018-172
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	18	Coin Door Switch (USA)	2	180-5024-00
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	18	FYI: Coin Door Switch (¥ Japan)	0	180-5091-00
8	Plastic Channel 42-5/8" Lg. (Left/Rt.)	2	545-5017-00	19	Bracket for above Portals™ Switches	1	535-6860-03
9	Side Armor "with holes" (Left & Right)	2	535-7297-02	19B	Push-Button Portals™ Switch (Black)	1	180-5192-00
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	19R	Push-Button Portals™ Switch (Red)	1	180-5192-02
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	19G	Push-Button Portals™ Switch (Green)	1	180-5192-04
12*	P/F Glass (Tmprd.) 21" X 43" X 3/16"	1	660-5001-00	20	Dual Switch Assembly	1	500-5808-00
ORDERING ABOVE (ITEM 20) ASSEMBLY PART Nº WILL INCLUDE:							
20A Mounting Bracket 1 535-6958-00							
20B Playfield Power Interlock Sw. (Top) 1 180-5136-00							
20C Memory Protect Switch (Bottom) 1 180-5000-01							
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.



Cabinet - General Parts & Switches Continued



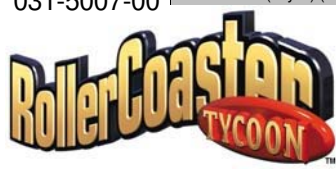
Take Note:

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

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
<i>Parts Table & Views continue on the previous page.</i>							
21	Front Molding Lockdown Assembly	1	500-6509-00	32	Speaker Grill 7" X 7"	1	545-5072-03
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)				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)			
22	Lockdown Spring (connected to handle)	1	265-5008-00	33	Power Input Box Sub-Assy.	1	515-5360-07
23A	Flipper Switch - Self-Cleaning for Lower Left	1	180-5160-00	ORDERING ABOVE (ITEM 33) SUB-ASSY. PART Nº WILL INCLUDE:			
23B	Flipper Sw. - X2 Stack for Lower/Upper Right	1	180-5164-00	33A	Power Box (Plain)	1	535-5932-00
24*	Foam Strip (2 on 23A; 1 on 23B)	3	626-5042-00	33B	Service Outlet (for USA)	1	180-5008-01
25	Start Button Switch (ONLY)	1	180-5174-00	33C	Line Cord 10' ROJ 3" Max.	1	034-5000-10
26	Grills 2-1/2" X 18" (on Back & Bottom)	2	545-5072-02	33D	Recessed Cup for Line Cord	1	545-5122-00
27	Cabinet Plumb Bob Tilt Switch	1	See Parts Below	33E	Line Filter	1	150-5000-00
ORDER ONLY INDIVIDUAL PART(S) NEEDED:				33F*	Varistor TNR159211KM	1	150-5001-00
27A	Bracket for Hanger Wire	1	535-5221-00	33G	Fuse 8 Amp 250v Slo-Blo (Domestic)	1	200-5000-05
27B	Hanger Wire	1	535-5319-00	33H	Fuse Holder	1	205-5001-00
27C	Contact Wire Form	1	535-7563-01	33I*	On/Off Switch Bracket	1	535-8318-00
27D	Plumb Bob Weight (includes Thumb-Screw)	1	535-5029-00	33J	On/Off Rocker Sw. (Arcoelectric C1350AB)	1	180-5001-01
Items 27A & 27C are secured by: #8 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5101-00)				33K	Power Box Decal	1	820-6123-03
28A	Slide & Pivot Support Bracket - Right	1	535-5990-00	34	Cash Box Plastic Bottom	1	545-5090-00
28B	Slide & Pivot Support Bracket - Left	1	535-5989-00	35	Cash Box Cover (Validator)	1	535-5013-03
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)				36	Cash Box Lock Bracket (wire)	1	535-7562-00
29	Prop Rod	1	535-7553-00	37	Large Hair-Pin Clip	1	535-7772-00
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)				38	Cabinet Light Bd. Assy. RollerCoaster	1	500-6413-78
30	Transformer 5.7v AC (with Ballast Winding)	1	010-5012-01	ORDERING ABOVE (ITEM 38) ASSEMBLY PART Nº WILL INCLUDE:			
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)				38A	Cabinet Light Board Plain (Generic)	1	525-5570-00
31	Speaker 8" ø Rd. 8010 4Ω	1	031-5007-00	38B	3-Lug Staple Down Socket	10	077-5001-00
				38C	#44 Bulb (Red) -02 x4, (Yel.) -06 x3	7	165-5053-02-06
				38D	#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 1 1/2" 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.



Sec. 4: Parts Id. ...

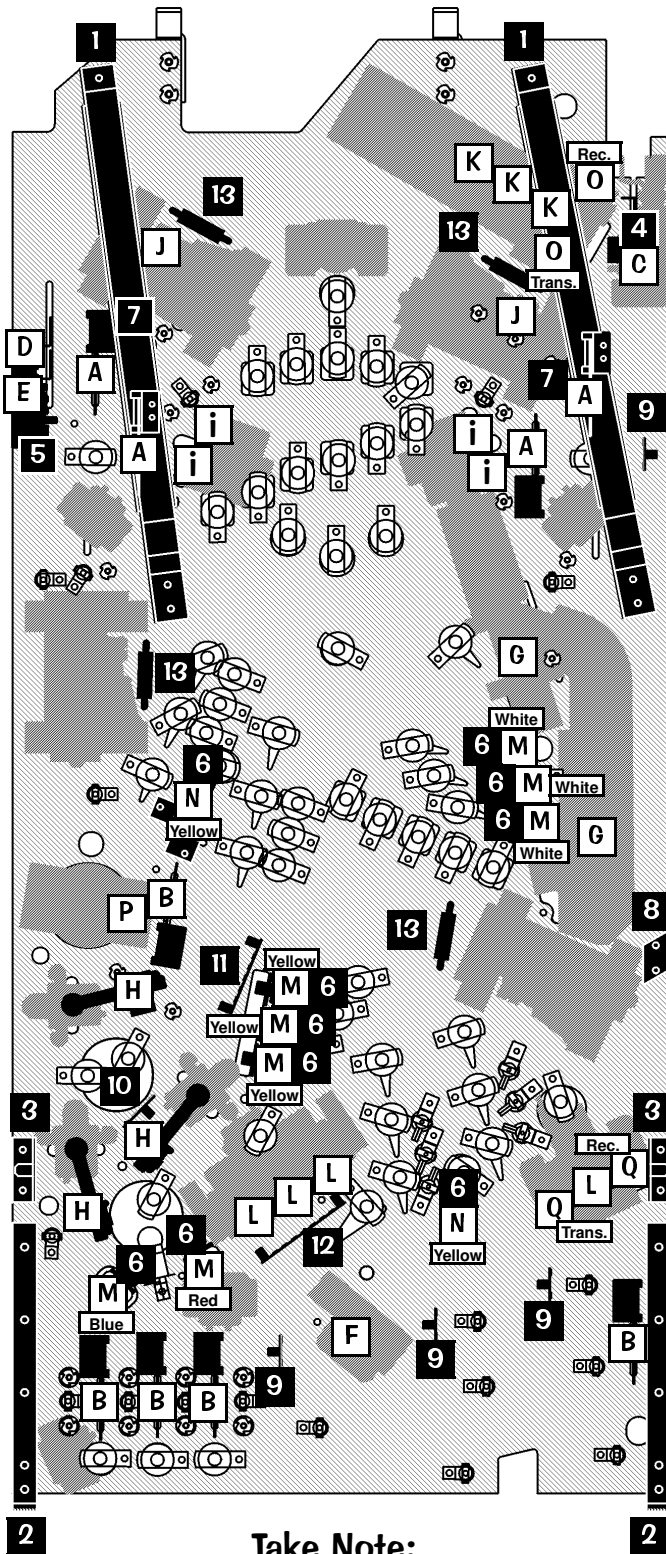
Playfield - General Parts & Switches (Below)

Nº	BELOW PLAYFIELD PART NAME	QTY.	SPI PART Nº
1	Playfield Support Slide Bracket	2	535-6862-02
Item 1 is secured by: #8 X 1/2" 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.			

Nº	BELOW SWITCHES PART NAME	QTY.	SPI PART Nº
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. 11 (end of manual).			

Nº	BELOW MISC. PCB PART NAME	QTY.	SPI PART Nº
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 109-111 (O), Page 142 (P) and Page 143 (Q).



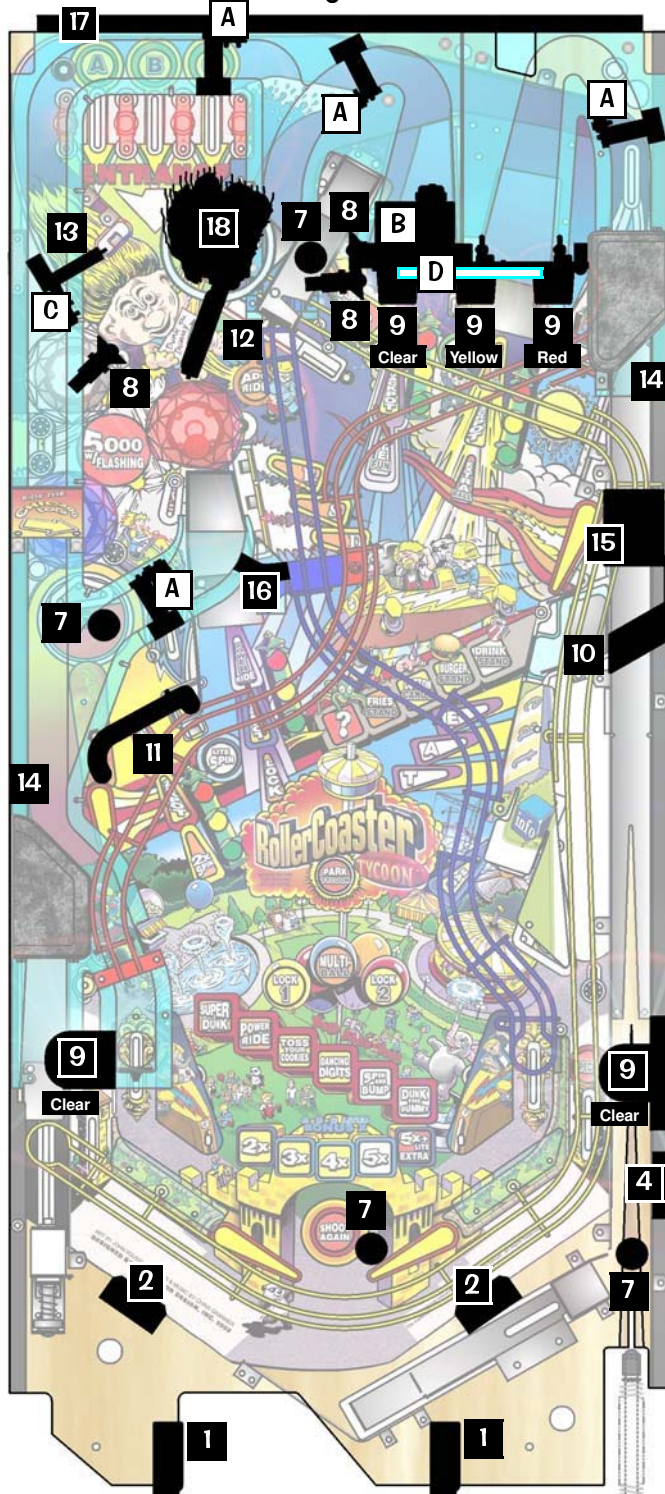
Take Note:

- * 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.

Sec. 4: Parts Id. ...



Playfield - General Parts & Switches (Above)



Nº	ABOVE PLAYFIELD PART NAME	QTY.	SPI PART Nº
PF	P/F Screened w/ Inserts & NO Parts	1	830-5178-00
PF	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 1/8" 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 Brct. (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

Nº	ABOVE SWITCHES PART NAME	QTY.	SPI PART Nº
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

Nº	ABOVE MISC. PCB PART NAME	QTY.	SPI PART Nº
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.

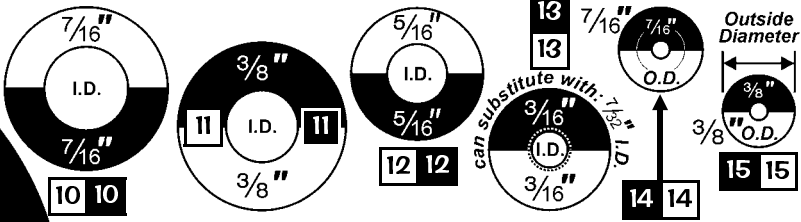
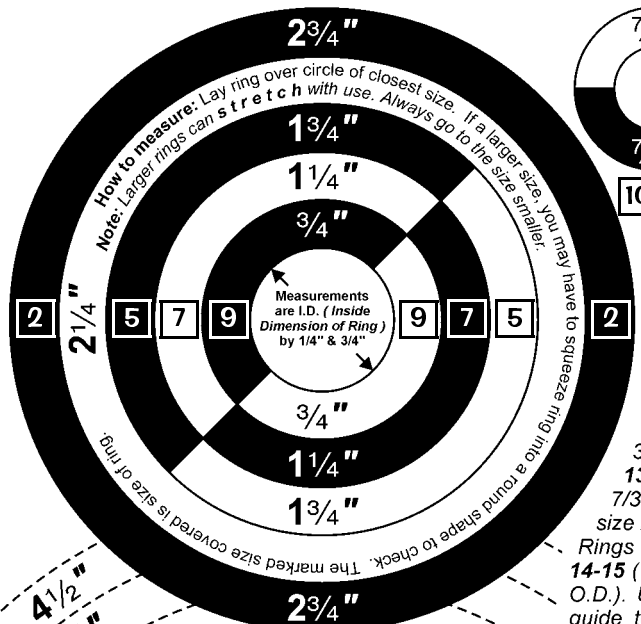
Take Note:

- 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.
- Legend Note:** Items noted with a black sq. ■ are General Parts. Items noted with a wht. sq. □ are Switches and Misc. PCB Boards.

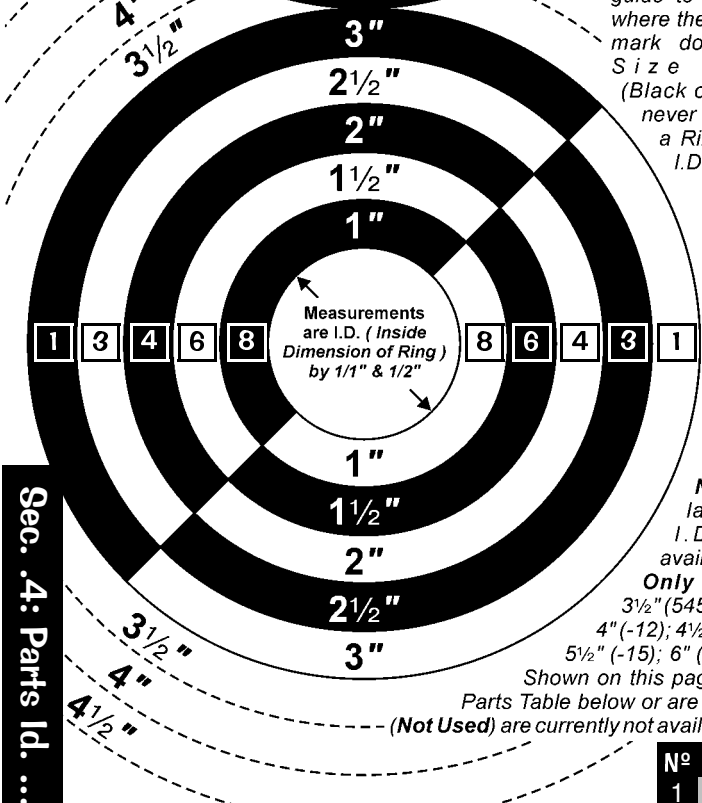
Sec. 4: Parts Id. ...



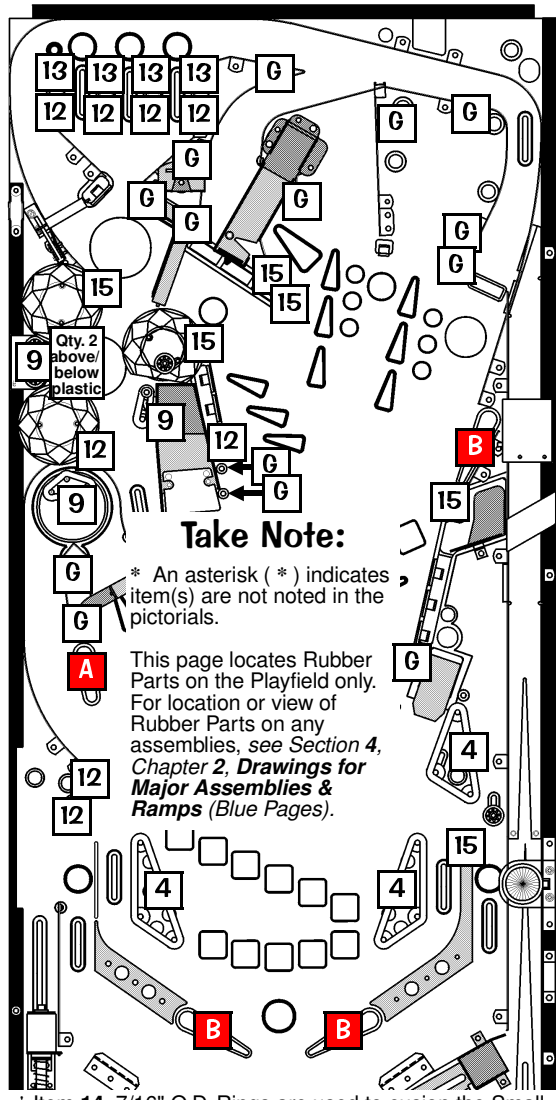
Playfield - Rubber Parts Red ■, Black ■ and White (Rings Actual Size) †



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 2 1/4" I.D. (Black or White) was never used. Choose a Ring Size +/- 1/4" I.D. if required.



Note: Sizes larger than 3" I.D. currently available in Black Only (Not Used): 3 1/2" (545-5348-11); 4" (-12); 4 1/2" (-13); 5" (-14); 5 1/2" (-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.



Take Note:

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

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

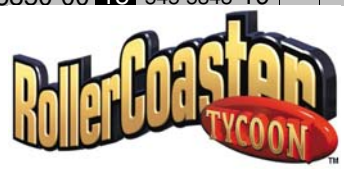
† Item 14, 7/16" O.D. Rings are used to cushion the Small & Large Bayonet (Metal) Sockets under the playfield.

Sec. 4: Parts Id. ...

Nº	RUBBER PART NAME	QTY.	SPI PART Nº
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
	Bumper BLACK (Post Sleeve, Tall)		545-5308-00
G	Bumper WHITE (Post Sleeve, Tall)	7	545-5308-08
H*	O-Ring 1 1/32" x 3/32" x 1/16" (on Flipper Button)	2	545-5850-00

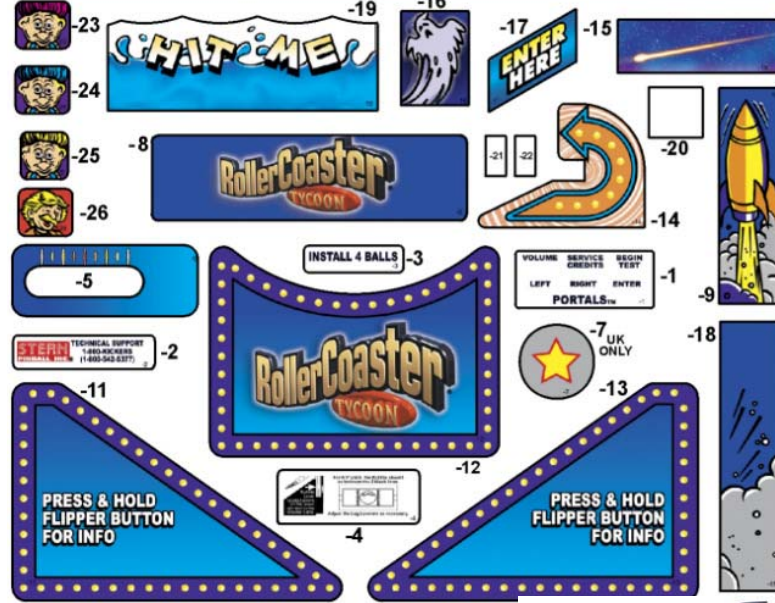
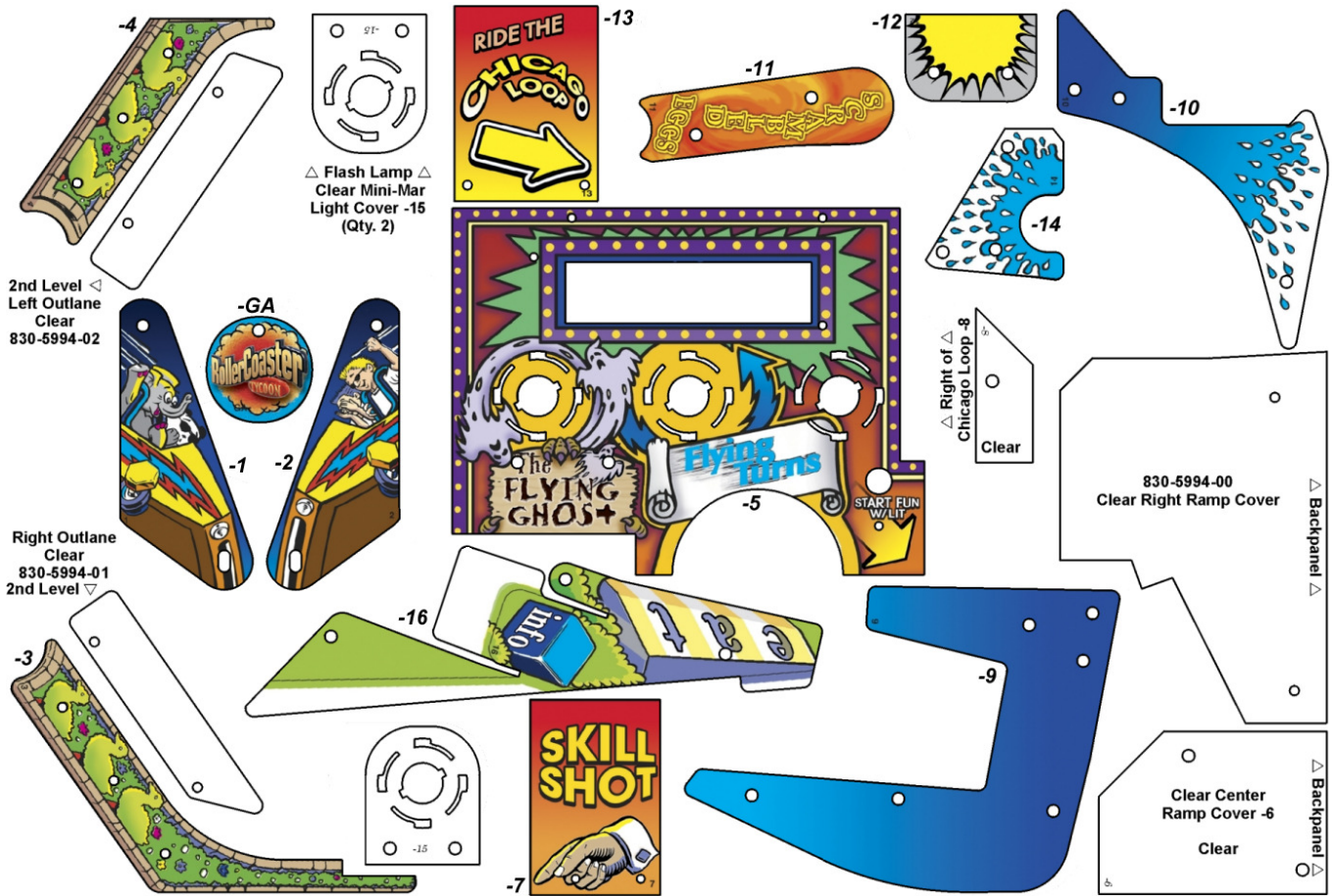
Nº	SPI PART Nº	QTY.	RUBBER PART NAME	QTY.	SPI PART Nº	Nº
1	545-5348-10		Black 3" I.D. Ring White		-60 N/U	1
2	545-5348-20		Black 2 3/4" I.D. Ring White		-70 N/U	2
3	545-5348-09		Black 2 1/2" I.D. Ring White		545-5348-59	3
4	545-5348-08		Black 2" I.D. Ring White	3	545-5348-58	4
5	545-5348-21		Black 1 3/4" I.D. Ring White		-71 N/U	5
6	545-5348-07		Black 1 1/2" I.D. Ring White		545-5348-57	6
7	545-5348-06		Black 1 1/4" 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 3/4" 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 3/8" 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 3/8" 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 N ^o	GAME PLASTICS PART NAME	SPI PART N ^o
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	Clear Plastic (Right Ramp Cover)	1 830-5994-00
Attention: In this set, the individual Plastic Pieces are not available. The entire Plastic Sheet Set must be ordered.		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:

- To order the entire Plastic Sheet Set (Screened & Clear), use the above Part N^o with the "-XX" ending. The 830-5994-00 thru -02 pieces are available individually.
- 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. -GA Key Fob (Not Used on game).

GAME DECALS	SPI PART N ^o
* 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 N ^o
Optional Clear P/F Set (Not Included with game)	820-5885-00
For an outline view, see the next page.	



Sec. 4: Parts Id. ...

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

Nº	WOOD RAIL PART NAME	QTY.	SPI PART Nº
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)

Nº	METAL RAIL PART NAME	QTY.	SPI PART Nº
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
17	Metal Rail (Shield by Scoop Hole)	1	535-9186-00

Items 3-16 are secured at Tabs by: #8 X 1/2" HWH AB (Zc.) (Qty. 1/per tab) (234-5101-00)
Item 17 is secured at Tab by: #8-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1) (232-5301-00)

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

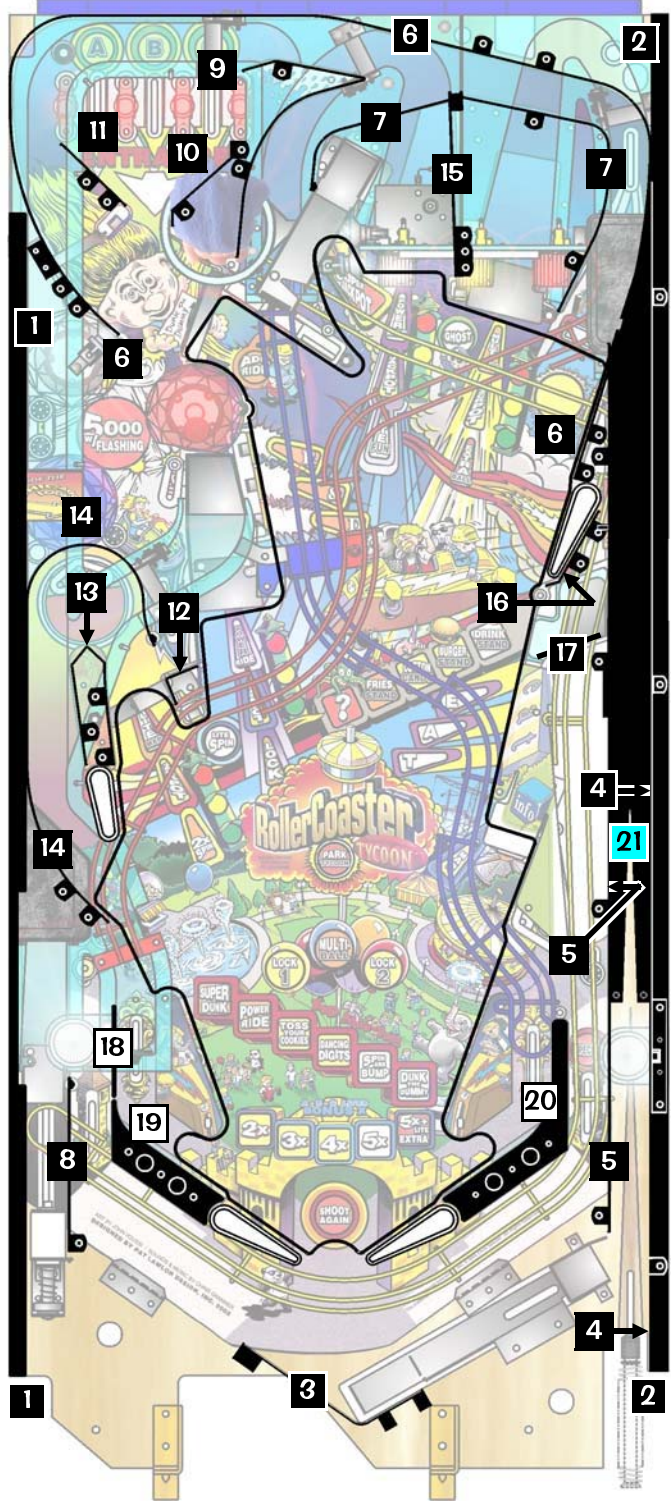
Item 18 is secured by the ends tapped into the playfield. Take care if removing.

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

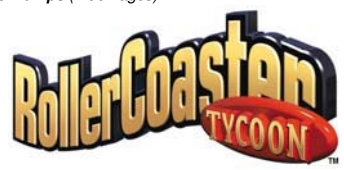
Items 19-20 are secured by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2/per) (232-5201-00)

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

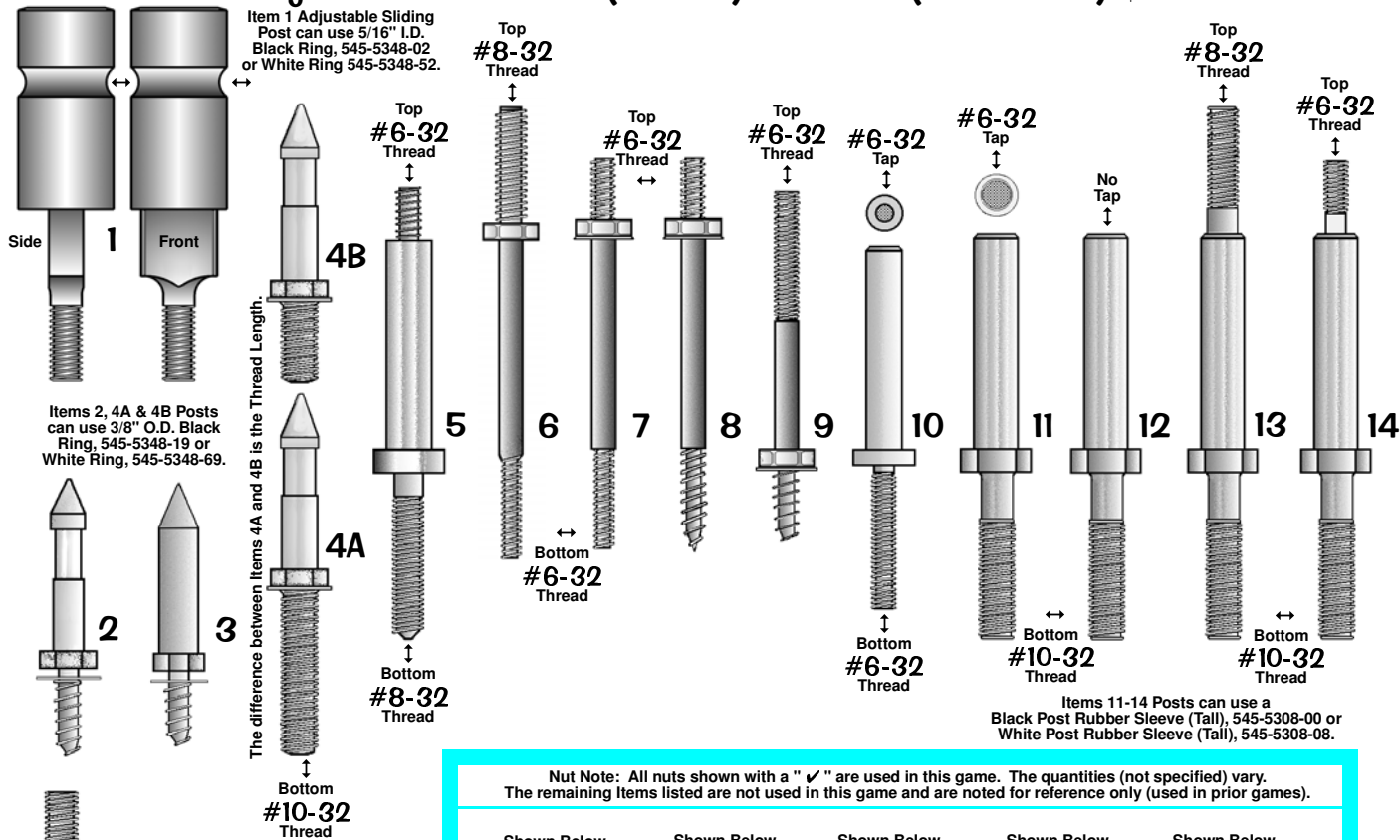
Item 21 is secured at Flap by: #4 X 5/8" PFH Black (Qty. 2) (237-5833-00)
All other Ramps, see Sec. 4, Chp. 2, Drawings for Major Assemblies & Ramps (Blue Pages).



Sec. 4: Parts Id. ...



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



Item 1 Adjustable Sliding Post can use 5/16" I.D. Black Ring, 545-5348-02 or White Ring 545-5348-52.

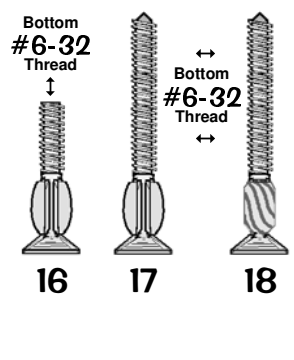
Items 2, 4A & 4B Posts can use 3/8" O.D. Black Ring, 545-5348-19 or White Ring, 545-5348-69.

The difference between Items 4A and 4B is the Thread Length.

Items 11-14 Posts can use a Black Post Rubber Sleeve (Tall), 545-5308-00 or White Post Rubber Sleeve (Tall), 545-5308-08.



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.



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

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~	Shown Below~	Shown Below~	Shown Below~	Shown Below~
• #6-32 Nylon Stop Nut: 240-5005-00 ✓	• #6-32 KEPS Nut (with Star Washer): 240-5008-00 ✓	• #6-32 Hex Nut (No Star Washer): 240-5004-00 ✓	• #6-32 T-Nut: 240-5002-00 ✓	• 1/4" X 20 Flange Nut: 240-5300-00 ✓
Top & Side Views	Bottom & Side Views	Top View	Bottom & Side Views	Top & Side Views
Nylon Stop Nuts Not Shown:	KEPS Nuts Not Shown:	Hex Nuts Not Shown:	T-Nuts Not Shown:	Miscellaneous Nuts Not Shown:
<ul style="list-style-type: none"> • #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 	<ul style="list-style-type: none"> • #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 	<ul style="list-style-type: none"> • #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 	<ul style="list-style-type: none"> • #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 	<ul style="list-style-type: none"> • 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

Sec. 4: Parts Id. ...

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



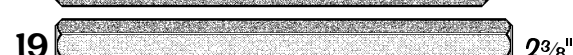
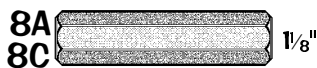
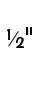
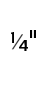
Playfield - Metal Spacers (Actual Size) †

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

Hex Spacers:

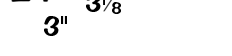
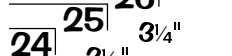
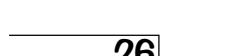
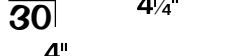
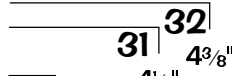
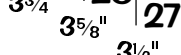
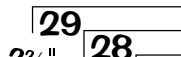
#6-32

Tap



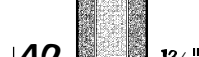
8B example of "Bs" 1 1/8" **Take Note:**

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



Note the Part No & Material Difference

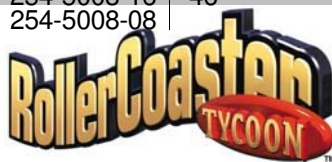
‡ Hex Spacers Not Used in current games may no longer be available. Choose one size up or down (+/-) and compensate with washers.



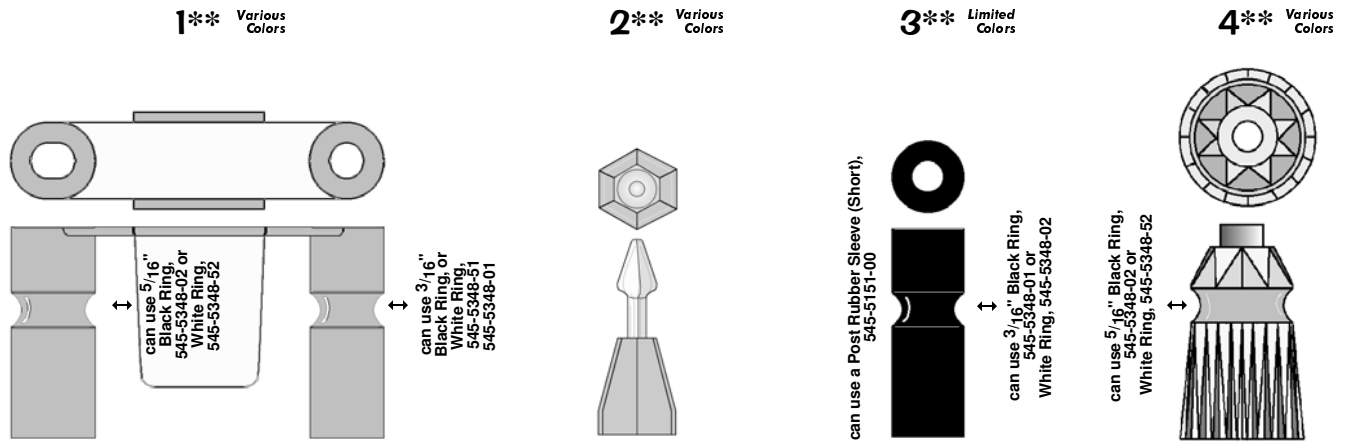
Sec. 4: Parts Id. ...

Nº	METAL SPACER NAME	QTY.	SPI PART Nº	Nº	METAL SPACER NAME	QTY.	SPI PART Nº
1	1/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-00	22	2 3/4" X 1/4" Hex Spacer #6-32 Tap	1	254-5008-15
2	3/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-12	23	2 7/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-31
3A	1/2" X 1/4" Hex Spacer #6-32 Tap	5	254-5008-03	24	3" X 1/4" Hex Spacer #6-32 Tap		254-5008-14
3B	Same as 3A but with Male End #6-32	--	254-5024-03	25	3 1/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-19
4A	5/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-02	26	3 1/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-26
4B*	Same as 4A but with Male End #6-32		254-5024-02	27	3 1/2" X 1/4" Hex Spacer #6-32 Tap		254-5008-27
5	3/4" X 1/4" Hex Spacer #6-32 Tap	5	254-5008-04	28	3 5/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-25
6A	7/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-05	29	3 3/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-36
6B*	Same as 6A but with Male End #6-32		254-5024-05	30	4" X 1/4" Hex Spacer #6-32 Tap		254-5008-21
7	1" X 1/4" Hex Spacer #6-32 Tap		254-5008-06	31	4 1/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-30
8A	1 1/8" X 1/4" Hex Spacer #6-32 Tap	3	254-5008-17	32	4 3/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-29
8B	Same as 8A but with #8-32 Tap	1	254-5031-06	33*	5 1/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-35
8C	Same as 8A but with Male End #6-32	--	254-5024-17	34	3/8" X 1/2" Spacer (Used with Backbox)	2	530-5099-00
9	1 1/4" X 1/4" Hex Spacer #6-32 Tap	1	254-5008-11	35	1/4" X 5/16" X .144" I.D. Spacer Tap		254-5014-03
10	1 5/16" X 1/4" Hex Spacer #6-32 Tap		254-5008-34	36	1/2" X 5/16" X .144" I.D. Spacer Tap	2	254-5014-00
11 ‡	1 3/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-33	37	9/16" X 5/16" X .144" I.D. Spacer Tap		254-5014-04
12	1 1/2" X 1/4" Hex Spacer #6-32 Tap	3	254-5008-09	38	3/4" X 5/16" X .144" I.D. Spacer Tap		254-5014-01
13 ‡	1 5/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-13	39	1 1/8" X 5/16" X .144" I.D. Spacer Tap		254-5014-02
14 ‡	1 3/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-10	40	1" X 5/16" X .144" I.D. Spacer Tap		254-5001-00
15 ‡	1 7/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-20	41	1 1/4" X 5/16" Hex Spacer #6-32 Tap		254-5018-09
16	2" X 1/4" Hex Spacer #6-32 Tap		254-5008-07	42	1 3/4" X 5/16" Hex Spacer #6-32 Tap		254-5018-06
17	2 1/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-32	43	2" X 5/16" Hex Spacer #6-32 Tap		254-5018-07
18	2 1/4" X 1/4" Hex Spacer #6-32 Tap		254-5008-18	44	4" X 5/16" Hex Spacer #6-32 Tap		254-5018-03
19	2 3/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-28	45	4 5/16" X 5/16" Hex Spacer #6-32 Tap		254-5018-00
20	2 1/2" X 1/4" Hex Spacer #6-32 Tap		254-5008-16	46	4.92" X 5/16" Hex Spacer #6-32 Tap		254-5018-04
21	2 5/8" X 1/4" Hex Spacer #6-32 Tap		254-5008-08				

† 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) †

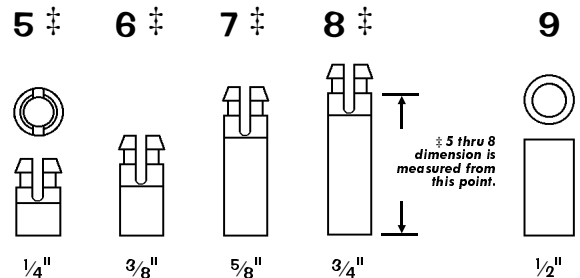


Take Note:

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 N^os which come in various colors, should be replaced with the desired 2-Digit N^o. from the above Color Chart. *Some colors may no longer be available for desired item.*

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

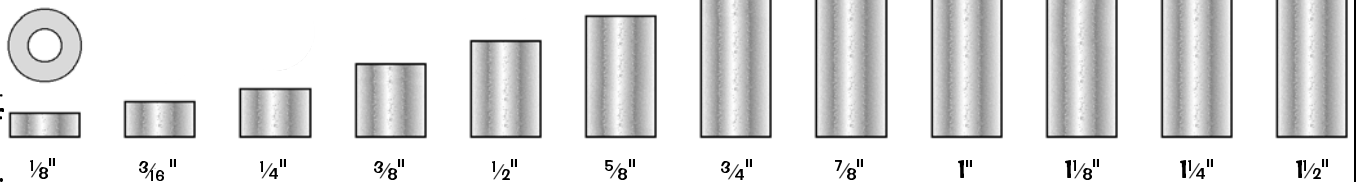


† Items 5 through 8 (Board Spacers) dimensions are measured from bottom to just under cut-away (see pictorial with Item 8 above).

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").



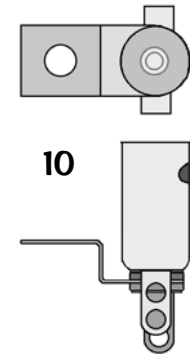
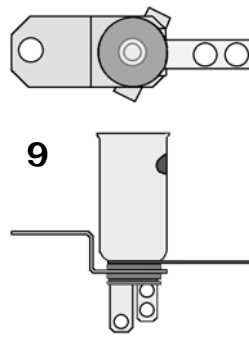
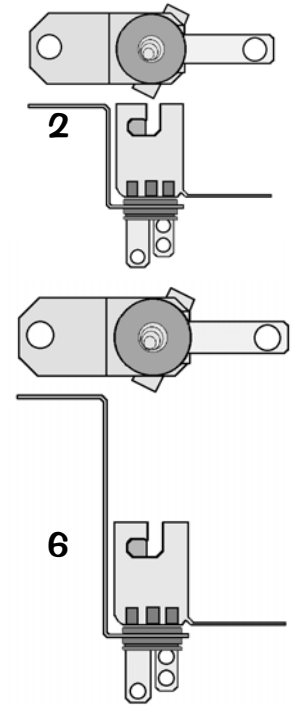
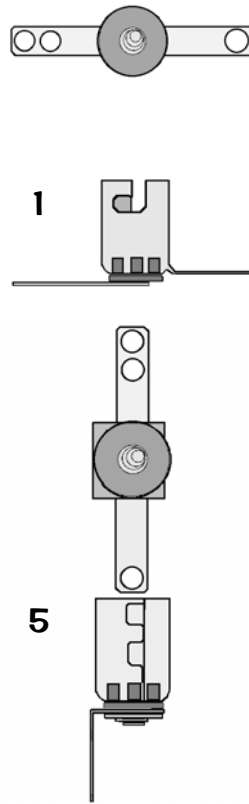
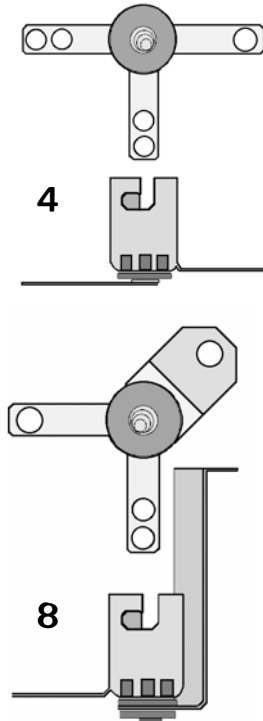
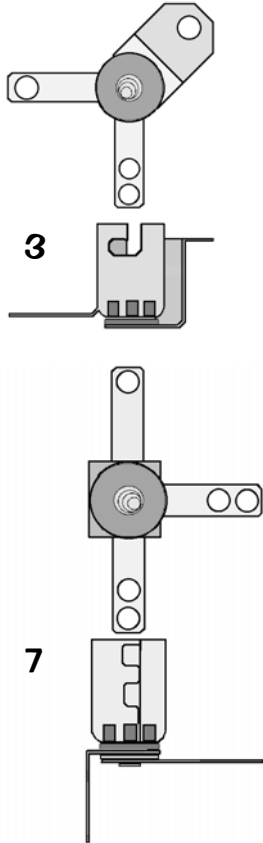
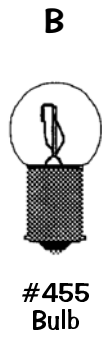
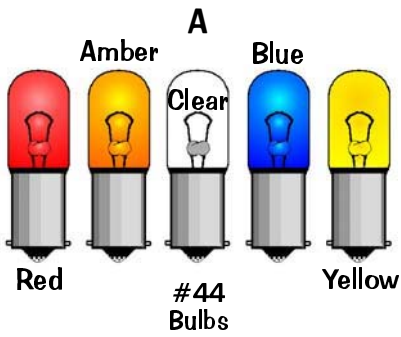
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

Nº	PLASTIC POST/SPACER NAME	QTY.	SPI PART Nº	Nº	PLASTIC POST/SPACER NAME	QTY.	SPI PART Nº
1**	Top Lane Mini-Light Hood (Red)	5	550-5061-02	10	1/8" X 3/8" Spacer Gray		254-5000-19
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)				11	3/16" X 3/8" Spacer Gray (4 for Dot Display)	4	254-5000-18
2**	Mini-Jewel Post Clear	1	550-5052-01	12	1/4" X 3/8" Spacer Gray	4	254-5000-02
Item 2 typically secured by: #6 X 3/8" HWH AB (Zinc) (Qty. 1/per) (234-5000-00)				13	3/8" X 3/8" Spacer Gray	8	254-5000-12
3**	1 1/16" Single Groove Post (Clear)	12	550-5059-01	14	1/2" X 3/8" Spacer Gray		254-5000-01
4**	Single Groove Jewel Post (Clear & Red)	10/1	550-5034-01/-02	15	5/8" X 3/8" Spacer Gray	6	254-5000-14
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).				16	3/4" X 3/8" Spacer Gray	3	254-5000-07
5 †	1/4" Slf. Rtn. Spacer White		254-5007-02	17	7/8" X 3/8" Spacer Gray		254-5000-11
6 †	3/8" Slf. Rtn. Spacer White		254-5007-01	18	1" X 3/8" Spacer Gray/Black		254-5000-04
7 †	5/8" Slf. Rtn. Spacer White		254-5007-00	19	1 1/8" X 3/8" Spacer Natural (-06 for Gray)	7	254-5000-06N
8 †	3/4" Slf. Rtn. Spacer White		254-5007-03	20	1 1/4" X 3/8" Spacer Gray		254-5000-05
9	1/2" X 1/4" Spacer White (Narrow)		254-5000-03	21	1 1/2" X 3/8" Spacer Gray		254-5000-08

Use
254-5000-06N
for Natural

Sec. 4: Parts Id. ...

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

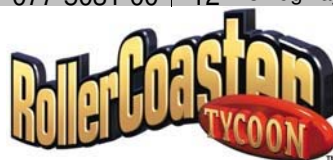


Sec. 4: Parts Id. ...

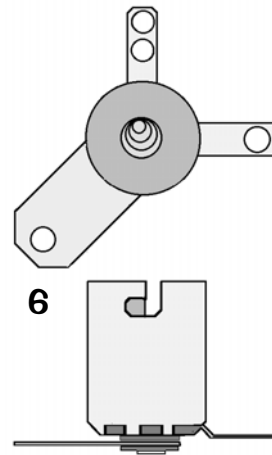
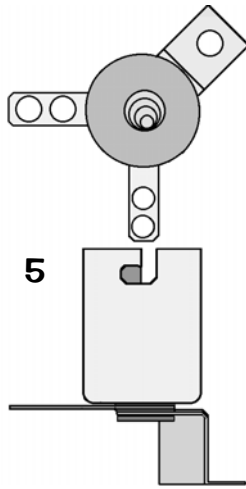
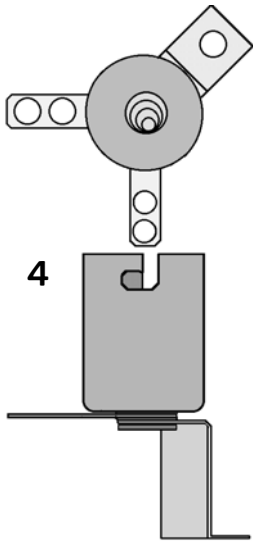
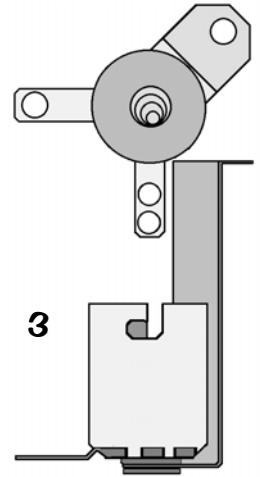
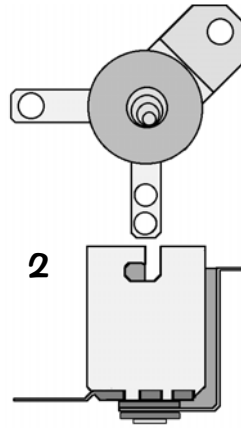
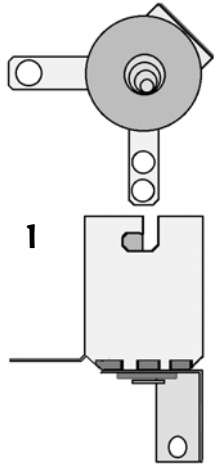
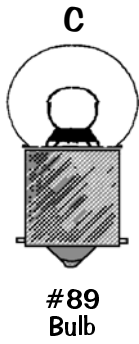
Nº	SMALL BULB & SOCKET NAME	QTY.	SPI PART Nº
A	#44 Bulb (Clear)	39	165-5000-44
A	#44 Bulb (Red)	4	165-5053-02
A	#44 Bulb (Amber)		165-5053-03
A	#44 Bulb (Blue)		165-5053-05
A	#44 Bulb (Yellow)	7	165-5053-06
B	#455 Twinkle Bulb		165-5003-00
1	2-Lug Staple Down Socket	3	077-5000-00
2	3-Lug Stand-Up Short 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

Nº	SMALL BULB & SOCKET NAME	QTY.	SPI PART Nº
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.



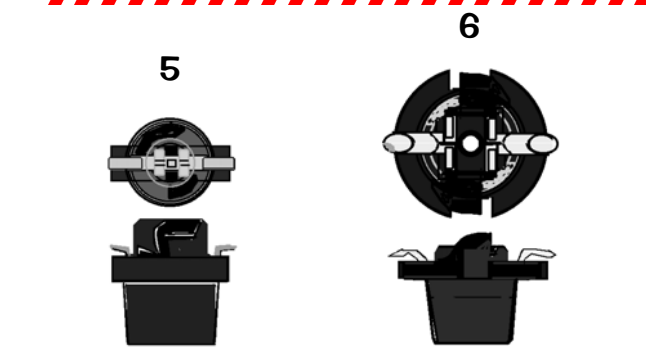
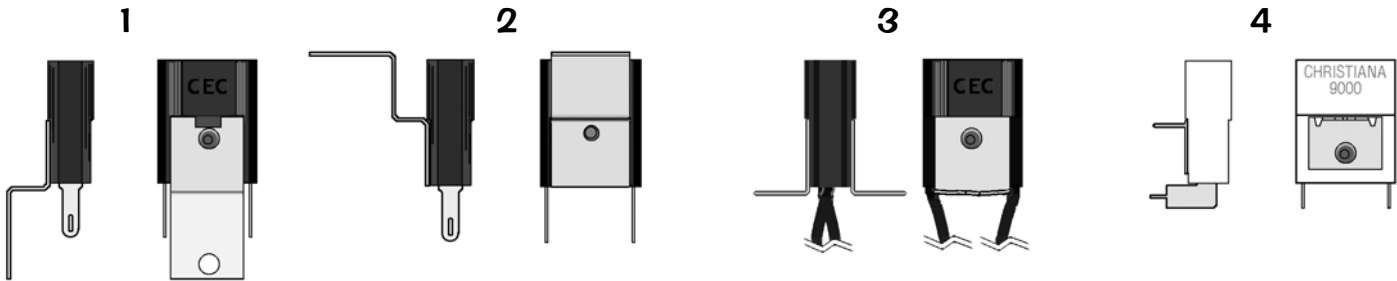
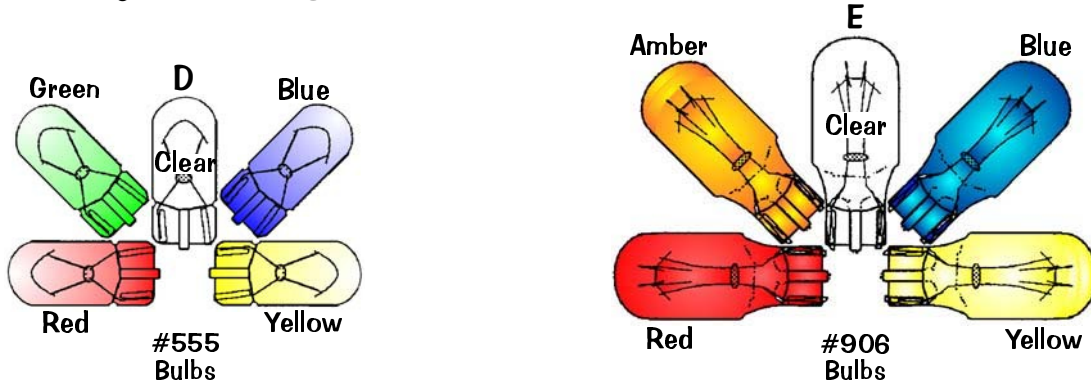
Playfield - Large Bayonet Type Bulb and Sockets (Actual Size) †



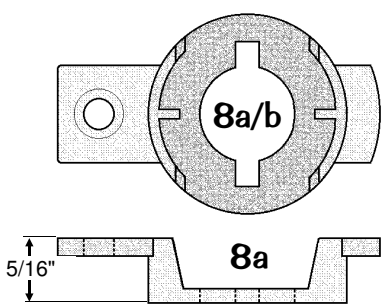
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

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

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



8a/b Top View (8b Side View is Not Shown)



Take Special Note

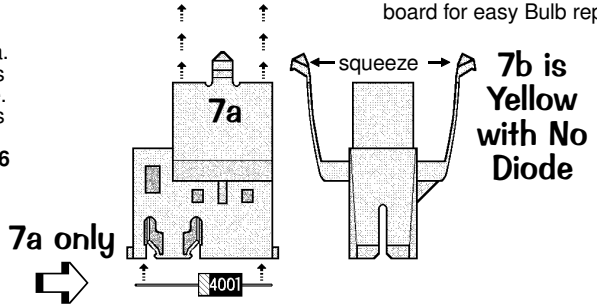
Item 7a is an IDC (Insulation Displacement Connection) Style Socket (this style is solderless). This socket is secured to the playfield or component by Items 8a or 8b Snap-On Socket Brackets, or may also be snapped into Item 9 Socket Mounting Plastic Board (used only when sockets are positioned closely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

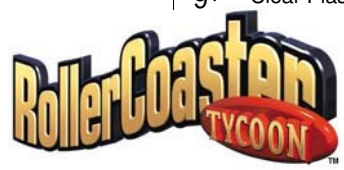
Note: Always replace with same type bulb in original application.



Sec. 4: Parts Id. ...

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

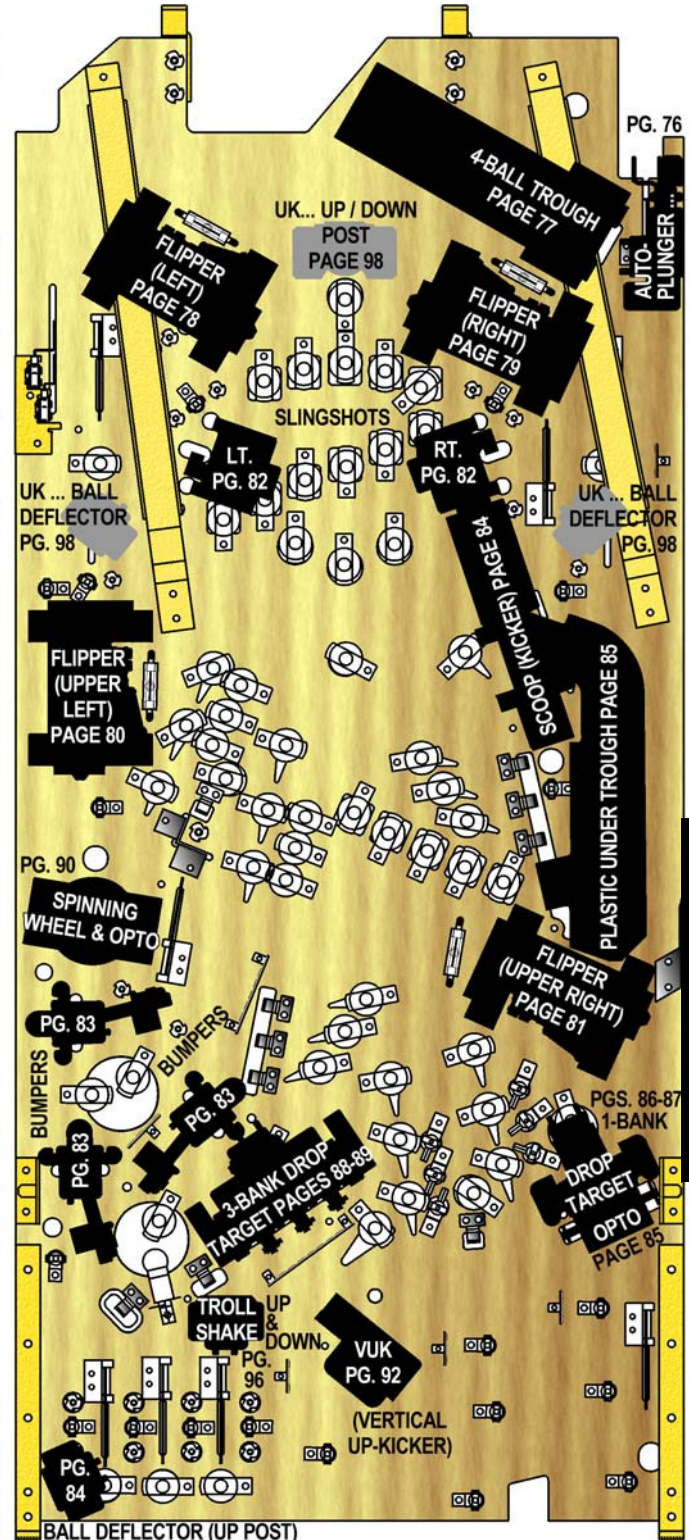
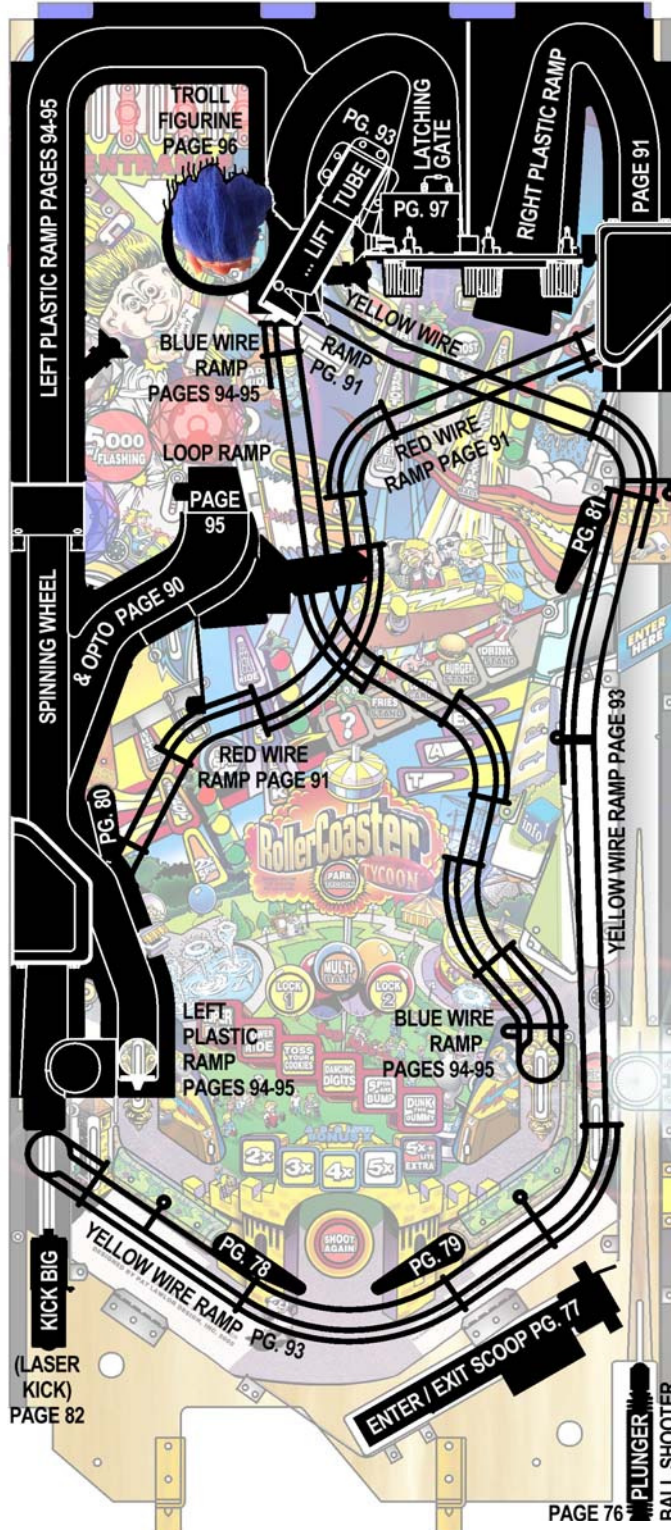
Nº	WEDGE BULB & SOCKET NAME	QTY.	SPI PART Nº	Nº	WEDGE BULB & SOCKET NAME	QTY.	SPI PART Nº
D	#555 Wedge Base Bulb (Clear)	64	165-5002-00	1	#555 Wedge Base Socket (Laydown)	3	077-5026-01
D	#555 Wedge Base Bulb (Red)		165-5054-02	2	#555 Wedge Base Socket (Offset)		077-5029-00
D	#555 Wedge Base Bulb (Green)		165-5054-04	3	#555 W.B. Socket (for Pop Bumper)	3	077-5206-00
D	#555 Wedge Base Bulb (Blue)		165-5054-05	4	#555 W.B. Socket (Solder Type)		077-5207-00
D	#555 Wedge Base Bulb (Yellow)		165-5054-06	5	#555 Wedge Base Socket (Twist)		077-5007-00
E	#906 Wedge Base Bulb (Clear)	2	165-5004-00	6	#906 Wedge Base Socket (Twist)		077-5016-00
E	#906 Wedge Base Bulb (Red)		165-5004-02	7a	#555 IDC Snap-On Socket	55	077-5216-00
E	#906 Wedge Base Bulb (Amber)		165-5004-03	7b	#555 IDC Snap-On Socket No Diode	5	077-5216-01
E	#906 Wedge Base Bulb (Blue)		165-5004-05	8a	5/16" Ht. Snap-On Socket Bracket	55	545-5760-18
E	#906 Wedge Base Bulb (Yellow)		165-5004-06	8b*	19/32" Ht. Snap-On Socket Bracket		545-5760-19
				9*	Clear Plastic Socket Mtg. Bd. (x/per)		Not Required



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 N°**. **ASSOCIATED PARTS (AP-)** are noted and/or viewed with the associated Major Assembly. **Important:** Read all "Take Note:" items.



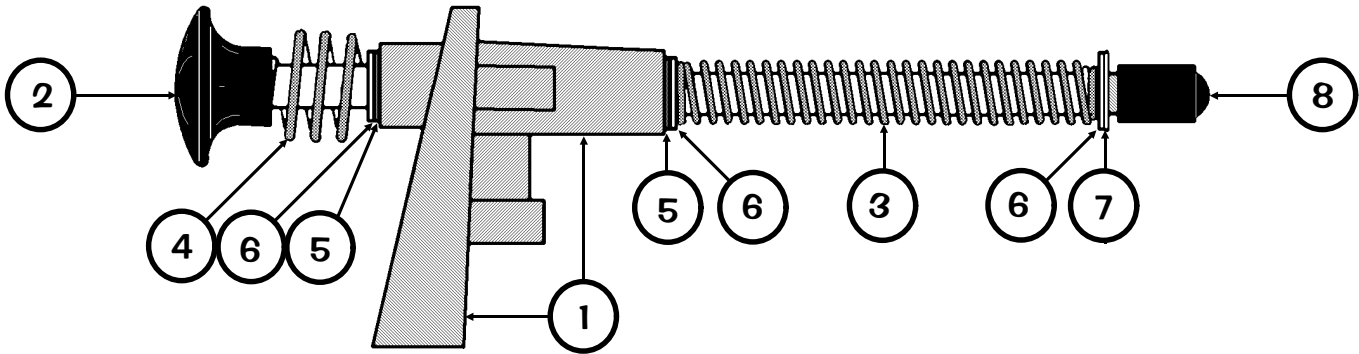
Sec. 4: Drawings ...



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

Manually launch the ball into play.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Housing (Shooter Assembly)	1	535-5067-02	4	Compression Spring (Short Plunger)	1	266-5010-00
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	7	Retaining Ring, 3/8" ø Shaft	1	270-5012-00
3	Comp. (Return) Spring (GRN, .035" ø)	1	266-5001-04	8	Plunger Tip (Black 50 Duro)	1	545-5276-00

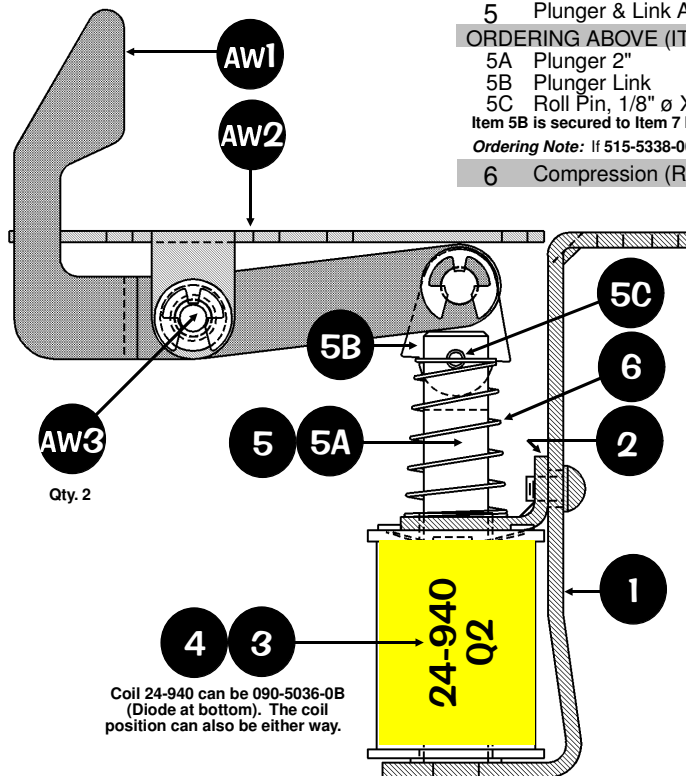


Autoplunger Arm Weld Assembly, 500-6091-00 (Items AW1-AW3)

Autoplunger Coil Assembly, 500-6092-02 (Items 7-9)

Automatically launches the ball into play.

Nº	... ARM WELD PART NAME	QTY.	SPI PART Nº	Nº	'PLUNGER COIL PART NAME	QTY.	SPI PART Nº
AW1	Arm Weld Assembly	1	515-6526-00	1	Autoplunger Coil Bracket Assembly	1	515-6527-00
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	2	Coil Retainer Bracket	1	535-5203-03
AW3	Nyliner, 1/4" (Thomson #411-FF)	2	545-5423-00	Item 2 is secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)			
3 Coil, 24-940 1 090-5036-00T							
ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:							
— Diode, 1N4004 (positioned at top) 1 112-5003-00							
4 Coil Sleeve 1 545-5031-00							
5 Plunger & Link Assembly 1 515-5338-00							
ORDERING ABOVE (ITEM 5) SUB-ASSY. PART Nº WILL INCLUDE:							
5A Plunger 2" 1 530-5025-01							
5B Plunger Link 1 545-5293-00							
5C Roll Pin, 1/8" ø X 5/8" Lg. 1 251-5008-00							
Item 5B is secured to Item 7 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)							
Ordering Note: If 515-5338-00 is unavailable, order the individual part(s) actually required.							
6 Compression (Return) Spring 1 266-5020-00							



Coil 24-940 can be 090-5036-0B (Diode at bottom). The coil position can also be either way.

Sec. 4: Drawings ...

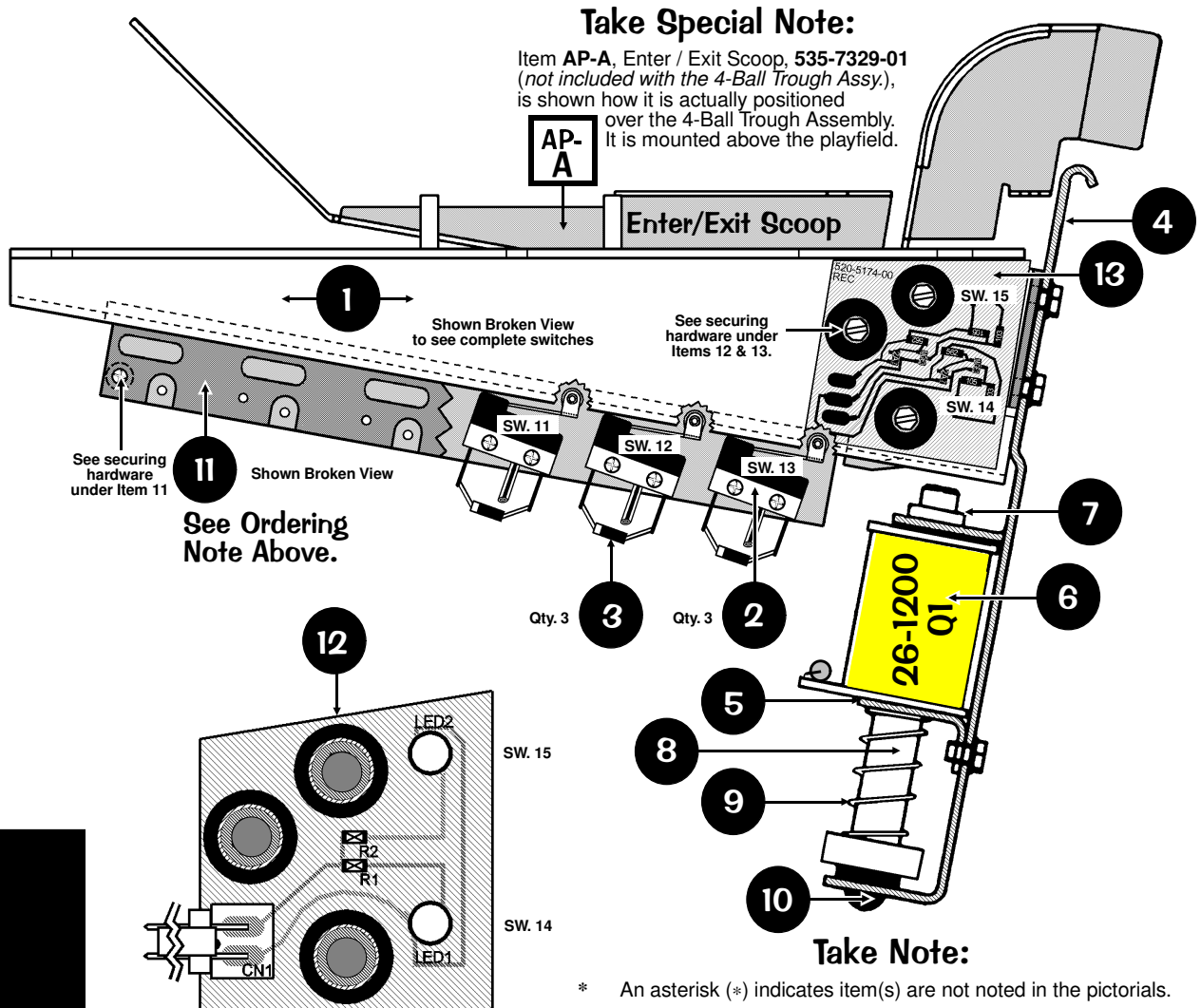


4-Ball Trough Assembly, 500-6318-14 (Items 1-13)

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).

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Ball Trough Outhole Mounting Bracket	1	515-6580-01	10	Rubber Bumper (Grommet)	1	545-5105-00
Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 6) (234-5101-00)				11	Trough Ball Guide Plate <i>Not Required</i>	0	535-7801-00
2	Micro Switch (Roller Actuator, Lite-Force)	3	180-5119-02	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)			
Item 2 is secured to Item 1 by: #2-56 X 1/2" HWH (Sr) UNS #4HD TR3 BO (Qty. 6) (237-5937-02)				12	Dual OPTO TRANS Board Assembly	1	515-0173-00
Item 2 requires: Heat Shrink Tubing 1/8" ø PUI-24 (Qty. 1"/per) (605-5006-00)				13	Dual OPTO REC Board Assembly	1	515-0174-00
3	Switch Diode, 1N4001	3	112-5001-00	Items 12 & 13 are by: #6-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 3/per) (237-5976-04)			
4	Coil Mounting Bracket	1	535-7330-01	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)			
Item 4 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Sr.) Zinc (Qty. 4) (237-5975-00)				ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.			
5	Coil Retaining Bracket	1	535-5203-03	Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
Item 5 is secured to Item 4 by: #8-32 X 1/4" HWH MS (Serr) Zinc (Qty. 2) (237-5964-01)				AP-A	Ball Trough Enter / Exit Scoop	1	535-7329-01
6	Coil, 26-1200	1	090-5044-00T	Item AP-A secured to the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5101-00).			
ORDERING ABOVE (ITEM 6) COIL PART Nº WILL INCLUDE:				AP-B*	Steel Balls (1-1/16" ø)	4	260-5000-00
—	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				



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.

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

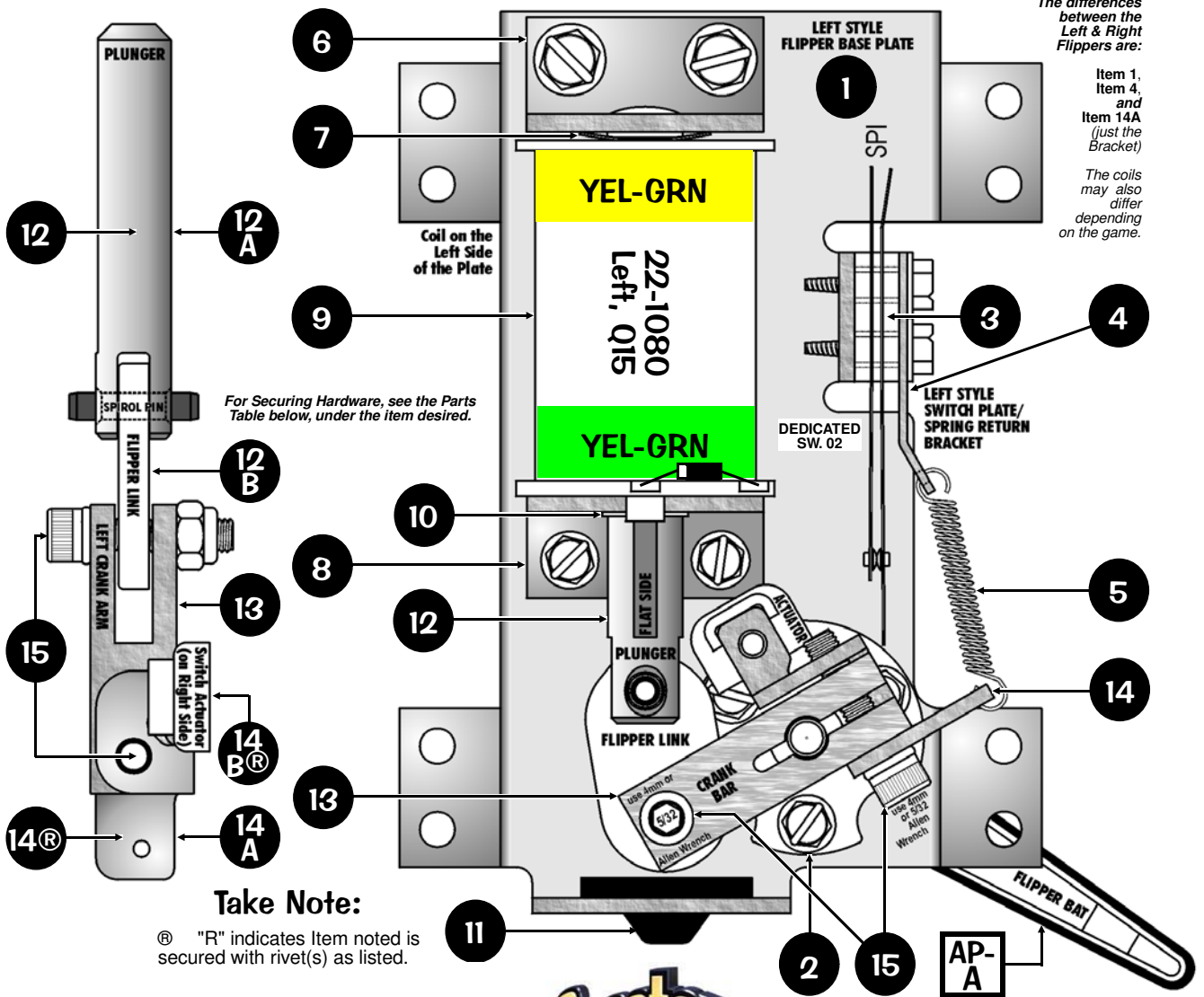
For a break-down of parts of Items 12 & 13, OPTO Boards (515-0173-00 & 515-0174-00), see Section 5, Chapter 4, *Trough Up-Kicker Dual OPTO Boards Theory of Operation & Schematic, Component Layout & Parts.*

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 №	№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Flipper Base Plate (LEFT)	1	See FRP1	13*	Crank Bar	1	530-5070-02
<small>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.</small>							
2	Flipper Bat Bushing (White Plastic)	1	545-5070-00	14*	Switch Actuator (LEFT) Sub-Assy.	1	515-7257-01
<small>Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)</small>							
3	Power (End of Stroke) Switch	1	180-5149-00	ORDERING ABOVE (ITEM 14) SUB-ASSY. PART № WILL INCLUDE:			
<small>Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)</small>							
4	Sw. Plate/Spring Return Brkt. (LEFT)	1	535-7354-01	14A	Actuator & Spring Bracket (LEFT)	1	535-9038-01
5	Flipper Return Spring	1	265-5035-00	14B	Switch Actuator (White Plastic)	1	545-5612-00
6*	Coil Stop Bracket Sub-Assembly	1	515-6308-01	<small>Item 14B is secured to 14A by: Rivet, 1/8" ø X 1/4" Lg. (Qty. 1) (249-5003-00)</small>			
<small>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)</small>							
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00	15*	Set Screw: #10-32 X 7/8" Socket Hd.	2	237-5966-00
8	Coil Support Bracket	1	535-7356-00	<small>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</small>			
<small>Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)</small>							
9	Coil, 22-1080 (YEL-GRN) (Left)	1	090-5032-00T	Flipper Rebuild Parts for Easier Installation, Save \$:			
ORDERING ABOVE (ITEM 9) COIL PART № WILL INCLUDE:							
— Diode, 1N4004 (positioned at top) 1 112-5003-00							
10*	Coil Sleeve	1	545-5388-00	Flipper Base Plate Kit (LEFT)			
11	Deflector Pad (Bumper)	1	545-5428-00	FRP1	Includes Item 1 pre-threaded, with the Securing Hardware for Items 2, 3, 6 & 8.		515-6617-01
12*	Flipper Plunger & Link Sub-Assy.	1	515-6304-03	Plunger, Link & Crank (LEFT) Assy.			
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							
<small>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)</small>							
<small>FRP2 Includes above Items 12, 13, 14 and 15 and is pre-assembled.</small>							
Flipper (LEFT) Rebuild Kit							
<small>FRP3 Same as FRP2, but also includes above Items 6 & 10.</small>							
<small>ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.</small>							
№	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				

Sec. 4: Drawings ...



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.

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

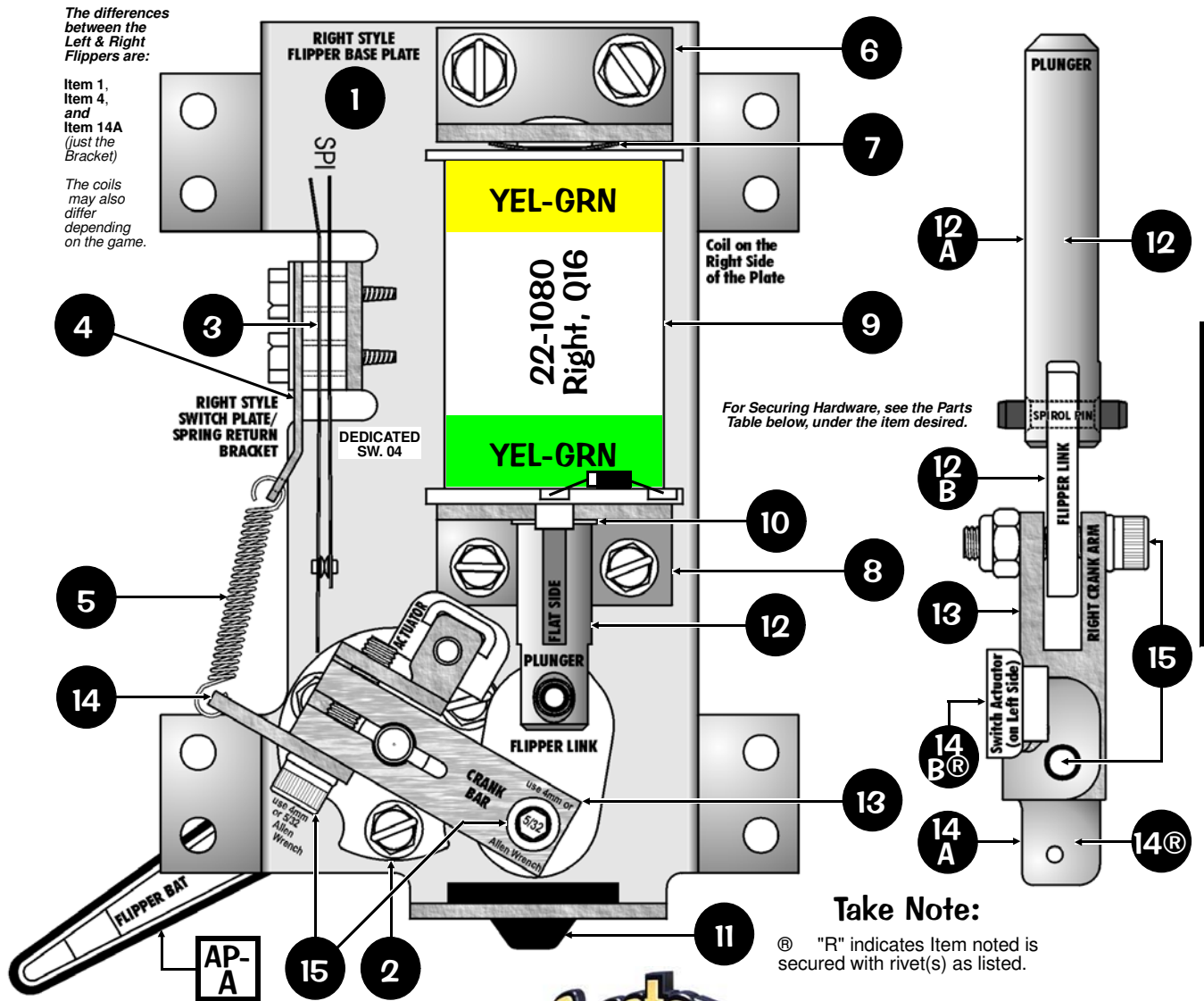


Flipper (Right) Assembly, 500-6543-02 (Items 1-15) and Associated Part: Yellow Flipper Bat & Shaft Assy., 515-5133-06-06 (Item AP-A)



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Flipper Base Plate (RIGHT)	1	See FRP1	13*	Crank Bar	1	530-5070-02
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.				Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)			
2	Flipper Bat Bushing (White Plastic)	1	545-5070-00	14*	® Switch Actuator (RIGHT) Sub-Assy.	1	515-7257-00
Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)				ORDERING ABOVE (ITEM 14) SUB-ASSY. PART Nº WILL INCLUDE:			
3	Power (End of Stroke) Switch	1	180-5149-00	14A	Actuator & Spring Bracket (RIGHT)	1	535-9038-00
Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)				14B	® Switch Actuator (White Plastic)	1	545-5612-00
4	Sw. Plate/Spring Return Brkt. (RIGHT)	1	535-7354-00	Item 14B is secured to 14A by: Rivet, 1/8" ø X 1/4" Lg. (Qty. 1) (249-5003-00)			
5	Flipper Return Spring	1	265-5035-00	15*	Set Screw: #10-32 X 7/8" Socket Hd.	2	237-5966-00
6*	Coil Stop Bracket Sub-Assembly	1	515-6308-01	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			
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)				Flipper Rebuild Parts for Easier Installation, Save \$:			
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00	FRP1	Flipper Base Plate Kit (RIGHT) Includes Item 1 pre-threaded, with the Securing Hardware for Items 2, 3, 6 & 8.		515-6617-00
8	Coil Support Bracket	1	535-7356-00	FRP2	Plunger, Link & Crank (RIGHT) Assy. Includes above Items 12, 13, 14 and 15 and is pre-assembled.		515-7203-00
Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)				FRP3	Flipper (RIGHT) Rebuild Kit Same as FRP2, but also includes above Items 6 & 10.		500-6307-00
9	Coil, 22-1080 (Right)	1	090-5032-00T	ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.			
ORDERING ABOVE (ITEM 9) COIL PART Nº WILL INCLUDE:				Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
—	Diode, 1N4004 (positioned at top)	1	112-5003-00	AP-A	YELLOW Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-5133-06-06
10*	Coil Sleeve	1	545-5388-00		Large Flipper RED Rubber Ring	1	545-5277-22
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:			
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	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)							

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



Drawings for Major Assemblies & Ramps



Section 4, Chapter 2
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Sec. 4: Drawings ...

Take Note:

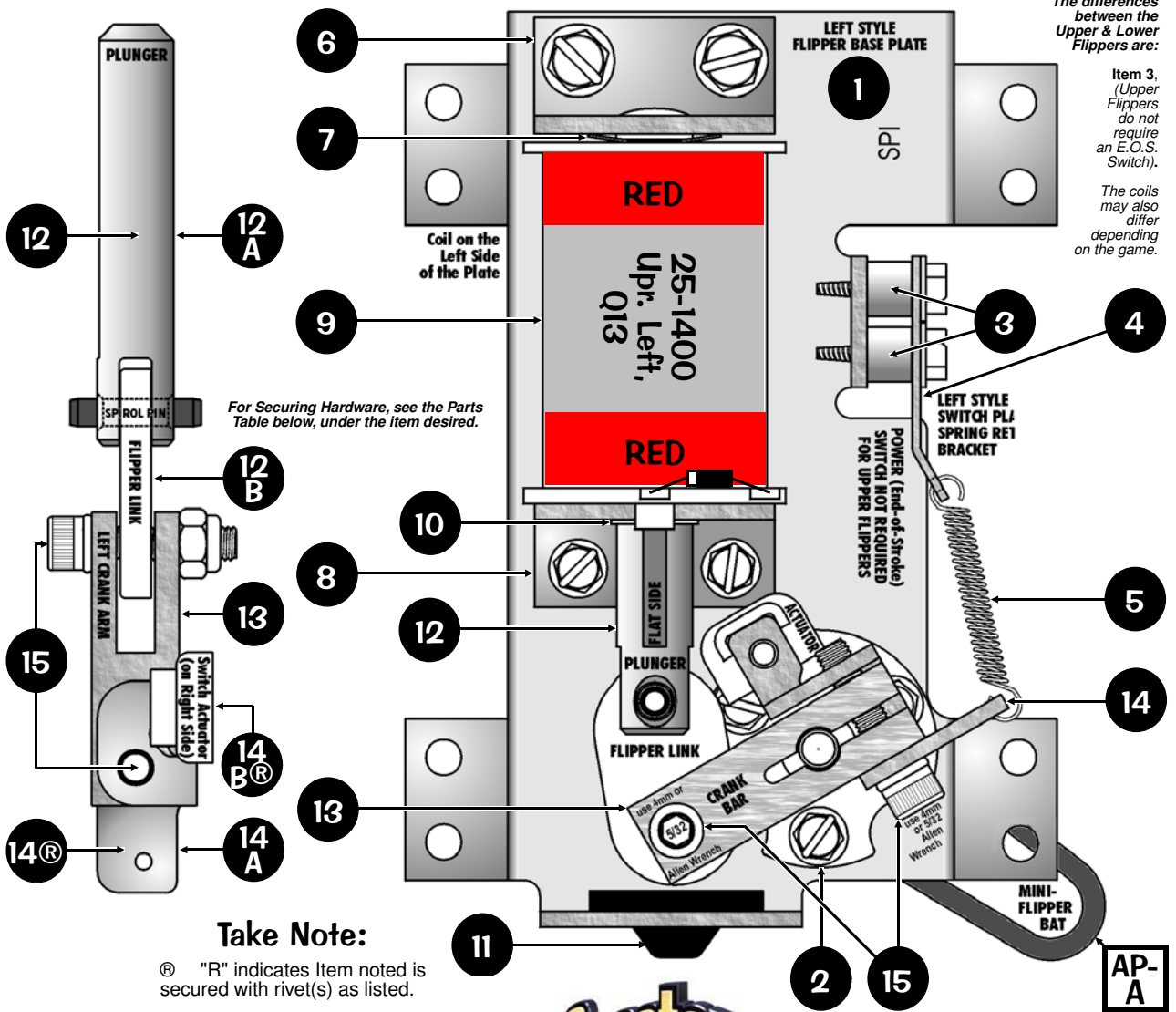
® "R" indicates Item noted is secured with rivet(s) as listed.

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	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Flipper Base Plate (LEFT)	1	See FRP1	13*	Crank Bar	1	530-5070-02
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.				Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)			
2	Flipper Bat Bushing (White Plastic)	1	545-5070-00	14*	® Switch Actuator (LEFT) Sub-Assy.	1	515-7257-01
Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)				ORDERING ABOVE (ITEM 14) SUB-ASSY. PART Nº WILL INCLUDE:			
3	1/4" X 3/8" Spacer Gray	2	254-5000-02	14A	Actuator & Spring Bracket (LEFT)	1	535-9038-01
Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Sw. (Ser.) Zc. (Qty. 1/per) (237-5976-04)				14B	® Switch Actuator (White Plastic)	1	545-5612-00
4	Sw. Plate/Spring Return Brkt. (LEFT)	1	535-7354-01	Item 14B is secured to 14A by: Rivet, 1/8" ø X 1/4" Lg. (Qty. 1) (249-5003-00)			
5	Flipper Return Spring	1	265-5035-00	15*	Set Screw: #10-32 X 7/8" Socket Hd.	2	237-5966-00
6*	Coil Stop Bracket Sub-Assembly	1	515-6308-01	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			
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)				Flipper Rebuild Parts for Easier Installation, Save \$:			
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00	Flipper Base Plate Kit (LEFT)			
8	Coil Support Bracket	1	535-7356-00	FRP1	Includes Item 1 pre-threaded, with the Securing Hardware for Items 2, 3, 6 & 8.		515-6617-01
Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)				Plunger, Link & Crank (LEFT) Assy.			
9	Coil, 25-1400 (RED) (Upper Left)	1	090-5067-00T	FRP2	Includes above Items 12, 13, 14 and 15 and is pre-assembled.		515-7203-01
ORDERING ABOVE (ITEM 9) COIL PART Nº WILL INCLUDE:				Flipper (LEFT) Rebuild Kit			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00	FRP3	Same as FRP2, but also includes above Items 6 & 10.		500-6307-10
10*	Coil Sleeve	1	545-5388-00	ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.			
11	Deflector Pad (Bumper)	1	545-5428-00	Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
12*	Flipper Plunger & Link Sub-Assy.	1	515-6304-03	YEL. Mini-Flipper Bat & Shaft (Plain)			
ORDERING ABOVE (ITEM 12) SUB-ASSY. PART Nº WILL INCLUDE:				AP-A	Small Flipper RED Rubber Ring	1	545-5207-22
12A	Flipper Plunger with "Flat"	1	530-5349-01	YEL. Mini-Flipper Bat & Shaft (Plain)			
12B	Plunger "Flipper" Link	1	545-5611-01	(Non-Knurled End) Assembly			
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)				Small Flipper RED Rubber Ring			

Sec. 4: Drawings ...



The differences between the Upper & Lower Flippers are:
Item 3. (Upper Flippers do not require an E.O.S. Switch).
The coils may also differ depending on the game.

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

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

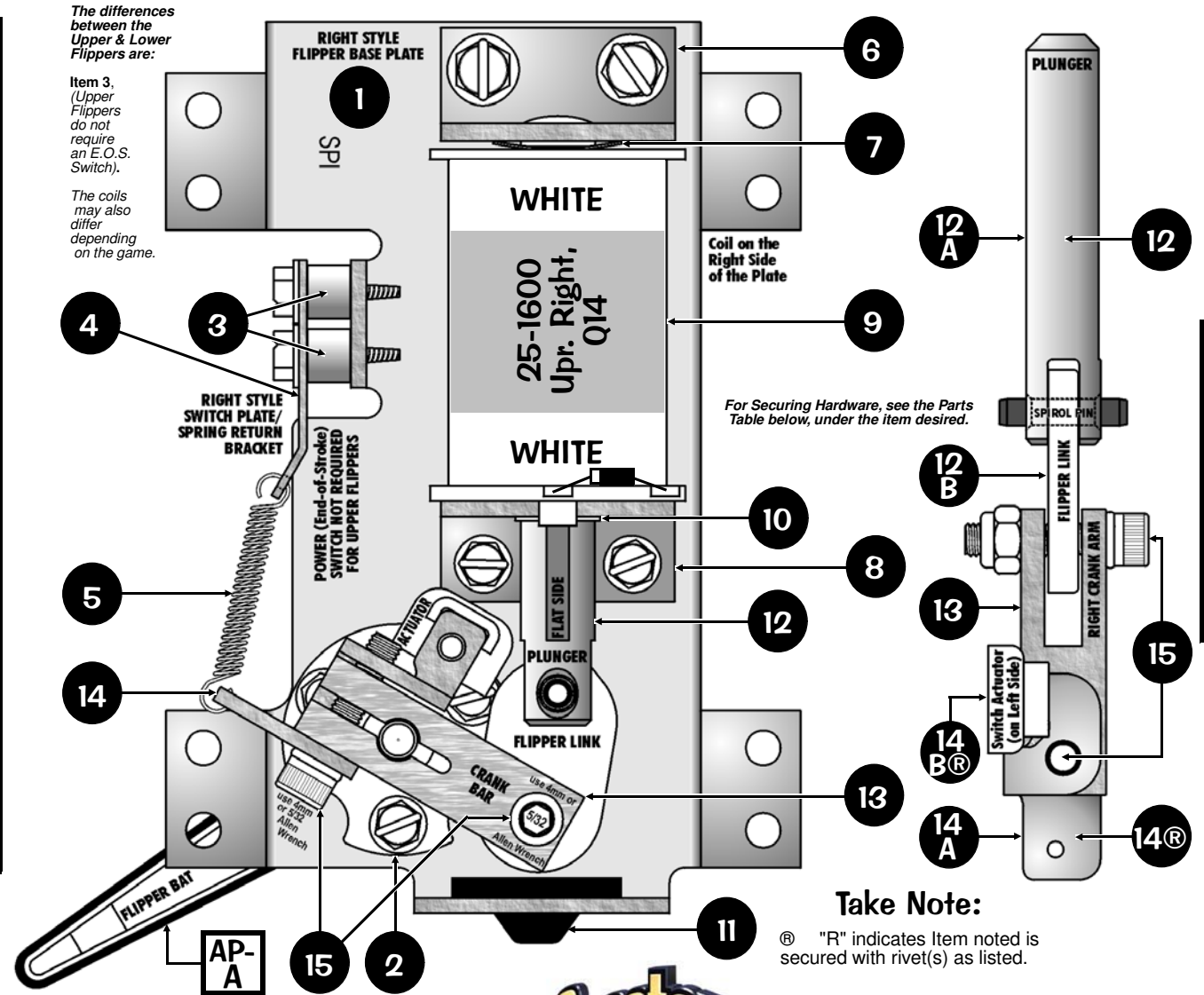


Flipper (Upper Right) Assembly, 500-6543-28 (Items 1-15) and Associated Part: Yellow Flipper Bat & Shaft Assy., 515-5133-06-06 (Item AP-A)



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Flipper Base Plate (RIGHT)	1	See FRP1	13*	Crank Bar	1	530-5070-02
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.				Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)			
2	Flipper Bat Bushing (White Plastic)	1	545-5070-00	14*	⊗ Switch Actuator (RIGHT) Sub-Assy.	1	515-7257-00
Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)				ORDERING ABOVE (ITEM 14) SUB-ASSY. PART Nº WILL INCLUDE:			
3	1/4" X 3/8" Spacer Gray	2	254-5000-02	14A	Actuator & Spring Bracket (RIGHT)	1	535-9038-00
Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Sw. (Ser.) Zc. (Qty. 1/per) (237-5976-04)				14B	⊗ Switch Actuator (White Plastic)	1	545-5612-00
4	Sw. Plate/Spring Return Brkt. (RIGHT)	1	535-7354-00	Item 14B is secured to 14A by: Rivet, 1/8" ø X 1/4" Lg. (Qty. 1) (249-5003-00)			
5	Flipper Return Spring	1	265-5035-00	15*	Set Screw: #10-32 X 7/8" Socket Hd.	2	237-5966-00
6*	Coil Stop Bracket Sub-Assembly	1	515-6308-01	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			
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)				Flipper Rebuild Tools for Easier Installation, Save \$:			
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00	Flipper Base Plate Kit (RIGHT)			
8	Coil Support Bracket	1	535-7356-00	FRP1	Includes Item 1 pre-threaded, with the Securing Hardware for Items 2, 3, 6 & 8.		515-6617-00
Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)				Plunger, Link & Crank (RIGHT) Assy.			
9	Coil, 25-1600 (WHT) (Upper Right)	1	090-5068-00T	FRP2	Includes above Items 12, 13, 14 and 15 and is pre-assembled.		515-7203-00
ORDERING ABOVE (ITEM 9) COIL PART Nº WILL INCLUDE:				Flipper (RIGHT) Rebuild Kit			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00	FRP3	Same as FRP2, but also includes above Items 6 & 10.		500-6307-00
10*	Coil Sleeve	1	545-5388-00	ASOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.			
11	Deflector Pad (Bumper)	1	545-5428-00	Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
12*	Flipper Plunger & Link Sub-Assy.	1	515-6304-03	AP-A	YELLOW Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-5133-06-06
ORDERING ABOVE (ITEM 12) SUB-ASSY. PART Nº WILL INCLUDE:				AP-A	Large Flipper RED Rubber Ring	1	545-5277-22
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)							

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



The differences between the Upper & Lower Flippers are:

Item 3, (Upper Flippers do not require an E.O.S. Switch).

The coils may also differ depending on the game.

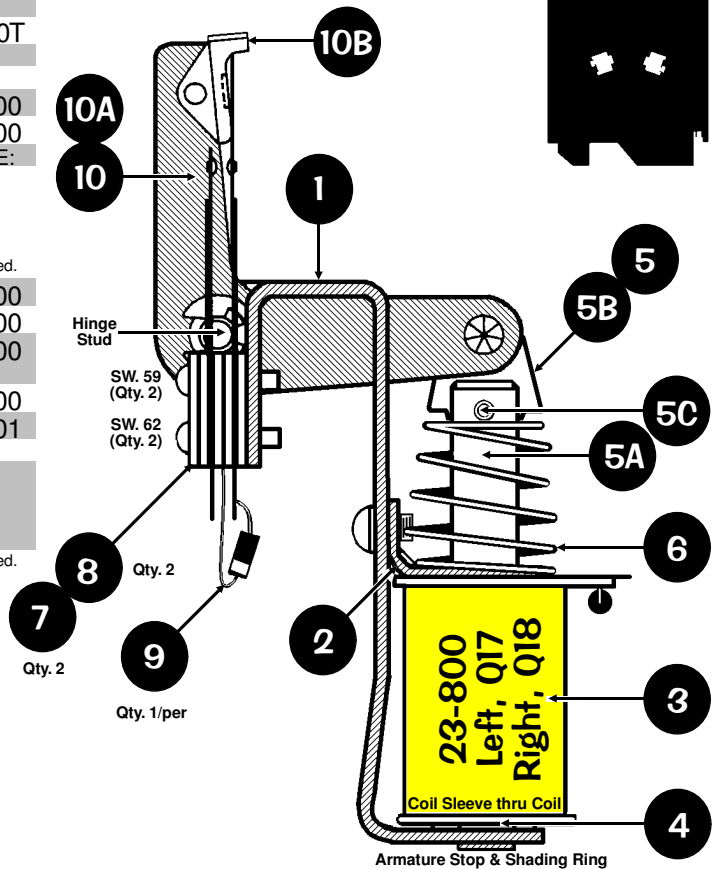
Take Note:
⊗ "R" indicates Item noted is secured with rivet(s) as listed.

Sec. 4: Drawings ...



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:

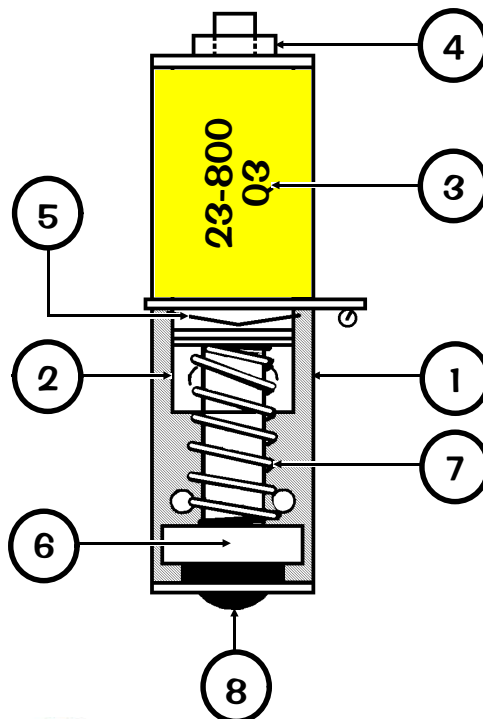
* An asterisk (*) indicates item(s) are not noted in the pictorials.

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

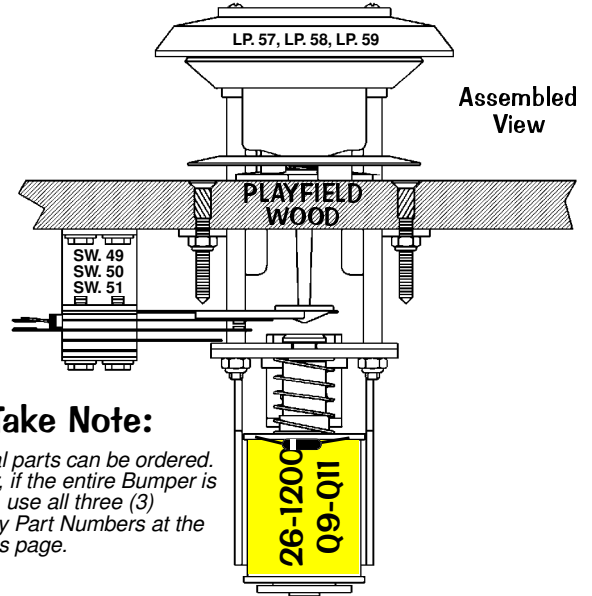
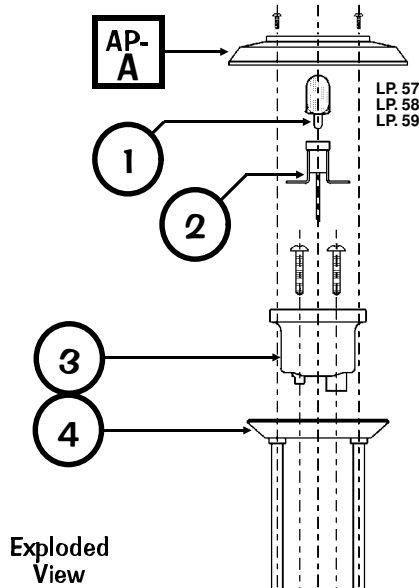
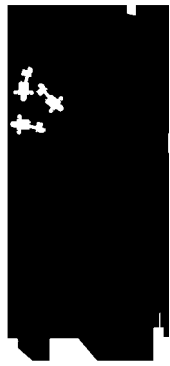
Kick Big (Laser Kick) Assembly, 500-5862-02 (Items 1-8)

Sec. 4: Drawings ...

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).			



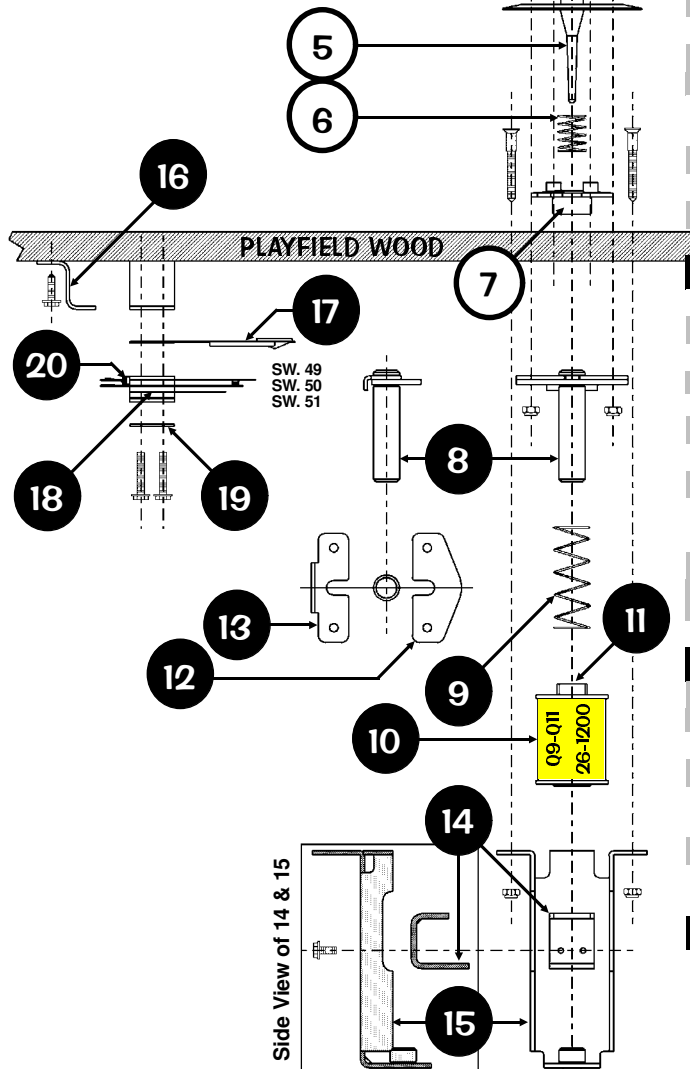
**Bumper Top Assemblies, 515-6459-01 (Qty. 3) (Items 1-7),
Bumper Bottom Assy., 515-6459-04 (Qty. 3) (Items 8-15),
Bumper Switch Assy., 515-6459-03 (Qty. 3) (Items 16-20)
and Associated Part(s): See Table Below (Item AP-A)**



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.

Exploded
View



Nº	BUMPER TOP PART NAME	QTY.	SPI PART Nº
1	#555 Wedge Base Bulb	1	165-5002-00
2	#555 Wedge Base Socket	1	077-5206-00
3	Bumper Body	1	545-5197-00
Item 3 is secured by: #5 X 7/8" PRH AB (Zinc) (Qty. 2) (237-5826-00)			
4	Ring Assembly	1	515-5085-00
Item 4 is secured by: #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00)			
5	Bumper Skirt	1	545-5607-00
6	Bumper Skirt Compression Spring	1	266-5048-00
7	Bumper Base	1	545-5195-00

Nº	BUMPER BOTTOM PART NAME	QTY.	SPI PART Nº
8	Plunger	1	530-5348-00
9	Compression (Return) Spring	1	266-5047-00
10	Coil, 26-1200	1	090-5044-00T
ORDERING ABOVE (ITEM 10) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
11	Coil Sleeve	1	545-5031-00
12	Fiber Yoke	1	545-5609-00
13	Metal Yoke	1	535-7346-00
14	Metal Yoke Stop	1	535-7347-00
Item 14 is secured by: #6-32 X 1/4" HWH Swage (Serr.) Zinc (Qty. 2) (237-5976-01)			
15	Coil Bracket Welded Assembly	1	515-5939-00
Item 15 is secured by: #6-32 X 1-3/16" Spiral Fin Shank (Qty. 3) (237-5957-00) and #6-32 Nylon Stop Nut (Qty. 3) (240-5005-00)			

Nº	BUMPER SWITCH PART NAME	QTY.	SPI PART Nº
16	Switch Bracket	1	535-7342-00
Item 16 is secured by: #8 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00)			
17	Spoon Switch Actuator	1	545-5610-01
18	Bumper Stack (Blade) Switch	1	180-5015-03
19	Switch Body Protect Plate	1	535-7344-00
Items 18 & 19 are secured by: #6-32 X 3/4" HWH Swage (Serr.) Zc. (Qty. 2) (237-5976-05)			
20	Switch Diode, 1N4001	1	112-5001-00

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

ASSOCIATED PART IS NOT INCLUDED WITH THE ABOVE ASSEMBLY.

Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
	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)			

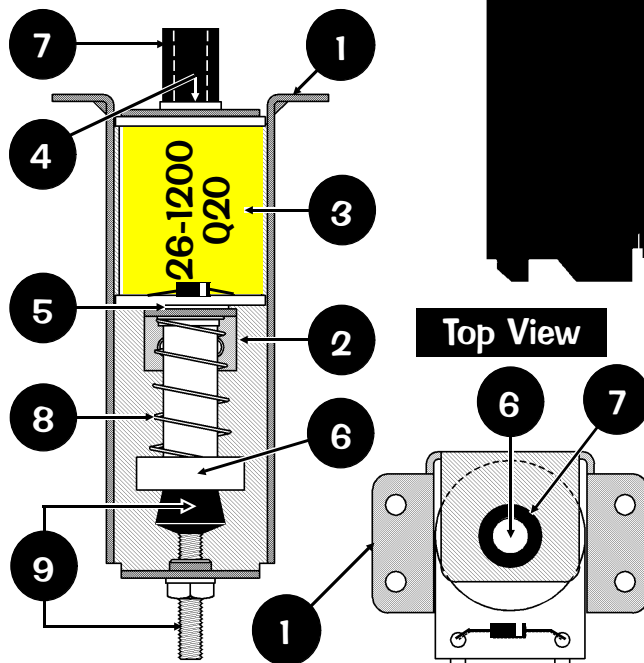
Sec. 4: Drawings ...

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

Stops the ball in the Left Orbit.

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 to Item 1 by: #8-32 X 1/4" PPH MS (Sems) (Qty. 2) (232-5300-00)			
3	Coil, 26-1200	1	090-5044-00T
ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
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.**

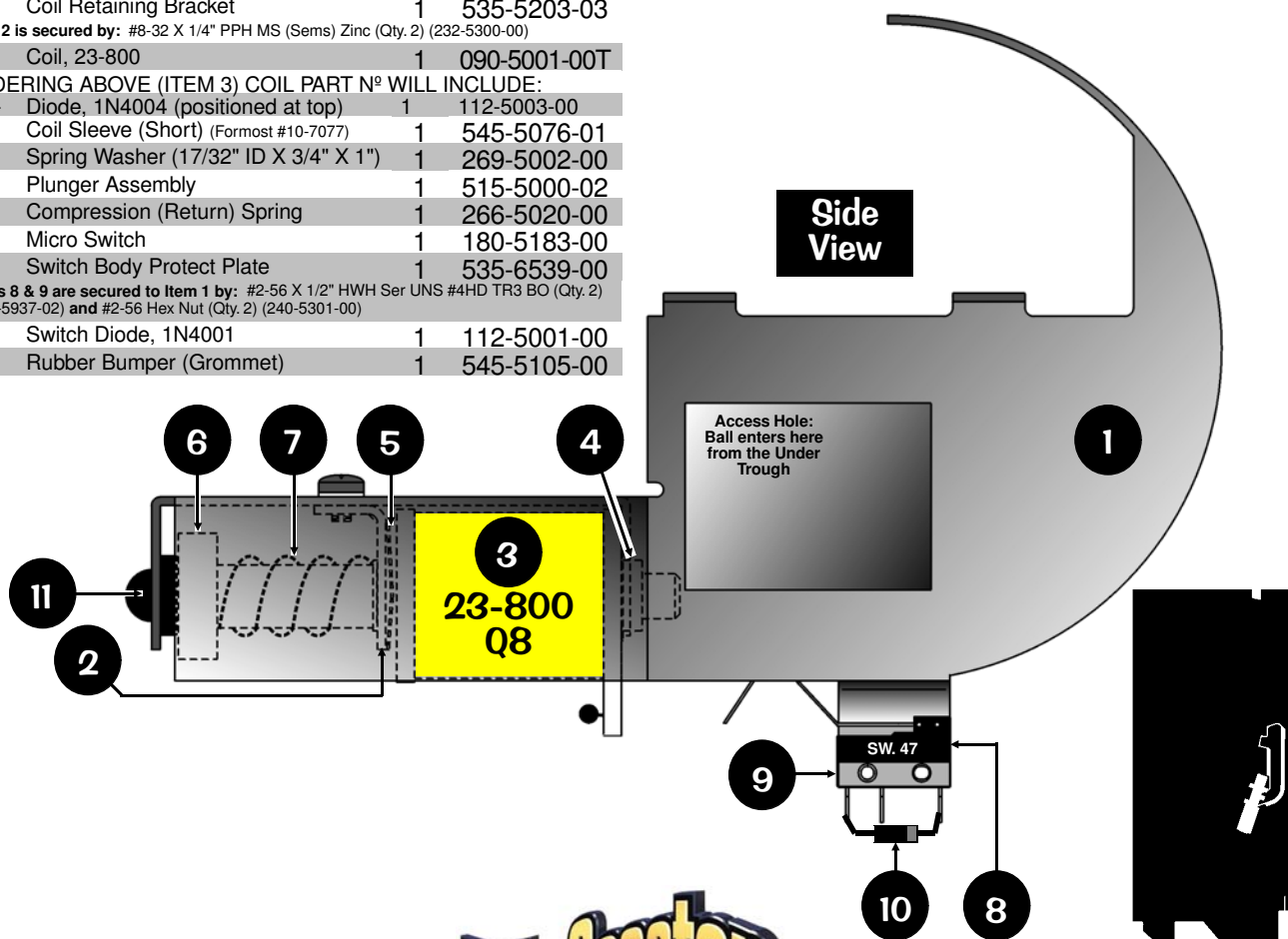


Scoop (Kicker) Assembly, 500-6585-00 (Items 1-11)

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

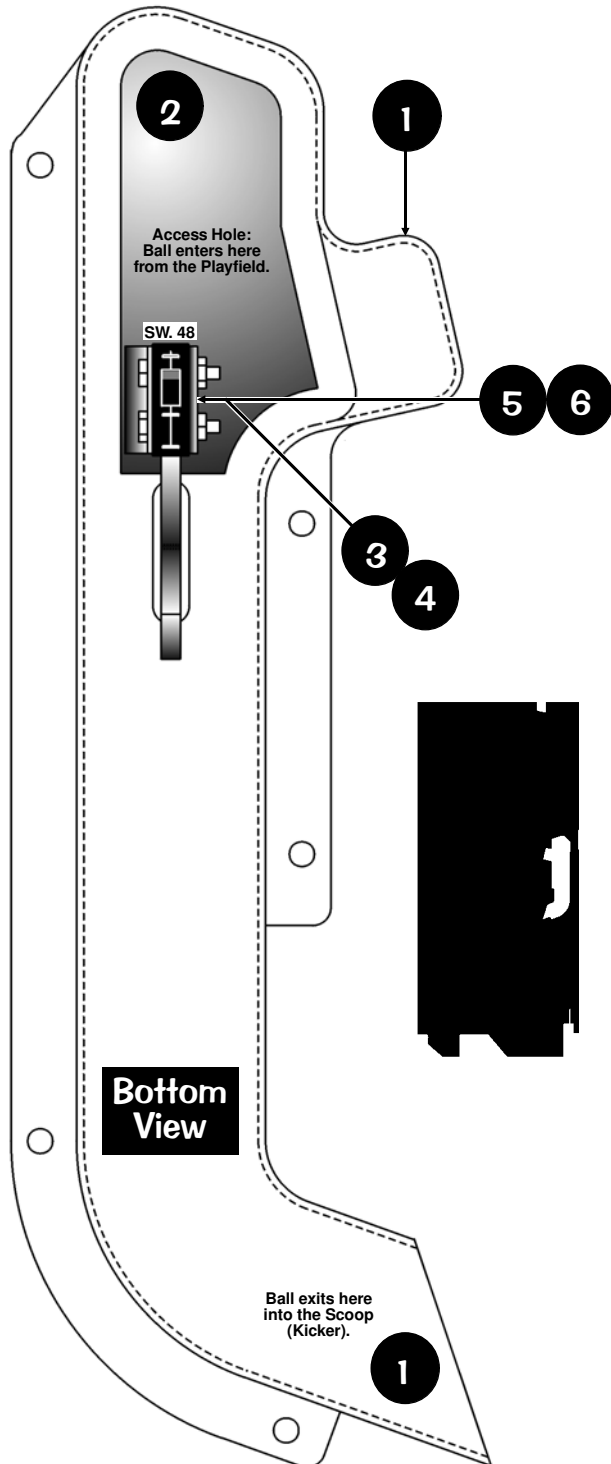
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Scoop Weldment Mounting Assy.	1	515-7165-02
Item 1 is secured under the P/F by: #8-32 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5101-00)			
2	Coil Retaining Bracket	1	535-5203-03
Item 2 is secured by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)			
3	Coil, 23-800	1	090-5001-00T
ORDERING ABOVE (ITEM 3) COIL PART 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	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

Sec. 4: Drawings ...



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
<small>Item 1 is secured under the P/F by: #8 X 1/2" HWH AB (Zinc) (Qty. 5) (234-5101-00)</small>			
2	Impact Plate	1	535-9185-00
3	Switch Bracket	1	535-6173-02
<small>Items 2 & 3 are secured by: #8-32 X 1/4" PFH 82 Undercut (Zinc) (Qty. 2) (237-6030-02)</small>			
4	Micro Switch (Happ # 95-1128-00)	1	180-5183-00
5	Switch Body Protect Plate	1	535-6539-00
<small>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)</small>			
6	Switch Diode, 1N4001	1	112-5001-00



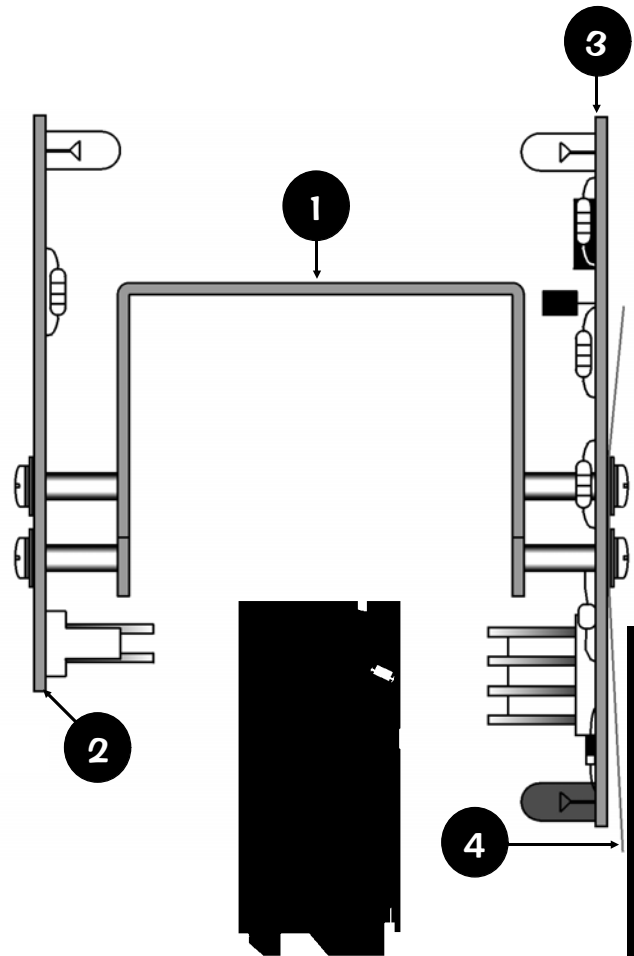
Bottom View

OPTO (Bracket & Pem) Individual Parts Only (Items 1-4) Detects Ball in the Right Orbit Lane behind the 1-Bank Drop Target (next page).

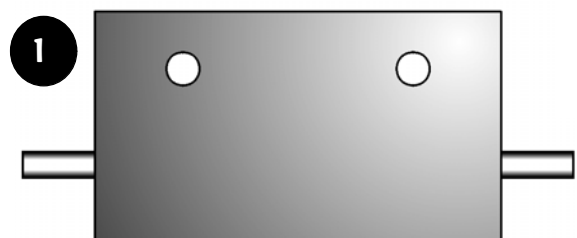
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	OPTO Mounting Bracket (with Pems)	1	535-9176-00
<small>Item 1 is secured under the P/F by: #8-32 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00)</small>			
2	OPTO Transmitter (TRANS) Board	1	520-5082-00
3	OPTO Receiver (REC) Board	1	520-5083-01
<small>Items 2 & 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)</small>			
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)**



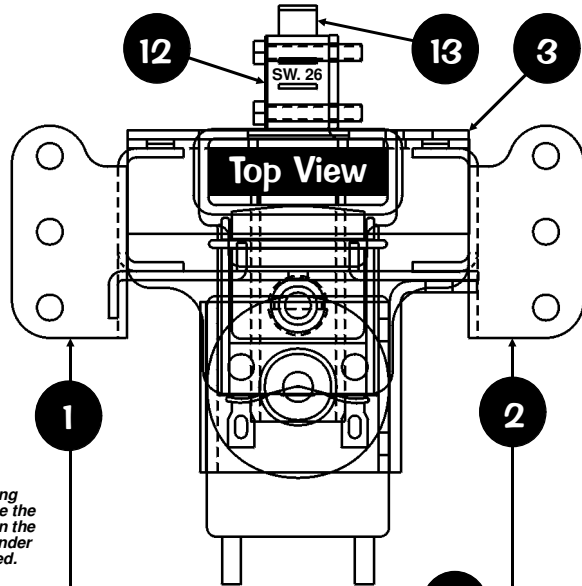
Sec. 4: Drawings ...

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 target 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.

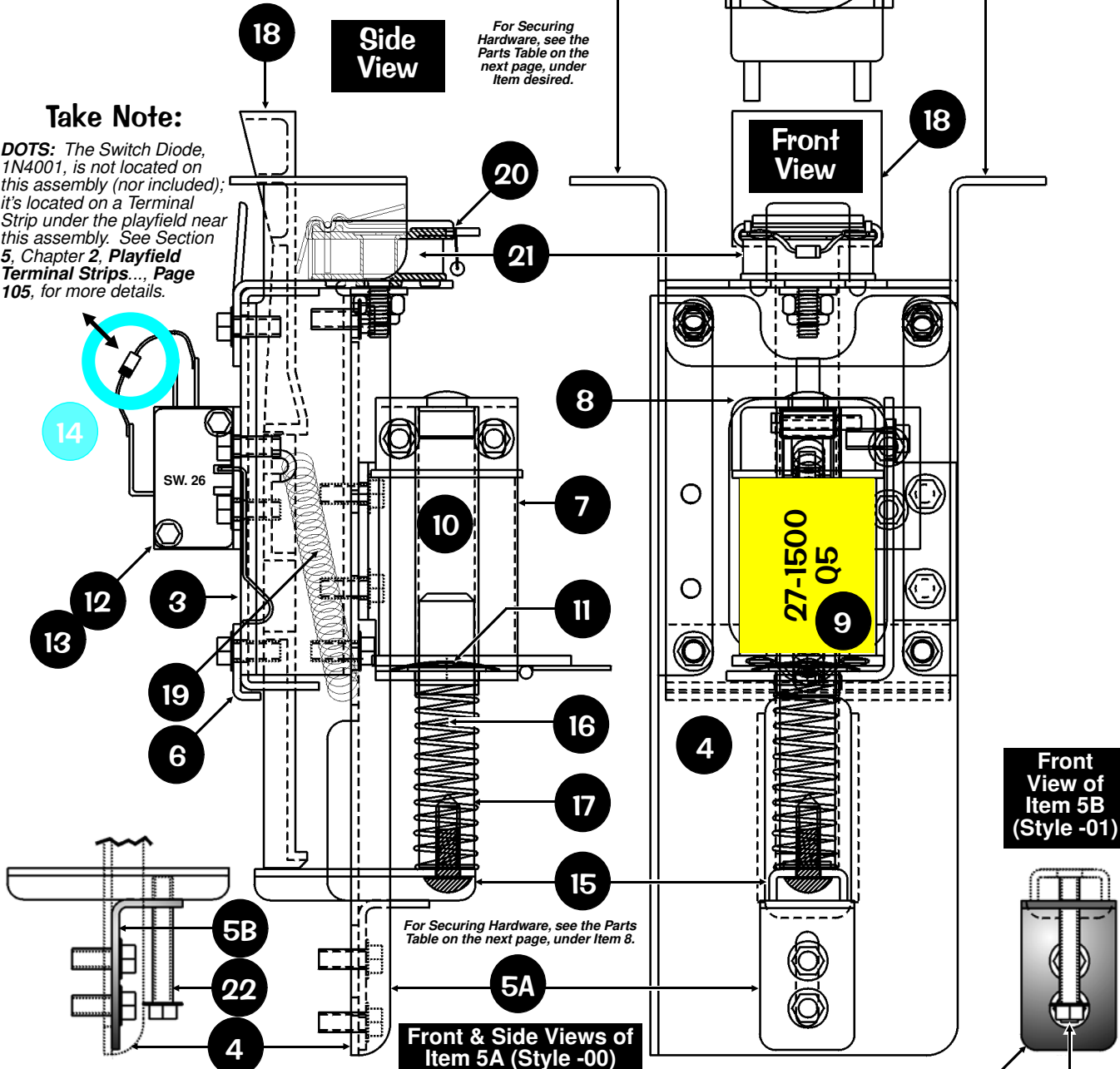


Side View

For Securing Hardware, see the Parts Table on the next page, under Item desired.

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.



For Securing Hardware, see the Parts Table on the next page, under Item 8.

Front & Side Views of Item 5A (Style -00)

Front View of Item 5B (Style -01)

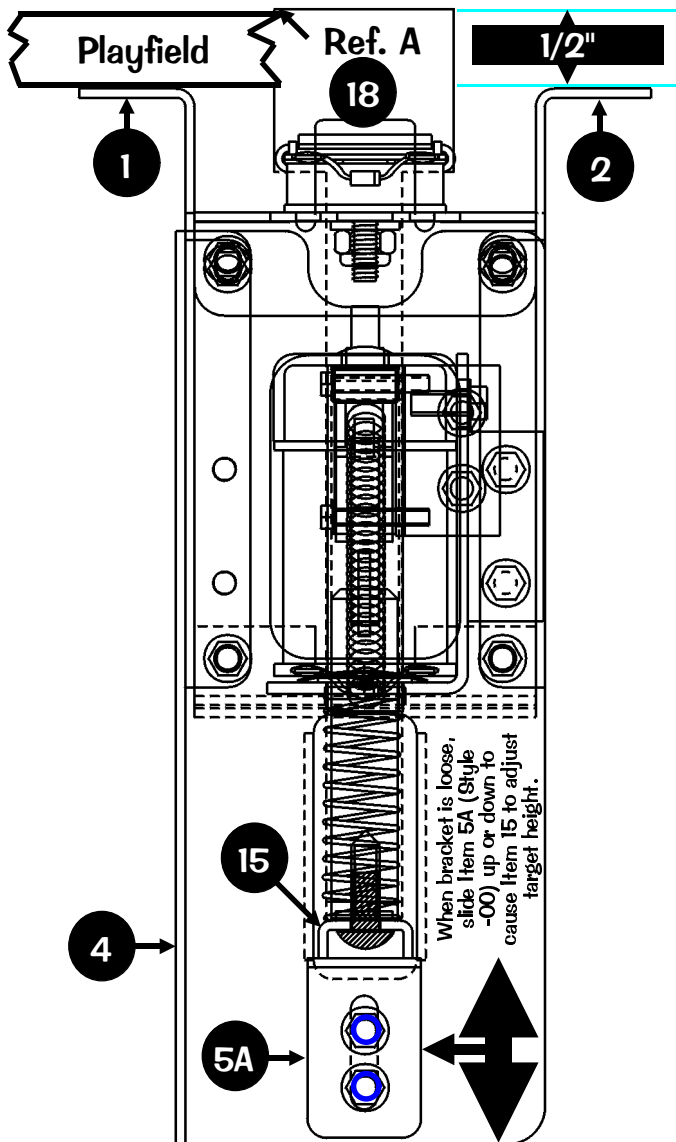
If Item 5A Bracket (-00) is installed, the Securing Hardware must be loosened to Adjust the Target Height by moving Item 15 up or down. If Item 5B Bracket (-01) is installed, Item 22, Height Adjustment Screw, is required to move Item 15 up or down (it's secured through the top of Item 5B Bracket (Style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

Sec. 4: Drawings ...



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

Different Views on the previous page.



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Bracket, Drop Target (Left Side)	1	535-8746-00
2	Bracket, Drop Target (Right Side)	1	535-8746-01
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
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 Nº 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 Nº: 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.	1	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 Nº: 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 Identification & 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.			

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 **not created** where the ball can rest in the target hole above the playfield.

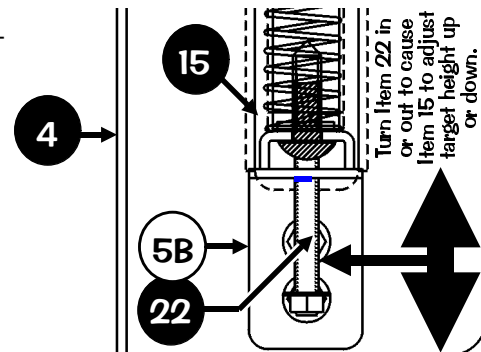
If you have the 5A Bracket (Style -00):

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.**

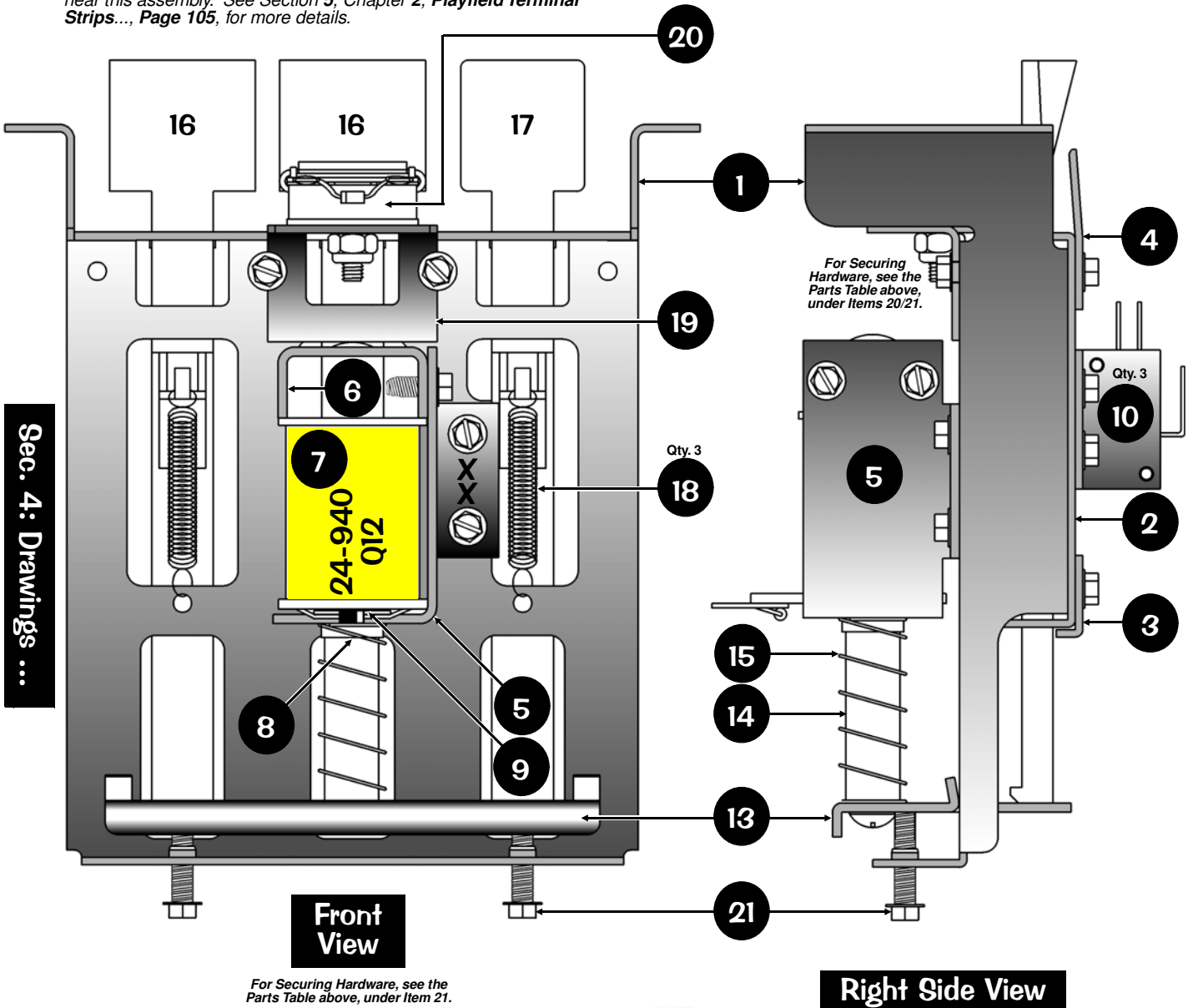
3-Bank Drop Target Assembly, 500-6577-13-78 (Items 1-21)

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

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Bracket, Main Housing	1	535-9126-03	12	Switch Diode, 1N4001 <i>See "Take Note" below.</i>	112-5001-00	
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	13	Bracket, Target Lift (3-Bank D/T)	1	535-9128-03
3	Bracket, Target Retainer (3-Bank D/T)	1	535-9129-03	14	Plunger (Drive Coil)	1	530-5410-00
4	Bracket, Target Back Stop	1	535-9131-03	Item 14 is secured to Item 13 by: #10-32 X 3/8" PPH (Sems) (Qty. 1) (232-5401-00)			
5	Bracket, Coil Housing	1	535-7707-00	To order Items 13-14 assembled with securing hardware, use SPI Nº: 515-7246-00.			
6	Bracket Cap, Coil Housing	1	515-6533-00	15	Compression (Return) Spring	1	266-5020-00
7	Coil, 24-940	1	090-5036-00B	16	Drop Target White (Rollover)	2	545-5533-01
ORDERING ABOVE (ITEM 7) COIL PART Nº WILL INCLUDE:							
—	Diode, 1N4004 (positioned at bottom)	1	112-5003-00	17	Drop Target White (Normal)	1	545-5048-01
8	Coil Sleeve	1	545-5709-00	Note: Individual Decals Not Available. The entire decal sheet must be ordered for replacement. See Sec. 4, Chp. 1, Parts Identification & Location, Game Decals, Page 67.			
9	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00	18	Spring, Target Reset	3	265-5003-00
To order Items 5-9 assembled with securing hardware, use SPI Nº: 515-6535-03.							
10	Bracket, Switch (Universal X-Bank D/T)	3	535-7710-00	19	Bracket, Trip Coil Mounting	1	535-9130-00
11	Switch (Drop Target)	3	180-5158-00	20	Coil, 32-1250 (Mini.) Assembly	1	515-6916-01
Item 11 is secured to Item 10 by: #4-40 X 5/8" HWH TF (Qty. 2) (237-5945-00)							
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	Ordering Note: If 500-6577-13 is unavailable, order the individual part(s) actually required.			
Items 3, 4, 5, 6, 10 & 19 are secured by: #8-32 X 3/8" HWH Swg. (Qty. 2) (237-5975-00)							

Take Note:

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



3-Bank Drop Target Assembly, 500-6577-13-78 (Items 1-21) Continued Different Views & Parts Table on the previous page.

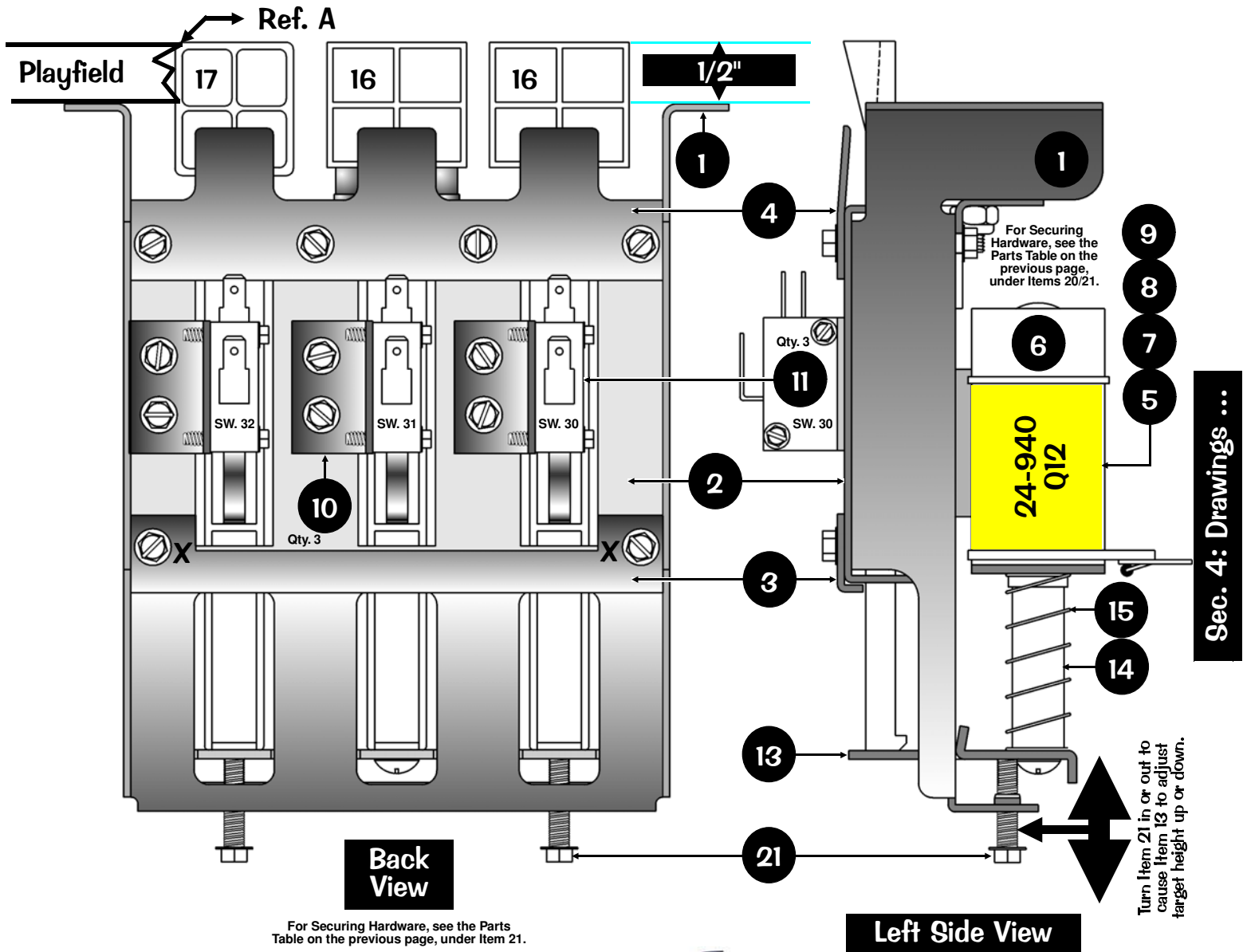
Target Height Adjustment Procedure:

With the Drop Targets (Rollover) (Item 16) and the Drop Target (Normal) (Item 17) in the **DOWN POSITION**, 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 **BALLTRAP** is *not created* 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.

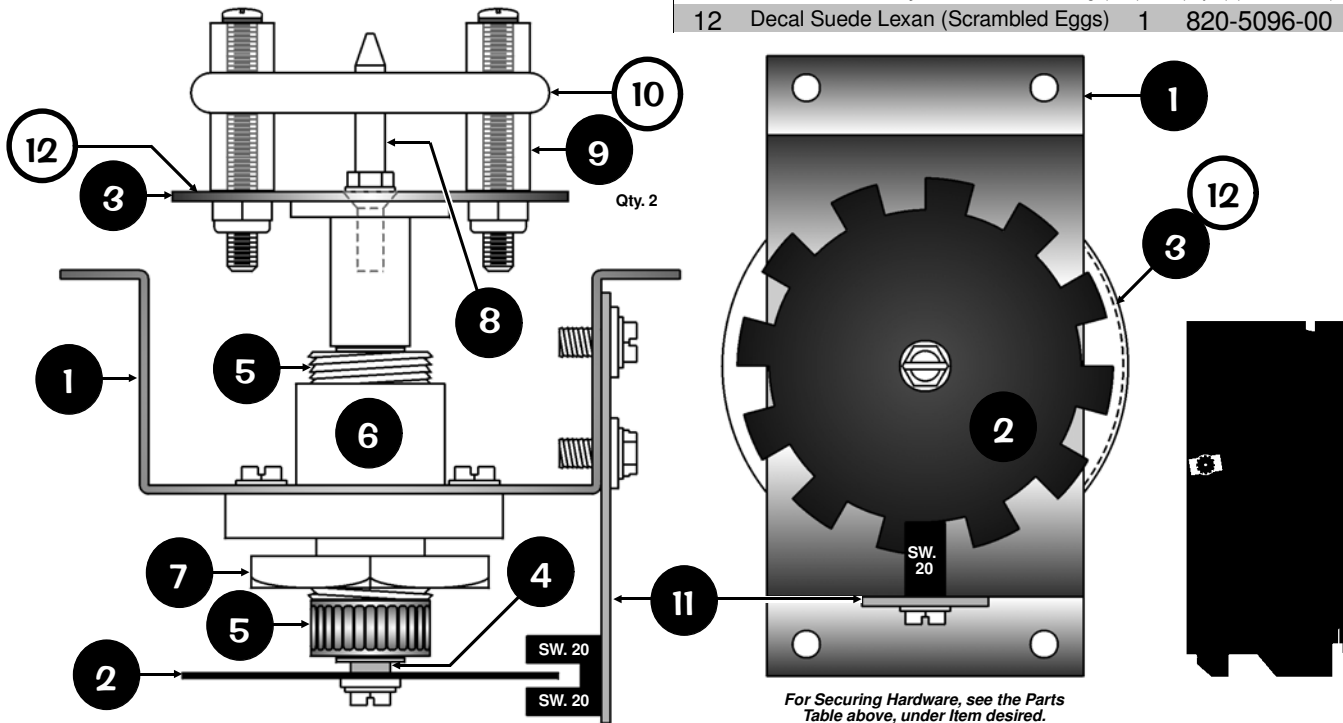
Drop Target Removal Procedure:

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).

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Bracket, Main House	1	535-9113-00	6	Gland (Nylon Bushing)	1	530-5616-00
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	7	Lock Nut 3/4"-16 CRFTCH-G102-110-18	1	530-5628-00
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	8	Mini-Post MS / #10-32 Bot. .4" Thread	1	530-5005-01
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	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)							
5	Adjusting Screw Assembly	1	515-7261-00	10	3/4" I.D. Ring White	1	545-5348-54
Ordering above Item 5 will include: Adjusting Screw (530-5617-00) and Bearing-Bronze Flange (283-5002-00)							
				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

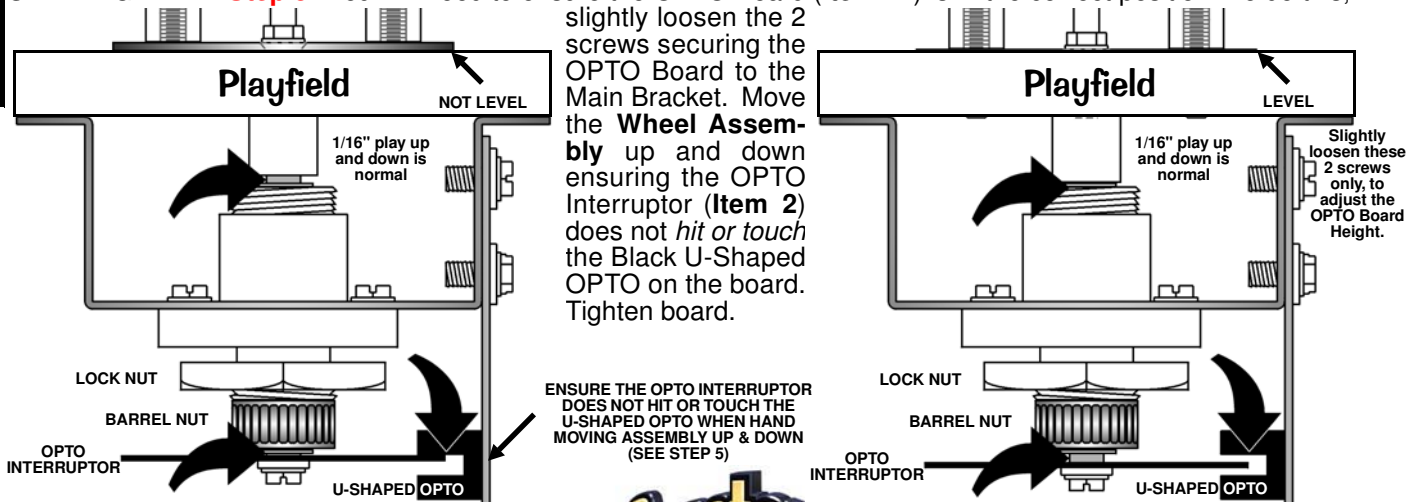


For Securing Hardware, see the Parts Table above, under Item desired.

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 *slight* 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,



Sec. 4: Drawings ...



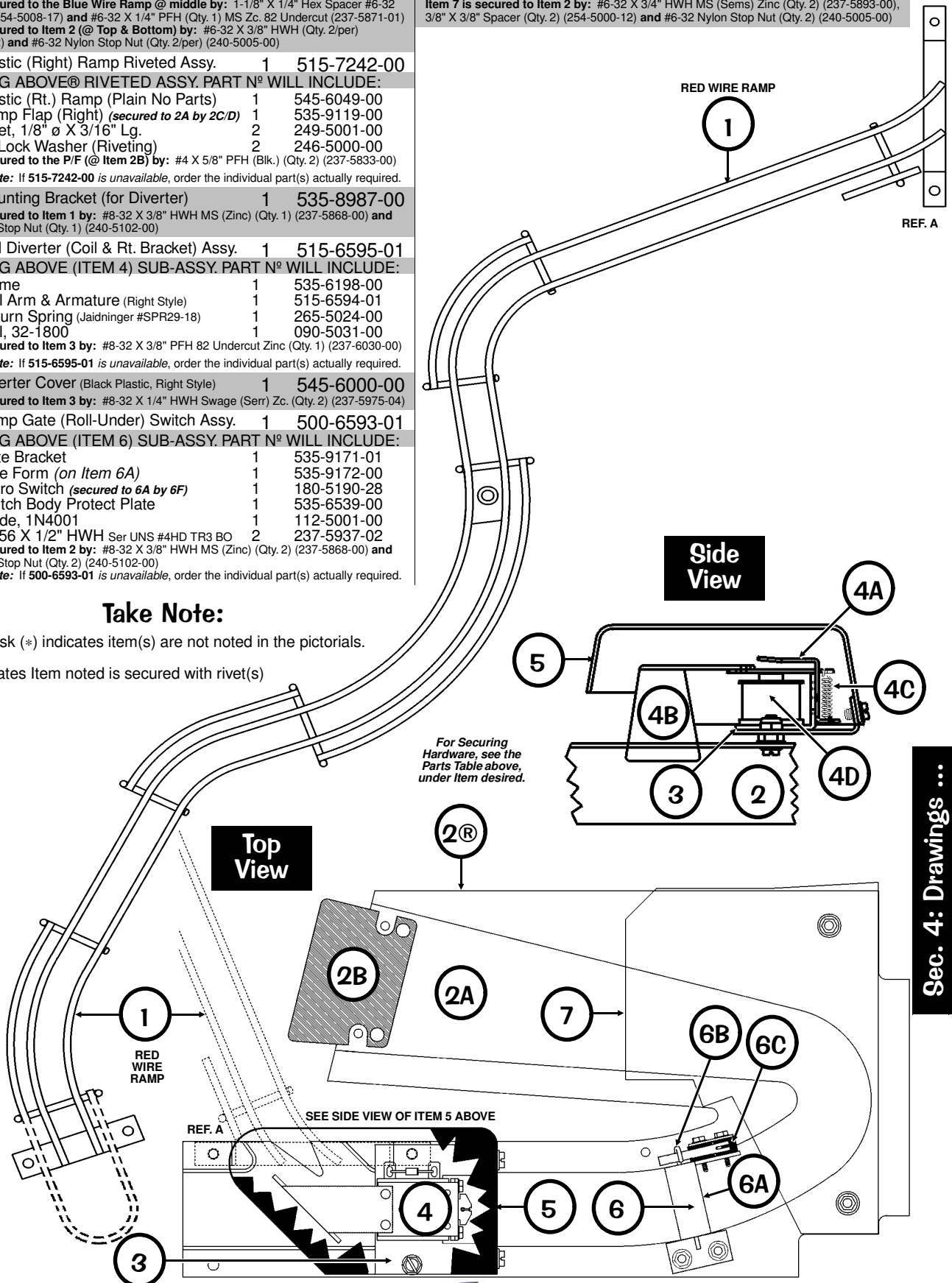
Red Wire Ramp and Right Plastic Ramp Individual Parts Only (Items 1-7)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Red Wire Ramp	1	535-9123-00	7	Clear Plastic (Butyrate) (Right Cover)	1	830-5994-00
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)				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)			
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.							

Take Note:

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

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



Sec. 4: Drawings ...

VUK (Vertical Up-Kicker, Right Style) Assembly, 500-6290-11 (Items 1-12)
 Launches ball into the Rocket Scoop (next page).

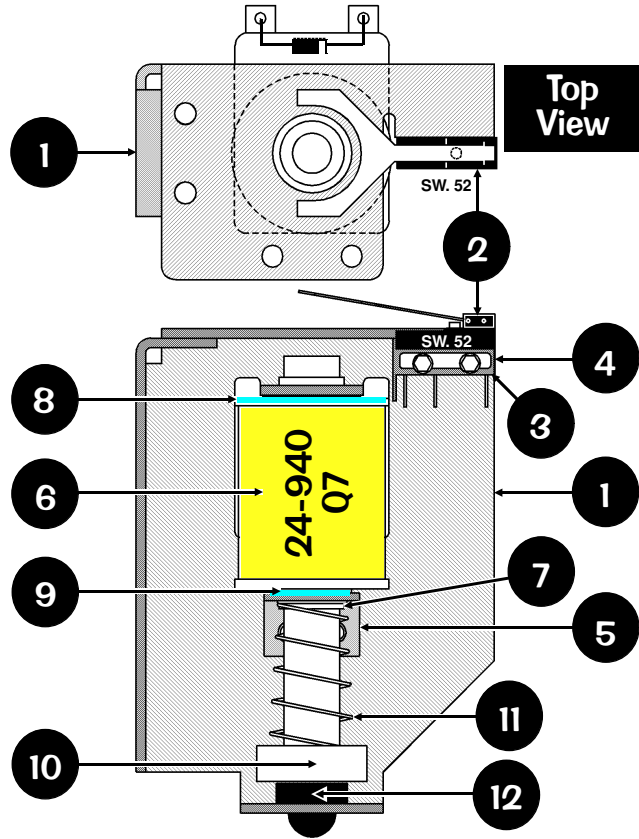
**Use this VUK (Coil) if the Rocket Lift Tube
 has a Top Gate.
 See the Next Page for more details.**

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.



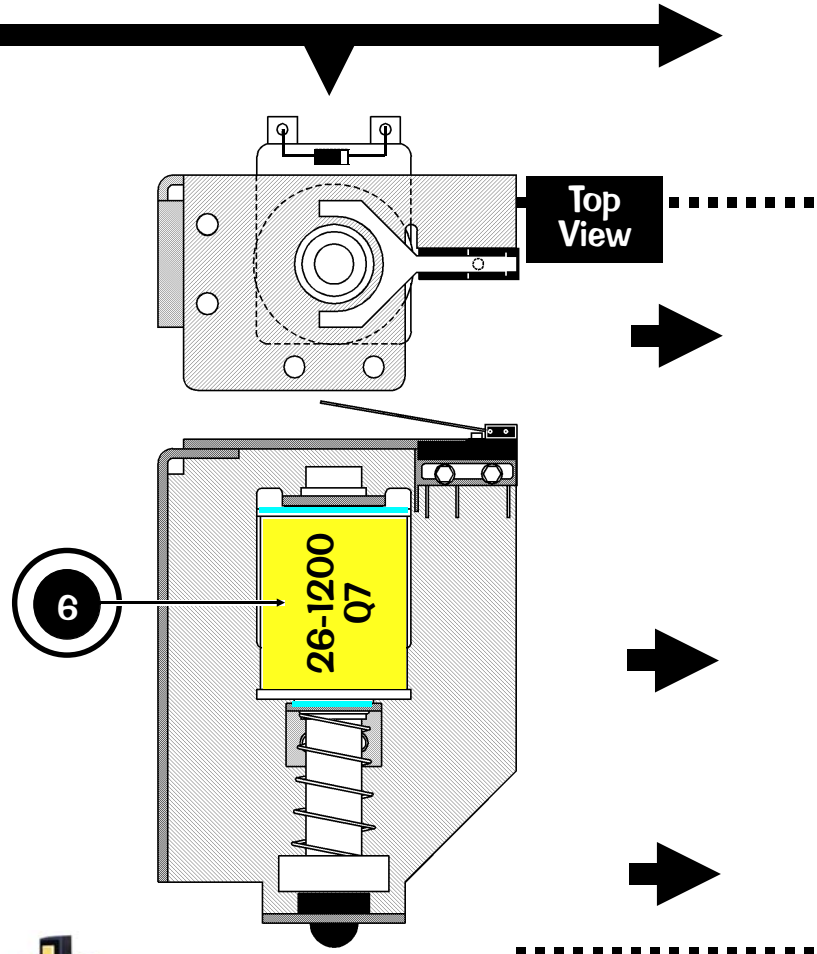
VUK (Vertical Up-Kicker, Right Style) Assembly (500-6290-01) (Items 1-12)
 Launches ball into the Rocket Scoop (next page).

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
<i>Items 1-5 identical to above Items 1-5.</i>			
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.

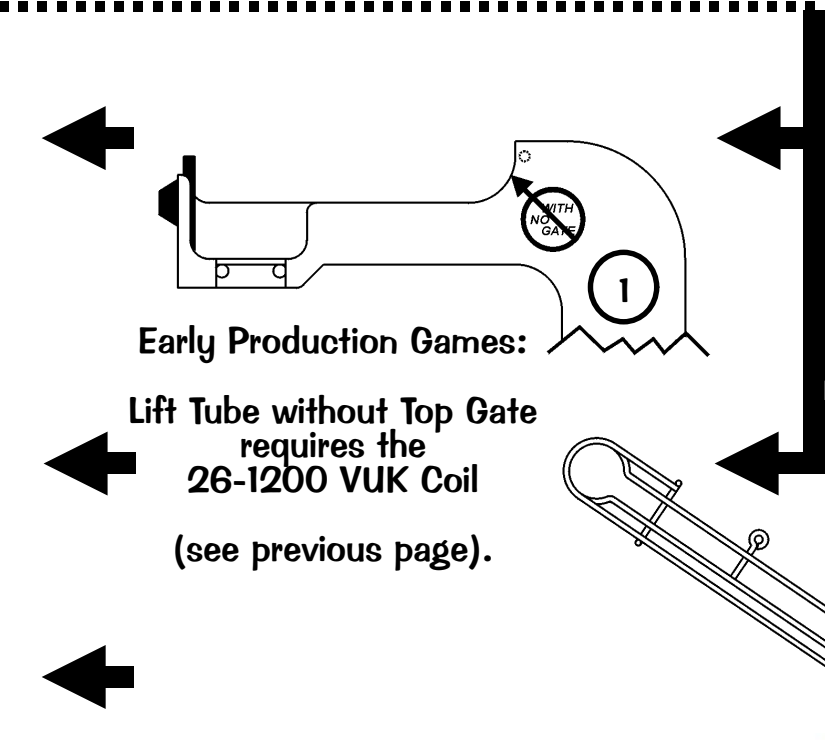
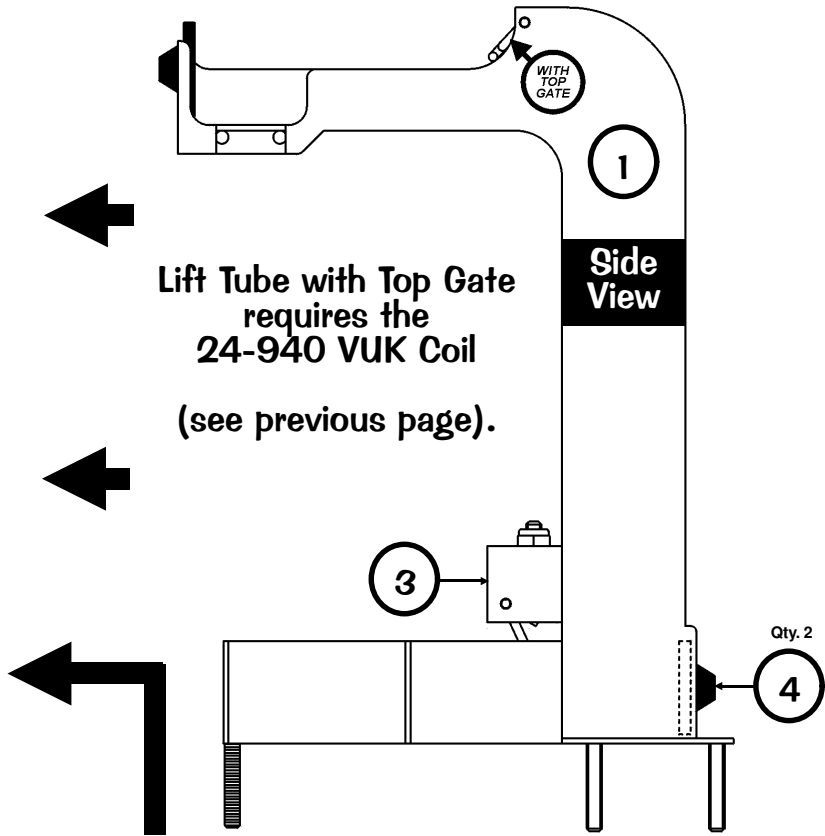
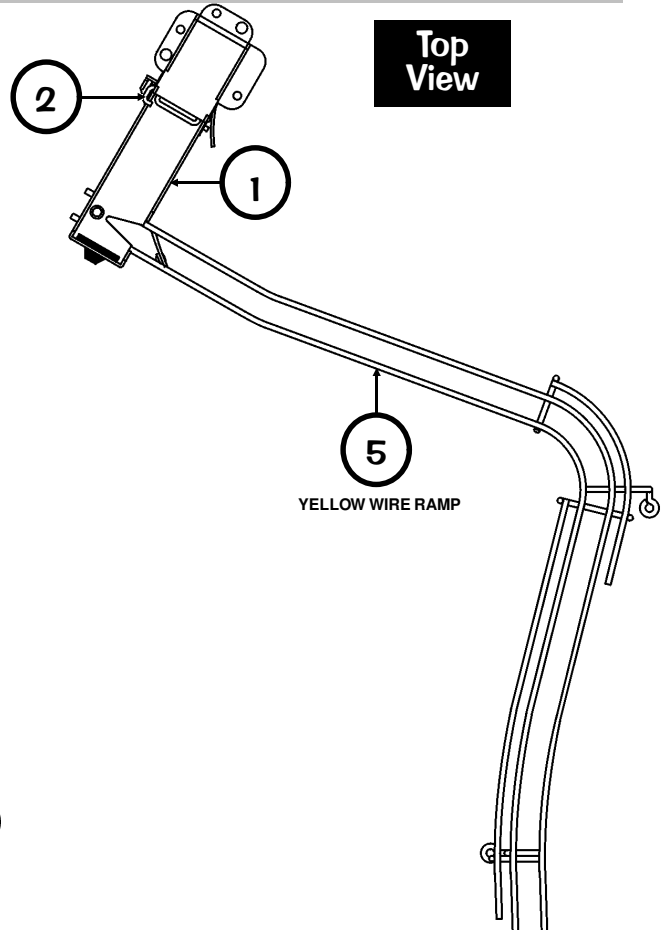


Sec. 4: Drawings ...



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

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Rocket Lift Tube	1	535-9164-00	4	Deflector Pad (Bumper)	2	545-5428-00
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 Identification & Location, Game Decals, Page 67.				5	Yellow Wire Ramp	1	535-9125-00
2	Ball Gate (Top) (See Note Below)	1	535-9204-00	Item 5 secured at the top of Item 1 by: #6-32 X 3/8" PFH (Qty. 1) (237-5850-00)			
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)							



Take Special Note:

Early Production Games:
 The Lift Tube (Item 1) did not have Ball Gate (Wireform) and **is not required** if the VUK Coil remains 26-1200. If replacing the Lift Tube, it may have the holes for a Ball Gate.

Do not order the Ball Gate (Item 2) unless your VUK Coil is 24-940. Replace the VUK Coil with the original coil strength. Keep this combination in mind:

Gate on TOP of the Lift Tube = 24-940 VUK Coil

No Gate on TOP of the Lift Tube = 26-1200 VUK Coil

Sec. 4: Drawings ...

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	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Blue Wire Ramp	1	535-9124-00	4	Ball Diverter (Coil & Lt. Bracket) Assy.	1	515-7288-00
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)				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 (Jaidinger #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.			
2®	Plastic (Left) Ramp Riveted Assy.	1	515-7243-00	5	Diverter Cover (Black Plastic, Left Style)	1	545-6059-00
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.				Item 5 is secured to Item 3 by: #8-32 X 1/4" HWH Swage (Serr) Zc. (Qty. 2) (237-5975-04)			
3	Mounting Bracket (for Diverter)	1	535-8987-00	6®	Loop (Metal) Ramp Assembly	1	500-6571-00
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)				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.

FOR LATCHING GATE
(GHOST) AND
ASSOCIATED PARTS,
SEE PAGE 97.

For Top View of Metal Rail (Center Enter, Right Side)
used as a Ramp Guard, see Sec. 4, Chp. 1, Parts
Identification & Location, Item 15, Page 68.

BLUE WIRE RAMP

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

FOR TROLL SHAKE UP
& DOWN ASSEMBLY
AND ASSOCIATED
PARTS, SEE PAGE 96.

Qty. 2

PLASTIC
RAMP
CONTINUES
NEXT PAGE

Sec. 4: Drawings ...

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	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
8	Clear Troll Acrylic Tank	1	545-6058-00	13®	Screened Plastic (Butyrate) -13	1	from 830-5993-XX
<i>Item 8 is secured to Item 7 by: #8-32 X 3/8" HWH Swg. (Serr) Zinc (Qty. 2) (237-5975-00)</i> <i>Note: Individual Decal Not Available. The entire decal sheet must be ordered for replacement. See Sec. 4, Chp. 1, Parts Identification & Location, Game Decals, Page 67.</i>							
9	Ramp Gate (Roll-Under) Switch Assy.	3	500-6593-01	14	Clear Plastic (Butyrate) (Lt. Cvr.) -6	1	from 830-5993-XX
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 <i>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)</i> Ordering Note: If 500-6593-01 is unavailable, order the individual part(s) actually required.							
10	Deflector Pad (Rubber Bumper)	1	545-5428-00	15	Clear Plastic (Butyrate) -15	1	from 830-5993-XX
11	Impact Plate (with Pem Stud)	1	535-9203-00	<i>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)</i> 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.			
12®	Bracket (Ride the...), Sign Mounting	2	535-8941-02	16	#555 IDC Snap-On Socket No Diode	1	077-5216-01
<i>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)</i>							
13®	Bracket (Ride the...), Sign Mounting	2	535-8941-02	17	#906 Wedge Base Bulb (Clear)	1	165-5004-00
<i>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)</i>							
14	Clear Plastic (Butyrate) (Lt. Cvr.) -6	1	from 830-5993-XX	18	Mini-Mars Lite Cover (Clear)	1	550-5030-01
15	Clear Plastic (Butyrate) -15	1	from 830-5993-XX	19	#555 Wedge Base Socket (Laydown)	2	077-5026-01
16	#555 IDC Snap-On Socket No Diode	1	077-5216-01	20	Light Reflector (Silver Plastic)	2	545-5409-01
17	#906 Wedge Base Bulb (Clear)	1	165-5004-00	21	#555 Wedge Base Bulb (Clear)	2	165-5002-00
18	Mini-Mars Lite Cover (Clear)	1	550-5030-01	<i>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)</i>			
19	#555 Wedge Base Socket (Laydown)	2	077-5026-01	22	Mini-Jewel Post Clear	1	550-5052-01
20	Light Reflector (Silver Plastic)	2	545-5409-01	<i>Item 22 is secured to Item 2 by: #6 X 3/8" HWH AB (Zinc) (Qty. 1) (234-5000-00)</i>			
21	#555 Wedge Base Bulb (Clear)	2	165-5002-00	23*	Cable Ties	11	040-5001-01

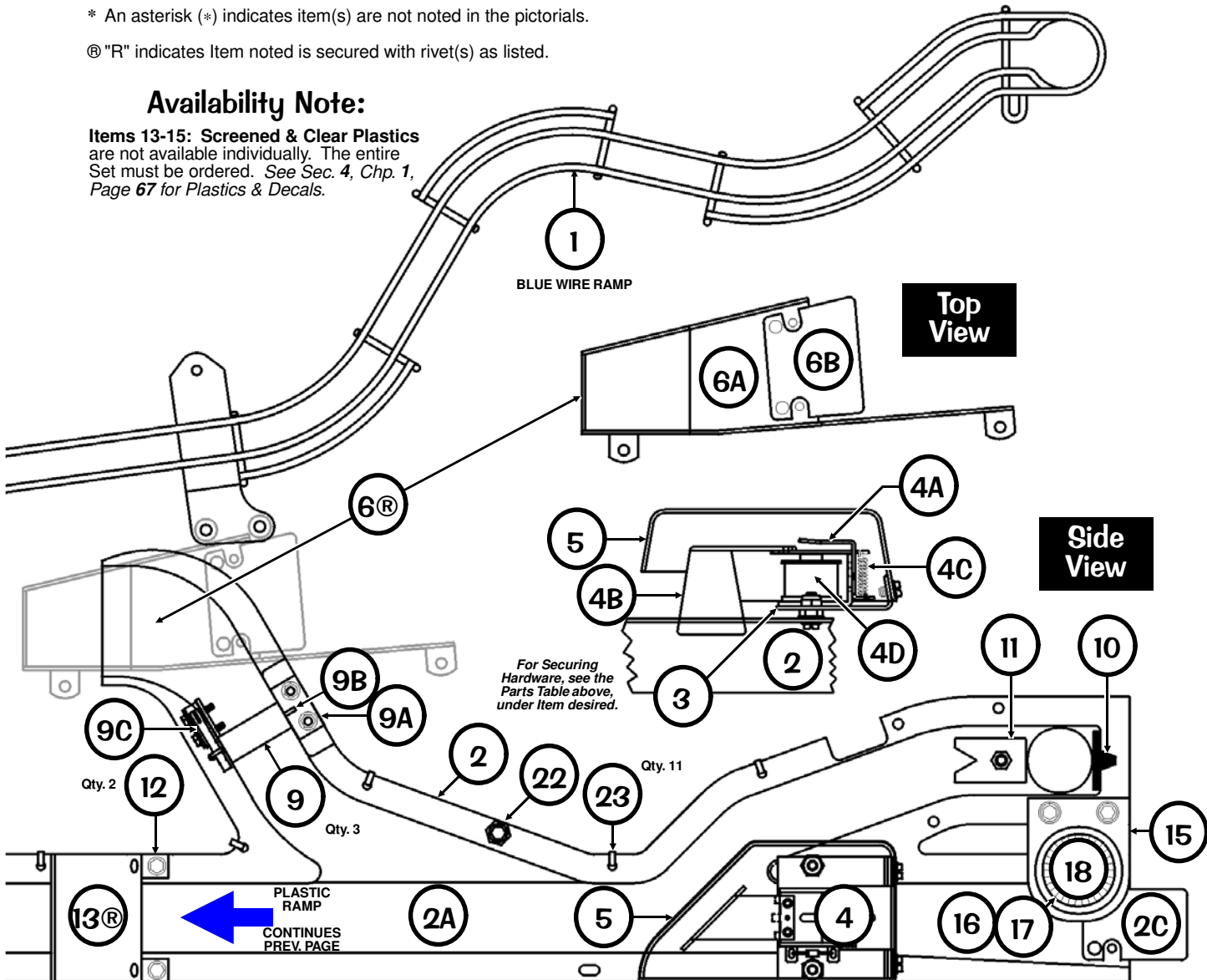
Take Note:

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

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

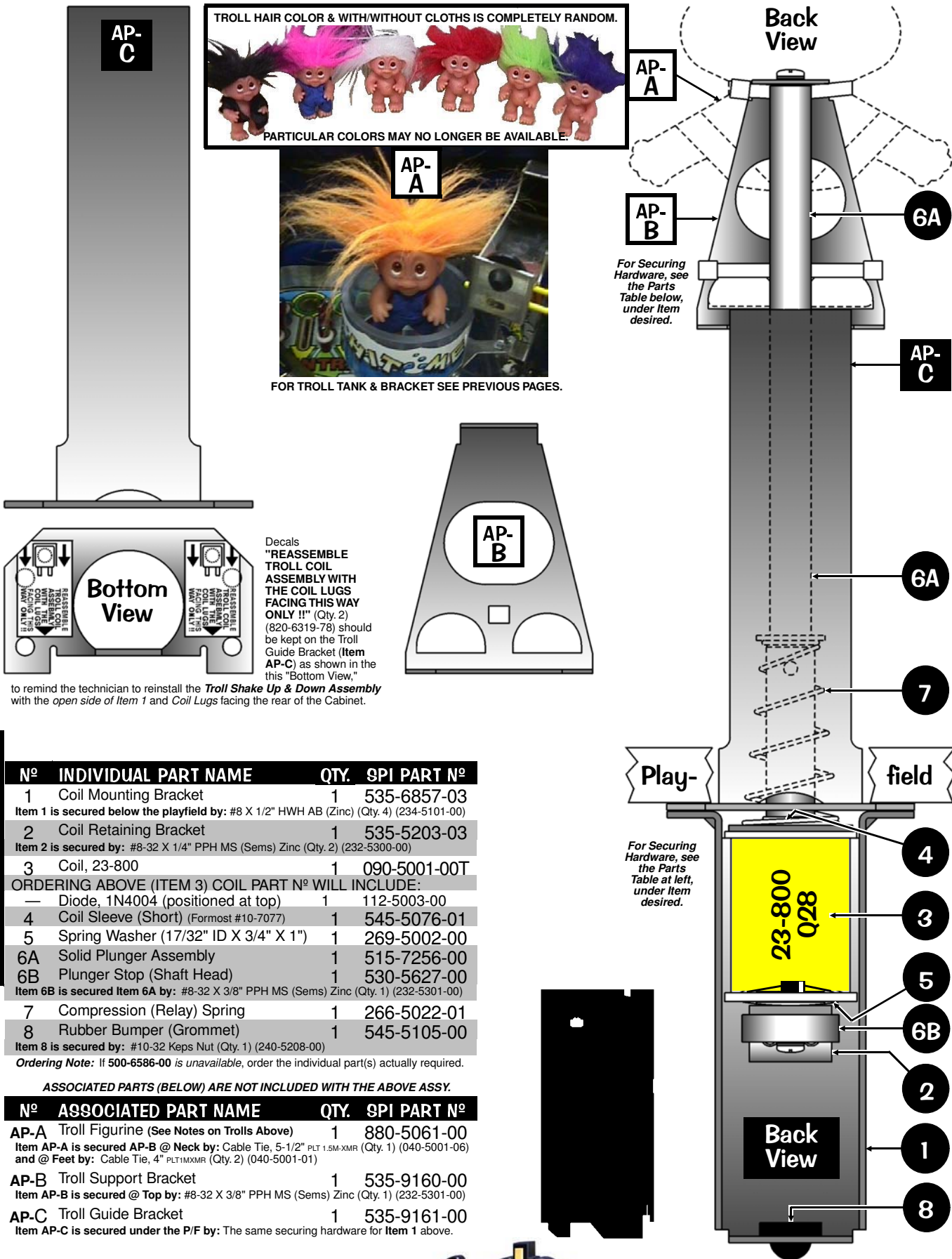
Availability Note:

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.



Sec. 4: Drawings ...

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)



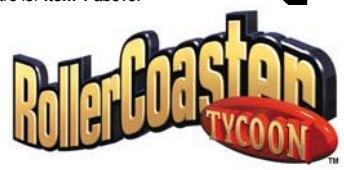
Sec. 4: Drawings ...

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.

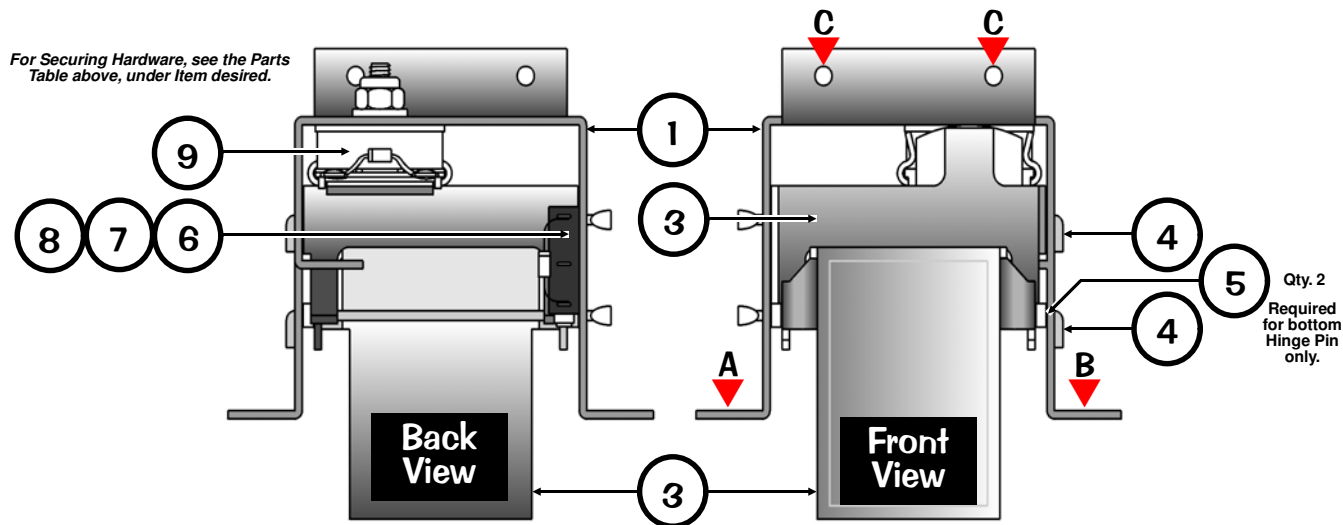
Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
AP-A	Troll Figurine (See Notes on Trolls Above)	1	880-5061-00
Item AP-A is secured AP-B @ Neck by: Cable Tie, 5-1/2" PLT 1.5M-XMR (Qty. 1) (040-5001-06) and @ Feet by: Cable Tie, 4" PLT1MXMR (Qty. 2) (040-5001-01)			
AP-B	Troll Support Bracket	1	535-9160-00
Item 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).

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Bracket, Main Housing	1	535-9167-00	7	Switch Body Protect Plate	1	535-6539-00
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)				Items 6-7 are secured by: #2-56 X 1/2" HWH MS (Serr) Zc TF 3/16" (Qty. 2) (237-5937-02)			
2	Latch	1	535-9168-00	8	Switch Diode, 1N4001	1	112-5001-00
3	Gate	1	535-9169-00	9	Coil, 32-1250 (Mini.) Assembly	1	515-6916-01
4	Hinge Pin	2	535-9170-00	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).			
5	Nylon Washer .065" ID X .179" OD X .078"	2	242-5069-00	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)			
6	Micro Switch (Roller Actuator)	1	180-5119-00	Note: Individual Decals Not Available. The entire decal sheet must be ordered for replacement. See Sec. 4, Chp. 2, Parts Identification & 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.**

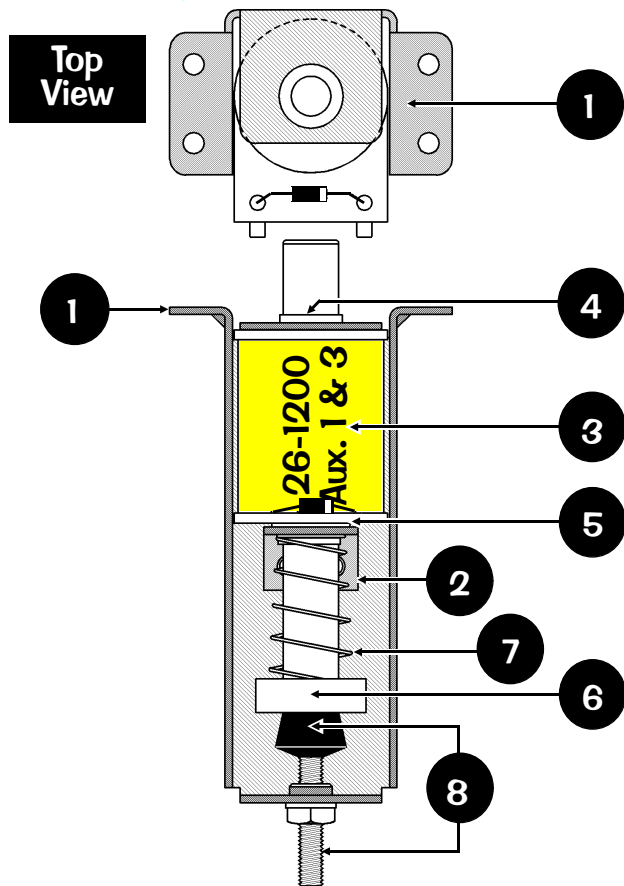
Blue Pages:
For **Ramps**, see **Pages 91-95** earlier in this chapter.

Sec. 4: Drawings ...

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

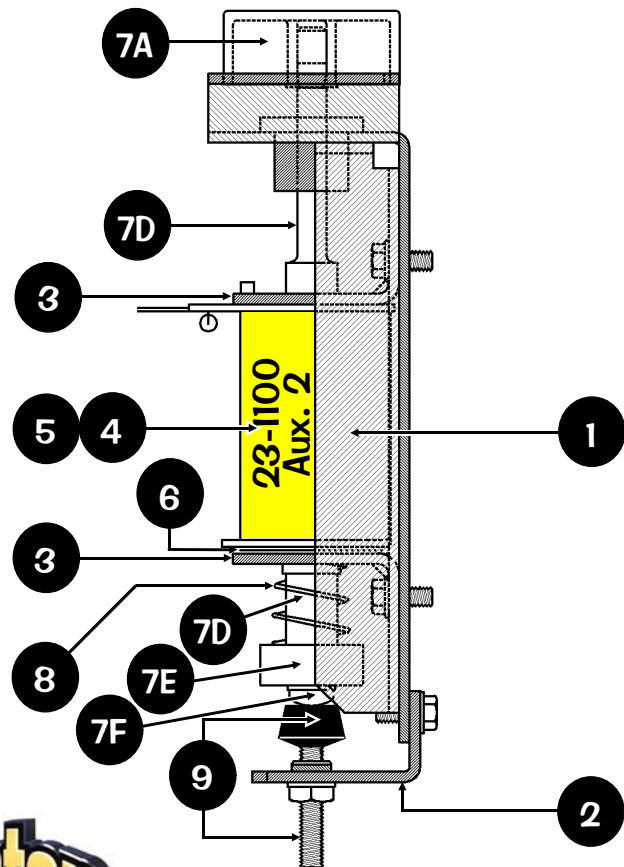
Ordering Note: If 515-6844-00 is unavailable, order the individual part(s) actually required. Item 7D, part of Item 7, Plunger & Shaft Sub-Assembly, is 1 piece and cannot be ordered separated.

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.



Sec. 4: Drawings ...



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:*

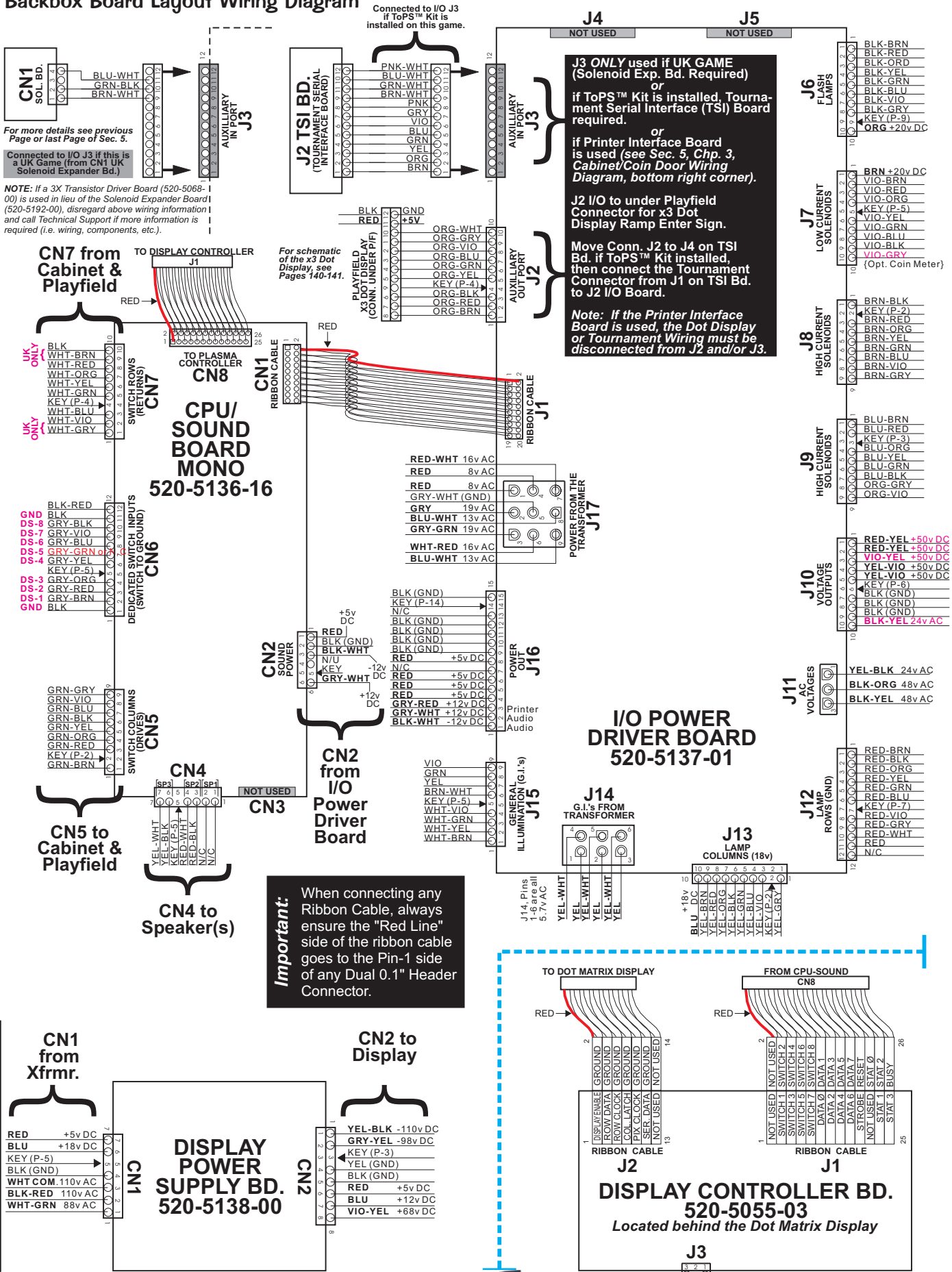
COILS DETAILED CHART TABLE

High Current Coils Group 1		Drive Transistor	Driver Output 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
<i>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.</i>									
#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 Output 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 Output 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
<i>D iode O n T ermi n al S tri p (if noted)</i>									
Low Current Coils Group 2		Drive Transistor	Driver Output 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
<i>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)</i>									
Auxiliary (UK ONLY)		Drive Transistor	Driver Output 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

Sec. 5: Schematics ...

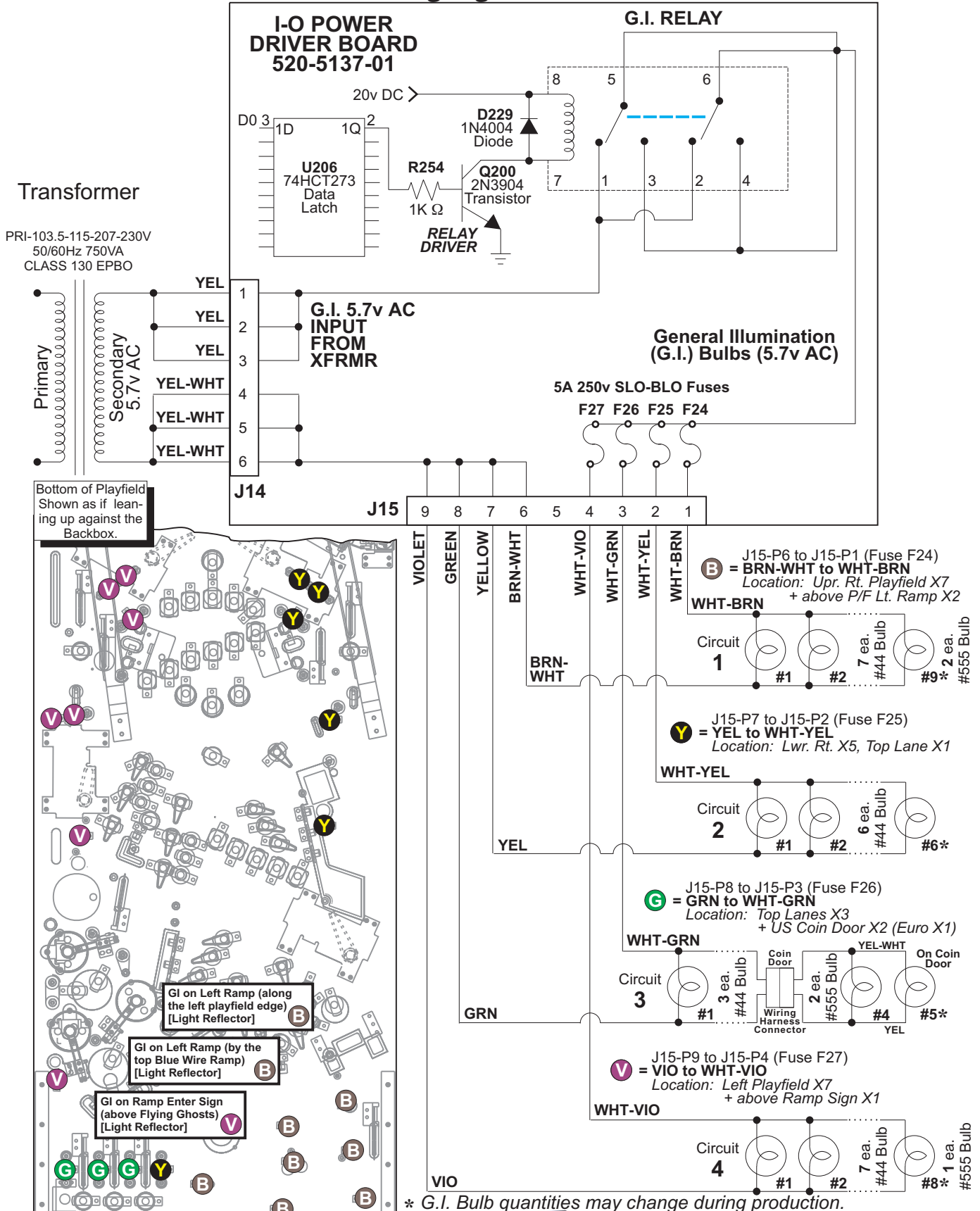


Backbox Board Layout Wiring Diagram



Playfield Wiring

General Illumination Circuit Detailed Wiring Diagram



Sec. 5: Playfield ...



Playfield Switch 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.

For Switches: 30-32, 39 & 52

Diode On Terminal Strip

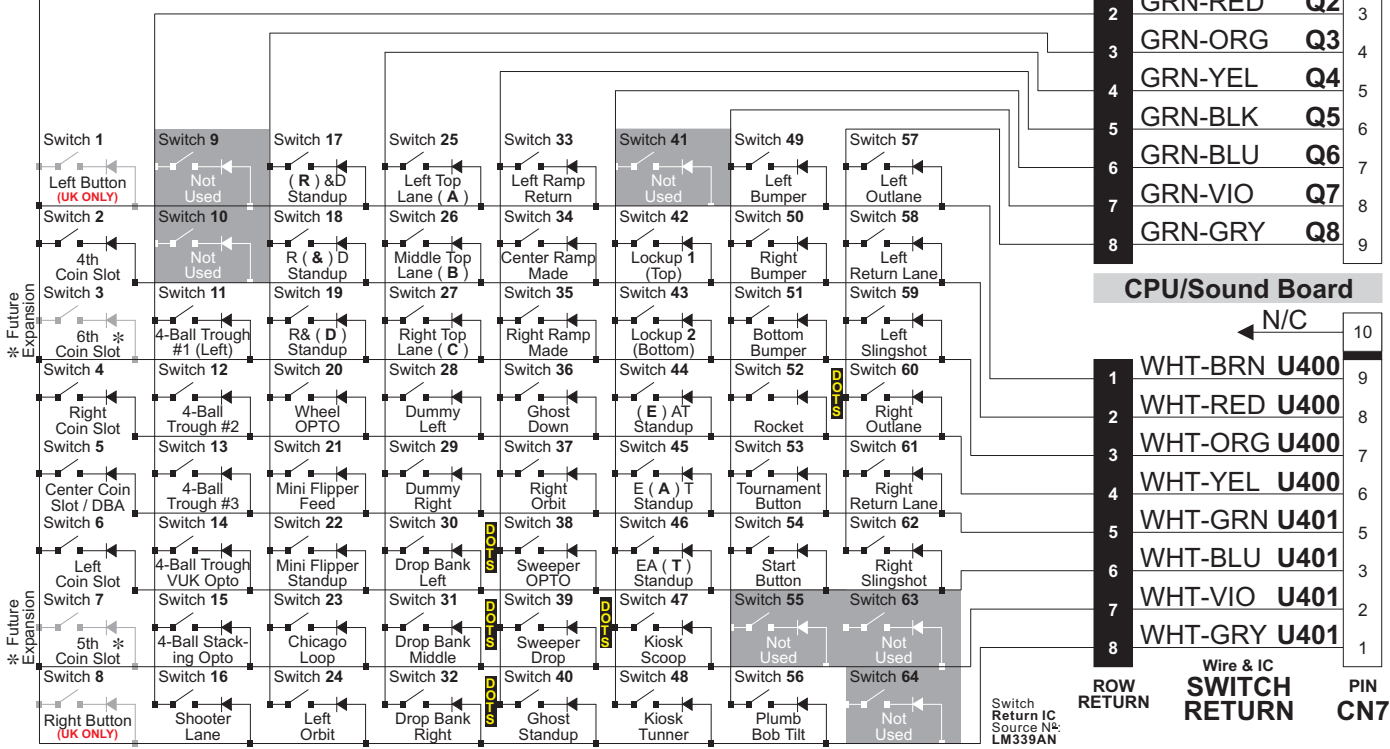
Diode On Diode Board

Switch Drive Transistor Source N#: 2N3904

SWITCH DRIVE

Wire & Transistor

CN5 PIN



Playfield Lamp 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.

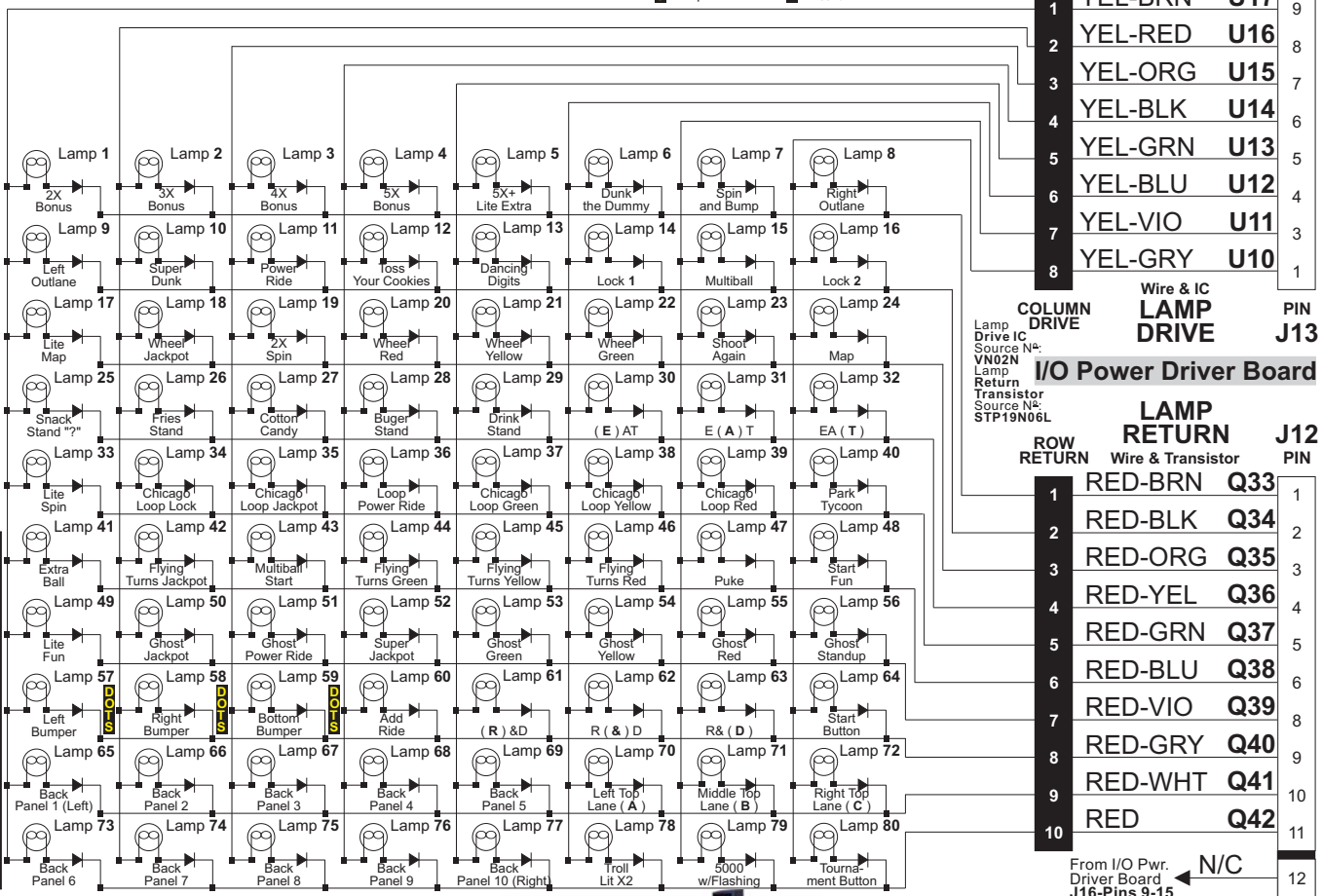
For Lamps: 57-59

Diode On Terminal Strip

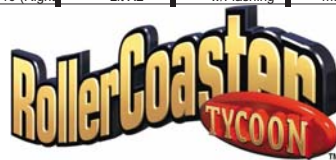
Diode On Diode Board

J13-Pin 10 is Power Out for +18v DC to the Display Power Supply Bd at CN1-Pin 6

BLUE



Sec. 5: Playfield ...

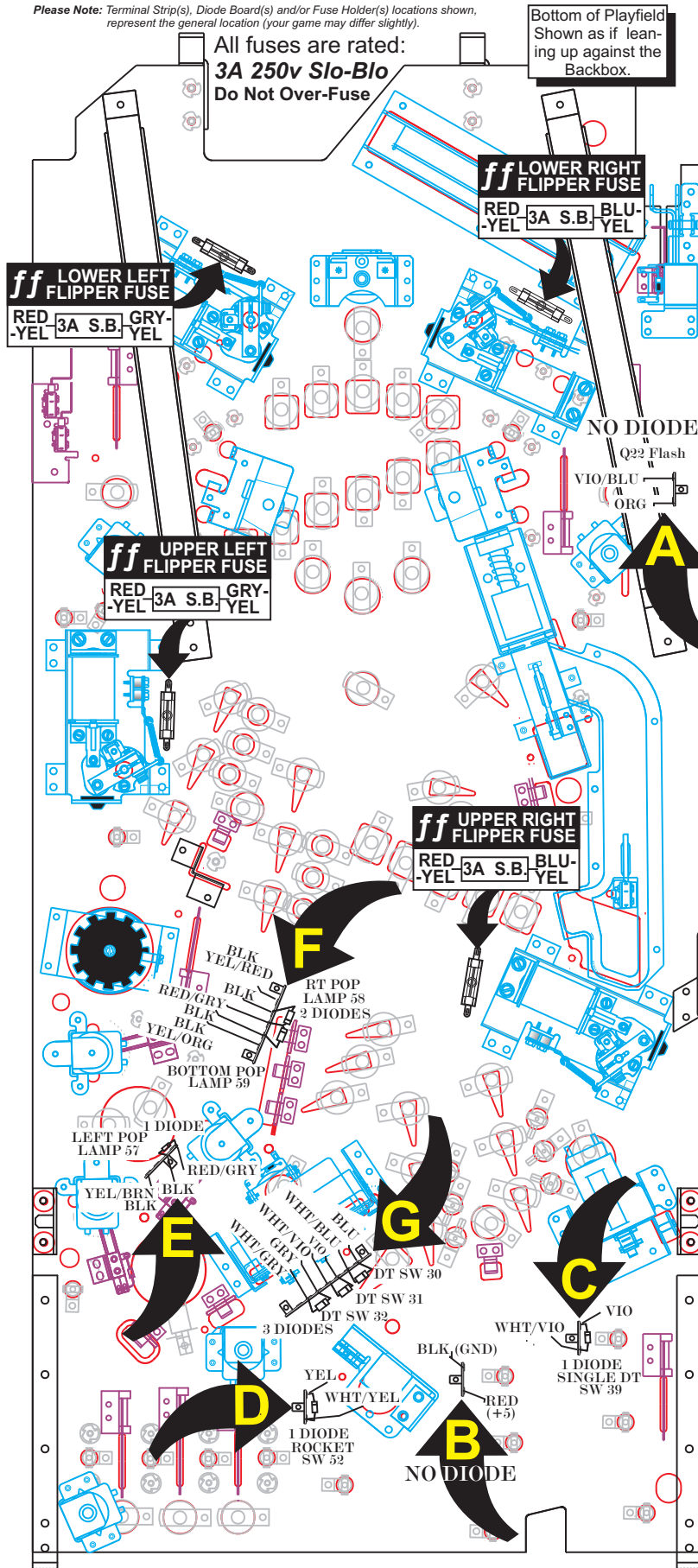


Playfield Terminal Strips, Fuses & Misc. Wiring Descriptions & Locations

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

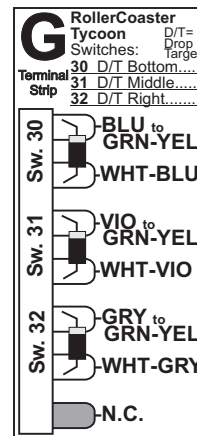
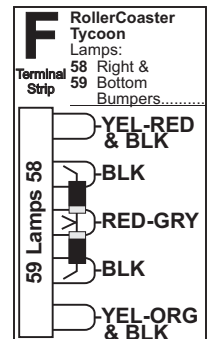
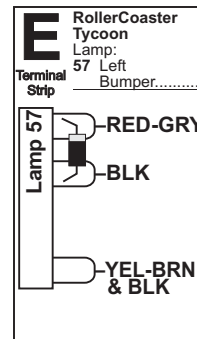
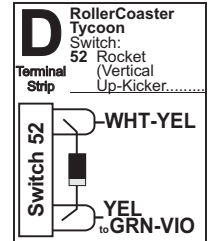
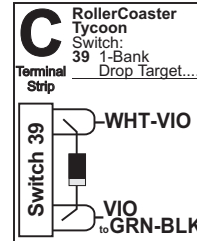
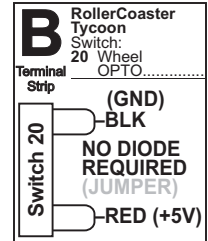
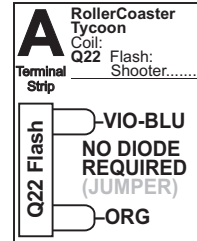
All fuses are rated:
3A 250v Slo-Blo
Do Not Over-Fuse

Bottom of Playfield
Shown as if leaning
up against the
Backbox.



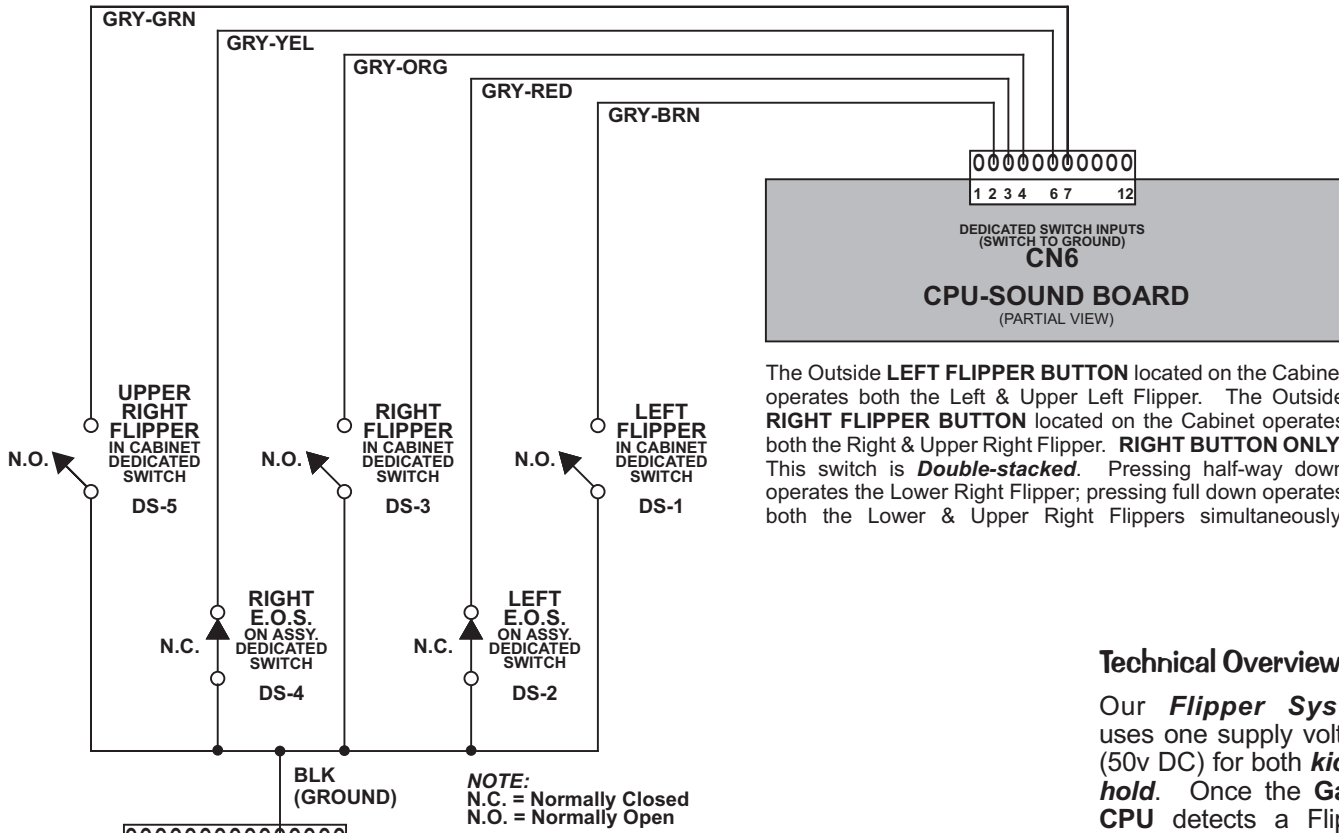
Explanation:

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: **"Diode On Terminal Strip"**) or on a Diode Board (noted by **"DODB"** meaning: **"Diode On Diode Board"**).



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

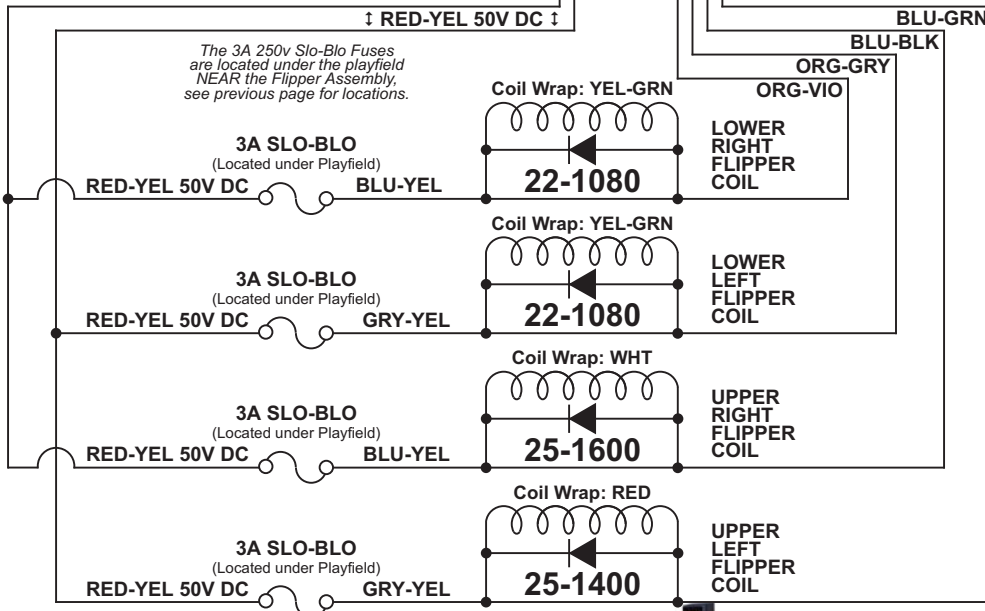
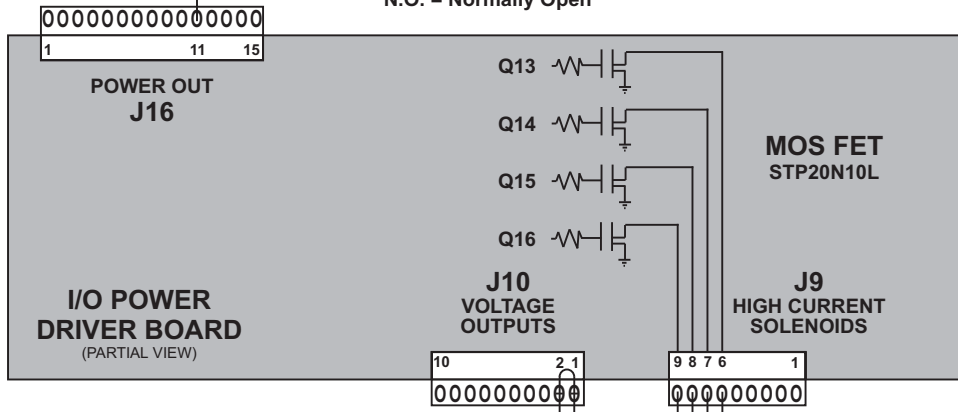


The Outside **LEFT FLIPPER BUTTON** located on the Cabinet operates both the Left & Upper Left Flipper. The Outside **RIGHT FLIPPER BUTTON** located on the Cabinet operates both the Right & Upper Right Flipper. **RIGHT BUTTON ONLY:** This switch is **Double-stacked**. Pressing half-way down operates 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 40msec 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 1msec every 12msecs for the duration of the hold cycle.

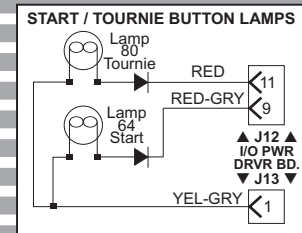
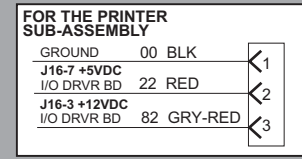
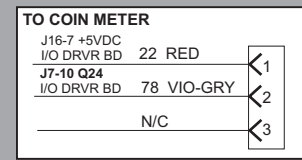
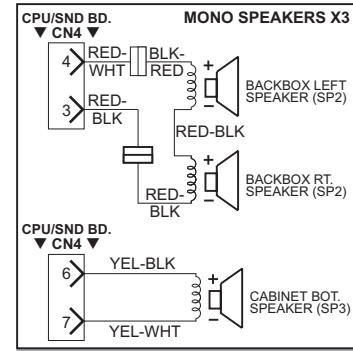
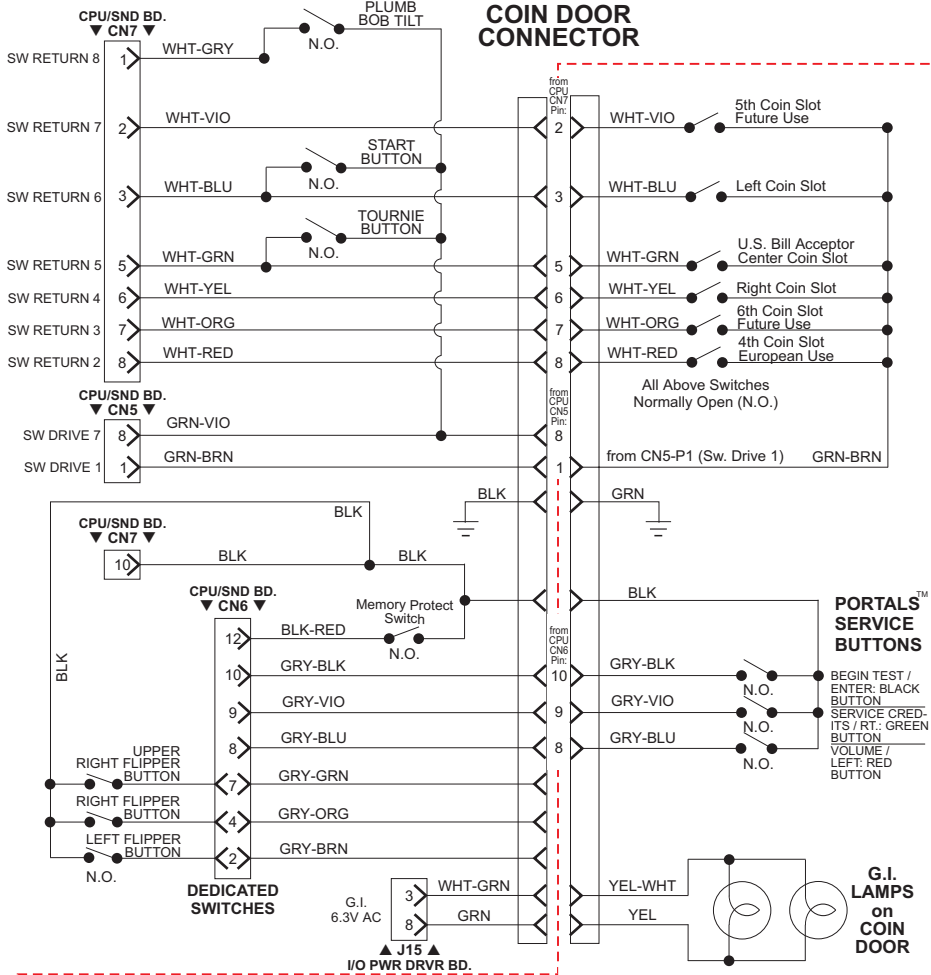
The **E.O.S.** (End-Of-Stroke) **Switch** serves the same function as before as it prevents foldback when the player has the flipper energized to capture balls. The **E.O.S. Switch** is a normally closed switch which opens approximately 1/16" when the flipper is energized. The **Game CPU** will detect a switch closure if the flipper bat is forced back by a high velocity shot or rebound on the playfield and will apply another 40msec pulse of 50v DC to the coil.



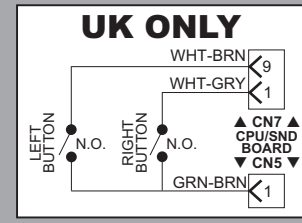
Sec. 5: Playfield ...



Cabinet / Coin Door Wiring Diagram

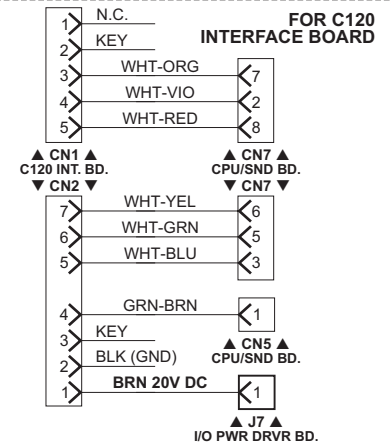
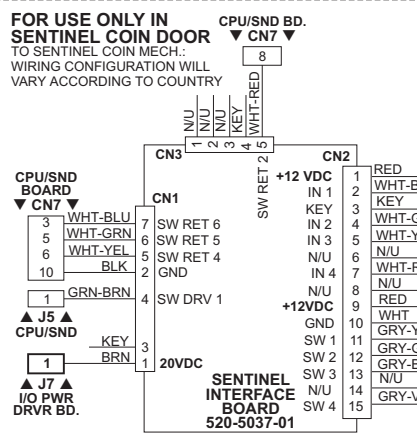
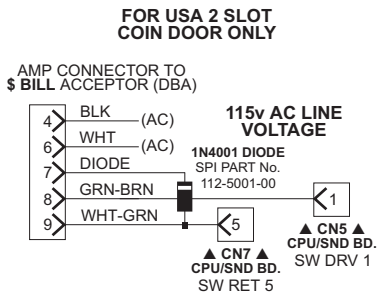
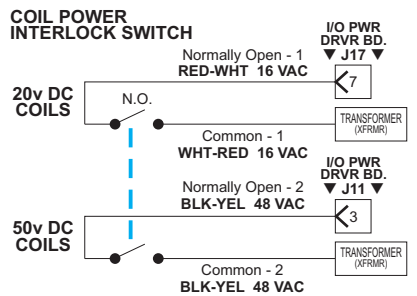
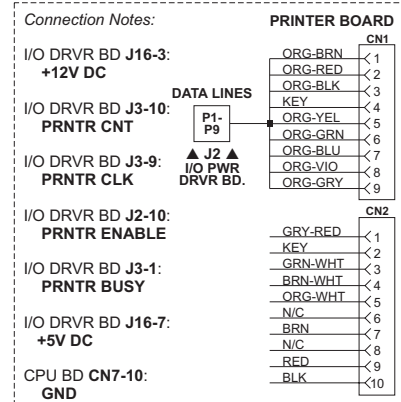


UK ONLY: 2 Extra Cabinet Buttons for the Post Save™ Feature are used. The Left Button operates the Left Outlane Ball Deflector. The Right Button operates the Right Outlane Ball Deflector. Both buttons pushed together operate the Center Up/Down Post. Both buttons are located under the Flipper Buttons.



PRINTER INTERFACE OPTIONAL

Cable Wiring Harness SPI Part N°: 036-5408-00
 RS-232 Printer Interface Board SPI Part N°: 520-5069-00



COIN DOOR

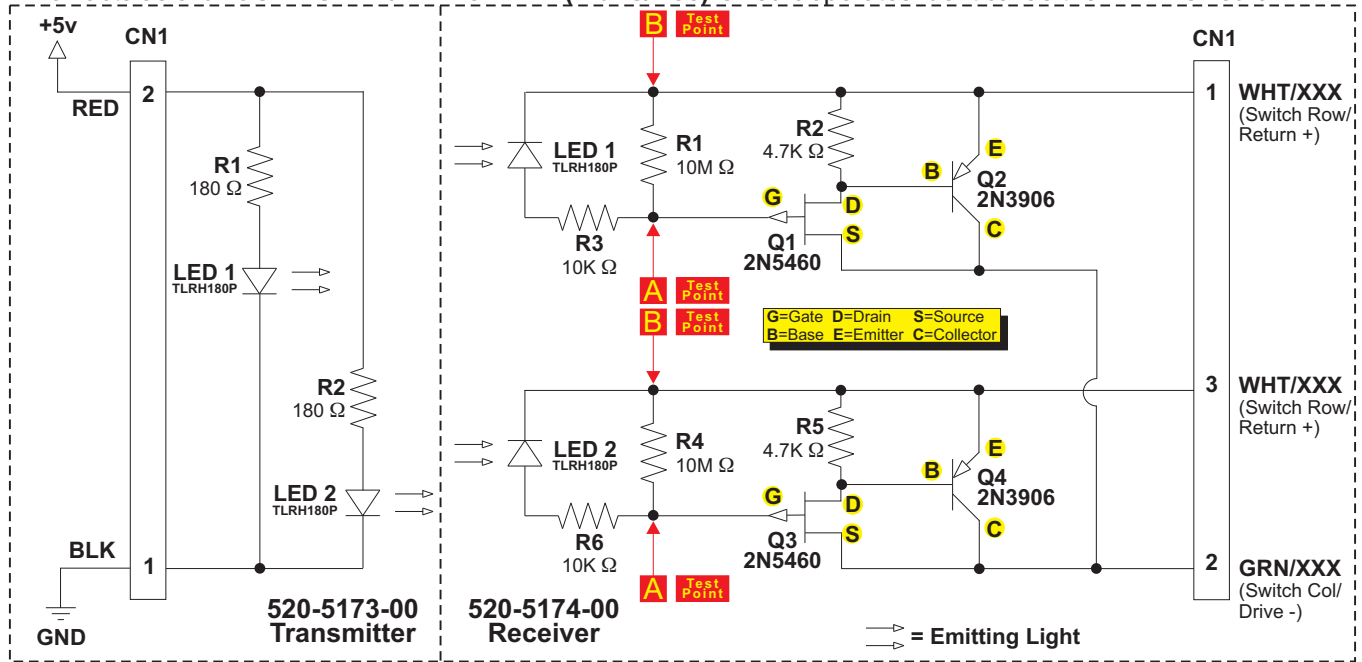
Sec. 5: Cabinet ...



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**.

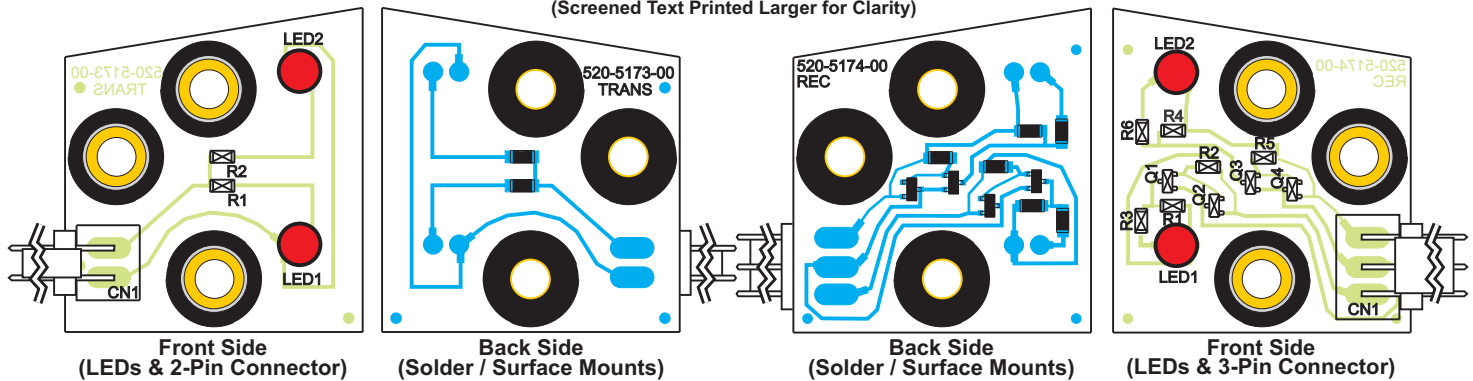


Trough Up-Kicker Dual OPTO Boards Component Layout & Parts

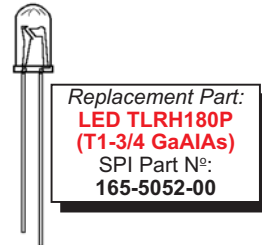
520-5173-00 (TRANS)

Boards Actual Size
(Screened Text Printed Larger for Clarity)

520-5174-00 (REC)



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



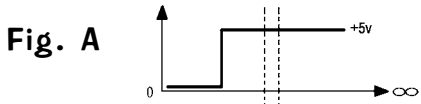
OPTO Troubleshooting

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

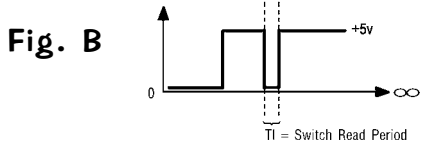
A. **OPEN OPTO** (Light Falling on LED) = *SWITCH OPEN*. Place meter leads across points **A** and **B** on the **LED1 Circuit** (Refer to Schematic Drawing on previous page, 520-5174-00 Receiver Side). It should read approximately 0.8 - 1.2v DC. The **LED2 Circuit** operates the same.

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):



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.



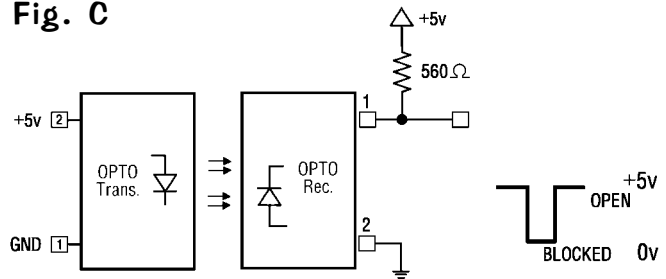
B. **CLOSED OPTO** (Light Blocked) = *SWITCH CLOSED*. Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (see Schematic). The Scope should display a **PULSE STREAM** indicating **Q2** has switched "On" as shown in **Fig. B**, Wave Form Diagram. This is your Switch Drive Pulse.

3. Bench Test (See Fig. C):

Please Note: To perform this test you must use a spare 560Ω Pull-Up Resistor, SPI N^o: 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.

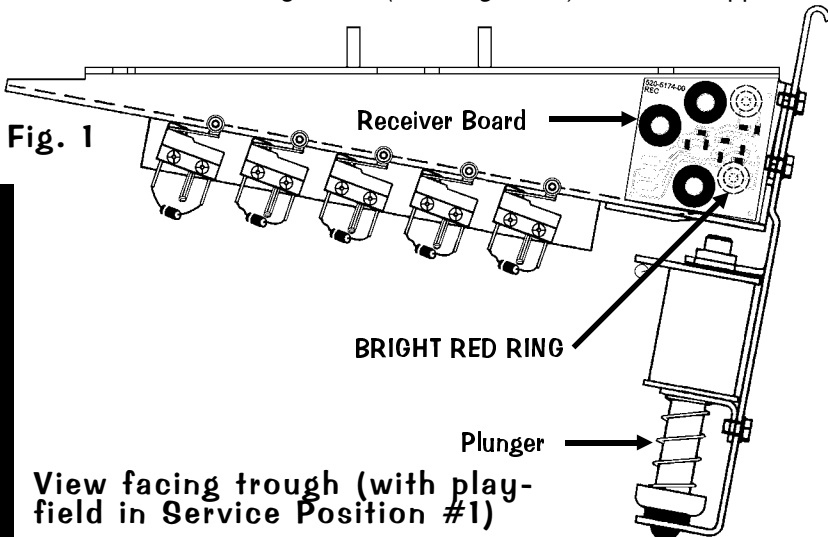
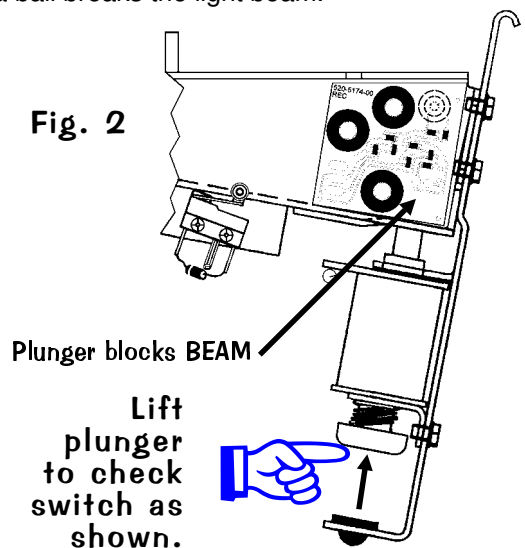
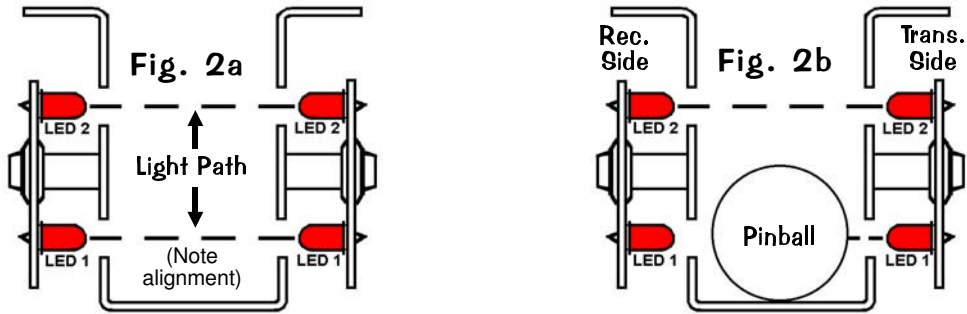


Fig. 2

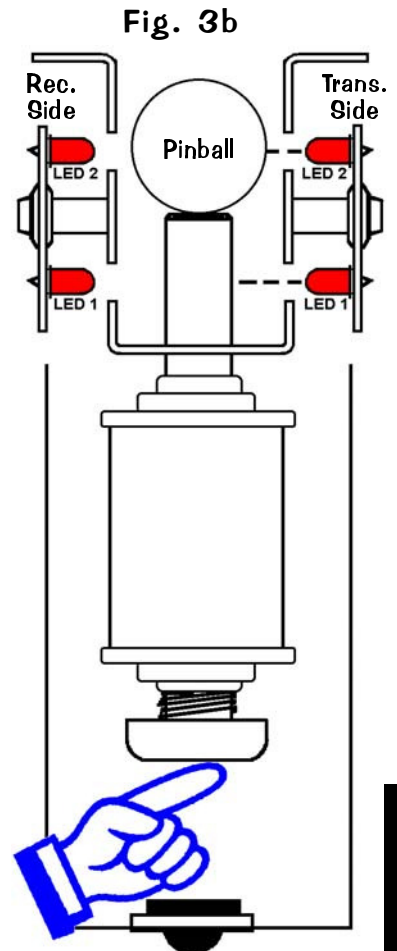
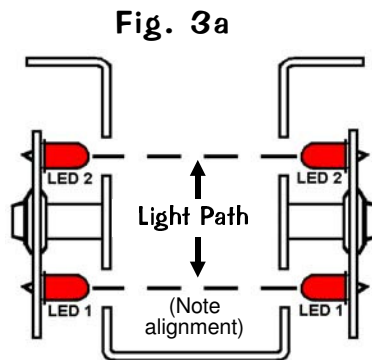
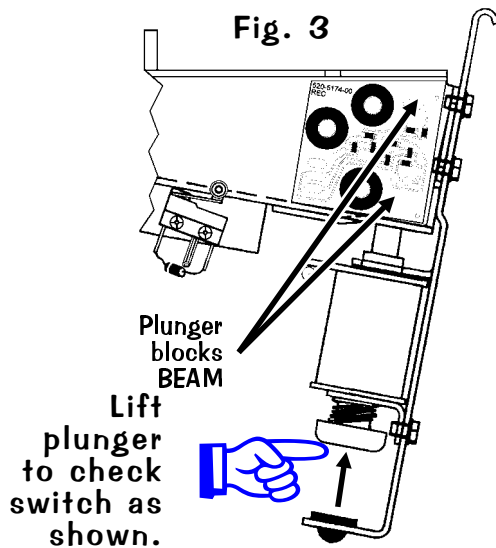


Sectional view from right (Fig. 2a & 2b)



Trough Dual OPTO Boards Alignment / Test for LED2

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



I M P O R T A N T

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

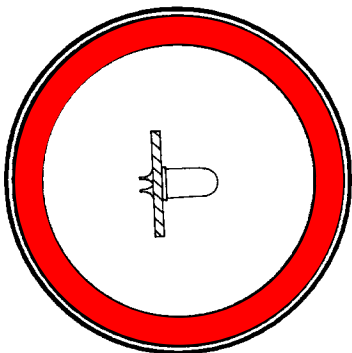


Fig. 4a
Correct Position

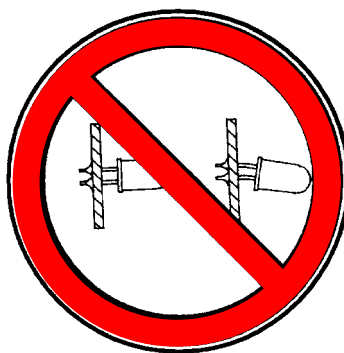
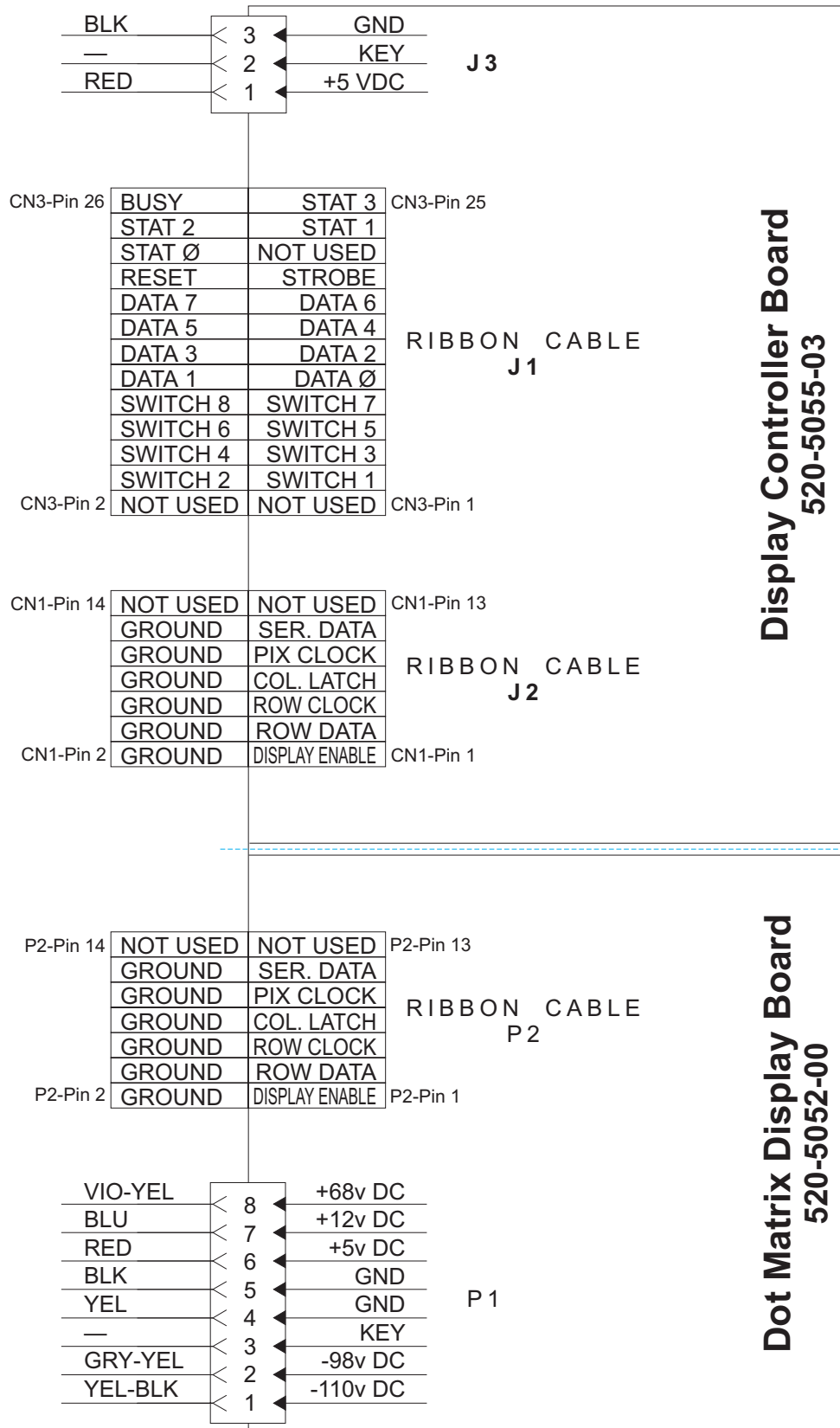
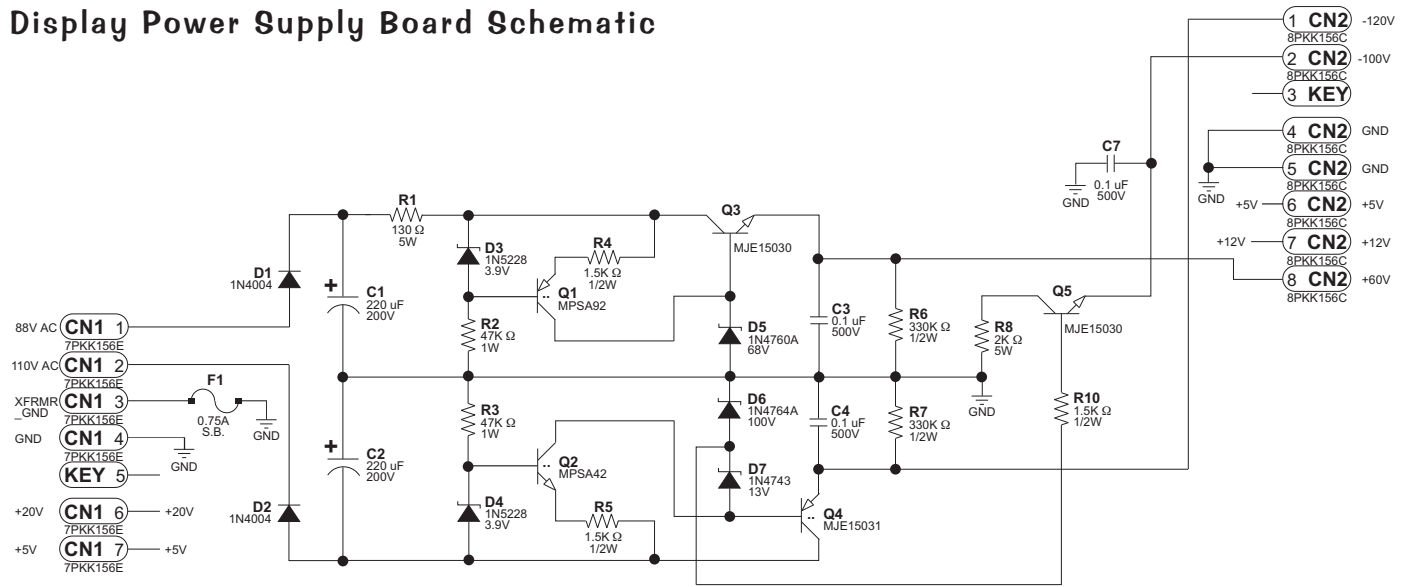


Fig. 4b
Incorrect Position

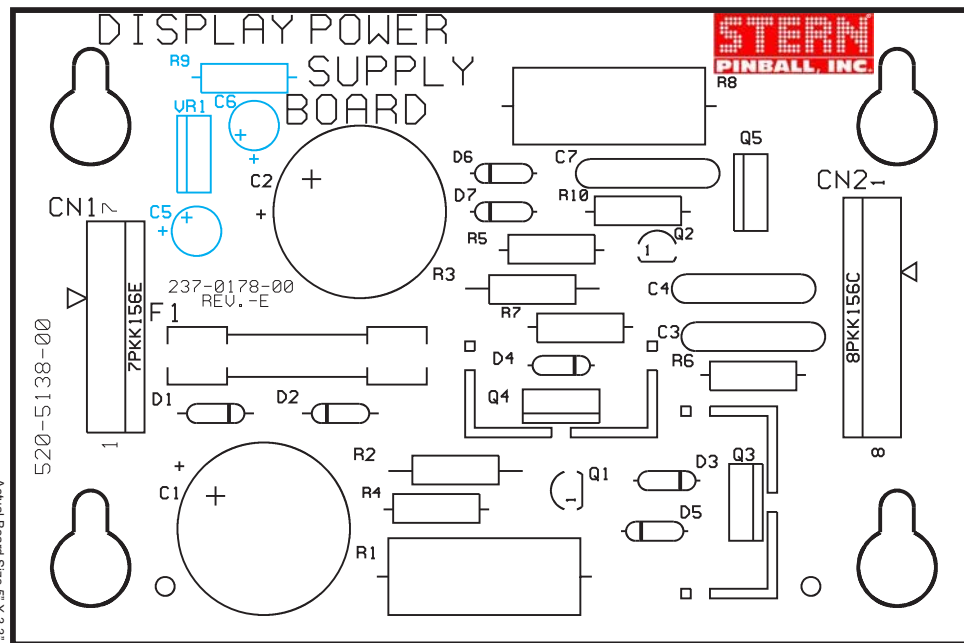
Dot Matrix Display / Display Controller Bd. Combined Display Connections



Display Power Supply Board Schematic



Display Power Supply Board Component Layout & Parts

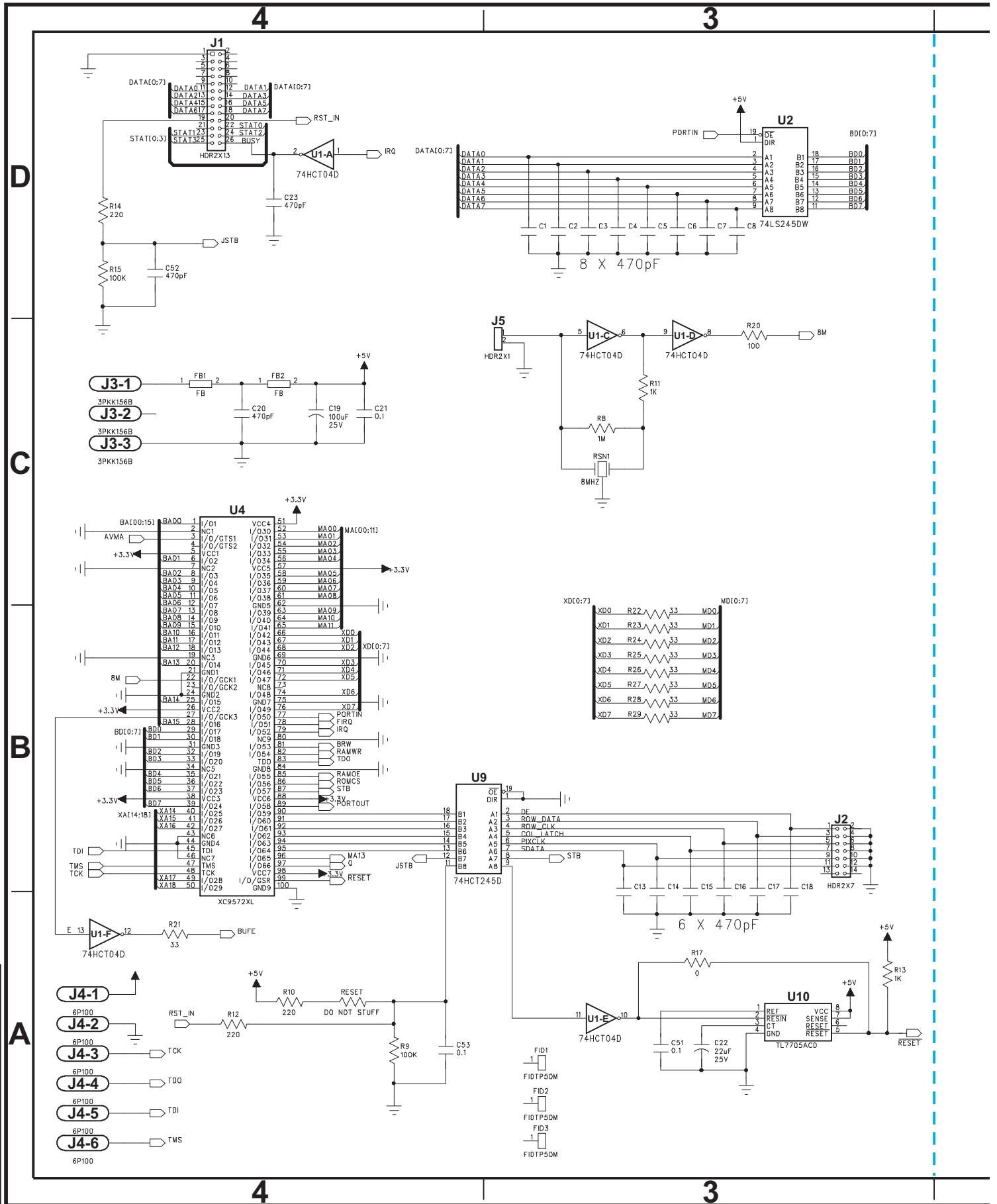


ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	1	520-5138-00	Display Power Supply Board	Complete PCB Assembly
01	2	125-5044-00	C1, C2	220uF, 200v, Radial Lytic Cap.
02	3	125-5035-00	C3, C4, C7	0.1uF, 500v, Ceramic Disk Cap.
03	0	125-5003-00	(C5, C6: NS)	22uF, 35v, Rad Lytic Cap
04	1	045-5015-07	CN1	7PKK156E (PIN5=KEY)
05	1	045-5015-08	CN2	8PKK156E (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



Sec. 5: PCBs

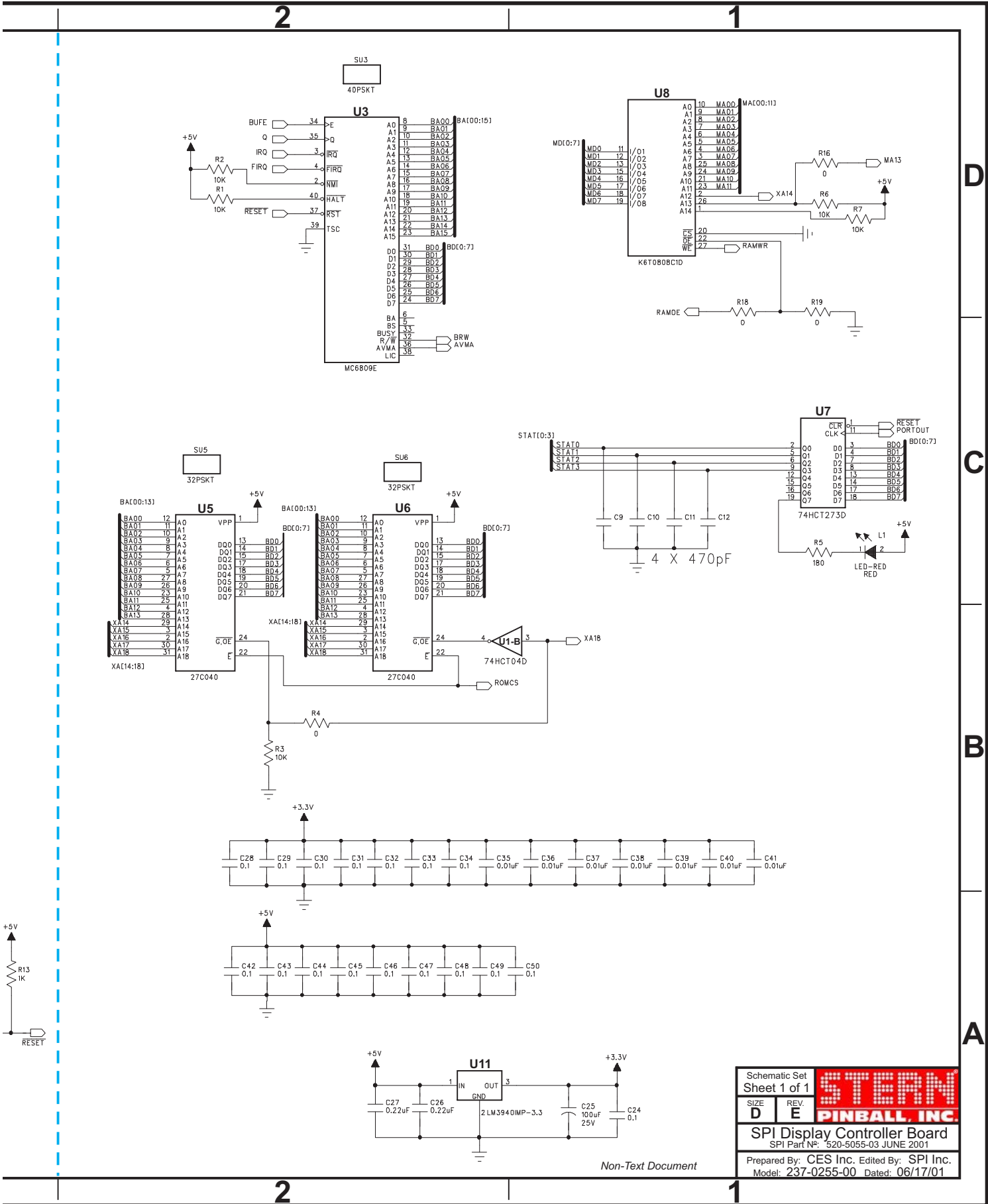
Display Controller Board Schematic



Sec. 5: PCBs



Display Controller Board Schematic



D
C
B
A

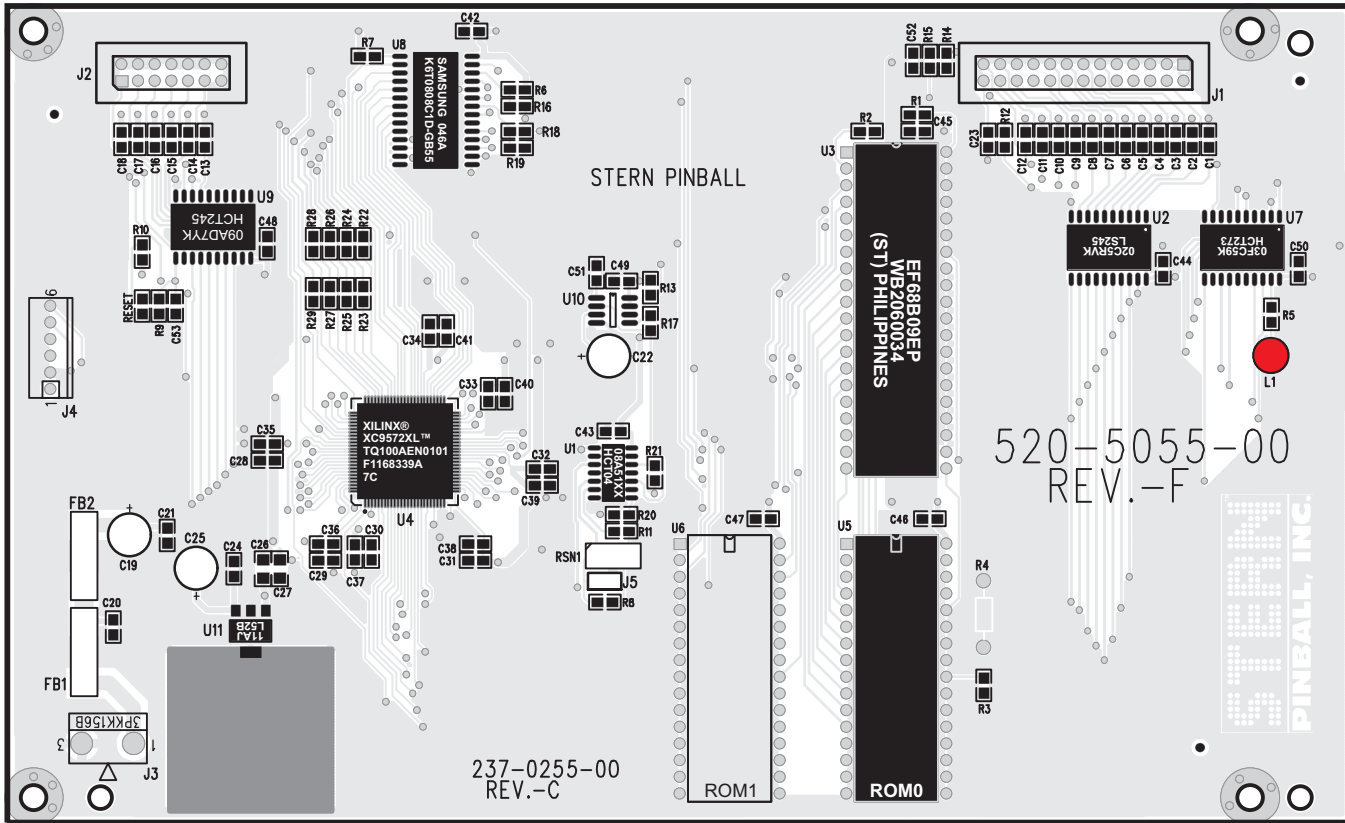
Sec. 5: PCBs

Schematic Set		STERN
Sheet 1 of 1		
SIZE	REV.	PINBALL, INC.
D	E	
SPI Display Controller Board		
SPI Part No: 520-5055-03 JUNE 2001		
Prepared By: CES Inc. Edited By: SPI Inc.		
Model: 237-0255-00 Dated: 06/17/01		

Non-Text Document



Display Controller Board Component Layout & Parts



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. © 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		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		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®

Sec. 5: PCBs



I/O Power Driver Board Theory of Operation

5v Supply:

An AC voltage of approximately 9v comes into the board at [J17-(1-4)] this AC voltage is then *full-wave rectified* by bridge **BRDG 21** and filtered by Capacitor **C203**. The resulting voltage is 11v DC which is inserted into a linear voltage regulator for the output of 5v DC. This 5v regulated voltage can be adjusted by potentiometer **R116** the voltage should be set to 5.00v. Besides powering the **I/O Board** the regulated 5 volts supplies power to the **CPU / Sound Board, Gas Plasma (Dot Matrix) Display and Plasma (Display) Controller Board**. Power for these devices comes off the **I/O Board** on [J16-(4-8)].

+5v, +20v, +50v, +18v, & +12v LED Indicators:

These DC voltages are derived on the **I/O Board** by rectification and filtering. Each has a **LED** indicating that power is being supplied to each of these voltage sources. The **-12v** supply comes from the same transformer winding as the **+12v** thus it does not have a **LED** indicator.

**** Note that the +50v & +20v power sources are turned off by the Interlock Switches when the Coin Door is OPEN.**

LED	SUPPLY VOLTAGE
L2	+ 5
L200	+ 20v
L201	+ 50v
L202	+ 18v
L203	+ 12v

Reset Circuitry:

The **I/O** will reset in three (3) cases:

1. The CPU is in reset. The CPU's reset signal is fed into the **I/O** through connector **J1** and forces the **I/O** into reset.
2. The 5v supply has fallen below 4.75v.
3. The watchdog is not being fed by the scanning of the light matrix. More specifically **Pin-19** of **U6** must be toggling once every **50ms** to prevent the watchdog from resetting. The scanning of the light matrix is controlled by the CPU through **J1**.

LED L204 shows the reset state of the **I/O Board**. If this **LED** is not lit either the 5v DC is below 4.75v or the **CPU/Sound Board** is holding the **I/O** in reset. If the **LED** is flashing this means that the watchdog is not being fed 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.

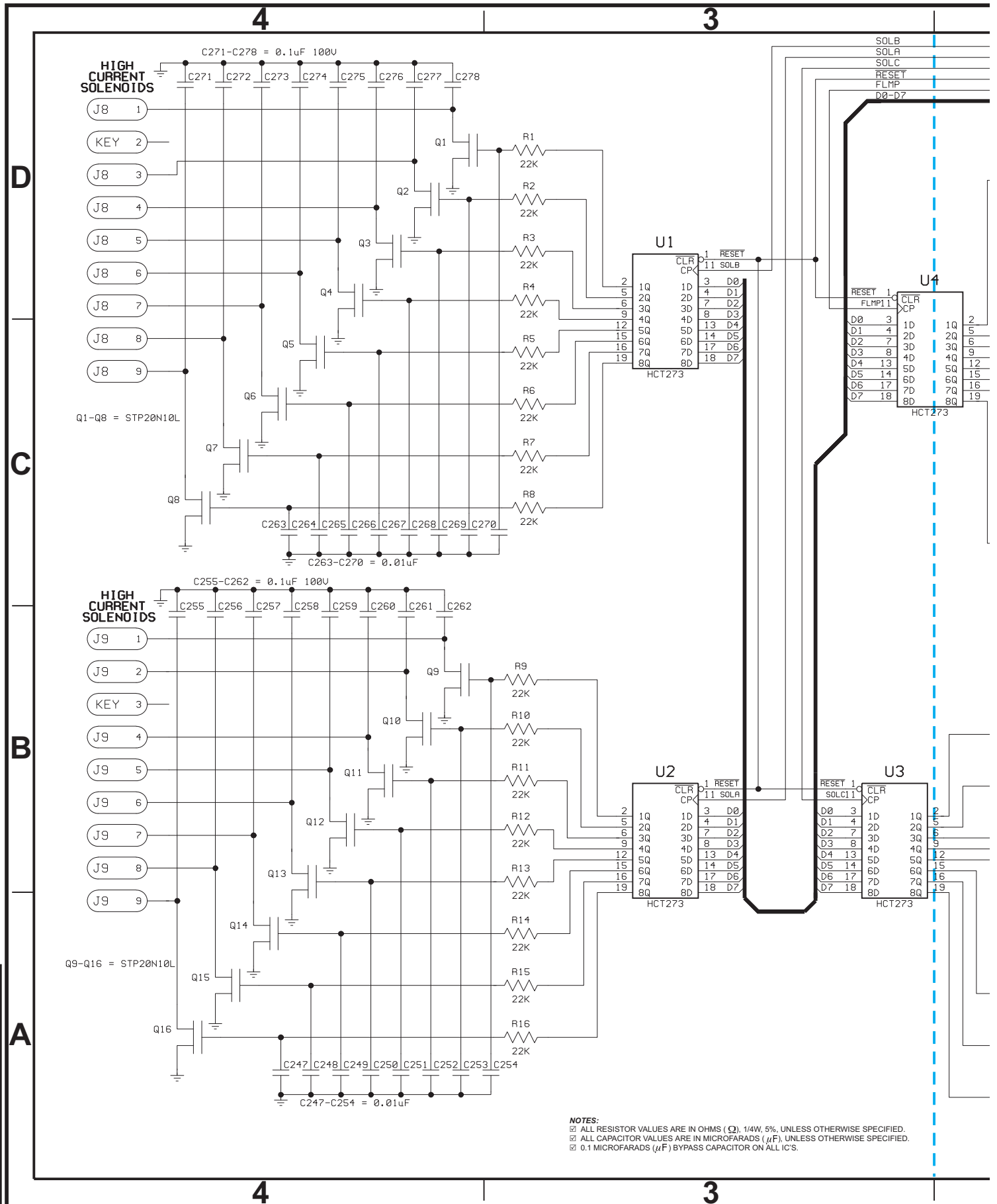
Lamp Matrix:

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.

I/O Power Driver Board Schematic (Sheet 1 of 5)



- 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.

Sec. 5: PCBs



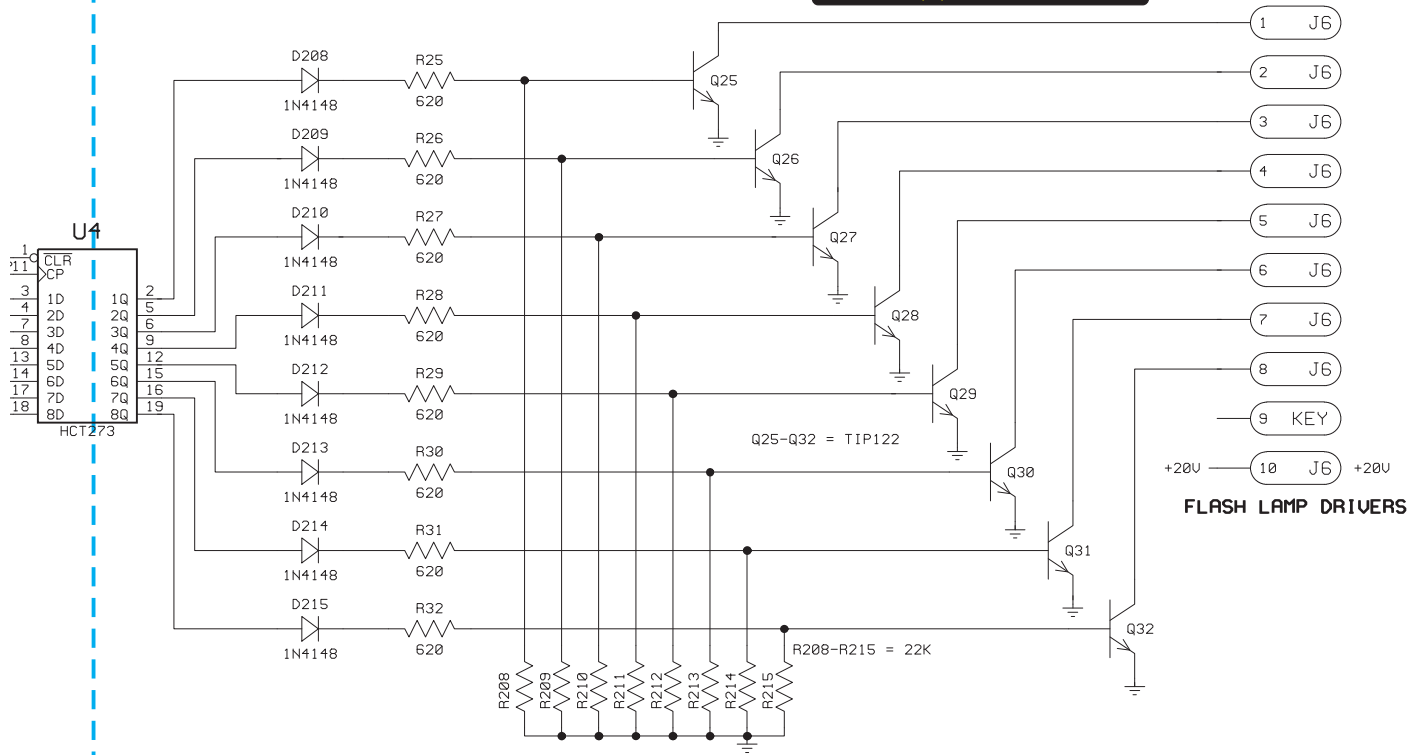
I/O Power Driver Board Schematic (Sheet 1 of 5)

2

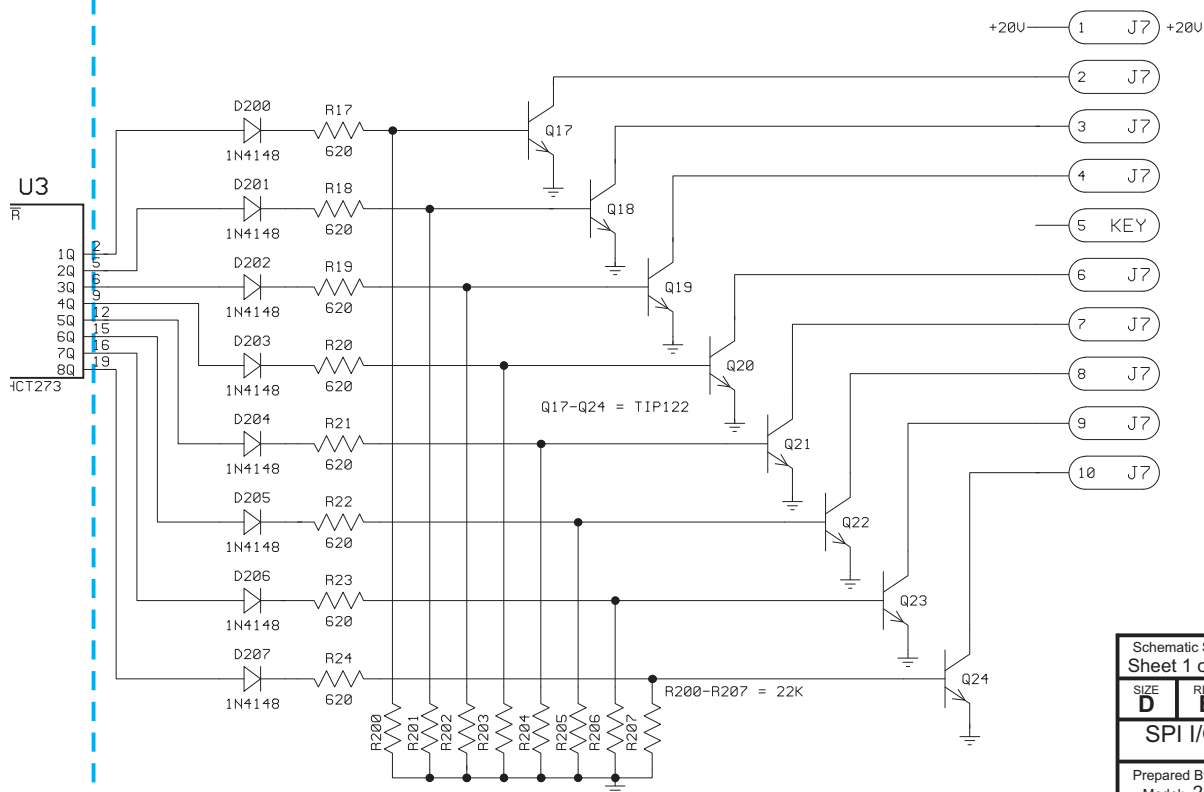
1

SOLB	(4-4D)
SOLA	(4-4D)
SOLC	(4-4D)
RESET	(2-4A, 3-4B, 4-1D)
FLMP	(4-4D)
D0-D7	(2-4A, 3-4B, 4-4B)

The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid



LOW CURRENT SOLENOIDS



Schematic Set		STERN
Sheet 1 of 5		
SIZE	REV.	PINBALL, INC.
D	E	
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		

D

C

B

A

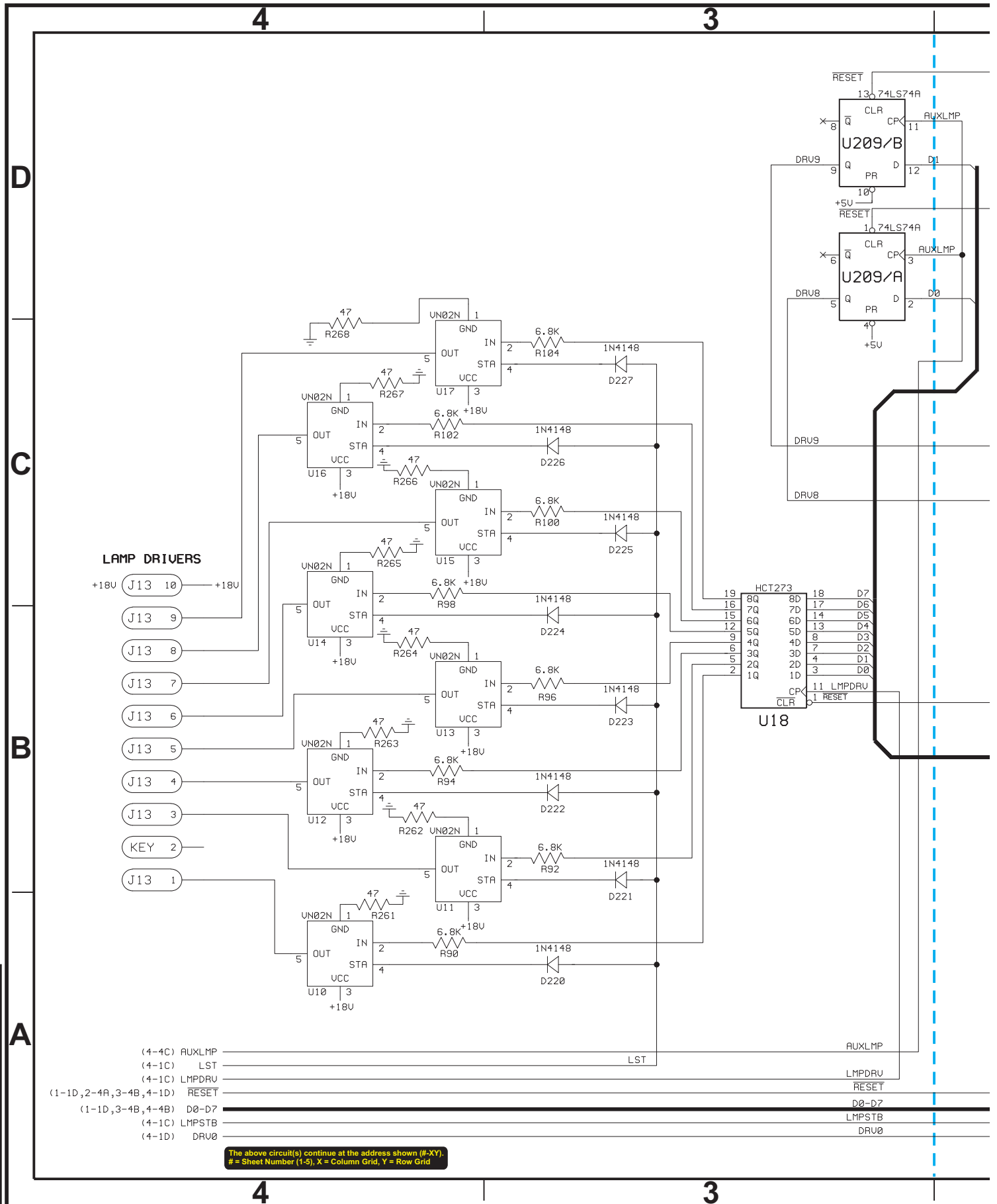
Sec. 5: PCBs

2

1



I/O Power Driver Board Schematic (Sheet 2 of 5)



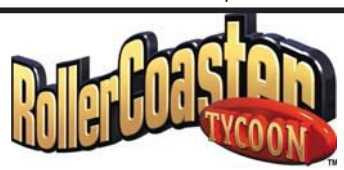
LAMP DRIVERS

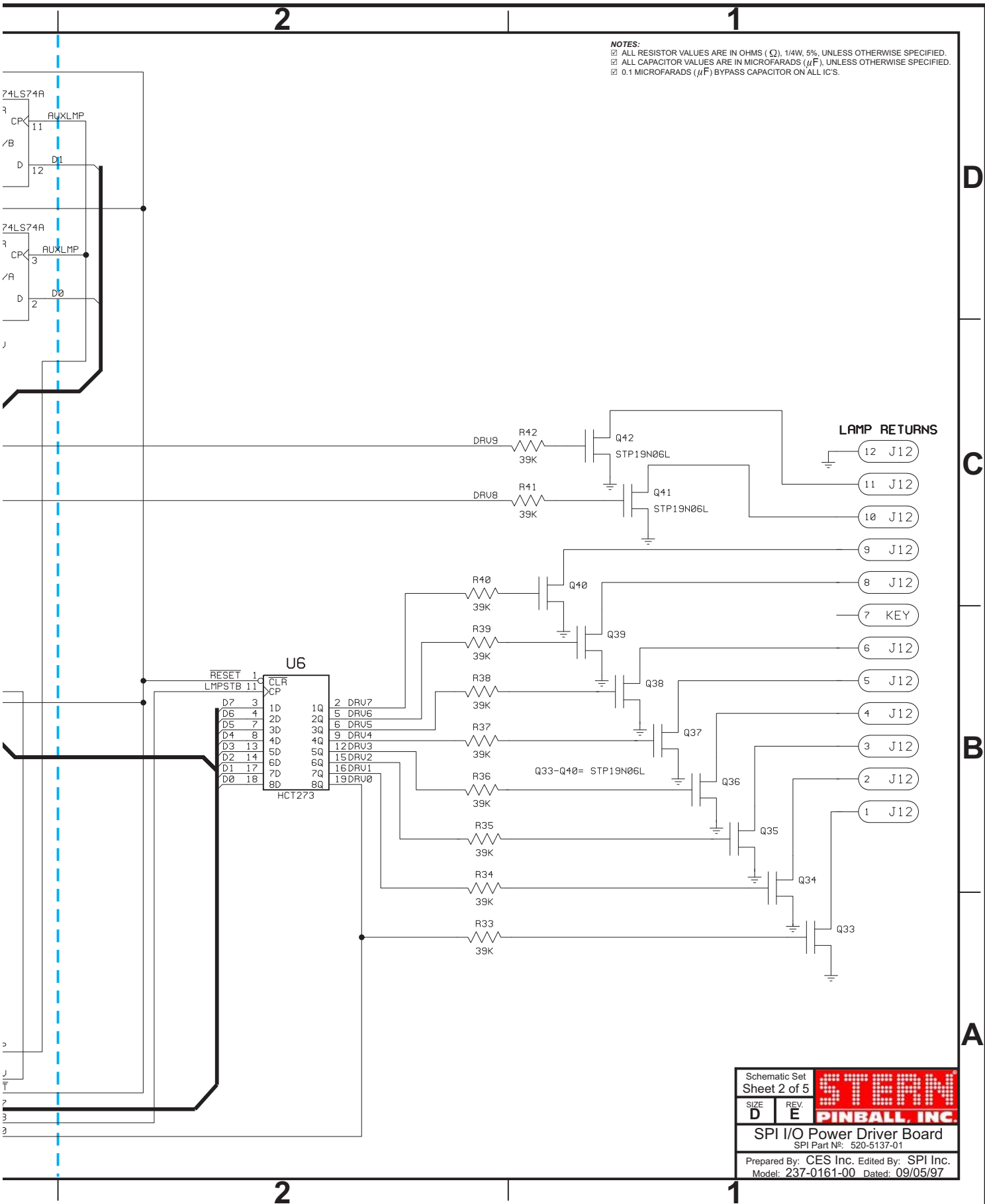
- +18V J13 10 — +18V
- J13 9
- J13 8
- J13 7
- J13 6
- J13 5
- J13 4
- J13 3
- KEY 2
- J13 1

- (4-4C) AUXLMP
- (4-1C) LST
- (4-1C) LMPDRV
- (1-1D, 2-4A, 3-4B, 4-1D) RESET
- (1-1D, 3-4B, 4-4B) D0-D7
- (4-1C) LMPSTB
- (4-1D) DRV0

The above circuit(s) continue at the address shown (#.XY).
 # = Sheet Number (1-5), X = Column Grid, Y = Row Grid

Sec. 5: PCBs



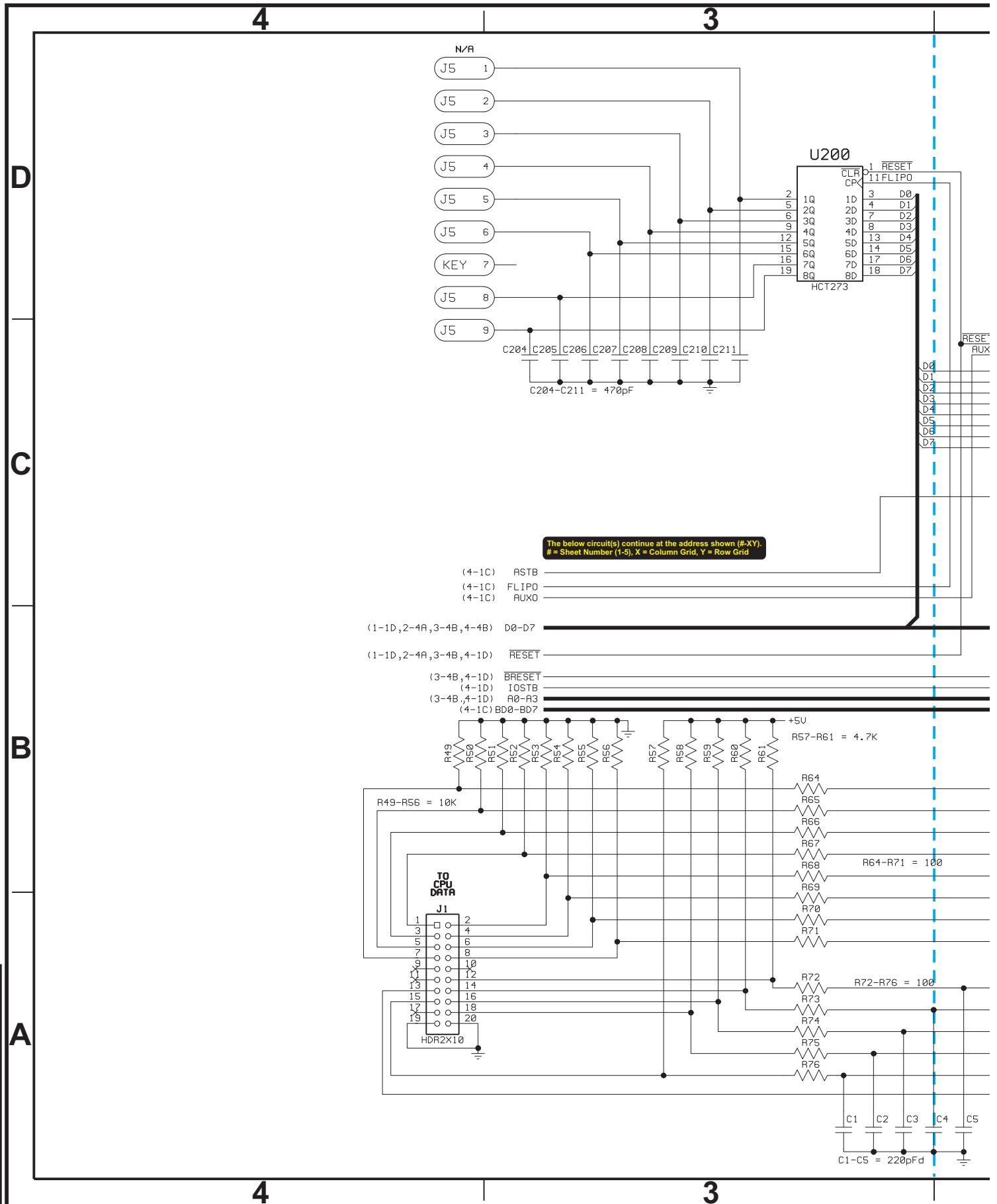


Schematic Set		STERN
Sheet 2 of 5		
SIZE	REV.	PINBALL, INC.
D	E	
SPI I/O Power Driver Board		
SPI Part No: 520-5137-01		
Prepared By: CES Inc. Edited By: SPI Inc.		
Model: 237-0161-00 Dated: 09/05/97		

Sec. 5: PCBs



I/O Power Driver Board Schematic (Sheet 3 of 5)



Sec. 5: PCBs

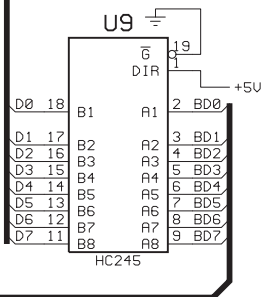
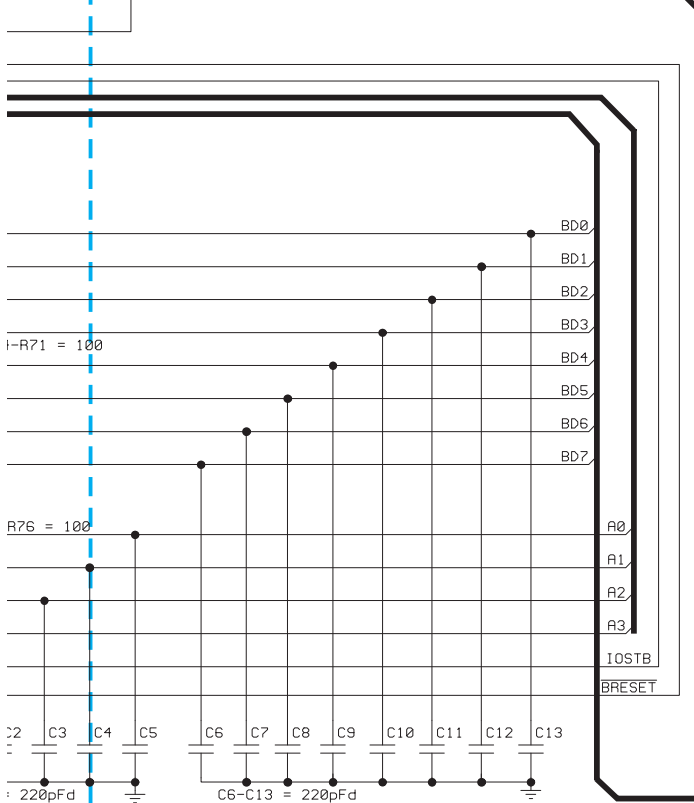
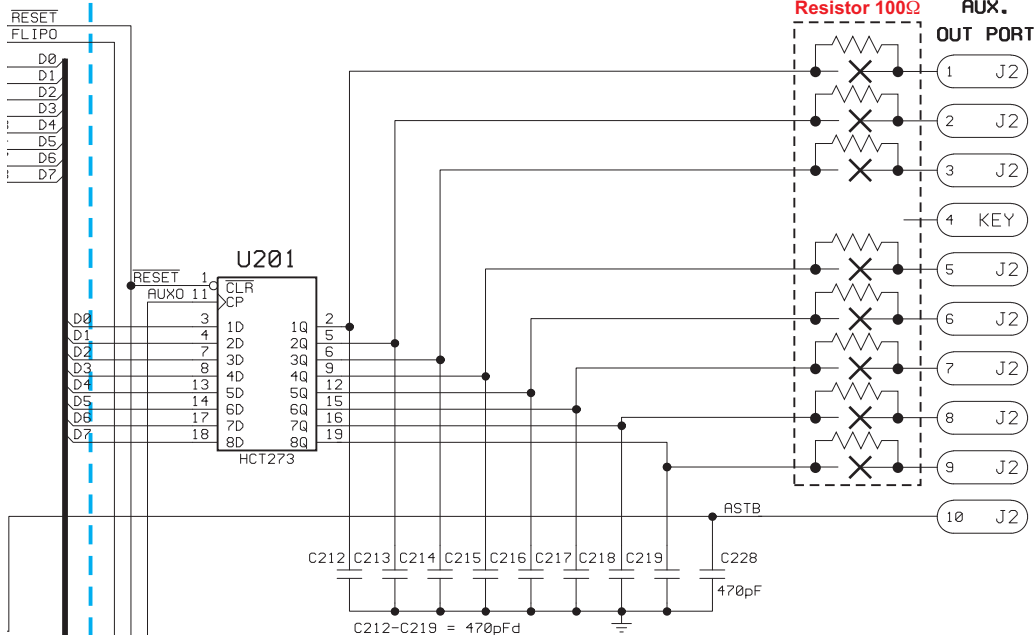


2

1

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 N#: 121-5007-00). This Modification (highlighted below at J2 with a dotted-line box) was accomplished on boards produced after Jan. 1, 2001. This board is backwards compatible for the White Star™ Board System.	TS	JET



Schematic Set Sheet 3 of 5		STERN PINBALL, INC.
SIZE D	REV. E	
SPI I/O Power Driver Board SPI Part N#: 520-5137-01		
Prepared By: CES Inc. Edited By: SPI Inc. Model: 237-0161-00 Dated: 09/05/97		

D

C

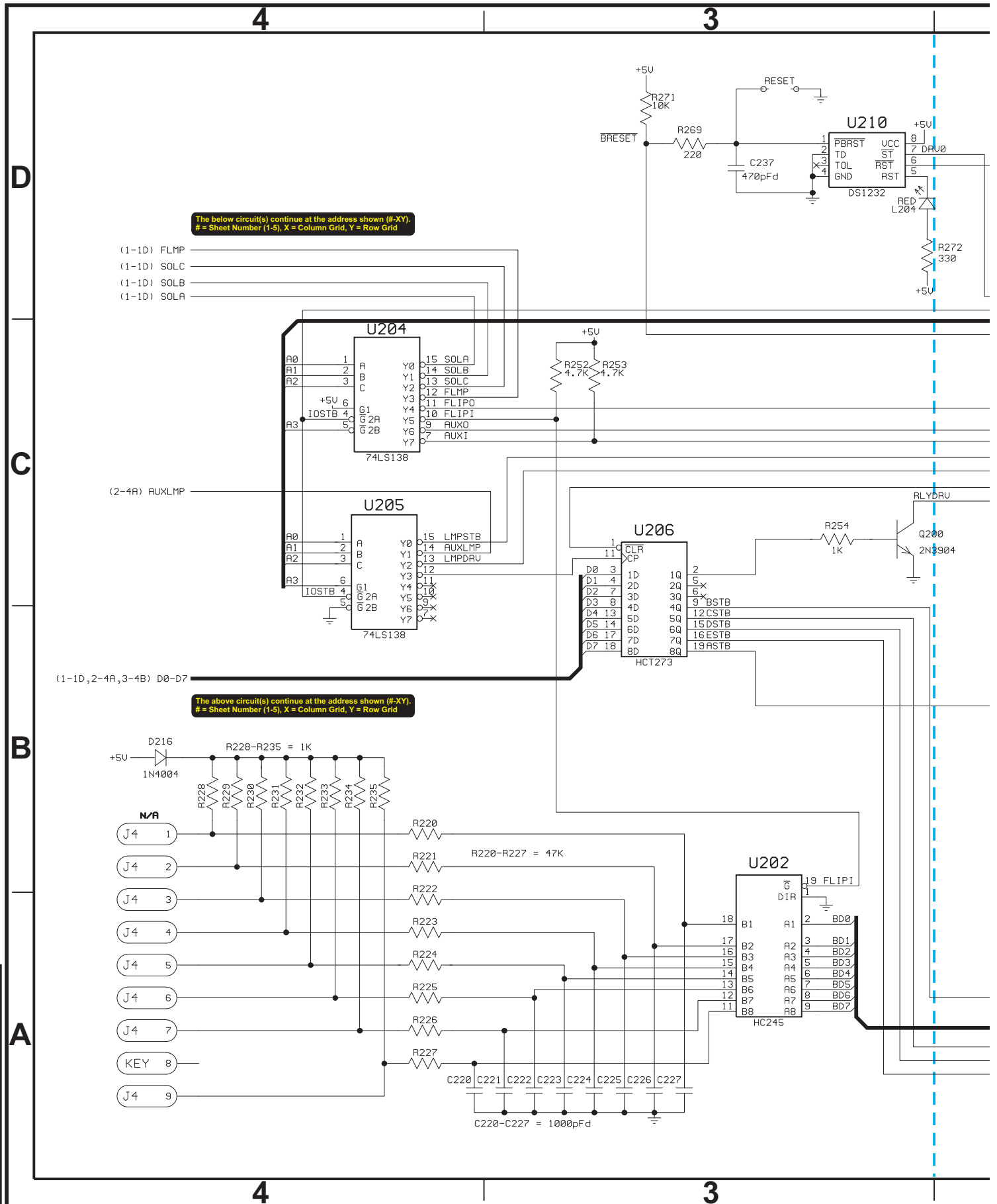
B

A

Sec. 5: PCBs



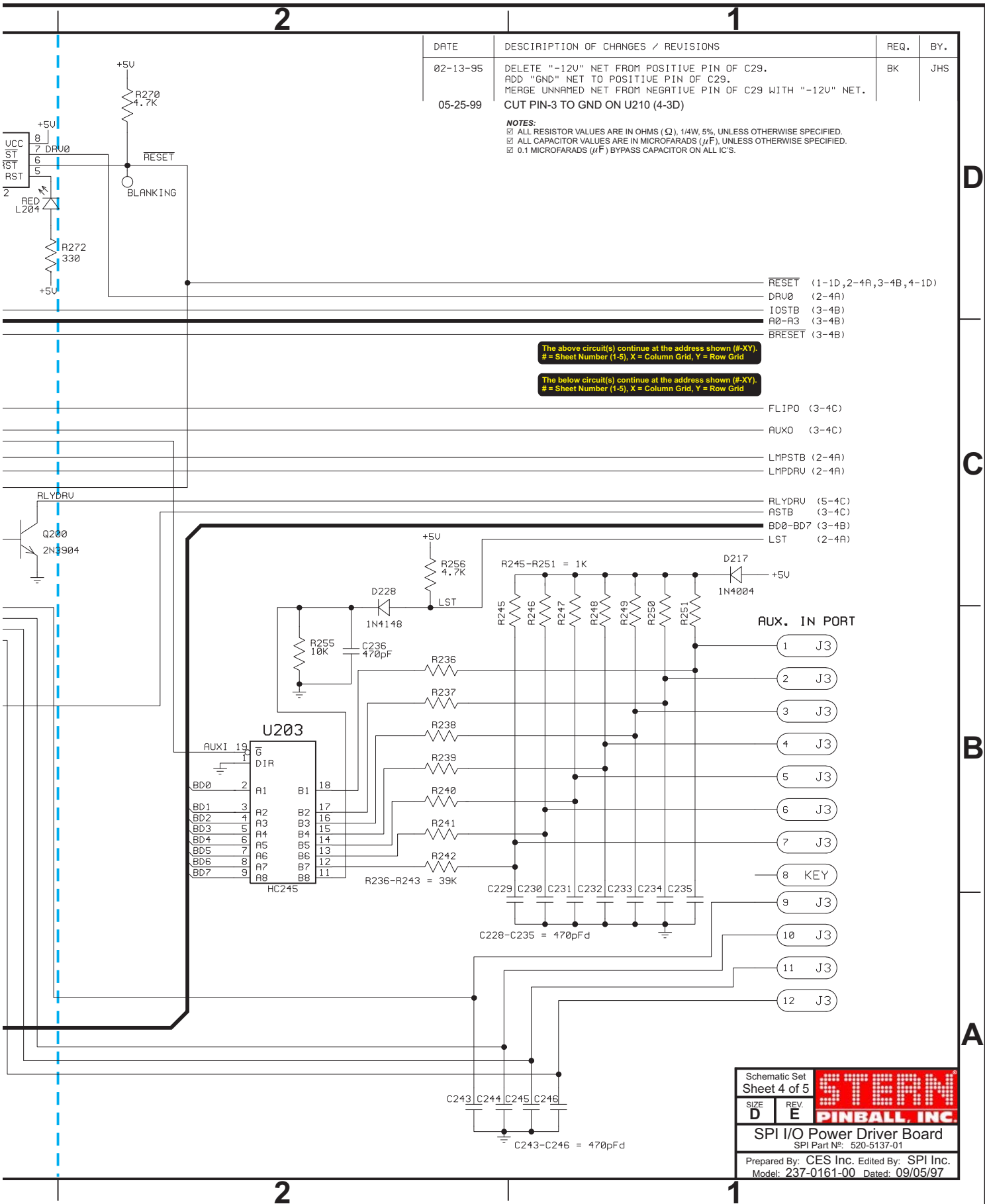
I/O Power Driver Board Schematic (Sheet 4 of 5)



Sec. 5: PCBs



I/O Power Driver Board Schematic (Sheet 4 of 5)

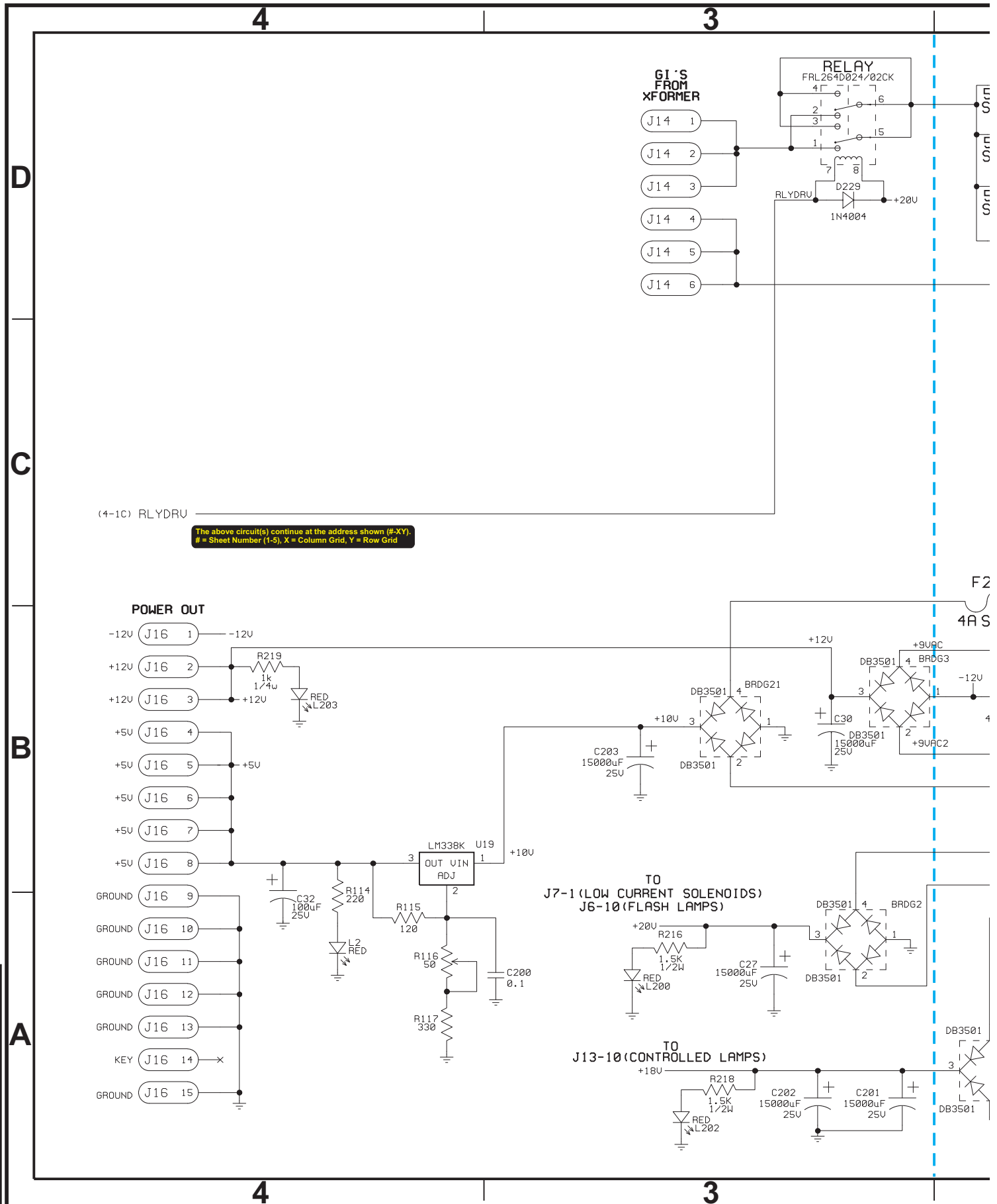


Sec. 5: PCBs



Schematic Set Sheet 4 of 5		STERN PINBALL, INC.
SIZE D	REV. E	
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		

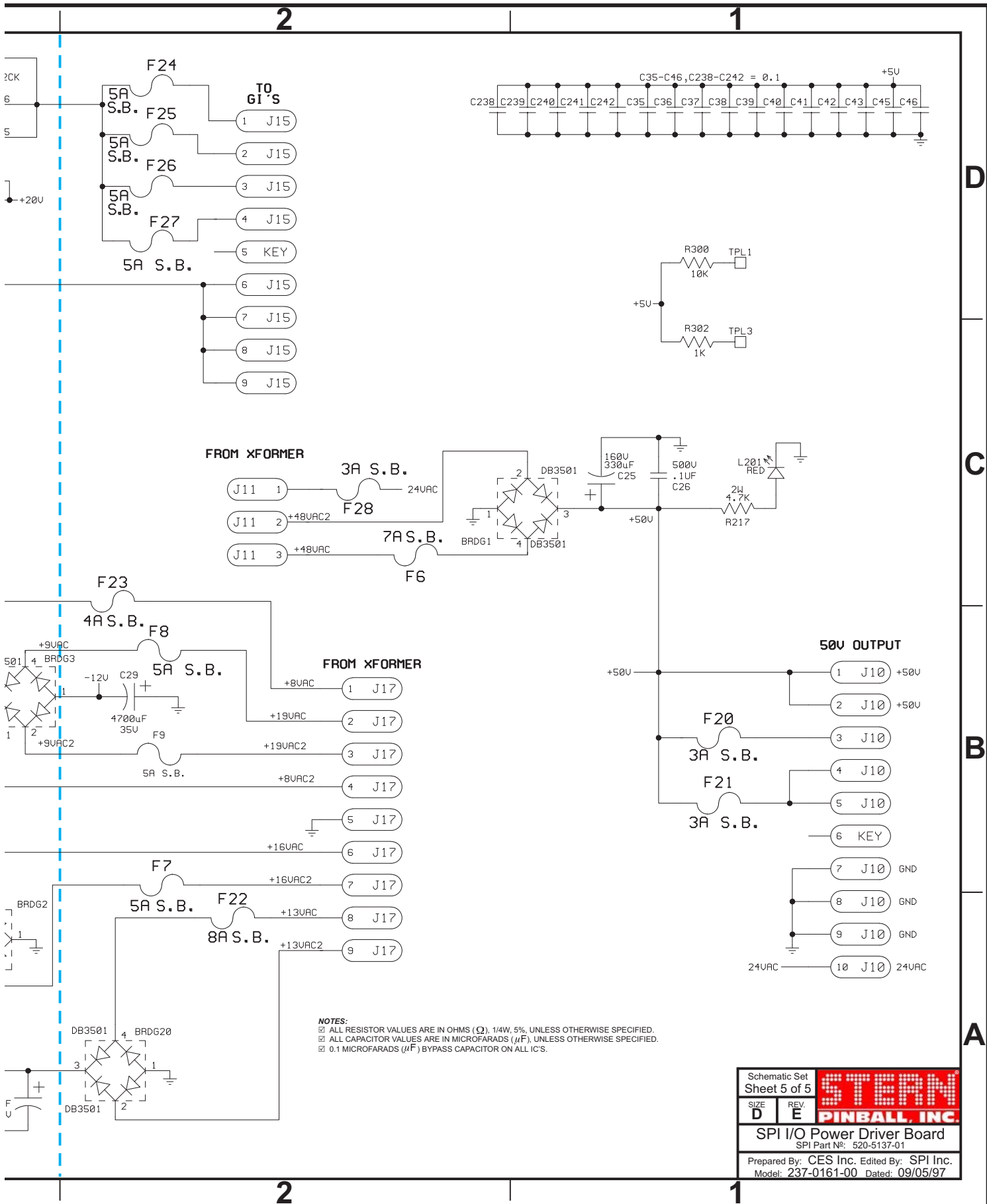
I/O Power Driver Board Schematic (Sheet 5 of 5)



The above circuit(s) continue at the address shown (#-XY).
 # = Sheet Number (1-5), X = Column Grid, Y = Row Grid

Sec. 5: PCBs



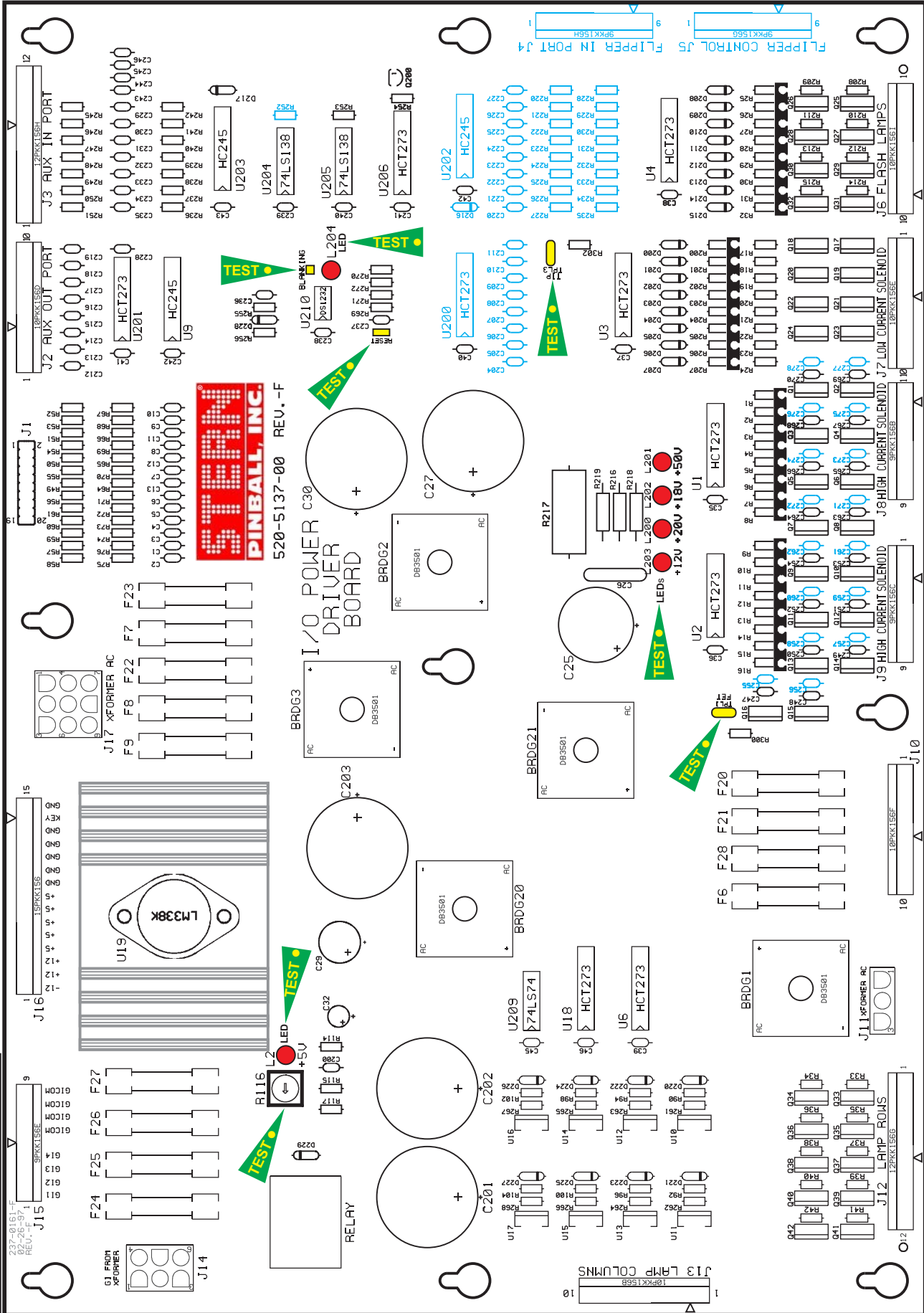


D
C
B
A

Sec. 5: PCBs



I/O Power Driver Board Component Layout



Test Points:



← TIP TPL3
← BLANKING
← L204 LED

← RESET

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

← FET TPL1

LED :
← L2+5V
← R116 POT

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	100 Ω 1/4W Res.
			Resistors on Solder Side @ J2-Pins: 1-3 & 5-9	
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



CPU/Sound Board Theory of Operation

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 68B09E (U6)** reads in this data and handles the interfacing to the **BSMT**.

Other Test Points:

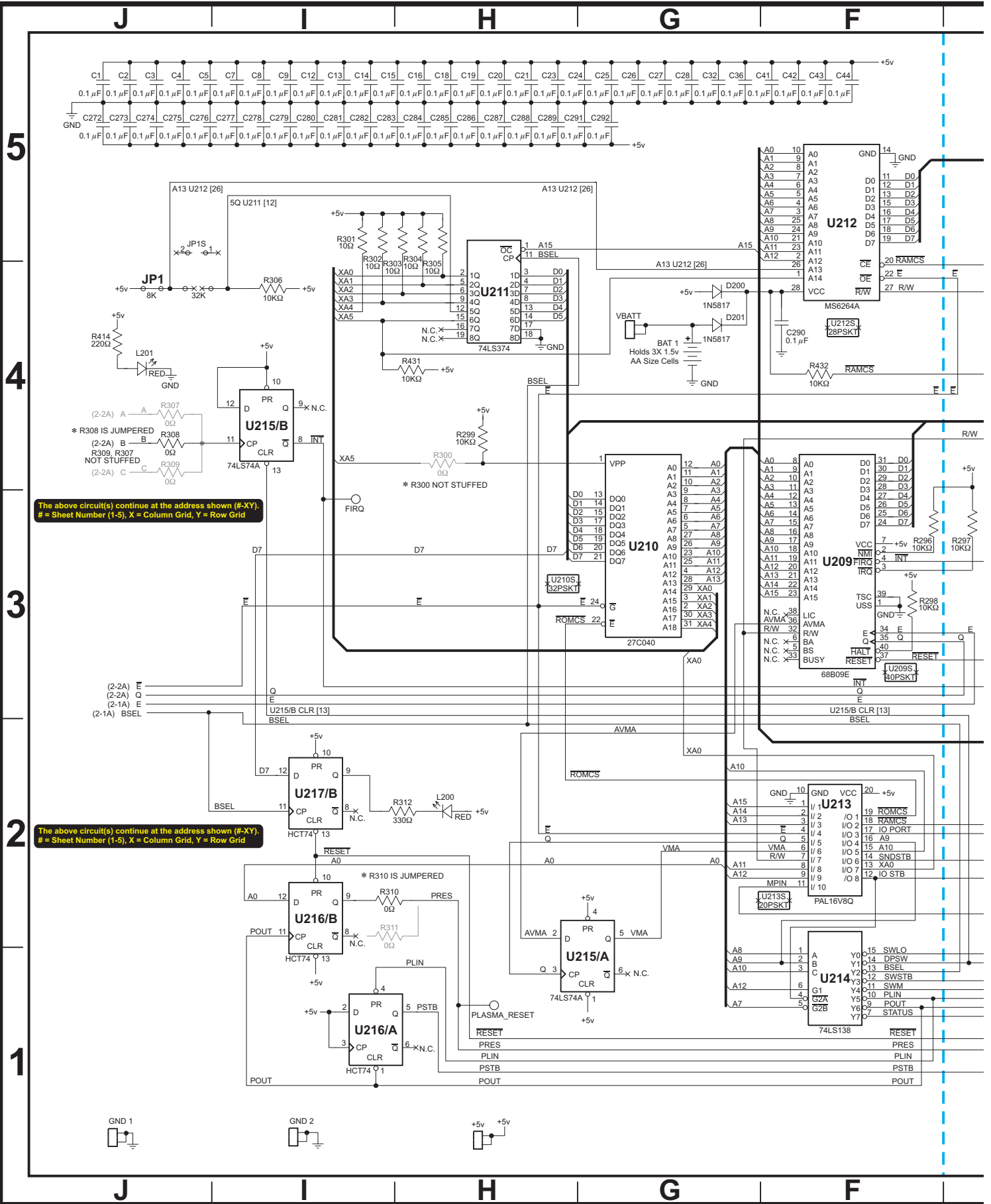
E & Q - The **CPU** signals for both **68B09E** processors. Should be at 2Mhz with **Q** leading **E** by **500 nsec**.

24Mhz - The oscillator used for the **BSMT** & derivation of **E & Q**.

SND-FIRQ - The sound sections **CPU Interrupt**.

6Mhz - This clock is generated internally on the **BSMT** and is used for shifting the data samples into the **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.

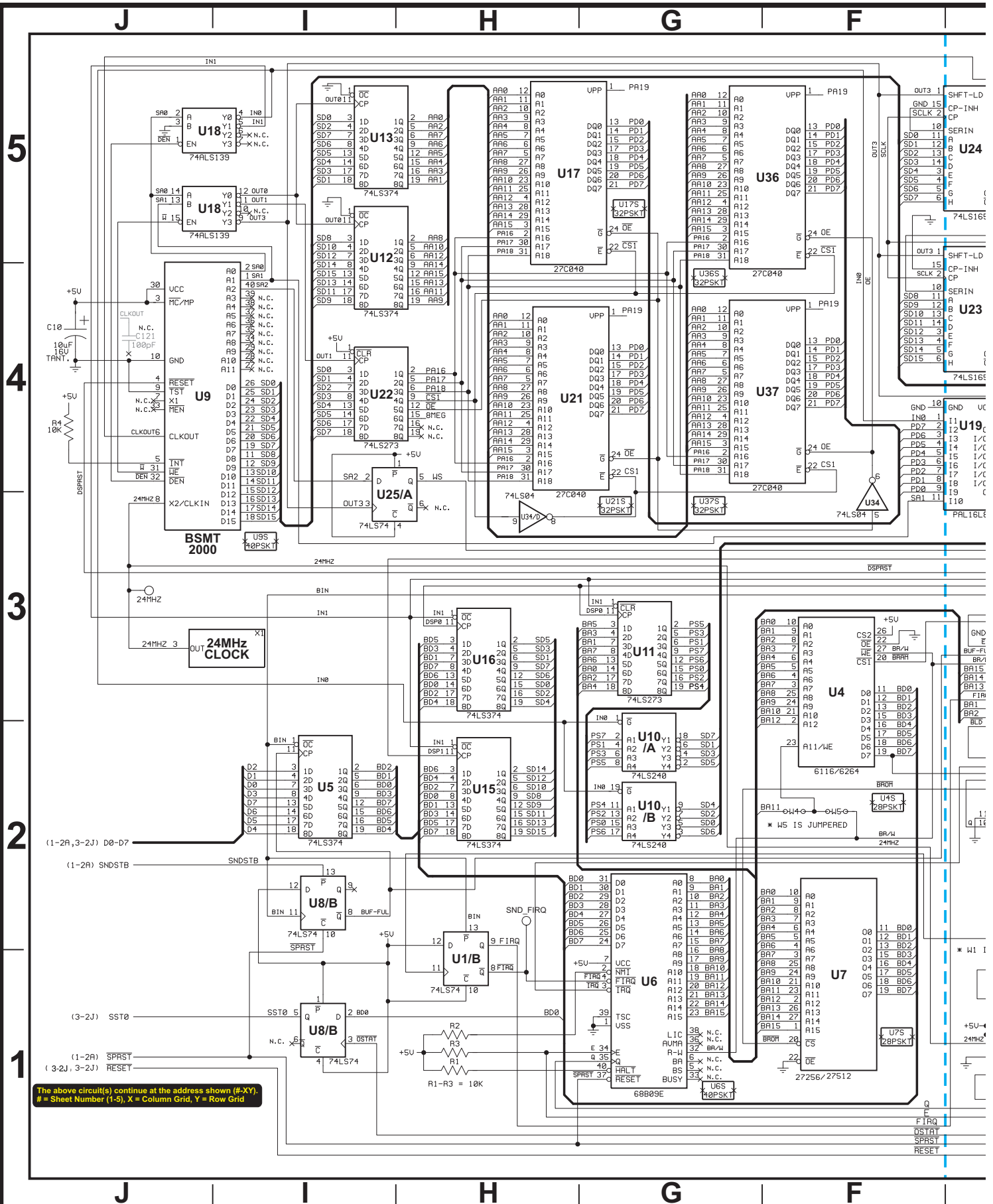


The above circuit(s) continue at the address shown (#-XY).
 #- = Sheet Number (1-5), X = Column Grid, Y = Row Grid

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 #- = Sheet Number (1-5), X = Column Grid, Y = Row Grid

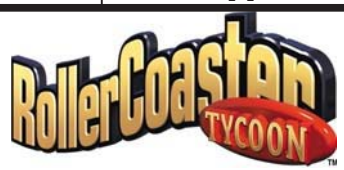
Sec. 5: PCBs

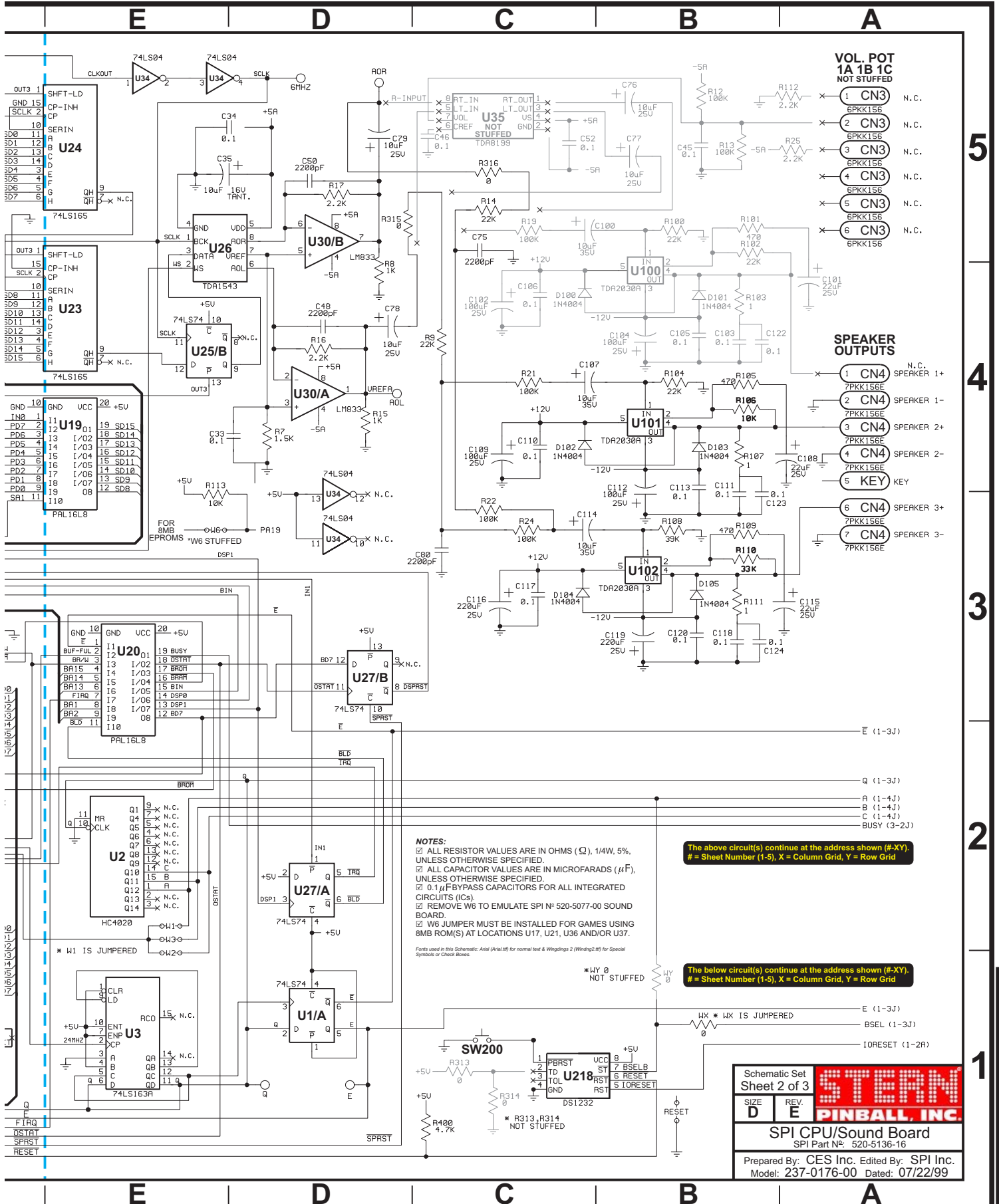




Sec. 5: PCBs

The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid





NOTES:
 [X] ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
 [Y] ALL CAPACITOR VALUES ARE IN MICROFARADS (μ F), UNLESS OTHERWISE SPECIFIED.
 [Z] 0.1 μ F/BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).
 [AA] REMOVE W6 TO EMULATE SPI N° 520-5077-00 SOUND BOARD.
 [AB] W6 JUMPER MUST BE INSTALLED FOR GAMES USING 8MB ROM(S) AT LOCATIONS U17, U21, U36 AND/OR U37.

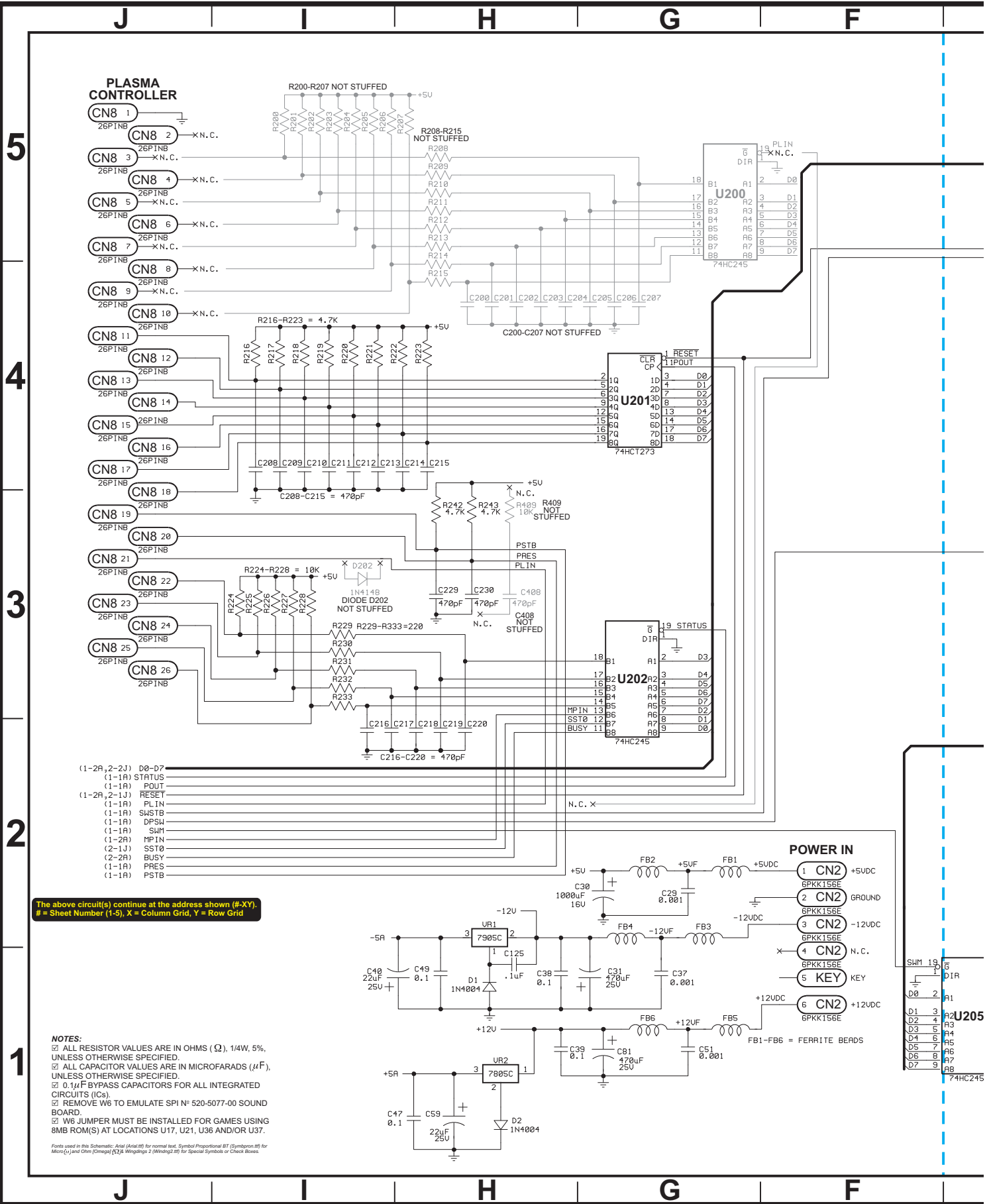
The above circuit(s) continue at the address shown (#-XY).
 # = Sheet Number (1-5), X = Column Grid, Y = Row Grid

The below circuit(s) continue at the address shown (#-XY).
 # = Sheet Number (1-5), X = Column Grid, Y = Row Grid

Schematic Set		STERN	
Sheet 2 of 3			
SIZE	REV	PINBALL, INC.	
D	E		
SPI CPU/Sound Board			
SPI Part N°: 520-5136-16			
Prepared By: CES Inc. Edited By: SPI Inc.			
Model: 237-0176-00 Dated: 07/22/99			



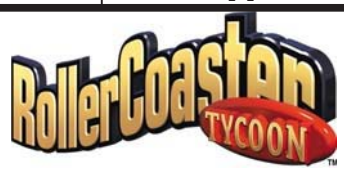
Sec. 5: PCBs

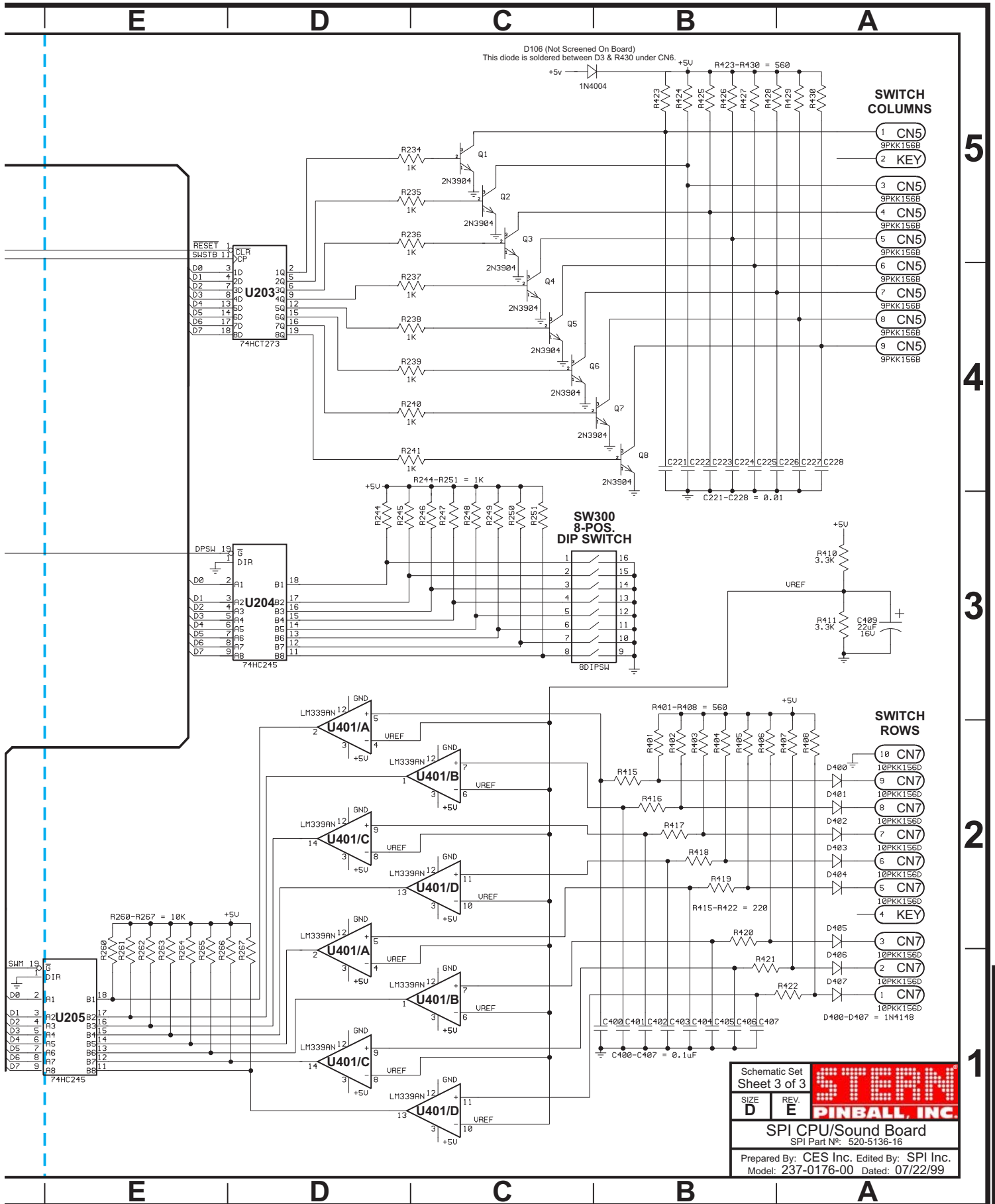


The above circuit(s) continue at the address shown (#-XY), # = Sheet Number (1-5), X = Column Grid, Y = Row Grid

- NOTES:**
- ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED
 - ☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
 - ☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).
 - ☑ REMOVE W6 TO EMULATE SPI N° 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®) for normal text, Symbol Proportional BT (Symbolpro BT®) for Mount(-) and Open Connectors (D36-Wingspan 2 (Wingspan2®)) for Special Symbols or Check Boxes.

Sec. 5: PCBs



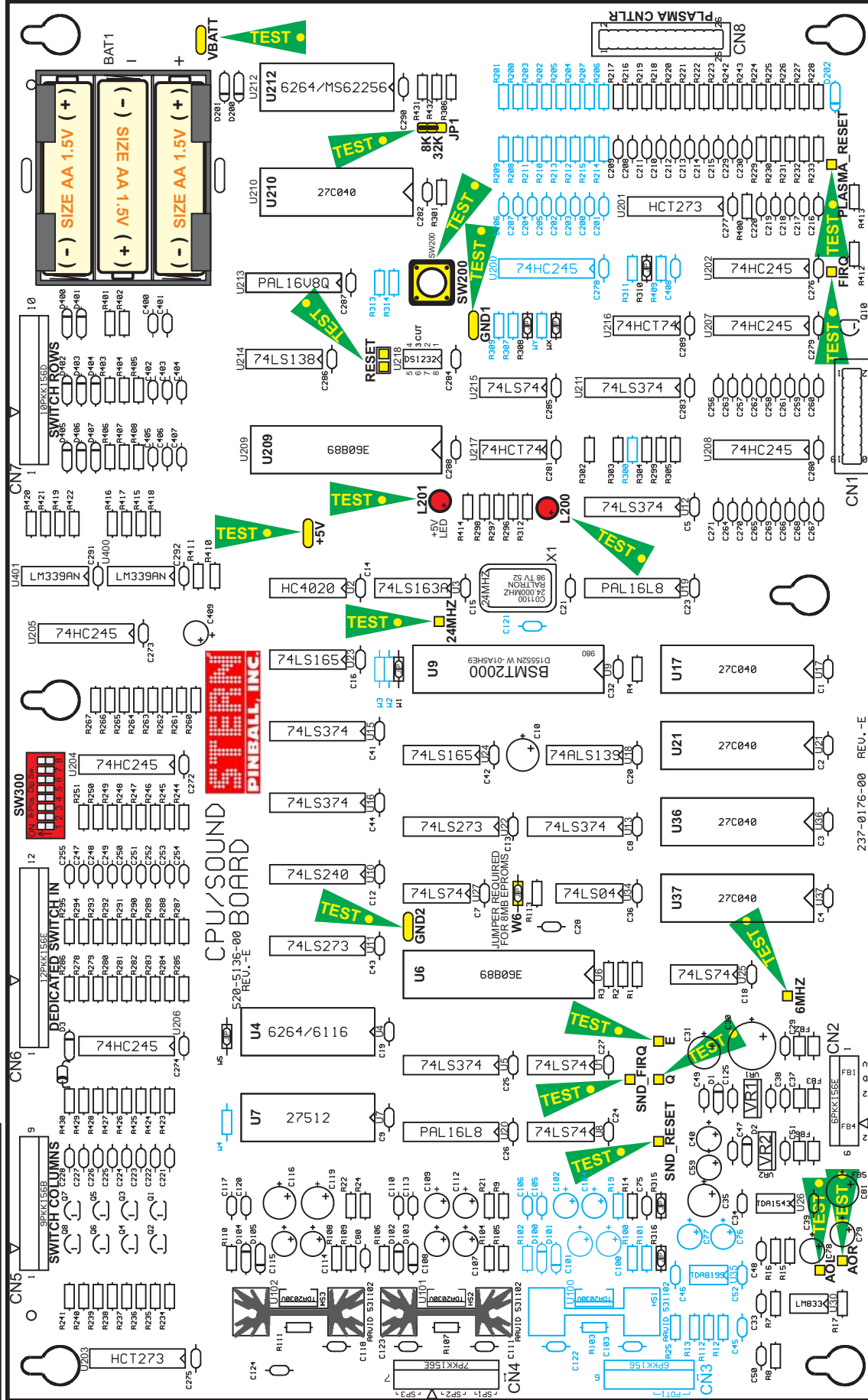


Schematic Set		STERN	
Sheet 3 of 3			
SIZE	REV	PINBALL, INC.	
D	E		
SPI CPU/Sound Board			
SPI Part No: 520-5136-16			
Prepared By: CES Inc. Edited By: SPI Inc.			
Model: 237-0176-00 Dated: 07/22/99			


Sec. 5: PCBs



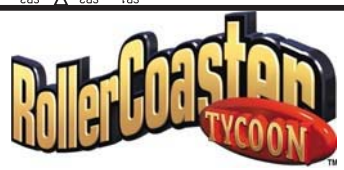
CPU/Sound Board Component Layout



Test Points:

- ← VBATT 
- ← 8K/32K JUMPER JPI
- ← PLASMA_RESET
- ← FIRQ SW200
- ← GND1
- ← RESET
- LEDs :
 - ← L201+5v & L200
 - ← +5V
- ← 24MHZ
- ← 237-0176-00 REV. U-E
- REQUIRED FOR 8MB EPROM USE
 - ← W6 JUMPER
 - ← GND2
 - ← 6MHZ
 - ← E
 - ← SND_FIRQ & Q
 - ← SND_RESET
 - ← AOL & AOR

Sec. 5: PCBs



Actual Board Size
14.67" X 9.125"

CPU/Sound Board Parts

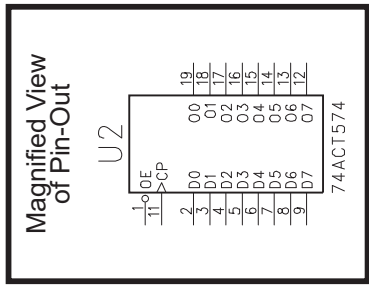
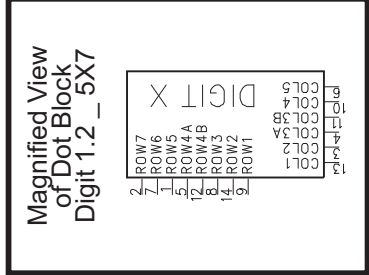
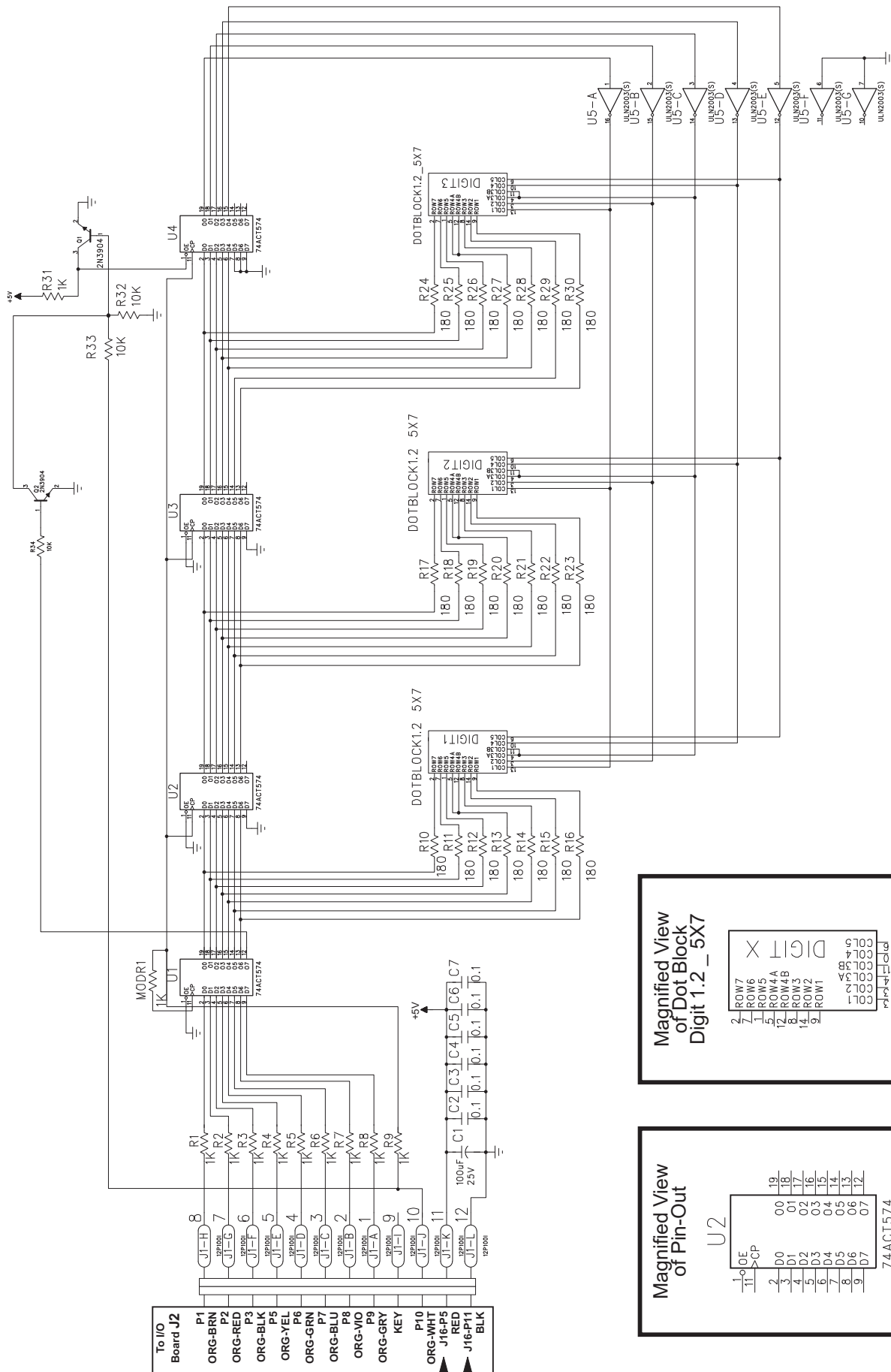
ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	1	520-5136-16	CPU/Sound Board Mono (FCC FEB98)	Complete PCB Assembly
01	1	545-5685-00	BAT1 HOLDER (Always replace all 3, Size AA 1.5v Cells, with new ones, when required)	
02	79	125-5031-00	C1, C2, C3, C4, C5, C7, C8, C9, C12, C13, 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	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	112-5054-00	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. Table)	U7	27512 EPROM
55	1	105-0116-00	U9	BSMT2000
56	1	100-0149-00	U10	74LS240
57	5	(See Pg. DR. 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.

Sec. 5: PCBs

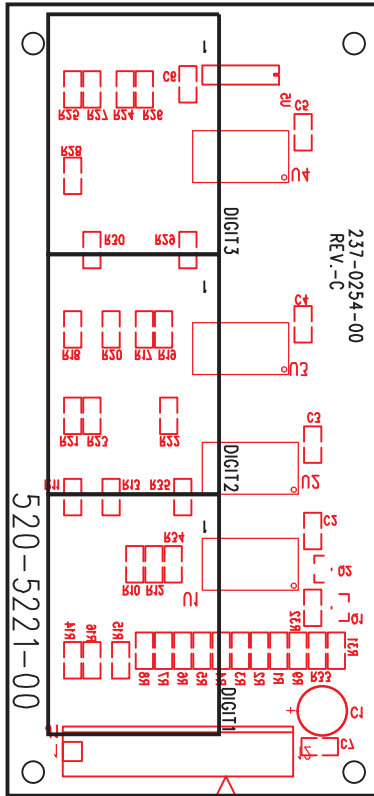


Dot Display (5X7) x3 PC Board (Flying Ghosts & Flying Turns Ramp Enter Sign) Schematic

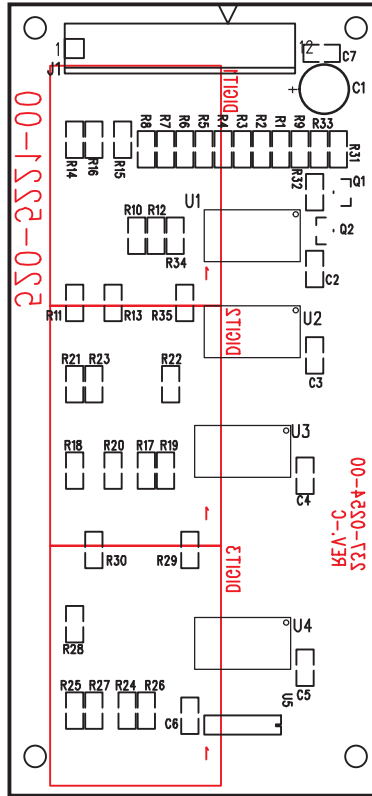
Sec. 5: PCBs



Dot Display (5X7) x3 PC Bd. (... Ramp Enter Sign) Component Layout & Parts



Front (Dot Block) Side



Component / Solder Side



Component / Solder Side

Note: To test this Dot Display Board via Portals™, see Section 3, Chapter 2, GO TO DIAGNOSTICS MENU, LED Test, Pages 27-28.



Note: The Dot Display x3 PC Board is shown how it is used in this game. The Screened Plastic (Bulkyrate) 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	2N3904S 40V 0.2A
3	4	100-5036-00	U1, U2, U3, U4	74ACT574
4	6	100-5039-00	C2-C7	Cap. 104-0805 0.1 50V
5	3	100-5040-00	DIGIT1, DIGIT2, DIGIT3	Dot Block 1.2: 5X7 GMA8875C
6	3	121-5084-00	R32-R34	10KΩ 1/10W 0805 Res.
7	10	121-5088-00	R1-R9, R31	1KΩ 1/10W 0805 Res.
8	21	121-5086-00	R10-R30	180Ω 1/10W 0805 Res.
9	1	100-5037-00	C1	100uF 25V T. Cap.
10	1	100-5038-00	U5	ULN2003(S)
11	1	121-5089-00	MOD1	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

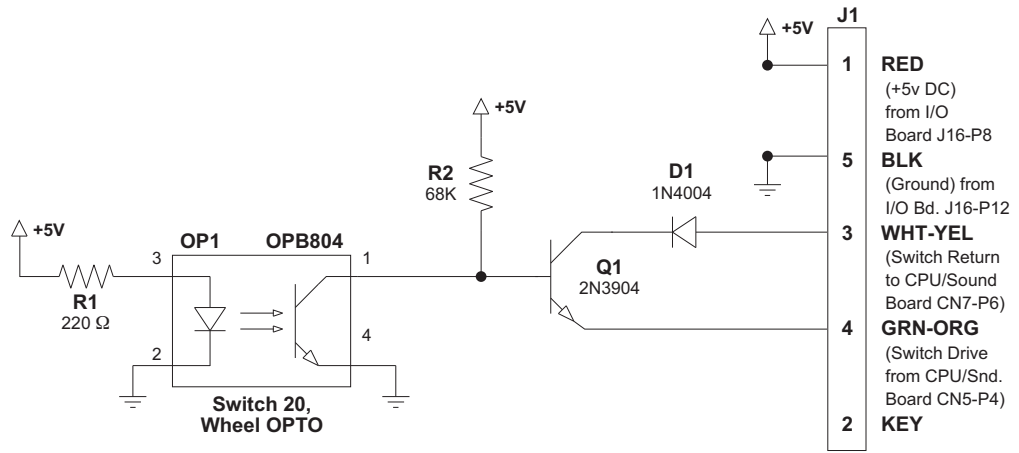
Printed Circuit Boards (PCBs)



Sec. 5: PCBs

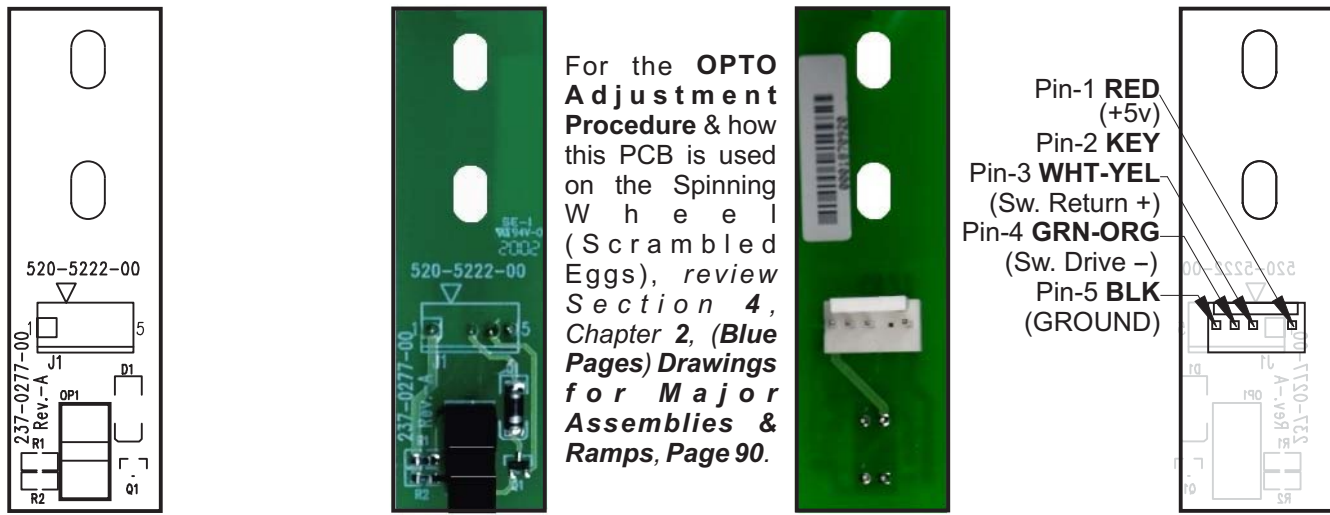
1-Position OPTO PC Board (Wheel-Spin) Theory of Operation & Schematic

The **OPTO Printed Circuit Board** (SPI Part N^o: 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



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).

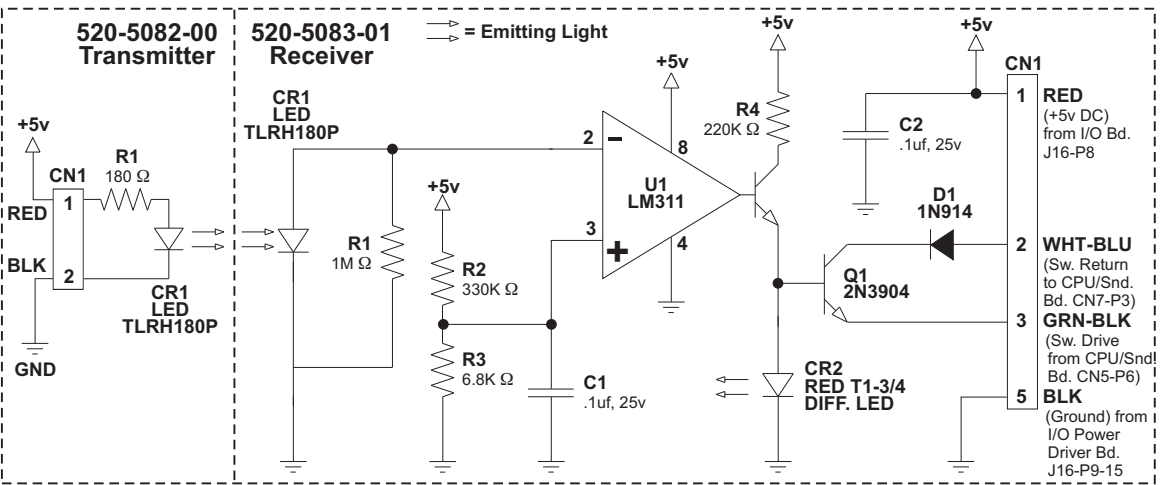
Sec. 5: PCBs

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
1	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

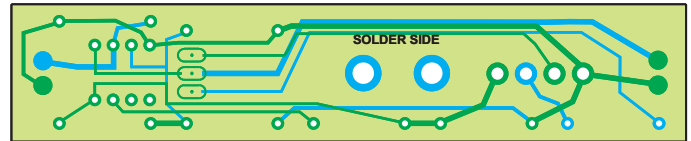


(during switch line strobos) or the indicator LED (CR2) (in between strobos). If a switch line is being strobed, the emitter of Q1 drops to the saturation voltage of the Switch Line Driver, about .3 volts. This plus the .7 volt drop on the base give a 1v forward bias voltage to Q1, which is lower than the 1.7v drop on LED (CR2) so the current flows through the Transistor during strobos. 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.

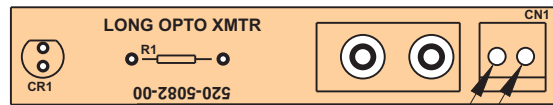
Playfield Switch OPTO "Long-Hop" Boards Component Layout & Parts



520-5082-00 (TRANS) Solder Side (Green)

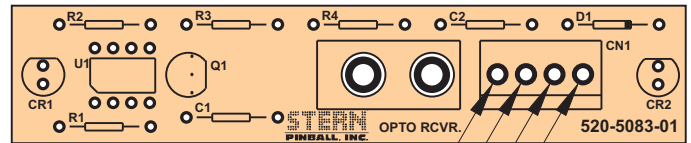


520-5083-01 (REC) Solder Side (Green)



Component Side (Beige)

Pin-1 RED (+5v)
Pin-2 BLK (GROUND)



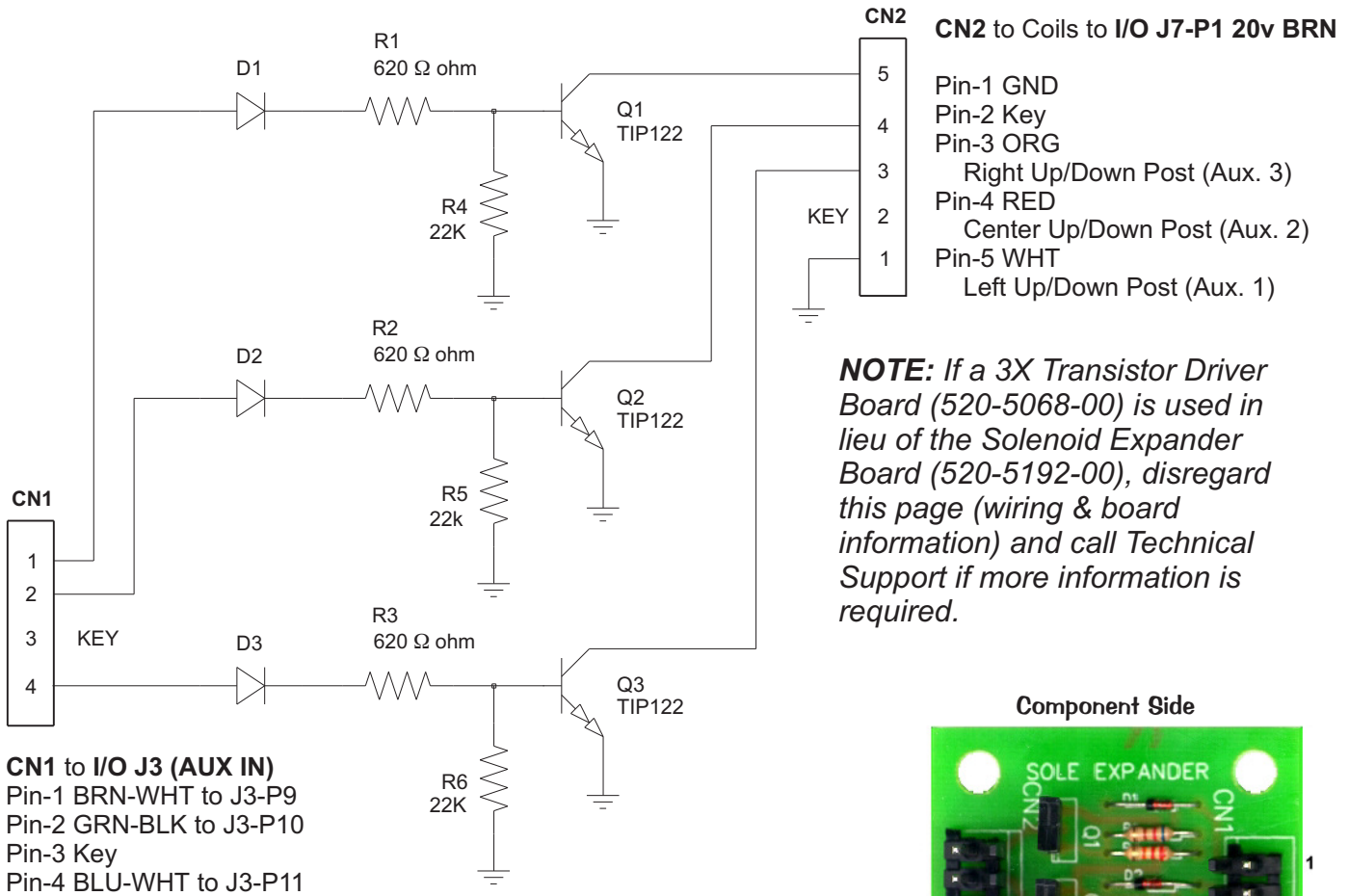
Component Side (Beige)

Pin-1 RED (+5v)
Pin-2 WHT-BLU (Sw. Return +)
Pin-3 GRN-BLK (Sw. Drive -)
Pin-4 BLK (GROUND)

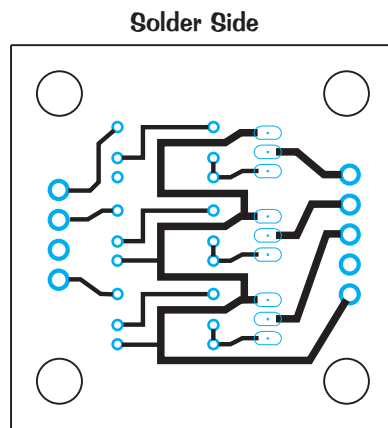
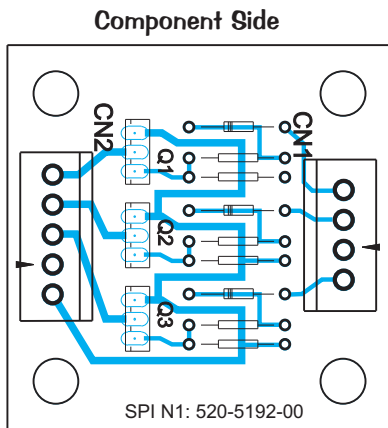
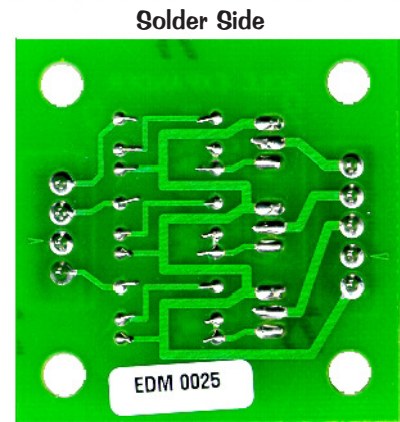
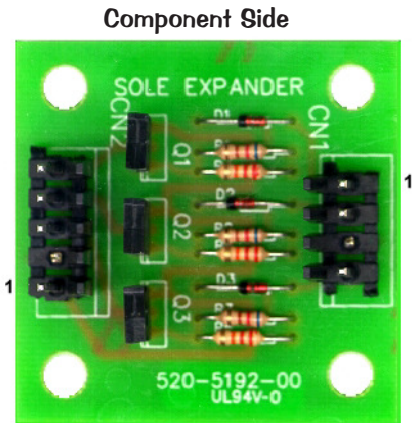
Note: In this game, this Combo OPTO Board is used as a P/F Detection Switch behind the 1-Bank Drop Target. See the Switch Matrix Grid (Pgs. 16-17 or 104). PCBs are used for Switch 38, (GRN-BLK, WHT-BLU).

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	4X1, .156" Locking Straight Hdr. Conn (Molex 50-84-1040)
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	2X1, .156" Locking Straight Hdr. Conn (Molex 50-84-1020)

(UK Only) Solenoid Expander PC Board Schematic



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



Sec. 5: PCBs

ITEM	QTY	PART NUMBER	REF-DESIGNATOR
1	1	520-5192-00	Solenoid Expander PC Board
2	1		CN1
3	1		CN2
4	3	112-5014-00	D1, D2, D3
5	3	121-5003-00	R1, R2, R3
6	3	121-5042-00	R4, R5, R6
7	3	110-0067-00	Q1, Q2, Q3
	1	036-5479-00-76	Not Shown

DESCRIPTION
Complete PCB Assembly
Connector, 4X .156"
Connector, 5X .156"
1N914, Signal Diode
620Ω 1/4W CF Resistor
22KΩ 1/4W CF Resistor
Tip122 (NPN Darl. Transistor)
UK Post Cable Wiring Harness



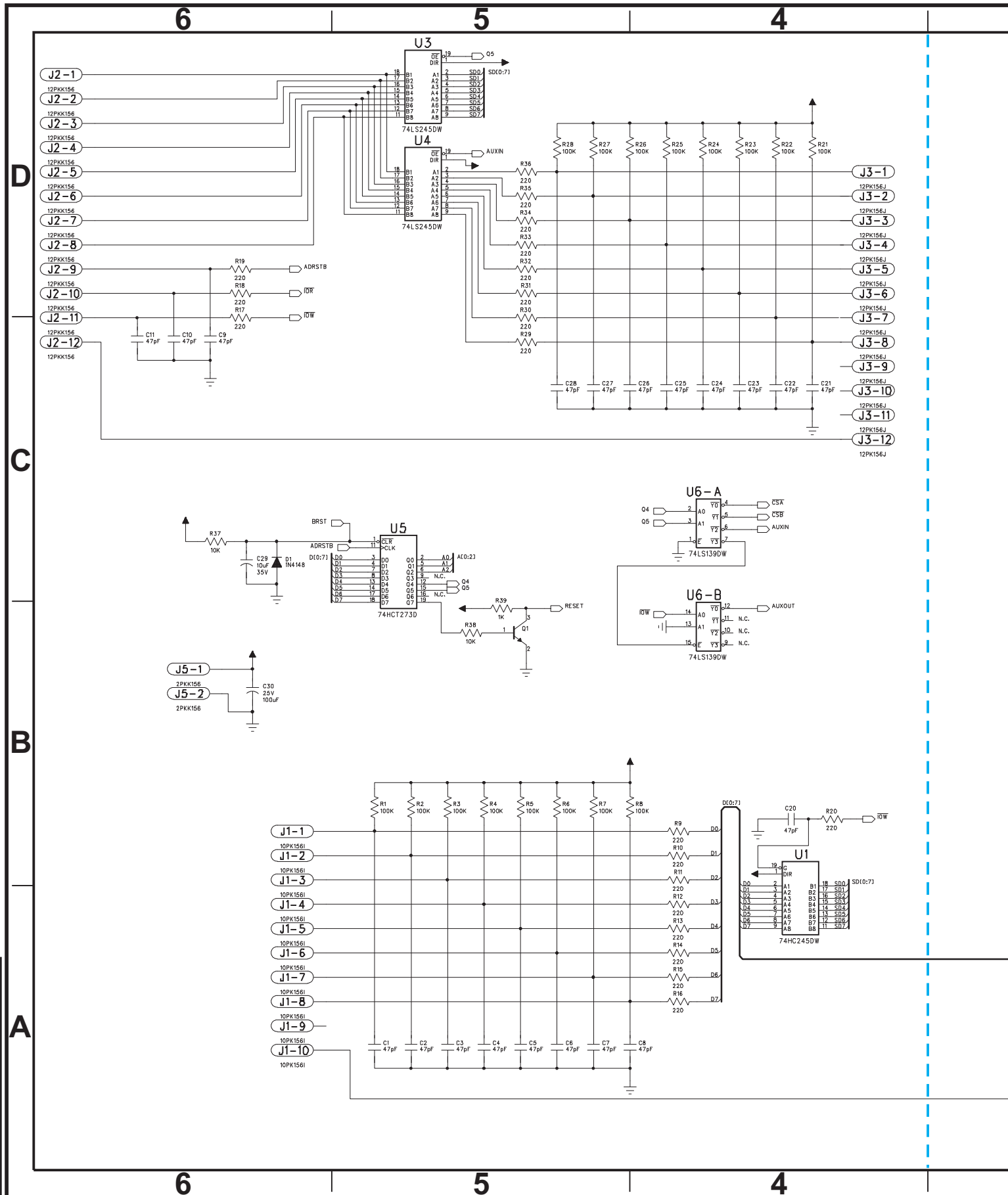
Order the Optional ToPS™ (Tournament Pinball System) Kit!
Call Technical Support at 1-800-542-5377 for more information



The logo for ToPS™ (Tournament Pinball System) features the letters 'T', 'O', 'P', and 'S' in a bold, red, sans-serif font. The letter 'O' is replaced by a silver pinball with a white dot and a shadow. A thin, grey, curved line arches over the letters 'P' and 'S'. A small 'TM' trademark symbol is positioned to the upper right of the 'S'.

TOURNAMENT PINBALL SYSTEM

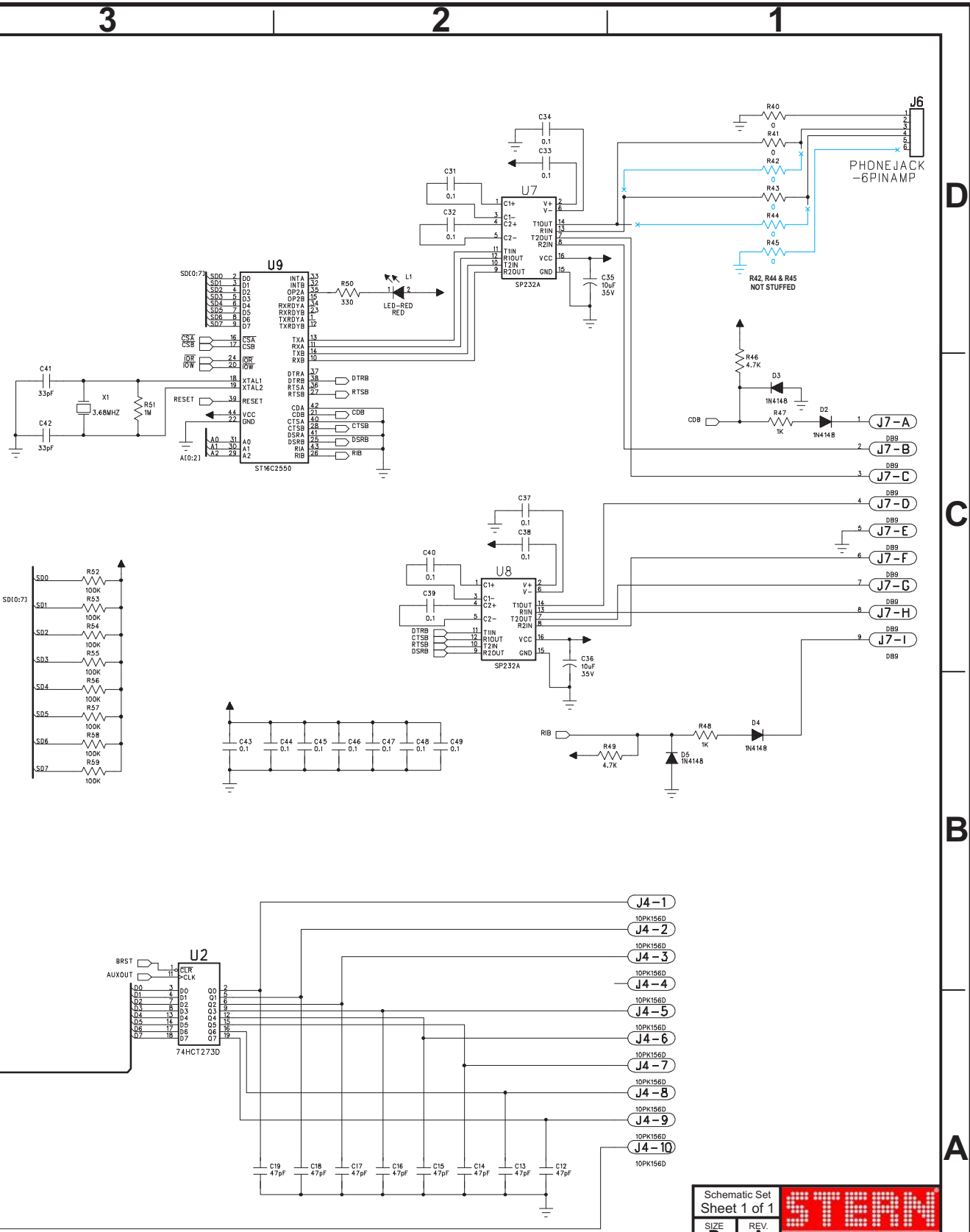
Tournament Serial Interface Board Schematic (Sheet 1 of 1)



Sec. 5: PCBs



Tournament Serial Interface Board Schematic (Sheet 1 of 1)



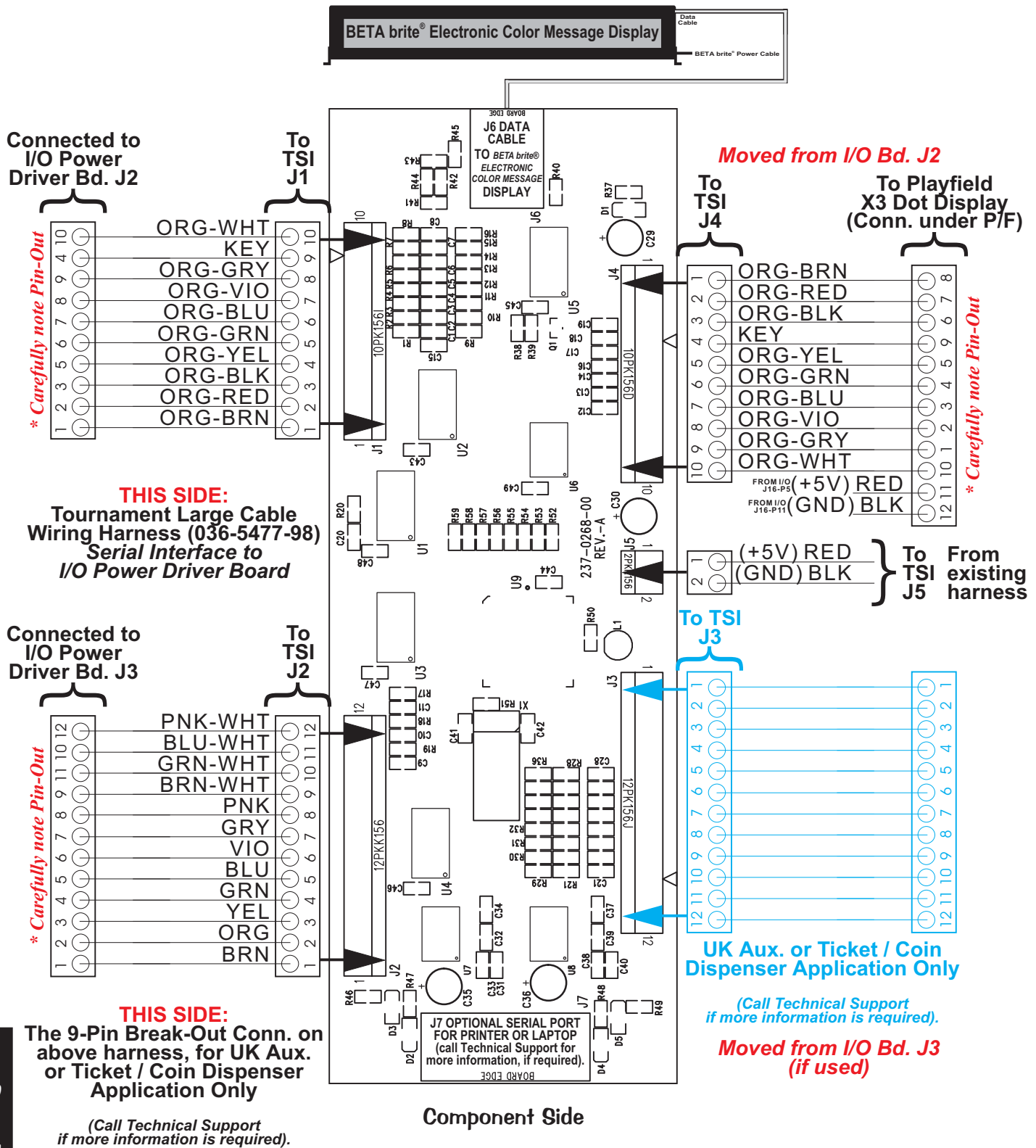
NOTES:
 [] ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
 [] ALL CAPACITOR VALUES ARE IN MICROFARADS (μ F), UNLESS OTHERWISE SPECIFIED.
 [] 0.1 MICROFARADS (μ F) BYPASS CAPACITOR ON ALL IC'S.

Non-Text Document

Schematic Set Sheet 1 of 1		STERN PINBALL, INC.
SIZE D	REV. A	
SPI Tournament Serial Interface Bd. SPI Part No: 520-5220-00		
Prepared By: CES Inc. Edited By: SPI Inc. Model: 237-0268-00 Dated: 08/2002		



Tournament Serial Interface Board Component Layout & Parts



Sec. 5: PCBs

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

- **Appendix A, Pinball Game Firmware Table A1-A2**
...describes the EPROM with its chip size, the Stern™ Pinball, Inc. (SPI) Part N^o, version (if applicable), and CPU Board & CPU/Sound Board Pin location(s).
- **Appendix B, Semi-Conductors / I.C.'s / Relays Cross-Reference Table B1**
...describes diodes and transistors with Source N^o, SPI Part N^o, NTE N^o, ECG N^o, Radio Shack N^o & RCA Part N^o (If applicable).
- **Appendix C, Game Mfg. Date, Manual Part N^o & CPU Jumper Table C1**
...provides the Game Manufactured Date & Manual Part N^o, the CPU version, the EPROM Position, Jumpers Installed and Jumpers Removed (games specified).
- **Appendix D, Board Type Table D1-D2**
...provides Board Part N^os for Games Laser War through Batman Forever (Flipper, Sound, Power Supply, Dot Matrix Display, Display Controller & OPTOs) and the White Star Board System, Games Apollo 13 through current (Flipper*, I/O Power Driver, CPU/Sound, Display Power Supply, Dot Matrix Display, Display Controller & OPTOs; *Flipper Board with the White Star Bd. System for A13 & Golden Eye only.)
- **Appendix E, Generic Coil Cross-Reference Guide & Flipper Coil Table E1-E2**
...provides the Coils used with Part N^o and Gauge-Turns (of the coil).
- **Appendix F, Motor Specification Table F1-F2**
...provides all the Motor Function, Specifications and Part N^o for Games Laser War through current.
- **Appendix G, Part Number Prefix Classification Codes..... G1**
...explains how our Part Numbers are developed to help sort parts easier.
- **Appendix H, Playfield Inserts (Plastic Light Covers) H1**
...gives a pictorial view with the name and Part N^o of all the inserts used (also gives the Color Code Chart).
- **Appendix I, Stand-Up Targets (Happ Modular & Regular) I1**
...gives a pictorial view with the name and Part N^o of all the Single Stand-Up Targets used (also gives the Color Code Chart).
- **Appendix J, Coin Cards (USA & International) J1**
...gives a pictorial view with the name and Part N^o of all the current Coin Cards for USA, Canada, Euro and other International Countries.
- **Glossary of Terms Last Page**
...gives definitions or explanations of some pinball terms and acronyms.
- **Limited Warranty, Cautions, Warnings & Notices Last Page**



APPENDIX A

Pinball Game Firmware Table

EPROM	Chip Size	Program Part N ^o	USA Ver.	Bd. Loc.	Raw Part N ^o	EPROM	Chip Size	Program Part N ^o	USA Ver.	Bd. Loc.	Raw Part N ^o
Laser War						Lethal Weapon 3					
CPU	(256K)	965-0004-00	LWAR.C5	C5	960-5007-00	CPU	(512K)	965-0082-00	A2.08	C5	960-7001-02
Sound (Old)	(256K)	965-0005-00		J5	960-5007-00	Voice 1	(2M)	965-0083-00		U17	960-5010-00
Sound (Old)	(256K)	965-0006-00		J6	960-5007-00	Voice 2	(2M)	965-0084-00		U21	960-5010-00
Sound (Old)	(256K)	965-0007-00		J7	960-5007-00	Sound	(256K)	965-0085-00		U7	960-5007-00
			- OR -			Display	(2M)	965-0086-00	A2.06	ROM 0	960-5010-00
Sound	(256K)	965-0008-00		7F	960-5007-00	Display	(2M)	965-0087-00	A2.06	ROM 1	960-5010-00
Sound 1	(512K)	965-0009-00		6F	960-7001-02			(Used on Display PCB 520-5055-00)			
Sound 2	(512K)	965-0010-00		4F	960-7001-02	Display	(4M)	965-0087-04	-OR- A2.06	ROM 0	960-5015-00
								(Used on Display PCB 520-5055-01)			
Secret Service						Star Wars					
CPU	(256K)	965-0011-00	A4-6	B5	960-5007-00	CPU	(512K)	965-0119-00	A1.03	C5	960-7001-02
CPU	(256K)	965-0012-00	A4-6	C5	960-5007-00	Voice 0	(4M)	965-0132-00		U17	960-5015-00
Voice 1	(512K)	965-0014-00		6F	960-7001-02	Voice 1	(2M)	965-0133-00		U21	960-5010-00
Voice 2	(512K)	965-0015-00		4F	960-7001-02	Sound	(256K)	965-0131-00		U7	960-5007-00
Sound	(256K)	965-0013-00		7F	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)			
						Display	(4M)	965-0122-00	-OR- A1.05	ROM 0	960-5015-00
								(Used on Display PCB 520-5055-01)			
Torpedo Alley						Rocky & Bullwinkle & Friends					
CPU	(256K)	965-0016-00	A2-1	B5	960-5007-00	CPU	(512K)	965-0138-00	A1.30	C5	960-7001-02
CPU	(256K)	965-0017-00	A2-1	C5	960-5007-00	Voice 0	(4M)	965-0139-00		U17	960-5015-00
Voice 1	(512K)	965-0019-00		6F	960-7001-02	Voice 1	(2M)	965-0140-00		U21	960-5010-00
Voice 2	(512K)	965-0020-00		4F	960-7001-02	Sound	(256K)	965-0141-00		U7	960-5007-00
Sound	(256K)	965-0018-00		7F	960-5007-00	Display	(4M)	965-0142-00	A1.30	ROM 0	960-5015-00
Time Machine						Jurassic Park					
CPU	(128K)	965-0021-00	A2-4	B5	960-5006-00	CPU	(512K)	965-0143-00	A5.13	C5	960-7001-02
CPU	(256K)	965-0022-00	A2-4	C5	960-5007-00	Voice 0	(4M)	965-0144-00		U17	960-5015-00
Voice 1	(512K)	965-0024-00		6F	960-7001-02	Voice 1	(2M)	965-0145-00		U21	960-5010-00
Voice 2	(512K)	965-0025-00		4F	960-7001-02	Sound	(256K)	965-0146-00		U7	960-5007-00
Sound	(256K)	965-0023-00		7F	960-5007-00	Display	(4M)	965-0147-00	A5.10	ROM 0	960-5015-00
Playboy 35th Anniversary						Last Action Hero					
CPU	(256K)	965-0046-00	A2-4	B5	960-5007-00	CPU	(512K)	965-0148-00	A1.12	C5	960-7001-02
CPU	(256K)	965-0047-00	A2-4	C5	960-5007-00	Voice 0	(4M)	965-0149-00		U17	960-5015-00
Voice 1	(512K)	965-0049-00		6F	960-7001-02	Voice 1	(2M)	965-0150-00		U21	960-5010-00
Voice 2	(512K)	965-0050-00		4F	960-7001-02	Sound	(256K)	965-0151-00		U7	960-5007-00
Sound	(256K)	965-0048-00		7F	960-5007-00	Display	(4M)	965-0152-00	A1.06	ROM 0	960-5015-00
ABC Monday Night Football						Tales from the Crypt					
CPU	(128K)	965-0031-00	A2-7	B5	960-5006-00	CPU	(512K)	965-0157-00	A3.03	C5	960-7001-02
CPU	(256K)	965-0032-00	A2-7	C5	960-5007-00	Voice 0	(4M)	965-0158-00		U17	960-5015-00
Voice 1	(512K)	965-0034-00		6F	960-7001-02	Voice 1	(2M)	965-0159-00		U21	960-5010-00
Voice 2	(512K)	965-0035-00		4F	960-7001-02	Sound	(256K)	965-0160-00		U7	960-5007-00
Sound	(256K)	965-0033-00		7F	960-5007-00	Display	(4M)	965-0161-00	A3.01	ROM 0	960-5015-00
Robocop						The Who's Tommy					
CPU	(256K)	965-0036-00	A3-4	B5	960-5007-00	CPU	(512K)	965-0162-00	A4.00	C5	960-7001-02
CPU	(256K)	965-0037-00	A3-4	C5	960-5007-00	Voice 1	(4M)	965-0163-00		U17	960-5015-00
Voice 1	(512K)	965-0039-00		6F	960-7001-02	Voice 2	(4M)	965-0166-00		U21	960-5010-00
Voice 2	(512K)	965-0040-00		4F	960-7001-02	Voice 3	(4M)	965-0167-00		U36	960-5015-00
Sound	(256K)	965-0038-00		7F	960-5007-00	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
Phantom of the Opera						WWF Royal Rumble					
CPU	(128K)	965-0026-00	A3-2	B5	960-5006-00	CPU	(512K)	965-0169-00	A1.06	C5	960-7001-02
CPU	(256K)	965-0027-00	A3-2	C5	960-5007-00	Voice 1	(4M)	965-0172-00		U17	960-5015-00
Voice 1	(512K)	965-0029-00		6F	960-7001-02	Voice 2	(4M)	965-0173-00		U21	960-5010-00
Voice 2	(512K)	965-0030-00		4F	960-7001-02	Voice 3	(4M)	965-0174-00		U36	960-5015-00
Sound	(256K)	965-0028-00		7F	960-5007-00	Sound	(512K)	965-0171-00		U7	960-7001-02
						Display	(4M)	965-0170-00	A1.02	ROM 0	960-5015-00
Back to the Future						Guns N' Roses					
CPU	(256K)	965-0041-00	A2-0	B5	960-5007-00	CPU	(512K)	965-0175-00	A3.00	C5	960-7001-02
CPU	(256K)	965-0042-00	A2-0	C5	960-5007-00	Voice 1	(4M)	965-0178-00		U17	960-5015-00
Voice 1	(512K)	965-0044-00		6F	960-7001-02	Voice 2	(4M)	965-0179-00		U21	960-5010-00
Voice 2	(512K)	965-0045-00		4F	960-7001-02	Voice 3	(4M)	965-0180-00		U36	960-5015-00
Sound	(256K)	965-0043-00		7F	960-5007-00	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
The Simpsons						Maverick *					
CPU	(128K)	965-0051-00	A2-7	B5	960-5006-00	CPU	(512K)	965-0182-00	A4.04	C5	960-7001-02
CPU	(256K)	965-0052-00	A2-7	C5	960-5007-00	Voice 1	(4M)	965-0186-00		U17	960-5015-00
Voice 1	(512K)	965-0054-00		6F	960-7001-02	Voice 2	(4M)	965-0187-00		U21	960-5010-00
Voice 2	(512K)	965-0055-00		4F	960-7001-02	Voice 3	(4M)	965-0187-01		U36	960-5015-00
Sound	(256K)	965-0053-00		7F	960-5007-00	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
Checkpoint						Mary Shelley's Frankenstein *					
CPU	(128K)	965-0056-00	A1-7	B5	960-5006-00	CPU	(512K)	965-0188-00	A1.03	C5	960-7001-02
CPU	(256K)	965-0134-00	A1-7	C5	960-5007-00	Voice 1	(4M)	965-0192-00		U17	960-5015-00
Voice 1	(1M)	965-0057-00		F7	960-5009-00	Voice 2	(4M)	965-0193-00		U21	960-5010-00
Voice 2	(1M)	965-0058-00		F5	960-5009-00	Voice 3	(4M)	965-0194-00		U36	960-5015-00
Sound	(256K)	965-0059-00		F4	960-5007-00	Sound	(512K)	965-0191-00		U7	960-7001-02
Display	(512K)	965-0060-00	CP80	U8	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
Teenage Mutant Ninja Turtles						Baywatch *					
CPU	(128K)	965-0061-00	A1.04	B5	960-5006-00	CPU	(512K)	965-0195-00	A4.00	C5	960-7001-02
CPU	(256K)	965-0062-00	A1.04	C5	960-5007-00	Voice 1	(4M)	965-0196-00		U17	960-5015-00
Voice 1	(1M)	965-0063-00		F5/6	960-5009-00	Voice 2	(4M)	965-0197-00		U21	960-5010-00
Voice 2	(1M)	965-0064-00		F4/5	960-5009-00	Sound	(512K)	965-0199-00		U7	960-7001-02
Sound	(256K)	965-0065-00		F7	960-5007-00	Display*	(4M)	965-0200-00	A4.00	ROM 0	960-5015-00
Display	(512K)	965-0066-00	A1.04	U8	960-7001-02	Display*	(4M)	965-0201-00	A4.00	ROM 3	960-5015-00
Batman						Batman Forever *					
CPU	(128K)	965-0067-00	A1.06	B5	960-5006-00	CPU	(512K)	965-0202-00	A3.02	C5	960-7001-02
CPU	(256K)	965-0135-00	A1.06	C5	960-5007-00	Voice 1	(4M)	965-0203-00		U17	960-5015-00
Voice 1	(2M)	965-0068-00		U17	960-5010-00	Voice 2	(4M)	965-0204-00		U21	960-5010-00
Voice 2	(2M)	965-0069-00		U21	960-5010-00	Sound	(512K)	965-0205-00		U7	960-7001-02
Sound	(256K)	965-0070-00		U7	960-5007-00	Display*	(4M)	965-0206-00			



APPENDIX A

Pinball Game Firmware (for White Star Board System) Table



ROM	Chip Size	Program Part N ^o	USA Ver. & Check Sum	Bd. Loc.	Raw Part N ^o
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		U17	960-5016-00
Voice 2	(8M)	965-0323-67		U21	960-5016-00
Voice 3	(8M)	965-0324-67		U36	960-5016-00
Voice 4	(4M)	965-0325-67		U37	960-5015-01

ROM	Chip Size	Program Part N ^o	USA Ver. & Check Sum	Bd. Loc.	Raw Part N ^o
Striker Xtreme (Notes 4, 5)					
Game ROM	(1M)	965-0326-68	A1.02 \$E4FF	U210	960-5009-00
Sound	(512K)	965-0327-68		U7	960-7001-02
Display	(4M)	965-0328-68	A1.03 \$1957	ROM 0	960-5015-01
Voice 1	(8M)	965-0329-68		U17	960-5016-00
Voice 2	(8M)	965-0330-68		U21	960-5016-00
Voice 3	(8M)	965-0331-68		U36	960-5016-00
Voice 4	(8M)	965-0332-68		U37	960-5016-00
NFL (Notes 4, 5)					
Game ROM	(1M)	965-0339-73	A1.00 \$D2FF	U210	960-5009-00
Sound	(512K)	965-0340-73		U7	960-7001-02
Display	(4M)	965-0341-73	A1.01 \$845A	ROM 0	960-5015-01
Voice 1	(8M)	965-0342-73		U17	960-5016-00
Voice 2	(8M)	965-0343-73		U21	960-5016-00
Voice 3	(8M)	965-0344-73		U36	960-5016-00
Voice 4	(8M)	965-0345-73		U37	960-5016-00
Sharkey's Shootout (Notes 4, 5)					
Game ROM	(1M)	965-0333-72	A2.11 \$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)	965-0355-74	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)	965-0366-75		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 into 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 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 No	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 <i>(old SPI Part No: 165-5100-00)</i>	-----	-----	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 N^o & CPU Jumper Table†

Game Name	Game Mfg. Date and Manual PN ^o	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.



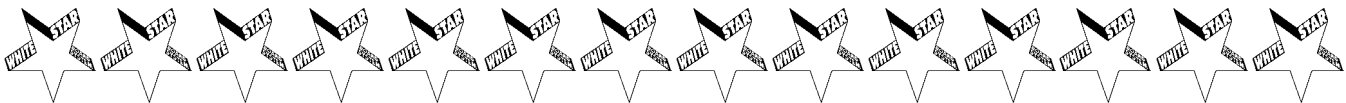
APPENDIX D

Board Type Table

Game Name	Flipper	Sound	Power Supply	Display X-Digit
• Laser War	2-Flipper Board Not Required	<i>initial:</i> 520-5002-00 <i>replaced with:</i> 520-5002-02 <i>520-5002-01 was not used.</i>	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			520-5030-00 16 Digit Alpha/Numeric Combined
• Playboy 35th Anniversary * • ABC Monday Night Football * • Robocop • Phantom of the Opera • Back to the Future • The Simpsons	520-5033-00 2-Flipper <i>(*only for 100 games of Playboy 35th Anniv. & ABC Mon. Night Football)</i>			

Game Name	Flipper	Sound	Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Application
• Checkpoint • Teenage Mutant Ninja Turtles	520-5033-00 2-Flipper	520-5002-03	520-5047-00	520-5042-00 128 X 16	520-5055-00			
• Batman • Star Trek 25th Anniv. • Hook		520-5050-01						
• Lethal Weapon 3 • Star Wars • Rocky & Bullwinkle & Friends		520-5050-02	520-5047-01					
• Jurassic Park		520-5076-00 3-Flipper	520-5047-02	520-5052-00 128 X 32				
• Last Action Hero		520-5070-00 2-Flipper						
• Tales from the Crypt • The Who's Tommy	520-5076-00 3-Flipper	520-5077-00	520-5055-01					
• WWF Royal Rumble	520-5070 / 5080-00 4-Flipper (2X2)	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
• Guns N' Roses	520-5076-00 3-Flipper							
• Maverick	520-5076-00 3-Flipper	520-5077-00	520-5126-02			520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker
• Mary Shelley's Frankenstein	520-5070 / 5080-00 4-Flipper (2X2)	520-5126-02				520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker
• Baywatch	520-5076-00 3-Flipper							
• Batman Forever	520-5076-00 3-Flipper							

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



GAMES HEREON USE THE WHITE STAR BOARD SYSTEM™ (with the addition of the I/O Power Driver Board):

Game Name	Flipper	I/O Power Driver	CPU/Sound Stereo	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Application
Apollo 13	520-5080-00 2-Flipper	520-5137-00	520-5136-00	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker
	Miscellaneous PC Boards:	Light Boards 520-5130-01, -04 & -05 Magnet Interface, 7-Segment Display & Light Bd. 520-5130-06 Magnet Driver Board 520-5130-02 Switch Membrane Board 520-5130-03				Relay Board 520-5010-00			
Golden Eye	520-5080-00 2-Flipper	520-5137-00	520-5136-00	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker
	Miscellaneous PC Boards:	Light Boards 520-5128-05 through -08		Mag. Processor X2 Driver Bd. 520-5143-00		Relay Board 520-5010-00			

GAMES HEREON USE THE WHITE STAR BOARD SYSTEM™ (with the deletion of the Flipper Board):

Game Name	I/O Power Driver	CPU/Sound Mono	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Application	Misc OPTO & App.
Twister	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Light Boards 520-5145-01 through -07		Mag. Drv. Bd. 520-5143-00	Relay Board 520-5010-00				
Independence Day (ID4)	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Light Boards 520-5149-01 through -10		Servo Mtr. Bd. 520-5152-00		520-5082-00 Long Hop opto	520-5083-00 Long Hop opto	Alien Head Enter	

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 Trilogy - Special Ed.	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00							
The Lost World: J.P.	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	520-5162-00 2-Pos. Motor Sensor on Snagger Motor
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Shaker Mtr. Bd. 520-5065-00						
The X-Files	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	520-5155-00 3-Pos. Motor Sensor on File Cab. Motor
	Miscellaneous PC Boards:					520-5082-00 Long Hop OPTO	520-5083-00 Long Hop OPTO	File Cabinet Enter	
Starship Troopers	520-5137-01	520-5136-15	520-5138-00	520-5052-00 128 X 32	520-5055-02	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	4X 7-Segment Display Board 520-5166-00				520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	L/R Orbit Lane Enter	
Viper Night Drivin'	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00				520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Jump Ramp	
Lost In Space	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00							
Godzilla	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Shaker Mtr. Bd. 520-5065-00							
South Park	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:					520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Kenny Under Trough Enter	
Harley-Davidson®	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00	Shaker Mtr. Bd. 520-5065-00	Diode Board 520-5146-00		520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Motorcycle Enter	
Striker Xtreme (NFL)	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5155-00 3-Pos. Motor Sensor on Goalie Motor
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Relay Board 520-5010-00	Diode Board 520-5146-00	for UK ONLY>- Solenoid Expander Bd. 520-5192-00	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Goalie Under- Trough Enter	
Sharkey's Shootout	520-5137-64	520-5136-64	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5194-00 4-Pos. Motor Sensor on ?-Ball Motor
	Miscellaneous PC Boards:	Relay Board 520-5010-00	Sol. Exp. Bd. 520-5192-00						
High Roller Casino	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5194-00 4-Pos. Motor Sensor on Roulette Wheel Motor
	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	Ball Lock under Roulette 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.

**Board
Type Table**



APPENDIX E

Generic Coil Cross-Reference Guide † ‡

STANDARD COILS						FLIPPER COILS			
GA-TURNS	Res. (Ω)	SPI PART N ^o	GA-TURNS	Res. (Ω)	SPI PART N ^o	GAUGE-TURNS	Res. (Ω)	COLOR	SPI PART N ^o
20-400	1.0 Ω	090-5021-00	24-940 †	5.5 Ω	090-5036-00T	21-900 †	<i>not available</i>	RED	090-5020-10T
22-500	1.7 Ω	090-5017-00			090-5036-00B				
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 †				
23-750	3.4 Ω	090-5019-00	090-5044-00B	23-620/30-2600 ‡		2.4 / 75.0 Ω	N/A	090-5006-00	
23-800 †	3.6 Ω	090-5001-00T	27-1300		14.2 Ω				090-5003-00
		090-5001-00B	27-1400	14.7 Ω	090-5015-00				
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^{1/2}-765	3.6 Ω	090-5037-03	28-1050	11.5 Ω	090-5046-00	23-900	3.8 Ω	GRN	090-5020-30
24-900	5.0 Ω	090-5002-00	29-2000	33.6 Ω	090-5016-00	23-1100	5.1 Ω	ORG	090-5030-00
						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 N^os 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 N^os 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 N ^o	GA-TURNS	Res. (Ω)	SPI PART N ^o	GA-TURNS	Res. (Ω)	SPI PART N ^o	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 N ^o	
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
20^{1/2}-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	N ^o of Flippers	LOWER FLIPPERS		UPPER FLIPPERS	
		SPI N ^o / GAUGE-TURNS / Color		SPI N ^o / 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	N ^o of Flippers	LOWER FLIPPERS		UPPER FLIPPERS	
		SPI N ^o / GAUGE-TURNS / Color		SPI N ^o / 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 N^os ending with a "T" signifies the Diode is on the top of the lug (on the coil-winding side);
Coil Part N^os 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 N ^o
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 4 1/4": 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/CW	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/CW	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








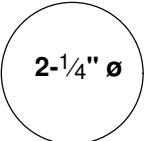
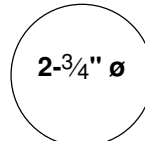
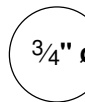
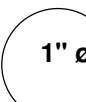
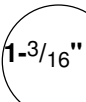
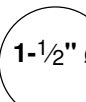
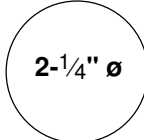
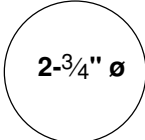
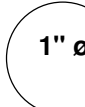
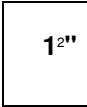
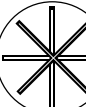
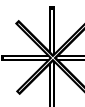
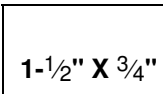
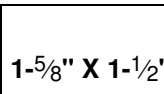
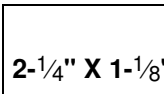
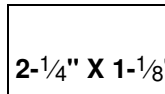
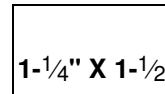
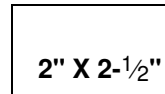


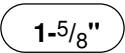
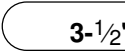
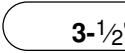


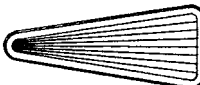
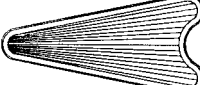
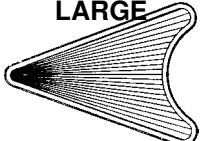
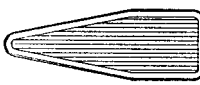
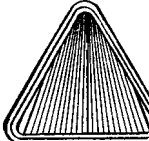
IX. Miscellaneous

- 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  550-5000-XX	STARBURST CIRCULAR  550-5001-XX	STARBURST CIRCULAR  550-5002-XX	STARBURST CIRCULAR  550-5003-XX	STARBURST CIRCULAR  550-5004-XX
STARBURST CIRCULAR  550-5005-XX	STARBURST CIRCULAR  550-5006-XX	PLAIN CIRCULAR  550-5007-XX	PLAIN CIRCULAR  550-5008-XX	PLAIN CIRCULAR  550-5009-XX	PLAIN CIRCULAR  550-5010-XX
PLAIN CIRCULAR  550-5011-XX	PLAIN CIRCULAR  550-5012-XX	STIPPLE CIRCULAR  550-5048-XX	STIPPLE 1" SQUARE  550-5019-XX	ROLLOVER BUTTON BASE  550-5026-XX	WHITE STAR (only in white)  545-5015-00
STIPPLE RECTANGULAR  550-5018-XX	STIPPLE RECTANGULAR  550-5051-XX	STARBURST RECTANGULAR  550-5044-XX	PLAIN RECTANGULAR  550-5049-XX	PLAIN RECTANGULAR  550-5050-XX	PLAIN RECTANGULAR  550-5063-XX
STARBURST MINI SHIELD  550-5024-XX	STARBURST LARGE SHIELD  550-5025-XX	MINI HOT DOG  550-5020-XX	BEVEL HOT DOG  550-5021-XX	PLAIN HOT DOG  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

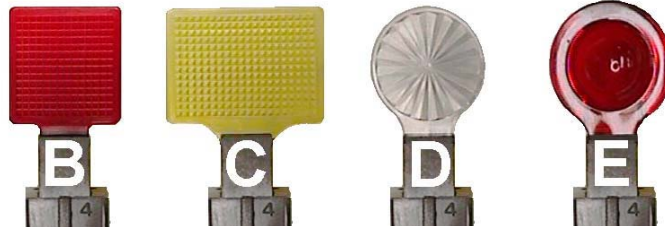
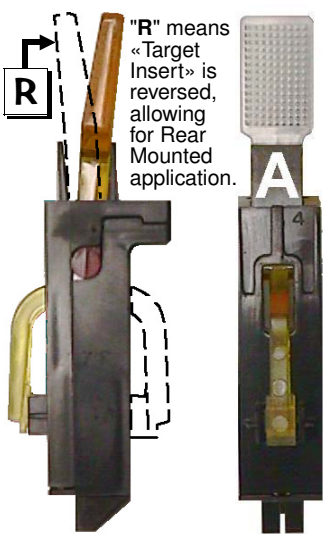
Note: The shapes and sizes shown above are not to scale. Some shapes may no longer be available in every color.

Instructions: Parts which may come in various colors (i.e. targets, some posts, playfield inserts, etc.) end in a 2-digit N^o which correspond to the color of that part. The "-XX" in Part N^os which may come in various colors should be replaced with the desired 2-Digit N^o. corresponding to the color desired. *Not all colors may be available.*

PLASTIC PART COLOR CHART											
N ^o	Color	N ^o	Color	N ^o	Color	N ^o	Color	N ^o	Color	N ^o	Color
-00	Black or Solid Clear	-03	Amber	-06	Yellow	-09	Purple	-12	Fluor. Blue	-15	Luminescent
-01	Clear	-04	Green	-07	Orange	-10	Fluor. Orange	-13	Teal Green	-16	Gold
-02	Red	-05	Blue	-08	White	-11	Fluor. Green	-14	Gray	-17	Trans. Brown

APPENDIX I

Stand-Up Targets

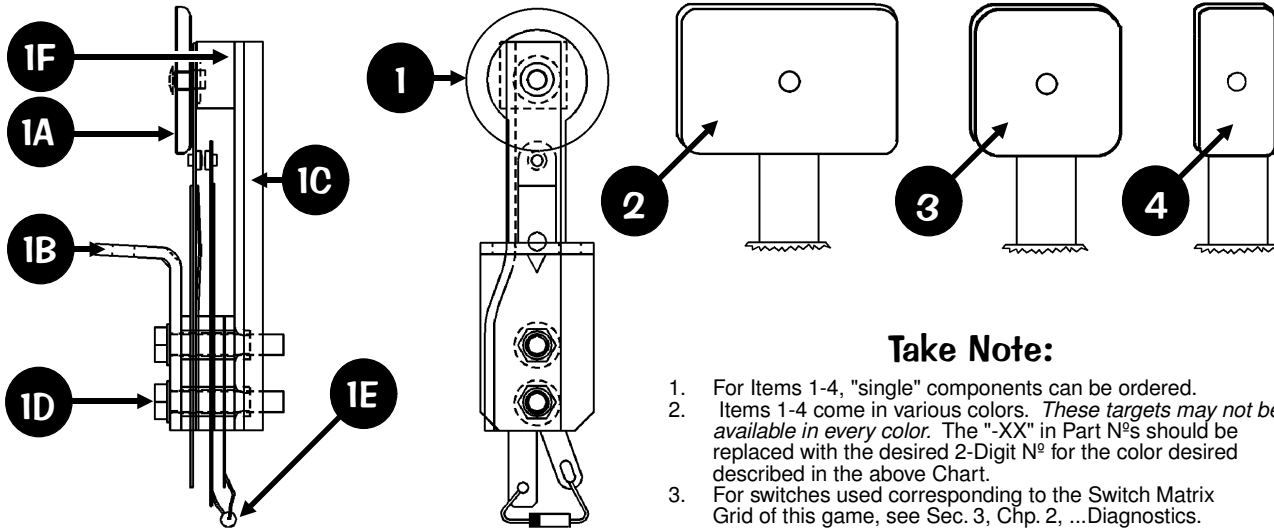


PLASTIC PART COLOR CHART	
Nº	Color
-00	Black
-01	Clear
-02	Red
-03	Amber
-04	Green
-05	Blue
-06	Yellow
-07	Orange
-08	White
-09	Purple
-10	Fluor. Orange
-11	Fluor. Green
-12	Fluor. Blue
-13	Teal Green
-14	Gray
-15	Luminescent
-16	Gold

Take Note:

- 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.
- 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).
- See Section 3, Chapter 2, Go To Diagnostics Menu, for switches used corresponding to the Switch Matrix Grid of this game.

Nº	STAND-UP TARGET NAME	SPI PART Nº	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	Note: To receive the Target Assembly with the «Target Insert» «Reversed» simply add a "R" at the end of the Part Nº. See Side View picture above to compare (dashed line shows target reversed).		
	Stand-Up Target Rectangle (Insert)	545-6228-XX			



Take Note:

- For Items 1-4, "single" components can be ordered.
- 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.
- 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	Nº	STAND-UP (FLAT) TARGET NAME	SPI PART Nº
1	1" Round Stand-Up Target Assy.	500-5835-XX	† 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).		
ORDERING ABOVE (ITEM 1) ASSY. PART Nº WILL INCLUDE:					
1A	Switch & Target Assy. 1" Round	515-5966-XX	3	1" Sq. Stand-Up Target Assy.	500-5232-XX
1B	Mounting Bracket	535-6896-00	ORDERING ABOVE (ITEM 3) ASSY. PART Nº WILL INCLUDE:		
1C	Switch Back Plate	535-6452-00	3A	Sw. & Target Assy. 1" Square	515-5162-XX
1D	6-32 X 3/4 HWH Swage (Qty. 2)	237-5976-05	Items 3B-F are identical to 1B-F		
1E	Switch Diode, 1N4001	112-5001-00	Same as 1B-F		
1F	Foam Pad	626-5029-00	† 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).		
2	1" X 1 1/2" Stand-Up Rect. Target Assy.	500-5321-XX	4	Narrow Stand-Up Target Assy.	500-5857-XX
ORDERING ABOVE (ITEM 2) ASSY. PART Nº WILL INCLUDE:					
2A	Sw. & Target Assy. 1" X 1 1/2" Rect.	515-6027-XX	4A	Sw. & Target Assy. Narrow	515-5967-XX
Items 2B-F are identical to 1B-F			Items 4B-F are identical to 1B-F		
Same as 1B-F			† Note: Item 4A, is a riveted Sub-Assy, which includes the following items for reference: A1— Stack Switch Square End (180-5132-00), A2— Washer 5/16" (242-5017-00), A3— Rivet 1/8" ø X 3/16" (249-5001-00) and A4— Narrow Target (545-5210-XX).		

Item 2 Table Note continued in the next column.



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 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.



GLOSSARY OF TERMS

- A** Followed after a number means "Amp." or Ampage in an expression relating to an electrical object. (e.g. **8A**).
- AC** (Acronym) **Alternating Current**.
- 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. **CN5-P3**).
- CT** (Abbreviation) Center.
- DC** (Abbreviation) Direct Current.
- DT** (Abbreviation) Drop Target(s).
- DOTS** (Acronym) **Diode On Terminal Strip**.
- EB** (Abbreviation) Extra Ball.
- Eject** Playfield surface device to kick ball back into play; Saucer.
- EPROM** (Acronym) **Erasable Programmable Read Only Memory**. Can be erased using UV Light and re-programmed.
- e.g.** (Abbreviation) Latin- Exempla gratia. For Example.
- EOS** (Acronym) **End-Of-Stroke** (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) **Integrated Circuit** (As in after 24-Pin IC).
- ID or I.D.** (Acronym) **Inside Dimension**.
- 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) **Light Emitting Diode**.
- 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 N° or #** (Abbreviation) Number
- NPF** (Acronym) **No Problem Found**.
- 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-P3**).
- PCB** (Acronym) **Printed Circuit Board**
- P/F** (Abbreviation) Playfield.
- PIA LED** (Acronym) **Peripheral Interface Adapter Light Emitting Diode**. 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) **Random Access Memory**. **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) **Read Only Memory**. **ROM cannot** store input instructions but can supply output information. **ROM can be programmed only once**.
- RMA** (Abbreviation) Return Merchandise Authorization Number
- RT, Rt. or R.** (Abbreviation) Right; ("**R**" at the end of Target Assy. Part N° signifies Target Insert is Reversed.)
- 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) **Vertical Up-Kicker** (Super or Standard).
- X** (Abbreviation) "Times" A multiplier; also used in dimensions.
- X-Ball** An undetermined number of ball(s) during game play.
- Zener Diode** A semi-conductor diode used for voltage regulation. Application depends on reverse break-down voltage.
- "-00B"** "B" at the end of Coil Part Numbers signifies that the diode is attached to the bottom of the lug.
- "-00T"** "T" at the end of Coil Part Numbers signifies that the diode is attached to the top of the lug (the side nearest the coil-winding).



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DOT MATRIX DISPLAY BOARDS: 9 MONTHS

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Always Disconnect The Line Voltage Before Servicing. Some Parts May Still Hold Current When Unplugged.

Warning

 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.

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In SWITCH MENU also select:

ACTIVE and DEDICATED SWITCH TESTS

SWITCH MATRIX GRID & DEDICATED SWITCHES

D iode O n T ermi n a l S tri p :									
Column (Drive)	1: Q1	2: Q2	3: Q3	4: Q4	5: Q5	6: Q6	7: Q7	8: Q8	IC U206 INPUT 8
Row (Return)	GRN-BRN CN5-P1	GRN-RED CN5-P3	GRN-ORG CN5-P4	GRN-YEL CN5-P5	GRN-BLK CN5-P6	GRN-BLU CN5-P7	GRN-VIO CN5-P8	GRN-GRY CN5-P9	Ground
1: U400	LEFT BUTTON (UK ONLY) on Cabinet side	NOT USED	(R) & D STANDUP on Brckt. Below	LEFT TOP LANE (A) on Brckt. Below	LEFT RAMP RETURN on Asm. Above	NOT USED	LEFT BUMPER on Asm. Below	LEFT OUTLANE on Brckt. Below	#1 LEFT FLIPPER BUTTON in Cabinet side
2: U400	4TH COIN SLOT on Coin Door	NOT USED	R (&) D STANDUP on Brckt. Below	MIDDLE TOP LANE (B) on Brckt. Below	CENTER RAMP MADE on Asm. Above	LOCKUP 1 (TOP) on Brckt. Below	RIGHT BUMPER on Asm. Below	LEFT RETURN LANE on Brckt. Below	#2 LEFT FLIPPER E.O.S (End-of-Stroke) in Cabinet side
3: U400	6TH COIN SLOT on Coin Door	4-BALL TROUGH #1 (LEFT) on Asm. Below	R & (D) STANDUP on Brckt. Below	RIGHT TOP LANE (C) on Brckt. Below	RIGHT RAMP MADE on Asm. Above	LOCKUP 2 (BOTTOM) on Brckt. Below	BOTTOM BUMPER on Asm. Below	LEFT SLINGSHOT on Asm. Below	#3 RIGHT FLIPPER BUTTON in Cabinet side
4: U400	RIGHT COIN SLOT on Coin Door	4-BALL TROUGH #2 on Asm. Below	WHEEL OPTO on Asm. Below	DUMMY LEFT on Brckt. Below	GHOST DOWN on Asm. Above	(E) AT STANDUP on Brckt. Below	ROCKET on Asm. Below	RIGHT OUTLANE on Brckt. Below	#4 RIGHT FLIPPER E.O.S (End-of-Stroke) in Cabinet side
5: U401	CENTER COIN SLOT / DBA on Coin Door	4-BALL TROUGH #3 on Asm. Below	MINI FLIPPER FEED on Brckt. Below	DUMMY RIGHT on Brckt. Below	RIGHT ORBIT on Brckt. Below	E (A) T STANDUP on Brckt. Below	TOURNAMENT BUTTON Cabinet Front	RIGHT RETURN LANE on Brckt. Below	#5 UPFR. RIGHT FLIPPER BUTTON in Cabinet side
6: U401	LEFT COIN SLOT on Coin Door	4-BALL TROUGH VUK OPTO on Asm. Below	MINI FLIPPER STANDUP on Brckt. Below	DROP BANK LEFT on Brckt. Below	SWEEPER OPTO on Brckt. Below	EA (T) STANDUP on Brckt. Below	START BUTTON Cabinet Front	RIGHT SLINGSHOT on Asm. Below	#6 VOLUME (RED BUTTON) (In Test: LEFT) on Coin Door
7: U401	5TH COIN SLOT on Coin Door	4-BALL STACKING OPTO on Asm. Below	CHICAGO LOOP on Asm. Above	DROP BANK MIDDLE on Asm. Below	SWEEPER DROP on Asm. Below	KIOSK SCOOP on Asm. Below	NOT USED	NOT USED	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) on Coin Door
8: U401	RIGHT BUTTON (UK ONLY) on Cabinet side	SHOOTER LANE on Brckt. Below	LEFT ORBIT on Brckt. Above	DROP BANK RIGHT on Asm. Below	GHOST STANDUP on Brckt. Below	KIOSK TUNNEL on Asm. Below	PLUMB BOB TILT Inside Cabinet	NOT USED	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) on Coin Door



In LAMP MENU also select:

TEST ALL LAMPS, ROW & COLUMN LAMP TESTS

LAMP MATRIX GRID

D iode O n T ermi n a l S tri p :								
Column (18v)	1: U17	2: U16	3: U15	4: U14	5: U13	6: U12	7: U11	8: U10
Row (GND)	YEL-BRN J13-P9	YEL-RED J13-P8	YEL-ORG J13-P7	YEL-BLK J13-P6	YEL-GRN J13-P5	YEL-BLU J13-P4	YEL-VIO J13-P3	YEL-GRY J13-P1
1: Q33	2X BONUS #555 Bulb	3X BONUS #555 Bulb	4X BONUS #555 Bulb	5X BONUS #555 Bulb	5X+ LITE EXTRA #555 Bulb	DUNK THE DUMMY #555 Bulb	SPIN AND BUMP #555 Bulb	RIGHT SPECIAL #555 Bulb
2: Q34	LEFT SPECIAL #555 Bulb	SUPER DUNK #555 Bulb	POWER RIDE #555 Bulb	TOSS YOUR COOKIES #555 Bulb	DANCING DIGITS #555 Bulb	LOCK 1 #555 Bulb	MULTIBALL #555 Bulb	LOCK 2 #555 Bulb
3: Q35	LITE MAP #555 Bulb	WHEEL JACKPOT #555 Bulb	2X SPIN #555 Bulb	WHEEL RED #555 Bulb	WHEEL YELLOW #555 Bulb	WHEEL GREEN #555 Bulb	SHOOT AGAIN #555 Bulb	MAP #555 Bulb
4: Q36	SNACK STAND "?" #555 Bulb	FRIES STAND #555 Bulb	COTTON CANDY #555 Bulb	BURGER STAND #555 Bulb	DRINK STAND #555 Bulb	(E)AT #555 Bulb	E(AT) #555 Bulb	EA(T) #555 Bulb
5: Q37	LITE SPIN #555 Bulb	CHICAGO LOOP LOCK #555 Bulb	CHICAGO LOOP JACKPOT #555 Bulb	LOOP POWER RIDE #555 Bulb	CHICAGO LOOP GREEN #555 Bulb	CHICAGO LOOP YELLOW #555 Bulb	CHICAGO LOOP RED #555 Bulb	PARK TYCOON #555 Bulb
6: Q38	EXTRA BALL #555 Bulb	MULTIBALL START #555 Bulb	FLYING TURNS JACKPOT #555 Bulb	FLYING TURNS GREEN #44 Bulb	FLYING TURNS YELLOW #44 Bulb	FLYING TURNS RED #44 Bulb	PUKE #555 Bulb	START FUN (on Ramp Sign) #44 Bulb
7: Q39	LITE FUN #555 Bulb	GHOST JACKPOT #555 Bulb	GHOST POWER RIDE #555 Bulb	SUPER JACKPOT #555 Bulb	GHOST GREEN #555 Bulb	GHOST YELLOW #555 Bulb	GHOST RED #555 Bulb	GHOST STANDUP #555 Bulb
8: Q40	LEFT BUMPER #555 Bulb	RIGHT BUMPER #555 Bulb	BOTTOM BUMPER #555 Bulb	ADD RIDE #44 Bulb	(R) & D #555 Bulb	R (&) D #555 Bulb	R (&) D #555 Bulb	START BUTTON #555 Bulb
9: Q41	BACK PANEL 1 (LEFT) #44 Bulb	BACK PANEL 2 #44 Bulb	BACK PANEL 3 #44 Bulb	BACK PANEL 4 #44 Bulb	BACK PANEL 5 #44 Bulb	TOP LANE A #555 Bulb	TOP LANE B #555 Bulb	TOP LANE C #555 Bulb
10: Q42	BACK PANEL 6 #44 Bulb	BACK PANEL 7 #44 Bulb	BACK PANEL 8 #44 Bulb	BACK PANEL 9 #44 Bulb	BACK PANEL 10 (RIGHT) #44 Bulb	TROLL LIT X2 #44 Bulb	5000 W/FLASHING #44 Bulb	TOURNAMENT BUTTON #555 Bulb



▼ U.S. ▼
Customary
Inch Ruler



Metric Conversion

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

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

- For metric, multiply inch value by metric value, e.g. 5" X 2.54cm = 12.7cm or 127mm.
- For US, multiply metric value by inch value, e.g. 13cm X .3937" = 5.1181"



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