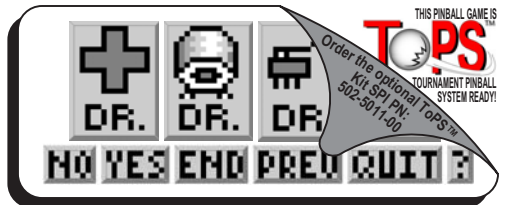


Find-It-In-Front: Dr. Pinball Section

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!



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Pinball Service Game Manual

Please call, eMail or visit us online for technical support, questions or comments regarding this pinball game.

Go to www.sternpinball.com and
click Tech. Support & Parts Sales



Once there, you will find Service Bulletins, ROM Code, Parts,
Appendixes, Coin Cards, helpful information and much more!

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Printed in the U.S.A.
February 2005

• Toll-Free: 1-800-KICKERS (542-5377) or 1-708-345-7700 • eMail: parts.service@sternpinball.com •

SPI Part Number
780-5085-00

For Proper Operation of this Pinball Game, four (4) Pinballs must be installed!

THE Sopranos PINBALL MACHINE CONTAINS ADULT LANGUAGE

Feature Game Adjustment 1, Adult Content Enabled:

Factory Default Setting is PARTIAL

1. **YES (ON)** : non-censored! Use of mild & harsh swear words (e.g. "SH"-word & "F"-word).
2. **PARTIAL (Factory Default)** : partially censored. Use of "bleep" over "F"-word or use of substitution word "friggin'".
3. **NO (OFF)** : censored! No "bleeping," no swearing. *Bada Bing! Dancing Girls DO NOT APPEAR in Dot Display.*

To change your setting, enter the **Portals™ Service Menu System** (see **Service Switch Set Access & Use, Section 3, Chapter 1, Page 8**). The Factory Default setting of this Feature Adjustment is **PARTIAL**. **Note:** If you change the setting, and perform a Factory Reset, the Feature Adjustment will revert to the **PARTIAL** setting (for more details, see **Go To Adjustments Menu, Section 3, Chapter 4, Pages 38-46**).



Exiting **Portals™** or turning game on/off will start the *Power-Up Routine*. Upon **Power-Up**, **HOLD IN THE RIGHT FLIPPER BUTTON** to view the CPU Game & Display Code Versions (+ Check-Sums), followed by the Location & Game ID Numbers and Alerts, if any (see *Sec. 3, Chp. 2, GO TO DIAGNOSTICS MENU, Technician Alerts*).



Look over the **TOURNAMENT MENU** in **Portals™**!

Read over *Section 3, Chapter 7, Pages 53-57*.



An *Optional Tournament Kit* is required for this **ToPS™ Ready** Pinball Game.

You can now easily set-up, start and end Tournaments for cash, tokens, tickets or points!



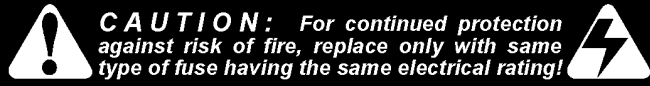
↑ Set-up Tournaments...

↑ 2 personal messages can be added ...

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 ¼A 250v S.B. 90v DC High Voltage Display

LOC: I / O POWER DRIVER BOARD

F6 7A 250v S.B. 50v DC Primary High Power Coils/Flippers

F7 5A 250v S.B. 20v DC Low Power Coils

F8 5A 250v S.B. 12v DC Logic Power

F9 5A 250v S.B. 12v DC Logic Power

F20 4A 250v S.B. 50v DC Magnets

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↔WHT-BRN)

F25 5A 250v S.B. 6.3v AC G.I. Lamps (YEL↔WHT-YEL)

F26 5A 250v S.B. 6.3v AC G.I. Lamps (GRN↔WHT-GRN)

F27 5A 250v S.B. 6.3v AC G.I. Lamps (VIO↔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)

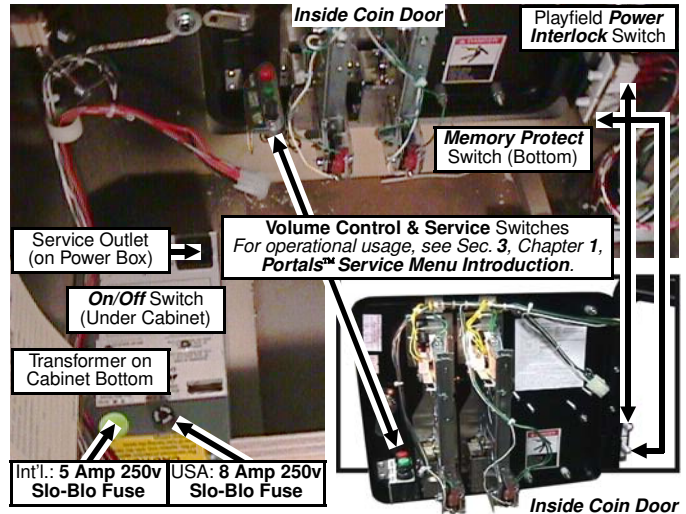
Playfield (P/F) Fuses

LOC: UNDER PLAYFIELD (near the assembly)

n/a 3A 250v S.B. 50v DC Right Flipper (BLU-YEL↔RED-YEL)

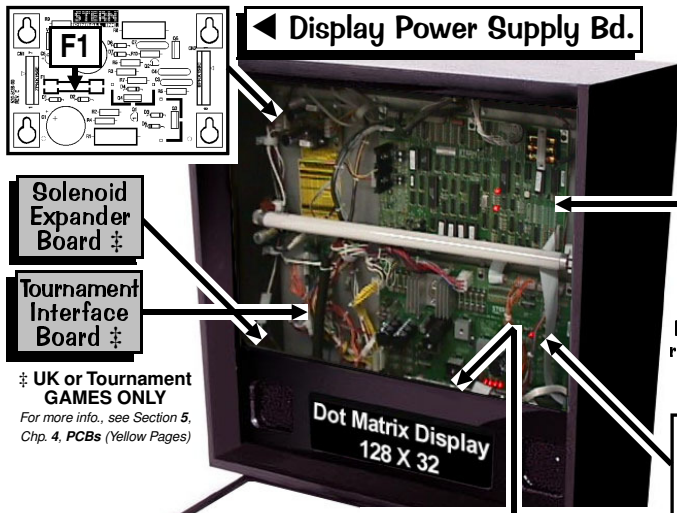
n/a 3A 250v S.B. 50v DC Left Flipper (GRY-YEL↔RED-YEL)

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



ROM TYPE on BD LOCATION | SIZE PART NUMBER

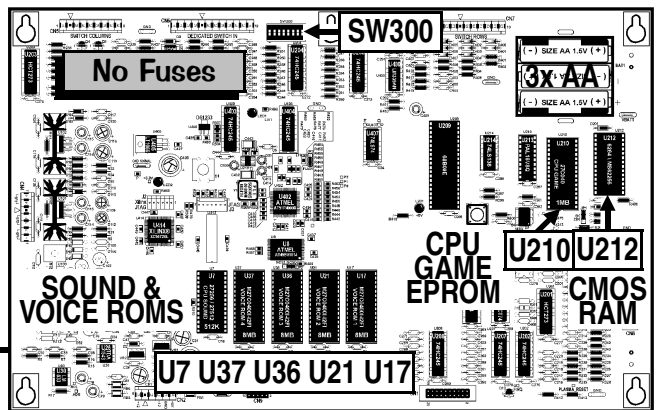
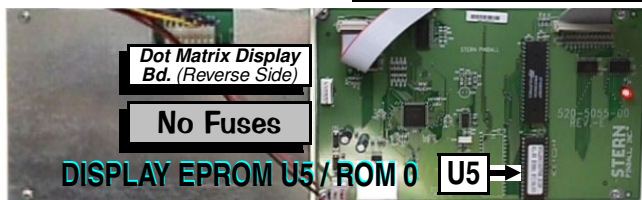
ROM TYPE on BD	LOCATION	SIZE	PART NUMBER
CPU Sound	U7	512K	965-0422-85
CPU Game	U210	1 MB	965-0423-85
CPU Voice ROM 1	U17	8 MB	965-0424-85
CPU Voice ROM 2	U21	8 MB	965-0425-85
CPU Voice ROM 3	U36	8 MB	965-0426-85
CPU Voice ROM 4	U37	8 MB	965-0427-85
DISPLAY Controller	U5	4 MB	965-0428-85



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

Display Controller Bd.

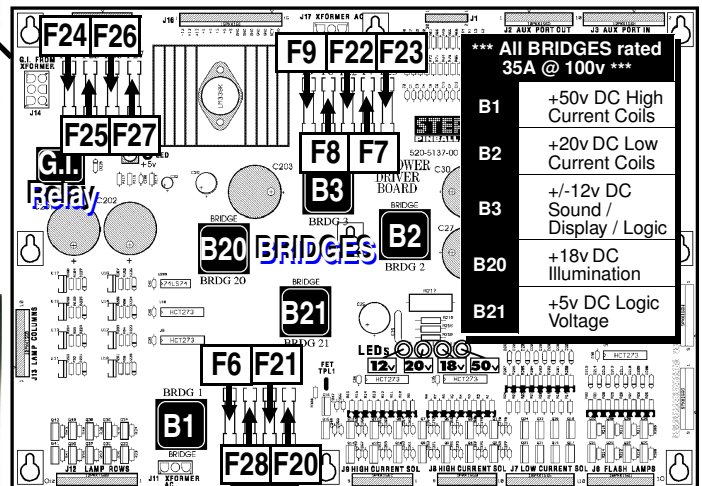
The Display Controller has the Display EPROM (Location: U5 / ROM 0). This board is located behind the 128 X 32 Dot Matrix Display Board.



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

CPU/Sound Bd. II w/ATMEL ▲

I/O Power Driver Board ▼



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

Bridge	Description
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

////// 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**.

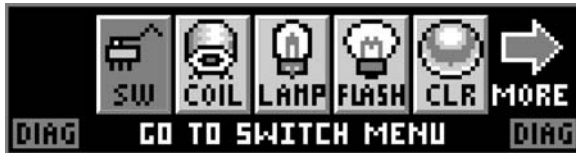
While in the Portals™ Service Menu, the **Start Button** can be used in lieu of the **Black Button**; the **Left & Right Flipper Buttons** can be used in lieu of the **Red & Green Buttons**. However, in **Switch or Active Switch Tests** only the **Red & Green Buttons** can be used.



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:



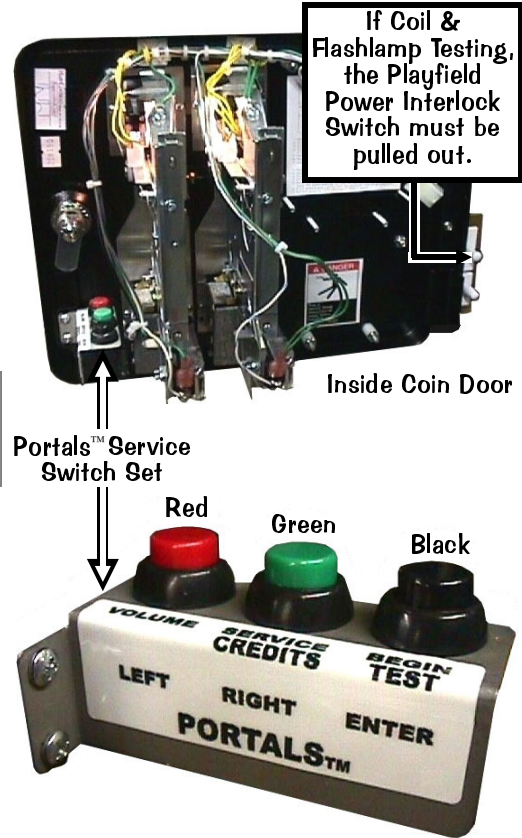
Press the **Black "ENTER" Button** to activate this ICON. The **DR. PINBALL MENU** (Flow Chart Menus) now appears with the COIL "DR." Icon flashing. Three (3) Icons, Coil "DR.", Switch "DR." and Lamp "DR." are available for selection. Selecting a particular Icon will give you a choice of which specific **Coil (Solenoid), 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.

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 **Coin Door** will initiate a *Factory Restore (Reset)*, by opening the **Memory Protect Switch**. Check battery voltage at **VBATT Test Point** on the **CPU/Sound Bd.** (*more details in Section 5, Chapter 4, PCBs*).

**OPERATOR ALERT!
#2 AUTO LAUNCH
COIL MALFUNCTION**

This **display** is shown momentarily during **Game Mode** or **Power-Up** to alert the operator of a coil malfunction (*coil doesn't energize or coil fires a multiple number of times*). **OPERATOR ALERT!** works by monitoring any **switch activated coil** that has the potential to trap a ball when disabled (*e.g. in the Auto Launch, Scoop, Eject, etc.*). This alert can also appear

if a switch associated with a coil (*e.g. #16 Shooter Lane & #2 Auto Launch*) is stuck closed (*caused by a switch jam or stuck ball*); the **CPU/Sound Board** will activate the coil approximately ten times and if the switch remains closed, the game will report this switch in **Technician Alerts** & will indicate the *following display warning*:

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

If this **Tech Report Alert flashes** (*along with an audible sound*), the game has detected faulty switches and/or missing pinballs. Select the "TECH" *Icon* for information (*review Technician Alerts, Pages 24-25*). For this **Alert display** to appear, *Standard Adj. 49, must be changed to POWERUP, COIN DOOR or POWERUP AND COIN DOOR, the default is NEVER* (*review Section 3, Chp. 4, GO TO ADJUSTMENTS MENU, Standard Adjustments, Page 44*).

NEVER (*review Section 3, Chp. 4, GO TO ADJUSTMENTS MENU, Standard Adjustments, Page 44*).

CPU DIP SWITCH SETTINGS

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

SW300 KSD08H

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



Find-It-In-Front:
Dr. Pinball

THE
Sopranos

DIAG AUD ADJ INST RESET TOUR QUIT
 MAIN GO TO DIAGNOSTICS MENU MAIN

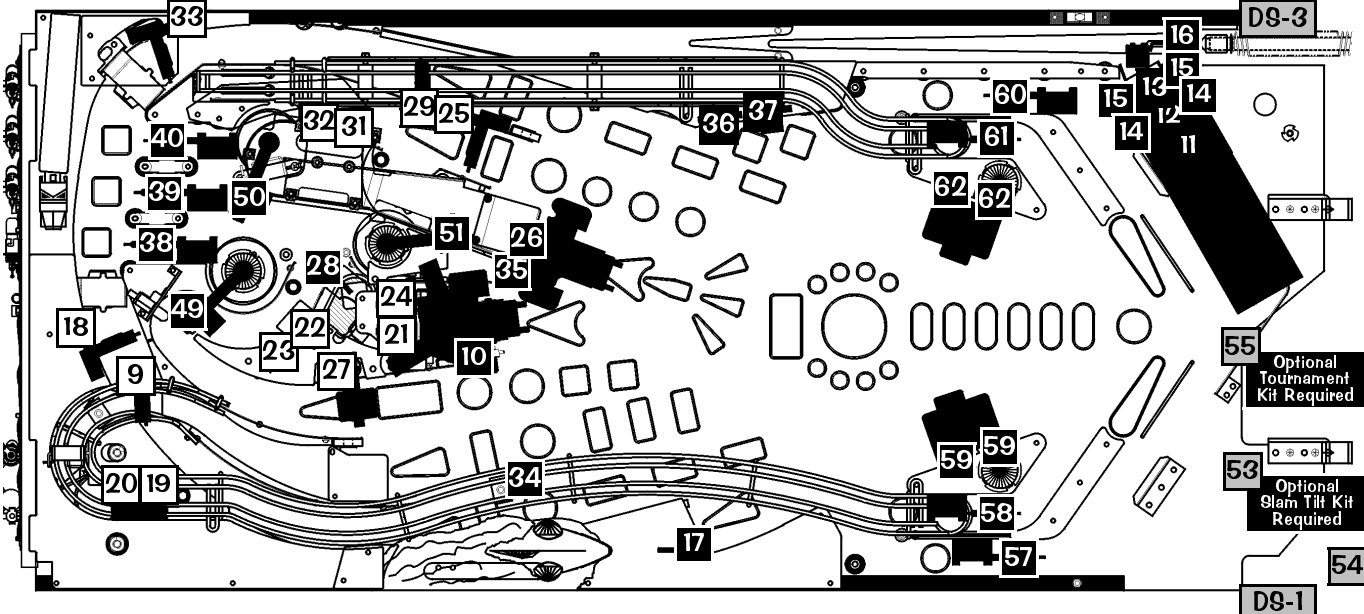
SW COIL LAMP FLASH CLR MORE
 DIAG GO TO SWITCH MENU DIAG

TEST ACT DED PREV QUIT HELP
 SWITCH TEST SW

SWITCH MENU: SWITCH, ACTIVE & DEDICATED

SWITCH MATRIX GRID, DEDICATED SWITCHES & LOCATIONS

Column (Drive)	1: Q1	2: Q2	3: Q3	4: Q4	5: Q5	6: Q6	7: Q7	8: Q8	GROUND	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 INPUTS	BLK CN6-P1, -P11
1: U400	1 Cabinet Side	9 Above P/F	17 Below P/F	25 Above P/F	33 Above P/F	41 NOT USED	49 Below P/F	57 Below P/F	1: U206	DS-1 on Cabinet Side
WHT-BRN CN7-P9	LT BUTTON (UK ONLY)	LEFT RAMP	LEFT EJECT	RIGHT RAMP	RIGHT ORBIT	NOT USED	LEFT BUMPER	LEFT OUTLANE	GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON
Sw. Part Number: 180-5160-00	180-5010-01	180-5186-01	180-5087-00	180-5087-00	180-5015-04	500-6227-02	180-5015-04	500-6227-02	Sw. Part Number: 180-5160-00	DS-2 Below Playfield
2: U400	2 Coin Door	10 Below P/F	18 Above P/F	26 Below P/F	34 Below P/F	42 NOT USED	50 Below P/F	58 Below P/F	2: U206	DS-2 Below Playfield
WHT-RED CN7-P8	4TH COIN SLOT	SAFE LIMIT	LEFT ORBIT	DROP TARGET	LEFT STANDUP	NOT USED	RIGHT BUMPER	LEFT RETURN LANE	GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke)
Sw. Part Number: 180-5204-00	180-5198-00	180-5087-00	180-5158-00	180-5132-00	180-5015-04	180-5015-04	500-6227-02	500-6227-02	Sw. Part Number: 180-5149-00 on Flipper	DS-3 on Cabinet Side
3: U400	3 Coin Door	11 Below P/F	19 Above P/F	27 Above P/F	35 Below P/F	43 NOT USED	51 Below P/F	59 Below P/F	3: U206	DS-3 on Cabinet Side
WHT-ORG CN7-P7	6TH COIN SLOT	4-BALL TROUGH #1 (LEFT)	BING 1	SPINNER	CENTER STANDUP	NOT USED	BOTTOM BUMPER	LEFT SLINGSHOT	GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON
Sw. Part Number: Future Use	180-5119-02	180-5010-04	180-5010-04	180-5132-00	180-5015-04	180-5015-04	500-6227-02	180-5054-00 (x2)	Sw. Part Number: 180-5160-00	DS-4 Below Playfield
4: U400	4 Coin Door	12 Below P/F	20 Above P/F	28 Below P/F	36 Below P/F	44 NOT USED	52 NOT USED	60 Below P/F	4: U206	DS-4 Below Playfield
WHT-YEL CN7-P6	RIGHT COIN SLOT	4-BALL TROUGH #2	BING 2	CENTER EJECT	R. 2-BANK TOP	NOT USED	NOT USED	RIGHT OUTLANE	GRY-YEL CN6-P6	#4 RIGHT FLIPPER E.O.S (End-of-Stroke)
Sw. Part Number: 180-5204-00	180-5119-02	180-5119-02	180-5186-01	180-5133-00	500-6227-02	500-6227-02	500-6227-02	500-6227-02	Sw. Part Number: 180-5149-00 on Flipper	DS-5
5: U401	5 Coin Door	13 Below P/F	21 Above P/F	29 Above P/F	37 Below P/F	45 NOT USED	53 In Cabinet	61 Below P/F	5: U206	DS-5
WHT-GRN CN7-P5	CENTER COIN SLOT / DBA	4-BALL TROUGH #3	SAFE HIT LEFT	RIGHT RAMP EXIT	R. 2-BANK BOTTOM	NOT USED	SLAM TILT (OPT)	RIGHT RETURN LANE	GRY-GRN CN6-P7	NOT USED
Sw. Part Number: 180-5204-00	180-5119-02	180-5119-02	180-5119-02	180-5010-01	180-5133-00	180-5133-00	180-5133-00	500-6227-02	Sw. Part Number: 180-5160-00	DS-6 on Coin Door
6: U401	6 Coin Door	14 Below P/F	22 Above P/F	30 Above P/F	38 Below P/F	46 NOT USED	54 In Cabinet	62 Below P/F	6: U206	DS-6 on Coin Door
WHT-BLU CN7-P3	LEFT COIN SLOT	4-BALL TROUGH VUK OPTO	CENTER LOCK 1	NOT USED	LEFT TOP LANE	NOT USED	START BUTTON	RIGHT SLINGSHOT	GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (In Test: LEFT)
Sw. Part Number: 180-5204-00	See Sw. 14 Note	180-5119-02	180-5119-02	500-6227-02	500-6227-02	500-6227-02	180-5174-00	180-5054-00 (x2)	Sw. Part Number: 180-5192-02	DS-7 on Coin Door
7: U401	7 Coin Door	15 Below P/F	23 Above P/F	31 Above P/F	39 Below P/F	47 NOT USED	55 In Cabinet	63	7: U206	DS-7 on Coin Door
WHT-VIO CN7-P2	5TH COIN SLOT	4-BALL STACKING OPTO	CENTER LOCK 2	BOAT LOCK 1	MIDDLE TOP LANE	NOT USED	TOURNAMENT START	NOT USED	GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT)
Sw. Part Number: Future Use	See Sw. 15 Note	180-5119-02	180-5119-02	180-5119-02	500-6227-02	500-6227-02	180-5174-00	180-5174-00	Sw. Part Number: 180-5192-04	DS-8 on Coin Door
8: U401	8 Cabinet Side	16 Below P/F	24 Above P/F	32 Above P/F	40 Below P/F	48 NOT USED	56 In Cabinet	64	8: U206	DS-8 on Coin Door
WHT-GRY CN7-P1	RT BUTTON (UK ONLY)	SHOOTER LANE	SAFE HIT RIGHT	BOAT LOCK 2	RIGHT TOP LANE	NOT USED	PLUMB BOB TILT	NOT USED	GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER)
Sw. Part Number: 180-5160-00	180-5157-00	180-5119-02	180-5119-02	180-5119-02	500-6227-02	500-6227-02	See Sw. 56 Note	180-5192-00	Sw. Part Number: 180-5192-00	DS-9



Playfield ▲

- = Switches above Playfield.
- = Switches below Playfield.
- = Switches not on Playfield.

Switch Part Notes: ¥ Yen Coin Switch is 180-5091-00. Part Numbers which start with 515- or 500- include the bracket, target, and/or housing.
Switches 14 & 15 Part Note: Transmitter & Receiver OPTO
 PC Boards are used as Switches:
 Transmitter: 515-0173-00 (Sw. 14 & 15);
 Receiver: 515-0174-00 (Sw. 14 & 15);

Sw. 56 Part Note: The Switch is comprised of a Hanger Bracket (535-5319-00) and Contact Wire (535-7563-01) located in the Cabinet.
 Some Switch Diodes may be located under the playfield, in the Cabinet or Backbox on Terminal Strips or Diode Boards and not on the assemblies.
 NOTES: D = Diode Q = Terminal S = Strip, see Sec. 5, Chp. 2, Playfield Wiring.

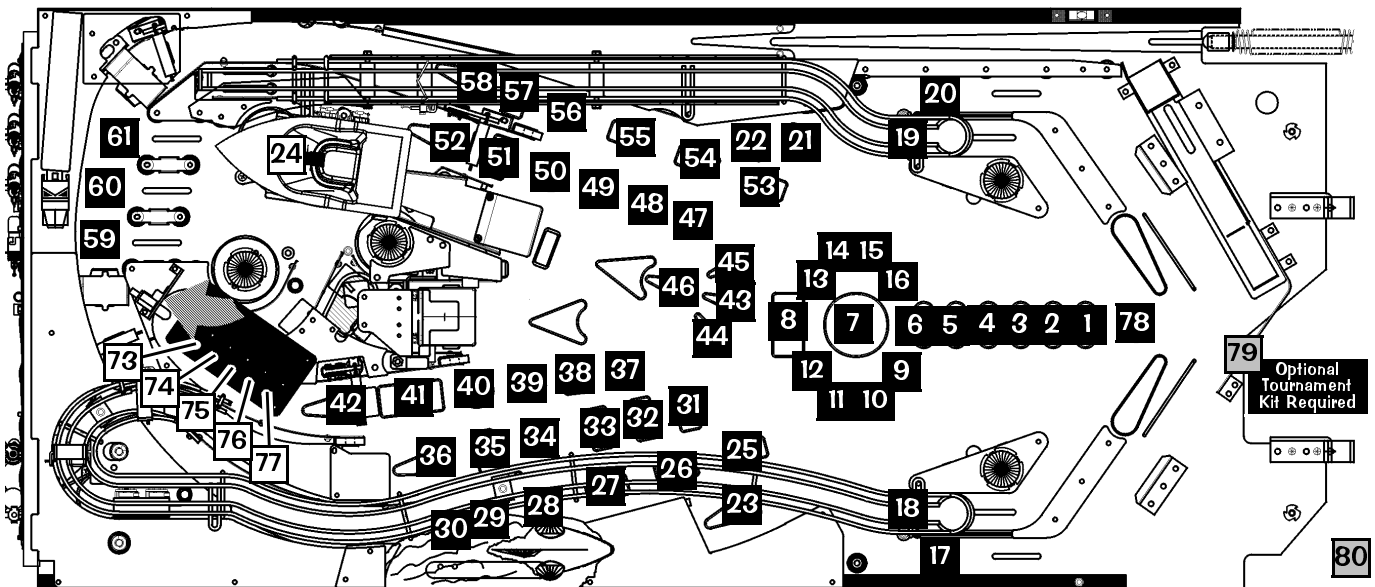




LAMP MENU: ONE, ALL, ROW & COLUMN

LAMP MATRIX GRID & LOCATIONS

Column (18v)	1: U17	2: U16	3: U15	4: U14	5: U13	6: U12	7: U11	8: U10
Row (Ground)	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	1 #555 Clear Bulb RED-BRN J12-P1 (RANKS) ASSOCIATE	2 #555 Clear Bulb (RANKS) SOLDIER	3 #555 Clear Bulb (RANKS) GOOD EARNER	4 #555 Clear Bulb (RANKS) ACTING CAPO	5 #555 Clear Bulb (RANKS) CAPO	6 #555 Clear Bulb (RANKS) CONSIGLIERE	7 #555 Clear Bulb (RANKS) UNDER BOSS	8 #44 Clear Bulb (RANKS) BOSS
2: Q34	9 #44 Clear Bulb RED-BLK J12-P2 BOSS: FOOD	10 #44 Clear Bulb BOSS: TRUCK HEIST	11 #44 Clear Bulb BOSS: BADA BING	12 #44 Clear Bulb BOSS: EPISODES	13 #44 Clear Bulb BOSS: SAFE	14 #44 Clear Bulb BOSS: RIP	15 #44 Clear Bulb BOSS: SUPER JACKPOT	16 #44 Clear Bulb BOSS: MEADOWLANDS
3: Q35	17 #555 Clear Bulb RED-ORG J12-P3 (F) ISH LEFT OUTLANE	18 #555 Clear Bulb F (I) SH LT RTRN LANE	19 #555 Clear Bulb FI (S) H RT RTRN LANE	20 #555 Clear Bulb FIS (H) RIGHT OUTLANE	21 #555 Clear Bulb PORK STORE STANDUP	22 #555 Clear Bulb LIGHT STANDUP	23 #555 Clear Bulb FISH	24 #44 LED Bulb THE STUGOTS
4: Q36	25 #555 Clear Bulb RED-YEL J12-P4 LEFT TRUCK HEIST 1 (BOT)	26 #555 Clear Bulb LEFT TRUCK HEIST 2	27 #555 Clear Bulb LEFT TRUCK HEIST 3	28 #555 Clear Bulb L ORBIT FOOD	29 #555 Clear Bulb L ORBIT (\$ ENVELOPE)	30 #555 Clear Bulb LEFT ORBIT ARROW	31 #555 Clear Bulb BADA BING 1 (BOT)	32 #555 Clear Bulb BADA BING 2
5: Q37	33 #555 Clear Bulb RED-GRN J12-P5 BADA BING 3	34 #555 Clear Bulb L RAMP FOOD	35 #555 Clear Bulb L RAMP (\$ ENVELOPE)	36 #555 Clear Bulb LEFT RAMP ARROW	37 #555 Clear Bulb START EPISODE	38 #555 Clear Bulb PORK STORE	39 #555 Clear Bulb SPECIAL	40 #555 Clear Bulb EXTRA BALL
6: Q38	41 #555 Clear Bulb RED-BLU J12-P6 ADVANCE RANK	42 #555 Clear Bulb CENTER ARROW	43 #555 Clear Bulb LIGHT LOCK	44 #555 Clear Bulb LOCK 1	45 #555 Clear Bulb LOCK 2	46 #555 Clear Bulb JACKPOT	47 #555 Clear Bulb MEADOWLANDS 1	48 #555 Clear Bulb MEADOWLANDS 2
7: Q39	49 #555 Clear Bulb RED-VIO J12-P8 MEADOWLANDS 3	50 #555 Clear Bulb R RAMP FOOD	51 #555 Clear Bulb R RAMP (\$ ENVELOPE)	52 #555 Clear Bulb RIGHT RAMP ARROW	53 #555 Clear Bulb RIGHT TRUCK HEIST 1 (BOT)	54 #555 Clear Bulb RIGHT TRUCK HEIST 2	55 #555 Clear Bulb RIGHT TRUCK HEIST 3	56 #555 Clear Bulb R ORBIT FOOD
8: Q40	57 #555 Clear Bulb RED-GRY J12-P9 R ORBIT (\$ ENVELOPE)	58 #555 Clear Bulb RIGHT ORBIT ARROW	59 #555 Clear Bulb (R.) I.P. LEFT TOP LANE	60 #555 Clear Bulb R. (L) P. MID. TOP LANE	61 #555 Clear Bulb RT. I. (P.) RT. TOP LANE	62 NOT USED	63 NOT USED	64 NOT USED
9: Q41	65 #44 Clear Bulb RED-WHT J12-P10 RIP 1 (TOP LEFT)	66 #44 Clear Bulb RIP 2	67 #44 Clear Bulb RIP 3	68 #44 Clear Bulb RIP 4	69 #44 Clear Bulb RIP 5 (BOT LEFT)	70 #44 Clear Bulb RIP 6	71 #44 Clear Bulb RIP 7	72 #44 Clear Bulb RIP 8
10: Q42	73 #555 Yel. Bulb RED J12-P11 EPISODES: ARSON	74 #555 Yel. Bulb EPISODES: EXTERMINATE	75 #555 Yel. Bulb EPISODES: HORSE RACE	76 #555 Yel. Bulb EPISODES: EXEC. GAME	77 #555 Yel. Bulb EPISODES: SATISFACTION	78 #555 Clear Bulb SHOOT AGAIN	79 OPTIONAL TOURNAMENT BUTTON	80 #555 Clear Bulb START BUTTON



Playfield ▲
Backpanel ◀

- ◻ = Lamps above Playfield.
- ◼ = Lamps below Playfield.
- ◐ = Lamps not on Playfield.

Lamp Part Notes: #555 Wedge Base Bulb Clear = 165-5002-00.

#555 Wedge Base Bulb Yellow = 165-5054-06

#44 Bayonet Bulb Clear = 165-5000-44.

See Section 4, Chapter 1, Parts Identification & Location, Pages 78-80 for more details on bulbs and corresponding sockets.

Some Lamp Diodes may be located under the playfield, in the Cabinet or Backbox on Terminal Strips and not on or with the Lamp Socket.

DOTS: □ diode Q n Terminal S trip, see Sec. 5, Chapter 2, Playfield Wiring.



Find-It-In-Front:
Dr. Pinball

THE Sopranos™



COIL MENU: SINGLE COIL & CYCLING COIL

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	23-800 ∪ 090-5001-00B
#3	CENTER EJECT	Q3		YEL-VIO	J10-P4/5	50v DC	BRN-ORG	J8-P4	26-1200 ∪ 090-5044-00B
#4	CENTER LOCK POST	Q4		YEL-VIO	J10-P4/5	50v DC	BRN-YEL	J8-P5	27-1500 ∪ 090-5004-00T
#5	LEFT CONTROL GATE	Q5		YEL-VIO	J10-P4/5	50v DC	BRN-GRN	J8-P6	32-1800 ∪ 515-6543-00
#6	RIGHT CONTROL GATE	Q6		YEL-VIO	J10-P4/5	50v DC	BRN-BLU	J8-P7	32-1800 ∪ (090-5031-00)
#7	1 BANK TRIP	Q7		YEL-VIO	J10-P4/5	50v DC	BRN-VIO	J8-P8	32-1250 ∪ 515-6916-01
#8	SAFE	Q8		VIO-YEL	J10-P3	50v DC	BRN-GRY	J8-P9	22-1080 ∪ 090-5032-00T

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 ∪ 090-5044-00B
#12	LEFT SLINGSHOT	Q12		YEL-VIO	J10-P4/5	50v DC	BLU-YEL	J9-P5	26-1200 ∪ 090-5044-00T
#13	RIGHT SLINGSHOT	Q13		YEL-VIO	J10-P4/5	50v DC	BLU-GRN	J9-P6	26-1200 ∪ 090-5044-00T
#14	1 BANK RESET	Q14		YEL-VIO	J10-P1/2	50v DC	BLU-BLK	J9-P7	27-1500 ∪ 090-5004-00B
#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	FISH JAW	Q17	▲ I/O Power Driver ▼	BROWN	J7-P1	20v DC	VIO-BRN	J7-P2	27-1500 ∪ 090-5004-00B
#18	BING MOTOR (RELAY)	Q18		BROWN	J7-P1	20v DC	VIO-RED	J7-P3	Relay Asm 500-6700-00
#19	FLASH: SUPER JP	Q19		ORANGE	J6-P10	20v DC	VIO-ORG	J7-P4	#89 Bulb 165-5000-89-HF
#20	FLASH: SAFE	Q20		ORANGE	J6-P10	20v DC	VIO-YEL	J7-P6	#89 Bulb 165-5000-89-HF
#21	LEFT EJECT	Q21		BROWN	J7-P1	20v DC	VIO-GRN	J7-P7	26-1200 ∪ 090-5044-00B
#22	BOAT LOCK POST	Q22		BROWN	J7-P1	20v DC	VIO-BLU	J7-P8	26-1200 ∪ 090-5044-00T
#23	BING LOCK POST	Q23		BROWN	J7-P1	20v DC	VIO-BLK	J7-P9	26-1200 ∪ 090-5044-00T
#24	OPTIONAL COIL	Q24		RED	J16-P7	5v DC	VIO-GRY	J7-P10	Opt. 5v

D iode O n T ermin al S trip (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	FLASH: FISH	Q25	▲ I/O Power Driver ▼	ORANGE	J6-P10	20v DC	BLK-BRN	J6-P1	#44 LED 112-5023-08
#26	FLASH: BACK X3	Q26		ORANGE	J6-P10	20v DC	BLK-RED	J6-P2	#89 #906 X2 & X1
#27	FLASH: LEFT SLING	Q27		ORANGE	J6-P10	20v DC	BLK-ORG	J6-P3	#906 Bulb 165-5004-00
#28	FLASH: RIGHT SLING	Q28		ORANGE	J6-P10	20v DC	BLK-YEL	J6-P4	#906 Bulb 165-5004-00
#29	FLASH: BUMPERS X2	Q29		ORANGE	J6-P10	20v DC	BLK-GRN	J6-P5	#906 Bulb 165-5004-00
#30	SAFE LATCH	Q30		BROWN	J7-P1	20v DC	BLK-BLU	J6-P6	27-1500 ∪ 090-5004-00B
#31	FLASH: PF LT & RT X2	Q31		ORANGE	J6-P10	20v DC	BLK-VIO	J6-P7	#89 Bulb 165-5000-89-HF
#32	FLASH: TRUCK X2	Q32		ORANGE	J6-P10	20v DC	BLK-GRY	J6-P8	#89 Bulb 165-5000-89-HF

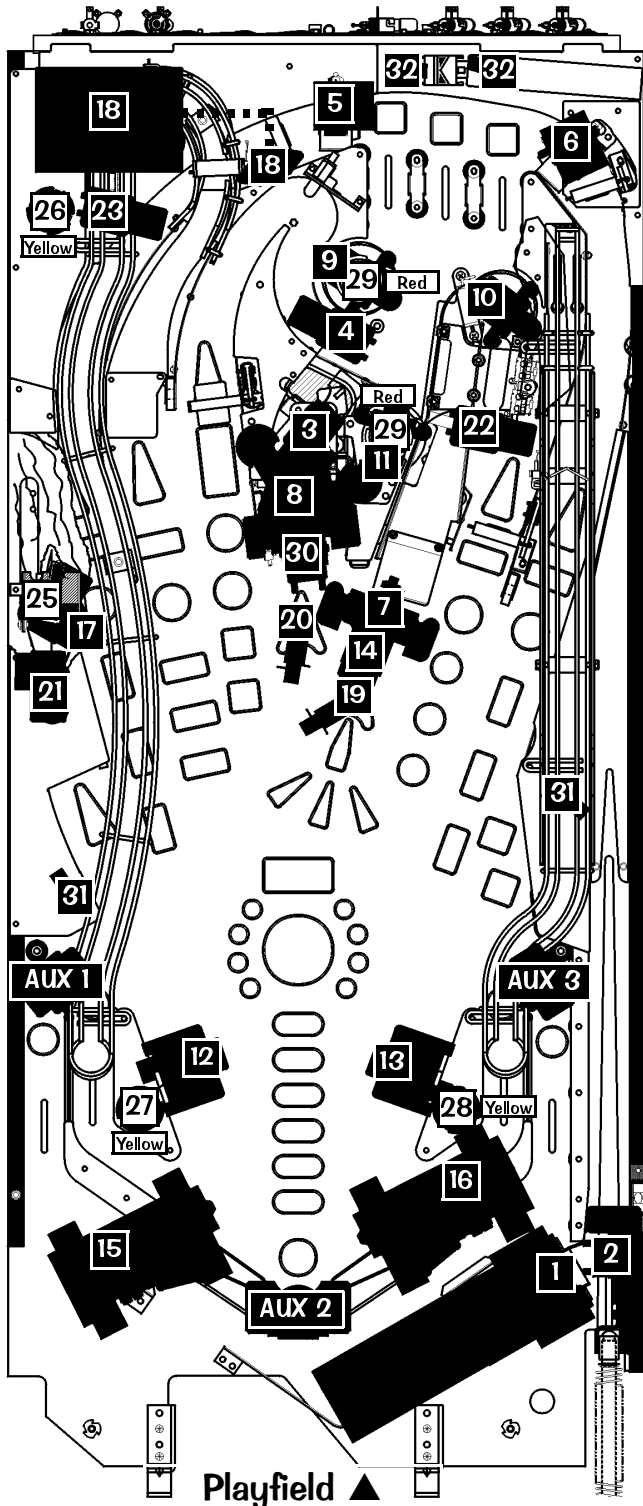
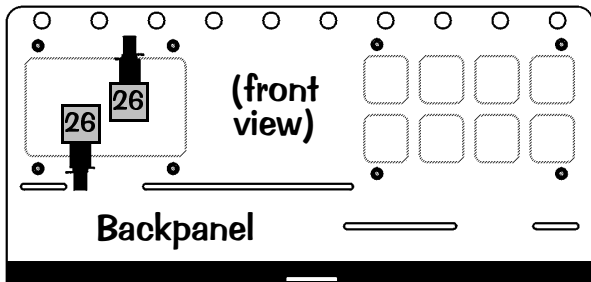
Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: Q19-Q20, Q25-Q29, Q31-Q32)

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	UK 3X Trans. Driver Board	BROWN	J7-P1	20v DC	WHITE	J2-P3	26-1200 ∪ 090-5044-00T	
AUX 2: CENTER UP/DOWN POST	Q2		BROWN	J7-P1	20v DC	RED	J2-P4	23-1100 ∪ 090-5030-00T	
AUX 3: RIGHT UP/DOWN POST	Q3		BROWN	J7-P1	20v DC	ORANGE	J2-P7	26-1200 ∪ 090-5044-00T	

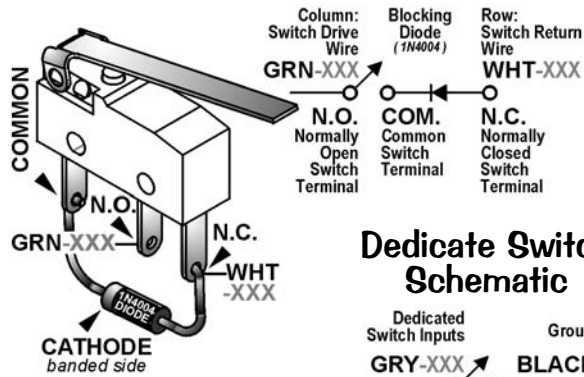
∪ Coil Note: ∪ Either -00B or -00T can be used for coil replacements. B/T listed is preferable for easier diode access & may differ on game.



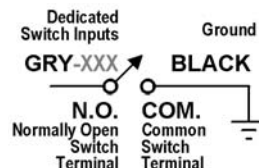
COIL & FLASH LAMP LOCATIONS



Typical Switch Wiring & Schematic

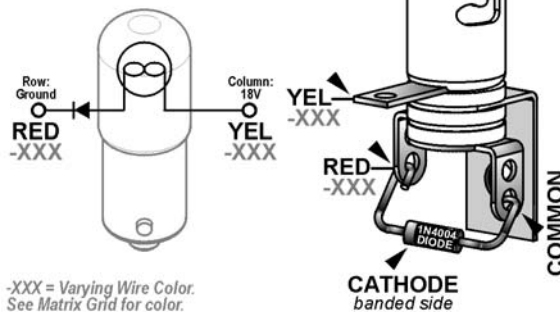


Dedicate Switch Schematic



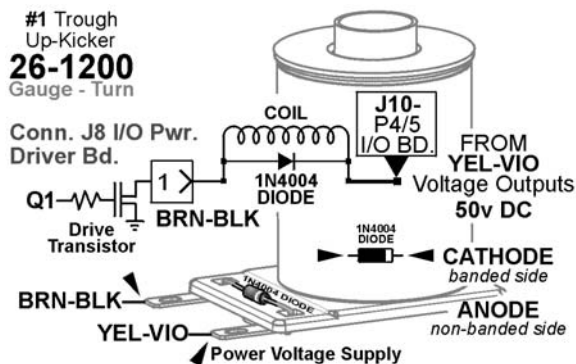
-XXX = Varying Wire Color. See Matrix Grid for color.

Typical Lamp Schematic & Wiring



-XXX = Varying Wire Color. See Matrix Grid for color.

Typical Coil Schematic & Wiring



- = Coils / Flash Lamps above Playfield.
- = Coils / Flash Lamps below Playfield.
- = Coils / Flash Lamps not on Playfield.

Color = Color of Mini-Mars of Flash Lamp Bulb.

Some Coil or Flash Lamp Diodes may be located under the playfield, in the Cabinet or Backbox on Terminal Strips or Diode Boards and not on the assemblies. DOTS: Diode On Terminal Strip See Section 5, Chapter 2, Playfield Wiring.

Coil Q24 is Optional. If either a Coin Meter, Token Dispenser or Knocker (all optional equipment) is required, call Technical Support for more information, 1-800-542-5377 or 1-708-345-7700.

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 Dist. International Cincinnati (1) 1-513-851-4100	Amusement Distributors San Antonio (3) 1-210-225-3844	ONTARIO Starburst Coin Mach. Toronto 1-416-251-2122
Franco Distributing Montgomery (2) 1-334-834-3455	Moss Distributing Des Moines 1-515-266-6422	Moss Distributing Kansas City (1) 1-816-231-6600	Cleveland Coin Cleveland (2) 1-216-692-0960	Betson Texas Dallas (1) 1-214-638-4900	BRITISH COLUMBIA Parts & Service Only: Can. Coin Machine Burnaby (1) 1-604-420-4008
ARIZONA	INDIANA	Shaffer Distributing St. Louis (2) 1-314-645-3393	Shaffer Distributing Columbus (3) 1-614-421-6800	Commercial Music Dallas (1) 1-214-741-6381	Discount Arcade Games Crowley (1) 1-817-297-0440
Betson West Phoenix 1-480-380-8857	Atlas Dist. International Indianapolis 1-317-786-6892	NEBRASKA	Valley View (4) 1-216-447-4486	H.A. Franz, & Co. Houston (2) 1-713-523-7366	Parts & Service Only: Pacific Vending Vancouver (2) 1-604-324-2164
Mountain Coin Phoenix 1-602-269-7596	Shaffer Distributing Indianapolis 1-317-899-2530	Central Dist. Omaha 1-402-493-5600	OKLAHOMA	San Antonio (3) 1-210-226-6322	
CALIFORNIA	KANSAS	Greater America Dist. Omaha 1-402-553-2812	Galaxy Distributing Tulsa 1-918-835-1166	UTAH	
Betson West Buena Park (1) 1-714-228-7500	United Dist., Inc. Wichita 1-316-263-6181	NEVADA	OREGON	Master Sales Corsicana (4) 1-903-874-4740	
So. San Francisco (2) 1-650-952-4220	LOUISIANA	Mountain Coin Las Vegas (1) 1-702-798-0900	Betson West Portland 1-503-772-4567	Struve Distributing Salt Lake City 1-801-328-1636	
C.A. Robinson Los Angeles (3) 1-323-735-3001	AMA Distributors, Inc. Metairie (1) 1-504-835-3232	Reno Game Sales Reno (2) 1-775-829-2080	Mountain Coin Portland 1-503-234-5491	WASHINGTON	
San Francisco (4) 1-650-871-4280	Parts & Service Only: New Orleans Novelty New Orleans (2) 1-504-888-3500	NEW JERSEY	Specialty Coin Products Portland 1-503-786-9200	Mountain Coin Salt Lake City 1-801-262-5494	
COLORADO	MARYLAND	Betson Enterprises Carlstadt (1) 1-201-438-1300	Toll-Free 1-800-987-4946	Struve Distributing Salt Lake City 1-801-328-1636	
Mountain Coin Denver 1-303-427-2133	Betson Enterprises Baltimore 1-410-646-4100	Jack Guarnieri Service Co., Inc. (Pinballsales.com) Lakewood (2) 1-732-364-9900	PENNSYLVANIA	WISCONSIN	
CONNECTICUT	Parts & Service Only: Weiner Distributing Baltimore 1-410-525-2600	NEW MEXICO	Betson Enterprises King Of Prussia (1) 1-610-265-1155	Pioneer Sales & Svc. Green Bay (1) 1-920-336-5800	
TDM Distributing Williamantic 1-860-423-1403	MASSACHUSETTS	Mountain Coin Albuquerque 1-505-345-7706	Pittsburgh (2) 1-412-331-8703	Menomonee Falls (2) 1-262-781-1420	
FLORIDA	Betson Ent. (NECO) Norwood (1) 1-781-769-9760	NEW YORK	Superior Amusements Wilkes-Barre (3) 1-570-824-9994	Lieberman/Viking Vend. Menomonee Falls (2) 1-262-703-4168	
Birmingham Vending Orlando (1) 1-407-425-1505	Gekay Sales E. Longmeadow (2) 1-413-525-2700	Betson Enterprises New Hyde Park (2) 1-516-354-4647	Shaffer Distributing Pittsburgh (2) 1-412-920-1300		
Brady Distributing Miami [Miramar] (2) 1-954-874-1100	MICHIGAN	Syracuse (3) 1-315-437-2400	SOUTH CAROLINA		
Orlando (1) 1-407-872-1666	Atlas Dist. International Wyoming (1) 1-616-241-1472	Parts & Service Only: Bay Coin Richmond Hill (1) 1-718-291-5757	Parts & Service Only: Green Coin Myrtle Beach 1-843-626-1900		
GEORGIA	Shaffer Distributing Livonia (2) 1-734-432-1040	NORTH CAROLINA	Brady Distributing Memphis 1-901-345-7811		
Greater Southern Dist. Smyrna 1-770-803-3040	MINNESOTA	Brady Distributing Charlotte (1) 1-704-357-6284	Parts & Service Only: Green G.A.M.E.S. Memphis 1-901-353-1000		
ILLINOIS	Lieberman Music Minneapolis (1) 1-952-887-5299	Parts & Service Only: Operators Distributing Archdale (2) 1-336-884-5714			
American Vending Elk Grove Village 1-847-439-9400	Moss Distributing Eagan (2) 1-612-798-8030				
Atlas Dist. International Elk Grove Village 1-847-952-7500					

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	DENMARK	GERMANY	THE NETHERLANDS	RUSSIA	SWITZERLAND
South Company Mar Del Plata [54] 2234-95-5532	JK Automater A/S Thisted [45] 9792-0925	ADP Gauselmann Espelkamp [49] 5741-27-3384	JVH Gaming Products Tilburg [31] 1359-5-3200	O.D.A. Game Machines Moscow [095] 219-2949 or [095] 219-8917	Novomat, A.G. Harkinggen [41] 6238-8-8961
AUSTRALIA	ENGLAND	Bergmann Int'l Gaming Rellingen [49] 4101-3-0240	NEW ZEALAND	SOUTH AFRICA	UNITED KINGDOM
Amusement Mach. Dist. Matraville [61] 2931-6-6000	see UNITED KINGDOM	Witten [49] 2302-28-2540	Coin Cascade Ltd. Christchurch [64] 3338-1411	K & W Amusements Port Elizabeth [27] 4148-4-3344 or [27] 4148-4-2940	Electrocoin London, England [44] 2089-65-2055
AUSTRIA	FINLAND	MEXIM Espelkamp [49] 5772-4-9422	Parts & Service Only: Amco Machine Supplies Auckland [64] 9846-7606	SPAIN	Parts & Service Only: Electrocoin Aftersales Cardiff, S. Glamorgan [44] 2920-45-0345
Parts & Service Only: R. Rupp Leibnitz [43] 3452-8-6105	Vantaa [35] 8 (0) 9-290-450	HOLLAND	Vendcomatic Oslo [47] 2291-8383	Comercial Cocamatic Coslada (Madrid) [34] 9167-1-6980	
Parts & Service Only: TAB Ansfelden [43] 7229-7-8040	FRANCE	see THE NETHERLANDS	NORWAY	Parts & Service Only: Sente, S.A. Madrid [34] 9154-1-7112	
BELGIUM	Avranches Automatic Ducey [33] 2338-9-6162	ITALY (RSM)	Portugal Jacinto & Martins, S.A. Belas [35] 1214-32-5624 or [35] 1214-32-5638	SWEDEN	
NAMUSCO Brussels [32] 2414-4596	SFA Paris [33] 1532-6-8080	Tecnoplay S.A. San Marino [39] 5499-0-1508		Bjuvia Fritid AB Bjув [46] 4238-6900	



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	CURRENT: 2.8AMP WATTAGE: 329w	MAX OPERATION CURRENT: 8AMP WATTAGE: 940w
	High Line: use 2x 5AMP 250v Slo-Blo Fuses. (*England & Hong Kong use an 8AMP 250v S/B Fuse.)		218v AC - 240v AC @ 50Hz AVG OPERATION CURRENT: 1.8AMP WATTAGE: 412w
Low Line: Export Japan Only use an 8AMP 250v Slo-Blo Fuse.		95v AC - 108v AC @ 50Hz / 60Hz	
Export Japan Only use an 8AMP 250v Slo-Blo Fuse.	AVG OPERATION	CURRENT: 2.6AMP WATTAGE: 264w	MAX OPERATION CURRENT: 8AMP WATTAGE: 812w

England & Hong Kong use an 8A Fuse.

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.

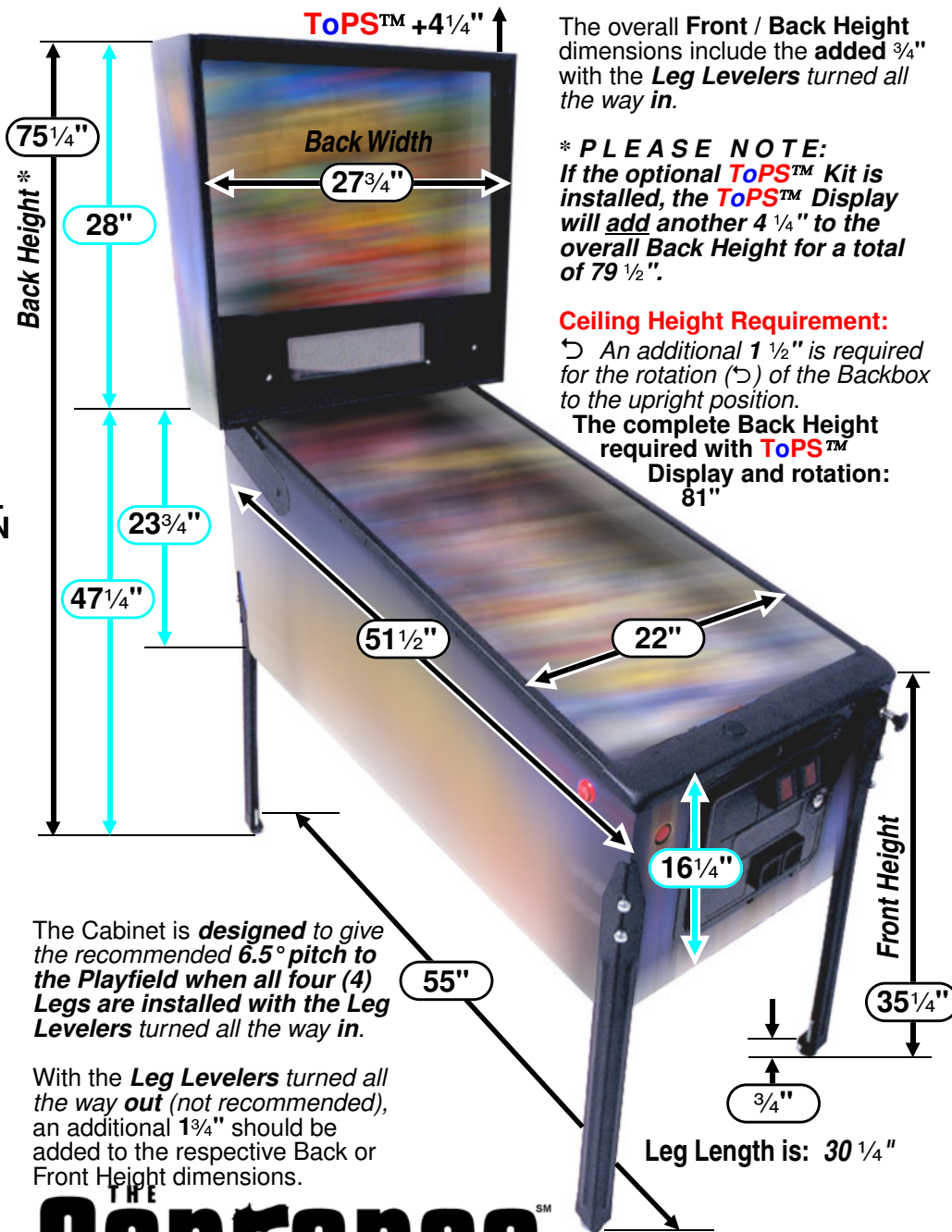
SAVE AND RETAIN ALL PRINTED INFORMATION INSIDE THE CABINET !

Shipping Box Dimensions

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

*** PLEASE NOTE:** If the optional **ToPS™** Kit is installed, the **ToPS™** Display will add another 4 1/4" to the overall **Back Height** for a total of 79 1/2".

Ceiling Height Requirement:
 ↪ An additional 1 1/2" is required for the rotation (↪) of the Backbox to the upright position.
 The complete **Back Height** required with **ToPS™** Display and rotation: 81"

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.

THE Sopranos™

Find-It-In-Front: Dr. Pinball



The SopranosSM Pinball Game Service Manual General Table of Contents
See Sections 3 & 5, Table Of Contents, for details of that Section and it's Chapters.

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

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

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

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

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

6. Lower the playfield and ensure game is **level side-to-side** by adjusting Leg Levelers, if required. See the illustration "**Leg Leveler Adjustment**" on Page 4. Start with the Leg Levelers turned all the way in (1.25" from floor to bottom of leg), depending on the condition of the floor, adjust the Leg Levelers as required until the **game pitch is 6.5°**, determined by the Bubble Level.

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

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

With the Coin Door Open:

7. If desired, perform any self tests at this time (see Section 3, Chapter 1, **Portals™ Service Menu Introduction**, and Chapter 2, **GO TO DIAGNOSTICS MENU**, for instructions on how to enter "**Begin Play Test**" and "**Game Name Test**" Menus to test components on the game).

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



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

THE
Sopranos™

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

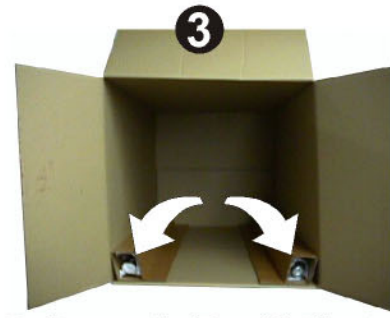
Sec. 1: After Set-Up



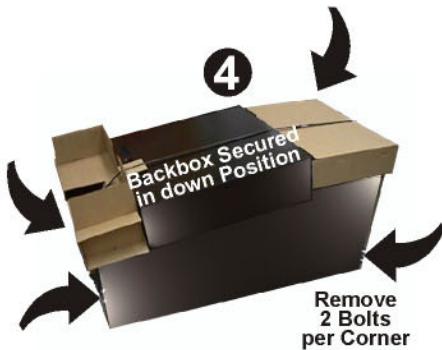
1. Before unpacking box, lay the box flat on its side with "TRUCK THIS SIDE ONLY" facing the floor.



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



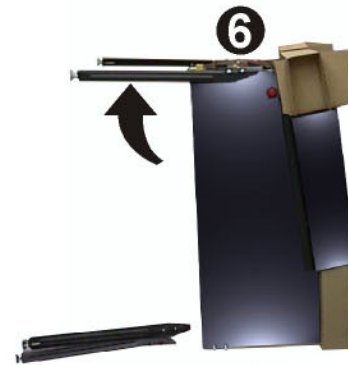
3. Remove the **Four (4) Identical Legs with Levelers** from the carton and set aside. (**SAVE!** all packing materials and information sheets related to this pinball until Set-Up is complete.)



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



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



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



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

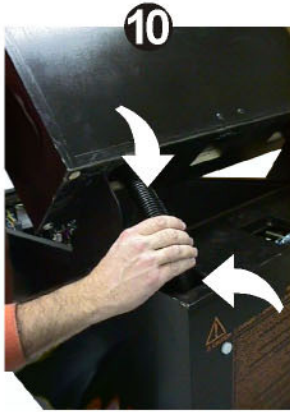


8. Using supports or two (2) people, prop the rear of the cabinet up and install **REAR LEGS**. Secure tightly.



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

Pinball Game Set-Up Future Reference Continued



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

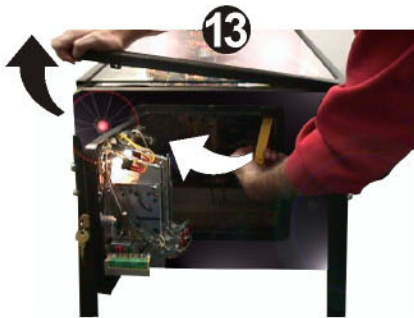


11. After the **BACKBOX** is in the **UPRIGHT POSITION**, locate the **5/16" HEX KEY**. While inserted, rotate **KEY** with a **3/4** turn until latched & locked.



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

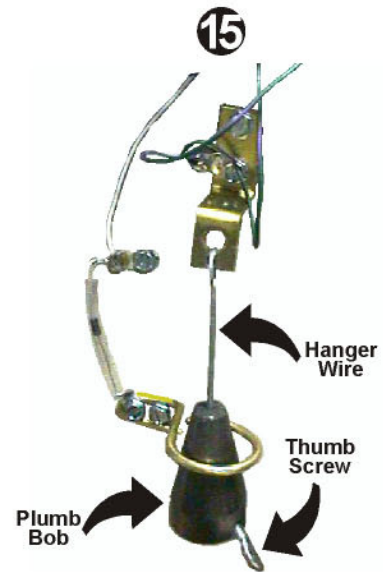
NOTE: KEYS are tied to the **Shooter Rod*** (if equipped) or taped to the **Playfield Glass** (if equipped with **Auto Plunger Button**). Remove keys. One (1) set of keys opens the **Coin Door**, the other set is used to unlock the **Back Glass** to gain access to the **White Star Board System**.



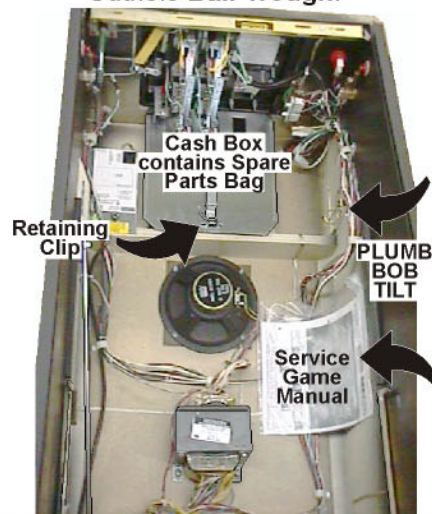
13. Open the **Coin Door** and pull the **YELLOW HANDLE** to the **LEFT** and at the same time pull up on the **FRONT TOP MOLDING** and remove. The **GLASS** can now be pulled out towards you and removed. **TAKE CARE** while moving; set glass on a safe surface.



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



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



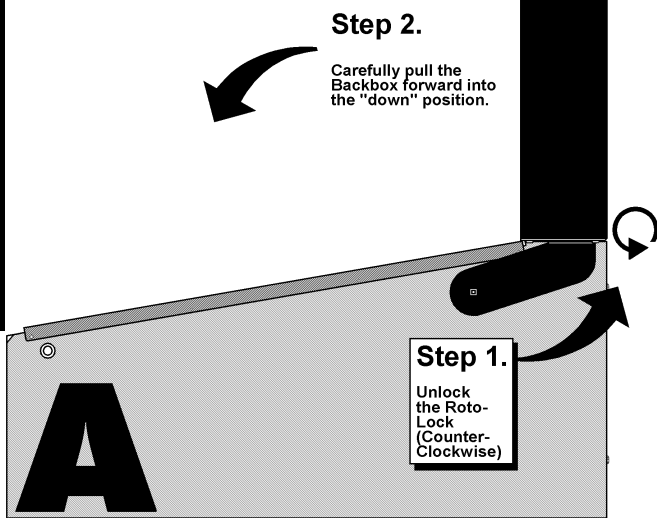
Remove the **PINBALL GAME MANUAL** (stapled to side of the left wall of the cabinet). Review **Section 1, Chapter 1**, which describes how to lift the playfield to access the **Plumb Bob Tilt Assembly**. The manual gives you all the important information you need to prepare for final set-up and other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

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

How to Secure the Backbox for Transporting

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

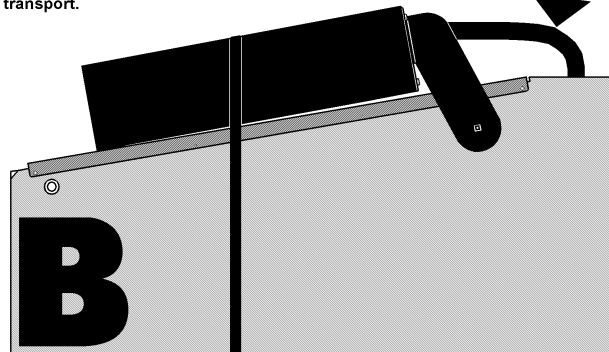
Sec. 1: After Set-Up



Step 3.

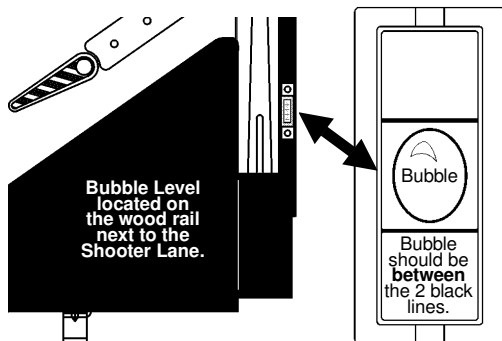
The top of the Backbox will rest on the Pinball Side Armor. Strap or tie down the Backbox to keep from "bouncing" during transport.

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



Leg Leveler Adjustment

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

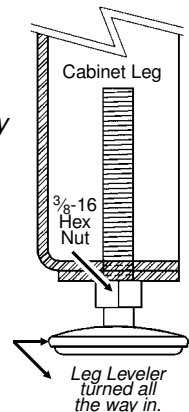


Start adjustment with the leg levelers *turned all the way in*.

View the *bubble* in the level provided on the right side wood rail.

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

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



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

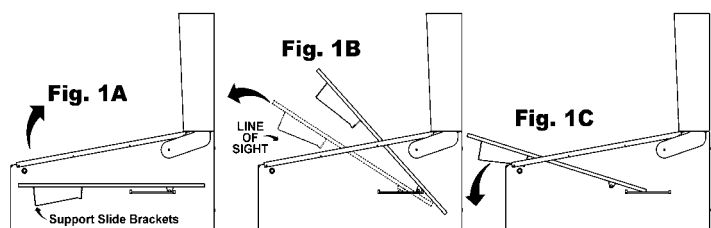
Note: For custom adjustment greater than >6.5° can be achieved by turning out the rear leg leveler(s), however, *it is not recommended.*

Easy Access Service System - 2 Positions

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

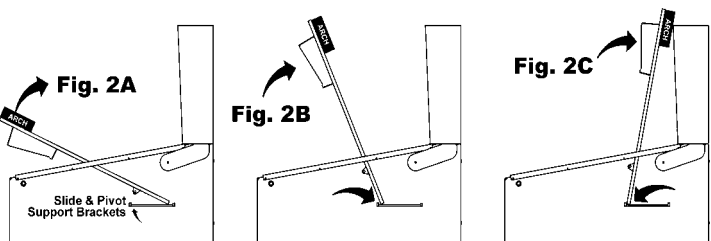
Position 1

When lifted high enough, the **Playfield Support Slide Brackets** (Fig. 1A) can be seen and can clear the cabinet front (Fig. 1B). At this time, pull the playfield toward the front of the cabinet, checking that the mechanical components clear the cabinet front, then rest the playfield on the **Playfield Support Slide Brackets** at the front channel of cabinet (Fig. 1C);



Position 2

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



Game Operation & Features

Start of Game Features

Starting a Normal Game

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

This option is adjustable with **Standard Adj. 50, Team Scores** (Default = **NO**). If **Standard Adj. 50, Team Scores** is changed to **YES**, then Team Play will be made available. **Team Play only works in a 4-Player Game**. The totals for Players 1/ 3 (Team 1) & Players 2 / 4 (Team 2) are then displayed individually **as well as** the combined score for **BOTH TEAMS**.

Starting Tournament Play with

This Pinball Game is **ToPS™ (Tournament Pinball System) Ready**. **Optional Tournament equipment & hardware (sold separately) is required**. Review **Section 3, Chp. 7, GO TO TOURNAMENT MENU**, for more info!

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*).

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 (*amount of balls used depends on game rules*).

Replay Feature

Replay awards are given as the player exceeds a High Score Level during game play. This can be adjusted with **Standard Adj. 3, Replay Award** (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, **Standard Adj. 15, 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 **Std. Adj. 13, 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 **Std. Adj. 29, 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: **Standard Adj. 31, 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, **Standard Adj. 01, Replay Type** (Default = **AUTO**, adjustable). The *Replay Percent* is automatically adjusted, **Standard Adj. 02, Replay Percentage**, 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, **Standard 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 **Standard Adj. 04, Replay Levels**. *For more details with Adjustments, see Section 3, Chapter 4, GO TO ADJUSTMENTS MENU; also, see see Section 3, Chapter 5, GO TO INSTALLS MENU for further customization of your Pinball Game.*

Sec. 2: Game Op.

Instruction Card

Below is a **COPY** of the Game Instruction Card (SPI Nr.: 755-5185-01-Y USA). For a replacement Game Instruction Card on Astrobright Solar Yellow Card Stock, add **-Y** to the end of the Part Number above. If your card is lost or damaged, simply **COPY** this page and **cut out** the 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

THE SopranosSM

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

FOLD HERE



OBJECT : Crack the **Safe 4** and collect **Envelopes 12673** to advance **Rank** and become **Underboss**.

MULTIBALL : Shoot the **Drop Target 5** in front of the **Boat** to light **Lock**. Lock two balls in the **Boat** to start **Stugots Multiball**. Shoot the **Left Ramp 2** to start "Party at the Bing". Finish "Party at the Bing" to start **Bing Multiball**.

EXTRA BALL : Advance **Rank** to **Acting Capo** by cracking the **Safe 4** or collecting **Envelopes 12673** to light **Extra Ball 3**.

FOOD : Collect **Food Plates 1267** to start **Food Fight**.

TRUCK HEIST : Shoot the **Left and Right Loops 17** to start **Truck Heist**. Shoot either **Loop** during **Truck Heist** to finish.

MEADOWLANDS : Shoot the **Right Ramp 6** to dispose of items in the **Meadowlands**.

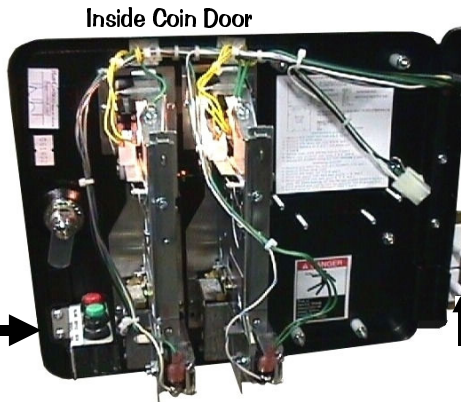
EPISODES : Shoot the **Spinner Lane 3** to start **Episodes**.

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Click on card to open the Instruction Card for printing.

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

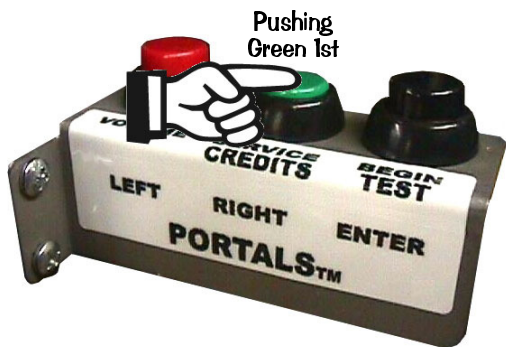


Pushing the **Red "VOLUME" Button** first, enters the **Volume Menu**. While in this Mode, to **DECREASE** the volume, hold down or depress the **Red "LEFT" Button** until desired the volume is achieved; to **INCREASE** the volume, hold down or depress the **Green "RIGHT" Button** until the desired volume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

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

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

Function 2, Service Credits Menu

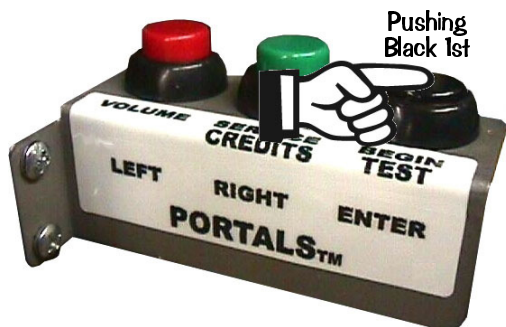


Pushing the **Green "SERVICE CREDITS" Button** first, adds **Service Credits** (will not affect your audits as "paid" credits). This is useful for the technician to test games in regular play without affecting the game audits. Each depression adds **1 credit**; up to **50 credits** can be applied. **Std. Adj. 16, 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 Standard Adjustment 30, Free Play, is set to YES. The Service Credits are limited to the Credit Limit in addition to any paid credits present in the game (e.g. If the Credit Limit is 30, and there are 8 paid credits present, only 22 Service Credits can be applied).

open
Adjustments

Function 3, Portals™ Service Menu



Pushing the **Black "BEGIN TEST" Button** 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:



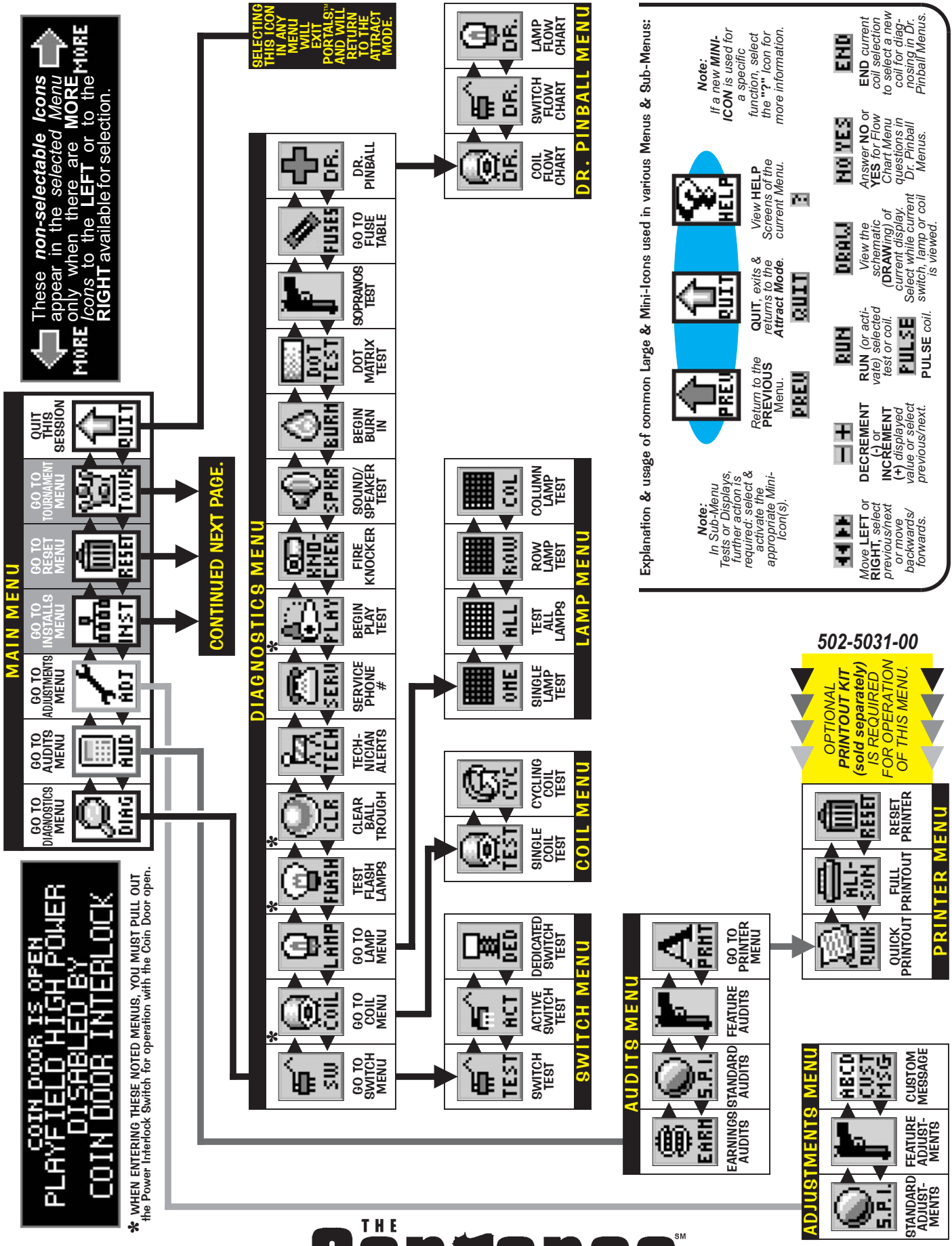
As the operator views the Menu Screen(s), the **MORE MORE** symbols indicates that there are more **Icons** to select in each direction. The **Icon** selected will blink. Pushing the **Black "ENTER" Button** (or **Start Button**) will select the **Icon** and the Menu Screen will change to the menu selected.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

Sec. 3: ...Menu Intro.

Sopranos Portals™ Service Menu Icon Tree



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	RUN PULSE	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>				

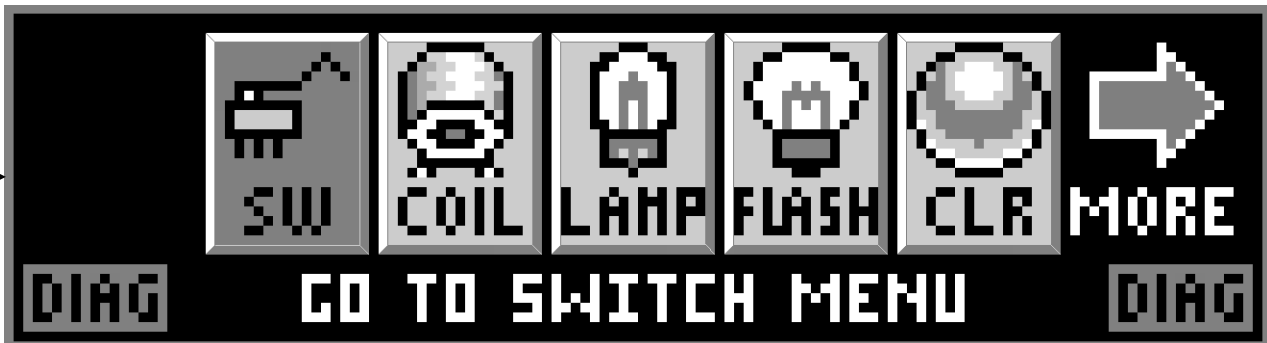
Sec. 3: ...Menu Intro.

Example:

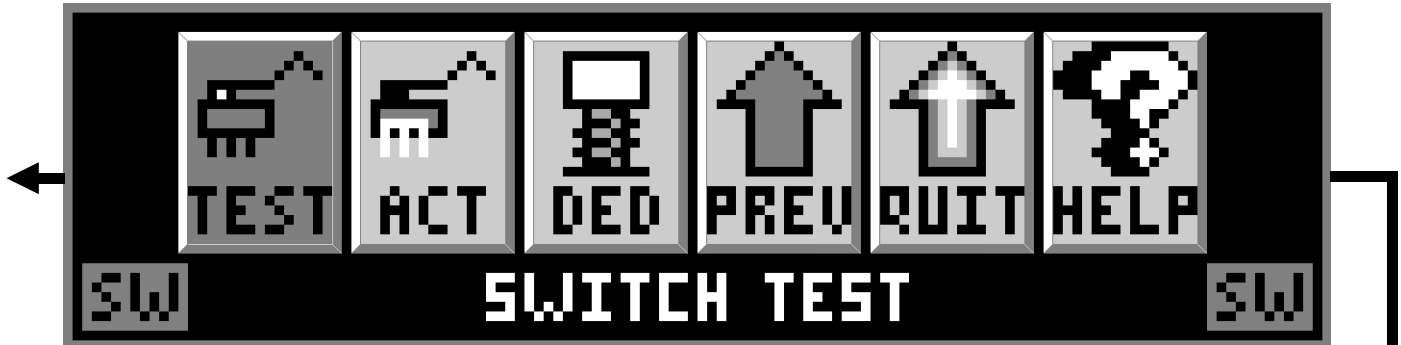
After entering **Portals™**, the **MAIN MENU** now appears with the "DIAG" *Icon* (**GO TO DIAGNOSTICS MENU**) flashing:



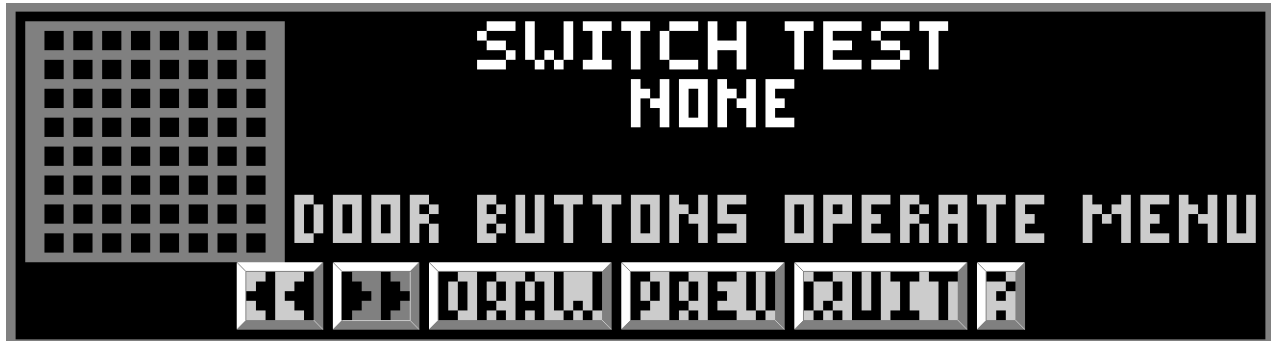
Press the **Black "ENTER" Button** to *activate* this **ICON**. The **DIAGNOSTICS MENU** now appears with the "SW" *Icon* (**GO TO SWITCH MENU**) flashing:



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.

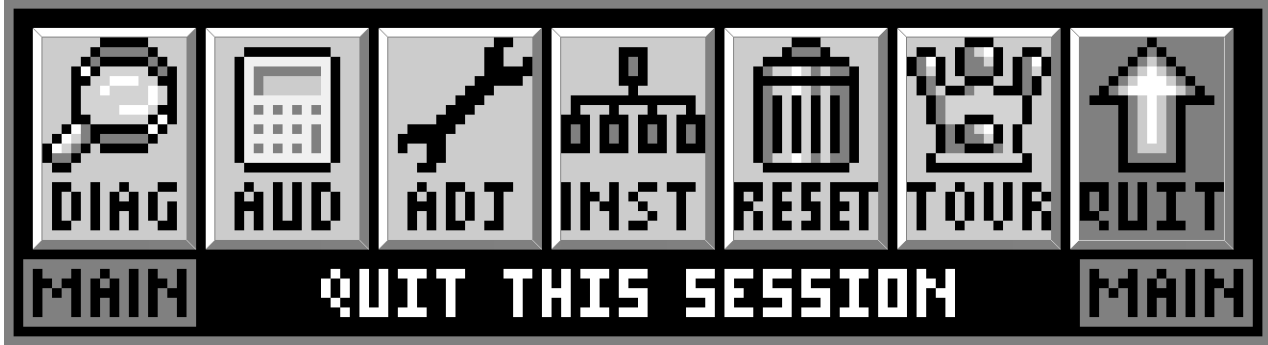
While in **Switch Test** or **Active Switch Test**, the **Flipper & Start Buttons** are deactivated (because they can be part of these tests). Use the **Red "LEFT," Green "RIGHT"** and/or **Black "ENTER" Buttons** to select and *activate* the "**MINI-ICONS**" at the bottom of the display. In **Switch 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 **Diagnositics** 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**.



Exiting **Portals™** or turning game on/off will start the *Power-Up Routine*. Upon **Power-Up**, **HOLD IN THE RIGHT FLIPPER BUTTON** to *view the CPU Game & Display Code Versions (+ Check-Sums)*, followed by the *Location & Game ID Numbers and Alerts*, if any (see *Sec. 3, Chp. 2, GO TO DIAGNOSTICS MENU, Technician Alerts*).



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

Problem / Solution Table

Sec. 3: ...Menu Intro.

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 Section 5, Chapter 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 Section 3, Chapter 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** (Game Reset) or opening the **Coin Door** 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 **Tech Report Alert flashes** (along with an audible sound), the game has detected faulty switches and/or missing pinballs. Select the "TECH" *Icon* for information (review **Technician Alerts, Pages 24-25**). * For this **Alert display** to appear, **Standard Adj. 49, must be changed to POWERUP, COIN DOOR or POWERUP AND COIN DOOR**, the default is **NEVER** (review Section 3, Chp. 4, **GO TO ADJUSTMENTS MENU**, **Standard Adjustments, Page 44**).

CAUTION: Remove all pinballs from the Ball Trough prior to lifting the playfield to its full upright position for servicing. **PULL OUT** the **Power Interlock Switch** for operation. To eject pinballs, 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* and press the **Black "ENTER" Button** or **Start Button** to remove one pinball at a time (this feature also useful to retrieve a pinball for game testing in **Begin Play Test & Game Specific Tests**).



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

Select and activate to:

MORE MORE	PREU	QUIT	HELP	RUN PULSE	RUN PULSE	DRAW
These <i>non-selectable icons</i> appear in the selected <i>Menu</i> 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.	DECREMENT (-) or INCREMENT (+) displayed value or select previous / next.	RUN (or activate) selected test or coil PULSE coil.
						View the schematic (DRAW ing) of current display. Select while current switch, lamp or coil is viewed.

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

GO TO DIAGNOSTICS MENU



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



Go To Switch Menu

To initiate, from the **DIAGNOSTICS MENU**, select the "SW" Icon with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Switches are configured in an 8 x 8 Matrix of Columns (Switch Drives) and Rows (Switch Returns) with up to **64** possible switches. The **SWITCH TEST MENU** consists of three (3) parts: **Switch Test, Active Switches & Dedicated Switch Test**. **Reminder: The Flipper & Start Buttons (part of Switch Tests) cannot be used as navigation buttons during these test(s)**



Switch Test

To initiate, from the **SWITCH MENU**, select the "TEST" Icon with either the **Red or Green Buttons & press the Black Button**. In **Switch Test**, close each switch and observe the display. The display will describe the switch in the **Switch Matrix Grid (below)**, 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

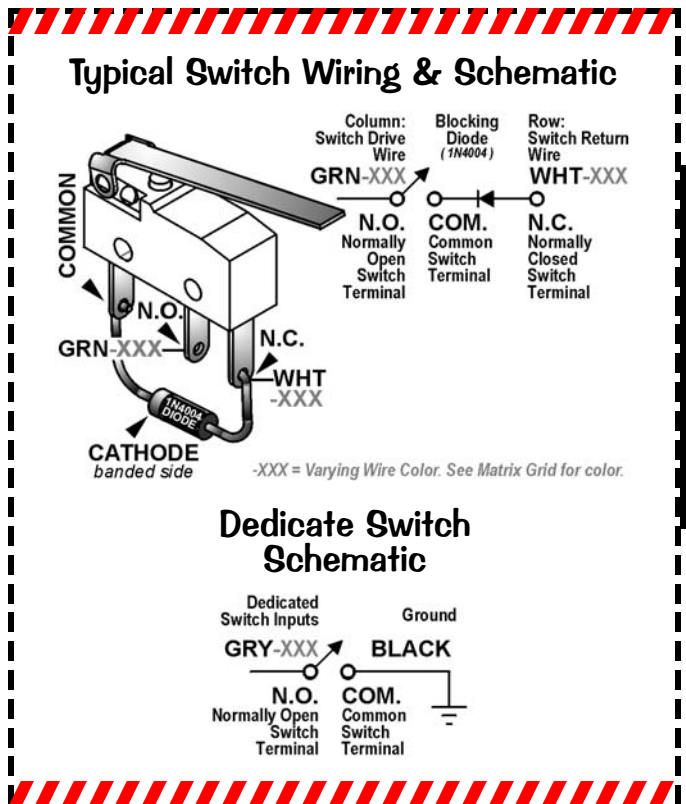
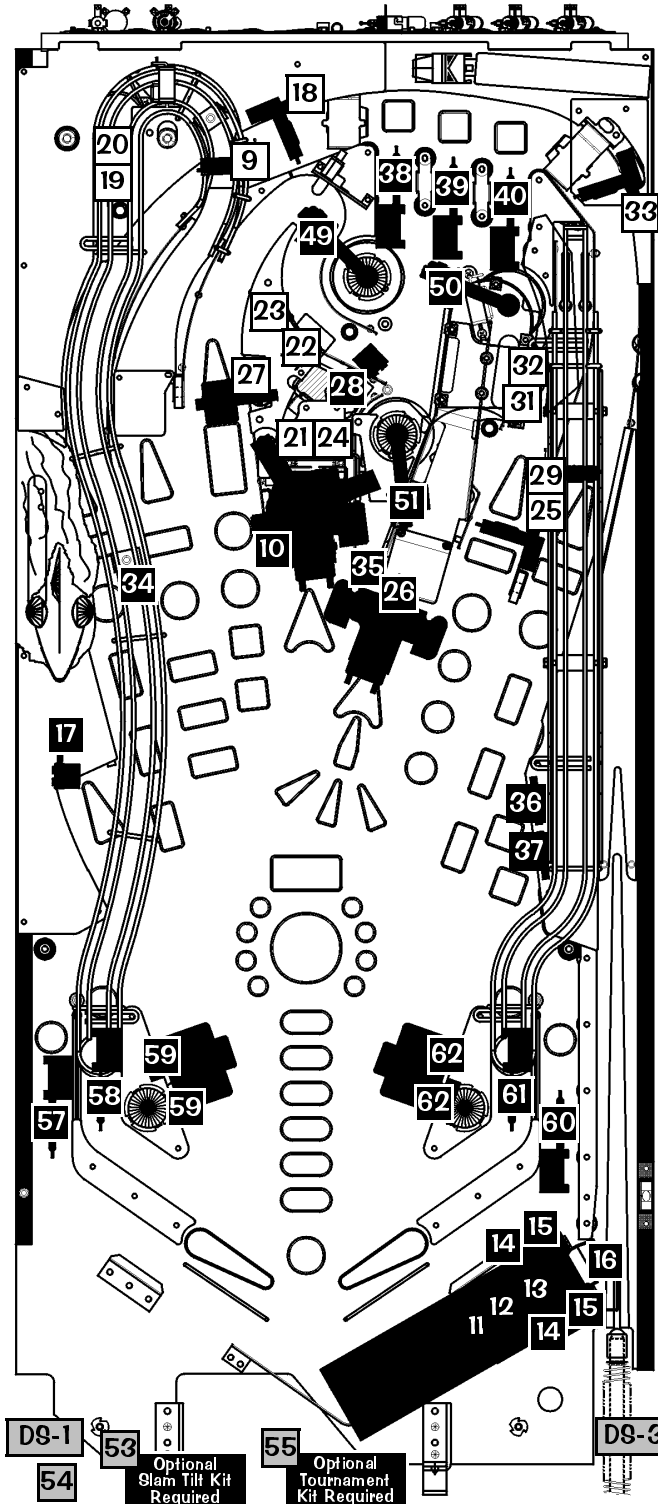
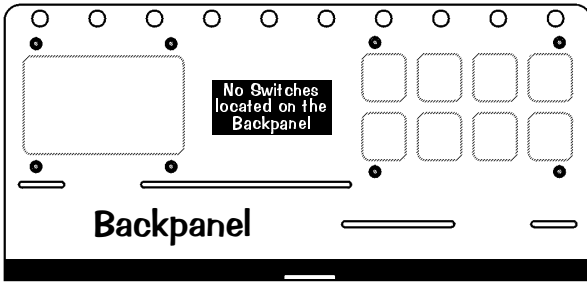
Column (Drive)	1: Q1	2: Q2	3: Q3	4: Q4	5: Q5	6: Q6	7: Q7	8: Q8
Row (Return)	GRN-BRN CN5-P1	GRN-RED CN5-P3	GRN-ORG CN5-P4	GRN-YEL CN5-P5	GRN-BLK CN5-P6	GRN-BLU CN5-P7	GRN-VIO CN5-P8	GRN-GRY CN5-P9
1: U400	1 Cabinet Side	9 Above P/F	17 Below P/F	25 Above P/F	33 Above P/F	41 NOT USED	49 Below P/F	57 Below P/F
WHT-BRN CN7-P9	LT BUTTON (UK ONLY)	LEFT RAMP	LEFT EJECT	RIGHT RAMP	RIGHT ORBIT	NOT USED	LEFT BUMPER	LEFT OUTLANE
Sw. Part Number:	180-5160-00	180-5010-01	180-5186-01	180-5087-00	180-5087-00		180-5015-04	500-6227-02
2: U400	2 Coin Door	10 Below P/F	18 Above P/F	26 Below P/F	34 Below P/F	42 NOT USED	50 Below P/F	58 Below P/F
WHT-RED CN7-P8	4TH COIN SLOT	SAFE LIMIT	LEFT ORBIT	DROP TARGET	LEFT STANDUP	NOT USED	RIGHT BUMPER	LEFT RETURN LANE
Sw. Part Number:	180-5204-00	180-5198-00	180-5087-00	180-5158-00	180-5132-00		180-5015-04	500-6227-02
3: U400	3 Coin Door	11 Below P/F	19 Above P/F	27 Above P/F	35 Below P/F	43 NOT USED	51 Below P/F	59 Below P/F
WHT-ORG CN7-P7	6TH COIN SLOT	4-BALL TROUGH #1 (LEFT)	BING 1	SPINNER	CENTER STANDUP	NOT USED	BOTTOM BUMPER	LEFT SLINGSHOT
Sw. Part Number:	Future Use	180-5119-02	180-5119-02	180-5010-04	180-5132-00		180-5015-04	180-5054-00 (x2)
4: U400	4 Coin Door	12 Below P/F	20 Above P/F	28 Below P/F	36 Below P/F	44 NOT USED	52 NOT USED	60 Below P/F
WHT-YEL CN7-P6	RIGHT COIN SLOT	4-BALL TROUGH #2	BING 2	CENTER EJECT	R. 2-BANK TOP	NOT USED	NOT USED	RIGHT OUTLANE
Sw. Part Number:	180-5204-00	180-5119-02	180-5119-02	180-5186-01	180-5133-00			500-6227-02
5: U401	5 Coin Door	13 Below P/F	21 Above P/F	29 Above P/F	37 Below P/F	45 NOT USED	53 In Cabinet	61 Below P/F
WHT-GRN CN7-P5	CENTER COIN SLOT / DBA	4-BALL TROUGH #3	SAFE HIT LEFT	RIGHT RAMP EXIT	R. 2-BANK BOTTOM	NOT USED	SLAM TILT (OPT)	RIGHT RETURN LANE
Sw. Part Number:	180-5204-00	180-5119-02	180-5119-02	180-5010-01	180-5133-00		180-	500-6227-02
6: U401	6 Coin Door	14 Below P/F	22 Above P/F	30 NOT USED	38 Below P/F	46 NOT USED	54 In Cabinet	62 Below P/F
WHT-BLU CN7-P3	LEFT COIN SLOT	4-BALL TROUGH VUK OPTO	CENTER LOCK 1	NOT USED	LEFT TOP LANE	NOT USED	START BUTTON	RIGHT SLINGSHOT
Sw. Part Number:	180-5204-00	See Sw. 14 Note	180-5119-02		500-6227-02		180-5174-00	180-5054-00 (x2)
7: U401	7 Coin Door	15 Below P/F	23 Above P/F	31 Above P/F	39 Below P/F	47 NOT USED	55 In Cabinet	63 NOT USED
WHT-VIO CN7-P2	5TH COIN SLOT	4-BALL STACKING OPTO	CENTER LOCK 2	BOAT LOCK 1	MIDDLE TOP LANE	NOT USED	TOURNAMENT START	NOT USED
Sw. Part Number:	Future Use	See Sw. 15 Note	180-5119-02	180-5119-02	500-6227-02		180-5174-00	
8: U401	8 Cabinet Side	16 Below P/F	24 Above P/F	32 Above P/F	40 Below P/F	48 NOT USED	56 In Cabinet	64 NOT USED
WHT-GRY CN7-P1	RT BUTTON (UK ONLY)	SHOOTER LANE	SAFE HIT RIGHT	BOAT LOCK 2	RIGHT TOP LANE	NOT USED	PLUMB BOB TILT	NOT USED
Sw. Part Number:	180-5160-00	180-5157-00	180-5119-02	180-5119-02	500-6227-02		See Sw. 56 Note	

GROUND	GROUND
IC U206 INPUTS	BLK CN6-P1, -P11
1: U206	DS-1 on Cabinet Side
GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON
Sw. Part Number:	180-5160-00
2: U206	DS-2 Below Playfield
GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke)
Sw. Part Number:	180-5149-00 on Flipper
3: U206	DS-3 on Cabinet Side
GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON
Sw. Part Number:	180-5160-00
4: U206	DS-4 Below Playfield
GRY-YEL CN6-P6	#4 RIGHT FLIPPER E.O.S (End-of-Stroke)
Sw. Part Number:	180-5149-00 on Flipper
5: U206	DS-5
GRY-GRN CN6-P7	NOT USED
Sw. Part Number:	
6: U206	DS-6 on Coin Door
GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (In Test: LEFT)
Sw. Part Number:	180-5192-02
7: U206	DS-7 on Coin Door
GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT)
Sw. Part Number:	180-5192-04
8: U206	DS-8 on Coin Door
GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER)
Sw. Part Number:	180-5192-00

Sec. 3: ... Diagnostics



SWITCH MATRIX GRID LOCATIONS



Sec. 3: ... Diagnostics

- = Switches above Playfield.
- = Switches below Playfield.
- = Switches not on Playfield.

Switch Part Notes: ¥ Yen Coin Switch is 180-5091-00. Part Numbers which start with 515- or 500- include the bracket, target, and/or housing.
Sw. 14 & 15 Part Note: OPTO PC Boards are used as Switches: Trans.: 515-0173-00 (Sw. 14 & 15); Receiver: 515-0174-00 (Sw. 14 & 15);

Sw. 56 Part Note: The Switch is comprised of a Hanger Bracket (535-5319-00) and Contact Wire (535-7563-01) located in the Cabinet.
Some Switch Diodes may be located under the playfield, in the Cabinet or Backbox on Terminal Strips or Diode Boards and not on the assemblies.
DOTS: Diode Qn Iterminal Strip, see Section 5, Chapter 2, Playfield Wiring.

Go To
Diagnostics Menu





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 **25-32** (*although may be used in any position & will be noted*).



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

Important: The Partial Coils Detailed Chart Table is used as a reference against the Coil & Flash Lamp Locations on the next page. For the **complete** Coils Detailed Chart Table, see the reverse of the following page. The Chart is shown to compare against the Backbox I/O Power Driver Board Detailed Wiring Diagram (shown again in Sec. 5, Chapter 1, **Playfield Wiring**). For more on troubleshooting and diagnosing, see Sec. 5, Chapter 4, **Printed Circuit Boards**.



Single Coil Test

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



Cycling Coil Test

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

⊖ **Coil Note:** ⊖ Either -00B or -00T can be used for coil replacements. *B/T listed is preferable for easier diode access & may differ on game.*

PARTIAL COILS DETAILED CHART ...

High Current Coils Group 1		Drive Transistor	Coil GA-Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	26-1200 ⊖ 090-5044-00T
#2	AUTO LAUNCH	Q2	23-800 ⊖ 090-5001-00B
#3	CENTER EJECT	Q3	26-1200 ⊖ 090-5044-00B
#4	CENTER LOCK POST	Q4	27-1500 ⊖ 090-5004-00T
#5	LEFT CONTROL GATE	Q5	32-1800 ⊖ 515-6543-00
#6	RIGHT CONTROL GATE	Q6	32-1800 ⊖ (090-5031-00)
#7	1 BANK TRIP	Q7	32-1250 ⊖ 515-6916-01
#8	SAFE	Q8	22-1080 ⊖ 090-5032-00T

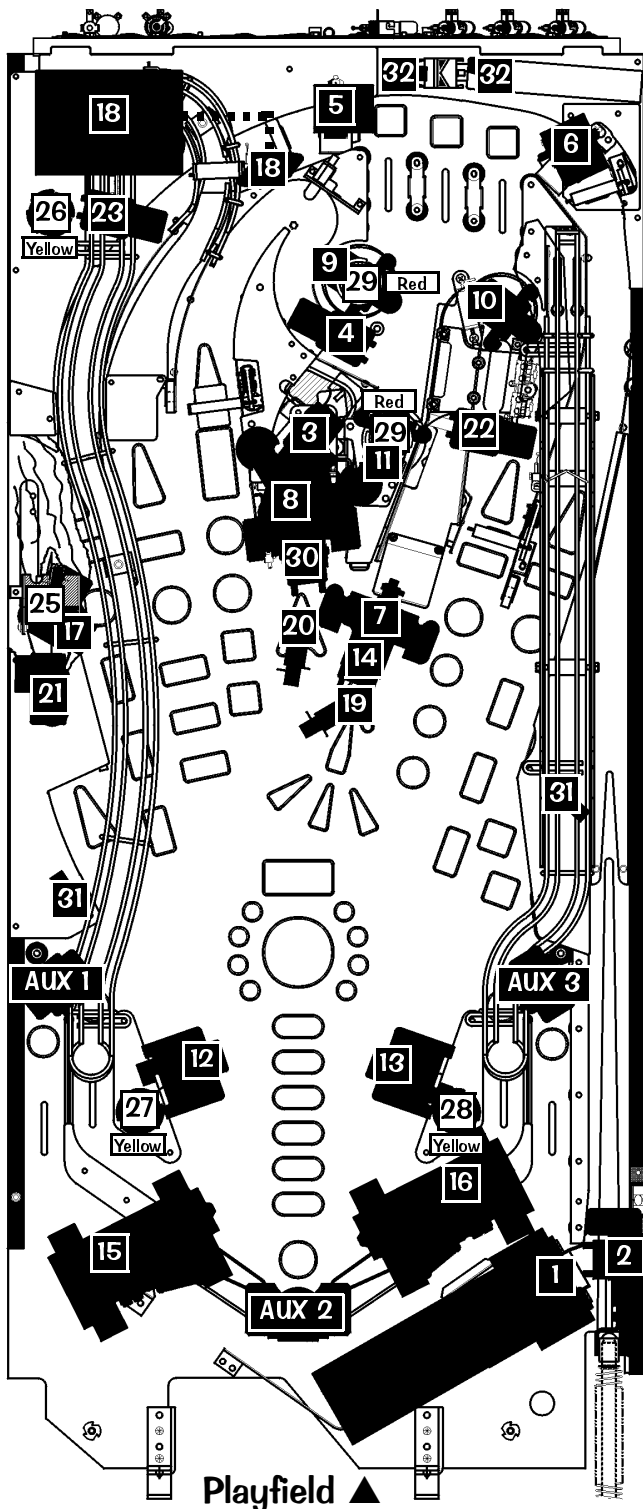
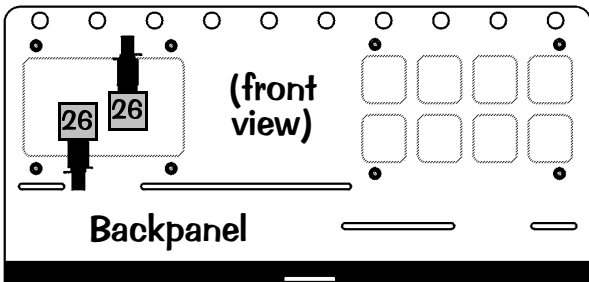
High Current Coils Group 2		Drive Transistor	Coil GA-Turn or Bulb Type
#9	LEFT BUMPER	Q9	26-1200 ⊖ 090-5044-00T
#10	RIGHT BUMPER	Q10	26-1200 ⊖ 090-5044-00T
#11	BOTTOM BUMPER	Q11	26-1200 ⊖ 090-5044-00B
#12	LEFT SLINGSHOT	Q12	26-1200 ⊖ 090-5044-00T
#13	RIGHT SLINGSHOT	Q13	26-1200 ⊖ 090-5044-00T
#14	1 BANK RESET	Q14	27-1500 ⊖ 090-5004-00B
#15	LEFT FLIPPER (50v RED/YEL)	Q15	22-1080 ⊖ 090-5032-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16	22-1080 ⊖ 090-5032-00T

Low Current Coils Group 1		Drive Transistor	Coil GA-Turn or Bulb Type
#17	FISH JAW	Q17	27-1500 ⊖ 090-5004-00B
#18	BING MOTOR (RELAY)	Q18	Relay Asm 500-6700-00
#19	FLASH: SUPER JP	Q19	#89 Bulb 165-5000-89-HF
#20	FLASH: SAFE	Q20	#89 Bulb 165-5000-89-HF
#21	LEFT EJECT	Q21	26-1200 ⊖ 090-5044-00B
#22	BOAT LOCK POST	Q22	26-1200 ⊖ 090-5044-00T
#23	BING LOCK POST	Q23	26-1200 ⊖ 090-5044-00T
#24	OPTIONAL COIL	Q24	Opt. 5v

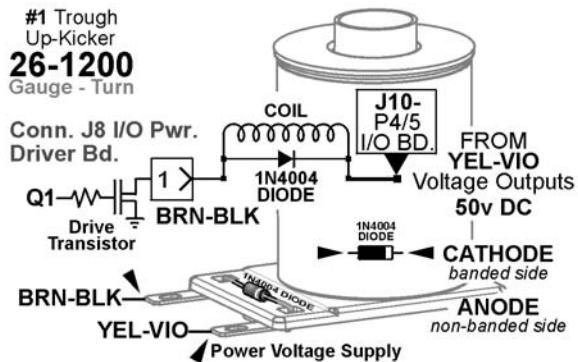
Low Current Coils Group 2		Drive Transistor	Coil GA-Turn or Bulb Type
#25	FLASH: FISH	Q25	#44 LED 112-5023-08
#26	FLASH: BACK X3	Q26	#89 #906 X2 & X1
#27	FLASH: LEFT SLING	Q27	#906 Bulb 165-5004-00
#28	FLASH: RIGHT SLING	Q28	#906 Bulb 165-5004-00
#29	FLASH: BUMPERS X2	Q29	#906 Bulb 165-5004-00
#30	SAFE LATCH	Q30	27-1500 ⊖ 090-5004-00B
#31	FLASH: PF LT & RT X2	Q31	#89 Bulb 165-5000-89-HF
#32	FLASH: TRUCK X2	Q32	#89 Bulb 165-5000-89-HF

Auxiliary (UK ONLY)		Drive Transistor	Coil GA-Turn
AUX 1:	LEFT UP/DOWN POST	Q1	26-1200 ⊖ 090-5044-00T
AUX 2:	CENTER UP/DOWN POST	Q2	23-1100 ⊖ 090-5030-00T
AUX 3:	RIGHT UP/DOWN POST	Q3	26-1200 ⊖ 090-5044-00T

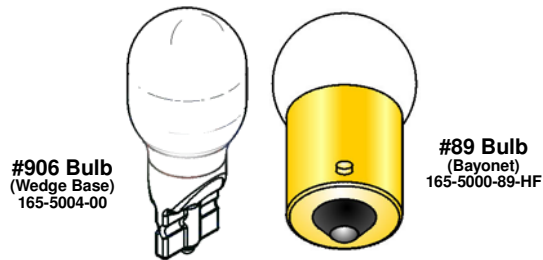
COIL & FLASH LAMP LOCATIONS



Typical Coil Schematic & Wiring



Bulb Types used for Flash Lamps



- = Coils / Flash Lamps above Playfield.
- = Coils / Flash Lamps below Playfield.
- = Coils / Flash Lamps not on Playfield.
- Color = Color of Mini-Mars of Flash Lamp Bulb.

Some Coil or Flash Lamp Diodes may be located under the playfield, in the Cabinet or Backbox on *Terminal Strips* or *Diode Boards* and not on the assemblies.
DOTS: Diode Qn Terminal Strip See Section 5, Chapter 2, **Playfield Wiring**.

Coil Q24 is Optional. If either a Coin Meter, Token Dispenser or Kicker (all optional equipment) is required, call Technical Support for more information, 1-800-542-5377 or 1-708-345-7700.



COIL MENU: SINGLE COIL & CYCLING COIL

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	23-800 ♂ 090-5001-00B
#3	CENTER EJECT	Q3		YEL-VIO	J10-P4/5	50v DC	BRN-ORG	J8-P4	26-1200 ♂ 090-5044-00B
#4	CENTER LOCK POST	Q4		YEL-VIO	J10-P4/5	50v DC	BRN-YEL	J8-P5	27-1500 ♂ 090-5004-00T
#5	LEFT CONTROL GATE	Q5		YEL-VIO	J10-P4/5	50v DC	BRN-GRN	J8-P6	32-1800 ♂ 515-6543-00
#6	RIGHT CONTROL GATE	Q6		YEL-VIO	J10-P4/5	50v DC	BRN-BLU	J8-P7	32-1800 ♂ (090-5031-00)
#7	1 BANK TRIP	Q7		YEL-VIO	J10-P4/5	50v DC	BRN-VIO	J8-P8	32-1250 ♂ 515-6916-01
#8	SAFE	Q8		VIO-YEL	J10-P3	50v DC	BRN-GRY	J8-P9	22-1080 ♂ 090-5032-00T

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 ♂ 090-5044-00B
#12	LEFT SLINGSHOT	Q12		YEL-VIO	J10-P4/5	50v DC	BLU-YEL	J9-P5	26-1200 ♂ 090-5044-00T
#13	RIGHT SLINGSHOT	Q13		YEL-VIO	J10-P4/5	50v DC	BLU-GRN	J9-P6	26-1200 ♂ 090-5044-00T
#14	1 BANK RESET	Q14		YEL-VIO	J10-P1/2	50v DC	BLU-BLK	J9-P7	27-1500 ♂ 090-5004-00B
#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	FISH JAW	Q17	▲ I/O Power Driver ▼	BROWN	J7-P1	20v DC	VIO-BRN	J7-P2	27-1500 ♂ 090-5004-00B
#18	BING MOTOR (RELAY)	Q18		BROWN	J7-P1	20v DC	VIO-RED	J7-P3	Relay Asm 500-6700-00
#19	FLASH: SUPER JP	Q19		ORANGE	J6-P10	20v DC	VIO-ORG	J7-P4	#89 Bulb 165-5000-89-HF
#20	FLASH: SAFE	Q20		ORANGE	J6-P10	20v DC	VIO-YEL	J7-P6	#89 Bulb 165-5000-89-HF
#21	LEFT EJECT	Q21		BROWN	J7-P1	20v DC	VIO-GRN	J7-P7	26-1200 ♂ 090-5044-00B
#22	BOAT LOCK POST	Q22		BROWN	J7-P1	20v DC	VIO-BLU	J7-P8	26-1200 ♂ 090-5044-00T
#23	BING LOCK POST	Q23		BROWN	J7-P1	20v DC	VIO-BLK	J7-P9	26-1200 ♂ 090-5044-00T
#24	OPTIONAL COIL	Q24		RED	J16-P7	5v DC	VIO-GRY	J7-P10	Opt. 5v

D iode O n T ermin al S trip (if noted)

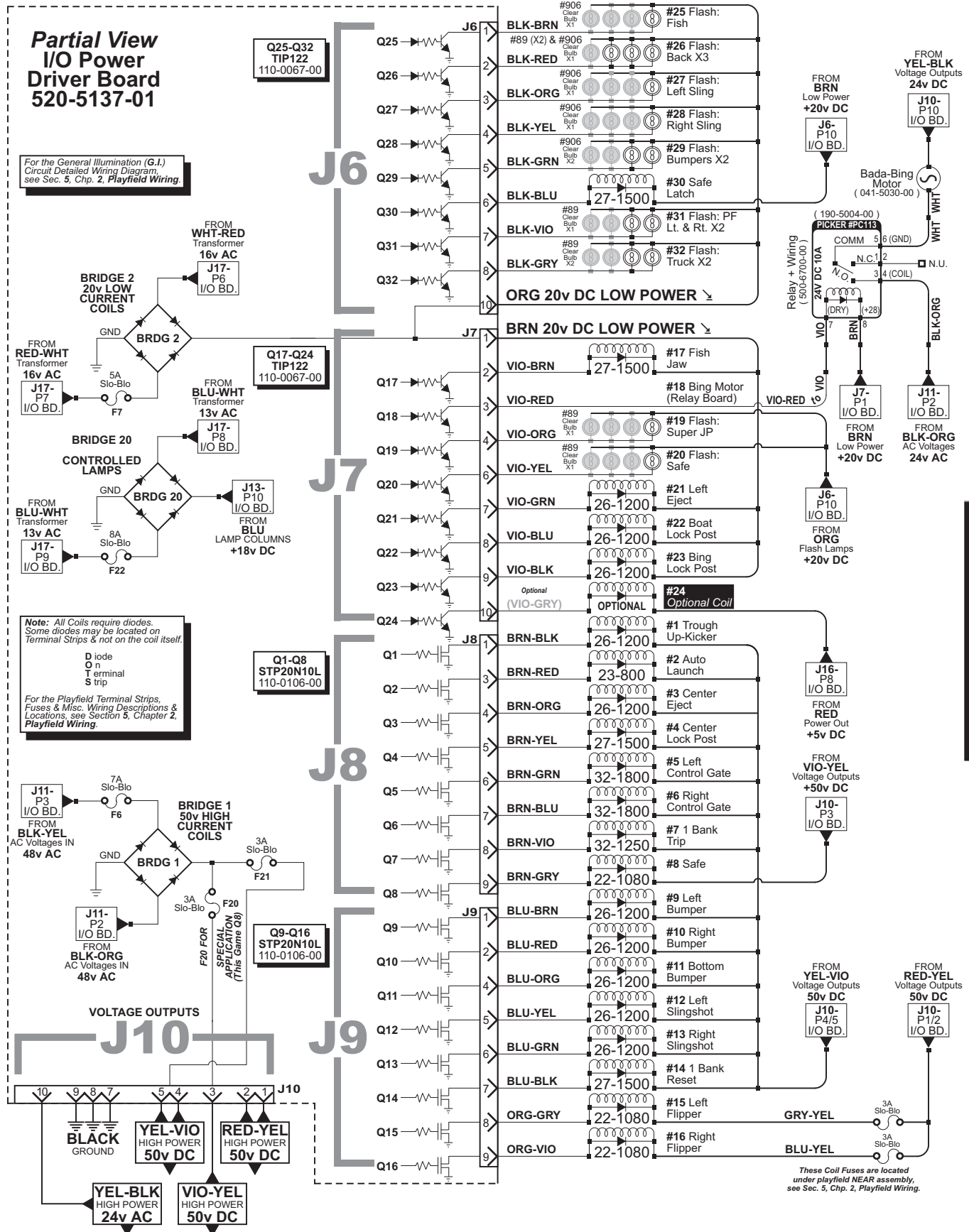
Low Current Coils Group 2		Drive Transistor	Driver Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#25	FLASH: FISH	Q25	▲ I/O Power Driver ▼	ORANGE	J6-P10	20v DC	BLK-BRN	J6-P1	#44 LED 112-5023-08
#26	FLASH: BACK X3	Q26		ORANGE	J6-P10	20v DC	BLK-RED	J6-P2	#89 #906 X2 & X1
#27	FLASH: LEFT SLING	Q27		ORANGE	J6-P10	20v DC	BLK-ORG	J6-P3	#906 Bulb 165-5004-00
#28	FLASH: RIGHT SLING	Q28		ORANGE	J6-P10	20v DC	BLK-YEL	J6-P4	#906 Bulb 165-5004-00
#29	FLASH: BUMPERS X2	Q29		ORANGE	J6-P10	20v DC	BLK-GRN	J6-P5	#906 Bulb 165-5004-00
#30	SAFE LATCH	Q30		BROWN	J7-P1	20v DC	BLK-BLU	J6-P6	27-1500 ♂ 090-5004-00B
#31	FLASH: PF LT & RT X2	Q31		ORANGE	J6-P10	20v DC	BLK-VIO	J6-P7	#89 Bulb 165-5000-89-HF
#32	FLASH: TRUCK X2	Q32		ORANGE	J6-P10	20v DC	BLK-GRY	J6-P8	#89 Bulb 165-5000-89-HF

Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: Q19-Q20, Q25-Q29, Q31-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	UK 3X Trans. Driver Board	BROWN	J7-P1	20v DC	WHITE	J2-P3	26-1200 ♂ 090-5044-00T	
AUX 2: CENTER UP/DOWN POST	Q2		BROWN	J7-P1	20v DC	RED	J2-P4	23-1100 ♂ 090-5030-00T	
AUX 3: RIGHT UP/DOWN POST	Q3		BROWN	J7-P1	20v DC	ORANGE	J2-P7	26-1200 ♂ 090-5044-00T	

♂ Coil Note: ♂ Either -00B or -00T can be used for coil replacements. B/T listed is preferable for easier diode access & may differ on game.

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 (*below*), 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

Column (18v)	1: U17	2: U16	3: U15	4: U14	5: U13	6: U12	7: U11	8: U10
Row (Ground)	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	1 #555 Clear Bulb RED-BRN J12-P1 (RANKS) ASSOCIATE	2 #555 Clear Bulb (RANKS) SOLDIER	3 #555 Clear Bulb (RANKS) GOOD EARNER	4 #555 Clear Bulb (RANKS) ACTING CAPO	5 #555 Clear Bulb (RANKS) CAPO	6 #555 Clear Bulb (RANKS) CONSIGLIERE	7 #555 Clear Bulb (RANKS) UNDER BOSS	8 #44 Clear Bulb (RANKS) BOSS
2: Q34	9 #44 Clear Bulb RED-BLK J12-P2 BOSS: FOOD	10 #44 Clear Bulb BOSS: TRUCK HEIST	11 #44 Clear Bulb BOSS: BADA BING	12 #44 Clear Bulb BOSS: EPISODES	13 #44 Clear Bulb BOSS: SAFE	14 #44 Clear Bulb BOSS: RIP	15 #44 Clear Bulb BOSS: SUPER JACKPOT	16 #44 Clear Bulb BOSS: MEADOWLANDS
3: Q35	17 #555 Clear Bulb RED-ORG J12-P3 (F) ISH LEFT OUTLANE	18 #555 Clear Bulb F (I) SH LT RTRN LANE	19 #555 Clear Bulb FI (S) H RT RTRN LANE	20 #555 Clear Bulb FIS (H) RIGHT OUTLANE	21 #555 Clear Bulb PORK STORE STANDUP	22 #555 Clear Bulb LIGHT STANDUP	23 #555 Clear Bulb FISH	24 #44 LED Bulb THE STUGOTS
4: Q36	25 #555 Clear Bulb RED-YEL J12-P4 LEFT TRUCK HEIST 1 (BOT)	26 #555 Clear Bulb LEFT TRUCK HEIST 2	27 #555 Clear Bulb LEFT TRUCK HEIST 3	28 #555 Clear Bulb L. ORBIT FOOD	29 #555 Clear Bulb L. ORBIT (\$ ENVELOPE	30 #555 Clear Bulb LEFT ORBIT ARROW	31 #555 Clear Bulb BADA BING 1 (BOT)	32 #555 Clear Bulb BADA BING 2
5: Q37	33 #555 Clear Bulb RED-GRN J12-P5 BADA BING 3	34 #555 Clear Bulb L. RAMP FOOD	35 #555 Clear Bulb L. RAMP (\$ ENVELOPE	36 #555 Clear Bulb LEFT RAMP ARROW	37 #555 Clear Bulb START EPISODE	38 #555 Clear Bulb PORK STORE	39 #555 Clear Bulb SPECIAL	40 #555 Clear Bulb EXTRA BALL
6: Q38	41 #555 Clear Bulb RED-BLU J12-P6 ADVANCE RANK	42 #555 Clear Bulb CENTER ARROW	43 #555 Clear Bulb LIGHT LOCK	44 #555 Clear Bulb LOCK 1	45 #555 Clear Bulb LOCK 2	46 #555 Clear Bulb JACKPOT	47 #555 Clear Bulb MEADOWLANDS 1	48 #555 Clear Bulb MEADOWLANDS 2
7: Q39	49 #555 Clear Bulb RED-VIO J12-P8 MEADOWLANDS 3	50 #555 Clear Bulb R. RAMP FOOD	51 #555 Clear Bulb R. RAMP (\$ ENVELOPE	52 #555 Clear Bulb RIGHT RAMP ARROW	53 #555 Clear Bulb RIGHT TRUCK HEIST 1 (BOT)	54 #555 Clear Bulb RIGHT TRUCK HEIST 2	55 #555 Clear Bulb RIGHT TRUCK HEIST 3	56 #555 Clear Bulb R. ORBIT FOOD
8: Q40	57 #555 Clear Bulb RED-GRY J12-P9 R. ORBIT (\$ ENVELOPE	58 #555 Clear Bulb RIGHT ORBIT ARROW	59 #555 Clear Bulb (R.) I. P. LEFT TOP LANE	60 #555 Clear Bulb R. (I.) P. MID. TOP LANE	61 #555 Clear Bulb R. I. (P.) RT. TOP LANE	62	63	64
9: Q41	65 #44 Clear Bulb RED-WHT J12-P10 RIP 1 (TOP LEFT)	66 #44 Clear Bulb RIP 2	67 #44 Clear Bulb RIP 3	68 #44 Clear Bulb RIP 4	69 #44 Clear Bulb RIP 5 (BOT LEFT)	70 #44 Clear Bulb RIP 6	71 #44 Clear Bulb RIP 7	72 #44 Clear Bulb RIP 8
10: Q42	73 #555 Yel. Bulb RED J12-P11 EPISODES: ARSON	74 #555 Yel. Bulb EPISODES: EXTERMINATE	75 #555 Yel. Bulb EPISODES: HORSE RACE	76 #555 Yel. Bulb EPISODES: EXEC. GAME	77 #555 Yel. Bulb EPISODES: SATISFACTION	78 #555 Clear Bulb SHOOT AGAIN	79 OPTIONAL TOURNAMENT BUTTON	80 #555 Clear Bulb START BUTTON



LAMP MATRIX GRID LOCATIONS



◀ Backpanel



Typical Lamp Schematic & Wiring

-XXX = Varying Wire Color. See Matrix Grid for color.

Bulb Types used for Control Lamps

Sec. 3: ... Diagnostics

- = Lamps above Playfield.
- = Lamps below Playfield.
- = Lamps not on Playfield.

Lamp Part Notes: #555 Bulb Clear = 165-5002-00.
 #44 Bulb (Hvy. Fil.) Clear = 165-5000-44-HF. #44 Bulb Red = 165-5053-02.
 #44 Bulb Blue = 165-5053-05. #44 Bulb Yellow = 165-5053-06.
 #44 Bulb Orange = 165-5053-07 (can sub. with Amber -03).
 See Section 4, Chapter 1, **Parts Identification & Location**, Pages 72-74 for more details on bulbs and corresponding sockets.
Some Lamp Diodes may be located under the playfield, in the Cabinet or Backbox on Terminal Strips and not on or with the Lamp Socket.
 DOTS: U n I erminal S trip, see Sec. 5, Chapter 2, **Playfield Wiring**.



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 : **Q19-Q20 & Q25-Q32**.



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

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



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

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



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*, and if any of the below criteria is met, the display will indicate *any or all* of the following categories: **POSSIBLY BROKEN SWITCH**, **CHECK SWITCHES** and/or **HYPERSENSITIVE 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 the "PREV" *Mini-Icon* and press the **Black "ENTER" Button**.

Switch Detection

During game play, activation of 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 replaced, *if necessary*.

Determination of switch usage can be checked 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.*

Technicians Alerts continued on the next page.



Pinball Detection



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

Important: Determine where the pinball is! **Do not add pinball(s)** until it is determined the pinball(s) are indeed missing & not just stuck. If pinball(s) are added, & 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).

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), this 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.

Tech Report Alert Option

This game has the capability of **automatically alerting** the operator upon **Power-Up** and/or opening the **Coin Door** if any switch problems and/or missing pinballs has occurred. Review *Section 3, Chapter 4, GO TO ADJUSTMENTS MENU, Standard Adjustments*. The Standard Adjustment to change is **49**. The default for this feature is **NEVER**. The options are: **POWERUP**, **COIN DOOR** or **POWERUP AND COIN DOOR**.



Upon **Power-Up** (Game Reset) and/or opening the **Coin Door** (depending on the option selected), this **display** will flash three (3) times along with an audible sound. To find out the problem, enter this **Technicians Alert Menu** and wait for the displays.

Note: Coils **are not reported** in **Technician Alerts**, **h o w e v e r**, if a **faulty switch** is the culprit, the switch will then be reported. The below **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 (example shown is #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 (o n l y i f **POWERUP**, **COIN DOOR** or **POWERUP AND COIN DOOR** is selected in Standard Adjustment **49**).



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 Sw.*, the *Autoplunger* should fire. If it kicks to early or too late, the switch actuator should be adjusted to compensate for this error. If it fails to fire, use the **Switch Test** or **Coil Test** to help determine the cause of the failure. During this **Play Test**, check all coil assemblies with related switches in the game. For unique **Game Test(s)**, select the "**r (gun)**" *Icon* in the **DIAGNOSTICS MENU**, reviewed on Pages **27-28**.



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.

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.

Sec. 3: ... Diagnostics

Note: For ROM Usage (Summary Table) & Locations, see Page DR.

① in the "Find-It-In-Front: Dr. Pinball Section". Voice ROMs (U17, U21, U36 and/or U37) which are 8MB must have a Jumper at W6 on the CPU/Sound Board to function properly.

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+



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

The display will immediately illuminate and cycle for **1 pass of each test** continuously for each of the following:

Test 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.

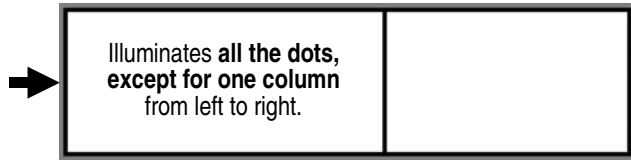
Test 2

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.

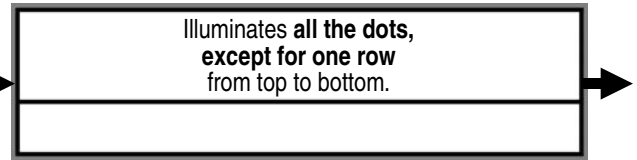


Dot Matrix Test Continued

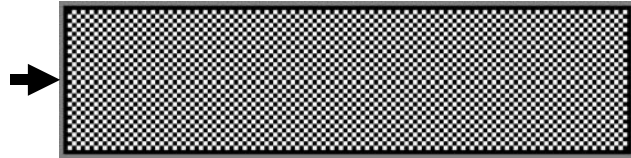
Test 3



Test 4

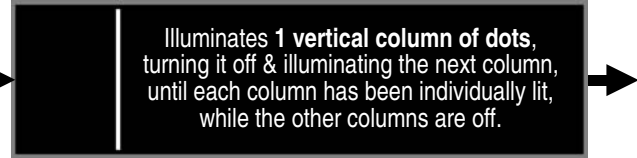


Test 5



Illuminates all the dots alternating even & odd, in both the rows and columns.

Test 1



Note: Pressing the Red, Green, Black or Flipper Buttons will exit the test and 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**.



Sopranos Test

To initiate, from the **DIAGNOSTICS MENU**, select the "r (gun)" *Icon* with either the Red "LEFT" or Green "RIGHT" Buttons and press the Black "ENTER" Button.



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



This will bring up the **SAFE TEST MENU**, with the "RUN" *Mini-Icon* flashing. This test is provided to allow a method of testing the operation of the safe mechanism: **Safe Coil (Q8) & Safe Latch Coil (Q30), Safe Limit (Sw. 10), Safe Hit Left Switch (Sw. 21) and Safe Hit Right Switch (Sw. 24)**.

The display indicates "SAFE DOWN" (which indicates the safe mechanism is in the down/closed (rest) position).



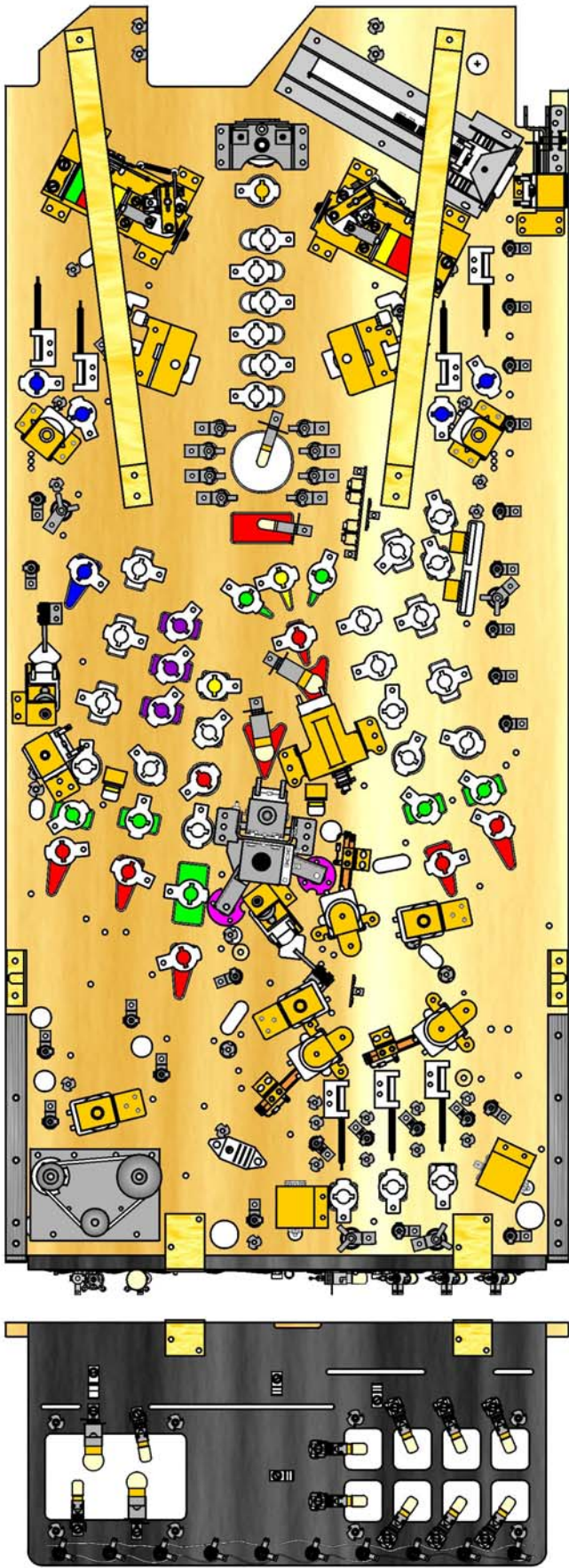
Select and activate the "RUN" *Mini-Icon* to fire (pulse) the **Safe Coil (Q8)**. The safe mechanism is launched up and locked in the up position. The Display indicates "SAFE UP" and the "SAFE LIMIT SW-10" box is highlighted (which indicates Switch 10 as being closed). Select and activate the "RUN" *Mini-Icon* AGAIN to fire both the **Safe Coil (Q8)** and the **Safe Latch Coil (Q30)**.

The display indicates "SAFE DOWN". Note: Q8 is pulsed simultaneously to raise the mechanism slightly so while Q30 is pulsed, the latch bracket can move away easier.

To test either **Safe Hit Left Switch (Sw. 21)** or **Safe Hit Right Switch (Sw. 24)**, ensure the Safe Mechanism is in the Down Position (*SAFE DOWN* should be indicated in the display). Use a pinball (or your finger) and physically hit the left or right side of the Safe Mechanism. The Display indicates the "L.SAFE SW-21" or "R.SAFE SW-24" box is highlighted (which indicates Switch 21 or 24 as being closed).



Sec. 3: ... Diagnostics





Go To Fuse Table

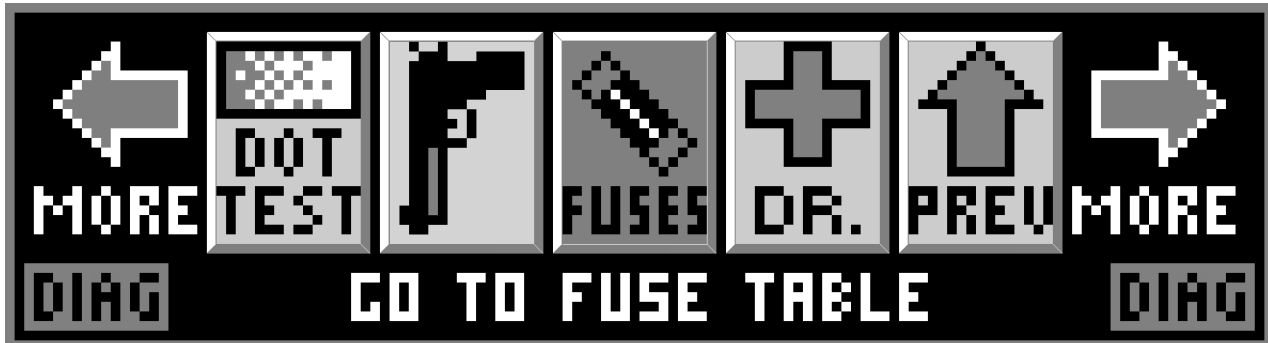
To initiate, from the **DIAGNOSTICS MENU**, select the "FUSES" *Icon* with either the Red "LEFT" or Green "RIGHT" Buttons and press the Black "ENTER" Button. The **FUSE TABLE MENU** now appears. This provides the technician with the current **Fuse Table** for this game (also noted on a decal in the Backbox).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



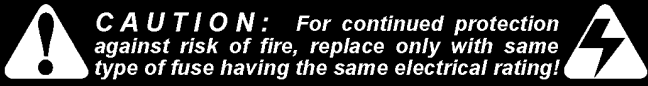
Press the Black Button to *activate* this **ICON**. The **FUSE TABLE** now appears.



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	:A250v S.B.	90v DC	High Voltage Display
LOC: I / O POWER DRIVER BOARD			
F6	7A 250v S.B.	50v DC	Primary High Power Coils/Flippers
F7	5A 250v S.B.	20v DC	Low Power Coils
F8	5A 250v S.B.	12v DC	Logic Power
F9	5A 250v S.B.	12v DC	Logic Power
F20	4A 250v S.B.	50v DC	Magnets
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↔WHT-BRN)
F25	5A 250v S.B.	6.3v AC	G.I. Lamps (YEL↔WHT-YEL)
F26	5A 250v S.B.	6.3v AC	G.I. Lamps (GRN↔WHT-GRN)
F27	5A 250v S.B.	6.3v AC	G.I. Lamps (VIO↔WHT-VIO)
F28	3A 250v S.B.	24v AC	Not Used / Spare

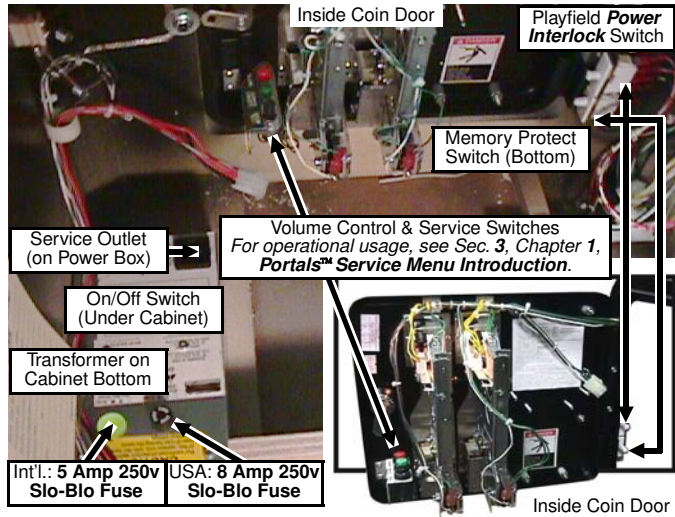
Cabinet Fuses

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

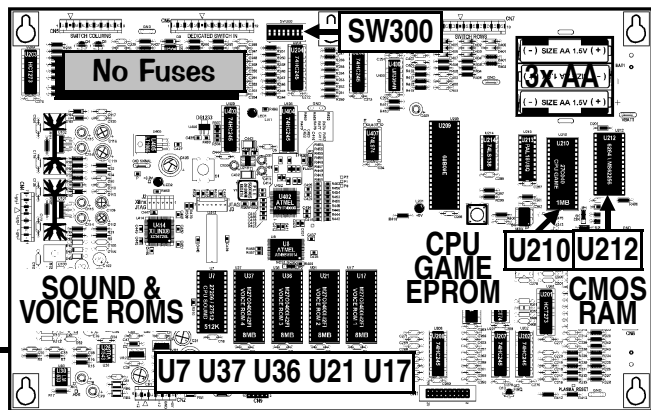
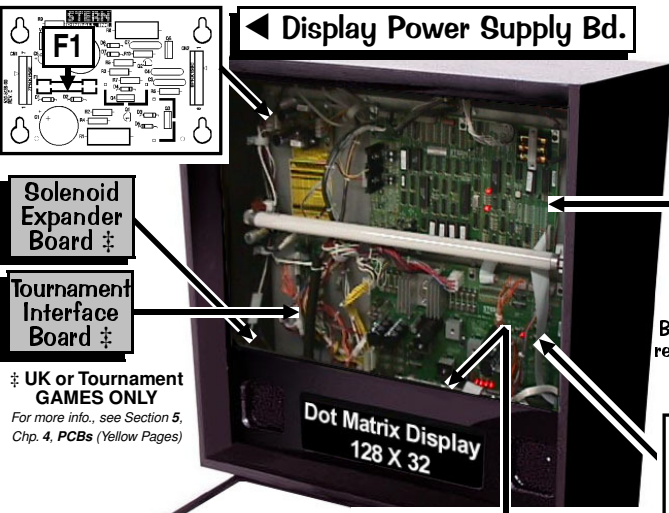
LOC: UNDER PLAYFIELD (near Flippers)			
n/a	3A 250v S.B.	50v DC	Right Flipper (BLU-YEL↔RED-YEL)
n/a	3A 250v S.B.	50v DC	Left Flipper (GRY-YEL↔RED-YEL)

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



ROM TYPE on BD	LOCATION	SIZE	PART NUMBER
CPU Sound	U7	512K	965-0422-85
CPU Game	U210	1 MB	965-0423-85
CPU Voice ROM 1	U17	8 MB	965-0424-85
CPU Voice ROM 2	U21	8 MB	965-0425-85
CPU Voice ROM 3	U36	8 MB	965-0426-85
CPU Voice ROM 4	U37	8 MB	965-0427-85
DISPLAY Controller	U5	4 MB	965-0428-85

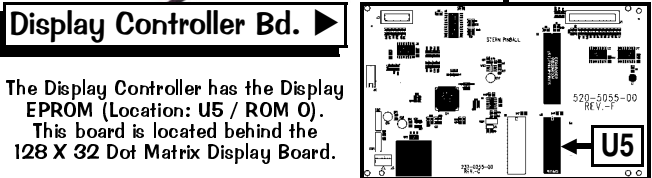
Sec. 3: ... Diagnostics



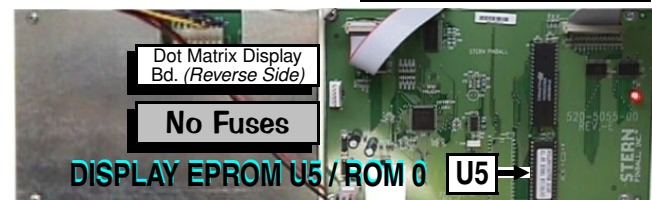
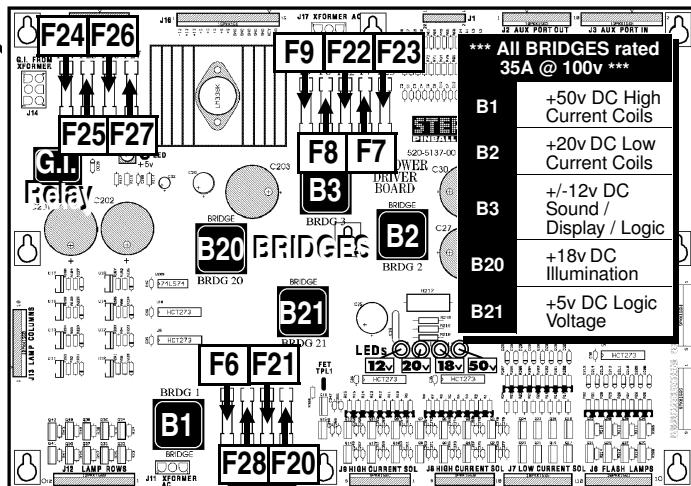
For Schematics and/or Component Parts on PC Boards shown on this page, review Section 5, Chapter 4, Printed Circuit Boards (The Yellow Pages).

CPU/Sound Bd. II w/ATMEL ▲

I/O Power Driver Board ▼



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





Dr. Pinball

To initiate, from the **DIAGNOSTICS MENU**, select the Cross "DR." *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. This will bring you (the operator / technician) into **DR. PINBALL (Flow Chart Menus)** which offers you a choice of three (3) *Icons*: Coil "DR.", Switch "DR." and Lamp "DR." *Icons*. Selecting a particular *Icon* will give you a choice of which specific Coil (*any and all coil assemblies such as Flippers, VUKs, Magnets, etc.*), Switch or Lamp circuit needs to be diagnosed. *Dr. Pinball* will now display a question or give a procedure to follow such as "Does the lamp turn on?" or "Check bridge rectifier BR-20, if short replace." When *Dr. Pinball* displays a question or requests a procedure, *Dr. Pinball* will expect a response such as "NO" or "YES" (*see below examples of the Mini-Icons* which will prompt the operator). You the operator/technician must respond by using the **Red or Green Buttons** to "SELECT" a *Mini-Icon* and the **Black Button** to "ACTIVATE or ENTER" your selection.



Coil Flow Chart

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



Switch Flow Chart

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



Lamp Flow Chart

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

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



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



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



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



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

STARTING METER Reading :

STARTING METER Date (MM/DD/YR) :

AUDITOR'S NAME :

CURRENT VOLUME SETTING:

CURRENT METER Reading :

AUDIT Date (MM/DD/YR) :

CPU Version :

DISPLAY Version :

GAME LOCATION NAME :

EARNINGS & STANDARD AUDIT TABLES



EARNINGS AUDITS

01-14 =

Audit definitions follow in this Chapter.

01	TOTAL PAID CREDITS	
02	FREE GAME PERCENTAGE	
03	AVERAGE BALL TIME	
04	AVERAGE GAME TIME	
05	COINS THRU LEFT SLOT	

06	COINS THRU RIGHT SLOT	
07	COINS THRU CENTER SLOT	
08	COINS THRU 4TH SLOT	
09	COINS THRU 5TH SLOT	
10	COINS THRU 6TH SLOT	

11	TOTAL COINS	
12	TOTAL EARNINGS	
13	METER CLICKS	
14	SOFTWARE METER	



STANDARD AUDITS

01-68 =

Audit definitions follow in this Chapter.

To track Feature & Tournament Audits, see Pages 36 or 54.

01	TOTAL BALLS PLAYED	
02	TOTAL EXTRA BALLS	
03	EXTRA BALL PERCENT	
04	REPLAY 1 AWARDS	
05	REPLAY 2+ AWARDS	
06	TOTAL REPLAYS	
07	REPLAY PERCENT	
08	TOTAL SPECIALS	
09	SPECIAL PERCENT	
10	TOTAL MATCHES	
11	HIGH SCORE AWARDS	
12	HIGH SCORE PERCENT	
13	TOTAL FREE PLAYS	
14	TOTAL PLAYS	
15	0-1.9M SCORES	
16	2M-3.9M SCORES	
17	4M-5.9M SCORES	
18	6M-7.9M SCORES	
19	8M-9.9M SCORES	
20	10M-12.4M SCORES	
21	12.5M-14.9M SCORES	
22	15M-17.4M SCORES	
23	17.5M-19.9M SCORES	
24	20M-22.4M SCORES	

25	22.5M-24.9M SCORES	
26	25M-34.9M SCORES	
27	35M-49.9M SCORES	
28	50M-74.9M SCORES	
29	75M-99.9M SCORES	
30	100M-149.9M SCORES	
31	150M+ SCORES	
32	AVERAGE SCORES	
33	SERVICE CREDITS	
34	BALL SEARCH STARTED	
35	LOST BALL FEEDS	
36	LOST BALL GAME STARTS	
37	LEFT DRAINS	
38	CENTER DRAINS	
39	RIGHT DRAINS	
40	TILTS	
41	TOTAL BALLS SAVED	
42	PROPRIETARY	
43	PROPRIETARY	
44	PROPRIETARY	
45	PROPRIETARY	
46	PROPRIETARY	
47	PROPRIETARY	
48	PROPRIETARY	

49	PROPRIETARY	
50	BASE REPLAY	
51	LEFT FLIPPER USED	
52	RIGHT FLIPPER USED	
53	PROPRIETARY	
54	PROPRIETARY	
55	0-1 MINUTE GAMES	
56	1 - 1.5 MINUTE GAMES	
57	1.5 - 2 MINUTE GAMES	
58	2 - 2.5 MINUTE GAMES	
59	2.5 - 3 MINUTE GAMES	
60	3 - 3.5 MINUTE GAMES	
61	3.5 - 4 MINUTE GAMES	
62	4 - 5 MINUTE GAMES	
63	5 - 6 MINUTE GAMES	
64	6 - 8 MINUTE GAMES	
65	8 - 10 MINUTE GAMES	
66	10 - 15 MINUTE GAMES	
67	15+ MINUTE GAMES	
68	RECENT REPLAY PERCENT	

Note: Audits are subject to change (with or without notice).

Go To Audits Menu

Overview

The Portals™ Service Menu System provides **151** 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 **01-68**) and • **Feature Audits (Programming Use Only)** (Audits **01-69**). 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.

Nr.	EARNINGS AUDIT NAME: Definition
01	TOTAL PAID CREDITS: Provides the total number of <i>Paid Credits</i> .
02	FREE GAME PERCENTAGE: Provides the percentage total by dividing Standard Audit 13, TOTAL FREE PLAYS , by Standard Audit 14, TOTAL PLAYS .
03	AVERAGE BALL TIME: In seconds, the average ball time is derived from the total play time divided by Standard Audit 01, 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 Mechanism Switch 06 was closed.
06	COINS THRU RIGHT SLOT: Provides the total number of times Coin Mechanism Switch 04 was closed.
07	COINS THRU CENTER SLOT: Provides the total number of times Coin Mechanism Switch 05 was closed.
08	COINS THRU 4TH SLOT: Provides the total number of times Coin Mechanism Switch 02 was closed.
09	COINS THRU 5TH SLOT: Provides the total number of times Coin Mechanism Switch 07 was closed.
10	COINS THRU 6TH SLOT: Provides the total number of times Coin Mechanism Switch 03 was closed.
11	TOTAL COINS: Provides the total amount of coins registered through all the <i>Coin Slots</i> .
12	TOTAL EARNINGS: The total cash value accumulated since the last Factory Reset occurred. See Section 3, Chapter 6, GO TO RESET MENU , Reset Coin Audits .
13	METER CLICKS: Provides the total number of money clicks accumulated. <i>Based on the country's lowest coin denomination used for the game credit.</i>
14	SOFTWARE METER: Provides the continuing total of Meter Clicks. <i>This audit cannot be reset; the display shows the constant addition of Meter Clicks.</i>



Standard Audits (01-68)

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.

Nr.	STANDARD AUDIT NAME: Definition
01	TOTAL BALLS PLAYED: Provides the total number of <i>Regular</i> and <i>Extra Balls</i> .
02	TOTAL EXTRA BALLS: Provides the total number of <i>Extra Balls</i> awarded.
03	EXTRA BALLS PERCENT: Provides the percentage total by dividing Standard Audit 02, TOTAL EXTRA BALLS , by Standard Audit 14, TOTAL PLAYS .
04	REPLAY 1 AWARDS: Provides the total <i>Awards (Credits, Extra Balls or Scores)</i> for Level 1.
05	REPLAY 2+ AWARDS: Provides the total <i>Awards (Credits, Extra Balls or Scores)</i> for Level 2 or higher.
06	TOTAL REPLAYS: Provides the total <i>Awards (Credits, Extra Balls or Scores)</i> for exceeding <i>Replay Score Levels</i> .
07	REPLAY PERCENT: Provides the percentage total from dividing Standard Audit 06, TOTAL REPLAYS , by Standard Audit 14, TOTAL PLAYS . The percentage reflects replay total awards for exceeding replay score levels.
08	TOTAL SPECIALS: Provides the total <i>Awards (Credits, Extra Balls, or Scores)</i> for making <i>Specials</i> .
09	SPECIAL PERCENT: Provides the percentage total by dividing Standard Audit 08, TOTAL SPECIALS , by Standard Audit 14, TOTAL PLAYS .
10	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 Standard Adjustment 13, MATCH PERCENTAGE , if enabled. See Section 3, Chapter 4, GO TO ADJUSTMENTS MENU, Standard Adjustments .
11	HIGH SCORE AWARDS: Provides the total <i>Awards (Credits, Extra Balls, or Scores)</i> for exceeding the High-Score-To-Date scores.
12	HIGH SCORE PERCENT: Provides the percentage total by dividing Standard Audit 11, HIGH SCORE AWARDS , by Standard Audit 14, TOTAL PLAYS .
13	TOTAL FREE PLAYS: Provides the total <i>Free Credits</i> for <i>Replays, High-Score-To-Date, Specials and Match</i> .
14	TOTAL PLAYS: This total is derived by adding the sum of Earnings Audit 01, TOTAL PAID CREDITS , and Standard Audit 13, TOTAL FREE PLAYS . <i>Note: Free Credits are not recorded in the Audit until they are actually used.</i>
15	0-1.9M SCORES: Provides the total number of games the Player's final score was 0 and 1,999,990 points.
16	2M-3.9M SCORES: ... and the Player's final score was between 2,000,000 and 3,999,990 points.
17	4M-5.9M SCORES: ... and the Player's final score was between 4,000,000 and 5,999,990 points.
18	6M-7.9M SCORES: ... and the Player's final score was between 6,000,000 and 7,999,990 points.
19	8M-9.9M SCORES: ... and the Player's final score was between 8,000,000 and 9,999,990 points.
20	10M-12.4M SCORES: ... and the Player's final score was between 10,000,000 and 12,499,990 points.
21	12.5M-14.9M SCORES: ... and the Player's final score was between 12,500,000 and 14,499,990 points.
22	15M-17.4M SCORES: ... and the Player's final score was between 15,000,000 and 17,499,990 points.
23	17.5M-19.9M SCORES: ... and the Player's final score was between 17,500,000 and 19,999,990 points.
24	20M-22.4M SCORES: ... and the Player's final score was between 20,000,000 and 22,499,990 points.
25	22.5M-24.9M SCORES: ... and the Player's final score was between 22,500,000 and 24,999,990 points.
26	25M-34.9M SCORES: ... and the Player's final score was between 25,000,000 and 34,999,990 points.
27	35M-49.9M SCORES: ... and the Player's final score was between 35,000,000 and 49,999,990 points.
28	50M-74.9M SCORES: ... and the Player's final score was between 50,000,000 and 74,999,990 points.
29	75M-99.9M SCORES: ... and the Player's final score was between 75,000,000 and 99,999,990 points.
30	100M-149.9M SCORES: ... and the Player's final score was between 100,000,000 and 149,999,990 points.
31	150M+ SCORES: Provides the total number of games the Player's final score was 150,000,000 points and over.
32	AVERAGE SCORES: This total is derived from adding the <i>Final Score</i> of each game to a table and dividing this sum by Standard Audit 14, TOTAL PLAYS .

Standard Audits 33-68 continued on the next page.



33	SERVICE CREDITS: Provides the total number of times the Portals™ Green Button (Dedicated Switch 7) was pushed in Attract Mode . <i>See Section 3, Chapter 1, Service Switch Set Access & Use, for how to receive Service Credits. See Sec. 3, Chp. 6, GO TO RESET MENU, Reset Credits, for how to delete Service (and Paid Credits).</i>
34	BALL SEARCH STARTED: Provides the total number of times the game performed a Ball Search .
35	LOST BALL FEEDS: Provides the total number of times the game added a pinball to play when it could not find a pinball after Ball Search . <i>See Section 3, Chapter 2, GO TO DIAGNOSTICS MENU, Technicians Alert [Pinball Detection].</i>
36	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. <i>See Section 3, Chapter 2, GO TO DIAGNOSTICS MENU, Technicians Alert [Pinball Detection].</i>
37	LEFT DRAINS: Provides the total number of times Rollover Switch 57 was closed.
38	CENTER DRAINS: Provides the total number of times the pinball had drained when the last switch closed was not Switch 57 or Switch 60.
39	RIGHT DRAINS: Provides the total number of times Rollover Switch 60 was closed.
40	TILTS: Provides the total number of times Contact Switch 56 was closed.
41	TOTAL BALLS SAVED: Provides the total number of times this feature was used (<i>this feature can be turned ON or OFF, see Standard Adj. 38, FREEZE TIME in Section 3, Chapter 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.
>>	42 - 49 PROPRIETARY: Proprietary Audits are used for Future Expansion or Programming .
50	BASE REPLAY: Provides the current base Replay Level Score .
51	LEFT FLIPPER USED: Provides the total number of times the Left Flipper Button (Dedicated Switch 1) was pushed in Game Mode .
52	RIGHT FLIPPER USED: Provides the total number of times the Right Flipper Button (Dedicated Switch 3) was pushed in Game Mode .
>>	53 - 54 PROPRIETARY: Proprietary Audits are used for Future Expansion or Programming .
55	0 - 1 MINUTE GAMES: Provides the total number of games the total game time was between 0:00 and 1:00 minute.
56	1 - 1.5 MINUTE GAMES: Provides the total number of games the total game time was between 1:00 and 1:30 minutes.
57	1.5 - 2 MINUTE GAMES: Provides the total number of games the total game time was between 1:30 and 2:00 minutes.
58	2 - 2.5 MINUTE GAMES: Provides the total number of games the total game time was between 2:00 and 2:30 minutes.
59	2.5 - 3 MINUTE GAMES: Provides the total number of games the total game time was between 2:30 and 3:00 minutes.
60	3 - 3.5 MINUTE GAMES: Provides the total number of games the total game time was between 3:00 and 3:30 minutes.
61	3.5 - 4 MINUTE GAMES: Provides the total number of games the total game time was between 3:30 and 4:00 minutes.
62	4 - 5 MINUTE GAMES: Provides the total number of games the total game time was between 4:00 and 5:00 minutes.
63	5 - 6 MINUTE GAMES: Provides the total number of games the total game time was between 5:00 and 6:00 minutes.
64	6 - 8 MINUTE GAMES: Provides the total number of games the total game time was between 6:00 and 8:00 minutes.
65	8 - 10 MINUTE GAMES: Provides the total number of games the total game time was between 8:00 and 10:00 minutes.
66	10 - 15 MINUTE GAMES: Provides the total number of games the total game time was between 10:00 and 15:00 minutes.
67	15+ MINUTE GAMES: Provides the total number of games the total game time was 15:00 and over.
68	RECENT REPLAY PERCENT: <i>Percent figured with programming thresholds for a determined number of games (again based on programming thresholds). The percentage reflects replay total awards for exceeding replay score levels.</i>



Feature Audits (01-69)

To initiate, from the **AUDITS MENU**, select the "r (gun)" *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
01-69 =

***** PROGRAMMING USE ONLY *****
UNLABELED BOXES ARE FOR FUTURE EXPANSION.

01	FISH SHOT		29	LOCK 2		57	CONSIGLIERE	
02	LEFT ORBIT		30	JACKPOT		58	UNDER-BOSS	
03	LEFT RAMP		31	DOUBLE JACKPOT		59	BOSS	
04	SPINNER		32	SUPER JACKPOT		60	FINISH BOSS	
05	CENTER LANE		33	MEADOWLANDS COMPLETED		61	BOSS FOOD	
06	SAFE HITS		34	PORK STORE LIT		62	BOSS TRUCK	
07	SAFE EJECT		35	PORK STORE AWARD		63	BOSS BING	
08	DROP HIT		36	PORK STORE EX. BALL LIT		64	BOSS EPISODES	
09	BOAT RAMP		37	PORK STORE SPECIAL LIT		65	BOSS SAFE	
10	RIGHT RAMP		38	PORK STORE BING		66	BOSS RIP	
11	RIGHT ORBIT		39	PORK STORE STUGOTS		67	BOSS SUPER	
12	FISH TALKED		40	RIP COMPLETE		68	BOSS MEADOWLANDS	
13	SHAKE DOWN COMPLETED		41	ALL RIP		69	ALL ADV BOSS	
14	FISH LIT		42	START ARSON				
15	FISH AWARDS		43	FINISH ARSON				
16	FISH AWARD ADD-A-BALL		44	START EXTERMINATE				
17	TRUCK HEIST STARTED		45	FINISH EXTERMINATE				
18	TRUCK HEIST AWARDED		46	START HORSE RACE				
19	FOOD PLATES		47	FINISH HORSE RACE				
20	START FOOD FIGHT		48	START EXECUTIVE GAME				
21	ENVELOPES		49	WIN EXECUTIVE GAME				
22	ALL ENVELOPES		50	START SATISFACTION				
23	TRIBUTES		51	FINISH SATISFACTIOON				
24	SAFE EXPLODES		52	ASSOCIATE				
25	SAFE AWARDS		53	SOLDIER				
26	BING STARTS		54	GOOD EARNER				
27	BING MULTIBALL STARTS		55	ACTING CAPO				
28	LOCK 1		56	CAPO				

Note: Audits are subject to change (with or without notice).



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 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 **Quick / Full Printout Kit*** and **RS-232 Communication Device**** (which can download serial information) 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 more details on the equipment & hardware required, installation and set-up, read the **Quick/Full Printout Set-Up Instruction Manual** (SPI Part Number: 780-6012-00) provided in the **Quick/Full Printout Kit** (SPI Part Number: 502-5031-00).

**Not included with this ToPS™ Ready Pinball Game. **Not included in the Quick/Full Printout Kit.*



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 & Tournament 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



FEATURE AUDIT ABBREVIATIONS USED IN THIS CHAPTER:

ADV Advance	EX Extra	RIP or R.I.P. Rest In Peace
----------------	-------------	--------------------------------



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



STARTING METER Reading :

STARTING METER Date (MM/DD/YR) :

AUDITOR'S NAME :

CURRENT VOLUME SETTING:

CURRENT METER Reading :

AUDIT Date (MM/DD/YR) :

CPU Version :

DISPLAY Version :

GAME LOCATION NAME :

EARNINGS & STANDARD AUDIT TABLES



EARNINGS AUDITS

01-14 =

Audit definitions follow in this Chapter.

01	TOTAL PAID CREDITS	
02	FREE GAME PERCENTAGE	
03	AVERAGE BALL TIME	
04	AVERAGE GAME TIME	
05	COINS THRU LEFT SLOT	

06	COINS THRU RIGHT SLOT	
07	COINS THRU CENTER SLOT	
08	COINS THRU 4TH SLOT	
09	COINS THRU 5TH SLOT	
10	COINS THRU 6TH SLOT	

11	TOTAL COINS	
12	TOTAL EARNINGS	
13	METER CLICKS	
14	SOFTWARE METER	



STANDARD AUDITS

01-68 =

Audit definitions follow in this Chapter.
To track Feature & Tournament Audits, see Pages 36 or 54.

01	TOTAL BALLS PLAYED	
02	TOTAL EXTRA BALLS	
03	EXTRA BALL PERCENT	
04	REPLAY 1 AWARDS	
05	REPLAY 2+ AWARDS	
06	TOTAL REPLAYS	
07	REPLAY PERCENT	
08	TOTAL SPECIALS	
09	SPECIAL PERCENT	
10	TOTAL MATCHES	
11	HIGH SCORE AWARDS	
12	HIGH SCORE PERCENT	
13	TOTAL FREE PLAYS	
14	TOTAL PLAYS	
15	0-1.9M SCORES	
16	2M-3.9M SCORES	
17	4M-5.9M SCORES	
18	6M-7.9M SCORES	
19	8M-9.9M SCORES	
20	10M-12.4M SCORES	
21	12.5M-14.9M SCORES	
22	15M-17.4M SCORES	
23	17.5M-19.9M SCORES	
24	20M-22.4M SCORES	

25	22.5M-24.9M SCORES	
26	25M-34.9M SCORES	
27	35M-49.9M SCORES	
28	50M-74.9M SCORES	
29	75M-99.9M SCORES	
30	100M-149.9M SCORES	
31	150M+ SCORES	
32	AVERAGE SCORES	
33	SERVICE CREDITS	
34	BALL SEARCH STARTED	
35	LOST BALL FEEDS	
36	LOST BALL GAME STARTS	
37	LEFT DRAINS	
38	CENTER DRAINS	
39	RIGHT DRAINS	
40	TILTS	
41	TOTAL BALLS SAVED	
42	PROPRIETARY	
43	PROPRIETARY	
44	PROPRIETARY	
45	PROPRIETARY	
46	PROPRIETARY	
47	PROPRIETARY	
48	PROPRIETARY	

49	PROPRIETARY	
50	BASE REPLAY	
51	LEFT FLIPPER USED	
52	RIGHT FLIPPER USED	
53	PROPRIETARY	
54	PROPRIETARY	
55	0-1 MINUTE GAMES	
56	1 - 1.5 MINUTE GAMES	
57	1.5 - 2 MINUTE GAMES	
58	2 - 2.5 MINUTE GAMES	
59	2.5 - 3 MINUTE GAMES	
60	3 - 3.5 MINUTE GAMES	
61	3.5 - 4 MINUTE GAMES	
62	4 - 5 MINUTE GAMES	
63	5 - 6 MINUTE GAMES	
64	6 - 8 MINUTE GAMES	
65	8 - 10 MINUTE GAMES	
66	10 - 15 MINUTE GAMES	
67	15+ MINUTE GAMES	
68	RECENT REPLAY PERCENT	

Note: Audits are subject to change (with or without notice).

Comments:

FEATURE AUDIT TABLE



FEATURE AUDITS

01-69 =

*** PROGRAMMING USE ONLY ***
UNLABELED BOXES ARE FOR FUTURE EXPANSION.

01	FISH SHOT		29	LOCK 2		57	CONSIGLIERE	
02	LEFT ORBIT		30	JACKPOT		58	UNDER-BOSS	
03	LEFT RAMP		31	DOUBLE JACKPOT		59	BOSS	
04	SPINNER		32	SUPER JACKPOT		60	FINISH BOSS	
05	CENTER LANE		33	MEADOWLANDS COMPLETED		61	BOSS FOOD	
06	SAFE HITS		34	PORK STORE LIT		62	BOSS TRUCK	
07	SAFE EJECT		35	PORK STORE AWARD		63	BOSS BING	
08	DROP HIT		36	PORK STORE EX. BALL LIT		64	BOSS EPISODES	
09	BOAT RAMP		37	PORK STORE SPECIAL LIT		65	BOSS SAFE	
10	RIGHT RAMP		38	PORK STORE BING		66	BOSS RIP	
11	RIGHT ORBIT		39	PORK STORE STUGOTS		67	BOSS SUPER	
12	FISH TALKED		40	RIP COMPLETE		68	BOSS MEADOWLANDS	
13	SHAKE DOWN COMPLETED		41	ALL RIP		69	ALL ADV BOSS	
14	FISH LIT		42	START ARSON				
15	FISH AWARDS		43	FINISH ARSON				
16	FISH AWARD ADD-A-BALL		44	START EXTERMINATE				
17	TRUCK HEIST STARTED		45	FINISH EXTERMINATE				
18	TRUCK HEIST AWARDED		46	START HORSE RACE				
19	FOOD PLATES		47	FINISH HORSE RACE				
20	START FOOD FIGHT		48	START EXECUTIVE GAME				
21	ENVELOPES		49	WIN EXECUTIVE GAME				
22	ALL ENVELOPES		50	START SATISFACTION				
23	TRIBUTES		51	FINISH SATISFACTION				
24	SAFE EXPLODES		52	ASSOCIATE				
25	SAFE AWARDS		53	SOLDIER				
26	BING STARTS		54	GOOD EARNER				
27	BING MULTIBALL STARTS		55	ACTING CAPO				
28	LOCK 1		56	CAPO				

MULTI-WEEK TOURNAMENT AUDIT TABLES

STARTING METER Reading :	STARTING METER Date (MM/DD/YR) :	AUDITOR'S NAME :	CURRENT VOLUME SETTING:																				
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STANDARD & FEATURE ADJUSTMENT TABLES



STANDARD ADJUSTMENTS 01-55



Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
01	REPLAY TYPE	AUTO	
02*	REPLAY PERCENTAGE	10%	
03	REPLAY AWARD	CREDIT	
04*	REPLAY LEVELS	1: 20,000,000	
05	REPLAY BOOST	YES	
06	SPECIAL AWARD	CREDIT	
07*	SPECIAL PERCENTAGE	2%	
08	FREE GAME LIMIT	05	
09*	EXTRA BALL LIMIT	09	
10*	EXTRA BALL PERCENTAGE	25%	
11	GAME PRICING	USA 5	
12	MATCH AWARD	CREDIT	
13*	MATCH PERCENTAGE	9%	
14	BALLS PER GAME	03	
15	TILT WARNINGS	01	
16	CREDIT LIMIT	30	
17	ALLOW HIGH SCORES	YES	
18	GRAND CHAMPION AWARDS	01	
19	HIGH SCORE #1 AWARDS	01	
20	HIGH SCORE #2 AWARDS	00	
21	HIGH SCORE #3 AWARDS	00	
22	HIGH SCORE #4 AWARDS	00	
23*	GRAND CHAMPION SCORE	75,000,000	
24*	DEFAULT HIGH SCORE #1	55,000,000	
25*	DEFAULT HIGH SCORE #2	45,000,000	
26*	DEFAULT HIGH SCORE #3	35,000,000	
27*	DEFAULT HIGH SCORE #4	25,000,000	
28	HSTD RESET COUNT	2,000	

Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
29	HIGH SCORE INITIALS	3 INITIALS	
30	FREE PLAY	NO	
31	CUSTOM MESSAGE	ON	
32	FLASH LAMP POWER	NORMAL	
33	COIL PULSE POWER	NORMAL	
34	KNOCKER VOLUME	NORMAL	
35	GAME RESTART	YES	
36	BILL VALIDATOR	NO	
37	BKGRND MUSIC VOLUME	01	
38*	FREEZE TIME	0:10	
39	UK POST SAVE ENABLED	NO	
40	TIMED PLUNGER	OFF	
41	FLIPPER BALL LAUNCH	DISABLED	
42	COINDOOR BALL SAVER	NO	
43	COMPETITION MODE	NO	
44	CONSOLATION BALL	YES	
45	FAST BOOT	YES	
46	Q24 OPTION	COIN METER	
47	TICKET DISP. INSTALLED	NO	
48	ALLOW PLAYER COMP. MODE	YES	
49	TECH ALERT WARNING	NEVER	
50	TEAM SCORES	NO	
51	LOCATION ID	00	
52	GAME ID	00	
53	FLIPPER ADJ 1	20	
54	FLIPPER ADJ 2	50	
55	FLIPPER ADJ 3	3	

Note: Adjustments and/or variables are subject to change (with or without notice).

* Defaults are subject to change during production (especially 02, 04, 07, 09, 10, 13, 23-27 & 38).

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.

Sec. 3: Adjustments



SHORTCUT TO STANDARD ADJUSTMENT 31.



FEATURE ADJUSTMENTS 01-25



Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
01	ADULT CONTENT ENABLED	PARTIAL	
02	RANK DIFFICULTY	MODERATE	
03	SAFE DIFFICULTY	MODERATE	
04	FOOD DIFFICULTY	MODERATE	
05	R-I-P DIFFICULTY	MODERATE	
06	STUGOTS DIFFICULTY	MODERATE	
07	SHAKEDOWN DIFFICULTY	MODERATE	
08	BING DIFFICULTY	MODERATE	
09	PORK STORE DIFFICULTY	MODERATE	
10	FISH DIFFICULTY	MODERATE	
11	FOOD FIGHT TIMER	30	
12	EXTERMINATE TIMER	30	
13	HORSE RACE TIMER	30	

Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
14	ARSON TIMER	30	
15	SATISFACTION TIMER	30	
16	SUPER JACKPOT TIMER	15	
17	UNDERBOSS LOCK TIMER	10	
18	BOSS FOOD	15	
19	BOSS TRUCK HEIST	04	
20	BOSS BING	01	
21	BOSS EPISODES	05	
22	BOSS SAFE	01	
23	BOSS R-I-P	01	
24	BOSS SUPER	01	
25	BOSS MEADOWLANDS	04	

Go To Adjustments Menu

Overview

The **Portals™ Service Menu System** provides **80** Adjustments to vary Game Functions to customize for your particular needs. The Adjustments are divided into 2 groups: • **Standard Adjustments (01-55)** and • **Feature Adjustments (01-25)**. 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 **Section 3, Chapter 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 (01-55)

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.

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

Nr.	STANDARD ADJUSTMENT NAME: Definition
-----	--------------------------------------

REPLAY TYPE: Set to **AUTO**, **DYNAMIC**, **FIXED** or **NONE**. Default is **AUTO**. Selecting **NONE** will make Standard Adjustments **2-5 NOT AVAILABLE**. Selecting **FIXED** will make Standard Adjustment **2 NOT AVAILABLE**. If selected **AUTO**, **DYNAMIC** or **FIXED**, you will need to then select the number of Replay Levels and Score Threshold (*in Standard Adj. 4*) desired for the player to receive a Replay Award (*select type in Standard Adj. 3*). The Default Score appears as a starting point after the Level amount is selected. **AUTO & DYNAMIC** will then get based on the Replay Percentage (*in Standard Adjustment 2*).

01

- Select **FIXED** to give the player a Replay Award as the Score Threshold is reached. This Score Threshold **will not** adjust up or down.
- Select **AUTO** to give the player a Replay Award as the Score Threshold is reached. This Score Threshold will automatically adjust up or down based on the Replay Percentage chosen (*in Std. Adj. 2*). The game periodically adjusts based upon the Player Base Skill Level.
- Select **DYNAMIC** to give the player a Replay Award as the Score Threshold is reached. This Score Threshold will go down every game based on the Replay Percentage selected. For (*Dynamic*) example, if the Score Threshold is 50,000,00 and the Replay Percentage selected is 10%, every game a player does not reach the Score Threshold, the score to reach will drop by 5,000,000 (10% of 50M). This will continue every game until the Threshold Score is reached. Thus, if the score then drops to 15,000,000 after 7 games and is then achieved, the Replay Award is given. The original Score Threshold is added to 15,000,000 and is now 65,000,000. It will then take the same player 10 games to reach 15,000,000.

Standard Adjustments 02-11 continued on the next page.



Standard Adjustments Continued.



STANDARD ADJUSTMENT NAME: Definition

- 02 **REPLAY PERCENTAGE:** Set between **01% - 50**. Default is **10%**. This Adjustment is required if Standard Adjustment 1 is set to **AUTO** or **DYNAMIC**.
- 03 **REPLAY AWARD:** Set to **EXTRA BALL**, **CREDIT**, **TICKET*** or **TOKEN***. Default is **CREDIT**. Select **EXTRA BALL** if awarding a **CREDIT**, **TICKET/TOKEN** is prohibited in your area.
**If TICKET or TOKEN is selected, the game will require an optional Ticket or Token Dispenser if selected Token, then Standard Adjustment 46, Q24 Option, must be changed accordingly.*
- 04 **REPLAY LEVELS:** Set between **1 - 4** for the number of Replay Levels to be active. Default is **1: 20,000.00**. A "Drop-Down" Table appears showing Replay Level 1. Adjust the Replay Level between 10M - 9.99B (Default Score appears as a starting point) using the "-" or "+" Mini-Icons, then use the ">>" Mini-Icon to go to next Level (if selected more than 1) and select the next highest Threshold Score(s) desired.
- 05 **REPLAY BOOST:** Set to **YES** or **NO**. Default is **YES**. This Adjustment works only when Standard Adjustment 1, **Replay Type**, is set to **FIXED** or **AUTO**. When set to **YES**, while **FIXED** or **AUTO** maintains the Replay Levels, Replay Boost works as follows: If the Replay Level is 7,000,000 (regardless of the Replay Percentage), and the Player scores 20M, and receives the Replay Award, the next game the Current Replay Level is added to this base. Thus the next game, the Replay Level is 14,000,000. The Player again scores 20M. The next game the Player will need to achieve 21,000,00 to earn the Replay Award. If the Player does not achieve 21,000,000, the next game reverts back to the original 7,000,000 or the new adjusted level maintained by the Fixed or Autopercentaging Feature.
- 06 **SPECIAL AWARD:** Set to **EXTRA BALL**, **CREDIT**, **TICKET***, **TOKEN*** or **POINTS**. Default is **CREDIT**. Select **EXTRA BALL** or **POINTS** if awarding a **CREDIT** or **TICKET/TOKEN** is prohibited in your area.
- 07 **SPECIAL PERCENTAGE:** Set between **1% - 5%**. Default is **2%**. This adjustment allows the operator to adjust how frequently the **Special Feature** is made available to the player.
- 08 **FREE GAME LIMIT:** Set between **01 - 09**, **NO FREE GAMES** or **UNLIMITED**. Default is **05**. Set the maximum number of *Free Games* that may be accumulated per game.
- 09 **EXTRA BALL LIMIT:** Set between **01 - 09**, **NO EXTRA BALLS** or **UNLIMITED**. Default is **09**. Set the number of *Extra Balls* that may be accumulated per game.
- 10 **EXTRA BALL PERCENTAGE:** Set between **01% - 50%**. Default is **25%**. This adjustment allows the operator to adjust how frequently the **Extra Ball Feature** is made available to the player.
- 11 **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*.

Sec. 3: Adjustments

The **Dip Switch Settings (Sw. 300)** on the **CPU/Sound Board** for each Country **must match** with what is shown in the **USA & Int'l. Standard Pricing Select Tables** for your country to have correct operation (see the next page). 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 and "lock-in" the 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.

In **Example 1**, note the **LEFT (and RIGHT) COIN: 3 PULSES** and **ONE CREDIT: 4 PULSES**. Since every Coin inserted produces 3 Pulses & every Credit requires 4 Pulses, 2 Coins (50¢) will produce 6 Pulses (4 Pulses for the 1st Credit + 2 Pulses remains in escrow). The 3rd Coin (75¢) provides another 3 Pulses for a total of 9 Pulses (4 Pulses for the 2nd Credit + 1 Pulse remains in escrow). The 4th Coin (\$1.00) provides another 3 Pulses for a total of 12 Pulses (4 Pulses for the 3rd Credit + 0 Pulses remain). The **CENTER COIN: 12 PULSES** is set this way (with a Bill Validator attached); every \$1-Bill inserted produces 12 Pulses or 3 Credits.

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 /50¢	2 /75¢	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 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 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 /50¢	2 /75¢	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

Standard Adjustment 11, Custom Pricing, continued on the next page.





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

Table for Example 3 showing coin mechanisms and pricing scheme details.

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

Table for Example 4 showing coin mechanisms and pricing scheme details.

USA & International (non-Euro) Standard Pricing Select Tables

Main table with columns for CPU/SOUND BOARD DIP SWITCH 300 SETTING, COUNTRY SETTING OPTION(S), COIN MECHANISMS (SWITCHES), PRICING SCHEME, and Requires SPI Coin Card(s) Part Number.

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Note: The Country Setting Option above noted with "«" & "»" denotes the Factory Default Setting (subject to change). Standard Adjustment 11, Custom Pricing, and Std. Adj. 12-17 continued on the next page.





Euro 1-12 Summary & International (Euro) Standard Pricing Select Table

Table with columns: CPU/SOUND BOARD DIP SWITCH 300 SETTING, COUNTRY SETTING OPTION(S), COIN MECHANISMS (SWITCHES) COINS THRU ... SLOT: LEFT CENTER RIGHT 4TH, PRICING SCHEME, Requires SPI Coin Card(s) Part Number. Rows include Euro 1 through Euro 12 with various pricing options.

For a different Euro Pricing Scheme (other than below default), scroll through Standard Adjustment 11: Euro 1-12 or CUSTOM* for new setting (reference above Euro 1-12 Summary). * Note: Unique Coin Door & Mech. for Germany, Italy & Portugal must use CUSTOM.

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Table of international settings for countries like Austria, Belgium, Finland, France, Germany, Greece, Italy, Netherlands, Portugal, and Spain. Each row includes a switch setting diagram and pricing details.

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

12 MATCH AWARD: Set to CREDIT, TICKET* or TOKEN*. Default is CREDIT.

*If TICKET or TOKEN is selected, the game will require an optional Ticket or Token Dispenser. If selected Token, then Standard Adjustment 46, Q24 Option, must be changed accordingly.

13 MATCH PERCENTAGE: Set between 0% - 10% or OFF. Default is 9%. At 0% the match display occurs at the end of the game but never awards a Credit. Set to OFF, no Match Animation Feature is shown.

14 BALLS PER GAME: Set between 02 - 10. Default is 03. Set the number of balls per game.

15 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.

16 CREDIT LIMIT: Set between 04 - 50. Default is 30. Set the maximum credits allowed.

17 ALLOW HIGH SCORES: Set to YES or NO. Default is YES. When set to YES if a player exceeds any 1 of the 4 High Scores, the player may receive an award (depending on Standard Adjustment 03, Replay Award). Set to NO to disable this feature. There are 5 High Scores that will allow the player to enter their initials (or name) (see Standard Adjustment 29, High Score Initials).

Standard Adjustments 18-38 continued on the next page.





- 18 **GRAND CHAMPION AWARDS:** Set between **00 - 05**. Default is **01**. Set the number of awards, awarded for exceeding Level 1 (*the highest of the five (5) Levels*).
- 19 **HIGH SCORE #1 AWARDS:** Set between **00 - 03**. Default is **01**. Set the number of awards, awarded for exceeding Level 2.
- 20 **HIGH SCORE #2 AWARDS:** Set between **00 - 02**. Default is **00**. Set the number of awards, awarded for exceeding Level 3.
- 21 **HIGH SCORE #3 AWARDS:** Set between **00 - 01**. Default is **00**. Set the number of awards, awarded for exceeding Level 4.
- 22 **HIGH SCORE #4 AWARDS:** Set between **00 - 01**. Default is **00**. Set the number of awards, awarded for exceeding Level 5.
- 23 **GRAND CHAMPION SCORE:** Set between **1,000,000 - 9,999,000,000** or **00** (*increments of 1M*). Default is **75,000,000**. Set the desired **High Score Level** to which Level 1 may be achieved. A score higher than the default, cannot be reset by Standard Adjustment **28, HSTD Reset Count**. *The High Score will revert to the Default Score ONLY if a Factory Reset is done or the batteries are removed from the CPU/Snd. Bd.*
- 24 **DEFAULT HIGH SCORE #1:** Set between **1,000,000 - 9,999,000,000** or **00** (*increments of 1M*). Default is **55,000,000**. Set the desired **High Score Level** to which Level 2 may be achieved. *Read Std. Adj. 28.*
- 25 **DEFAULT HIGH SCORE #2:** Set between **1,000,000 - 9,999,000,000** or **00** (*increments of 1M*). Default is **45,000,000**. Set the desired **High Score Level** to which Level 3 may be achieved. *Read Std. Adj. 28.*
- 26 **DEFAULT HIGH SCORE #3:** Set between **1,000,000 - 9,999,000,000** or **00** (*increments of 1M*). Default is **35,000,000**. Set the desired **High Score Level** to which Level 4 may be achieved. *Read Std. Adj. 28.*
- 27 **DEFAULT HIGH SCORE #4:** Set between **1,000,000 - 9,999,000,000** or **00** (*increments of 1M*). Default is **25,000,000**. Set the desired **High Score Level** to which Level 5 may be achieved. *Read Std. Adj. 28.*
- 28 **HSTD RESET COUNT:** Set between **100 - 9,900** or **OFF** (*increments of 100*). Default is **2,000**. **HSTD (High Score To Date)**. Set the number of games between "automatic resets of High Score Levels" to "Default Scores" for **ONLY** Standard Adj. **24-27, Default High Score #1-#4**.
- 29 **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.
- 30 **FREE PLAY:** Set to **YES** or **NO**. Default is **NO**. When set to **YES**, no coins are required for *Game Play*.
- 31 **CUSTOM MESSAGE:** Set to **ON, CHANGE** or **OFF**. Default is **ON**. When set to **CHANGE**, a new message can be set or the old one can be edited (*select the "+" Mini-Icon to change settings until "CHANGE" appears in the display, then select the ">>" Mini-Icon to access.*). This adjustment can be accessed in two (2) ways by either selecting the "S.P.I." Icon and advancing to this Adjustment, **or** can be directly accessed by selecting the "ABCD CUST MSG" Icon in the **ADJUSTMENTS MENU**.
View the Custom Message Shortcut summary (end of this chapter) for how to enter text or symbols.
- 32 **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.
- 33 **COIL PULSE POWER:** Set to **NORMAL, HARD** or **SOFT**. Default is **NORMAL**. When set to **HARD**, the coil pulse power is **increased** by **12.5%** of the normal pulse rate. When set to **SOFT** the coil pulse power is **decreased** by **12.5%** of the normal pulse rate. This adj. is provided to compensate for *Low Line* or *High Line voltage* conditions where the solenoids (coils) appear to *kicking too weak or too hard*. Adjust as required.
- 34 **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.
- 35 **GAME RESTART:** Set to **YES** or **NO**. Default is **YES**. When set to **YES**, a new game may be started during any ball after the first ball is completed (*if credits are available*). Pressing the **Start Button** during the first ball will add additional players. When set to **NO**, the game disables the **Start Button** after the first ball until the final ball is in play. *Review Sec. 2, Chp. 1, GAME OPERATIONS & FEATURES, for details.*
- 36 **BILL VALIDATOR:** Set to **YES** or **NO**. Default is **NO**. When set to **YES**, in *Game Attract Mode* the Display will show an *"Insert Bill Animation."* When set to **NO**, the Display will show an *"Insert Coin Animation."*
- 37 **BKGRND (BACKGROUND) MUSIC VOLUME:** Set between **01 - 15**. Default is **01**. After volume is set via Portals Service Buttons (*see Section 3, Chapter 1, PORTALS™ SERVICE MENU INTRODUCTION*) this adjustment can be utilized to adjust the background music (*1 all the way on, 15 all the way off*) while keeping the Special Sound FX the same level.
- 38 **FREEZE TIME (BALL SAVE):** Set to **OFF, 0:01-0:15** or **AUTO**. Default is **0:10**. When set to **OFF** this feature is unavailable. Set between **0:01** through **0:15** (*single increments*) for the ball to be sent back into play if the time set is not met (*per ball*). Set to **AUTO** to automatically adjust the Freeze Timer based on the average ball time.

Standard Adjustments 39-52 continued on the next page.



UK ONLY Dip Switch Must Be Set

- 39 **UK POST SAVE ENABLED:** Set to **YES** or **NO**. Default is **NO**, (*UK Default is YES*). When set to **YES** this feature is available when lit. Set to **NO** to disable this feature. (*UK Games have Outlane/Center Post Save Devices which are accessed in differently; Non-UK Games cannot adjust this setting.*)

- 40 **TIMED PLUNGER:** Set to **OFF** or **0:15 - 1:00**. Default is **OFF**. When set to **0:15** to **1:00**, the plunger will "Autoplunge" the ball (*at the time set*) when the ball is at the beginning of play, awaiting the skill shot by the player.

- 41 **FLIPPER BALL LAUNCH:** Set to **DISABLED**, **LEFT FLIPPER**, **RIGHT FLIPPER**, **EITHER FLIPPER** or **BOTH FLIPPERS**. Default is **DISABLED**. This feature allows the player to operate the *Auto Ball Launch* with the **FLIPPER BUTTON(S)** depending on which setting is chosen.

- 42 **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.

- 43 **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 Comp.** was made (*changing default to YES*), and was changed back to **NO**, the **COMPETITION MODE** will be turned **OFF** (*see Sec. 3, Chp. 5, GO TO INSTALLS MENU, \$. 50 or Free Play Competition*). Set to **YES**, this feature is available (*required for Competition Modes*); this feature will equalize random game features and global score values during multi-player games.

- 44 **CONSOLATION BALL:** Set to **YES** or **NO**. Default is **YES**. When set to **YES**, the **EXTRA BALL** (*Playfield Light Insert, location varies*) will be lit on the last ball in play, if certain programming criteria is met.

- 45 **FAST BOOT:** Set to **YES** or **NO**. Default is **YES**. When set to **NO** or if you hold the **RIGHT Flipper Button** during Power-Up, this feature is not available and will display all normal Power-Up screens. When set to **YES**, the game will not display the normal informative Power-Up screens, specifically the CPU Version screen and the Location/Game ID screen. Regardless of the setting, normal Power-Up safety checks are still performed.

- 46 **Q24 OPTION:** Set to **COIN METER**, **TOKEN DISPENSER** or **KNOCKER**. Default is **COIN METER**. This Coil (Solenoid) Location is left "open" at the Factory to allow for these optional Mechanisms to be added to the game. If selecting **TOKEN DISPENSER**, Standard Adjustments 03, 06 & 12 should be changed to **TOKEN**. *Call Technical Support at 1-800-542-5377 if more information is required on this option.*

- 47 **TICKET DISP. INSTALLED:** Set to **YES** or **NO**. Default is **NO**. *This adjustment is required only for games which have an optional Deltronics (DL-1275-2 PCB Style, SPI Part Nr. 515-7275-00) Ticket Dispenser installed. Unique CPU Sound Bd. Dip Switch (Sw. 300) Setting required, changes the Default to YES.*

- 48 **ALLOW PLAYER COMP. MODE:** Set to **YES** or **NO**. Default is **YES**. **Competition Mode** unrandomizes feature events, and standardizes game play and rule sets (*varies from game to game*) for fair competitions. With adequate credit, to enter **Competition Mode**, hold the **Flipper Button** in while pressing the **Start Button**. **Watch the Dot Display for more details** (*rules and operation are subject to change*). General rules are covered in the Instruction Card. Other **Hints and/or Rules** can be made known on this game either visually (*the Dot Display or Flashing Light Inserts*) or can be audible.

- 49 **TECH ALERT WARNING:** A Portals™ Function. *Review Sec. 3, Chp. 2, GO TO DIAGNOSTICS MENU, Page 25, regarding Technician Alerts and its' functions.* Set to **NEVER**, **POWERUP**, **COIN DOOR** or **POWERUP AND COIN DOOR**. Default is **NEVER**. When set to **NEVER**, the Tech Report Alert display will not appear upon Power-Up or opening the Coin Door, if the game detects any problems. When set to **POWERUP**, the display will appear only upon Power-Up (*if problems detected*). When set to **COIN DOOR**, the display will appear only when the Coin Door is opened (*if problems detected*). When set to **POWERUP AND COIN DOOR**, the display will appear upon Power-Up and if the Coin Door is opened (*if problems detected*).

- 50 **TEAM SCORES:** Set to **YES** or **NO**. Default is **NO**. Set to **YES**, then Team Play will be made available. **Team Play only works in a 4-Player Game**. The totals for Players 1 / 3 (Team 1) & Players 2 / 4 (Team 2) are then displayed individually **as well as** the combined score for **BOTH TEAMS** to enable **Team Play (Doubles)**. *See Section 2, Chapter 1, Game Operation & Features, for non-adjustable Features.*

- 51 **LOCATION ID:** Set between **00** to **9999**. Default is **00**. This adjustment allows the operator to assign a location identification number to the audit print-out sheet. (*Will not be affected by Factory Reset.*)

- 52 **GAME ID:** Set between **00** to **9999**. Default is **00**. This adjustment allows the operator to assign a game identification number to the audit print-out sheet. (*Will not be affected by Factory Reset.*)

Sec. 3: Adjustments

Standard Adjustments 53-55 continued on the next page.





Standard Adjustments Continued.



S.F.I.

STANDARD ADJUSTMENT NAME: Definition

- 53 **FLIPPER ADJ 1:** Set between **05** to **40**. Default is **20**. This adjustment sets the *minimum* fire time for a flipper coil in milliseconds.
- 54 **FLIPPER ADJ 2:** Set between **40** to **60**. Default is **50**. This adjustment sets the *maximum* fire time for a flipper coil in milliseconds.
- 55 **FLIPPER ADJ 3:** Set between **0** to **10**. Default is **3**. This adjustment sets the amount of time to fire the coil *after the EOS switch is seen* in milliseconds.

Standard Adjustments 53-55 Note: • *Flippers will now fire when the button is pushed until the End-of-Stroke (EOS) Switch closure is seen. When EOS is seen, continue firing for the amount of time in Std. Adj. 55. When this time is expired, if the minimum time has not yet been met (Std. Adj. 53), then keep firing until it has. Otherwise switch to hold power.* • *If the flipper has been firing and it reaches the maximum (Std. Adj. 54), then switch to hold power.* • *If the flipper caves-in (EOS re-closes) while the button is still held, then refire the flipper at full power. Switch to hold power as soon as EOS is seen, no minimum times are enforced in this situation.* • *If the flipper caves in several times on the same single flipper button press, then stop refiring at full power and just stay at hold.* • *If the flipper fails to open the EOS switch several times, then assume it isn't working and fall back to a "safe" fire time so as not to burn up the coil.*



Feature Adjustments (01-25)



To initiate, from the **ADJUSTMENTS MENU**, select the "r (gun)" *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.

***** **Variables, Game Play, Rules, Settings and Explanation Subject to Change** *****

Nr.	FEATURE ADJUSTMENT NAME: Definition
01	ADULT CONTENT ENABLED: Set to PARTIAL, YES or NO . Default is PARTIAL . Controls whether the game will make use of more mature content. Set to YES (ON) : non-censored! Use of mild & harsh swear words (e.g. "SH"-word & "F"-word). Set to PARTIAL (Factory Default) : partially-censored. Use of "bleep" over "F"-word or use of substitution "F"-word (<i>friggin'</i>). Set to NO (OFF) : Censored! No "bleeping," no swearing. <i>Bada Bing! Dancing Girls DO NOT APPEAR in Dot Display.</i> View Instruction Sheet 756-5036-85 Rev. B 0307 .
02	RANK DIFFICULTY : Set to EASY or MODERATE . Default is MOD . Controls the player's starting Rank. EASY = starting Rank is ASSOCIATE MODERATE = no starting Rank
03	SAFE DIFFICULTY : Set to EASY, MODERATE or HARD . Default is MODERATE . Controls the starting number of hits required to open the Safe. EASY = 2 hits MODERATE = 3 hits HARD = 4 hits
04	FOOD DIFFICULTY : Set to EASY, MODERATE or HARD . Default is MODERATE . Controls the number of Food shots required to start the Food Fight feature. EASY = 10 shots MOD = 15 shots HARD = 20 shots
05	R-I-P DIFFICULTY : Set to MODERATE or HARD . Default is MOD . Controls the number of times the R.I.P. Top Lanes need to be completed to collect the next person in R.I.P.. MOD = 1 completion HARD = 2 completions
06	STUGOTS DIFFICULTY : Set to EX. EASY, EASY, MODERATE, HARD or EX. HARD . Default is MODERATE . Controls the ease at which Stugots Multiball is achieved. EX. EASY = 2 ball locks for Stugots Multiball EASY = 1 drop target hit, 2 ball locks for Stugots Multiball MODERATE = 1 drop target hit, 1 ball lock, 1 drop target hit, 1 ball lock for Stugots Multiball HARD = 2 drop target hits, 1 ball lock, 2 drop target hits, 1 ball lock for Stugots Multiball EX. HARD = 3 drop target hits, 1 ball lock, 3 drop target hits, 1 ball lock for Stugots Multiball.
07	SHAKEDOWN DIFFICULTY : Set to EASY, MODERATE or HARD . Default is MOD . Controls the number of pop bumper hits needed to complete the Shakedown feature. EASY = 10 hits MOD = 15 hits HARD = 20 hits
08	BING DIFFICULTY : Set to EASY, MODERATE or HARD . Default is MODERATE . Controls the number of switch hits needed to start Bing Multiball. EASY = 50 switch hits MOD = 75 switch hits HARD = 100 switch hits
09	PORK STORE DIFFICULTY : Set to EASY, MODERATE or HARD . Default is MODERATE . Controls how the Pork Store feature is set up at the start of each ball. EASY = the Pork Store feature is lit at the start of every ball MODERATE = the Pork Store feature is lit at the start of the first ball HARD = the game does not attempt to light the Pork Store feature at the start of a new ball
10	FISH DIFFICULTY : Set to EASY, MODERATE or HARD . Default is MODERATE . Controls how the Fish feature is set up at the start of each ball. EASY = the Fish feature is lit at the start of every ball MODERATE = the Fish feature is lit at the start of the first ball HARD = the game does not attempt to light the Fish feature at the start of a new ball.
11	FOOD FIGHT TIMER : Set between 20-40 . Default is 30 . This adjustment determines how many seconds the player is given to play this feature (Food Fight) mode.

Feature Adjustments 12-25 continued on the next page.



Feature Adjustments Continued. [Left] [Right] [Minus] [Plus]

FEATURE ADJUSTMENT NAME: Definition

- 12 **EXTERMINATE TIMER** : Set between **20-40**. Default is **30**. This adjustment determines how many seconds the player is given to play this feature (Exterminate) mode.
- 13 **HORSE RACE TIMER** : Set between **20-40**. Default is **30**. This adjustment determines how many seconds the player is given to play this feature (Horse Race) mode.
- 14 **ARSON TIMER** : Set between **20-40**. Default is **30**. This adjustment determines how many seconds the player is given to play this feature (Arson) mode.
- 15 **SATISFACTION TIMER** : Set between **20-40**. Default is **30**. This adjustment determines how many seconds the player is given to play this feature (Satisfaction) mode.
- 16 **SUPER JACKPOT TIMER** : Set between **10-20**. Default is **15**. This adjustment determines how many seconds the player is given to collect the Super Jackpot during Stugots Multiball.
- 17 **UNDERBOSS LOCK TIMER** : Set between **08-15**. Default is **10**. This adjustment determines how many seconds the player is given to lock balls during this feature (Underboss) mode.
- 18 **BOSS FOOD**: Set between **10-30**. Default is **15**. This adjustment determines the total number of Food shots needed to earn the "Food" light for this feature (Boss) mode.
- 19 **BOSS TRUCK HEIST**: Set between **01-05**. Default is **04**. This adjustment determines the total number of Truck Heist Hurry-Ups that need to be collected to earn the "Truck Heist" light for the Boss feature.
- 20 **BOSS BING**: Set between **01-03**. Default is **01**. This adjustment determines the total number of times Bing Multiball needs to be started to earn the "Bada Bing!" light for the Boss feature.
- 21 **BOSS EPISODES**: Set between **03-05**. Default is **05**. This adjustment determines the total number of Episodes that need to be started to earn the "Episodes" light for the Boss feature.
- 22 **BOSS SAFE**: Set between **01-05**. Default is **01**. This adjustment determines the total number of times the Safe needs to be completed to earn the "Safe" light for the Boss feature.
- 23 **BOSS R-I-P**: Set between **01-02**. Default is **01**. This adjustment determines the number of times all of the R.I.P. people need to be collected to earn the "R.I.P." light for the Boss feature.
- 24 **BOSS SUPER**: Set between **01-03**. Default is **01**. This adjustment determines the total number Super Jackpots that need to be collected to earn the "Super Jackpot" light for the Boss feature.
- 25 **BOSS MEADOWLANDS**: Set between **01-04**. Default is **04**. This adjustment determines the number of times the Meadowlands feature mode needs to be completed to earn the "Meadowlands" light for the Boss feature.

Sec. 3: Adjustments

ABCD Custom Message

To go directly to **Standard Adjustment 31, Custom Message**, from the **ADJUSTMENT MENU**, select the "CUST MSG" icon with either the Red "LEFT" or Green "RIGHT" Buttons and press the Black "ENTER" Button. At the top left corner of the Display, the letter **A** is indicated (*blinking*) in the first available position (*Thirty-Six (36) characters including spaces are available*). Vary the letter(s) by operating the Left and Right Flipper Buttons (or "RED" or "GREEN" Buttons). With the desired letter indicated, depress the **Start Button** to lock in the letter and advance to the next character. Repeat this procedure until the desired message is completed in the display. Select the "<" or ">" characters to back-space (*erase*) and/or to move forward in an already typed message. After completion, press the "BLACK" Button, "REQUEST INSTALLED" is indicated and then exits this sub-menu.



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



Go To Installs Menu

Overview

The Portals™ Service Menu System provides **15 Installs** to vary **Game Play (Feature Adjustments) Difficulty** or **Game Play Type** and **Install Factory** (restores all adjustments to Factory Defaults).



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 Adjustments and/or settings are subject to change during production, and may differ than what is described in the tables at the end of this chapter*). 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**, see **Section 3, Chapter 4, GO TO ADJUSTMENTS MENU**).
- 2.: **Install Factory** (see opposite this page) on how to reset all of the **Standard & Feature Adjustments** back to the **Factory Default Settings**.

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**. Any adjustments which you changed and are not affected by the Install will remain as set.

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



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



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



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



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



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

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

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

Sec. 3: Go To Installs

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**.

View **Pages 49 & 50** for an Overview of the **Standard & Feature Adjustment(s)** which have changed upon selection.



Install Extra Easy, Easy, Normal, Hard or Extra Hard

To initiate, from the **INSTALLS MENU**, select the "X.EZ," "EASY," "FACT," "HARD," or "X.HD" **Icons** 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 previously selected **Icon** flashing.



Install Directors Cut

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



Install 3-Ball or 5-Ball

To initiate, from the **INSTALLS MENU**, select the "3BAL" or "5BAL" *Icon* with either the **Red "LEFT"** or **Green "RIGHT"** Buttons and press the **Black "ENTER"** Button. **Game Play Type** is set to 3- or 5-BALL PLAY. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the previously selected *Icon* flashing.



\$.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.



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.



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.



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.



Install Novelty

Note: 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.



Install Add-A-Ball

Note: 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.



Install Factory (ONLY affects all Adjustments/Installs)

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. **▲ All Standard & Feature Adjustments** which were changed in the **INSTALLS** or **ADJUSTMENTS MENU** are returned to the **Factory Defaults**. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "FACT" *Icon* flashing.

Overview of Standard Adjustment Changes upon selection of an Install:

ONLY THE STANDARD ADJUSTMENTS LISTED ARE AFFECTED AS NOTED IN THE TABLES BELOW.



Nr.	STANDARD ADJUSTMENT NAME	INSTALL EXTRA EASY	INSTALL EASY	INSTALL NORMAL	INSTALL HARD	INSTALL EXTRA HARD	INSTALL DIRECTOR'S CUT	INSTALL 3-BALL	INSTALL 5-BALL
10	EXTRA BALL PERCENTAGE	35%	30%	25%	20%	15%	25%	25%	15%
14	BALLS PER GAME			03				03	05
38	FREEZE TIME	0:14	0:12	0:10	OFF	OFF	OFF	0:10	OFF

ONLY THE STANDARD ADJUSTMENTS LISTED ARE AFFECTED AS NOTED IN THE TABLES BELOW.



Nr.	STANDARD ADJUSTMENT NAME	\$.50 COMPETITION *	FREE PLAY COMP. *	INSTALL HOME PLAY	FILM STAR RESET	INSTALL NOVELTY	INSTALL ADD-A-BALL	INSTALL FACTORY
01	REPLAY TYPE					NONE		CAUTION! : Upon selection of Install Factory ("FACT" Icon), all Standard & Feature Adjustments which were changed in the INSTALLS or ADJUSTMENTS MENU are returned to the Factory Defaults (see the Adjustment Tables on Page 38 for details). * If Competition Mode was set, it is suggested to Install Factory to restore all Adjustments to the Factory Defaults . Then recustomize, if desired.
03	REPLAY AWARD						EX. BALL	
04	REPLAY LEVELS					NONE		
06	SPECIAL AWARD					POINTS	EX. BALL	
08	FREE GAME LIMIT					NO FREE..	NO FREE..	
09	EXTRA BALL LIMIT					NO EXTRA...	09	
10	EXTRA BALL PERCENTAGE			25%	20%			
11	GAME PRICING	USA 3						
13	MATCH PERCENTAGE			10%		OFF	OFF	
15	TILT WARNINGS	02	02					
18	GRAND CHAMPION AWARDS					00	00	
19	HIGH SCORE #1 AWARDS					00	00	
20	HIGH SCORE #2 AWARDS					00	00	
21	HIGH SCORE #3 AWARDS					00	00	
22	HIGH SCORE #4 AWARDS					00	00	
23	GRAND CHAMPION SCORE			25,000,000	25,000,000			
24	DEFAULT HIGH SCORE #1			20,000,000	20,000,000			
25	DEFAULT HIGH SCORE #2			15,000,000	15,000,000			
26	DEFAULT HIGH SCORE #3			10,000,000	10,000,000			
27	DEFAULT HIGH SCORE #4			5,000,000	5,000,000			
30	FREE PLAY	NO	YES	YES	YES			
35	GAME RESTART	NO	NO					
38	FREEZE TIME				0:10			
42	COINDOOR BALL SAVER **	(YES)**	(YES)**					
43	COMPETITION MODE ***	YES***	YES***					

** Adjustment 42 Default will not change; Installing \$.50 or Free Play Competition will override this Adjustment regardless of the setting.
 *** If Adjustment 43 is changed back to **NO** after this Install, the Competition Mode Install will be canceled (turned off).

Sec. 3: Go To Installs

Overview of Feature Adjustment Changes upon selection of an Install:

ONLY THE FEATURE ADJUSTMENTS LISTED ARE AFFECTED AS NOTED IN THE TABLES BELOW.



Nr.	FEATURE ADJUSTMENT NAME	INSTALL EXTRA EASY	INSTALL EASY	INSTALL NORMAL (FACTORY)	INSTALL HARD	INSTALL EXTRA HARD	INSTALL DIRECTOR'S CUT	INSTALL 3-BALL	INSTALL 5-BALL
01	ADULT CONTENT ENABLED	PARTIAL	PARTIAL	PARTIAL	PARTIAL	PARTIAL	ON	PARTIAL	PARTIAL
02	RANK DIFFICULTY	EASY	EASY	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
03	SAFE DIFFICULTY	EASY	EASY	MODERATE	HARD	HARD	MODERATE	MODERATE	HARD
04	FOOD DIFFICULTY	EASY	EASY	MODERATE	HARD	HARD	MODERATE	MODERATE	HARD
05	R-I-P DIFFICULTY	MODERATE	MODERATE	MODERATE	HARD	HARD	MODERATE	MODERATE	MODERATE
06	STUGOTS DIFFICULTY	EX. EASY	EASY	MODERATE	HARD	EX. HARD	MODERATE	MODERATE	HARD
07	SHAKEDOWN DIFFICULTY	EASY	EASY	MODERATE	HARD	HARD	MODERATE	MODERATE	HARD
08	BING DIFFICULTY	EASY	EASY	MODERATE	HARD	HARD	MODERATE	MODERATE	MODERATE
09	PORK STORE DIFFICULTY	EASY	EASY	MODERATE	HARD	HARD	MODERATE	MODERATE	MODERATE
10	FISH DIFFICULTY	EASY	EASY	MODERATE	HARD	HARD	MODERATE	MODERATE	MODERATE

Overview of Feature Adjustment Changes (this table) ... continued on the next page.

Overview of Feature Adjustment Changes upon selection of an Install Continued:

ONLY THE FEATURE ADJUSTMENTS LISTED ARE AFFECTED AS NOTED IN THE TABLES BELOW.



Nr.	FEATURE ADJUSTMENT NAME	INSTALL EXTRA EASY	INSTALL EASY	INSTALL NORMAL (FACTORY)	INSTALL HARD	INSTALL EXTRA HARD	INSTALL DIRECTOR'S CUT	INSTALL 3-BALL	INSTALL 5-BALL
11	FOOD FIGHT TIMER	40	35	30	25	20	30	30	30
12	EXTERMINATE TIMER	40	35	30	25	20	30	30	30
13	HORSE RACE TIMER	40	35	30	25	20	30	30	30
14	ARSON TIMER	40	35	30	25	20	30	30	30
15	SATISFACTION TIMER	40	35	30	25	20	30	30	30
16	SUPER JACKPOT TIMER	20	20	15	10	10	15	15	20
17	UNDERBOSS LOCK TIMER	15	12	10	08	08	10	10	10
18	BOSS FOOD	10	10	15	20	25	15	15	15
19	BOSS TRUCK HEIST	02	03	04	05	05	04	04	04
20	BOSS BING	01	01	01	02	03	01	01	01
21	BOSS EPISODES	03	04	05	05	05	05	05	05
22	BOSS SAFE	01	01	01	03	05	01	01	01
23	BOSS R-I-P	01	01	01	02	02	01	01	01
24	BOSS SUPER	01	01	01	02	03	01	01	01
25	BOSS MEADOWLANDS	02	03	04	04	04	04	04	04

ONLY THE FEATURE ADJUSTMENTS LISTED ARE AFFECTED AS NOTED IN THE TABLES BELOW.



Sec. 3: Go To Installs

Nr.	FEATURE ADJUSTMENT NAME	\$ 50 COMPE TITION *	FREE PLAY COMP. *	INSTALL HOME PLAY	FILM STAR RESET	INSTALL NOVELTY	INSTALL ADD-A-BALL	INSTALL FACTORY
01	ADULT CONTENT ENABLED				ON			
02	RANK DIFFICULTY				EASY			
03	SAFE DIFFICULTY				EASY			
04	FOOD DIFFICULTY				EASY			
05	R-I-P DIFFICULTY				MODERATE			
06	STUGOTS DIFFICULTY				EASY			
07	SHAKEDOWN DIFFICULTY				EASY			
08	BING DIFFICULTY				EASY			
09	PORK STORE DIFFICULTY				EASY			
10	FISH DIFFICULTY				EASY			
11	FOOD FIGHT TIMER				35			
12	EXTERMINATE TIMER				35			
13	HORSE RACE TIMER				35			
14	ARSON TIMER				35			
15	SATISFACTION TIMER				35			
16	SUPER JACKPOT TIMER				20			
17	UNDERBOSS LOCK TIMER				12			
18	BOSS FOOD				10			
19	BOSS TRUCK HEIST				03			
20	BOSS BING				01			
21	BOSS EPISODES				04			
22	BOSS SAFE				01			
23	BOSS R-I-P				01			
24	BOSS SUPER				01			
25	BOSS MEADOWLANDS				03			

CAUTION! : Upon selection of **Install Factory** ("FACT" Icon), all Standard & Feature Adjustments which were changed in the **INSTALLS** or **ADJUSTMENTS MENU** are returned to the **Factory Defaults** (see the Adjustment Tables on Page 38 for details).



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**. "**REQ. INSTALLED**" is indicated & returns to the **RESET MENU** with the "**COIN**" icon flashing.



Reset Game Audits

Note: **Coin Audits (05-13) & Software Meter Audit (14)** will not be reset.

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) & Standard Audits (01-67)** will be reset to zero (0), **Factory Default Settings**. "**REQUEST INSTALLED**" is indicated and returns to the **RESET MENU** with the "**AUD**" icon flashing.



Reset High Scores

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**).

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. "**REQUEST INSTALLED**" is indicated and returns to the **RESET MENU** with the "**HSTD**" icon flashing.



Reset Grand Champion

To initiate, from the **RESET MENU**, select the "**GC**" icon with either the **Red** or **Green Buttons** and press the **Black Button**. ⚠ **ONLY** the **Grand Champion Score** will be reset to the current value. "**REQUEST INSTALLED**" is indicated and returns to the **RESET MENU** with the "**GC**" 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

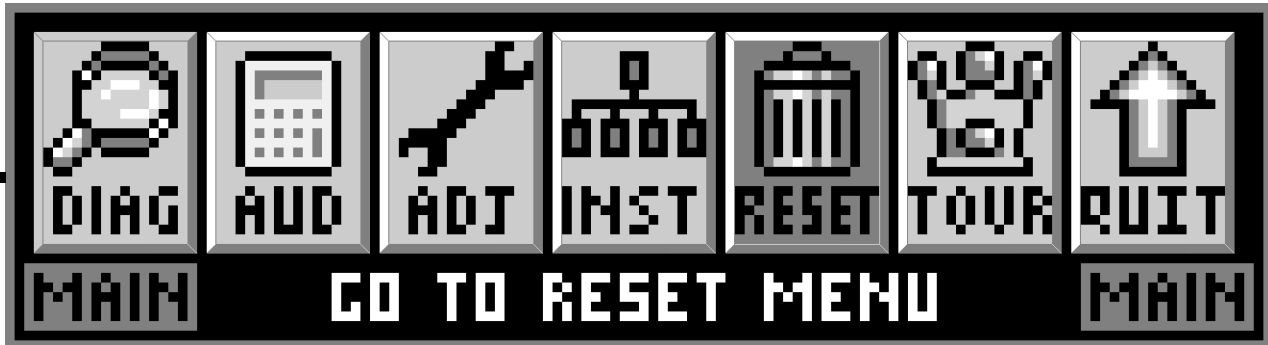
Note: To **RESET ONLY** the **ADJUSTMENTS & INSTALLS** (leaving all the **Audits** alone), see **Section 3, Chapter 5, GO TO INSTALLS MENU, Install Factory**.

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**), all **Adjustments** and **Installs** will be reset to the **Factory Default Settings**. "**REQUEST INSTALLED**" is indicated and the **Service Menu** is exited, returning to the **Attract Mode**.

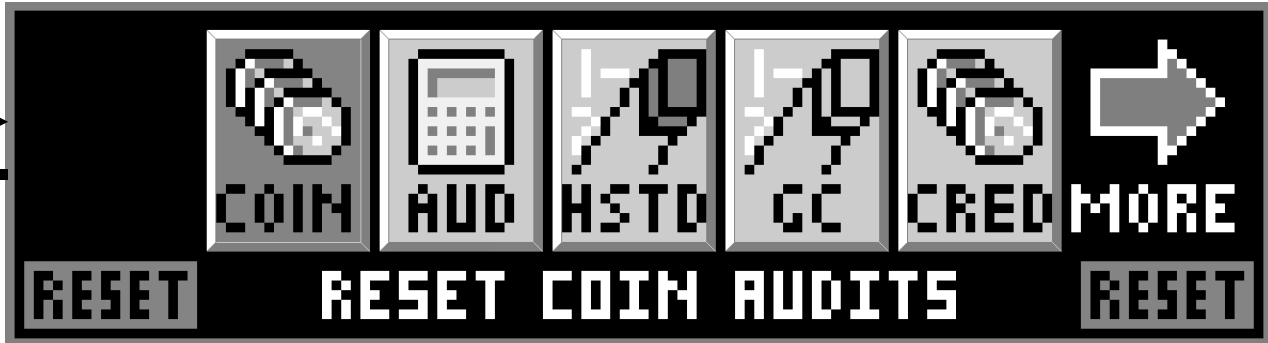
Sec. 3: Go To Reset

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", "GC", "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**.



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: 780-6011-01) 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 01-15



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	JAN. 01, 2004 12:00:00 AM	
06	START DATE	FEB. 01, 2004 12:00:00 AM	
07	END DATE	MARCH 01, 2004 12:00:00 AM	
08	# OF PRIZES	03	

Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
09	AWARD TYPE	CASH	
10	SHOW PLAYER'S CASH	YES	
11	TOURNAMENT TYPE	BUMP N' WIN	
12	BUMP N' WIN BASE	"varies"	
13	BALLS PER TOURNAMENT	03	
14	BNW DATE SENSITIVE	YES	
15	BNW FIRST PLACE	BUMP	

Note: Adjustments and/or variables are subject to change (with or without notice).

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 16-17)



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

Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
17	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

01-14

Audit definitions follow in this Chapter.

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

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

11	ACCUM. EARNINGS
12	ACCUM. TOUR EARNINGS
13	ACCUM. JACKPOT
14	# TOURNAMENTS



Tournament Adjustments (01-15)



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.

Note on Tournament Adjustments 5, 6 & 7: *Requires the **TIMEKEEPER™ IC (included in the kit) installed in Location U212 on the CPU/Snd. Board**. How to change the **CURRENT DATE/TIME, START DATE & END DATE**: Upon entering the menu, the ">>" *Mini-Icon* and the Month is flashing. Use the "+" or "-" *Mini-Icon* to change the month. Select the ">>" *Mini-Icon* again, now the day can be changed. Continue this until all is set to your liking. After the **CURRENT DATE/TIME (T. Adj. 05)** and the **START & END DATE/TIME (T. Adj. 06/07)** are set, the "STRT" *Icon* must be activated, in order for the Tournament to start and end automatically. In the event you have to **End a Tournament** before your designated date/time or you do not have the **TIMEKEEPER™ IC** installed go back to the **TOURNAMENT MENU** and select the "END" *Icon* (see the next page) to stop the Tournament.

IMPORTANT FOR TOURNAMENT USERS: *Select the settings carefully.* 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.

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 MONTH, DAY, YEAR, HOUR (AM/PM), MINUTE and SECOND . Default is JAN. 01, 2004 12:00:00 AM .												
06	START DATE : Set the desired MONTH, DAY, YEAR, HOUR (AM/PM), MINUTE and SECOND . Default is FEB. 01, 2004 12:00:00 AM .												
07	END DATE : Set the desired MONTH, DAY, YEAR, HOUR (AM/PM), MINUTE and SECOND . Default is MARCH 01, 2004 12:00:00 AM .												
	# OF PRIZES : Set between 01 - 05 (<i>If Tournament Adj. 11 is set to REGULAR</i>) or 02 - 05 (<i>If Tournament Adj. 11 is set to BUMP N' WIN</i>). Default (for either) is 04 . Set the max. number of <i>Prize Positions</i> to be awarded during a Tournament. Selections are as follows (<i>percentage distribution cannot be changed</i>):												
08	<table border="0"> <tr> <td>If below Tournament Adj. 11 is set to REGULAR :</td> <td>If Trn. Adj. 11 is set to BUMP N' WIN (<i>Default</i>) :</td> </tr> <tr> <td>Set to 01 1 Winner 100% (1) <i>Prize Pool</i></td> <td><i>Cannot set to 01. Minimum of 2 winners required.</i></td> </tr> <tr> <td>Set to 02 2 Winners 65% (1) 35% (2)</td> <td>Set to 02 2 Winners 65% (1) 35% (2)</td> </tr> <tr> <td>Set to 03 3 Winners 50% (1) 30% (2) 20% (3)</td> <td>Set to 03 3 Winners 50% (1) 25% (2) 25% (3)</td> </tr> <tr> <td>Set to 04 4 Winners 50% (1) 25% (2) 15% (3) 10% (4)</td> <td>Set to 04 4 Winners 40% (1) 20% (2) 20% (3) 20% (4)</td> </tr> <tr> <td>Set to 05 5 Winners 50% (1) 20% (2) 15% (3) 10% (4) 5% (5)</td> <td>Set to 05 5 Winners 40% (1) 15% (2) 15% (3) 15% (4) 15% (5)</td> </tr> </table>	If below Tournament Adj. 11 is set to REGULAR :	If Trn. Adj. 11 is set to BUMP N' WIN (<i>Default</i>) :	Set to 01 1 Winner 100% (1) <i>Prize Pool</i>	<i>Cannot set to 01. Minimum of 2 winners required.</i>	Set to 02 2 Winners 65% (1) 35% (2)	Set to 02 2 Winners 65% (1) 35% (2)	Set to 03 3 Winners 50% (1) 30% (2) 20% (3)	Set to 03 3 Winners 50% (1) 25% (2) 25% (3)	Set to 04 4 Winners 50% (1) 25% (2) 15% (3) 10% (4)	Set to 04 4 Winners 40% (1) 20% (2) 20% (3) 20% (4)	Set to 05 5 Winners 50% (1) 20% (2) 15% (3) 10% (4) 5% (5)	Set to 05 5 Winners 40% (1) 15% (2) 15% (3) 15% (4) 15% (5)
If below Tournament Adj. 11 is set to REGULAR :	If Trn. Adj. 11 is set to BUMP N' WIN (<i>Default</i>) :												
Set to 01 1 Winner 100% (1) <i>Prize Pool</i>	<i>Cannot set to 01. Minimum of 2 winners required.</i>												
Set to 02 2 Winners 65% (1) 35% (2)	Set to 02 2 Winners 65% (1) 35% (2)												
Set to 03 3 Winners 50% (1) 30% (2) 20% (3)	Set to 03 3 Winners 50% (1) 25% (2) 25% (3)												
Set to 04 4 Winners 50% (1) 25% (2) 15% (3) 10% (4)	Set to 04 4 Winners 40% (1) 20% (2) 20% (3) 20% (4)												
Set to 05 5 Winners 50% (1) 20% (2) 15% (3) 10% (4) 5% (5)	Set to 05 5 Winners 40% (1) 15% (2) 15% (3) 15% (4) 15% (5)												
09	AWARD TYPE : Set to CASH, POINTS, TICKET, NONE or PRIZE . Default is 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 TICKET for the display to represent the <i>Prize Pool amount</i> in Tickets . Select NONE NOT TO represent the <i>Prize Pool amount</i> (<i>if prize(s) to be awarded are not Cash, Points or Tickets</i>). Select PRIZE , if applicable.												
	Above T-Adj. 9 determines how the Prize Pool is to be represented in the Attract Mode on both the Normal & top Beta-Brite® Displays.												
10	SHOW PLAYER'S CASH : Set to YES or NO . Default is YES . When set to YES , the >>> previous <<< Tournament Winners & Cash amount will show in the Attract Mode on both Dot Displays.												
11	TOURNAMENT TYPE : Set to REGULAR or BUMP N' WIN . Default is BUMP N' WIN .												
12	BUMP N' WIN BASE : Set between X,000,000 - XX,000,000 (<i>increments of 1M</i>). Default is *varies* . Set the desired Bump N' Win Tournament base score . Tournament Adj. 11 must be set to BUMP N' WIN .												
13	BALLS PER TOURNAMENT : This adjustment only affects TOURNAMENT GAMES . Set between 02 - 09 . Default is 03 . Set the max. number of balls per game.												
14	BNW DATE SENSITIVE : Set to YES or NO . Default is YES . When set to YES , the scores/criterion selected are influenced by the Tournament End Date selected.												
15	BNW FIRST PLACE : Set to BUMP or REPLACE . Default is BUMP . When set to BUMP , the 1st place player is bumped to 2nd (<i>and in-turn bumps remaining leaders down 1</i>). When set to REPLACE , the 1st place player is replaced by the new 1st place player (<i>the other board leaders are therefore not bumped down</i>).												

Score Range and Default varies from title to title.

Sec. 3: Tournament ...



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 if no TIMEKEEPER is installed*)

* If **Timekeeper is NOT installed** or you have to end the **Tournament prematurely**, use this *Icon* to end it. 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 (01-14) <<<>>>

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

IMPORTANT FOR TOURNAMENT USERS: >>>> **A L L** of the **Tournament Audits 01-14** are **RESET O N L Y** if a **Factory Reset is done** (see **Section 3, Chapter 6, GO TO RESET MENU**). >>>> **Tournament Audits 01-07** are **RESET ONLY** if a **new Tournament is started**. >>>> **Tournament Audits 07-14** 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 is active (in progress)</i> . This total is derived by adding the below Tournament Audit 02 with Regular Plays .
02	TOURNAMENT PLAYS : Provides the total number of <i>Tournament Games</i> played while a <i>Tournament is active (in progress)</i> .
03	TOTAL QUALIFYING PLAYS : Provides the total number of times a player qualified (<i>invited to enter name</i>).
04	TOTAL GAME EARNINGS : Provides the total Gross Earnings accepted , while a <i>Tournament is active (in progress)</i> .
05	TOTAL TOUR. EARNINGS : Provides the total Tournament Earnings (Audit 04 less Regular Game Earnings) while a <i>Tournament is active (in progress)</i> .
06	JACKPOT (PRIZE POOL TOTAL) : Provides the total Prize Pool (Jackpot) Amount to be paid out while a <i>Tournament is active (in progress)</i> .

Tournament Audits 07-14 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 **NET EARNINGS** : Provides the total Net Earnings (*Gross Earnings less Prize Pool*) while a *Tournament is active (in progress)*.
- 08 **ACCUM. TOTAL PLAYS** : Provides the accumulative total amount of *Regular & Tournament Games* played since the first Tournament was played.
- 09 **ACCUM. TOUR. PLAYS** : Provides the accumulative total amount of *Tournament Games* played since the first Tournament was played.
- 10 **ACCUM. QUALIFYING PLAYS** : Provides the accumulative total number of times a player qualified (*invited to enter name*).
- 11 **ACCUM. EARNINGS** : Provides the total Gross Earnings *accepted*, since the first Tournament was played.
- 12 **ACCUM. TOUR EARNINGS** : Provides the accumulative total Tournament Game Earnings since the first Tournament was played.
- 13 **ACCUM. JACKPOT** : Provides the accumulative total of Prize Pool (*Jackpot*) Amounts paid out since the first Tournament was played.
- 14 **# TOURNAMENTS** : Provides the number of Tournaments (*not individual Tournament Games*) since the first Tournament was played.



Sign Messages A-B (Tournie Adj. 16-17) [Left Arrow] [Right Arrow] [-] [+]

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

- 16 **LOCATION MESSAGE** : Set to **ON, CHANGE** or **OFF**. Default is **ON**. When set to **CHANGE**, a new message can be set or the old one can be edited (*select the "+" Mini-Icon to change settings until "CHANGE" appears in the display, then select the ">>" Mini-Icon to access.*). At the top left corner of the Display, the letter **A** is indicated (*blinking*) in the first available position. Vary the letter(s) by operating the Left and Right Flipper Buttons (*or "RED" or "GREEN" Buttons*). With the desired letter indicated, depress the **Start Button** to lock in the letter and advance to the next character. Repeat this procedure until the desired message is completed in the display. Select the "<" or ">" characters to back-space (*erase*) and/or to move forward in an already typed message. After completion, press the **"BLACK" Button**, **"REQUEST INSTALLED"** is indicated and then exits this sub-menu.
- 17 **PRIZE MESSAGE** : Set to **ON, CHANGE** or **OFF**. Default is **ON**. *Procedure identical to Tournament Adjustment 16, Location Message.*

The **DEFAULT LOCATION MESSAGE** is:

STERN PINBALL PROUDLY PRESENTS...

The **DEFAULT PRIZE MESSAGE** is:

YOU CAN BE THE NEXT BIG WINNER!



IMPORTANT FOR TOURNAMENT USERS: 2 additional messages can be added by using the **Beta Brite® Remote**. More details in the **ToPS™ Tournament Pinball System Kit Installation Manual** (SPI Part Number: 780-6011-01) provided in the **Optional Tournament Kit** (SPI Part Number: 502-5011-00).

BETA Brite

HOW TO ENTER A MESSAGE:

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

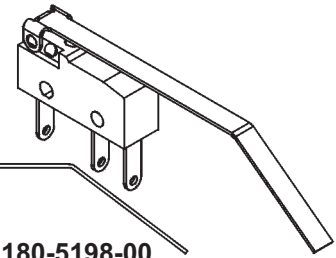
SEE YOUR PROGRAMMING MANUAL FOR ADDITIONAL INSTRUCTIONS AND DISPLAY FEATURES.

ON/OFF CAR LOCK
PROGRAM MODE
FONT
RUN
FON
5
0
E
J
O
Y
SYMBOL
COLOR
RETURN
SPACE
APPEND
6
A
L
K
P
Z
7
B
G
-
Q
Y
SPACE
MEANS
INSERT
8
@
C
H
M
R
W
RETURN
SPEED
DELETE
9
D
N
S
X
COLOR
DOTS
ADV
SELECT

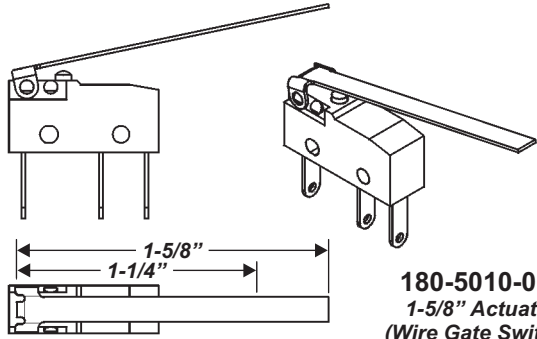
Sec. 3: Tournament ...

Which Switch is Which? Switch between chapters ...

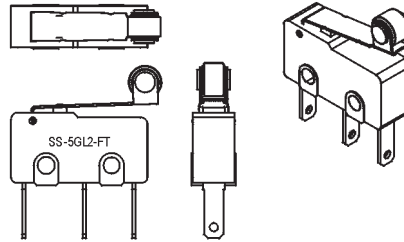
Identifying switches. Find your switch in the **Pink** or **Blue Pages**. For playfield switch location, see Pages **66-67**. These pages identify the type, quantity used, location and switch matrix number. You can also find your switch on the assembly itself, by looking in **Chapter 2, Drawings for Major Assemblies & Ramps**; see Page **81** to locate your assembly and page number.



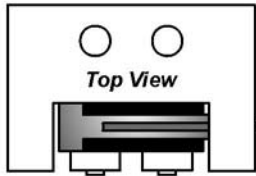
180-5198-00
Custom Actuator
(Special Application Switch)
Cherry DA3A-B1A



180-5010-01
1-5/8" Actuator
(Wire Gate Switch)
180-5010-04
1-1/4" Actuator
(Spinner Switch)

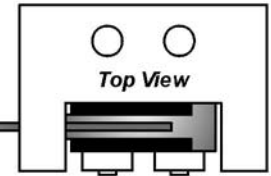


180-5119-02
Roller Actuator
(Ball Trough Switch
and Special Applications)
SS-5GL2-FT

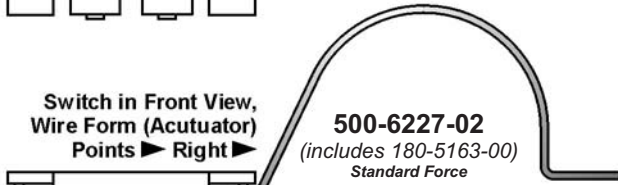


Top View

Telling your Left from your Right ...



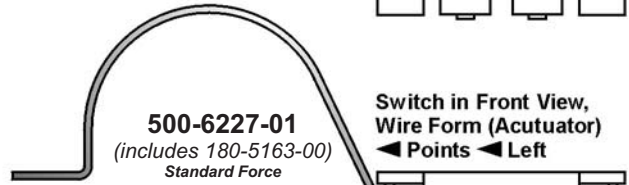
Top View



Switch in Front View,
Wire Form (Acuator)
Points ▶ Right

500-6227-02
(includes 180-5163-00)
Standard Force

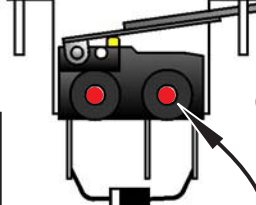
500-6227-04
(includes 180-5163-00)
Light Force
(Roll-Over Switch, Right Style)



Switch in Front View,
Wire Form (Acuator)
Points ◀ Left

500-6227-01
(includes 180-5163-00)
Standard Force

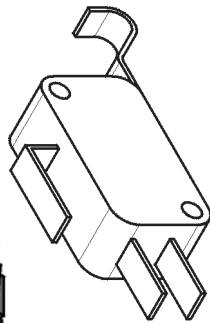
500-6227-03
(includes 180-5163-00)
Light Force
(Roll-Over Switch, Left Style)



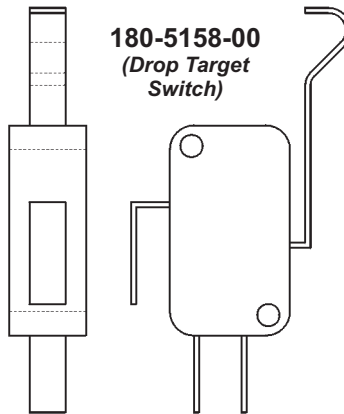
Light Force is indicated
with the switch mounting
studs painted red. ●
Standard Force remains
the natural color of the
plastic bracket.



Light Force is indicated
with the switch mounting
studs painted black. ●
Standard Force remains
the natural color of the
plastic bracket.

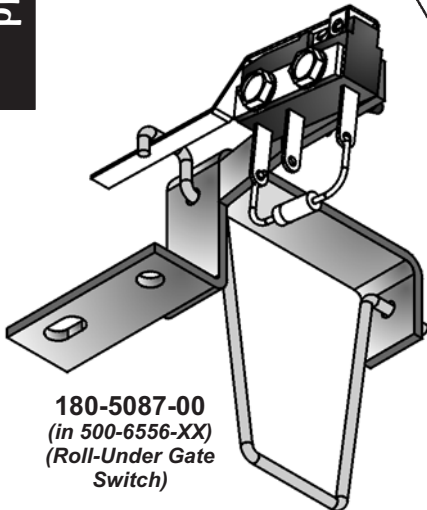


180-5158-00
(Drop Target
Switch)



180-5157-00
(in 500-5096-00)
(Shooter Lane
Switch)

180-5186-01
(in 500-6520-01)
(Eject Switch)



180-5087-00
(in 500-6556-XX)
(Roll-Under Gate
Switch)

Sec. 4: Parts Id. ...

Parts Identification & Location
(The Pink Pages)

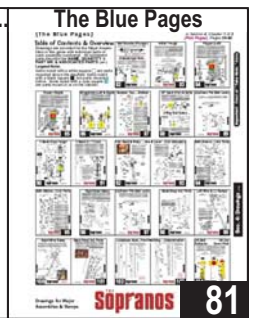
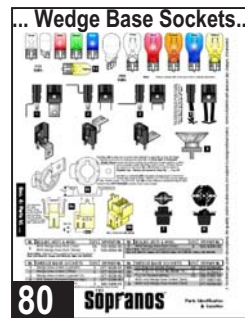
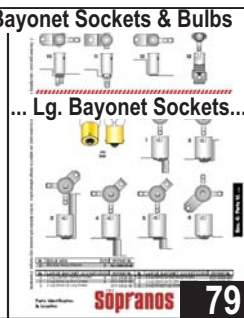
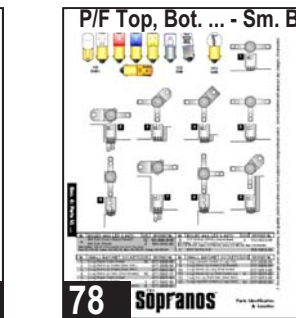
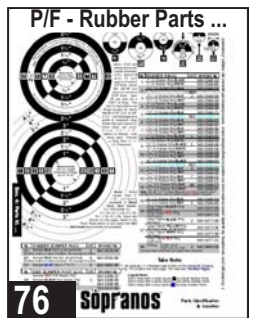
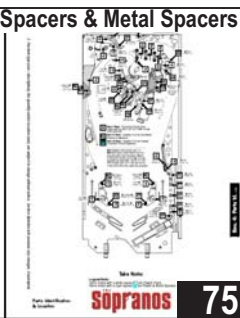
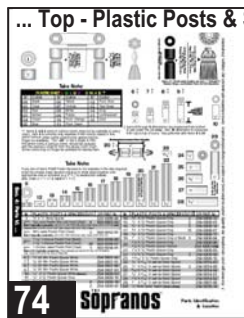
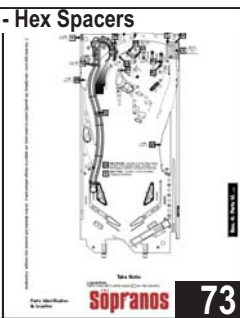
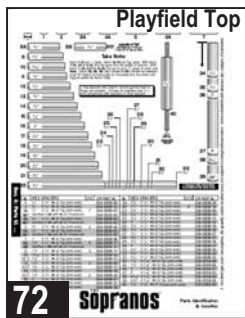
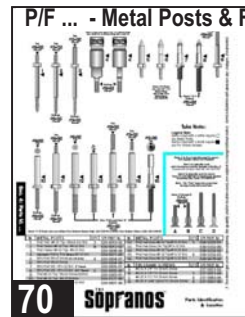
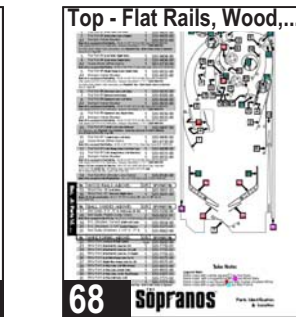
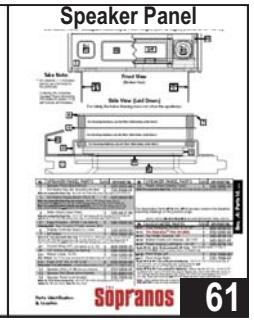
View Drawings for Major Assemblies & Ramps, in Section 4, Chapter 2 of 2 (Blue Pages), Pages 81-104.



Table of Contents & Overview

This section provides the part number and locations of most of the components in this Pinball Machine. These parts are arranged in 3 groups: **BACKBOX**, **CABINET** & **PLAYFIELD**
Note Pages 70-80: All Posts, Nuts, Spacers, Rubber Parts, Sockets and Bulbs shown are drawn **Actual Size**. If no quantity is shown, that item is not used on this game (however, quantities and/or parts may change during production with or without notice).

Optional Kits available through your Distributor:
Pinball Location Maintenance Standard & Deluxe Kits!
See Pages 63 or 64 for Part Number & more info!



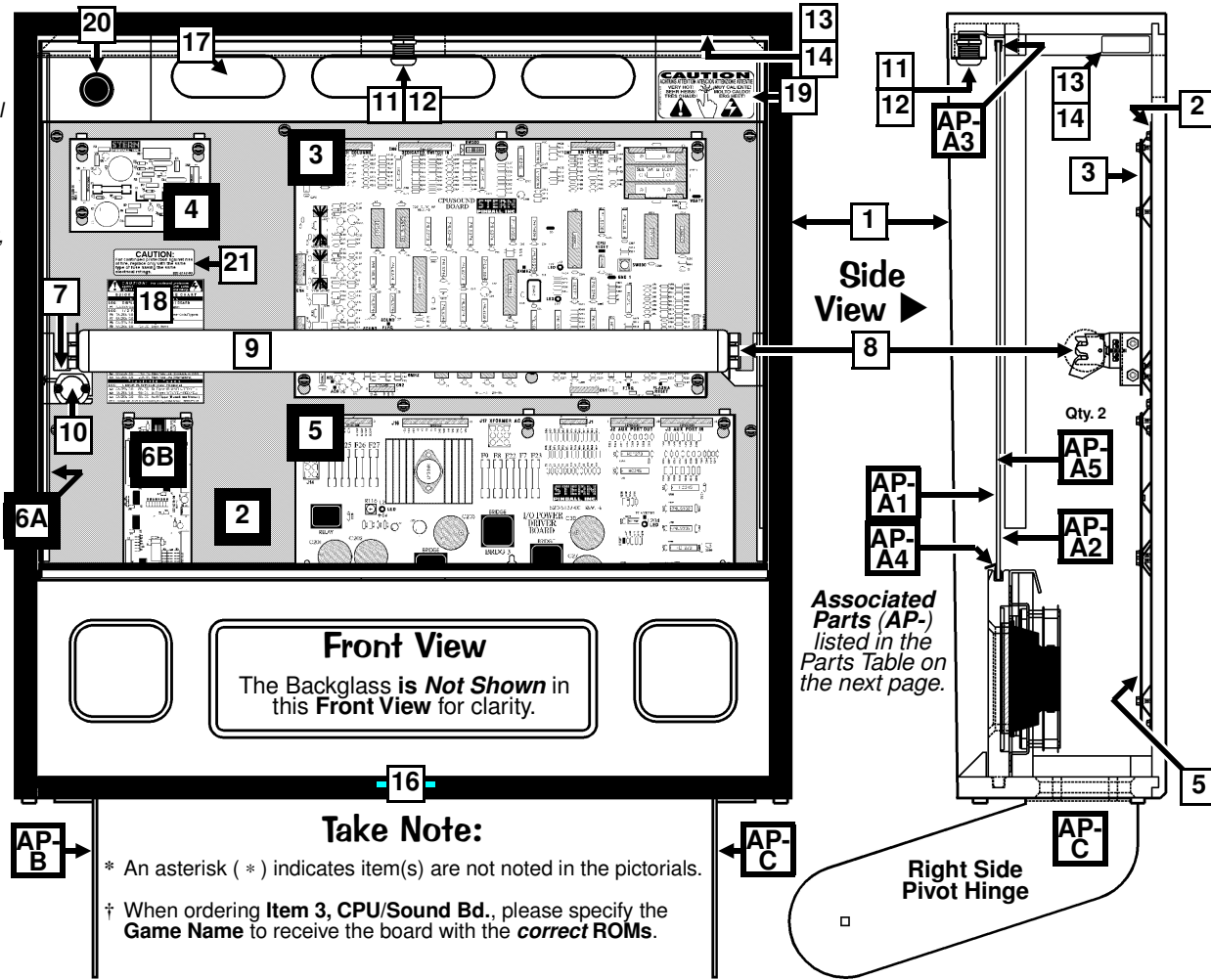
Important: Read all "Take Note: " items

Sec. 4: Parts Id. ...

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

The SopranosSM Pinball Backbox Assembly, 505-6002-85-85 (Items 1-29)

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



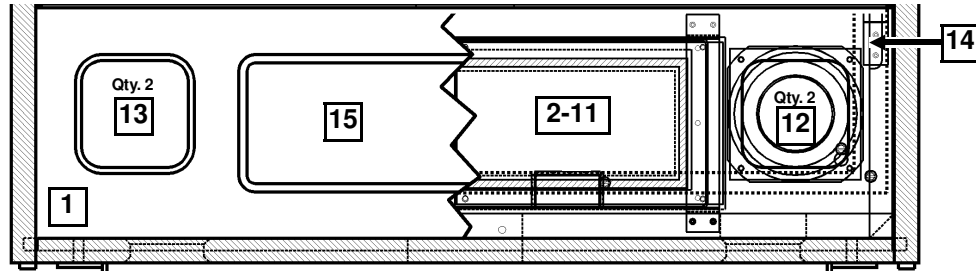
Sec. 4: Parts Id. ...

Nr.	BACKBOX PARTS	QTY.	SPI PART Nr.	Nr.	BACKBOX PARTS	QTY.	SPI PART Nr.
1	Backbox SopranosSM Screened No Parts	1	525-5631-17-85	13	Ballast Mounting Plate	1	535-8657-00
<i>Item 1 Note: Chrome T-Molding is installed and cannot be ordered separately.</i>				14	Ballast CU45Z-W 1/2" Core 120v 60 Hz 13W	1	010-5015-00
2	PCB Metal Mounting Plate	1	535-5809-14	Items 13 & 14 are secured to Item 1 by: #6 X 5/8" SLT HWH AB (Zc) (Qty. 2) (234-5102-04) EU / UK Only Ordering Note: Ballast, 5/8" Core 50/60 Hz (010-5015-01)			
<i>Item 2 is secured to Item 1 by: #8 X 1/2" SLT 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)</i>				15*	#1 Roto Lock Male (on Cabinet)	1	355-5006-01
3 †	CPU/Snd. Bd. w/ATMEL Sound Processor	1	520-5300-00	16	#1 Roto Lock Female (R2-0002-02)	1	355-5006-02
4	Display Power Supply Board	1	520-5138-00	Item 16 is secured by: #10-24 X 1-3/4" CBSN (231-5022-00), #10-24 Keps Nut (Qty. 2) (240-5207-00), #10-24 X 2" CBSN (231-5045-00), #10-24 Keps Nut (240-5207-00) and #10 Washer 7/32" ID X .5" OD X 1/16" (Qty. 5) (242-5003-00)			
5	I/O Power Driver Board <i>Rev. G or higher</i>	1	520-5137-01	17	Back Vent Grill 2-1/2" X 18"	1	545-5072-02
<i>Items 3, 4 & 5 are secured to Item 2 by: #8-32 X 3/8" HWH MS (Qty. 19) (237-5903-00)</i>				Item 17 is secured by: Staple 5/16" (Qty. 23) (631-5000-00)			
6A	3X Trans. Drvr. Bd. (UK/Special Apps.Only)	520-5068-01		18	Fuse Description Decal (Generic)	1	820-6152-02
6B	ToPS™ Tournament Serial Interface (TSI) Board	520-5220-00		19	"CAUTION - VERY HOT" Decal	1	820-6266-00
<i>**optional** 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 **optional** Item 6B ToPS™ TSI Board.</i>				20 ‡	Button Hole Plug (Blk) (Happ #52-6214-00)	1	500-6566-00
7	Fluorescent Light Bracket Assy. Left	1	515-6545-00	21	Fuse Label (UL)	1	820-6143-00
Assembly Parts Included : Fluorescent Light Bracket Left (535-7739-00), Lamp Holder** (Self-Locking) (077-5214-00) and Starter Base (with Leads)*** (077-5213-00).				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
Assembly Parts Included : Fluorescent Light Bracket Right (535-7739-01), Lamp Holder** (Self-Locking) (077-5214-00) and Starter Base (with Leads)*** (077-5213-00).				Item 23 (20-Pin) connects the CPU/Sound Board to the I/O Power Driver Board.			
<i>** secured by: #6-32 X 5/8" PPH MS (Sems) Zinc (Qty. 1) (232-5203-00)</i>				24*	Ribbon Cable, 26-Pin (40")	1	036-5001-40
<i>*** secured by: #4-40 X 1/2" PPH MS (Sems) Zinc (Qty. 2) (237-5813-00)</i>				Item 24 (26-Pin) connects the CPU/Sound Board to the Display Controller Board.			
Items 7 & 8 are secured to Item 1 by: #10-24 X 1-1/4" Carriage Bolt Sq. Neck (Qty. 2/per) (231-5012-00), #10-24 Keps Nut (Qty. 2/per) (240-5207-00) and 3/4" X 3" Reinforced Strapping Tape (Qty. 1, Sold in 12" Lengths only) (626-5040-00)				25*	Display Cable (Wiring Harness)	1	036-5454-00
9	Fluorescent Tube 24" (F20T9CW)	1	165-5061-00	26*	1/4" Clamp (Double)	2	040-5000-23
10	Starter - Fluorescent (FS2 Light)	1	165-5011-01	27*	1/2", 3/4" & 1" Clamp (Single)	9	040-5000-XX
11	Lock Mounting Plate	1	535-8128-01	Items 26-27 are secured to Item 1 by: #8 X 1/2" SLT HWH AB (Zc) (Qty. 13) (234-5101-00) -XX Note: for 1/2" use -06 (Qty. 1); for 3/4" use -08 (Qty. 2); for 1" use -09 (Qty. 6)			
12	Lock 5/8" Barrel, 3/4"ø, 1.5" Flat Cam	1	355-5055-00	28*	Ground Strap (5") (by Item 12)	1	600-5006-05
Items 11-12 are secured by: #8 X 5/8" TP Torx T20 (Qty. 4) (237-5947-00)				29*	Braided Wire (1.5')	1	600-5001-00
				Item 29 is secured by: Staple 5/16" (Qty. 13) (631-5000-00)			



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

SopranosSM Pinball 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)



Take Note:

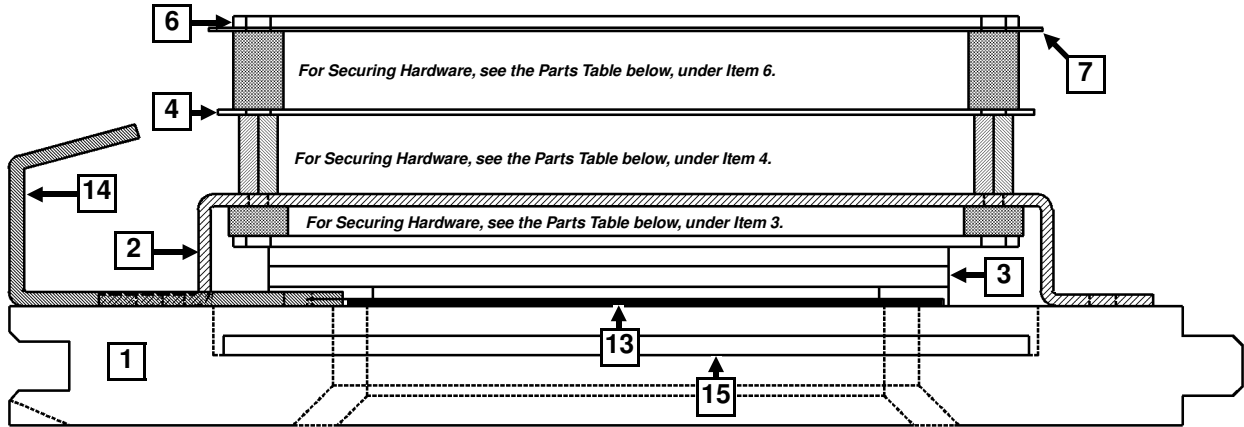
* An asterisk (*) indicates item(s) are not noted in the pictorials.

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).

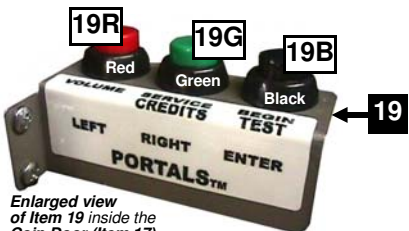


Nr.	SPEAKER PANEL PARTS	QTY.	SPI PART Nr.	Nr.	SPEAKER PANEL PARTS	QTY.	SPI PART Nr.
1	Speaker Panel (Black Wood)	1	525-5515-00	15	Plastic Shield (Display Cover)	1	545-5884-00
2	Dot Matrix Disp. Bd. Mounting Bracket	2	535-8368-01	Item 15 is secured to Item 2 by: #6 X 3/8" SLT HWH AB (Zinc) (Qty. 8) (234-5000-00)			
Item 2 is secured to Item 1 by: #8 X 3/4" SLT HWH AB (Zinc) (Qty. 4/per) (234-5103-00)							
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.			
Item 3 is secured to Item 2 by (at corners): 3/16" X 3/8" Spacer Gray (Qty. 4) (254-5000-18) and #6-32 X 1/2" SLT HWH Swage (Serr) Zinc (Qty. 4) (237-5976-03)							
Item 3 is secured to Item 4 (at the top center) by: 3/4" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-04) and #6-32 X 1/4" PPH MS (Sems) Zinc (Qty. 1) (232-5200-00)							
4	Static Shield (Steel Plate)	1	535-6437-00	ASSOC. PARTS ARE NOT INCLUDED WITH BACKBOX/SPKR. PANEL ASSY'S.			
Item 4 is secured to Item 2 by: 1/2" X 1/4" Hex Spacer #6-32 Tap (Qty. 4) (254-5008-03) and #6-32 X 1/2" PPH MS (Sems) Zinc (Qty. 2, on Left Side only) (232-5202-00)							
5*	Edge Protector - SPGS-1 (on Item 4)	1	545-5592-02	Nr.	ASSOCIATED PARTS	QTY.	SPI PART Nr.
Ordering Note: "Item 5" is sold in 12" length. Required: .67 Ft.							
6	Display Controller Board FCC-FEB98	1	520-5055-03	AP-A1	Clear Backglass 25.906" X 19.187"	1	660-5038-02
7	RF Shield	1	820-5092-00	AP-A2	The Sopranos SM Film Art (#85)	1	830-5285-00
Items 6 & 7 are secured to Item 4 by: 1/2" X 5/16" X .144 ID Spr. (Qty. 3) (254-5014-00), #6-32 X 3/4" PPH MS (Sems) Zinc (Qty. 3) (237-5504-00), 1/2" X 1/4" Hex Spacer #6-32 (Qty. 1) (254-5008-03) and #6-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5200-00)							
8*	Ground Strap (25") (on Items 4, 6, 12)	4	600-5006-25	AP-A3	Top Plastic Channel - 26"	1	545-5018-15
9*	1/2" Clamp (Single) (on Item 4)	1	040-5000-06	AP-A4	Bottom Plastic Lift Channel - 26-1/16"	1	545-5021-01
10*	Ribbon Cable, 14-Pin	1	036-5260-00	AP-A5	Plastic Edging (Left/Right) - 18-1/8"	2	545-5018-14
Item 10 Note: The 14-Pin cable connects the Dot Matrix Disp. Bd. to the Disp. Controller Bd.							
11*	Foam 3/16" Thk. X 1/4" X 36"	6	626-5026-00	Items AP-A3, -A4 & -A5 are secured to AP-A1 by: Taple (Double-Sided), 12" (Qty. 1) (626-5005-00) Note: Only 6" required, sold in 12" lengths only.			
Above Item 11 is self-adhesive. Located between Items 3 & 17. Sold in 12" Lengths only.							
12	Speaker (Shld.) 4" 8Ω MG Elec #4060SH	2	031-5004-01	AP-B	Pivot Hinge Left	1	535-7999-00
13	Speaker Grill (Black w/no Artwork)	2	535-8081-01	AP-C	Pivot Hinge Right	1	535-7999-01
14	Speaker Panel Hook Bracket	2	535-7009-02	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 12, 13 & 14 are secured by: #8 X 5/8" SLT HWH AB (Green) (234-5102-04) (Items 12 / 13: (Qty. 4/per); Item 14: (Qty. 2/per))							
Items AP-B & AP-C are secured to Cabinet by: Spacer Hex Nut 1/2" O.D. - 1/4-20 X 1/2" TD (Black) (Qty. 1/per) (254-5042-00), Spacer Washer (Qty. 1/per) (242-5084-00), 1/4-20 X 1/2" Carriage Bolt Sq. Neck (Black) (Qty. 1/per) (231-5072-00), 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 - Parts & Switches

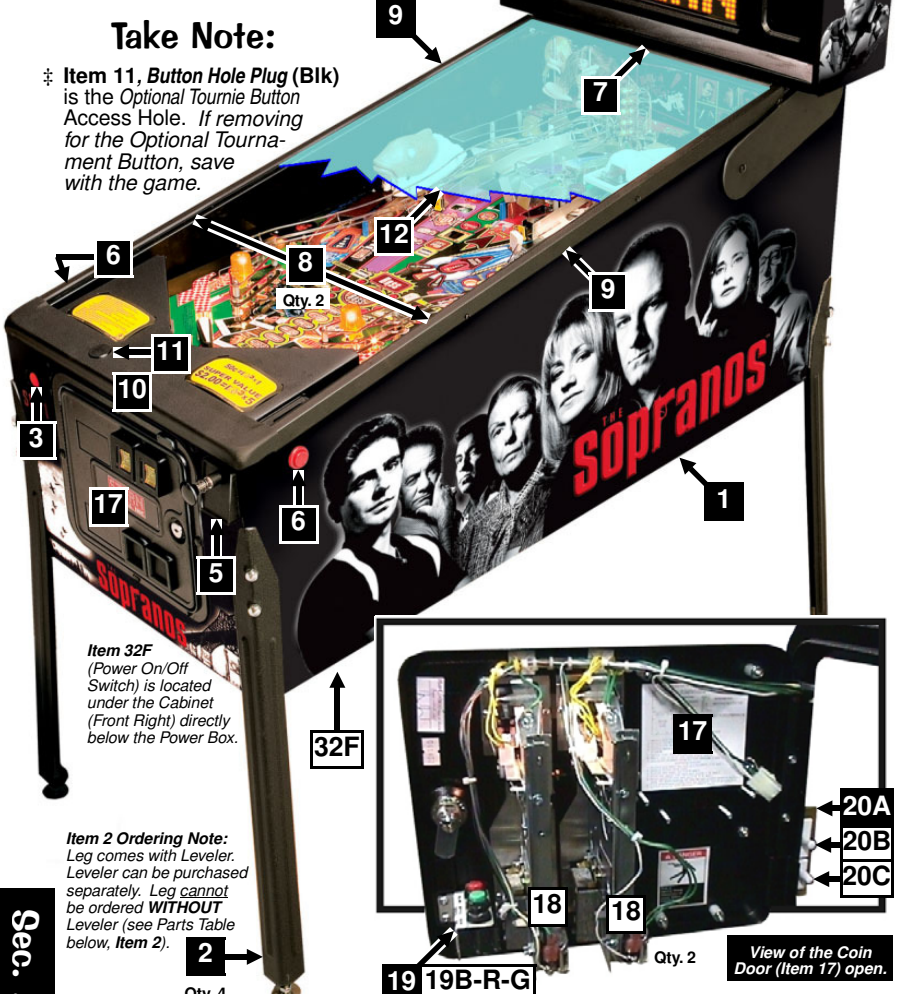
For Backbox Parts see the previous two pages.



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

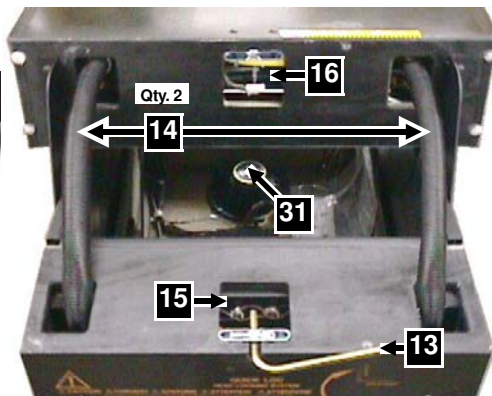
Take Note:

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



Item 32F (Power On/Off Switch) is located under the Cabinet (Front Right) directly below the Power Box.

Item 2 Ordering Note: Leg comes with Leveler. Leveler can be purchased separately. Leg cannot be ordered WITHOUT Leveler (see Parts Table below, Item 2).



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.

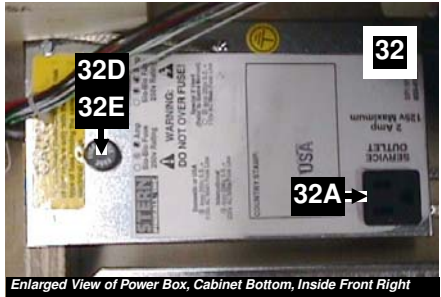
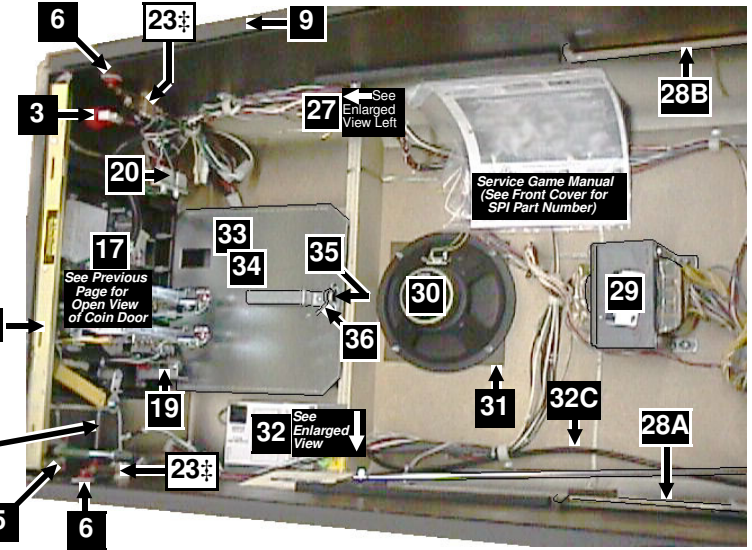
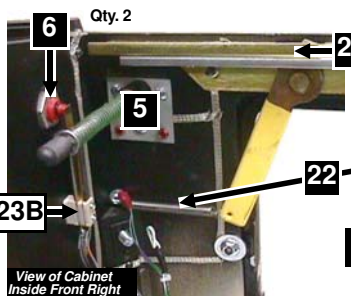
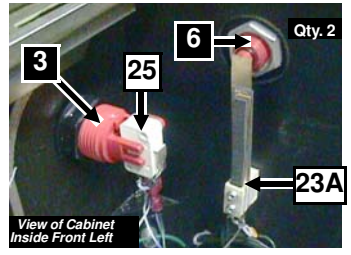
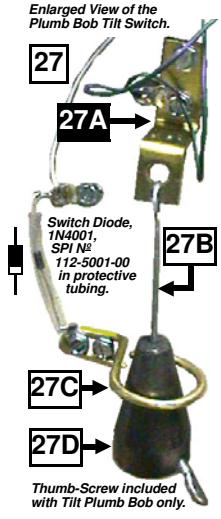
Legend Note: Items noted with a black square are Cabinet Parts. Items noted with a white square are Switches.

Sec. 4: Parts Id. ...

Nr.	CABINET PARTS	QTY.	SPI PART Nr.	Nr.	CAB. PARTS & SWITCHES	QTY.	SPI PART Nr.		
1	SopranosSM Screened Cab. (No Parts)		525-5395-15P-85	10	New Front Molding - Black	1	See Page 103		
2	Black Leg with Leveler Asm.	4	500-5921-50	Item 10 requires: Self-Adhesive Foam Rubber 3/8" X 3/16" X 20-3/8" (626-5001-00). Ordering Note : Can only be used in conjunction with new Lockdown Asm. 500-6881-00 (See Pg. 103)					
3	Start Button (Red) + Lamp Assembly	1	500-6388-02	11	Button Hole Plug (Black)	1	See Page 103		
4*	#555 Wedge Base Bulb (Clear)	1	165-5002-00	12	P/F Glass (Tmprd.) 21" X 43" X 3/16"	1	660-5001-00		
5	Ball Shooter (Plunger) Assembly	1	500-6146-00-04	13	Hex Key Allen Wrench 5/16"	1	777-0001-00		
6	Flipper Button (Red) Assembly	2	500-5026-32	14	Corrugated Tubing Black 1"ø X 2.6' Lg.	1	605-5008-03		
7	Rear Glass Channel 20-3/8" Length	1	545-5038-00	Above Item 14 covers the Cables Wiring Harnesses going into the Backbox from the Cab.					
8	Plastic Channel 42-5/8" Lg. (Left/Rt.)	2	545-5017-00	15	#1 Roto Lock Male (R2-0055-02)	1	355-5006-01		
9	Side Armor "with holes" (Left & Right)	2	535-7297-02	Item 15 is secured by: #10-24 X 1-3/4" Carr. Bolt Sq. Neck (Qty. 2) (231-5022-00), #10-24 N.S. Nut (Qty. 2) (240-5206-00) and #10 Washer 7/32" X .5" X 1/16" (Qty. 2) (242-5003-00)					
Item 9 is secured @ front by: Pem Stud 1/4 X 1" FH Black (Qty. 1/per) (237-6116-01) and 1/4-20 Flange Nut (Qty. 1/per) (240-5300-00); @ center by: #8 X 5/8" PPH AB Black (Qty. 2/per) (232-5101-01); @ rear (backbox) by: #10-24 X 1" Sq. Neck Carriage Bolt Black (Qty. 1/per) (231-5021-00) and #10-24 Hex Nut (Qty. 1/per) (240-5202-00)				16	#1 Roto Lock Female (on Backbox)	1	355-5006-02		
Item 10 is secured below button in cabinet by: #6 X 1/2" SLT HWH AB Zinc (Qty. 1) (234-5101-02). Note: 1N4004 Diodes (112-5003-00) are used in all Diode applications.				17	Coin Door (with Validator) USA only	1	500-5018-172		
Item 11 is included with Item 3, for just a replacement Bulb use the above number.				Item 17 is secured by: 1/4"-20 X 1-1/4" Carriage Bolt Sq. Neck (Qty. 4) (231-5003-00) 1/4"-20 Flange Nut (Qty. 4) (240-5300-00) and Fend Washer 1/4" I.D. X 1" O.D. (Qty. 3) (242-5009-00) Note: For Coin Door other than USA call Technical Support for SPI Part Nr.					
FOR A BREAKDOWN OF PARTS SEE: Sec. 4, Chp. 2, Drawings for ... Assemblies...				Coin Door Sw. (USA) (Happ Control)				2	180-5024-01
Item 12 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) Leg Leveler ONLY (3/8"-16 X 3") (500-5017-00).				18				ALT. SWITCHES	18: Coin Door Switch (USA) (Coin Control) (180-5024-00) 18J: Coin Door Switch (¥ Japan) (180-5091-00)
Item 13 includes the Switch. FOR SWITCH ONLY see Item 25 on the Next Page.				Bracket for below Portals™ Switches				1	535-6860-03
* Diode Terminal Strip 2-Lug (810) Isolated				19				SWITCHES	19B: Push-Button Portals™ Switch (Black) (180-5192-00) 19R: Push-Button Portals™ Switch (Red) (180-5192-02) 19G: Push-Button Portals™ Switch (Green) (180-5192-04)
Above Item is secured below button in cabinet by: #6 X 1/2" SLT HWH AB Zinc (Qty. 1) (234-5101-02). Note: 1N4004 Diodes (112-5003-00) are used in all Diode applications.				Ordering Note: Securing hardware for switches included. For Decal Kit, see Page 69.					

Parts Table & Views continue on the next page.

Cabinet - Parts & Switches Continued



Optional Meter +12v DC with Bracket Diode included. **G-0053-013-102** **Optional Meter +12v DC No Bracket Diode included.** **G-0053-013-102A**
Meters are optional and were not included with this Pinball Machine. Each optional meter sold separately.

Take Note:

* An asterisk (*) indicates item(s) are not noted in the pictorials.
Legend Note: Items noted with a black square ■ are Cabinet Parts. Items noted with a white square are Switches.

The Front Molding & Lockdown Assembly are detailed in The Blue Pages!
See [The Blue Pages](#), Section 4, Chapter 2, Drawings for Major Assemblies ... , Page 103.
For General Bulbs & Sockets:
See these Pink Pages, Section 4, Chapter 1, Parts Identification & Location, Pages 78-80

Pinball Location Maintenance Standard Kit: 502-6002-85
This kit consists of 8 oz. Novus Wax #2 Fine (Red) (675-0003-01), cloth and all Rubber Rings & Bulbs used in this Pinball Machine.
Pinball Location Maintenance Deluxe Kit: 502-6003-85
This kit consists of the Standard Kit above plus Flipper Rebuild Kits (quantity of Flipper Rebuild Kits depends on how many flippers in game)

Nr.	CAB. PARTS & SWITCHES	QTY.	SPI PART Nr.
<i>Parts Table & Views continue on the previous page.</i>			
20	Dual Switch Assembly	1	500-5808-00
Assembly Parts Included : Mounting Bracket (535-6958-00), Playfield Power Interlock Switch (Top) (180-5136-00) and Memory Protect Switch (Bottom) (180-5000-01)			
Item 20 is secured to Cabinet by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5101-00)			
21	New Front Molding Lockdown Asm.	1	 See Page 103
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 1/2" SLT HWH AB Zinc (Qty. 1) (234-5101-00) and #10 Washer 7/32" ID X 1/2" OD X 1/16" (Qty. 1) (242-5003-00)			
22	Lockdown Spring (connected to handle)	1	265-5008-00
23	Flipper Switch Assembly	2	500-6889-00
Assembly Parts Included : Flipper Switch Stack (Self-Cleaning) (180-5160-00), Capacitor - Ceramic .05 Mfd 25 volt (031-5001-00) and Foam Strip (626-5042-00)			
Item 23 is secured to Cabinet by: #5 X 1-1/4 PRH AB (Zinc) (Qty. 2/per) (237-5835-00)			
24*	Foam Strip (For Item 23 - Noise Suppression)	1	626-5042-00
25	Start Button Switch (ONLY)	1	180-5174-00
26	Grills 2-1/2" X 18" (on Back & Bottom)	2	545-5072-02
27	Plumb Bob Tilt Switch (made up of 4 individual parts)		
27A	Bracket for Hanger Wire	1	535-5221-00
27B	Hanger Wire	1	535-5319-00
27C	Contact Wire Form	1	535-7563-01
27D	Plumb Bob Weight (includes Thumb-Screw)	1	535-5029-00
Item 27A is secured to Cabinet by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 4) (234-5101-00)			
28A	Slide & Pivot Support Bracket - Right	1	535-5990-00
28B	Slide & Pivot Support Bracket - Left	1	535-5989-00
Items 28A & 28B are secured by: #10-24 X 1-1/4" Carriage Bolt Sq. Neck WHITE (1/per) (231-5012-02), #10-24 X 1-1/4" Carriage Bolt Square Neck Black (2/per) (231-5012-00) and #10-24 KEPS Nut (3/per) (240-5207-00)			

Nr.	CAB. PARTS & SWITCHES	QTY.	SPI PART Nr.
29	Transformer 5.7v AC (with Ballast Winding)	1	010-5012-01
Item 29 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)			
30	Speaker 8" ø Rd. 8010 4Ω	1	031-5007-00
31	Speaker Grill 7" X 7"	1	545-5072-03
Items 30 & 31 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)			
32	Power Input Box Sub-Assy.	1	515-5360-07
32A	Service Outlet (for USA)	1	180-5008-01
32B	Line Cord 10' ROJ 3" Max.	1	034-5000-10
32C	Recessed Cup for Line Cord	1	545-5122-00
32D	Fuse 8 Amp 250v Slo-Blo (Domestic)	1	200-5000-05
32E	Fuse 5 Amp 250v Slo-Blo (Foreign)	(2)	(200-5003-00)
32F	Fuse Holder	1	205-5001-00
32F	Switch, On/Off Rocker APEM R210C5NBB	1	180-5001-03
Assembly Parts Included : Power Box (No Parts) Mounting Frame (535-5932-00), Line Filter (150-5000-00), Domestic Varistor* TRN159211KM (150-5001-00), On/Off Switch Bracket (535-8318-00), Power Box Decal (820-6123-03) and the following (noted in pictures): *Note: Euro Varistor TRM15G431KM use 150-5002-00			
33	Cash Box Plastic Bottom	1	545-5090-00
34	Cash Box Cover (Validator)	1	535-5013-03
35	Cash Box Lock Bracket (wire)	1	535-7562-00
36	Large Hair-Pin Clip	1	535-7772-00

Playfield Top - Miscellaneous Parts and Brackets

Nr.	THE PLAYFIELD	QTY.	SPI PART Nr.
PF	P/F Screened w/ Inserts & NO Parts	1	830-5100-85
	P/F Complete w/ Inserts & ALL Parts	1	505-6004-85-85

Nr.	MISC. PARTS (ABOVE)	QTY.	SPI PART Nr.
1	Arch (Black Metal) no Forks	1	535-8392-01

Item 1 is secured to the playfield by: #10-32 X 5/16" PH FL U/C MS STL Zinc (Qty. 2) (237-6013-00). **Usage Note:** When replacing the Arch, order new replacement **Nelson Protect Strips** (not included) (Qty. 2) (545-5212-02).

2	Instruction Card (USA) < Sopranos SM >	1	755-5185-00-Y
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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 755-5185-02-Y; German 755-5185-03-Y; Italian 755-5185-04-Y; French 755-5185-05-Y.

3	Coin Card (2-Sided) Yellow Stock	1	755-5400-00-Y
4	Coin Card (2-Sided) Yellow Stock	1	755-5400-02-Y

For Coin Card views, see below or **Appendix J** (back of manual). **Ordering Note:** If this is a non-US Game, Coin Card(s) Part Numbers provided will differ.

5	Semi-Truck (only)	1	880-5083-00
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Item 5 is secured to Plastic (Screened -11) by: 4" Cable Ties (Qty. 3) 040-5001-00

6A	Fish Jaw (only)	1	545-6126-00
6B	Fish Head & Body Glued Assembly	1	515-7455-00
7	Boat, The Stugots (only)	1	545-6140-00

Note: For how Items 6A-6B & 7 are secured & more details on the assemblies they're on, see **Drawings for Major Assemblies ...** (**The Blue Pages**), Sec. 4, Chp. 2., Pg. 92-93 & 96.

8A	Doll (Black Hair) & Tube Glued Asm.	1	515-7475-01
8B	Doll (Red Hair) & Tube Glued Asm.	1	515-7475-02

Ordering Note: Doll Hair Color, shape, type and/or position are subject to change and availability. For more details, see **Drawings for ...** (**The Blue Pages**), Sec. 4, Chp. 2., Pg. 98.

9	Light Reflector (Silver Color Plastic)	3	545-5409-01
10A	Mini-Mars Lite Cover (Snap-In) (Yellow)	3	550-5030-06
10B	Mini-Mars Lite Cover (Snap-In) (Red)	2	550-5030-02

11	Bubble Level Assembly	1	500-6815-00
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Assembly Parts Included: Level .8mm Empire #0224 (545-6001-01) or Level Mount (545-6068-00). Flange secured by: #6-32 X 1/4" PPH MS (no Sems) Zinc (237-5500-00) and #6-32 Keps Nut (240-5008-00). **Item 11 is secured to the wood rail by:** #6 X 1/2" HWH AB Zinc Red (Qty. 2) (234-5001-02)

12	Pinball (Steel) 1 1/8" ø	4	260-5000-00
13*	Plug-Cap (3/16") Black Plastic	0	545-5232-01

Note: Item 13 should plug hole if a Center Post (@ Drain) is used, then removed.

Nr.	MISC. BRACKETS (ABOVE)	QTY.	SPI PART Nr.
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14	Sign Mounting Bracket (for Plastic -24)	2	535-8941-00
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Item 14 is secured to Plastic -24 (Billboard Sign) by: Rivet, 1/8" ø X 3/16" Long (Qty. 1/per) (249-5001-00) and is secured on the Hex Spacers by: #6-32 X 3/8" PPH MS Ext. Sems (Zinc) (Qty. 1/per) (232-5201-00)

15	Ramp Mounting Bracket	1	515-6508-00
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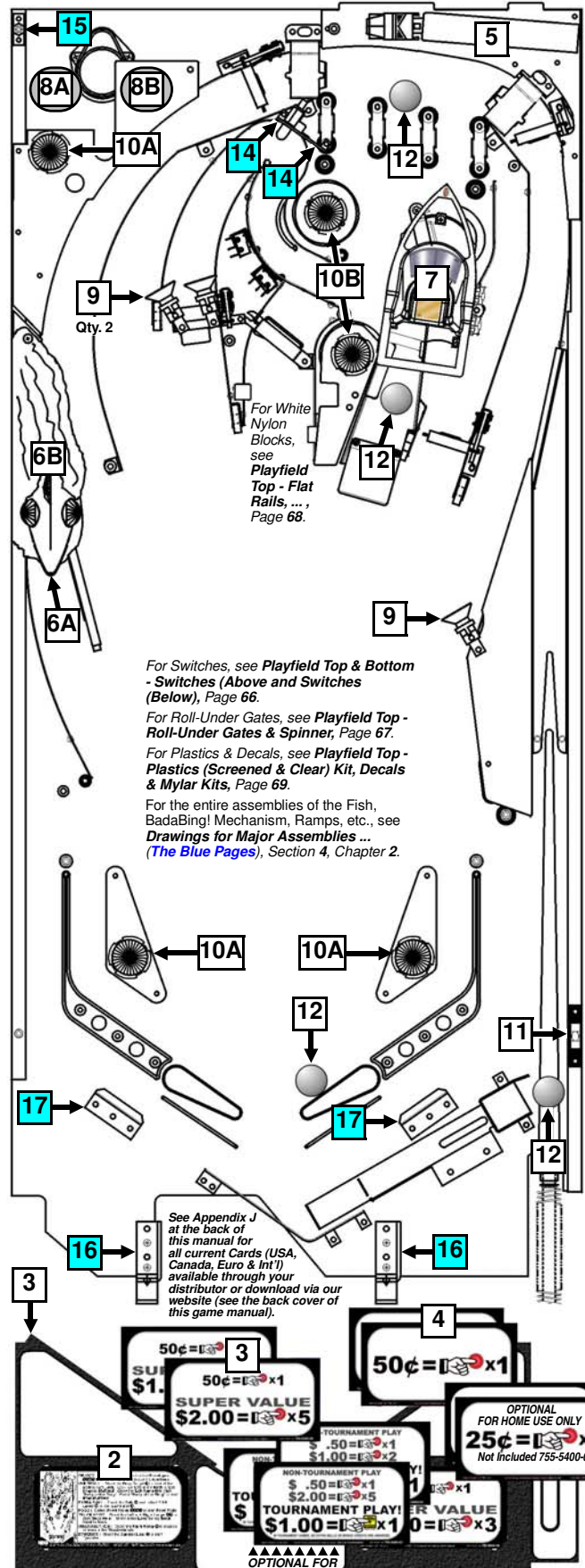
Item 15 is secured to the Left Wood Rail by: #6 X 1/2" PTH A (Zinc) (Qty. 2) 237-5809-00

16	Playfield Hanger Bracket	2	535-8385-00
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Item 16 is secured to the P/F by: #8-32 X 7/8" HWH MS Zinc (Qty. 2/per) (237-5890-00)

17	Arch Retaining (Hold-Down) Bracket	2	535-8394-00
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Item 17 is secured to the P/F by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 3/per) (234-5101-00)



Sec. 4: Parts Id. ...

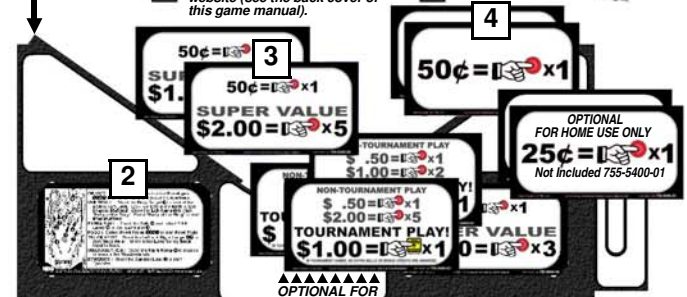
Optional Kits available through your Distributor:

Pinball Location Maintenance Standard Kit: 502-6002-85
This kit consists of 8 oz. Novus Wax #2 Fine (Red) (675-0003-01), cloth and all Rubber Rings & Bulbs used in this Pinball Machine.

Pinball Location Maintenance Deluxe Kit: 502-6003-85
This kit consists of the Standard Kit above plus Flipper Rebuild Kits (quantity of Flipper Rebuild Kits depends on how many flippers in game)

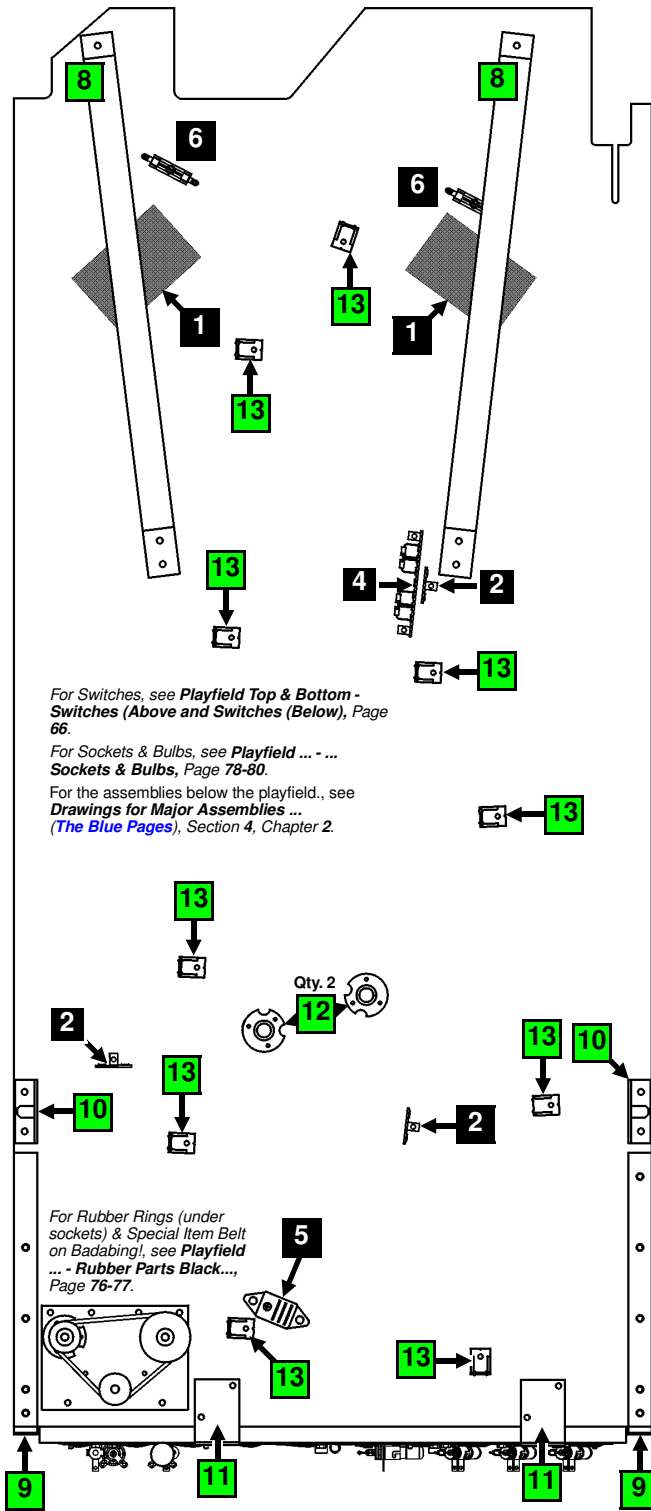
Take Note:

Legend Note:
Items noted with a white square are Misc. Parts (Above).
Items noted with a cyan square are Misc. Brackets (Above).



TOURNAMENT USE ONLY
Not Included 755-5400-03 & 755-5400-04

Playfield Bottom - Miscellaneous Parts ■ and Brackets ■



Nr.	THE PLAYFIELD	QTY.	SPI PART Nr.
PF	P/F Screened w/ Inserts & NO Parts	1	830-5100-85
	P/F Complete w/ Inserts & ALL Parts	1	505-6004-85-85

Nr.	MISC. PARTS (BELOW)	QTY.	SPI PART Nr.
1	Insulation Fiche Paper (under Lower Flippers)	2	545-5721-00
2	Diode Terminal Strip 2-Lug (810) Isolated	3	055-5203-00
3	Diode Terminal Strip 4-Lug (821) Isolated		055-5204-04
4	Diode Terminal Strip 7-Lug Isolated	1	055-5204-07

Items 2-4 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. **Current Limiting Resistor (390Ω 1/2 Watt) (121-5028-00)** is located on one Diode Terminal Strip 2-Lug for the Fish LED Wiring. See *Playfield Terminal Strips, Fuses & Misc. Wiring ...*, Section 5, Chapter 2, Page 111.

5	Relay Assembly with Cable Wiring	1	500-6700-00
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For Individual Items use : Relay 24V DC 10A (*PICKER #PC113) (190-5004-00), Metal Oxide Varistor 47Z7 (150-5010-00) and Cable Wiring (036-5491-00)

6	3A 250v Slo-Blo Fuse	2	200-5000-08
	Fuse Clip Holder (Socket)	2	205-5000-01

Item 6 is secured by: #6 X 1/2" PPH AB (Qty. 1/per) (237-5805-00)
Note: Item 6, 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).

7*	Diode Terminal Strip/Fuse Decals A-D	1	820-6221-85
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Note: For Decal Descriptions & Locations, see *Playfield Terminal Strips, Fuses & Misc. Wiring Descriptions & Locations, Section 5, Chapter 2, Page 111.*

Nr.	MISC. BRACKETS (BELOW)	QTY.	SPI PART Nr.
8	Playfield Support Slide Bracket	2	535-6862-02

Item 8 is secured by: #8 X 1/2" SLT 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)

9	Edge Slide Bracket (Extended)	2	535-5988-01
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Item 9 is secured by: #4 X 1/2" PFH (Zinc) (Qty. 5/per) (237-5840-00)

10	Pivot Pin Bracket Welded Assembly	2	500-5329-03
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Item 10 is secured by: #8-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 2/per) (237-5975-03)

11	Bracket, Back Panel Mounting	2	535-8964-00
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Item 11 is secured by: #8 X 1/2" SLT HWH AB (Zc) (Qty. 2/per) (234-5101-00)

12	Bushing (Red Plastic) .281" I.D.	2	545-5070-01
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Item 12 is secured by: #6-32 X 3/8" HWH Swage (Serr) Zinc (Qty. 3/per) (237-5976-02)

13	Tie Post 3.5" (Ladder), White Plastic	10	545-5253-01
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Item 13 is secured by: #6 X 5/8" SLT HWH AB (Zc) (Qty. 1/per) (234-5002-00)

Take Note:

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

Legend Note:

Items noted with a black square ■ are Miscellaneous Parts (Below).
 Items noted with a green square ■ are Misc. Brackets (Below).

Playfield Top & Bottom - Switches (Above) and Switches (Below)

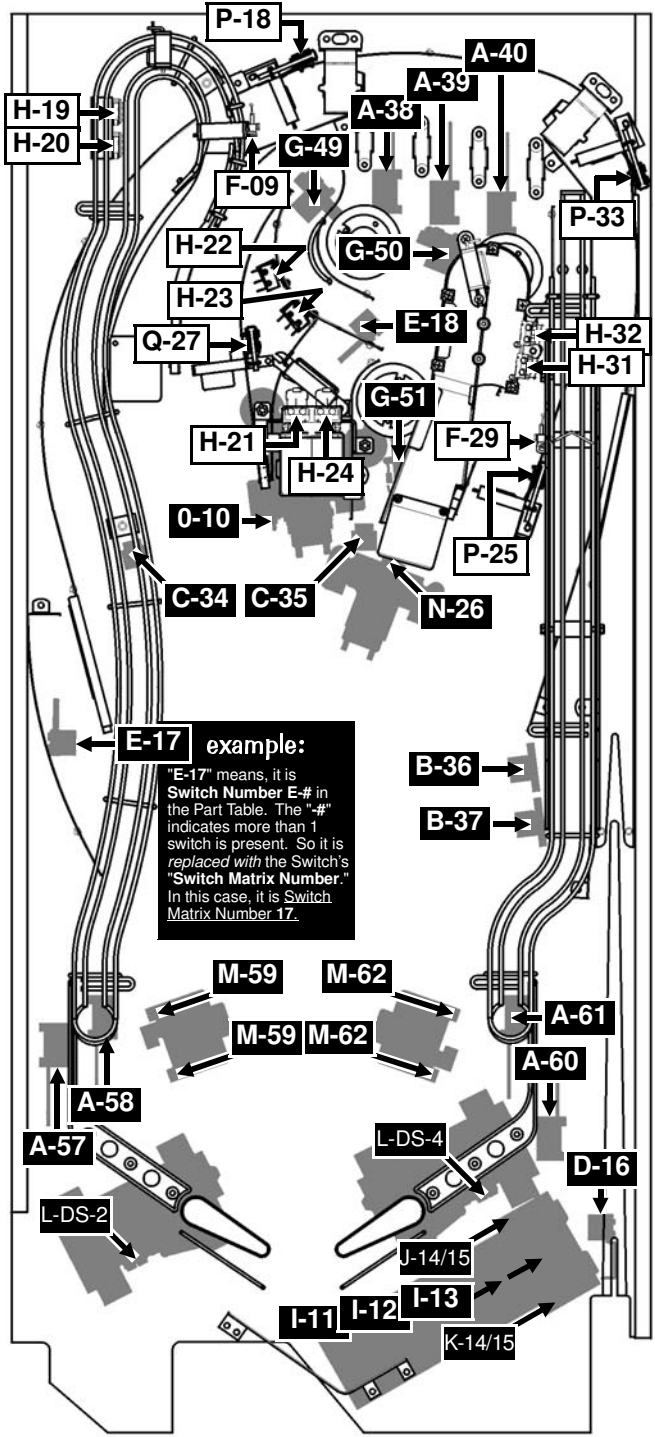
Nr.	SWITCHES	QTY.	SPI PART Nr.
A-#	Roll-Over Switch (<i>Right Mount Style</i>) Bracket secured to Playfield by: #6 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5001-02) <i>Switch Matrix Numbers 38, 39, 40, 57, 58, 60 & 61</i>	7	500-6227-02
B-#	Switch & Target Asm. Rect. (White) Assembly Parts Included : Stack Sw. Radius End (180-5133-00), 1" X 1-1/2" Rect. Target White (545-5145-08), Rivet 1/8" ø X 3/16" (249-5001-00) and Washer 9/64" I.D. X 5/16" O.D. X .048" Thick (Zinc) (242-5017-00) Associated Part Not Included : Switch Mounting Bracket (535-6896-00) Bracket secured to Playfield by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5101-00) <i>Switch Matrix Numbers 36 & 37</i>	2	515-6027-08
C-#	Switch & Target Asm. Narrow (Yellow) Assembly Parts Included : Stack Sw. Square End (180-5132-00), Narrow Target Yellow (545-5210-06), Rivet 1/8" ø X 3/16" (249-5001-00) and Washer 9/64" I.D. X 5/16" O.D. X .048" Thick (Zinc) (242-5017-00) Associated Part Not Included : Switch Mounting Bracket (535-6896-00) Bracket secured to Playfield by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5101-00) <i>Switch Matrix Numbers 34 & 35</i>	2	515-5967-06
D-16	Switch (<i>for Shooter Lane</i>) Associated Part Not Included : Switch Mounting Bracket (535-6173-00) Bracket secured to Playfield by: #6 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5001-02) <i>Switch Matrix Number 16</i>	1	180-5157-00
E-#	Switch (<i>for Ejects</i>) Associated Part Not Included : Switch Mounting Bracket (535-6173-00) Bracket secured to P/F by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5101-00) <i>Switch Matrix Numbers 17 & 18</i>	2	180-5186-01
F-#	Switch (1 5/8" Actuator) (<i>for Wire Gates</i>) Item F-# is secured by: Same screws which secures the Sw. Protect Plate & Plastic Spacer <i>Switch Matrix Numbers 09 & 29</i>	2	180-5010-01
G-#	Switch Asm., Stack (Blade) (<i>for Pops</i>) Assembly Parts Included : Switch (180-5015-04), Sw. Mounting Bracket (535-7342-00), Spoon Actuator (545-5610-02), Sw. Body Protect Plate (535-7344-00), Diode 1N4004 (Qty. 1/per) (112-5003-00) and #6-32 X 3/4" HWH Zc (Qty. 2/per) (237-5976-05) Bracket secured to Playfield by: #8 X 1/2" SLT HWH AB (Z) (Qty. 2) (234-5101-00) <i>Switch Matrix Numbers 49, 50 & 51</i>	3	515-6459-09
H-#	Switch (Roller Actuator, Lite-Force) <i>Switch Matrix Numbers 19, 20, 21, 22, 23, 24, 31 & 32</i>	8	180-5119-02
I-#	Switch (Roller Actuator, Lite-Force) Associated Parts Not Included : Heat Shrink Tubing 1/8" ø PUI-24 (Qty. 1/per) (605-5006-00) and Diode 1N4004 (Qty. 1/per) (112-5003-00) Item I-# is secured by: #2-56 X 1/2" Unslit HWH #4 Hex TR3 Blk (Qty. 2/per) (237-5937-02) <i>Switch Matrix Numbers 11, 12 & 13</i>	3	180-5119-02
J-#	Dual OPTO TRANS PC Board Asm. Assembly Parts Included : Dual OPTO Trans. PCB (Qty. 1) (520-5173-00), OPTO PCB Tube Spacer (Brass) (Qty. 3) (530-5308-02) and Rubber Grommet (Qty. 3) (545-5518-00) Items J-# is secured by: #6-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 3/per) (237-5976-04) <i>Switch Matrix Numbers 14 & 15</i>	1	515-0173-00
K-#	Dual OPTO REC PCB Assembly Assembly Parts Included : Dual OPTO Rec. PCB (Qty. 1) (520-5174-00), OPTO PCB Tube Spacer (Brass) (Qty. 3) (530-5308-02) and Rubber Grommet (Qty. 3) (545-5518-00) Items K-# is secured by: #6-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 3/per) (237-5976-04) <i>Switch Matrix Numbers 14 & 15</i>	1	515-0174-00
L-#	Switch (End-of-Stroke), Stack (Blade) Item L-# is secured by: #6-32 X 5/8" HWH Sw (Sr) Zc (Qty. 2/per) (237-5976-04) <i>Dedicated Switch Numbers DS-2 & DS-4</i>	2	180-5149-00
M-#	Switch, Stack (Blade) (<i>for Slings</i>) Associated Parts Not Included : Switch Body Protect Plate (Qty. 1/per) (535-5045-00) and Diode 1N4004 (Qty. 1 for every 2 connected together) (112-5003-00) Item M-# is secured by: #6-32 X 5/8" HWH Swage (Ser.) Zinc (Qty. 2/per) (237-5976-04) <i>Switch Matrix Numbers 59 & 62</i>	4	180-5054-00
N-26	Switch (<i>for Drop Target</i>) Item N-26 is secured by: #4-40 X 5/8" Slotted HWH C (Zinc) Wax (Qty. 2) (237-5945-00) <i>Switch Matrix Number 26</i>	1	180-5158-00
O-10	Sw. (<i>Custom Actuator</i>) Cherry DA3A-B1A <i>Switch Matrix Number 10</i>	1	180-5198-00
P-#	Switch (<i>for Wire Gates</i>) <i>Switch Matrix Numbers 18, 25 & 33</i>	3	180-5087-00
Q-27	Switch (1 1/4" Actuator) <i>Switch Matrix Number 27</i>	1	180-5010-04

Switches D-16, E-#, F-#, H-#, O-10, P-# & Q-27 above require :
Switch Body Protect Plate (Qty. 1/per) (535-6539-00), Diode 1N4004 (Qty. 1/per) (112-5003-00) and #2-56 X 1/2" Unslit Serr HWH #4 Hd TR3 Black (Qty. 2/per) (237-5937-02)

Switches D-16 & E-# above require additional :
#2-56 Hex Nut (Qty. 2/per) (240-5301-00)

Switches F-# above require additional :
Plastic (Clear) Spacer -22 (Qty. 1/per between welded Ramp Bracket & Switch)
(Kit: 803-5000-85) **Note:** Individual Plastics (830-6033-22) are not available individually, ordering of kit is required. For all pieces, see P/F - Plastics (Screened & Clear) ..., Page 69.

Switches O-10 above require additional :
Split Lock Washer (Qty. 2) (244-5003-00)



Take Note:

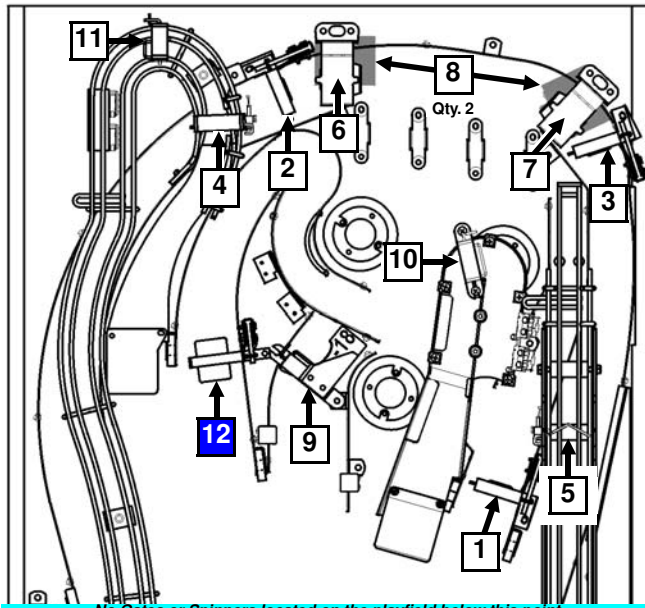
Legend Note:
Items noted with a white rectangle are Switches mounted above.
Items noted with a black rectangle are Switches mounted below.
The -# in the Item Number (Nr.) is replaced with the Switch Matrix Number of that switch (e.g. A-# is noted on the Playfield as A-38, A-39, A-40, etc.).

Note Items B - Q: For better Switch view(s), see **Drawings for Major Assemblies ... (The Blue Pages)**, Sec. 4, Chapter 2, (Page 81), (view Table of Contents for exact page).

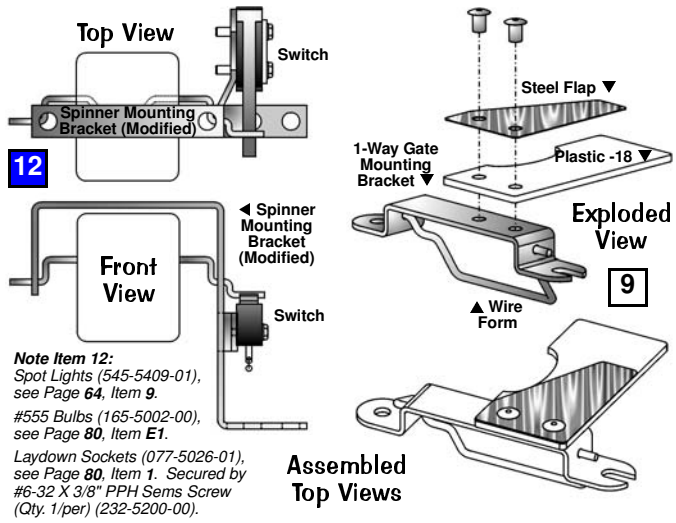
Note Items C & D: For better Target & Switch view(s), see **Appendix I, Page 11** (the end of this Service Game Manual).

Sec. 4: Parts Id. ...

Playfield Top - Roll-Under Gates & Spinner

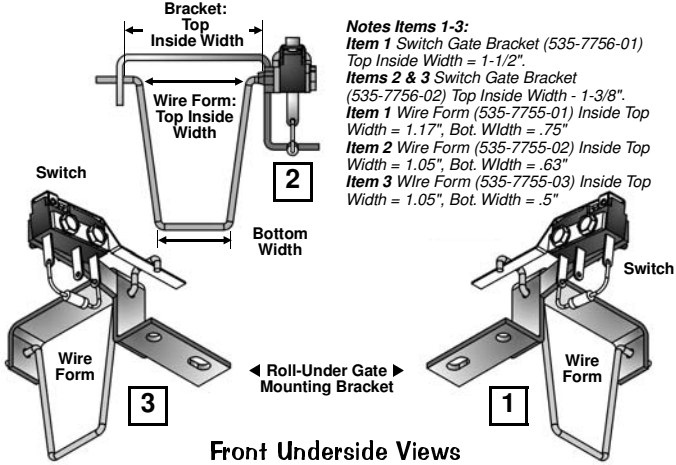


Nr.	ROLL-UNDER GATE PARTS	QTY.	SPI PART Nr.
1	Roll-Under Switch Gate <i>Individual Parts Only</i> : Switch (180-5087-00), Switch Gate Bracket (535-7756-01) and Wire Form on Bracket (535-7755-01) Switch Matrix Number 25	1	Ind. Parts Only
2	Roll-Under Switch Gate <i>Individual Parts Only</i> : Switch (180-5087-00), Switch Gate Bracket (535-7756-02) and Wire Form on Bracket (535-7755-02) Switch Matrix Number 18	1	Ind. Parts Only
3	Roll-Under Switch Gate <i>Individual Parts Only</i> : Switch (180-5087-00), Switch Gate Bracket (535-7756-02) and Wire Form on Bracket (535-7755-03) Switch Matrix Number 33	1	Ind. Parts Only
Items 1-3 are secured to Flat Rail by: #6-32 X 3/8" PPH (Qty. 2/per) (232-5201-00) and #6-32 Nylon Stop Nut (Qty. 2/per) (240-5005-00)			
4	Roll-Under Switch Gate <i>Individual Parts Only</i> : Switch (180-5010-01), Switch Gate Bracket (welded to Left Wire Ramp) and Wire Form on Bracket (535-9375-00) Switch Matrix Number 9	1	Ind. Parts Only
5	Roll-Under Switch Gate <i>Individual Parts Only</i> : Switch (180-5010-01), Switch Gate Bracket (welded to Right Wire Ramp) and Wire Form on Bracket (535-9375-01) Switch Matrix Number 29	1	Ind. Parts Only
Note Items 1-5 do differ! Look closely at the Switch, Bracket & Wire Form Part Numbers. Also, additional minor switch parts are noted at the bottom of this Parts Table.			



Note Item 12:
Spot Lights (545-5409-01), see Page 64, Item 9.
#555 Bulbs (165-5002-00), see Page 80, Item E1.
Laydown Sockets (077-5026-01), see Page 80, Item 1. Secured by #6-32 X 3/8" PPH Sems Screw (Qty. 1/per) (232-5200-00).

6	2-Way Ball Gate (Upper Left) <i>Individual Parts Only</i> : Ball Gate Mounting Bracket (535-9470-00), Ball Gate Flap (535-9471-00), Rebound Hinge (535-5372-04) and Wire Form (Qty. 1) (535-7721-02) ◀ note Wire Form for left gate differs	1	Ind. Parts Only
7	2-Way Ball Gate (Upper Right) <i>Individual Parts Only</i> : Ball Gate Mounting Bracket (535-9470-00), Ball Gate Flap (535-9471-00), Rebound Hinge (535-5372-04) and Wire Form (Qty. 1) (535-7721-03) ◀ note Wire Form for right gate differs	1	Ind. Parts Only
Items 6 & 7 are secured by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5101-00)			
8	Ball Gate Coil & Mntg. Bracket Asm. Item 8 opens and closes the 2-Way Ball Gates (Items 6 & 7). <i>Assembly Parts Included</i> : Coil Mounting Bracket (535-7727-01), Mini-Coil Assembly (515-6543-00) consists of : Mini-Coil 32-1800 (090-5031-00) & Coil Frame (535-6198-00), #8-32 X 3/8" PPH MS Ext Sems (Zinc) (232-5301-00) and Spring Extension (265-5045-01) Item 8 is secured below the P/F by: #8 X 1/2" SHWH AB (Zinc) (Qty. 2/per) (234-5101-00) Coil (Solenoid) Numbers Q5 & Q6	2	515-6544-01
9	1-Way Ball Gate Bracket (behind Safe) <i>Individual Parts Only</i> : Ball Gate Mounting Bracket (535-9555-00), Wire Form (535-9553-00), Steel Flap (535-9563-00) and Plastic (Clr.) -18 (ref. only) (Kit: 803-5000-85) Note: Individual Plastics (830-6033-18) are not available individually, ordering of kit is required. For all pieces, see P/F - Plastics (Screened & Clear) ... Page 69. Flap & Plastic secured onto bracket by: Rivet, 1/8" ø X 3/16" Long (Qty. 2) (249-5001-00) Item 9 is secured by: #6-32 X 3/8" PPH MS Ext. Sems (Zinc) (Qty. 1) (232-5201-00) and #6-32 Nylon Stop Nut (Qty. 1) (240-5005-00)	1	Ind. Parts Only
10	1-Way Ball Gate Bracket (Rt. Steel Ramp) <i>Individual Parts Only</i> : Ball Gate Mounting Bracket, Small (535-5269-03) and Wire Form (535-5307-03) Item 10 is secured to the Rt. Steep Ramp by: #6-32 X 3/14" PPH MS Sems (Zinc) (Qty. 2) (232-5200-00)	1	Ind. Parts Only
11	1-Way Ball Gate Bracket (Lt. Wire Ramp) <i>Individual Parts Only</i> : Ball Gate Mounting Bracket (welded to Left Wire Ramp) and Wire Form (535-9551-00)	1	Ind. Parts Only



Notes Items 1-3:
Item 1 Switch Gate Bracket (535-7756-01) Top Inside Width = 1-1/2".
Items 2 & 3 Switch Gate Bracket (535-7756-02) Top Inside Width - 1-3/8".
Item 1 Wire Form (535-7755-01) Inside Top Width = 1.17", Bot. Width = .75"
Item 2 Wire Form (535-7755-02) Inside Top Width = 1.05", Bot. Width = .63"
Item 3 Wire Form (535-7755-03) Inside Top Width = 1.05", Bot. Width = .5"

Front Underside Views

Take Note:

Legend Note:
Items noted with a white square are Roll-Under Gates, which includes gravity 1-way gates (without coil assist or switches), gates with switches and/or 2-way gates (open/close coil assisted).
Items noted with a blue square are Spinner Gate(s).

Nr.	SPINNER PARTS	QTY.	SPI PART Nr.
12	Spinner & Switch <i>Individual Parts Only</i> : Switch (1-1/4" Actuator) (180-5010-04), Spinner Mounting Bracket Modified (535-8684-85) and Spinner Target Sub-Assembly (515-7088-00) and Lexan Decals (reference only) (Kit: 802-5001-85) Note: Individual Lexan Decals (830-6359-01 & -02) are not available individually, ordering of kit is required. For all pieces, see P/F - Plastics (Screened & Clear) Kit, Decals & Mylar Kits, Page 69. (ASM. REF. 500-6421-85) (Identical to 500-6421-00 (with unmodified Bracket, 535-8684-00))	1	Ind. Parts Only
Item 12 is secured to Flat Rail by: #6 X 1/2" SHWH AB (Red) (Qty. 1) (234-5001-02) and #6-32 X 1/2" Sit. HWH Sw (Zinc) Wax (Qty. 1) (237-5976-03), 500-6421-00 Switch Matrix Number 27			

Switches on Items 1, 2, 3, 4, 5 & 12 above require :
Switch Body Protect Plate (Qty. 1/per) (535-6539-00), Diode 1N4004 (Qty. 1/per) (112-5003-00) and #2-56 X 1/2" Unslotted Serrated HWH #4 Head TR3 Black (Qty. 2/per) (237-5937-02)

Switches on Items 4 & 5 above require additional :
Plastic (Clear) Spacer -22 (Qty. 1/per between welded Ramp Bracket & Switch)

Note Items 4, 5, 6, 7, 8, 10 & 11: For better view(s), see **Drawings for Major Assemblies & Ramps (The Blue Pages)**, Section 4, Chapter 2, (Page 81), (view Table of Contents for exact page).

Playfield Top - Flat Rails , Wood Rails , Ball Guides & Wire Forms

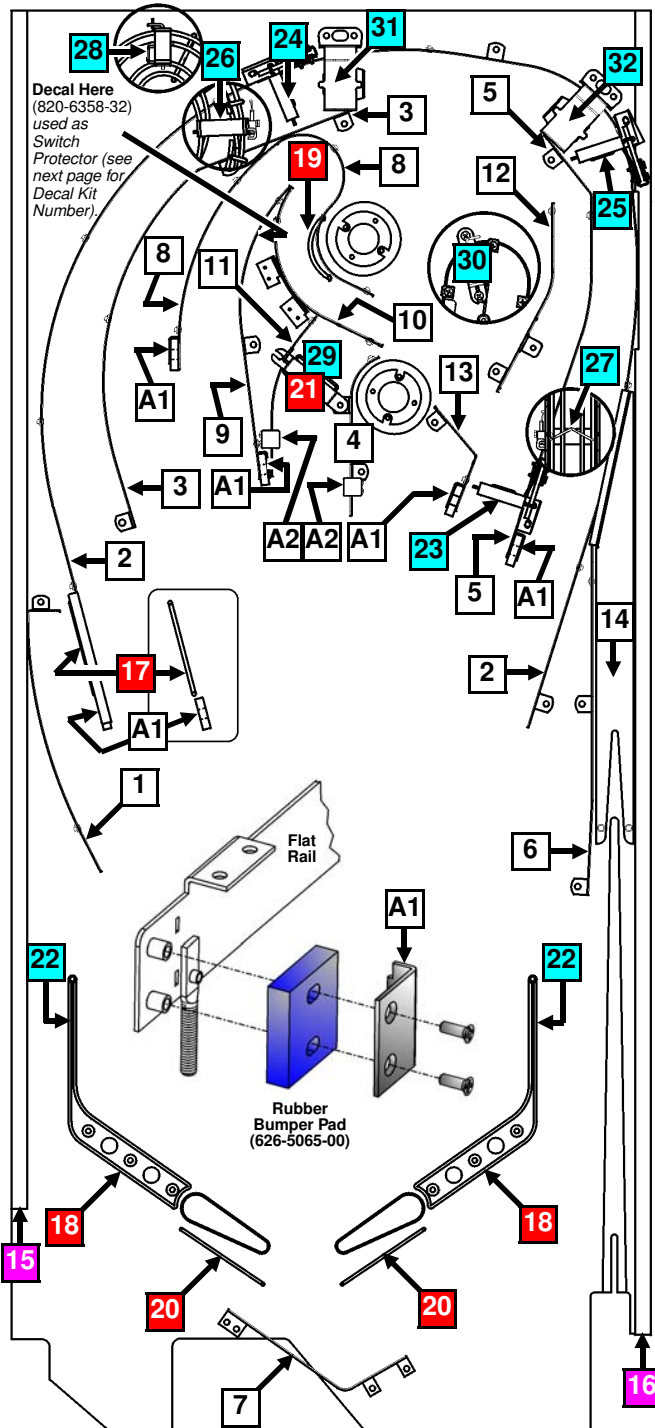
Nr.	FLAT RAILS (ABOVE)	QTY.	SPI PART Nr.
1	Flat Rail #1 (Fish Lane, Left Side)	1	535-9491-00
2	Flat Rail #2 (Full Orbit, Left to Right)	1	535-9493-00
A1	Bumper Holder Bracket	1	535-9533-00
Item A1 is secured to Flat Rail by: #4-40 X 5/16" PFH UC MS (Zinc) MC91099A160 (Qty. 2/per) (237-6151-00) Reference: Bumper Pad (Blue) 1.1" X 1" (626-5065-00)			
For Roll-Under Switch Gate Assemblies, see Playfield Top - Roll-Under Gates & Spinner , Items 2 & 3, Page 67.			
3	Flat Rail #3 (Left Orbit, Right Side)	1	535-9494-00
4	Flat Rail #4 (Safe Enter, Right Side)	1	535-9496-00
A2	Guide Block (White Nylon)	1	545-6130-00
Item A2 is secured Flat Rail by: #4-40 X 3/8" PPH TT Zinc Wax (Qty. 2/per) (237-5979-00)			
5	Flat Rail #5 (Right Ramp Enter, Right Side)	1	535-9532-00
A1	Bumper Holder Bracket	1	535-9533-00
Item A1 is secured to Flat Rail by: #4-40 X 5/16" PFH UC MS (Zinc) MC91099A160 (Qty. 2/per) (237-6151-00) Reference: Bumper Pad (Blue) 1.1" X 1" (626-5065-00)			
For Roll-Under Switch Gate Assembly, see Playfield Top - Roll-Under Gates & Spinner , Item 1, Page 67.			
6	Flat Rail #6 (Shooter Lane, Left Side)	1	535-9535-00
7	Flat Rail #7 (Bottom Arch Drain)	1	535-8393-00
8	Flat Rail #8 (Spinner Lane, Left Side)	1	535-9544-00
A1	Bumper Holder Bracket	1	535-9533-00
Item A1 is secured to Flat Rail by: #4-40 X 5/16" PFH UC MS (Zinc) MC91099A160 (Qty. 2/per) (237-6151-00) Reference: Bumper Pad (Blue) 1.1" X 1" (626-5065-00)			
9	Flat Rail #9 (Spinner Lane, Right Side)	1	535-9536-00
A1	Bumper Holder Bracket	1	535-9533-00
Item A1 is secured to Flat Rail by: #4-40 X 5/16" PFH UC MS (Zinc) MC91099A160 (Qty. 2/per) (237-6151-00) Reference: Bumper Pad (Blue) 1.1" X 1" (626-5065-00)			
10	Flat Rail #10 (Ball Lock Lane, Bottom)	1	535-9497-00
For Switches, see Playfield Top & Bottom - Switches (Above) & Switch (Below) , Item H-# (H-22 & H-23), Page 66.			
11	Flat Rail #11 (Safe Enter, Left Side)	1	535-9495-00
A2	Guide Block (White Nylon)	1	545-6130-00
Item A2 is secured Flat Rail by: #4-40 X 3/8" PPH TT Zc. Wax (Qty. 2/per) (237-5979-00)			
12	Flat Rail #12 (Rt. Ramp Enter, Left Side Top)	1	535-9498-00
13	Flat Rail #13 (Rt. Ramp Enter, Left Side Bot.)	1	535-9531-00
A1	Bumper Holder Bracket	1	535-9533-00
Item A1 is secured to Flat Rail by: #4-40 X 5/16" PFH UC MS (Zinc) MC91099A160 (Qty. 2/per) (237-6151-00) Reference: Bumper Pad (Blue) 1.1" X 1" (626-5065-00)			
Items 1-13 are secured at Tabs by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 1/per tab) (234-5101-00) and/or by: #8 Washer (Qty. 1/per) (242-5005-00) and #8-32 Nylon Stop Nut (Qty. 1/per) (240-5102-00)			
14	Flat Rail #14 (Shooter Lane Ramp)	1	535-8145-00
Item 14 is secured to the Playfield by: #4 x 1/2" PFH (Zinc) (Qty. 2) (237-5840-00)			

Nr.	WOOD RAILS (ABOVE)	QTY.	SPI PART Nr.
15	Wood Rail, 38" (Left Side)	1	525-5007-03
16	Wood Rail, 42" Notched (Right Side)	1	525-5641-00
Items 15-16 are secured by: #6 X 1-1/4" PFH A (Zinc) (15: Qty. 5 // 16: Qty. 6) (237-5804-00)			

Nr.	BALL GUIDES (ABOVE)	QTY.	SPI PART Nr.
17	Ball Guide, 3" X .12" ø (Fish Lane, Rt. Sd)	1	535-5356-04
18	Ball Guide, Plastic (Long, Clear)	2	550-5037-01
Item 18 is secured to the P/F by: #6-32 X 2" PPH MS (Zinc) (Qty. 4/per) (237-5513-00)			
19	B.G. (Snubber, Curved) (Ball Lock Lane)	1	535-9554-00
20	B.G. (Snubber), 3.125" (under Flippers)	2	535-5373-01
21	Ball Guide (Snubber), 2.125" X .17" ø	1	535-9562-00

Nr.	WIRE FORMS (ABOVE)	QTY.	SPI PART Nr.
22	Wire Form (on Item 18 Ball Guide)	1/per	535-5642-00
23	Wire Form (Flat Rail #5, Gate Sw. 25)	1	535-7755-01
24	Wire Form (Flat Rail #2, Gate Sw. 18, Left)	1	535-7755-02
25	Wire Form (Flat Rail #2, Gate Sw. 33, Right)	1	535-7755-03
26	Wire Form (Left Wire Ramp Gate Sw. 9)	1	535-9375-00
27	Wire Form (Right Wire Ramp Gate Sw. 29)	1	535-9375-01
28	Wire Form (1-Way Gate, Left Wire Ramp)	1	535-9551-00
29	Wire Form (1-Way Gate, inside Safe)	1	535-9553-00
30	Wire Form (1-Way Gate, on Rt. Steel Ramp)	1	535-5307-03
31	Wire Form (2-Way Ball Gate, Left)	1	535-7721-02
32	Wire Form (2-Way Ball Gate, Right)	1	535-7721-03

For Roll-Under Switch Gate Assemblies, see **Playfield Top - Roll-Under Gates & Spinner**, Items 1 - 3, Page 67.

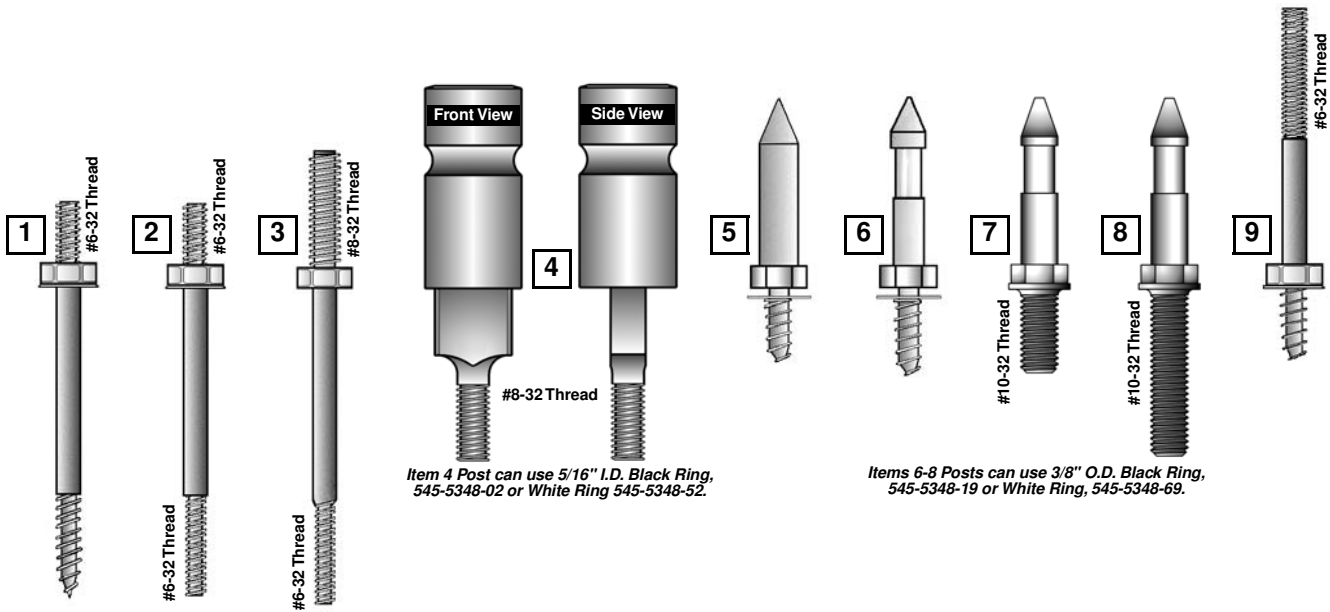


Take Note:

Legend Note:

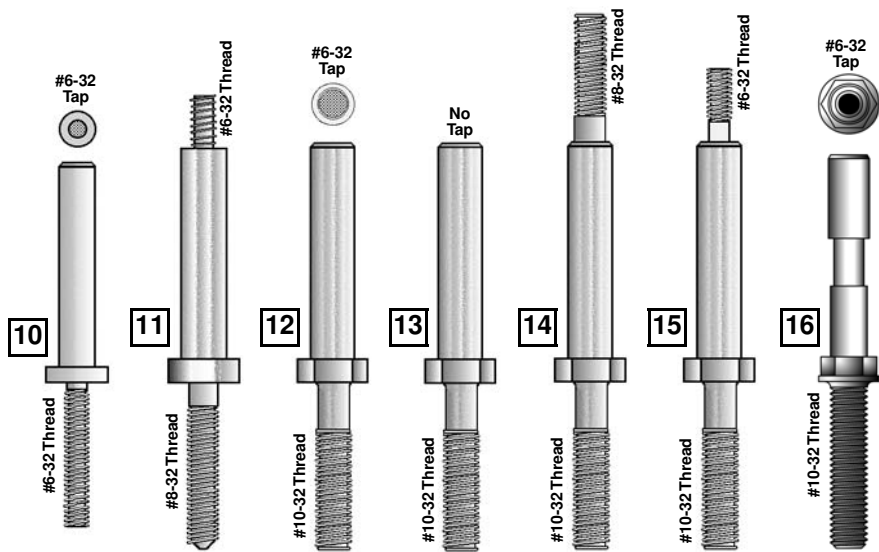
Items noted with a white square are Flat Rails.
 Items noted with a magenta square are Wood Rails.
 Items noted with a red square are Ball Guides (Snubber Wires)
 Items noted with a cyan square are Wire Forms.

Playfield Top & Bottom - Metal Posts & Fin Shank Screws (Actual Size) †



Item 4 Post can use 5/16" I.D. Black Ring, 545-5348-02 or White Ring 545-5348-52.

Items 6-8 Posts can use 3/8" O.D. Black Ring, 545-5348-19 or White Ring, 545-5348-69.

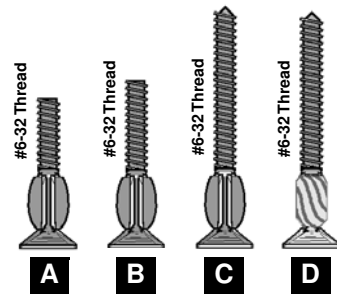


Items 11-15 Posts can use a Black Post Rubber Sleeve (Tall), 545-5308-00 or White Post Rubber Sleeve (Tall), 545-5308-08.

Take Note:

Legend Note:
 Items noted with a white square are Metal Posts.
 Items noted with a black square are Fin Shank Screws.

- A & B** *Items A & B Note:* Used to secure Hex Spacers onto the Playfield Wood.
- C** *Item C Note:* Quantity 4 on bottom Cabinet Speaker Grill (Qty. 4) (also requires #6-32 Nylon Stop Nut, 240-5005-00).
- D** *Item D Note:* Quantity 3/per on the Coil Bracket Welded Assembly (515-5939-00) in the Bumper Bottom Assembly (515-6459-04).
- A - D** *Items A-D Note:* The "Fins" keep the screw from turning inside the wood hole.



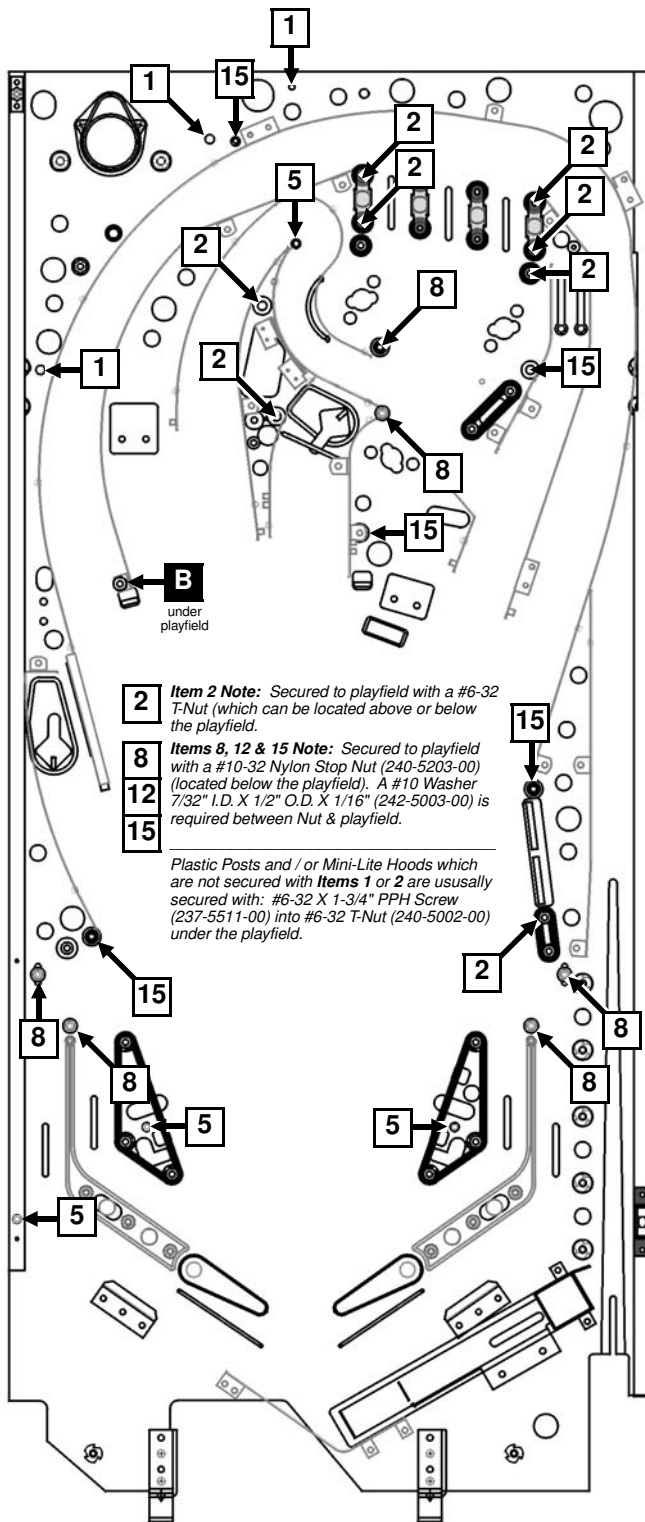
Sec. 4: Parts Id. ...

Nr.	METAL POSTS	QTY.	SPI PART Nr.	Nr.	METAL POSTS	QTY.	SPI PART Nr.
1	Post Fstn. #6-32 Top / Wood Scr. Bot.	3	530-5010-02	12	Post Hex Base #6-32 Tap/#10-32 Bot.	1	530-5332-01
2	Post Fasten #6-32 Top / #6-32 Bot.	8	530-5012-02	13	Post Hex Base (No Tap)#10-32 Bot.		530-5332-00
3	Post Fasten #8-32 Top / #6-32 Bot.		530-5008-00	14	Post Hex Base #8-32 Top/#10-32 Bot.		530-5332-02
4	Adjustable Sliding Post (Brass) #8-32 Bot.		530-5621-00	15	Post Hex Base #6-32 Top/#10-32 Bot.	4	530-5332-03
5	Mini-Post Wood Screw (no cut-away)	4	530-5004-01	16	Post Hex Base #6-32 Tap/#10-32 Bot.		530-5679-00
6	Mini-Post Wood Screw		530-5004-00				
7	Mini-Post MS / #10-32 Bot. .4" Thread		530-5005-01				
8	Mini-Post MS / #10-32 Bot. .875" Thread	5	530-5005-00				
9	Post #6-32 Top / Wood Screw Bottom		530-5263-01				
10	Post #6-32 Tap / #6-32 Bottom		530-5127-00				
11	Post Fasten #6-32 Top / #8-32 Bot.		530-5007-00				
				Nr.	FIN SHANK SCREWS	QTY.	SPI PART Nr.
				A	#6-32 X 3/4" Fin Shank Screw		237-5921-02
				B	#6-32 X 7/8" Fin Shank Screw	1	237-5921-04
				C	#6-32 X 1 1/4" Fin Shank Screw	4	237-5883-00
				D	#6-32 X 1 3/16" Spiral Fin Shank Screw	9	237-5957-00

† The item type (size / description), the quantity and/or location used, are subject to change without notice. Service Bulletins will announce any changes, if warranted.

Playfield Top & Bottom - Metal Posts & Fin Shank Screws Continued

† The item type (size / description), the quantity and/or location used, are subject to change without notice. Service Bulletins will announce any changes, if warranted.



Item 2 Note: Secured to playfield with a #6-32 T-Nut (which can be located above or below the playfield).

Items 8, 12 & 15 Note: Secured to playfield with a #10-32 Nylon Stop Nut (240-5203-00) (located below the playfield). A #10 Washer 7/32" I.D. X 1/2" O.D. X 1/16" (242-5003-00) is required between Nut & playfield.

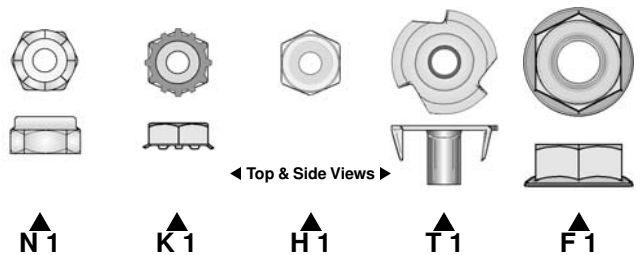
Plastic Posts and / or Mini-Lite Hoods which are not secured with **Items 1 or 2** are usually secured with: #6-32 X 1-3/4" PPH Screw (237-5511-00) into #6-32 T-Nut (240-5002-00) under the playfield.

Take Note:

Legend Note:

Items noted with a white square  are Metal Posts.
Items noted with a black square  are Fin Shank Screws.

Playfield Top & Bottom - Nylon Stop, KEPS, Hex, T-, Flange, Pal & Wing Nuts* (Actual Size) †



Nr.	NYLON STOP NUTS*	QTY.	SPI PART Nr.
N1	#6-32 Nylon Stop Nut	53	240-5005-00
N2	#6-32 N.S. Nut (with 1/4" Hex Body)		240-5010-00
N3	#8-32 Nylon Stop Nut	39	240-5102-00
N4	#10-32 Nylon Stop Nut	11	240-5203-00
N5	#10-24 Nylon Stop Nut	2	240-5206-00
<small>Item N5 used with #10-24 X 1-3/4" Carriage Bolt Square Neck Black (231-5022-00) located in the Cabinet for the Roto Lock (Male) (355-5006-01).</small>			
N6	#4-40 Nylon Stop Nut		240-5303-00
N7	#4-40 (18/8 Stainless) Nylon Stop Nut		240-5303-01
N8	5/16"-18 Nylon Stop Nut		240-5316-00

Nr.	KEPS NUTS*	QTY.	SPI PART Nr.
K1	#6-32 Keps Nut (with Star Washer)	6	240-5008-00
K2	#6-32 Keps Nut (with 1/4" Hex Body)		240-5011-00
K3	#8-32 Keps Nut		240-5104-00
K4	#10-32 Keps Nut		240-5208-00
K5	#10-24 Keps Nut	14	240-5207-00
K6	#4-40 Keps Nut		240-5318-00

Nr.	HEX NUTS*	QTY.	SPI PART Nr.
H1	#6-32 Hex Nut (No Star Washer)	4	240-5004-00
H2	#8-32 Hex Nut		240-5103-00
H3	#10-32 Hex Nut		240-5201-00
H4	#10-24 Hex Nut	2	240-5202-00
<small>Item H4 used with #10-24 X 1" Carriage Bolt Square Neck Black (231-5021-00) located in the Cabinet for the Side Armor Rear (towards Backbox).</small>			
H5	#10-32 X 3/8" Hex Nut		240-5209-00
H6	3/4"-16 Hex Nut		240-5315-00
H7	#2-56 Hex Nut	6	240-5301-00
H8	7/8"-14 Hex Nut		240-5317-00

Nr.	T-NUTS*	QTY.	SPI PART Nr.
T1	#6-32 T-Nut	40	240-5002-00
T2	#6-32 T-Nut (with Side Cut Off)		240-5002-01
T3	#8-32 T-Nut	14	240-5101-00
T4	#10-32 (Black Oxide) T-Nut		240-5007-00
T5	#10-32 T-Nut (with Side Cut Off)		240-5205-00
T6	#10-32 X 5/16" T-Nut		240-5204-00
T7	#10-24 T-Nut		240-5200-00

Nr.	FLANGE NUT*	QTY.	SPI PART Nr.
F1	1/4" X 20 Flange Nut	8	240-5300-00
<small>Item F1 used with 1/4"-20 X 1-1/4 Sq. Neck Carriage Bolt Black (231-5003-00) located in the Cabinet for the Slide Armor (Front) and Pivot Hinges.</small>			

Nr.	PAL NUTS*	QTY.	SPI PART Nr.
P1	Plastic Pal Nut (on Flipper Buttons)		240-5003-00
P2	Metal Pal Nut (on Flipper Buttons)	2	240-5003-01

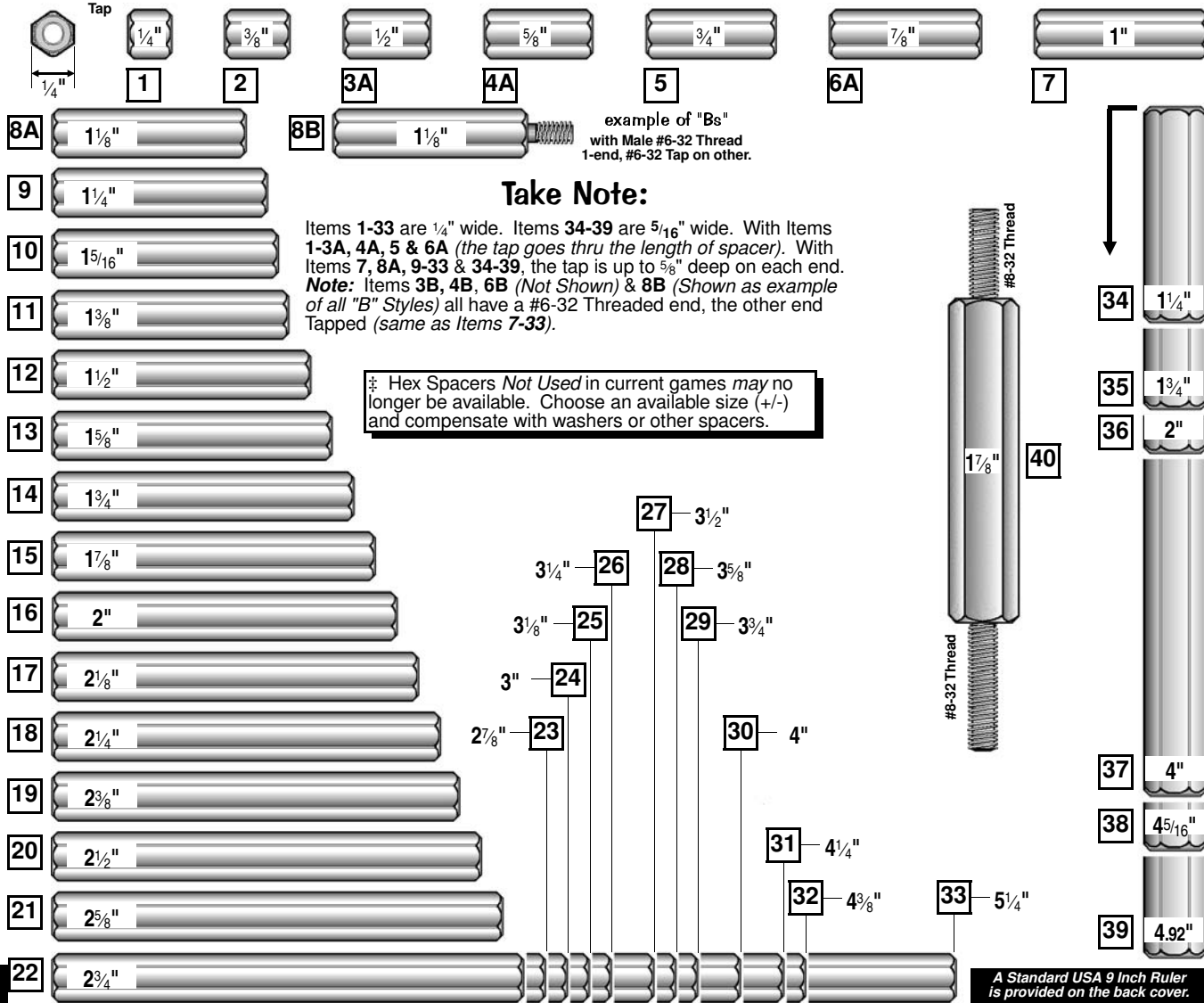
Nr.	WING NUTS*	QTY.	SPI PART Nr.
W1	#6-32 Wing Nut		240-5001-00
W2	#8-32 Wing Nut		240-5100-00
W3	#10-24 Wing Nut		240-5211-00
W4	1/4"-20 Wing Nut		240-5302-00
W5	1/4"-20 Toggle Wing		240-5324-00

* Not Shown: Items N2-N8, K2-K6, H2-H8, T2-T7, P1-P2 & W1-W5

Sec. 4: Parts Id. ...

Playfield Top - Hex Spacers (Actual Size) †

Hex Spacers:
#6-32
Tap



Take Note:

Items 1-33 are 1/4" wide. Items 34-39 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 & 34-39, 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) all have a #6-32 Threaded end, the other end Tapped (same as Items 7-33).

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

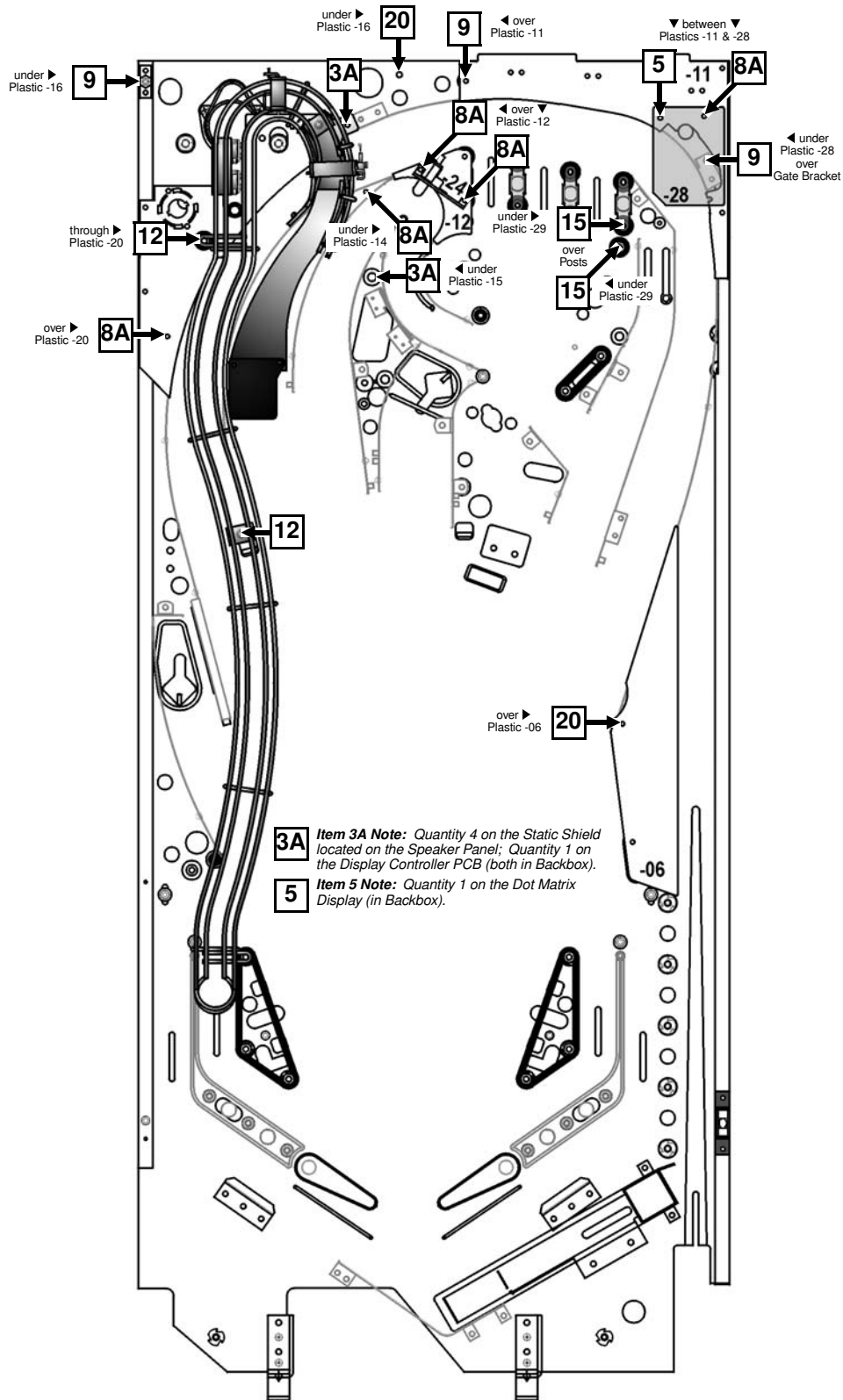
Sec. 4: Parts Id. ...

Nr.	HEX SPACERS	QTY.	SPI PART Nr.	Nr.	HEX SPACERS	QTY.	SPI PART Nr.
1	1/4" X 1/4" : #6-32 Tap (both ends)		254-5008-00	19	2 3/8" X 1/4" : #6-32 Tap (both ends)		254-5008-28
2	3/8" X 1/4" : #6-32 Tap (both ends)		254-5008-12	20	2 1/2" X 1/4" : #6-32 Tap (both ends)	2	254-5008-16
3A	1/2" X 1/4" : #6-32 Tap (both ends)	7	254-5008-03	21	2 5/8" X 1/4" : #6-32 Tap (both ends)		254-5008-08
3B*	Identical to 3A with #6-32 Thread end		254-5024-03	22	2 3/4" X 1/4" : #6-32 Tap (both ends)		254-5008-15
4A	5/8" X 1/4" : #6-32 Tap (both ends)		254-5008-02	23	2 7/8" X 1/4" : #6-32 Tap (both ends)		254-5008-31
4B*	Identical to 4A with #6-32 Thread end		254-5024-02	24	3" X 1/4" : #6-32 Tap (both ends)		254-5008-14
5	3/4" X 1/4" : #6-32 Tap (both ends)	2	254-5008-04	25	3 1/8" X 1/4" : #6-32 Tap (both ends)		254-5008-19
6A	7/8" X 1/4" : #6-32 Tap (both ends)		254-5008-05	26	3 1/4" X 1/4" : #6-32 Tap (both ends)		254-5008-26
6B*	Identical to 6A with #6-32 Thread end		254-5024-05	27	3 1/2" X 1/4" : #6-32 Tap (both ends)		254-5008-27
7	1" X 1/4" : #6-32 Tap (both ends)		254-5008-06	28	3 5/8" X 1/4" : #6-32 Tap (both ends)		254-5008-25
8A	1 1/8" X 1/4" : #6-32 Tap (both ends)	5	254-5008-17	29	3 3/4" X 1/4" : #6-32 Tap (both ends)		254-5008-36
8B	Identical to 8A with #6-32 Thread end		254-5024-17	30	4" X 1/4" : #6-32 Tap (both ends)		254-5008-21
9	1 1/4" X 1/4" : #6-32 Tap (both ends)	3	254-5008-11	31	4 1/4" X 1/4" : #6-32 Tap (both ends)		254-5008-30
10	1 5/16" X 1/4" : #6-32 Tap (both ends)		254-5008-34	32	4 3/8" X 1/4" : #6-32 Tap (both ends)		254-5008-29
11 ‡	1 3/8" X 1/4" : #6-32 Tap (both ends)		254-5008-33	33	5 1/4" X 1/4" : #6-32 Tap (both ends)		254-5008-35
12 ‡	1 1/2" X 1/4" : #6-32 Tap (both ends)	2	254-5008-09	34	1 1/4" X 5/16" : #6-32 Tap (both ends)		254-5018-09
13 ‡	1 5/8" X 1/4" : #6-32 Tap (both ends)		254-5008-13	35	1 3/4" X 5/16" : #6-32 Tap (both ends)		254-5018-06
14 ‡	1 3/4" X 1/4" : #6-32 Tap (both ends)		254-5008-10	36	2" X 5/16" : #6-32 Tap (both ends)		254-5018-07
15 ‡	1 7/8" X 1/4" : #6-32 Tap (both ends)	2	254-5008-20	37	4" X 5/16" : #6-32 Tap (both ends)		254-5018-03
16	2" X 1/4" : #6-32 Tap (both ends)		254-5008-07	38	4 5/16" X 5/16" : #6-32 Tap (both ends)		254-5018-00
17	2 1/8" X 1/4" : #6-32 Tap (both ends)		254-5008-32	39	4.92" X 5/16" : #6-32 Tap (both ends)		254-5018-04
18	2 1/4" X 1/4" : #6-32 Tap (both ends)		254-5008-18	40	1 7/8" X 3/8" : #8-32 Thread (both ends)		530-5285-00

† The item type (size / description), the quantity and/or location used, are subject to change without notice. Service Bulletins will announce any changes, if warranted.

Playfield Top - Hex Spacers Continued

The item type (size / description), the quantity and/or location used, are subject to change without notice. Service Bulletins will announce any changes, if warranted.



3A *Item 3A Note: Quantity 4 on the Static Shield located on the Speaker Panel; Quantity 1 on the Display Controller PCB (both in Backbox).*

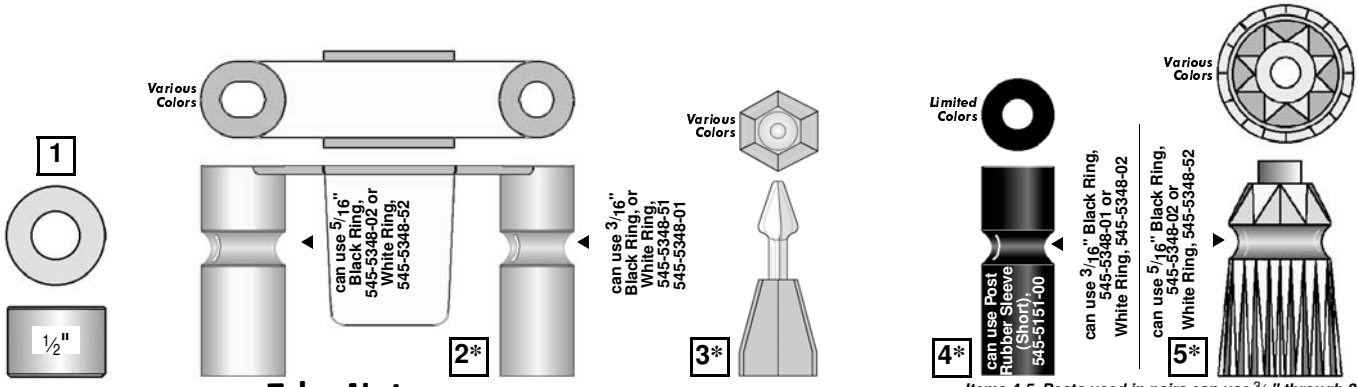
5 *Item 5 Note: Quantity 1 on the Dot Matrix Display (in Backbox).*

Take Note:

Legend Note:
Items noted with a white square are Hex Spacers.

Sec. 4: Parts Id. ...

Playfield Top - Plastic Posts & Spacers & Metal Spacers (Actual Size) †



Take Note:

PLASTIC PART COLOR CHART

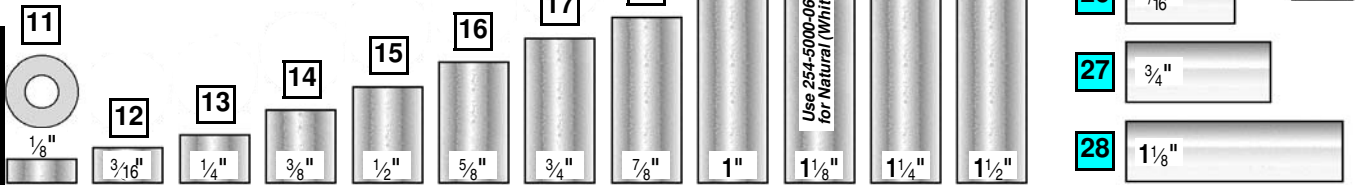
Nr.	Color	Nr.	Color	Nr.	Color
-00	Black	-06	Yellow	-12	Fluor. Blue
-01	Clear	-07	Orange	-13	Teal Green
-02	Red	-08	White	-14	Gray
-03	Amber	-09	Purple	-15	Luminescent
-04	Green	-10	Fluor. Orange	-16	Gold
-05	Blue	-11	Fluor. Green		

* Items 2 - 5 come in various colors (may not be available in every color). Item 4 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 6 through 9 dimensions are measured from bottom to just under the cut-away. Item 30 dimension is measured from top-to-top of curve. See pictorials with Items 9 & 30.

Take Note:

If any one of Items 11-23 Plastic 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 1/8" is needed but unavailable, order a 1/2" + 5/8" & stack to = 1 1/8").

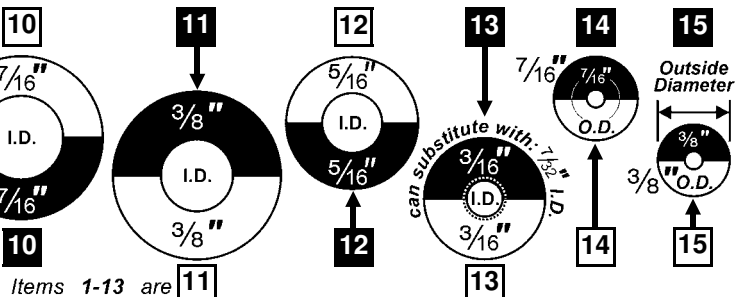
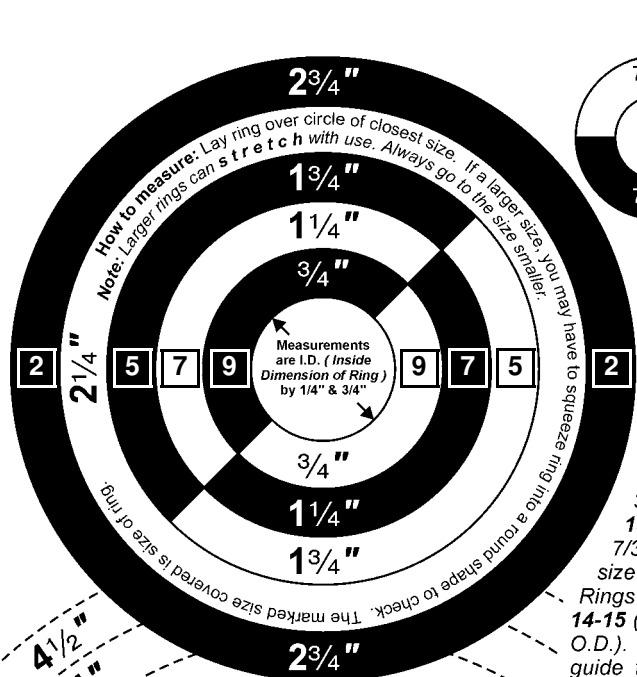


Nr.	PLASTIC POSTS & SPACERS	QTY.	SPI PART Nr.	Nr.	PLASTIC POSTS & SPACERS	QTY.	SPI PART Nr.
1	3/8" X 1/2" Metal Spacer		530-5099-00	14	3/8" X 3/8" Plastic Spacer Gray	2	254-5000-12
2**	Top Lane Plastic Mini-Lite Hood (Red)	4	550-5061-02	15	1/2" X 3/8" Plastic Spacer Gray	2	254-5000-01
Item 2 typically 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), if used.				16	5/8" X 3/8" Plastic Spacer Gray	3	254-5000-14
3**	Mini-Jewel Plastic Post (Clear)	2	550-5052-01	17	3/4" X 3/8" Plastic Spacer Gray	11	254-5000-07
Item 3 typically secured by: #6 X 3/8" HWH AB (Zinc) (Qty. 1/per) (234-5000-00)				18	7/8" X 3/8" Plastic Spacer Gray		254-5000-11
4**	1 1/16" 1-Groove Plastic Post (Black)		550-5059-00	19	1" X 3/8" Plastic Spacer Gray or Black	1	254-5000-04
	1 1/16" 1-Groove Plastic Post (Clear)	21	550-5059-01	20	1 1/8" X 3/8" Plastic Spacer Gray		254-5000-06
5**	1-Groove Jewel Plastic Post (Clear)	1	550-5034-01		1 1/8" X 3/8" Plastic Spacer Natural		254-5000-06N
Items 4 & 5 typically secured by: Post Fastening Screw #6-32 Top / #6-32 Bottom (Qty. 1/per) (530-5012-02, Item 6 Page 69).				21	1 1/4" X 3/8" Plastic Spacer Gray		254-5000-05
6 †	1/4" Slf. Rtn. Plastic Spacer White		254-5007-02	22	1 1/2" X 3/8" Plastic Spacer Gray	3	254-5000-08
7 †	3/8" Slf. Rtn. Plastic Spacer White		254-5007-01	23	1 5/16" X 3/8" Plastic Spacer Gray		254-5000-15
8 †	5/8" Slf. Rtn. Plastic Spacer White		254-5007-00	24	1/4" X 5/16" X .144" I.D. Metal Spacer		254-5014-03
9 †	3/4" Slf. Rtn. Plastic Spacer White		254-5007-03	25	1/2" X 5/16" X .144" I.D. Metal Spacer	3	254-5014-00
10	1/2" X 1/4" Plastic Spacer White (Narrow)		254-5000-03	26	9/16" X 5/16" X .144" I.D. Metal Spacer		254-5014-04
11	1/8" X 3/8" Plastic Spacer Gray		254-5000-19	27	3/4" X 5/16" X .144" I.D. Metal Spacer		254-5014-01
12	3/16" X 3/8" Plastic Spacer Gray	6	254-5000-18	28	1 1/8" X 5/16" X .144" I.D. Metal Spacer		254-5014-02
13	1/4" X 3/8" Plastic Spacer Gray	2	254-5000-02	29	1" X 5/16" X .144" I.D. Metal Spacer		254-5001-00
				30 †	7/8" Plastic Spacer Support (Dual-Locking)		254-5039-14

Sec. 4: Parts Id. ...

† The item type (size / description), the quantity and/or location used, are subject to change without notice. Service Bulletins will announce any changes, if warranted.

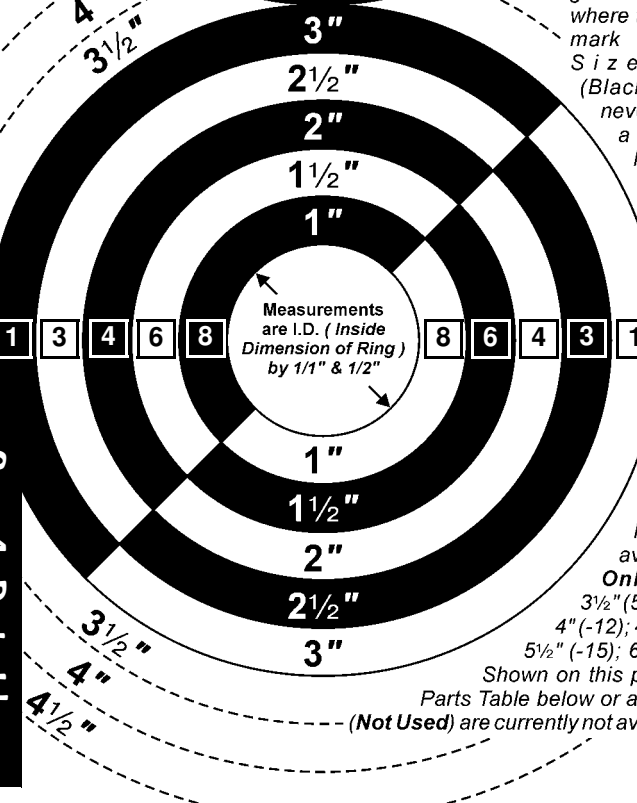
P/F Top & Bot. - Rubber Parts Black ■, White □ & Blue ■ (Rings Actual Size) †



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.

Nr.	RUBBER RINGS	QTY.	SPI PART Nr.
1	3" I.D. Rubber Ring BLACK		545-5348-10
	3" I.D. Rubber Ring WHITE		545-5348-60
2	2 3/4" I.D. Rubber Ring BLK		545-5348-20
	2 3/4" I.D. Rubber Ring WHT	N/U	545-5348-70
3	2 1/2" I.D. Rubber Ring BLK	2	545-5348-09
	2 1/2" I.D. Rubber Ring WHT		545-5348-59
4	2" I.D. Rubber Ring BLACK		545-5348-08
	2" I.D. Rubber Ring WHITE		545-5348-58
5	1 3/4" I.D. Rubber Ring BLK		545-5348-21
	1 3/4" I.D. Rubber Ring WHT	N/U	545-5348-71
6	1 1/2" I.D. Rubber Ring BLK		545-5348-07
	1 1/2" I.D. Rubber Ring WHT		545-5348-57
7	1 1/4" I.D. Rubber Ring BLK		545-5348-06
	1 1/4" I.D. Rubber Ring WHT		545-5348-56
8	1" I.D. Rubber Ring BLACK	2	545-5348-05
	1" I.D. Rubber Ring WHITE		545-5348-55
9	3/4" I.D. Rubber Ring BLACK	1	545-5348-04
	3/4" I.D. Rubber Ring WHITE		545-5348-54
10	7/16" I.D. Rubber Ring BLK		545-5348-18
	7/16" I.D. Rubber Ring WHT		545-5348-68
11	3/8" I.D. Rubber Ring BLACK		545-5348-03
	3/8" I.D. Rubber Ring WHITE	N/U	545-5348-53
12	5/16" I.D. Rubber Ring BLK	5	545-5348-02
	5/16" I.D. Rubber Ring WHT		545-5348-52
13	3/16" I.D. Rubber Ring BLK	7	545-5348-01
	3/16" I.D. Rubber Ring WHT		545-5348-51
14	7/16" O.D. Rubber Ring BLK	49	545-5348-17
	7/16" O.D. Rubber Ring WHT		545-5348-67
15	3/8" O.D. Rubber Ring BLK		545-5348-19
	3/8" O.D. Rubber Ring WHT	1	545-5348-69
16	Small Flipper BLACK Ring (Soft Duro)		545-5207-00
	Small Flipper RED Ring (Soft Duro)		545-5207-22
	Large Flipper BLACK Ring (50 Duro)	2	545-5277-00
	Large Flipper YELLOW Ring (50 Duro) (use -06 40 Duro)		545-5277-04
17	Large Flipper WHITE Ring (50 Duro)		545-5277-08
	Large Flipper RED Ring (Soft Duro)		545-5277-22
18	O-Ring 11/32" I.D. X 7/32" O.D. X 1/16"	2	545-5850-00

Note: Item 14, 7/16" O.D. Black Rings (Qty. 44 of 49) are used to cushion the Bayonet Sockets under the playfield (between bracket & playfield).



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.

Nr.	RUBBER BUMPER PADS	QTY.	SPI PART Nr.
A*	Bumper BLK Pad (Lg. w/ grommet)	2	545-5428-00
Item B are located on Flipper Assemblies. See next page for location.			
B*	Bumper BLK Pad (Sm. w/ grommet)	4	545-5105-00
Item B are located on multiple assemblies. See next page for location.			
C*	Bumper BLUE Pad (1.1" X 1")	5	626-5065-00

Nr.	RBR. BUMPER POST SLVS.	QTY.	SPI PART Nr.
D*	Bumper RED Post Sleeve (Tall)		545-5308-22
	Bumper BLACK Post Sleeve (Tall)	3	545-5308-00
	Bumper WHITE Post Sleeve (Tall)		545-5308-08
E*	Bumper Post Sleeve (Short)		545-5151-00

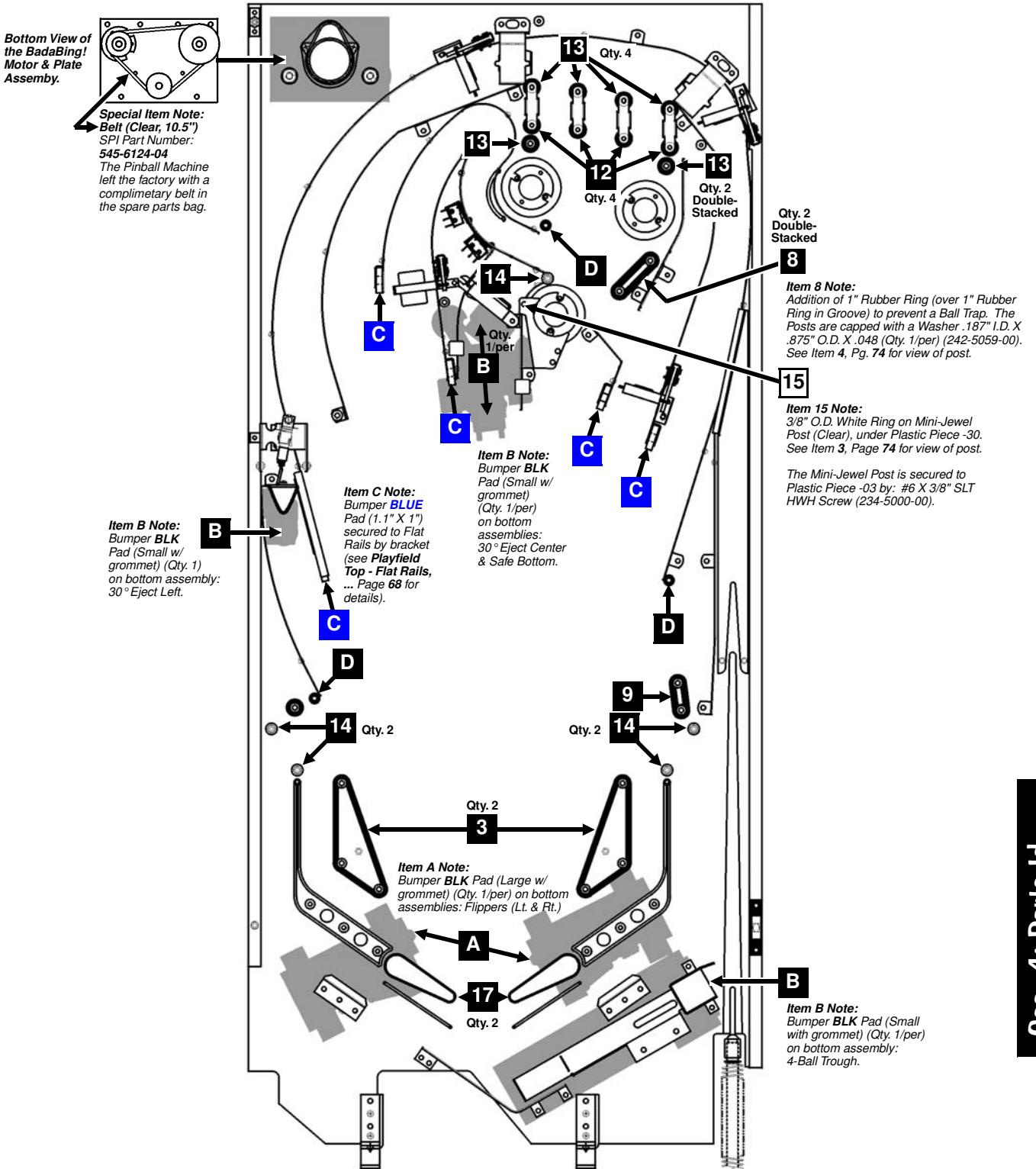
Take Note:

* An asterisk (*) indicates view of item on the Assembly Drawing only (for location see next page). For better view(s), see Drawings for Major Assemblies... (The Blue Pages), Section 4, Chapter 2, (Page 81), (view Table of Contents for exact page).

Legend Note:
 Items noted with a black square ■ are Black Rubber Parts.
 Items noted with a white square □ are White Rubber Parts.
 Items noted with a blue square ■ are Blue Rubber Parts.

† The item type (size / description), the quantity and/or location used, are subject to change without notice. Service Bulletins will announce any changes, if warranted.

The item type (size / description), the quantity and/or location used, are subject to change without notice. Service Bulletins will announce any changes, if warranted.

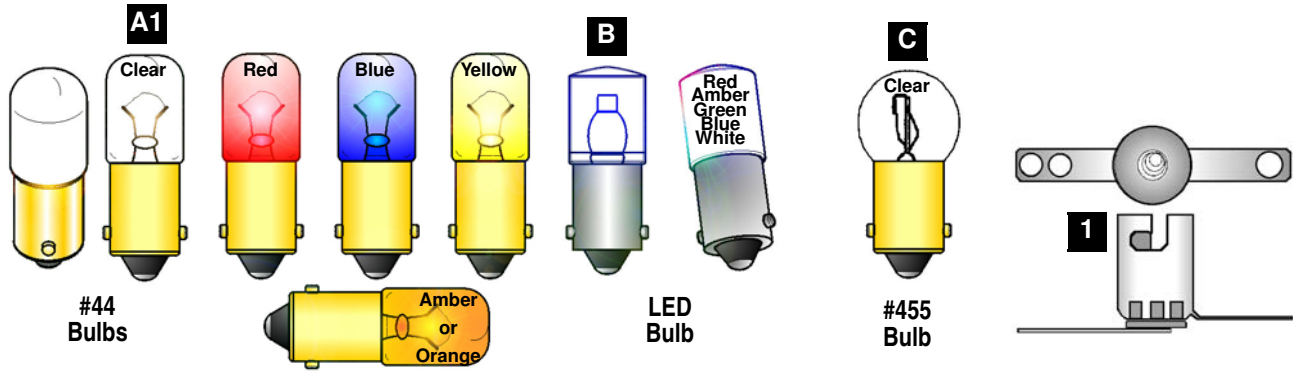


Take Note:

Legend Note:
 Items noted with a black square ■ are Black Rubber Parts.
 Items noted with a white square □ are White Rubber Parts.
 Items noted with a blue square ■ are Blue Rubber Parts.

Sec. 4: Parts Id. ...

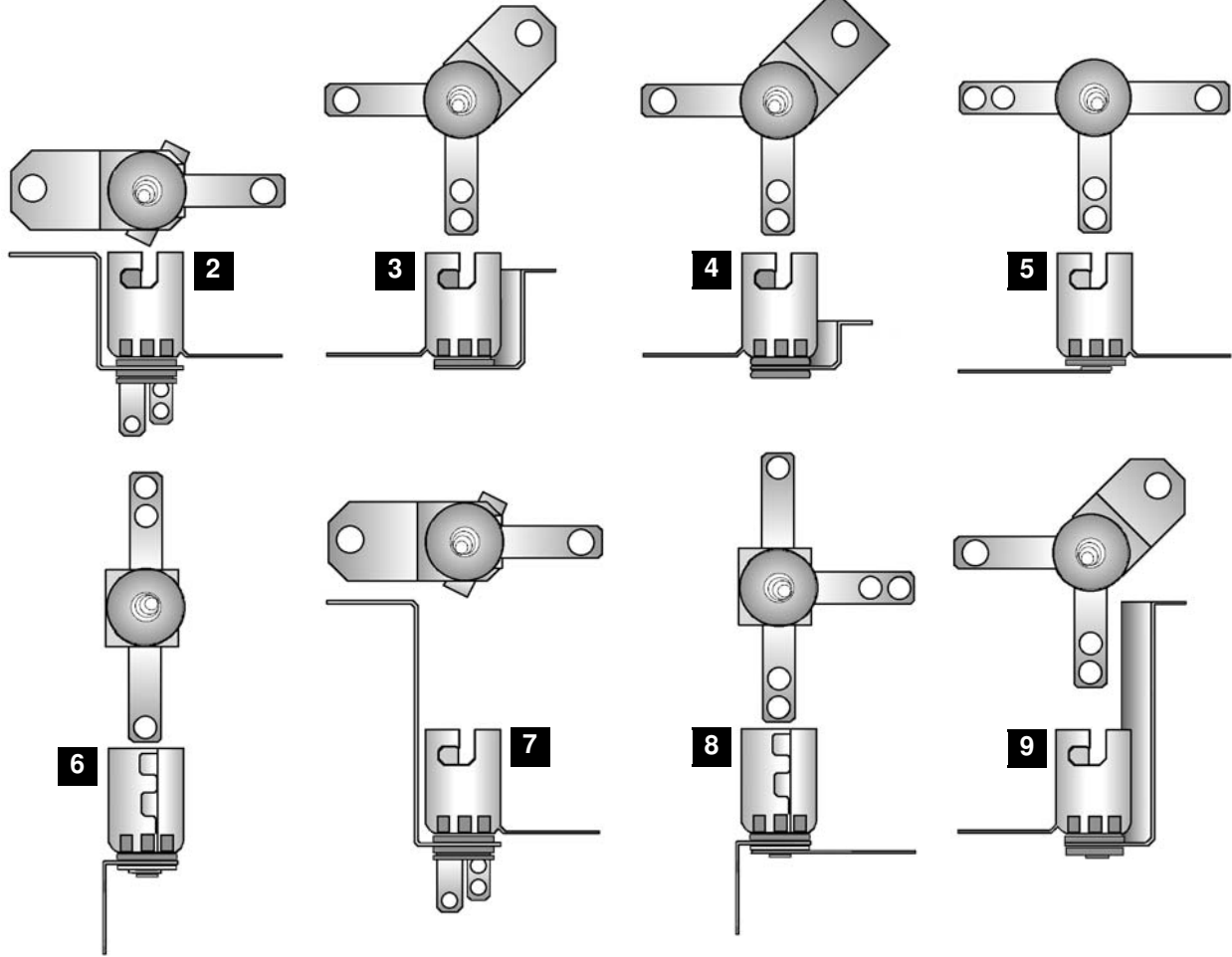
Playfield Top & Bottom - Small Bayonet Sockets & Bulbs ■ (Actual Size) †



#44 Bulbs

LED Bulb

#455 Bulb



Sec. 4: Parts Id. ...

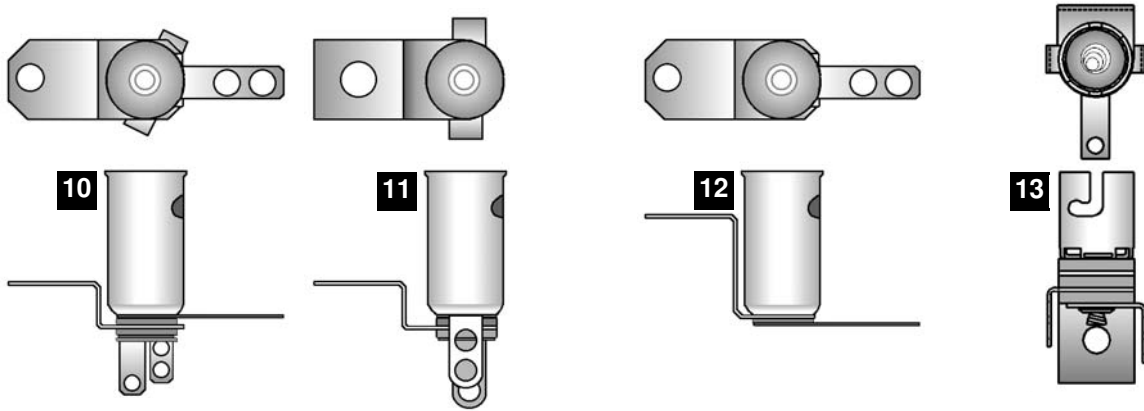
† The item type (size / description), the quantity and/or location used, are subject to change without notice. Service Bulletins will announce any changes, if warranted.

Nr.	BULBS (#44, LED & #455)	QTY.	SPI PART Nr.	Nr.	BULBS (#44, LED & #455)	QTY.	SPI PART Nr.
A	#44 Bulb (Clear) Heavy Filament	62	165-5000-44-HF	B	LED Module (White) (12.8v 20-25mA)	2	112-5023-08
	#44 Bulb (Yellow)	4	165-5053-06	<i>Item B Note: Different Colors available (not used in this game) ~</i>			
	<i>Item A Note: Different Colors available (not used in this game) ~</i>			C	#455 Twinkle Bulb		165-5003-00
	Red (165-5053-02); Amber (165-5053-03); Blue (165-5053-05); Orange (165-5053-07)				Red (112-5023-02); Amber (112-5023-03); Green (112-5023-04); Blue (112-5023-05);		

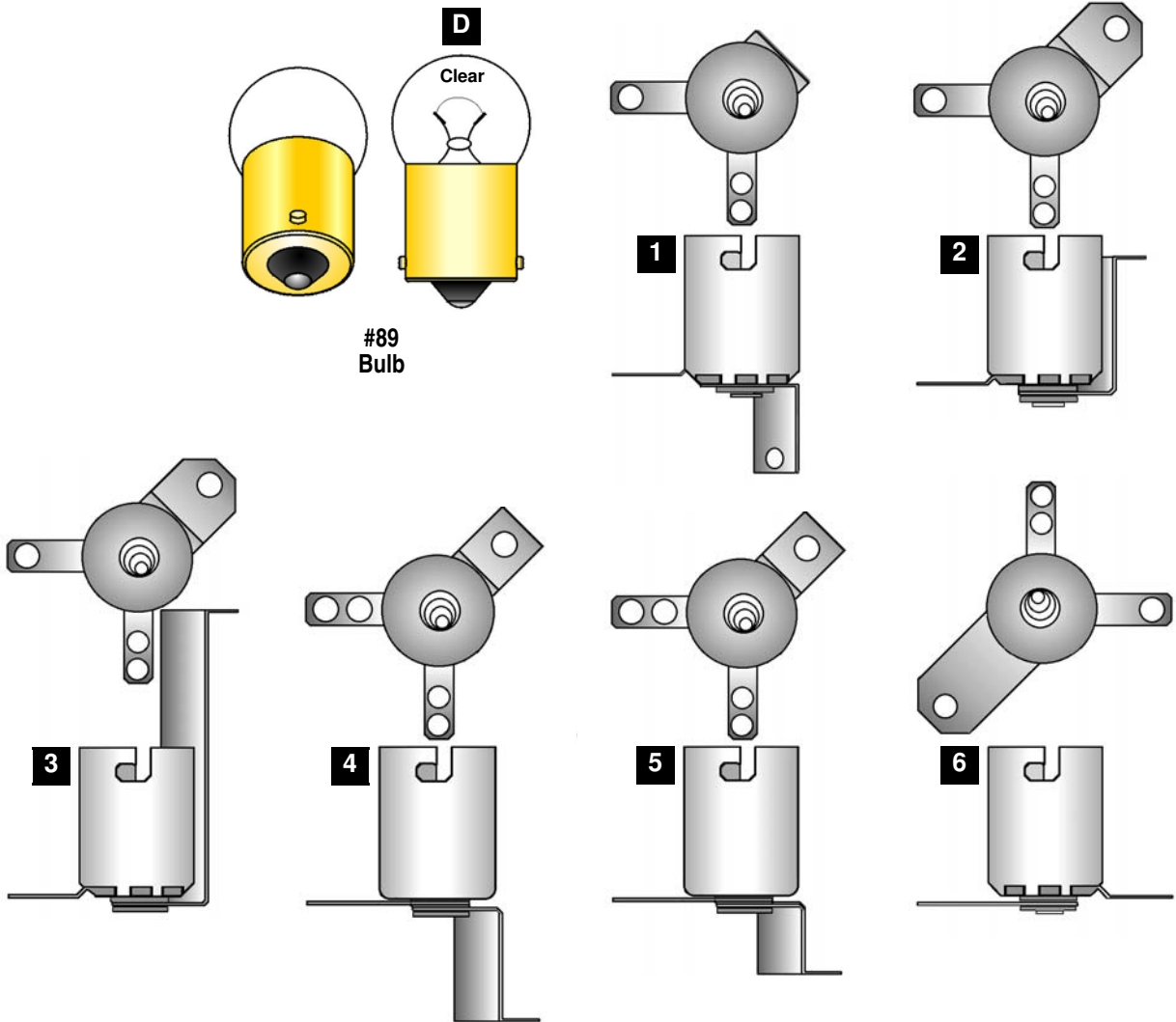
Nr.	SMALL BAYONET SOCKETS	QTY.	SPI PART Nr.	Nr.	SMALL BAYONET SOCKETS	QTY.	SPI PART Nr.
1	2-Lug Staple Down Socket	14	077-5000-00	8	3-Lug Laydown Socket (3 Lugs Flat)		077-5006-00
2	3-Lug Stand-Up Socket (Med. Brkt.)		077-5008-00	9	2-Lug Stand-Up Socket (Tall Bracket)		077-5005-00
3	2-Lug Stand-Up Socket (Med. Brkt.)		077-5002-00	10	3-Lug Stand-Up Long Shell Socket		077-5013-00
4	2-Lug Stand-Up Sckt. (Short Bracket)	19	077-5002-31	11	2-Lug Stand-Up Lg. Shell Socket (Gls)	9	077-5031-00
5	3-Lug Staple Down Socket		077-5001-00	12	1-Lug S-U Lg. Shell Sckt. (Med. Brkt.)		077-5012-00
6	2-Lug Laydown Socket	1	077-5003-00	13	3-Lug Laydown Socket (2 Lugs Bent)	13	077-5032-00
7	3-Lug Stand-Up Socket (Tall Bracket)	8	077-5009-00				

Playfield Top & Bot. - Small Bayonet Sockets & Bulbs ■ (Actual Size) † Continued

† The item type (size / description), the quantity and/or location used, are subject to change without notice. Service Bulletins will announce any changes, if warranted.



Playfield Bottom - Large Bayonet Sockets & Bulbs ■ (Actual Size) †

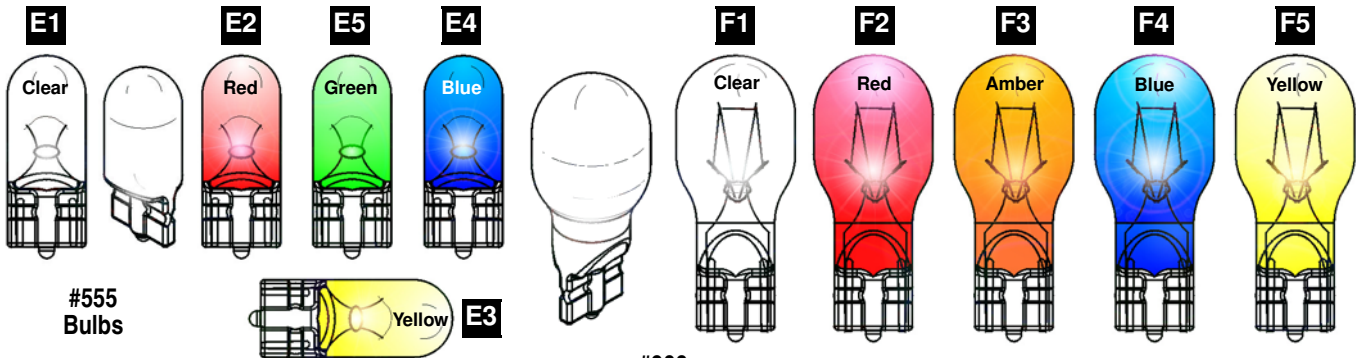


Nr.	BULB (#89)	QTY.	SPI PART Nr.
D	#89 Bulb Heavy Filament	8	165-5000-89-HF

Nr.	LARGE BAYONET SOCKETS	QTY.	SPI PART Nr.	Nr.	LARGE BAYONET SOCKETS	QTY.	SPI PART Nr.
1	2-Lug Laydown Standard Socket	4	077-5100-00	4	2-Lug Stand-Up Rev. Mount Socket		077-5103-00
2	2-Lug Stand-Up Short Socket	4	077-5101-00	5	2-Lug Stand-Up Rv. Mnt. Short Socket		077-5106-00
3	2-Lug Stand-Up Long Socket		077-5102-00	6	2-Lug Straight Leg Socket		077-5107-00

Sec. 4: Parts Id. ...

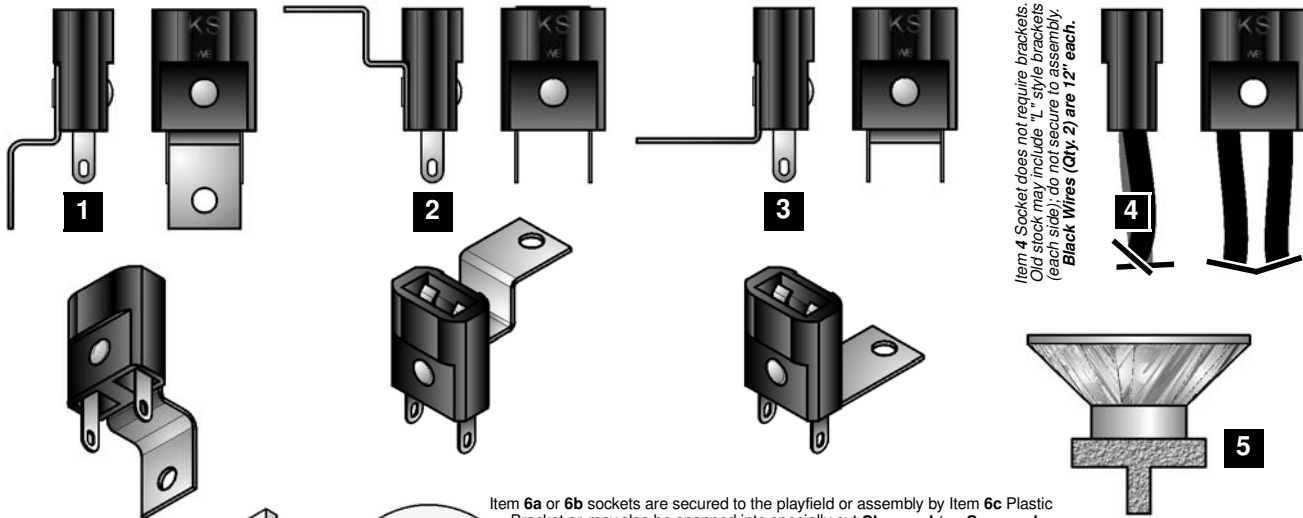
Playfield Top & Bottom - Wedge Base Sockets & Bulbs (Actual Size) †



#555 Bulbs

#906 Bulbs

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



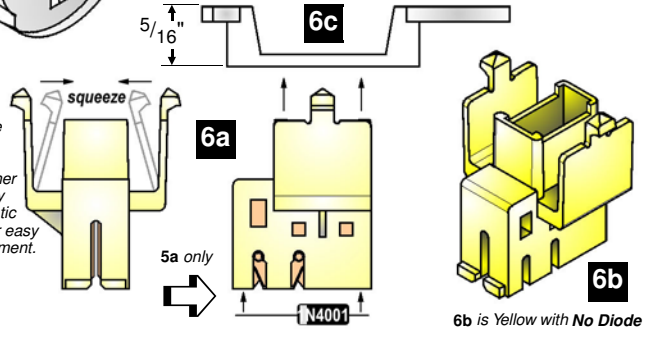
Item 4 Socket does not require brackets. Old stock may include "L" style brackets (each side); do not secure to assembly. Black Wires (Qty. 2) are 12" each.

Item 6a or 6b sockets are secured to the playfield or assembly by Item 6c Plastic Bracket or may also be snapped into specially cut Clear and / or Screened Plastic Pieces (used only when sockets are positioned closely together or when used on plastics under Mini-Mars Light Covers. If Plastic Pieces are used to mount some 6a or 6b Sockets, it will be noted on Playfield Top - Plastics (Screened & Clear) Kit, ..., Page 69.

Item 6a is a solderless IDC (Insulation Displacement Connection) Socket with a built-in Diode, 1N4003 (112-5003-00) (can be replaced with 1N4001 Diode, 112-5001-00). Item 6b Socket (Yellow) is identical to 6a (Socket) except it does NOT REQUIRE a diode (Flash Lamp usage).

Sec. 4: Parts Id. ...

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



6b is Yellow with No Diode

Nr.	BULBS (#555 & #906)	QTY.	SPI PART Nr.
E	#555 Wedge Base Bulb (Clear)	54	165-5002-00
	#555 Wedge Base Bulb (Yellow)	5	165-5054-06

Item E Note: Different Colors available (not used in this game) ~ Red (165-5054-02); Green (165-5054-04); Blue (165-5054-05);

Nr.	BULBS (#555 & #906)	QTY.	SPI PART Nr.
F	#906 Wedge Base Bulb (Clear)	6	165-5004-00

Item F Note: Different Colors available (not used in this game) ~ Red (165-5004-02); Amber (165-5004-03); Blue (165-5004-05); Yellow (165-5004-06)

Nr.	WEDGE BASE SOCKETS	QTY.	SPI PART Nr.
1	Wedge Base Socket (Laydown)	3	077-5026-01
2	Wedge Base Socket (Offset)	5	077-5029-00
3	Wedge Base Socket (Laydown GI)	2	077-5030-00
4	W.B. Socket (Bumpers/Special App.)	2	077-5206-00
5	Light Reflector (Silver Plastic)	3	545-5409-01

Note Item 5: Typically used with Item 1 (but will fit on any similar Wedge Base Socket).

Nr.	WEDGE BASE SOCKETS	QTY.	SPI PART Nr.
6a	IDC Snap-On Socket (Biege)	51	077-5216-00
6b	IDC Snap-On Socket No Diode (Yel.)	3	077-5216-01
6c	5/16" Ht. Bracket (White)	51	545-5760-18
7	#555 only Wedge Base Socket (Twist)		077-5007-00
8	#906 only Wedge Base Socket (Twist)		077-5016-00

† The item type (size / description), the quantity and/or location used, are subject to change without notice. Service Bulletins will announce any changes, if warranted.

Drawings for Major Assemblies & Ramps (The Blue Pages)

View **Parts Id. & Location**
(for parts not described in this chapter)
in Section 4, Chapter 1 of 2
(**Pink Pages**), Pages 59-80.

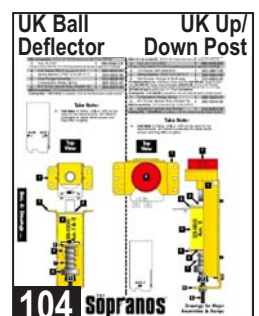
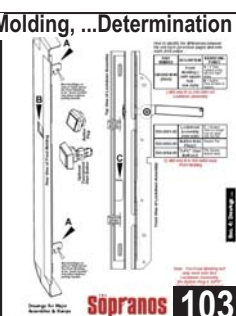
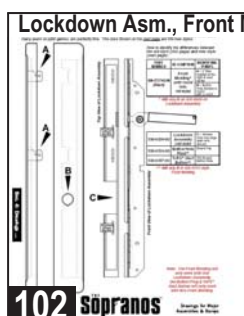
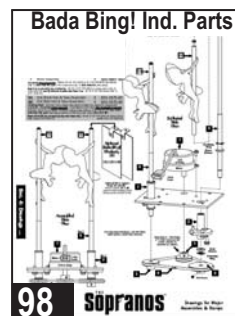
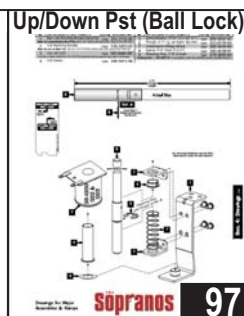
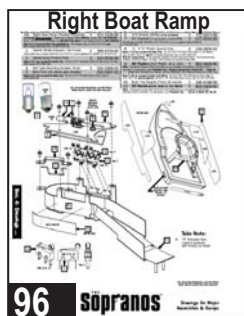
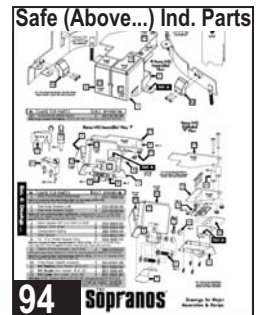
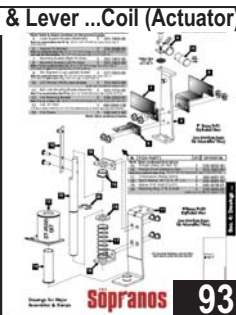
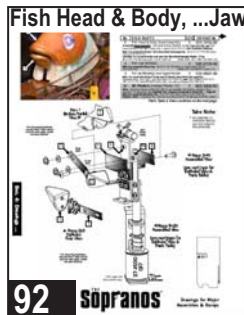
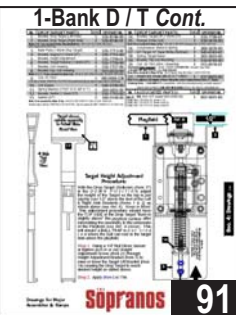
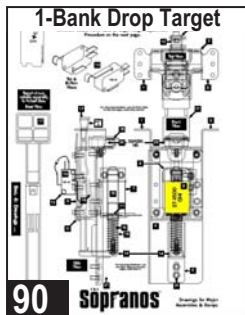
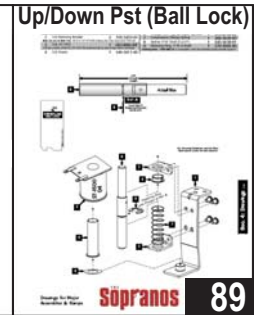
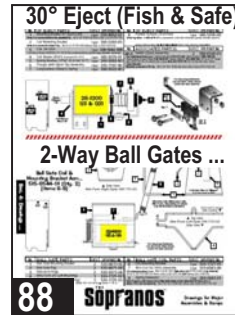
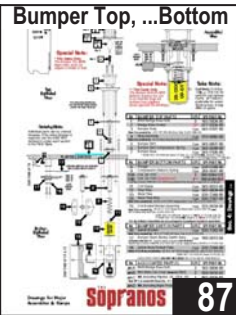
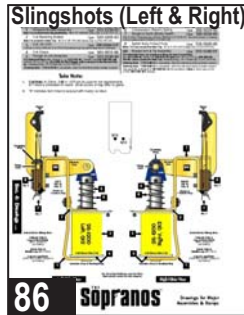


Table of Contents & Overview

Drawings are provided for the Major Assemblies in this game with individual parts of each assembly numbered. All numbered parts describe the **NAME, QUANTITY & PART NR. & ASSOCIATED PARTS (AP-)**.

Legend Note:

Items noted with a white square are parts mounted above the playfield. Items noted with a black square are parts mounted below. Items noted with a cyan square are parts mount in or on the cabinet.

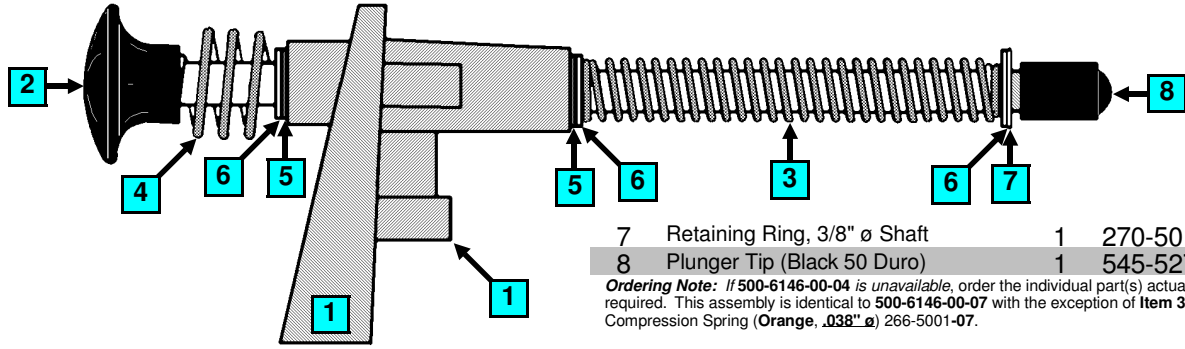


Important: Read all "Take Note: " items

Sec. 4: Drawings ...

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

Nr.	BALL SHOOTER PARTS	QTY.	SPI PART Nr.	Nr.	BALL SHOOTER PARTS	QTY.	SPI PART Nr.
1	Housing (Shooter Assembly)	1	535-5067-02	3	Comp. Spring (GREEN, .035" ø)	1	266-5001-04
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) (244-5003-00) and #6 X 5/8" SHWH AB (Zinc) (Qty. 2) (234-5002-00)				4	Compression Spring (Short Plunger)	1	266-5010-00
2	Rod Assembly (w/Black Knob)	1	515-6557-00	5	Bushing, 3/8" I.D. (Oilite)	2	280-5010-00
				6	Washer, 3/8" I.D. X 5/8" O.D. X 1/16"	3	242-5014-00



7	Retaining Ring, 3/8" ø Shaft	1	270-5012-00
8	Plunger Tip (Black 50 Duro)	1	545-5276-00

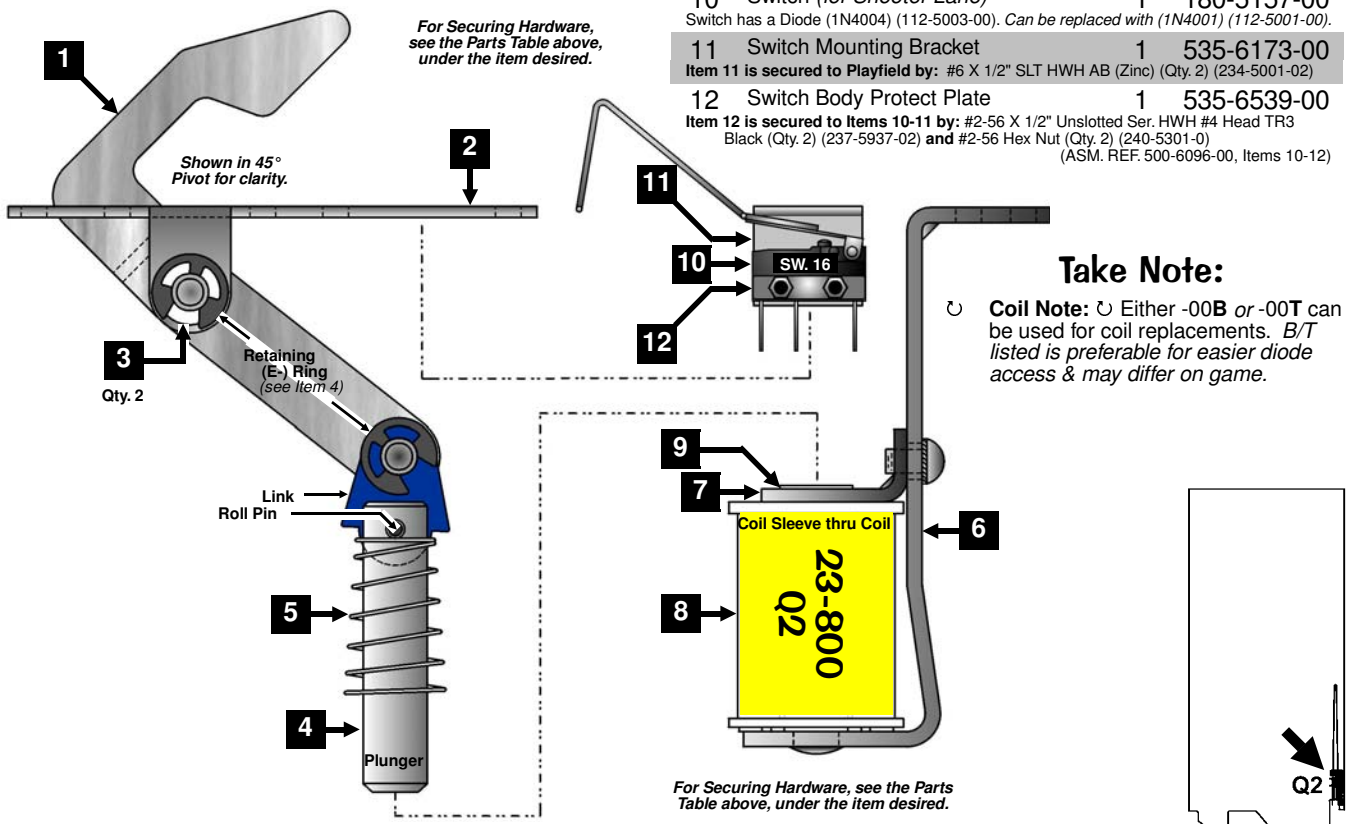
Ordering Note: If 500-6146-00-04 is unavailable, order the individual part(s) actually required. This assembly is identical to 500-6146-00-07 with the exception of item 3, Compression Spring (Orange, .038" ø) 266-5001-07.

Autoplunger Arm Weld Assembly, 500-6091-00 (Items 1-5) and Autoplunger Coil Assembly, 500-6092-03B (Items 6-9) Shooter Lane Switch Assembly, 500-6096-00 (Items 10-12)

Nr.	AUTOPL. ARM WELD PARTS	QTY.	SPI PART Nr.	Nr.	AUTOPLNGR. COIL PARTS	QTY.	SPI PART Nr.
1	Arm Weld Assembly	1	515-6526-00	6	Autoplunger Coil Bracket Assembly	1	515-6527-00
Item 1 is secured to Item 2 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)				Items 1 & 6 are secured below the P/F by: #8 X 1/2" SHWH AB (Zc.) (Qty. 9) (234-5101-00)			
2	Autoplunger Fulcrum	1	535-7697-00	7	Coil Retainer Bracket	1	535-5203-03
3	Nyliner, 1/4" (Thomson #411-FF)	2	545-5423-00	Item 7 is secured to Item 6 by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)			
4	Plunger & Link Assembly	1	515-5338-00	8	Coil, 23-800	1	090-5001-00B
Item 4 is secured to Item 1 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)				Coil has a Diode (1N4004) (112-5003-00) positioned @ bot. (below lugs opposite windings).			
For Individual Items use: Plunger 2" Lg. (530-5025-01), Plunger Link (545-5293-00) and Roll Pin 1/8" ø x 5/8" Lg. (251-5008-00)				9	Coil Sleeve	1	545-5031-00
5	Compression (Return) Spring	1	266-5020-00	(ASM. REF. 500-6092-03B, Items 6-9)			
(ASM. REF. 500-6091-00, Items 1-5)							

Nr.	SWITCH PARTS	QTY.	SPI PART Nr.
10	Switch (for Shooter Lane)	1	180-5157-00
Switch has a Diode (1N4004) (112-5003-00). Can be replaced with (1N4001) (112-5001-00).			
11	Switch Mounting Bracket	1	535-6173-00
Item 11 is secured to Playfield by: #6 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5001-02)			
12	Switch Body Protect Plate	1	535-6539-00
Item 12 is secured to Items 10-11 by: #2-56 X 1/2" Unslotted Ser. HWH #4 Head TR3 Black (Qty. 2) (237-5937-02) and #2-56 Hex Nut (Qty. 2) (240-5301-0)			
(ASM. REF. 500-6096-00, Items 10-12)			

Sec. 4: Drawings ...



Take Note:
 ☺ **Coil Note:** ☺ Either -00B or -00T can be used for coil replacements. B/T listed is preferable for easier diode access & may differ on game.

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

Ordering Note: Identical to 500-6318-24 with exceptions, see note below Item 13 (Parts Table).

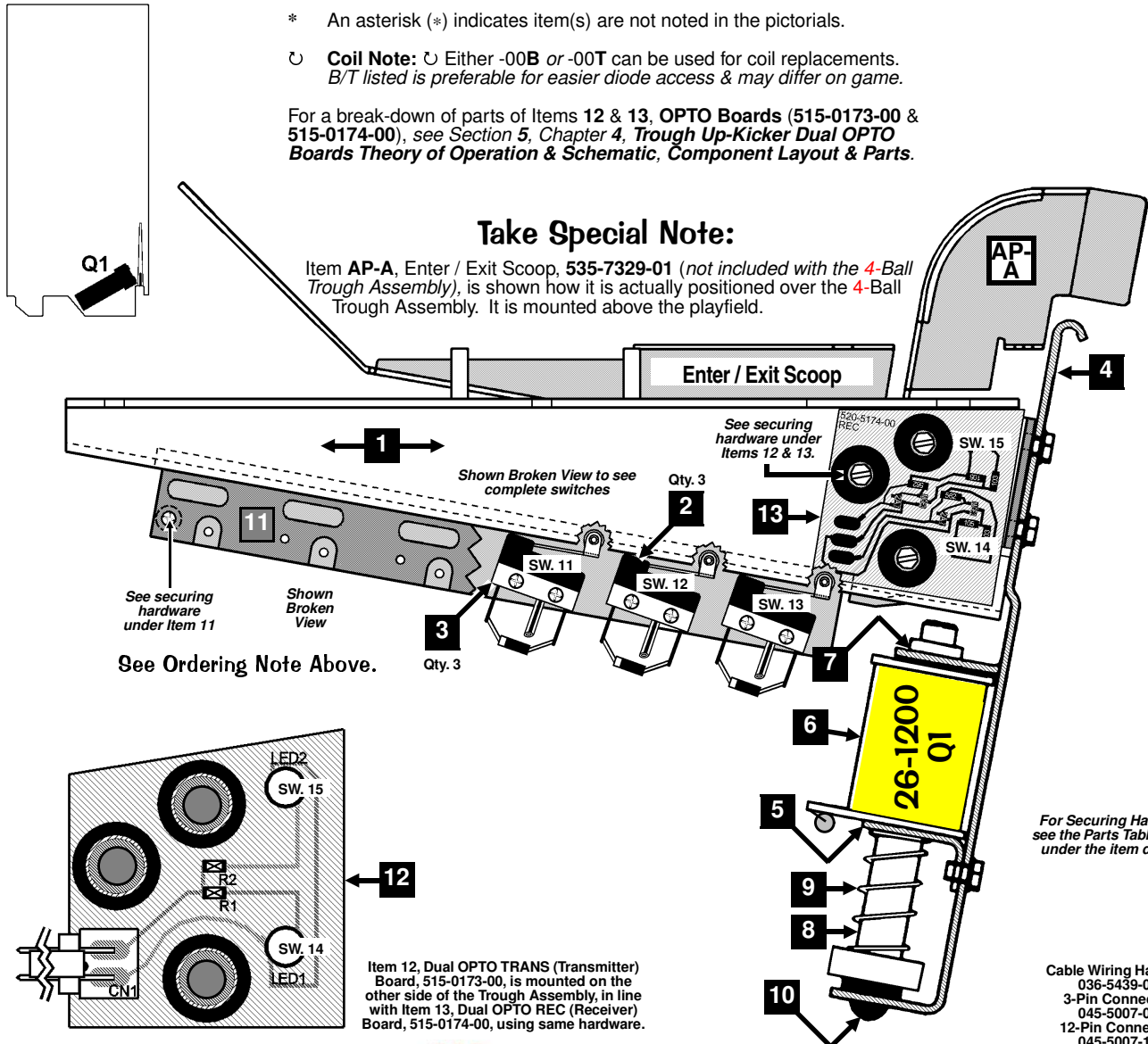
Nr.	4-BALL TROUGH PARTS	QTY.	SPI PART Nr.	Nr.	4-BALL TROUGH PARTS	QTY.	SPI PART Nr.
1	Ball Trough Outhole Mounting Bracket <small>Item 1 is secured below the playfield by: #8 X 1/2" SHWH AB (Zinc) (Qty. 6) (234-5101-00)</small>	1	515-6580-01	11	Trough Ball Guide Plate <i>Not Required</i> <small>Item 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)</small>	0	535-7801-00
2	Micro Switch (Roller Actuator, Lite-Force) <small>Item 2 requires: Heat Shrink Tubing 1/8" ø PUI-24 (Qty. 1"/per) (605-5006-00). Switch has a Diode (1N4004) (112-5003-00). Can be replaced with (1N4001) (112-5001-00).</small>	3	180-5119-02	12	Dual OPTO TRANS Board Assembly	1	515-0173-00
3	Switch Body Protect Plate	3	535-6539-00	13	Dual OPTO REC Board Assembly <small>Items 12 & 13 are secured by: #6-32 X 5/8" HWH Swg (Ser) Zc (Qty. 3/per) (237-5976-04) For Individual Items use : Dual OPTO Transmitter Board (Qty. 1) (520-5173-00), Dual OPTO Receiver Board (Qty. 1) (520-5174-00), OPTO PCB Tube Spacer (Brass) (Qty. 3/per) (530-5308-02) and OPTO PCB Rubber Grommet (Qty. 3/per) (545-5518-00)</small>	1	515-0174-00
4	Coil Mounting Bracket <small>Item 4 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Sr.) Zinc (Qty. 4) (237-5975-00)</small>	1	535-7330-01	Ordering Note: If 500-6318-14 is unavailable, order the individual part(s) actually required. This assembly is identical to 500-6318-24, -15 or -25 except for the quantity of Item 2 (an additional switch & diode is required for the 5-Ball Trough) and Item 3, Switch Body Protect Plates, are required when not using Item 11 (not required, no Magnet Mech. used in game).			
5	Coil Retaining Bracket <small>Item 5 is secured to Item 4 by: #8-32 X 1/4" HWH MS (Serr) Zinc (Qty. 2) (237-5964-01)</small>	1	535-5203-03	ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.			
6	Coil, 26-1200 <small>Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).</small>	1	090-5044-00T	Nr.	ASSOCIATED PART(S)	QTY.	SPI PART Nr.
7	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01	AP-A	Ball Trough Enter / Exit Scoop	1	535-7329-01
8	Plunger Assembly <small>For Individual Items use : Plunger (530-5210-00) & Nylon Plunger (530-5277-01)</small>	1	515-5941-01	<small>Item AP-A secured to the playfield by: #8 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00).</small>			
9	Compression (Return) Spring	1	266-5020-00	AP-B	* Steel Balls (1-1/16" ø)	4	260-5000-00
10	Rubber Bumper (Grommet)	1	545-5105-00				

Take Note:

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

⊖ **Coil Note:** ⊖ Either -00B or -00T can be used for coil replacements. B/T listed is preferable for easier diode access & may differ on game.

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.



Sec. 4: Drawings ...

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

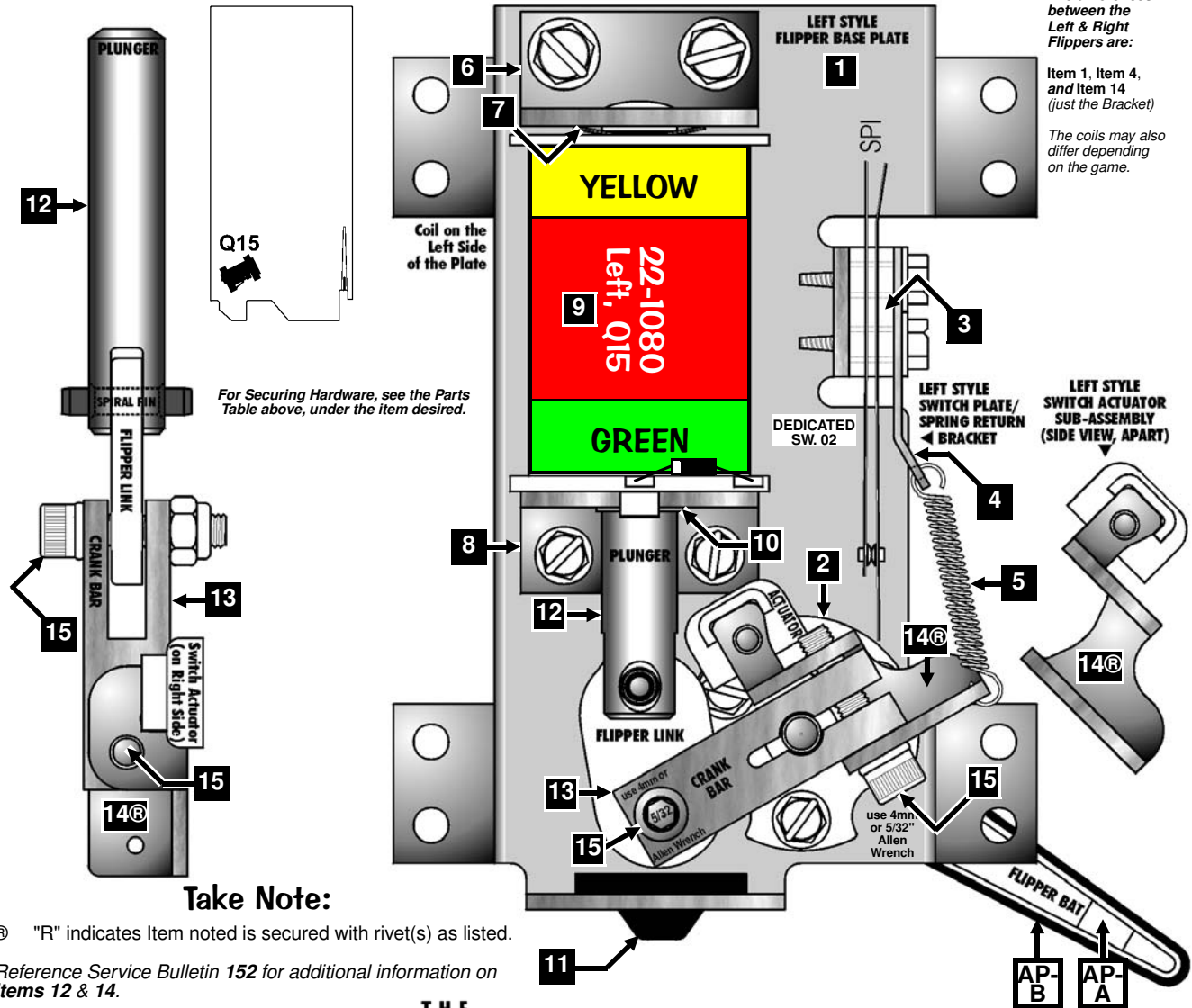


Nr.	FLIPPER (LEFT) PARTS	QTY.	SPI PART Nr.	Nr.	FLIPPER (LEFT) PARTS	QTY.	SPI PART Nr.
1	Flipper Base Plate (LEFT)	1	See FRP1	13	Crank Bar	1	530-5070-02
Item 1 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00) Ordering Note: Use Item FRP1, see the end of this Parts 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) 1/4" ø I.D.	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)				For Individual Items use : Actuator & Spring Bracket (LEFT) (535-9038-01) and ® Switch Actuator (White Plastic) (545-5612-00) and is secured to the Bracket by: Rivet, 1/8" ø X 1/4" Lg. (Qty. 1) (249-5003-00)			
3	Power (EOS / End-of-Stroke) Switch	1	180-5149-00	15	Set Screw: #10-32 X 3/4" Socket Hd.	2	237-6144-00
Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)				Item 15 requires: #10-32 Nylon Stop Nut (Qty. 1 Flipper Link Side Only) (240-5203-00) and #10 Split Lock Washer (244-5003-00) Tool Required for Item 15: 5/32" or 4mm Allen Wrench			
4	Sw. Plate/Spring Return Brkt. (LEFT)	1	535-7354-01	Flipper Rebuild Parts for Easier Installation, Save \$:			
5	Flipper Return Spring	1	265-5035-00	FRP1	Flipper Base Plate Kit (LEFT)		515-6617-01
6	Coil Stop Bracket Sub-Assembly	1	515-6308-01	Includes Item 1 pre-threaded, with the Securing Hardware for Items 2, 3, 6 & 8.			
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)				FRP2	Plunger, Link & Crank (LEFT) Assy.		515-7203-01
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00	Includes above Items 12, 13, 14 and 15 and is pre-assembled.			
8	Coil Support Bracket	1	535-7356-00	FRP3	Flipper (LEFT) Rebuild Kit		500-6307-10
Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)				Same as FRP2, but also includes above Items 6 & 10.			
9	Coil, 22-1080 (YEL-GRN) (Left)	1	090-5032-00T	ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.			
Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).				Nr.	ASSOCIATED PART(S)	QTY.	SPI PART Nr.
10	Coil Sleeve	1	545-5388-00	AP-A	WHITE Flipper Bat (Plain) & Shaft (Non-Knurled End) Assembly	1	515-5133-08-06
11	Deflector Pad (Bumper)	1	545-5428-00	AP-B	Large Flipper BLACK Rubber Ring	1	545-5277-00
12	Flipper Plunger & Link Sub-Assy.	1	515-6304-03	For Individual Items use : Flipper Plunger (530-5349-01) and Plunger "Flipper" Link (545-5611-01) and is secured to the Plunger by: Bushing, .16" ø ID X .281" ø OD X .187" (Qty. 1) (530-5532-00) and Spiral Pin ø 5/32" X 3/4" Lg. (Qty. 1) (251-5015-02)			



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

Sec. 4: Drawings ...



Take Note:

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

Reference Service Bulletin 152 for additional information on Items 12 & 14.



Flipper (Right) Assembly, 500-6543-02 (Items 1-15) and Assoc. Parts: White Flipper Bat & Shaft Assy., 515-5133-08-06 (Item AP-A/-B)



Nr.	FLIPPER (RIGHT) PARTS	QTY.	SPI PART Nr.	Nr.	FLIPPER (RIGHT) PARTS	QTY.	SPI PART Nr.
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" ϕ ID X .312" ϕ OD X .195" (Qty. 1) (530-5139-00)			
2	Flipper Bat Bushing (White Plastic) 1/4" ϕ I.D.	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)				For Individual Items use : Actuator & Spring Bracket (RIGHT) (535-9038-00) and Ⓜ Switch Actuator (White Plastic) (545-5612-00) and is secured to the Bracket by: Rivet, 1/8" ϕ X 1/4" Lg. (Qty. 1) (249-5003-00)			
3	Power (EOS / End-of-Stroke) Switch	1	180-5149-00	15	Set Screw: #10-32 X 3/4" Socket Hd.	2	237-6144-00
Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)				Item 15 requires: #10-32 Nylon Stop Nut (Qty. 1 Flipper Link Side Only) (240-5203-00) and #10 Split Lock Washer (244-5003-00) Tool Required for Item 15: 5/32" or 4mm Allen Wrench			
4	Sw. Plate/Spring Return Brkt. (RIGHT)	1	535-7354-00	Flipper Rebuild Parts for Easier Installation, Save \$:			
5	Flipper Return Spring	1	265-5035-00	FRP1	Flipper Base Plate Kit (RIGHT)		515-6617-00
6*	Coil Stop Bracket Sub-Assembly	1	515-6308-01	Includes Item 1 pre-threaded, with the Securing Hardware for Items 2, 3, 6 & 8.			
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)				FRP2	Plunger, Link & Crank (RIGHT) Assy.		515-7203-00
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00	Includes above Items 12, 13, 14 and 15 and is pre-assembled.			
8	Coil Support Bracket	1	535-7356-00	FRP3	Flipper (RIGHT) Rebuild Kit		500-6307-00
Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)				Same as FRP2, but also includes above Items 6 & 10.			
9	Coil, 22-1080 (YEL-GRN) (Right)	1	090-5032-00T	ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.			
Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).				Nr.	ASSOCIATED PART(S)	QTY.	SPI PART Nr.
10	Coil Sleeve	1	545-5388-00	AP-A	WHITE Flipper Bat (Plain) & Shaft (Non-Knurled End) Assembly	1	515-5133-08-06
11	Deflector Pad (Bumper)	1	545-5428-00	AP-B	Large Flipper BLACK Rubber Ring	1	545-5277-00
12	Flipper Plunger & Link Sub-Assy.	1	515-6304-03				
For Individual Items use : Flipper Plunger (530-5349-01) and Plunger "Flipper" Link (545-5611-01) and is secured to the Plunger by: Bushing, .16" ϕ ID X .281" ϕ OD X .187" (Qty. 1) (530-5532-00) and Spiral Pin ϕ 5/32" X 3/4" Lg. (Qty. 1) (251-5015-02)							

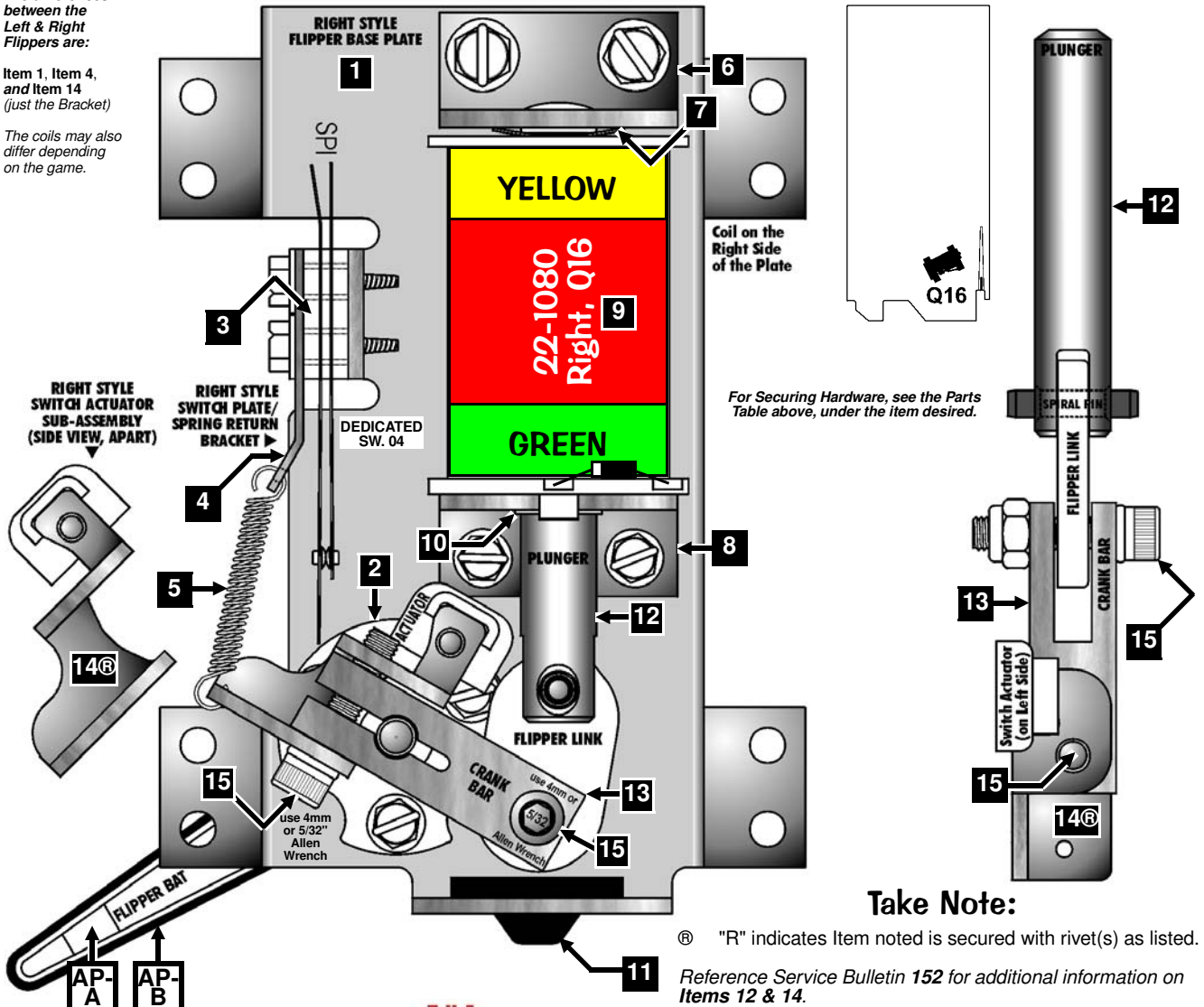


* To Order the Flipper (Right) Rebuild Kit ask for Part Nr.: 500-6307-00 (includes Items 6, 10, 12, 13, 14 & 15)

The differences between the Left & Right Flippers are:

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

The coils may also differ depending on the game.



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

Take Note:

Ⓜ "R" indicates Item noted is secured with rivet(s) as listed.
Reference Service Bulletin 152 for additional information on Items 12 & 14.

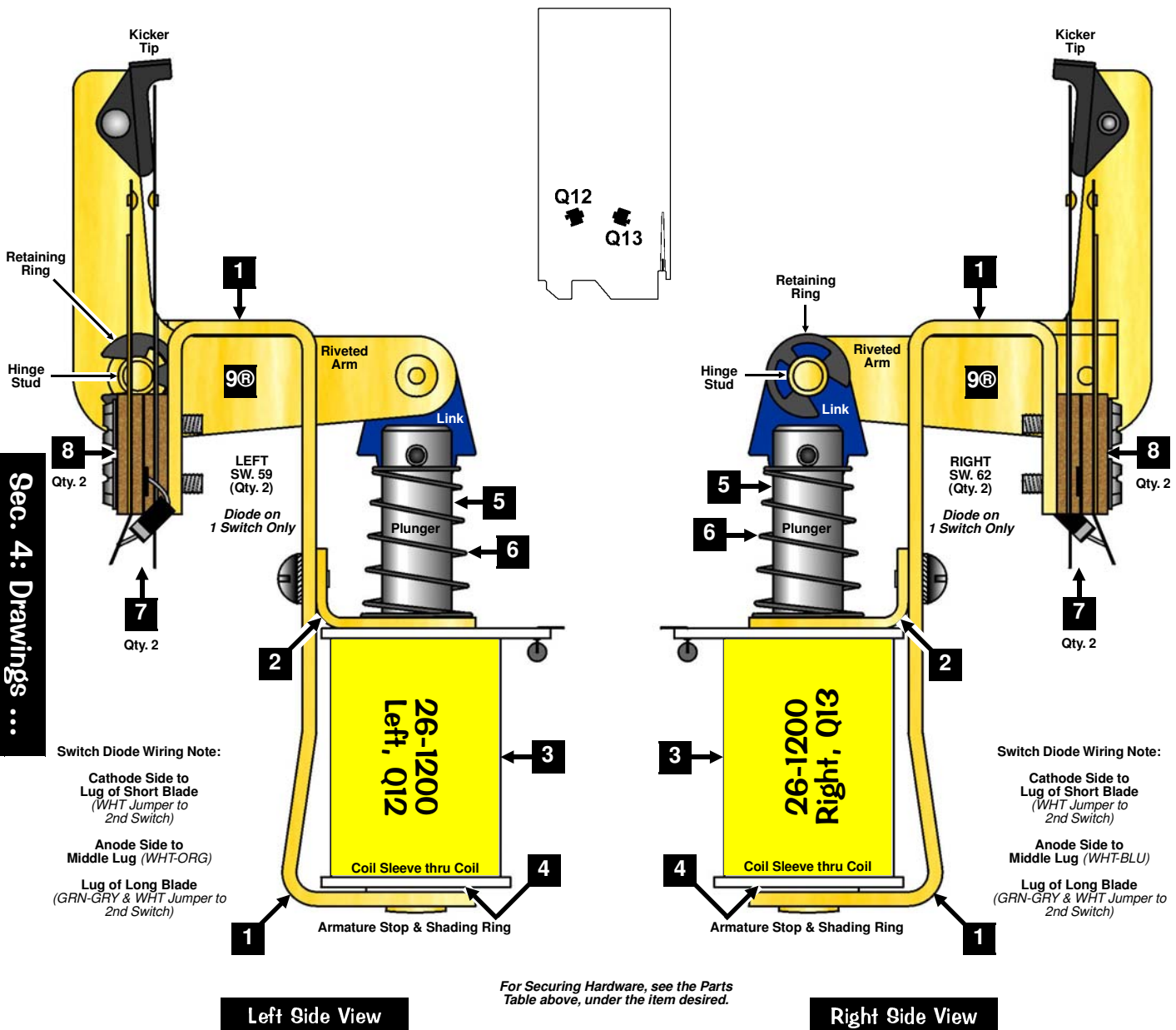
Sec. 4: Drawings ...

Slingshot (Left & Right) Assemblies, 500-5849-01 (Qty. 2) (Items 1-9)

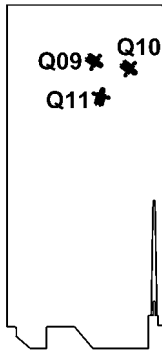
Nr.	SLINGSHOT PARTS	QTY.	SPI PART Nr.	Nr.	SLINGSHOT PARTS	QTY.	SPI PART Nr.
1	Slingshot Bracket Assembly Item 1 is secured below the playfield by: #8 X 1/2" SHWH AB (Zinc) (Qty. 3) (234-5101-00)	1/per	515-5339-01	6	Compression (Return) Spring	1/per	266-5020-00
2	Coil Retaining Bracket Item 2 is secured to Item 1 by: #8-32 X 3/8" PPH MS (Sems) (Qty. 2) (232-5301-00)	1/per	535-5203-03	7	Slingshot Stack (Blade) Switch Only 1 of the 2 Switches has a Diode (1N4004) (112-5003-00). See Note Below on Drawing. Can be replaced with (1N4001) (112-5001-00).	2/per	180-5054-00
3	Coil, 26-1200 Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).	1/per	090-5044-00T	8	Switch Body Protect Plate Items 7 & 8 are secured to Item 1 by: #6-32 X 5/8" HWH Swage (Qty. 4) (237-5976-04)	2/per	535-5045-00
4	Coil Sleeve	1/per	545-5031-00	9Ⓜ	Riveted Arm & Tip Assembly For Individual Parts use (requires drilling out rivet & re-venting): Arm (515-5341-01), Kicker Tip (545-5216-01) and Rivet, 1/8" ø x 1/4" Lg. (249-5003-00) The Riv. Arm is secured to Item 1 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)	1/per	515-5340-01
5	Plunger & Link Assembly For Individual Items use: Plunger 2" Lg. (530-5025-01), Plunger Link (545-5293-00) and Roll Pin 1/8" ø x 5/8" Lg. (251-5008-00) The Plunger Link is secured to the Riveted Arm by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)	1/per	515-5338-00	Ordering Note: If 515-5340-01 is unavailable, order the individual part(s) actually required.			
Ordering Note: If 515-5338-00 is unavailable, order the individual part(s) actually required.				Ordering Note: If 500-5849-01 is unavailable, order the individual part(s) actually required. This assembly is identical to 500-5849-00 with the exception of Item 3, which uses a Coil, 23-800 (090-5001-00T) instead.			

Take Note:

- ⊖ **Coil Note:** ⊖ Either -00B or -00T can be used for coil replacements. B/T listed is preferable for easier diode access & may differ on game.
- Ⓜ "R" indicates Item noted is secured with rivet(s) as listed.



Bumper Top*, Bumper Bottom** & Bumper Switch Individual Parts Only (Items 2-18) and Associated Parts: See Parts Table Below



Special Note:

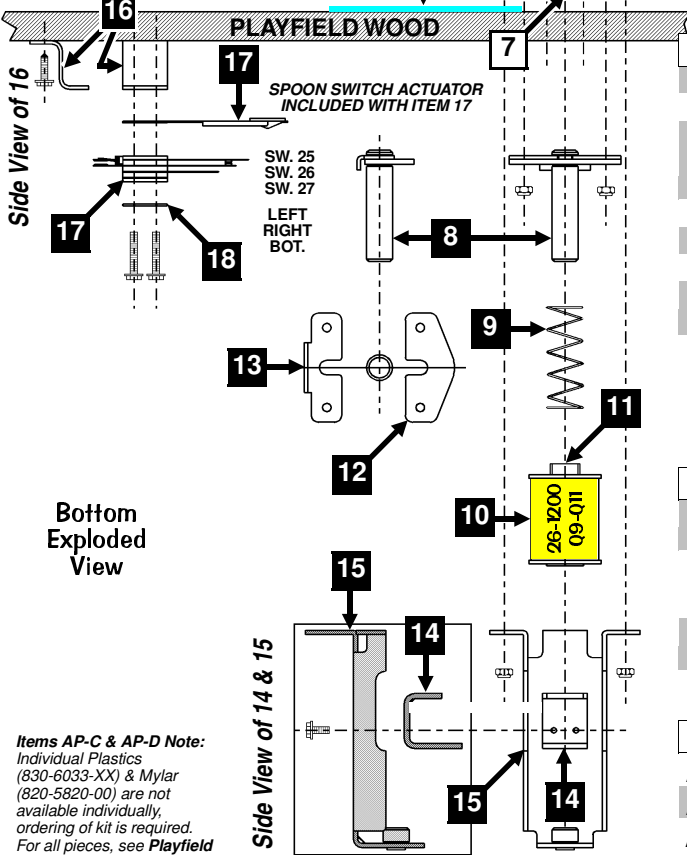
* **This Game Only:** The Bumper Top (Q10, Right Side) does not require a socket or bulb.

Top Exploded View

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

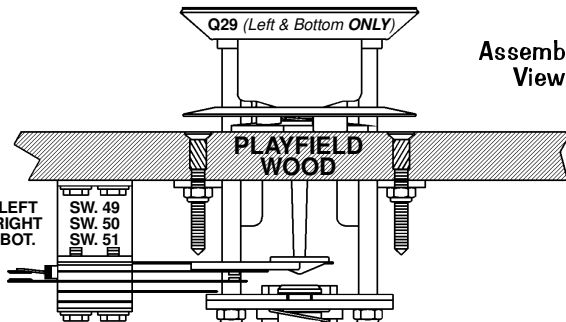
Ordering Note:

Individual parts can be ordered. However, if the entire Bumper is required, use the ASM. REF. Number(s) under each section in the Parts Table.



Bottom Exploded View

Items AP-C & AP-D Note: Individual Plastics (830-6033-XX) & Mylar (820-5820-00) are not available individually, ordering of kit is required. For all pieces, see *Playfield Top - Plastics (Screened & Clear) Kit, Decals & Mylar Kits*, Page 69.



Assembled View

Special Note:

** **This Game Only:** The Bumper Bottom (Q11, Bottom) requires the coil to be inverted (lugs are furthest from playfield, diode opposite the windings).

Take Note:

Coil Note: ∪ Either -00B or -00T can be used for coil replacements. B/T listed is preferable for easier diode access & may differ on game.

Nr.	BUMPER TOP PARTS	QTY.	SPI PART Nr.
1	#555 Wedge Base Bulb	0	165-5004-00
2	Wedge Base Socket	2*	077-5206-00
3	Bumper Body	1/per	545-5197-00
Item 3 is secured by: #5 X 7/8" PRH AB (Zinc) (Qty. 2) (237-5826-00)			
4	Ring Assembly	1/per	515-5085-00
Item 4 is secured by: #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00)			
5	Bumper Skirt	1/per	545-5607-00
6	Bumper Skirt Compression Spring	1/per	266-5048-00
7	Bumper Base	1/per	545-5195-00
* (ASM. REF. 515-6459-08, Items 3-7 (Qty. 1)); 515-6459-08B, Items 2-7 (Qty. 2) [ASM. REF. 515-6459-01, Items 1-7 (Qty. 0)]			

Nr.	BUMPER BOTTOM PARTS	QTY.	SPI PART Nr.
8	Plunger	1/per	530-5348-00
9	Compression (Return) Spring	1/per	266-5047-00
10A	Coil, 26-1200	2	090-5044-00T
10B	Coil, 26-1200 (inverted coil)	1**	090-5044-00B
Coil has a Diode (1N4004) (112-5003-00) positioned @ -T (top) -B (bottom).			
11	Coil Sleeve	1/per	545-5031-00
12	Fiber Yoke	1/per	545-5609-00
13	Metal Yoke	1/per	535-7346-00
14	Metal Yoke Stop	1/per	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/per	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)			
(ASM. REF. 515-6459-04, Items 8, 9, 10A & 11-15 Only (Qty. 2)); ** (ASM. REF. 515-6459-04B, Items 8, 9, 10B & 11-15 (Qty. 1))			

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

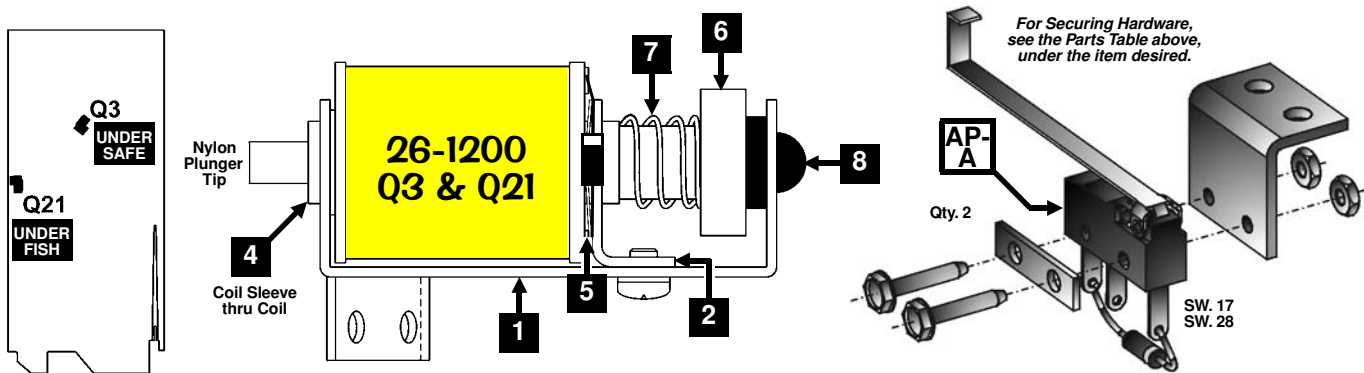
Nr.	BUMPER SWITCH PARTS	QTY.	SPI PART Nr.
16	Switch Bracket	1/per	535-7342-00
Item 16 is secured by: #8 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00)			
17	Bumper Stack (Blade) Switch Assy.	1/per	180-5015-04
Included with Item 17: Spoon Switch Actuator (545-5610-02). Switch has a Diode (1N4004) (112-5003-00). Can be replaced with (1N4001) (112-5001-00).			
18	Switch Body Protect Plate	1/per	535-7344-00
Items 17 & 18 are secured by: #6-32 X 3/4" HWH Swage (Serr) Zc. (Qty. 2) (237-5976-05) (ASM. REF. 515-6459-09, Items 16-18 (Qty. 3))			

ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLIES.

Nr.	ASSOCIATED PART(S)	QTY.	SPI PART Nr.
AP-A	#906 Wedge Base Bulb	2	165-5004-00
AP-B	Mini-Mars Lite Cover (Snap-In) (Red)	2	550-5030-02
AP-C	Kit: Plastics (includes -08, -09 & -19)	1	803-5000-85
Item AP-C is secured to Item 4 by: #4 X 3/8" PFH MS (Black) (Qty. 2/per) (237-5983-00)			
AP-D	Kit: Mylar (including Mylar Protectors)	1	802-5002-85

30° Eject (under Fish & under Safe) Assemblies, 500-6511-01 (Qty. 2) (Items 1-8) and Associated Parts: See Parts Table Below

Nr.	30° EJECT PARTS	QTY.	SPI PART Nr.	Nr.	30° EJECT PARTS	QTY.	SPI PART Nr.
1	Mounting Bracket 30° Eject (Left)	1/per	535-8932-02	8	Rubber Bumper (Grommet)	1/per	545-5105-00
Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00)				Ordering Note: If 500-6511-01 is unavailable, order the individual part(s) actually required.			
2	Coil Retaining Bracket	1/per	535-5203-03	ASSOCIATED PART IS NOT INCLUDED WITH THE ABOVE ASSEMBLY.			
Item 2 is secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) (Qty. 2) (232-5300-00)				Nr.	ASSOCIATED PART(S)	QTY.	SPI PART Nr.
3	Coil, 26-1200	1/per	090-5044-00B	AP-A	Switch (Eject) Assembly	2	500-6520-01
Coil has a Diode (1N4004) (112-5003-00) positioned @ bot (below lugs opposite windings).				For Individual Items use : Switch Bracket (535-6173-00), Micro Switch (180-5186-01), Switch Body Protect Plate (535-6539-00), Diode 1N4004 (112-5003-00), #2-56 X 1/2" Unslt Serr HWH #4 Hd TR3 Black (Qty. 2/per) and (237-5937-02) #2-56 Hex Nut (Qty. 2/per) (240-5301-00)			
4	Coil Sleeve (Short) (Formost #10-7077)	1/per	545-5076-01	Bracket secured to P/F by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5101-00)			
5	Spring Washer (17/32" ID X 3/4" X 1")	1/per	269-5002-00				
6	Plunger (with Nylon Tip) Assembly	1/per	515-7197-00				
7	Compression (Return) Spring	1/per	266-5022-00				

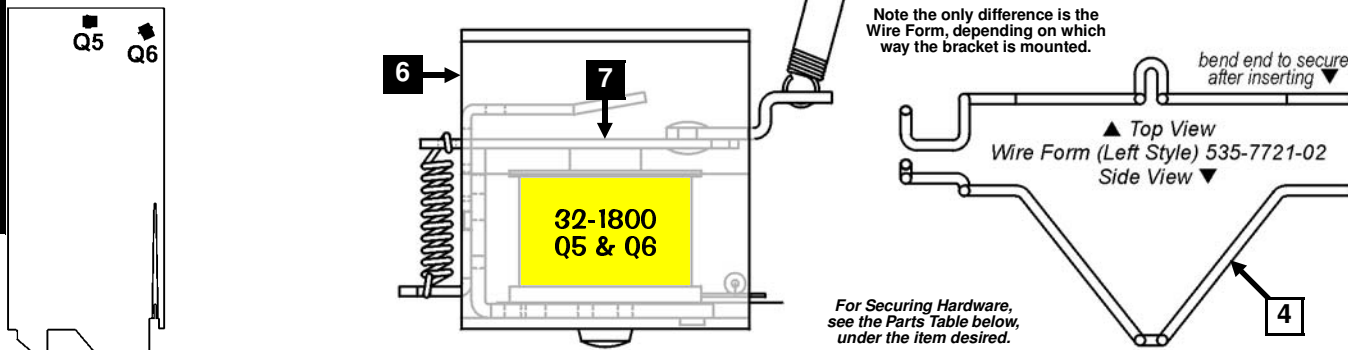


2-Way Ball Gates (Left & Right) Individual Parts Only (Items 1-5)

and

Ball Gate Coil & Mounting Bracket Asm., 515-6544-01 (Qty. 2) (Items 6-8)

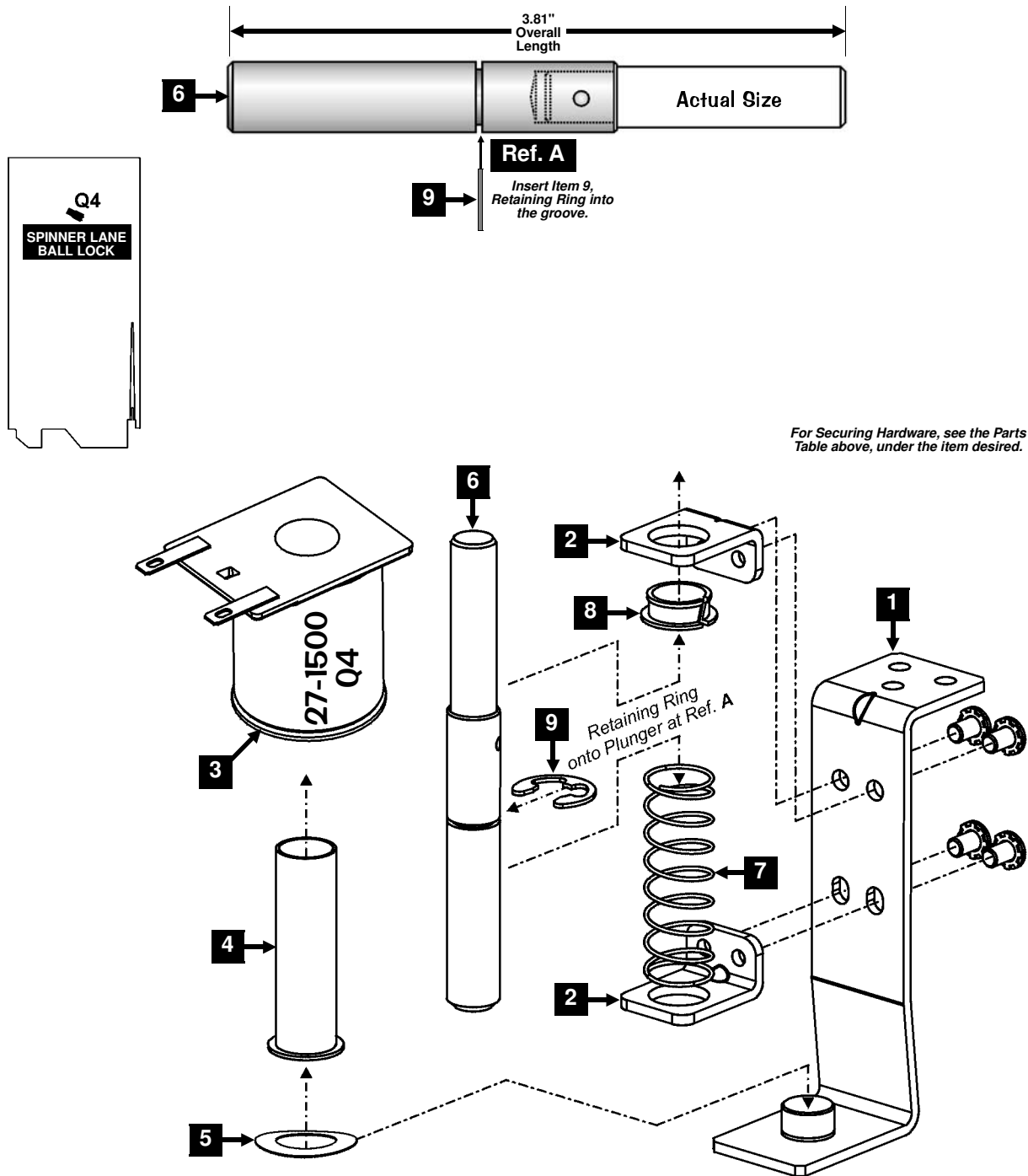
Sec. 4: Drawings ...



Nr.	BALL GATE PARTS	QTY.	SPI PART Nr.	Nr.	BALL GATE COIL PARTS	QTY.	SPI PART Nr.
1	Ball Gate Mounting Bracket	2	535-9470-00	6	Coil Mounting Bracket	1/per	535-7727-01
2	Ball Gate Flap	2	535-9471-00	7	Mini-Coil (32-1800) Assembly	1/per	515-6543-00
3	Rebound Hinge	2	535-5372-04	For Individual Items use : Mini-Coil 32-1800 (090-5031-00) & Coil Frame (535-6198-00), #8-32 X 3/8" PPH MS Ext Sems (Zinc) (232-5301-00) and Spring (265-5046-00)			
4	Wire Form (for Left Mounting)	1	535-7721-02	8	Spring Extension	1/per	265-5045-01
5	Wire Form (for Right Mounting)	1	535-7721-03	Item 8 opens and closes the 2-Way Ball Gates when attached to Items 4 or 5. Items 1 & 6 are secured by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5101-00)			

Up/Down Post (Spinner Lane Ball Lock) Assembly, 500-5867-02 (Items 1-9)

Nr.	UP/DOWN POST PARTS	QTY.	SPI PART Nr.	Nr.	UP/DOWN POST PARTS	QTY.	SPI PART Nr.
1	Ball Lock Mounting Bracket Assembly	1	515-7132-00	5	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
Item 1 is secured below the P/F by: #8 X 1/2" SHWH AB (Zinc) (Qty. 3/per) (234-5101-00)							
2	Coil Retaining Bracket	2	535-5203-03	6	Plunger, 3.81" Lg. (w/ Nylon Tip) Asm.	1	515-6119-02
Item 2 is sec. to Item 1 by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2/per) (232-5300-00)							
3	Coil, 27-1500	1	090-5004-00T	7	Compression (Relay) Spring	1	266-5020-00
Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).							
4	Coil Sleeve	1	545-5411-00	8	Nyliner 7/16" Shaft (7L2-FF)	1	545-5418-01
				9	Retaining Ring, 7/16" ø Shaft	1	270-5005-00
Ordering Note: If 500-5867-02 is unavailable, order the individual part(s) actually required.							



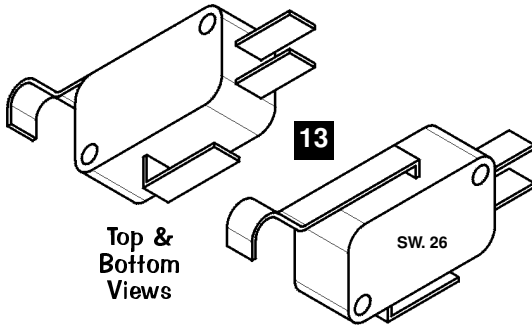
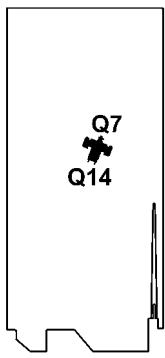
Sec. 4: Drawings ...

1-Bank Drop Target Assembly, 500-6893-01 (Items 1-21)

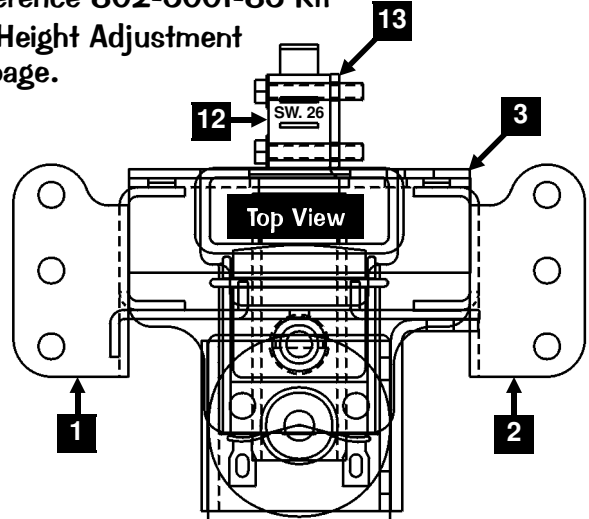
and Associated Part: Lexan Decal Reference 802-5001-85 Kit

Different Views, Parts Table & Target Height Adjustment

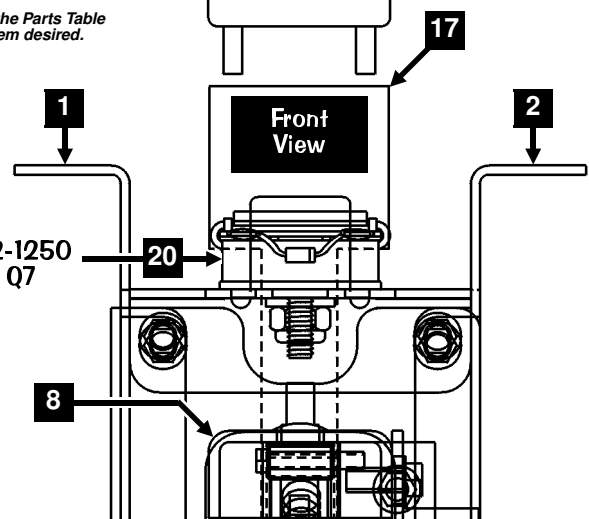
Procedure on the next page.



Top & Bottom Views



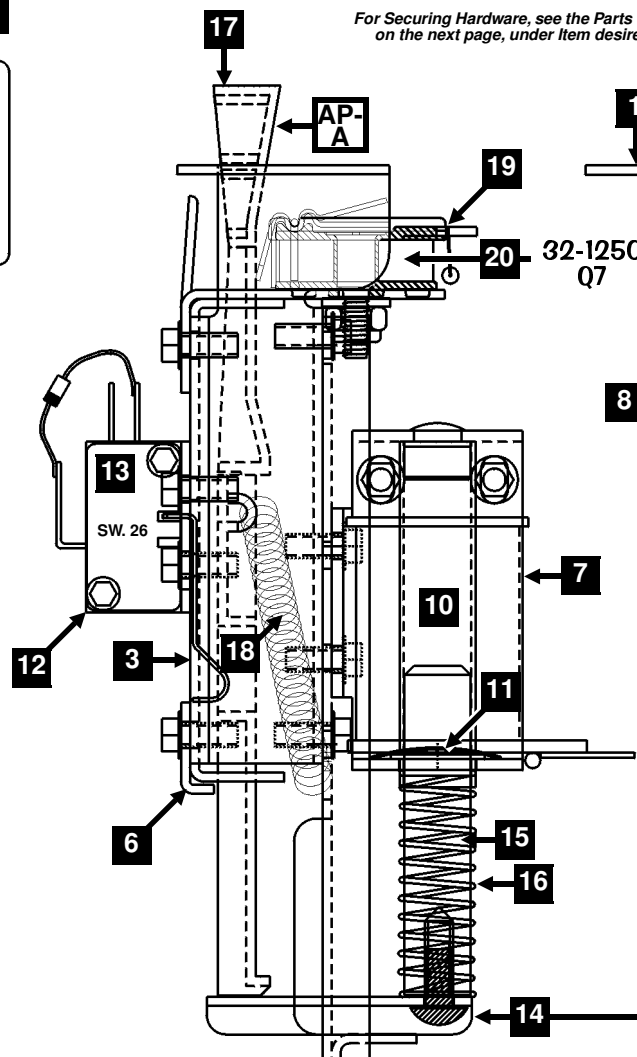
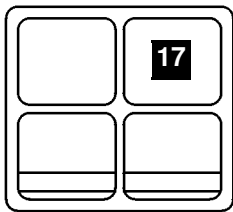
Top View



Front View

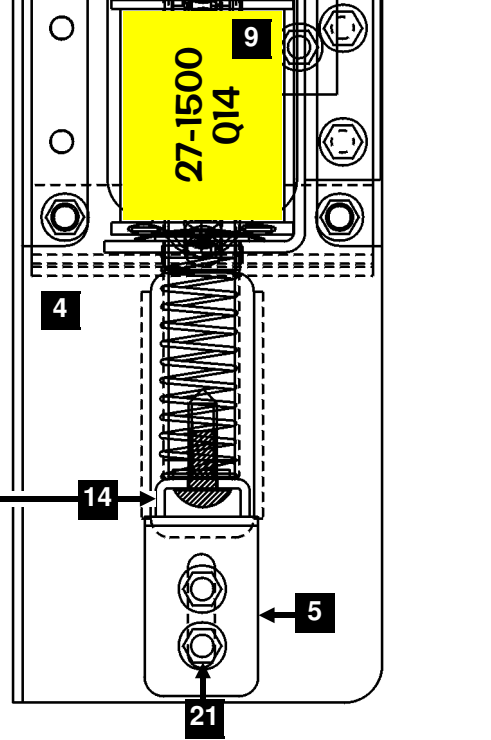
For Securing Hardware, see the Parts Table on the next page, under Item desired.

Target shown outside assembly is Actual Size.
Rear View



Side View

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



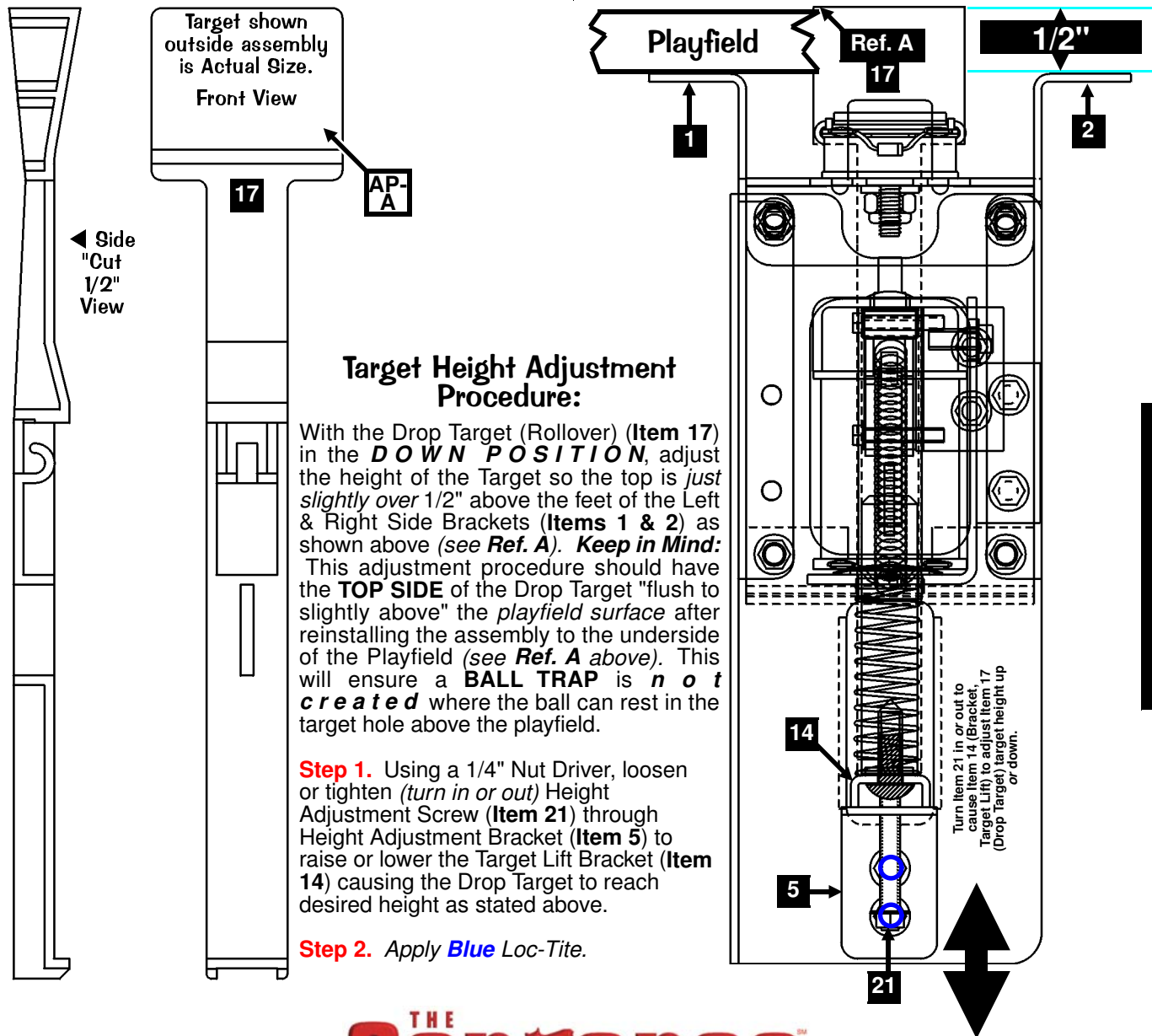
27-1500 Q14

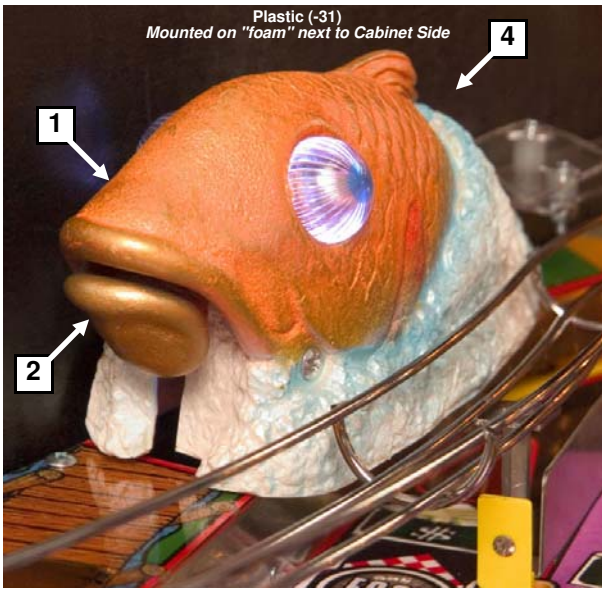
Sec. 4: Drawings ...

1-Bank Drop Target Assembly, 500-6893-01 (Items 1-21) Continued

Different Views on the previous page.

Nr.	DROP TARGET PARTS	QTY.	SPI PART Nr.	Nr.	DROP TARGET PARTS	QTY.	SPI PART Nr.
1	Bracket, Drop Target (Left Side)	1	535-8746-00	14	Bracket, Target Lift (1-Bank D/T)	1	535-7706-01
2	Bracket, Drop Target (Right Side)	1	535-8746-01	15	Plunger (Drive Coil)	1	530-5410-00
Items 1 & 2 are secured below the playfield by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 3/per) (234-5101-00)				Item 15 is secured to Item 14 by: #10-32 X 3/8" PPH (Sems) (Qty. 1) (232-5401-00)			
3	Back Plate (1-Bank Drop Target)	1	535-7713-00	16	Compression (Return) Spring	1	266-5020-00
4	Bracket, Support (1-Bank D/T)	1	535-7712-00	17	D/T Target 10° Taper White (Rollover)	1	545-6143-01
5	Bracket, Height Adjustment	1	535-7709-01	18	Spring, Target Reset <i>Heavy Duty</i>	1	265-5003-02
6	Bracket, Target Retainer (1-Bank D/T)	1	535-7728-00	19	Bracket, Trip Coil Mounting	1	535-8745-00
7	Bracket, Coil Housing	1	535-7707-00	20	Coil, 32-1250 (Mini.) Assembly	1	515-6916-01
8	Bracket Cap, Coil Housing	1	515-6533-00	Assembly Parts Included: Diode, 1N4004 (112-5003-00), Actuator Flap Plate (535-8597-00) and Retainer Clip (530-5550-00).			
Items 1-3, 5, 7-8 are secured to Item 4 by: #8-32 X 3/8" HWH Sw. (Qty. 16) (237-5975-00)				Item 20 is secured to Item 19 by: #8-32 Nylon Stop Nut (Qty. 1) (240-5102-00)			
9	Coil, 27-1500	1	090-5004-00B	21	Height Adj. Screw (#8-32 X 1" HWH)	1	237-6003-00
Coil has a Diode (1N4004) (112-5003-00) positioned @ bot (below lugs opposite windings).				Item 21 is adjusts the Height of Item 5 Bracket, which raises/lowers Item 17, Target.			
10	Coil Sleeve	1	545-5709-00	Ordering Note: If 500-6893-01 is unavailable, order the individual part(s) actually required ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLIES.			
11	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00	Nr.	ASSOCIATED PART(S)	QTY.	SPI PART Nr.
12	Bracket, Switch (1-Bank D/T)	1	535-7710-00	AP-A	Kit: Lexan (incl. D/T 820-6359-00)	1	802-5001-85
13	Switch (D/T)	1	180-5158-00	Note: Individual Lexans (Heavy Duty Decals) (820-6359-XX) are not available individually, ordering of kit is required. For all pieces, see Playfield Top - Plastics (Screened & Clear) Kit, Decals & Mylar Kits , Page 69.			
Item 13 is secured to Item 12 by: #4-40 X 5/8" HWH TF (Qty. 2) (237-5945-00)				(ASM. REF. 515-6535-01, Items 7-11)			
Switch has a Diode (1N4004) (112-5003-00). Can be replaced with (1N4001) (112-5001-00).				(ASM. REF. 515-6537-00, Items 14 & 15)			
				(ASM. REF. 515-7113-00, Items 19 & 20)			





Fish Head & Body, Fish Jaw & Lever Support Bracket & Fish Jaw (Coil) Actuator Individual Parts Only (Items 1-20)

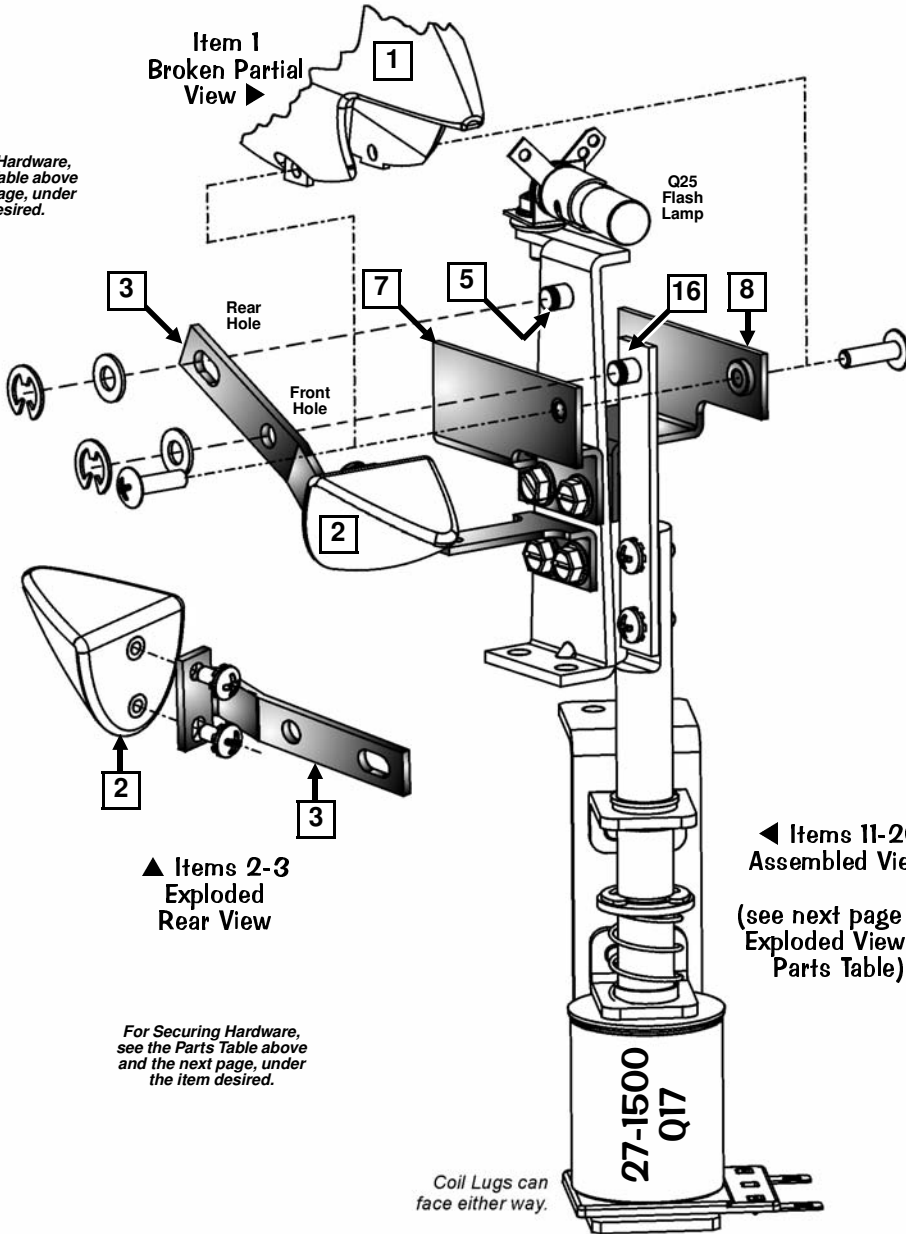
Nr.	FISH PARTS	QTY.	SPI PART Nr.
1	Fish Head & Body Glued Assembly	1	515-7455-00
<i>Assembly Parts Included</i> : Fish Head & Body (Molded, no jaw) (545-6127-00) and Fish Eyes (Trimmed Lite Hats, Clear) (Qty. 2, glued) (550-5072-01) (Not Available Unglued)			
Item 1 is secured to Items 7 & 8 (described next page) by: #6-32 X 1/2" PTH MS (Zinc) (Qty. 2) (237-6157-00)			
and Item 1 is secured at the rear onto the Wood Rail through Plastic -23 by: #6 X 1/2" PTH AB (Zinc) (Qty. 1) (237-5809-00) (ASM. DWG. REF. ONLY 500-6861-00)			
2	Fish Jaw (Molded)	1	545-6126-00
Item 2 is secured to Item 3 by: #6-32 X 1/4" PPH MS Ext. Sems (Zinc) (Qty. 2) (232-5200-00) (ASM. REF. 500-6864-00, Items 2-3)			
3	Fish Jaw (Mounting) Lever Support Bracket	1	535-9597-00
Item 3 is secured to Items 5 (rear) and 16 (front) (described next page) by: Retaining Ring, 3/16" (Qty. 1 per Pem Stud) (270-5024-00) and Fiber Washer 3/16" I.D. X 3/8" O.D. X .031 Thick MC95601A305 (Qty. 1 per side as shown) (242-5083-00)			
4*	Kit: Plastics (includes Plastic -31)	1	803-5000-85
<i>Note:</i> Individual Plastics (830-6033-XX) are not available individually, ordering of kit is required. For all pieces, see Playfield Top - Plastics (Screened & Clear) Kit, ..., Page 69.			
Item 4 is secured onto Item 1 by: #4 X 1/2" PFH (Zinc) (Qty. 2) (237-5840-00)			
Replace. Note: If replacing fish, note the mounting holes for the ball trap prevention plastic.			

Parts Table & Views continue on the next page.

Take Note:

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

For Securing Hardware, see the Parts Table above and the next page, under the item desired.

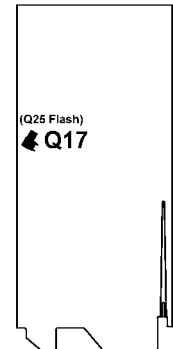


◀ Items 5-10 Assembled View

(see next page for Exploded View & Parts Table)

◀ Items 11-20 Assembled View

(see next page for Exploded View & Parts Table)



Sec. 4: Drawings ...

▲ Items 2-3 Exploded Rear View

For Securing Hardware, see the Parts Table above and the next page, under the item desired.

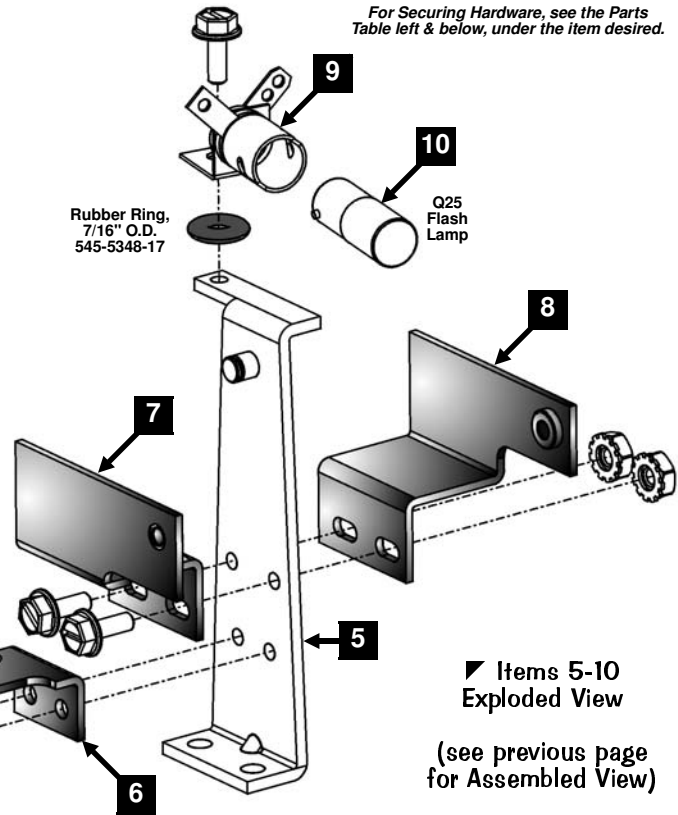
Fish Head & Body, Fish Jaw & Lever Support Bracket & Fish Jaw (Coil) Actuator Individual Parts Only (Items 1-20) Continued

Nr.	FISH PARTS	QTY.	SPI PART Nr.
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Parts Table & Views continue on the previous page.

5	Lever Support Bracket (Weldment)	1	515-7460-00
Item 5 is secured above the P/F by: #8-32 X 5/8" PPH MS Ext. Sems (Zinc) (Qty. 2) (232-5300-00)			
6	Support Tie Bracket	1	535-9598-00
Item 6 is secured to Item 5 by: #6-32 X 1/4" HWH Swage Sr. (Zinc) (Qty. 2) (237-5976-01) and onto the Wood Rail by: #6 X 1/2" PTH AB (Zinc) (Qty. 1) (237-5809-00)			
7	Mounting Bracket (Right Fin Side)	1	515-7461-00
8	Mounting Bracket (Left Fin Side)	1	515-7462-00
Items 7 & 8 is secured to Item 5 by: #6-32 X 3/8" HWH Swage Serr. (Zinc) (Qty. 2) (237-5976-02) and #6-32 Keps Nut (Qty. 2) (240-5008-00)			
9	Sm. Bayonet 2-Lug Laydown Socket	1	077-5003-00
Item 9 is secured to Item 5 by: #6-32 X 3/8" HWH Swage Serr. (Zinc) (Qty. 1) (237-5976-02) and Rubber Ring, 7/16" O.D. (Qty. 1) (545-5348-17)			
10	LED Module (White) (12.8v 20-25mA)	1	112-5023-08
(ASM. REF. 500-6863-00, Items 5-10)			
11	Ball Lock Mounting Bracket Assembly	1	515-7132-00
Item 11 is secured below the P/F by: #8 X 1/2" SHWH AB (Zinc) (Qty. 3) (234-5101-00)			
12	Coil Retaining Bracket	2	535-5203-03
Item 12 is sec. to Item 1 by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2/per) (232-5300-00)			
13	Coil, 27-1500	1	090-5004-00B
Coil has a Diode (1N4004) (112-5003-00) positioned @ bot (below lugs opposite windings).			
14	Coil Sleeve	1	545-5411-00

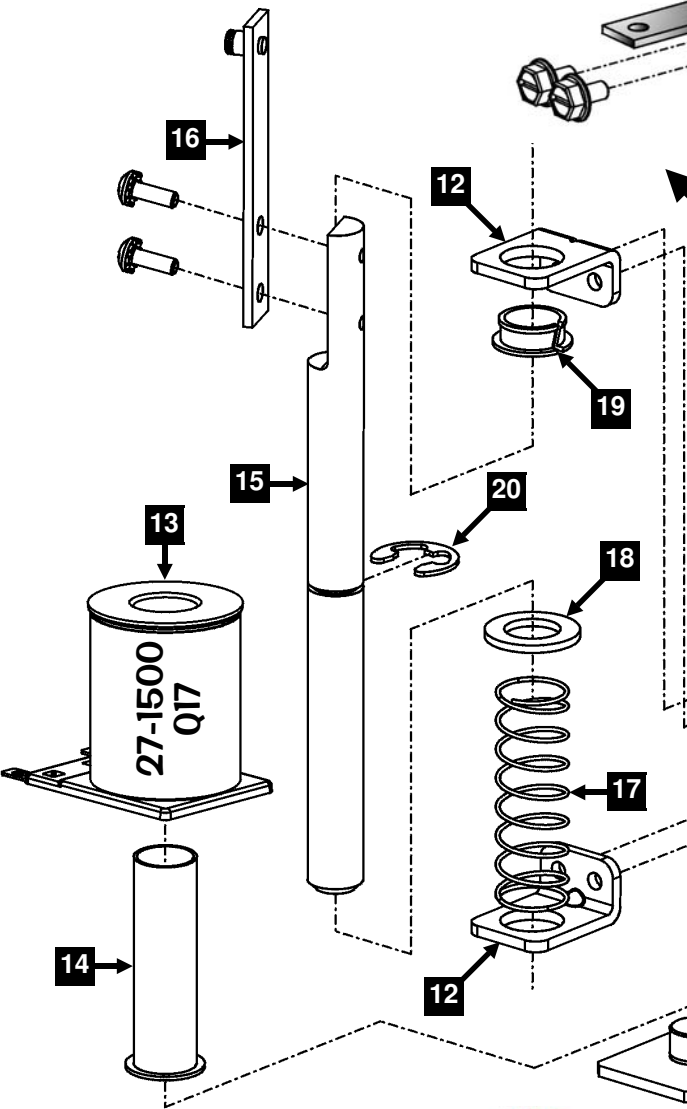
Parts Table continued below.



For Securing Hardware, see the Parts Table left & below, under the item desired.

Items 5-10 Exploded View

(see previous page for Assembled View)



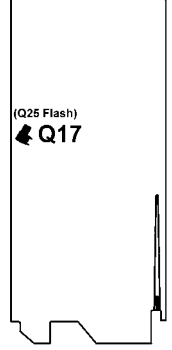
Parts Table continued from above.

Nr.	FISH PARTS	QTY.	SPI PART Nr.
15	Plunger (Steel) (for Item 16)	1	530-5692-00
16	Plunger (Pivot Extension) Asm.	1	515-7463-00
Item 16 is secured to Item 15 by: #6-32 X 3/8" PPH Sems (Zinc) (Qty. 2) (232-5201-00)			
17	Compression (Relay) Spring	1	266-5081-00
18	Nylon Washer .44" I.D. X .75" O.D.	1	242-5081-00
19	Nyliner 7/16" Shaft (7L2-FF)	1	545-5418-01
20	Retaining Ring, 7/16" ø Shaft	1	270-5005-00
(ASM. REF. 500-6862-00, Items 11-20)			

Items 11-20 Exploded View

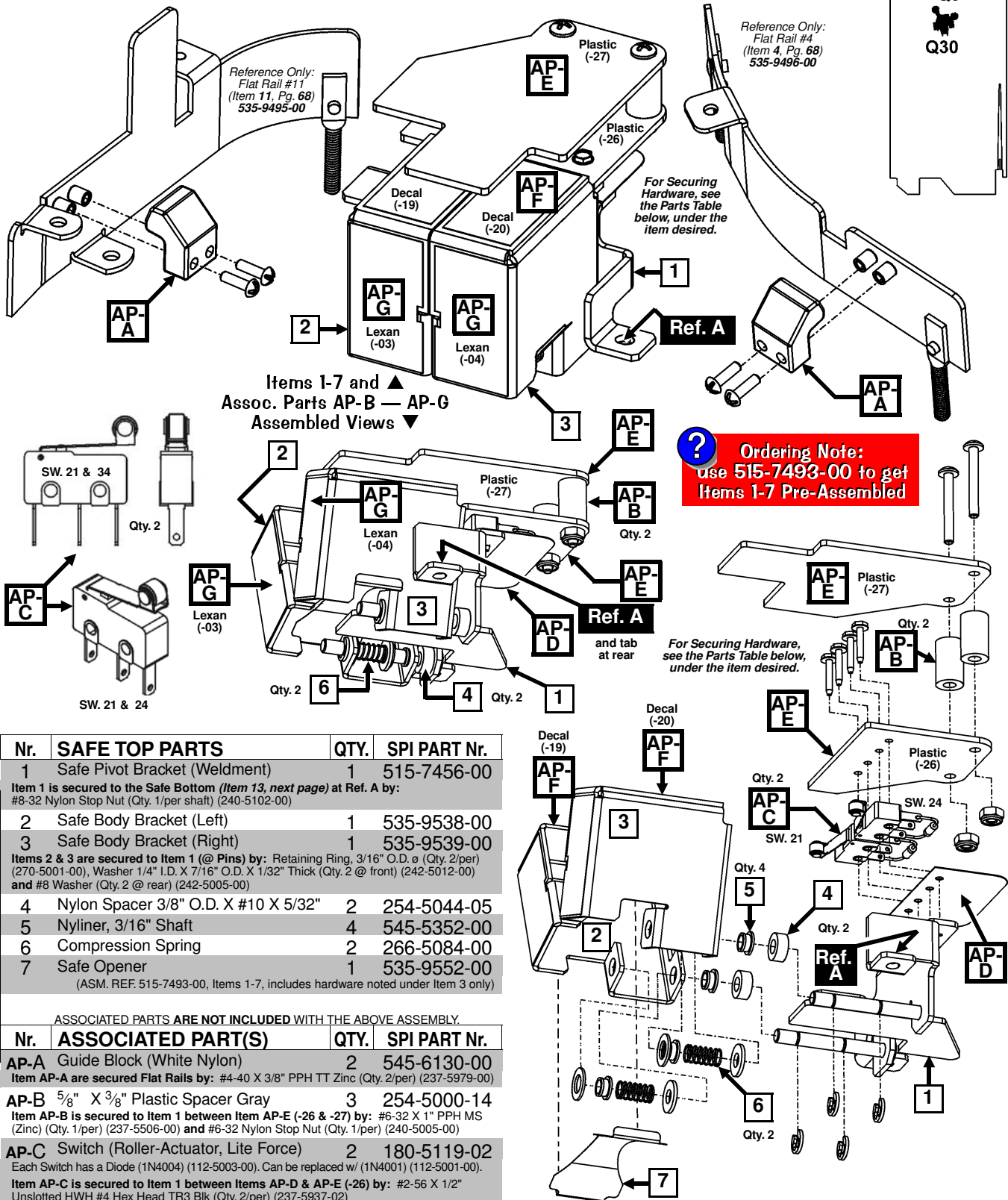
(see previous page for Assembled View)

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



Sec. 4: Drawings ...

Safe Front (Above Playfield) Asm., 515-7493-00 (Items 1-7) and Associated Parts: See Parts Table Below (Items AP-A through AP-G)



Nr.	SAFE TOP PARTS	QTY.	SPI PART Nr.
1	Safe Pivot Bracket (Weldment)	1	515-7456-00
Item 1 is secured to the Safe Bottom (Item 13, next page) at Ref. A by: #8-32 Nylon Stop Nut (Qty. 1/per shaft) (240-5102-00)			
2	Safe Body Bracket (Left)	1	535-9538-00
3	Safe Body Bracket (Right)	1	535-9539-00
Items 2 & 3 are secured to Item 1 (@ Pins) by: Retaining Ring, 3/16" O.D. ø (Qty. 2/per) (270-5001-00), Washer 1/4" I.D. X 7/16" O.D. X 1/32" Thick (Qty. 2 @ front) (242-5012-00) and #8 Washer (Qty. 2 @ rear) (242-5005-00)			
4	Nylon Spacer 3/8" O.D. X #10 X 5/32"	2	254-5044-05
5	Nyliner, 3/16" Shaft	4	545-5352-00
6	Compression Spring	2	266-5084-00
7	Safe Opener	1	535-9552-00
(ASM. REF. 515-7493-00, Items 1-7, includes hardware noted under Item 3 only)			

ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.

Nr.	ASSOCIATED PART(S)	QTY.	SPI PART Nr.
AP-A	Guide Block (White Nylon)	2	545-6130-00
Item AP-A are secured Flat Rails by: #4-40 X 3/8" PPH TT Zinc (Qty. 2/per) (237-5979-00)			
AP-B	5/8" X 3/8" Plastic Spacer Gray	3	254-5000-14
Item AP-B is secured to Item 1 between Item AP-E (-26 & -27) by: #6-32 X 1" PPH MS (Zinc) (Qty. 1/per) (237-5506-00) and #6-32 Nylon Stop Nut (Qty. 1/per) (240-5005-00)			
AP-C	Switch (Roller-Actuator, Lite Force)	2	180-5119-02
Each Switch has a Diode (1N4004) (112-5003-00). Can be replaced w/ (1N4001) (112-5001-00). Item AP-C is secured to Item 1 between Items AP-D & AP-E (-26) by: #2-56 X 1/2" Unslotted HWH #4 Hex Head TR3 Blk (Qty. 2/per) (237-5937-02)			
AP-D	Fiche Paper (Switch Insulator)	1	545-6161-00
AP-E	Kit: Plastics (incl. Plastic -26 & -27)	1	803-5000-85
AP-F	Kit: Decals (incl. Decals -19 & -20)	1	802-5000-85
AP-G	Kit: Lexan (incl. Lexan -03 & -04)	1	802-5001-85

Note Items AP-E thru AP-G: Ind. Plastics (830-6033-XX), Ind. Decals (820-6358-XX & 820-6368-00) and Individual Lexans (Heavy Duty Decals) (820-6359-XX) are not available individually, ordering of kit is required. For all pieces, see P/F Top - Plastics .. Kit, Decals & Mylar Kits, Page 69. (ASM. REF. 500-6866-00, Items 1-7 and AP-A thru AP-G Separately)

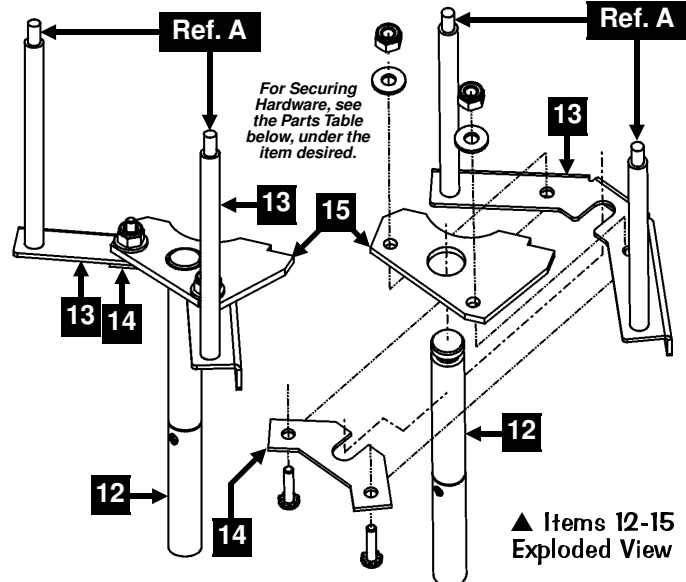
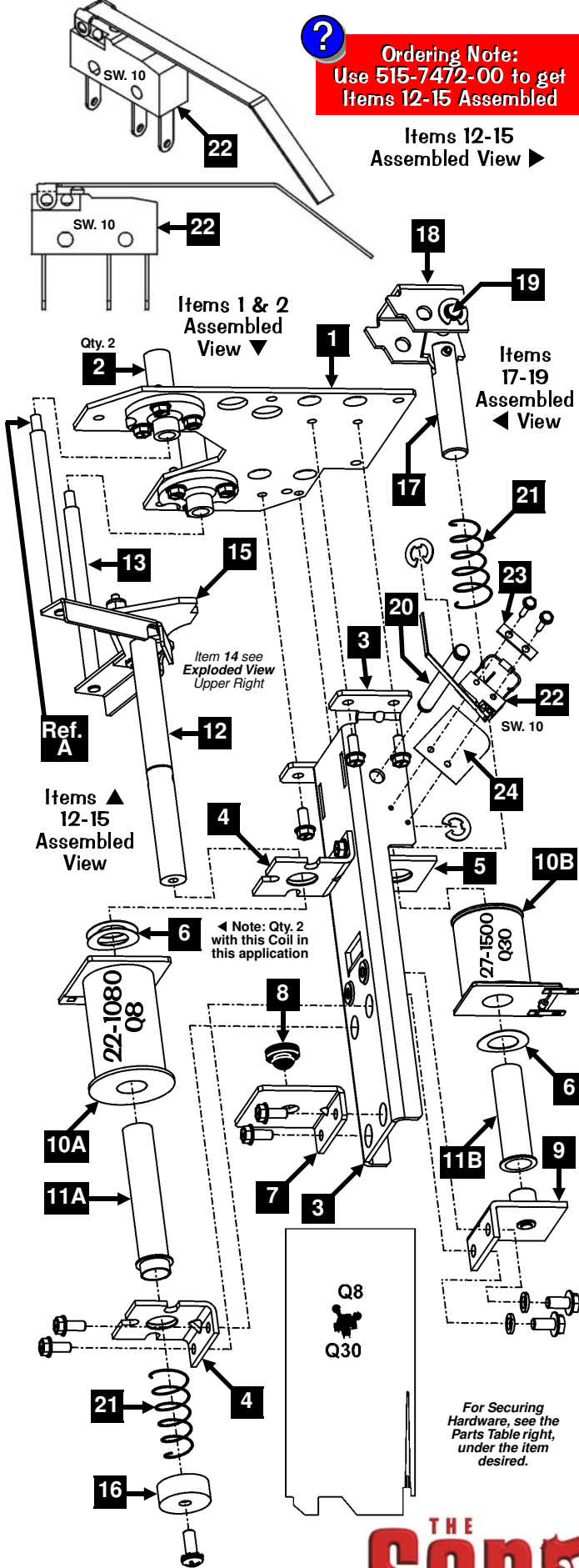
▲ Items 1-7 and Associated Parts AP-B — AP-G Exploded View ▲

For Securing Hardware, see the Parts Table left, under the item desired.

Sec. 4: Drawings ...

Safe Bottom (Below Playfield) Assembly, 500-6865-00 (Items 1-24)

Ordering Note:
Use 515-7472-00 to get
Items 12-15 Assembled



Nr.	SAFE BOTTOM PARTS	QTY.	SPI PART Nr.
1	Plate Mounting Bracket, Safe Bottom	1	535-9561-00
Item 1 is secured below the playfield by: #8 X 1/2" SHWH AB (Zc) (Qty. 4) (234-5101-00) and #8-32 X 5/8" SLT HWH Swage (Serr) Zinc Wax (Qty. 2) (237-5975-03)			
2	Bushing (Red Plastic) .281" I.D.	2	545-5070-01
Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Sw. (Serr) Zc. (Qty. 3/per) (237-5976-02)			
3	Dual Coil Mounting Bracket	1	535-9540-00
Item 3 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Sr.) Zinc (Qty. 4) (237-5975-00)			
4	Coil Retaining Bracket (with notches)	2	535-7356-00
5	Coil Retaining Bracket (no notches)	1	535-9559-00
6	Spring Washer (17/32" ID X 3/4" X 1")	3	269-5002-00
Item 6 Usage Note: Item 4 requires Qty. 2; Item 5 requires Qty. 1 (see drawing).			
7	Plunger Stop Bracket (w/ hole for Item 8)	1	535-9556-00
Items 4, 5 & 7 are secured to Item 3 by: #8-32 X 3/8" HWH Swage (Serr.) Zc (Qty. 2/per) (237-5975-00)			
8	Rubber Bumper (Grommet)	1	545-5105-00
9	Plunger Stop Bracket Asm.	1	515-7470-00
Item 9 is secured to Item 3 by: #10-32 X 3/8" SLT HWH Swage (Serr.) Zinc Wax (Qty. 2) (237-5985-00) and #10 Lock Washer (Qty. 2) (244-5003-00)			
10A	Coil, 22-1080 (YEL-GRN) (Left)	1	090-5032-00T
Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).			
10B	Coil, 27-1500	1	090-5004-00B
Coil has a Diode (1N4004) (112-5003-00) positioned @ bot. (below lugs opposite windings).			
11A	Coil Sleeve (with Extension)	1	545-5847-00
11B	Coil Sleeve (Short)	1	545-5411-00
12	Plunger Asm. (Threaded with Groove)	1	515-7467-01
Assembly Parts Included: Solid Plunger (530-5611-00), Steel Shaft (530-5696-00) and Roll Pin 1/8" ø X 3/8" Long (251-5013-00)			
13	Lift Bracket (Weldment) (Safe Lift)	1	515-7457-00
Item 13 secures to the Safe Pivot Bracket (Item 1, previous page) at Ref. A.			
14	Bracket Retainer (Safe Lift)	1	535-9534-00
15	Latch Plate	1	535-9557-00
Item 14 is secured (under Item 13) and Item 15 is secured (above Item 13) by: #8-32 X 5/8" PPH MS Ext. Sems (Zinc) (Qty. 2) (232-5303-00), #8 Washer (Qty. 2) (242-5005-00) and #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00) (ASM. REF. 515-7472-00, Items 12-15)			
16	Plunger Head	1	530-5511-00
Item 16 is secured to Item 12 by: #10-32 X 1/2" PPH MS Ext. Sems (Zc) (Qty. 1) (232-5402-00)			
17	Plunger & Link Assembly	1	515-5338-00
Assembly Parts Included: Plunger 2" (530-5025-01), Link (545-5293-00) and Roll Pin 1/8" ø X 5/8" Long (251-5008-00)			
18	Latch Bracket	1	535-9558-00
19	Plunger Pin (1.6" Lg. X .25" Ø) (thru 17-18)	1	530-5672-00
20	Pivot Pin (2.25" Lg. X .25" Ø) (thru 3 / 18)	1	530-5671-00
Items 19 & 20 secured at each side by: Retaining Ring, 1/4" ø (Qty. 2/per) (270-5002-00)			
21	Compression (Return) Spring	2	266-5020-00
22	Sw. (Custom Actuator) Cherry DA3A-B1A	1	180-5198-00
Switch has a Diode (1N4004) (112-5003-00). Can be replaced with (1N4001) (112-5001-00).			
23	Switch Body Protect Plate	1	535-6539-00
24	Fiche Paper (Switch Insulator)	1	545-6141-01
Items 23-24 are secured to Item 3 by: #2-56 X 1/2" Unslit HWH #4 Hex HD TR3 Blk (Qty. 2) (237-5937-02) (ASM. REF. 500-6865-00, Items 1-24)			

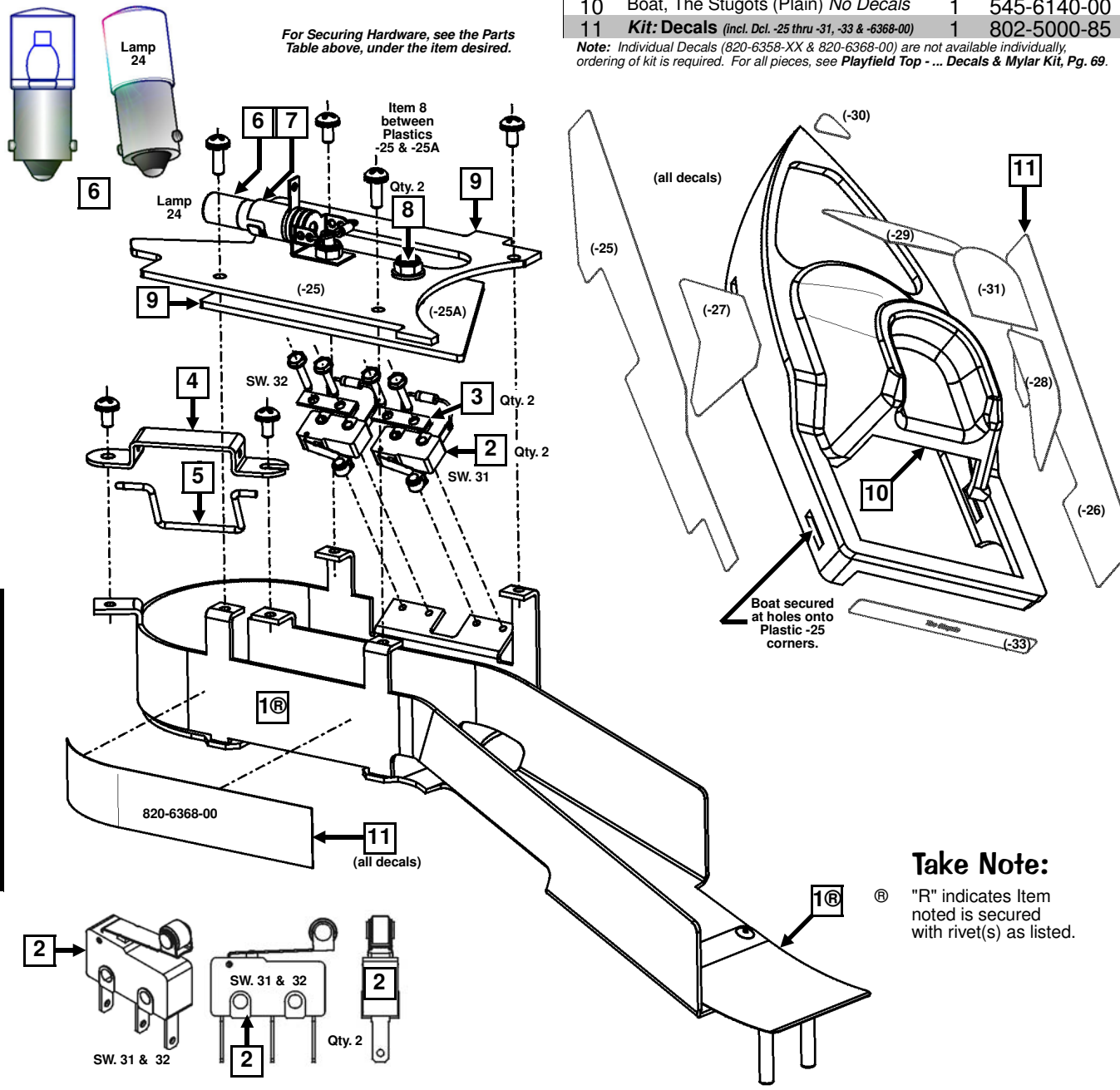
Sec. 4: Drawings ...

Drawings for Major Assemblies & Ramps



Right (Steel) Boat Ramp Individual Parts Only (Items 1-11)

Nr.	RT. RAMP & BOAT PARTS	QTY.	SPI PART Nr.	Nr.	RT. RAMP & BOAT PARTS	QTY.	SPI PART Nr.
1 [®]	Right Steel Ramp (Riveted Assembly)	1	515-7459-00	6	LED Module (White) (12.8v 20-25mA)	1	112-5023-08
Assembly Parts Included : Steel Ramp (Right) (535-7458-00), Ramp Flap (535-9548-00), Rivet, 1/8" ϕ X 3/16" Long (Qty. 2) (249-5001-00) and #6 Lock Washer (Qty. 2) (246-5000-00) Item 1[®] is secured below the playfield by: #8 Washer (Qty. 2) (242-5005-00) and #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00)							
2	Switch (Roller-Actuator, Lite Force)	2	180-5119-02	7	Sm. Bayonet (3-Lug Laydown, 2 bent) Sckt.	1	077-5032-00
Each Switch has a Diode (1N4004) (112-5003-00). Can be replaced w/ (1N4001) (112-5001-00).							
3	Switch Body Protect Plate	3	535-6539-00	8	1/4" X 3/8" Plastic Spacer Gray	2	254-5000-02
Items 2 & 3 are secured to Item 1 by: #2-56 X 1/2" Unslotted HWH #4 Hex Head TR3 Blk (Qty. 2/per) (237-5937-02)							
4	Ball Gate Mounting Bracket, Small	1	535-5269-03	9	Kit: Plastics (incl. Plastic -25 & -25A)	1	803-5000-85
5	Wire Form (for above gate bracket)		535-5307-03	Note: Individual Plastics (830-6033-XX) are not available individually, ordering of kit is required. For all pieces, see Playfield Top - Plastics (Screened & Clear) Kit, ..., Page 69. (ASM. REF. 500-6873-00, Items 1-8 (-9), ASM. REF. 515-7469-00, Items 6-7 (-9 & -11))			
Items 4 & 5 are secured to Item 1 by: #6-32 X 1/4" PPH MS Sems (Zinc) (Qty. 2) (232-5200-00)							
10	Boat, The Stugots (Plain) No Decals	1	545-6140-00	10	Boat, The Stugots (Plain) No Decals	1	545-6140-00
11	Kit: Decals (incl. Dec. -25 thru -31, -33 & -6368-00)	1	802-5000-85	Note: Individual Decals (820-6358-XX & 820-6368-00) are not available individually, ordering of kit is required. For all pieces, see Playfield Top - ... Decals & Mylar Kit, Pg. 69.			



Sec. 4: Drawings ...

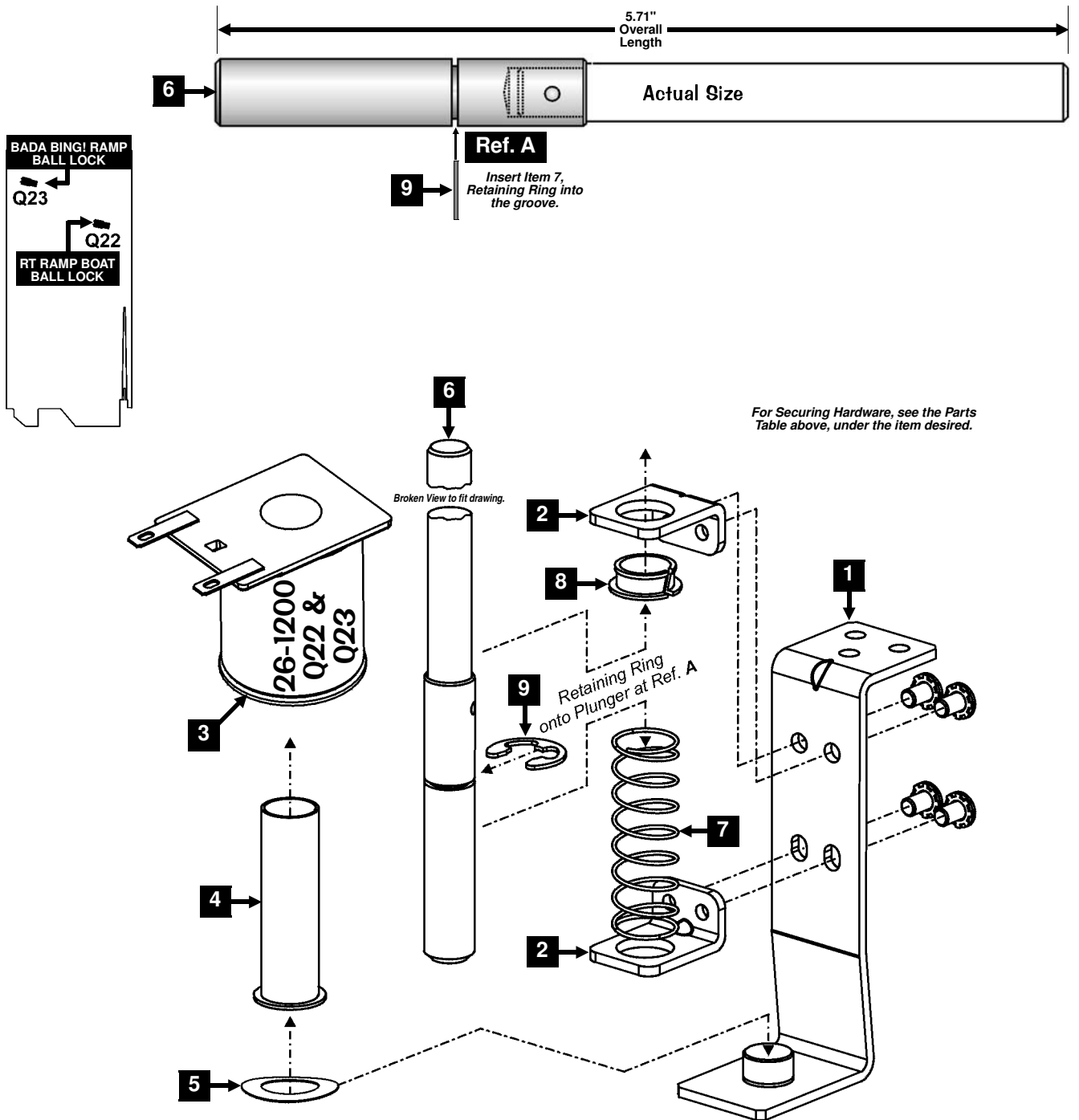
Take Note:

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

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

Up/Down Post (Right Boat Ramp Ball Lock & Bada Bing! Ramp Ball Lock) Assemblies, 500-5867-09 (Qty. 2) (Items 1-9)

Nr.	UP/DOWN POST PARTS	QTY.	SPI PART Nr.	Nr.	UP/DOWN POST PARTS	QTY.	SPI PART Nr.
1	Ball Lock Mounting Bracket Assembly	1/per	515-7132-00	5	Spring Washer (17/32" ID X 3/4" X 1")	1/per	269-5002-00
Item 1 is secured below the P/F by: #8 X 1/2" SHWH AB (Zinc) (Qty. 3/per) (234-5101-00)				6	Plunger, 5.71" Lg. (w/ Nylon Tip) Asm.	1/per	515-6119-04
2	Coil Retaining Bracket	2/per	535-5203-03	7	Compression (Relay) Spring	1/per	266-5020-00
Item 2 is sec. to Item 1 by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2/per) (232-5300-00)				8	Nyliner 7/16" Shaft (7L2-FF)	1/per	545-5418-01
3	Coil, 26-1200	1/per	090-5044-00T	9	Retaining Ring, 7/16" ø Shaft	1/per	270-5005-00
Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).				Ordering Note: If 500-5867-09 is unavailable, order the individual part(s) actually required.			
4	Coil Sleeve	1/per	545-5411-00				



Sec. 4: Drawings ...

Bada Bing! (behind Left Wire Ramp) Individual Parts Only (Items 1-8B)

Nr.	BADA BING! PARTS	QTY.	SPI PART Nr.
1	Bada Bing! Mounting Plate	1	535-9594-00
Item 1 is secured below the P/F by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 4) (234-5101-00)			
2	Bushing (White Plastic) 1/4" ø I.D.	2	545-5070-00
Item 2 is secured to Item 1 by: #6-32 X 3/8" SLT HWH Swage (Qty. 3/per) (237-5976-02)			
3	Pulley (1")	2	042-5001-01
4	Pulley (1-1/2")	1	042-5001-02
5	Belt (Clear, 10-1/2")	1	545-6124-04
6	Shaft	2	530-5691-00

Item 6 is secured to Items 2 & 3 through Items 1 & 2 by: #6-32 X 1/8" Set Screw (Qty. 1/per) (237-5838-03), Washer 1/4" I.D. X 1/2" O.D. X 1/16" Thick (Qty. 1/per @ below plate) (242-5008-00), Washer (Nylon, Plastic) 6/6 MMC 90295A140 (Qty. 1/per @ above plate) (242-5072-01) and Retaining Ring, 1/4" ø (Qty. 2/per above/below plate in grooves) (270-5002-00)

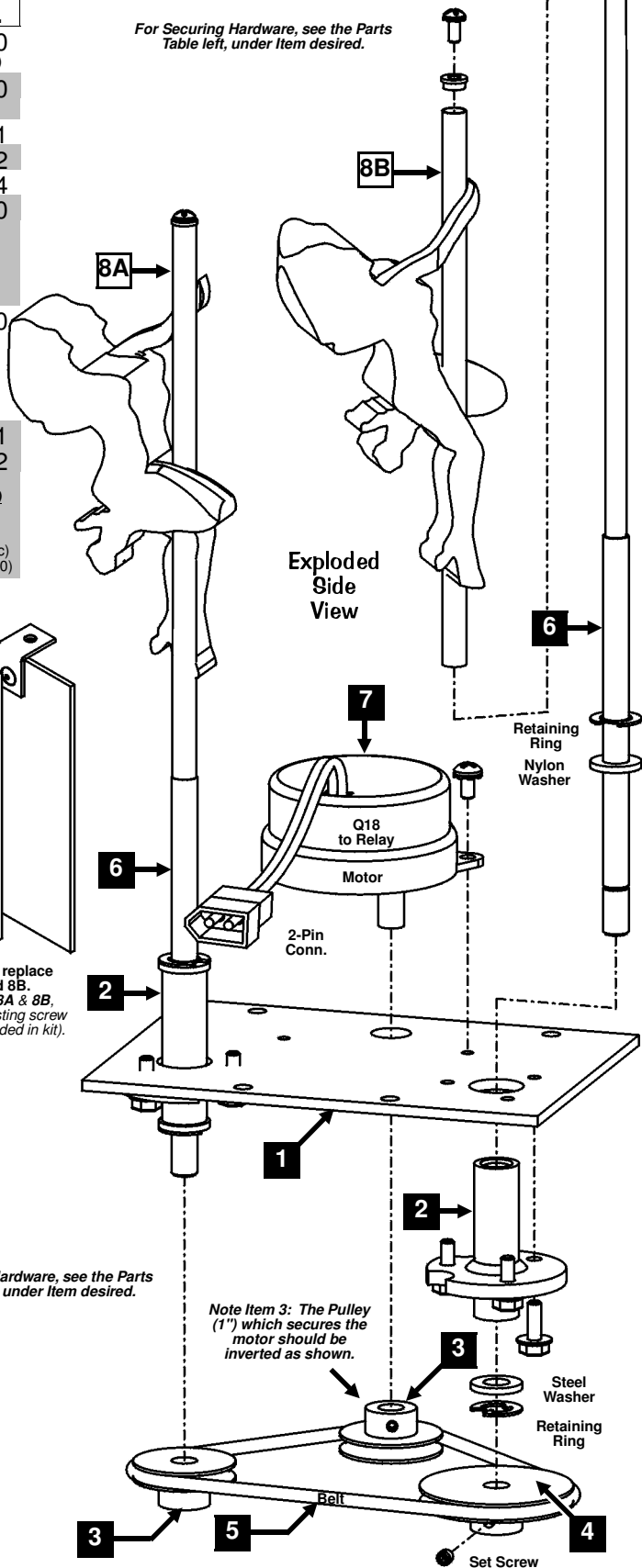
7 Motor Assembly 1 500-6887-00
Assembly Parts Included: Motor 24v AC 4W 50/60Hz 45.7/54.9 RPM Bi-Directional (Qty. 1) (041-5092-00) and 2-Pin Connector (Qty. 1) (045-5004-02) with wiring
 Item 8 is secured @ top of plate by: #6-32 X 1/4" PPH MS Ext. Sems (Zinc) (Qty. 2) (232-5200-00) and @ bottom of plate into Item 3 by: #6-32 X 1/8" Set Screw (Qty. 1) (237-5838-03)

8A Doll (Black Hair) & Tube Glued Asm. 1 515-7475-01
 8B Doll (Red Hair) & Tube Glued Asm. 1 515-7475-02

Ordering Note: Doll Hair Color, shape, type and/or position are subject to change and availability. **Assembly Parts Included:** Doll (Black or Red Hair) (Not Available Unglued) (PN REF. 545-6125-01 Black; -02 Red), Tubing (Clear Sleeve) 3/16" O.D. X 5.5" (Qty. 1/per) (605-5017-00) and Plug Spacer (glued in Tube Top) (Qty. 1/per) (605-5017-0P)

Items 8A & 8B are secured @ top onto Item 6 by: #4-40 X 1/4" PPH MS Ext. Sems (Zinc) (Qty. 1/per) (237-5909-00) (ASM. REF. 500-6859-00)

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



Exploded Side View

Assembled Side View

Optional Kit to replace Items 8A and 8B. Remove Items 8A & 8B, resecure with existing screw (extra screw included in kit).

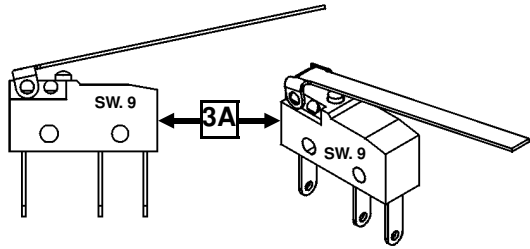
For Securing Hardware, see the Parts Table above, under Item desired.

Note Item 3: The Pulley (1") which secures the motor should be inverted as shown.

Sec. 4: Drawings ...

Left Wire Ramp Individual Parts Only (Items 1-5) and Left Steel Ramp 515-7464-00 (Item 6)

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

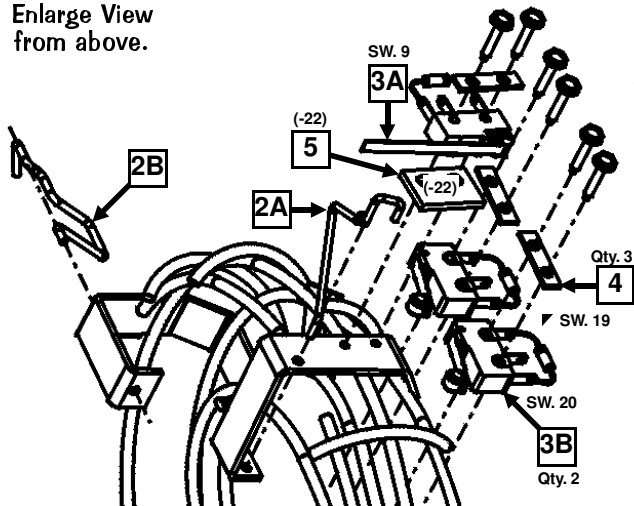


A = Through Plastic -16 on Hex Spacer 1-1/2" (254-5008-09, Page 72, Item 12 for view), #6 Washer (Qty. 2, above and below wire tab) (242-5001-00) and #6-32 X 3/8" PPH MS Sems Ext. (Zinc) (232-5201-00)

Ref. A

Nr.	LEFT RAMP PARTS	QTY.	SPI PART Nr.
1	Wire Ramp (Left) <i>No Parts</i>	1	515-7450-00
Item 1 is secured to Item 6 @ top by: Ramp secured at Ref. A, B & C (see drawing).			
2A	Wire Form (Left Style) (Gate Sw. 9)	1	535-9375-00
2B	Wire Form (for 1-Way Gate)	1	535-9551-00
3A	Switch (1 5/8" Actuator) (for Wire Gates)	1	180-5010-01
Switch has a Diode (1N4004) (112-5003-00). Can be replaced with (1N4001) (112-5001-00).			
3B	Switch (Roller-Actuator, Lite Force)	2	180-5119-02
Each Switch has a Diode (1N4004) (112-5003-00). Can be replaced w/ (1N4001) (112-5001-00).			
4	Switch Body Protect Plate	3	535-6539-00
Items 3A, 3B, 4 & 5 (Plastic -22 for Item 3A only) are secured to Item 1 by: #2-56 X 1/2" Unslotted HWH #4 Hex Head TR3 Blk (Qty. 2/per) (237-5937-02)			
5	Kit: Plastics (incl. Plastic -22)	1	803-5000-85
Note: Individual Plastics (830-6033-XX) are not available individually, ordering of kit is required. For all pieces, see <i>Playfield Top - Plastics (Screened & Clear) Kit, ...</i> , Page 69. (ASM. REF 500-6876-00, Items 1-5)			
6®	Left Steel Ramp (Riveted Assembly)	1	515-7464-00
Assembly Parts Included: Steel Ramp (Left) (535-9545-00), Ramp Flap (535-9549-00), Rivet, 1/8" ø X 3/16" Long (Qty. 2) (249-5001-00) and #6 Lock Washer (Qty. 2) (246-5000-00)			
Item 6® is secured below the playfield by: #8 Washer (Qty. 2) (242-5005-00) and #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00) Ramp secured at Ref. D (see drawing).			

Enlarge View from above.



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

D = Onto Post Hex Base #6-32 Top / #10-32 Bottom (530-5332-03, Page 70, Item 15 for view), Hex Spacer 1/2" (254-5008-16, Page 72, Item 3A for view), #6-32 X 3/8" PPH MS Sems Ext. (Zinc) (232-5201-00) and 1/4" Clamp (Single0) (040-5003-00)

Ref. D

E = To Wire Ramp with a #6-32 X 3/8" PPH MS 82° Undercut (Zinc) (237-5871-00)

Ref. E

Take Note:

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

Ref. B

B = Onto Hex Spacer 1-1/2" (254-5008-09, Page 72, Item 12 for view) with a #6-32 X 3/8" PPH MS 82° Undercut (Zinc) (237-5871-00)

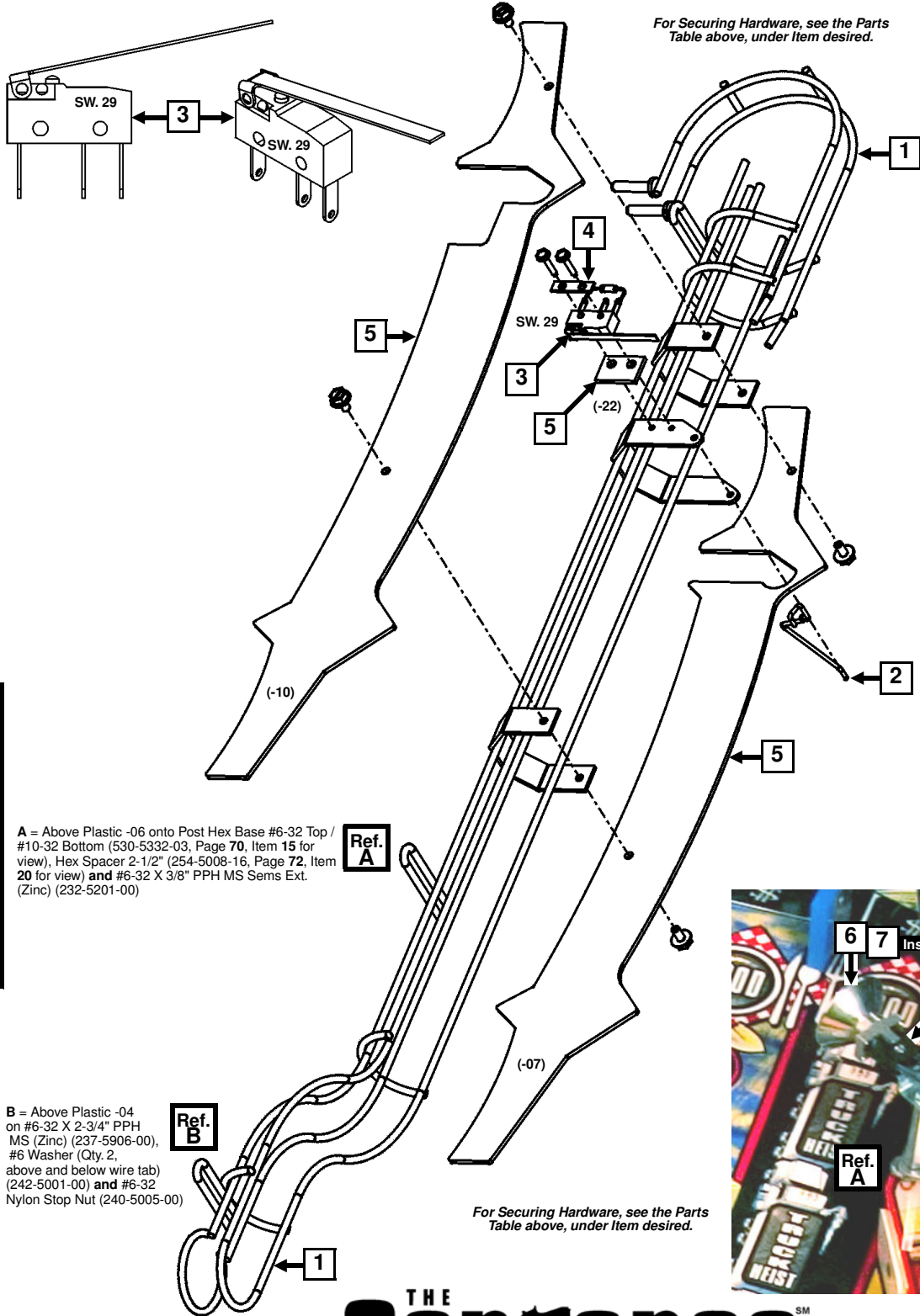
C = Above Plastic -02 on #6-32 X 2-3/4" PPH MS (Zinc) (237-5906-00), #6 Washer (Qty. 2, above and below wire tab) (242-5001-00) and #6-32 Nylon Stop Nut (240-5005-00)

Ref. C

Sec. 4: Drawings ...

Right Wire Ramp Individual Parts Only (Items 1-8)

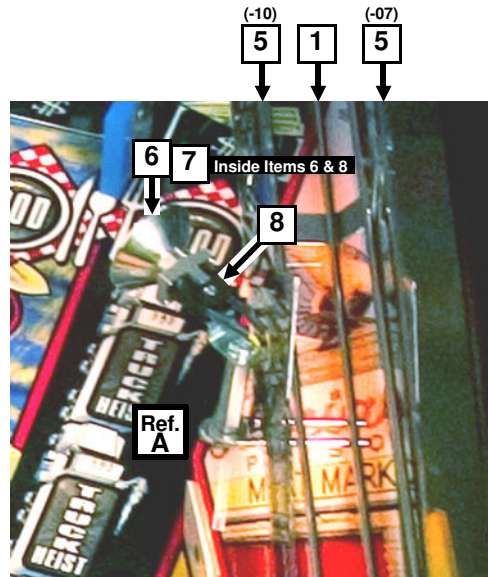
Nr.	RIGHT WIRE RAMP PARTS	QTY.	SPI PART Nr.	Nr.	RIGHT WIRE RAMP PARTS	QTY.	SPI PART Nr.
1	Wire Ramp (Right) <i>No Parts</i>	1	515-7449-00	5	Kit: Plastics (incl. Pl. -07, -10 & -22)	1	803-5000-85
Item 1 is secured under the Playfield by: #8 Washer (Qty. 2) (242-5005-00) and #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00) <i>Ramp secured at Ref. A & B (see drawing).</i>				Note: Individual Plastics (830-6033-XX) are not available individually, ordering of kit is required. For all pieces, see Playfield Top - Plastics (Screened & Clear) Kit, ... , Page 69. Items -07 & -10 are secured to Item 1 by: #6-32 X 1/4" SLT HWH Swage (Zinc) Wax (Qty. 2/per) (237-5976-01) (ASM. REF. 500-6874-00, Items 1-5)			
2	Wire Form (Right Style) (<i>Gate Sw. 29</i>)	1	535-9375-01	6	Light Reflector (Silver Color Plastic)	1	545-5409-01
3	Switch (1 $\frac{5}{8}$ " Actuator) (<i>for Wire Gates</i>)	1	180-5010-01	7	#555 Wedge Base Bulb (Clear)	1	165-5002-00
Switch has a Diode (1N4004) (112-5003-00). Can be replaced with (1N4001) (112-5001-00).				8	Wedge Base Socket (Laydown)	1	077-5026-01
4	Switch Body Protect Plate	1	535-6539-00	Item 8 is secured to Item 1 by: (See Ref. A drawing & photo below.)			
Items 3, 4 & 5 (Plastic -22) are secured to Item 1 by: #2-56 X 1/2" Unslotted HWH #4 Hex Head TR3 Blk (Qty. 2) (237-5937-02)							



Ref. A
 A = Above Plastic -06 onto Post Hex Base #6-32 Top / #10-32 Bottom (530-5332-03, Page 70, Item 15 for view), Hex Spacer 2-1/2" (254-5008-16, Page 72, Item 20 for view) and #6-32 X 3/8" PPH MS Sems Ext. (Zinc) (232-5201-00)

Ref. B
 B = Above Plastic -04 on #6-32 X 2-3/4" PPH MS (Zinc) (237-5906-00), #6 Washer (Qty. 2, above and below wire tab) (242-5001-00) and #6-32 Nylon Stop Nut (240-5005-00)

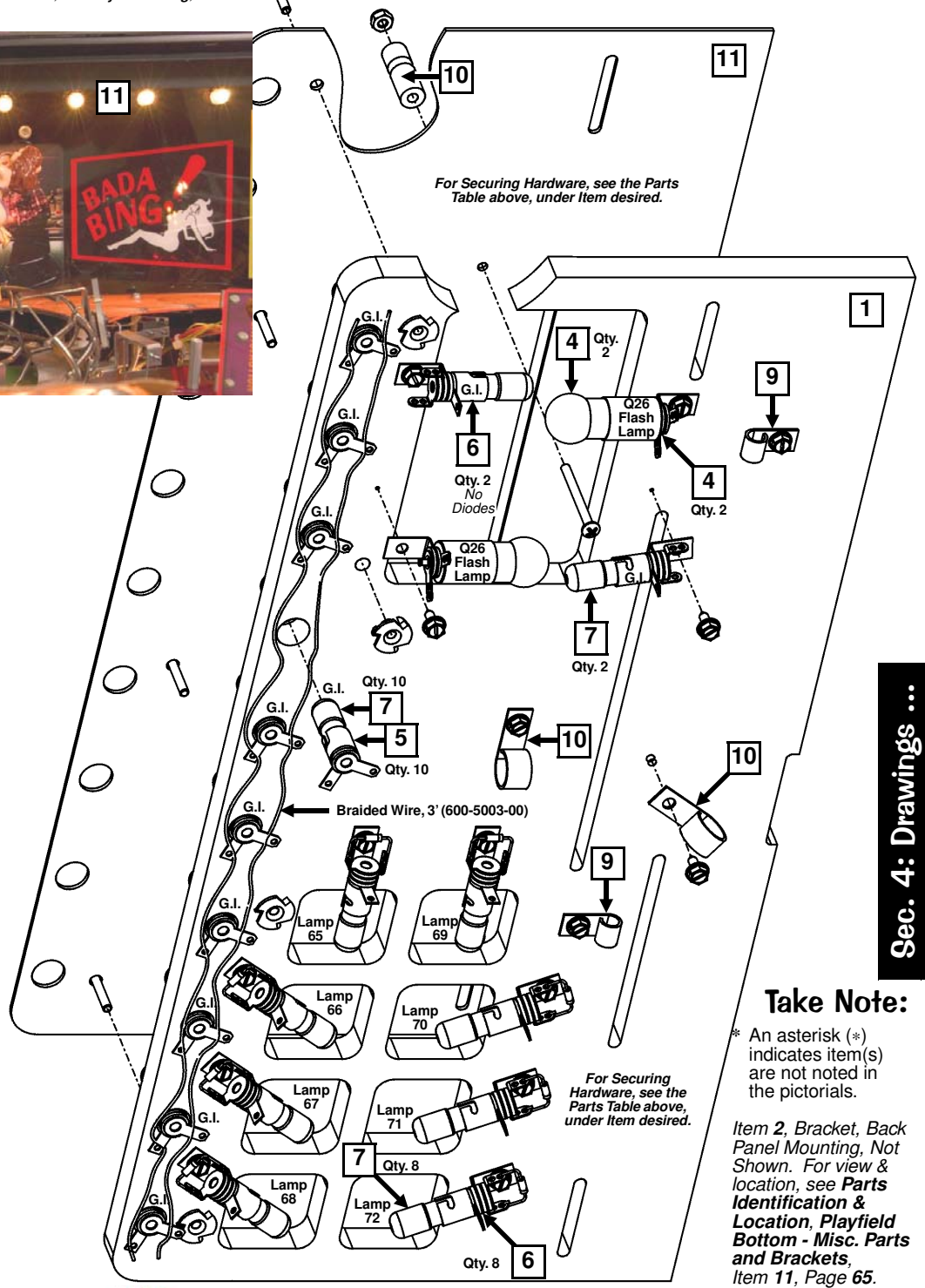
For Securing Hardware, see the Parts Table above, under Item desired.



Sec. 4: Drawings ...

Back Panel Individual Parts Only (Items 1-11)

Nr.	BACK PANEL PARTS	QTY.	SPI PART Nr.	Nr.	BACK PANEL PARTS	QTY.	SPI PART Nr.
1	Back Panel (Black, Wood) <i>No Parts</i>	1	525-5640-00	7	#44 Bulb (Clear) <i>Heavy Filament</i>	20	165-5000-44-HF
<small>Item 1 is secured below the Playfield with Item 2 by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5101-00)</small>							
2*	Bracket, Back Panel Mounting	2	535-8964-00	8	1/2" Cable Clamp	2	040-5000-06
<small>Item 2 is secured to Item 2 by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5101-00)</small>							
3	Lg. Bayonet (2-Lug Laydown Std.) Socket	2	077-5100-00	9	1/4" Cable Clamp	2	040-5000-03
4	#89 Bulb <i>Heavy Filament</i>	2	165-5000-89-HF	<small>Items 3, 5, 6, 8 & 9 are secured to Item 1 by: #6 X 3/8" SHWH (Qty. 1/per) (234-5000-00)</small>			
5	Sm. Bayonet (2-Lug Staple Down) Socket	10	077-5000-00	10	1-1/16" 1-Groove Plastic Post (Clear)	1	550-5059-01
6	Sm. Bayonet (3-Lug Laydown, 2 bent) Sckt.	10	077-5032-00	<small>Item 10 is secured through Item 11 by: #6-32 X 1-1/2" PPH MS (Zinc) (Qty. 1) (237-5510-00) and #6-32 Nylon Stop Nut (Qty. 1) (240-5005-00)</small>			
<small>Socket has a Diode (1N4004) (112-5003-00). Can be replaced with (1N4001) (112-5001-00). Item 6 Note: 2 (two) sockets next to Item 3 Sockets do not require diodes (they are used for General Illumination, see Playfield Wiring, Section 5, Chapter 2, Page 109).</small>							
				11	Kit: Plastics (includes Plastic -21)	1	803-5000-85
<small>Note: Individual Plastics (830-6033-XX) are not available individually, ordering of kit is required. For all pieces, see Playfield Top - Plastics (Screened & Clear) Kit, ..., Page 69. Item 11 is secured to Item 1 by: #8-32 X 3/4" SLT HWH Swage (Zinc) Wax (Qty. 4) (237-5975-02) and #8-32 T-Nut (Qty. 4) (240-5101-00) (ASM. REF. 500-6857-00)</small>							



Sec. 4: Drawings ...

Take Note:

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

Item 2, Bracket, Back Panel Mounting, Not Shown. For view & location, see **Parts Identification & Location, Playfield Bottom - Misc. Parts and Brackets, Item 11, Page 65.**

Lockdown Assembly, Front Molding & Button Plug Ordering Replacement Parts Reference

The Front Molding and Lockdown Assemblies are evolving. The ones shown on this page, which have been used many years on past games, are perfectly fine. The ones shown on the next page are the new styles.

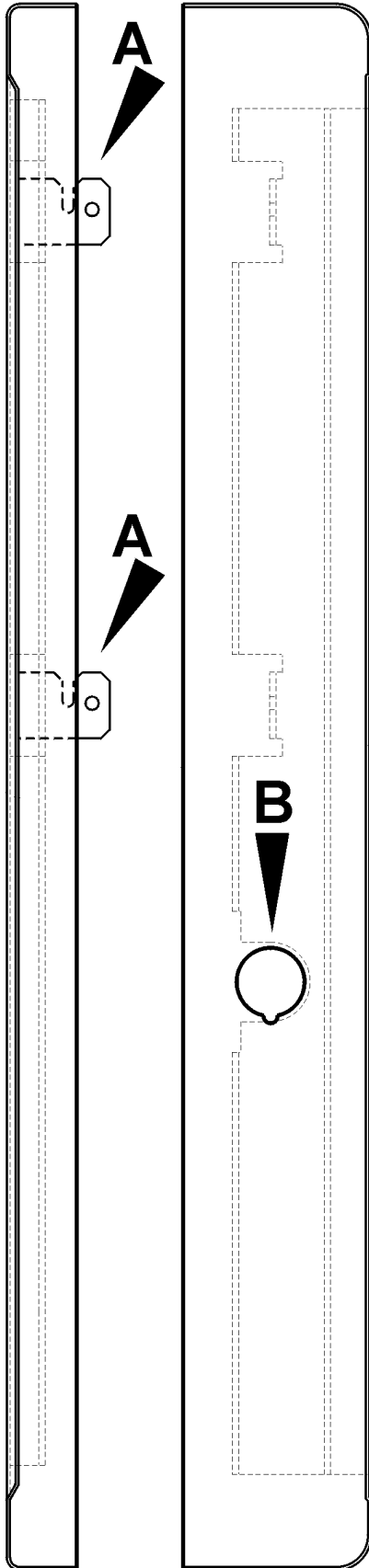
How to identify the differences between the **old style (this page)** and **new style (next page)** :

PART NUMBER	DESCRIPTION	IDENTIFYING POINTS
500-5757-02-00 (Black)	Front Molding* (with round hole; old style)	A = 2 Tabs located at the right & near center. B = Button Hole Access is round with a notch.

** Will only fit on 500-6509-00 Lockdown Assembly*

500-6509-00	Lockdown Assembly (old style)	C = Access Hole has large open end cut-out.
500-6566-00	Button Hole Plug**	Round Top
500-6587-06	ToPS™ Start Button**	Fits Round Button Hole

*** Will only fit in 500-5757-style Front Molding*



Top View of Lockdown Assembly

Playfield Hanger Bracket

C

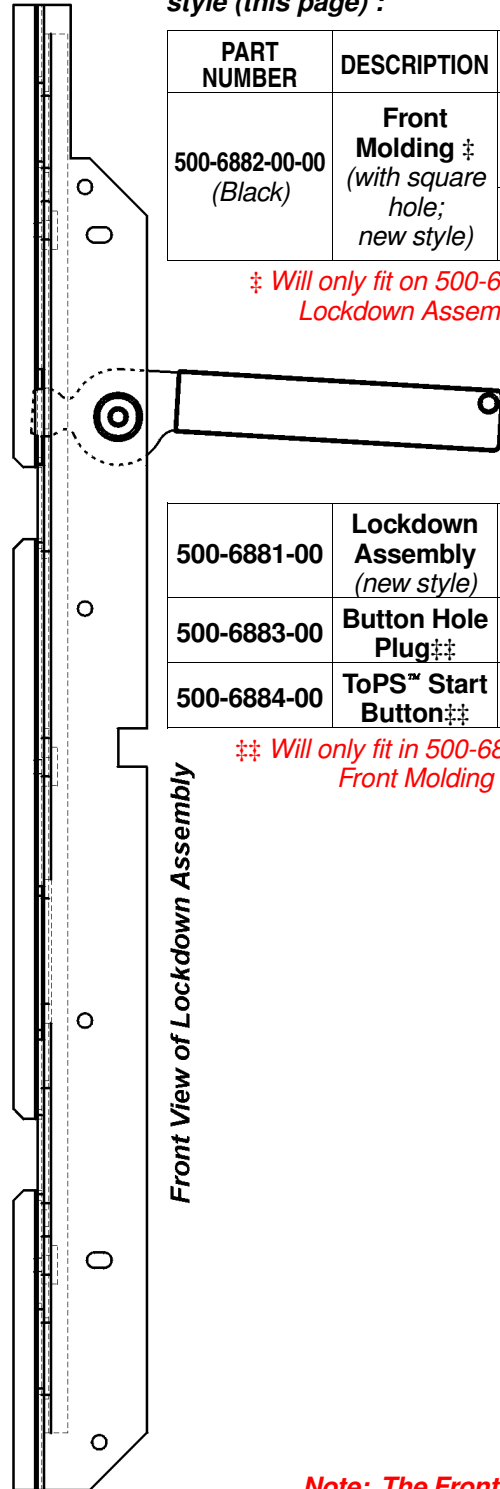
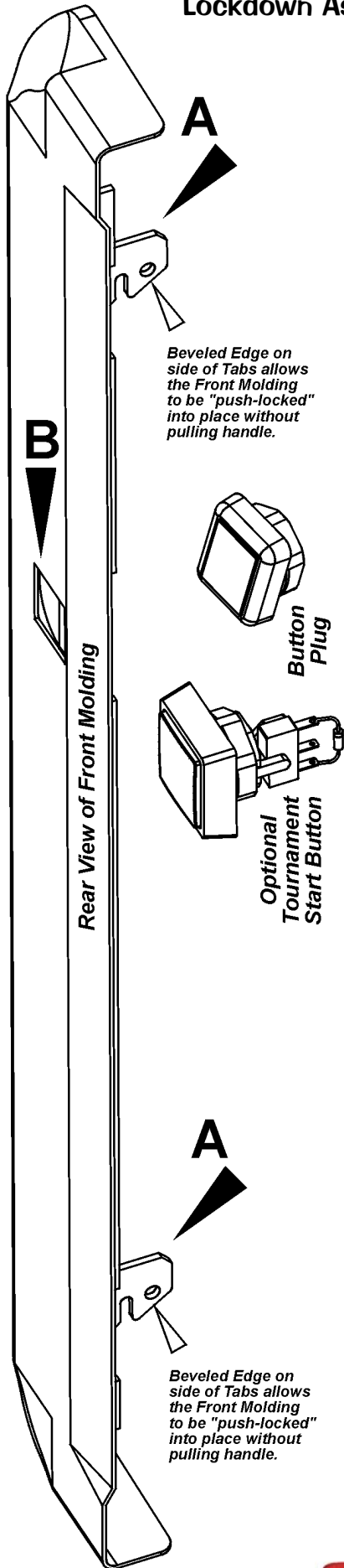
Playfield Hanger Bracket

Front View of Lockdown Assembly

Sec. 4: Drawings ...

Note: The Front Molding will only work with this Lockdown Assembly, the Button Plug & ToPS™ Start Button will only work with this Front Molding.

Lockdown Assembly, Front Molding & Button Plug (New Style)



How to identify the differences between the old style (previous page) and new style (this page) :

PART NUMBER	DESCRIPTION	IDENTIFYING POINTS
500-6882-00-00 (Black)	Front Molding ‡ (with square hole; new style)	A = 2 Tabs located at the left and right sides. B = Button Hole Access is square.

‡ Will only fit on 500-6881-00 Lockdown Assembly

500-6881-00	Lockdown Assembly (new style)	C = Access Hole no longer has an open end cut-out.
500-6883-00	Button Hole Plug ‡‡	Square Top
500-6884-00	ToPS™ Start Button ‡‡	Fits Square Button Hole

‡‡ Will only fit in 500-6882-style Front Molding

Note: The Front Molding will only work with this Lockdown Assembly, the Button Plug & ToPS™ Start Button will only work with this Front Molding.

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

UK ONLY OPTIONAL
Up/Down Post Assy., 500-6293-00
(Items 1-9)

Nr.	BALL DEFLECTOR PARTS	QTY.	SPI PART Nr.
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
Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).			
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)			

Nr.	UP/DOWN POST PARTS	QTY.	SPI PART Nr.
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	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)			
3	Coil, 23-1100 (ORG)	1	090-5030-00T
Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).			
4	Coil Sleeve (with extension)	1	545-5847-00
5	Spring Washer, 17/32" ID X 3/4" X 1"	1	269-5002-00
6	Ball Bumper, Plunger & Shaft Assy.	1	515-6844-00
For Individual Items use : Ball Bumper Plastic (Top) Red (550-5029-02), Plunger & Shaft Only (515-6841-00), Plunger Head (detachable) (530-5511-00), #10-32 X 3/8" PPH MS (Sems) Zinc (secures Plunger Head to Shaft) (232-5401-00), Roll Pin 3/32" ø x 1/2" Long (251-5002-00) and Retaining Ring, 1/4" ø Shaft (270-5002-00)			

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

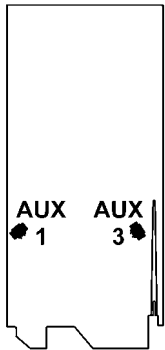
Ordering Note: If 515-6844-00 is unavailable, order the individual part(s) actually required.

Take Note:

⊖ **Coil Note:** ⊖ Either -00B or -00T can be used for coil replacements. B/T listed is preferable for easier diode access and may differ on game.

Take Note:

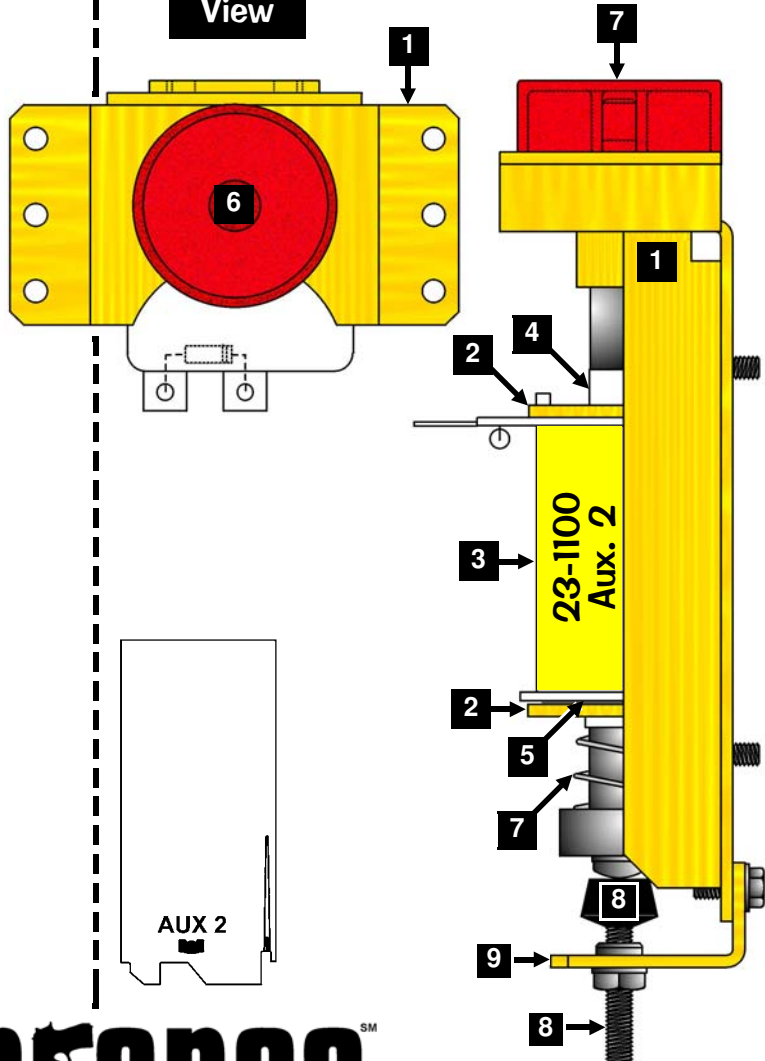
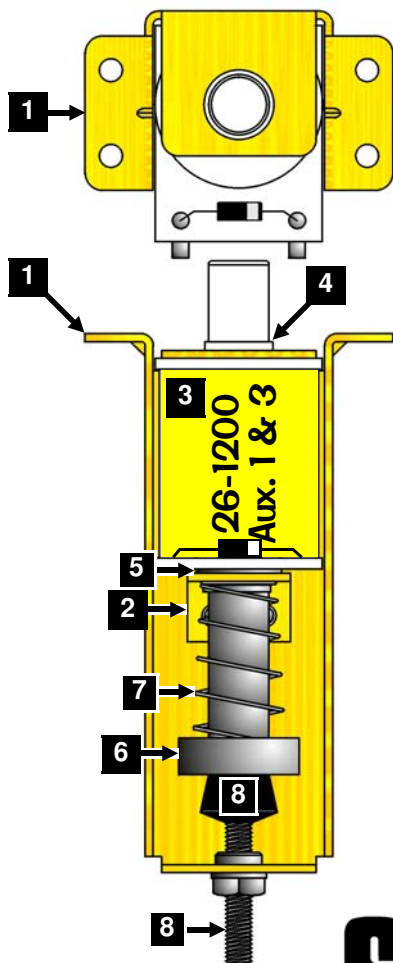
⊖ **Coil Note:** ⊖ Either -00B or -00T can be used for coil replacements. B/T listed is preferable for easier diode access and may differ on game.



Top View

Top View

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:*

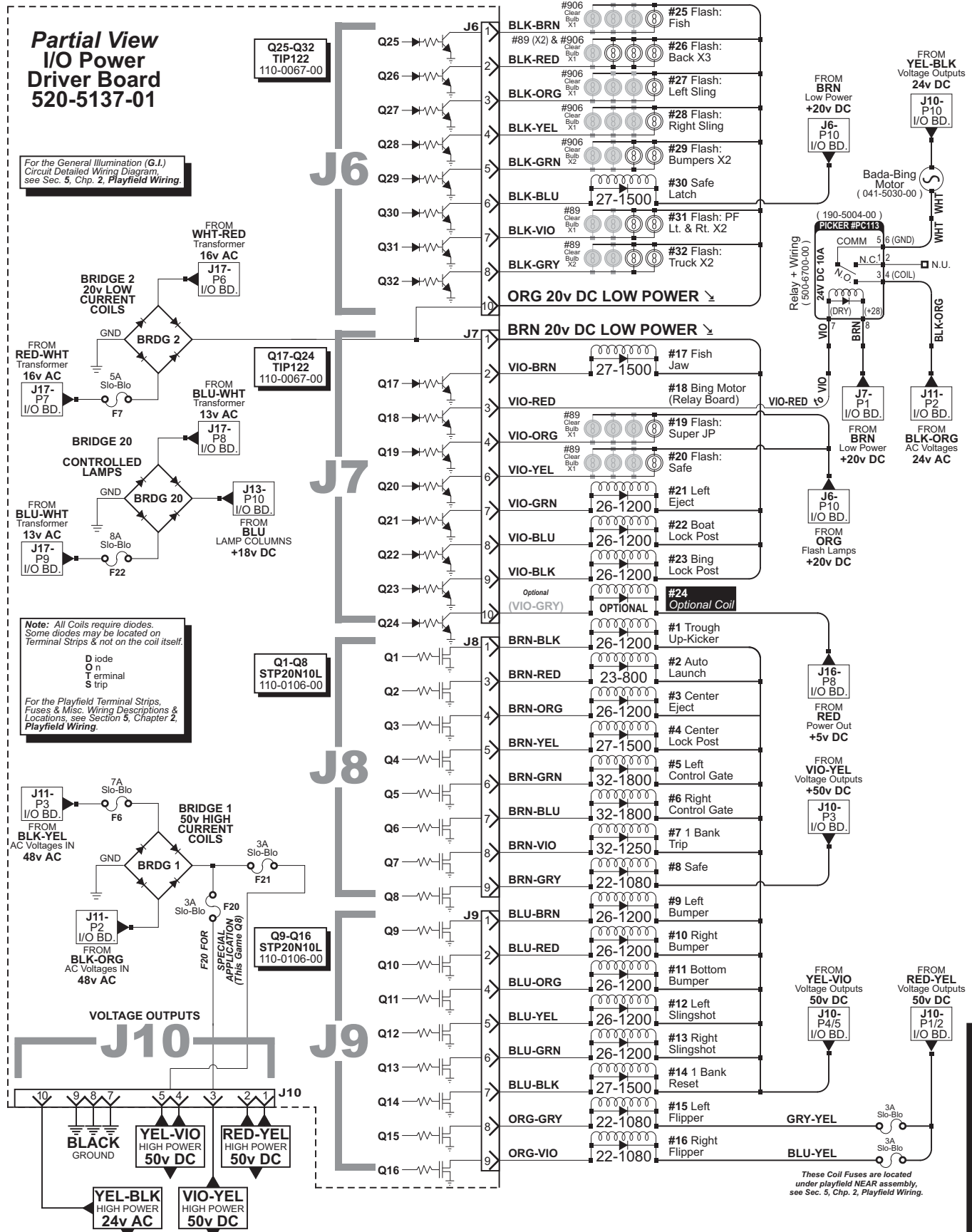
COILS DETAILED CHART TABLE

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	23-800 ♂ 090-5001-00B
#3	CENTER EJECT	Q3		YEL-VIO	J10-P4/5	50v DC	BRN-ORG	J8-P4	26-1200 ♂ 090-5044-00B
#4	CENTER LOCK POST	Q4		YEL-VIO	J10-P4/5	50v DC	BRN-YEL	J8-P5	27-1500 ♂ 090-5004-00T
#5	LEFT CONTROL GATE	Q5		YEL-VIO	J10-P4/5	50v DC	BRN-GRN	J8-P6	32-1800 ♂ 515-6543-00
#6	RIGHT CONTROL GATE	Q6		YEL-VIO	J10-P4/5	50v DC	BRN-BLU	J8-P7	32-1800 ♂ (090-5031-00)
#7	1 BANK TRIP	Q7		YEL-VIO	J10-P4/5	50v DC	BRN-VIO	J8-P8	32-1250 ♂ 515-6916-01
#8	SAFE	Q8		VIO-YEL	J10-P3	50v DC	BRN-GRY	J8-P9	22-1080 ♂ 090-5032-00T
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 ♂ 090-5044-00B
#12	LEFT SLINGSHOT	Q12		YEL-VIO	J10-P4/5	50v DC	BLU-YEL	J9-P5	26-1200 ♂ 090-5044-00T
#13	RIGHT SLINGSHOT	Q13		YEL-VIO	J10-P4/5	50v DC	BLU-GRN	J9-P6	26-1200 ♂ 090-5044-00T
#14	1 BANK RESET	Q14		YEL-VIO	J10-P1/2	50v DC	BLU-BLK	J9-P7	27-1500 ♂ 090-5004-00B
#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	FISH JAW	Q17	▲ I/O Power Driver ▼	BROWN	J7-P1	20v DC	VIO-BRN	J7-P2	27-1500 ♂ 090-5004-00B
#18	BING MOTOR (RELAY)	Q18		BROWN	J7-P1	20v DC	VIO-RED	J7-P3	Relay Asm 500-6700-00
#19	FLASH: SUPER JP	Q19		ORANGE	J6-P10	20v DC	VIO-ORG	J7-P4	#89 Bulb 165-5000-89-HF
#20	FLASH: SAFE	Q20		ORANGE	J6-P10	20v DC	VIO-YEL	J7-P6	#89 Bulb 165-5000-89-HF
#21	LEFT EJECT	Q21		BROWN	J7-P1	20v DC	VIO-GRN	J7-P7	26-1200 ♂ 090-5044-00B
#22	BOAT LOCK POST	Q22		BROWN	J7-P1	20v DC	VIO-BLU	J7-P8	26-1200 ♂ 090-5044-00T
#23	BING LOCK POST	Q23		BROWN	J7-P1	20v DC	VIO-BLK	J7-P9	26-1200 ♂ 090-5044-00T
#24	OPTIONAL COIL	Q24		RED	J16-P7	5v DC	VIO-GRY	J7-P10	Opt. 5v
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	FLASH: FISH	Q25	▲ I/O Power Driver ▼	ORANGE	J6-P10	20v DC	BLK-BRN	J6-P1	#44 LED 112-5023-08
#26	FLASH: BACK X3	Q26		ORANGE	J6-P10	20v DC	BLK-RED	J6-P2	#89 #906 X2 & X1
#27	FLASH: LEFT SLING	Q27		ORANGE	J6-P10	20v DC	BLK-ORG	J6-P3	#906 Bulb 165-5004-00
#28	FLASH: RIGHT SLING	Q28		ORANGE	J6-P10	20v DC	BLK-YEL	J6-P4	#906 Bulb 165-5004-00
#29	FLASH: BUMPERS X2	Q29		ORANGE	J6-P10	20v DC	BLK-GRN	J6-P5	#906 Bulb 165-5004-00
#30	SAFE LATCH	Q30		BROWN	J7-P1	20v DC	BLK-BLU	J6-P6	27-1500 ♂ 090-5004-00B
#31	FLASH: PF LT & RT X2	Q31		ORANGE	J6-P10	20v DC	BLK-VIO	J6-P7	#89 Bulb 165-5000-89-HF
#32	FLASH: TRUCK X2	Q32		ORANGE	J6-P10	20v DC	BLK-GRY	J6-P8	#89 Bulb 165-5000-89-HF
Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: Q19-Q20, Q25-Q29, Q31-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	UK 3X Trans. Driver Board	BROWN	J7-P1	20v DC	WHITE	J2-P3	26-1200 ♂ 090-5044-00T
	AUX 2: CENTER UP/DOWN POST	Q2		BROWN	J7-P1	20v DC	RED	J2-P4	23-1100 ♂ 090-5030-00T
	AUX 3: RIGHT UP/DOWN POST	Q3		BROWN	J7-P1	20v DC	ORANGE	J2-P7	26-1200 ♂ 090-5044-00T

♂ Coil Note: ♂ Either -00B or -00T can be used for coil replacements. B/T listed is preferable for easier diode access & may differ on game.

Sec. 5: Schematics...

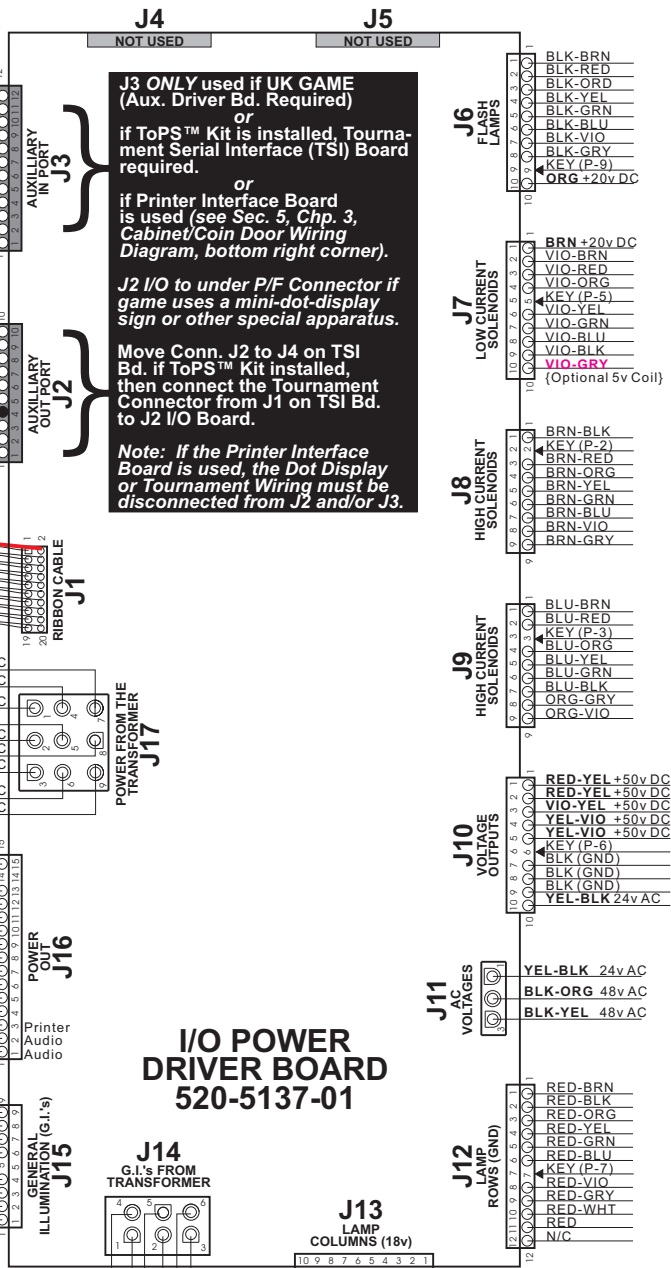
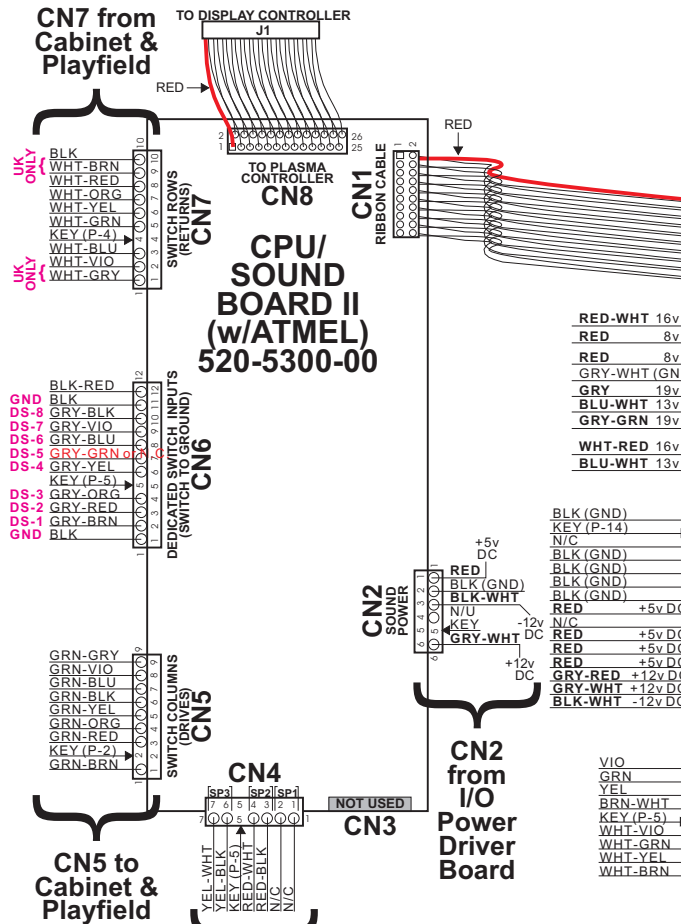
Backbox I/O Power Driver Board Detailed Wiring Diagram



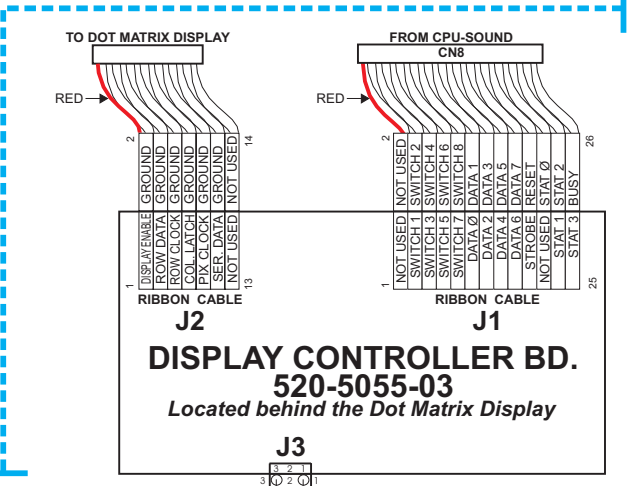
Backbox Board Layout Wiring Diagram

See Section 5, Chapter 4, Printed Circuit Boards (PCBs), Pages 148-154, for UK & Special Application(s) 3X Transistor Driver Board and ToPS™ Overview & Wiring, regarding the use of J2 & J3.

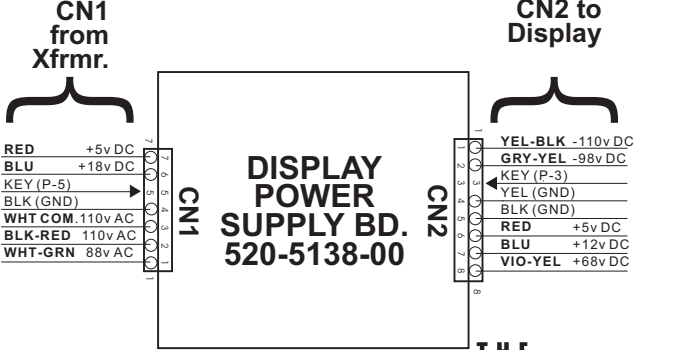
J3 ONLY used if UK GAME (Aux. Driver Bd. Required) or if ToPS™ Kit is installed, Tournament Serial Interface (TSI) Board required. or if Printer Interface Board is used (see Sec. 5, Chp. 3, Cabinet/Coin Door Wiring Diagram, bottom right corner).
J2 I/O under P/F Connector if game uses a mini-dot-display sign or other special apparatus.
 Move Conn. J2 to J4 on TSI Bd. if ToPS™ Kit installed, then connect the Tournament Connector from J1 on TSI Bd. to J2 I/O Board.
 Note: If the Printer Interface Board is used, the Dot Display or Tournament Wiring must be disconnected from J2 and/or J3.



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

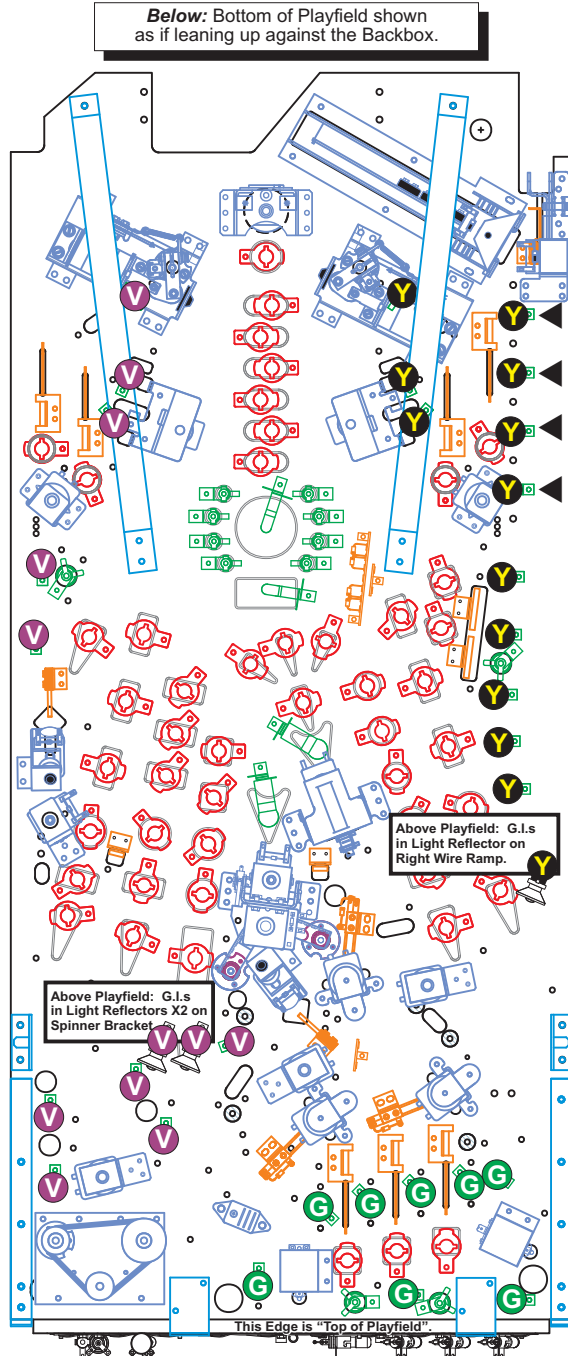


Sec. 5: Backbox ...

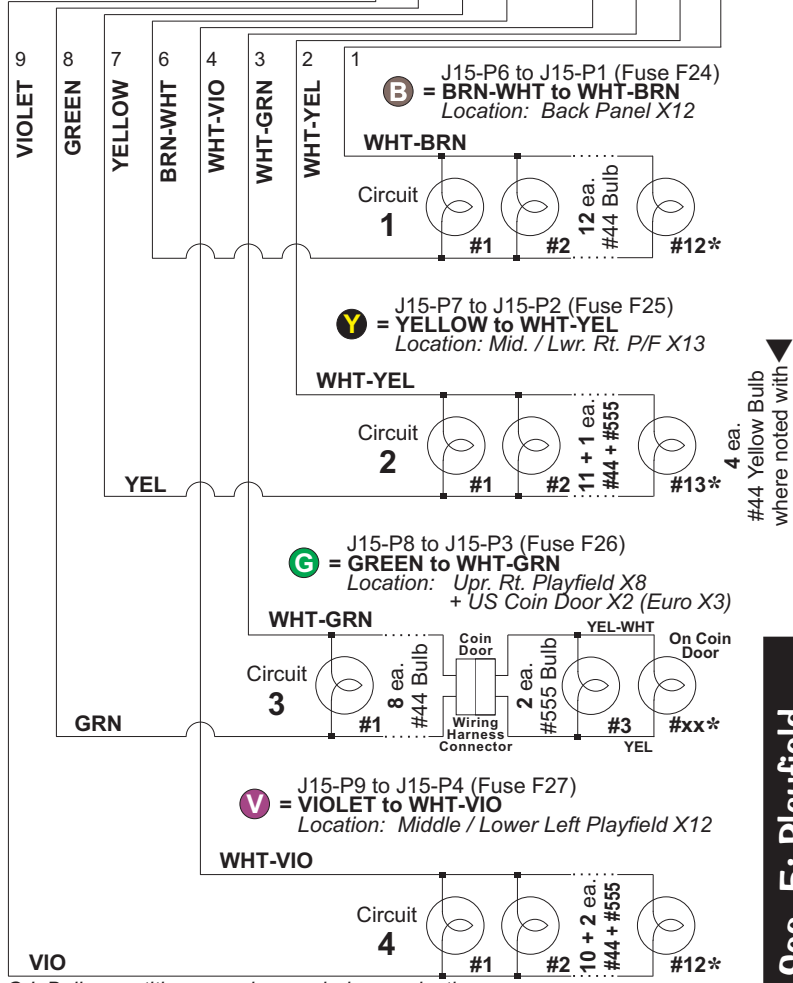
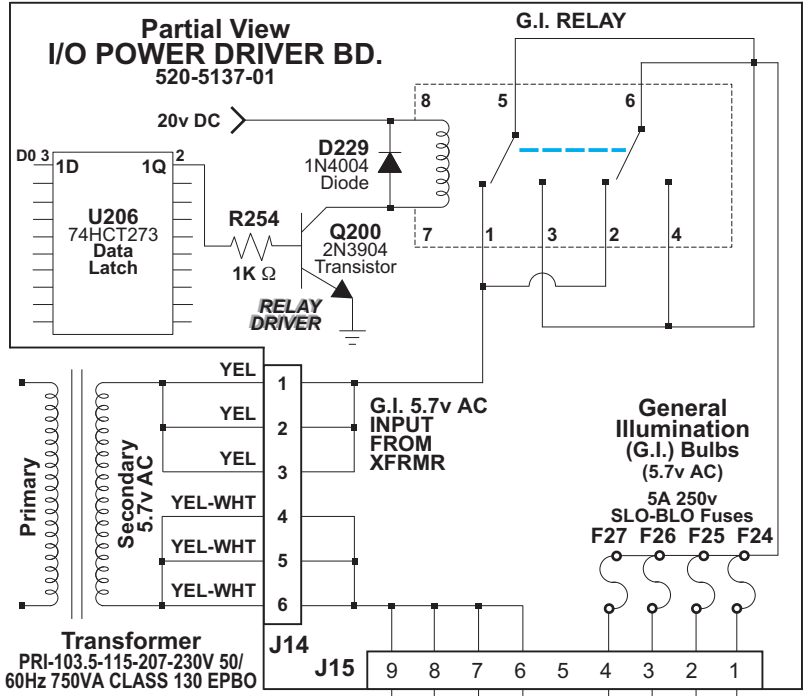
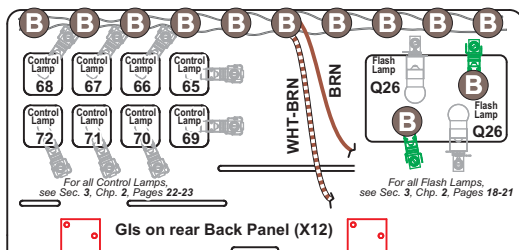


Playfield Wiring

General Illumination Circuit Detailed Wiring Diagram



Below: Located at the top of the P/F, rear view of the Back Panel.



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

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 Switch(es): none

Diode On Terminal Strip

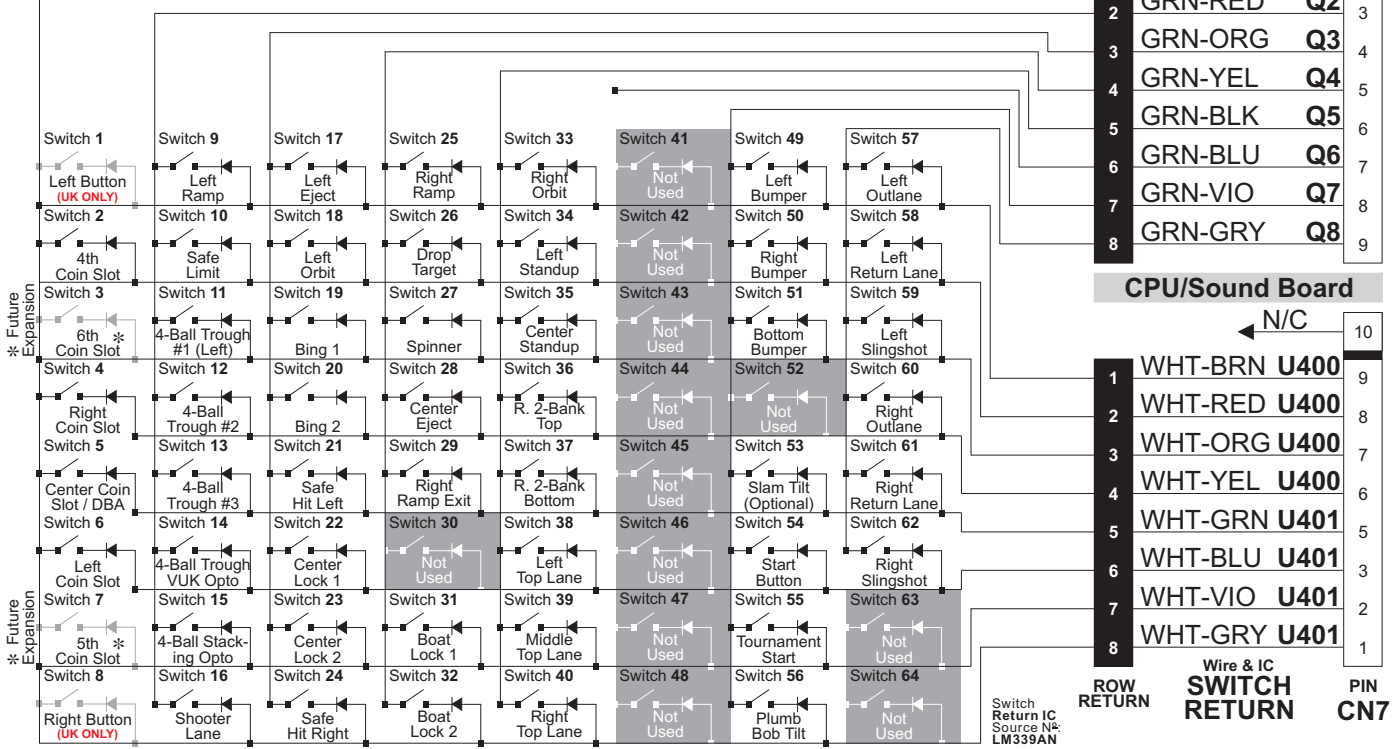
Diode On Diode Board

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 Lamp(s): 73-77

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

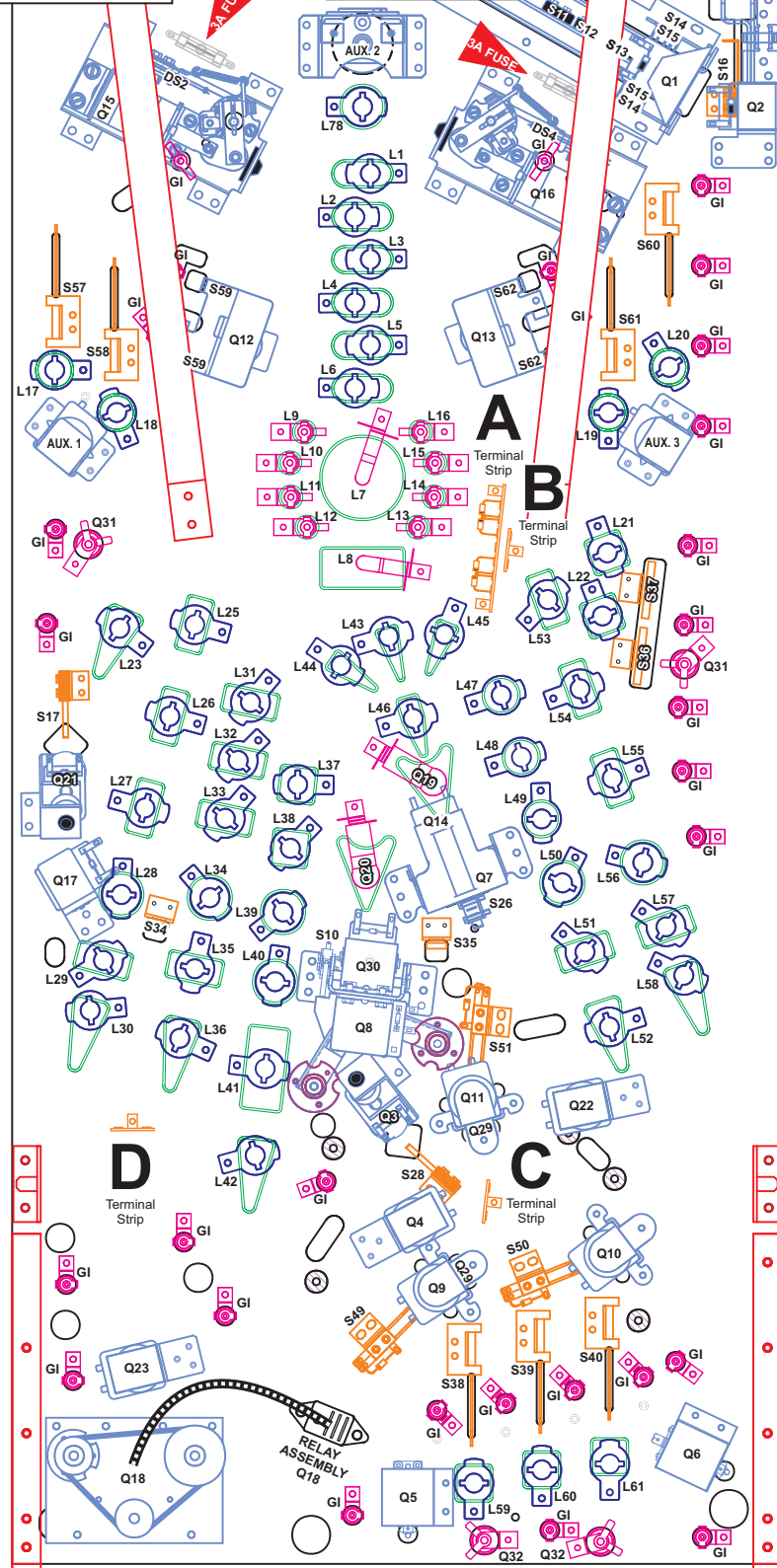
Please Note: Terminal Strip(s), Diode Board(s) and/or Fuse Holder(s) locations shown, represent the general location (your game may differ slightly).

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

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

**LOWER LEFT
 FLIPPER FUSE**
 RED -3A S.B. GRY-
 YEL -YEL

**LOWER RIGHT
 FLIPPER FUSE**
 RED -3A S.B. BLU-
 YEL -YEL

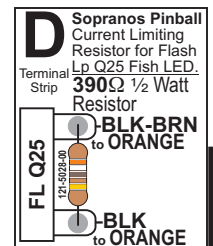
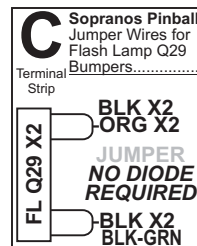
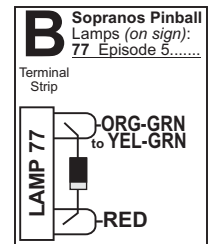
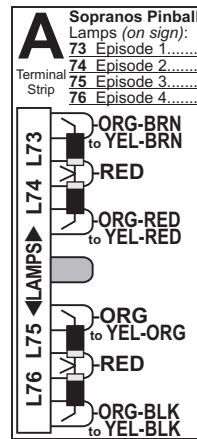


Explanation:

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").

Legend:

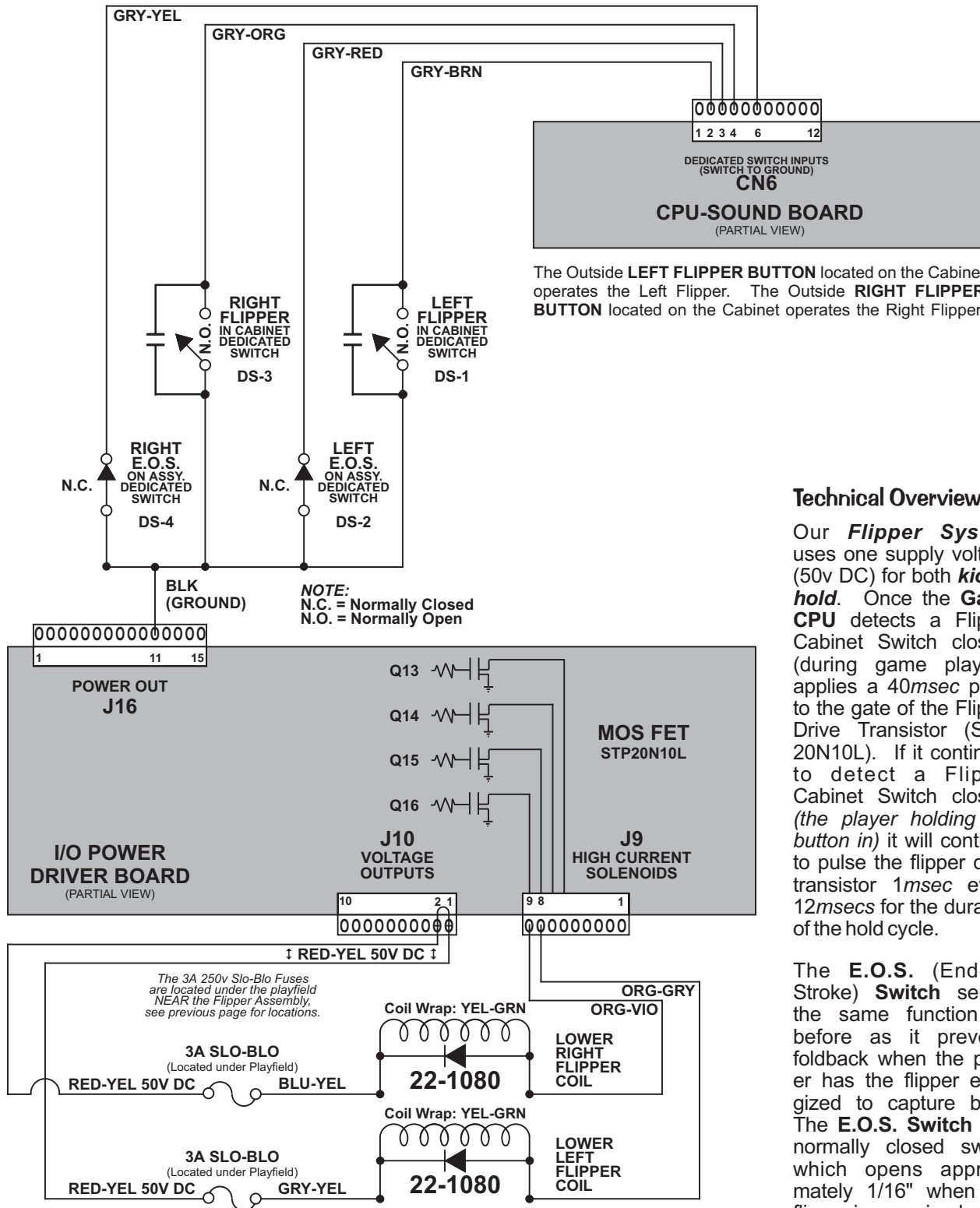
- S = Switch Matrix Number (Below P/F Only)
- L = Lamp Matrix Number (Below P/F Only)
- Q = Coil / Flash (see Pages 106-107)
- DTS / TS = (Diode) Terminal Strips (A-D)



See the Pink Pages, Playfield Bottom - Switches (Stand-Alone) and Switches (on Assemblies) (Below) (Page 67) for Terminal Strips, Diodes, Fuses and Fuse Holders Part Numbers.

Sec. 5: Playfield ...

2-Flipper Circuit Wiring Diagram



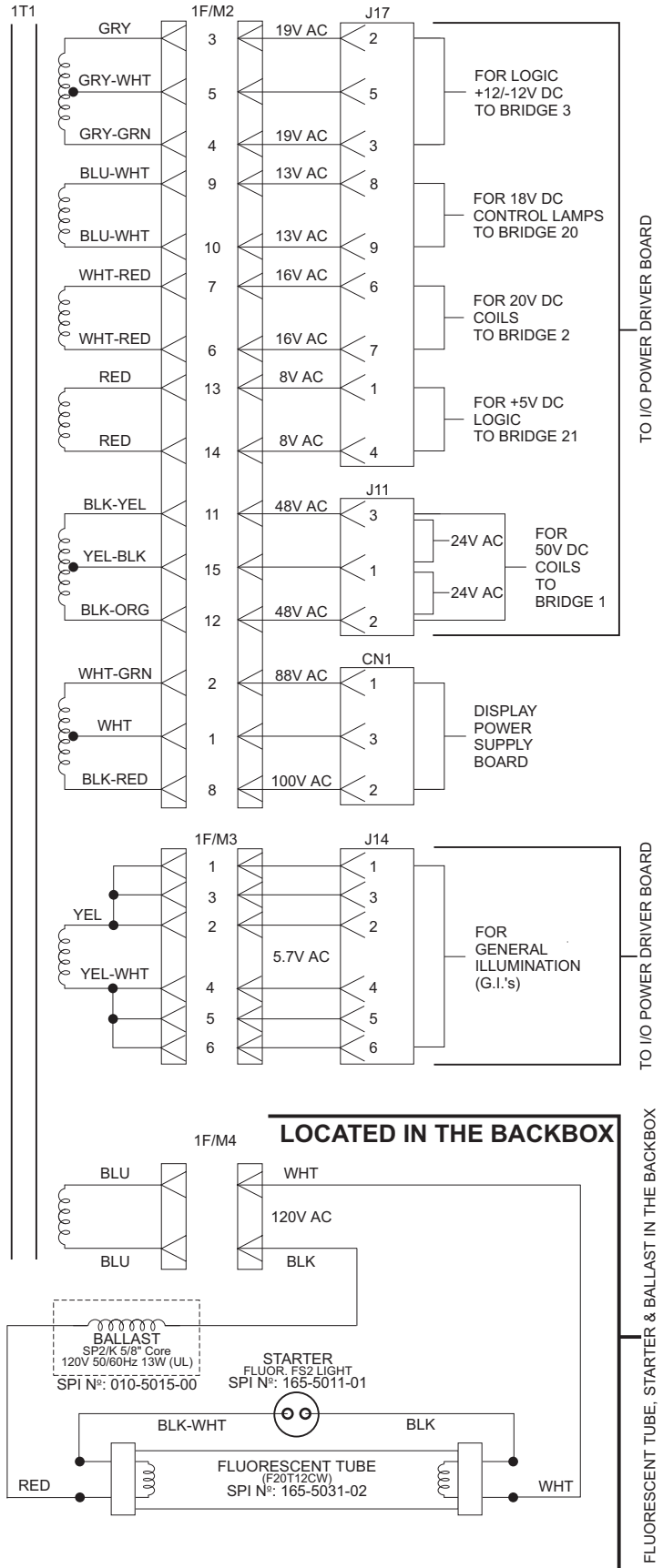
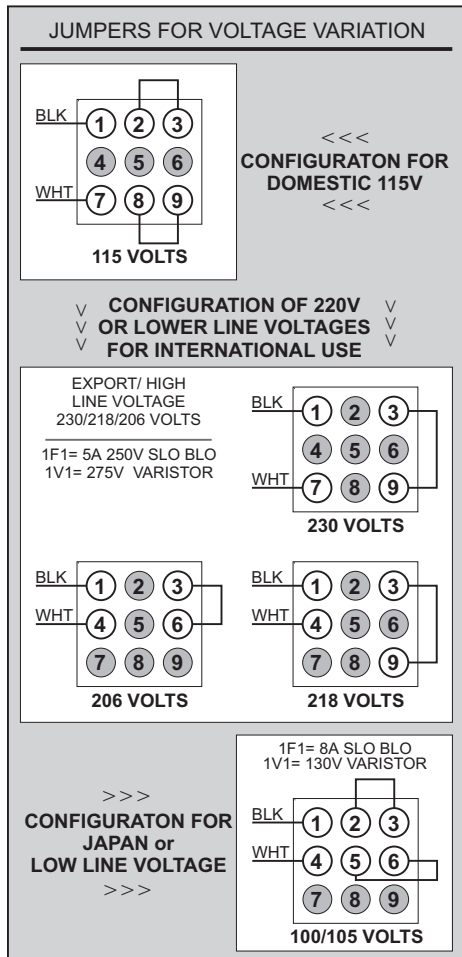
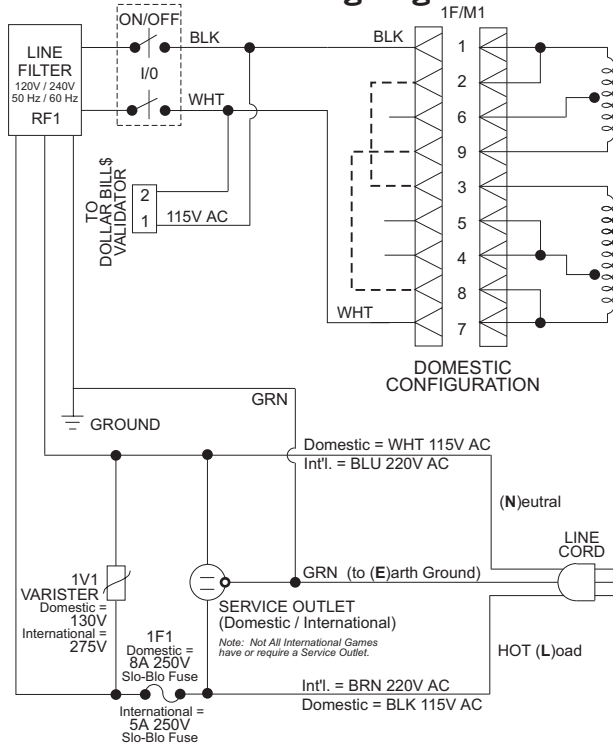
Technical Overview

Our **Flipper System** uses one supply voltage (50v DC) for both **kick & hold**. Once the **Game CPU** detects a Flipper Cabinet Switch closure (during game play) it applies a 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.

Cabinet Wiring

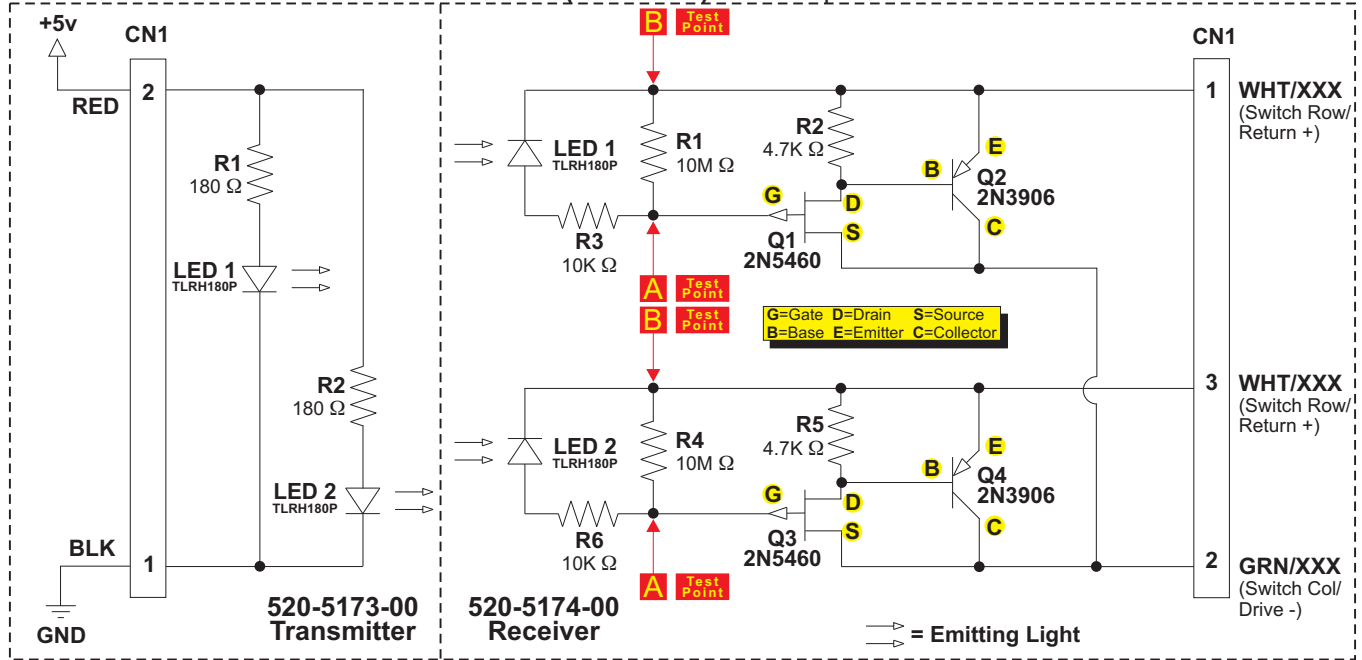
Transformer Power Wiring Diagram



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**.

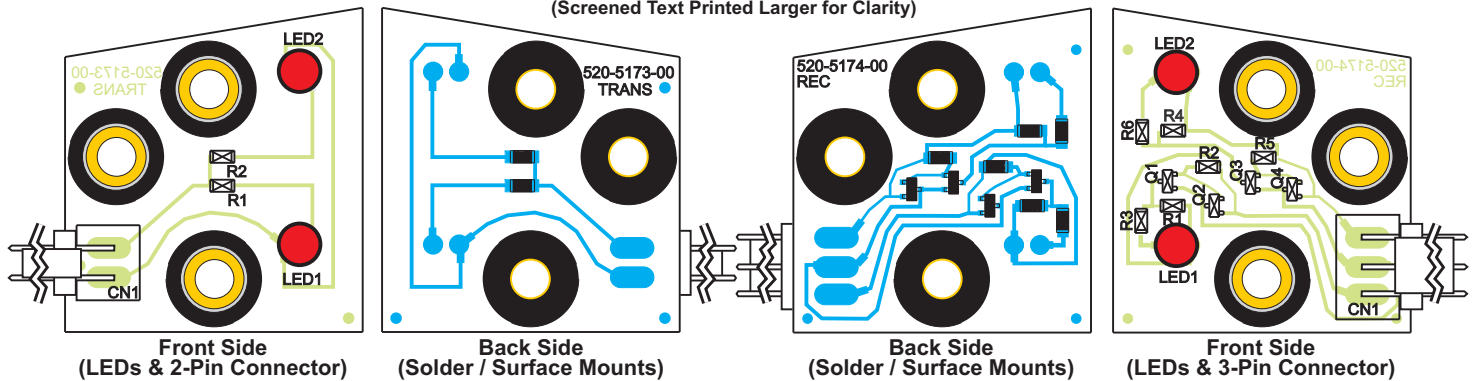


Trough Up-Kicker Dual OPTO Boards Component Layout & Parts

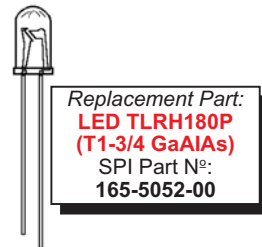
520-5173-00 (TRANS)

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	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
02	2	165-5052-00	LED 1, LED 2	
03	2	110-5006-00	Q1, Q3	
04	2	110-0086-00	Q2, Q4	
05	2	121-5082-00	R1, R4	
06	2	121-5083-00	R2, R5	
07	2	121-5011-00	R3, R6	
08	3	530-5308-02	n/a	
09	3	545-5518-00	n/a	



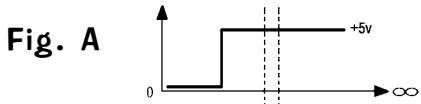
OPTO Troubleshooting

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

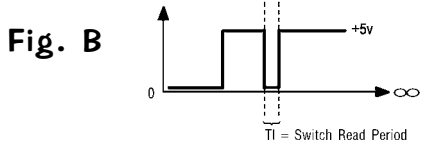
A. **OPEN OPTO** (Light Falling on LED) = *SWITCH OPEN*. Place meter leads across points **A** and **B** on the **LED1 Circuit** (Refer to Schematic Drawing on previous page, 520-5174-00 Receiver Side). It should read approximately 0.8 - 1.2v DC. The **LED2 Circuit** operates the same.

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.



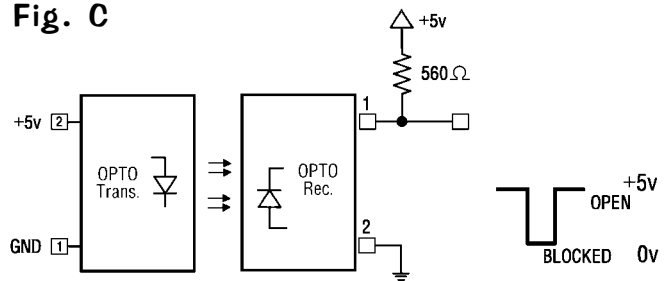
B. **CLOSED OPTO** (Light Blocked) = *SWITCH CLOSED*. Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (see Schematic). The Scope should display a **PULSE STREAM** indicating **Q2** has switched "On" as shown in **Fig. B**, Wave Form Diagram. This is your Switch Drive Pulse.

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

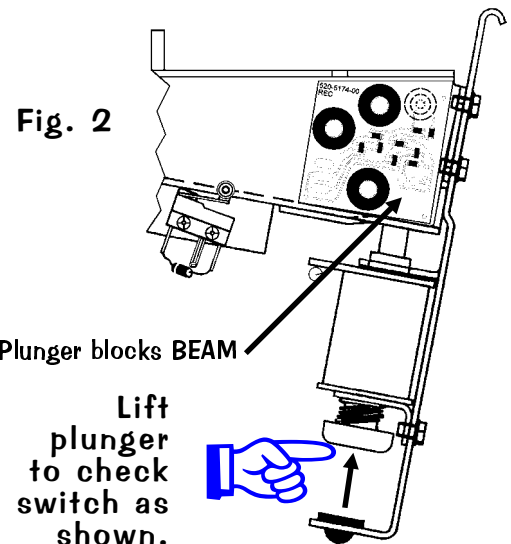
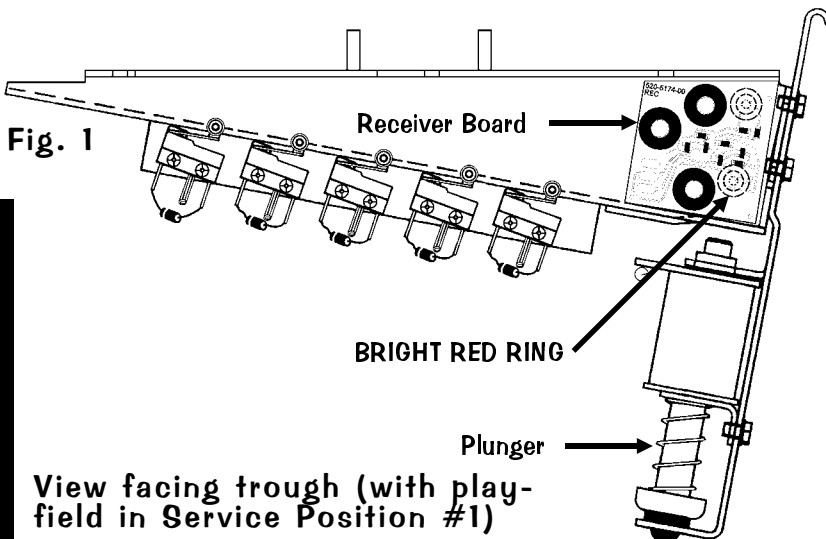
Disconnect the **OPTO Transmitter / Receiver Board** from the circuit. Connect one side of a 560Ω Pull-Up Resistor to **Pin-1** of the OPTO Receiver Bd. and the other side of the resistor to a 5v DC source. Connect **Pin-2** to GND. Connect a +5v DC source to **Pin-1** of the Transmitter & GND to **Pin-2**. 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



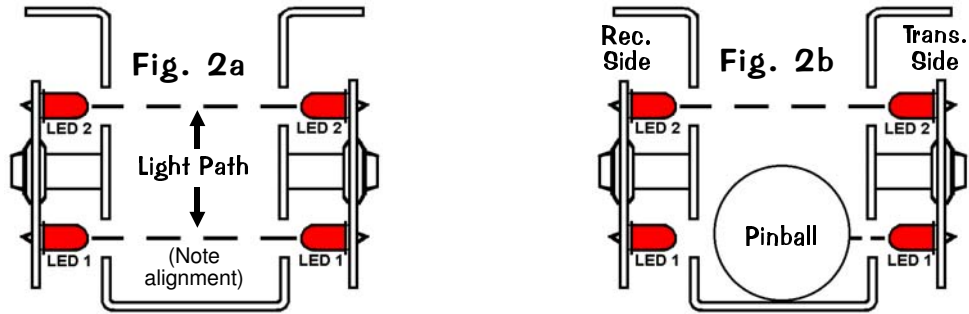
Trough Dual OPTO Boards Alignment / Test for LED1

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.



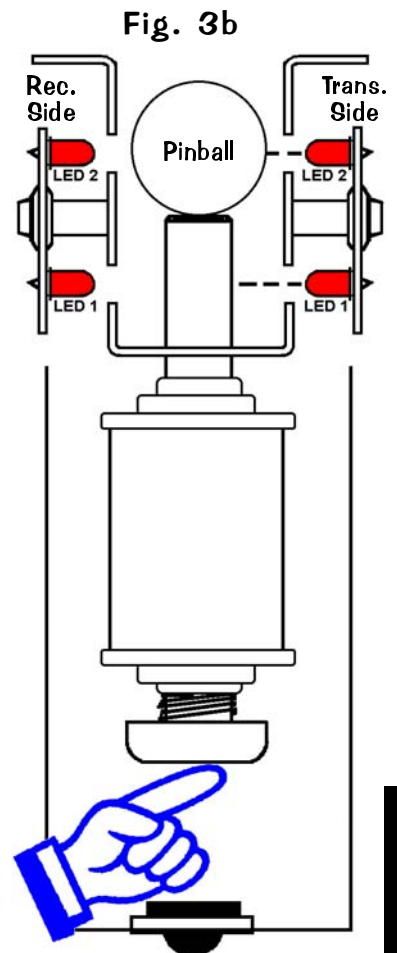
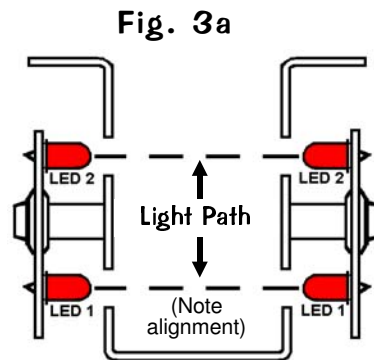
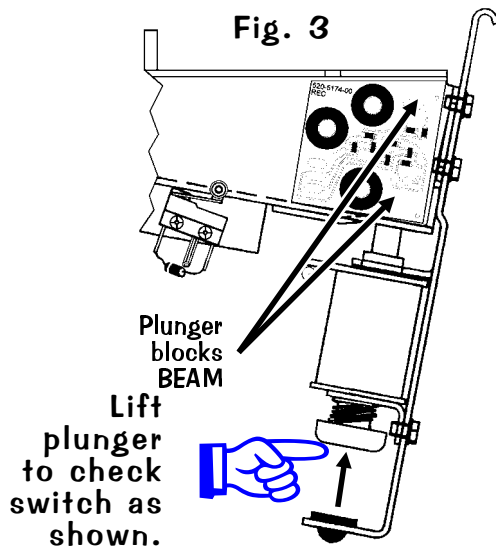
Sec. 5: PCBs

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



Trough Dual OPTO Boards Alignment / Test for LED2

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



I M P O R T A N T

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

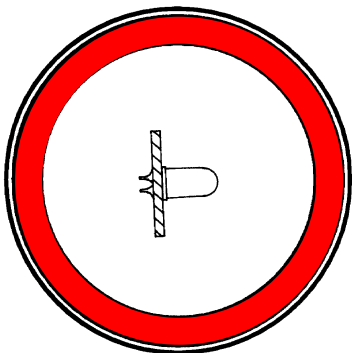


Fig. 4a
Correct Position

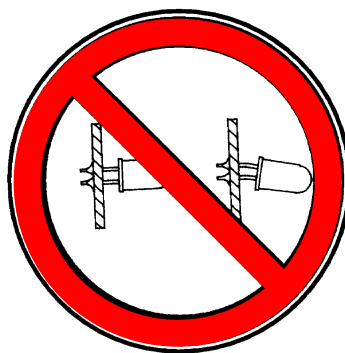
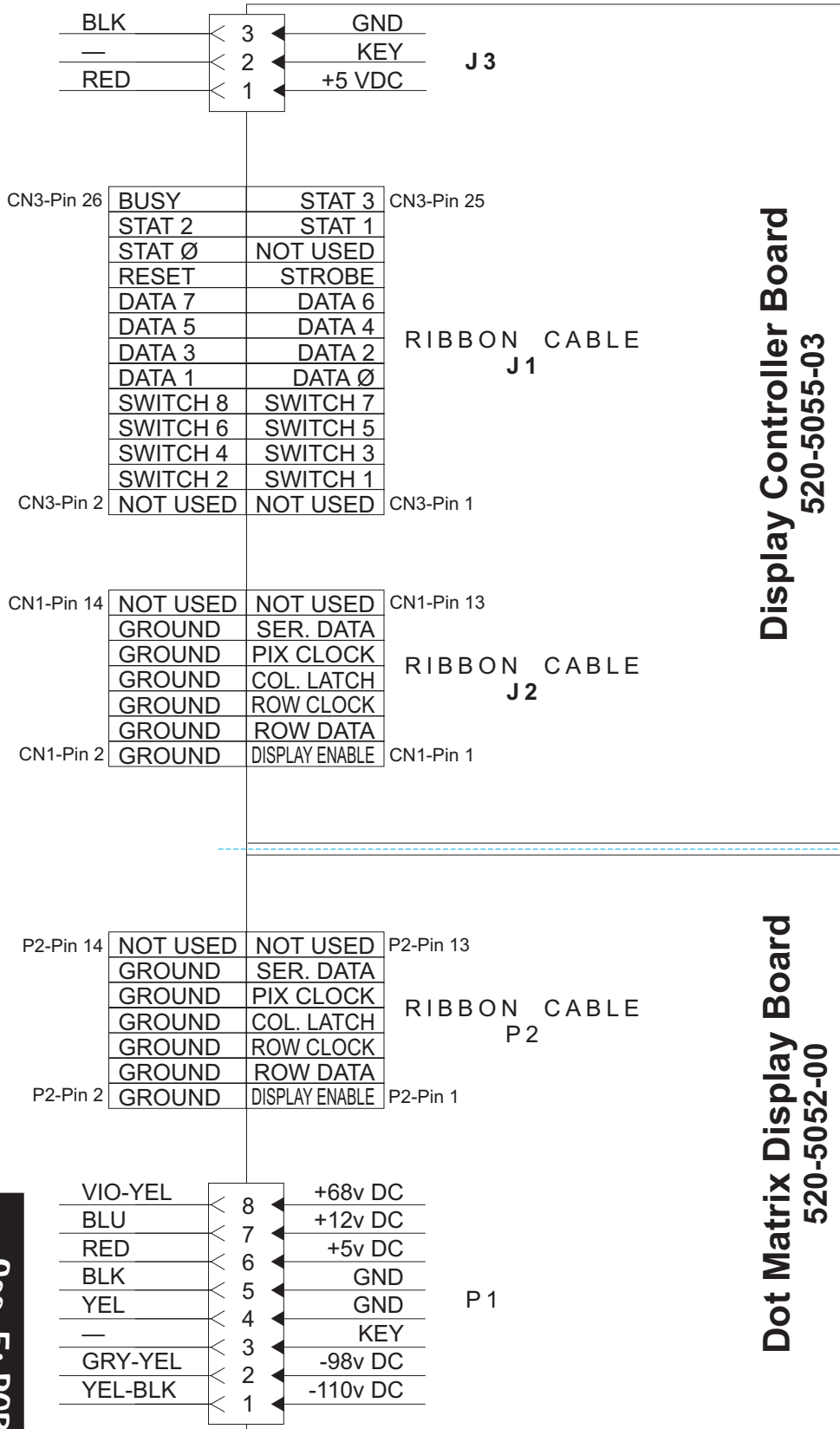


Fig. 4b
Incorrect Position

Dot Matrix Display / Display Controller Bd. Combined Display Connections

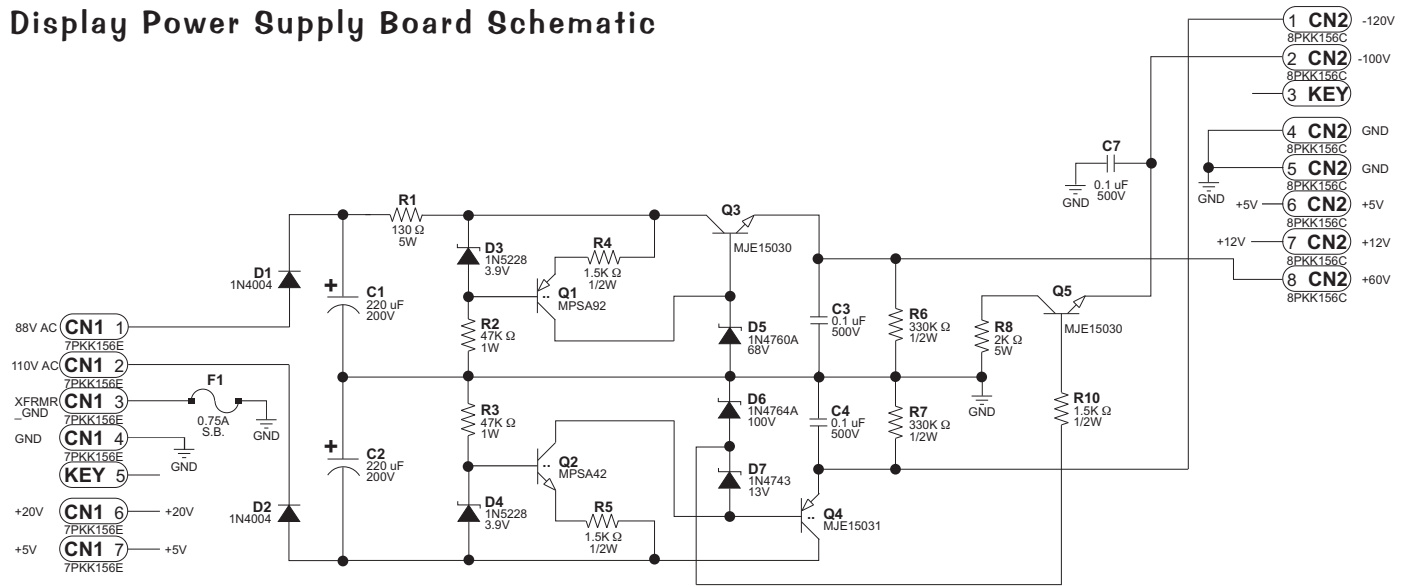


Dot Matrix Display Explained

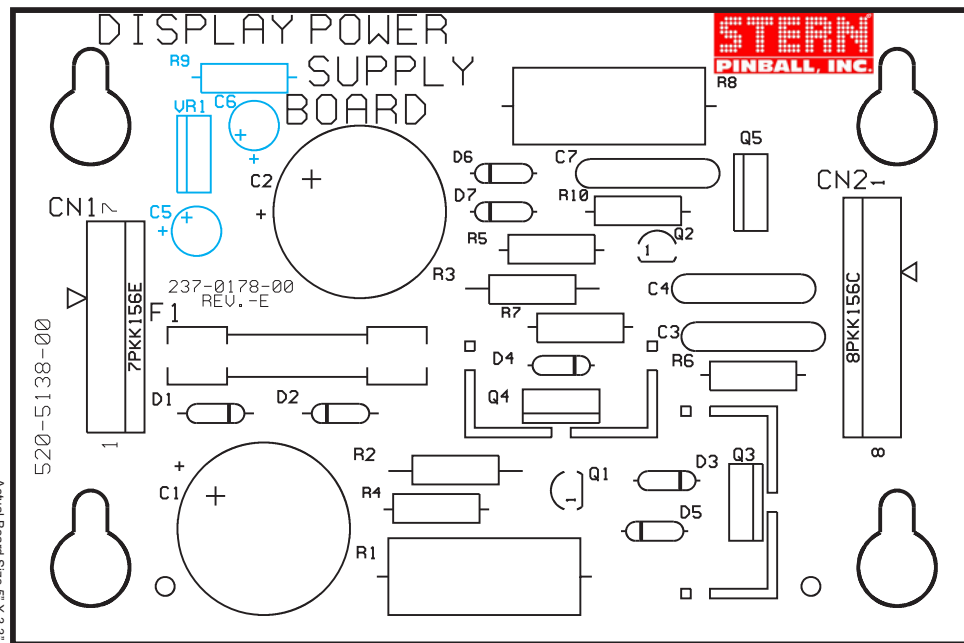
The display utilizes a Micro-Processor Control Board mounted in piggyback fashion to the Dot Matrix Display (128 X 32) Driver Board. The purpose behind this board is to provide more information to the operator as well as displaying graphics to the player.

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

Display Power Supply Board Schematic



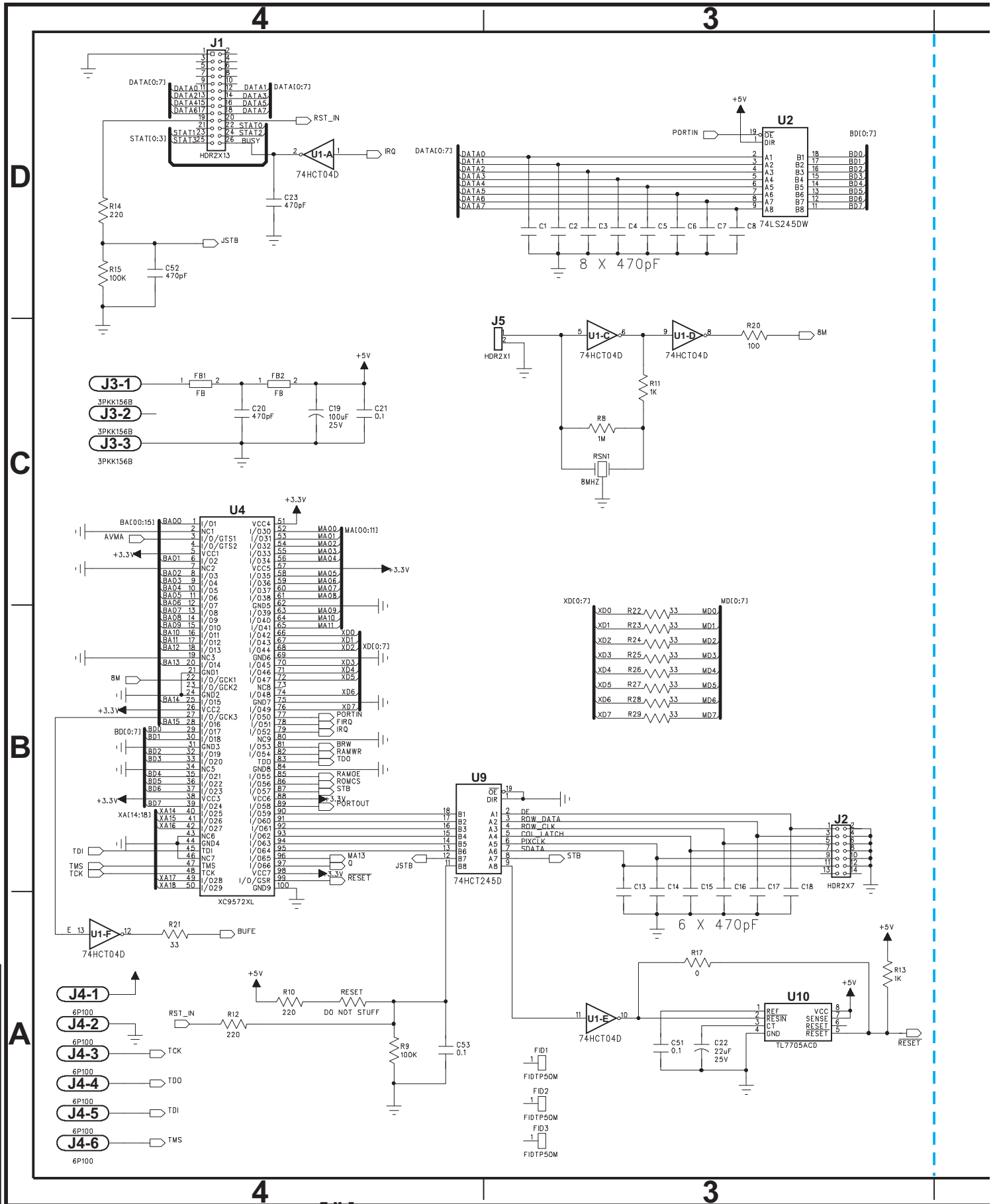
Display Power Supply Board Component Layout & Parts



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

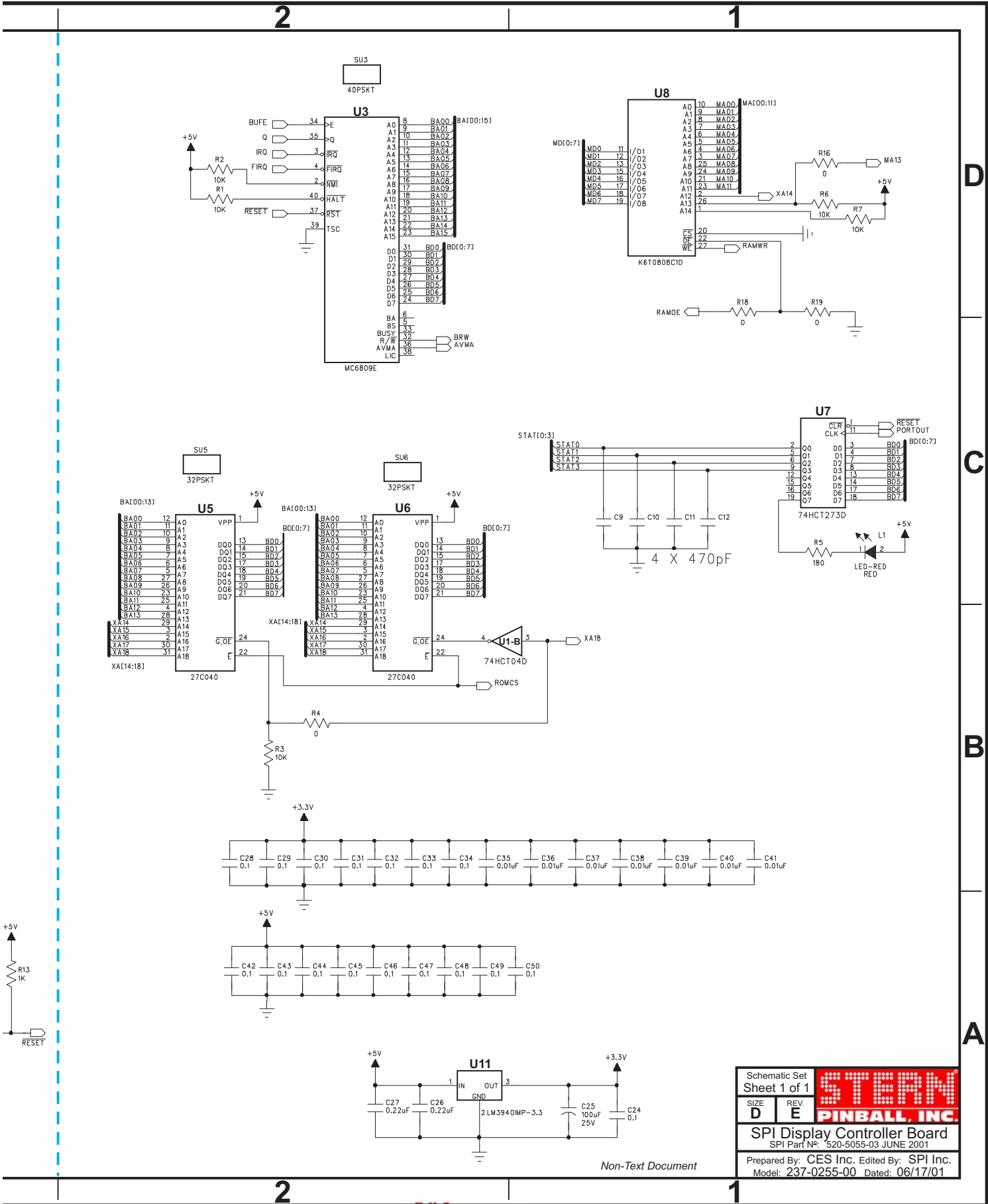
Sec. 5: PCBs

Display Controller Board Schematic



Sec. 5: PCBs

Display Controller Board Schematic



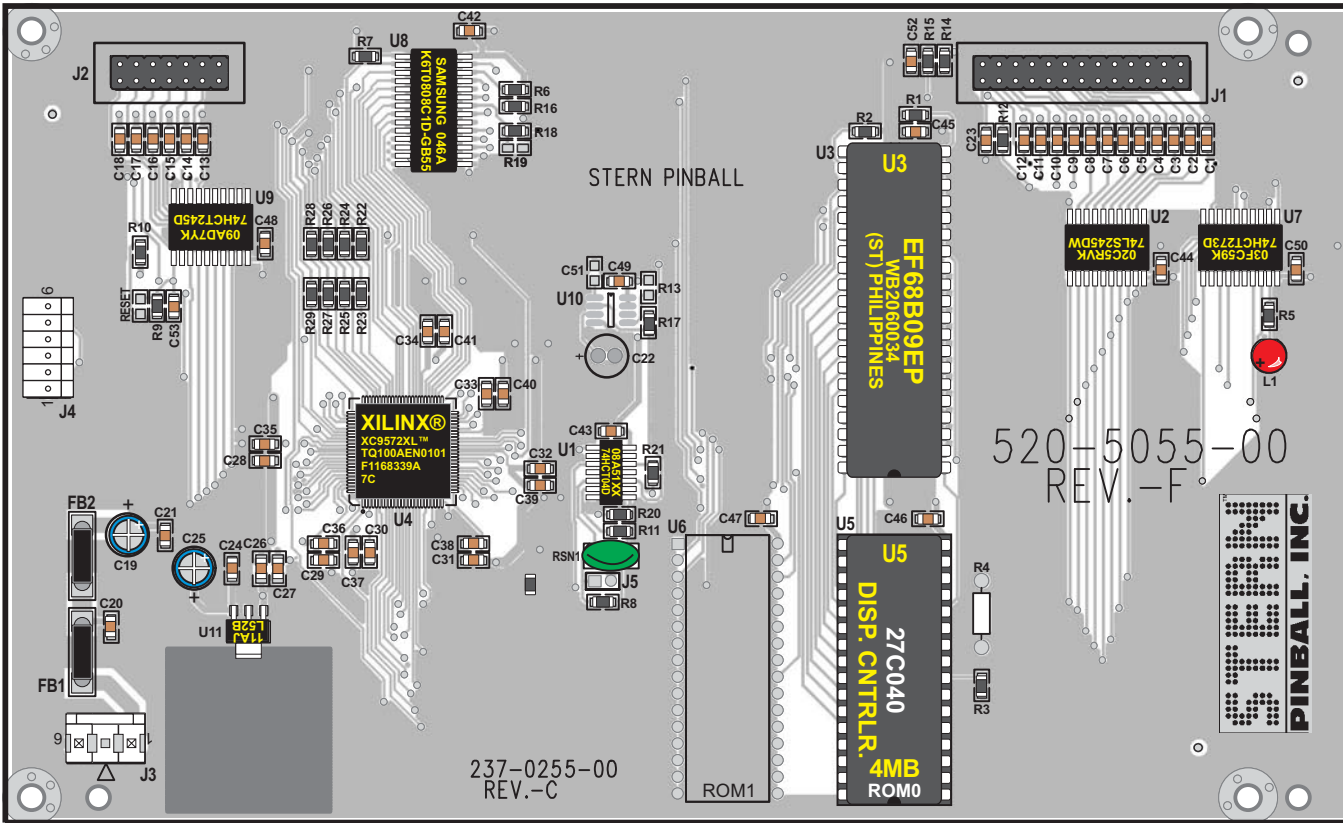
D
C
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Sec. 5: PCBs

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
01	1	045-5015-26	J1	13-Pin, Dual row .1" Hdr. Conn HDR2X13
02	1	045-5015-02	J2	7-Pin, Dual Row .1" Hdr. Conn HDR2X7
03	1	045-5015-03	J3	3-Pin, PKK156B Connector
04	1		J4	6-Pin (6P100)
05	7		C35-C39, C40, C41	SMT 0.01uF, 50v Cap. 103-0805-X7R
06	20		C21, C24, C28-C32, C33, C34, C42, C43, C44, C45, C46 C47, C48, C49, C50, C53 (C51: NS)	SMT 0.1uF, 50v Cap. 104-0805
07	2		C26, C27	SMT 0.22uF, 50v Cap. 224-1206-Z5U
08	21		C1-C12, C13-C18, C20, C23, C52	SMT 470pF, 50v Cap. 471-0805
09	2		C19, C25	100uF, 25v TCap.
10	1	165-5099-00	L1	LED T1-3/4 DIFFUSER RED
11	4		R16-R18 (R19: NS)	0 Ω 1/10W Resistor 0805
12	1	n/a	RESET	DO NOT STUFF
13	2		R11, R13	SMT 1K Ω 1/10W Resistor 0805
14	1		R8	SMT 1M Ω 1/10W Resistor 0805
15	5		R1, R2, R3, R7 (R6: NS)	SMT 10K Ω 1/10W Resistor 0805
16	9		R21, R22-R29	SMT 33 Ω 1/10W Resistor 0805
17	1		R20	SMT 100 Ω 1/10W Resistor 0805
18	2		R9, R15	SMT 100K Ω 1/10W Resistor 0805
19	1		R5	SMT 180 Ω 1/10W Resistor 0805
20	3		R10, R12, R14	SMT 220 Ω 1/10W Resistor 0805
21	1	100-5054-00	U1	SMT 74HCT04D (74LS04)
22	1	100-5055-00	U2	SMT 74LS245DW
23	1	100-0189-01	U3 (40-Pin Socket, 077-X)	MC6809E
24	1	100-5044-00	U4	XILINX®, XC9572XL
25	2 (See Pg. DR. Table)		U5 (ROM0) (U6: NS) (32-Pin, IC Dip Socket, 077-5217-00)	4MB ROM 27C040 (M27C401-100)
26	1	100-5056-00	U7	SMT 74HCT273D
27	1	100-5045-00	U8	K6T0808C1D-GB55, Int. Samsung 046A
28	1	100-5057-00	U9	SMT 74HCT245D
29	1	100-5058-00	U11	SMT LM3940IMP-3.3v Regulator
30	1	140-0041-00	RSN1	8MHZRSN (8Mhz) Crystal
31	2	n/a	FB1, FB2	Ferrite Bead, FB0370
32	0		FID1-3	FIDTP50M

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

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.

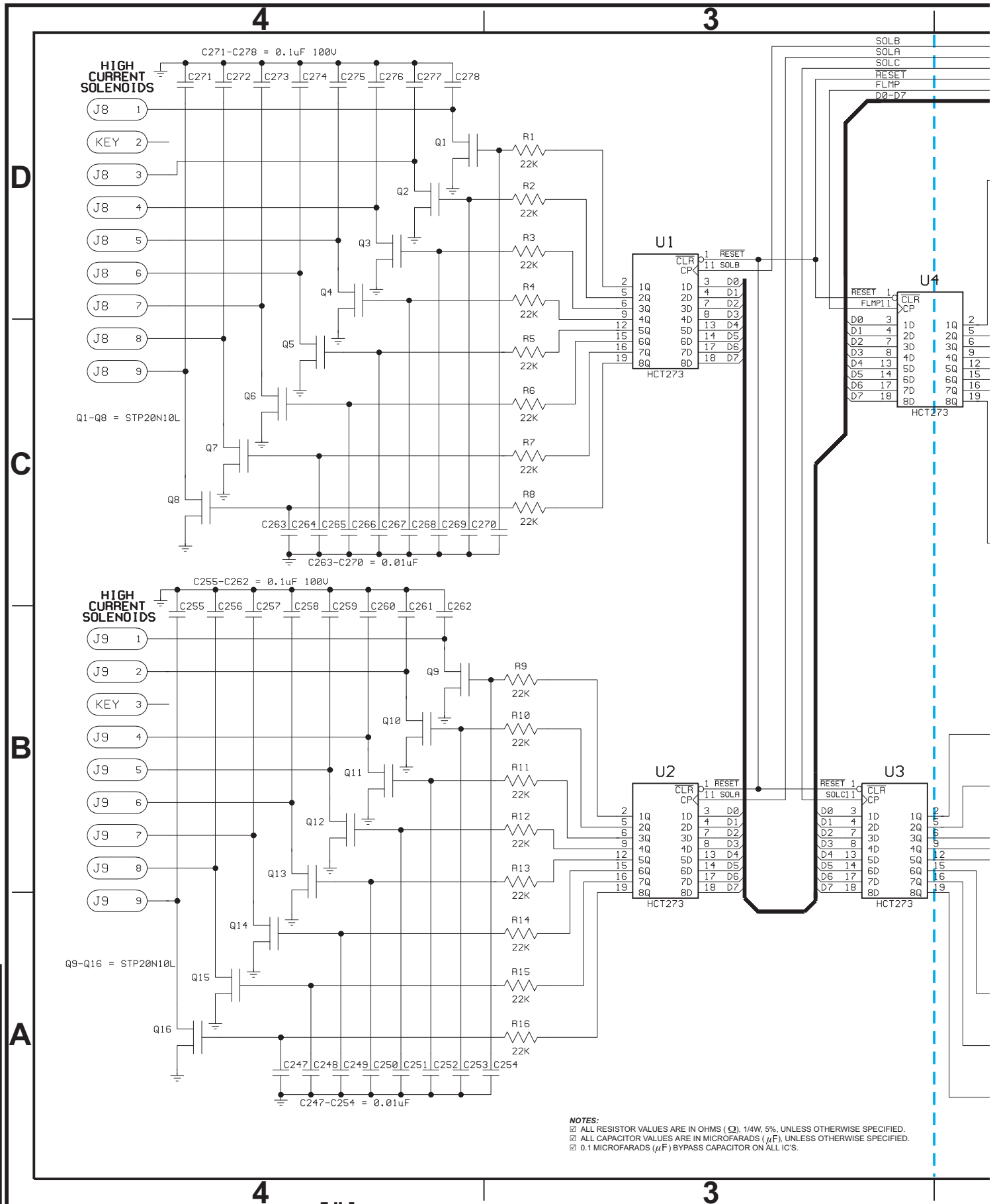
Lamp Matrix:

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:

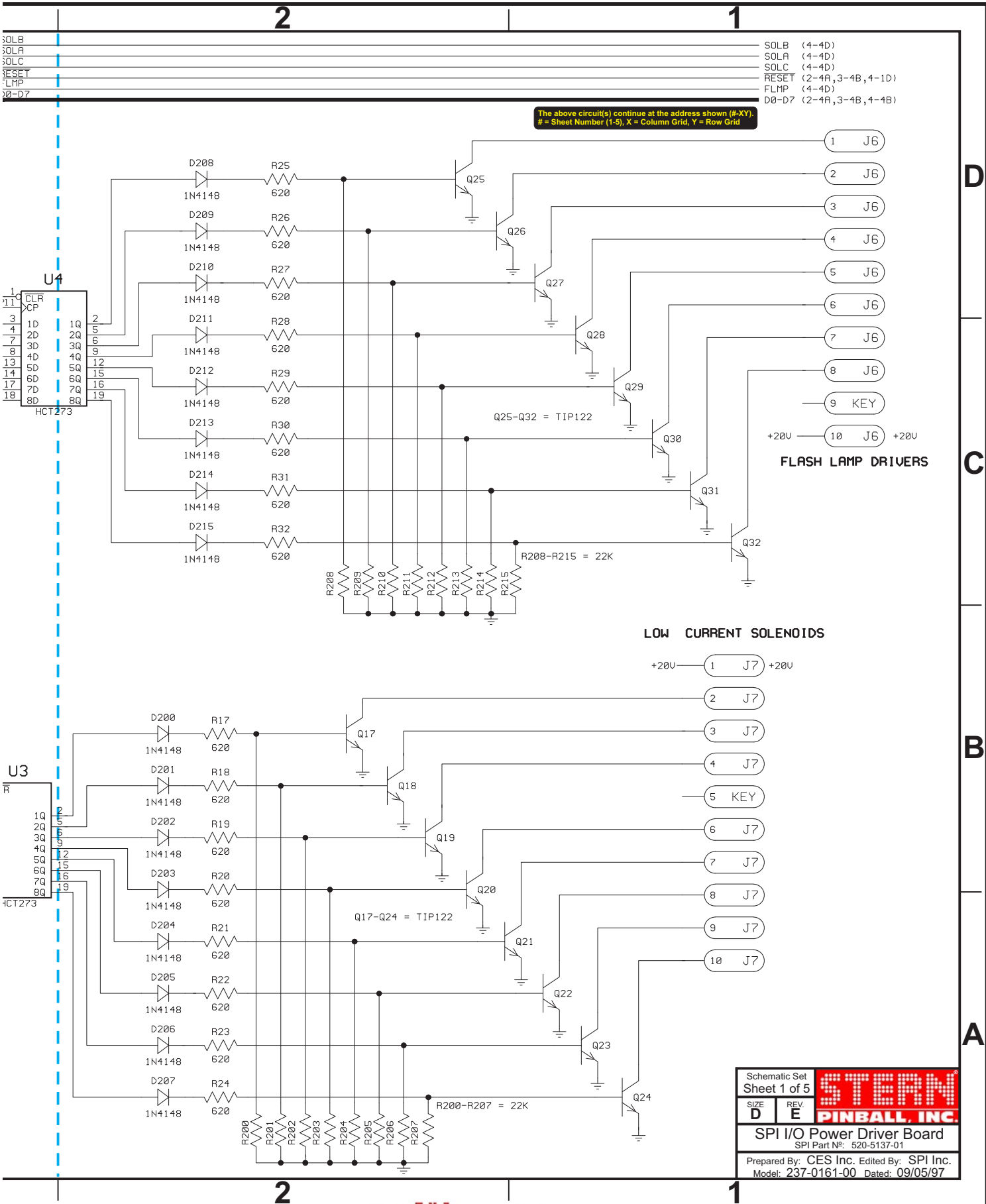
J15 has 6v AC switched on & off by a relay on the **I/O Board**. The relay is controlled by **Q200** which supplies power to the 24v coil winding to activate the relay. There are 4 taps on **J15** each fused at 5A for this 6v AC source.

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 (μ F), UNLESS OTHERWISE SPECIFIED.
 - ☑ 0.1 MICROFARADS (μ F) BYPASS CAPACITOR ON ALL IC'S.

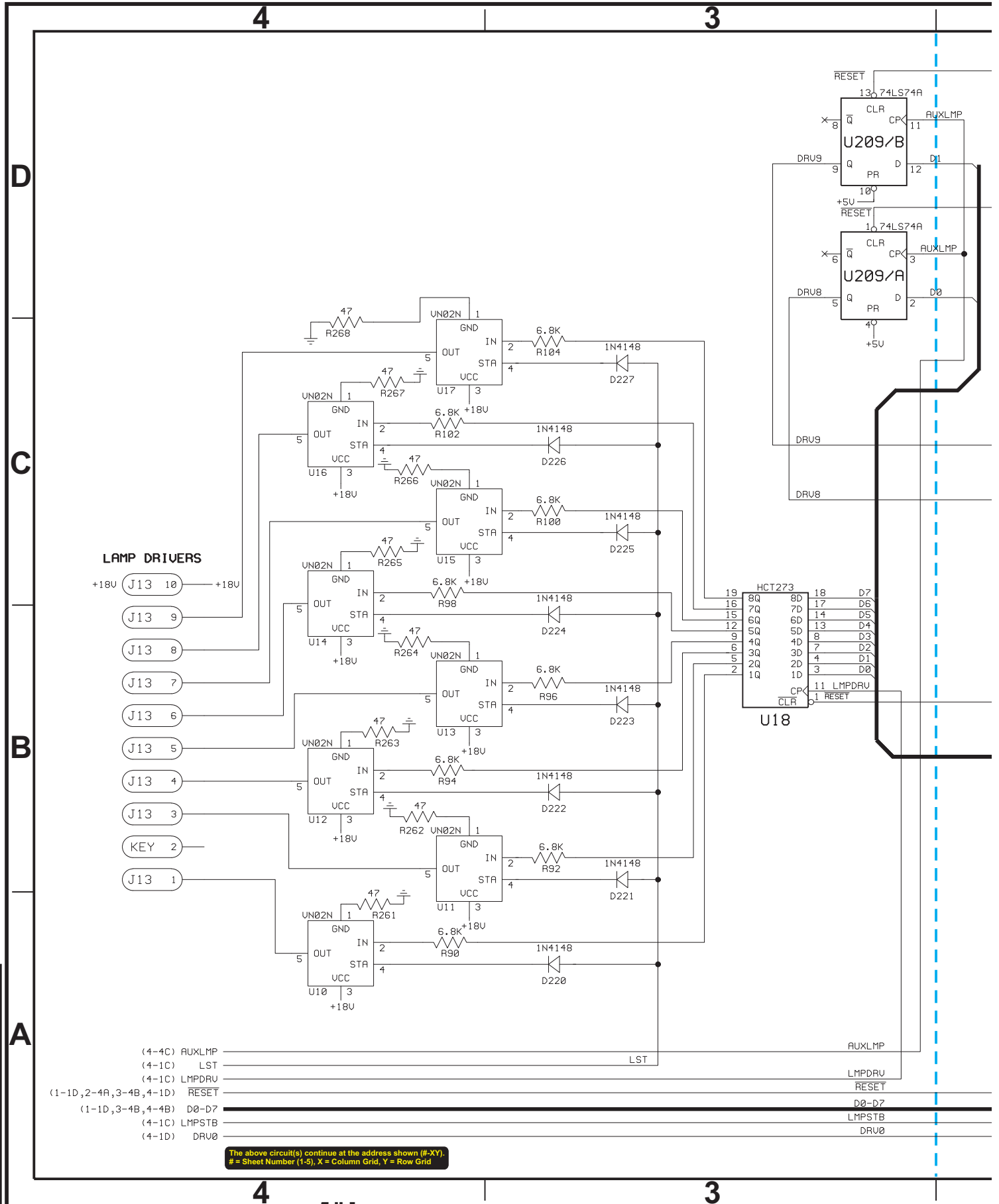
Sec. 5: PCBs



D
C
B
A

Sec. 5: PCBs

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		



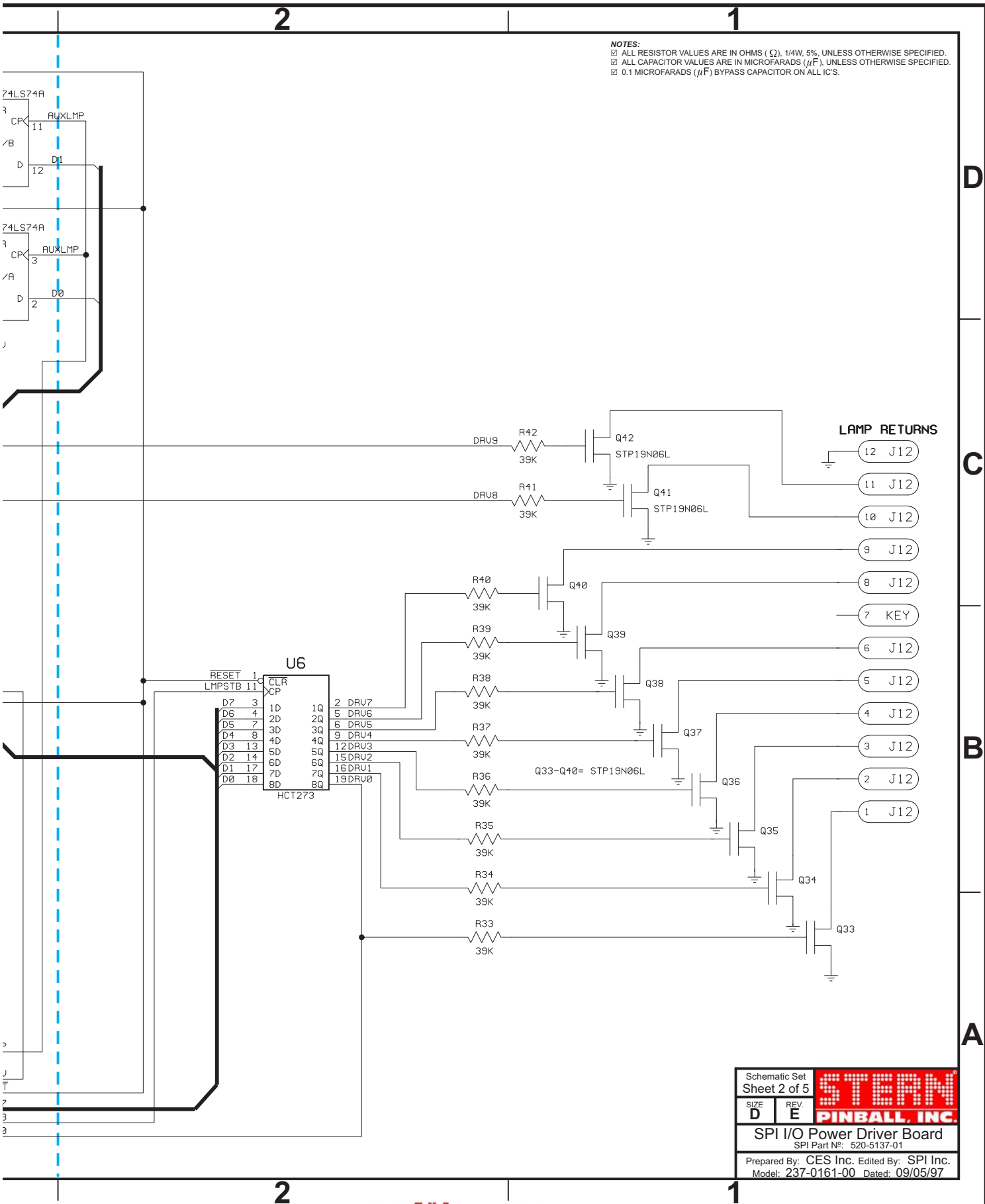
LAMP DRIVERS

- +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

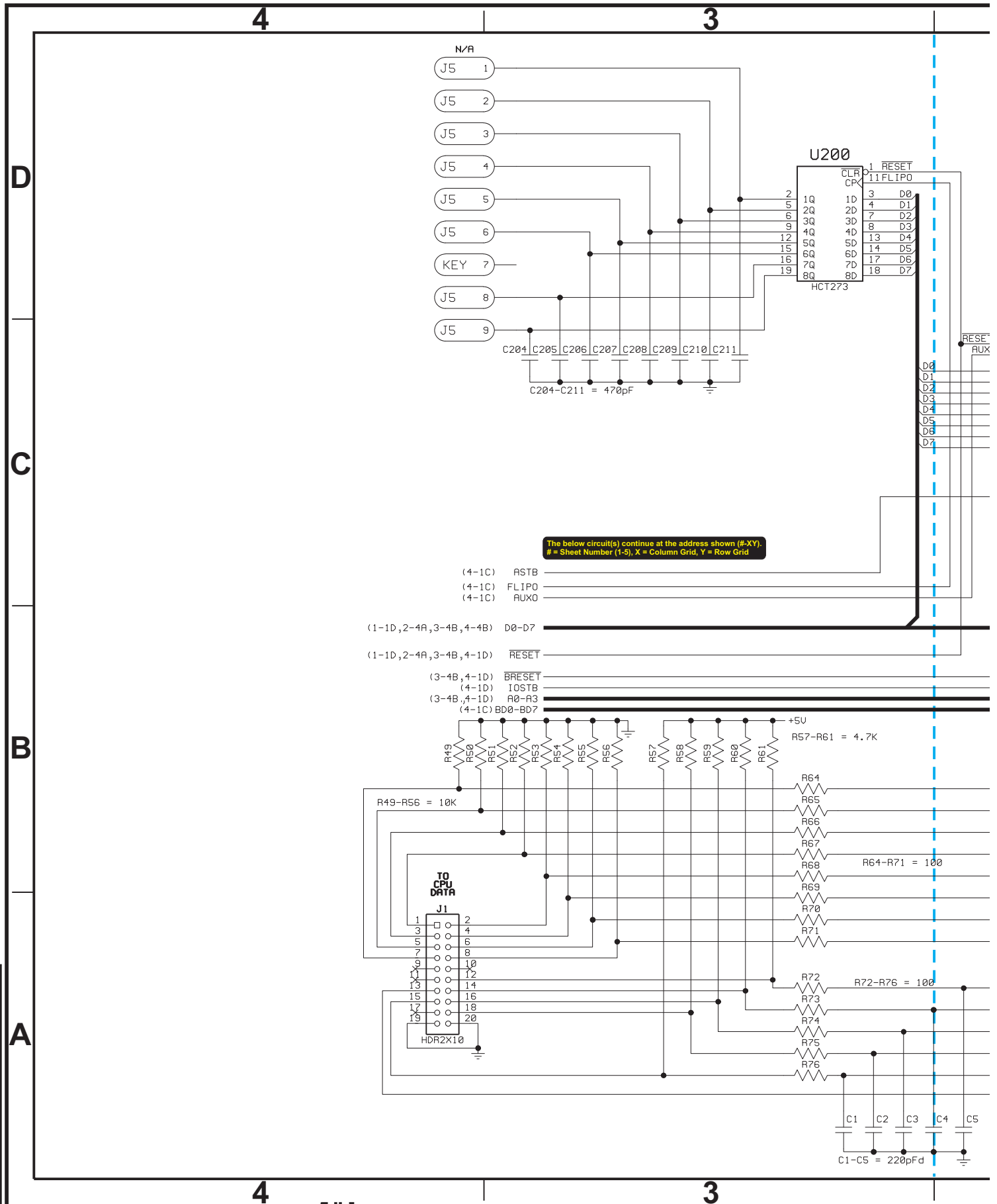
Sec. 5: PCBs



Schematic Set Sheet 2 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		

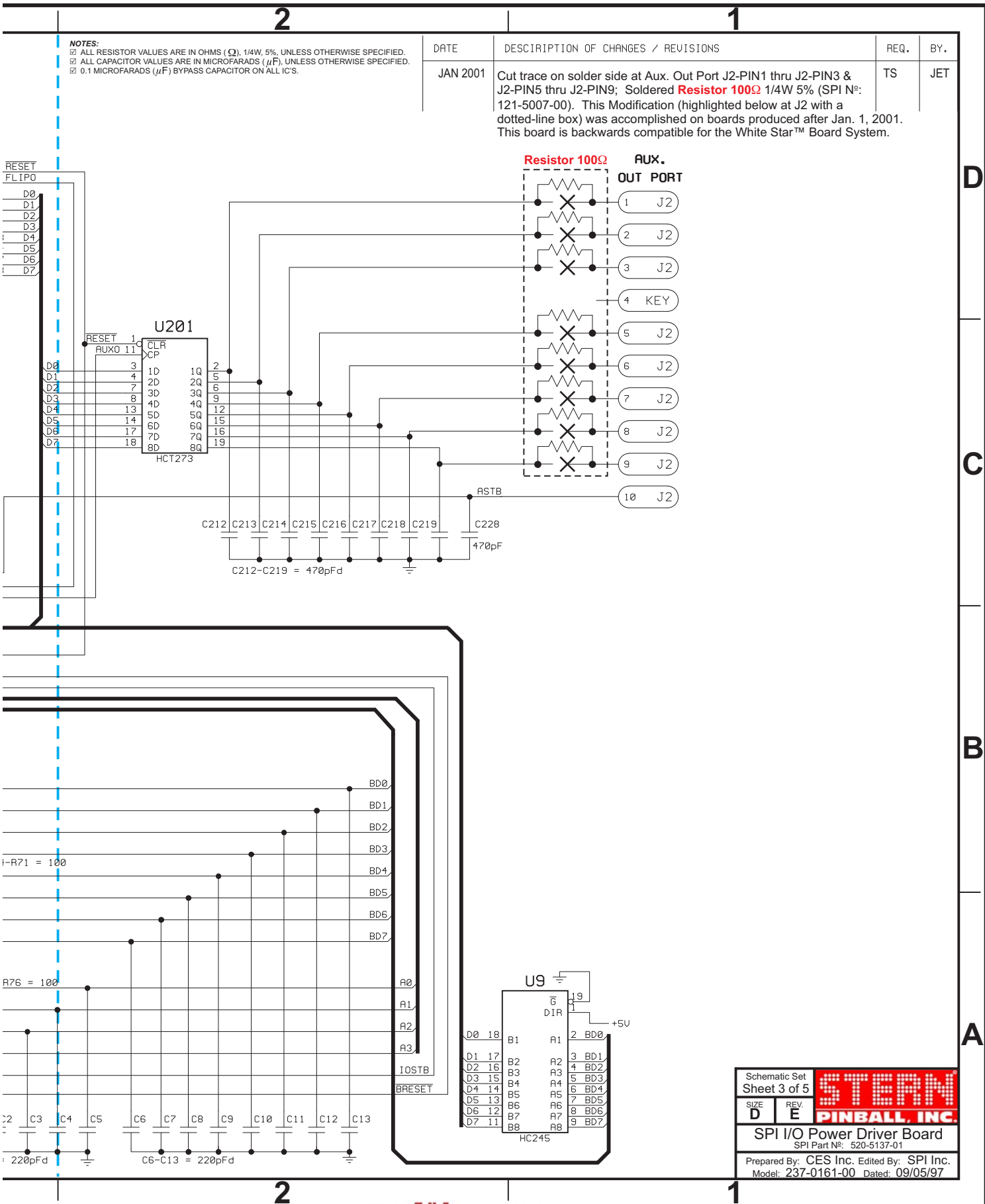
Sec. 5: PCBs

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



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

Sec. 5: PCBs

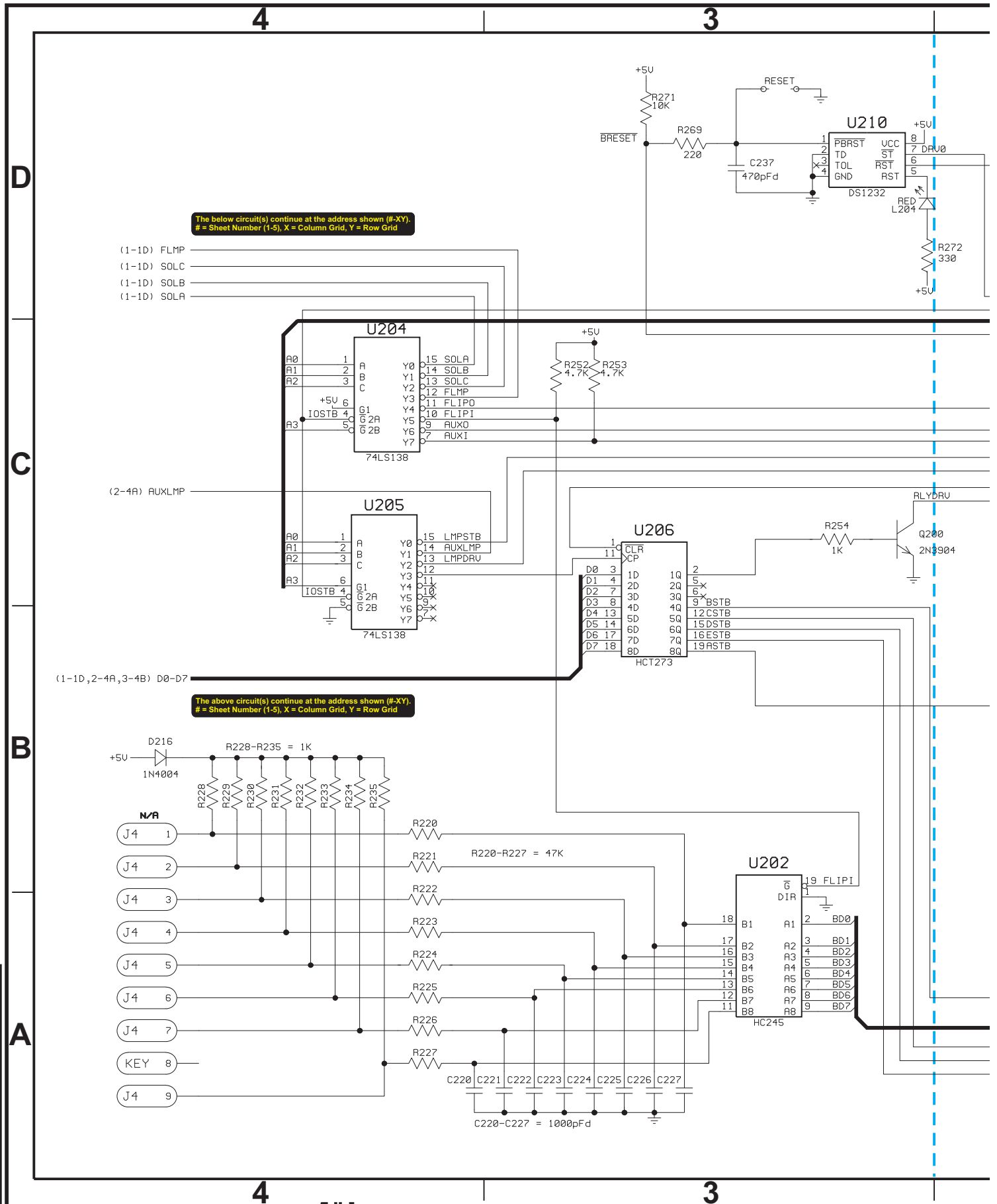


D
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Sec. 5: PCBs

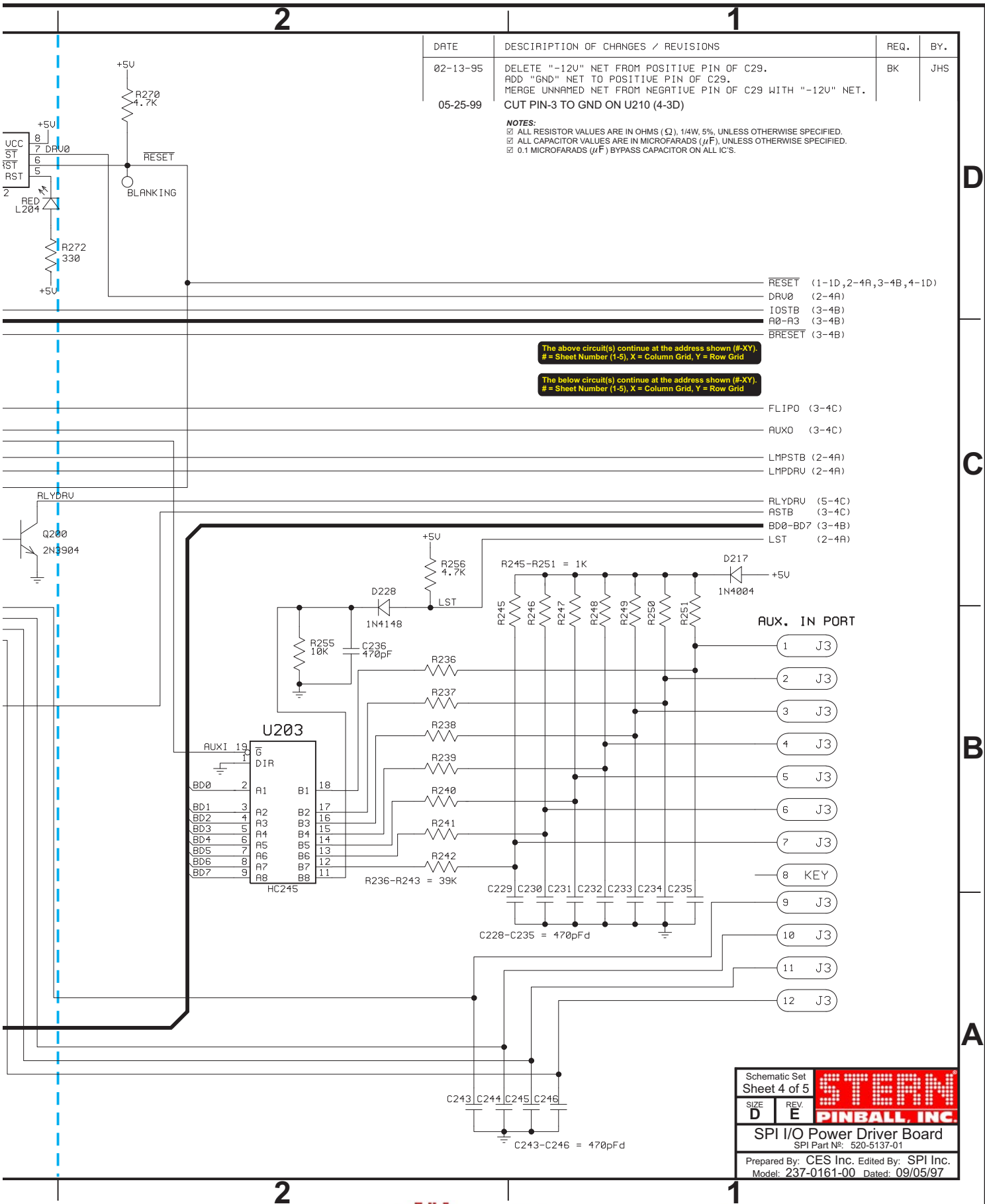
Schematic Set		STERN
Sheet 3 of 5		
SIZE	REV.	PINBALL, INC.
D	E	
SPI I/O Power Driver Board		
SPI Part N#: 520-5137-01		
Prepared By: CES Inc. Edited By: SPI Inc.		
Model: 237-0161-00 Dated: 09/05/97		

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



Sec. 5: PCBs

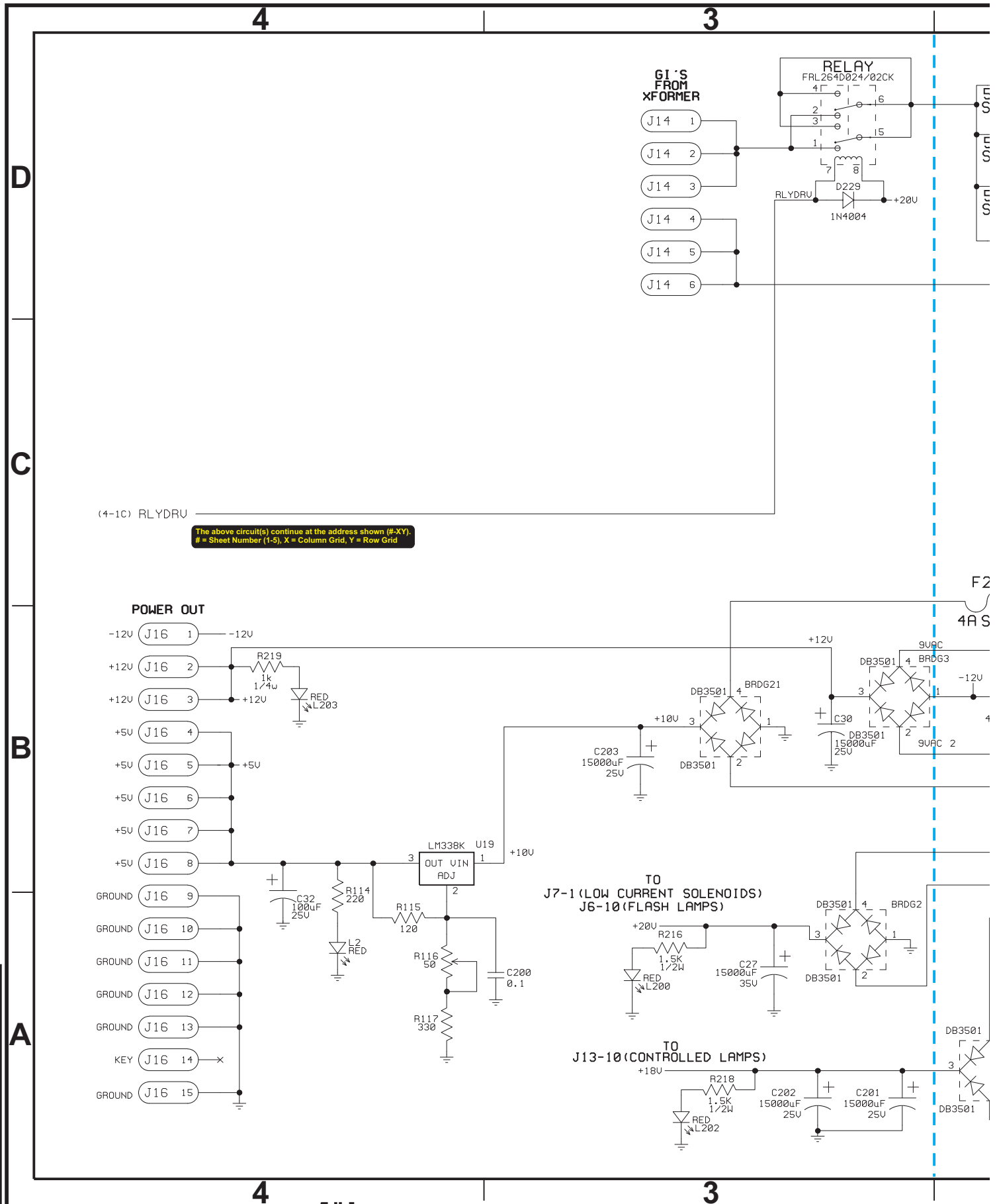
I/O Power Driver Board Schematic (Sheet 4 of 5)



D
C
B
A

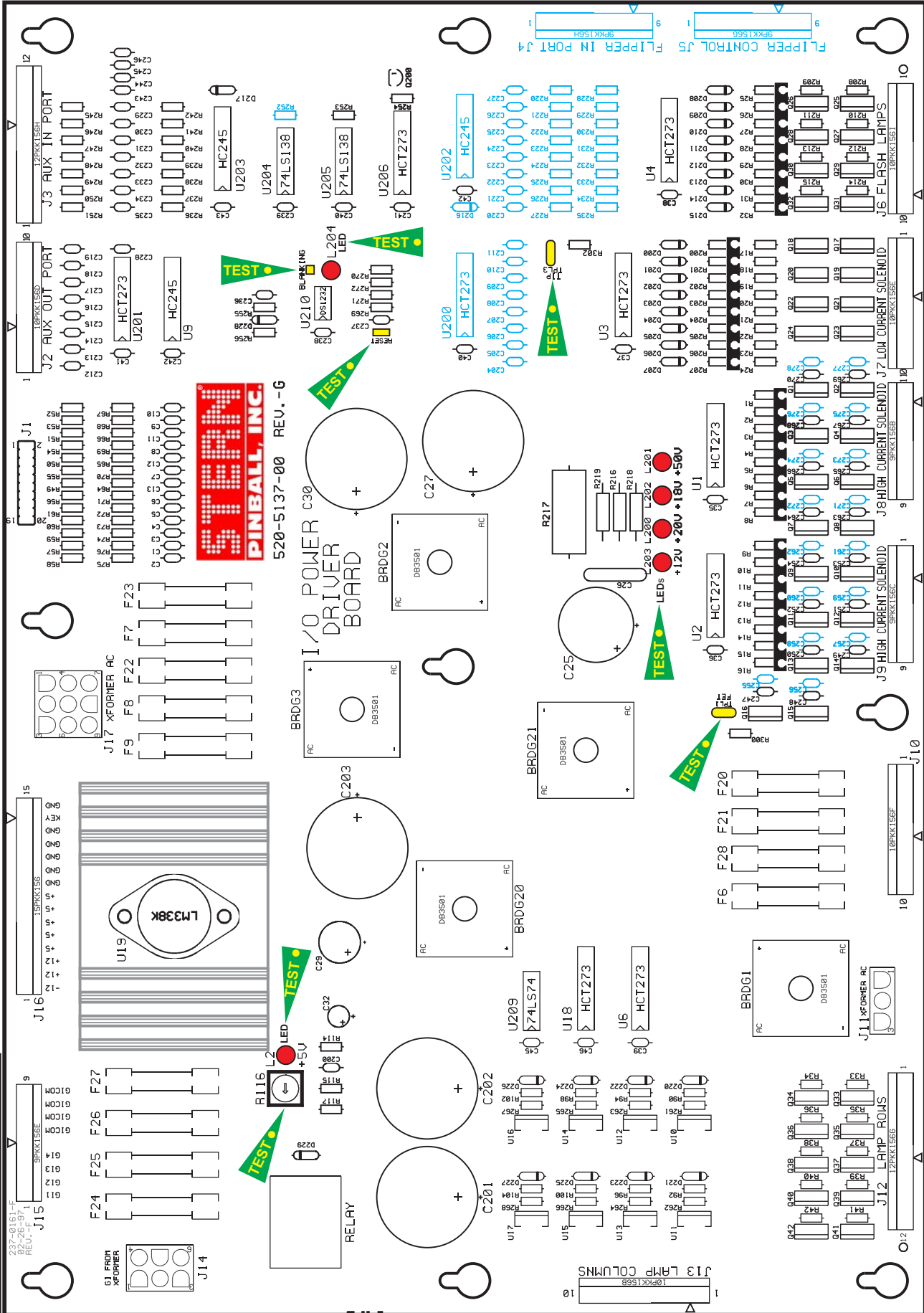
Sec. 5: PCBs

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		



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 Rev. G	Complete PCB Assembly
01	5	112-5000-00	BRDG1, BRDG2, BRDG3, BRDG20, BRDG21	DB3501
02	13	125-5030-00	C1, C2, C3>C6, C7, C8, C9>C10, C11, C12	220pF, (221), Cap.
03	1	125-5033-00	C25	100uF, 150v, Radial Lytic Cap.
04	1	125-5035-00	C26	.1uF, 500v, Ceramic Disk Cap.
05A	4	125-5036-00	C30, C201, C202, C203	15000uF, 25v, Radial Lytic Cap.
05B	1	125-5036-01	C27	15000uF, 35v , Radial Lytic Cap.
06	1	125-5034-00	C29	4700uF, 35v, Radial Lytic Cap.
07	1	125-5032-00	C32	100uF, 25v, Radial Lytic Cap.
08	17	125-5031-00	C35, C36, C37, C38, C39, C40, C41, C42, C43, C45, C46, C200, C238, C239, C240, C241, C242	0.1uF, (104), Cap.
09	22	125-5028-00	C212>C219, C228>C237, C243>C246 (C204-C211: NS)	470pF, (471), Axial Cap.
10	0	n/a	(C220>C227: NS)	
11	16	125-5029-00	C247>C254, C263>C270	0.01uF, (103), 100v Cap.
12	0	125-5027-00	(C255>C262, C271>C278: NS)	0.1uF, (104), 100v, Cap.
13	25	112-0054-00	D200>D207, D208>D215, D220, D221, D222, D223, D224, D225, D226, D227	1N4148, Diode
14	2	112-5003-00	D217, D229 (D216: NS)	1N4004, Diode
15	26	205-0004-00	F6, F7, F8, F9, F20, F21, F22, F23, F24> F27, F28	Fuse Clips
16	1	200-5000-03	F6	7A 250v S.B. Fuse
17	7	200-5000-01	F7, F8, F9, F24>F27	5A 250v S.B. Fuse
18	2	200-5000-08	F21, F28	3A 250v S.B. Fuse
19	1	200-5000-05	F22	8A 250v S.B. Fuse
20	2	200-5000-06	F20, F23	4A 250v S.B. Fuse
21	1	045-5015-01	J1	20-Pin, 0.1 Dual Row Header
22	1	045-5014-01	J2 (Key Pin-4), J6 (Key Pin-9), J7 (Key Pin-5), J10 (Key Pin-6), J13 (Key Pin-2)	10PKK156
23	1	045-5015-00	J3 (Key Pin-8)	12PKK156
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, R245>R251, R254, R302 (R228>R235: NS)	1K Ω 1/4W Res.
49	8	121-5016-00	R261, R262, R263, R264, R265, R266, R267, R268	47 Ω 1/4W Res.
50	1	190-5002-00	RELAY	FRL264D024/02CK Relay
51	2	n/a	TPL1, TPL3	Test Point Wire (24ga.) Loops
52	8	100-5012-00	U1, U2, U3, U4, U6, U18, U201, U206 (U200: NS)	74HCT273
53	1	110-0058-00	U9	74LS245
54	1	100-5023-00	U210	DS1232
55	8	110-0089-00	U10, U11, U12, U13, U14, U15, U16, U17	VN02N
56	1	100-0356-00	U19	LM338K
57	1	n/a	U19	Heatsink (5v Reg.)
58	1	100-0338-00	U203 (U202: NS)	74HC245
59	2	100-0148-00	U204, U205	74LS138
60	1	100-0037-00	U209	74LS74
61	1	n/a	BLANKING, RESET	Test Points



Sec. 5: PCBs

THE Sopranos

50¢ = 1  x1
\$2.00 = 1  x5

CPU/Sound Board II (with ATMEL Processor) 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)** Battery Pack which has a **TEST POINT (TP): VBATT** to check the battery voltage status. The write protected area consists of 512 Bytes used for storing game settings. This section of **RAM** can only be written to when the coin door is open. The Coin Door switch comes into the **CPU** on **CN6-12** and is fed into the address decoding **PAL U213**. When this memory protect signal is low writes to the protected **RAM** area are prohibited. Address decoding for the system is accomplished by one **PAL U213** and one 1-of-8 decoder **U214**.

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

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

Switches:

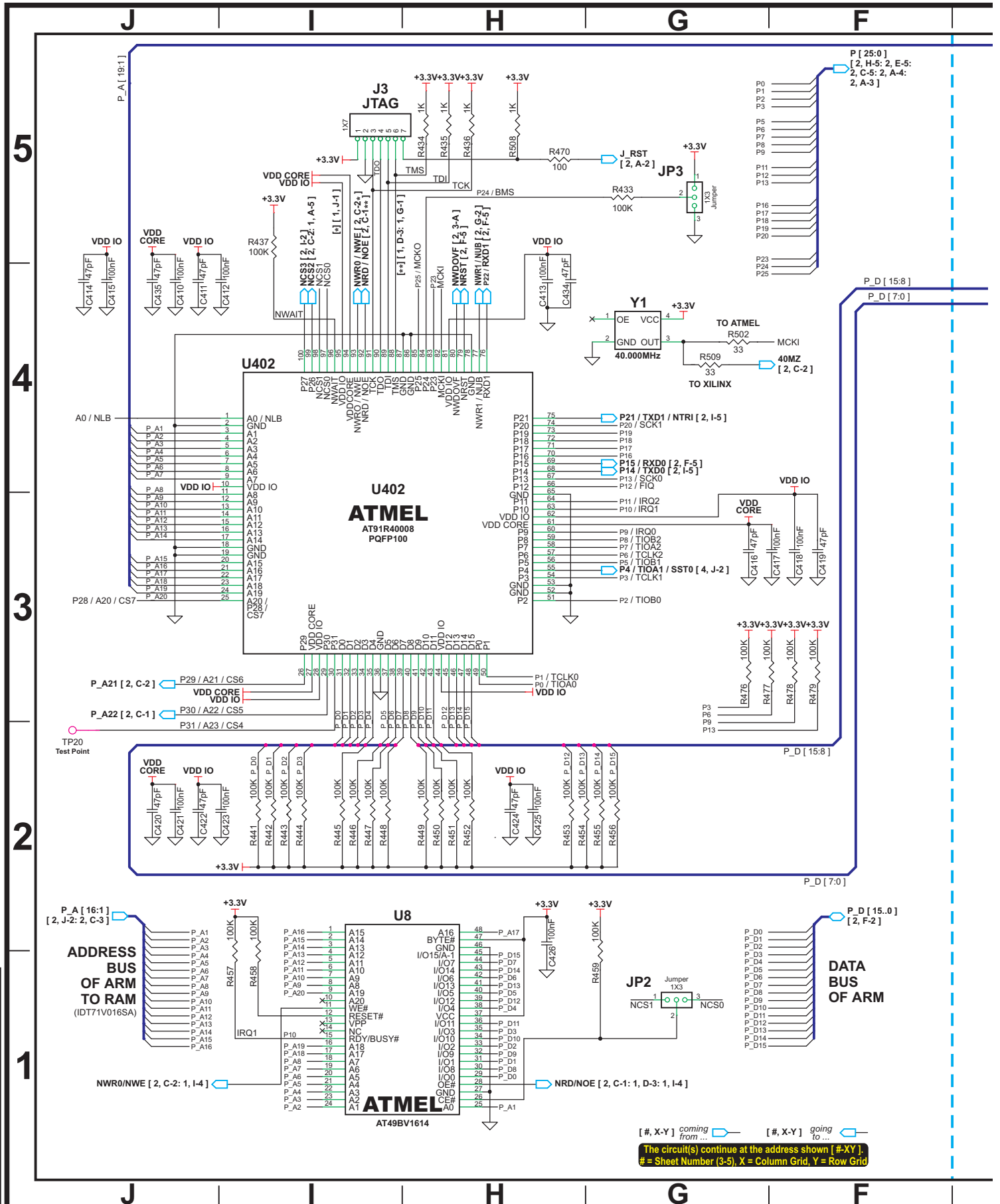
The Switch Matrix consists of eight (8) **2N3904** Transistors(**Q1-Q8**) which pull one of 8 strobes 'low' to *activate* a Single Column of switches. The *Switch Return Signals* are fed into **CN7** [SWITCH ROWS] and are highly filtered and compared to a 2.5v *reference voltage*. The *Switch Return Voltage* must be below 2.5v to make a *Valid Switch Closure*. If *false switches* are appearing, check that none of the **2N3904** Transistors are permanently pulling the *strobe line low*. Only one strobe from **CN5** [SWITCH COLUMNS] should be *low at any time*. **CN6** [DEDICATED SWITCH IN] is a *Dedicated Bank of Input Switches*. Switches connected to **CN6** are connected to ground instead of a strobe and may be read at any time.

Plasma Interface:

The data path for communication to and from the **Plasma Controller Board** is 8 bits wide. There are separate *Input* and *Output Busses*. Data going out to the controller comes from the **CPU's Data Bus** through **U201** and onto **CN8-Pins 11-18**. Status back from the Plasma Controller comes in on **CN8-Pins 22-26** and is fed into **U202** for input to the **CPU's Data Bus**. Two control signals that go out to the Plasma Controller are **PRES** [TP17: PLASMA RESET] and **CN8-Pin 19 [PSTB - Plasma Strobe]**. The Plasma Reset is software controllable through **U216/B** and also has a test point "Plasma Reset". The *Plasma Strobe Signal* to the controller is generated from **U216/A** and is *used to latch data* into the Plasma Controller.

Other Test Points (TP):

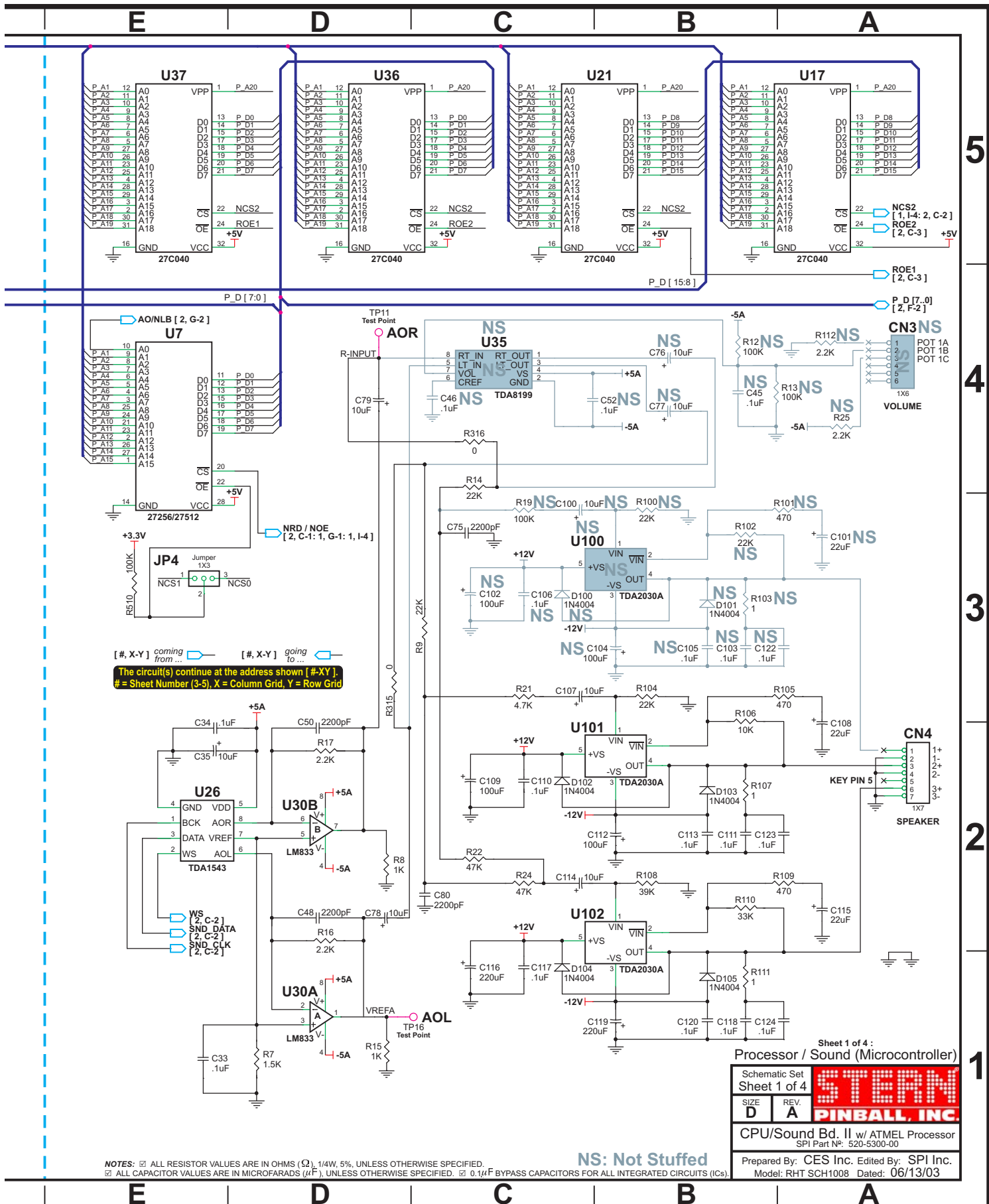
TP 7: E & TP5: Q - The **CPU** signals for both **68B09E** processors. Should be at 2Mhz with **Q** leading **E** by **500 nsec**. **TP2: P0. TP3: P1. TP4: P2. TP20: (near U402). TP8: (near U219). TP1: +3.3V.**



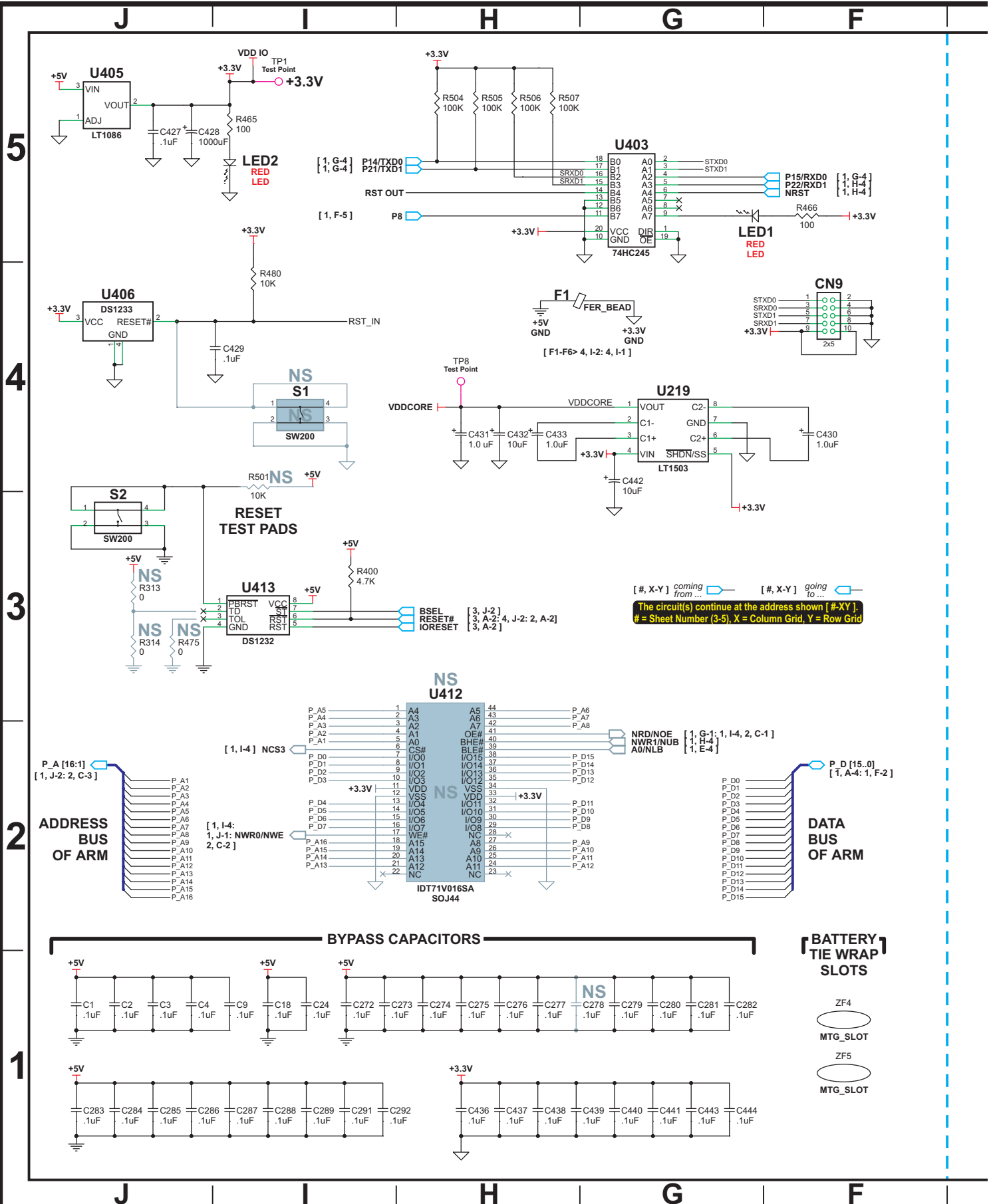
Sec. 5: PCBs

[# X-Y] coming from ... [# X-Y] going to ...
The circuit(s) continue at the address shown [# X-Y].
= Sheet Number (3-5), X = Column Grid, Y = Row Grid

CPU/Sound Board II (with ATMEL Processor) Schematic (Sheet 1 of 4)

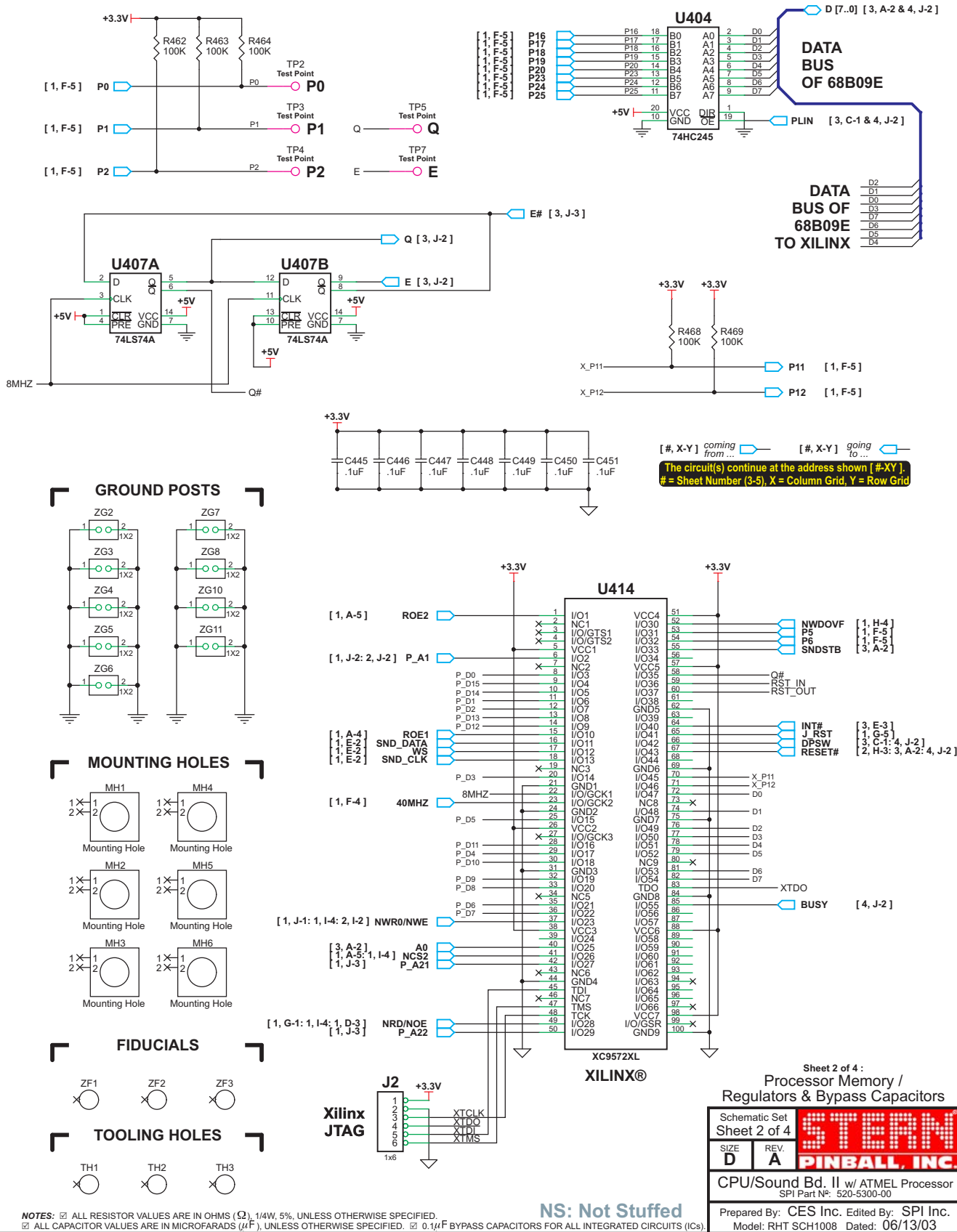


Sec. 5: PCBs



Sec. 5: PCBs

CPU/Sound Board II (with ATMEL Processor) Schematic (Sheet 2 of 4)



Sheet 2 of 4 : Processor Memory / Regulators & Bypass Capacitors

Schematic Set	Sheet 2 of 4	STERN
SIZE	REV	
D	A	PINBALL, INC.

CPU/Sound Bd. II w/ ATMEL Processor
SPI Part N#: 520-5300-00

Prepared By: CES Inc. Edited By: SPI Inc.
Model: RHT SCH1008 Dated: 06/13/03

[#, X-Y] coming from ... [#, X-Y] going to ...
 The circuit(s) continue at the address shown [#-XY].
 # = Sheet Number (3-5), X = Column Grid, Y = Row Grid

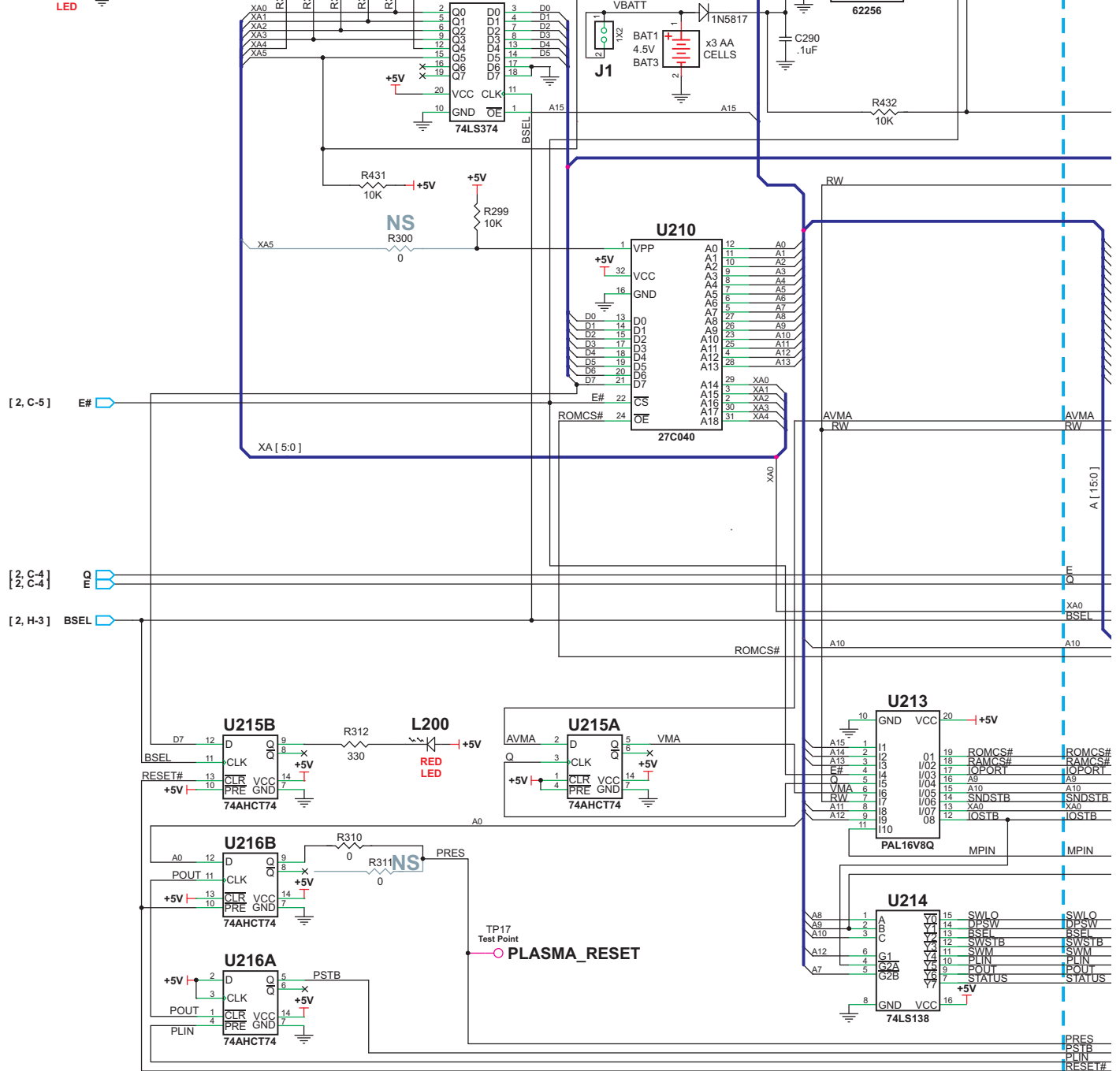
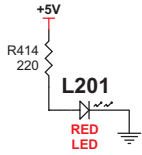
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4

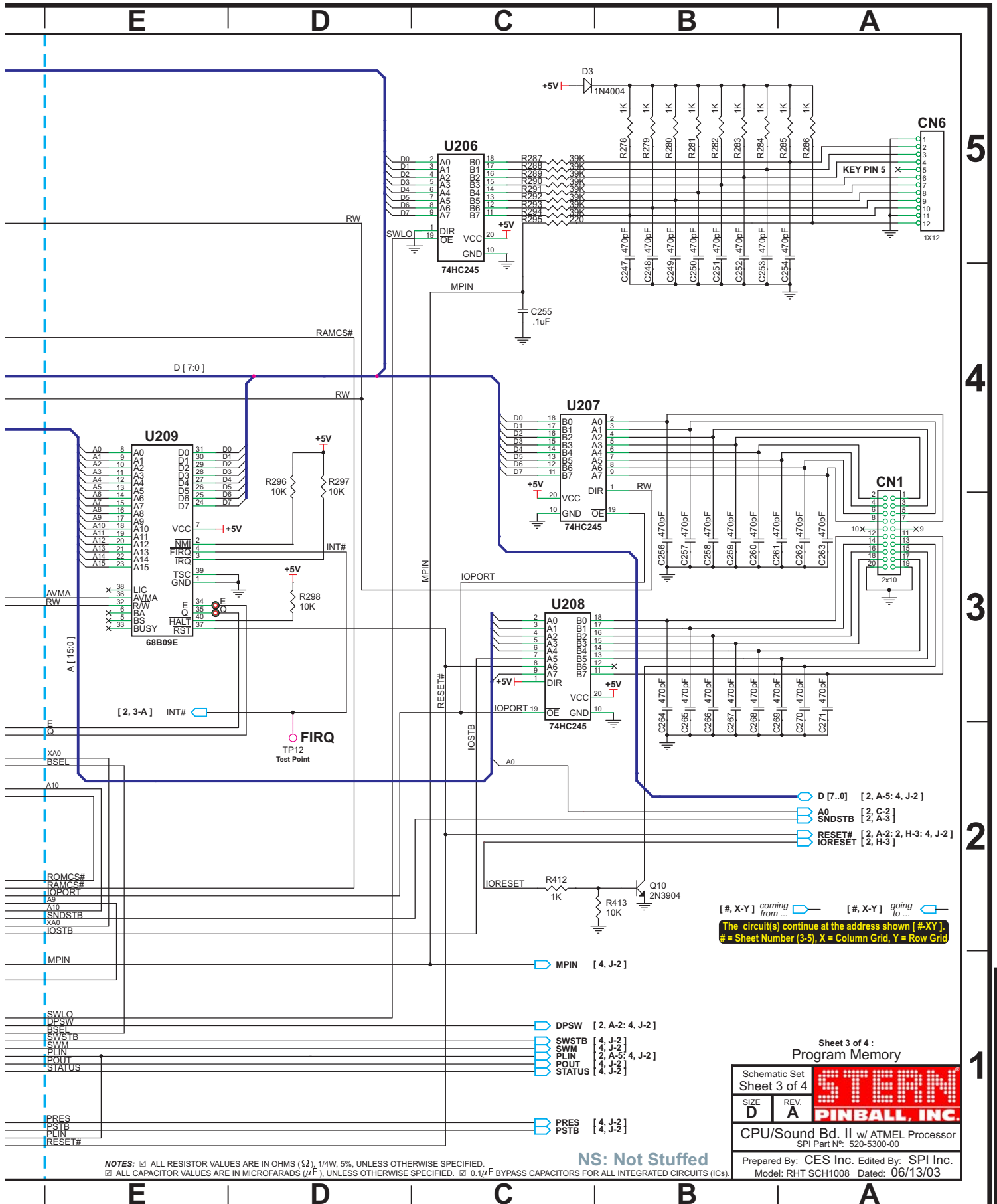
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2

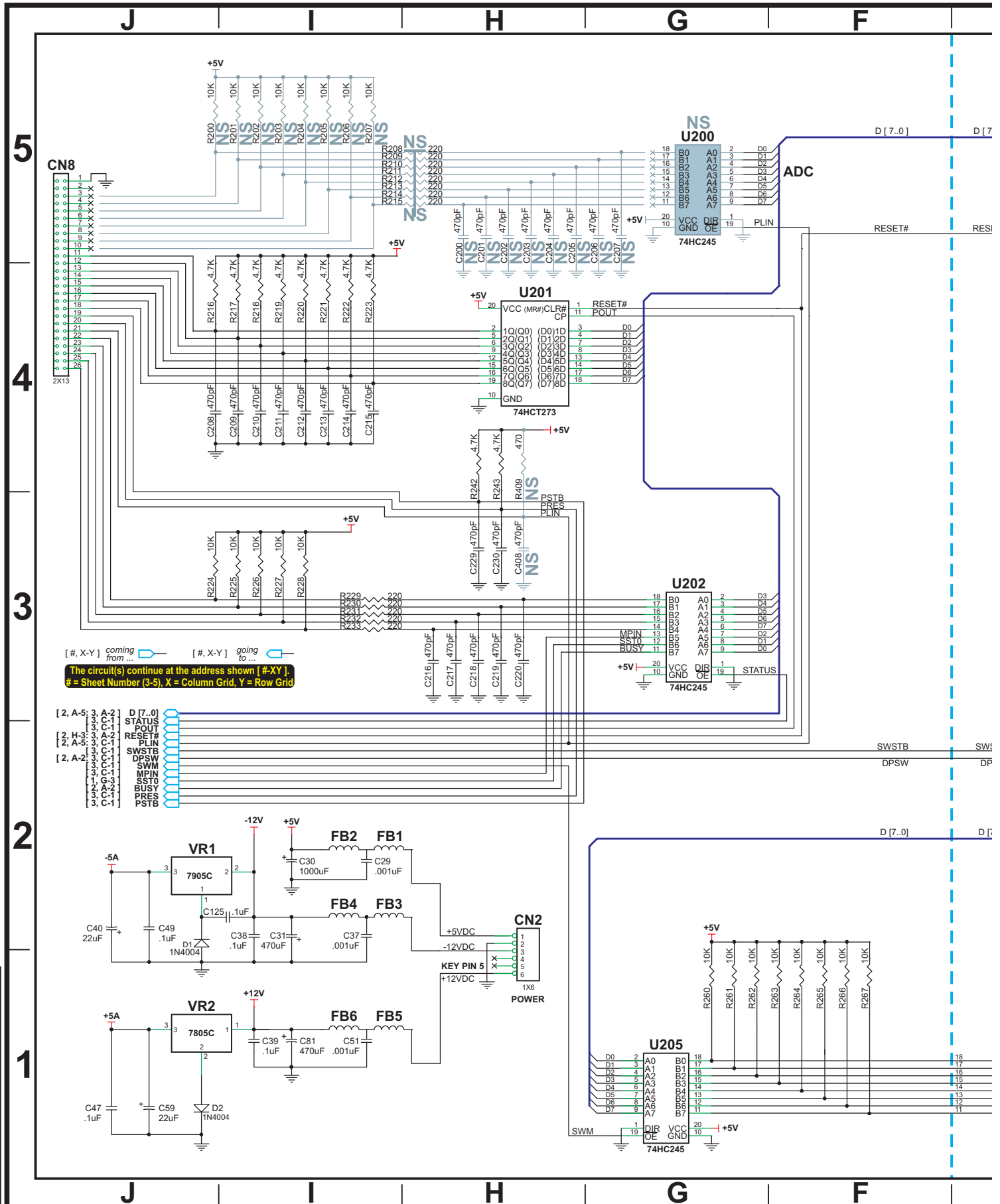
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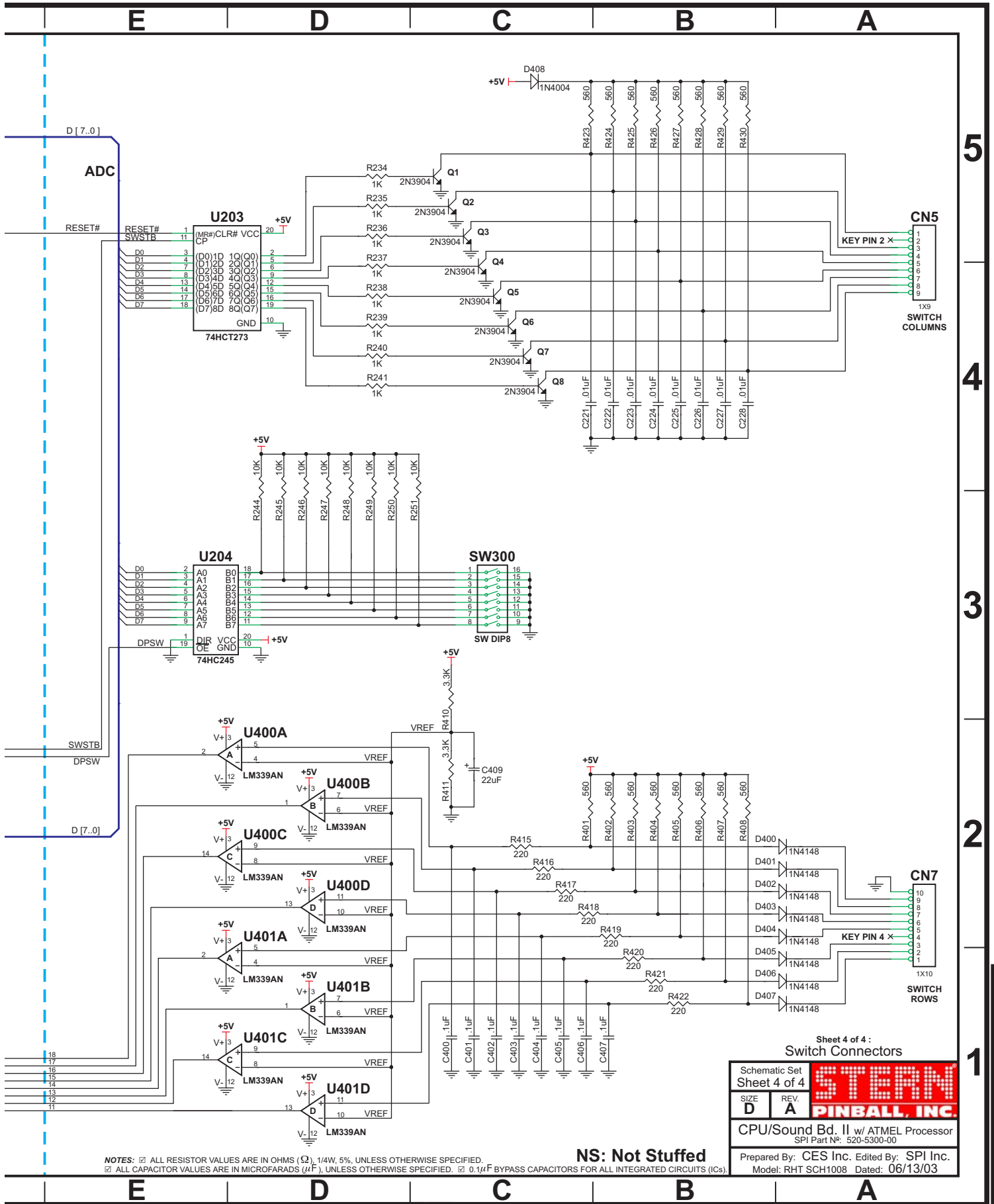
Sec. 5: PCBs



Sec. 5: PCBs



Sec. 5: PCBs



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

NS: Not Stuffed

Sheet 4 of 4:
 Switch Connectors

Schematic Set	Sheet 4 of 4	STERN	
SIZE	D		REV
CPU/Sound Bd. II w/ ATMEL Processor			
SPI Part N°: 520-5300-00			
Prepared By: CES Inc. Edited By: SPI Inc.			
Model: RHT SCH1008 Dated: 06/13/03			

Sec. 5: PCBs

CPU/Sound II Board (with Atmel Processor) Parts

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
			CPU/Sound II Board (with Atmel Processor)	Complete PCB Assembly
01	1	520-5300-00	JP1, JP2, JP3, JP4	3-Pin Jumper & 2-Pin Cover
02	4		CN2 (Key Pin-5)	6-Pin, 6PKK156
03	1	045-5015-06	J2 JTAG Xilinx®	6-Pin, ## Header
04	1	045-5015-07	CN4 (Key Pin-5)	7-Pin, 7PKK156
05	1		J3 JTAG	7-Pin, ## Header
06	1	045-5013-00	CN5 (Key Pin-2)	9-Pin, 9PKK156
07	1		CN9	10-Pin, 0.1 Header
08	1	045-5014-01	CN7 (Key Pin-4)	10-Pin, 10PKK156
09	1	045-5015-00	CN6 (Key Pin-5)	12-Pin, 12PKK156
10	1	045-5015-01	CN1	20-Pin, 0.1 Header
11	1	045-5015-26	CN8	26-Pin, 0.1 Header
12	3	125-5043-00	C29, C37, C51	0.001uF (102), Cap.
13	4	125-5039-00	C48, C50, C75, C80	0.0022uF or 2200pF, (222), Cap.
14	8	125-5029-00	C221>C228	0.01uF (103), 100v Cap.
15	52	125-5031-00	C1>C4, C9, C18, C24, C33, C34, C38, C39, C47, C49, C110, C111, C113, C117, C118, C120, C123, C124, C125, C255, C272>C277, C279>C292, C400>C407, C444 (C45, C46, C52, C103, C105, C106, C122, C278: NS)	0.1uF (104), Axial Cer. Cap.
16	3		C430, C431, C433 (near U403, U404)	1.0uF, ##v, Radial Lytic Cap.
17	1	125-5017-00	C35	10uF, 16v, Radial Tant. Cap.
18	4	125-5017-00	C78, C79, C107, C114 (C76, C77, C100: NS)	10uF, 25v-35v, Radial Lytic Cap.
19	2	125-5015-00	C109, C112 (C102, C104: NS)	100uF, 25v, Radial Lytic Cap.
20	1	125-5014-00	C409	22uF, 16v, Radial Lytic Cap.
21	4	125-5020-00	C40, C59, C108, C115 (C101: NS)	22uF, 25v, Radial Lytic Cap.
22	2	125-5012-00	C116, C119	220uF, 25v, Radial Lytic Cap.
23	2	125-5019-00	C31, C81	470uF, 25v, Radial Lytic Cap.
24	39	125-5028-00	C208>C215, C216>C220, C229, C230, C247>C254, C256>C263, C264>C271 (C200>C207, C408: NS)	470pF (471), Cer. Cap.
25	2	125-5037-00	C30, C428	1000uF, 16v, Radial Lytic Cap.
26	17		C427, C429, C436>C441, C443, C445>C451	SMT .1uF Cap.
27	2		C432, C442 (near U403 & U404)	SMT 10uF Cap.
28	9		C411, C414, C416, C419, C420, C422, C424, C434, C435	SMT 47pF Cap.
29	10		C410, C412, C413, C415, C417, C418, C421, C423, C425, C426	SMT 100nF Cap.
30	7	112-5003-00	D1>D3, D102>D105, D408 (D100, D101: NS)	1N4004, Diode
31	2	112-5008-00	D200, D201	1N5817, Diode
32	8	112-0054-00	D400-D407	1N1418, Diode
33	4	165-5099-00	LED1, LED2, L200, L201	LED T1-3/4 DIFFUSER LED
34	3	124-5064-00	R310, R315, R316 (R300, R311, R313, R314, R475: NS)	0Ω Jumper Res. (1-Stripe)
35	2	121-5041-00	R107, R111 (R103: NS)	1 Ω 1/4W Res.
36	1	121-5009-00	R8, R15, R234>R241, R278>R286, R412	1K Ω 1/4W Res.
37	2	121-5018-00	R7	1.5K Ω 1/4W Res.
38	2	121-5043-00	R16, R17 (R25, R112: NS)	2.2K Ω 1/4W Res.
39	2	121-5048-00	R410, R411	3.3K Ω 1/4W Res.
40	12	121-5021-00	R21, R216>R223, R242, R243, R400	4.7K Ω 1/4W Res.
	36	121-5011-00	R106, R224>R228, R244>R251, R260>R267, R296>R299, R301>R306, R413, R431, R432 (R200>R207, R501: NS)	10K Ω 1/4W Res.
41	3	121-5023-00	R9, R14, R104 (R100, R102: NS)	22K W 1/4W Res.
42	1	121-5022-04	R110	33K Ω 1/4W Res.
43	9	121-5045-00	R108, R287>R294	39K Ω Res.
44	2	121-5032-00	R22, R24	47K Ω 1/4W Res.
45	15	121-5014-00	R229>R233, R295, R414>R422 (R208>R215: NS)	220 Ω 1/4W Res.
46	1	121-5036-00	R312	330 Ω 1/4W Res.
47	2	121-5046-01	R105, R109 (R101, R409: NS)	470 Ω 1/4W Res.
48	16	121-5047-00	R401>R408, R423>R430	560 Ω 1/4W Res.
49	1		F1	SMT xx Res.
50	4		R434, R435, R436, R508	SMT 1K Ω Res.
51	1		R480	SMT 10K Ω Res.
52	2		R502, R509	SMT 33 Ω Res.
53	3		R465, R466, R470	SMT 100 Ω Res.
54	35		R433, R437, R441>R459, R462>R464, R468, R469, R476>R479, R504>R507, R510	SMT 100K Ω Res.
55	9	110-0069-00	Q1-Q8, Q10	2N3904, Transistor
56	1	100-5051-00	U402	ATMEL , AT91R40008
57	1	100-5050-00	U8	ATMEL , AT49BV1614
58	1	100-5044-00	U14	XILINX® , XC9572XL (programmed)
59	1	(See Pg. DR. Ⓢ Table)	U7	512K EPROM Sound (27512)
60	1	(See Pg. DR. Ⓢ Table)	U210 (32-Pin, IC Socket, 077-5217-00)	1MB EPROM CPU Game (27C040)
61	4	(See Pg. DR. Ⓢ Table)	U17, U21, U36, U37 (32-Pin, IC Socket, 077-5217-00)	8MB EPROM Voice 1-4 (M27C04001-12FI)
62	1	965-6504-00	U213 (BLUE DOT)	PAL16V8Q (Programmed) BLUE DOT
63	1	105-5046-00	U212 (28-Pin, IC Dip Socket, 077-5208-00)	6264/MS62256 (MS6264A) (28-Pin)
64	1	100-0189-01	U209 (40-Pin, IC Socket, 077-5209-00)	68B09E (40-Pin)
65	2	100-5015-00	U215, U216	74AHC74 (14-Pin)
66	8	100-0338-00	U202, U204, U205, U206, U207, U208, U403, U404 (U200: NS)	74HC245 (20-Pin)
67	2	100-5012-00	U201, U203	74HCT273 (20-Pin)
68	1	100-0037-00	U407	74LS74 (14-Pin)
69	1	100-0148-00	U214	74LS138 (16-Pin)
70	1	100-0064-00	U211	74LS374 (20-Pin)
71	1	100-5052-00	U406	SMT 3.3v Watchdog, DS1233 (3-Pin)
72	1	100-5023-00	U413	5.0v Watchdog, DS1232 (8-Pin)
73	1	100-5053-00	U219	1.8v Volt. Regulator LT1503 (8-Pin)
74	1	100-5059-00	U405	3.3v Volt. Regulator LT1086 (3-Pin)
75	1	124-5002-00	VR1	-5v Regulator, LM7905CT
76	1	124-5001-00	VR2	+5v Regulator, LM7805CT
77	2	100-0377-00	U400, U401	LM339AN (14-Pin)
78	1	100-0375-00	U30	LM833 (8-Pin)
79	1	100-5018-00	U26	TDA1543 (8-Pin)
80	2	100-5016-20	U101, U102 (U100: NS)	TDA2030A (5-Pin)
81	1		Y1	40MHz Clock PLE SQ3300S
82	1	181-5002-00	SW300	Dip Switch 8-Pos., (KSD08H Black)
83		n/a	FB1>FB6	Ferrite Bead
84		535-5000-10	HS2, HS3, (HS1: NS) (over U101, U102)	Heat Sink (AAVID 531102)
85	1		S2 (Reset)	Push-Button Switch (B3F4000)
86	1	545-5685-00	BAT1 HOLDER	(Always replace all 3, Size AA 1.5v Cells, with new ones, when required)

* Surface Mounts (SMT) are not listed.

* Surface Mounts (SMT) are not listed.

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

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

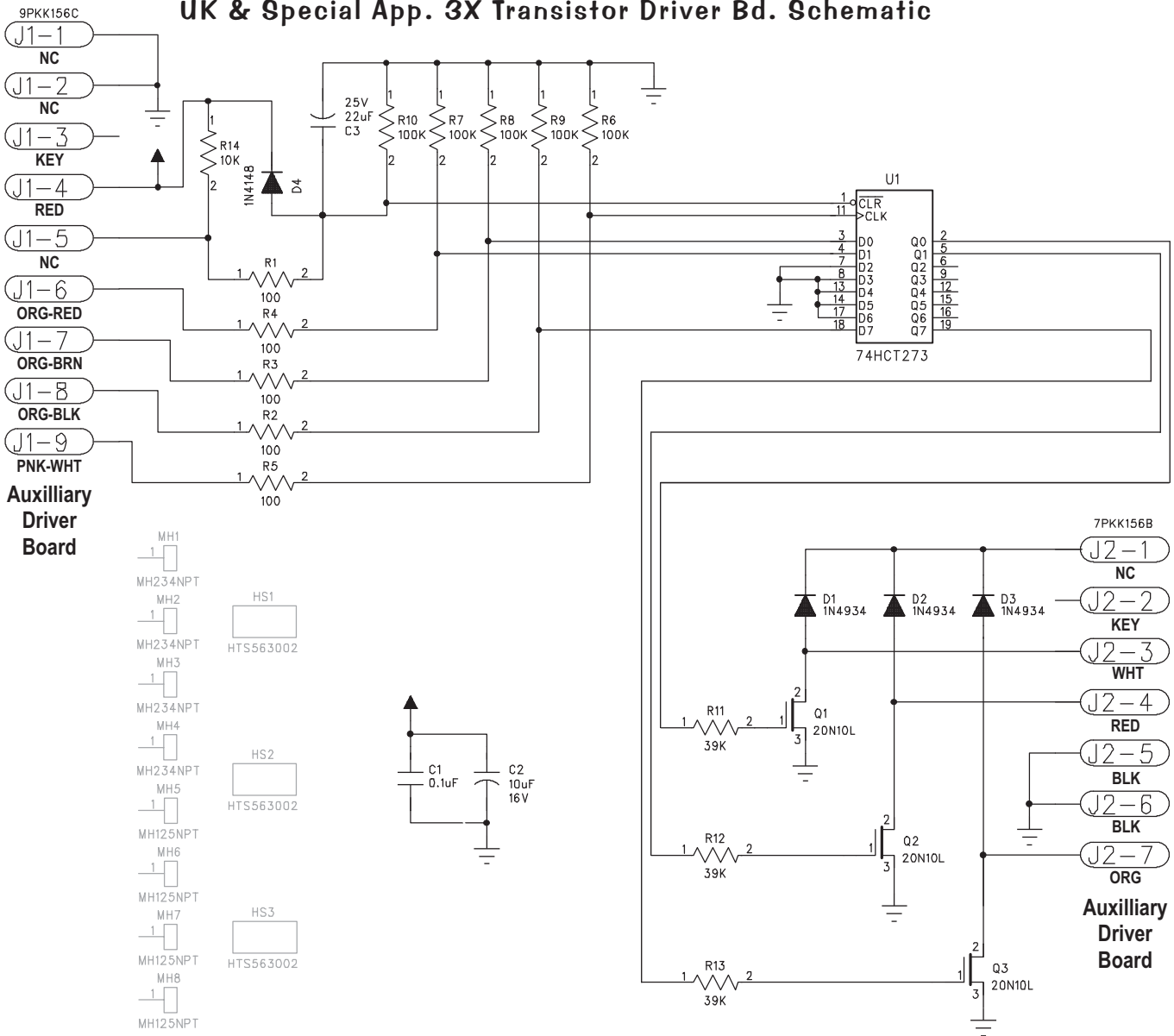
If a part is required where a part number is not provided, call Tech. Support (see back of cover).

Printed Circuit Boards (PCBs)

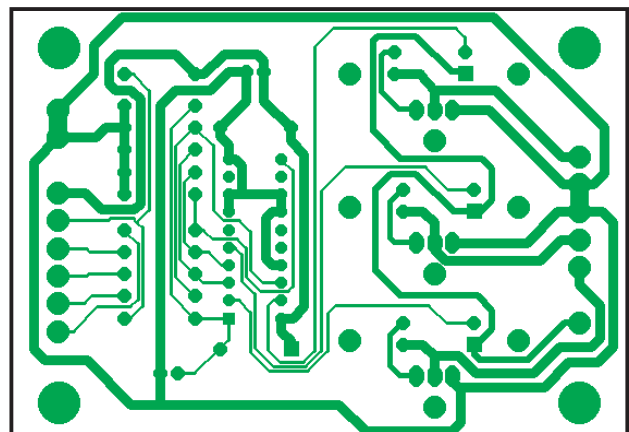
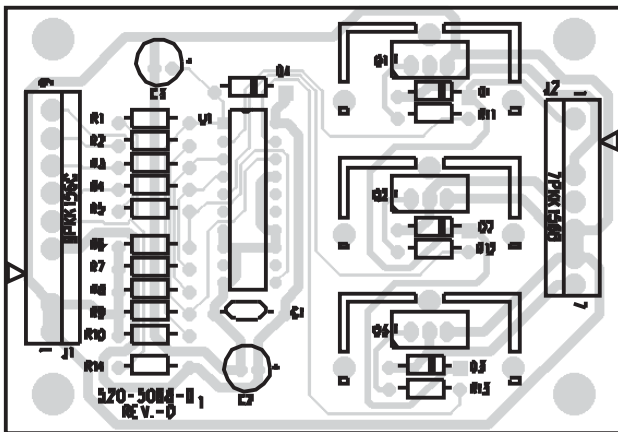


Sec. 5: PCBs

UK & Special App. 3X Transistor Driver Bd. Schematic



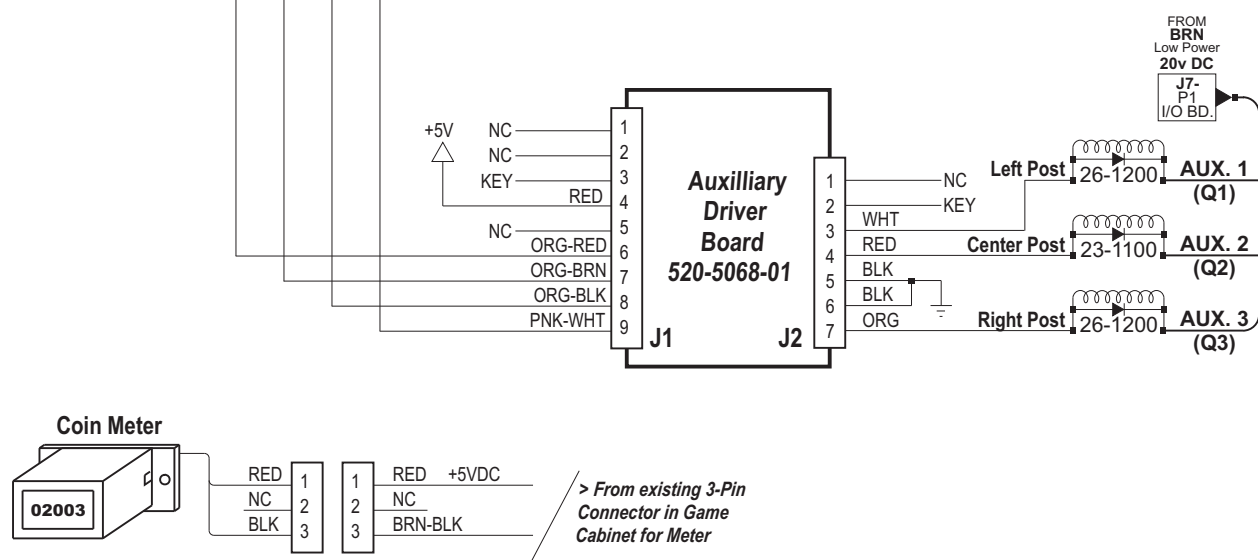
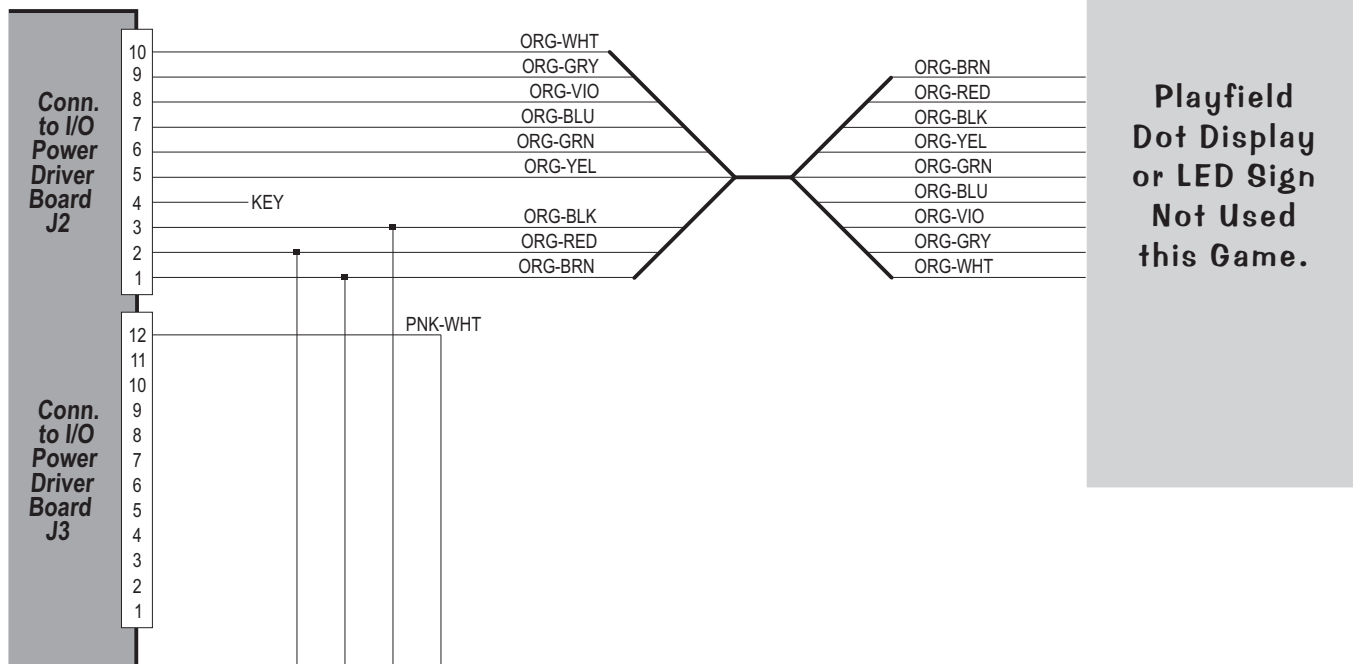
UK & Special App. 3X Transistor Driver Bd. Component Layout (Sol. Exp. Bd.)



Sec. 5: PCBs

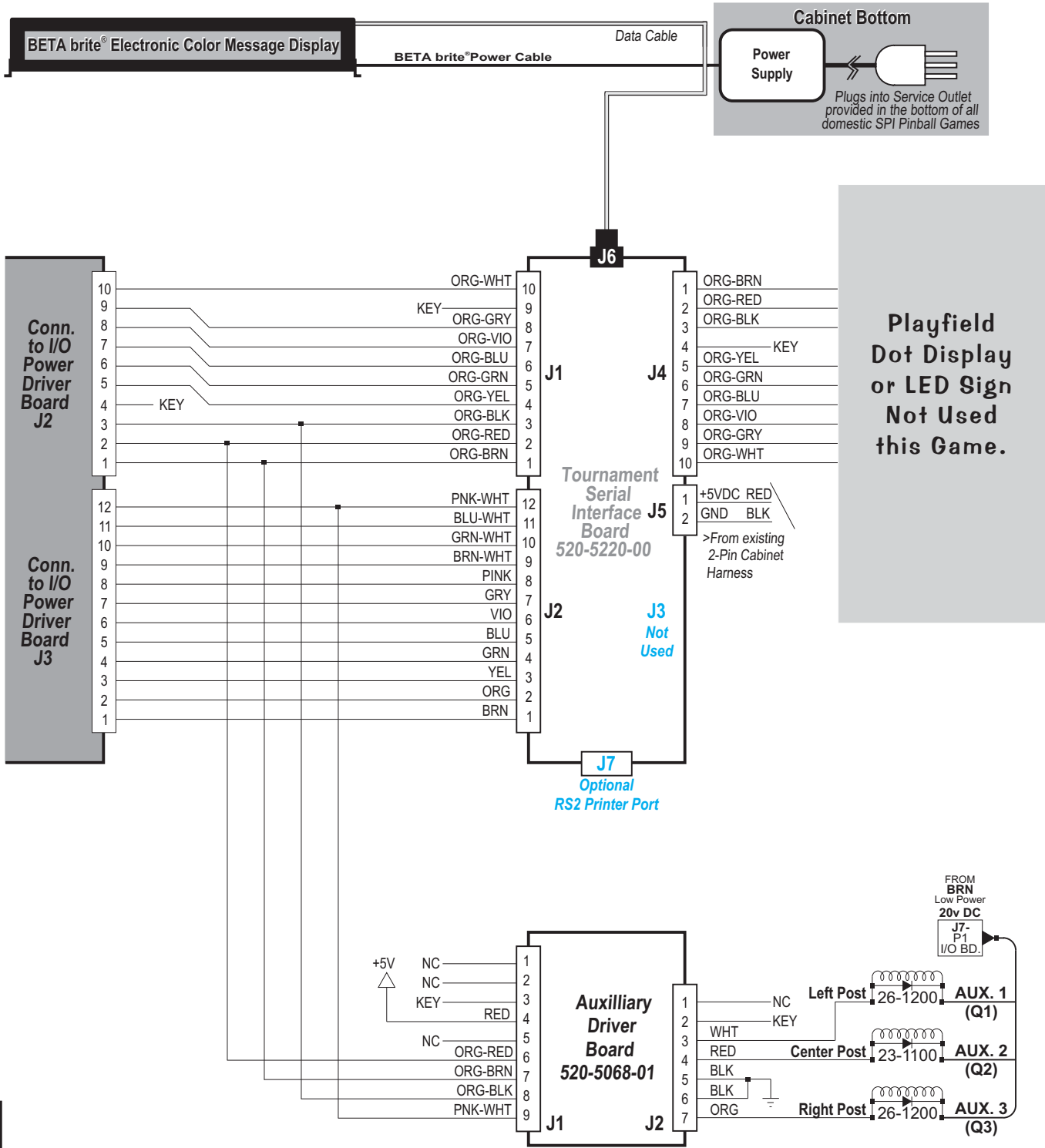
ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
—	1	520-5068-01	Solenoid Expander (x3 Transistor) PC Board	Complete PCB Assembly

UK 3X Transistor Driver Board for Up-Posts & P/F Dot Display or LED Sign (if used)

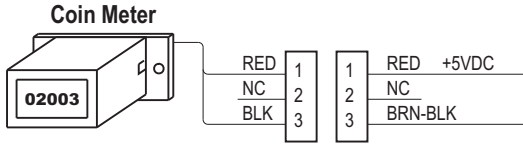


Sec. 5: PCBs

UK 3X Transistor Driver Board for Up-Posts & P/F Dot Display or LED Sign (if used) with the Tournament Serial Interface (TSI) Board



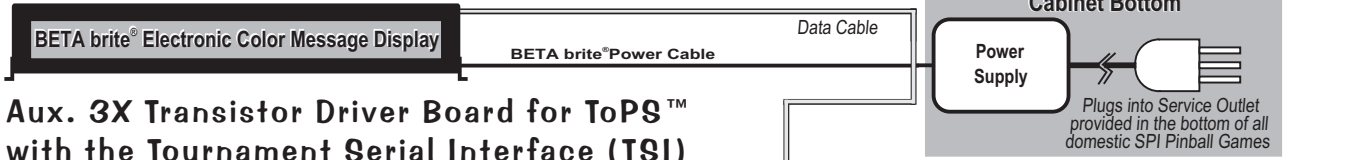
Sec. 5: PCBs



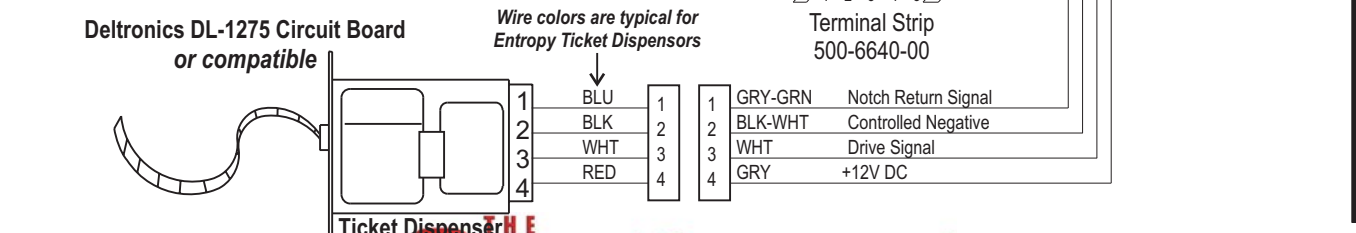
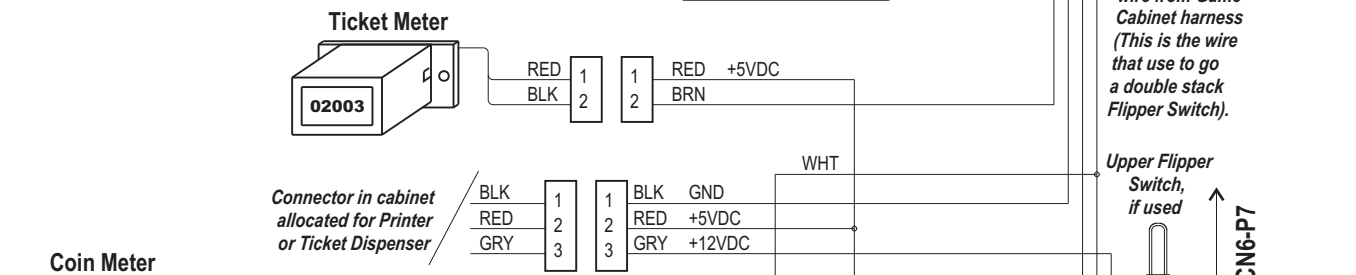
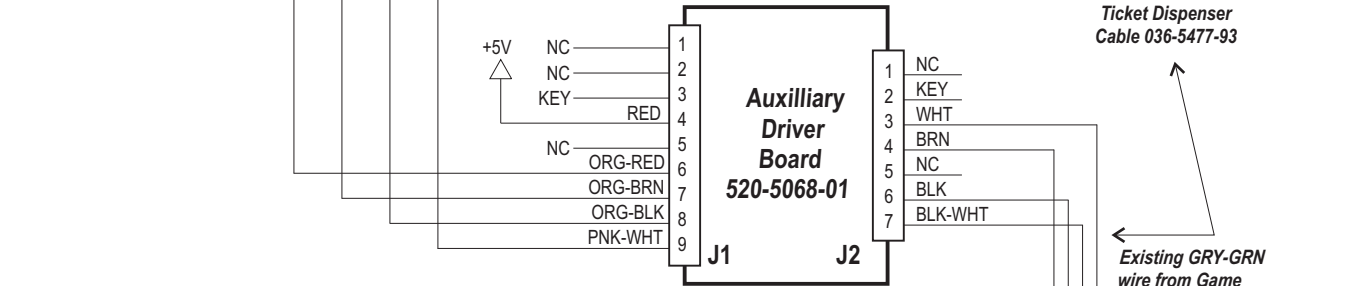
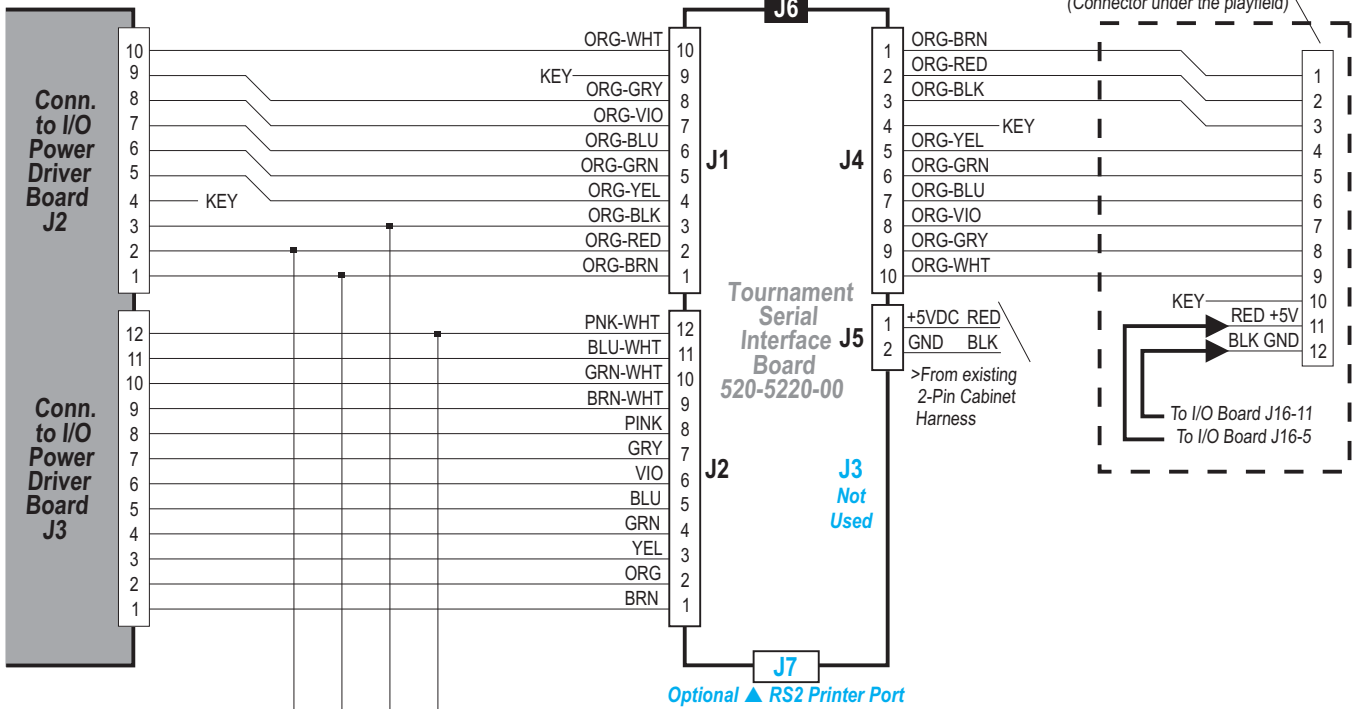
Order the Optional TOPS™ (Tournament Pinball System) Kit!
Call Technical Support at 1-800-542-5377 for more information



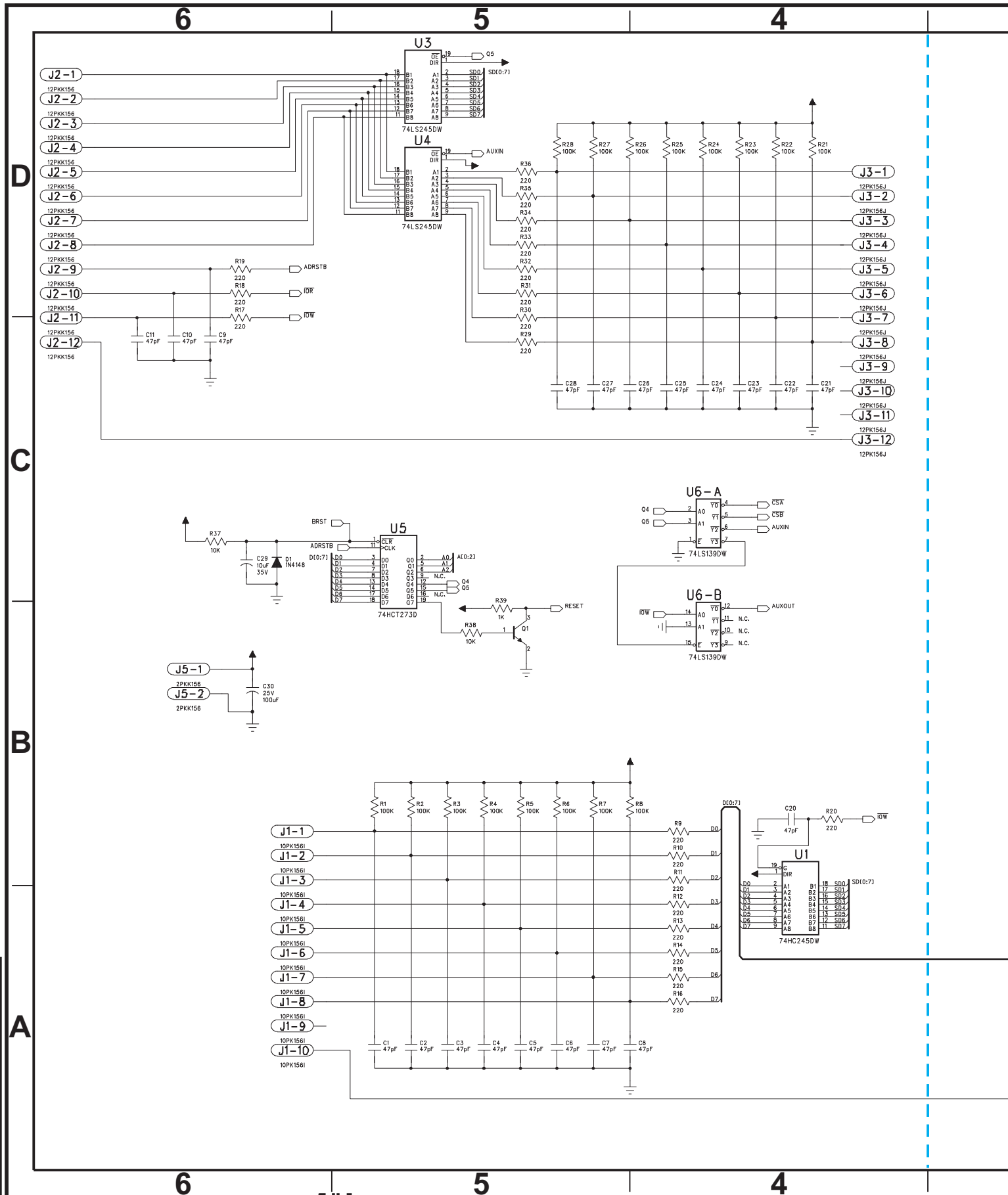
THE SopranosSM



Aux. 3X Transistor Driver Board for ToPS™ with the Tournament Serial Interface (TSI) Board and Ticket Interface

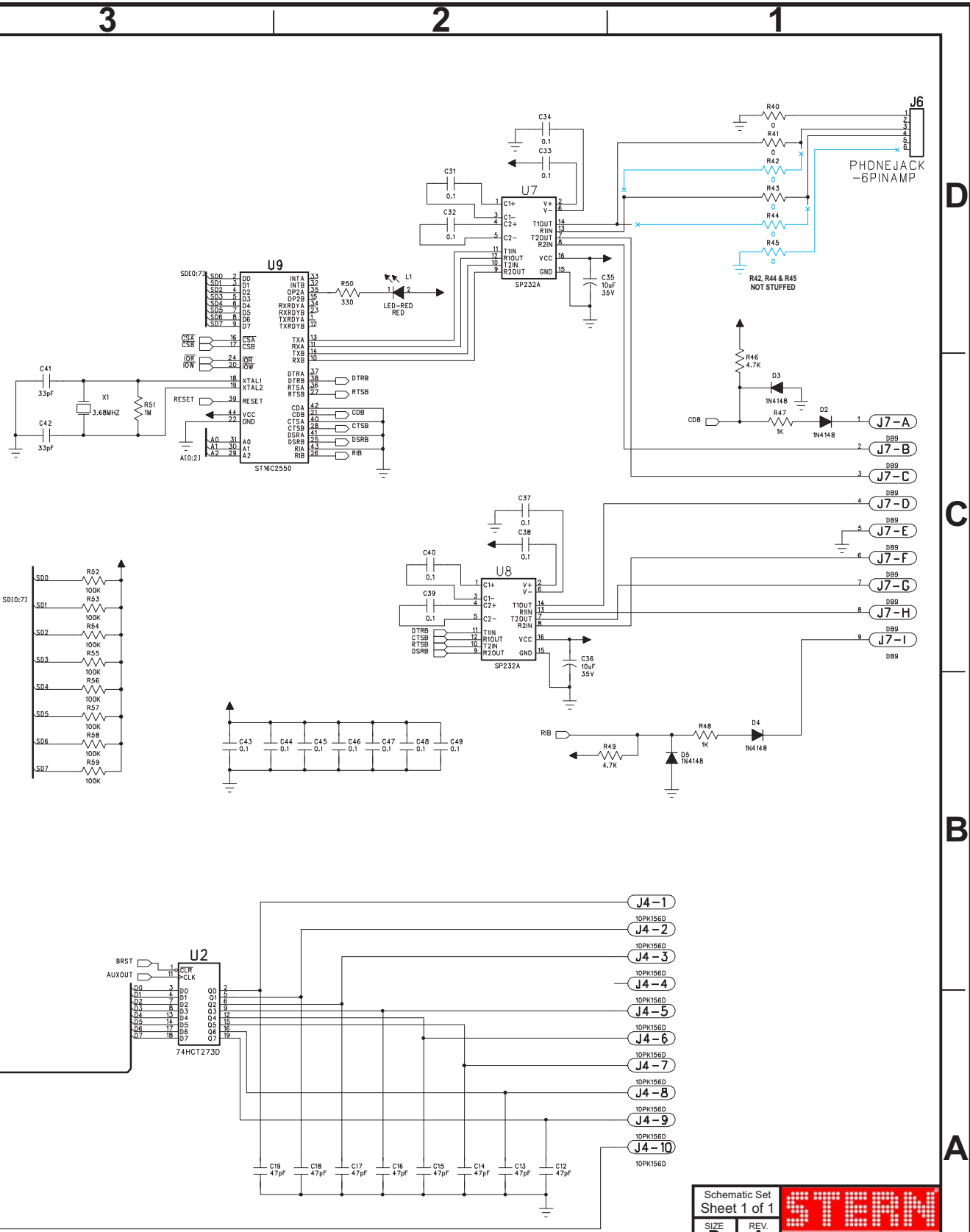


Tournament Serial Interface Board Schematic (Sheet 1 of 1)



Sec. 5: PCBs

Tournament Serial Interface Board Schematic (Sheet 1 of 1)



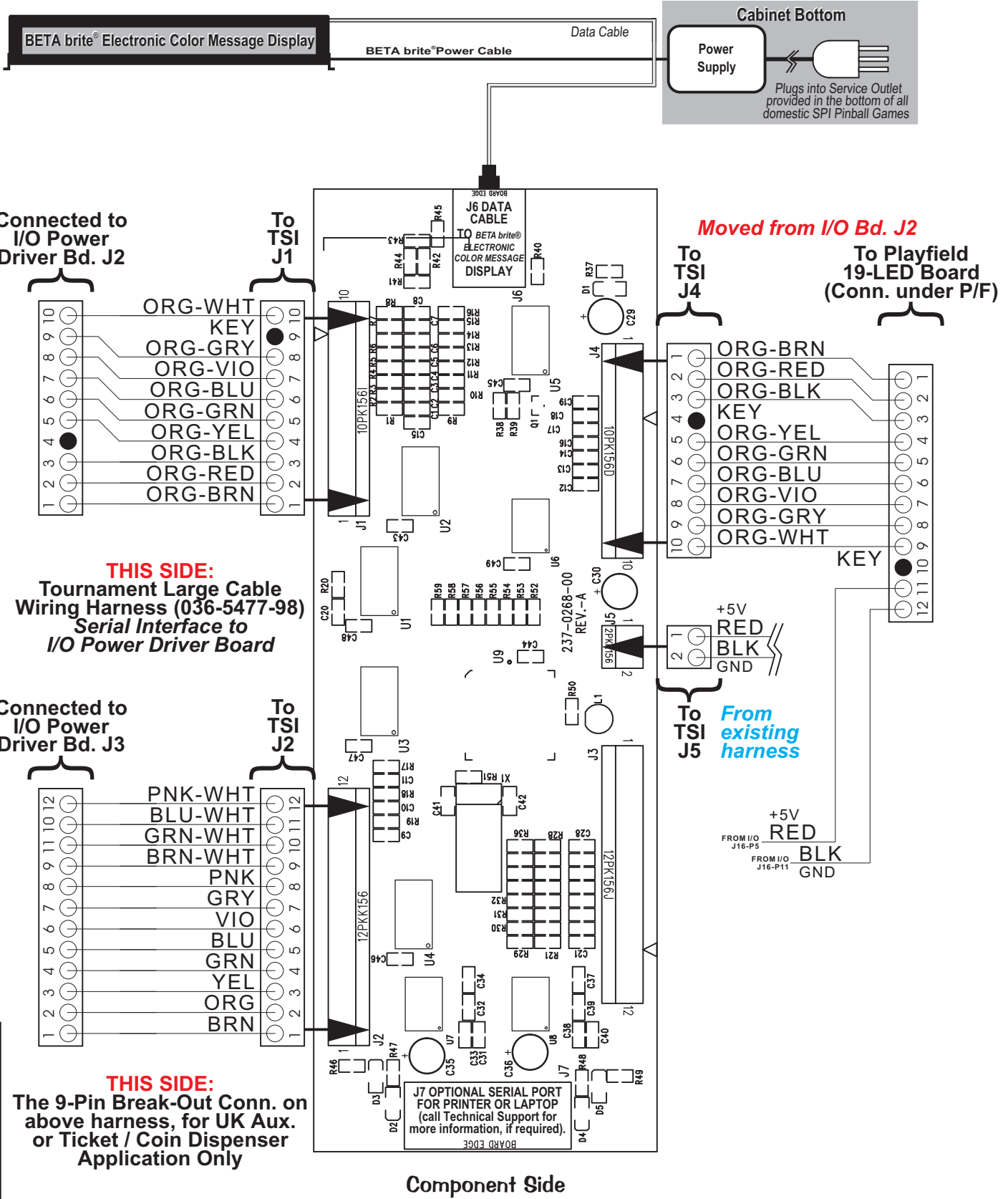
NOTES:
 [] ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
 [] ALL CAPACITOR VALUES ARE IN MICROFARADS (μ F), UNLESS OTHERWISE SPECIFIED.
 [] 0.1 MICROFARADS (μ F) BYPASS CAPACITOR ON ALL IC'S.

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		

Sec. 5: PCBs

Tournament Serial Interface Board Component Layout



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

Table of Contents for Appendixes

- **Appendix A : Pinball Game Firmware TableA1-A2**
 - ▶ [White Star Board System and S.A.M. System Only*]
 - ▷ ... describes the ROM / Chip Size / Program & Raw Part Number / USA Version / Check Sum and CPU/Sound PCB I & II ROM locations for Games Apollo 13 — Grand Prix (White Star Games); World Poker Tour – current (S.A.M. Games).
- **Appendix B : Semi-Conductors / I.C.'s / Relays Cross-Reference Table B1**
 - ▷ ...describes diodes and transistors with Source Number, SPI Part Number, NTE Number, ECG Number, Radio Shack Number & RCA Part Number (If applicable).
- **Appendix C : Production Start Date, Manual Part N^o, ROM Size & Positions and Jumper W6 .. C1**
 - ▶ [White Star Board System and S.A.M. System Only*]
 - ▷ ...provides the Production Start Date, Manual Part Number, ROM Position(s), and Jumpers Installed for Games Apollo 13 — Grand Prix (White Star Games); World Poker Tour – current (S.A.M. Games).
- **Appendix D : Board TyPe Table D1-D2**
 - ▶ [White Star Board System and S.A.M. System Only*]
 - ▷ ...provides the Flipper**, I/O Power Driver, CPU/Sound, Display Power Supply, Dot Matrix Display, Display Controller, OPTOs and Misc. Board Part Numbers for Games Apollo 13 — Grand Prix (White Star Games); World Poker Tour – current (S.A.M. Games). ***Flipper Bd. with White Star Bd. System for A13 & Golden Eye only.*
- **Appendix E : Generic Coil Cross-Reference Guide & Flipper Coil TableE1-E2**
 - ▶ [White Star Board System and S.A.M. System Only*]
 - ▷ ...provides the Coils used with Part Number and Gauge-Turns (of the coil) for Games Apollo 13 — Grand Prix (White Star Games); World Poker Tour – current (S.A.M. Games).
- **Appendix F : Motor Specification Table F1-F2**
 - ▶ [White Star Board System and S.A.M. System Only*]
 - ▷ ...provides all the Motor Function, Specifications and Part Number for Games Apollo 13 — Grand Prix (White Star Games); World Poker Tour – current (S.A.M. Games)..
- **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 pictoral view with the name and Part Nr. of all the inserts used (with Color Code Chart).
- **Appendix I : Stand-Up Targets & Modular Stand-Up Targets I1-I2**
 - ▷ ...gives a pictoral view with the name and Part Number of all the Single Stand-Up Targets used (with Color Code Chart).
- **Appendix J : Coin Cards (USA & International) J1**
 - ▷ ...gives a pictoral view with the name and Part Number of all the current Coin Cards for USA, Canada, Euro and other International Countries. For all Coin Cards and/or free Coin Card files for download, visit our website : www.sternpinball.com



APPENDIX A



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

See website for the latest International Code or Updated USA version / checksums

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	1.00	\$5244	U7	960-7001-02
Display (4M)	965-0217-42	A5.00	\$B92B	ROM 0	960-5015-01
Voice 1 (4M)	965-0209-00	1.00	\$7FC7	U17	n/a (masked)
Voice 2 (4M)	965-0210-00	1.00	\$8E55	U21	n/a (masked)
Voice 3 (4M)	965-0211-00	1.00	\$08EE	U36	n/a (masked)
Golden Eye (Note 1)					
Game ROM (1M)	965-0214-42	A4.04	\$3FFF	U210	960-5009-00
Sound (512K)	965-0217-42	1.00	\$D615	U7	960-7001-02
Display (4M)	965-0218-42	A4.00	\$E6ED	ROM 0	960-5015-01
Voice 1 (4M)	965-0215-42	1.00	\$3E32	U17	n/a (masked)
Voice 2 (4M)	965-0216-42	1.00	\$71F0	U21	n/a (masked)
Twister (Note 2)					
Game ROM (1M)	965-0219-41	A4.05	\$E9FF	U210	960-5009-00
Sound (512K)	965-0221-41	1.00	\$1FFF	U7	960-7001-02
Display (4M)	965-0222-41	A4.00	\$FD01	ROM 0	960-5015-01
Voice 1 (4M)	965-0220-41	1.00	\$3650	U17	960-5015-01
Voice 2 (4M)	965-0223-41	1.00	\$9300	U21	960-5015-01
ID4: Independence Day (Note 2)					
Game ROM (1M)	965-0224-45	A2.02	\$9CFF	U210	960-5009-00
Sound (512K)	965-0227-45	1.00	\$222B	U7	960-7001-02
Display (4M)	965-0228-45	A2.00	\$AB7	ROM 0	960-5015-01
Voice 1 (4M)	965-0225-45	1.00	\$3AF1	U17	960-5015-01
Voice 2 (4M)	965-0226-45	1.00	\$206E	U21	960-5015-01
Space Jam (Note 2)					
Game ROM (1M)	965-0229-43	A3.00	\$E6FF	U210	960-5009-00
Sound (512K)	965-0233-43	1.00	\$F1E7	U7	960-7001-02
Display (4M)	965-0234-43	A3.00	\$0057	ROM 0	960-5015-01
Voice 1 (4M)	965-0230-43	1.00	\$DBA8	U17	960-5015-01
Voice 2 (4M)	965-0231-43	1.00	\$DDF1	U21	960-5015-01
Voice 3 (4M)	965-0232-43	1.00	\$F32A	U36	960-5015-01
The Star Wars Trilogy - Special Edition (S.E.) (Note 2)					
Game ROM (1M)	965-0235-56	A4.03	\$5EFF	U210	960-5009-00
Sound (512K)	965-0238-56	1.00	\$4A7D	U7	960-7001-02
Display (4M)	965-0239-56	A4.00	\$8817	ROM 0	960-5015-01
Voice 1 (4M)	965-0236-56	1.00	\$E66B	U17	960-5015-01
Voice 2 (4M)	965-0237-56	1.00	\$8F54	U21	960-5015-01
The Lost World: Jurassic Park (Note 2)					
Game ROM (1M)	965-0240-53	A2.02	\$C8FF	U210	960-5009-00
Sound (512K)	965-0243-53	1.00	\$A35B	U7	960-7001-02
Display (4M)	965-0244-53	A2.01	\$7F46	ROM 0	960-5015-01
Voice 1 (4M)	965-0241-53	1.00	\$1D27	U17	960-5015-01
Voice 2 (4M)	965-0242-53	1.00	\$8DA4	U21	960-5015-01
The X-Files (Note 2)					
Game ROM (1M)	965-0245-46	A3.03	\$A2FF	U210	960-5009-00
Sound (512K)	965-0248-46	1.00	\$65A8	U7	960-7001-02
Display (4M)	965-0249-46	A3.00	\$66D0	ROM 0	960-5015-01
Voice 1 (4M)	965-0246-46	1.00	\$349D	U17	960-5015-01
Voice 2 (4M)	965-0247-46	1.00	\$629C	U21	960-5015-01
Starship Troopers (Note 3)					
Game ROM (1M)	965-0250-59	A2.00	\$85FF	U210	960-5009-00
Sound (512K)	965-0253-59	1.00	\$64B2	U7	960-7001-02
Display (4M)	965-0254-59	A2.00	\$E77B	ROM 0	960-5015-01
Voice 1 (4M)	965-0251-59	1.00	\$152A	U17	960-5015-01
Voice 2 (4M)	965-0252-59	1.00	\$0291	U21	960-5015-01
Voice 3 (4M)	965-0255-59	1.00	\$95A7	U36	960-5015-01
Viper Night Drivin' (Note 4)					
Game ROM (1M)	965-0266-35	A2.01	\$C5FF	U210	960-5009-00
Sound (512K)	965-0271-35	1.00	\$4DF8	U7	960-7001-02
Display (4M)	965-0272-35	A2.01	\$C17D	ROM 0	960-5015-01
Voice 1 (4M)	965-0267-35	1.00	\$9018	U17	960-5015-01
Voice 2 (4M)	965-0268-35	1.00	\$2157	U21	960-5015-01
Voice 3 (4M)	965-0269-35	1.00	\$B5A6	U36	960-5015-01
Voice 4 (4M)	965-0270-35	1.00	\$D01E	U37	960-5015-01
Lost In Space (Note 4)					
Game ROM (1M)	965-0282-60	A1.01	\$B2FF	U210	960-5009-00
Sound (512K)	965-0287-60	1.00	\$A6AF	U7	960-7001-02
Display (4M)	965-0288-60	A1.02	\$32AB	ROM 0	960-5015-01
Voice 1 (4M)	965-0283-60	1.00	\$4391	U17	960-5015-01
Voice 2 (4M)	965-0284-60	1.00	\$8215	U21	960-5015-01
Voice 3 (4M)	965-0285-60	1.00	\$5B32	U36	960-5015-01
Voice 4 (4M)	965-0286-60	1.00	\$8971	U37	960-5015-01
Godzilla (Note 4)					
Game ROM (1M)	965-0289-40	A2.05	\$B1FF	U210	960-5009-00
Sound (512K)	965-0294-40	1.00	\$0CC9	U7	960-7001-02
Display (4M)	965-0295-40	A2.00	\$C929	ROM 0	960-5015-01
Voice 1 (4M)	965-0290-40	1.00	\$0D75	U17	960-5015-01
Voice 2 (4M)	965-0291-40	1.00	\$CCCF	U21	960-5015-01
Voice 3 (4M)	965-0292-40	1.00	\$227F	U36	960-5015-01
Voice 4 (4M)	965-0293-40	1.00	\$DB69	U37	960-5015-01
South Park (Notes 4, 5)					
Game ROM (1M)	965-0301-71	A1.03	\$58FF	U210	960-5009-00
Sound (512K)	965-0306-71	1.00	\$1286	U7	960-7001-02
Display (4M)	965-0307-71	A1.01	\$166F	ROM 0	960-5015-01
Voice 1 (8M)	965-0302-71	1.00	\$7BF8	U17	960-5016-00
Voice 2 (8M)	965-0303-71	1.00	\$9CCC	U21	960-5016-00
Voice 3 (8M)	965-0304-71	1.00	\$ADD9	U36	960-5016-00
Voice 4 (8M)	965-0305-71	1.00	\$6659	U37	960-5016-00

ROM	Chip Size	Program Part N ^o	USA ver. & Check Sum	Bd. Loc.	Raw Part N ^o
Harley-Davidson® (Notes 4, 5, 6) Original (1999-2001)					
Game ROM (1M)	965-0319-67	A1.03	\$3EFF	U210	960-5009-00
Sound (512K)	965-0320-67	1.00	\$F4FF	U7	960-7001-02
Display (4M)	965-0321-67	A1.04	\$FC7C	ROM 0	960-5015-01
Voice 1 (8M)	965-0322-67	1.00	\$CD26	U17	960-5016-00
Voice 2 (8M)	965-0323-67	1.00	\$3936	U21	960-5016-00
Voice 3 (8M)	965-0324-67	1.00	\$FB72	U36	960-5016-00
Voice 4 (4M)	965-0325-67	1.00	\$6100	U37	960-5015-01
► Harley-Davidson® (Notes 4, 5, 6, 8) 2nd Edition (2002-2003)					
Game ROM (1M)	965-0319-67A	A1.08	\$23FF	U210	960-5009-00
Display (4M)	965-0321-67A	A1.05	\$B594	ROM 0	960-5015-01
► Harley-Davidson® (Notes 4, 5, 6, 8) 3rd Edition (2004)					
Game ROM (1M)	965-0319-87	A4.00	\$1CFF	U210	960-5009-00
Display (4M)	965-0321-87	A4.00	\$F4FF	U5	960-5015-01
Striker Xtreme (Notes 4, 5)					
Game ROM (1M)	965-0326-68	A1.03	\$E4FF	U210	960-5009-00
Sound (512K)	965-0327-68	1.00	\$3BCA	U7	960-7001-02
Display (4M)	965-0328-68	A1.03	\$1957	ROM 0	960-5015-01
Voice 1 (8M)	965-0329-68	1.00	\$482A	U17	960-5016-00
Voice 2 (8M)	965-0330-68	1.00	\$7312	U21	960-5016-00
Voice 3 (8M)	965-0331-68	1.00	\$DE2F	U36	960-5016-00
Voice 4 (8M)	965-0332-68	1.00	\$C508	U37	960-5016-00
NFL (Notes 4, 5) Not on CD-R or Website: Code through Distributor Only.					
Game ROM (1M)	965-0339-73	A1.00	\$D2FF	U210	960-5009-00
Sound (512K)	965-0340-73	1.00	U7	960-7001-02	
Display (4M)	965-0341-73	A1.01	\$845A	ROM 0	960-5015-01
Voice 1 (8M)	965-0342-73	1.00	U17	960-5016-00	
Voice 2 (8M)	965-0343-73	1.00	U21	960-5016-00	
Voice 3 (8M)	965-0344-73	1.00	U36	960-5016-00	
Voice 4 (8M)	965-0345-73	1.00	U37	960-5016-00	
Sharkey's Shootout (Notes 4, 5)					
Game ROM (1M)	965-0333-72	A2.11	\$49FF	U210	960-5009-00
Sound (512K)	965-0333-72	1.01	\$9796	U7	960-7001-02
Display (4M)	965-0335-72	A2.01	\$6C33	ROM 0	960-5015-01
Voice 1 (8M)	965-0336-72	1.00	\$58EA	U17	960-5016-00
Voice 2 (8M)	965-0337-72	1.00	\$272B	U21	960-5016-00
Voice 3 (8M)	965-0338-72	1.00	\$41AE	U36	960-5016-00
High Roller Casino (Notes 4, 5)					
Game ROM (1M)	965-0346-65	A3.00	\$90FF	U210	960-5009-00
Sound (512K)	965-0347-65	1.00	\$581C	U7	960-7001-02
Display (4M)	965-0348-65	A3.00	\$74B3	ROM 0	960-5015-01
Voice 1 (8M)	965-0349-65	1.00	\$E12D	U17	960-5016-00
Voice 2 (8M)	965-0350-65	1.00	\$38F4	U21	960-5016-00
Voice 3 (8M)	965-0351-65	1.00	\$1B54	U36	960-5016-00
Voice 4 (8M)	965-0352-65	1.00	\$D720	U37	960-5016-00
Austin Powers™ (Notes 4, 5)					
Game ROM (1M)	965-0353-74	A3.02	\$5DFF	U210	960-5009-00
Sound (512K)	965-0354-74	1.00	\$D47B	U7	960-7001-02
Display (4M)	965-0355-74	A3.00	\$6A3A	ROM 0	960-5015-01
Voice 1 (8M)	965-0356-74	1.00	\$D2B9	U17	960-5016-00
Voice 2 (8M)	965-0357-74	1.00	\$9E75	U21	960-5016-00
Voice 3 (8M)	965-0358-74	1.00	\$51F3	U36	960-5016-00
Voice 4 (8M)	965-0359-74	1.00	\$0AE5	U37	960-5016-00
MONOPOLY® (Notes 4, 5)					
Game ROM (1M)	965-0360-75	A3.20	\$07FF	U210	960-5009-00
Sound (512K)	965-0361-75	1.00	\$8C18	U7	960-7001-02
Display (4M)	965-0362-75	A3.01	\$A381	ROM 0	960-5015-01
Voice 1 (8M)	965-0363-75	1.00	\$35E6	U17	960-5016-00
Voice 2 (8M)	965-0364-75	1.00	\$B35A	U21	960-5016-00
Voice 3 (8M)	965-0365-75	1.00	\$8A9F	U36	960-5016-00
Playboy (Notes 4, 5, 7)					
Game ROM (1M)	965-0367-76	A5.00	\$7DFF	U210	960-5009-00
Sound (512K)	965-0368-76	1.02	\$E7C2	U7	960-7001-02
Display (4M)	965-0369-76	A5.00	\$A5FF	ROM 0	960-5015-01
Voice 1 (8M)	965-0370-76	1.00	\$9ABE	U17	960-5016-00
Voice 2 (8M)	965-0371-76	1.00	\$9F34	U21	960-5016-00
Voice 3 (8M)	965-0372-76	1.00	\$374B	U36	960-5016-00
Voice 4 (8M)	965-0373-76	1.00	\$237A	U37	960-5016-00
RollerCoaster Tycoon™ (Notes 4, 5, 7)					
Sound (512K)	965-0374-78	1.00	\$F663	U7	960-7001-02
Game ROM (1M)	965-0375-78	A7.02	\$E5FF	U210	960-5009-00
Voice 1 (8M)	965-0377-78	1.00	\$3C4A	U17	960-5016-00
Voice 2 (8M)	965-0378-78	1.00	\$057A	U21	960-5016-00
Voice 3 (8M)	965-0379-78				



APPENDIX A

Pinball Game Firmware (White Star Board System* & S.A.M. System** Only) Table



See website for the latest International Code or Updated USA version / checksums

ROM	Chip Size	Program Part N°	USA Ver. & Check Sum	Bd. Loc.	Raw Part N°
Ripley's Believe It or Not!® (Notes 7, 8)					
Sound	(512K)	965-0408-81	1.00 \$D93D	U7	960-7001-02
Game ROM	(1M)	965-0409-81	A3.20 \$43FF	U210	960-5009-00
Voice 1	(8M)	965-0410-81	1.00	\$067B U17	960-5016-00
Voice 2	(8M)	965-0411-81	1.00	\$C8B8 U21	960-5016-00
Voice 3	(8M)	965-0412-81	1.00	\$64C2 U36	960-5016-00
Voice 4	(8M)	965-0413-81	1.00	\$5341 U37	960-5016-00
Display	(4M)	965-0414-81	A3.00 \$DE4B	U5 DC PCB	960-5015-01

Elvis® (Notes 7, 8)					
Sound	(512K)	965-0415-84	1.00 \$8CD2	U7	960-7001-02
Game ROM	(1M)	965-0416-84	A5.00 \$50FF	U210	960-5009-00
Voice 1	(8M)	965-0417-84	1.00	\$538D U17	960-5016-00
Voice 2	(8M)	965-0418-84	1.00	\$8BCD U21	960-5016-00
Voice 3	(8M)	965-0419-84	1.00	\$60F8 U36	960-5016-00
Voice 4	(8M)	965-0420-84	1.00	\$14D8 U37	960-5016-00
Display	(4M)	965-0421-84	A5.00 \$A1F6	U5 DC PCB	960-5015-01

The SopranosSM (Notes 7, 8)					
Sound	(512K)	965-0422-85	4.00 \$9B5A	U7	960-7001-02
Game ROM	(1M)	965-0423-85	A5.00 \$5BFF	U210	960-5009-00
Voice 1	(8M)	965-0424-85	3.00	\$F01E U17	960-5016-00
Voice 2	(8M)	965-0425-85	1.04	\$C14C U21	960-5016-00
Voice 3	(8M)	965-0426-85	1.04	\$47A3 U36	960-5016-00
Voice 4	(8M)	965-0427-85	1.04	\$ADC D U37	960-5016-00
Display	(4M)	965-0428-85	A5.00 \$B4BB	U5 DC PCB	960-5015-01

NASCAR® (Notes 7, 8)					
Sound	(512K)	965-0429-86	2.00 \$32B3	U7	960-7001-02
Game ROM	(1M)	965-0430-86	A4.50 \$39FF	U210	960-5009-00
Voice 1	(8M)	965-0431-86	2.00	\$CFFB U17	960-5016-00
Voice 2	(8M)	965-0432-86	2.00	\$22C0 U21	960-5016-00
Voice 3	(8M)	965-0433-86	2.00	\$5FC8 U36	960-5016-00
Voice 4	(8M)	965-0434-86	2.00	\$2902 U37	960-5016-00
Display	(4M)	965-0435-86	A4.00 \$92BD	U5 DC PCB	960-5015-01

Grand Prix (Notes 7, 8)					
Sound	(512K)	965-0429-91	V1.00 \$6F89	U7	960-7001-02
Game ROM	(1M)	965-0430-91	A4.50 \$5EFF	U210	960-5009-00
Voice 1	(8M)	965-0431-91	1.00	\$C0E U17	960-5016-00
Voice 2	(8M)	965-0432-91	1.00	\$F40E U21	960-5016-00
Voice 3	(8M)	965-0433-91	1.00	\$057D U36	960-5016-00
Voice 4	(8M)	965-0434-91	1.00	\$2646 U37	960-5016-00
Display	(4M)	965-0435-91	A4.00 \$DA8E	U5 DC PCB	960-5015-01

[NDSE] (Notes 7, 8) <i>Call for more info if code update required.</i>					
Sound	(512K)	965-0436-97		U7	960-7001-02
Game ROM	(1M)	965-0437-97		U210	960-5009-00
Voice 1	(8M)	965-0438-97		U17	960-5016-00
Voice 2	(8M)	965-0439-97		U21	960-5016-00
Voice 3	(8M)	965-0440-97		U36	960-5016-00
Voice 4	(8M)	965-0441-97		U37	960-5016-00
Display	(4M)	965-0442-97		U5 DC PCB	960-5015-01

**** GAMES BELOW THIS LINE / NEXT COLUMN ARE S.A.M. SYSTEM GAMES**

TO ORDER MEMORY STICK WITH GAME FILES FROM YOUR DISTRIBUTOR, USE SPI PART NUMBER 970-0128-00 & INCLUDE THE GAME NAME / LANGUAGE FILE(S) DESIRED.

World Poker Tour™ Pinball (WPT) (Notes 7, 9)					
Boot B-02	(8M)	965-BOOT-SAM	1.04 \$7E62	U9	960-5016-00 unprogrammed
Memory Stick 128MB (970-0128-00)		Version		System	Bin Files:
English + Spanish		1.12AL		1.17+	WPT0112AL.bin
English Only		1.12A		1.17+	WPT0112A.bin
English + French		1.12AF		1.17+	WPT0112AF.bin
French Only		1.12F		1.17+	WPT0112F.bin
German + French		1.12GF		1.17+	WPT0112GF.bin
German Only		1.12G		1.17+	WPT0112G.bin
English + Italian		1.12AI		1.17+	WPT0112AI.bin
Italian Only		1.12I		1.17+	WPT0112I.bin

NOTE: THE TYPICAL SIZE PER UNZIPPED BIN FILE IS 25MB – 30MB+/-

The Simpsons™ Kooky Carnival Redemption (Note 9)					
Boot B-02	(8M)	965-BOOT-SAM	1.04 \$7E62	U9	960-5016-00 unprogrammed
Memory Stick 128MB (970-0128-00)		Version		Bin Files:	
English Only		1.05		SKC0105.bin	
English New Jersey Only		0.09NJ		SKC0090NJ.bin	

NOTE: THE TYPICAL SIZE PER UNZIPPED BIN FILE IS 5.5MB +/-

©Disney's Pirates of the Caribbean Pinball (POTC) (Notes 7, 9)					
Boot B-02	(8M)	965-BOOT-SAM	1.06 \$2014	U9	960-5016-00 unprogrammed
Memory Stick 128MB (970-0128-00)		Version		System	Bin Files:
English + Spanish		1.15AS		1.17+	POTC115AS.bin
English + French		1.15AF		1.17+	POTC115AF.bin
German + French		1.15GF		1.17+	POTC115GF.bin
English + Italian		1.15AI		1.17+	POTC115AI.bin

NOTE: THE TYPICAL SIZE PER UNZIPPED BIN FILE IS 25MB – 30MB+/-

Family Guy™ Pinball (FG) (Notes 7, 9)					
Boot B-02	(8M)	965-BOOT-SAM	2.09 \$10A3	U9	960-5016-00 unprogrammed
Memory Stick 128MB (970-0128-00)		Version		System	Bin Files:
English + Spanish		10.00AL		1.23+	FG1000AL.bin
English + French		10.00AF		1.23+	FG1000AF.bin
English + German		10.00AG		1.23+	FG1000GF.bin
English + Italian		10.00AI		1.23+	FG1000AI.bin

NOTE: THE TYPICAL SIZE PER UNZIPPED BIN FILE IS 25MB – 30MB+/-

Spider-Man™ Pinball (S-M) (Notes 7, 9)					
Boot B-02	(8M)	965-BOOT-SAM	2.10 \$F625	U9	960-5016-00 unprogrammed
Memory Stick 128MB (970-0128-00)		Version		System	Bin Files:
English + Spanish		1.3ES		1.27+	spd_1_30_es.bin
English + French		1.3EF		1.27+	spd_1_30_ef.bin
German + French		1.3GF		1.27+	spd_1_30_gf.bin
English + Italian		1.3EI		1.27+	spd_1_30_ei.bin

NOTE: THE TYPICAL SIZE PER UNZIPPED BIN FILE IS 25MB – 30MB+/-

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)



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				-OR-		
Sound 2	(512K)	965-0010-00		4F	960-7001-02	Display	(4M)	965-0087-04	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)		
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)	965-0018-00		6F	960-7001-02	Voice 1	(2M)	965-0140-00		U21	960-5010-00
Voice 2	(512K)	965-0019-00		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
									(Used on Display PCB 520-5055-01)		
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	(1M)	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	A3.00	ROM 0	960-5015-00
Display	(1M)	965-0071-00	A1.06	U8	960-5009-00	Display*	(4M)	965-0207-00	A3.00	ROM 3	960-5015-00

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

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



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

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

- Installed **W6** so 8MB ROMS can be utilized. See the **CPU/Sound Board Schematic** (Sheet 2 of 3, Address Location 3E) in the games' Service Game Manual. Games 52 - 57 CPU/Sound Board differ than <51 (See Appendix D).

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

Game Name White Star Board System™	Production Start Date and Manual Part Nr.	CPU/Sound Board Sound U7 512K CPU/Sound Board Game U210 1MB CPU/Sound Board Voice ROMS:				
		U17	U21	U36	U37	
54	Elvis®	AUG 04 780-5084-00	8MB	8MB	8MB	8MB
55	The Sopranos™	FEB 05 780-5085-00	8MB	8MB	8MB	8MB
56	NASCAR®	JUL 05 780-5086-00	8MB	8MB	8MB	8MB
57	Grand Prix	SEP 05 780-5091-00	8MB	8MB	8MB	8MB

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

Game Name S.A.M. System	Production Start Date and Manual Part Nr.	S.A.M. System CPU/Sound Board Boot EPROM U9			
		965-BOOT-SAM (Programmed)			
58	World Poker Tour™ (WPT)	JUN 06 780-5088-00	8MB	B-02 V2.1+ chksum \$F625	LOC: U9
59	The Simpsons™ Kooky Carnival	APR 06 780-5090-00	8MB	B-02 V2.1+ chksum \$F625	LOC: U9
60	©Disney's Pirates of the Caribbean	AUG 06 780-5092-00	8MB	B-02 V2.1+ chksum \$F625	LOC: U9
61	Famil Guy™	DEC 06 780-5093-00	8MB	B-02 V2.1+ chksum \$F625	LOC: U9
62	Spider-Man™	MAY 07 780-5094-00	8MB	B-02 V2.1+ chksum \$F625	LOC: U9

Games 58 – current, S.A.M. System : CPU/Sound & I/O Power Driver PCBs differ than White Star (previous Games 29 – 57); Disp. Controller Not Required.





APPENDIX D

Board Type (White Star Board System* Only) Table



Game Name	Flipper	I/O Power Driver	CPU/Sound Stereo	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Application
Apollo 13	520-5080-00 2-Flipper	520-5137-00	520-5136-00	520-5138-00	520-5052-00 128 X 32 Dots	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 Dots	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker
	Miscellaneous PC Boards:	Light Boards 520-5128-05 through -08		Mag. Processor X2 Driver Bd. 520-5143-00	Relay Board 520-5010-00				
GAMES HEREON NO LONGER REQUIRE THE FLIPPER BOARD WITH THE WHITE STAR BOARD SYSTEM™									
Game Name	I/O Power Driver	CPU/Sound Mono	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Application	Misc OPTO & App.
Twister	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32 Dots	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 Dots	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Light Boards 520-5149-01 through -10		Servo Mtr. Bd. 520-5152-00		520-5082-00 Long Hop OPTO	520-5083-00 Long Hop OPTO	Alien Head Enter	
Space Jam	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32 Dots	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 Dots	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 Dots	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 Dots	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 Dots	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 Dots	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 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00							
Godzilla	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Shaker Mtr. Bd. 520-5065-00							
South Park	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:					520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Kenny Under Trough Enter	
Harley-Davidson® 1st-3rd* Editions	520-5137-01	520-5136-16 *520-5300-00*	520-5138-00	520-5052-00 128 X 32 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00		Shaker Mtr. Bd. 520-5065-00	Diode Board 520-5146-00	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Motorcycle Enter	
Striker Xtreme (NFL)	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5155-00 3-Pos. Motor Sensor on Goalie Motor
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Relay Board 520-5010-00	Diode Board 520-5146-00	for UK ONLY- Solenoid Expander Bd. 520-5192-00	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Goalie Under- Trough Enter	
Sharkey's Shootout	520-5137-64	520-5136-64	520-5138-00	520-5052-00 128 X 32 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5194-00 4-Pos. Motor Sensor on ? -Ball Motor
	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 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5194-00 4-Pos. Motor Sensor on Roulette Wheel Motor
	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 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5212-00 Pulse-Stretcher OPTO on Spini-Me
	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 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Mini-Dot Display (3 by 5X7) 520-5197-00 (Electric C- Sign)		for UK ONLY- Solenoid Expander Bd. 520-5192-00	520-5218-00 4-Pos. OPTO	520-5210-00 4-Pos. OPTO	Bank Door	

Table continued on the next page.





APPENDIX D

Board Type (White Star Board System* & S.A.M. System** Only) Table



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

Game Name	I/O Power Driver**	CPU / Sound**	Disp. Power Supply	Dot Matrix Display	Dual OPTO Transmitter	Dual OPTO Receiver	Dual OPTO Transceiver	OPTO Transceiver Miscellaneous
World Poker Tour™ (WPT)	520-5249-00 Backbox	520-5246-00 Backbox	520-5138-00 Backbox	520-5052-00 128 X 32 Dots	515-0173-00 4-Ball Trough	515-0174-00 4-Ball Trough	500-6775-00 4 Switch Pairs (Qty. 8)	520-5251-00 'U' 1/per PCB Jail Bars Up Ace/Hole Mech 520-5252-04 'U' 4/per PCB Drop Targets 4- & 8- Banks
	Miscellaneous PCBs:	520-5254-00 50V Step-Up Drv	520-5250-14 14LED 5X7 Disp.	520-5239-01 OPTO Amplifier	520-5247-00 Ace/Hole Mech	520-5248-00 Ace/Hole Mech		
The Simpsons™ Kooky Carnival	520-5249-00 Back Door	520-5246-00 Back Door	520-5138-00 Cabinet Rear	520-5052-00 128 X 32 Dots			520-5253-00-ASY Coin Drop (Qty. 11)	
	Miscellaneous PCBs:	515-5742-00 Shaker PCB	500-6700-00 Relay (incl. Wiring + Conn.)					
©Disney's Pirates of the Caribbean	520-5249-00 Backbox	520-5246-00 Backbox	520-5138-00 Backbox	520-5052-00 128 X 32 Dots	515-0173-00 4-Ball Trough	515-0174-00 4-Ball Trough	500-6775-00 5 Switch Pairs (Qty. 10)	
	Miscellaneous PCBs:	520-5239-01 OPTO Amp. (X3)	511-5024-03 Relay (incl. Wiring + Conn.)	520-5238-00 : H-E-A-R-T LED PCB				
Family Guy™	520-5249-00 Backbox	520-5246-00 Backbox	520-5138-00 Backbox	520-5052-00 128 X 32 Dots	515-0173-00 4-Ball Trough	515-0174-00 4-Ball Trough	500-6775-00 3 Switch Pairs (Qty. 6)	520-5252-01 'U' 1/per PCB Drop Target 1-Bank
	Miscellaneous PCBs:	520-5239-01 OPTO Amp. (X2)	520-5261-00 Stepper Motor	511-5042-01 Trgt. Sensor (X2)			500-6775-01 1 Switch Pair (Qty. 2)	520-5252-04 'U' 4/per PCB Drop Target 4-Bank
Spider-Man™	520-5249-00 Backbox	520-5246-00 Backbox	520-5138-00 Backbox	520-5052-00 128 X 32 Dots	515-0173-00 4-Ball Trough	515-0174-00 4-Ball Trough	500-6775-00 3 Switch Pairs (Qty. 6)	
	Miscellaneous PCBs:	520-5239-01 OPTO Amp. (X2)						



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>			
		520-5002-03		

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		520-5050-02	520-5047-01									
• Star Wars • Rocky & Bullwinkle & Friends			520-5052-00 128 X 32									
• Jurassic Park	520-5076-00 3-Flipper	520-5047-02		520-5055-01								
• Last Action Hero	520-5070-00 2-Flipper		520-5050-03									
• Tales from the Crypt • The Who's Tommy	520-5076-00 3-Flipper		520-5077-00									
• 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								520-5077-00	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker
• Baywatch	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
• Batman Forever	520-5076-00 3-Flipper											

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





APPENDIX E

Flipper Coil (White Star Board System* & S.A.M. System** Only) Table



Typical Coil Diode 1N4004 unless noted otherwise (Diode Top = above lugs next to windings; Diode Below (Bottom) = under lugs opposite of windings).

STANDARD COILS (TYPICAL APPLICATIONS)			LARGE COILS (FLIPPERS & SPECIAL APPLICATIONS)		
Ga.-Turn	Res (Ω)	SPI Part Number and Comments	Ga.-Turn	Res (Ω)	SPI Part Number and Comments
20-400	1.0 Ω	090-5021-use: -00 Diode Top	21-900	call Ω	090-5020-use: -01 3-Lugs + 1N4004 & 1N5404 Diodes -10 Diode Top <BROWN><RED>
22-500	1.7 Ω	090-5017-use: -00 Diode Top	22-750 / 30-2600	2.6 Ω 92.0 Ω	090-5011-use: -00 DUAL WND COIL // 3-Lugs Diode x2
22-600	2.2 Ω	090-5017-use: -0B Diode Below // -0T Diode Top			
23-700	3.1 Ω	090-5022-use: -0B Diode Below // -0T Diode Top	22-900	3.45 Ω	090-5020-use: -20T Diode Top <YELLOW> // -20-ND No Diode
23-750	3.4 Ω	090-5019-use: -00 Diode Top			
23-800	3.6 Ω	090-5001-use: -0B Diode Below // -0T Diode Top // -NL No Lugs 11" Leads // -ND No Diode	22-1080	4.2 Ω	090-5032-use: -0B D. Below // -0T D. Top <YEL-GRN> -NL No Diode
23-840	4.0 Ω	090-5005-use: -00 Diode Top			
23.5-765	3.6 Ω	090-5037-use: -03 Diode Top	23-620 / 30-2600	2.4 Ω 75.0 Ω	090-5006-use: -00 DUAL WND COIL // 3-Lugs Diode x2
24-900	5.0 Ω	090-5002-use: -02 Diode Top // -10 No Lugs 14" Leads			
24-940	5.5 Ω	090-5036-use: -0B Diode Below // -0T Diode Top use 090-5051-01 No Lugs 11" Leads	23-700 / 30-2600	3.0 Ω 83.5 Ω	090-5013-use: -00 DUAL WOUND COIL // Diode Top
25-1240	9.3 Ω	090-5034-use: -00 Diode Below			
26-1200	10.3 Ω	090-5044-use: -0B Diode Below // -0T Diode Top // -NL No Lugs 11" Leads // -ND No Diode	23-800 / 30-2600	2.4 Ω 90.5 Ω	090-5012-use: -00 DUAL WOUND COIL // Diode Top
27-1300	14.2 Ω	090-5003-use: -0T Diode Top			
27-1400	14.7 Ω	090-5015-use: -00 Diode Below	23-1100	5.1 Ω	090-5030-use: -0T Diode Top <ORANGE> -ND No Diode
27-1400	14.7 Ω	511-5031-00 Special App.: No Diode / Lugs + Conn.			
27-1500	16.3 Ω	090-5004-use: -0B Diode Below // -0T Diode Top	23-1200	7.1 Ω	090-5008-use: -00 Diode Top <BLACK>
29-2000	33.6 Ω	090-5016-use: -00 Diode Top			
LARGE, MEDIUM & MINI COILS (MAGNET APPLICATIONS)			23-1500	4.4 Ω	090-5062-use: -00 Diode Top <BLUE>
20.5-480	2.9 Ω	090-5064-use: -02 No Lugs or Core; 14" Leads // Large			
22-650	4.3 Ω	090-5042-use: -00 No Lugs or Core; 6" Leads // Large -01 No Lugs or Core; 12" Leads // Large	24-1570	9.5 Ω	090-5025-use: -00 Diode Top <BLUE>
24-780	8.0 Ω	090-5061-use: -00 No Lugs or Core; 6" Lds. // Medium			
29-1000	15.2 Ω	090-5059-use: -00 Lugs + Diode + Magnet Core // Mini	25-1400	call Ω	090-5067-use: -0T Diode Top <RED>
31-1500	52.0 Ω	090-5054-00: Straight Lugs + Diode + Mag Core // Mini 090-5055-00: 90° Lugs + Diode + Magnet Core // Mini			
MINI COILS (RESET / TRIP APPLICATIONS)			25-1600	call Ω	090-5068-use: -0T Diode Top <WHITE>
27-950	call Ω	090-5046-use: -01 Diode Top			
28-1050	11.5 Ω	090-5046-use: -00 Diode Top	27-880	call Ω	500-6976-01 No Lugs or Diode + 6" Leads & Conn.
27-880	call Ω	500-6976-01 No Lugs or Diode + 6" Leads & Conn.			
31-590	call Ω	090-5010-use: -00 Diode Top	32-1250	35.0 Ω	515-6916-01: includes Flap & Screw <YELLOW>
32-1250	35.0 Ω	515-6916-01: includes Flap & Screw <YELLOW>			
32-1800	50.2 Ω	090-5031-use: -0B Diode Below // -0T Diode Top (515-6110-00) use 515-# to include mounting & armature brackets	33-1590	59.0 Ω	515-6916-00: includes brackets <WHITE>
33-1590	59.0 Ω	515-6916-00: includes brackets <WHITE>			

Please Note: Ohm values may vary +/- .03 depending on meter calibration.
 Ordering Note: Coils typically should not come with Coil Sleeves. IF A SLEEVE EXISTS, ensure it is the correct sleeve for the application usage. For the correct Coil Sleeve, refer to the Game Assembly Drawing the coil exists on and order separately.



Flipper Coil (White Star Board System* Only) Table

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

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

Table continued on the next page.





APPENDIX E

Flipper Coil (White Star Board System* & S.A.M. System** Only) Table



GAME NAME	N ^o of Flippers	FLIPPERS w/E.O.S. Switch		FLIPPERS no E.O.S. Switch	
		SPI N ^o / GAUGE-TURNS / Color		SPI N ^o / GAUGE-TURNS / Color	
		LOWER LEFT	LOWER RIGHT	UPPER LEFT	UPPER RIGHT
Harley-Davidson® † and 1st through 3rd Editions	2	090-5032-0T 22-1080 -YEL-GRN-	090-5030-0T 23-1100 -ORANGE-	Not Used	Not Used
Striker Xtreme (NFL) †	3	090-5032-0T 22-1080 -YEL-GRN-	090-5030-0T 23-1100 -ORANGE-	090-5030-0T 23-1100 -ORANGE-	Not Used
Sharkey's Shootout †	3	090-5030-0T 23-1100 -ORANGE-	SAME	090-5030-0T 23-1100 -ORANGE-	Not Used
High Roller Casino †	2	090-5032-20T 22-900 -YELLOW-	090-5032-0T 22-1080 -YEL-GRN-	Not Used	Not Used
Austin Powers™ †	2	090-5020-30 23-900 -GREEN-	090-5030-0T 23-1100 -ORANGE-	Not Used	Not Used
MONOPOLY® †	3	090-5032-0T 22-1080 -YEL-GRN-	SAME	Not Used	090-5062-0T 23-1500 -BLUE-
Playboy †	2	090-5030-0T 23-1100 -ORANGE-	SAME	Not Used	Not Used
RollerCoaster Tycoon™ †	4	090-5032-0T 22-1080 -YEL-GRN-	SAME	090-5067-0T 25-1400 -RED-	090-5068-0T 25-1600 -WHITE-
The Simpsons™ Pinball Party †	6** (5 with Flipper Bats)	090-5032-0T 22-1080 -YEL-GRN-	SAME	Not Used	090-5030-0T 23-1100 -ORANGE-
		** The Homer Head Assembly is affixed to an Upr. Rt. Style Flipper (no E.O.S. Switch):		Flippers (Mini-Bats) on 2nd Level Playfield:	
			** 090-5020-20T 22-900 -YELLOW-	090-5041-00T 25-1800 -BLU-GRN-	090-5025-00 24-1570 -BLUE-
Terminator® 3: Rise of the Machines™ †	2	090-5032-0T 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
The Lord of the Rings™ †	2	090-5020-20T 22-900 -YELLOW-	SAME	Not Used	Not Used
Ripley's Believe It or Not!® †	3	090-5032-0T 22-1080 -YEL-GRN-	SAME	Not Used	090-5067-00T 25-1400 -RED-
Elvis® †	4	090-5020-20T 22-900 -YELLOW-	SAME	090-5020-30 23-900 -GREEN-	SAME
The Sopranos™ †	2	090-5032-0T 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
NASCAR® and [NDSE] †	2	090-5030-0T 23-1100 -ORANGE-	SAME	Not Used	Not Used
Grand Prix †	2	090-5030-0T 23-1100 -ORANGE-	SAME	Not Used	Not Used
† Coil Part Numbers ending with a "T" signifies the Diode is on the top of the lug (on the coil-winding side); Coil Part Numbers ending with a "B" signifies the Diode is on the bottom of the lugs.					
** S.A.M. System Games DO NOT REQUIRE DIODES. If you use a coil from your stock which has a diode, remove it ONLY FOR S.A.M. System Games.					
World Poker Tour™ (WPT)**	4	090-5032-ND 22-1080 [NO DIODE]	SAME	090-5030-ND 23-1100 [NO DIODE]	SAME
©Disney's Pirates of the Caribbean**	2	090-5030-ND 23-1100 [NO DIODE]	SAME	Not Used	Not Used
Family Guy™ **	3 Norm.	090-5030-ND 23-1100 [NO DIODE]	SAME	090-5062-ND 23-1500 [NO DIODE]	Not Used
	2 Mini	090-5046-01-ND 27-950 [NO DIODE]	SAME		
Spider-Man™ **	3	090-5032-ND 22-1080 [NO DIODE]	SAME	Not Used	090-5032-ND 22-1080 [NO DIODE]



APPENDIX E

Generic Coil Cross-Reference Guide † ‡

Flipper Coil Table ‡ ††

GAME NAME	N ^o of Flippers	FLIPPERS w/E.O.S. Switch		FLIPPERS no E.O.S. Switch	
		SPI N ^o / GAUGE-TURNS / Color		SPI N ^o / GAUGE-TURNS / Color	
		LOWER LEFT	LOWER RIGHT	UPPER LEFT	UPPER 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-YEL-	SAME	Not Used	Not Used
ABC Monday Night Football ††	2	090-5020-02 22-900 -YEL-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 is 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-YEL-	SAME	Not Used	Not Used
Phantom of the Opera	2	090-5020-20 22-900 -YEL-YEL-	SAME	Not Used	Not Used
Back to the Future	2	090-5020-20 22-900 -YEL-YEL-	SAME	Not Used	Not Used
The Simpsons	2	090-5020-20 22-900 -YEL-YEL-	SAME	Not Used	Not Used
Checkpoint	2	090-5020-20 22-900 -YEL-YEL-	SAME	Not Used	Not Used
Teenage Mutant Ninja Turtles	2	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	Not Used
Batman	2	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	Not Used
Star Trek 25th Anniversary	2	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	Not Used
Hook	2	090-5030-00 23-1100 -ORG-ORG-	090-5020-30 23-900 -GRN-GRN-	Not Used	Not Used
Lethal Weapon 3	2	090-5030-00 23-1100 -ORG-ORG-	SAME	Not Used	Not Used
Star Wars	2	090-5032-00 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
Rocky & Bullwinkle & Friends	2	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	Not Used
Jurassic Park	3	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	090-5030-00 23-1100 -ORG-ORG-

Table continued on the next page.



APPENDIX E

Flipper Coil Table †

GAME NAME	N ^o of Flippers	FLIPPERS w/ E.O.S. Switch		FLIPPERS no E.O.S. Switch	
		SPI N ^o / GAUGE-TURNS / Color		SPI N ^o / GAUGE-TURNS / Color	
		LOWER LEFT	LOWER RIGHT	UPPER LEFT	UPPER RIGHT
Last Action Hero	2	090-5020-30 23-900 -GRN-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-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-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-ORG-	SAME	Not Used	090-5030-00 23-1100 -ORG-ORG-
Baywatch	4	090-5030-00 23-1100 -ORG-ORG-	090-5020-30 23-900 -GRN-GRN-	090-5025-00 24-1570 -See Note-	090-5030-00 23-1100 -ORG-ORG-
Batman Forever	3	090-5032-00 22-1080 -YEL-GRN-	090-5020-20 22-900 -YEL-YEL-	Not Used	090-5020-30 23-900 -GRN-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-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-GRN-
Space Jam †	2	090-5032-00T 22-1080 -YEL-GRN-	090-5020-20T 22-900 -YEL-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-ORG-	SAME	Not Used	090-5032-00T 22-1080 -YEL-GRN-
Viper Night Drivin' †	2	090-5030-00T 23-1100 -ORG-ORG-	SAME	Not Used	Not Used
Lost In Space †	2	090-5030-00T 23-1100 -ORG-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-ORG-	SAME	Not Used	Not Used
Harley-Davidson® † and Harley-Davidson® 2nd Ed. †	2	090-5032-00T 22-1080 -YEL-GRN-	090-5030-00T 23-1100 -ORG-ORG-	Not Used	Not Used
Striker Xtreme (NFL) †	3	090-5032-00T 22-1080 -YEL-GRN-	090-5030-00T 23-1100 -ORG-ORG-	090-5030-00T 23-1100 -ORG-ORG-	Not Used
Sharkey's Shootout †	3	090-5030-00T 23-1100 -ORG-ORG-	SAME	090-5030-00T 23-1100 -ORG-ORG-	Not Used
High Roller Casino †	2	090-5020-20T 22-900 -YEL-YEL-	090-5032-00T 23-1080 -YEL-GRN-	Not Used	Not Used
Austin Powers™ †	2	090-5020-30 23-900 -GRN-GRN-	090-5030-00T 23-1100 -ORG-ORG-	Not Used	Not Used
MONOPOLY® †	3	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	090-5062-00T 23-1500 -BLU-BLU-
Playboy †	2	090-5030-00T 23-1100 -ORG-ORG-	SAME	Not Used	Not Used
RollerCoaster Tycoon™ †	4	090-5032-00T 22-1080 -YEL-GRN-	SAME	090-5067-00T 25-1400 -RED-RED-	090-5068-00T 25-1600 -WHT-WHT
The Simpsons™ Pinball Party †	6* (5 with Flipper Bats)	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	090-5030-00T 23-1100 -ORG-ORG-
		* The Homer Head Assembly is affixed to an Up. Rt. Style Flipper (no E.O.S. Switch):		Flippers (Mini-Bats) on 2nd Level Playfield:	
			* 090-5020-20T 22-900 -YEL-YEL-	090-5041-00T 25-1800 -BLU-GRN-	090-5025-00T 24-1570 -See Note-
Terminator® 3: Rise of the Machines™ †	2	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
The Lord of the Rings™ †	2	090-5020-20T 22-900 -YEL-YEL-	SAME	Not Used	Not Used
Ripley's Believe It or Not!® †	3	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	090-5067-00T 25-1400 -RED-RED-

† 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 (White Star Board System* Only) Table



Game Name	Function	Specifications	Part Number
Apollo 13	Rocket Up/Down Movement	Bowman Motor 24VAC 60Hz 3W 6 RPM CCW	515-6383-00 <i>incl. Connector</i>
	Moon Unit Rotational Orbit	Multi Products Motor 24VAC 50/60Hz 3W 6 RPM CCW	515-6487-00 <i>incl. Connector</i>
	Shaker	Johnson Motor (Vibrator) 10.5VDC 10 AMP 2950 RPM CW	041-5029-00 MOTOR ONLY
Golden Eye	Satellite Left/Right Movement	Bowman Motor 24VAC 60Hz 3W 6 RPM CW	515-6528-00 <i>incl. Connector</i>
Twister	Spinning Disc with Magnet	Multi Products Motor 24VAC (041-5026-00) 50/60Hz 3W 325 RPM CCW	515-6347-00 <i>incl. Connector</i>
	Backbox Fan (Tornado Wind)	Multi Products Motor 24VAC (041-5052-00) 50/60Hz 3W 3600 RPM CW	515-6531-00 <i>incl. Connector</i>
ID4: Independence Day	Alien Head Open/Close Movement	Servo Motor (94322)	041-5045-00 MOTOR ONLY
<i>SPACE JAM (NO MOTOR USED)</i>			
The Star Wars Trilogy - S.E.	X-Wing Left/Right Movement	Bowman Motor 24VAC (041-5058-00) 60Hz 3W 10 RPM CCW	515-6383-01 <i>incl. Connector</i>
The Lost World: Jurassic Park	Snagger & Center Link Lift Up/Down Movement	Multi Products Motor 20VDC (041-5059-03) 9 RPM Non-Directional	515-6715-03 <i>incl. Connector</i>
	Shaker	Johnson Motor (Vibrator) 10.5VDC 10 AMP 2950 RPM CW	041-5029-00 MOTOR ONLY
The X-Files	X-File Cabinet Lift Up/Down Movement	Multi Products Motor 20VDC 9 RPM CCW	041-5057-00 MOTOR ONLY
Starship Troopers	Warrior Bug Forward/Reverse Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12VDC 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not included) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 <i>incl. Connector</i> Requires 7" Shaft: 530-5503-00
<i>VIPER NIGHT DRIVIN' (NO MOTOR USED)</i>			
Lost In Space	Spinning Disc with Magnet	Multi Products Motor 24VAC (041-5046-00) 50/60Hz 3W 325 RPM CCW	515-6347-00 <i>incl. Connector</i>
Godzilla	Shaker ‡	Multi #3811 0630 Motor (Vibrator) 12VDC 3100 RPM CW (w/DRL PTS) ‡	041-5029-01 MOTOR ONLY
<i>SOUTH PARK (NO MOTOR USED)</i>			
Harley-Davidson® 1st through 3rd Editions	Shaker ‡	Multi #3811 0630 Motor (Vibrator) 12VDC 3100 RPM CW (w/DRL PTS) ‡	041-5029-01 MOTOR ONLY
	Motorcycle Lift Up/Down Movement	Autotrol 24VAC (041-5072-02) 20 RPM CCW	515-7025-00 <i>incl. Connector</i>
Striker Xtreme (NFL)	Goalie (Linebacker) Left to Right Movement	Multi #3590 12VDC (041-5075-00) 60 RPM	515-7071-00 <i>incl. Connector</i>
Sharkey's Shootout	Mystery Ball Rotating Movement	Hankscraft Motor Model-E 24VAC (041-5076-00) 50/60Hz 3W 20 RPM CW	515-7095-00 <i>incl. Connector</i>
High Roller Casino	Roulette Wheel Rotating Movement	Multi Products Motor 20VDC (041-5078-00) 17 RPM CCW	515-7153-00 <i>incl. Connector</i>
	Up/Dn. Ramp in Slot Mach. Lift Up/Down Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12VDC 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not included) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 <i>incl. Connector</i> Requires Shaft ¾": 530-5503-01
Austin Powers™	Time Machine Rotating Movement	Multi Products Motor 24VAC (041-5079-00) 50/60Hz 20RPM CCW	515-7141-00 <i>incl. Connector</i>
	Laser Beam Left to Right Directional	Autotrol Motor 24VAC (041-5081-00) 50/60Hz 4W 10RPM Bi-Directional	515-7171-00 <i>incl. Connector</i>
	Dr. Evil Target Lift Up/Down Movement	Hankscraft Motor Model-E 24VAC (041-5030-00) 50/60Hz 6RPM CCW	515-5900-00 <i>incl. Connector</i>
Monopoly®	Mini-Flipper (Waterworks) Rotating Movement	Multi Prod. Motor & Gear Box #7000 EX00159A 20VDC 50/60Hz 85RPM CC/CCW	041-5083-00 MOTOR ONLY
Playboy	Triangular Billboard Rotating Movement	Autotrol Motor (BD511 150-1387) 24VAC 50/60Hz 12RPM Bi-Directional	041-5086-02 MOTOR ONLY
	Centerfold Mechanism Open/Close Movement	Multi Products (3680) Motor 12v DC 10/12 RPM CC/CCW	041-5075-04 MOTOR ONLY
	Tease Drop Screen Lift Up/Down Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12VDC 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not included) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 <i>incl. Connector</i> Requires 7" Shaft: 530-5503-00

‡ Please Note: "01" Shaker Motor is **Not Compatible** with old Shaker Motor 041-5029-00 (Shaker Motor Assy. 515-5893-00). THIS NEW MOTOR CAN ONLY BE USED IN NEW SHAKER MOTOR ASSY. 515-5893-01.

Table continued on the next page.





APPENDIX F

Motor Specification (White Star Board System* & S.A.M. System** Only) Table



Game Name	Function	Specifications	Part Number
ROLLERCOASTER TYCOON™ (NO MOTOR USED)			
THE SIMPSONS™ PINBALL PARTY (NO MOTOR USED)			
Terminator® 3: Rise of the Machines™	Backbox Ball Shooter Up/Down Movement	Multi Products Motor 24VAC (041-5079-01) 21 RPM CW	515-7317-00 <i>incl. Connector</i>
The Lord of the Rings™	Balrog (Motor & Gate) Open/Close Movement	Multi Prod. Motor 20VDC Series 600B (or equiv.) 50/60Hz 10 RPM Bi-Directional	041-5088-01 MOTOR ONLY
RIPLEY'S BELIEVE IT OR NOT!® (NO MOTOR USED)			
Elvis®	Elvis™ Front/Back Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12VDC 10W (041-5089-00), (Non-Captive Shaft not included) HSI #46868-12-002	500-6809-00 <i>incl. Connector</i> Requires 7.25" Shaft: 530-5658-00
	▶▶▶ OPTIONAL ◀◀◀ Shaker	Multi #3811 0630 Motor (Vibrator) 12VDC (041-5029-01) 3100 RPM (w/DRL PTS)	515-5893-01 <i>incl. Connector</i>
The Sopranos™	Bada Bing! Girls x2 Rotating Posts Movement	Autotrol Synchronous Motor 24VAC 4W 50/60Hz 45.7/54.9 RPM Bi-Directional	041-5092-00 <i>w/1" Shaft + 12" Leads</i>
NASCAR® and [NDSE]	Back Panel Rotating (Car) Windmill (Skill Ball Enter)	Multi Products Motor & Gear Box 20VDC Model #8000 (EX-04-073) 10 RPM	041-5093-00 MOTOR ONLY
Grand Prix	Back Panel Rotating (Car) Windmill (Skill Ball Enter)	Multi Products Motor & Gear Box 20VDC Model #8000 (EX-04-073) 10 RPM	041-5093-00 MOTOR ONLY
World Poker Tour™ (WPT) (NO MOTOR USED)			
The Simpsons™ Kooky Carnival	Bart on Skateboard Left/Right Movement	Multi Products Motor with Crank 24VAC (041-5095-01) 50/60Hz 3W 14 RPM	500-6947-01 <i>incl. Connector</i>
	Left & Right Ramps Up/Down Movement	Multi Products Motor 24VAC (041-5048-01) 50/60Hz 3W 15 RPM CCW (Qty. 2 in game)	515-7558-00 <i>incl. Connector</i>
	Shaker <i>(details in SKC Manual, Page 24)</i>	Multi #3811 0630 Motor (Vibrator) 12VDC 3100 RPM (w/DRL PTS)	041-5029-01 MOTOR ONLY
©Disney's Pirates of the Caribbean	Spinning Disk	Multi #3811R 0630 Motor (Vibrator) 12VDC (041-5029-04) 3100 RPM (w/DRL PTS) -04 is RoHS compliant; can substitute with -01 domestic	511-5024-04 <i>incl. Connector</i>
	Pirate Ship Sinking/Raising Movement	Multi Products Motor & Gear Box 24VDC Model #7000-DCM 12 RPM	041-5101-00 MOTOR ONLY
Family Guy™	Stewie Figurine Left & Right Movement	Stepper Motor NPM PF35T-48D4STD 5V RVB (041-5102-00 Reference Only)	511-5043-00 <i>incl. Connector</i>
Spider-Man™	Doc Ock, Sandman & 3-Bank Up/Down Movement	Sync. Motor 24VAC 50/60Hz 3W 12 RPM CW (041-5103-00 Reference Only)	511-5063-00 <i>incl. Connector</i>
	▶▶▶ OPTIONAL ◀◀◀ Shaker Motor Kit 502-5027-00	Multi #3811R 0630 Motor (Vibrator) 12VDC (041-5029-04) 3100 RPM (w/DRL PTS) -04 is RoHS compliant; can substitute with -01 domestic	515-5893-01 <i>incl. Connector</i>



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

APPENDIX G

Part Number Prefix Classification Codes

I. Electrical Source, Energy & Signal Converters

- 010- Transformers
- 031- Speakers
- 090- Solenoids (Coils)
- 150- Filters, Outlets, Varistors, Thermistors
- 200- Fuses

II. Conductors, Connectors & Insulators

- 034- Line Cords
- 036- Cable Assemblies & Wiring Harnesses
- 041- Motors
- 045- Connectors (All Types)
- 055- Lugs (M/F), Pins (M/F), Discs, Ring Terminals, Terminal Strips, etc.
- 060- Polarizing Keys and Conn. Covers
- 077- Lamp Sockets

III. Circuits & Circuit Elements

- 100- ICs
- 110- Transistors
- 112- Diodes (All Types including LEDs & Modules)
- 121- Resistors
- 123- Resistors (Variable & Adjustable)
- 124- Regulators & Bridge Rectifiers
- 125- Capacitors (Radial Lytics & Ferrites)
- 126- Piezo Crystal
- 127- Heatsinks
- 130- Capacitors (Tectates & Ceramics)
- 140- Oscillators (Clocks/Crystals)
- 165- Light Bulbs
- 180- Switches
- 181- Switch Membranes (Pads) & Piezo Sensors
- 190- Relays
- 960- EPROM (*Raw Part*)
- 965- EPROM (*Programmed Part*)

IV. Bolts, Screws, Nuts, Washers & Nails

- 231- Bolts
- 232- Screws (Pan Head)
- 234- Screws (HWH)
- 237- Screws (Misc.)
- 240- Nuts (Misc.)
- 242- Washers (Flat, Round)
- 244- Washers (Split Lock)
- 245- Nyloners
- 246- Washers (Lockers, External Tooth)
- 281- Nails

V. Mechanical Components

- 249- Rivets
- 251- Pins (Dowel), Finishing Nails, Hairpins, Spring Pins and Clevis Pins
- 254- Stand-Offs, Spacers and Shims
- 260- Steel Ball (All Types Steel, Glowing, Delrin, etc.)
- 265- Springs (Extension)
- 266- Springs (Compression)
- 267- Springs (Torsion)
- 269- Springs (Washers - Belleville, Wave)
- 270- Retaining Rings
- 280- Grommets, Bushings and Nyloners
- 283- Bearings

VI. Handles, Locks, Catches, Latches, Keys

- 355- Handles, Locks, Catches, Latches and Keys

VII. Fabricated Parts

- 390- Hinges
- 501- Coin Doors
- 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 and Rubber Parts (Rings, Sleeves, etc.)
- 550- Molded (Inserts)

VIII. In-House Assemblies

- 500- End Product (Systems and Models)
- 502- Kits (Created In-House)
- 505- Cabinets (complete)
- 510- Riveted Sub-Assemblies (In-House)
- 511- Sub-Assemblies (In-House)
- 515- Sub-Assemblies*

*2 or more 515-'s but still a sub-assembly.

IX. Bulk Materials

- 600- Braided Wire & Ground Straps
- 601- Stranded Wire
- 602- Ribbon Cable
- 604- Telephone Line Cord
- 605- Sleeving (Shrink Tubing)
- 625- Velcro (non-adhesive)
- 626- Foam Rubber, Foam Pads, Rubber Bumpers (Blue Pads), Tape (All Types) Velcro (adhesive) and String / Rope








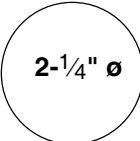
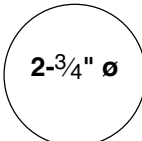
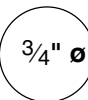
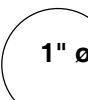
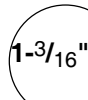
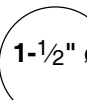
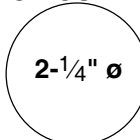
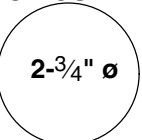

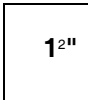
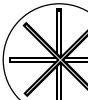
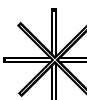
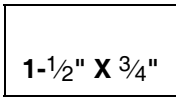
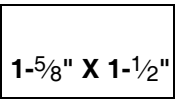
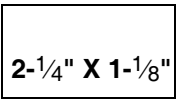
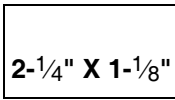
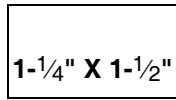
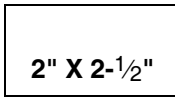



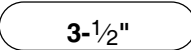
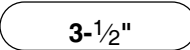

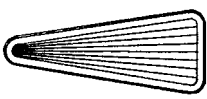
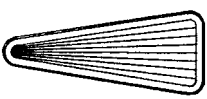
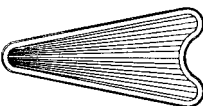
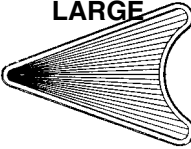

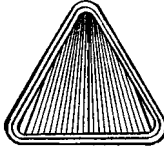
X. Miscellaneous

- 000- Tools (*see also 777-*) and Supplies
- 040- Clamps, Ties & Clips
- 042- Pulleys
- 091- Coin Mechs
- 205- Fuse Holders
- 631- Staples
- 660- Glass (Playfield, Backglass, etc.)
- 675- Cleaners
- 705- Packing & Shipping Items
- 755- Instruction, Coin Cards, Ins. Sheets
- 756- Information Sheets, Service Bulletins, Instruction Sheets in Kits and Templates
- 777- Tools (Wrenches and Drivers)
- 780- Manuals
- 802- Decal Kits (comprised of 820's)
- 820- Decals, Mylar and Labels (Sheets/Sets)
- 803- Plastic Kits (comprised of 830's)
- 830- Plastic Pieces (Butyrate Sheets/Sets)
- 880- Toys, Models, Figurines, etc.
- 900- Game Posters



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

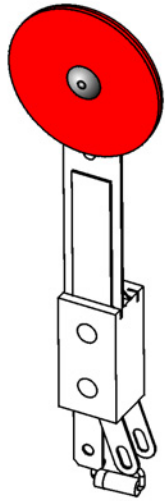
Note: The shapes and sizes shown above are not to scale. Some shapes may no longer be available in every color.

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

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

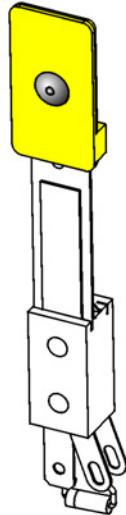
APPENDIX I

Stand-Up Targets

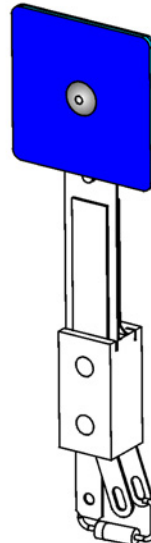


112-5003-00
Switch Diode, 1N4004
(all Stand-Up Targets)

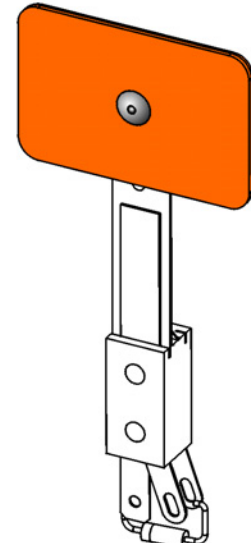
515-5966-XX
1" ROUND STAND-UP
SWITCH & TARGET
RIVETED ASSEMBLY*



515-5967-XX or 515-7581-XX
STANDARD ANTI-LOFT
1" X 1/2" NARROW STAND-UP
SWITCH & TARGET
RIVETED ASSEMBLY*



515-5162-XX
1" X 1" SQUARE STAND-UP
SWITCH & TARGET
RIVETED ASSEMBLY*



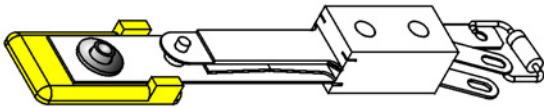
515-6027-XX
1" X 1-1/2" RECTANGLE STAND-UP
SWITCH & TARGET
RIVETED ASSEMBLY*

**Note: Does not include the Switch Back Plate, Mounting Bracket or screws.*

To include the Switch Back Plate, Foam Pad, and Switch Mounting Bracket assembled, use the follow assembly part numbers (replace the -XX with 2-digit number from chart):

500-5835-XX : 1" ROUND TARGET 500-5857-XX : 1" X 1/2" NARROW TARGET 500-5232-XX : 1" X 1" SQUARE TARGET 500-5321-XX : 1" X 1-1/2" RECT. TARGET

REAR VIEW 515-5967-06 SHOWN



SHOWN BELOW : 500-5857-06
1" X 1/2" NARROW STAND-UP
TARGET ASSEMBLY COMPLETE

-XX REPLACE WITH 2-DIGIT FOR 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

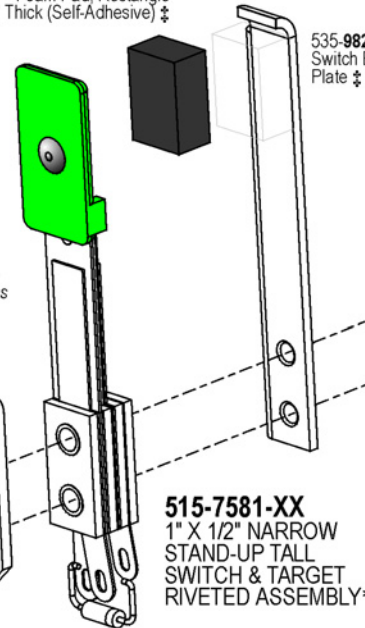
Note: Not all colors available.

SHOWN BELOW : 500-6985-04

1" X 1/2" NARROW ANTI-LOFT
STAND-UP TARGET
ASSEMBLY COMPLETE

626-5069-00
Foam Pad, Rectangle
.6" X .4" X .25" Thick (Self-Adhesive) ‡

535-9823-01
Switch Back
Plate ‡



515-7581-XX
1" X 1/2" NARROW
STAND-UP TALL
SWITCH & TARGET
RIVETED ASSEMBLY*

ORDERING NOTE: 515-7581-XX (500-6985-XX)

differences from 515-5967-XX (500-5857-XX) are:

1. Switch & Target Taller (Target sits higher over P/F)
2. Switch Back Plate differs (bend, shape & tab)
3. Foam Pad differs (thicker, taller, different type foam)

**Note: Does not include the Switch Back Plate, Mounting Bracket or screws.*

626-5029-00
Foam Pad, Square
.44" X .44" X .125" Thick (Self-Adhesive)**

** Note:
Use with all Switch
& Targets THIS page
except for 515-7581-XX

535-6896-00
Bracket, Switch
Mounting
(all targets THIS page)

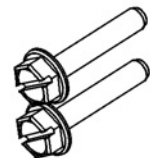
237-5976-05
#6-32 X 3/4" SHWH Sc.
(all targets THIS page)

515-5967-XX
1" X 1/2" NARROW
STAND-UP (STANDARD)
SWITCH & TARGET
RIVETED ASSEMBLY*

535-6896-00
Bracket, Switch
Mounting
(all targets THIS page)

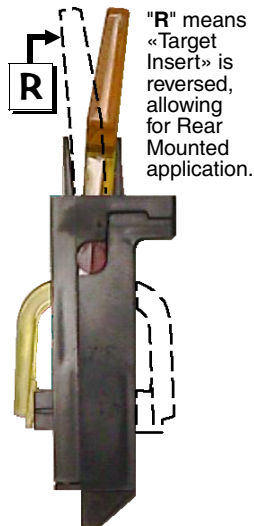
535-6452-00
Switch Back Plate**

237-5976-05
#6-32 X 3/4" SHWH Sc.
(all targets THIS page)



APPENDIX I

Modular Stand-Up Targets



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



Take Note:

- 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 number for the color desired as described in the Color Chart below. As of print date, the following colors were used :
 -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)
- For location(s) and type of Stand-Up Targets used, if any, see Section 4, Chapter 1, Parts Identification & Location.

-XX REPLACE WITH 2-DIGIT FOR COLOR:

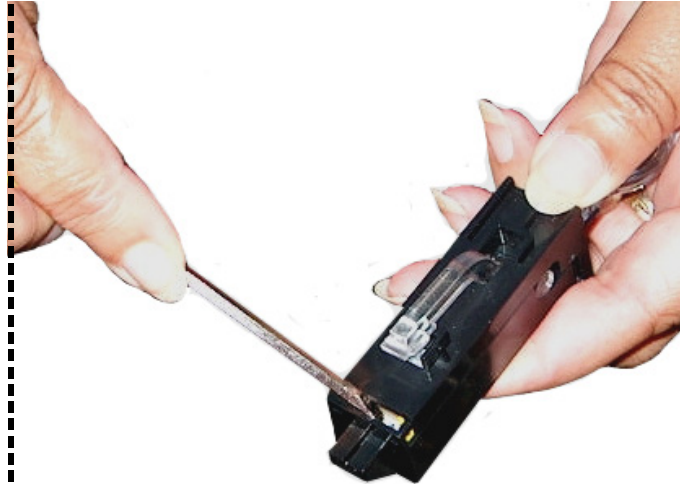
- 00 Black
- 01 Clear
- 02 Red
- 03 Amber
- 04 Green
- 05 Blue
- 06 Yellow
- 07 Orange
- 08 White
- 09 Purple
- 10 Fluor. Orange
- 11 Fluor. Green
- 12 Fluor. Blue
- 13 Teal Green
- 14 Gray
- 15 Luminescent
- 16 Gold

Note: Not all colors available.

Nr.	STAND-UP TARGET PARTS	SPI PART Nr.
A	Modular Stand-Up Target Narrow Assy.	500-6138-XX
	Stand-Up Target Narrow (Insert)	545-6138-XX
B	Modular Stand-Up Target Square Assy.	500-6139-XX
	Stand-Up Target Square (Insert)	545-6139-XX
C	Modular Stand-Up Target Rectangle Assy.	500-6228-XX
	Stand-Up Target Rectangle (Insert)	545-6228-XX
D	Modular Stand-Up Target Round Assy.	500-6075-XX
	Stand-Up Target Round (Insert)	545-6075-XX
E	Mod. Stand-Up Target 1" Spherical Assy.	500-6189-XX
	Stand-Up Target 1" Spherical (Insert)	545-6189-XX

To Replace the « Target Insert » or change Target Orientation :

Items A-E Note: For the Target Assembly use the "500-" SPI Part Number(s) shown in the Parts Table below. To receive the Target Assembly with the « Target Insert » « Reversed » simply add a "R" at the end of the Part Number. See Side View picture left to compare (dashed line shows target reversed). For just the «Target Insert» use the "545-" SPI Part Number.



To reverse it yourself or to just change the insert:

- With a small flat head screwdriver, push into the small tab at the bottom of the target front and give a slight twist motion to "pop" the two halves.

- Push the Target Insert bottom in at the same time while you slide the top (front) part up, then let go of the insert as the two halves come apart.



- Replace target or reinsert it into the other size while sliding the two halves back together.

Note: If you were reversing the orientation, don't forget to also turn the Switch Actuator PCB 180°. Test Switch.

APPENDIX J

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

If more than one Pricing Scheme is available for countries listed, the **F.** listed beside the option, denotes the Factory Default Setting.
FOR VIEWS OF THE LATEST or OPTIONAL USA, INTERNATIONAL / EURO AND CUSTOM COIN CARDS, VISIT OUR WEBSITE.
 Not Shown USA 755-5400-10 Tournament Option \$2 = X1; 755-5400-11 Tournament Option \$1.50 = X1

USA 10 F. 755-5400-11 Front		USA 10 755-5400-11 Back		USA 2-7 or CANADA 755-5400-02 Front		FOR CUSTOM PRICING † 755-5400-01, -02 or -04 Back		USA 3 with ToPS™ 755-5400-03 or -09 Front		USA 5 with ToPS™ 755-5400-03 Back / -08 Front	
AUSTRALIA 1 F. 755-5406-00 Front		AUSTRALIA 2 755-5406-00 Back		CROATIA 755-5410-00 Front		FOR CUSTOM PRICING † 755-5410-00 Back		DENMARK 1 F. 755-5402-00 Front		DENMARK 2 755-5402-00 Back	
JAPAN 1 755-5408-01 Front		JAPAN 2 F. 755-5408-01 Back		MIDDLE EAST 755-5400-06 Front		ANY COUNTRY CAN USE 755-5400-06 Back		NEW ZEALAND 1 F. 755-5406-00 Back		NEW ZEALAND 2 755-5406-00 Front	
NORWAY 1 F. 755-5403-01 Front		NORWAY 2 755-5403-01 Back		RUSSIA F. 755-5411-00 Front		RUSSIA (ALTERNATE) 755-5411-00 Back		SOUTH AFRICA 755-5409-01 Front		FOR CUSTOM PRICING † 755-5409-01 Back	
SWEDEN 1 F. 755-5404-00 Front		SWEDEN 2 755-5404-00 Back		SWITZERLAND 1 F. 755-5405-00 Front		SWITZERLAND 2 755-5405-00 Back		TAIWAN 755-5412-00 Front		FOR CUSTOM PRICING † 755-5412-00 Back	
UK 1 755-5407-00 Front		UK 3 755-5407-00 Back		UK 5 F. 755-5407-01 Front		FOR CUSTOM PRICING † 755-5407-01 Back		Appendix J Notes: 1. Coin Card on Game is determined by original shipping country destination. 2. Optional Coin Card(s), are available via your distributor or via free download @ www.sternpinball.com/coinagecards.shtml . Older style Coin Cards (foreign or domestic) not available on our website or no longer available through your distributor, are obsolete. 3. Coin Cards which have a Blank Backside can be used for †Custom Pricing.			

Not Shown EURO 755-5401-20 Tournament Custom (can fill in your own pricing).

EURO 1 755-5401-01 1-Side Only		EURO 2 755-5401-02 1-Side Only		EURO 3 755-5401-03 1-Side Only		EURO 4 755-5401-04 1-Side Only		EURO 5 755-5401-05 1-Side Only		EURO 6 755-5401-06 1-Side Only	
EURO 7 755-5401-07 1-Side Only		EURO 8 755-5401-08 1-Side Only		EURO 9 755-5401-09 1-Side Only		EURO 10 755-5401-10 1-Side Only		EURO 11 755-5401-11 1-Side Only		EURO 12 755-5401-12 1-Side Only	

▶ EURO FACTORY DEFAULT SUMMARY TABLE ◀

EURO 1	EURO 2	EURO 3	EURO 4	EURO 5	EURO 6	EURO 7	EURO 8	EURO 9	EURO 10	EURO 11	EURO 12
BELGIUM ITALY 1 PORTUGAL	GERMANY 2	NETHERLANDS SPAIN			GREECE		FINLAND	AUSTRIA	FRANCE		

Section 3, Chapter 4, GO TO ADJUSTMENTS MENU, Adj. 18, Game Pricing, USA & International (non-Euro) and Euro 1-12 Summary & International (Euro) Standard Pricing Select Tables, summarizes Standard or Custom Pricing Schemes & the Dip Switch Setting required.





APPENDIX A



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

See website for the latest International Code or Updated USA version / checksums

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	1.00	\$5244	U7	960-7001-02
Display (4M)	965-0213-00	A5.00	\$B92B	ROM 0	960-5015-01
Voice 1 (4M)	965-0209-00	1.00	\$7FC7	U17	n/a (masked)
Voice 2 (4M)	965-0210-00	1.00	\$8E55	U21	n/a (masked)
Voice 3 (4M)	965-0211-00	1.00	\$08EE	U36	n/a (masked)
Golden Eye (Note 1)					
Game ROM (1M)	965-0214-42	A4.04	\$3FFF	U210	960-5009-00
Sound (512K)	965-0217-42	1.00	\$D615	U7	960-7001-02
Display (4M)	965-0218-42	A4.00	\$E6ED	ROM 0	960-5015-01
Voice 1 (4M)	965-0215-42	1.00	\$3E32	U17	n/a (masked)
Voice 2 (4M)	965-0216-42	1.00	\$71F0	U21	n/a (masked)
Twister (Note 2)					
Game ROM (1M)	965-0219-41	A4.05	\$E9FF	U210	960-5009-00
Sound (512K)	965-0221-41	1.00	\$1FFF	U7	960-7001-02
Display (4M)	965-0222-41	A4.00	\$FD01	ROM 0	960-5015-01
Voice 1 (4M)	965-0220-41	1.00	\$3650	U17	960-5015-01
Voice 2 (4M)	965-0223-41	1.00	\$9300	U21	960-5015-01
ID4: Independence Day (Note 2)					
Game ROM (1M)	965-0224-45	A2.02	\$9CFF	U210	960-5009-00
Sound (512K)	965-0227-45	1.00	\$222B	U7	960-7001-02
Display (4M)	965-0228-45	A2.00	\$AB7	ROM 0	960-5015-01
Voice 1 (4M)	965-0225-45	1.00	\$3AF1	U17	960-5015-01
Voice 2 (4M)	965-0226-45	1.00	\$206E	U21	960-5015-01
Space Jam (Note 2)					
Game ROM (1M)	965-0229-43	A3.00	\$E6FF	U210	960-5009-00
Sound (512K)	965-0233-43	1.00	\$F1E7	U7	960-7001-02
Display (4M)	965-0234-43	A3.00	\$0057	ROM 0	960-5015-01
Voice 1 (4M)	965-0230-43	1.00	\$D8A8	U17	960-5015-01
Voice 2 (4M)	965-0231-43	1.00	\$DDF1	U21	960-5015-01
Voice 3 (4M)	965-0232-43	1.00	\$F32A	U36	960-5015-01
The Star Wars Trilogy - Special Edition (S.E.) (Note 2)					
Game ROM (1M)	965-0235-56	A4.03	\$5EFF	U210	960-5009-00
Sound (512K)	965-0238-56	1.00	\$4A7D	U7	960-7001-02
Display (4M)	965-0239-56	A4.00	\$8817	ROM 0	960-5015-01
Voice 1 (4M)	965-0236-56	1.00	\$E66B	U17	960-5015-01
Voice 2 (4M)	965-0237-56	1.00	\$8F54	U21	960-5015-01
The Lost World: Jurassic Park (Note 2)					
Game ROM (1M)	965-0240-53	A2.02	\$C8FF	U210	960-5009-00
Sound (512K)	965-0243-53	1.00	\$A35B	U7	960-7001-02
Display (4M)	965-0244-53	A2.01	\$7F46	ROM 0	960-5015-01
Voice 1 (4M)	965-0241-53	1.00	\$1D27	U17	960-5015-01
Voice 2 (4M)	965-0242-53	1.00	\$8DA4	U21	960-5015-01
The X-Files (Note 2)					
Game ROM (1M)	965-0245-46	A3.03	\$A2FF	U210	960-5009-00
Sound (512K)	965-0248-46	1.00	\$65A8	U7	960-7001-02
Display (4M)	965-0249-46	A3.00	\$66D0	ROM 0	960-5015-01
Voice 1 (4M)	965-0246-46	1.00	\$349D	U17	960-5015-01
Voice 2 (4M)	965-0247-46	1.00	\$629C	U21	960-5015-01
Starship Troopers (Note 3)					
Game ROM (1M)	965-0250-59	A2.00	\$85FF	U210	960-5009-00
Sound (512K)	965-0253-59	1.00	\$64B2	U7	960-7001-02
Display (4M)	965-0254-59	A2.00	\$E77B	ROM 0	960-5015-01
Voice 1 (4M)	965-0251-59	1.00	\$152A	U17	960-5015-01
Voice 2 (4M)	965-0252-59	1.00	\$0291	U21	960-5015-01
Voice 3 (4M)	965-0255-59	1.00	\$95A7	U36	960-5015-01
Viper Night Drivin' (Note 4)					
Game ROM (1M)	965-0266-35	A2.01	\$C5FF	U210	960-5009-00
Sound (512K)	965-0271-35	1.00	\$4DF8	U7	960-7001-02
Display (4M)	965-0272-35	A2.01	\$C17D	ROM 0	960-5015-01
Voice 1 (4M)	965-0267-35	1.00	\$9018	U17	960-5015-01
Voice 2 (4M)	965-0268-35	1.00	\$2157	U21	960-5015-01
Voice 3 (4M)	965-0269-35	1.00	\$B5A6	U36	960-5015-01
Voice 4 (4M)	965-0270-35	1.00	\$D01E	U37	960-5015-01
Lost In Space (Note 4)					
Game ROM (1M)	965-0282-60	A1.01	\$B2FF	U210	960-5009-00
Sound (512K)	965-0287-60	1.00	\$A6AF	U7	960-7001-02
Display (4M)	965-0288-60	A1.02	\$32AB	ROM 0	960-5015-01
Voice 1 (4M)	965-0283-60	1.00	\$4391	U17	960-5015-01
Voice 2 (4M)	965-0284-60	1.00	\$8215	U21	960-5015-01
Voice 3 (4M)	965-0285-60	1.00	\$5B32	U36	960-5015-01
Voice 4 (4M)	965-0286-60	1.00	\$8971	U37	960-5015-01
Godzilla (Note 4)					
Game ROM (1M)	965-0289-40	A2.05	\$B1FF	U210	960-5009-00
Sound (512K)	965-0294-40	1.00	\$0CC9	U7	960-7001-02
Display (4M)	965-0295-40	A2.00	\$C929	ROM 0	960-5015-01
Voice 1 (4M)	965-0290-40	1.00	\$0D75	U17	960-5015-01
Voice 2 (4M)	965-0291-40	1.00	\$CCCF	U21	960-5015-01
Voice 3 (4M)	965-0292-40	1.00	\$227F	U36	960-5015-01
Voice 4 (4M)	965-0293-40	1.00	\$DB69	U37	960-5015-01
South Park (Notes 4, 5)					
Game ROM (1M)	965-0301-71	A1.03	\$58FF	U210	960-5009-00
Sound (512K)	965-0306-71	1.00	\$1286	U7	960-7001-02
Display (4M)	965-0307-71	A1.01	\$166F	ROM 0	960-5015-01
Voice 1 (8M)	965-0302-71	1.00	\$7BF8	U17	960-5016-00
Voice 2 (8M)	965-0303-71	1.00	\$9CCC	U21	960-5016-00
Voice 3 (8M)	965-0304-71	1.00	\$ADD9	U36	960-5016-00
Voice 4 (8M)	965-0305-71	1.00	\$6659	U37	960-5016-00

ROM	Chip Size	Program Part N ^o	USA ver. & Check Sum	Bd. Loc.	Raw Part N ^o
Harley-Davidson® (Notes 4, 5, 6) Original (1999-2001)					
Game ROM (1M)	965-0319-67	A1.03	\$3EFF	U210	960-5009-00
Sound (512K)	965-0320-67	1.00	\$F4FF	U7	960-7001-02
Display (4M)	965-0321-67	A1.04	\$FC7C	ROM 0	960-5015-01
Voice 1 (8M)	965-0322-67	1.00	\$CD26	U17	960-5016-00
Voice 2 (8M)	965-0323-67	1.00	\$3936	U21	960-5016-00
Voice 3 (8M)	965-0324-67	1.00	\$FB72	U36	960-5016-00
Voice 4 (4M)	965-0325-67	1.00	\$6100	U37	960-5015-01
► Harley-Davidson® (Notes 4, 5, 6, 8) 2nd Edition (2002-2003)					
Game ROM (1M)	965-0319-67A	A1.08	\$23FF	U210	960-5009-00
Display (4M)	965-0321-67A	A1.05	\$B594	ROM 0	960-5015-01
► Harley-Davidson® (Notes 4, 5, 6, 8) 3rd Edition (2004)					
Game ROM (1M)	965-0319-87	A4.00	\$1CFF	U210	960-5009-00
Display (4M)	965-0321-87	A4.00	\$F4FF	U5	960-5015-01
Striker Xtreme (Notes 4, 5)					
Game ROM (1M)	965-0326-68	A1.03	\$E4FF	U210	960-5009-00
Sound (512K)	965-0327-68	1.00	\$3BCA	U7	960-7001-02
Display (4M)	965-0328-68	A1.03	\$1957	ROM 0	960-5015-01
Voice 1 (8M)	965-0329-68	1.00	\$482A	U17	960-5016-00
Voice 2 (8M)	965-0330-68	1.00	\$7312	U21	960-5016-00
Voice 3 (8M)	965-0331-68	1.00	\$DE2F	U36	960-5016-00
Voice 4 (8M)	965-0332-68	1.00	\$C508	U37	960-5016-00
NFL (Notes 4, 5) Not on CD-R or Website: Code through Distributor Only.					
Game ROM (1M)	965-0339-73	A1.00	\$D2FF	U210	960-5009-00
Sound (512K)	965-0340-73	1.00	U7	960-7001-02	
Display (4M)	965-0341-73	A1.01	\$845A	ROM 0	960-5015-01
Voice 1 (8M)	965-0342-73	1.00	U17	960-5016-00	
Voice 2 (8M)	965-0343-73	1.00	U21	960-5016-00	
Voice 3 (8M)	965-0344-73	1.00	U36	960-5016-00	
Voice 4 (8M)	965-0345-73	1.00	U37	960-5016-00	
Sharkey's Shootout (Notes 4, 5)					
Game ROM (1M)	965-0333-72	A2.11	\$49FF	U210	960-5009-00
Sound (512K)	965-0333-72	1.01	\$9796	U7	960-7001-02
Display (4M)	965-0335-72	A2.01	\$6C33	ROM 0	960-5015-01
Voice 1 (8M)	965-0336-72	1.00	\$58EA	U17	960-5016-00
Voice 2 (8M)	965-0337-72	1.00	\$272B	U21	960-5016-00
Voice 3 (8M)	965-0338-72	1.00	\$41AE	U36	960-5016-00
High Roller Casino (Notes 4, 5)					
Game ROM (1M)	965-0346-65	A3.00	\$90FF	U210	960-5009-00
Sound (512K)	965-0347-65	1.00	\$581C	U7	960-7001-02
Display (4M)	965-0348-65	A3.00	\$74B3	ROM 0	960-5015-01
Voice 1 (8M)	965-0349-65	1.00	\$E12D	U17	960-5016-00
Voice 2 (8M)	965-0350-65	1.00	\$38F4	U21	960-5016-00
Voice 3 (8M)	965-0351-65	1.00	\$1B54	U36	960-5016-00
Voice 4 (8M)	965-0352-65	1.00	\$D720	U37	960-5016-00
Austin Powers™ (Notes 4, 5)					
Game ROM (1M)	965-0353-74	A3.02	\$5DFF	U210	960-5009-00
Sound (512K)	965-0354-74	1.00	\$D47B	U7	960-7001-02
Display (4M)	965-0355-74	A3.00	\$6A3A	ROM 0	960-5015-01
Voice 1 (8M)	965-0356-74	1.00	\$D2B9	U17	960-5016-00
Voice 2 (8M)	965-0357-74	1.00	\$9E75	U21	960-5016-00
Voice 3 (8M)	965-0358-74	1.00	\$51F3	U36	960-5016-00
Voice 4 (8M)	965-0359-74	1.00	\$0AE5	U37	960-5016-00
MONOPOLY® (Notes 4, 5)					
Game ROM (1M)	965-0360-75	A3.20	\$07FF	U210	960-5009-00
Sound (512K)	965-0361-75	1.00	\$8C18	U7	960-7001-02
Display (4M)	965-0362-75	A3.01	\$A381	ROM 0	960-5015-01
Voice 1 (8M)	965-0363-75	1.00	\$35E6	U17	960-5016-00
Voice 2 (8M)	965-0364-75	1.00	\$B35A	U21	960-5016-00
Voice 3 (8M)	965-0365-75	1.00	\$8A9F	U36	960-5016-00
Playboy (Notes 4, 5, 7)					
Game ROM (1M)	965-0367-76	A5.00	\$7DFF	U210	960-5009-00
Sound (512K)	965-0368-76	1.02	\$E7C2	U7	960-7001-02
Display (4M)	965-0369-76	A5.00	\$A5FF	ROM 0	960-5015-01
Voice 1 (8M)	965-0370-76	1.00	\$9ABE	U17	960-5016-00
Voice 2 (8M)	965-0371-76	1.00	\$9F34	U21	960-5016-00
Voice 3 (8M)	965-0372-76	1.00	\$374B	U36	960-5016-00
Voice 4 (8M)	965-0373-76	1.00	\$237A	U37	960-5016-00
RollerCoaster Tycoon™ (Notes 4, 5, 7)					
Sound (512K)	965-0374-78	1.00	\$F663	U7	960-7001-02
Game ROM (1M)	965-0375-78	A7.02	\$E5FF	U210	960-5009-00
Voice 1 (8M)	965-0377-78	1.00	\$3C4A	U17	960-5016-00
Voice 2 (8M)	965-0378-78	1.00	\$057A	U21	960-5016-00
Voice 3 (8M)	965-0379-78				



APPENDIX A

Pinball Game Firmware (White Star Board System* & S.A.M. System** Only) Table



See website for the latest International Code or Updated USA version / checksums

ROM	Chip Size	Program Part N ^o	USA Ver. & Check Sum	Bd. Loc.	Raw Part N ^o
Ripley's Believe It or Not!® (Notes 7, 8)					
Sound	(512K)	965-0408-81	1.00 \$D93D	U7	960-7001-02
Game ROM	(1M)	965-0409-81	A3.20 \$43FF	U210	960-5009-00
Voice 1	(8M)	965-0410-81	1.00	\$067B U17	960-5016-00
Voice 2	(8M)	965-0411-81	1.00	\$C8E8 U21	960-5016-00
Voice 3	(8M)	965-0412-81	1.00	\$64C2 U36	960-5016-00
Voice 4	(8M)	965-0413-81	1.00	\$5341 U37	960-5016-00
Display	(4M)	965-0414-81	A3.00 \$DE4B	U5 DC PCB	960-5015-01

Elvis® (Notes 7, 8)					
Sound	(512K)	965-0415-84	1.00 \$8CD2	U7	960-7001-02
Game ROM	(1M)	965-0416-84	A5.00 \$50FF	U210	960-5009-00
Voice 1	(8M)	965-0417-84	1.00	\$538D U17	960-5016-00
Voice 2	(8M)	965-0418-84	1.00	\$8BCD U21	960-5016-00
Voice 3	(8M)	965-0419-84	1.00	\$60F8 U36	960-5016-00
Voice 4	(8M)	965-0420-84	1.00	\$14D8 U37	960-5016-00
Display	(4M)	965-0421-84	A5.00 \$A1F6	U5 DC PCB	960-5015-01

The SopranosSM (Notes 7, 8)					
Sound	(512K)	965-0422-85	4.00 \$9B5A	U7	960-7001-02
Game ROM	(1M)	965-0423-85	A5.00 \$5BFF	U210	960-5009-00
Voice 1	(8M)	965-0424-85	3.00	\$F01E U17	960-5016-00
Voice 2	(8M)	965-0425-85	1.04	\$C14C U21	960-5016-00
Voice 3	(8M)	965-0426-85	1.04	\$47A3 U36	960-5016-00
Voice 4	(8M)	965-0427-85	1.04	\$ADCD U37	960-5016-00
Display	(4M)	965-0428-85	A5.00 \$B4BB	U5 DC PCB	960-5015-01

NASCAR® (Notes 7, 8)					
Sound	(512K)	965-0429-86	2.00 \$32B3	U7	960-7001-02
Game ROM	(1M)	965-0430-86	A4.50 \$39FF	U210	960-5009-00
Voice 1	(8M)	965-0431-86	2.00	\$CFFB U17	960-5016-00
Voice 2	(8M)	965-0432-86	2.00	\$22C0 U21	960-5016-00
Voice 3	(8M)	965-0433-86	2.00	\$5FC8 U36	960-5016-00
Voice 4	(8M)	965-0434-86	2.00	\$2902 U37	960-5016-00
Display	(4M)	965-0435-86	A4.00 \$92BD	U5 DC PCB	960-5015-01

Grand Prix (Notes 7, 8)					
Sound	(512K)	965-0429-91	V1.00 \$6F89	U7	960-7001-02
Game ROM	(1M)	965-0430-91	A4.50 \$5EFF	U210	960-5009-00
Voice 1	(8M)	965-0431-91	1.00	\$C0E5 U17	960-5016-00
Voice 2	(8M)	965-0432-91	1.00	\$F4C6 U21	960-5016-00
Voice 3	(8M)	965-0433-91	1.00	\$057D U36	960-5016-00
Voice 4	(8M)	965-0434-91	1.00	\$2646 U37	960-5016-00
Display	(4M)	965-0435-91	A4.00 \$DA8E	U5 DC PCB	960-5015-01

[NDSE] (Notes 7, 8) <i>Call for more info if code update required.</i>					
Sound	(512K)	965-0436-97		U7	960-7001-02
Game ROM	(1M)	965-0437-97		U210	960-5009-00
Voice 1	(8M)	965-0438-97		U17	960-5016-00
Voice 2	(8M)	965-0439-97		U21	960-5016-00
Voice 3	(8M)	965-0440-97		U36	960-5016-00
Voice 4	(8M)	965-0441-97		U37	960-5016-00
Display	(4M)	965-0442-97		U5 DC PCB	960-5015-01

**** GAMES BELOW THIS LINE / NEXT COLUMN ARE S.A.M. SYSTEM GAMES**

TO ORDER MEMORY STICK WITH GAME FILES FROM YOUR DISTRIBUTOR, USE SPI PART NUMBER 970-0128-00 & INCLUDE THE GAME NAME / LANGUAGE FILE(S) DESIRED.

World Poker Tour™ Pinball (WPT) (Notes 7, 9)					
Boot B-02	(8M)	965-BOOT-SAM	1.04 \$7E62	U9	960-5016-00 unprogrammed
Memory Stick 128MB (970-0128-00)		Version		System	Bin Files:
English + Spanish		1.12AL		1.17+	WPT0112AL.bin
English Only		1.12A		1.17+	WPT0112A.bin
English + French		1.12AF		1.17+	WPT0112AF.bin
French Only		1.12F		1.17+	WPT0112F.bin
German + French		1.12GF		1.17+	WPT0112GF.bin
German Only		1.12G		1.17+	WPT0112G.bin
English + Italian		1.12AI		1.17+	WPT0112AI.bin
Italian Only		1.12I		1.17+	WPT0112I.bin

NOTE: THE TYPICAL SIZE PER UNZIPPED BIN FILE IS 25MB – 30MB+/-

The Simpsons™ Kooky Carnival Redemption (Note 9)					
Boot B-02	(8M)	965-BOOT-SAM	1.04 \$7E62	U9	960-5016-00 unprogrammed
Memory Stick 128MB (970-0128-00)		Version		Bin Files:	
English Only		1.05		SKC0105.bin	
English New Jersey Only		0.09NJ		SKC0090NJ.bin	

NOTE: THE TYPICAL SIZE PER UNZIPPED BIN FILE IS 5.5MB +/-

©Disney's Pirates of the Caribbean Pinball (POTC) (Notes 7, 9)					
Boot B-02	(8M)	965-BOOT-SAM	1.06 \$2014	U9	960-5016-00 unprogrammed
Memory Stick 128MB (970-0128-00)		Version		System	Bin Files:
English + Spanish		1.15AS		1.17+	POTC115AS.bin
English + French		1.15AF		1.17+	POTC115AF.bin
German + French		1.15GF		1.17+	POTC115GF.bin
English + Italian		1.15AI		1.17+	POTC115AI.bin

NOTE: THE TYPICAL SIZE PER UNZIPPED BIN FILE IS 25MB – 30MB+/-

Family Guy™ Pinball (FG) (Notes 7, 9)					
Boot B-02	(8M)	965-BOOT-SAM	2.09 \$10A3	U9	960-5016-00 unprogrammed
Memory Stick 128MB (970-0128-00)		Version		System	Bin Files:
English + Spanish		10.00AL		1.23+	FG1000AL.bin
English + French		10.00AF		1.23+	FG1000AF.bin
English + German		10.00AG		1.23+	FG1000GF.bin
English + Italian		10.00AI		1.23+	FG1000AI.bin

NOTE: THE TYPICAL SIZE PER UNZIPPED BIN FILE IS 25MB – 30MB+/-

Spider-Man™ Pinball (S-M) (Notes 7, 9)					
Boot B-02	(8M)	965-BOOT-SAM	2.10 \$F625	U9	960-5016-00 unprogrammed
Memory Stick 128MB (970-0128-00)		Version		System	Bin Files:
English + Spanish		1.3ES		1.27+	spd_1_30_es.bin
English + French		1.3EF		1.27+	spd_1_30_ef.bin
German + French		1.3GF		1.27+	spd_1_30_gf.bin
English + Italian		1.3EI		1.27+	spd_1_30_ei.bin

NOTE: THE TYPICAL SIZE PER UNZIPPED BIN FILE IS 25MB – 30MB+/-

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)



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)	965-0018-00		6F	960-7001-02	Voice 1	(2M)	965-0140-00		U21	960-5010-00
Voice 2	(512K)	965-0019-00		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	(1M)	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	A		

APPENDIX B

Semi-Conductors / Integrated Circuits (I.C.) / Relays Cross-Reference Table

Table No	Type	Source Number	STERN® PINBALL	NTE®	ECG®	Radio Shack®	RCA®
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

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



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

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

• Installed **W6** so 8MB ROMS can be utilized. See the **CPU/Sound Board Schematic** (Sheet 2 of 3, Address Location 3E) in the games' Service Game Manual. Games 52 - 57 CPU/Sound Board differ than <51 (See Appendix D).

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

Game Name White Star Board System™	Production Start Date and Manual Part Nr.	CPU/Sound Board Sound U7 512K CPU/Sound Board Game U210 1MB CPU/Sound Board Voice ROMS:				
		U17	U21	U36	U37	
54	Elvis®	AUG 04 780-5084-00	8MB	8MB	8MB	8MB
55	The Sopranos™	FEB 05 780-5085-00	8MB	8MB	8MB	8MB
56	NASCAR®	JUL 05 780-5086-00	8MB	8MB	8MB	8MB
57	Grand Prix	SEP 05 780-5091-00	8MB	8MB	8MB	8MB

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

Game Name S.A.M. System	Production Start Date and Manual Part Nr.	S.A.M. System CPU/Sound Board Boot EPROM U9			
		965-BOOT-SAM (Programmed)			
58	World Poker Tour™ (WPT)	JUN 06 780-5088-00	8MB	B-02 V2.1+ chksum \$F625	LOC: U9
59	The Simpsons™ Kooky Carnival	APR 06 780-5090-00	8MB	B-02 V2.1+ chksum \$F625	LOC: U9
60	©Disney's Pirates of the Caribbean	AUG 06 780-5092-00	8MB	B-02 V2.1+ chksum \$F625	LOC: U9
61	Famil Guy™	DEC 06 780-5093-00	8MB	B-02 V2.1+ chksum \$F625	LOC: U9
62	Spider-Man™	MAY 07 780-5094-00	8MB	B-02 V2.1+ chksum \$F625	LOC: U9

Games 58 – current, S.A.M. System : CPU/Sound & I/O Power Driver PCBs differ than White Star (previous Games 29 – 57); Disp. Controller Not Required.





APPENDIX D

Board Type (White Star Board System* Only) Table



Game Name	Flipper	I/O Power Driver	CPU/Sound Stereo	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Application
Apollo 13	520-5080-00 2-Flipper	520-5137-00	520-5136-00	520-5138-00	520-5052-00 128 X 32 Dots	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 Dots	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker
	Miscellaneous PC Boards:	Light Boards 520-5128-05 through -08		Mag. Processor X2 Driver Bd. 520-5143-00	Relay Board 520-5010-00				
GAMES HEREON NO LONGER REQUIRE THE FLIPPER BOARD WITH THE WHITE STAR BOARD SYSTEM™									
Game Name	I/O Power Driver	CPU/Sound Mono	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Application	Misc OPTO & App.
Twister	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32 Dots	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 Dots	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Light Boards 520-5149-01 through -10		Servo Mtr. Bd. 520-5152-00		520-5082-00 Long Hop OPTO	520-5083-00 Long Hop OPTO	Alien Head Enter	
Space Jam	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32 Dots	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 Dots	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 Dots	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 Dots	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 Dots	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 Dots	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 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00							
Godzilla	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Shaker Mtr. Bd. 520-5065-00							
South Park	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:					520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Kenny Under Trough Enter	
Harley-Davidson® 1st-3rd* Editions	520-5137-01	520-5136-16 *520-5300-00*	520-5138-00	520-5052-00 128 X 32 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00		Shaker Mtr. Bd. 520-5065-00	Diode Board 520-5146-00	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Motorcycle Enter	
Striker Xtreme (NFL)	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5155-00 3-Pos. Motor Sensor on Goalie Motor
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Relay Board 520-5010-00	Diode Board 520-5146-00	for UK ONLY- Solenoid Expander Bd. 520-5192-00	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Goalie Under- Trough Enter	
Sharkey's Shootout	520-5137-64	520-5136-64	520-5138-00	520-5052-00 128 X 32 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5194-00 4-Pos. Motor Sensor on ? -Ball Motor
	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 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5194-00 4-Pos. Motor Sensor on Roulette Wheel Motor
	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 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5212-00 Pulse-Stretcher OPTO on Spini-Me
	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 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Mini-Dot Display (3 by 5X7) 520-5197-00 (Electric C- Sign)		for UK ONLY- Solenoid Expander Bd. 520-5192-00	520-5218-00 4-Pos. OPTO	520-5210-00 4-Pos. OPTO	Bank Door	

Table continued on the next page.





APPENDIX D

Board Type (White Star Board System* & S.A.M. System** Only) Table



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

Game Name	I/O Power Driver**	CPU / Sound**	Disp. Power Supply	Dot Matrix Display	Dual OPTO Transmitter	Dual OPTO Receiver	Dual OPTO Transceiver	OPTO Transceiver Miscellaneous
World Poker Tour™ (WPT)	520-5249-00 Backbox	520-5246-00 Backbox	520-5138-00 Backbox	520-5052-00 128 X 32 Dots	515-0173-00 4-Ball Trough	515-0174-00 4-Ball Trough	500-6775-00 4 Switch Pairs (Qty. 8)	520-5251-00 'U' 1/per PCB Jail Bars Up Ace/Hole Mech 520-5252-04 'U' 4/per PCB Drop Targets 4- & 8- Banks
	Miscellaneous PCBs:	520-5254-00 50V Step-Up Drv	520-5250-14 14LED 5X7 Disp.	520-5239-01 OPTO Amplifier	520-5247-00 Ace/Hole Mech	520-5248-00 Ace/Hole Mech		
The Simpsons™ Kooky Carnival	520-5249-00 Back Door	520-5246-00 Back Door	520-5138-00 Cabinet Rear	520-5052-00 128 X 32 Dots			520-5253-00-ASY Coin Drop (Qty. 11)	
	Miscellaneous PCBs:	515-5742-00 Shaker PCB	500-6700-00 Relay (incl. Wiring + Conn.)					
©Disney's Pirates of the Caribbean	520-5249-00 Backbox	520-5246-00 Backbox	520-5138-00 Backbox	520-5052-00 128 X 32 Dots	515-0173-00 4-Ball Trough	515-0174-00 4-Ball Trough	500-6775-00 5 Switch Pairs (Qty. 10)	
	Miscellaneous PCBs:	520-5239-01 OPTO Amp. (X3)	511-5024-03 Relay (incl. Wiring + Conn.)	520-5238-00 : H-E-A-R-T LED PCB				
Family Guy™	520-5249-00 Backbox	520-5246-00 Backbox	520-5138-00 Backbox	520-5052-00 128 X 32 Dots	515-0173-00 4-Ball Trough	515-0174-00 4-Ball Trough	500-6775-00 3 Switch Pairs (Qty. 6)	520-5252-01 'U' 1/per PCB Drop Target 1-Bank
	Miscellaneous PCBs:	520-5239-01 OPTO Amp. (X2)	520-5261-00 Stepper Motor	511-5042-01 Trgt. Sensor (X2)			500-6775-01 1 Switch Pair (Qty. 2)	520-5252-04 'U' 4/per PCB Drop Target 4-Bank
Spider-Man™	520-5249-00 Backbox	520-5246-00 Backbox	520-5138-00 Backbox	520-5052-00 128 X 32 Dots	515-0173-00 4-Ball Trough	515-0174-00 4-Ball Trough	500-6775-00 3 Switch Pairs (Qty. 6)	
	Miscellaneous PCBs:	520-5239-01 OPTO Amp. (X2)						



APPENDIX D

Board Type Table

Game Name	Flipper	Sound	Power Supply	Display X-Digit
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> Secret Service Torpedo Alley 	3-Flipper Board Not Required	520-5002-02		520-5014-01 7 Digit Alpha/Numeric Combined
<ul style="list-style-type: none"> Time Machine 	2-Flipper Board Not Required			520-5030-00 16 Digit Alpha/Numeric Combined
<ul style="list-style-type: none"> 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>			
		520-5002-03		

Game Name	Flipper	Sound	Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Application
<ul style="list-style-type: none"> 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			
<ul style="list-style-type: none"> Batman Star Trek 25th Anniv. Hook 		520-5050-01						
<ul style="list-style-type: none"> Lethal Weapon 3 		520-5050-02	520-5047-01					
<ul style="list-style-type: none"> Star Wars Rocky & Bullwinkle & Friends 			520-5052-00 128 X 32					
<ul style="list-style-type: none"> Jurassic Park 				520-5047-02				
<ul style="list-style-type: none"> Last Action Hero 	520-5050-03	520-5047-03	520-5075-00 192 X 64	520-5092-01				
<ul style="list-style-type: none"> Tales from the Crypt The Who's Tommy 	520-5077-00							
<ul style="list-style-type: none"> WWF Royal Rumble 	520-5070 / 5080 -00 4-Flipper (2X2)	520-5050-03	520-5126-02					
<ul style="list-style-type: none"> Guns N' Roses 	520-5076-00 3-Flipper							
<ul style="list-style-type: none"> Maverick 	520-5076-00 3-Flipper	520-5077-00			520-5102-00 Single OPTO	520-5103-00 Single OPTO	Paddle Boat Wheel Enter	
<ul style="list-style-type: none"> Mary Shelley's Frankenstein 	520-5076-00 3-Flipper							
<ul style="list-style-type: none"> Baywatch 	520-5070 / 5080 -00 4-Flipper (2X2)	520-5124-00 Single OPTO	520-5125-00 Single OPTO	520-5125-00 Single OPTO	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker	
<ul style="list-style-type: none"> Batman Forever 	520-5076-00 3-Flipper				520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	

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





APPENDIX E

Flipper Coil (White Star Board System* & S.A.M. System** Only) Table



Typical Coil Diode 1N4004 unless noted otherwise (Diode Top = above lugs next to windings; Diode Below (Bottom) = under lugs opposite of windings).

STANDARD COILS (TYPICAL APPLICATIONS)			LARGE COILS (FLIPPERS & SPECIAL APPLICATIONS)		
Ga.-Turn	Res (Ω)	SPI Part Number and Comments	Ga.-Turn	Res (Ω)	SPI Part Number and Comments
20-400	1.0 Ω	090-5021-use: -00 Diode Top	21-900	call Ω	090-5020-use: -01 3-Lugs + 1N4004 & 1N5404 Diodes -10 Diode Top <BROWN><RED>
22-500	1.7 Ω	090-5017-use: -00 Diode Top	22-750 / 30-2600	2.6 Ω 92.0 Ω	090-5011-use: -00 DUAL WND COIL // 3-Lugs Diode x2
22-600	2.2 Ω	090-5017-use: -0B Diode Below // -0T Diode Top			
23-700	3.1 Ω	090-5022-use: -0B Diode Below // -0T Diode Top	22-900	3.45 Ω	090-5020-use: -20T Diode Top <YELLOW> // -20-ND No Diode
23-750	3.4 Ω	090-5019-use: -00 Diode Top			
23-800	3.6 Ω	090-5001-use: -0B Diode Below // -0T Diode Top // -NL No Lugs 11" Leads // -ND No Diode	22-1080	4.2 Ω	090-5032-use: -0B D. Below // -0T D. Top <YEL-GRN> -NL No Diode
23-840	4.0 Ω	090-5005-use: -00 Diode Top			
23.5-765	3.6 Ω	090-5037-use: -03 Diode Top	23-620 / 30-2600	2.4 Ω 75.0 Ω	090-5006-use: -00 DUAL WND COIL // 3-Lugs Diode x2
24-900	5.0 Ω	090-5002-use: -02 Diode Top // -10 No Lugs 14" Leads			
24-940	5.5 Ω	090-5036-use: -0B Diode Below // -0T Diode Top use 090-5051-01 No Lugs 11" Leads	23-700 / 30-2600	3.0 Ω 83.5 Ω	090-5013-use: -00 DUAL WOUND COIL // Diode Top
25-1240	9.3 Ω	090-5034-use: -00 Diode Below			
26-1200	10.3 Ω	090-5044-use: -0B Diode Below // -0T Diode Top // -NL No Lugs 11" Leads // -ND No Diode	23-800 / 30-2600	2.4 Ω 90.5 Ω	090-5012-use: -00 DUAL WOUND COIL // Diode Top
27-1300	14.2 Ω	090-5003-use: -0T Diode Top			
27-1400	14.7 Ω	090-5015-use: -00 Diode Below	23-1100	5.1 Ω	090-5030-use: -0T Diode Top <ORANGE> -ND No Diode
27-1400	14.7 Ω	511-5031-00 Special App.: No Diode / Lugs + Conn.			
27-1500	16.3 Ω	090-5004-use: -0B Diode Below // -0T Diode Top	23-1200	7.1 Ω	090-5008-use: -00 Diode Top <BLACK>
29-2000	33.6 Ω	090-5016-use: -00 Diode Top	23-1500	4.4 Ω	090-5062-use: -00 Diode Top <BLUE>
LARGE, MEDIUM & MINI COILS (MAGNET APPLICATIONS)			24-1570	9.5 Ω	090-5025-use: -00 Diode Top <BLUE>
20.5-480	2.9 Ω	090-5064-use: -02 No Lugs or Core; 14" Leads // Large	25-1400	call Ω	090-5067-use: -0T Diode Top <RED>
22-650	4.3 Ω	090-5042-use: -00 No Lugs or Core; 6" Leads // Large -01 No Lugs or Core; 12" Leads // Large	25-1600	call Ω	090-5068-use: -0T Diode Top <WHITE>
24-780	8.0 Ω	090-5061-use: -00 No Lugs or Core; 6" Lds. // Medium	MINI COILS (RESET / TRIP APPLICATIONS)		
29-1000	15.2 Ω	090-5059-use: -00 Lugs + Diode + Magnet Core // Mini	27-950	call Ω	090-5046-use: -01 Diode Top
31-1500	52.0 Ω	090-5054-00: Straight Lugs + Diode + Mag Core // Mini 090-5055-00: 90° Lugs + Diode + Magnet Core // Mini	28-1050	11.5 Ω	090-5046-use: -00 Diode Top
Please Note: Ohm values may vary +/- .03 depending on meter calibration.			27-880	call Ω	500-6976-01 No Lugs or Diode + 6" Leads & Conn.
Ordering Note: Coils typically should not come with Coil Sleeves. IF A SLEEVE EXISTS, ensure it is the correct sleeve for the application usage. For the correct Coil Sleeve, refer to the Game Assembly Drawing the coil exists on and order separately.			31-590	call Ω	090-5010-use: -00 Diode Top
			32-1250	35.0 Ω	515-6916-01: includes Flap & Screw <YELLOW>
			32-1800	50.2 Ω	090-5031-use: -0B Diode Below // -0T Diode Top (515-6110-00) use 515-# to include mounting & armature brackets
			33-1590	59.0 Ω	515-6916-00: includes brackets <WHITE>

Flipper Coil (White Star Board System* Only) Table

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

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

Table continued on the next page.





APPENDIX E

Flipper Coil (White Star Board System* & S.A.M. System** Only) Table



GAME NAME	N ^o of Flippers	FLIPPERS w/E.O.S. Switch		FLIPPERS no E.O.S. Switch	
		SPI N ^o / GAUGE-TURNS / Color		SPI N ^o / GAUGE-TURNS / Color	
		LOWER LEFT	LOWER RIGHT	UPPER LEFT	UPPER RIGHT
Harley-Davidson® † and 1st through 3rd Editions	2	090-5032-0T 22-1080 -YEL-GRN-	090-5030-0T 23-1100 -ORANGE-	Not Used	Not Used
Striker Xtreme (NFL) †	3	090-5032-0T 22-1080 -YEL-GRN-	090-5030-0T 23-1100 -ORANGE-	090-5030-0T 23-1100 -ORANGE-	Not Used
Sharkey's Shootout †	3	090-5030-0T 23-1100 -ORANGE-	SAME	090-5030-0T 23-1100 -ORANGE-	Not Used
High Roller Casino †	2	090-5032-20T 22-900 -YELLOW-	090-5032-0T 22-1080 -YEL-GRN-	Not Used	Not Used
Austin Powers™ †	2	090-5020-30 23-900 -GREEN-	090-5030-0T 23-1100 -ORANGE-	Not Used	Not Used
MONOPOLY® †	3	090-5032-0T 22-1080 -YEL-GRN-	SAME	Not Used	090-5062-0T 23-1500 -BLUE-
Playboy †	2	090-5030-0T 23-1100 -ORANGE-	SAME	Not Used	Not Used
RollerCoaster Tycoon™ †	4	090-5032-0T 22-1080 -YEL-GRN-	SAME	090-5067-0T 25-1400 -RED-	090-5068-0T 25-1600 -WHITE-
The Simpsons™ Pinball Party †	6** (5 with Flipper Bats)	090-5032-0T 22-1080 -YEL-GRN-	SAME	Not Used	090-5030-0T 23-1100 -ORANGE-
		** The Homer Head Assembly is affixed to an Upr. Rt. Style Flipper (no E.O.S. Switch):		Flippers (Mini-Bats) on 2nd Level Playfield:	
			** 090-5020-20T 22-900 -YELLOW-	090-5041-00T 25-1800 -BLU-GRN-	090-5025-00 24-1570 -BLUE-
Terminator® 3: Rise of the Machines™ †	2	090-5032-0T 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
The Lord of the Rings™ †	2	090-5020-20T 22-900 -YELLOW-	SAME	Not Used	Not Used
Ripley's Believe It or Not!® †	3	090-5032-0T 22-1080 -YEL-GRN-	SAME	Not Used	090-5067-00T 25-1400 -RED-
Elvis® †	4	090-5020-20T 22-900 -YELLOW-	SAME	090-5020-30 23-900 -GREEN-	SAME
The Sopranos™ †	2	090-5032-0T 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
NASCAR® and [NDSE] †	2	090-5030-0T 23-1100 -ORANGE-	SAME	Not Used	Not Used
Grand Prix †	2	090-5030-0T 23-1100 -ORANGE-	SAME	Not Used	Not Used
† Coil Part Numbers ending with a "T" signifies the Diode is on the top of the lug (on the coil-winding side); Coil Part Numbers ending with a "B" signifies the Diode is on the bottom of the lugs.					
** S.A.M. System Games DO NOT REQUIRE DIODES. If you use a coil from your stock which has a diode, remove it ONLY FOR S.A.M. System Games.					
World Poker Tour™ (WPT)**	4	090-5032-ND 22-1080 [NO DIODE]	SAME	090-5030-ND 23-1100 [NO DIODE]	SAME
©Disney's Pirates of the Caribbean**	2	090-5030-ND 23-1100 [NO DIODE]	SAME	Not Used	Not Used
Family Guy™ **	3 Norm.	090-5030-ND 23-1100 [NO DIODE]	SAME	090-5062-ND 23-1500 [NO DIODE]	Not Used
	2 Mini	090-5046-01-ND 27-950 [NO DIODE]	SAME		
Spider-Man™ **	3	090-5032-ND 22-1080 [NO DIODE]	SAME	Not Used	090-5032-ND 22-1080 [NO DIODE]



APPENDIX E

Generic Coil Cross-Reference Guide † ‡

Flipper Coil Table ‡ ††

GAME NAME	Nº of Flippers	FLIPPERS w/E.O.S. Switch		FLIPPERS no E.O.S. Switch	
		SPI Nº / GAUGE-TURNS / Color		SPI Nº / GAUGE-TURNS / Color	
		LOWER LEFT	LOWER RIGHT	UPPER LEFT	UPPER RIGHT
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-YEL-	SAME	Not Used	Not Used
ABC Monday Night Football ††	2	090-5020-02 22-900 -YEL-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 is 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-YEL-	SAME	Not Used	Not Used
Phantom of the Opera	2	090-5020-20 22-900 -YEL-YEL-	SAME	Not Used	Not Used
Back to the Future	2	090-5020-20 22-900 -YEL-YEL-	SAME	Not Used	Not Used
The Simpsons	2	090-5020-20 22-900 -YEL-YEL-	SAME	Not Used	Not Used
Checkpoint	2	090-5020-20 22-900 -YEL-YEL-	SAME	Not Used	Not Used
Teenage Mutant Ninja Turtles	2	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	Not Used
Batman	2	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	Not Used
Star Trek 25th Anniversary	2	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	Not Used
Hook	2	090-5030-00 23-1100 -ORG-ORG-	090-5020-30 23-900 -GRN-GRN-	Not Used	Not Used
Lethal Weapon 3	2	090-5030-00 23-1100 -ORG-ORG-	SAME	Not Used	Not Used
Star Wars	2	090-5032-00 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
Rocky & Bullwinkle & Friends	2	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	Not Used
Jurassic Park	3	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	090-5030-00 23-1100 -ORG-ORG-

Table continued on the next page.



APPENDIX E

Flipper Coil Table †

GAME NAME	N ^o of Flippers	FLIPPERS w/ E.O.S. Switch		FLIPPERS no E.O.S. Switch	
		SPI N ^o / GAUGE-TURNS / Color		SPI N ^o / GAUGE-TURNS / Color	
		LOWER LEFT	LOWER RIGHT	UPPER LEFT	UPPER RIGHT
Last Action Hero	2	090-5020-30 23-900 -GRN-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-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-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-ORG-	SAME	Not Used	090-5030-00 23-1100 -ORG-ORG-
Baywatch	4	090-5030-00 23-1100 -ORG-ORG-	090-5020-30 23-900 -GRN-GRN-	090-5025-00 24-1570 -See Note-	090-5030-00 23-1100 -ORG-ORG-
Batman Forever	3	090-5032-00 22-1080 -YEL-GRN-	090-5020-20 22-900 -YEL-YEL-	Not Used	090-5020-30 23-900 -GRN-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-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-GRN-
Space Jam †	2	090-5032-00T 22-1080 -YEL-GRN-	090-5020-20T 22-900 -YEL-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-ORG-	SAME	Not Used	090-5032-00T 22-1080 -YEL-GRN-
Viper Night Drivin' †	2	090-5030-00T 23-1100 -ORG-ORG-	SAME	Not Used	Not Used
Lost In Space †	2	090-5030-00T 23-1100 -ORG-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-ORG-	SAME	Not Used	Not Used
Harley-Davidson® † and Harley-Davidson® 2nd Ed. †	2	090-5032-00T 22-1080 -YEL-GRN-	090-5030-00T 23-1100 -ORG-ORG-	Not Used	Not Used
Striker Xtreme (NFL) †	3	090-5032-00T 22-1080 -YEL-GRN-	090-5030-00T 23-1100 -ORG-ORG-	090-5030-00T 23-1100 -ORG-ORG-	Not Used
Sharkey's Shootout †	3	090-5030-00T 23-1100 -ORG-ORG-	SAME	090-5030-00T 23-1100 -ORG-ORG-	Not Used
High Roller Casino †	2	090-5020-20T 22-900 -YEL-YEL-	090-5032-00T 23-1080 -YEL-GRN-	Not Used	Not Used
Austin Powers™ †	2	090-5020-30 23-900 -GRN-GRN-	090-5030-00T 23-1100 -ORG-ORG-	Not Used	Not Used
MONOPOLY® †	3	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	090-5062-00T 23-1500 -BLU-BLU-
Playboy †	2	090-5030-00T 23-1100 -ORG-ORG-	SAME	Not Used	Not Used
RollerCoaster Tycoon™ †	4	090-5032-00T 22-1080 -YEL-GRN-	SAME	090-5067-00T 25-1400 -RED-RED-	090-5068-00T 25-1600 -WHT-WHT
The Simpsons™ Pinball Party †	6* (5 with Flipper Bats)	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	090-5030-00T 23-1100 -ORG-ORG-
		<i>* The Homer Head Assembly is affixed to an Upr. Rt. Style Flipper (no E.O.S. Switch):</i>		Flippers (Mini-Bats) on 2nd Level Playfield:	
			* 090-5020-20T 22-900 -YEL-YEL-	090-5041-00T 25-1800 -BLU-GRN-	090-5025-00T 24-1570 -See Note-
Terminator® 3: Rise of the Machines™ †	2	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
The Lord of the Rings™ †	2	090-5020-20T 22-900 -YEL-YEL-	SAME	Not Used	Not Used
Ripley's Believe It or Not!® †	3	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	090-5067-00T 25-1400 -RED-RED-

† 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 (White Star Board System* Only) Table



Game Name	Function	Specifications	Part Number
Apollo 13	Rocket Up/Down Movement	Bowman Motor 24VAC 60Hz 3W 6 RPM CCW	515-6383-00 <i>incl. Connector</i>
	Moon Unit Rotational Orbit	Multi Products Motor 24VAC 50/60Hz 3W 6 RPM CCW	515-6487-00 <i>incl. Connector</i>
	Shaker	Johnson Motor (Vibrator) 10.5VDC 10 AMP 2950 RPM CW	041-5029-00 MOTOR ONLY
Golden Eye	Satellite Left/Right Movement	Bowman Motor 24VAC 60Hz 3W 6 RPM CW	515-6528-00 <i>incl. Connector</i>
Twister	Spinning Disc with Magnet	Multi Products Motor 24VAC (041-5026-00) 50/60Hz 3W 325 RPM CCW	515-6347-00 <i>incl. Connector</i>
	Backbox Fan (Tornado Wind)	Multi Products Motor 24VAC (041-5052-00) 50/60Hz 3W 3600 RPM CW	515-6531-00 <i>incl. Connector</i>
ID4: Independence Day	Alien Head Open/Close Movement	Servo Motor (94322)	041-5045-00 MOTOR ONLY
<i>SPACE JAM (NO MOTOR USED)</i>			
The Star Wars Trilogy - S.E.	X-Wing Left/Right Movement	Bowman Motor 24VAC (041-5058-00) 60Hz 3W 10 RPM CCW	515-6383-01 <i>incl. Connector</i>
The Lost World: Jurassic Park	Snagger & Center Link Lift Up/Down Movement	Multi Products Motor 20VDC (041-5059-03) 9 RPM Non-Directional	515-6715-03 <i>incl. Connector</i>
	Shaker	Johnson Motor (Vibrator) 10.5VDC 10 AMP 2950 RPM CW	041-5029-00 MOTOR ONLY
The X-Files	X-File Cabinet Lift Up/Down Movement	Multi Products Motor 20VDC 9 RPM CCW	041-5057-00 MOTOR ONLY
Starship Troopers	Warrior Bug Forward/Reverse Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12VDC 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not included) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 <i>incl. Connector</i> Requires 7" Shaft: 530-5503-00
<i>VIPER NIGHT DRIVIN' (NO MOTOR USED)</i>			
Lost In Space	Spinning Disc with Magnet	Multi Products Motor 24VAC (041-5046-00) 50/60Hz 3W 325 RPM CCW	515-6347-00 <i>incl. Connector</i>
Godzilla	Shaker ‡	Multi #3811 0630 Motor (Vibrator) 12VDC 3100 RPM CW (w/DRL PTS) ‡	041-5029-01 MOTOR ONLY
<i>SOUTH PARK (NO MOTOR USED)</i>			
Harley-Davidson® 1st through 3rd Editions	Shaker ‡	Multi #3811 0630 Motor (Vibrator) 12VDC 3100 RPM CW (w/DRL PTS) ‡	041-5029-01 MOTOR ONLY
	Motorcycle Lift Up/Down Movement	Autotrol 24VAC (041-5072-02) 20 RPM CCW	515-7025-00 <i>incl. Connector</i>
Striker Xtreme (NFL)	Goalie (Linebacker) Left to Right Movement	Multi #3590 12VDC (041-5075-00) 60 RPM	515-7071-00 <i>incl. Connector</i>
Sharkey's Shootout	Mystery Ball Rotating Movement	Hankscraft Motor Model-E 24VAC (041-5076-00) 50/60Hz 3W 20 RPM CW	515-7095-00 <i>incl. Connector</i>
High Roller Casino	Roulette Wheel Rotating Movement	Multi Products Motor 20VDC (041-5078-00) 17 RPM CCW	515-7153-00 <i>incl. Connector</i>
	Up/Dn. Ramp in Slot Mach. Lift Up/Down Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12VDC 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not included) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 <i>incl. Connector</i> Requires Shaft ¾": 530-5503-01
Austin Powers™	Time Machine Rotating Movement	Multi Products Motor 24VAC (041-5079-00) 50/60Hz 20RPM CCW	515-7141-00 <i>incl. Connector</i>
	Laser Beam Left to Right Directional	Autotrol Motor 24VAC (041-5081-00) 50/60Hz 4W 10RPM Bi-Directional	515-7171-00 <i>incl. Connector</i>
	Dr. Evil Target Lift Up/Down Movement	Hankscraft Motor Model-E 24VAC (041-5030-00) 50/60Hz 6RPM CCW	515-5900-00 <i>incl. Connector</i>
Monopoly®	Mini-Flipper (Waterworks) Rotating Movement	Multi Prod. Motor & Gear Box #7000 EX00159A 20VDC 50/60Hz 85RPM CC/CCW	041-5083-00 MOTOR ONLY
Playboy	Triangular Billboard Rotating Movement	Autotrol Motor (BD511 150-1387) 24VAC 50/60Hz 12RPM Bi-Directional	041-5086-02 MOTOR ONLY
	Centerfold Mechanism Open/Close Movement	Multi Products (3680) Motor 12v DC 10/12 RPM CC/CCW	041-5075-04 MOTOR ONLY
	Tease Drop Screen Lift Up/Down Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12VDC 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not included) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 <i>incl. Connector</i> Requires 7" Shaft: 530-5503-00

‡ Please Note: "01" Shaker Motor is **Not Compatible** with old Shaker Motor 041-5029-00 (Shaker Motor Assy. 515-5893-00). THIS NEW MOTOR CAN ONLY BE USED IN NEW SHAKER MOTOR ASSY. 515-5893-01.

Table continued on the next page.





APPENDIX F

Motor Specification (White Star Board System* & S.A.M. System** Only) Table



Game Name	Function	Specifications	Part Number
ROLLERCOASTER TYCOON™ (NO MOTOR USED)			
THE SIMPSONS™ PINBALL PARTY (NO MOTOR USED)			
Terminator® 3: Rise of the Machines™	Backbox Ball Shooter Up/Down Movement	Multi Products Motor 24VAC (041-5079-01) 21 RPM CW	515-7317-00 <i>incl. Connector</i>
The Lord of the Rings™	Balrog (Motor & Gate) Open/Close Movement	Multi Prod. Motor 20VDC Series 600B (or equiv.) 50/60Hz 10 RPM Bi-Directional	041-5088-01 MOTOR ONLY
RIPLEY'S BELIEVE IT OR NOT!® (NO MOTOR USED)			
Elvis®	Elvis™ Front/Back Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12VDC 10W (041-5089-00), (Non-Captive Shaft not included) HSI #46868-12-002	500-6809-00 <i>incl. Connector</i> Requires 7.25" Shaft: 530-5658-00
	▶▶▶ OPTIONAL ◀◀◀ Shaker	Multi #3811 0630 Motor (Vibrator) 12VDC (041-5029-01) 3100 RPM (w/DRL PTS)	515-5893-01 <i>incl. Connector</i>
The Sopranos™	Bada Bing! Girls x2 Rotating Posts Movement	Autotrol Synchronous Motor 24VAC 4W 50/60Hz 45.7/54.9 RPM Bi-Directional	041-5092-00 <i>w/1" Shaft + 12" Leads</i>
NASCAR® and [NDSE]	Back Panel Rotating (Car) Windmill (Skill Ball Enter)	Multi Products Motor & Gear Box 20VDC Model #8000 (EX-04-073) 10 RPM	041-5093-00 MOTOR ONLY
Grand Prix	Back Panel Rotating (Car) Windmill (Skill Ball Enter)	Multi Products Motor & Gear Box 20VDC Model #8000 (EX-04-073) 10 RPM	041-5093-00 MOTOR ONLY
World Poker Tour™ (WPT) (NO MOTOR USED)			
The Simpsons™ Kooky Carnival	Bart on Skateboard Left/Right Movement	Multi Products Motor with Crank 24VAC (041-5095-01) 50/60Hz 3W 14 RPM	500-6947-01 <i>incl. Connector</i>
	Left & Right Ramps Up/Down Movement	Multi Products Motor 24VAC (041-5048-01) 50/60Hz 3W 15 RPM CCW (Qty. 2 in game)	515-7558-00 <i>incl. Connector</i>
	Shaker <i>(details in SKC Manual, Page 24)</i>	Multi #3811 0630 Motor (Vibrator) 12VDC 3100 RPM (w/DRL PTS)	041-5029-01 MOTOR ONLY
©Disney's Pirates of the Caribbean	Spinning Disk	Multi #3811R 0630 Motor (Vibrator) 12VDC (041-5029-04) 3100 RPM (w/DRL PTS) -04 is RoHS compliant; can substitute with -01 domestic	511-5024-04 <i>incl. Connector</i>
	Pirate Ship Sinking/Raising Movement	Multi Products Motor & Gear Box 24VDC Model #7000-DCM 12 RPM	041-5101-00 MOTOR ONLY
Family Guy™	Stewie Figurine Left & Right Movement	Stepper Motor NPM PF35T-48D4STD 5V RVB (041-5102-00 Reference Only)	511-5043-00 <i>incl. Connector</i>
Spider-Man™	Doc Ock, Sandman & 3-Bank Up/Down Movement	Sync. Motor 24VAC 50/60Hz 3W 12 RPM CW (041-5103-00 Reference Only)	511-5063-00 <i>incl. Connector</i>
	▶▶▶ OPTIONAL ◀◀◀ Shaker Motor Kit 502-5027-00	Multi #3811R 0630 Motor (Vibrator) 12VDC (041-5029-04) 3100 RPM (w/DRL PTS) -04 is RoHS compliant; can substitute with -01 domestic	515-5893-01 <i>incl. Connector</i>



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

APPENDIX G

Part Number Prefix Classification Codes

I. Electrical Source, Energy & Signal Converters

- 010- Transformers
- 031- Speakers
- 090- Solenoids (Coils)
- 150- Filters, Outlets, Varistors, Thermistors
- 200- Fuses

II. Conductors, Connectors & Insulators

- 034- Line Cords
- 036- Cable Assemblies & Wiring Harnesses
- 041- Motors
- 045- Connectors (All Types)
- 055- Lugs (M/F), Pins (M/F), Discs, Ring Terminals, Terminal Strips, etc.
- 060- Polarizing Keys and Conn. Covers
- 077- Lamp Sockets

III. Circuits & Circuit Elements

- 100- ICs
- 110- Transistors
- 112- Diodes (All Types including LEDs & Modules)
- 121- Resistors
- 123- Resistors (Variable & Adjustable)
- 124- Regulators & Bridge Rectifiers
- 125- Capacitors (Radial Lytics & Ferrites)
- 126- Piezo Crystal
- 127- Heatsinks
- 130- Capacitors (Tectates & Ceramics)
- 140- Oscillators (Clocks/Crystals)
- 165- Light Bulbs
- 180- Switches
- 181- Switch Membranes (Pads) & Piezo Sensors
- 190- Relays
- 960- EPROM (*Raw Part*)
- 965- EPROM (*Programmed Part*)

IV. Bolts, Screws, Nuts, Washers & Nails

- 231- Bolts
- 232- Screws (Pan Head)
- 234- Screws (HWH)
- 237- Screws (Misc.)
- 240- Nuts (Misc.)
- 242- Washers (Flat, Round)
- 244- Washers (Split Lock)
- 245- Nyloners
- 246- Washers (Lockers, External Tooth)
- 281- Nails

V. Mechanical Components

- 249- Rivets
- 251- Pins (Dowel), Finishing Nails, Hairpins, Spring Pins and Clevis Pins
- 254- Stand-Offs, Spacers and Shims
- 260- Steel Ball (All Types Steel, Glowing, Delrin, etc.)
- 265- Springs (Extension)
- 266- Springs (Compression)
- 267- Springs (Torsion)
- 269- Springs (Washers - Belleville, Wave)
- 270- Retaining Rings
- 280- Grommets, Bushings and Nyloners
- 283- Bearings

VI. Handles, Locks, Catches, Latches, Keys

- 355- Handles, Locks, Catches, Latches and Keys

VII. Fabricated Parts

- 390- Hinges
- 501- Coin Doors
- 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 and Rubber Parts (Rings, Sleeves, etc.)
- 550- Molded (Inserts)

VIII. In-House Assemblies

- 500- End Product (Systems and Models)
- 502- Kits (Created In-House)
- 505- Cabinets (complete)
- 510- Riveted Sub-Assemblies (In-House)
- 511- Sub-Assemblies (In-House)
- 515- Sub-Assemblies*

*2 or more 515-'s but still a sub-assembly.

IX. Bulk Materials








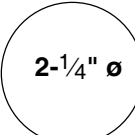
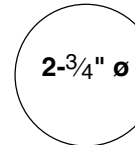

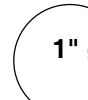
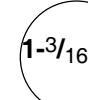
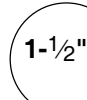
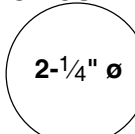
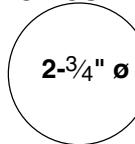
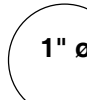


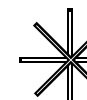
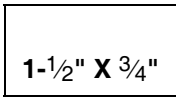
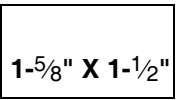
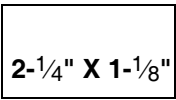
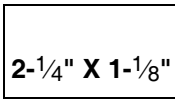
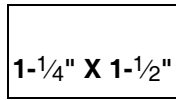
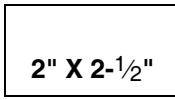


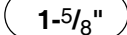
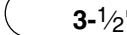




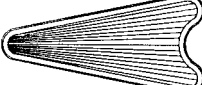
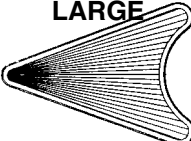

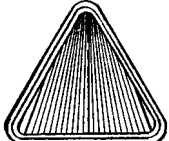
- 600- Braided Wire & Ground Straps
- 601- Stranded Wire
- 602- Ribbon Cable
- 604- Telephone Line Cord
- 605- Sleeving (Shrink Tubing)
- 625- Velcro (non-adhesive)
- 626- Foam Rubber, Foam Pads, Rubber Bumpers (Blue Pads), Tape (All Types) Velcro (adhesive) and String / Rope

X. Miscellaneous

- 000- Tools (*see also 777-*) and Supplies
- 040- Clamps, Ties & Clips
- 042- Pulleys
- 091- Coin Mechs
- 205- Fuse Holders
- 631- Staples
- 660- Glass (Playfield, Backglass, etc.)
- 675- Cleaners
- 705- Packing & Shipping Items
- 755- Instruction, Coin Cards, Ins. Sheets
- 756- Information Sheets, Service Bulletins, Instruction Sheets in Kits and Templates
- 777- Tools (Wrenches and Drivers)
- 780- Manuals
- 802- Decal Kits (comprised of 820's)
- 820- Decals, Mylar and Labels (Sheets/Sets)
- 803- Plastic Kits (comprised of 830's)
- 830- Plastic Pieces (Butyrate Sheets/Sets)
- 880- Toys, Models, Figurines, etc.
- 900- Game Posters

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

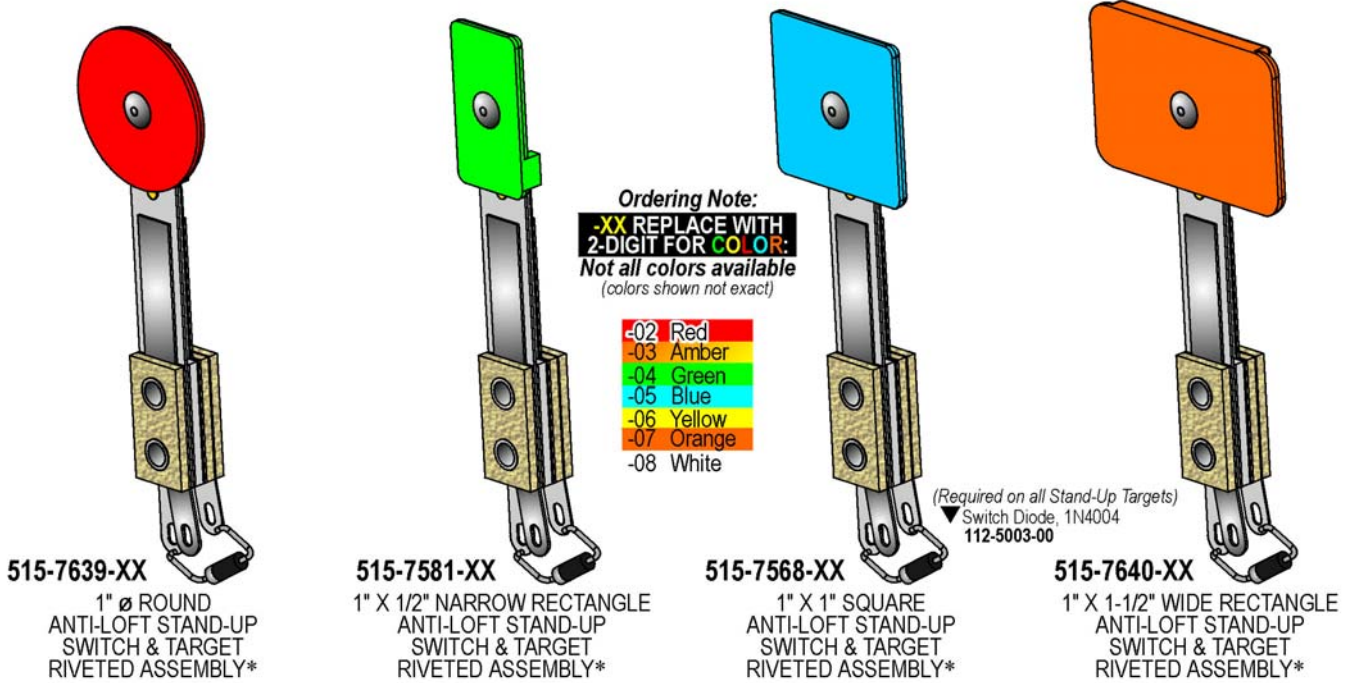
Note: The shapes and sizes shown above are not to scale. Some shapes may no longer be available in every color.

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

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

APPENDIX I

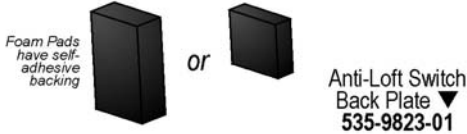
Anti-Loft Stand-Up Targets



*Some targets may require the lugs position be changed to the left or to the right, depending on the application; these targets will have a different part number and are called out in the game manual they are used in (see Section 4, Chapter 1, Parts Identification & Location, Playfield ... -Switches.) Review the game manual for the game desired for the original target used or application.

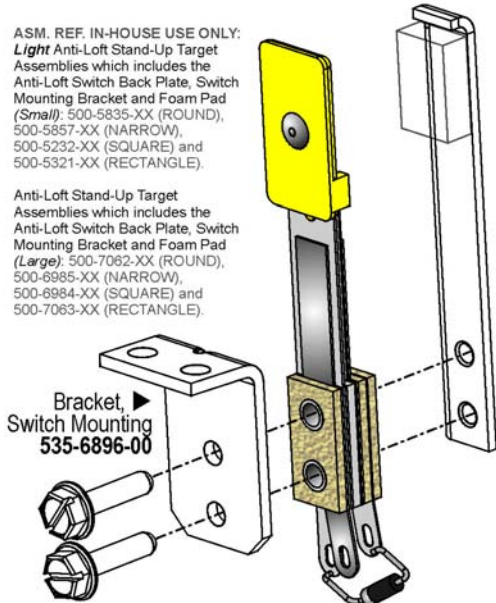
For Anti-Loft Application use
 Large Foam Pad,
 5/8" X 7/16" X 3/16" Thick
626-5078-00

For > Light < Anti-Loft Application use
 Small Foam Pad,
 7/16" X 7/16" X 1/8" Thick
626-5029-00

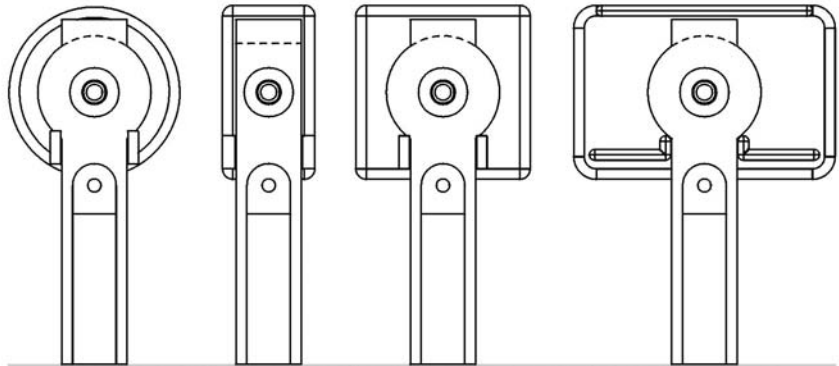


ASM. REF. IN-HOUSE USE ONLY:
Light Anti-Loft Stand-Up Target Assemblies which includes the Anti-Loft Switch Back Plate, Switch Mounting Bracket and Foam Pad (Small): 500-5835-XX (ROUND), 500-5857-XX (NARROW), 500-5232-XX (SQUARE) and 500-5321-XX (RECTANGLE).

Anti-Loft Stand-Up Target Assemblies which includes the Anti-Loft Switch Back Plate, Switch Mounting Bracket and Foam Pad (Large): 500-7082-XX (ROUND), 500-6985-XX (NARROW), 500-6984-XX (SQUARE) and 500-7063-XX (RECTANGLE).



▲ #6-32 X 5/8" Slotted HWH Swage (Zinc) Screws (Qty. 2/per) **237-5976-04**



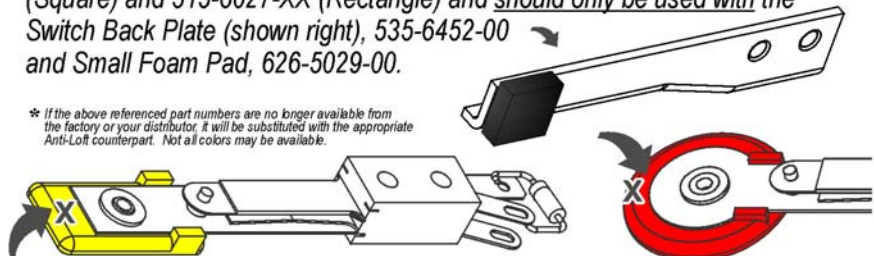
REAR VIEWS OF ANTI-LOFT TARGET & SWITCH ASSEMBLIES

The material of the Anti-Loft Switch has been extended higher to be used with the Anti-Loft Switch Back Plate. **IMPORTANT:** Switch & Target Assemblies (X) without the extension (the predecessors) **SHOULD NOT** be used with an Anti-Loft Switch Back Plate (shown left).

APPENDIX REFERENCE FOR PINBALL GAMES WHICH USED THE BELOW SWITCH & TARGET ASSEMBLIES NOTE:

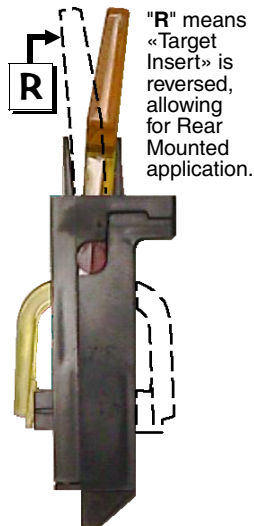
The Switch & Target Assemblies (X) without the extension have the following part numbers*: 515-5966-XX (Round), 515-5967-XX (Narrow), 515-5162-XX (Square) and 515-6027-XX (Rectangle) and should only be used with the Switch Back Plate (shown right), 535-6452-00 and Small Foam Pad, 626-5029-00.

* If the above referenced part numbers are no longer available from the factory or your distributor, it will be substituted with the appropriate Anti-Loft counterpart. Not all colors may be available.



APPENDIX I

Modular Stand-Up Targets



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



Take Note:

- 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 number for the color desired as described in the Color Chart below. As of print date, the following colors were used :
 -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)
- For location(s) and type of Stand-Up Targets used, if any, see Section 4, Chapter 1, Parts Identification & Location.

-XX REPLACE WITH 2-DIGIT FOR COLOR:

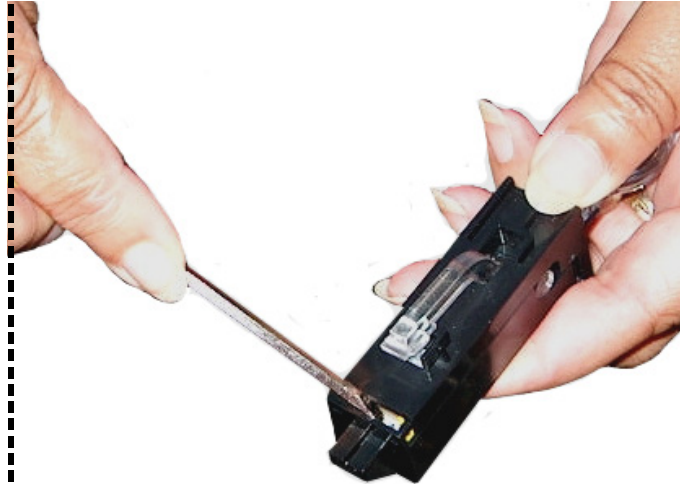
- 00 Black
- 01 Clear
- 02 Red
- 03 Amber
- 04 Green
- 05 Blue
- 06 Yellow
- 07 Orange
- 08 White
- 09 Purple
- 10 Fluor. Orange
- 11 Fluor. Green
- 12 Fluor. Blue
- 13 Teal Green
- 14 Gray
- 15 Luminescent
- 16 Gold

Note: Not all colors available.

Nr.	STAND-UP TARGET PARTS	SPI PART Nr.
A	Modular Stand-Up Target Narrow Assy.	500-6138-XX
	Stand-Up Target Narrow (Insert)	545-6138-XX
B	Modular Stand-Up Target Square Assy.	500-6139-XX
	Stand-Up Target Square (Insert)	545-6139-XX
C	Modular Stand-Up Target Rectangle Assy.	500-6228-XX
	Stand-Up Target Rectangle (Insert)	545-6228-XX
D	Modular Stand-Up Target Round Assy.	500-6075-XX
	Stand-Up Target Round (Insert)	545-6075-XX
E	Mod. Stand-Up Target 1" Spherical Assy.	500-6189-XX
	Stand-Up Target 1" Spherical (Insert)	545-6189-XX

To Replace the « Target Insert » or change Target Orientation :

Items A-E Note: For the Target Assembly use the "500-" SPI Part Number(s) shown in the Parts Table below. To receive the Target Assembly with the « Target Insert » « Reversed » simply add a "R" at the end of the Part Number. See Side View picture left to compare (dashed line shows target reversed). For just the «Target Insert» use the "545-" SPI Part Number.



To reverse it yourself or to just change the insert:

- With a small flat head screwdriver, push into the small tab at the bottom of the target front and give a slight twist motion to "pop" the two halves.

- Push the Target Insert bottom in at the same time while you slide the top (front) part up, then let go of the insert as the two halves come apart.



- Replace target or reinsert it into the other size while sliding the two halves back together.

Note: If you were reversing the orientation, don't forget to also turn the Switch Actuator PCB 180°. Test Switch.

APPENDIX J

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

If more than one Pricing Scheme is available for countries listed, the **F.** listed beside the option, denotes the Factory Default Setting.

FOR VIEWS OF THE LATEST or OPTIONAL USA, INTERNATIONAL / EURO AND CUSTOM COIN CARDS, VISIT OUR WEBSITE.

Not Shown USA 755-5400-10 Tournament Option \$2 = X1; 755-5400-11 Tournament Option \$1.50 = X1

USA 10 F. 755-5400-11 Front		USA 10 755-5400-11 Back		USA 2-7 or CANADA 755-5400-02 Front		FOR CUSTOM PRICING † 755-5400-01, -02 or -04 Back		USA 3 with ToPS™ 755-5400-03 or -09 Front		USA 5 with ToPS™ 755-5400-03 Back / -08 Front	
AUSTRALIA 1 F. 755-5406-00 Front		AUSTRALIA 2 755-5406-00 Back		CROATIA 755-5410-00 Front		FOR CUSTOM PRICING † 755-5410-00 Back		DENMARK 1 F. 755-5402-00 Front		DENMARK 2 755-5402-00 Back	
JAPAN 1 755-5408-01 Front		JAPAN 2 F. 755-5408-01 Back		MIDDLE EAST 755-5400-06 Front		ANY COUNTRY CAN USE 755-5400-06 Back		NEW ZEALAND 1 F. 755-5406-00 Back		NEW ZEALAND 2 755-5406-00 Front	
NORWAY 1 F. 755-5403-01 Front		NORWAY 2 755-5403-01 Back		RUSSIA F. 755-5411-00 Front		RUSSIA (ALTERNATE) 755-5411-00 Back		SOUTH AFRICA 755-5409-01 Front		FOR CUSTOM PRICING † 755-5409-01 Back	
SWEDEN 1 F. 755-5404-00 Front		SWEDEN 2 755-5404-00 Back		SWITZERLAND 1 F. 755-5405-00 Front		SWITZERLAND 2 755-5405-00 Back		TAIWAN 755-5412-00 Front		FOR CUSTOM PRICING † 755-5412-00 Back	
UK 1 755-5407-00 Front		UK 3 755-5407-00 Back		UK 5 F. 755-5407-01 Front		FOR CUSTOM PRICING † 755-5407-01 Back		Appendix J Notes: 1. Coin Card on Game is determined by original shipping country destination. 2. Optional Coin Card(s), are available via your distributor or via free download @ www.sterpinball.com/coinagecards.shtml . Older style Coin Cards (foreign or domestic) not available on our website or no longer available through your distributor, are obsolete. 3. Coin Cards which have a Blank Backside can be used for †Custom Pricing.			

Not Shown EURO 755-5401-20 Tournament Custom (can fill in your own pricing).

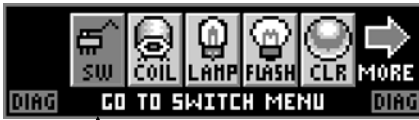
EURO 1 755-5401-01 1-Side Only		EURO 2 755-5401-02 1-Side Only		EURO 3 755-5401-03 1-Side Only		EURO 4 755-5401-04 1-Side Only		EURO 5 755-5401-05 1-Side Only		EURO 6 755-5401-06 1-Side Only	
EURO 7 755-5401-07 1-Side Only		EURO 8 755-5401-08 1-Side Only		EURO 9 755-5401-09 1-Side Only		EURO 10 755-5401-10 1-Side Only		EURO 11 755-5401-11 1-Side Only		EURO 12 755-5401-12 1-Side Only	

▶ EURO FACTORY DEFAULT SUMMARY TABLE ◀

EURO 1	EURO 2	EURO 3	EURO 4	EURO 5	EURO 6	EURO 7	EURO 8	EURO 9	EURO 10	EURO 11	EURO 12
BELGIUM ITALY 1 PORTUGAL	GERMANY 2	NETHERLANDS SPAIN			GREECE		FINLAND	AUSTRIA	FRANCE		

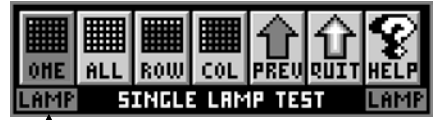
Section 3, Chapter 4, GO TO ADJUSTMENTS MENU, Adj. 18, Game Pricing, USA & International (non-Euro) and Euro 1-12 Summary & International (Euro) Standard Pricing Select Tables, summarizes Standard or Custom Pricing Schemes & the Dip Switch Setting required.





SWITCH MATRIX GRID & DEDICATED SWITCHES (for notes & locations, see Page DR. 4 or 17)

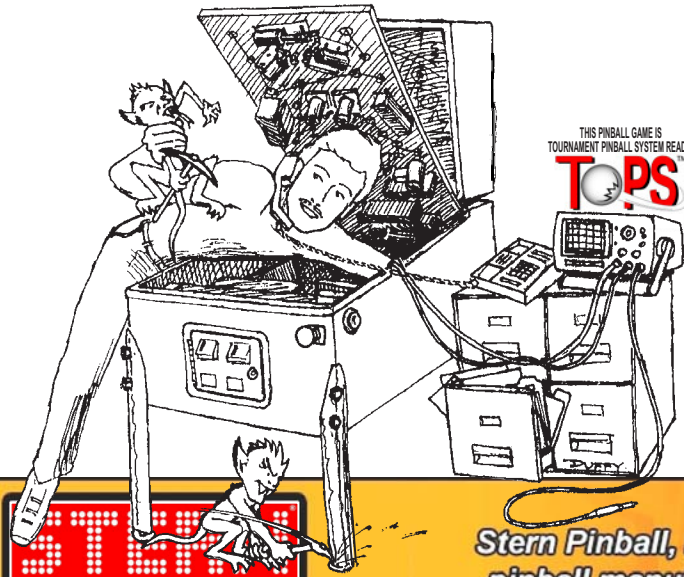
Column (Drive)	1: Q1	2: Q2	3: Q3	4: Q4	5: Q5	6: Q6	7: Q7	8: Q8	GROUND	GROUND
Row (Return)	GRN-BRN CN5-P1	GRN-RED CN5-P3	GRN-ORG CN5-P4	GRN-YEL CN5-P5	GRN-BLK CN5-P6	GRN-BLU CN5-P7	GRN-VIO CN5-P8	GRN-GRY CN5-P9	IC 206 INPUTS	BLK CN6-P1, -P11
1: U400	1 Cabinet Side	9 Above P/F	17 Below P/F	25 Above P/F	33 Above P/F	41 NOT USED	49 Below P/F	57 Below P/F	1: U206	DS-1 on Cabinet Side
WHT-BRN CN7-P9	LT BUTTON (UK ONLY)	LEFT RAMP	LEFT EJECT	RIGHT RAMP	RIGHT ORBIT	NOT USED	LEFT BUMPER	LEFT OUTLANE	GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON
Sw. Part Number: 180-5160-00	180-5010-01	180-5186-01	180-5087-00	180-5087-00	180-5087-00	180-5015-04	500-6227-02	500-6227-02	Sw. Part Number: 180-5149-00 on Flipper	180-5160-00
2: U400	2 Coin Door	10 Below P/F	18 Above P/F	26 Below P/F	34 Below P/F	42 NOT USED	50 Below P/F	58 Below P/F	2: U206	DS-2 Below Playfield
WHT-RED CN7-P8	4TH COIN SLOT	SAFE LIMIT	LEFT ORBIT	DROP TARGET	LEFT STANDUP	NOT USED	RIGHT BUMPER	LEFT RETURN LANE	GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke)
Sw. Part Number: 180-5204-00	180-5198-00	180-5087-00	180-5158-00	180-5132-00	180-5015-04	180-5015-04	500-6227-02	500-6227-02	Sw. Part Number: 180-5149-00 on Flipper	180-5160-00
3: U400	3 Coin Door	11 Below P/F	19 Above P/F	27 Above P/F	35 Below P/F	43 NOT USED	51 Below P/F	59 Below P/F	3: U206	DS-3 on Cabinet Side
WHT-ORG CN7-P7	6TH COIN SLOT	4-BALL TROUGH #1 (LEFT)	BING 1	SPINNER	CENTER STANDUP	NOT USED	BOTTOM BUMPER	LEFT SLINGSHOT	GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON
Sw. Part Number: Future Use	180-5119-02	180-5119-02	180-5010-04	180-5132-00	180-5015-04	180-5015-04	500-6227-02	180-5054-00 (x2)	Sw. Part Number: 180-5160-00	180-5160-00
4: U400	4 Coin Door	12 Below P/F	20 Above P/F	28 Below P/F	36 Below P/F	44 NOT USED	52 NOT USED	60 Below P/F	4: U206	DS-4 Below Playfield
WHT-YEL CN7-P6	RIGHT COIN SLOT	4-BALL TROUGH #2	BING 2	CENTER EJECT	R. 2-BANK TOP	NOT USED	NOT USED	RIGHT OUTLANE	GRY-YEL CN6-P6	#4 RIGHT FLIPPER E.O.S (End-of-Stroke)
Sw. Part Number: 180-5204-00	180-5119-02	180-5119-02	180-5186-01	180-5133-00	180-5133-00	500-6227-02	500-6227-02	500-6227-02	Sw. Part Number: 180-5149-00 on Flipper	180-5192-00
5: U401	5 Coin Door	13 Below P/F	21 Above P/F	29 Above P/F	37 Below P/F	45 NOT USED	53 In Cabinet	61 Below P/F	5: U206	DS-5 NOT USED
WHT-GRN CN7-P5	CENTER COIN SLOT/DBA	4-BALL TROUGH #3	SAFE HIT LEFT	RIGHT RAMP EXIT	R. 2-BANK BOTTOM	NOT USED	SLAM TILT (OPT)	RIGHT RETURN LANE	GRY-GRN CN6-P7	NOT USED
Sw. Part Number: 180-5204-00	180-5119-02	180-5119-02	180-5010-01	180-5133-00	180-5133-00	180-5174-00	500-6227-02	500-6227-02	Sw. Part Number: 180-5149-00 on Flipper	180-5192-00
6: U401	6 Coin Door	14 Below P/F	22 Above P/F	30 NOT USED	38 Below P/F	46 NOT USED	54 In Cabinet	62 Below P/F	6: U206	DS-6 on Coin Door
WHT-BLU CN7-P3	LEFT COIN SLOT	4-BALL TROUGH VUK OPTO	CENTER LOCK 1	NOT USED	LEFT TOP LANE	NOT USED	START BUTTON	RIGHT SLINGSHOT	GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (In Test: LEFT)
Sw. Part Number: 180-5204-00	See Sw. 14 Note	180-5119-02	180-5119-02	500-6227-02	500-6227-02	180-5174-00	180-5054-00 (x2)	180-5054-00 (x2)	Sw. Part Number: 180-5192-00	180-5192-00
7: U401	7 Coin Door	15 Below P/F	23 Above P/F	31 Above P/F	39 Below P/F	47 NOT USED	55 In Cabinet	63 NOT USED	7: U206	DS-7 on Coin Door
WHT-VIO CN7-P2	5TH COIN SLOT	4-BALL STACKING OPTO	CENTER LOCK 2	BOAT LOCK 1	MIDDLE TOP LANE	NOT USED	TOURNAMENT START	NOT USED	GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT)
Sw. Part Number: Future Use	See Sw. 15 Note	180-5119-02	180-5119-02	180-5119-02	500-6227-02	500-6227-02	180-5174-00	180-5174-00	Sw. Part Number: 180-5192-00	180-5192-00
8: U401	8 Cabinet Side	16 Below P/F	24 Above P/F	32 Above P/F	40 Below P/F	48 NOT USED	56 In Cabinet	64 NOT USED	8: U206	DS-8 on Coin Door
WHT-GRY CN7-P1	RT BUTTON (UK ONLY)	SHOOTER LANE	SAFE HIT RIGHT	BOAT LOCK 2	RIGHT TOP LANE	NOT USED	PLUMB BOB TILT	NOT USED	GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER)
Sw. Part Number: 180-5160-00	180-5157-00	180-5119-02	180-5119-02	180-5119-02	500-6227-02	500-6227-02	See Sw. 56 Note	See Sw. 56 Note	Sw. Part Number: 180-5192-00	180-5192-00



LAMP MATRIX GRID (for notes & locations, see Page DR. 5 or 23)

Column (18v)	1: U17	2: U16	3: U15	4: U14	5: U13	6: U12	7: U11	8: U10
Row (Ground)	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	1 #555 Clear Bulb	2 #555 Clear Bulb	3 #555 Clear Bulb	4 #555 Clear Bulb	5 #555 Clear Bulb	6 #555 Clear Bulb	7 #555 Clear Bulb	8 #44 Clear Bulb
RED-BRN J12-P1	(RANKS) ASSOCIATE	(RANKS) SOLDIER	(RANKS) GOOD EARNER	(RANKS) ACTING CAPO	(RANKS) CAPO	(RANKS) CONSIGLIERE	(RANKS) UNDER BOSS	(RANKS) BOSS
2: Q34	9 #44 Clear Bulb	10 #44 Clear Bulb	11 #44 Clear Bulb	12 #44 Clear Bulb	13 #44 Clear Bulb	14 #44 Clear Bulb	15 #44 Clear Bulb	16 #44 Clear Bulb
RED-BLK J12-P2	BOSS: FOOD	BOSS: TRUCK HEIST	BOSS: BADA BING	BOSS: EPISODES	BOSS: SAFE	BOSS: RIP	BOSS: SUPER JACKPOT	BOSS: MEADOWLANDS
3: Q35	17 #555 Clear Bulb	18 #555 Clear Bulb	19 #555 Clear Bulb	20 #555 Clear Bulb	21 #555 Clear Bulb	22 #555 Clear Bulb	23 #555 Clear Bulb	24 #44 LED Bulb
RED-ORG J12-P3	(F) ISH LEFT OUTLANE	F (I) SH LT RTRN LANE	FI (S) H RT RTRN LANE	FIS (H) RIGHT OUTLANE	PORK STORE STANDUP	LIGHT STANDUP	FISH	THE STUGOTS
4: Q36	25 #555 Clear Bulb	26 #555 Clear Bulb	27 #555 Clear Bulb	28 #555 Clear Bulb	29 #555 Clear Bulb	30 #555 Clear Bulb	31 #555 Clear Bulb	32 #555 Clear Bulb
RED-YEL J12-P4	LEFT TRUCK HEIST 1 (BOT)	LEFT TRUCK HEIST 2	LEFT TRUCK HEIST 3	L ORBIT FOOD	L ORBIT ENVELOPE	LEFT ORBIT ARROW	BADA BING 1 (BOT)	BADA BING 2
5: Q37	33 #555 Clear Bulb	34 #555 Clear Bulb	35 #555 Clear Bulb	36 #555 Clear Bulb	37 #555 Clear Bulb	38 #555 Clear Bulb	39 #555 Clear Bulb	40 #555 Clear Bulb
RED-GRN J12-P5	BADA BING 3	L RAMP FOOD	L RAMP ENVELOPE	LEFT RAMP ARROW	START EPISODE	PORK STORE	SPECIAL	EXTRA BALL
6: Q38	41 #555 Clear Bulb	42 #555 Clear Bulb	43 #555 Clear Bulb	44 #555 Clear Bulb	45 #555 Clear Bulb	46 #555 Clear Bulb	47 #555 Clear Bulb	48 #555 Clear Bulb
RED-BLU J12-P6	ADVANCE RANK	CENTER ARROW	LIGHT LOCK	LOCK 1	LOCK 2	JACKPOT	MEADOWLANDS 1	MEADOWLANDS 2
7: Q39	49 #555 Clear Bulb	50 #555 Clear Bulb	51 #555 Clear Bulb	52 #555 Clear Bulb	53 #555 Clear Bulb	54 #555 Clear Bulb	55 #555 Clear Bulb	56 #555 Clear Bulb
RED-VIO J12-P8	MEADOWLANDS 3	R RAMP FOOD	R RAMP ENVELOPE	RIGHT RAMP ARROW	RIGHT TRUCK HEIST 1 (BOT)	RIGHT TRUCK HEIST 2	RIGHT TRUCK HEIST 3	R ORBIT FOOD
8: Q40	57 #555 Clear Bulb	58 #555 Clear Bulb	59 #555 Clear Bulb	60 #555 Clear Bulb	61 #555 Clear Bulb	62 NOT USED	63 NOT USED	64 NOT USED
RED-GRY J12-P9	R ORBIT ENVELOPE	RIGHT ORBIT ARROW	(R.) I. P. LEFT TOP LANE	R. (L.) P. MID. TOP LANE	R. I. (P.) RT. TOP LANE	NOT USED	NOT USED	NOT USED
9: Q41	65 #44 Clear Bulb	66 #44 Clear Bulb	67 #44 Clear Bulb	68 #44 Clear Bulb	69 #44 Clear Bulb	70 #44 Clear Bulb	71 #44 Clear Bulb	72 #44 Clear Bulb
RED-WHT J12-P10	RIP 1 (TOP LEFT)	RIP 2	RIP 3	RIP 4	RIP 5 (BOT LEFT)	RIP 6	RIP 7	RIP 8
10: Q42	73 #555 Yel. Bulb	74 #555 Yel. Bulb	75 #555 Yel. Bulb	76 #555 Yel. Bulb	77 #555 Yel. Bulb	78 #555 Clear Bulb	79 OPTIONAL	80 #555 Clear Bulb
RED J12-P11	EPISODES: ARSON	EPISODES: EXTERMINATE	EPISODES: HORSE RACE	EPISODES: EXEC. GAME	EPISODES: SATISFACTION	SHOOT AGAIN	TOURNAMENT BUTTON	START BUTTON

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Offering Service Game Manual excerpts:
Parts Identification & Location, Drawings for Major Assemblies & Ramps and Appendixes A-J (*updated with each game*)

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Offering game code for all Data East®, Sega™ and STERN® Pinballs (*EPROM Programmer required*)

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Schematics, Theory of Operation

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Drawings on the White Star Board System™

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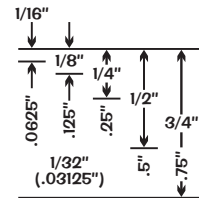
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Radio Shack Component Catalogue



Metric Conversion



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

For metric, multiply the inch value by the metric value:

example: 5" X 2.54 cm =
12.7 cm or 127 mm

For US, multiply the metric value by the inch value:

example: 13 cm X .3937" =
5.1181"

1-800-KICKERS



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Customary
Inch Ruler



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7 8 0 - 5 0 8 5 - 0 0