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

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

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

STERN PINBALL, INC.

DR. DR. DR.
NO YES END PREV QUIT ?

THIS PINBALL GAME IS TOPS™ TOURNAMENT PINBALL SYSTEM READY!
Order the optional TOPS™ Kit SPI PN: 502-5011-00

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



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

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

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Printed in the U.S.A.
February 2005

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****).*

LOOK

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

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

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!



New to our Pinball Games?

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

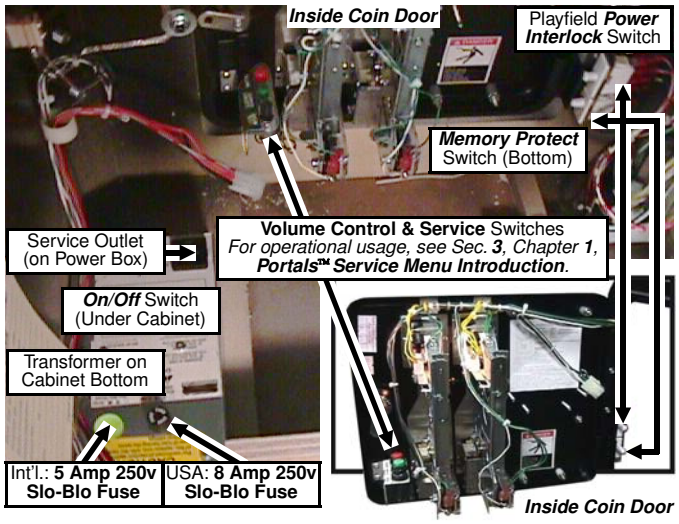
Backbox PCB Fuses, ROMs, Bridges, Relays, P/F & Cabinet Fuses, Cab. Switches

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

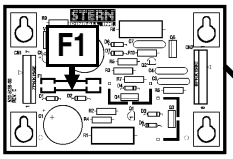
QUICK REFERENCE FUSE CHART

Backbox Fuses			
LOC:	**DISPLAY POWER SUPPLY (P.S.) BOARD**		
F1	¾A250v 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
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



◀ Display Power Supply Bd.

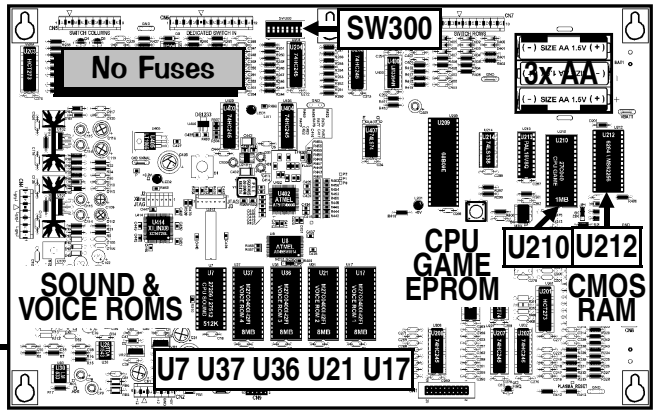


Solenoid Expander Board ‡

Tournament Interface Board ‡

‡ UK or Tournament GAMES ONLY

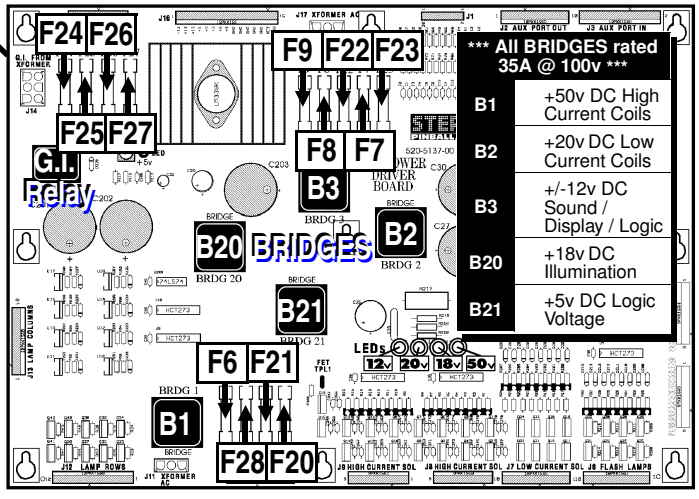
For more info., see Section ***5****, Chp.* ***4****,* ***PCBs*** *(Yellow Pages)*



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

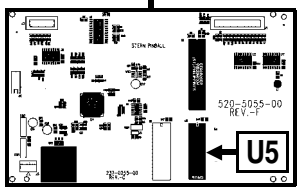
CPU/Sound Bd. II w/ATMEL ▲

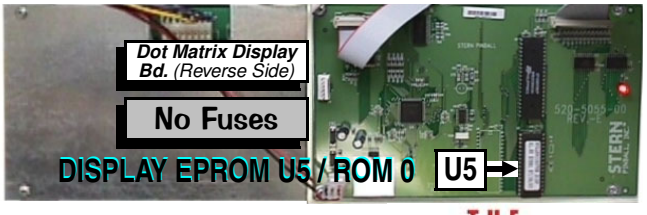
I/O Power Driver Board ▼



Display Controller Bd. ▶

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





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

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

How It Works

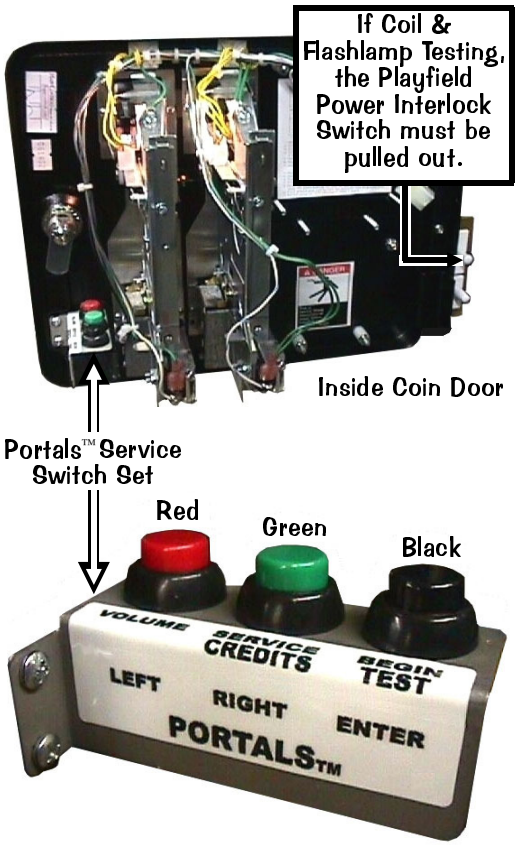
First, the operator / technician must enter the ***Service Menu Mode*** *(for a complete description of the* ***Portals™ Service Menu*** *and* ***ICONS Read!*** *Section* ***3****, Chapter* ***1****).* To get into the ***Service Menu Mode***, power-up the game *(if not already)* and open the **Coin Door**.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

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

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



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



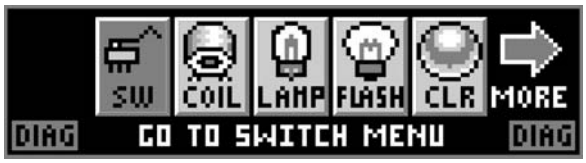
While in the **Portals™ Service Menu**, the **Start Button** can be used in lieu of the **Black Button**; the **Left** & **Right Flipper Buttons** can be used in lieu of the **Red** & **Green Buttons**. However, in *Switch* or *Active Switch Tests* ***only*** the **Red** & **Green Buttons** can be used.



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



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



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









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

DIAGNOSTIC AIDS



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



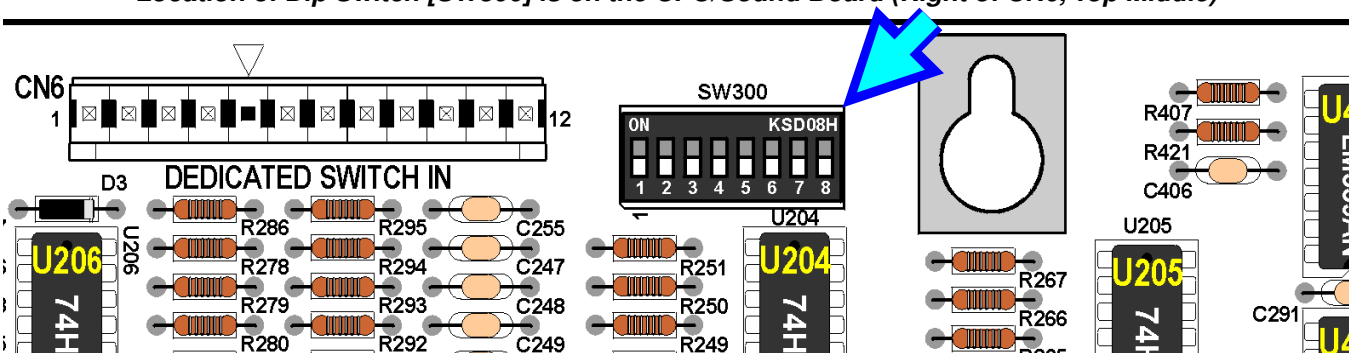
This ***display*** is shown momentarily during **Game Mode** or **Power-Up** to alert the operator of a coil malfunction *(coil doesn't energize or coil fires a multiple number of times)*. **OPERATOR ALERT!** works by monitoring any *switch activated coil* that has the potential to trap a ball when disabled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



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**).*

CPU DIP SWITCH SETTINGS

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



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

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

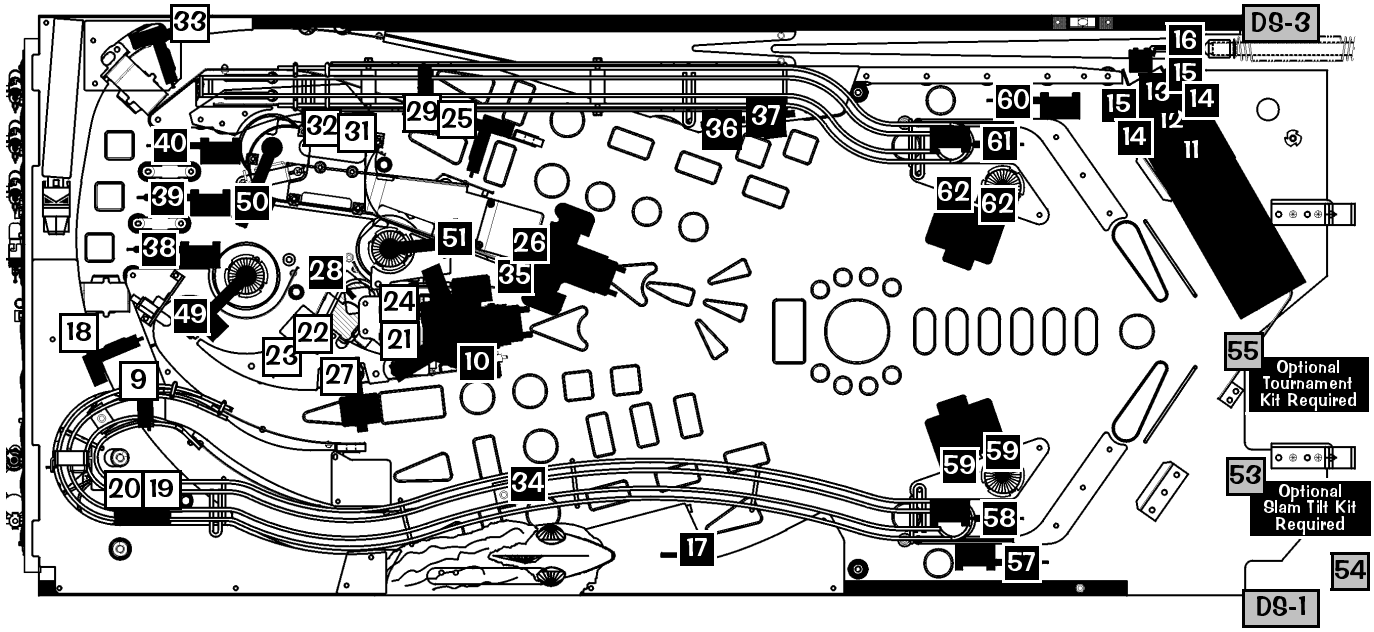


SWITCH MENU: SWITCH, ACTIVE & DEDICATED

SWITCH MATRIX GRID, DEDICATED SWITCHES & LOCATIONS

Column (Drive) / Row (Return)	1: Q1	2: Q2	3: Q3	4: Q4	5: Q5	6: Q6	7: Q7	8: Q8
	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 WHT-BRN CN7-P9	1 Cabinet Side: LT BUTTON (UK ONLY)	9 Above P/F: LEFT RAMP	17 Below P/F: LEFT EJECT	25 Above P/F: RIGHT RAMP	33 Above P/F: RIGHT ORBIT	41 NOT USED	49 Below P/F: LEFT BUMPER	57 Below P/F: 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 WHT-RED CN7-P8	2 Coin Door: 4TH COIN SLOT	10 Below P/F: SAFE LIMIT	18 Above P/F: LEFT ORBIT	26 Below P/F: DROP TARGET	34 Below P/F: LEFT STANDUP	42 NOT USED	50 Below P/F: RIGHT BUMPER	58 Below P/F: 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 WHT-ORG CN7-P7	3 Coin Door: 6TH COIN SLOT	11 Below P/F: 4-BALL TROUGH #1 (LEFT)	19 Above P/F: BING 1	27 Above P/F: SPINNER	35 Below P/F: CENTER STANDUP	43 NOT USED	51 Below P/F: BOTTOM BUMPER	59 Below P/F: 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 WHT-YEL CN7-P6	4 Coin Door: RIGHT COIN SLOT	12 Below P/F: 4-BALL TROUGH #2	20 Above P/F: BING 2	28 Below P/F: CENTER EJECT	36 Below P/F: R. 2-BANK TOP	44 NOT USED	52 NOT USED	60 Below P/F: 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 WHT-GRN CN7-P5	5 Coin Door: CENTER COIN SLOT / DBA	13 Below P/F: 4-BALL TROUGH #3	21 Above P/F: SAFE HIT LEFT	29 Above P/F: RIGHT RAMP EXIT	37 Below P/F: R. 2-BANK BOTTOM	45 NOT USED	53 In Cabinet: *SLAM TILT (OPT)* [K1]	61 Below P/F: 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 WHT-BLU CN7-P3	6 Coin Door: LEFT COIN SLOT	14 Below P/F: 4-BALL TROUGH VUK OPTO	22 Above P/F: CENTER LOCK 1	30 NOT USED	38 Below P/F: LEFT TOP LANE	46 NOT USED	54 In Cabinet: START BUTTON	62 Below P/F: 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 WHT-VIO CN7-P2	7 Coin Door: 5TH COIN SLOT	15 Below P/F: 4-BALL STACKING OPTO	23 Above P/F: CENTER LOCK 2	31 Above P/F: BOAT LOCK 1	39 Below P/F: MIDDLE TOP LANE	47 NOT USED	55 In Cabinet: *TOURNA-MENT START* [K1]	63 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 WHT-GRY CN7-P1	8 Cabinet Side: RT BUTTON (UK ONLY)	16 Below P/F: SHOOTER LANE	24 Above P/F: SAFE HIT RIGHT	32 Above P/F: BOAT LOCK 2	40 Below P/F: RIGHT TOP LANE	48 NOT USED	56 In Cabinet: PLUMB BOB TILT	64 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 / IC U206 INPUTS	GROUND: BLK CN6-P1, -P11
1: U206 GRY-BRN CN6-P2	DS-1 on Cabinet Side: #1 LEFT FLIPPER BUTTON
Sw. Part Number:	180-5160-00
2: U206 GRY-RED CN6-P3	DS-2 Below Playfield: #2 LEFT FLIPPER E.O.S (End-of-Stroke)
Sw. Part Number:	180-5149-00 *on Flipper*
3: U206 GRY-ORG CN6-P4	DS-3 on Cabinet Side: #3 RIGHT FLIPPER BUTTON
Sw. Part Number:	180-5160-00
4: U206 GRY-YEL CN6-P6	DS-4 Below Playfield: #4 RIGHT FLIPPER E.O.S. (End-of-Stroke)
Sw. Part Number:	180-5149-00 *on Flipper*
5: U206 GRY-GRN CN6-P7	DS-5 NOT USED
Sw. Part Number:	
6: U206 GRY-BLU CN6-P8	DS-6 on Coin Door: #6 VOLUME (RED BUTTON) (In Test: LEFT)
Sw. Part Number:	180-5192-02
7: U206 GRY-VIO CN6-P9	DS-7 on Coin Door: #7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT)
Sw. Part Number:	180-5192-04
8: U206 GRY-BLK CN6-P10	DS-8 on Coin Door: #8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER)
Sw. Part Number:	180-5192-00



Playfield ▲

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

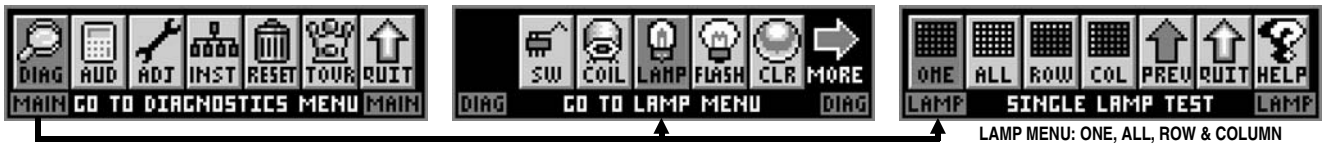
Switch Part Notes: *¥ Yen Coin Switch is 180-5091-00. Part Numbers which start with 515- or 500- include the bracket, target, and/or housing.*
Switches 14 & 15 Part Note: *Transmitter & Receiver OPTO PC Boards are used as Switches:*
Transmitter: 515-0173-00 (Sw. 14 & 15);
Receiver: 515-0174-00 (Sw. 14 & 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: Diode On Terminal Strip, *see Sec.* ***5****, Chp.****2****,* ***Playfield Wiring****.*

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DR. ❹

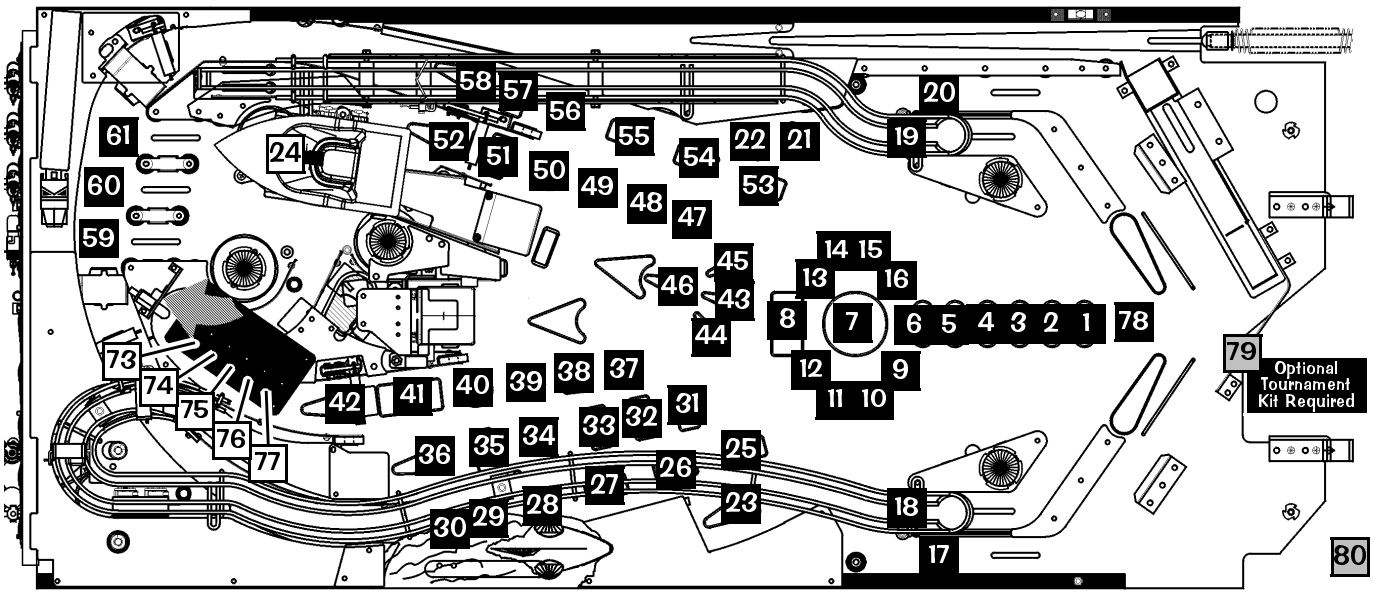
Find-It-In-Front: Dr. Pinball

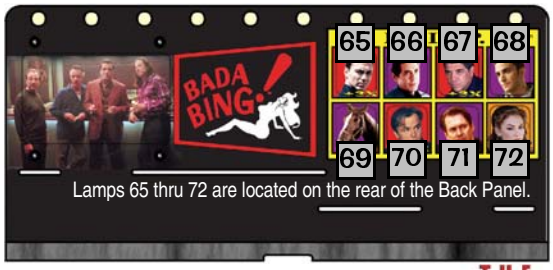


LAMP MENU: ONE, ALL, ROW & COLUMN

LAMP MATRIX GRID & LOCATIONS

Column (18v) / Row (Ground)	1: U17 YEL-BRN J13-P9	2: U16 YEL-RED J13-P8	3: U15 YEL-ORG J13-P7	4: U14 YEL-BLK J13-P6	5: U13 YEL-GRN J13-P5	6: U12 YEL-BLU J13-P4	7: U11 YEL-VIO J13-P3	8: U10 YEL-GRY J13-P1
1: Q33 RED-BRN J12-P1	1 #555 Clear Bulb (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 RED-BLK J12-P2	9 #44 Clear Bulb 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 RED-ORG J12-P3	17 #555 Clear Bulb (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 RED-YEL J12-P4	25 #555 Clear Bulb 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 ($) ENVELOPE	30 #555 Clear Bulb LEFT ORBIT ARROW	31 #555 Clear Bulb BADA BING 1 (BOT)	32 #555 Clear Bulb BADA BING 2
5: Q37 RED-GRN J12-P5	33 #555 Clear Bulb BADA BING 3	34 #555 Clear Bulb L. RAMP FOOD	35 #555 Clear Bulb L. RAMP ($) 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 RED-BLU J12-P6	41 #555 Clear Bulb 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 RED-VIO J12-P8	49 #555 Clear Bulb MEADOWLANDS 3	50 #555 Clear Bulb R. RAMP FOOD	51 #555 Clear Bulb R. RAMP ($) ENVELOPE	52 #555 Clear Bulb RIGHT RAMP ARROW	53 #555 Clear Bulb RIGHT TRUCK HEIST 1 (BOT)	54 #555 Clear Bulb RIGHT TRUCK HEIST 2	55 #555 Clear Bulb RIGHT TRUCK HEIST 3	56 #555 Clear Bulb R. ORBIT FOOD
8: Q40 RED-GRY J12-P9	57 #555 Clear Bulb R. ORBIT ($) 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 NOT USED	63 NOT USED	64 NOT USED
9: Q41 RED-WHT J12-P10	65 #44 Clear Bulb 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 RED J12-P11	73 #555 Yel. Bulb 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.

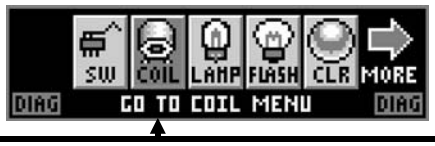
Lamp Part Notes: *#555 Wedge Base Bulb Clear = 165-5002-00.*
#555 Wedge Base Bulb Yellow = 165-5054-06
#44 Bayonet Bulb Clear = 165-5000-44.
*See Section **4**, Chapter **1**, **Parts Identification & Location**, Pages **78-80** for more details on bulbs and corresponding sockets.*
***Some Lamp Diodes may be located under the playfield, in the Cabinet or Backbox** on Terminal Strips and not on or with the Lamp Socket.*
DOTS: **D**iode **O**n **T**erminal **S**trip, *see Sec. **5**, Chapter **2**, **Playfield Wiring**.*

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

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DR. 5







COIL MENU: SINGLE COIL & CYCLING COIL

COILS DETAILED CHART TABLE

	High Current Coils Group 1	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BRN-BLK	J8-P1	26-1200 ↻ 090-5044-00T
#2	AUTO LAUNCH	Q2		YEL-VIO	J10-P4/5	50v DC	BRN-RED	J8-P3	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 Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#9	LEFT BUMPER	Q9	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BLU-BRN	J9-P1	26-1200 ↻ 090-5044-00T
#10	RIGHT BUMPER	Q10		YEL-VIO	J10-P4/5	50v DC	BLU-RED	J9-P2	26-1200 ↻ 090-5044-00T
#11	BOTTOM BUMPER	Q11		YEL-VIO	J10-P4/5	50v DC	BLU-ORG	J9-P4	26-1200 ↻ 090-5044-00B
#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 Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#17	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 erminal S trip (if noted)

	Low Current Coils Group 2	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#25	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

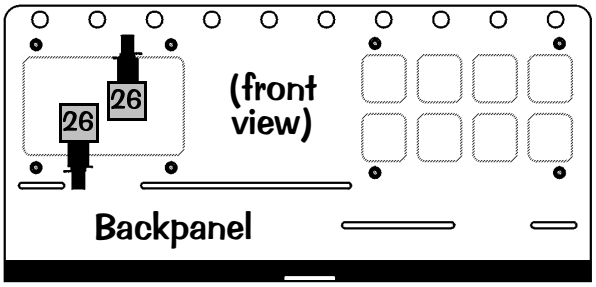
Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: Q19-Q20, Q25-Q29, Q31-Q32)

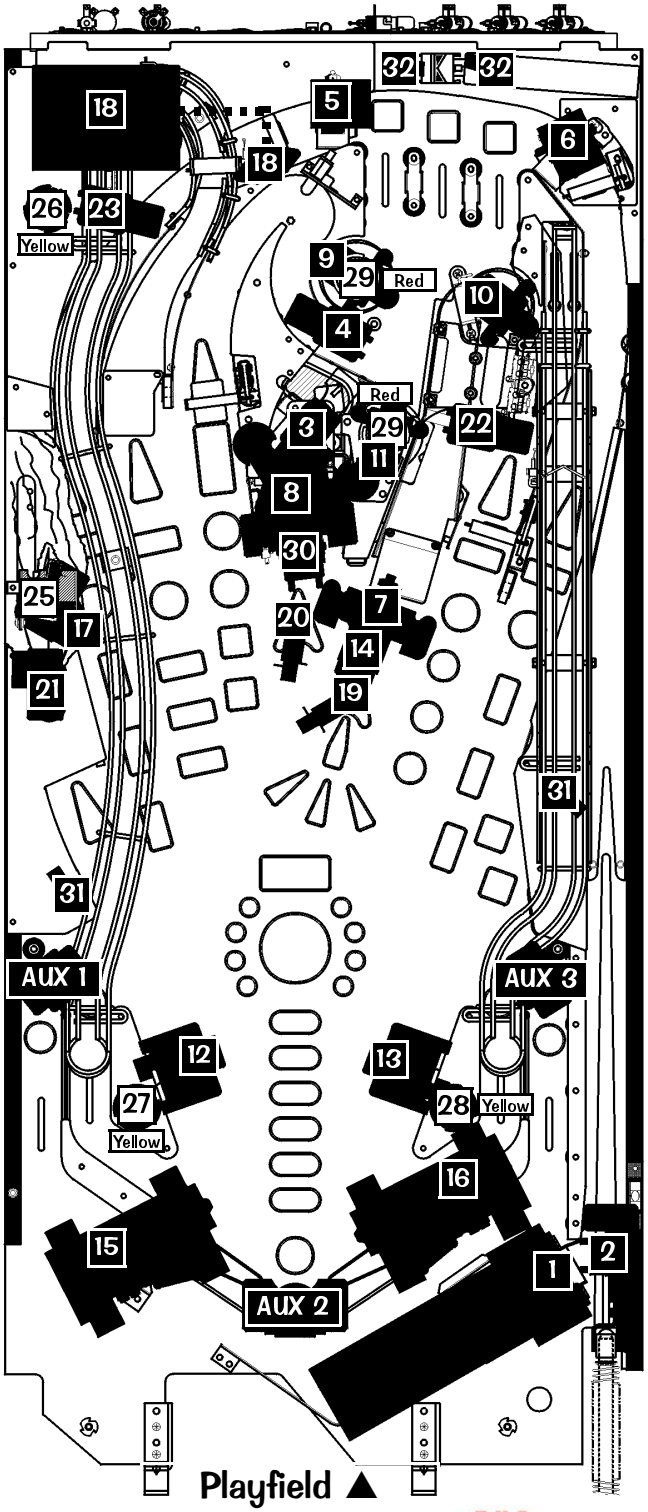
	Auxiliary (UK ONLY)	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn
	AUX 1: LEFT UP/DOWN POST	Q1	UK 3X Trans. Driver Board	BROWN	J7-P1	20v DC	WHITE	J2-P3	26-1200 ↻ 090-5044-00T
	AUX 2: 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 -00**B** *or* -00**T** can be used for coil replacements. *B/T listed is preferable for easier diode access & may differ on game.*

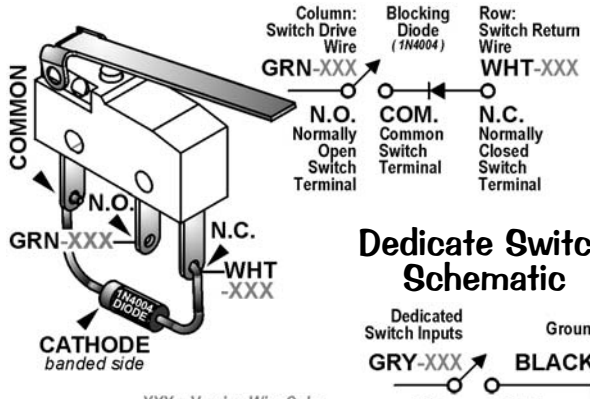
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COIL & FLASH LAMP LOCATIONS



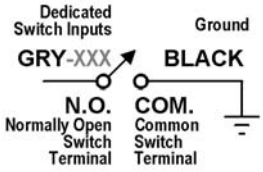


Typical Switch Wiring & Schematic

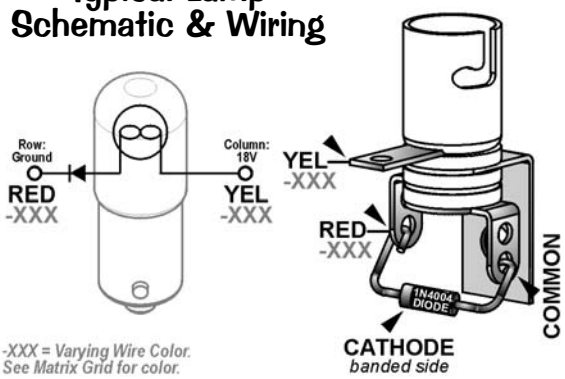


-XXX = Varying Wire Color.
See Matrix Grid for color.

Dedicate Switch Schematic

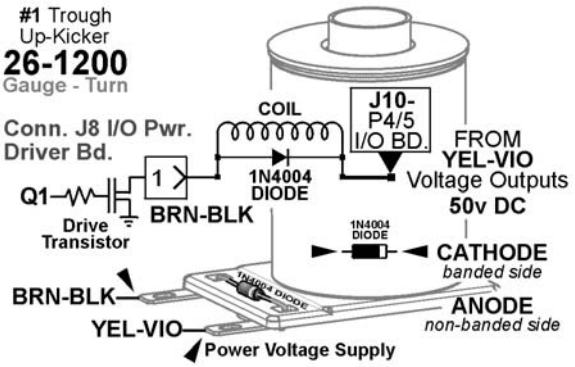


Typical Lamp Schematic & Wiring



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

Typical Coil Schematic & Wiring



= Coils / Flash Lamps above Playfield.

= Coils / Flash Lamps below Playfield.

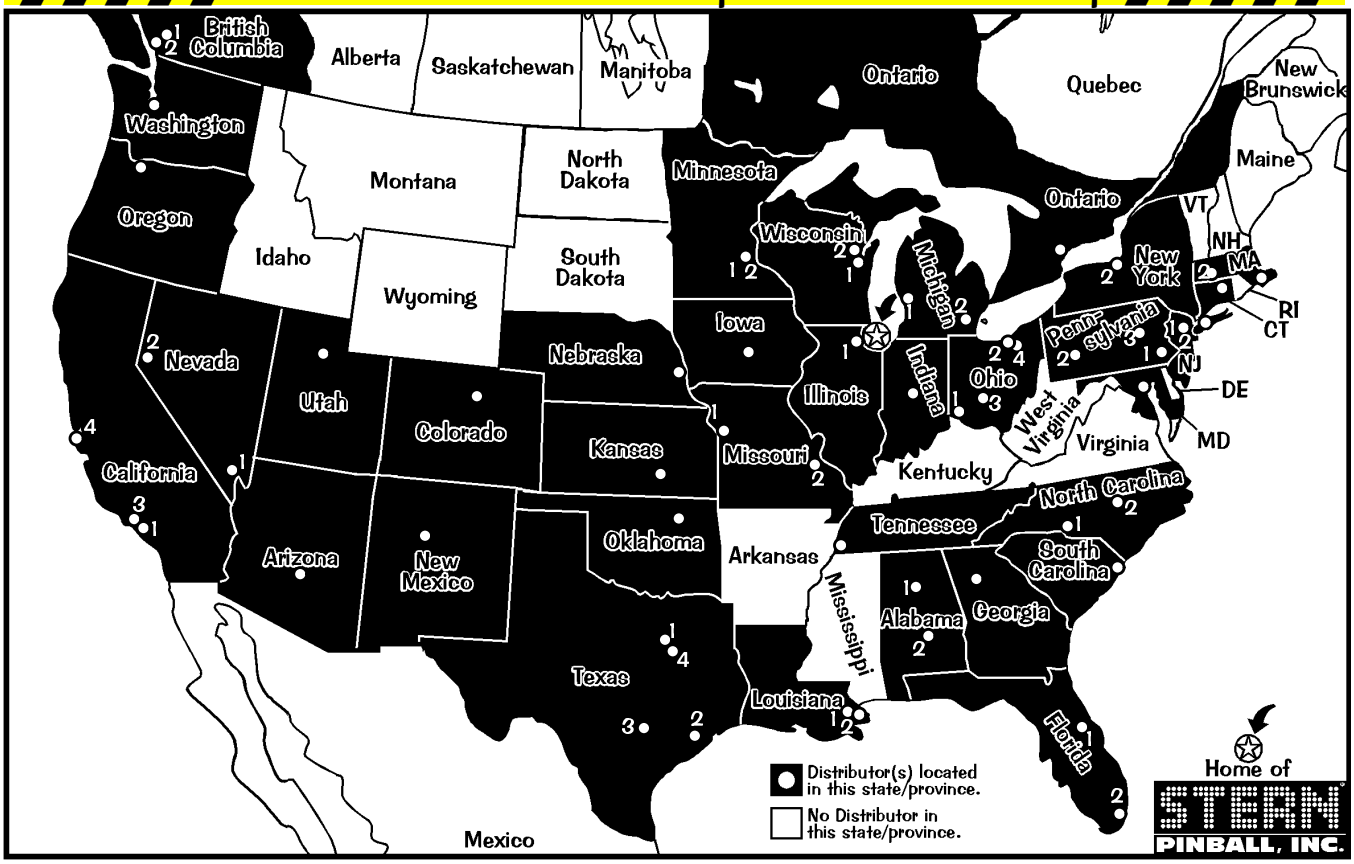
= Coils / Flash Lamps not on Playfield.

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

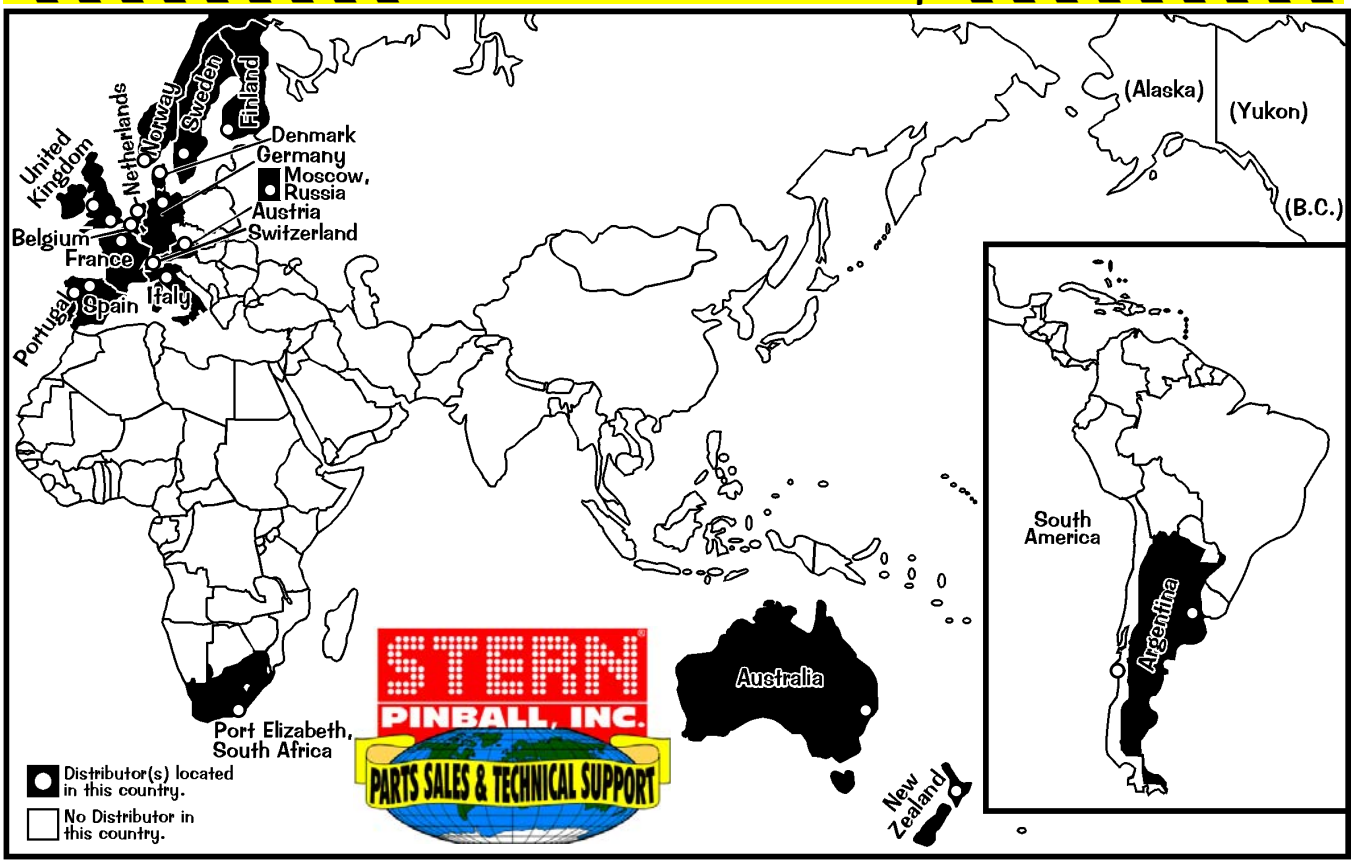
Some Coil or Flash Lamp Diodes may be located under the playfield, in the Cabinet or Backbox *on Terminal Strips* ***or*** *Diode Boards and not on the assemblies.*
DOTS: D iode O n T erminal S trip *See Section* ***5****, Chapter* ***2****,* ***Playfield Wiring****.*

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 Map



International Distributors Map



For *Parts & Service*, call your nearest Distributor. View the above maps & the directories on the next page to locate your closest Distributor in your state, province, or country. Distributors and phone numbers are subject to change. Call **Stern® Pinball, Inc.** *(Parts Sales & Technical Support)* with any questions or if your Distributor cannot help you: **1-800-542-5377** (in **USA** or **Canada**) or **1-708-786-5466**. Visit us at www.SternPinball.com for current Distributor Information & other pinball needs.

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Domestic Pinball & Redemption Distributors Directory

ALABAMA

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

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

ARIZONA

Betson West
Phoenix
1-480-380-8857

Mountain Coin
Phoenix
1-602-269-7596

CALIFORNIA

Betson West
Buena Park (1)
1-714-228-7500
So. San Francisco (2)
1-650-952-4220

C.A. Robinson
Los Angeles (3)
1-323-735-3001
San Francisco (4)
1-650-871-4280

COLORADO

Mountain Coin
Denver
1-303-427-2133

CONNECTICUT

TDM Distributing
Williamantic
1-860-423-1403

FLORIDA

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

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

GEORGIA

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

ILLINOIS

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

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

IOWA

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

Moss Distributing
Des Moines
1-515-266-6422

INDIANA

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

Shaffer Distributing
Indianapolis
1-317-899-2530

KANSAS

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

LOUISIANA

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

Parts & Service Only:

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

MARYLAND

Betson Enterprises
Baltimore
1-410-646-4100

Parts & Service Only:

Weiner Distributing
Baltimore
1-410-525-2600

MASSACHUSETTS

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

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

MICHIGAN

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

Shaffer Distributing
Livonia (2)
1-734-432-1040

MINNESOTA

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

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

MISSOURI

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

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

Shaffer Distributing
St. Louis (2)
1-314-645-3393

NEBRASKA

Central Dist.
Omaha
1-402-493-5600

Greater America Dist.
Omaha
1-402-553-2812

NEVADA

Mountain Coin
Las Vegas (1)
1-702-798-0900

Reno Game Sales
Reno (2)
1-775-829-2080

NEW JERSEY

Betson Enterprises
Carlstadt (1)
1-201-438-1300

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

NEW MEXICO

Mountain Coin
Albuquerque
1-505-345-7706

NEW YORK

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

Parts & Service Only:

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

NORTH CAROLINA

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

Parts & Service Only:

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

OHIO

Atlas Dist. International
Cincinnati (1)
1-513-851-4100

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

Shaffer Distributing
Columbus (3)
1-614-421-6800
Valley View (4)
1-216-447-4486

OKLAHOMA

Galaxy Distributing
Tulsa
1-918-835-1166

OREGON

Betson West
Portland
1-503-772-4567

Mountain Coin
Portland
1-503-234-5491

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

PENNSYLVANIA

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

Superior Amusements
Wilkes-Barre (3)
1-570-824-9994

Shaffer Distributing
Pittsburgh (2)
1-412-920-1300

SOUTH CAROLINA

Parts & Service Only:

Green Coin
Mrytle Beach
1-843-626-1900

TENNESSEE

Brady Distributing
Memphis
1-901-345-7811

Parts & Service Only:

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

TEXAS

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

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

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

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

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

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

UTAH

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

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

WASHINGTON

Mountain Coin
Auburn (Seattle)
1-206-682-5700

WISCONSIN

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

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

CANADA

ONTARIO

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

BRITISH COLUMBIA

Parts & Service Only:

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

Parts & Service Only:

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

Note: *For states and Canadian Provinces which do not have Distributors, call the neighboring state or province with the city closest to you (indicated with a white dot). States or Provinces with more than 1 city containing a distributor are numbered. View the map on the previous page.*

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

International Distributors Directory

ARGENTINA

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

AUSTRALIA

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

AUSTRIA

Parts & Service Only:

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

Parts & Service Only:

TAB
Ansfelden
[43] 7229-7-8040

BELGIUM

NAMUSCO
Brussels
[32] 2414-4596

DENMARK

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

ENGLAND

see UNITED KINGDOM

FINLAND

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

FRANCE

Avranches Automatic
Ducey
[33] 2338-9-6162

SFA
Paris
[33] 1532-6-8080

GERMANY

ADP Gauselmann
Espelkamp
[49] 5741-27-3384

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

MEXIM
Espelkamp
[49] 5772-4-9422

HOLLAND

see THE NETHERLANDS

ITALY (RSM)

Tecnoplay S.A.
San Marino
[39] 5499-0-1508

THE NETHERLANDS

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

NEW ZEALAND

Coin Cascade Ltd.
Christchuch
[64] 3338-1411

Parts & Service Only:

Amco Machine Supplies
Auckland
[64] 9846-7606

NORWAY

Vendcomatic
Oslo
[47] 2291-8383

PORTUGAL

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

RUSSIA

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

SOUTH AFRICA

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

SPAIN

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

Parts & Service Only:

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

SWEDEN

Bjuvia Fritid AB
Bjuv
[46] 4238-6900

SWITZERLAND

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

UNITED KINGDOM

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

Parts & Service Only:

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

THE Sopranos™

POWER REQUIREMENTS

This game ***must be connected to a properly grounded outlet to reduce shock hazard*** & insure proper game operation. *See Sec.* ***5****, Schematics & Troubleshooting, Chp.* ***3****, Cabinet Wiring (Transformer Power Wiring), for transformer connections required for* ***Normal****,* ***High****, and* ***Low Line*** *conditions.*

Normal Line:	**110v AC - 125v AC @ 60Hz**	
Domestic use an 8AMP 250v Slo-Blo Fuse.	**AVG OPERATION** CURRENT: **2.8AMP** WATTAGE: **329w**	**MAX OPERATION** CURRENT: **8AMP** WATTAGE: **940w**
High Line:	**218v AC - 240v AC @ 50Hz**	
Export use 2x 5AMP 250v Slo-Blo Fuses. (*England & Hong Kong use an 8AMP 250v S/B Fuse.)	**AVG OPERATION** CURRENT: **1.8AMP** WATTAGE: **412w**	**MAX OPERATION** CURRENT: **5AMP** | **8AMP*** (England & Hong Kong use an 8A Fuse.) WATTAGE: **1145w** | **1832w***
Low Line:	**95v AC - 108v AC @ 50Hz / 60Hz**	
Export Japan Only use an 8AMP 250v Slo-Blo Fuse.	**AVG OPERATION** CURRENT: **2.6AMP** WATTAGE: **264w**	**MAX OPERATION** CURRENT: **8AMP** WATTAGE: **812w**

TRANSPORTATION

BEFORE TRANSPORTING



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

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

SAVE AND RETAIN ALL PRINTED INFORMATION INSIDE THE CABINET !

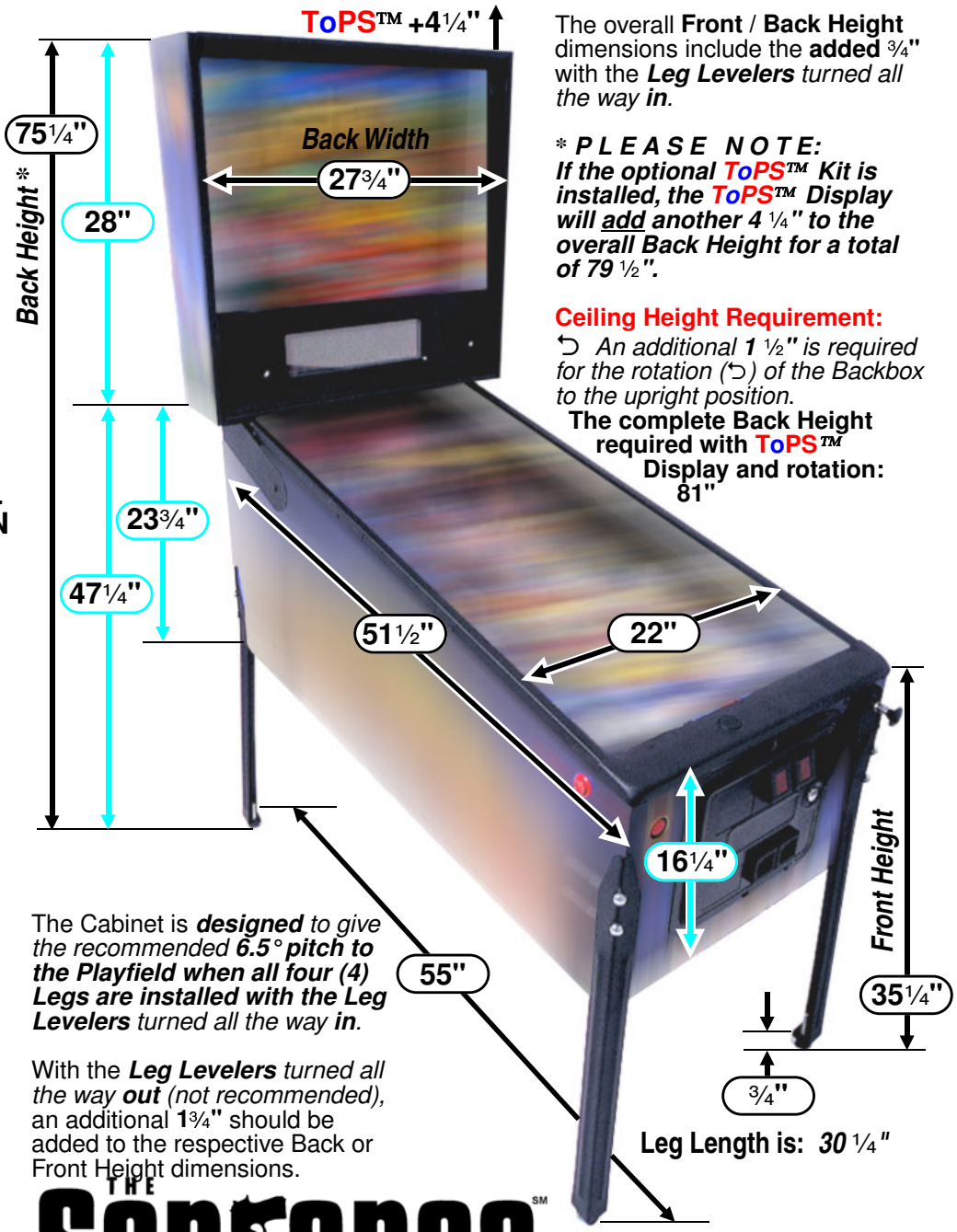
Shipping Box Dimensions

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

CAUTION

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

GAME DIMENSIONS



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

**** PLEASE NOTE:***
If the optional ToPS™ Kit is installed, the ToPS™ Display will add another 4 ¼" to the overall Back Height for a total of 79 ½".

Ceiling Height Requirement:
↺ *An additional* ***1 ½"*** *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 **1¾"** should be added to the respective Back or Front Height dimensions.

Leg Length is: *30 ¼"*

THE Sopranos℠

Find-It-In-Front: Dr. Pinball

STERN PINBALL, INC.

The Sopransos℠ Pinball Game Service Manual General Table of Contents

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

Pinball Game Set-Up Procedures

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



With the Back Glass Removed:

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

With the Playfield Glass Removed:

2. 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."

CE

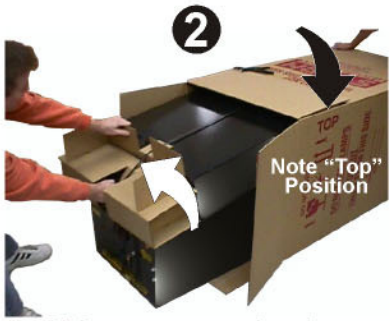
Open up the Printable Version in both 8-1/2 X 11 & 11 X 17.

Pinball Game Set-Up Future Reference

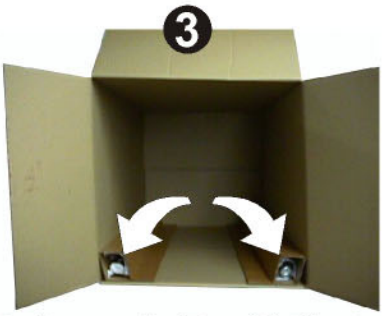
CAUTION: At least 2 people are required to move and maneuver game.
Use proper moving equipment & extreme care while handling. Pinball game is 260lbs (+/- 10).
Refer to Game Manual for further Game Set-Up Procedures (Sec. 1, Chp. 1) and other important information!
TOOLS REQUIRED: 5/8" Socket Wrench &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



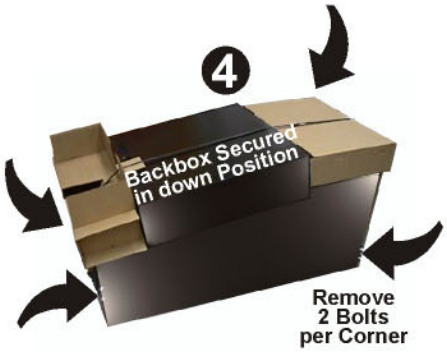
1. Before unpacking box, lay the box flat on its side with **"TRUCK THIS SIDE ONLY"** facing the floor.



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



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



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



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



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



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

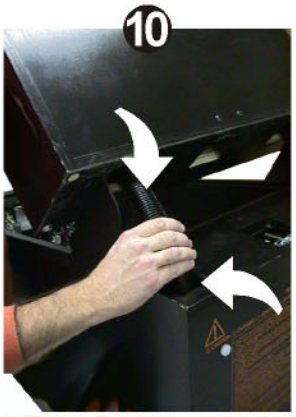


8. Using supports or two (2) people, prop the rear of the cabinet up and install **REAR LEGS**. *Secure tightly.*



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

Pinball Game Set-Up Future Reference Continued



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

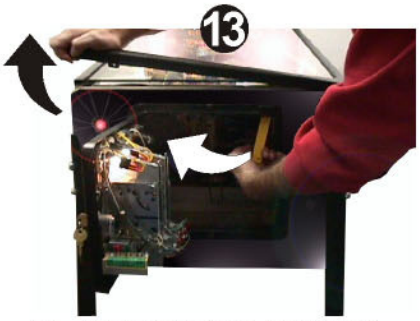


11. After the **BACKBOX** is in the **UPRIGHT POSITION**, locate the **5/16" HEX KEY**. While inserted, rotate **KEY** with a **3/4** turn until latched & locked.



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

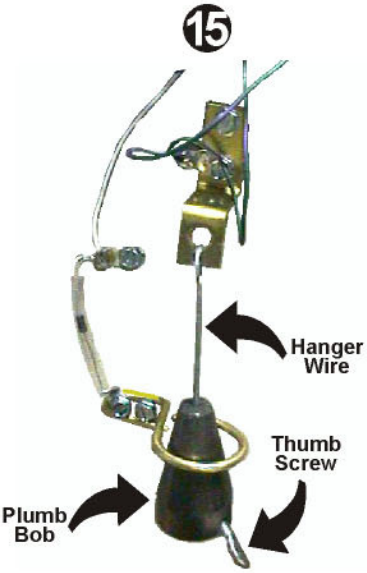
NOTE: KEYS are tied to the **Shooter Rod*** *(if equipped)* or taped to the **Playfield Glass** *(if equipped with Auto Plunger Button). Remove keys. One (1) set of keys opens the Coin Door, the other set is used to unlock the* ***Back Glass*** *to gain access to the White Star Board System.*



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

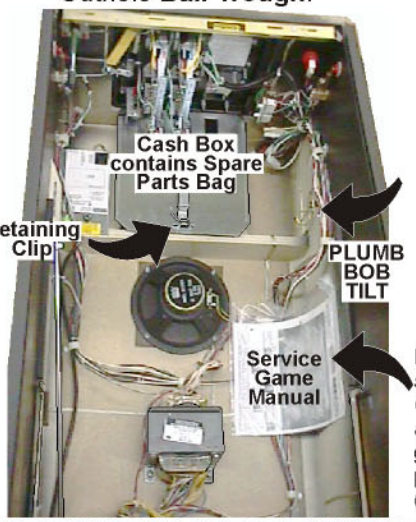


14. Through the open **Coin Door**, remove the **RETAINING RING** at the rear of the **CASH BOX** and open. Remove the **PINBALLS** & the **PLUMB BOB** *from the* **SPARE PARTS BAG.** *(Save the other spare parts in cabinet).* Install the **PINBALLS** by placing them on the playfield so they can roll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



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



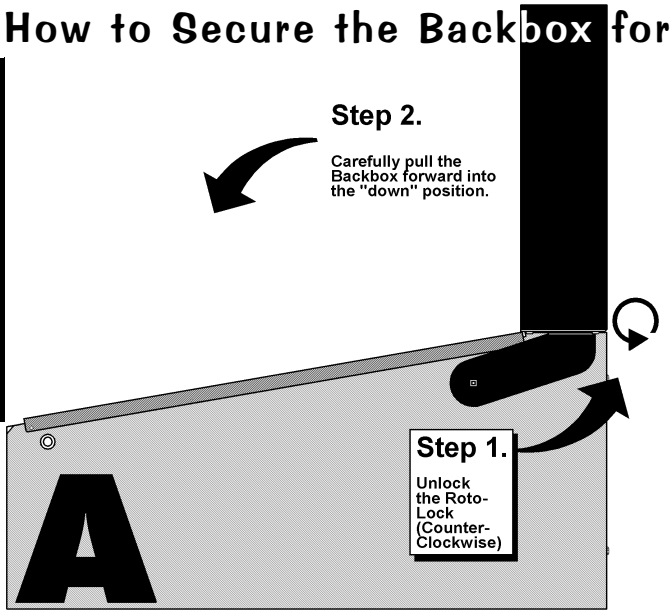


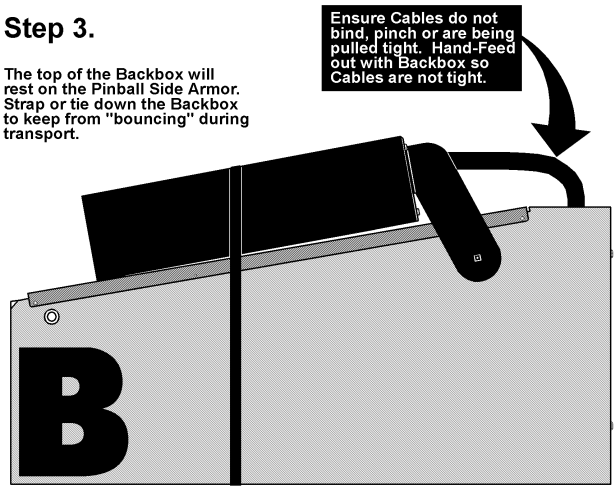
Remove the **PINBALL GAME MANUAL** *(stapled to side of the left wall of the cabinet). Review Section 1, Chapter 1, which describes how to lift the playfield to access the Plumb Bob Tilt Assembly.* The manual gives you all the important information you need to prepare for final set-up and other important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

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

How to Secure the Backbox for Transporting

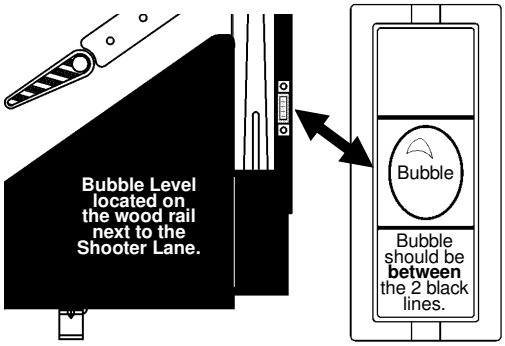
*For more Backbox details & part numbers, see Section **4**, Chapter **1**, **Backbox Assembly**, Pages 60-61.*





Leg Leveler Adjustment

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

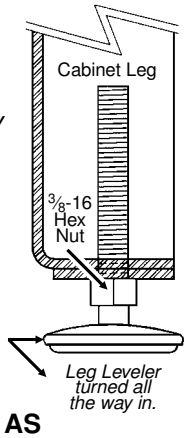


Start adjustment with the leg levelers *turned all the way in*.

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

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

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



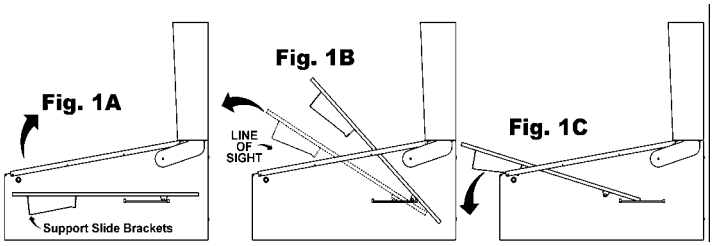
YOUR PLAYFIELD PITCH IS NOW AT 6.5° AS REQUIRED FOR PROPER GAME PLAY!

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

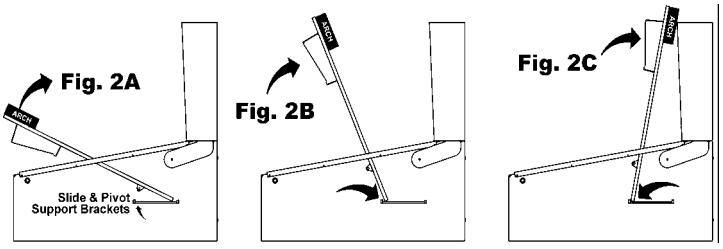
Easy Access Service System - 2 Positions

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

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



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



Game Operation & Features

Start of Game Features

Starting a Normal Game

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

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 percent- age 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.*

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 Sopranos SM

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

FOLD HERE



Click on card to open the Instruction Card for printing.

Service Menu System

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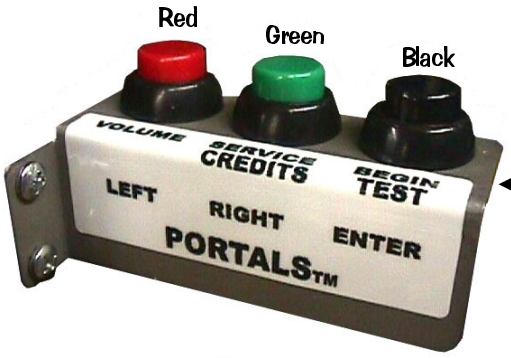
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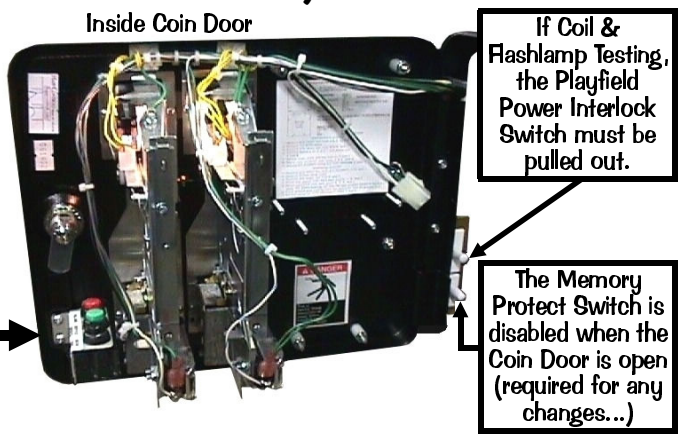
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Service Switch Set (Red, Green & Black Buttons) Access & Use

The ***Service Switch Set*** provides access for ***three (3) functions*** available for your use. They are **Volume Menu**, **Service Credits Menu** and **Portals™ Service Menu**. All are accessed separately depending on which colored button (**Red**, **Green** or **Black**) is ***pushed first***.





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

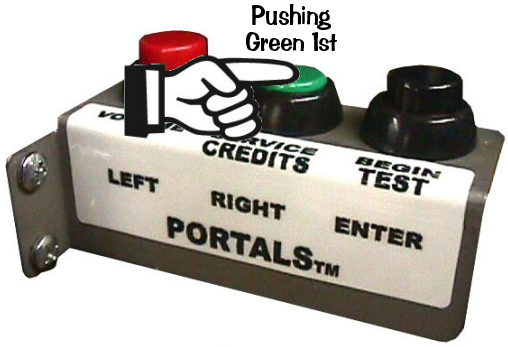


Function 1, Volume Menu

Pushing the ***Red "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.

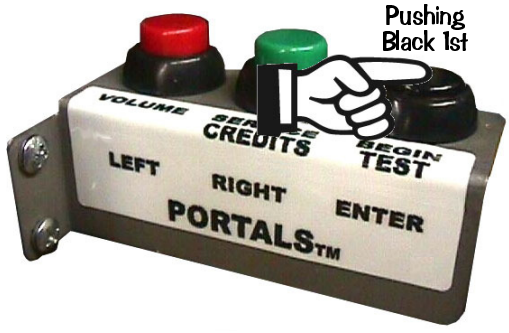


Function 2, Service Credits Menu

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!***

back to Page 8

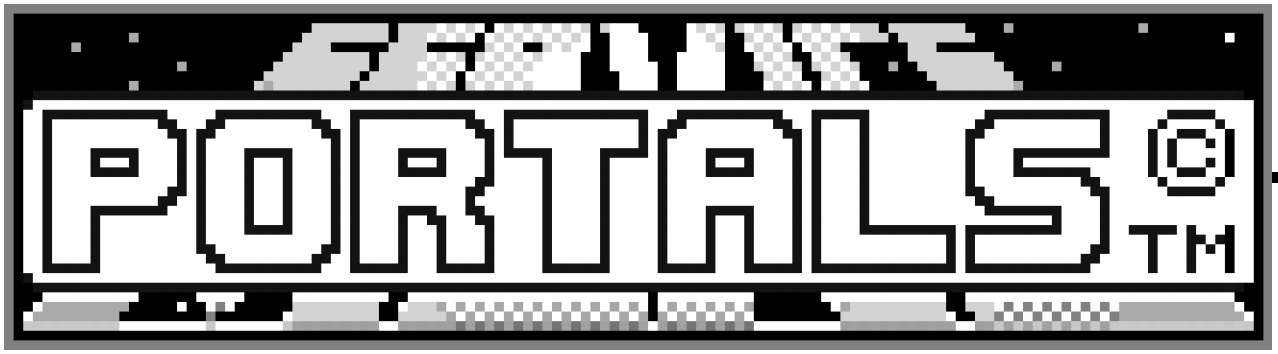
Portals™ Service Menu Introduction

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**:

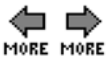


Sec. 3: ...Menu Intro.

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:

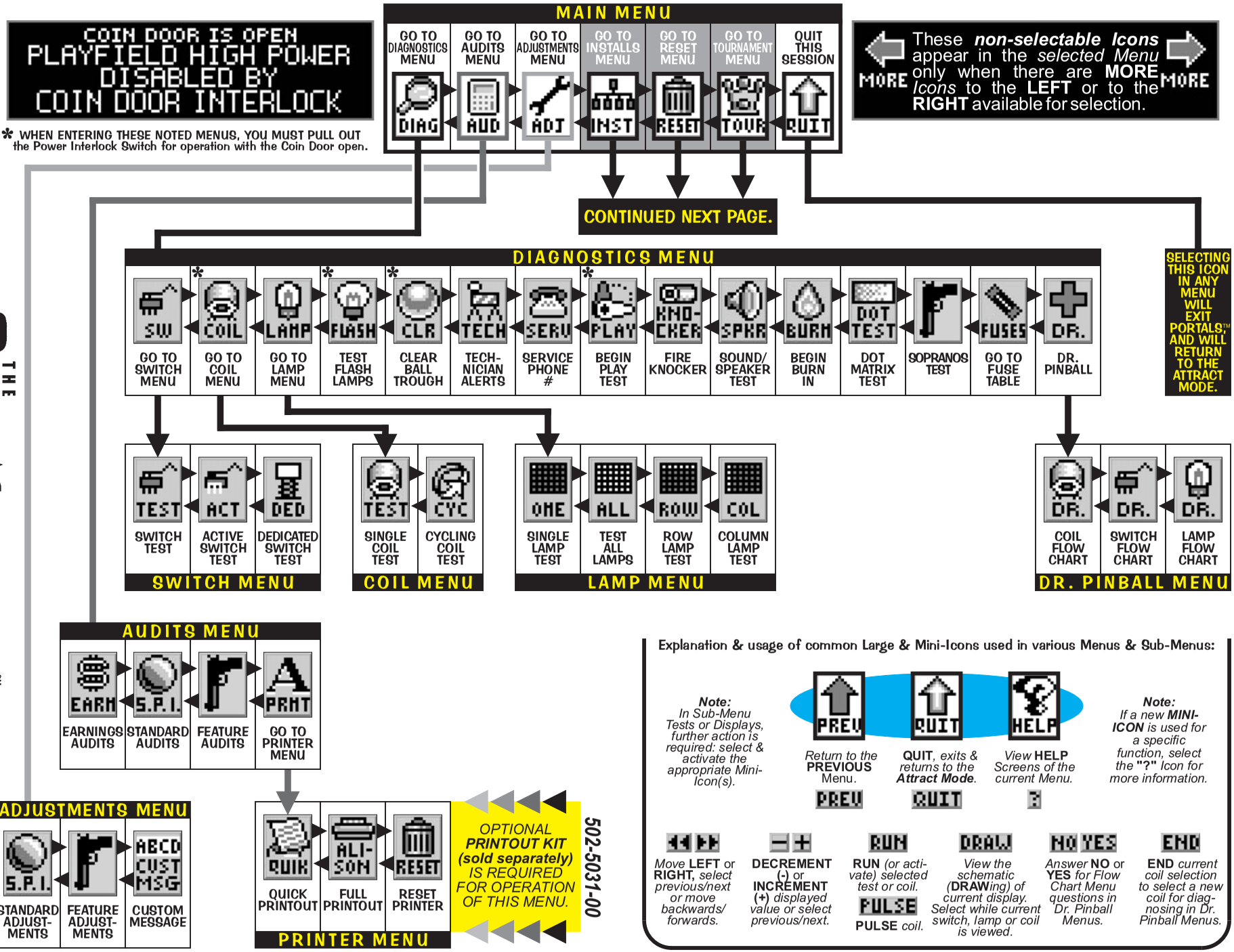




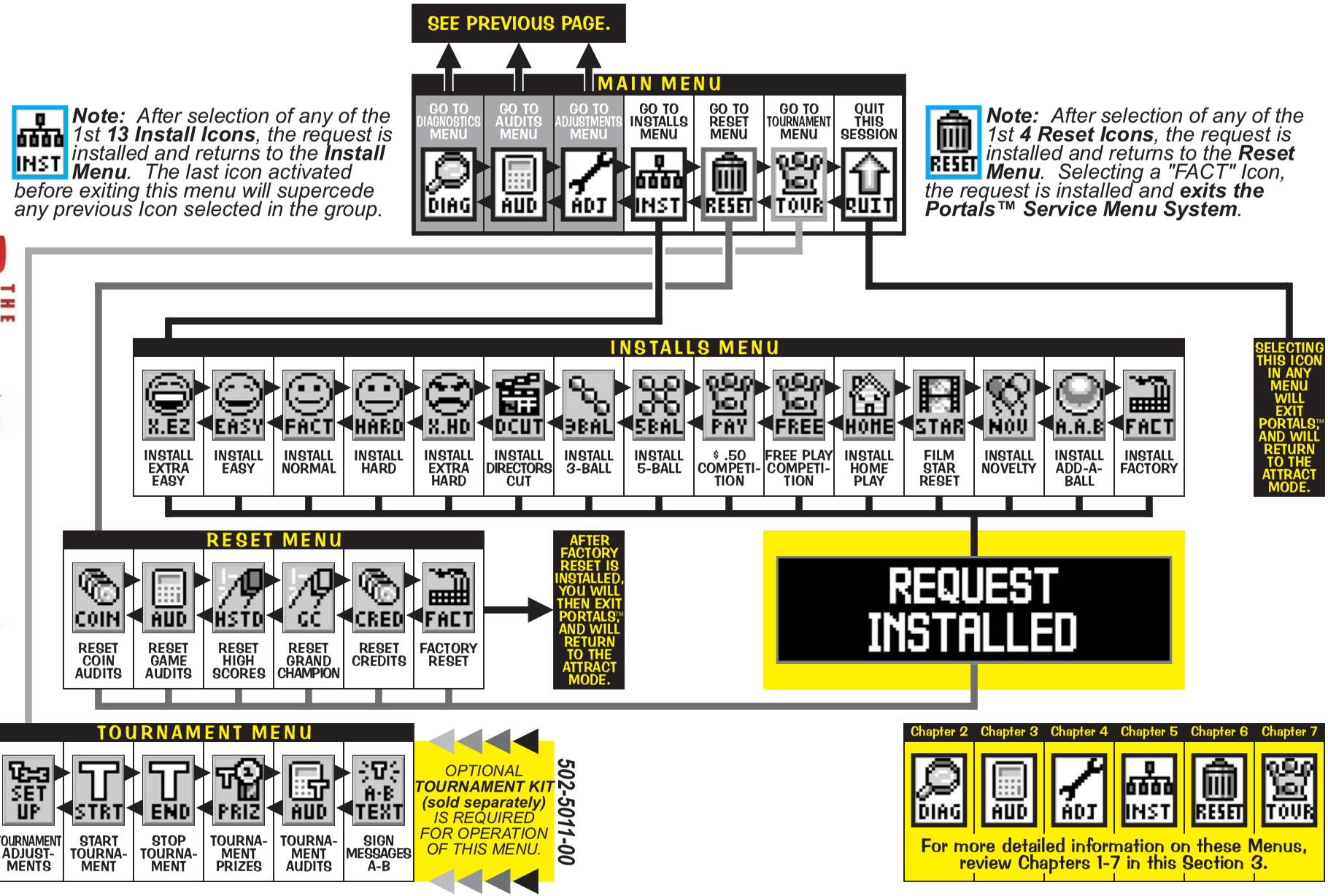
As the operator views the Menu Screen(s), the symbols indicates that there are more *Icons* to select in each direction. The *Icon* selected will blink. Pushing the **Black "ENTER" Button** (or **Start Button**) will select the *Icon* and the Menu Screen will change to the menu selected. Select the **"PREV"**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


COIN DOOR IS OPEN
PLAYFIELD HIGH POWER DISABLED BY COIN DOOR INTERLOCK
* WHEN ENTERING THESE NOTED MENUS, YOU MUST PULL OUT the Power Interlock Switch for operation with the Coin Door open.
MAIN MENU
GO TO DIAGNOSTICS MENU
GO TO AUDITS MENU
GO TO ADJUSTMENTS MENU
GO TO INSTALLS MENU
GO TO RESET MENU
GO TO TOURNAMENT MENU
QUIT THIS SESSION
DIAG
AUD
ADJ
INST
RESET
TOUR
QUIT
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.
MORE
MORE
CONTINUED NEXT PAGE.
DIAGNOSTICS MENU
SW
COIL
LAMP
FLASH
CLR
TECH
SERV
PLAY
KNO-CKER
SPKR
BURN
DOT TEST
FUSES
DR.
GO TO SWITCH MENU
GO TO COIL MENU
GO TO LAMP MENU
TEST FLASH LAMPS
CLEAR BALL TROUGH
TECH-NICIAN ALERTS
SERVICE PHONE #
BEGIN PLAY TEST
FIRE KNOCKER
SOUND/ SPEAKER TEST
BEGIN BURN IN
DOT MATRIX TEST
SOPRANOS TEST
GO TO FUSE TABLE
DR. PINBALL
SELECTING THIS ICON IN ANY MENU WILL EXIT PORTALS™ AND WILL RETURN TO THE ATTRACT MODE.
TEST
ACT
DED
SWITCH TEST
ACTIVE SWITCH TEST
DEDICATED SWITCH TEST
SWITCH MENU
TEST
CYC
SINGLE COIL TEST
CYCLING COIL TEST
COIL MENU
ONE
ALL
ROW
COL
SINGLE LAMP TEST
TEST ALL LAMPS
ROW LAMP TEST
COLUMN LAMP TEST
LAMP MENU
DR.
DR.
DR.
COIL FLOW CHART
SWITCH FLOW CHART
LAMP FLOW CHART
DR. PINBALL MENU
AUDITS MENU
EARN
S.P.I.
PRNT
EARNINGS AUDITS
STANDARD AUDITS
FEATURE AUDITS
GO TO PRINTER MENU
ADJUSTMENTS MENU
S.P.I.
STANDARD ADJUST-MENTS
FEATURE ADJUST-MENTS
ABCD CUST MSG
CUSTOM MESSAGE
QUIK
ALI-SON
RESET
QUICK PRINTOUT
FULL PRINTOUT
RESET PRINTER
PRINTER MENU
OPTIONAL PRINTOUT KIT (sold separately) IS REQUIRED FOR OPERATION OF THIS MENU.
502-5031-00
Explanation & usage of common Large & Mini-Icons used in various Menus & Sub-Menus:
Note: In Sub-Menu Tests or Displays, further action is required: select & activate the appropriate Mini-Icon(s).
PREV
QUIT
HELP
Return to the PREVIOUS Menu.
QUIT, exits & returns to the Attract Mode.
View HELP Screens of the current Menu.
Note: If a new MINI-ICON is used for a specific function, select the "?" Icon for more information.
PREV
QUIT
?
Move LEFT or RIGHT, select previous/next or move backwards/ forwards.
DECREMENT (-) or INCREMENT (+) displayed value or select previous/next.
RUN
RUN (or activate) selected test or coil.
PULSE
PULSE coil.
DRAW
View the schematic (DRAWing) of current display. Select while current switch, lamp or coil is viewed.
NO YES
Answer NO or YES for Flow Chart Menu questions in Dr. Pinball Menus.
END
END current coil selection to select a new coil for diagnosing in Dr. Pinball Menus.

Sopranos Portals™ Service Menu Icon Tree Continued



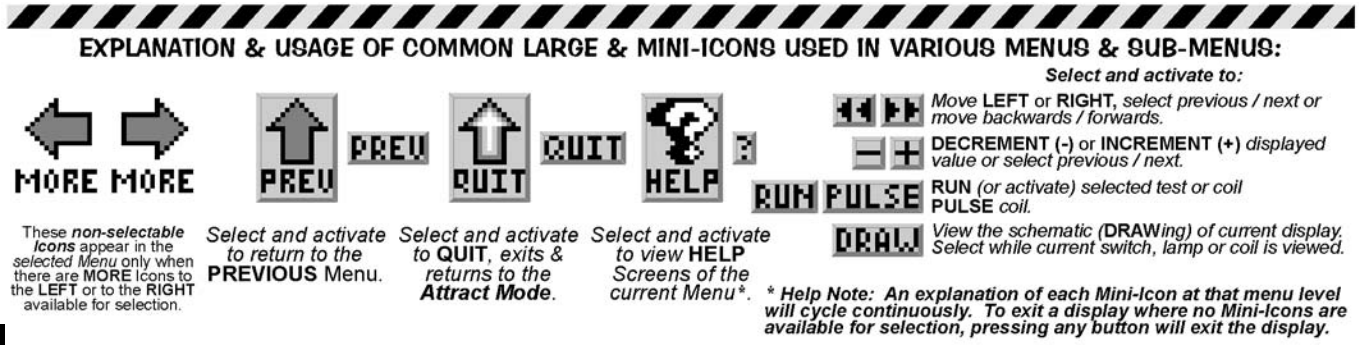
Sopranos Portals™ Service Menu Icon Tree Continued

Portals™ Service Menu Example

This example will demonstrate activation of *Icons* in the **DIAGNOSTICS MENU**. The example will show activation of the "SW" *Icon* (**GO TO SWITCH MENU**). In this menu, the switches can be tested individually and also all active switches can be tested. Use the same technique to access all the *Icons* in the **Portals™ Service Menu**. Follow **Portals™ Service Menu Icon Tree** on the previous pages as a guide to help navigate through the entire system (Also, go to the chapter in this manual explaining the icon(s) selected.).

If the display is in any other menu other than the **MAIN MENU**, use the **Red "LEFT"** & **Green "RIGHT" Buttons** to select the "PREV" *Icon* and press the **Black "ENTER" Button** to *activate* the **ICON** thus moving back to the previous menu. Do so until **MAIN MENU** appears.

Chapters **2** through **7** will cover all menu items within the **Portals™ Service Menu**. The *Icon* is shown preceding the text. Find the *Icon* in the **Portals™ Service Menu** by navigating with the **Red** or **Green Buttons**. Each chapter started is from the **MAIN MENU**. Within the chapter, and Sub-Menu will be covered sequentially with their explanation & function. If the operator *"gets lost"*, select and *activate* the "PREV" *Icon* until the display indicates **MAIN MENU**. For more help on Button Usage, select & *activate* the "HELP" *Icon* or "?" *Mini-Icons.*

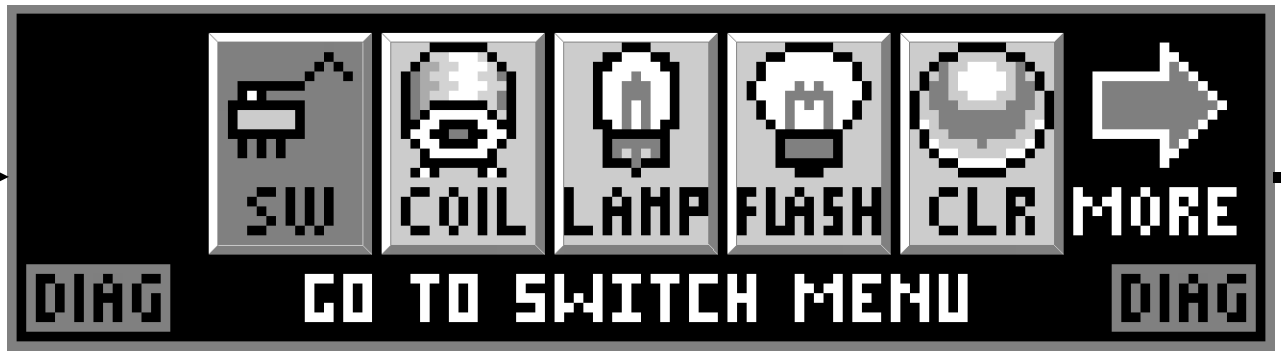


Example:

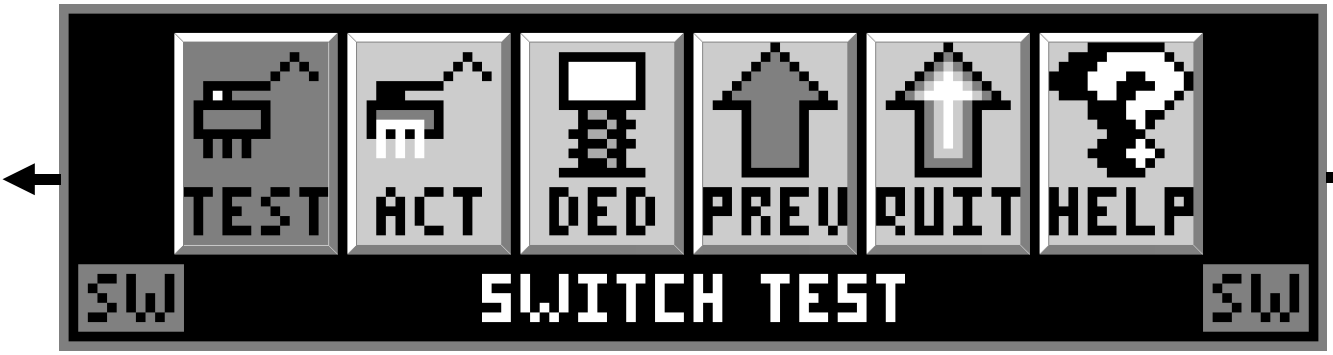
After entering **Portals™**, the **MAIN MENU** now appears with the **"DIAG"** *Icon* (**GO TO DIAGNOSTICS MENU**) flashing:



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



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

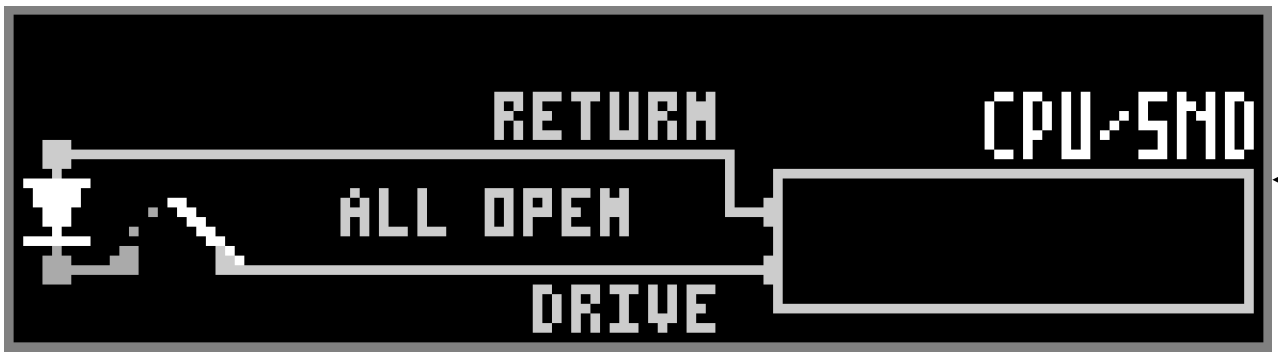


Press the **Black "ENTER" Button** to *activate* this icon. The **Switch Test Display** now appears.



All switches can be tested one at a time. When possible, use a pinball to close any playfield switches; rolling the ball at Stand-Up Targets or over/under switches is suggested. Use finger for all non-playfield switches. As each switch is closed, the respective Switch Matrix Grid Position (1-64) will be lit.

To view the schematic for the switch selected, press either the **Red** or **Green Button** to select the "DRAW" *Mini-Icon*. Press the **Black Button** to *activate* this *Mini-Icon*; do so while the switch is momentarily closed. This will bring up the **Switch Schematic Display**. The display describes the switch in the Switch Matrix which includes the name of the switch, the Return (Row) Wire and the Drive (Column) Wire, drive transistor, and the "Pin-Outs" from the CPU/Sound Board. *Activating* the "DRAW" *Icon* when a switch is not closed, will give the generic switch schematic as shown below.



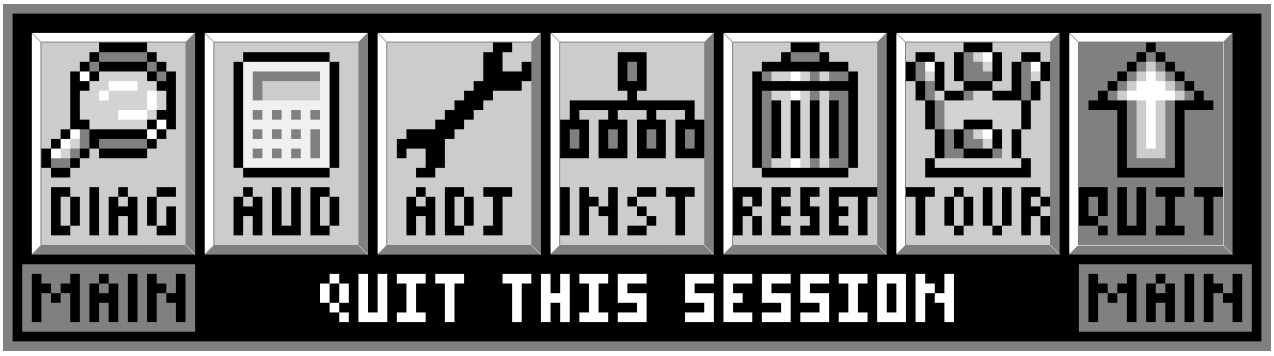
To ***exit any display where there are no Mini-Icons*** *(Schematics or Help Displays)*, ***press any button*** to return to the previous Menu.

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

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

QUIT THIS SESSION (Exiting the Portals™ Service Menu)

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



LOOK 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

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

Problem / Solution Table

PROBLEM	SOLUTION
Will not enter the **Service Mode** after depressing the **Black "BEGIN TEST" Button**.	• Check the Service Switch(es) (**Red, Green & Black Buttons**) for loose connections or bad Ground. • Check the associated wiring harness to/from the CPU/Sound Board, Connector **CN6**. • Check CPU/Sound Board for possible failure.
All Service Buttons (**Red, Green** and **Black**) appear nonfunctional.	• Check the Service Switches wiring harness for poor or no connection and/or broken wires.
The **Green Service Button** in the Attract Mode will not enter the **SERVICE CREDITS MENU** to add Service Credits.	• Check to make sure the Game is not in "**Free Play**." *If the game is set to Free Play, adding Service Credits is not required.* • Check the Service Switches wiring harness for poor or no connection and/or broken wires.
The **Display** "blanks out."	• Check the Dot Matrix Display for loose wiring harness for poor or no connection and/or broken wires. • Check **F1** (3/4A Fuse) on the Display Power Supply Board. Refer to Section **5**, Chapter **4**, **SCHEMATICS & TROUBLESHOOTING**.
Icons *"scroll"* along continuously in the **MAIN MENU**.	• Check for a stuck switch on the **Green Button**. • If the Service Switch Set and/or the Coin Door was replaced, ensure the Locking Mechanism on the **Green Button** was removed. If the Green Button "clicks" and locks into an up/down position, the **Green Button** has this lock switch. Remove it. (Ref. to Svc. Bulletin #74.)
The **Start** and **Flipper Buttons** do not select or activate *Icons* in the **SWITCH TEST MENU**.	• This is normal. These switches are deactivated, as they are a part of the Switch Test. Use the **Red "LEFT"** or **Green "RIGHT" & Black "ENTER" Buttons** in this Sub-Menu. Refer to Section **3**, Chapter **2**, **GO TO DIAGNOSTICS MENU**, **Switch Test**.
Can't move selection of *Icon* with the **Left** and/or **Right Flipper Buttons**.	• Check the **Flipper Buttons** for loose connections or bad Ground and refer to Section **5**, Chapter **2**, Playfield Wiring, #-Flipper Circuit Wiring Diagram. • This is normal ***only*** in ***Diagnostic's Switch & Active Switch Tests*** *(see previous Problem).*
Some *Icons* appear non-functional in the **PRINTER MENU(S)**.	• If no printing equipment is connected, the "-" *Icon*, "+" *Icon* and "RUN" *Icon* will appear not to function. Refer Section **3**, Chapter **3**, **GO TO PRINTER MENU**.
Some *Icons* appear non-functional in the **GAME SPECIFIC MENU** under the **DIAGNOSTICS MENU**.	• If there is no other test under this Menu, the "<<" & ">>" *Mini-Icons* will appear not to function. The remaining *Icons* should function as normal. ***Note:*** *If there is no "Go To (Game Name) Test(s), the "GAME NAME" Icon will not invoke another display.*
The display returns to the **ATTRACT MODE** exiting the Service Session after a **FACTORY RESET**.	• This is normal. After a **FACTORY RESET**, the Service Session is automatically exited. Refer to Section **3**, Chapter **6**, **GO TO RESET MENU**, **Factory Reset**.
In **COIL TEST MENU**, the coils and flashlamps ***do not*** fire after activating the "RUN" *Icon*.	• Ensure the **POWER INTERLOCK SWITCH *is pulled out*** *(see the start of this Chapter).*
In **ADJUSTMENTS MENU**, with the Coin Door **CLOSED**, adjustments are not getting changed as desired (using the **Flipper** & **Start Buttons**).	• This is normal. The ***Memory Protect Switch*** is enabled when the Coin Door is **CLOSED**. Changes can be made with the Coin Door **OPEN** only.
In **Portals™ Service Menu**, the volume cannot be adjusted with the **Red** or **Green Buttons**.	• The Volume adjustment can only be made when in the **Attract Mode**. The **Volume Mode** is entered by pressing the **Red "VOLUME" Button**. Then use the **Red "LEFT"** to decrease / decrement (-) or **Green "RIGHT" Button** to increase / increment (+) the volume.
In **Portals™ Service Menu**, the display seems to lock up, or the Help Display appears to be non-functional.	• If you cannot clear the situation by exiting back one Menu, exit completely out of the **Portals™ Service Menu**, and re-enter. If the problem persists, call Technical Support for additional help.

Go To Diagnostics Menu

Overview

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

Important: *Upon **Power-Up** (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 be either failure in memory *(e.g. batteries are dead and/or faulty **RAM**)* or upon installation of updated version of game code. Opening the **Coin Door** will initiate a *Factory Restore (Reset)*, by opening the ***Memory Protect Switch***. Check battery voltage at **VBATT Test Point** on the **CPU/Sound Bd.** *(more details in Sec. **5**, Chp. **4**, **PCBs**).*



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



This ***display*** is shown momentarily during **Game Mode** or **Power-Up** to alert the operator of a coil malfunction *(coil doesn't energize or coil fires a multiple number of times)*. **OPERATOR ALERT!** works by monitoring any *switch activated coil* that has the potential to trap a ball when disabled *(more details in this Chapter, **Technician Alerts**, **Pages 24-25**).*



* If this ***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 it's 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:



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

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

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

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

**** Help Note:** An explanation of each 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 if displayed momentarily. To view the schematic for the switch selected, press either the **Red** or **Green Button** to select the "DRAW" *Mini-Icon*. Press the **Black Button** to *activate* this *Mini-Icon*; do so while the switch is momentarily closed. To return to **Switch Test**, press the **Black Button** again.



Active Switch Test

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



Dedicated Switch Test

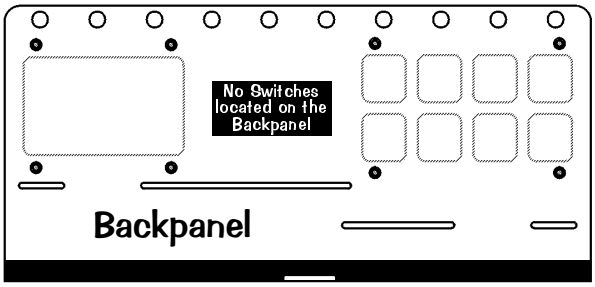
To initiate, from the **SWITCH MENU**, select the "DED" *Icon* with either **Flipper Button** & press the **Start Button** *(the Service Switches are deactivated during this test.).* In **Dedicated Switch Test**, the display will describe the switch which includes the Switch Name, Return (Row) Wire,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

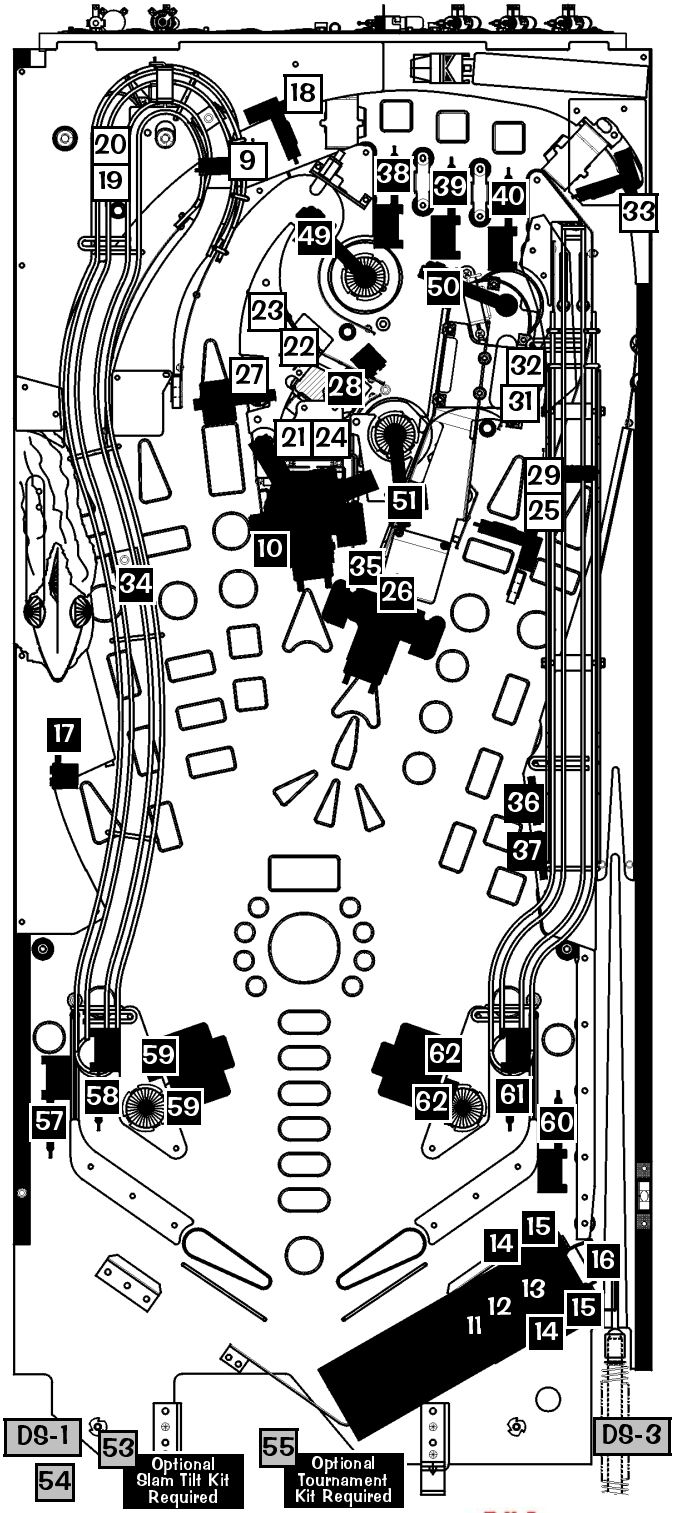
SWITCH MATRIX GRID & DEDICATED SWITCHES

Row (Return) \ Column (Drive)	1: Q1	2: Q2	3: Q3	4: Q4	5: Q5	6: Q6	7: Q7	8: Q8
	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 WHT-BRN CN7-P9	1 Cabinet Side: LT BUTTON (UK ONLY)	9 Above P/F: LEFT RAMP	17 Below P/F: LEFT EJECT	25 Above P/F: RIGHT RAMP	33 Above P/F: RIGHT ORBIT	41 NOT USED	49 Below P/F: LEFT BUMPER	57 Below P/F: 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 WHT-RED CN7-P8	2 Coin Door: 4TH COIN SLOT	10 Below P/F: SAFE LIMIT	18 Above P/F: LEFT ORBIT	26 Below P/F: DROP TARGET	34 Below P/F: LEFT STANDUP	42 NOT USED	50 Below P/F: RIGHT BUMPER	58 Below P/F: 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 WHT-ORG CN7-P7	3 Coin Door: 6TH COIN SLOT	11 Below P/F: 4-BALL TROUGH #1 (LEFT)	19 Above P/F: BING 1	27 Above P/F: SPINNER	35 Below P/F: CENTER STANDUP	43 NOT USED	51 Below P/F: BOTTOM BUMPER	59 Below P/F: 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 WHT-YEL CN7-P6	4 Coin Door: RIGHT COIN SLOT	12 Below P/F: 4-BALL TROUGH #2	20 Above P/F: BING 2	28 Below P/F: CENTER EJECT	36 Below P/F: R. 2-BANK TOP	44 NOT USED	52 NOT USED	60 Below P/F: 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 WHT-GRN CN7-P5	5 Coin Door: CENTER COIN SLOT / DBA	13 Below P/F: 4-BALL TROUGH #3	21 Above P/F: SAFE HIT LEFT	29 Above P/F: RIGHT RAMP EXIT	37 Below P/F: R. 2-BANK BOTTOM	45 NOT USED	53 In Cabinet: *SLAM TILT (OPT)* [K1]	61 Below P/F: 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 WHT-BLU CN7-P3	6 Coin Door: LEFT COIN SLOT	14 Below P/F: 4-BALL TROUGH VUK OPTO	22 Above P/F: CENTER LOCK 1	30 NOT USED	38 Below P/F: LEFT TOP LANE	46 NOT USED	54 In Cabinet: START BUTTON	62 Below P/F: 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 WHT-VIO CN7-P2	7 Coin Door: 5TH COIN SLOT	15 Below P/F: 4-BALL STACKING OPTO	23 Above P/F: CENTER LOCK 2	31 Above P/F: BOAT LOCK 1	39 Below P/F: MIDDLE TOP LANE	47 NOT USED	55 In Cabinet: *TOURNA-MENT START* [K1]	63 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 WHT-GRY CN7-P1	8 Cabinet Side: RT BUTTON (UK ONLY)	16 Below P/F: SHOOTER LANE	24 Above P/F: SAFE HIT RIGHT	32 Above P/F: BOAT LOCK 2	40 Below P/F: RIGHT TOP LANE	48 NOT USED	56 In Cabinet: PLUMB BOB TILT	64 NOT USED
Sw. Part Number:	180-5160-00	180-5157-00	180-5119-02	180--5119-02	500-6227-02		*See Sw. 56 Note*	

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

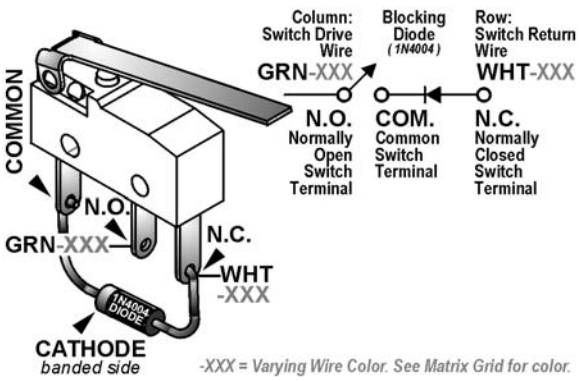
SWITCH MATRIX GRID LOCATIONS





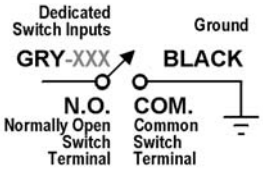
Playfield ▲

Typical Switch Wiring & Schematic



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

Dedicate Switch Schematic



= 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: **D** iode **O** n **T** erminal **S** trip, *see Section* ***5,*** *Chapter* ***2,*** ***Playfield Wiring****.*

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 -00**B** *or* -00**T** 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

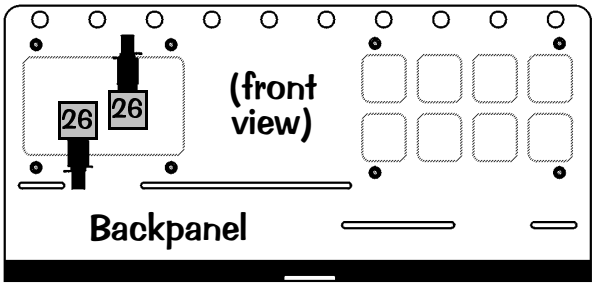
Low Current Coils Group 1		Drive Transistor	Coil GA-Turn or Bulb Type
#17	FISH JAW	Q17	27-1500 ↻ 090-5004-00B
#18	BING MOTOR (RELAY)	Q18	Relay Asm 500-6700-00
#19	FLASH: SUPER JP	Q19	#89 Bulb 165-5000-89-HF
#20	FLASH: SAFE	Q20	#89 Bulb 165-5000-89-HF
#21	LEFT EJECT	Q21	26-1200 ↻ 090-5044-00B
#22	BOAT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

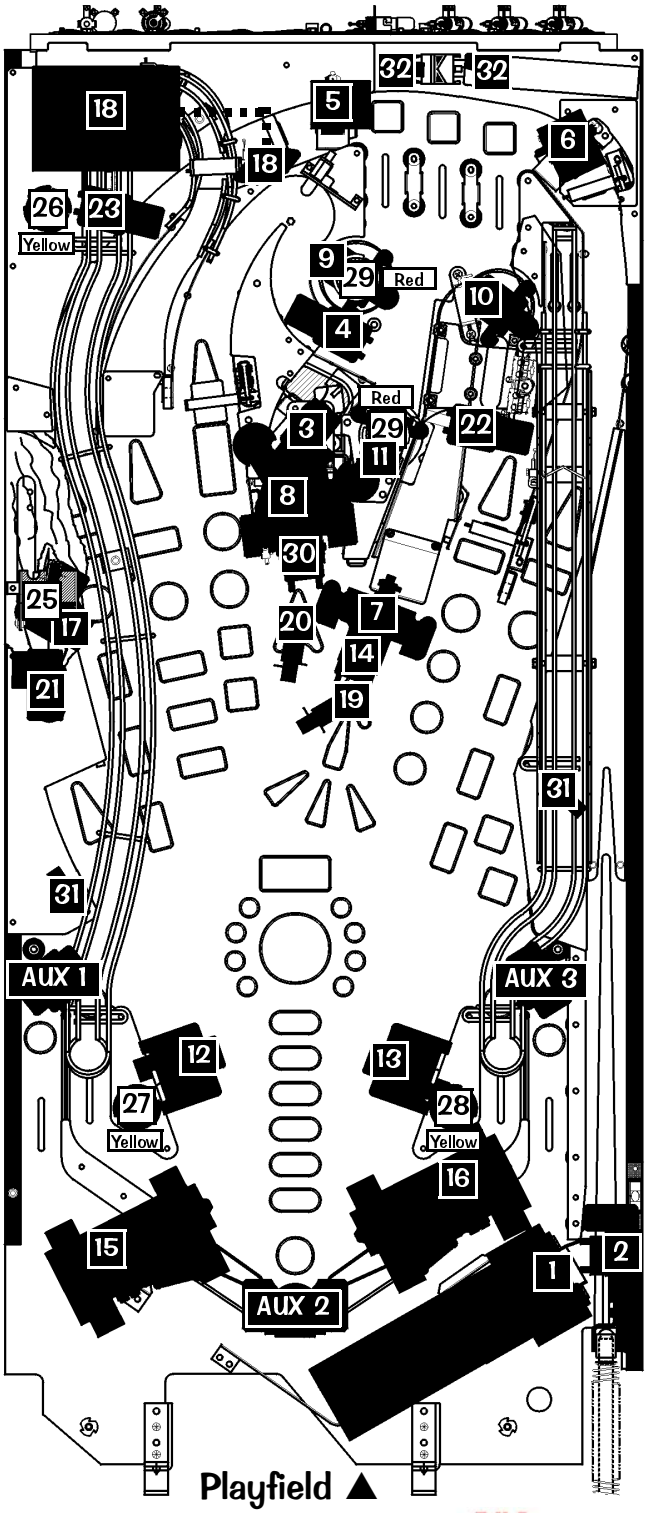
Diode **O**n **T**erminal **S**trip (if noted)

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

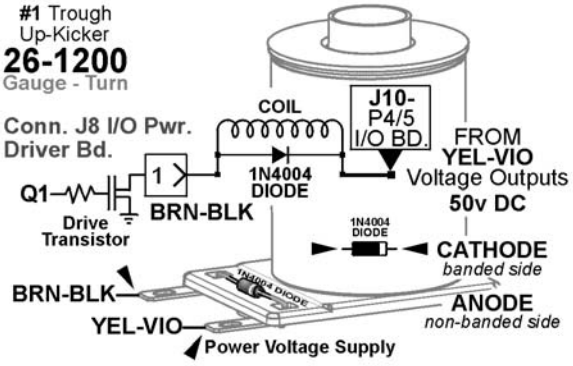
Auxiliary (UK ONLY)	Drive Transistor	Coil GA-Turn
AUX 1: LEFT UP/DOWN POST	Q1	26-1200 ↻ 090-5044-00T
AUX 2: CENTER UP/DOWN POST	Q2	23-1100 ↻ 090-5030-00T
AUX 3: RIGHT UP/DOWN POST	Q3	26-1200 ↻ 090-5044-00T

COIL & FLASH LAMP LOCATIONS

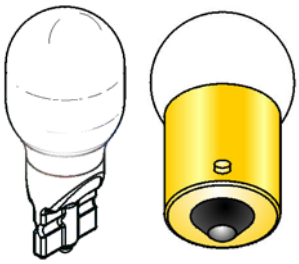




Typical Coil Schematic & Wiring



Bulb Types used for Flash Lamps



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

#89 Bulb
(Bayonet)
165-5000-89-HF

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







COIL MENU: SINGLE COIL & CYCLING COIL

COILS DETAILED CHART TABLE

	High Current Coils Group 1	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BRN-BLK	J8-P1	26-1200 ↻ 090-5044-00T
#2	AUTO LAUNCH	Q2		YEL-VIO	J10-P4/5	50v DC	BRN-RED	J8-P3	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 Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#9	LEFT BUMPER	Q9	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BLU-BRN	J9-P1	26-1200 ↻ 090-5044-00T
#10	RIGHT BUMPER	Q10		YEL-VIO	J10-P4/5	50v DC	BLU-RED	J9-P2	26-1200 ↻ 090-5044-00T
#11	BOTTOM BUMPER	Q11		YEL-VIO	J10-P4/5	50v DC	BLU-ORG	J9-P4	26-1200 ↻ 090-5044-00B
#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 Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#17	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

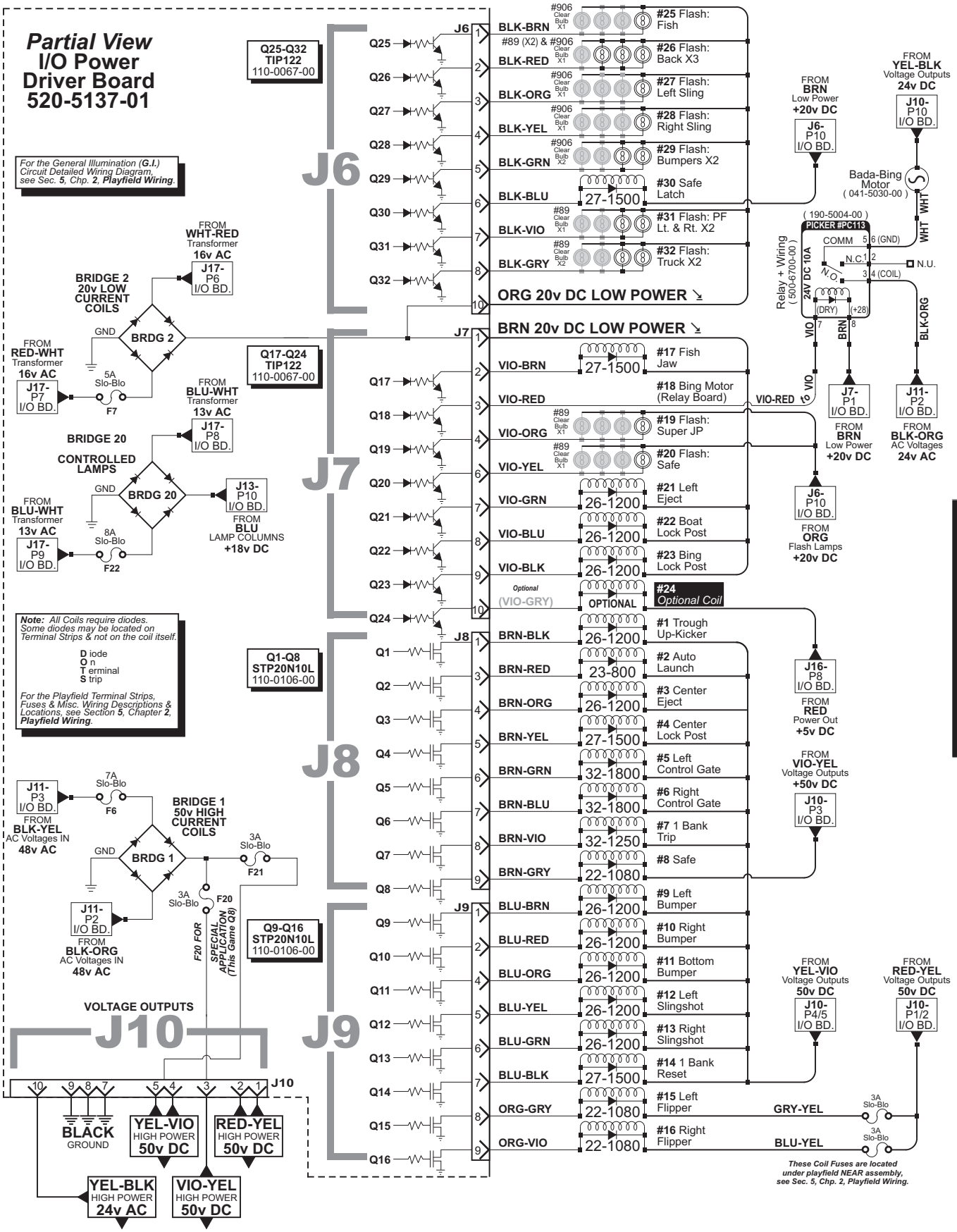
D iode O n T erminal S trip (if noted)

	Low Current Coils Group 2	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#25	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 Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn
	AUX 1: LEFT UP/DOWN POST	Q1	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 -00**B** *or* -00**T** can be used for coil replacements. *B/T listed is preferable for easier diode access & may differ on game.*


Partial View
I/O Power
Driver Board
520-5137-01
For the General Illumination (G.I.) Circuit Detailed Wiring Diagram, see Sec. 5, Chp. 2, Playfield Wiring.
Q25-Q32
TIP122
110-0067-00
J6
BLK-BRN
#25 Flash: Fish
BLK-RED
#26 Flash: Back X3
BLK-ORG
#27 Flash: Left Sling
BLK-YEL
#28 Flash: Right Sling
BLK-GRN
#29 Flash: Bumpers X2
BLK-BLU
27-1500
#30 Safe Latch
BLK-VIO
#31 Flash: PF Lt. & Rt. X2
BLK-GRY
#32 Flash: Truck X2
ORG 20v DC LOW POWER
FROM BRN Low Power +20v DC
J6- P10 I/O BD.
FROM YEL-BLK Voltage Outputs 24v DC
J10- P10 I/O BD.
Bada-Bing Motor (041-5030-00)
WHT
WHT
(190-5004-00)
PICKER #PC113
COMM 5 6 (GND)
N.C. 1 2
N.O.
N.U.
3 4 (COIL)
Relay + Wiring (500-6700-00)
24V DC 10A
(DRY) (+28)
7 8
VIO
BRN
BLK-ORG
FROM WHT-RED Transformer 16v AC
J17- P6 I/O BD.
BRIDGE 2 20v LOW CURRENT COILS
BRDG 2
GND
FROM RED-WHT Transformer 16v AC
J17- P7 I/O BD.
5A Slo-Blo
F7
FROM BLU-WHT Transformer 13v AC
J17- P8 I/O BD.
BRIDGE 20 CONTROLLED LAMPS
BRDG 20
GND
J13- P10 I/O BD.
FROM BLU LAMP COLUMNS +18v DC
FROM BLU-WHT Transformer 13v AC
J17- P9 I/O BD.
8A Slo-Blo
F22
J7
BRN 20v DC LOW POWER
Q17-Q24
TIP122
110-0067-00
VIO-BRN
27-1500
#17 Fish Jaw
VIO-RED
#18 Bing Motor (Relay Board)
VIO-ORG
#19 Flash: Super JP
VIO-YEL
#20 Flash: Safe
VIO-GRN
26-1200
#21 Left Eject
VIO-BLU
26-1200
#22 Boat Lock Post
VIO-BLK
26-1200
#23 Bing Lock Post
Optional (VIO-GRY)
OPTIONAL
#24 Optional Coil
VIO-RED
VIO
J7- P1 I/O BD.
FROM BRN Low Power +20v DC
J11- P2 I/O BD.
FROM BLK-ORG AC Voltages 24v AC
J6- P10 I/O BD.
FROM ORG Flash Lamps +20v DC
Note: All Coils require diodes. Some diodes may be located on Terminal Strips & not on the coil itself.
Diode
On
Terminal
Strip
For the Playfield Terminal Strips, Fuses & Misc. Wiring Descriptions & Locations, see Section 5, Chapter 2, Playfield Wiring.
J8
Q1-Q8
STP20N10L
110-0106-00
BRN-BLK
26-1200
#1 Trough Up-Kicker
BRN-RED
23-800
#2 Auto Launch
BRN-ORG
26-1200
#3 Center Eject
BRN-YEL
27-1500
#4 Center Lock Post
BRN-GRN
32-1800
#5 Left Control Gate
BRN-BLU
32-1800
#6 Right Control Gate
BRN-VIO
32-1250
#7 1 Bank Trip
BRN-GRY
22-1080
#8 Safe
J16- P8 I/O BD.
FROM RED Power Out +5v DC
FROM VIO-YEL Voltage Outputs +50v DC
J10- P3 I/O BD.
J11- P3 I/O BD.
7A Slo-Blo
F6
FROM BLK-YEL AC Voltages IN 48v AC
BRIDGE 1 50v HIGH CURRENT COILS
BRDG 1
GND
3A Slo-Blo
F21
3A Slo-Blo
F20
F20 FOR SPECIAL APPLICATION (This Game Q8)
J11- P2 I/O BD.
FROM BLK-ORG AC Voltages IN 48v AC
J9
Q9-Q16
STP20N10L
110-0106-00
BLU-BRN
26-1200
#9 Left Bumper
BLU-RED
26-1200
#10 Right Bumper
BLU-ORG
26-1200
#11 Bottom Bumper
BLU-YEL
26-1200
#12 Left Slingshot
BLU-GRN
26-1200
#13 Right Slingshot
BLU-BLK
27-1500
#14 1 Bank Reset
ORG-GRY
22-1080
#15 Left Flipper
ORG-VIO
22-1080
#16 Right Flipper
FROM YEL-VIO Voltage Outputs 50v DC
J10- P4/5 I/O BD.
FROM RED-YEL Voltage Outputs 50v DC
J10- P1/2 I/O BD.
GRY-YEL
BLU-YEL
3A Slo-Blo
3A Slo-Blo
These Coil Fuses are located under playfield NEAR assembly, see Sec. 5, Chp. 2, Playfield Wiring.
VOLTAGE OUTPUTS
J10
10 9 8 7 5 4 3 2 1
BLACK GROUND
YEL-VIO HIGH POWER 50v DC
RED-YEL HIGH POWER 50v DC
YEL-BLK HIGH POWER 24v AC
VIO-YEL HIGH POWER 50v DC



Go To Lamp Menu

To initiate, from the **DIAGNOSTICS MENU**, select the "LAMP" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Controlled lamps are configured in and 8 x 10 Matrix of Columns (Lamp Drives) and Rows (Lamp Returns) with up to **80** lamps possible. The Lamp Test Menu consists of four (4) parts: **Single Lamp Test**, **Test All Lamps**, **Row Lamp Test** & **Column Lamp Test**.



Single Lamp Test

To initiate, from the **LAMP MENU**, select the "ONE" *Icon* with either the **Red** or **Green Buttons** and press the **Black Button**. Select either the "-" or "+" *Mini-Icons*. Start with the "+" *Mini-Icon* to start the manual **Single Lamp Test** from Column 1, Row 1, Lamp 1. Press the **Black Button** on the "+" *Mini-Icon*, as each lamp is selected, the lamp will light at it's location on the playfield as well as the display, indicating the Lamp Matrix Grid Position *(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.

LAMP MATRIX GRID

Column (18v) / Row (Ground)	1: U17 YEL-BRN J13-P9	2: U16 YEL-RED J13-P8	3: U15 YEL-ORG J13-P7	4: U14 YEL-BLK J13-P6	5: U13 YEL-GRN J13-P5	6: U12 YEL-BLU J13-P4	7: U11 YEL-VIO J13-P3	8: U10 YEL-GRY J13-P1
1: Q33 RED-BRN J12-P1	1 #555 Clear Bulb (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 RED-BLK J12-P2	9 #44 Clear Bulb 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 RED-ORG J12-P3	17 #555 Clear Bulb (**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 RED-YEL J12-P4	25 #555 Clear Bulb 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 ($) ENVELOPE	30 #555 Clear Bulb LEFT ORBIT ARROW	31 #555 Clear Bulb BADA BING 1 (BOT)	32 #555 Clear Bulb BADA BING 2
5: Q37 RED-GRN J12-P5	33 #555 Clear Bulb BADA BING 3	34 #555 Clear Bulb L. RAMP FOOD	35 #555 Clear Bulb L. RAMP ($) 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 RED-BLU J12-P6	41 #555 Clear Bulb 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 RED-VIO J12-P8	49 #555 Clear Bulb MEADOWLANDS 3	50 #555 Clear Bulb R. RAMP FOOD	51 #555 Clear Bulb R. RAMP ($) ENVELOPE	52 #555 Clear Bulb RIGHT RAMP ARROW	53 #555 Clear Bulb RIGHT TRUCK HEIST 1 (BOT)	54 #555 Clear Bulb RIGHT TRUCK HEIST 2	55 #555 Clear Bulb RIGHT TRUCK HEIST 3	56 #555 Clear Bulb R. ORBIT FOOD
8: Q40 RED-GRY J12-P9	57 #555 Clear Bulb R. ORBIT ($) 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 NOT USED	63 NOT USED	64 NOT USED
9: Q41 RED-WHT J12-P10	65 #44 Clear Bulb 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 RED J12-P11	73 #555 Yel. Bulb EPISODES: ARSON bolts	74 #555 Yel. Bulb EPISODES: EXTERMINATE bolts	75 #555 Yel. Bulb EPISODES: HORSE RACE bolts	76 #555 Yel. Bulb EPISODES: EXEC. GAME bolts	77 #555 Yel. Bulb EPISODES: SATISFACTION bolts	78 #555 Clear Bulb SHOOT AGAIN	79 *OPTIONAL* *TOURNAMENT BUTTON*	80 #555 Clear Bulb START BUTTON

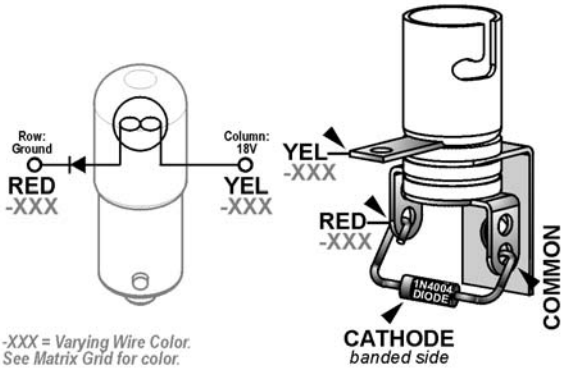
LAMP MATRIX GRID LOCATIONS



◀ Backpanel



Typical Lamp Schematic & Wiring



Bulb Types used for Control Lamps



▲ #555 Bulb (Wedge) 165-5002-00

▲ #44 LED (Bayonet) 112-5023-08

▲ #44 Bulb (Bayonet) 165-5004-00-HF

= 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: **D**iode **O**n **T**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.



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

Flashers tested are Flash Lamps in Positions: **Q1-Q32** and in this game Flash Lamp(s) are : **Q19-Q20 & Q25-Q32.**

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**.



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

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

Technician Alerts



To initiate, from the **DIAGNOSTICS MENU**, select the "TECH" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. This Menu is provided to show any switch probl
ems 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 **HYPERSENSTIVE 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



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

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****.*



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.

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

Test 3

Illuminates **all the dots, except for one column** from left to right.

Test 4

Illuminates **all the dots, except for one row** from top to bottom.

Test 5

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

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.

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).*

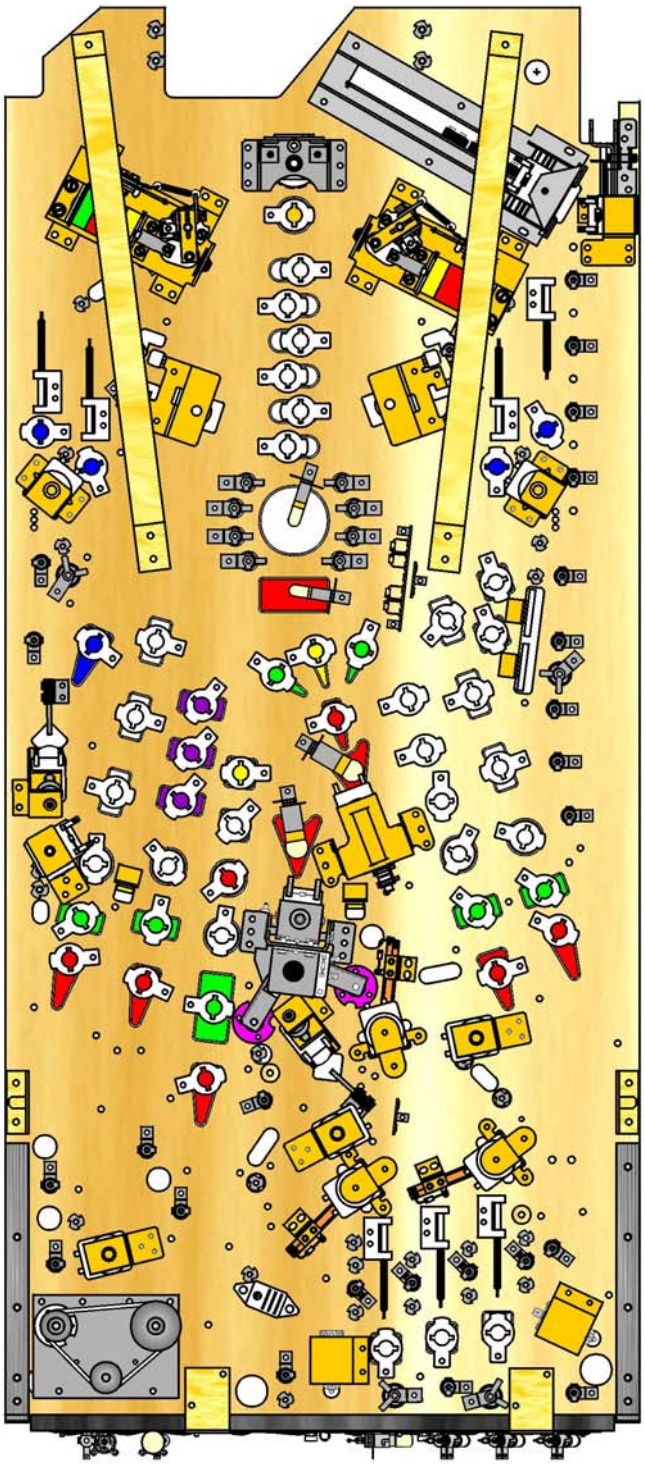


Select and *activate* the "RUN" *Mini-Icon* to fire *(pulse)* the **Safe Coil (Q8)**. *The safe mechanism is launched up and locked in the up position.* The Display indicates "**SAFE UP**" and the "**SAFE LIMIT SW-10**" box is highlighted *(which indicates Switch 10 as being closed).* Select and *activate*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

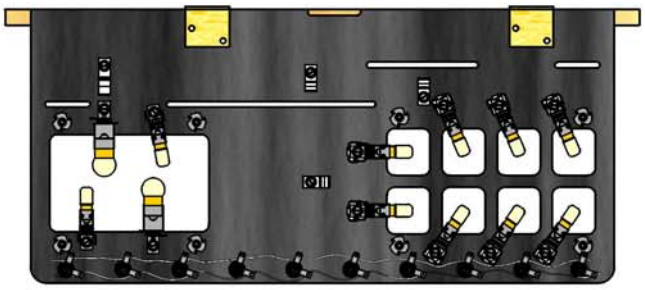







BADA BING!
R. I. P.


R I P
SHAKE DOWN
Boss
Under Boss
SAFE
EPISODES
HBO
TRUCK HEIST
FOOD
MEADOWLANDS
Ranks
CONFIDENTIAL





Go To Fuse Table

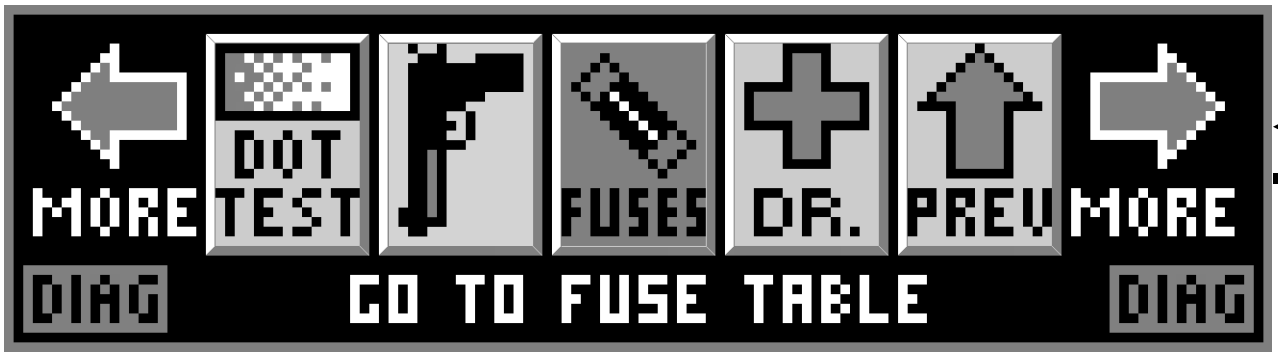
To initiate, from the **DIAGNOSTICS MENU**, select the "FUSES" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. The **FUSE TABLE MENU** now appears. This provides the technician with the current **Fuse Table** for this game *(also noted on a decal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

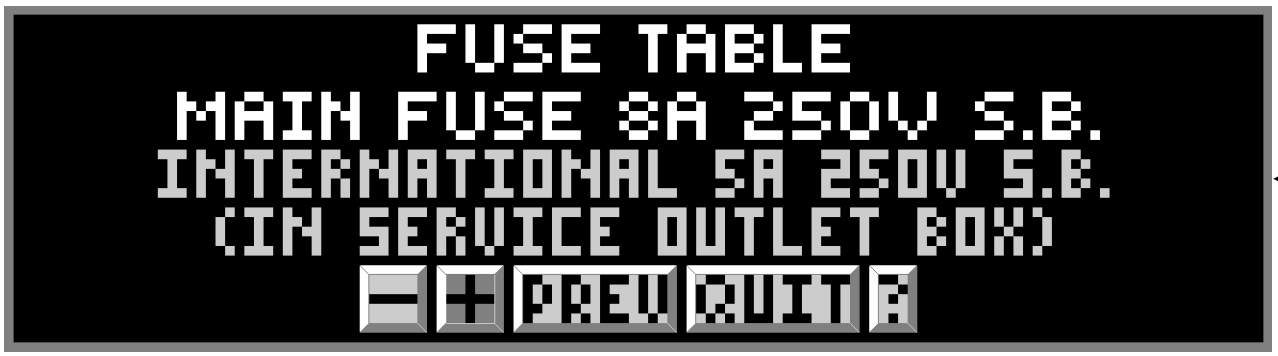
After entering **Portals™**, the **MAIN MENU** now appears with the "DIAG" *Icon* (**GO TO DIAGNOSTICS MENU**) flashing:



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*.

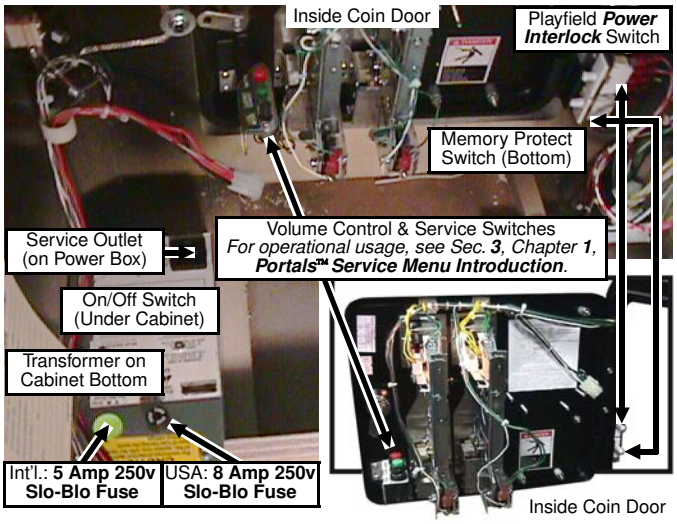
Go To Fuse Table continued on the next page.

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

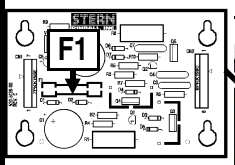
QUICK REFERENCE FUSE CHART

Backbox Fuses			
LOC:	**DISPLAY POWER SUPPLY (P.S.) BOARD**		
F1	: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



◀ Display Power Supply Bd.

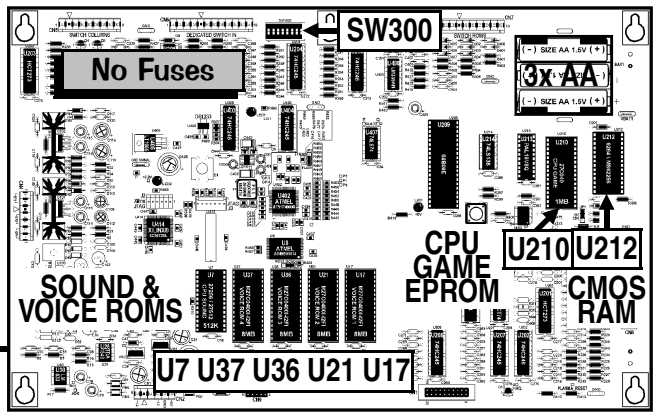


Solenoid Expander Board ‡

Tournament Interface Board ‡

‡ UK or Tournament GAMES ONLY

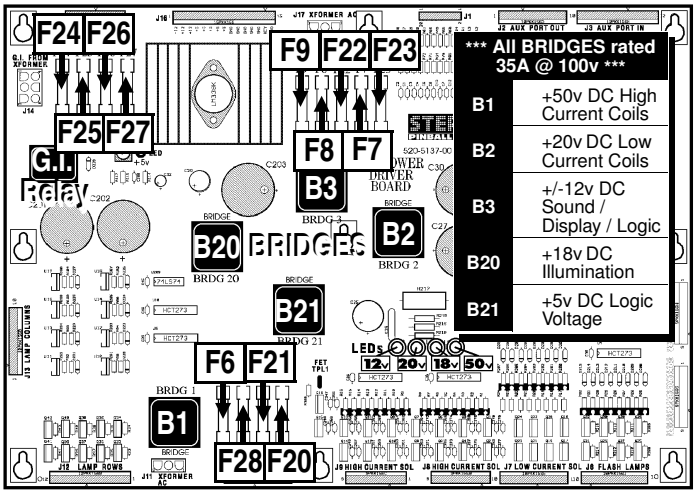
*For more info., see Section **5**, Chp. **4**, **PCBs** (Yellow Pages)*



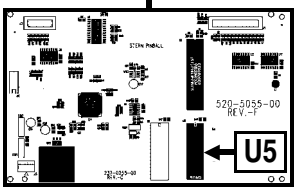
CPU/Sound Bd. II w/ATMEL ▲

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

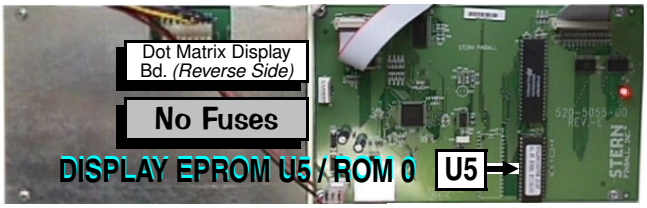
I/O Power Driver Board ▼



Display Controller Bd. ▶



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



THE Sopranos℠

Go To Diagnostics Menu



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





STANDARD AUDITS

01-68 ✍ = ✎ ◀◀ ▶▶

Audit definitions follow in this Chapter.

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

01	TOTAL BALLS PLAYED		25	22.5M–24.9M SCORES		49	PROPRIETARY	
02	TOTAL EXTRA BALLS		26	25M–34.9M SCORES		50	BASE REPLAY	
03	EXTRA BALL PERCENT		27	35M–49.9M SCORES		51	LEFT FLIPPER USED	
04	REPLAY 1 AWARDS		28	50M–74.9M SCORES		52	RIGHT FLIPPER USED	
05	REPLAY 2+ AWARDS		29	75M–99.9M SCORES		53	PROPRIETARY	
06	TOTAL REPLAYS		30	100M–149.9M SCORES		54	PROPRIETARY	
07	REPLAY PERCENT		31	150M+ SCORES		55	0–1 MINUTE GAMES	
08	TOTAL SPECIALS		32	AVERAGE SCORES		56	1 – 1.5 MINUTE GAMES	
09	SPECIAL PERCENT		33	SERVICE CREDITS		57	1.5 – 2 MINUTE GAMES	
10	TOTAL MATCHES		34	BALL SEARCH STARTED		58	2 – 2.5 MINUTE GAMES	
11	HIGH SCORE AWARDS		35	LOST BALL FEEDS		59	2.5 – 3 MINUTE GAMES	
12	HIGH SCORE PERCENT		36	LOST BALL GAME STARTS		60	3 – 3.5 MINUTE GAMES	
13	TOTAL FREE PLAYS		37	LEFT DRAINS		61	3.5 – 4 MINUTE GAMES	
14	TOTAL PLAYS		38	CENTER DRAINS		62	4 – 5 MINUTE GAMES	
15	0–1.9M SCORES		39	RIGHT DRAINS		63	5 – 6 MINUTE GAMES	
16	2M–3.9M SCORES		40	TILTS		64	6 – 8 MINUTE GAMES	
17	4M–5.9M SCORES		41	TOTAL BALLS SAVED		65	8 – 10 MINUTE GAMES	
18	6M–7.9M SCORES		42	PROPRIETARY		66	10 – 15 MINUTE GAMES	
19	8M–9.9M SCORES		43	PROPRIETARY		67	15+ MINUTE GAMES	
20	10M–12.4M SCORES		44	PROPRIETARY		68	RECENT REPLAY PERCENT	
21	12.5M–14.9M SCORES		45	PROPRIETARY				
22	15M–17.4M SCORES		46	PROPRIETARY				
23	17.5M–19.9M SCORES		47	PROPRIETARY				
24	20M–22.4M SCORES		48	PROPRIETARY				

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:



Select and activate to:

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

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

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

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

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

**** Help Note:** An explanation of each 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 *Paid Credits.*
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 *Coin Slots.*
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. *Based on the country's lowest coin denomination used for the game credit.*
14	**SOFTWARE METER:** Provides the continuing total of Meter Clicks. *This audit cannot be reset; the display shows the constant addition of Meter Clicks.*

Standard Audits (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 *Regular* and *Extra Balls.*
02	**TOTAL EXTRA BALLS:** Provides the total number of *Extra Balls* 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 *Awards (Credits, Extra Balls or Scores)* for Level 1.
05	**REPLAY 2+ AWARDS:** Provides the total *Awards (Credits, Extra Balls or Scores)* for Level 2 or higher.
06	**TOTAL REPLAYS:** Provides the total *Awards (Credits, Extra Balls or Scores)* for exceeding *Replay Score Levels.*
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 *Awards (Credits, Extra Balls, or Scores)* for making *Specials.*
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 *Credits* awarded for matching the last two digits of the score with the *System-Generated Match Number* at the end of the game. Percentage of *Match Credits* is adjustable from **0%** to **10%** by 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 *Awards (Credits, Extra Balls, or Scores)* 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 *Free Credits* for *Replays, High-Score-To-Date, Specials and Match.*
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**. ***Note:** Free Credits are not recorded in the Audit until they are actually used.*
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 *Final Score* 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.

	STANDARD AUDIT NAME: Definition
33	**SERVICE CREDITS:** Provides the total number of times the **Portals™ Green Button** (Dedicated Switch 7) was pushed in **Attract Mode**. *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).*
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*. *See Section **3**, Chapter **2**, **GO TO DIAGNOSTICS MENU**, **Technicians Alert** [Pinball Detection].*
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. *See Section **3**, Chapter **2**, **GO TO DIAGNOSTICS MENU**, **Technicians Alert** [Pinball Detection].*
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 *(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**).* 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:** *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.*

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 "№ 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**.

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) : 0

AUDITOR'S NAME :

CURRENT VOLUME SETTING:

CURRENT METER Reading :

AUDIT Date (MM/DD/YR) : 0

CPU Version : .

DISPLAY Version : .

GAME LOCATION NAME :

EARNINGS & STANDARD AUDIT TABLES





EARNINGS AUDITS 01-14

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).*

THE Sopranos™

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 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				

THE Sopranos℠

MULTI-WEEK TOURNAMENT AUDIT TABLES

STARTING METER Reading : | | | | | | |

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

AUDITOR'S NAME :

CURRENT VOLUME SETTING: ▶ ▶ ▶ | |

CURRENT METER Reading : | | | | | | |

AUDIT Date (MM/DD/YR) : | | | | | 0 | |

CPU Version : | | . | | DISPLAY Version : | | | . | |

GAME LOCATION NAME :

01	TOTAL PLAYS	06	JACKPOT	11	ACCUM. EARNINGS
02	TOURNAMENT PLAYS	07	NET EARNINGS	12	ACCUM. TOUR EARNINGS
03	TOTAL QUALIFYING PLAYS	08	ACCUM. TOTAL PLAYS	13	ACCUM. JACKPOT
04	TOTAL GAME EARNINGS	09	ACCUM. TOUR. PLAYS	14	# TOURNAMENTS
05	TOTAL TOUR. EARNINGS	10	ACCUM. QUALIFYING PLAYS		

STARTING METER Reading : | | | | | | |

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

AUDITOR'S NAME :

CURRENT VOLUME SETTING: ▶ ▶ ▶ | |

CURRENT METER Reading : | | | | | | |

AUDIT Date (MM/DD/YR) : | | | | | 0 | |

CPU Version : | | . | | DISPLAY Version : | | | . | |

GAME LOCATION NAME :

01	TOTAL PLAYS	06	JACKPOT	11	ACCUM. EARNINGS
02	TOURNAMENT PLAYS	07	NET EARNINGS	12	ACCUM. TOUR EARNINGS
03	TOTAL QUALIFYING PLAYS	08	ACCUM. TOTAL PLAYS	13	ACCUM. JACKPOT
04	TOTAL GAME EARNINGS	09	ACCUM. TOUR. PLAYS	14	# TOURNAMENTS
05	TOTAL TOUR. EARNINGS	10	ACCUM. QUALIFYING PLAYS		

STARTING METER Reading : | | | | | | |

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

AUDITOR'S NAME :

CURRENT VOLUME SETTING: ▶ ▶ ▶ | |

CURRENT METER Reading : | | | | | | |

AUDIT Date (MM/DD/YR) : | | | | | 0 | |

CPU Version : | | . | | DISPLAY Version : | | | . | |

GAME LOCATION NAME :

01	TOTAL PLAYS	06	JACKPOT	11	ACCUM. EARNINGS
02	TOURNAMENT PLAYS	07	NET EARNINGS	12	ACCUM. TOUR EARNINGS
03	TOTAL QUALIFYING PLAYS	08	ACCUM. TOTAL PLAYS	13	ACCUM. JACKPOT
04	TOTAL GAME EARNINGS	09	ACCUM. TOUR. PLAYS	14	# TOURNAMENTS
05	TOTAL TOUR. EARNINGS	10	ACCUM. QUALIFYING PLAYS		

STARTING METER Reading : | | | | | | |

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

AUDITOR'S NAME :

CURRENT VOLUME SETTING: ▶ ▶ ▶ | |

CURRENT METER Reading : | | | | | | |

AUDIT Date (MM/DD/YR) : | | | | | 0 | |

CPU Version : | | . | | DISPLAY Version : | | | . | |

GAME LOCATION NAME :

01	TOTAL PLAYS	06	JACKPOT	11	ACCUM. EARNINGS
02	TOURNAMENT PLAYS	07	NET EARNINGS	12	ACCUM. TOUR EARNINGS
03	TOTAL QUALIFYING PLAYS	08	ACCUM. TOTAL PLAYS	13	ACCUM. JACKPOT
04	TOTAL GAME EARNINGS	09	ACCUM. TOUR. PLAYS	14	# TOURNAMENTS
05	TOTAL TOUR. EARNINGS	10	ACCUM. QUALIFYING PLAYS		





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.*







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 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 Ajustment 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 agains 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**.

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 5 Pulses *(4 Pulses for the 2nd Credit + 1 Pulse remains in es crow).* The 4th Coin ($1.00) provides another 3 Pulses for a total of 4 Pulses (*4 Pulses for the 3rd Credit + 0 Pulses remain).* The **CENTER COIN: 12 PULSES** is set this way *(with a Bill Validator attached);* every $1-Bill inserted produces 12 Pulses or 3 Credits.

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

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

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

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

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

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

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

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.

LEFT	CENTER	RIGHT	4TH	Example 3			LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:	ONE CREDIT:	BONUS 1:	BONUS 2:	BONUS 1:	BONUS 2:	LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:
25¢	$1.00	25¢	Not Used	1 /25¢	6/ $1.00	13/ $2.00	5	20	5	0	4	20	40	1	0	1	4	1	1
Coin Mechanisms Used				Pricing Scheme Desired			PULSES	PULSES	PULSES	PULSES	PULSES	PULSES	PULSES	CREDIT	CREDITS	CLICK	CLICKS	CLICK	CLICK

In **Example 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.

LEFT	CENTER	RIGHT	4TH	Example 4			LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:	ONE CREDIT:	BONUS 1:	BONUS 2:	BONUS 1:	BONUS 2:	LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:
10p	50p	£1	20p	1 /30p	2 /50p	5 /£1	1	6	15	2	3	0	0	0	0	1	4	1	1
Coin Mechanisms Used				Pricing Scheme Desired			PULSE	PULSES	PULSES	PULSES	PULSES	PULSES	PULSES	CREDITS	CREDITS	CLICK	CLICKS	CLICK	CLICK

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

CPU/SOUND BOARD DIP SWITCH 300 SETTING	COUNTRY SETTING OPTION(S)	COIN MECHANISMS (SWITCHES) COINS THRU ... SLOT: LEFT	CENTER	RIGHT	4TH	PRICING SCHEME Number of Plays (Credits) for Price Amount Shown See "Appendix J" for Coin Cards Examples & Info!			Requires SPI Coin Card(s) Part Number
Pos. 1 2 3 4 5 6 7 8	Alternate Settings								
ON ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲	USA 1					1 /$.25			755-5400-01
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼	USA 2					1 /$.50	2 /$.75	3 /$1.00	755-5400-02
	USA 3					1 /$.50			755-5400-02
	USA 4					1 /$.50	*For USA Defaults 6 & 7 use:*		755-5400-02
	USA 5 »	$.25	$1.00	$.25		» 1 /$.50	5 /$2.00	**755-5400-02**	755-5400-00
	USA 6					1 /$.50	2 /'4 X 25¢'	3 /$1.00 Bill	◀ Used to promote the Bill Validator.
	USA 7					1 /$.50	4 /$1.50	6 /$2.00	
	USA 8					1 /$.50	3 /$1.00		755-5400-00
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▼ ▲ ▲ ▼ ▼ ▼ ▼	**Australia 1** «	20¢	$A1	$A2		» 1 /$A1	3 /$A2		755-5406-00 (Side 1)
OFF	Australia 2					1 /$A1			
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▲ ▼ ▼ ▼ ▼ ▼ ▼	**Canada**	Can$.25	Can$.25	Can$1	Can$2	1 /50¢	2 /75¢	3/ Can$1	755-5400-00 *or -01 or -02*
Pos. 1 2 3 4 5 6 7 8									
ON ▼ ▲ ▲ ▼ ▲ ▼ ▼ ▼	**Croatia**	1 kuna	2 kuna	5 kuna		1 /3 kuna	2 /5 kuna		755-5410-00 (2-Sided)
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▼ ▼ ▲ ▼ ▼ ▼ ▼	**Denmark 1** «	1 DKr	5 DKr	10 DKr	20 DKr	» 1 /3 DKr	2 /5 DKr		755-5402-00 (2-Sided)
OFF	Denmark 2					1 /2 DKr	3 /5 DKr	7 /10 DKr	
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▼ ▲ ▼ ▲ ▼ ▼ ▼	Japan 1	100¥		100¥		1 /100¥			755-5408-01 (2-Sided)
OFF	**Japan 2** «					» 1 /100¥	3 /200¥		
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▲ ▲ ▼ ▲ ▼ ▼ ▼	**Middle East**	1 Token		1 Token		1 /1 Token			755-5400-06 (2-Sided)
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▼ ▼ ▼ ▼ ▼ ▼ ▼	**New Zealand 1** «	$NZ1		$NZ2		» 1 /$NZ1			755-5406-00 (Side 2)
OFF	New Zealand 2					1 /$NZ1	3 /$NZ2		
Pos. 1 2 3 4 5 6 7 8									
ON ▼ ▲ ▼ ▲ ▼ ▼ ▼ ▼	**Norway 1** «	10 NKr	5 NKr	20 NKr		» 1 /5 NKr			755-5403-00 (2-Sided)
OFF	Norway 2					1 /10 NKr	3 /20 NKr		
Pos. 1 2 3 4 5 6 7 8									
ON ▼ ▼ ▲ ▲ ▼ ▼ ▼ ▼	**South Africa**	50c	R1	R2	R5	1 /R2			755-5409-01 (2-Sided)
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▲ ▼ ▲ ▼ ▼ ▼ ▼	**Sweden 1** «	1 SKr	5 SKr	10 SKr		» 1 /10 SKr	2 /15 SKr	3 /20 SKr	755-5404-00 (2-Sided)
OFF	Sweden 2					1 /5 SKr			
Pos. 1 2 3 4 5 6 7 8									
ON ▼ ▼ ▲ ▲ ▼ ▼ ▼ ▼	**Switzerland 1** «	1 SwF	2 SwF	5 SwF		» 1 /1 SwF	6 /5 SwF		755-5405-00 (2-Sided)
OFF	Switzerland 2					1 /1 SwF	3 /2 SwF	9 /5 SwF	

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

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

Standard Adjustment 11, Custom Pricing, and Std. Adj. 12-17 continued on the next page.

STANDARD ADJUSTMENT NAME: Definition

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

CPU/SOUND BOARD DIP SWITCH 300 SETTING	COUNTRY SETTING OPTION(S)	COIN MECHANISMS (SWITCHES) COINS THRU ... SLOT: LEFT	CENTER	RIGHT	4TH	PRICING SCHEME Number of Plays (Credits) for Price Amount Shown See "Appendix J" for Coin Cards Examples & Info!			Requires SPI Coin Card(s) Part Number
Pos. 1 2 3 4 5 6 7 8									
ON S E E B E L O W									
OFF S E T T I N G S									
Euro 1-12 are alternate settings for countries using the Euro: If choosing an alternate Euro Setting other than your Country's Default, please remember to use your Country Dip Switch Setting.	**Euro 1**	€.50	€1.00	€2.00	*optional* €.20 *optional*	1 /€.50			755-5401-01
	Euro 2					1 /€.50	5 /€2.00		755-5401-02
	Euro 3					1 /€.50	3 /€1.00		755-5401-03
	Euro 4					1 /€.50	6 /€2.00		755-5401-04
	Euro 5					1 /€.50	3 /€1.00	7 /€2.00	755-5401-05
	Euro 6					2 /€.50			755-5401-06
	Euro 7					1 /€1.00	5 /€4.00		755-5401-07
	Euro 8					1 /€1.00	3 /€2.00		755-5401-08
	Euro 9					1 /€1.00	2 /€1.50	3 /€2.00	755-5401-09
	Euro 10					1 /€1.00	3 /€2.00	7 /€3.00	755-5401-10
	Euro 11					1 /€1.00	4 /€2.00		755-5401-11
	Euro 12					2 /€1.00	9 /€4.00		755-5401-12

*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.*

Austria **Euro 9**	€.50	€1.00	€2.00		1 /€1.00	2 /€1.50	3 /€2.00	755-5401-09
Belgium **Euro 1**	€.50	€1.00	€2.00		1 /€.50			755-5401-01
Finland **Euro 8**	€.50	€1.00	€2.00		1 /€1.00	3 /€2.00		755-5401-08
France **Euro 10**	0,50 €	1,00 €	2,00 €		1 /1,00 €	3 /2,00 €	7 /3,00 €	755-5401-10
Germany 1					1 /0,50¢			755-5401-01
Germany 2 «	€0,50	€1,00	€2,00		» 1 /0,50¢	5 /€2,00		755-5401-02
Germany 3					1 /0,50¢	6 /€2,00		755-5401-04
Greece **Euro 6**	€.50	€1.00	€2.00		2 /€.50			755-5401-06
Italy 1 «	€.50		€.50		» 1 /.50¢			755-5401-01 &
Italy 2					1 /€1.00	3 /€2.00		755-5401-08
Netherlands **Euro 3**	€.50	€1.00	€2.00		1 /€.50	3 /€1.00		755-5401-03
Portugal	€.50		€.50		1 /€.50			755-5401-01
Spain **Euro 3**	€.50	€1.00	€2.00		1 /€.50	3 /€1.00		755-5401-03

***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 Ajustment 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.

	STANDARD ADJUSTMENT NAME: Definition
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** *(**H**igh **S**core **T**o **D**ate).* 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.

	STANDARD ADJUSTMENT NAME: Definition
39	**UK ONLY** / **Dip Switch Must Be Set** / **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.)*

Standard Adjustments 53-55 continued on the next page.

Standard Adjustments Continued.

	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-Icon*s to view the next or previous Adjustment in this group. Select and *activate* either of the "-" or "+" *Mini-Icons* to change the setting, if desired *(the Default Setting is noted in the definitions below)*. The display will describe the **Adjustment Number**, **Adjustment Name** and the **Current Adjustment Setting**. The current Adjustment will remain in the display until the next Adjustment is view or when this Menu is exited.

********** ***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 *(friggin')*. *Set to* **NO (OFF) :** Censored! No "bleeping," no swearing. *Bada Bing! Dancing Girls* ***DO NOT APPEAR*** *in Dot Display.* 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 **MODRATE =** 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 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.

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.



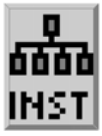
Select and activate to **QUIT**, *exits & returns to the* ***Attract Mode***.



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.***



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.

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



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.

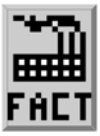
To initiate, from the **INSTALLS MENU**, select the "NOV" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. **Game Play Type** is set to **RESTRICTED PLAY**. **"REQUEST INSTALLED"** is indicated and returns to the **INSTALLS MENU** with the "NOV" *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 DIRECTORS 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 COMPE-TITION *	FREE PLAY COMP. *	INSTALL HOME PLAY	FILM STAR RESET	INSTALL NOVELTY	INSTALL ADD-A-BALL	INSTALL FACTORY
01	REPLAY TYPE					NONE		
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 ***					

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.

*** 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).*

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 DIRECTORS 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 DIRECTORS 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.



(SELECT ANY RESET...)

RESET ALL AUDITS, ADJUSTMENTS & INSTALLS

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.



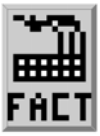
Reset Grand Champion

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.



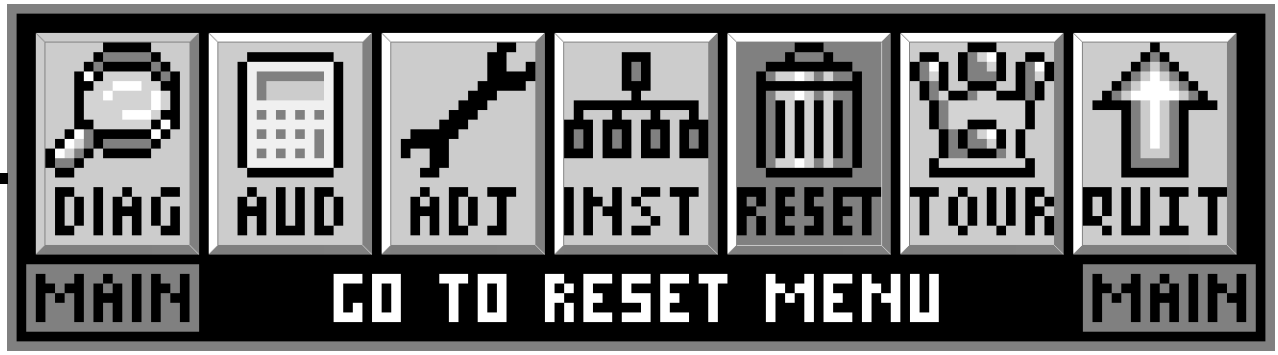
Factory Reset

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

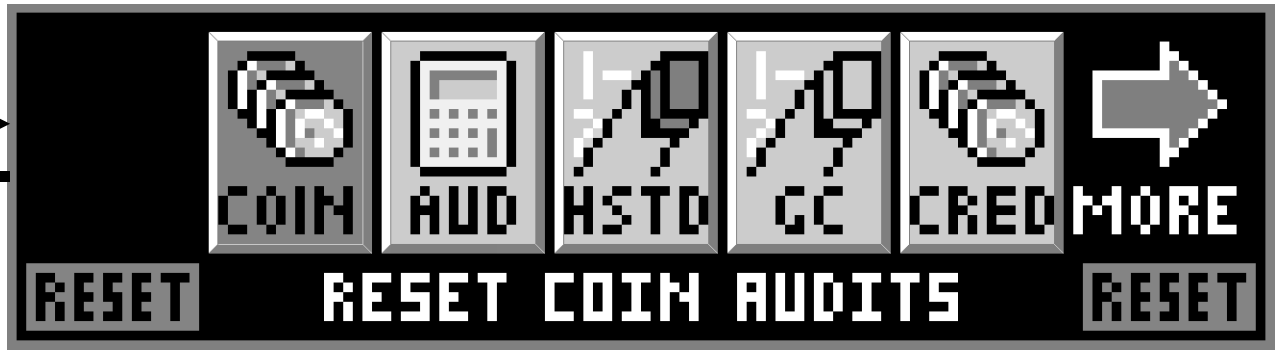
To initiate, from the **RESET MENU**, select the "FACT" *Icon* with either the **Red** or **Green Buttons** and press the **Black Button**. ⚠ All **Audits** *(except for Audit **14**, **Software Meter**)*, all **Adjustments** and **Installs** will be reset to the *Factory Default Settings*. **"REQUEST INSTALLED"** is indicated and the **Service Menu** is exited, returning to the ***Attract Mode***.

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:

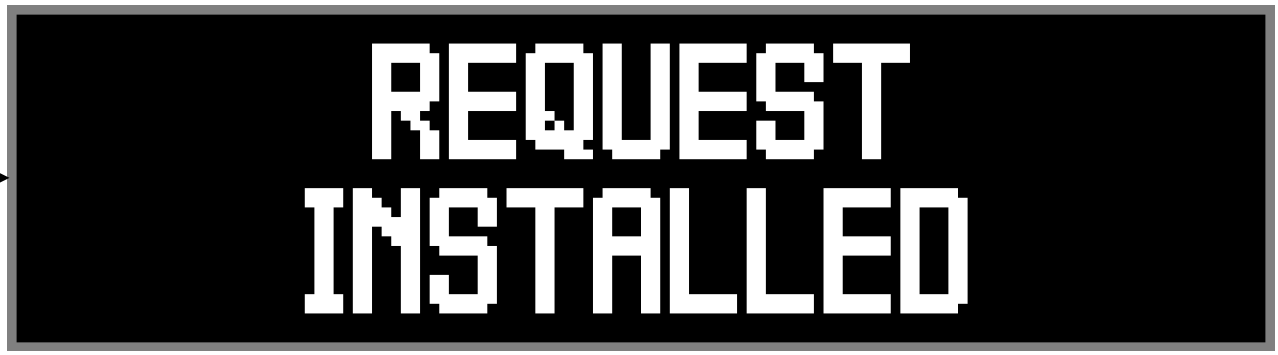


From the **RESET MENU**, select any of the *Icons* ("COIN", "AUD", "HSTD", "GC", "CRED") with either the **Red** or **Green Buttons** and press the **Black Button** to *activate* the **ICON** chosen. After the **ICON** is selected & *activated,* "REQUEST INSTALLED" is indicated and is returned to the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



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.*** ❽ *&* ❾ *in the* ***Find-It-In-Front: Dr. Pinball****).* You can also call Technical Support or visit our website *(details on the back cover of this manual).*

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

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



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



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



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



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

Select and activate to:

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

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

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



GO TO TOURNAMENT MENU (OPTIONAL USE ONLY)

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

Tournament Adjustment & Audit Tables on the next page.





TOURNAMENT ADJUSTMENT TABLES

TOURNAMENT ADJUSTMENTS 01-15

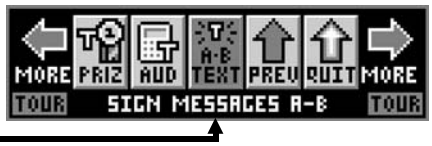
Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
01	CREDITS PER PLAY	02	
02	JACKPOT BASE	$20.00	
03	JACKPOT INCREMENT	$00.50	
04	JACKPOT MAX.	$2,500.00	
05	CURRENT DATE/TIME	JAN. 01, 2004 12:00:00 AM	
06	START DATE	FEB. 01, 2004 12:00:00 AM	
07	END DATE	MARCH 01, 2004 12:00:00 AM	
08	# OF PRIZES	03	

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 :

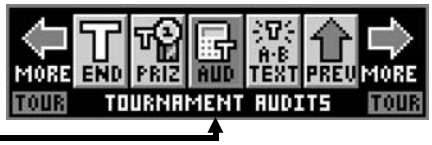
See Adj. 06 & 07 above >>

TOURNAMENT START DATE :

TOURNAMENT END DATE :

TOURNAMENT AUDIT TABLE





TOURNAMENT AUDITS 01-14

Audit definitions follow in this Chapter.

01	TOTAL PLAYS	06	JACKPOT	11	ACCUM. EARNINGS
02	TOURNAMENT PLAYS	07	NET EARNINGS	12	ACCUM. TOUR EARNINGS
03	TOTAL QUALIFYING PLAYS	08	ACCUM. TOTAL PLAYS	13	ACCUM. JACKPOT
04	TOTAL GAME EARNINGS	09	ACCUM. TOUR. PLAYS	14	# TOURNAMENTS
05	TOTAL TOUR. EARNINGS	10	ACCUM. QUALIFYING PLAYS		

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-Icon*s to view the next or previous Tournament Adjustment in this group. Select and *activate* either of the "-" or "+" *Mini-Icons* to change the setting, if desired *(the Default Setting is noted in the definitions below)*. The display will describe the **Tournament Adjustment Number**, **Tournament Adjustment Name** and the **Current Tournament Adjustment Setting**. The current Tournament Adjustment will remain in the display until the next Tournament Adjustment is viewed or when this Menu is exited.

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 *Credits* that may be accumulated per game.
02	**JACKPOT BASE :** Set between **$00.00 - $999,999.00** *(increments of $1).* Default is **$20.00**. Set the initial *Prize Pool Amount* to be offered for the Tournament. ***Note:*** *The displays will present the words "**PRIZE POOL**" in lieu of the word "JACKPOT".*
03	**JACKPOT INCREMENT :** Set between **$00.00 - $999,999.99** *(increments of 1¢).* Default is **$00.50**. Set the *Prize Pool Increment* which will increase the *Prize Pool Amount* with each Tournament Game played.
04	**JACKPOT MAX. :** Set between **$00.00 - $999,999.00** *(increments of $1).* Default is **$2,500.00**. Set the maximum cap to be placed on the *Prize Pool* during a Tournament. ***Note:*** *The displays will present the words "**PRIZE POOL**" in lieu of "JACKPOT".*
05	**CURRENT DATE/TIME :** Set the current **MONTH**, **DAY**, **YEAR**, **HOUR (AM/PM)**, **MINUTE** and **SECOND**. Default is **JAN. 01, 2004 12:00:00 AM**.
06	**START DATE :** Set the desired **MONTH**, **DAY**, **YEAR**, **HOUR (AM/PM)**, **MINUTE** and **SECOND**. Default is **FEB. 01, 2004 12:00:00 AM**.
07	**END DATE :** Set the desired **MONTH**, **DAY**, **YEAR**, **HOUR (AM/PM)**, **MINUTE** and **SECOND**. Default is **MARCH 01, 2004 12:00:00 AM**.
08	**# OF PRIZES :** Set between **01 - 05** *(If Tournament Adj. 11 is set to REGULAR)* or **02 - 05** *(If Tournament Adj. 11 is set to BUMP N' WIN).* Default (for either) is **04**. Set the max. number of *Prize Positions* to be awarded during a Tournament. ***Selections are as follows*** *(percentage distribution cannot be changed):*
	If below Tournament Adj. 11 is set to **REGULAR :** / If Trn. Adj. 11 is set to **BUMP N' WIN** *(Default)* **:**
	Set to **01** 1 Winner **100%** (1) Prize Pool / *Cannot set to 01. Minimum of 2 winners required.*
	Set to **02** 2 Winners **65%** (1) **35%** (2) / Set to **02** 2 Winners **65%** (1) **35%** (2)
	Set to **03** 3 Winners **50%** (1) **30%** (2) **20%** (3) / Set to **03** 3 Winners **50%** (1) **25%** (2) **25%** (3)
	Set to **04** 4 Winners **50%** (1) **25%** (2) **15%** (3) **10%** (4) / Set to **04** 4 Winners **40%** (1) **20%** (2) **20%** (3) **20%** (4)
	Set to **05** 5 Winners **50%** (1) **20%** (2) **15%** (3) **10%** (4) **5%** (5) / Set to **05** 5 Winners **40%** (1) **15%** (2) **15%** (3) **15%** (4) **15%** (5)
09	**AWARD TYPE :** Set to **CASH**, **POINTS**, **TICKET**, **NONE** or **PRIZE**. Default is **CASH**. Select **CASH** for the displays to represent the Prize Pool amount *(based on Jackpot Base and Max.)* in ***$Dollars***. Select **POINTS** for the displays to represent the Prize Pool amount in ***Points***. Select **TICKET** for the display to represent the Prize Pool amount in ***Tickets***. Select **NONE** ***NOT TO*** represent the Prize Pool amount *(if prize(s) to be awarded are not Cash, Points or Tickets).* Select **PRIZE**, if applicable.
	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** *(increments of 1M).* 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 *(and in-turn bumps remaining leaders down 1).* When set to **REPLACE**, the 1st place player is replaced by the new 1st place player *(the other board leaders are therefore not bumped down).*

Score Range and Default varies from title to title.

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!***

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 *Regular* and *Tournament Games* played while a *Tournament is active (in progress).* This total is derived by adding the below Tournament Audit **02** with ***Regular Plays.***
02	**TOURNAMENT PLAYS :** Provides the total number of *Tournament Games* played while a *Tournament is active (in progress).*
03	**TOTAL QUALIFYING PLAYS :** Provides the total number of times a player qualified *(invited to enter name).*
04	**TOTAL GAME EARNINGS :** Provides the total Gross Earnings *accepted,* while a *Tournament is active (in progress).*
05	**TOTAL TOUR. EARNINGS :** Provides the total Tournament Earnings *(Audit* ***04*** *less Regular Game Earnings)* while a *Tournament is active (in progress).*
06	**JACKPOT (PRIZE POOL TOTAL) :** Provides the total Prize Pool *(Jackpot)* Amount to be paid out while a *Tournament is active (in progress).*

Tournament Audits 07-14 continued on the next page.

TOURNAMENT AUDIT NAME: Definition	

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

07	**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)

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.

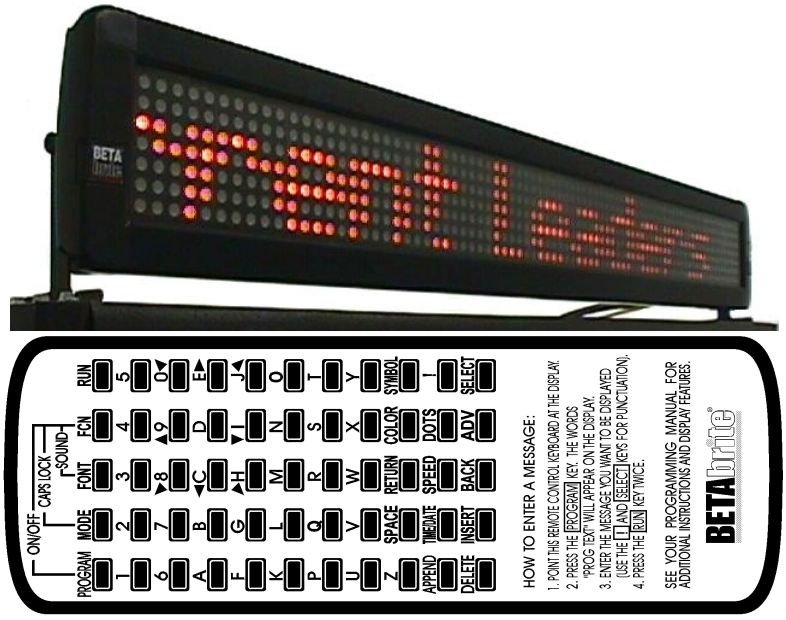
Nr.	TOURNAMENT ADJUSTMENT NAME: Definition
16	**LOCATION MESSAGE :** Set to **ON, CHANGE** or **OFF**. Default is **ON**. When set to **CHANGE**, a new message can be set or the old one can be edited *(select the "+" Mini-Icon to change settings until "CHANGE" appears in the display, then select the ">>" 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:

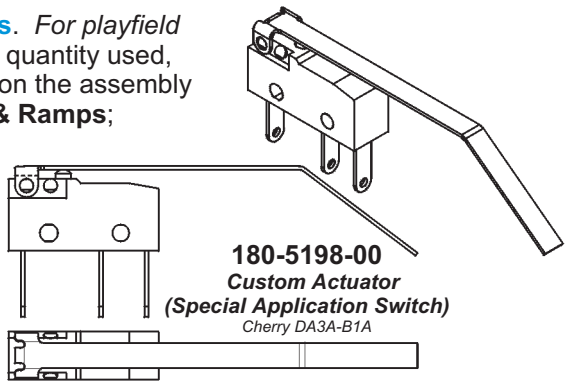
YOU CAN BE THE NEXT BIG WINNER!



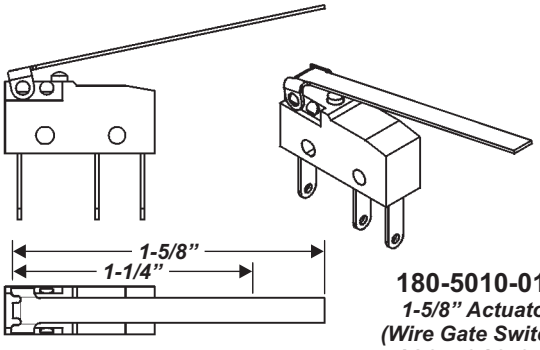
IMPORTANT FOR TOURNAMENT USERS: ***2 additional messages can be added*** by using the **Beta Brite® Remote**. More details in the **ToPS™ Tournament Pinball System Kit Installation Manual** *(SPI Part Number: 780-6011-01)* provided in the ***Optional Tournament Kit*** *(SPI Part Number: 502-5011-00).*

Which Switch is Which? Switch between chapters ...

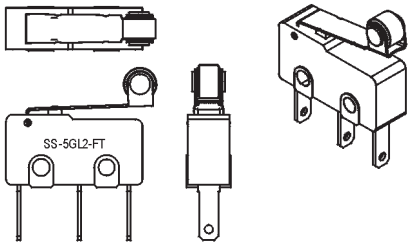
Identifying switches. Find your switch in the **Pink** or **Blue Pages**. *For playfield switch location, see Pages **66-67**.* These pages identify the type, quantity used, location and switch matrix number. You can also find your switch on the assembly itself, by looking in **Chapter 2, Drawings for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



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

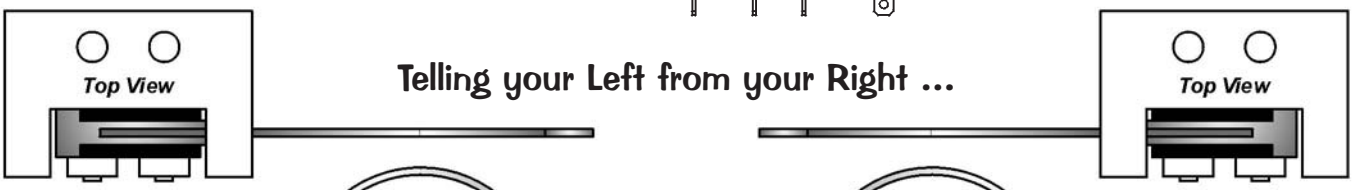


180-5010-01
1-5/8" Actuator
(Wire Gate Switch)
180-5010-04
1-1/4" Actuator
(Spinner Switch)



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

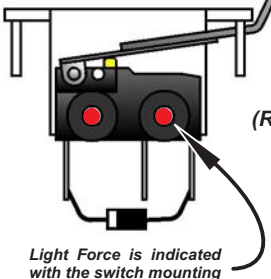
Telling your Left from your Right ...



Switch in Front View, Wire Form (Acutuator) 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)

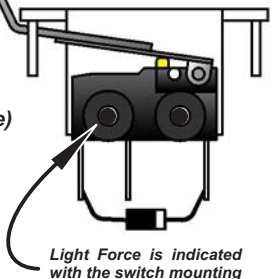


Light Force is indicated with the switch mounting studs painted red. Standard Force remains the natural color of the plastic bracket.

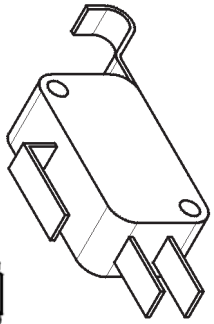
500-6227-01
(includes 180-5163-00)
Standard Force

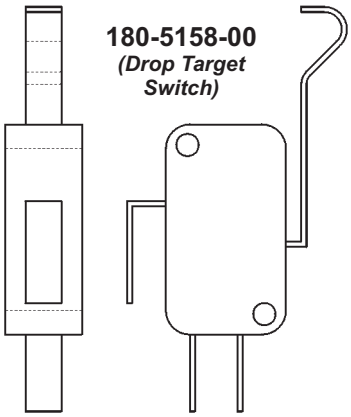
500-6227-03
(includes 180-5163-00)
Light Force
(Roll-Over Switch, Left Style)

Switch in Front View, Wire Form (Acutuator) ◄ Points ◄ Left

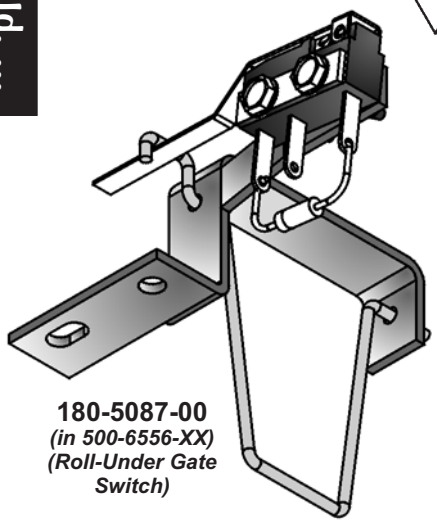


Light Force is indicated with the switch mounting studs painted black. Standard Force remains the natural color of the plastic bracket.

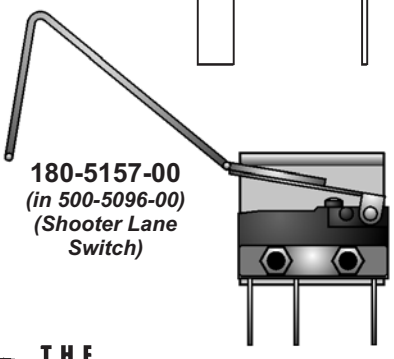




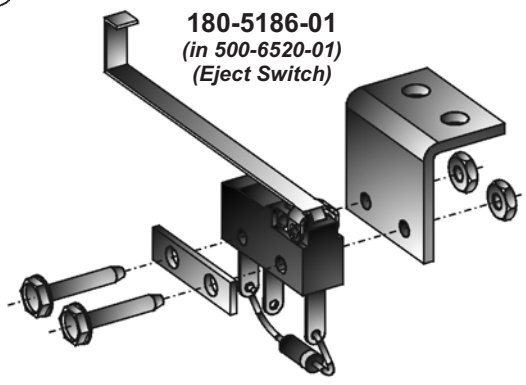
180-5158-00
(Drop Target Switch)



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



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



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

Backbox — 60
Speaker Panel — 61
Cabinet — 62
Cabinet Continued — 63
Playfield Top & Bottom - Misc. Parts & Brackets — 64
... — 65
...Top & Bot. - Switches... — 66
...Top - Roll-Under Gates — 67
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P/F ... - Metal Posts & Fin Shank Screws & Nuts — 70
... — 71
Playfield Top - Hex Spacers — 72
... — 73
... Top - Plastic Posts & Spacers & Metal Spacers — 74
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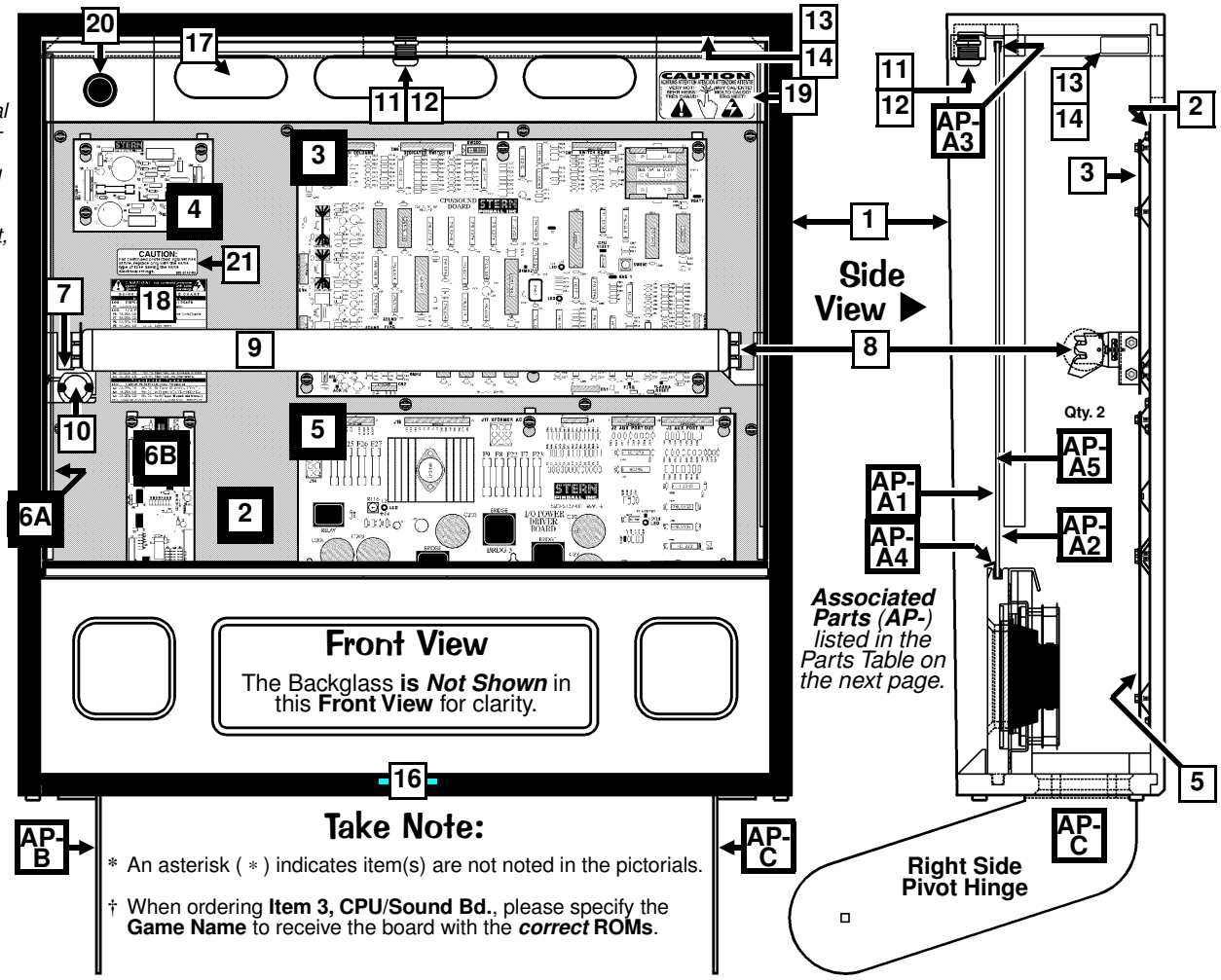
Important: *Read all* ***"Take Note:"*** *items*

Sec. 4: Parts Id. ...

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

The Sopranos℠ 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.*

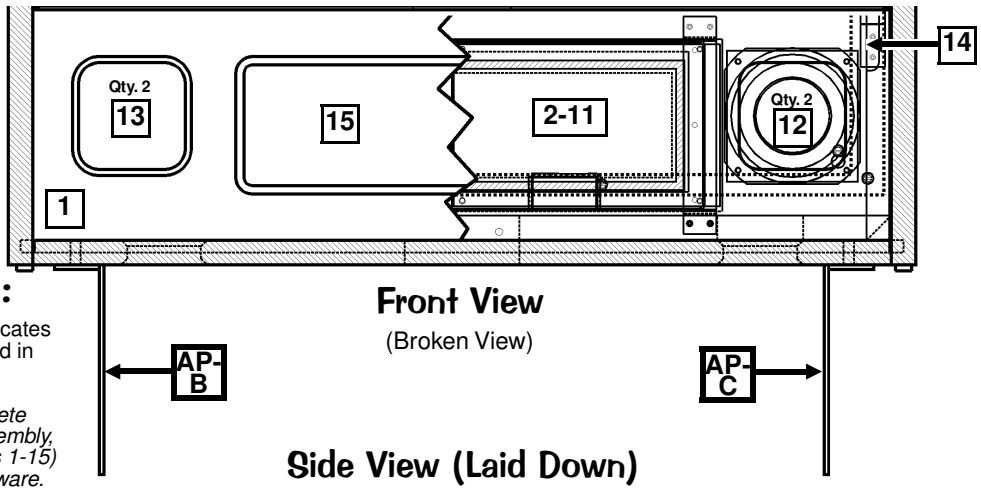


Nr.	BACKBOX PARTS	QTY.	SPI PART Nr.
1	Backbox Sopranos℠ Screened No Parts	1	525-5631-17-85
	Item 1 Note: *Chrome T-Molding is installed and cannot be ordered separately.*		
2	PCB Metal Mounting Plate	1	535-5809-14
	Item 2 is secured to Item 1 by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 13) (234-5101-00) **and** #10 Washer 7/32" I.D. X .5" O.D. X 1/16" Thick (Qty. 4) (242-5003-00)		
3 †	CPU/Snd. Bd. **w/ATMEL Sound Processor**	1	**520-5300-00**
4	Display Power Supply Board	1	520-5138-00
5	I/O Power Driver Board *Rev. **G** or higher*	1	520-5137-01
	Items 3, 4 & 5 are secured to Item 2 by: #8-32 X 3/8" HWH MS (Qty. 19) (237-5903-00)		
6A	3X Trans. Drvr. Bd. **(UK/Special Apps.Only)**		520-5068-01
6B	ToPS™ Tournament Serial Interface (TSI) Board		520-5220-00
	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.***		
7	Fluorescent Light Bracket Assy. Left	1	515-6545-00
	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**).		
8	Fluorescent Light Bracket Assy. Right	1	515-6545-01
	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**). ** **secured by:** #6-32 X 5/8" PPH MS (Sems) Zinc (Qty. 1) (232-5203-00) *** **secured by:** #4-40 X 1/2" PPH MS (Sems) Zinc (Qty. 2) (237-5813-00)		
	Items 7 & 8 are secured to Item 1 by: #10-24 X 1-1/4" Carriage Bolt Sq. Neck (Qty. 2/per) (231-5012-00), #10-24 Keps Nut (Qty. 2/per) (240-5207-00) **and** 3/4" X 3" Reinforced Strapping Tape (Qty. 1, Sold in 12" Lengths only) (626-5040-00)		
9	Fluorescent Tube 24" (F20T9CW)	1	165-5061-00
10	Starter - Fluorescent (FS2 Light)	1	165-5011-01
11	Lock Mounting Plate	1	535-8128-01
12	Lock 5/8" Barrel, 3/4"ø, 1.5" Flat Cam	1	355-5055-00
	Items 11-12 are secured by: #8 X 5/8" TP Torx T20 (Qty. 4) (237-5947-00)		

Nr.	BACKBOX PARTS	QTY.	SPI PART Nr.
13	Ballast Mounting Plate	1	535-8657-00
14	Ballast *CU45Z-W 1/2" Core 120v 60 Hz 13W*	1	010-5015-00
	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)*		
15*	*#1 Roto Lock Male (on Cabinet)*	*1*	*355-5006-01*
16	#1 Roto Lock Female (R2-0002-02)	1	355-5006-02
	Item 16 is secured by: #10-24 X 1-3/4" CBSN (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)		
17	Back Vent Grill 2-1/2" X 18"	1	545-5072-02
	Item 17 is secured by: Staple 5/16" (Qty. 23) (631-5000-00)		
18	Fuse Description Decal (Generic)	1	820-6152-02
19	"CAUTION - VERY HOT" Decal	1	820-6266-00
20‡	Button Hole Plug (Blk) **(Happ #52-6214-00)**	1	500-6566-00
21	Fuse Label (UL)	1	820-6143-00
22*	Backbox Date Label	1	820-5091-00
23*	Ribbon Cable, 20-Pin (4")	1	036-5000-04
	***Item 23 (20-Pin) connects the** CPU/Sound Board to the I/O Power Driver Board.*		
24*	Ribbon Cable, 26-Pin (40")	1	036-5001-40
	***Item 24 (26-Pin) connects the** CPU/Sound Board to the Display Controller Board.*		
25*	Display Cable *(Wiring Harness)*	1	036-5454-00
26*	1/4" Clamp (Double)	2	040-5000-23
27*	1/2", 3/4" & 1" Clamp (Single)	9	040-5000-XX
	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"s** use **-08** (Qty. 2); for **1"** use **-09** (Qty. 6)		
28*	Ground Strap (5") *(by Item 12)*	1	600-5006-05
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.

Sopranos℠ 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)



Front View
(Broken View)

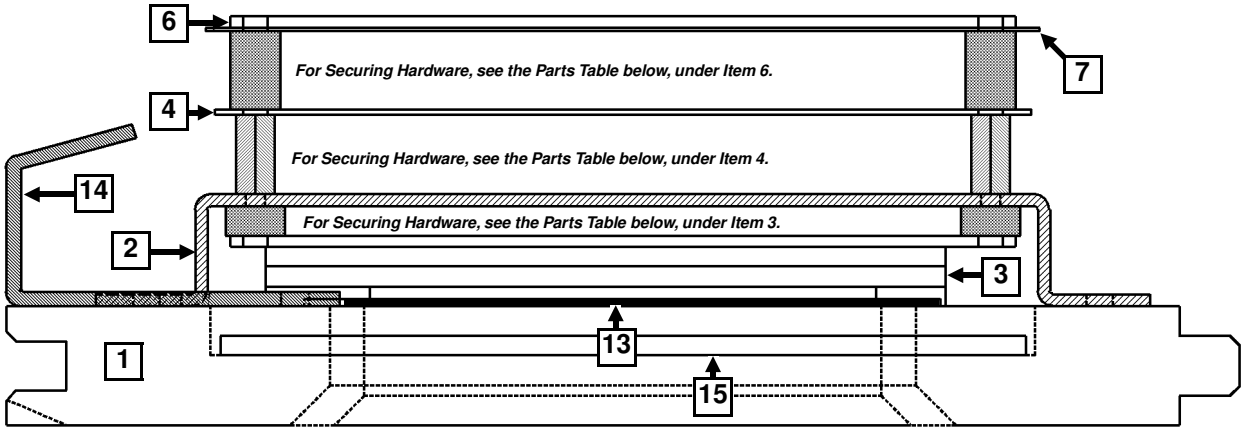
Take Note:

* 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.

Side View (Laid Down)

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



Nr.	SPEAKER PANEL PARTS	QTY.	SPI PART Nr.
1	Speaker Panel (Black Wood)	1	525-5515-00
2	Dot Matrix Disp. Bd. Mounting Bracket	2	535-8368-01
	Item 2 is secured to Item 1 by: #8 X 3/4" SLT HWH AB (Zinc) (Qty. 4/per) (234-5103-00)		
3	Dot Matrix Display Board 128 X 32	1	520-5052-00
	Item 3 is secured to Item 2 by *(at corners)*: 3/16" X 3/8" Spacer Gray (Qty. 4) (254-5000-18) **and** #6-32 X 1/2" 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
	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
	Ordering Note: *"Item 5" is sold in 12" length. Required:* ***.67*** *Ft.*		
6	Display Controller Board FCC-FEB98	1	520-5055-03
7	RF Shield	1	820-5092-00
	Items 6 & 7 are secured to Item 4 by: 1/2" X 5/16" X .144 ID Spcr. (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
9∗	1/2" Clamp (Single) *(on Item 4)*	1	040-5000-06
10∗	Ribbon Cable, 14-Pin	1	036-5260-00
	Item 10 Note: *The 14-Pin cable connects the Dot Matrix Disp. Bd. to the Disp. Controller Bd.*		
11∗	Foam 3/16" Thk. X 1/4" X 36"	6	626-5026-00
	Above Item 11 is self-adhesive. *Located between Items 3 & 17. Sold in 12" Lengths only.*		
12	Speaker (Shld.) 4" 8Ω MG Elec #4060SH	2	031-5004-01
13	Speaker Grill (Black w/no Artwork)	2	535-8081-01
14	Speaker Panel Hook Bracket	2	535-7009-02
	Items 12, 13 & 14 are secured by: #8 X 5/8" SLT HWH AB (Green) (234-5102-04) (**Items 12 / 13:** (Qty. 4/per); **Item 14:** (Qty. 2/per)		

Nr.	SPEAKER PANEL PARTS	QTY.	SPI PART Nr.
15	Plastic Shield (Display Cover)	1	545-5884-00
	Item 15 is secured to Item 2 by: #6 X 3/8" SLT HWH AB (Zinc) (Qty. 8) (234-5000-00)		

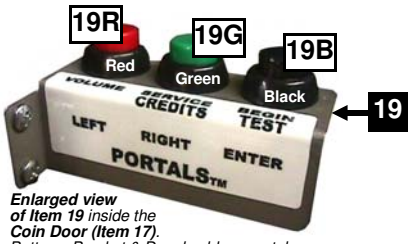
The Associated Parts ***AP-A*** *thru* ***AP-C*** *are also noted in the Backbox Assembly drawings on the previous page.*

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

Nr.	ASSOCIATED PARTS	QTY.	SPI PART Nr.
AP-A1	Clear Backglass 25.906" X 19.187"	1	660-5038-02
AP-A2	The Sopranos℠ Film Art (#85)	1	830-5285-00
AP-A3	Top Plastic Channel - 26"	1	545-5018-15
AP-A4	Bottom Plastic Lift Channel - 26-1/16"	1	545-5021-01
AP-A5	Plastic Edging (Left/Right) - 18-1/8"	2	545-5018-14
	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.*		
AP-B	Pivot Hinge Left	1	535-7999-00
AP-C	Pivot Hinge Right	1	535-7999-01
	Items AP-B & AP-C are secured to Backbox by: 1/4"-20 X 1-1/4" C.B. Sq. Neck (Qty. 4) (231-5003-00), 1/4"-20 Flange Nut (Qty. 4) (240-5300-00) **and** Fend Washer 1/4" I.D. X 1" O.D. (Qty. 1) (242-5009-00) **Items AP-B & AP-C are secured to Cabinet by:** 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.*

Cabinet - Parts ■ & Switches □



***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**.*

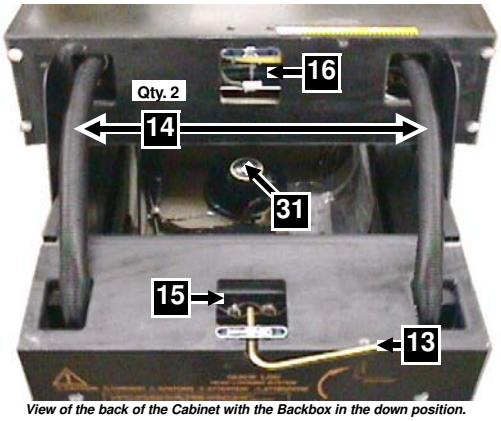
For Backbox Parts see the previous two pages.

Take Note:

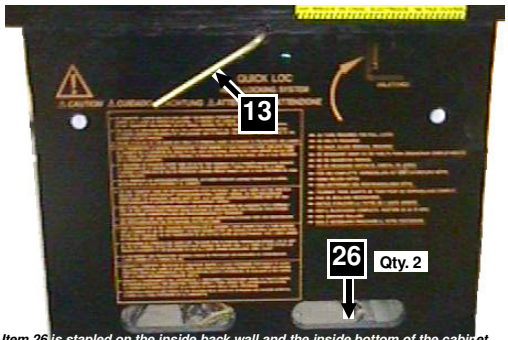
‡ **Item 11**, ***Button Hole Plug*** **(Blk)** is the *Optional Tournie Button Access Hole. If removing for the Optional Tournament Button, save with the game.*



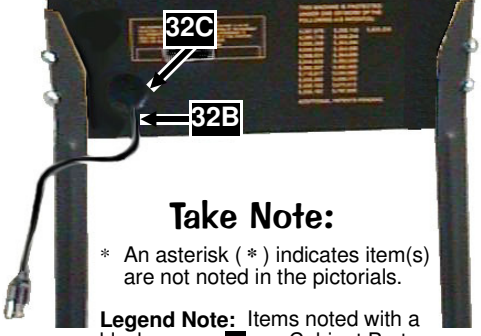
***Item 32F** (Power On/Off Switch) is located under the Cabinet (Front Right) directly below the Power Box.*



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



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



View of the Coin Door (Item 17) open.

***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**).*

2 Qty. 4

Take Note:

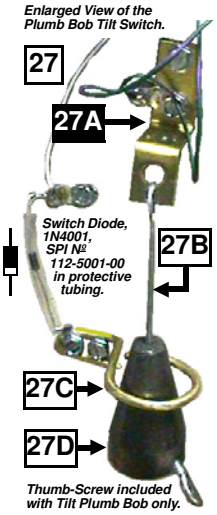
* An asterisk (*) indicates item(s) are not noted in the pictorials.

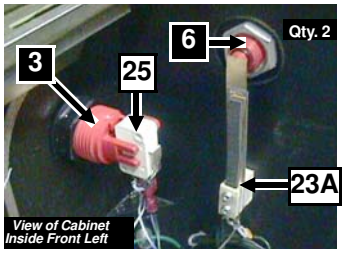
Legend Note: Items noted with a black square ■ are Cabinet Parts. Items noted with a white square □ are Switches.

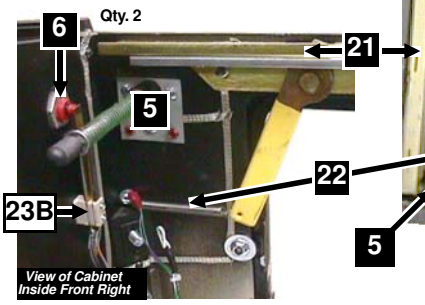
Nr.	CABINET PARTS	QTY.	SPI PART Nr.
1	Sopranos℠ Screened Cab. (No Parts)		525-5395-15P-85
2	Black Leg with Leveler Asm.	4	500-5921-50
	Item 2 is secured by: Leg Bolt Back Plate (**535-5703-00**) **and** Leg Bolt 3/8" X 16 X 2-1/2" Hex 5/8" Hd. (2/per) (231-5001-01) *Leg Leveler ONLY (3/8"-16 X 3") (500-5017-00).*		
3	Start Button (Red) + Lamp Assembly	1	500-6388-02
	Item 3 includes the Switch.* FOR SWITCH ONLY *see Item 25 on the Next Page.		
*	Diode Terminal Strip 2-Lug (810) Isolated	1	055-5203-00
	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.*		
4*	#555 Wedge Base Bulb (Clear)	1	165-5002-00
	Item 4 is included with Item 3, for just a replacement Bulb use the above number.		
5	Ball Shooter (Plunger) Assembly	1	500-6146-00-04
	FOR A BREAKDOWN OF PARTS SEE: Sec. 4, Chp. 2, Drawings for ... Assemblies...		
6	Flipper Button (Red) Assembly	2	500-5026-32
	Item 6 is secured by: Pal Nut for Flipper Button (Metal) (Qty. 2/per) (240-5003-01) **and is fitted with:** O-Ring 11/32" X 7/32" X 1/16" (Qty. 1/per) (545-5850-00) **Item 6** ***DOES NOT*** **include the Switch Asm. FOR SWITCH ONLY** ***see Item 23 on the Next Page.***		
7	Rear Glass Channel 20-3/8" Length	1	545-5038-00
8	Plastic Channel 42-5/8" Lg. (Left/Rt.)	2	545-5017-00
9	Side Armor "with holes" (Left & Right)	2	535-7297-02
	Item 9 is secured @ 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)		

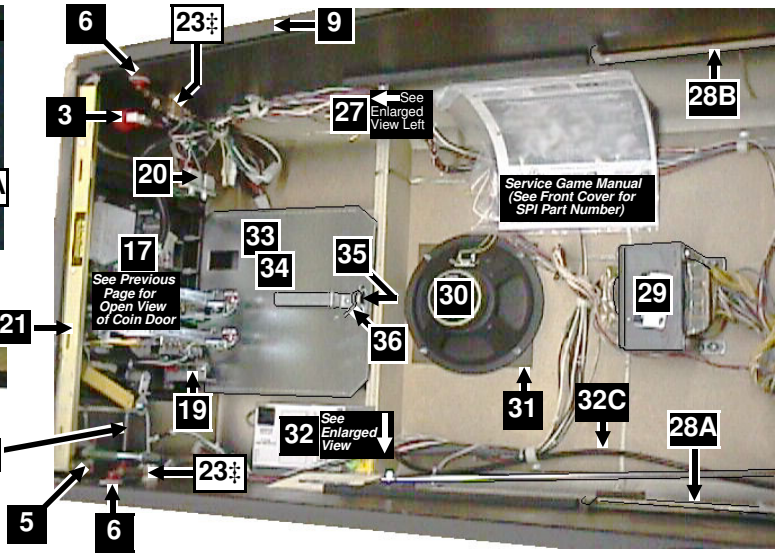
Nr.	CAB. PARTS & SWITCHES	QTY.	SPI PART Nr.
10	***New*** Front Molding - Black	1	*See Page 103*
	Item 10 requires: Self-Adhesive Foam Rubber 3/8" X 3/16" X 20-3/8" (626-5001-00). ***Ordering Note :** Can only be used in conjunction with new Lockdown Asm. 500-6881-00 (See Pg. 103)*		
11‡	Button Hole Plug (Black)	1	*See Page 103*
12	P/F Glass (Tmprd.) 21" X 43" X 3/16"	1	660-5001-00
13	Hex Key Allen Wrench 5/16"	1	777-0001-00
14	Corrugated Tubing Black **1"ø X 2.6' Lg.**	1	605-5008-03
	*Above Item **14** covers the Cables Wiring Harnesses going into the Backbox from the Cab.*		
15	#1 Roto Lock Male (R2-0055-02)	1	355-5006-01
	Item 15 is secured by: #10-24 X 1-3/4" Carr. Bolt Sq. Neck (Qty. 2) (231-5022-00), #10-24 N.S. Nut (Qty. 2) (240-5206-00) **and** #10 Washer 7/32" X .5" X 1/16" (Qty. 2) (242-5003-00)		
16	*#1 Roto Lock Female (on Backbox)*	*1*	*355-5006-02*
17	Coin Door (with Validator) USA only	1	500-5018-172
	Item 17 is secured by: 1/4"-20 X 1-1/4" Carriage Bolt Sq. Neck (Qty. 4) (231-5003-00) 1/4"-20 Flange Nut (Qty. 4) (240-5300-00) **and** Fend Washer 1/4" I.D. X 1" O.D. (Qty. 3) (242-5009-00) ***Note:** For Coin Door other than USA call Technical Support for SPI Part Nr.*		
18	Coin Door Sw. (USA) (Happ Control)	2	180-5024-**01**
	ALT. SWITCHES **18:** Coin Door Switch (USA) (Coin Control) (**180-5024-00**) **18J:** Coin Door Switch (¥ Japan) (**180-5091-00**)		
19	Bracket for below Portals™ Switches	1	535-6860-03
	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**)		
	***Ordering Note:** Securing hardware for switches included. For Decal Kit, see Page **69**.*		

Parts Table & Views continue on the next page.

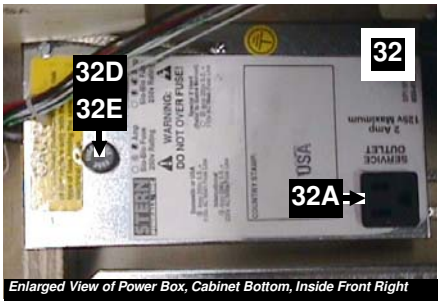








Optional Meter +12v DC ***with Bracket*** *Diode included.* **G-0053-013-102**	*Optional* Meter +12v DC ***No Bracket*** *Diode included.* **G-0053-013-102A**
Meters are optional and were not included with this Pinball Machine.	***Each optional meter sold separately.***



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.
	Parts Table & Views continue on the previous page.		
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)		

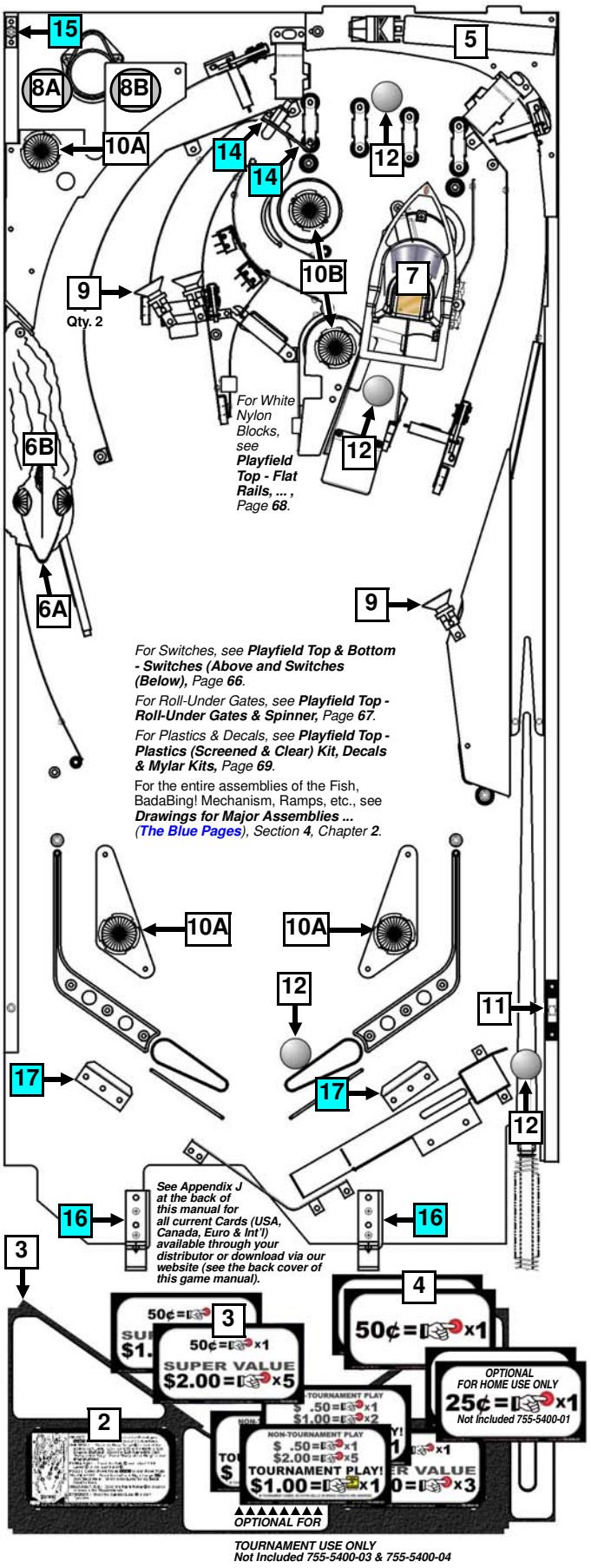
Nr.	CAB. PARTS & SWITCHES	QTY.	SPI PART Nr.
29	Transformer 5.7v AC *(with Ballast Winding)*	1	010-5012-01
	Item 29 is secured by: 1/4"-20 X 5/8" PPH MS (Zinc) (Qty. 4) (237-5854-00) **and** 1/4" Split Lock Washer (Qty. 4) (244-5000-00)		
30	Speaker 8" ø Rd. 8010 4Ω	1	031-5007-00
31	Speaker Grill 7" X 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
	Fuse 5 Amp 250v Slo-Blo (Foreign)	(2)	(200-5003-00)
32E	Fuse Holder	1	205-5001-00
32F	Switch, On/Off Rocker **APEM R2101C5NBB**	1	180-5001-03
	Assembly Parts Included : Power Box (No Parts) Mounting Frame (**535-5932-00**), Line Filter (**150-5000-00**), Domestic Varistor* TNR159211KM (**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℠ >	1	755-5185-00-Y
	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
	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
	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 1/16" 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.
14	Sign Mounting Bracket ***(for Plastic -24)***	2	535-8941-00
	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
	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
	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
	Item 17 is secured to the P/F by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 3/per) (234-5101-00)		



Optional Kits available through your Distributor:

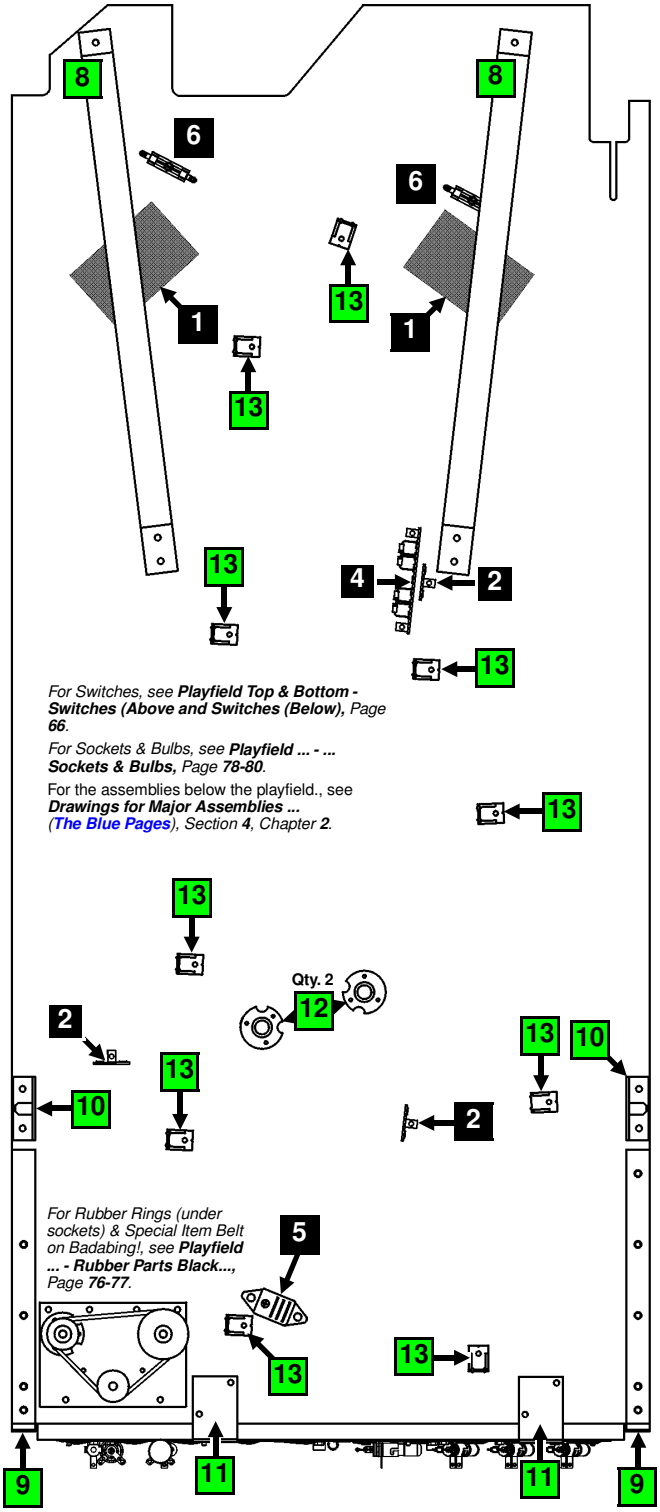
Pinball Location Maintenance Standard Kit: 502-6002-85
This kit consists of 8 oz. Novus Wax #2 Fine (Red) (675-0003-01), cloth and all Rubber Rings & Bulbs used in this Pinball Machine.

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).

Playfield Bottom - Miscellaneous Parts ■ and Brackets ■



*For Switches, see **Playfield Top & Bottom - Switches (Above and Switches (Below),** Page **66**.*

*For Sockets & Bulbs, see **Playfield ... - ... Sockets & Bulbs,** Page **78-80**.*

For the assemblies below the playfield., see ***Drawings for Major Assemblies ...*** *(**The Blue Pages**), Section **4**, Chapter **2**.*

*For Rubber Rings (under sockets) & Special Item Belt on Badabing!, see **Playfield ... - Rubber Parts Black...,** Page **76-77**.*

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

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

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

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

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

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

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

Item 13 is secured by: #6 X 5/8" SLT HWH AB (Zc) (Qty. 1/per) (234-5002-00)

Take Note:

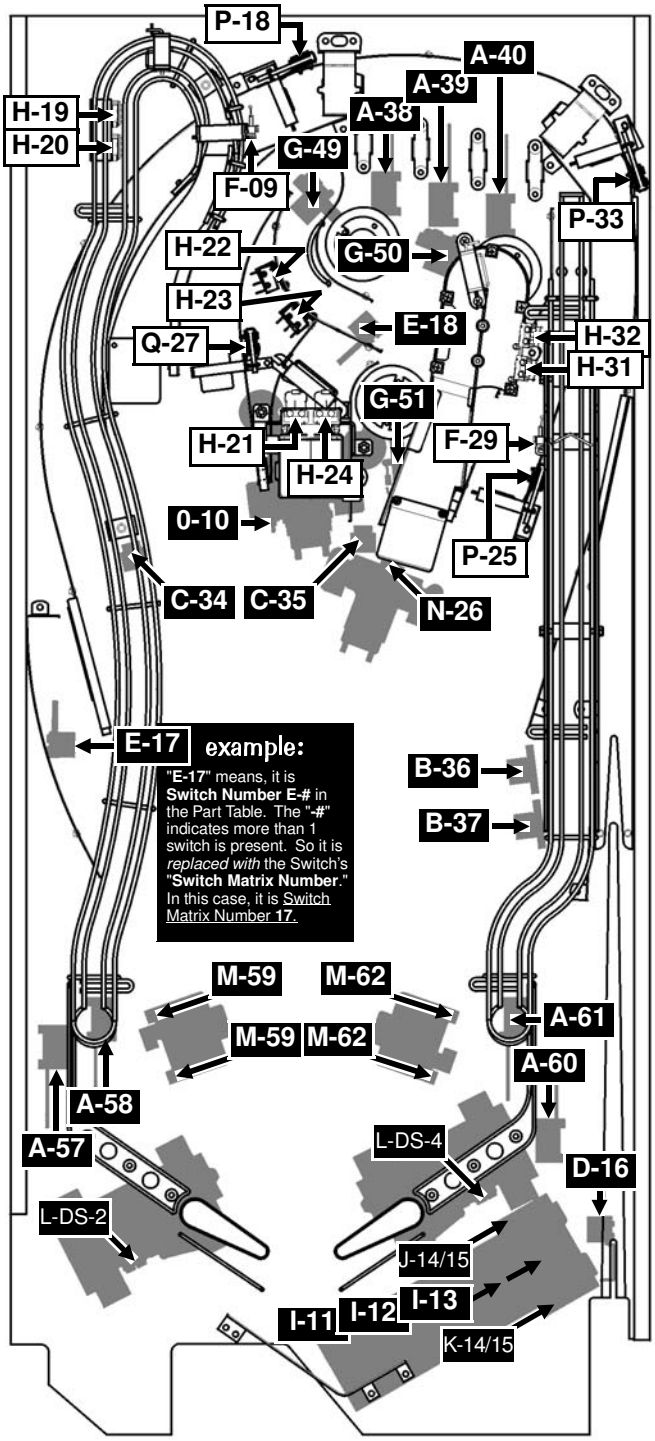
* An asterisk (*) indicates item(s) are not noted in the pictorials.

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 *(Right Mount Style)*	7	500-6227-02
	Bracket secured to Playfield by: #6 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5001-02)		
	*Switch Matrix Numbers **38**, **39**, **40**, **57**, **58**, **60** & **61***		
B-#	Switch & Target Asm. **Rect.** (White)	2	515-6027-08
	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)		
	*Switch Matrix Numbers **36** & **37***		
C-#	Switch & Target Asm. **Narrow** (Yellow)	2	515-5967-06
	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)		
	*Switch Matrix Numbers **34** & **35***		
D-16	Switch *(for Shooter Lane)*	1	180-5157-00
	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)		
	*Switch Matrix Number **16***		
E-#	Switch *(for Ejects)*	2	180-5186-01
	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)		
	*Switch Matrix Numbers **17** & **18***		
F-#	Switch (1⅝" Actuator) *(for Wire Gates)*	2	180-5010-01
	Item F-# is secured by: *Same screws which secures the Sw. Protect Plate & Plastic Spacer*		
	*Switch Matrix Numbers **09** & **29***		
G-#	Switch Asm., Stack (Blade) *(for Pops)*	3	515-6459-09
	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)		
	*Switch Matrix Numbers **49**, **50** & **51***		
H-#	Switch (Roller Actuator, Lite-Force)	8	180-5119-02
	*Switch Matrix Numbers **19**, **20**, **21**, **22**, **23**, **24**, **31** & **32***		
I-#	Switch (Roller Actuator, Lite-Force)	3	180-5119-02
	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" Unslt HWH #4 Hex TR3 Blk (Qty. 2/per) (237-5937-02)		
	*Switch Matrix Numbers **11**, **12** & **13***		
J-#	Dual OPTO TRANS PC Board Asm.	1	515-0173-00
	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)		
	*Switch Matrix Numbers **14** & **15***		
K-#	Dual OPTO REC PCB Assembly	1	515-0174-00
	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)		
	*Switch Matrix Numbers **14** & **15***		
L-#	Switch (End-of-Stroke), Stack (Blade)	2	180-5149-00
	Item L-# is secured by: #6-32 X 5/8" HWH Sw (Sr) Zc (Qty. 2/per) (237-5976-04)		
	*Dedicated Switch Numbers **DS-2** & **DS-4***		
M-#	Switch, Stack (Blade) *(for Slings)*	4	180-5054-00
	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)		
	*Switch Matrix Numbers **59** & **62***		
N-26	Switch *(for Drop Target)*	1	180-5158-00
	Item N-26 is secured by: #4-40 X 5/8" Slotted HWH C (Zinc) Wax (Qty. 2) (237-5945-00)		
	*Switch Matrix Number **26***		
O-10	Sw. *(Custom Actuator)* **Cherry DA3A-B1A**	1	180-5198-00
	*Switch Matrix Number **10***		
P-#	Switch *(for Wire Gates)*	3	180-5087-00
	*Switch Matrix Numbers **18**, **25** & **33***		
Q-27	Switch (1¼" Actuator)	1	180-5010-04
	*Switch Matrix Number **27***		

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" Unslt 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**)



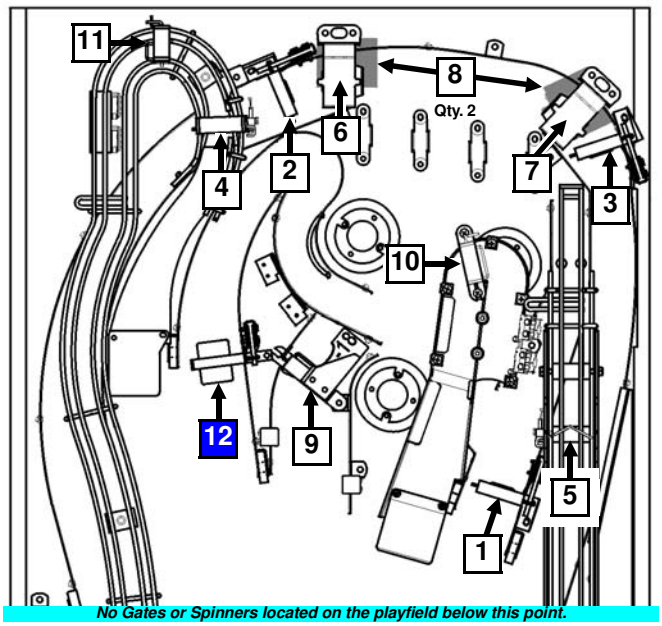
Take Note:

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.).*

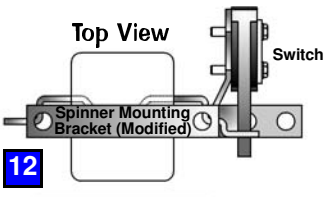
Note Items B - Q: *For better Switch view(s), see* ***Drawings for Major Assemblies ...*** *(**The Blue Pages**), Sec. **4**, Chapter **2**, (Page **81**), (view Table of Contents for exact page).*

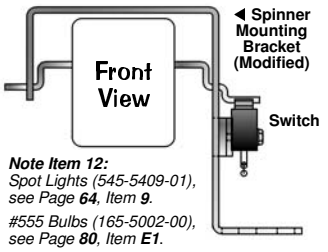
Note Items C & D: *For better Target & Switch view(s), see* ***Appendix I****, Page **I1** (the end of this Service Game Manual).*

Playfield Top - Roll-Under Gates ☐ & Spinner ■



No Gates or Spinners located on the playfield below this point.

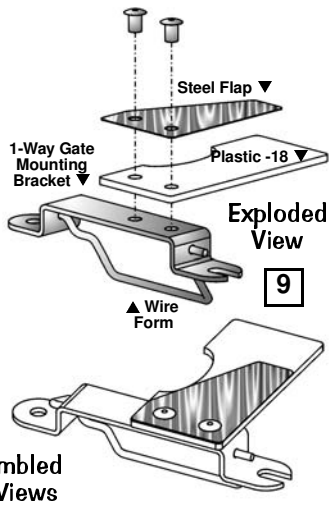




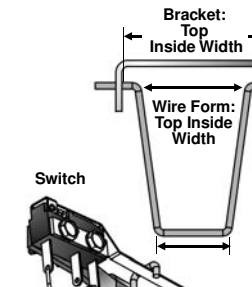
Note Item 12:
*Spot Lights (545-5409-01), see Page **64**, Item **9**.*

*#555 Bulbs (165-5002-00), see Page **80**, Item **E1**.*

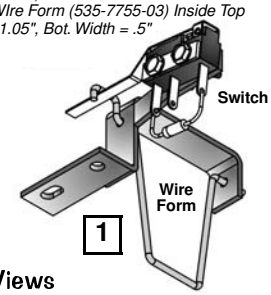
*Laydown Sockets (077-5026-01), see Page **80**, Item **1**. Secured by #6-32 X 3/8" PPH Sems Screw (Qty. 1/per) (232-5200-00).*



Assembled Top Views



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.	ROLL-UNDER GATE PARTS	QTY.	SPI PART Nr.
1	Roll-Under Switch Gate	1	***Ind. Parts Only***
	Individual Parts Only : Switch (**180-5087-00**), Switch Gate Bracket (**535-7756-01**) **and** Wire Form on Bracket (**535-7755-01**) (ASM. REF. 515-6556-**01**)		
	*Switch Matrix Number **25***		
2	Roll-Under Switch Gate	1	***Ind. Parts Only***
	Individual Parts Only : Switch (**180-5087-00**), Switch Gate Bracket (**535-7756-02**) **and** Wire Form on Bracket (**535-7755-02**) (ASM. REF. 515-6556-**02**)		
	*Switch Matrix Number **18***		
3	Roll-Under Switch Gate	1	***Ind. Parts Only***
	Individual Parts Only : Switch (**180-5087-00**), Switch Gate Bracket (**535-7756-02**) **and** Wire Form on Bracket (**535-7755-03**) (ASM. REF. 515-6556-**06**)		
	*Switch Matrix Number **33***		
	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	1	***Ind. Parts Only***
	Individual Parts Only : Switch (**180-5010-01**), Switch Gate Bracket *(welded to Left Wire Ramp)* **and** Wire Form on Bracket (**535-9375-00**) (ASM. REF. 515-7450-00)		
	*Switch Matrix Number **9***		
5	Roll-Under Switch Gate	1	***Ind. Parts Only***
	Individual Parts Only : Switch (**180-5010-01**), Switch Gate Bracket *(welded to Right Wire Ramp)* **and** Wire Form on Bracket (**535-9375-01**) (ASM. REF. 515-7449-00)		
	*Switch Matrix Number **29***		
	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.*		
6	2-Way Ball Gate *(Upper Left)*	1	***Ind. Parts Only***
	Individual Parts Only : 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* (ASM. REF. 500-6100-**03**)		
7	2-Way Ball Gate *(Upper Right)*	1	***Ind. Parts Only***
	Individual Parts Only : 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* (ASM. REF. 500-6100-**04**)		
	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.	2	515-6544-01
	Item 8 opens and closes the 2-Way Ball Gates (Items 6 & 7).		
	Assembly Parts Included : 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***		
9	1-Way Ball Gate Bracket ***(behind Safe)***	1	***Ind. Parts Only***
	Individual Parts Only : 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) (ASM. REF. 500-6894-00)		
10	1-Way Ball Gate Bracket ***(Rt. Steel Ramp)***	1	***Ind. Parts Only***
	Individual Parts Only : Ball Gate Mounting Bracket, Small (**535-5269-03**) **and** Wire Form (**535-5307-03**) (on ASM. REF. 515-7459-00)		
	Item 10 is secured to the Rt. Steep Ramp by: #6-32 X 314" PPH MS Sems (Zinc) (Qty. 2) (232-5200-00)		
11	1-Way Ball Gate Bracket ***(Lt. Wire Ramp)***	1	***Ind. Parts Only***
	Individual Parts Only : Ball Gate Mounting Bracket *(welded to Left Wire Ramp)* **and** Wire Form (**535-9551-00**) (ASM. REF. 515-7450-00)		

Nr.	SPINNER PARTS	QTY.	SPI PART Nr.
12	Spinner & Switch	1	***Ind. Parts Only***
	Individual Parts Only : 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))*		
	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" Slt. 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 ■

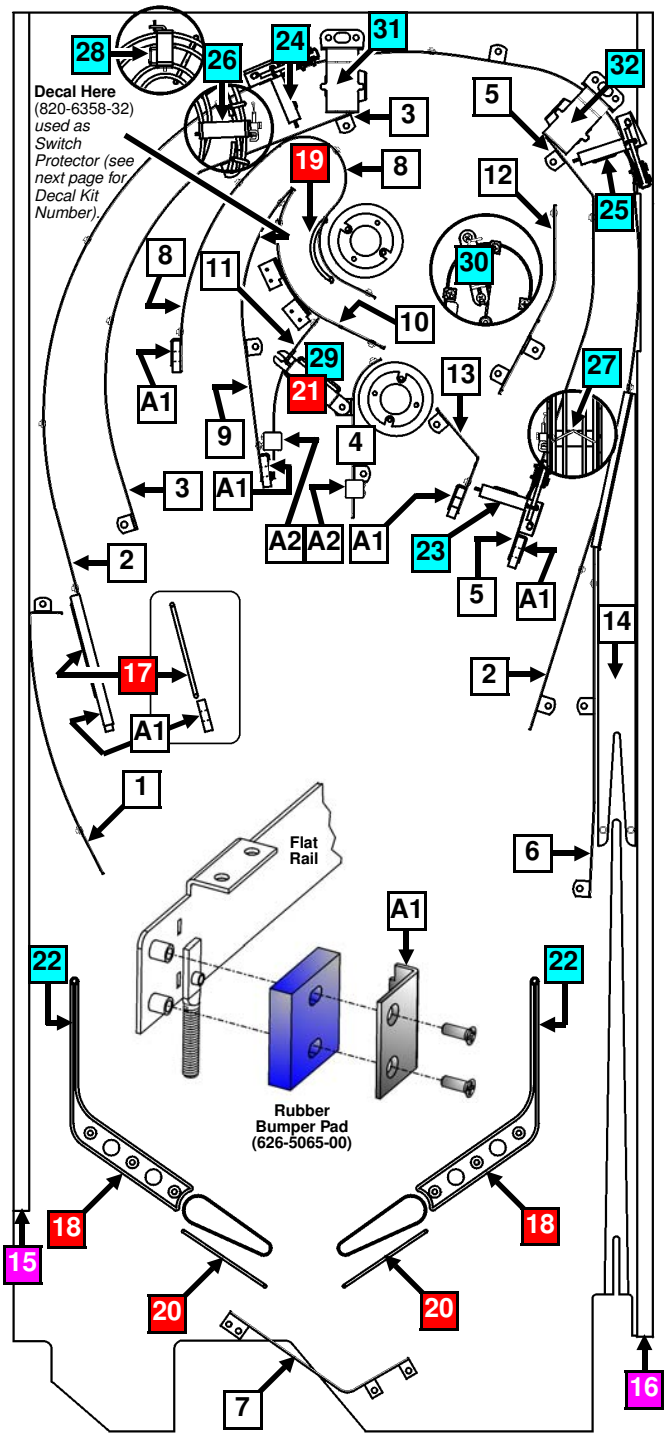
Nr.	FLAT RAILS (ABOVE)	QTY.	SPI PART Nr.
1	Flat Rail #1 **(Fish Lane, Left Side)**	1	535-9491-00
2	Flat Rail #2 **(Full Orbit, Left to Right)**	1	535-9493-00
A1	Bumper Holder Bracket	1	535-9533-00
	Item A1 is secured to Flat Rail by: #4-40 X 5/16" PFH UC MS (Zinc) MC91099A160 (Qty. 2/per) (237-6151-00) *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

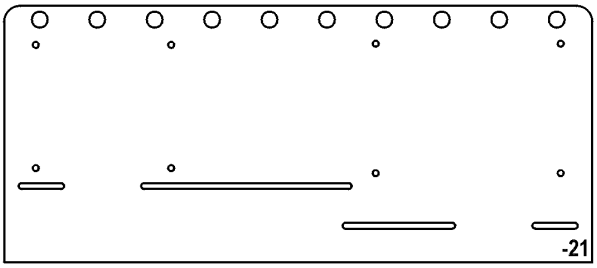
*For Roll-Under Switch Gate Assemblies, see **Playfield Top - Roll-Under Gates & Spinner**, Items **1 - 3**, Page **67**.*

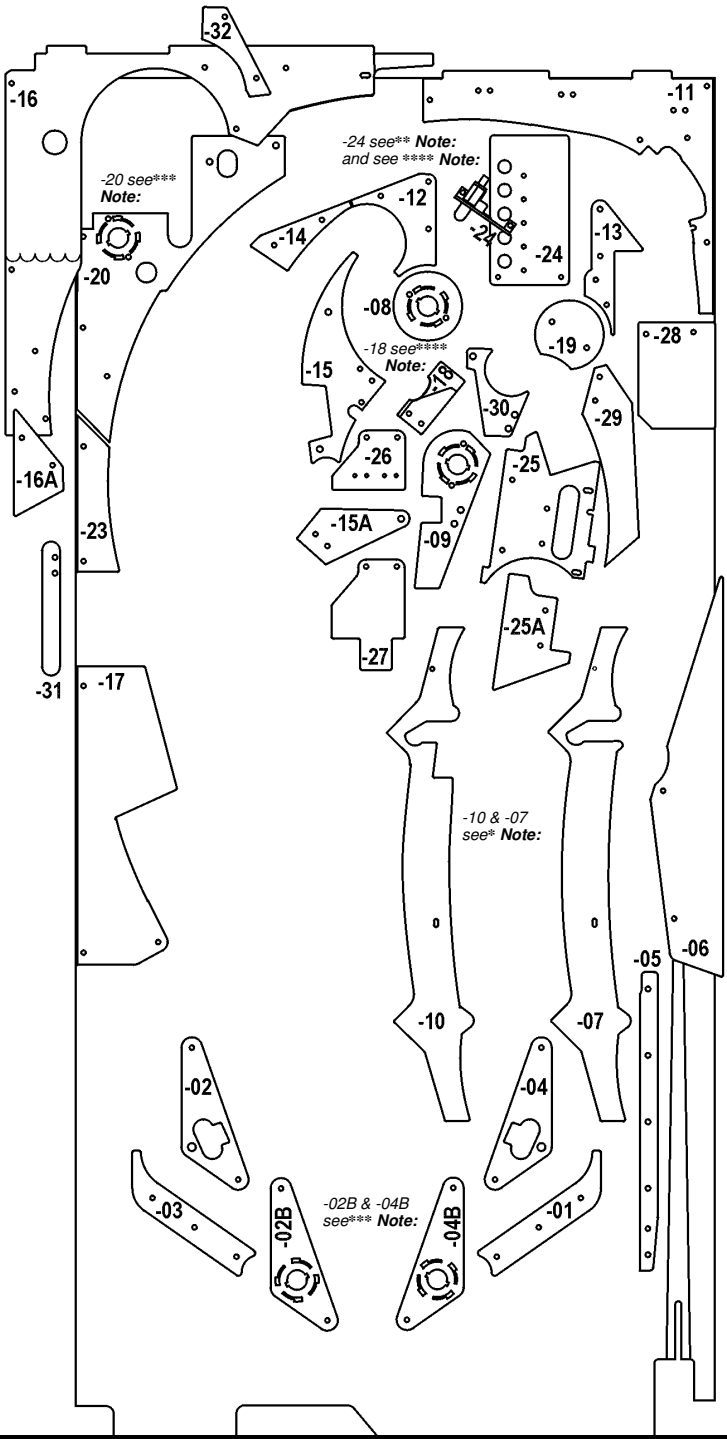


Take Note:

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 - Plastics (Screened & Clear) Kit, Decals & Mylar Kits ‡





PLASTICS (BUTYRATE) KIT	SPI PART Nr.

Kit: **Playfield Plastics (Screened & Clear)**

803-5000-85 ***Kit includes:***

Screened & Clear Set (830-6033-XX)

DECAL & MYLAR KITS	SPI PART Nr.

Kits: **Playfield & Assembly Decals, Lexan & Mylar**

802-5000-85 ***Kit (Decals) includes:***

Decal Set (820-6358-XX) & Right Steel Ramp Decal (820-6368-00)

Most last 2-digits are sequential. *The following numbers were not used: -14 thru -18, -21, -23, -34 thru -97*

802-5001-85 ***Kit (Lexan) includes:***

Lexan (Heavy Duty Decal) Set (820-6359-XX)

-00 Drop Target, -01 & -02 Spinner, -03 & -04 Safe Front

802-5002-85 ***Kit (Mylar) includes:***

Full Playfield Mylar (820-5999-85), Ball Drop Mylar (820-5815-00) ***and*** *Pop Bumper Protector Mylar (820-5820-00, Qty. 2)*

‡ Attention: No individual Plastic or Decal can be ordered separately, unless noted otherwise.

Other miscellaneous plastics and/or decals can be found on the ***Backbox & Speaker Panel Assemblies*** *(Pages* ***60-61****),* ***Cabinet - Parts & Switches*** *(Pages* ***62-63****) and* ***Playfield Bottom - Miscellaneous Parts & Brackets*** *(Page* ***65****).*

Plastic Pieces ***-02B****,* ***-04B****,* ***-06****,* ***-07*****,* ***-10*****,* ***-15A****,* ***-16****,* ***-16A****,* ***-18********,* ***-24**** */ ****,* ***-25A****,* ***-28****,* ***-31*** *and* ***-32*** *are shown "* ***out of position*** *" for clarity (they are in the general area of where they are located).*

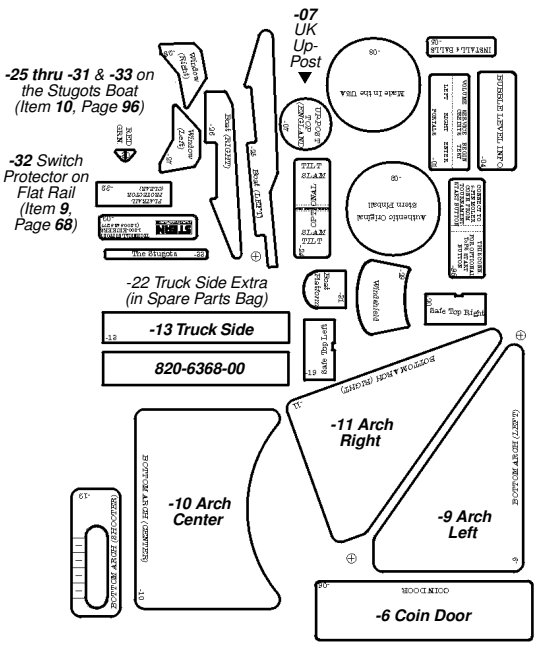
* ***Note:*** *-07 & -10 Horizontal views, pieces poitioned vertically on the Right Wire Ramp.*

** ***Note:*** *-24 Horizontal view, piece positioned vertically above -12.*

*** ***Note:*** *-02B, -04B & -20 are use to mount IDC Snap-On Sockets (Qty. 1/per). (see Page* ***80****, Item* ***5b****, for socket views).*

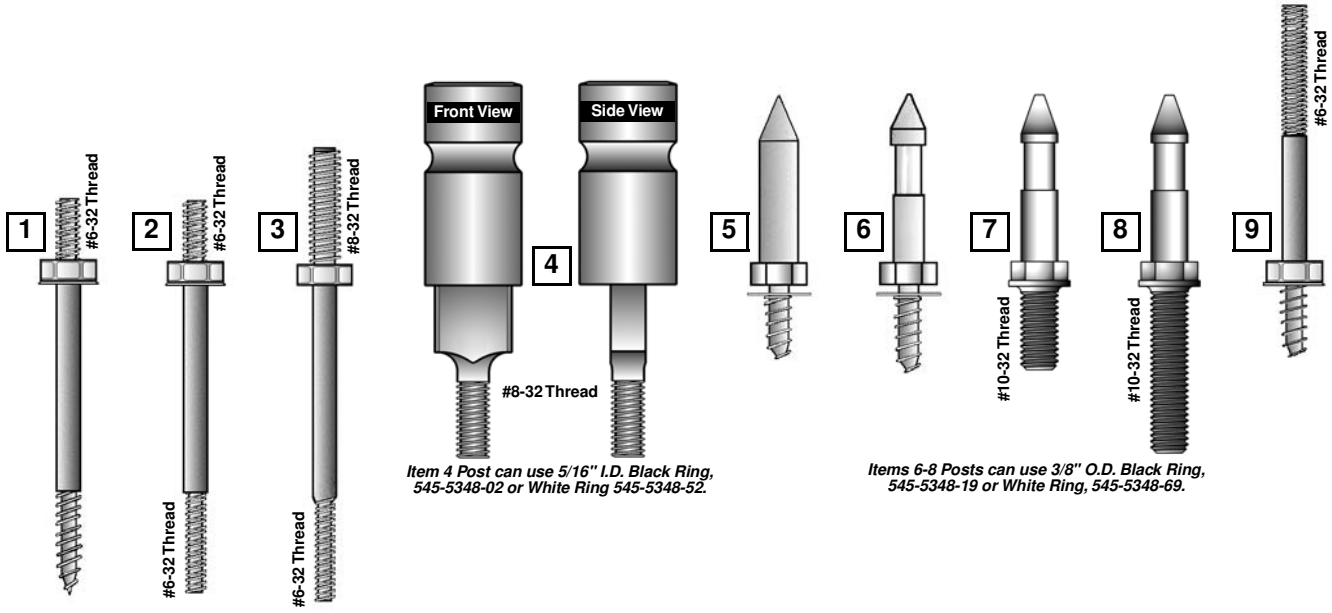
**** ***Note:*** *-18 & -24 have various parts riveted to them.*
-24 Screened (Billboard Sign), see Page ***64****, Item* ***14****.*
-18 Clear (1-Way Gate inside Safe), see Page ***67****, Item* ***9****.*

Note: *For views & usage of plastics on Assemblies see* ***Drawings for Major Assemblies and Ramps*** *(The Blue Pages), Section* ***4****, Chapter* ***2*** *:*
-31 *over Fish (Page* ***92****);* ***-26*** *&* ***-27*** *over Safe (Page* ***94****);* ***-25*** *&* ***-25A*** *over Right (Steel) Boat Ramp (Page* ***96****);* ***-22*** *Switch Spacer (Pages* ***99-100****);* ***-07*** *&* ***-10*** *on Right Wire Ramp (Page* ***100****);*



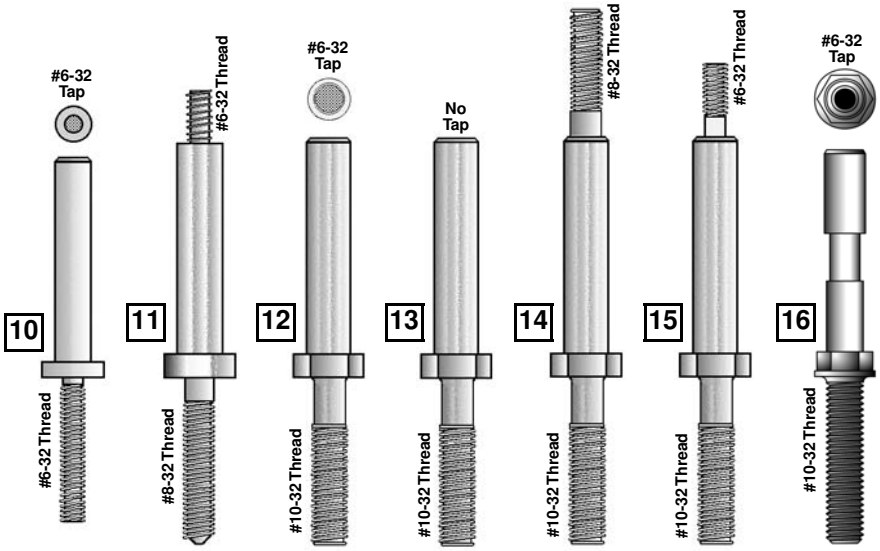
Plastics & Decals are subject to change without notice during and after production. Shapes and/or Screening may change. Pieces can be added or subtracted. Service Bulletin(s) will announce any critical changes, if warranted.

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:

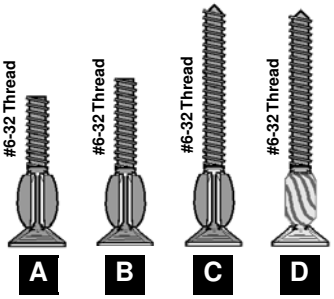
Legend Note:
Items noted with a white square □ are Metal Posts.
Items noted with a black square ■ are Fin Shank Screws.

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.*



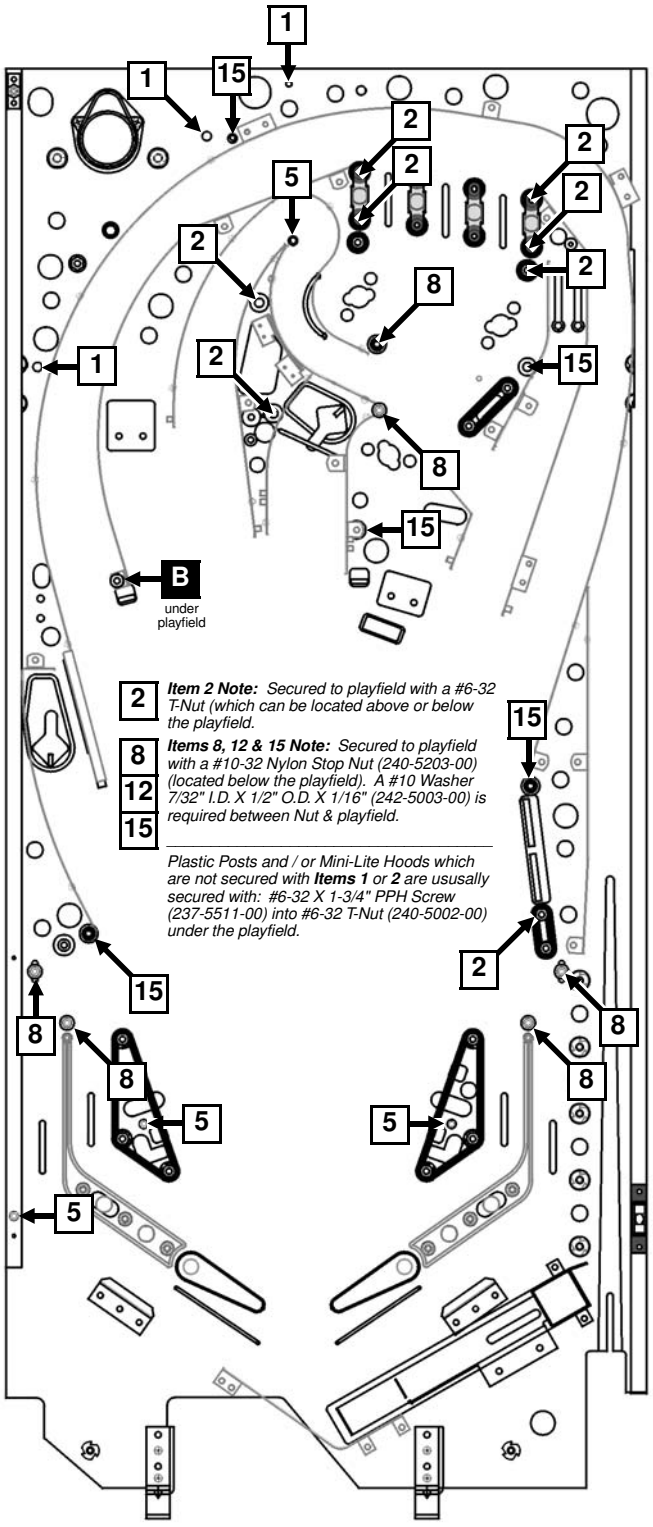
Nr.	METAL POSTS	QTY.	SPI PART Nr.
1	Post Fstn. #6-32 Top / Wood Scr. Bot.	3	530-5010-02
2	Post Fasten #6-32 Top / #6-32 Bot.	8	530-5012-02
3	Post Fasten #8-32 Top / #6-32 Bot.		530-5008-00
4	***Adjustable*** Sliding Post **(Brass)** #8-32 Bot.		530-5621-00
5	Mini-Post Wood Screw **(no cut-away)**	4	530-5004-01
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.	METAL POSTS	QTY.	SPI PART Nr.
12	Post Hex Base #6-32 Tap/#10-32 Bot.	1	530-5332-01
13	Post Hex Base (No Tap)/#10-32 Bot.		530-5332-00
14	Post Hex Base #8-32 Top/#10-32 Bot.		530-5332-02
15	Post Hex Base #6-32 Top/#10-32 Bot.	4	530-5332-03
16	Post Hex Base #6-32 Tap/#10-32 Bot.		530-5679-00

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 1¼" 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 anounce any changes, if warranted.*

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



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.*

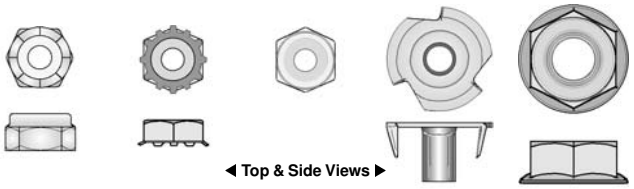
*Plastic Posts and / or Mini-Lite Hoods which are not secured with **Items 1** or **2** are ususally secured with: #6-32 X 1-3/4" PPH Screw (237-5511-00) into #6-32 T-Nut (240-5002-00) under the playfield.*

Take Note:

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

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

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



N 1 K 1 H 1 T 1 F 1

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
	*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).*		
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
	*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).*		
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

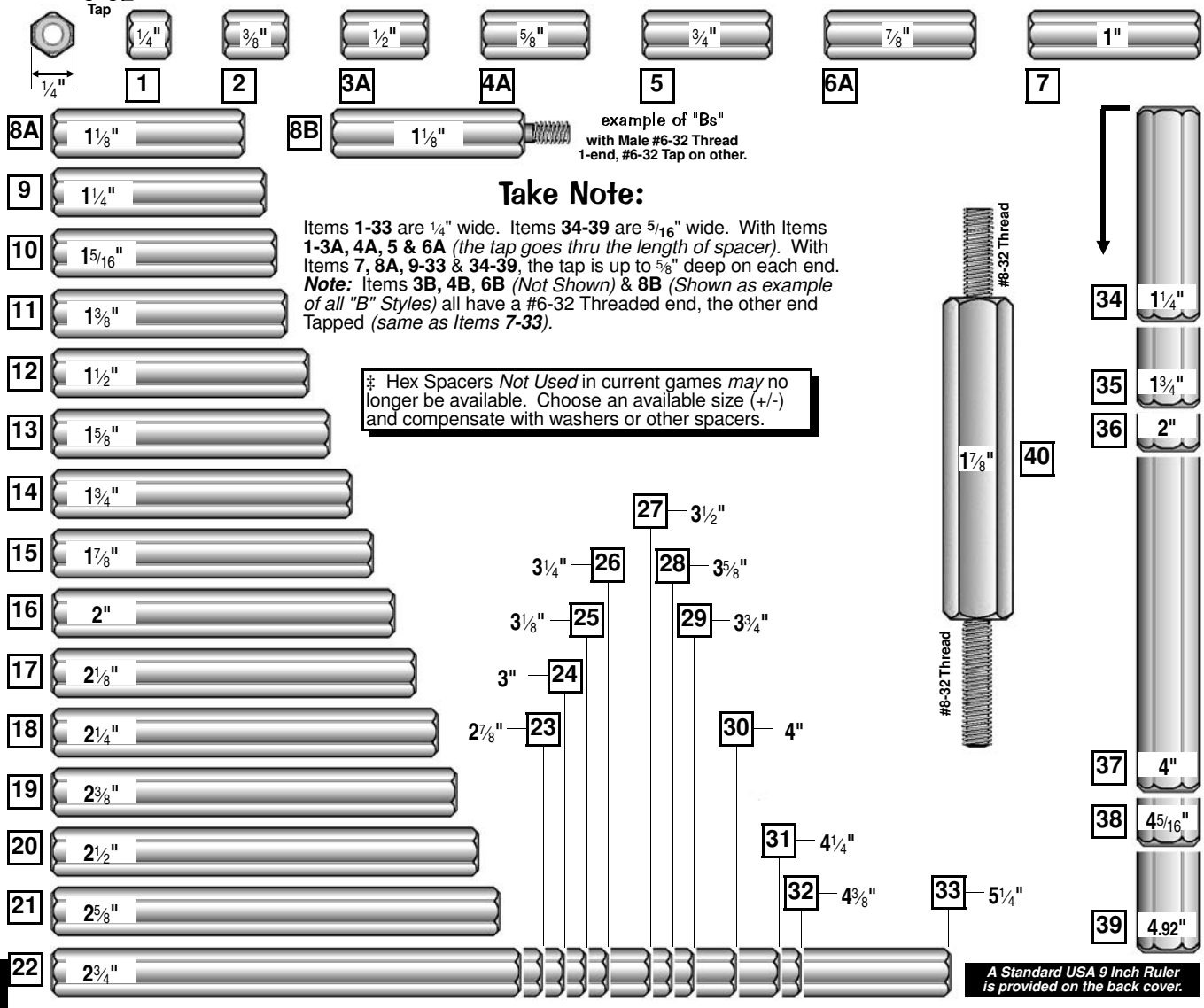
Nr.	FLANGE NUT*	QTY.	SPI PART Nr.
F1	1/4" X 20 Flange Nut	8	240-5300-00
	*Item **F1** used with 1/4-20 X 1-1/4 Sq. Neck Carriage Bolt Black (231-5003-00) located in the Cabinet for the SIde Armor (Front) and Pivot Hinges.*		

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*

Playfield Top - Hex Spacers ☐ (Actual Size) †



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.

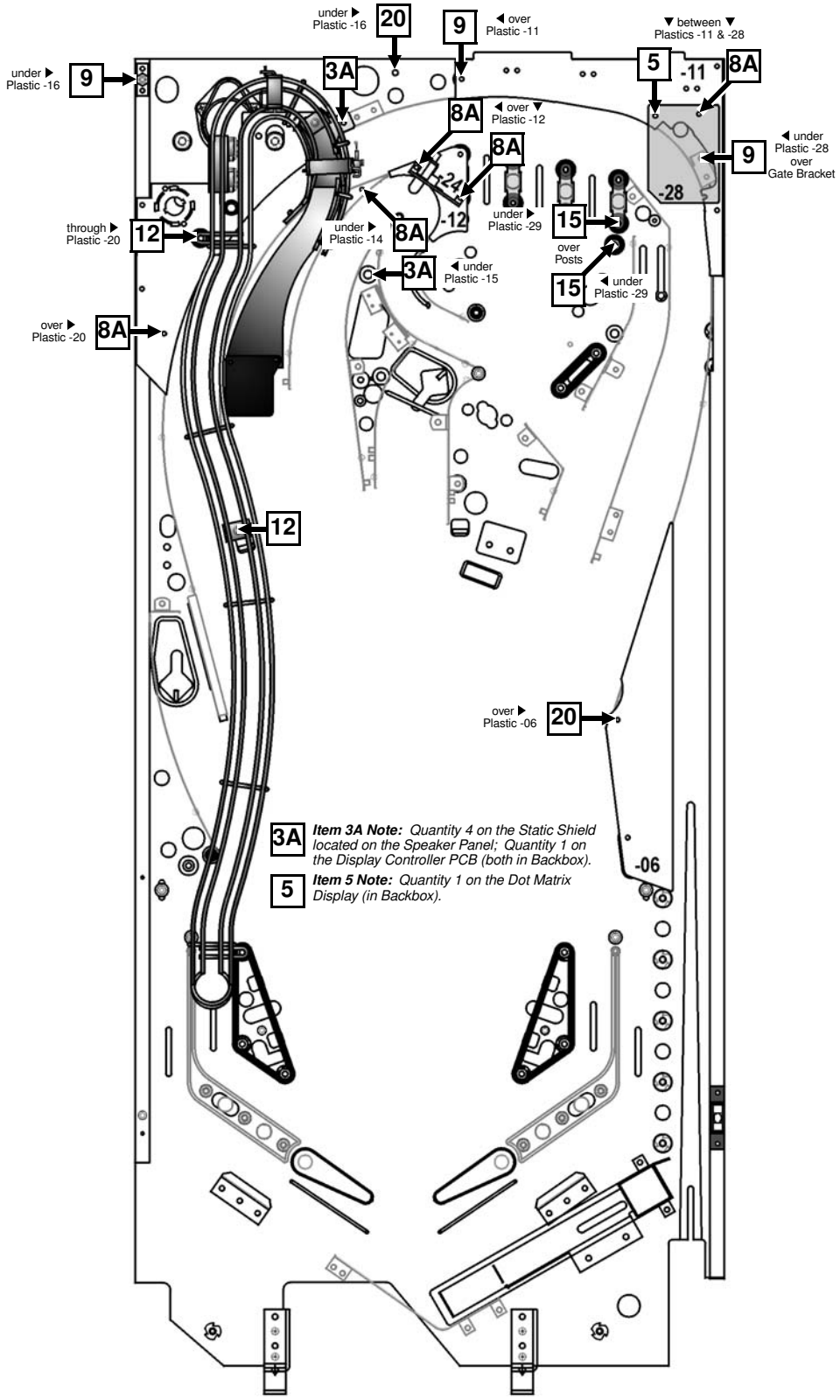
A Standard USA 9 Inch Ruler is provided on the back cover.

Nr.	HEX SPACERS		QTY.	SPI PART Nr.
1	1/4"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-00
2	3/8"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-12
3A	1/2"	X 1/4" : #6-32 Tap *(both ends)*	7	254-5008-03
3B*	Identical to **3A** *with #6-32 Thread end*			254-5024-03
4A	5/8"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-02
4B*	Identical to **4A** *with #6-32 Thread end*			254-5024-02
5	3/4"	X 1/4" : #6-32 Tap *(both ends)*	2	254-5008-04
6A	7/8"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-05
6B*	Identical to **6A** *with #6-32 Thread end*			254-5024-05
7	1"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-06
8A	1 1/8"	X 1/4" : #6-32 Tap *(both ends)*	5	254-5008-17
8B	Identical to **8A** *with #6-32 Thread end*			254-5024-17
9	1 1/4"	X 1/4" : #6-32 Tap *(both ends)*	3	254-5008-11
10	1 5/16"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-34
11 ‡	1 3/8"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-33
12	1 1/2"	X 1/4" : #6-32 Tap *(both ends)*	2	254-5008-09
13 ‡	1 5/8"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-13
14	1 3/4"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-10
15 ‡	1 7/8"	X 1/4" : #6-32 Tap *(both ends)*	2	254-5008-20
16	2"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-07
17	2 1/8"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-32
18	2 1/4"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-18

Nr.	HEX SPACERS		QTY.	SPI PART Nr.
19	2 3/8"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-28
20	2 1/2"	X 1/4" : #6-32 Tap *(both ends)*	2	254-5008-16
21	2 5/8"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-08
22	2 3/4"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-15
23	2 7/8"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-31
24	3"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-14
25	3 1/8"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-19
26	3 1/4"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-26
27	3 1/2"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-27
28	3 5/8"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-25
29	3 3/4"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-36
30	4"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-21
31	4 1/4"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-30
32	4 3/8"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-29
33	5 1/4"	X 1/4" : #6-32 Tap *(both ends)*		254-5008-35
34	1 1/4"	X 5/16" : #6-32 Tap *(both ends)*		254-5018-09
35	1 3/4"	X 5/16" : #6-32 Tap *(both ends)*		254-5018-06
36	2"	X 5/16" : #6-32 Tap *(both ends)*		254-5018-07
37	4"	X 5/16" : #6-32 Tap *(both ends)*		254-5018-03
38	4 5/16"	X 5/16" : #6-32 Tap *(both ends)*		254-5018-00
39	4.92"	X 5/16" : #6-32 Tap *(both ends)*		254-5018-04
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

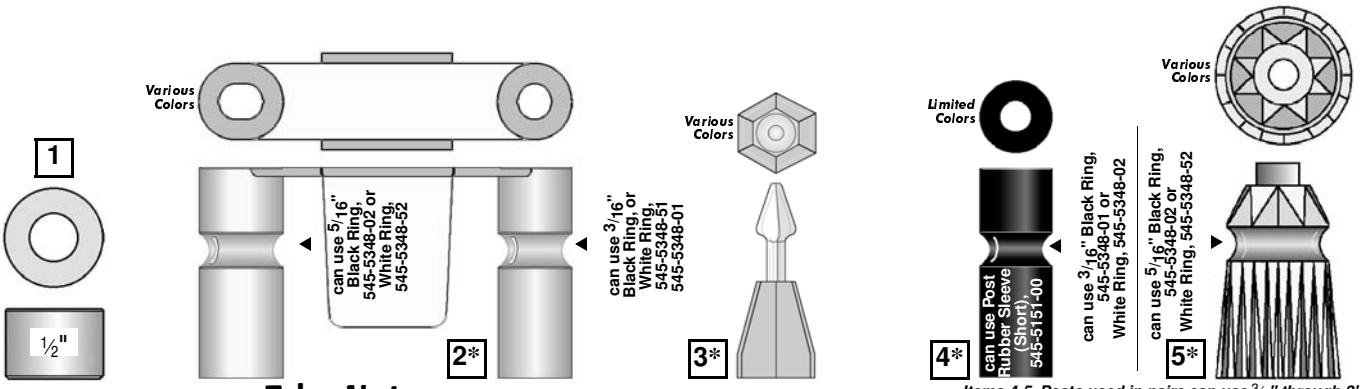


Take Note:

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

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

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



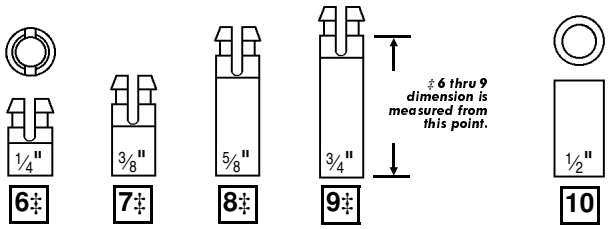
Items 4-5 Posts used in pairs can use ¾" through 3" Rubber Rings, see Rubber Parts for Part Numbers.

Take Note:

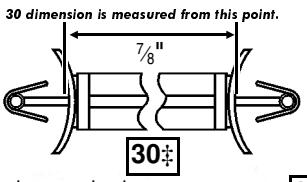
PLASTIC PART COLOR CHART

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 Nºs which come in various colors, should be replaced with the desired 2-Digit Nº from the above Color Chart. Some colors may no longer be available for desired item.



‡ Items **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**.*



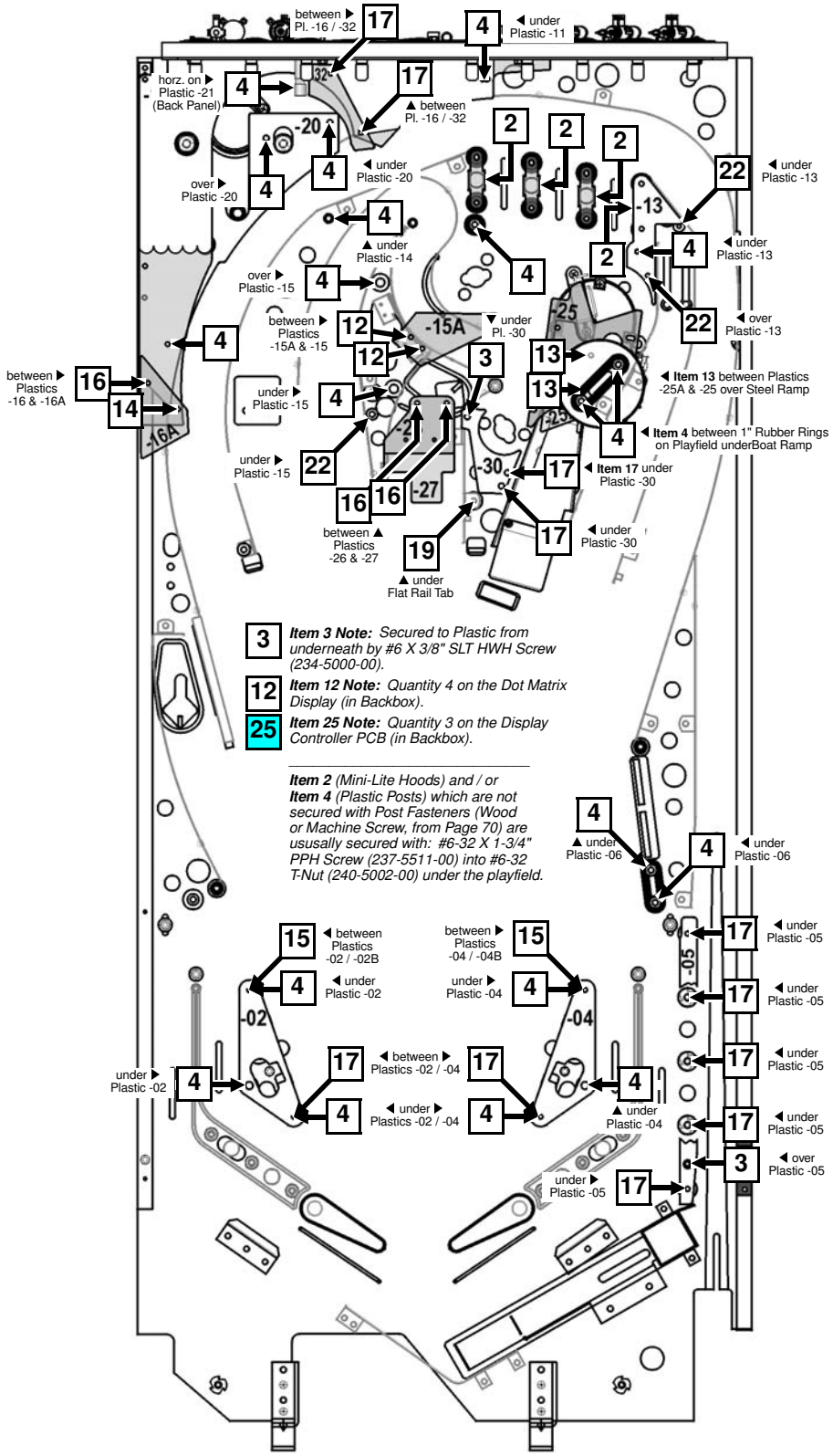
Take Note:

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 1⅛" is needed but unavailable, order a ½" + ⅝" & stack to = 1⅛").*

Nr.	PLASTIC POSTS & SPACERS	QTY.	SPI PART Nr.
1	⅜" X ½" Metal Spacer		530-5099-00
2**	Top Lane Plastic Mini-Lite Hood (Red)	4	550-5061-02
	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.		
3**	Mini-Jewel Plastic Post (Clear)	2	550-5052-01
	Item 3 typically secured by: #6 X 3/8" HWH AB (Zinc) (Qty. 1/per) (234-5000-00)		
4**	1 1/16" 1-Groove Plastic Post (Black)		550-5059-00
	1 1/16" 1-Groove Plastic Post (Clear)	21	550-5059-01
5**	1-Groove Jewel Plastic Post (Clear)	1	550-5034-01
	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).		
6 ‡	¼" Slf. Rtn. Plastic Spacer White		254-5007-02
7 ‡	⅜" Slf. Rtn. Plastic Spacer White		254-5007-01
8 ‡	⅝" Slf. Rtn. Plastic Spacer White		254-5007-00
9 ‡	¾" Slf. Rtn. Plastic Spacer White		254-5007-03
10	½" X ¼" Plastic Spacer White **(Narrow)**		254-5000-03
11	⅛" X ⅜" Plastic Spacer Gray		254-5000-19
12	3/16" X ⅜" Plastic Spacer Gray	6	254-5000-18
13	¼" X ⅜" Plastic Spacer Gray	2	254-5000-02

Nr.	PLASTIC POSTS & SPACERS	QTY.	SPI PART Nr.
14	⅜" X ⅜" Plastic Spacer Gray	2	254-5000-12
15	½" X ⅜" Plastic Spacer Gray	2	254-5000-01
16	⅝" X ⅜" Plastic Spacer Gray	3	254-5000-14
17	¾" X ⅜" Plastic Spacer Gray	11	254-5000-07
18	⅞" X ⅜" Plastic Spacer Gray		254-5000-11
19	1" X ⅜" Plastic Spacer Gray *or* Black	1	254-5000-04
20	1⅛" X ⅜" Plastic Spacer Gray		254-5000-06
	1⅛" X ⅜" Plastic Spacer Natural		254-5000-06N
21	1¼" X ⅜" Plastic Spacer Gray		254-5000-05
22	1½" X ⅜" Plastic Spacer Gray	3	254-5000-08
23	1 15/16" X ⅜" Plastic Spacer Gray		254-5000-15
24	¼" X 5/16" X .144" I.D. Metal Spacer		254-5014-03
25	½" X 5/16" X .144" I.D. Metal Spacer	3	254-5014-00
26	9/16" X 5/16" X .144" I.D. Metal Spacer		254-5014-04
27	¾" X 5/16" X .144" I.D. Metal Spacer		254-5014-01
28	1⅛" X 5/16" X .144" I.D. Metal Spacer		254-5014-02
29	1" X 5/16" X .144" I.D. Metal Spacer		254-5001-00
30‡	⅞" Plastic Spacer Support **(Dual-Locking)**		254-5039-14

† *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.*



3 ***Item 3 Note:*** *Secured to Plastic from underneath by #6 X 3/8" SLT HWH Screw (234-5000-00).*

12 ***Item 12 Note:*** *Quantity 4 on the Dot Matrix Display (in Backbox).*

25 ***Item 25 Note:*** *Quantity 3 on the Display Controller PCB (in Backbox).*

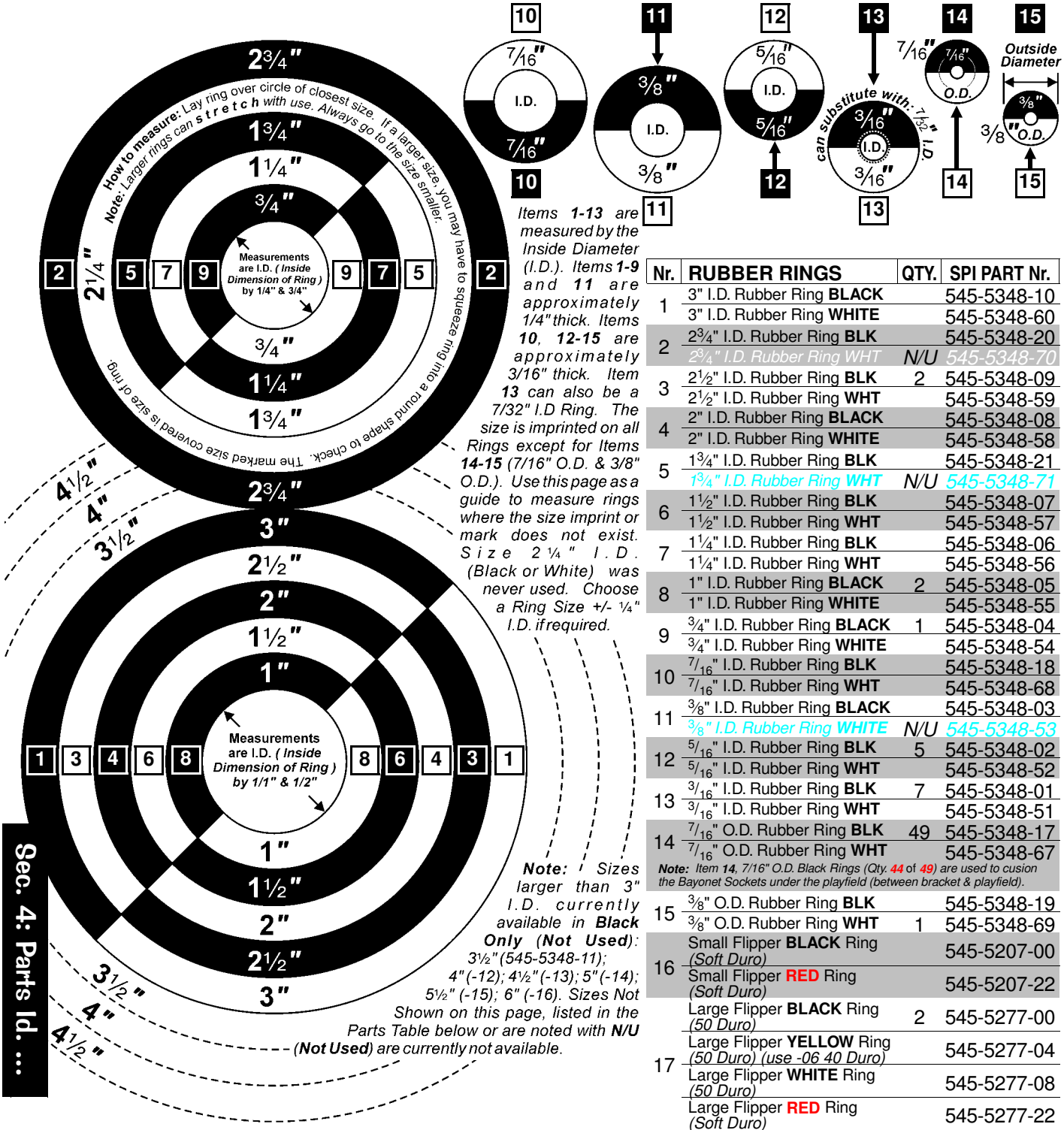
Item 2 *(Mini-Lite Hoods) and / or* ***Item 4*** *(Plastic Posts) which are not secured with Post Fasteners (Wood or Machine Screw, from Page 70) are ususally secured with: #6-32 X 1-3/4" PPH Screw (237-5511-00) into #6-32 T-Nut (240-5002-00) under the playfield.*

Take Note:

Legend Note:
Items noted with a white square ☐ are Plastic Posts & Spacers.
Items noted with a cyan square ■ are Metal Spacers.

† *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 ¼" I.D. (Black or White) was never used. Choose a Ring Size +/- ¼" I.D. if required.*

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

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	2¾" I.D. Rubber Ring **BLK**		545-5348-20
	2¾" I.D. Rubber Ring WHT	*N/U*	*545-5348-70*
3	2½" I.D. Rubber Ring **BLK**	2	545-5348-09
	2½" 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	1¾" I.D. Rubber Ring **BLK**		545-5348-21
	*1¾" I.D. Rubber Ring **WHT***	*N/U*	*545-5348-71*
6	1½" I.D. Rubber Ring **BLK**		545-5348-07
	1½" I.D. Rubber Ring **WHT**		545-5348-57
7	1¼" I.D. Rubber Ring **BLK**		545-5348-06
	1¼" 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	¾" I.D. Rubber Ring **BLACK**	1	545-5348-04
	¾" 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
	***Note:** Item **14**, 7/16" O.D. Black Rings (Qty. **44** of **49**) are used to cusion the Bayonet Sockets under the playfield (between bracket & playfield).*		
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
17	Large Flipper **BLACK** Ring *(50 Duro)*	2	545-5277-00
	Large Flipper **YELLOW** Ring *(50 Duro) (use -06 40 Duro)*		545-5277-04
	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
	(Located inside Cabinet with each Flipper Button Assembly)		

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.
	Bumper **RED** Post Sleeve (Tall)		545-5308-22
D*	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:

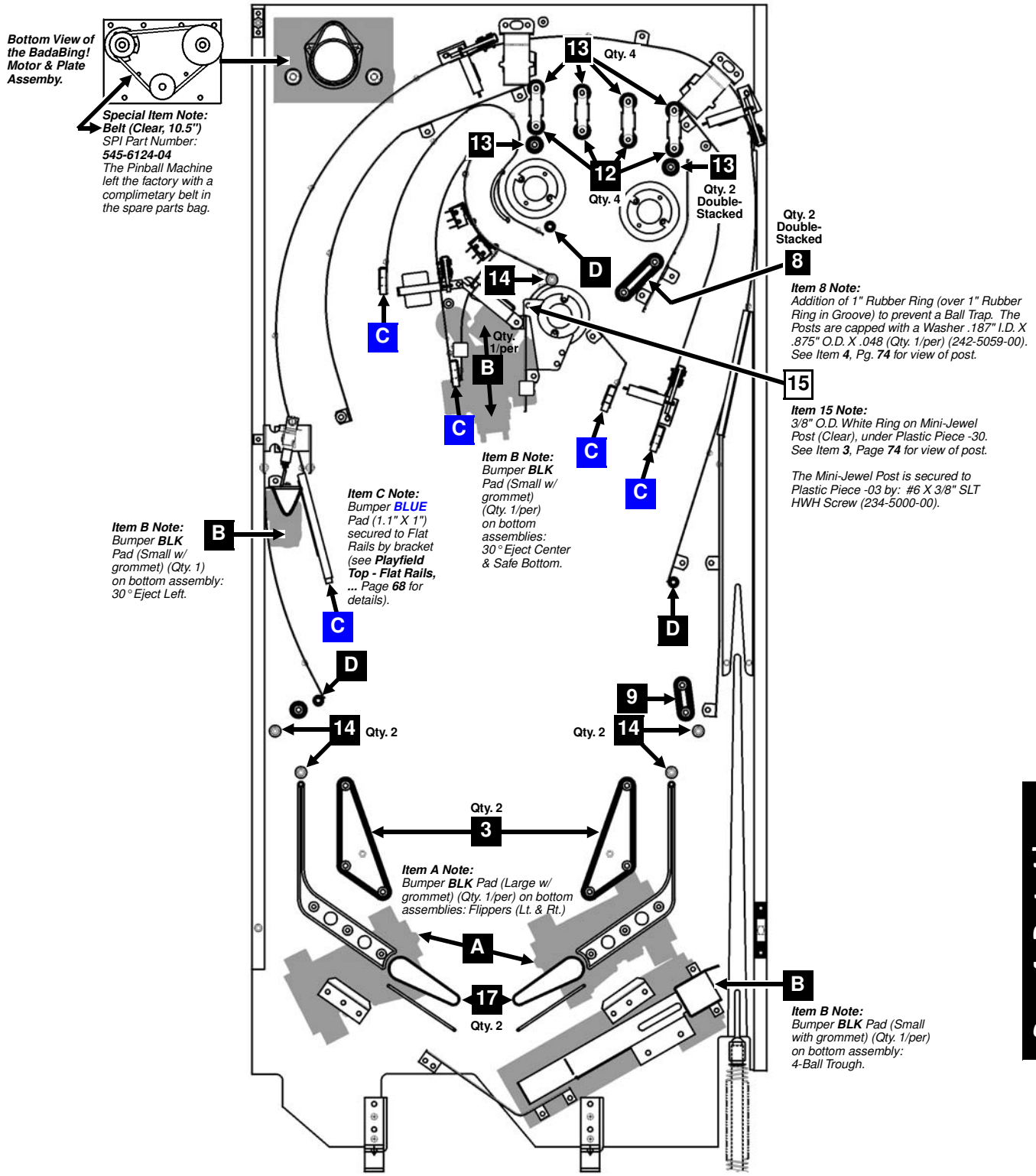
* An asterisk (*) indicates view of item on the Assembly Drawing only *(for location see next page). For better view(s), see **Drawings for Major Assemblies...** (**The Blue Pages**), Section **4**, Chapter **2**, (Page **81**), (view Table of Contents for exact page).*

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.

Sec. 4: Parts Id. ...

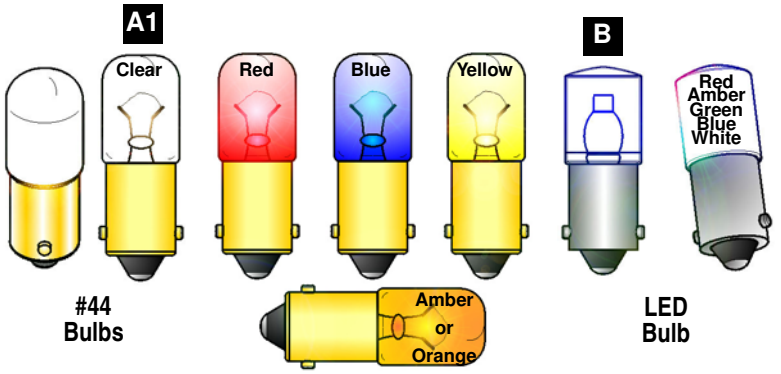
† *The item type (size / description), the quantity and/or location used, are subject to change without notice. Service Bulletins will announce any changes, if warranted.*

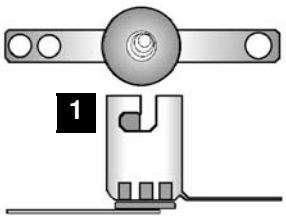


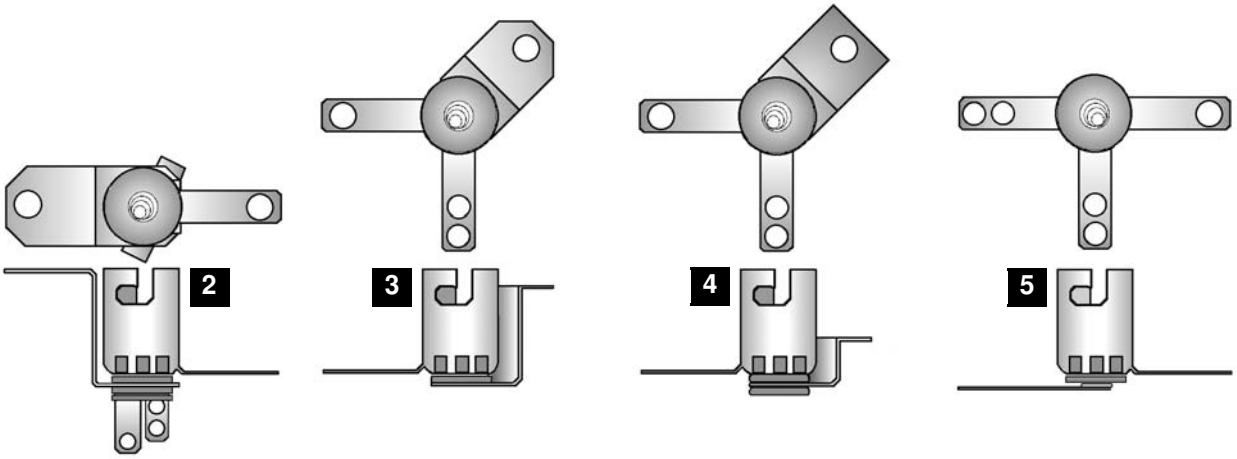
Take Note:

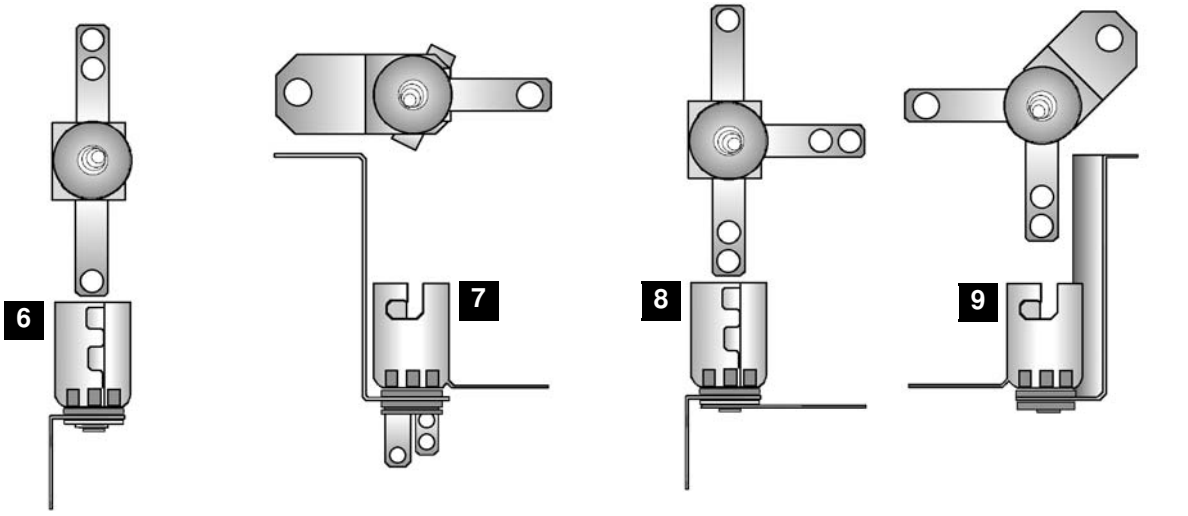
Legend Note:
Items noted with a black square ■ are Black Rubber Parts.
Items noted with a white square □ are White Rubber Parts.
Items noted with a blue square ■ are Blue Rubber Parts.

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





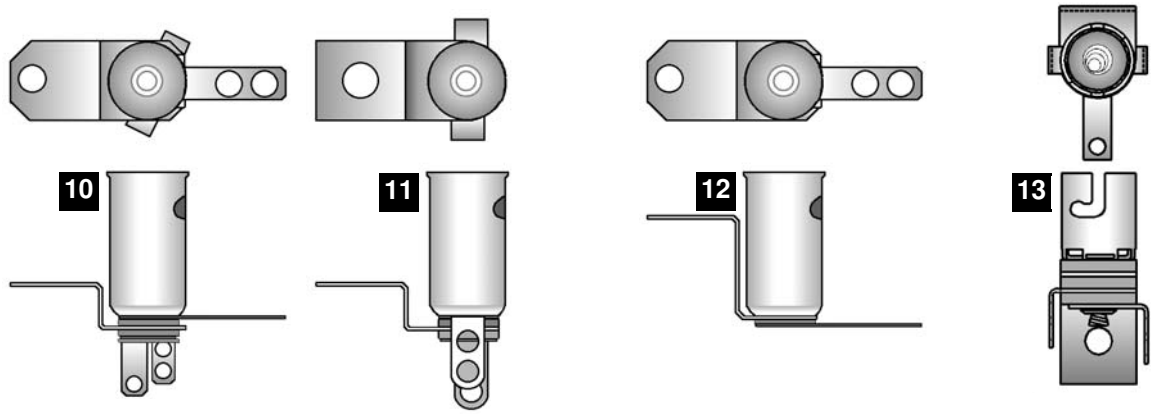




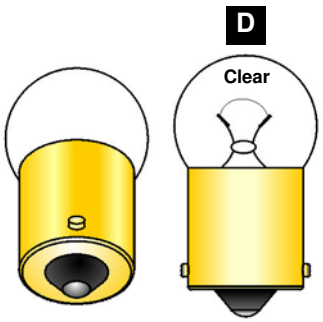
Nr.	BULBS (#44, LED & #455)	QTY.	SPI PART Nr.
A	#44 Bulb (Clear) *Heavy Filament*	62	**165-5000-44-HF**
	#44 Bulb (Yellow)	4	165-5053-06
	Item A Note: *Different Colors available (not used in this game) ~* **Red** (**165-5053-02**); **Amber** (**165-5053-03**); **Blue** (**165-5053-05**); **Orange**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

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

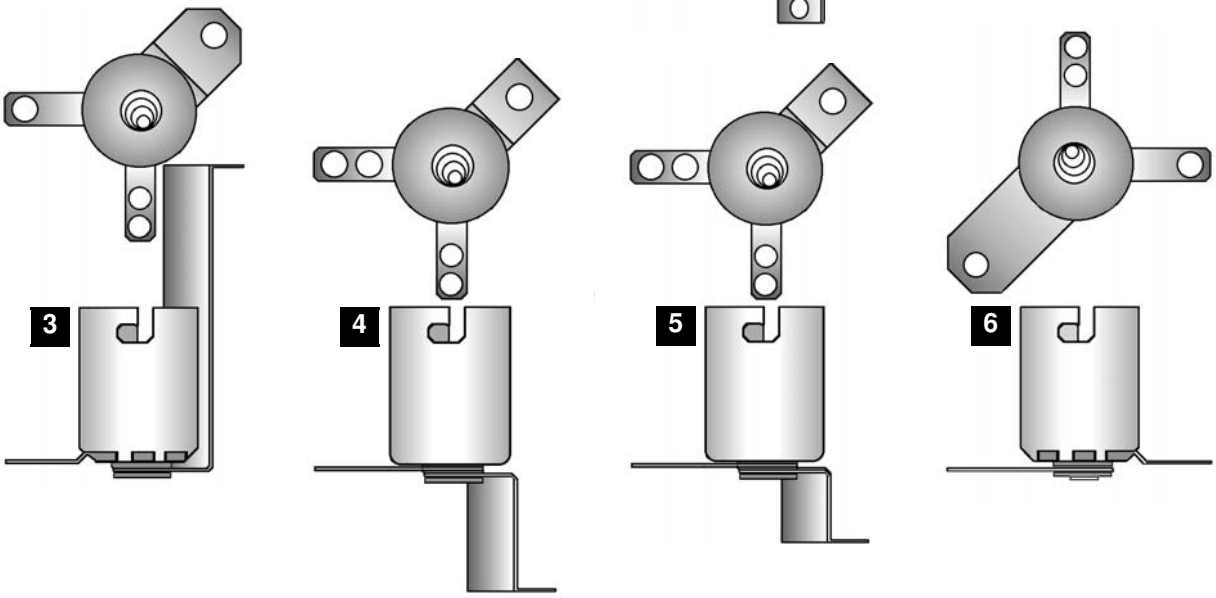
† *The item type (size / description), the quantity and/or location used, are subject to change without notice. Service Bulletins will announce any changes, if warranted.*



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



#89
Bulb



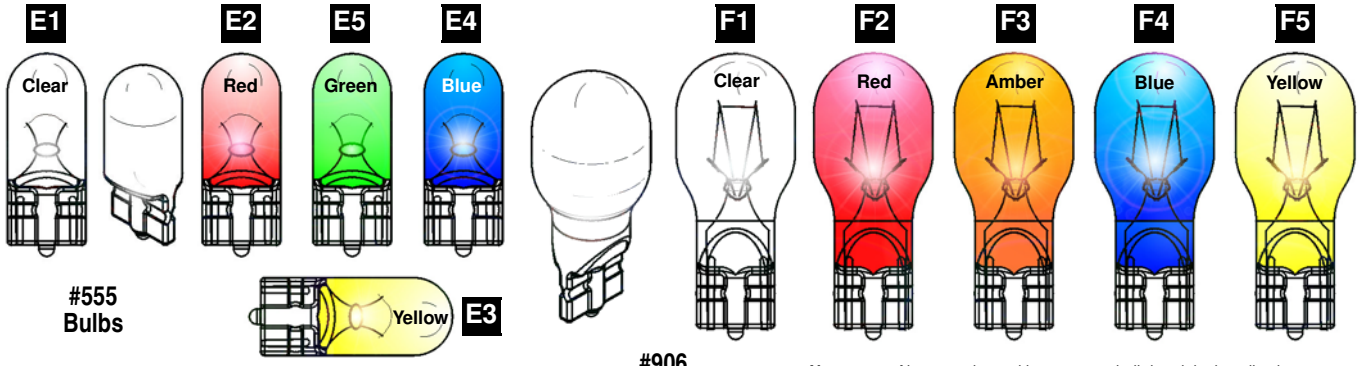
Nr.	BULB (#89)	QTY.	SPI PART Nr.
D	#89 Bulb *Heavy Filament*	8	**165-5000-89-HF**

Nr.	LARGE BAYONET SOCKETS	QTY.	SPI PART Nr.
1	2-Lug Laydown Standard Socket	4	077-5100-00
2	2-Lug Stand-Up Short Socket	4	077-5101-00
3	2-Lug Stand-Up Long Socket		077-5102-00

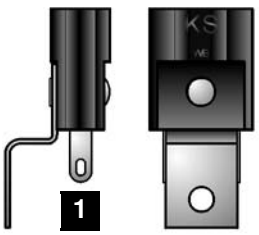
Nr.	LARGE BAYONET SOCKETS	QTY.	SPI PART Nr.
4	2-Lug Stand-Up Rev. Mount Socket		077-5103-00
5	2-Lug Stand-Up Rv. Mnt. Short Socket		077-5106-00
6	2-Lug Straight Leg Socket		077-5107-00

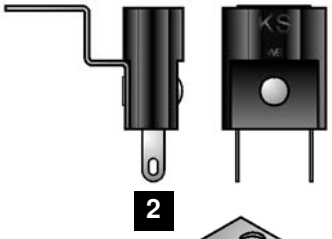
† The item type (size / description), the quantity and/or location used, are subject to change without notice. Service Bulletins will anounce any changes, if warranted.

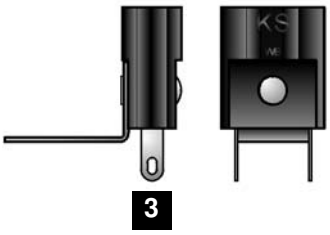
Playfield Top & Bottom - Wedge Base Sockets & Bulbs ■ (Actual Size) †



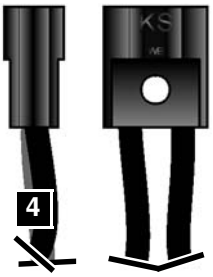
Note: *Always replace with same type bulb in original application.*



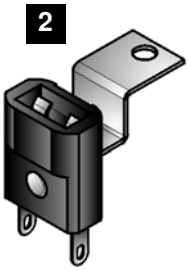


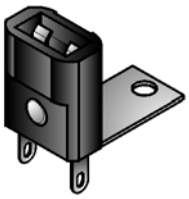


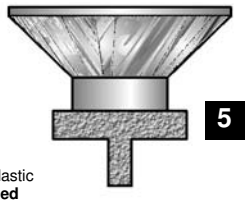
*Item **4** Socket does not require brackets. Old stock may include "L" style brackets (each side); do not secure to assembly.* ***Black Wires (Qty. 2) are 12" each.***

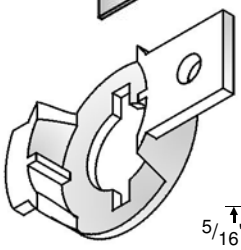


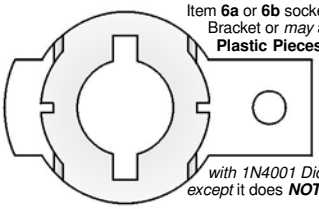






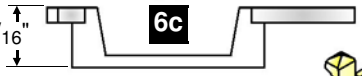


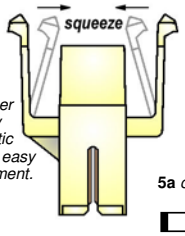




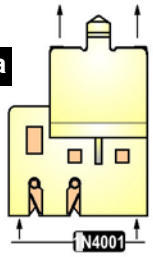
Item **6a** or **6b** sockets are secured to the playfield or assembly by Item **6c** Plastic Bracket or *may* also be snapped into specially cut **Clear and / or Screened Plastic Pieces** *(used only when sockets are positioned closely together or when used on plastics under Mini-Mars Light Covers. 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**.*

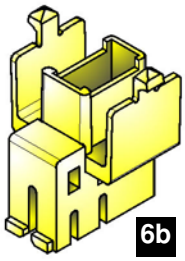
Item **6a** is a solderless **IDC** *(Insulation Displacement Connection)* Socket with a built-in Diode, 1N4003 (112-5003-00) *(can be replaced with 1N4001 Diode, 112-5001-00).* Item **6b** Socket (Yellow) is identical to **6a** (Socket) *except* it does ***NOT REQUIRE*** a diode *(Flash Lamp usage).*





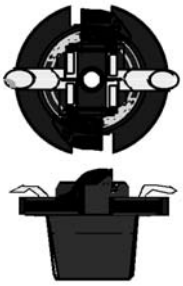
Just squeeze the "side arms" of the socket together and pull away from the plastic or bracket for easy Bulb replacement.





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)		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 similiar 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.*

Sec. 4: Parts Id. ...

Drawings for Major Assemblies & Ramps (The Blue Pages)

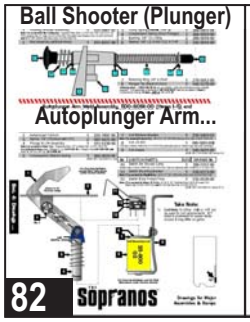
*View **Parts Id. & Location***
(for parts not described in this chapter)
*in Section **4**, Chapter **1** of **2***
*(**Pink Pages**), Pages **59-80**.*

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:

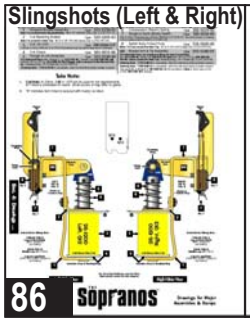
Items noted with a white square ☐ are parts mounted above the playfield. Items noted with a black square ■ are parts mounted below. Items noted with a cyan square ■ are parts mount in or on the cabinet.

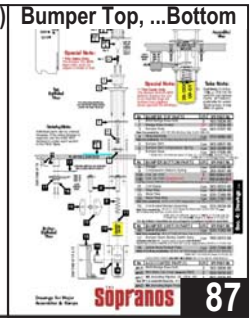


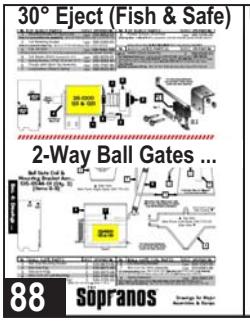


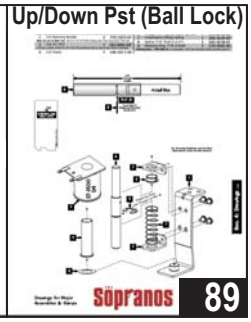


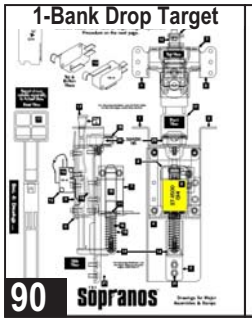


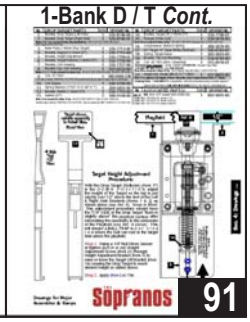


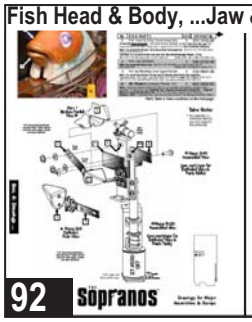


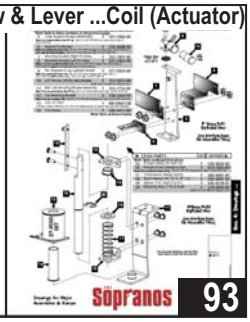






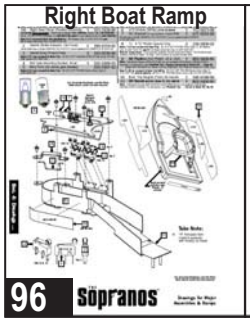


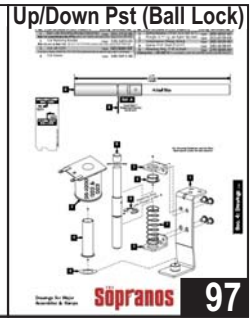


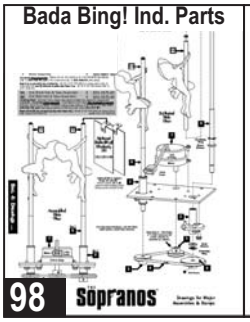








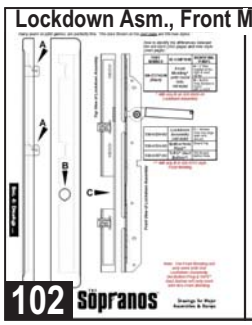


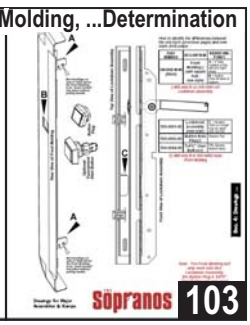


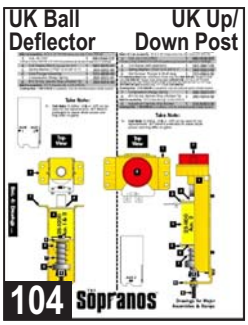






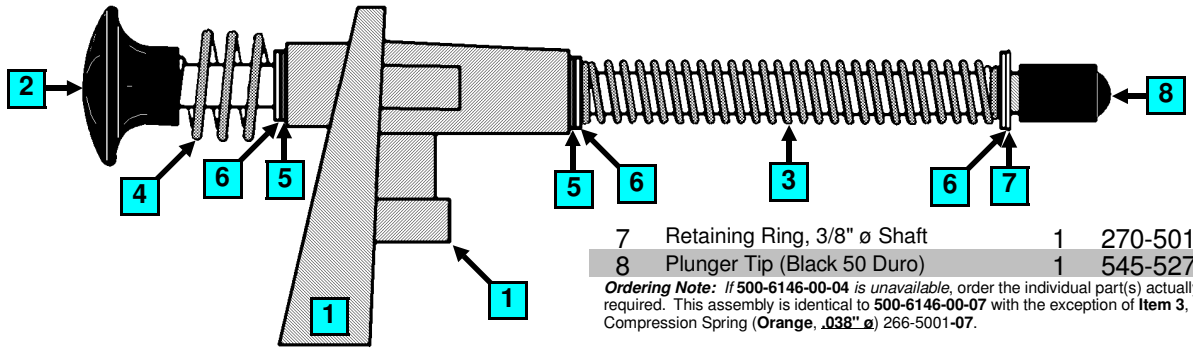






Ball Shooter (Plunger) Assembly, 500-6146-00-04 (Items 1-8)

Nr.	BALL SHOOTER PARTS	QTY.	SPI PART Nr.
1	Housing (Shooter Assembly)	1	535-5067-02
	Item 1 is secured to the Cabinet by: Support Plate (Qty. 1) (535-5027-00), #10-32 X 1/2" PPH (Sems) Zinc TF (Qty. 3) (237-6033-00), #10 Split Lock Washer (Qty. 3) (244-5003-00) **and** #6 X 5/8" SHWH AB (Zinc) (Qty. 2) (234-5002-00)		
2	Rod Assembly (w/Black Knob)	1	515-6557-00
3	Comp. Spring (**GREEN**, .035" ø)	1	266-5001-04
4	Compression Spring (Short Plunger)	1	266-5010-00
5	Bushing, 3/8" I.D. (Oilite)	2	280-5010-00
6	Washer, 3/8" I.D. X 5/8" O.D. X 1/16"	3	242-5014-00
7	Retaining Ring, 3/8" ø Shaft	1	270-5012-00
8	Plunger Tip (Black 50 Duro)	1	545-5276-00



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.
1	Arm Weld Assembly	1	515-6526-00
	Item 1 is secured to Item 2 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)		
2	Autoplunger Fulcrum	1	535-7697-00
3	Nyliner, 1/4" (Thomson #4l1-FF)	2	545-5423-00
4	Plunger & Link Assembly	1	515-5338-00
	Item 4 is secured to Item 1 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00) ***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**)		
5	Compression (Return) Spring	1	266-5020-00

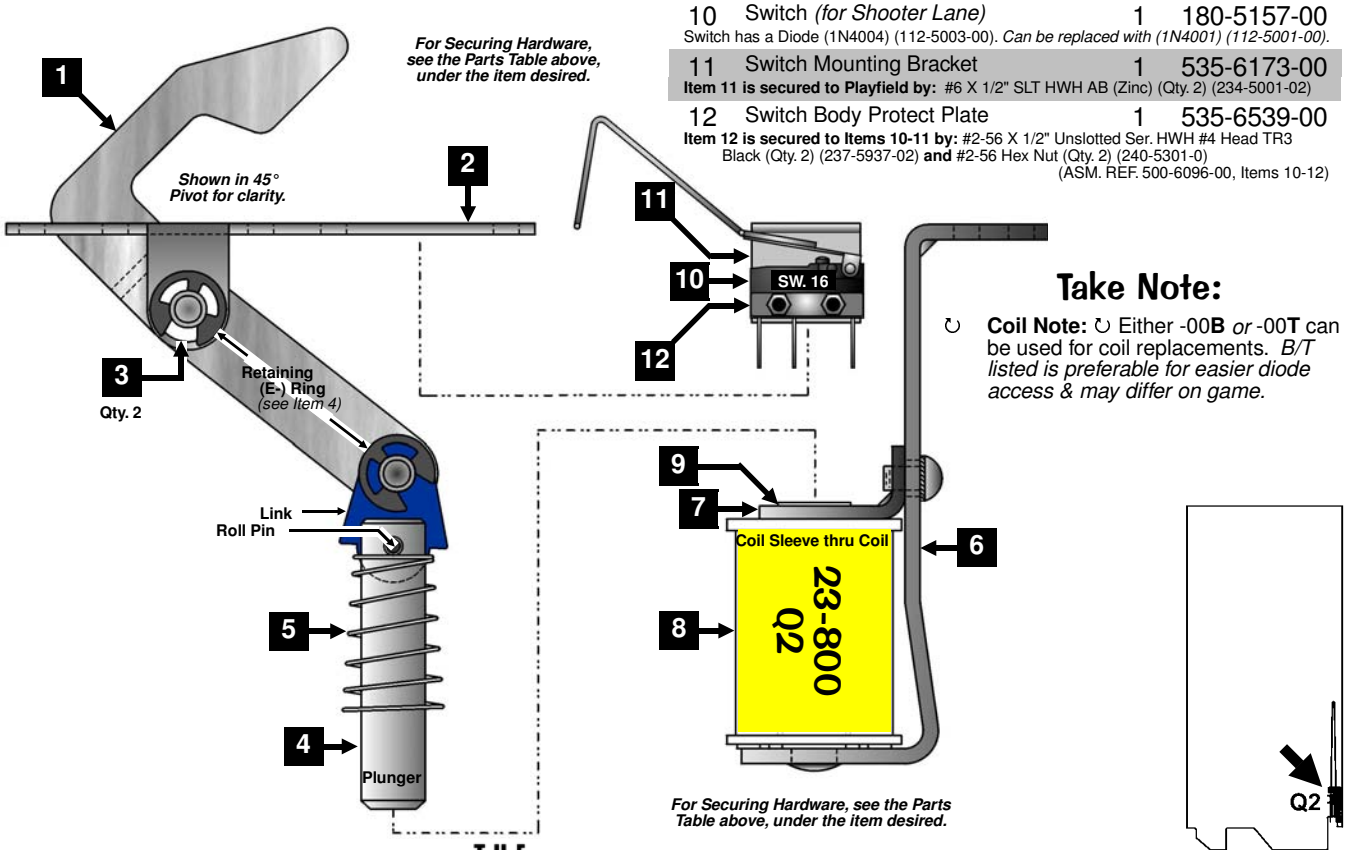
(ASM. REF. 500-6091-00, Items 1-5)

Nr.	AUTOPLNGR. COIL PARTS	QTY.	SPI PART Nr.
6	Autoplunger Coil Bracket Assembly	1	515-6527-00
	Items 1 & 6 are secured below the P/F by: #8 X 1/2" SHWH AB (Zc.) (Qty. 9) (234-5101-00)		
7	Coil Retainer Bracket	1	535-5203-03
	Item 7 is secured to Item 6 by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)		
8	Coil, 23-800	1	090-5001-00B
	Coil has a Diode (1N4004) (112-5003-00) positioned @ bot. (below lugs opposite windings).		
9	Coil Sleeve	1	545-5031-00

(ASM. REF. 500-6092-03B, Items 6-9)

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)



Take Note:

↻ **Coil Note:** ↻ Either -00**B** *or* -00**T** 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 excepttions, see note below Item 13 (Parts Table).

Nr.	4-BALL TROUGH PARTS	QTY.	SPI PART Nr.
1	Ball Trough Outhole Mounting Bracket **Item 1 is secured below the playfield by:** #8 X 1/2" SHWH AB (Zinc) (Qty. 6) (234-5101-00)	1	515-6580-01
2	Micro Switch **(Roller Actuator, Lite-Force)** **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).*	3	180-5119-02
3	Switch Body Protect Plate	3	535-6539-00
4	Coil Mounting Bracket **Item 4 is secured to Item 1 by:** #8-32 X 3/8" HWH Swage (Sr.) Zinc (Qty. 4) (237-5975-00)	1	535-7330-01
5	Coil Retaining Bracket **Item 5 is secured to Item 4 by:** #8-32 X 1/4" HWH MS (Serr) Zinc (Qty. 2) (237-5964-01)	1	535-5203-03
6	Coil, 26-1200 Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).	1	090-5044-00T
7	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
8	Plunger Assembly ***For Individual Items use :*** Plunger (**530-5210-00**) & Nylon Plunger (**530-5277-01**)	1	515-5941-01
9	Compression (Return) Spring	1	266-5020-00
10	Rubber Bumper (Grommet)	1	545-5105-00

Nr.	4-BALL TROUGH PARTS	QTY.	SPI PART Nr.
11	Trough Ball Guide Plate *Not Required* **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)	0	535-7801-00
12	Dual OPTO TRANS Board Assembly	1	515-0173-00
13	Dual OPTO REC Board Assembly **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**)	1	515-0174-00

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**, Swich Body Protect Plates, are required when not using **Item 11** *(not required, no Magnet Mech. used in game).*

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

Nr.	ASSOCIATED PART(S)	QTY.	SPI PART Nr.
AP-A	Ball Trough Enter / Exit Scoop **Item AP-A secured to the playfield by:** #8 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00).	1	535-7329-01
AP-B	* Steel Balls (1-1/16" ø)	4	260-5000-00

Take Note:

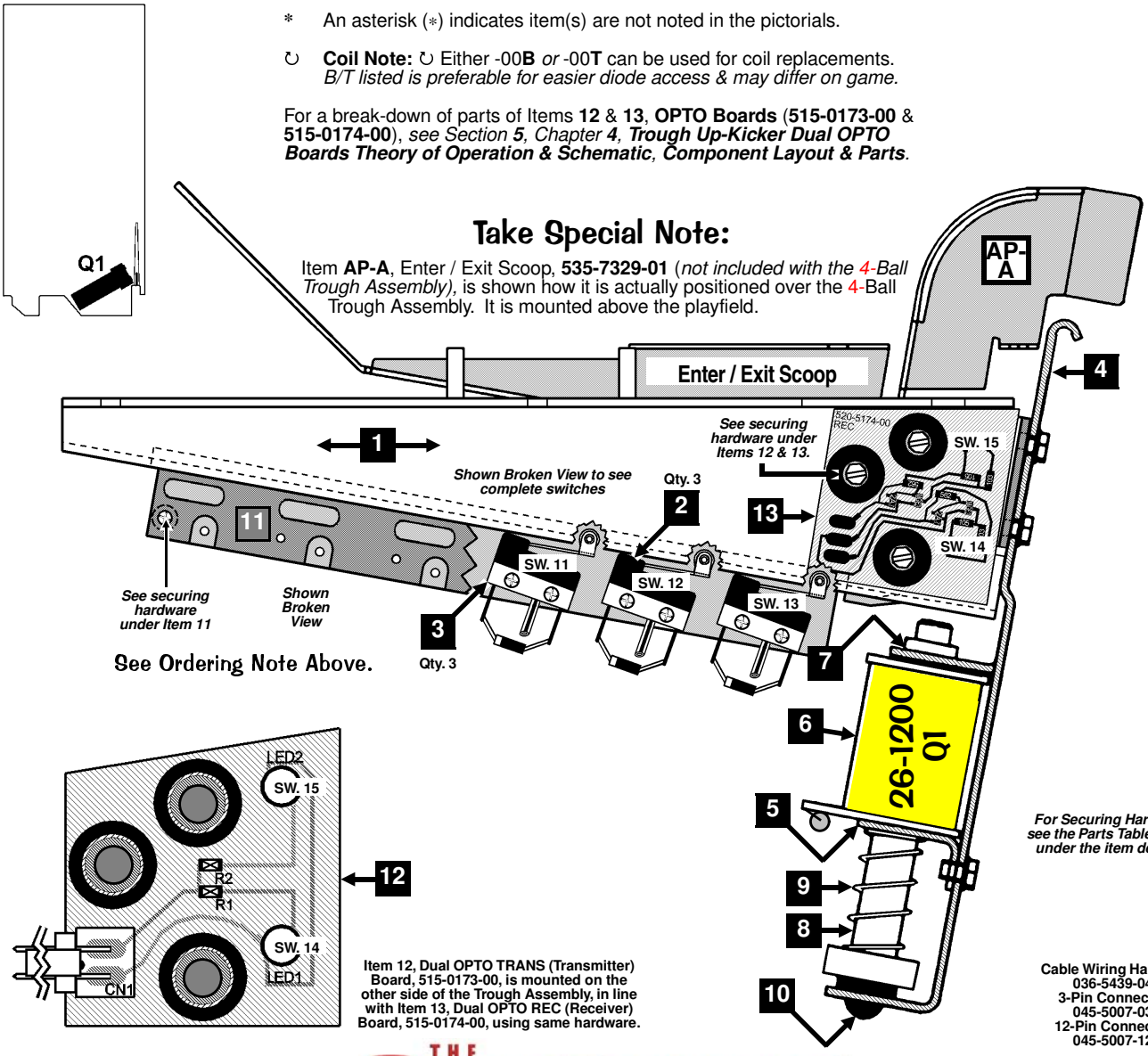
* An asterisk (*) indicates item(s) are not noted in the pictorials.

↻ **Coil Note:** ↻ Either -00**B** *or* -00**T** 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**.*

Take Special Note:

Item **AP-A**, Enter / Exit Scoop, **535-7329-01** (*not included with the 4-Ball Trough Assembly),* is shown how it is actually positioned over the 4-Ball Trough Assembly. It is mounted above the playfield.



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.
1	Flipper Base Plate (**LEFT**)	1	**See FRP1**
	Item 1 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00) ***Ordering Note:*** *Use Item **FRP1**, see the end of this Parts Table.*		
2	Flipper Bat Bushing (White Plastic) 1/4" ø I.D.	1	545-5070-00
	Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)		
3	Power (EOS / End-of-Stroke) Switch	1	180-5149-00
	Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)		
4	Sw. Plate/Spring Return Brkt. (**LEFT**)	1	535-7354-**01**
5	Flipper Return Spring	1	265-5035-00
6	Coil Stop Bracket Sub-Assembly	1	515-6308-01
	Item 6 is secured to Item 1 by: #10-32 X 3/8" SHWH Swage (Serr) Zinc (Qty. 2) (237-5985-00) **and** #10 Split Lock Washer (Qty. 2) (244-5003-00)		
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
8	Coil Support Bracket	1	535-7356-00
	Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)		
9	Coil, 22-1080 (YEL-GRN) (Left)	1	090-5032-00T
	Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).		
10	Coil Sleeve	1	545-5388-00
11	Deflector Pad (Bumper)	1	545-5428-00
12	Flipper Plunger & Link Sub-Assy.	1	515-6304-03
	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)		

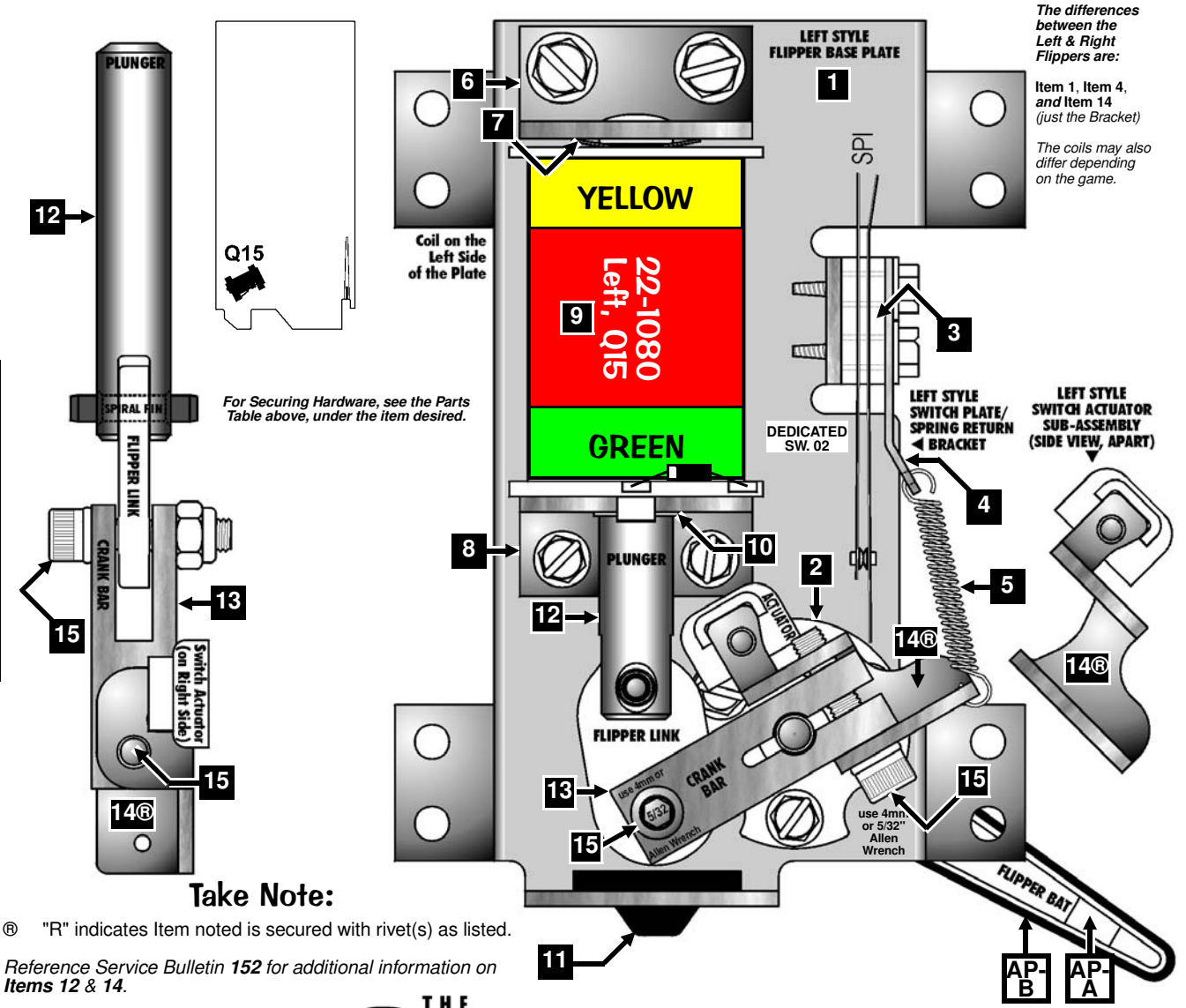
Nr.	FLIPPER (LEFT) PARTS	QTY.	SPI PART Nr.
13	Crank Bar	1	530-5070-02
	Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)		
14®	Switch Actuator (**LEFT**) Sub-Assy.	1	515-7257-**01**
	For Individual Items use : Actuator & Spring Bracket (**LEFT**) (**535-9038-01**) **and** ® 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)		
15	Set Screw: #10-32 X 3/4" Socket Hd.	2	237-6144-00
	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**		

Flipper Rebuild Parts for Easier Installation, $ave $:

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

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

Nr.	ASSOCIATED PART(S)	QTY.	SPI PART Nr.
AP-A	**WHITE** Flipper Bat (Plain) & Shaft (Non-Knurled End) Assembly	1	515-5133-08-06
AP-B	Large Flipper **BLACK** Rubber Ring	1	545-5277-00



Take Note:

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

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

* *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 ...

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.
1	Flipper Base Plate (**RIGHT**)	1	**See FRP1**
	Item 1 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00) ***Ordering Note:*** *Use Item **FRP1**, see the end of this Parts Table.*		
2	Flipper Bat Bushing (White Plastic) 1/4" ø I.D.	1	545-5070-00
	Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)		
3	Power (EOS / End-of-Stroke) Switch	1	180-5149-00
	Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)		
4	Sw. Plate/Spring Return Brkt. (**RIGHT**)	1	535-7354-**00**
5	Flipper Return Spring	1	265-5035-00
6*	Coil Stop Bracket Sub-Assembly	1	515-6308-01
	Item 6 is secured to Item 1 by: #10-32 X 3/8" SHWH Swage (Serr) Zinc (Qty. 2) (237-5985-00) **and** #10 Split Lock Washer (Qty. 2) (244-5003-00)		
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
8	Coil Support Bracket	1	535-7356-00
	Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)		
9	Coil, 22-1080 (YEL-GRN) (Right)	1	090-5032-00T
	Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).		
10	Coil Sleeve	1	545-5388-00
11	Deflector Pad (Bumper)	1	545-5428-00
12	Flipper Plunger & Link Sub-Assy.	1	515-6304-03
	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)		

Nr.	FLIPPER (RIGHT) PARTS	QTY.	SPI PART Nr.
13	Crank Bar	1	530-5070-02
	Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)		
14®	Switch Actuator (**RIGHT**) Sub-Assy.	1	515-7257-**00**
	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" ø X 1/4" Lg. (Qty. 1) (249-5003-00)		
15	Set Screw: #10-32 X 3/4" Socket Hd.	2	237-6144-00
	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**		

Flipper Rebuild Parts for Easier Installation, $ave $:

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

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

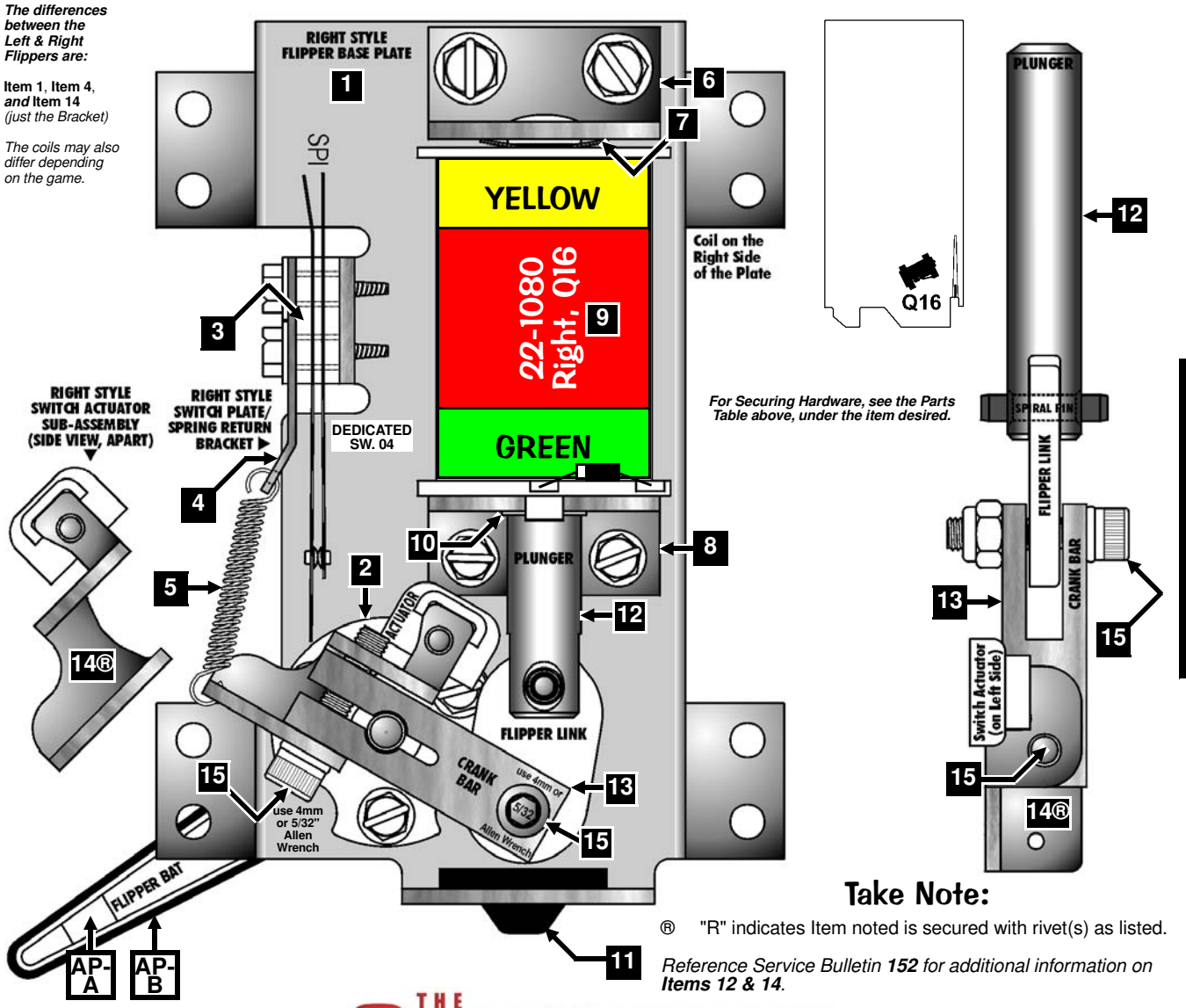
Nr.	ASSOCIATED PART(S)	QTY.	SPI PART Nr.
AP-A	**WHITE** Flipper Bat (Plain) & Shaft (Non-Knurled End) Assembly	1	515-5133-08-06
AP-B	Large Flipper **BLACK** Rubber Ring	1	545-5277-00

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

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**.*

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

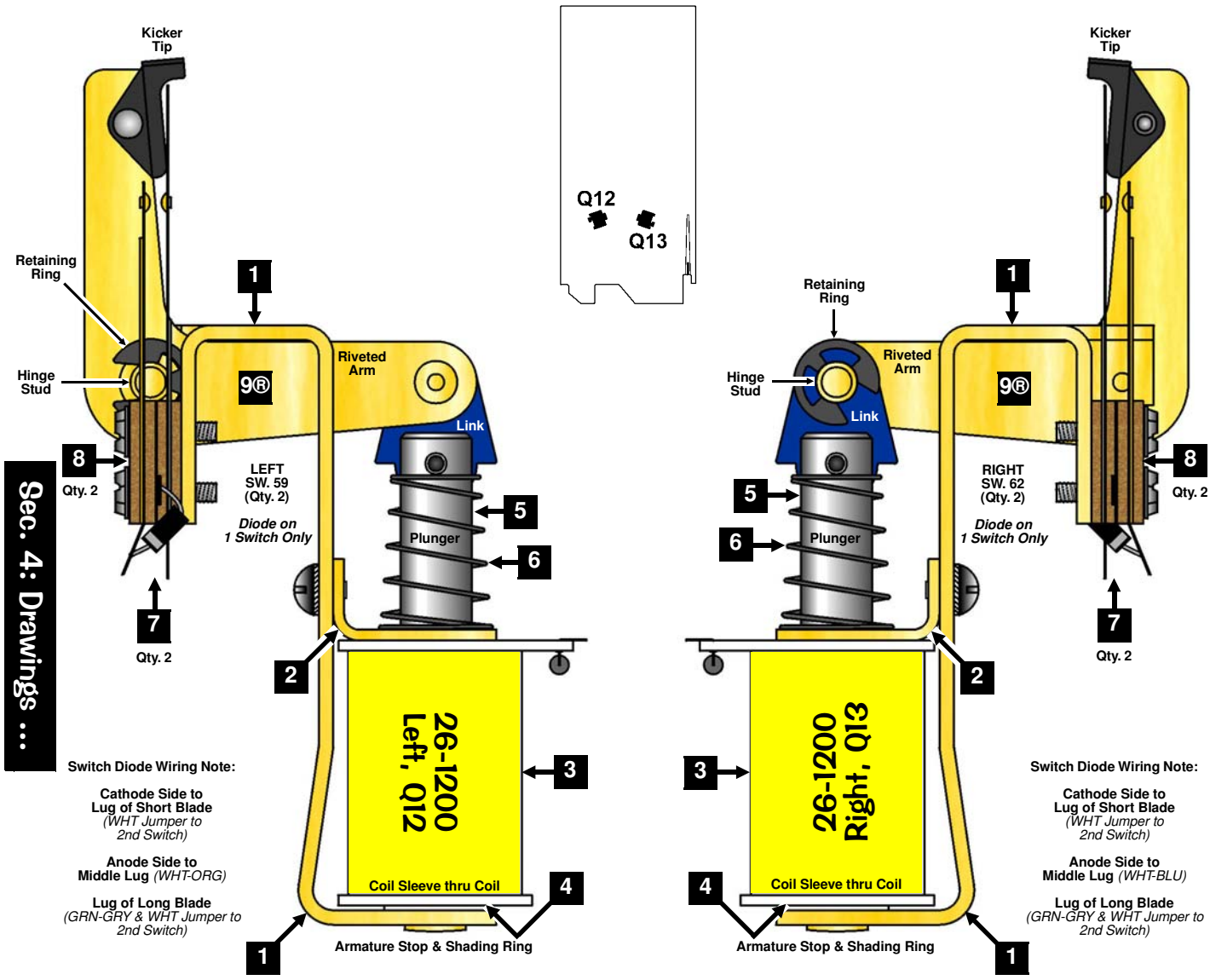
Nr.	SLINGSHOT PARTS	QTY.	SPI PART Nr.
1	Slingshot Bracket Assembly	1/per	515-5339-01
	Item 1 is secured below the playfield by: #8 X 1/2" SHWH AB (Zinc) (Qty. 3) (234-5101-00)		
2	Coil Retaining Bracket	1/per	535-5203-03
	Item 2 is secured to Item 1 by: #8-32 X 3/8" PPH MS (Sems) (Qty. 2) (232-5301-00)		
3	Coil, 26-1200	1/per	090-5044-00T
	Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).		
4	Coil Sleeve	1/per	545-5031-00
5	Plunger & Link Assembly	1/per	515-5338-00
	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)		
	Ordering Note: *If* **515-5338-00** *is unavailable*, order the individual part(s) actually required.		

Nr.	SLINGSHOT PARTS	QTY.	SPI PART Nr.
6	Compression (Return) Spring	1/per	266-5020-00
7	Slingshot Stack (Blade) Switch	2/per	180-5054-00
	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).*		
8	Switch Body Protect Plate	2/per	535-5045-00
	Items 7 & 8 are secured to Item 1 by: #6-32 X 5/8" HWH Swage (Qty. 4) (237-5976-04)		
9®	Riveted Arm & Tip Assembly	1/per	515-5340-01
	For Individual Parts use (requires drilling out rivet & rereviting) : 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)		
	Ordering Note: *If* **515-5340-01** *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 -00**B** *or* -00**T** 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.



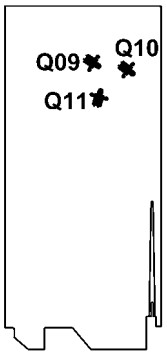
Left Side View

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

Right Side View

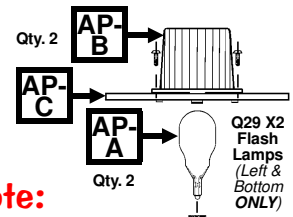
Sec. 4: Drawings ...

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



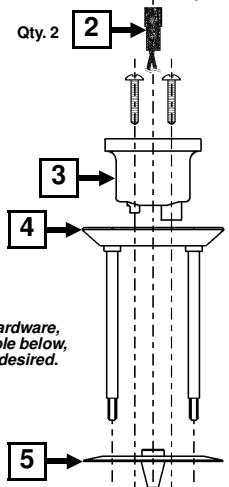
Special Note:

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



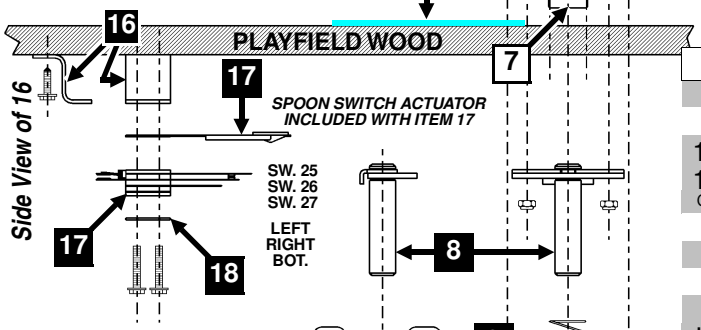
Top Exploded View

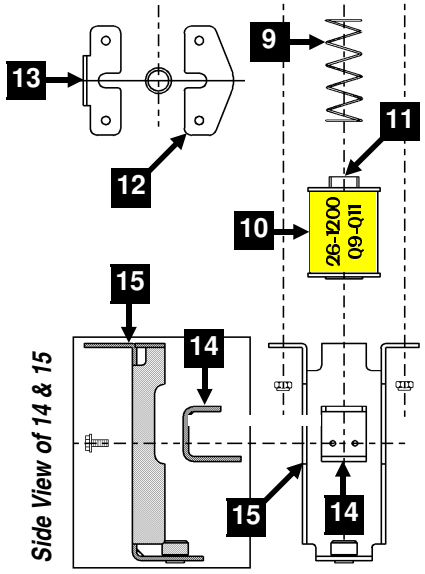
For Securing Hardware, see the Parts Table below, under the item desired.



Ordering Note:

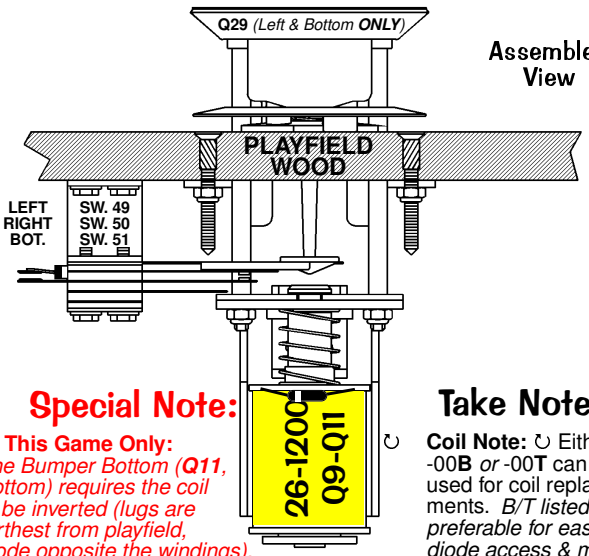
Individual parts can be ordered. However, if the entire Bumper is required, use the ASM. REF. Number(s) under each section in the Parts Table.





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 -00**B** *or* -00**T** 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**	090-5044-00**B**
	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.

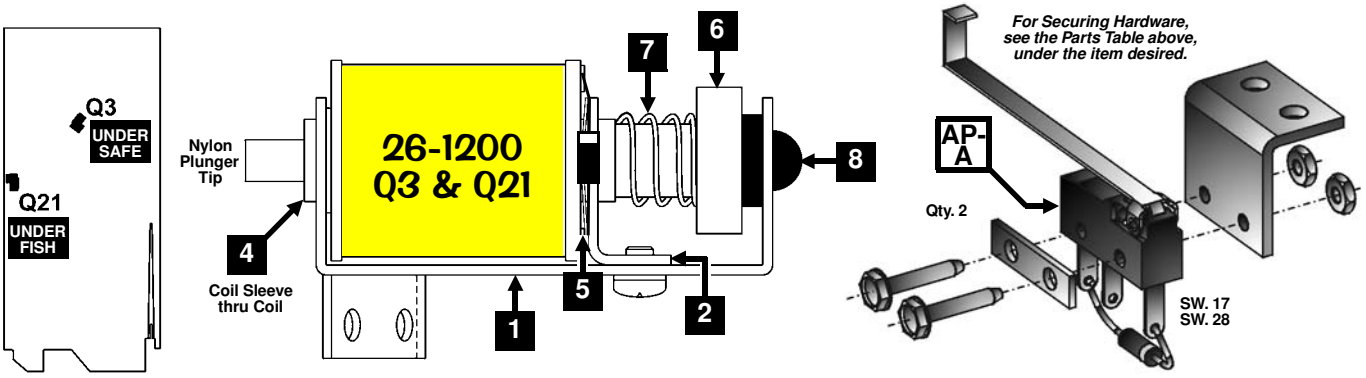
Nr.	ASSOCIATED PART(S)	QTY.	SPI PART Nr.
AP-A	#906 Wedge Base Bulb	2	165-5004-00
AP-B	Mini-Mars Lite Cover **(Snap-In)** (Red)	2	550-5030-02
AP-C	***Kit:* Plastics** *(includes -08, -09 & -19)*	1	803-5000-85
	Item AP-C is secured to Item 4 by: #4 X 3/8" PFH MS (Black) (Qty. 2/per) (237-5983-00)		
AP-D	***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.
1	Mounting Bracket 30° Eject (Left)	1/per	535-8932-02
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00)		
2	Coil Retaining Bracket	1/per	535-5203-03
	Item 2 is secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) (Qty. 2) (232-5300-00)		
3	Coil, 26-1200	1/per	090-5044-00B
	Coil has a Diode (1N4004) (112-5003-00) positioned @ bot (below lugs opposite windings).		
4	Coil Sleeve (Short) (Formost #10-7077)	1/per	545-5076-01
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
8	Rubber Bumper (Grommet)	1/per	545-5105-00
	Ordering Note: If **500-6511-01** *is unavailable*, order the individual part(s) actually required.		

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

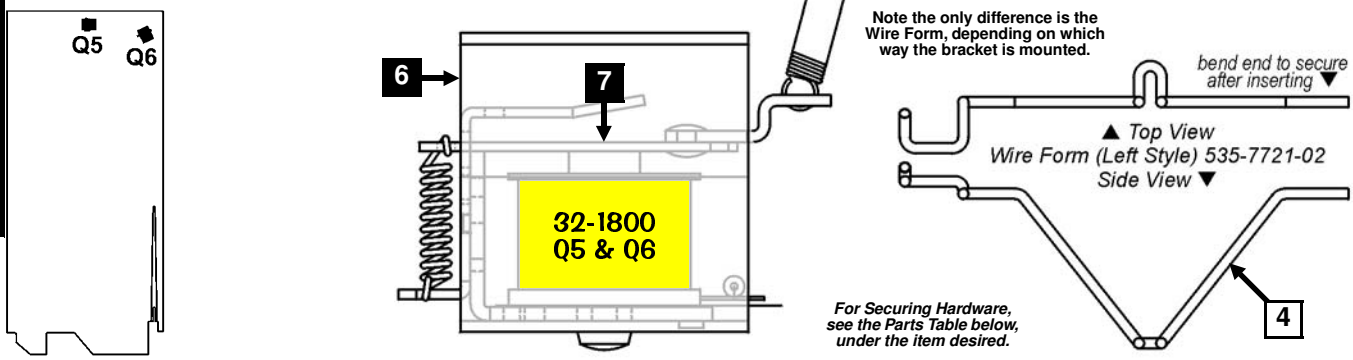
Nr.	ASSOCIATED PART(S)	QTY.	SPI PART Nr.
AP-A	Switch (Eject) Assembly	2	500-6520-01
	For Individual Items use : Switch Bracket (**535-6173-00**), Micro Switch (**180-5186-01**), Switch Body Protect Plate (**535-6539-00**), Diode 1N4004 (**112-5003-00**), #2-56 X 1/2" Unslt Serr HWH #4 Hd TR3 Black (Qty. 2/per) **and** (**237-5937-02**) #2-56 Hex Nut (Qty. 2/per) (**240-5301-00**)		
	Bracket secured to P/F by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5101-00)		



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)

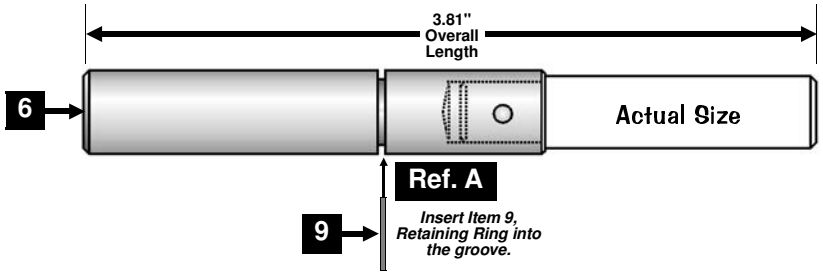


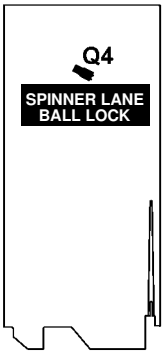
Nr.	BALL GATE PARTS	QTY.	SPI PART Nr.
1	Ball Gate Mounting Bracket	2	535-9470-00
2	Ball Gate Flap	2	535-9471-00
3	Rebound Hinge	2	535-5372-04
4	Wire Form *(for Left Mounting)*	1	535-7721-02
5	Wire Form *(for Right Mounting)*	1	535-7721-03
	(ASM. REF. 500-6100-**03**, Items 1-4)	(ASM. REF. 500-6100-**04**, Items 1-3 & 5)	

Nr.	BALL GATE COIL PARTS	QTY.	SPI PART Nr.
6	Coil Mounting Bracket	1/per	535-7727-01
7	Mini-Coil (32-1800) Assembly	1/per	515-6543-00
	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)		
8	Spring Extension	1/per	265-5045-01
	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)		

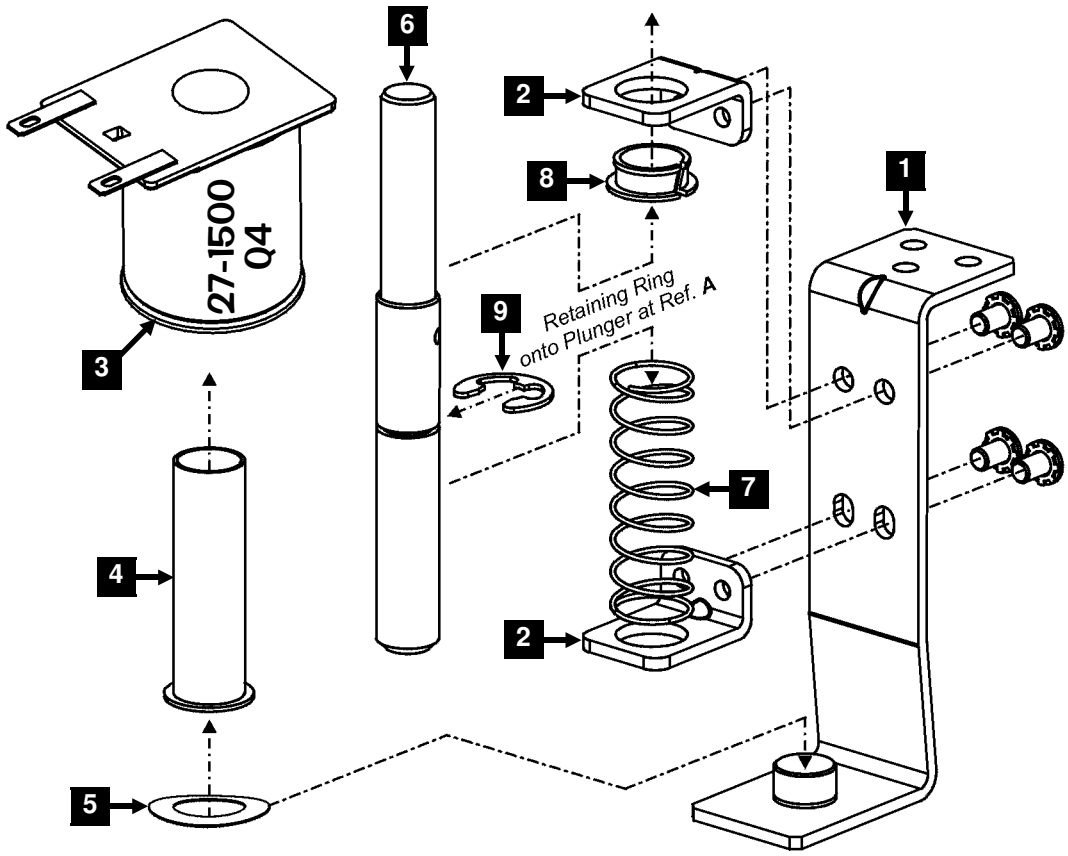
Up/Down Post (Spinner Lane Ball Lock) Assembly, 500-5867-02 (Items 1-9)

Nr.	UP/DOWN POST PARTS	QTY.	SPI PART Nr.
1	Ball Lock Mounting Bracket Assembly	1	515-7132-00
	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
	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
	Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).		
4	Coil Sleeve	1	545-5411-00
5	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
6	Plunger, 3.81" Lg. *(w/ Nylon Tip)* Asm.	1	515-6119-02
7	Compression (Relay) Spring	1	266-5020-00
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.		





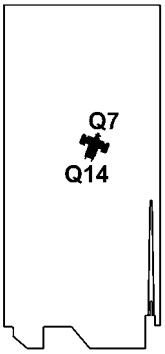
For Securing Hardware, see the Parts Table above, under the item desired.

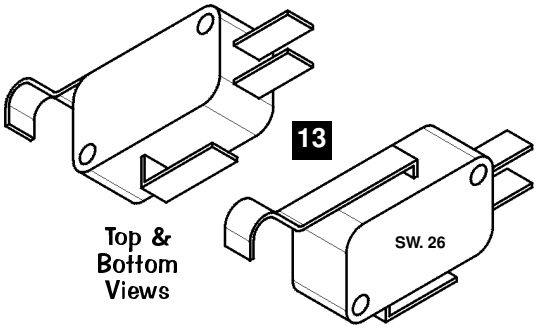


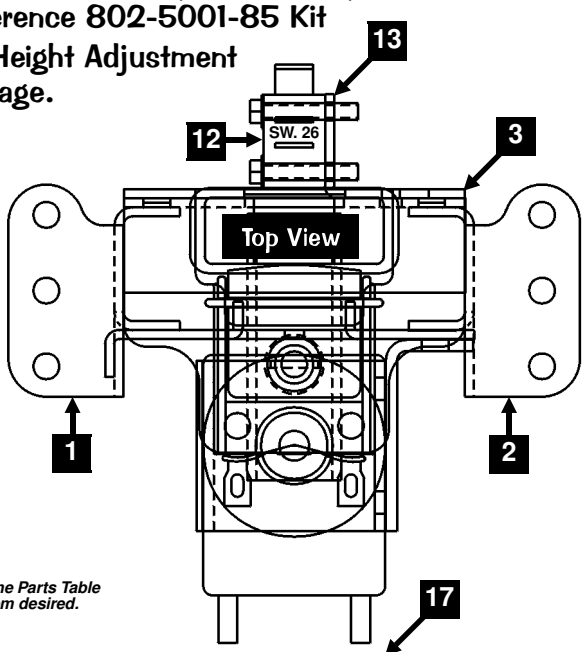
1-Bank Drop Target Assembly, 500-6893-01 (Items 1-21)

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

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

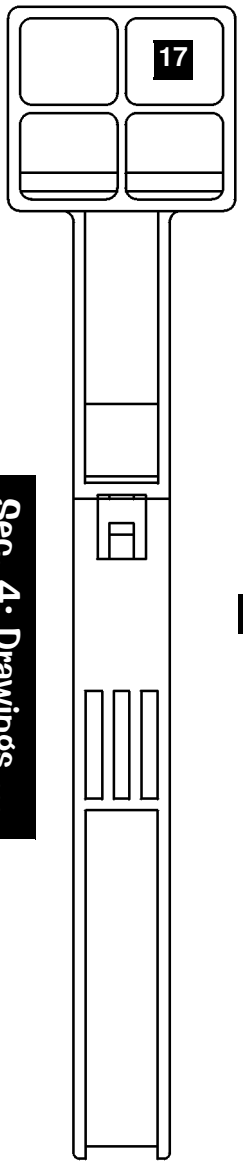




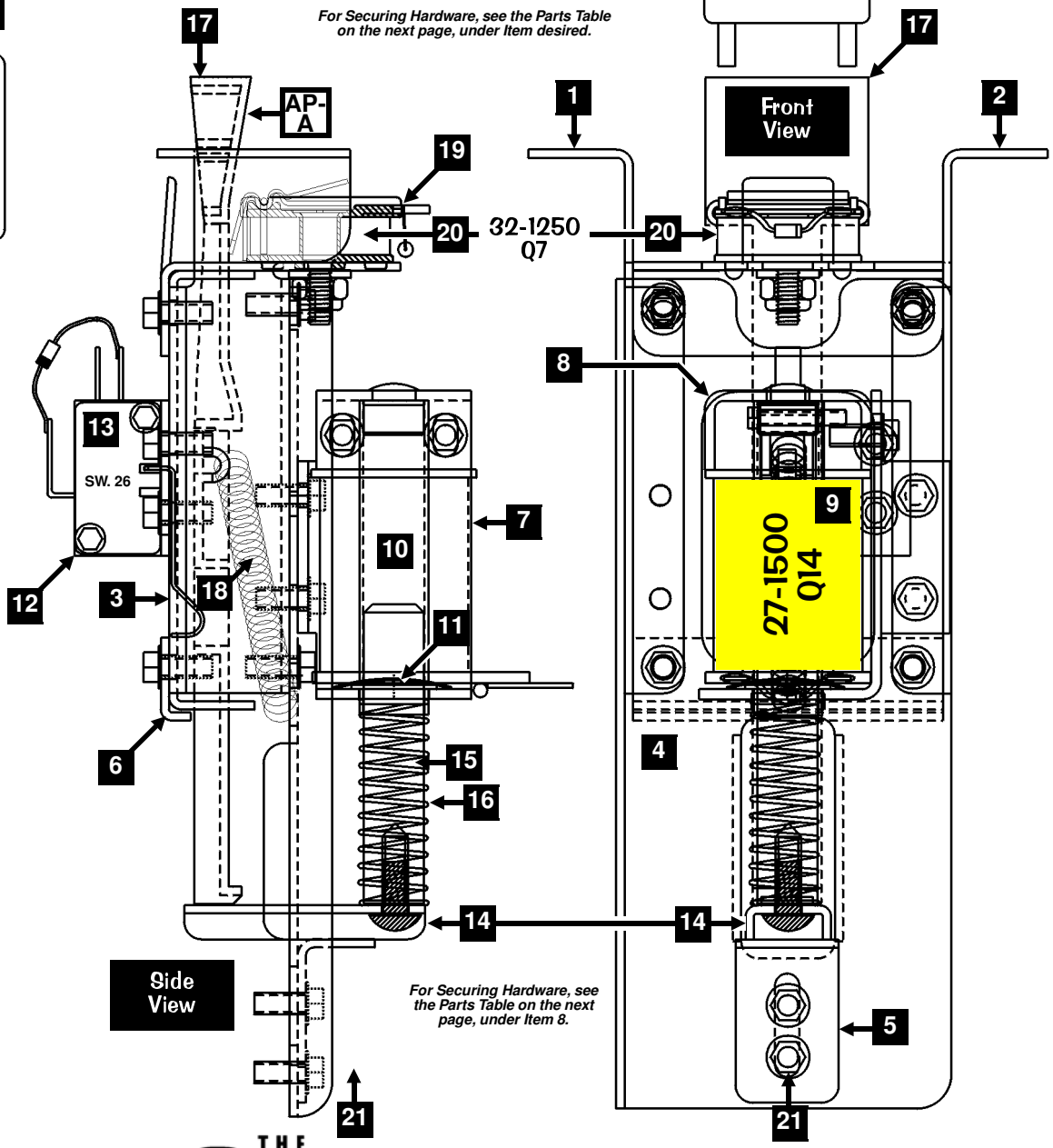


Target shown outside assembly is Actual Size.

Rear View



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



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

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.
1	Bracket, Drop Target (Left Side)	1	535-8746-00
2	Bracket, Drop Target (Right Side)	1	535-8746-01
	Items 1 & 2 are secured below the playfield by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 3/per) (234-5101-00)		
3	Back Plate (1-Bank Drop Target)	1	535-7713-00
4	Bracket, Support (1-Bank D/T)	1	535-7712-00
5	Bracket, Height Adjustment	1	535-7709-**01**
6	Bracket, Target Retainer (1-Bank D/T)	1	535-7728-00
7	Bracket, Coil Housing	1	535-7707-00
8	Bracket Cap, Coil Housing	1	515-6533-00
	Items 1-3, 5, 7-8 are secured to Item 4 by: #8-32 X 3/8" HWH Sw. (Qty. 16) (237-5975-00)		
9	Coil, 27-1500	1	090-5004-00B
	Coil has a Diode (1N4004) (112-5003-00) positioned @ bot (below lugs opposite windings).		
10	Coil Sleeve	1	545-5709-00
11	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
12	Bracket, Switch (1-Bank D/T)	1	535-7710-00
13	Switch (D/T)	1	180-5158-00
	Item 13 is secured to Item 12 by: #4-40 X 5/8" HWH TF (Qty. 2) (237-5945-00)		
	Switch has a Diode (1N4004) (112-5003-00). *Can be replaced with (1N4001) (112-5001-00).*		

Nr.	DROP TARGET PARTS	QTY.	SPI PART Nr.
14	Bracket, Target Lift (1-Bank D/T)	1	535-7706-01
15	Plunger (Drive Coil)	1	530-5410-00
	Item 15 is secured to Item 14 by: #10-32 X 3/8" PPH (Sems) (Qty. 1) (232-5401-00)		
16	Compression (Return) Spring	1	266-5020-00
17	D/T Target 10° Taper White (Rollover)	1	545-6143-01
18	Spring, Target Reset *Heavy Duty*	1	265-5003-02
19	Bracket, Trip Coil Mounting	1	535-8745-00
20	Coil, 32-1250 (Mini.) Assembly	1	515-6916-01
	Assembly Parts Included : *Diode, 1N4004 (**112-5003-00**), Actuator Flap Plate (**535-8597-00**) **and** Retainer Clip (**530-5550-00**).*		
	Item 20 is secured to Item 19 by: #8-32 Nylon Stop Nut (Qty. 1) (240-5102-00)		
21	Height Adj. Screw (#8-32 X 1" HWH)	1	237-6003-00
	Item 21 is adjusts the Height of Item 5 Bracket, which raises/lowers Item 17, Target.		

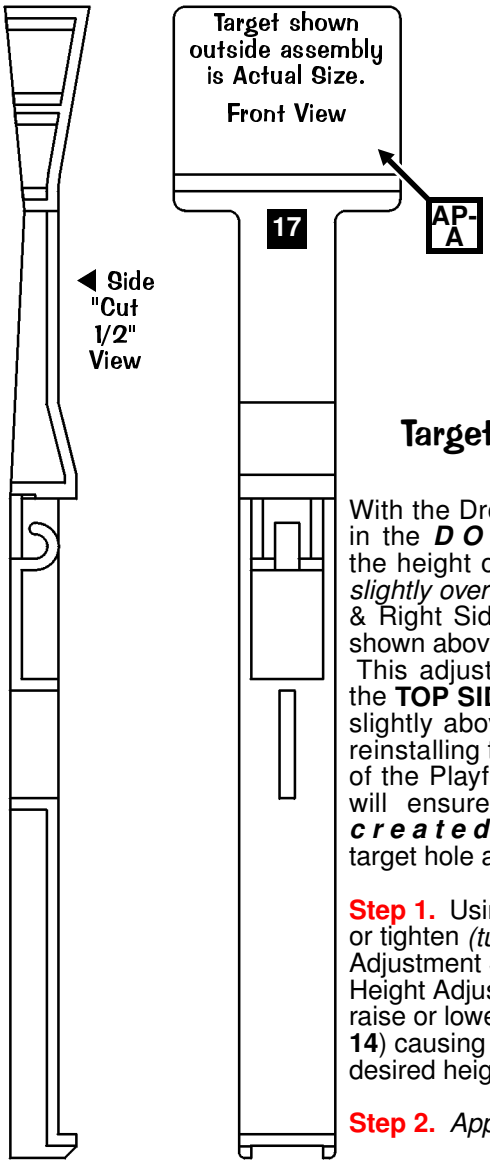
Ordering Note: *If **500-6893-01** is unavailable,* order the individual part(s) actually required

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

Nr.	ASSOCIATED PART(S)	QTY.	SPI PART Nr.
AP-A	***Kit:*** **Lexan** *(incl. D/T 820-6359-00)*	1	802-5001-85

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**.*

(ASM. REF. 515-6535-01, Items 7-11)
(ASM. REF. 515-6537-00, Items 14 & 15)
(ASM. REF. 515-7113-00, Items 19 & 20)

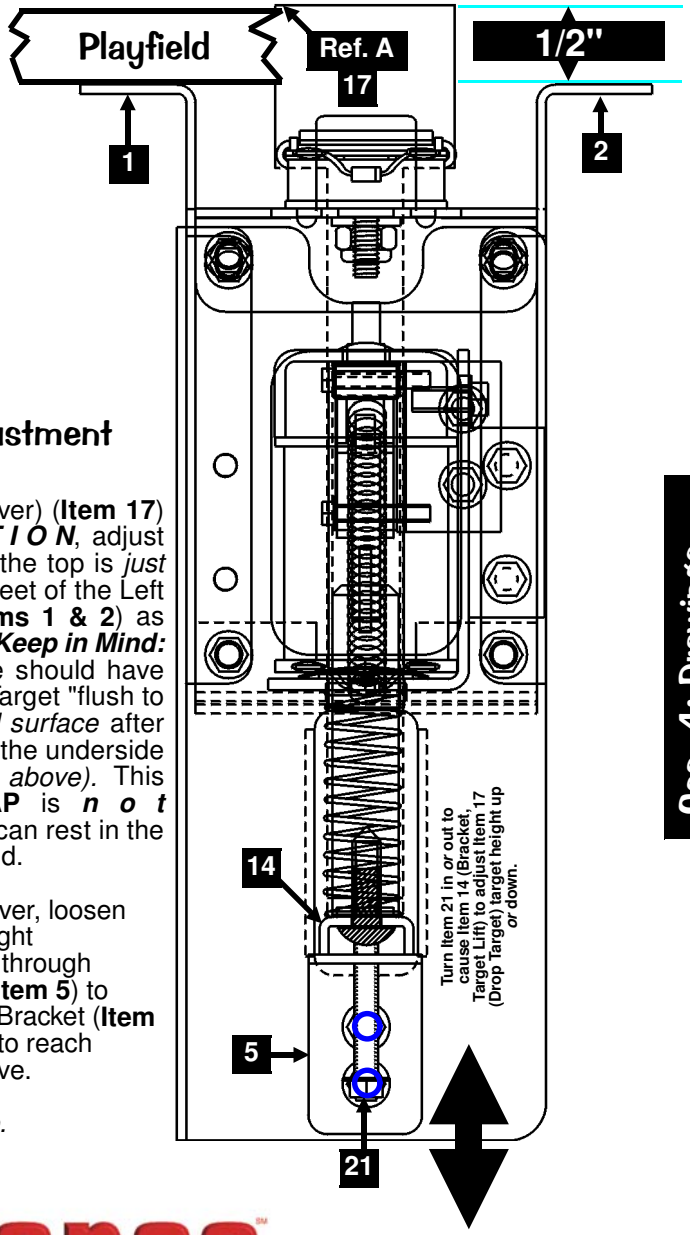


Target Height Adjustment Procedure:

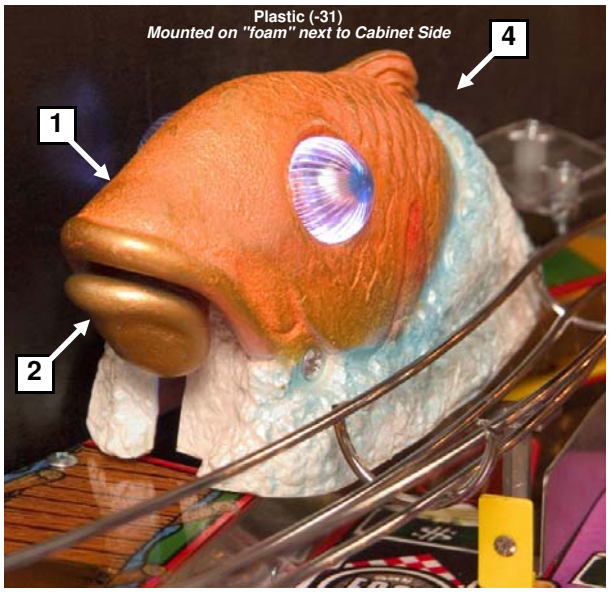
With the Drop Target (Rollover) (**Item 17**) in the ***D O W N P O S I T I O N***, adjust the height of the Target so the top is *just slightly over* 1/2" above the feet of the Left & Right Side Brackets (**Items 1 & 2**) as shown above *(see **Ref. A**)*. ***Keep in Mind:*** This adjustment procedure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

Step 1. Using a 1/4" Nut Driver, loosen or tighten *(turn in or out)* Height Adjustment Screw (**Item 21**) through Height Adjustment Bracket (**Item 5**) to raise or lower the Target Lift Bracket (**Item 14**) causing the Drop Target to reach desired height as stated above.

Step 2. *Apply **Blue** Loc-Tite.*



Sec. 4: Drawings ...

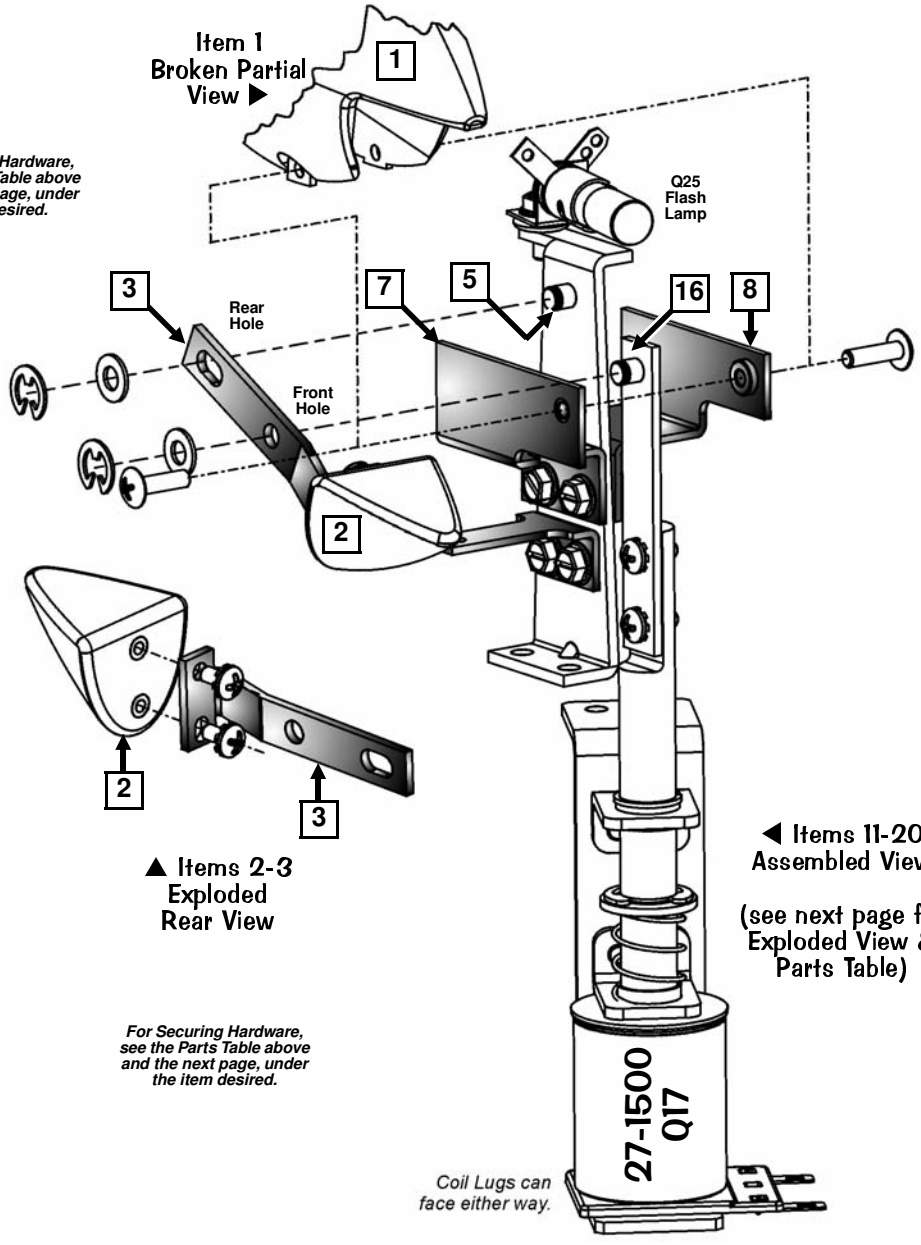


Fish Head & Body, Fish Jaw & Lever Support Bracket & Fish Jaw (Coil) Actuator Individual Parts Only (Items 1-20)

Nr.	FISH PARTS	QTY.	SPI PART Nr.
1	Fish Head & Body Glued Assembly	1	515-7455-00
	Assembly Parts Included : 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
	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 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.

Item 1
Broken Partial
View ▶



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 2-3
Exploded
Rear View

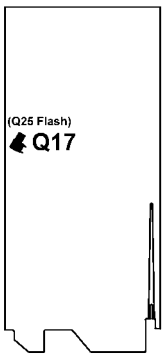
◀ Items 11-20
Assembled View

(see next page for Exploded View & Parts Table)

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

Take Note:

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

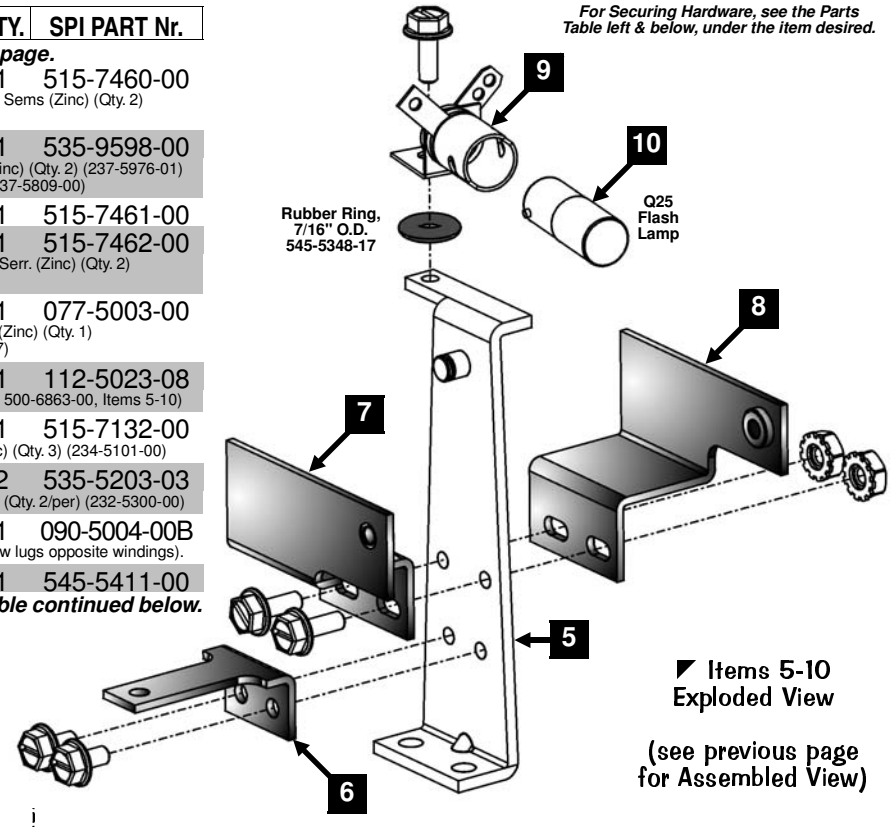


Fish Head & Body, Fish Jaw & Lever Support Bracket & Fish Jaw (Coil) Actuator Individual Parts Only (Items 1-20) Continued

Nr.	FISH PARTS	QTY.	SPI PART Nr.
	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.

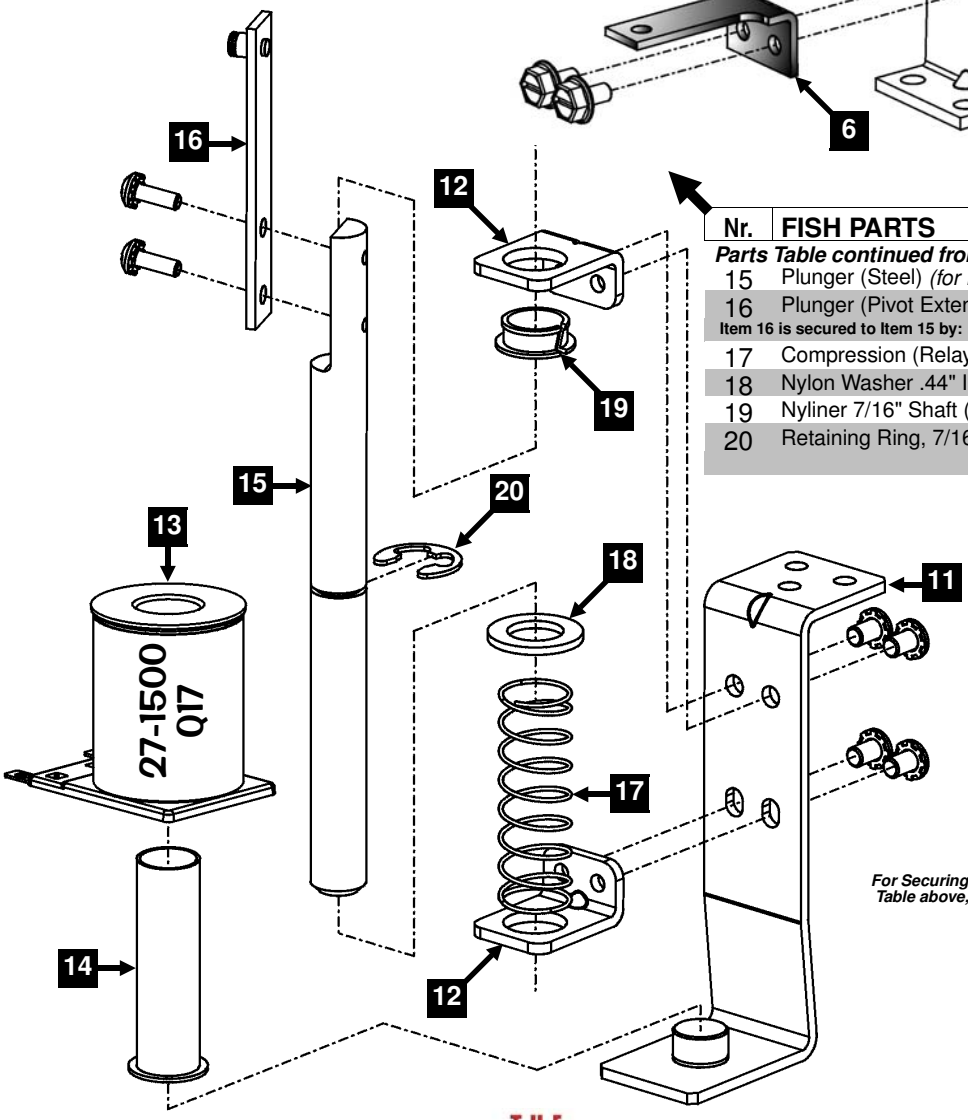
For Securing Hardware, see the Parts Table left & below, under the item desired.



◤ Items 5-10 Exploded View

(see previous page for Assembled View)

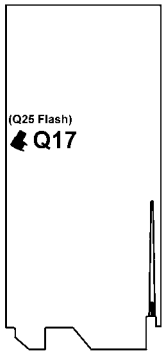
Nr.	FISH PARTS	QTY.	SPI PART Nr.
	Parts Table continued from above.		
15	Plunger (Steel) *(for Item 16)*	1	530-5692-00
16	Plunger (Pivot Extension) Asm.	1	515-7463-00
	Item 16 is secured to Item 15 by: #6-32 X 3/8" PPH Sems (Zinc) (Qty. 2) (232-5201-00)		
17	Compression (Relay) Spring	1	266-5081-00
18	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)		



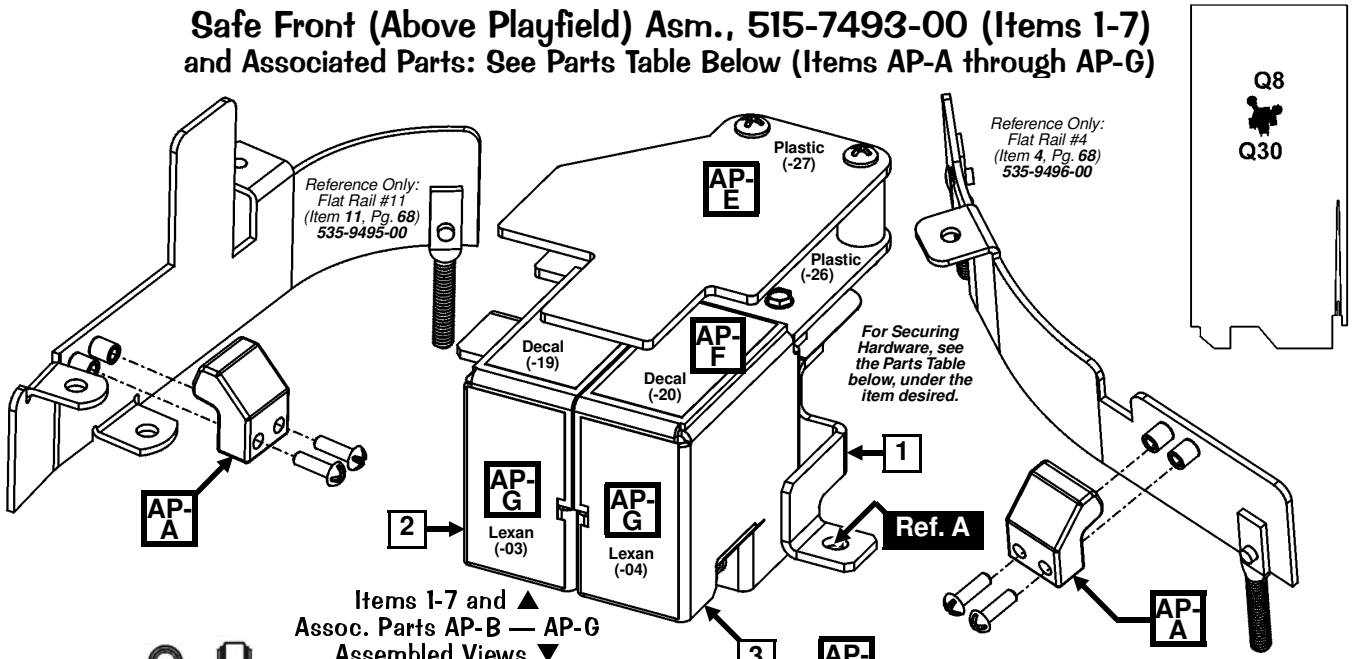
◢ Items 11-20 Exploded View

(see previous page for Assembled View)

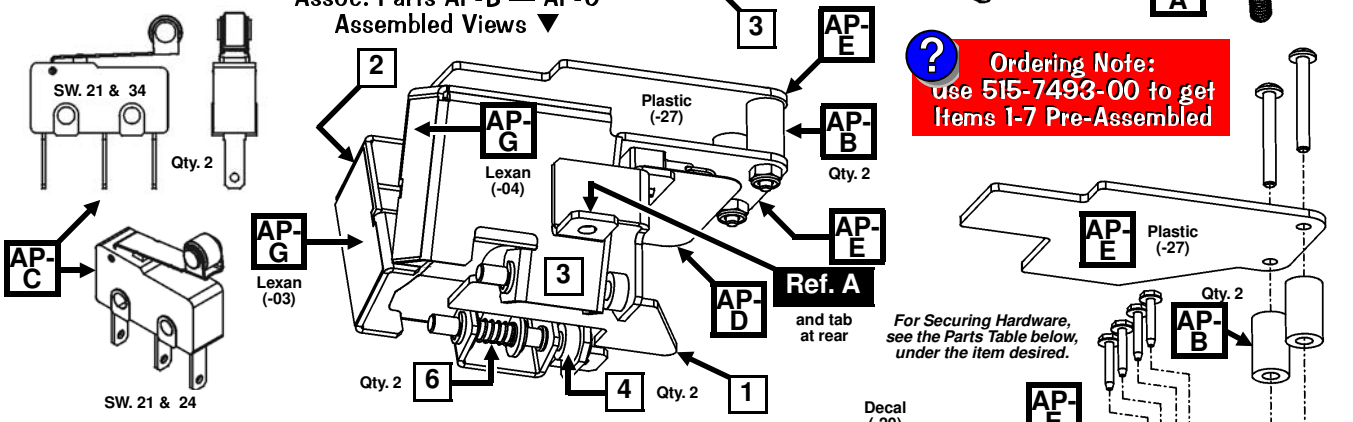
For Securing Hardware, see the Parts Table above, under the item desired.



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



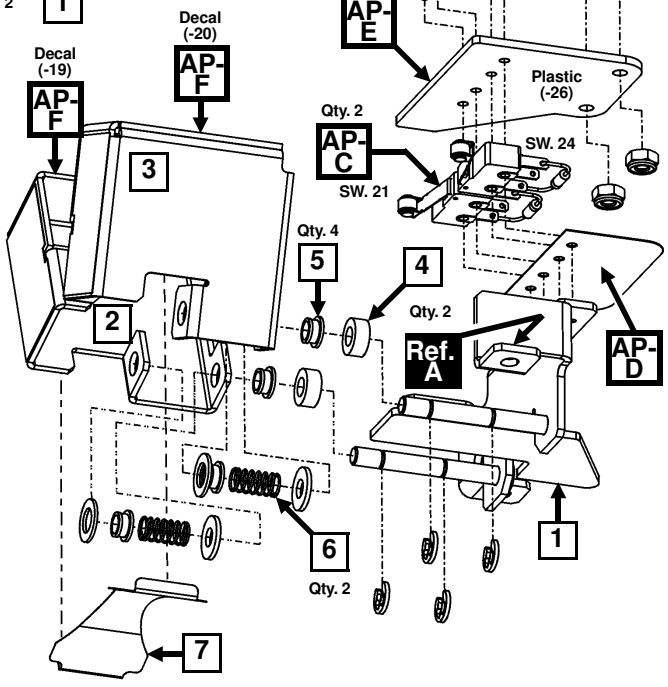
Items 1-7 and ▲
Assoc. Parts AP-B — AP-G
Assembled Views ▼



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.

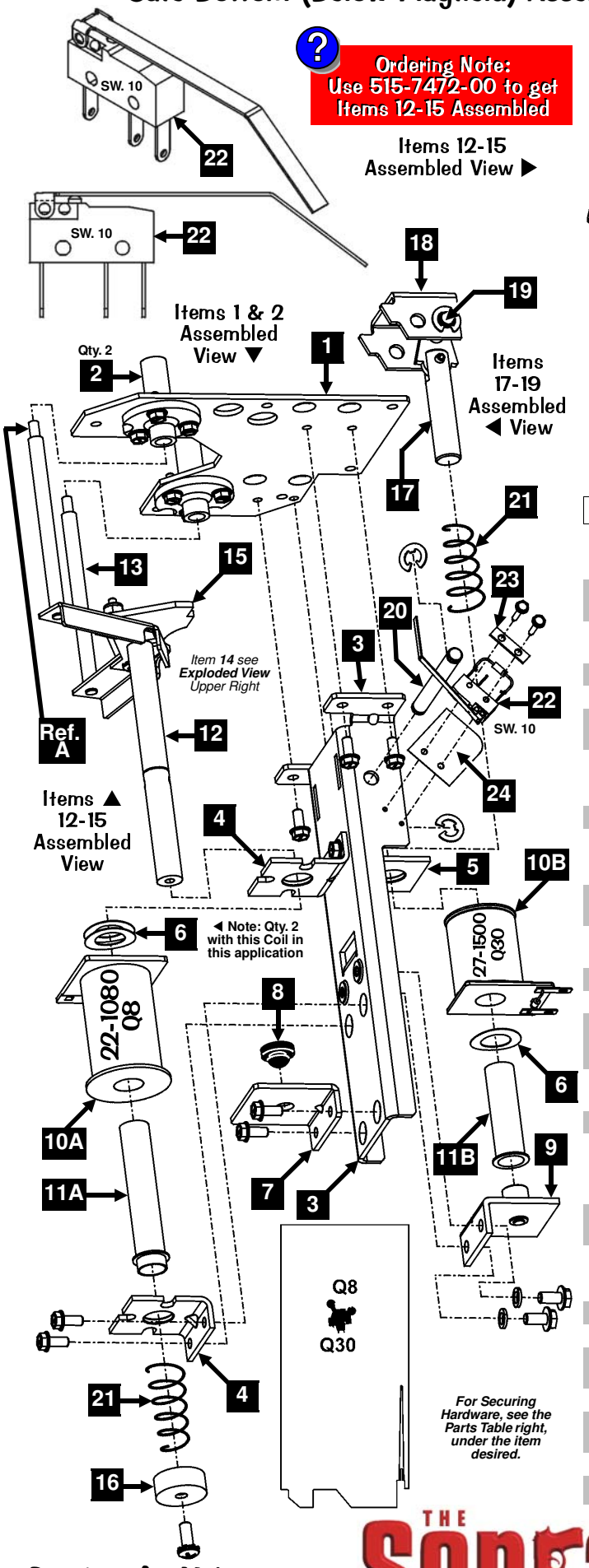
Nr.	ASSOCIATED PART(S)	QTY.	SPI PART Nr.
AP-A	Guide Block (White Nylon)	2	545-6130-00
	Item AP-A are secured Flat Rails by: #4-40 X 3/8" PPH TT Zinc (Qty. 2/per) (237-5979-00)		
AP-B	5/8" X 3/8" Plastic Spacer Gray	3	254-5000-14
	Item AP-B is secured to Item 1 between Item AP-E (-26 & -27) by: #6-32 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)		

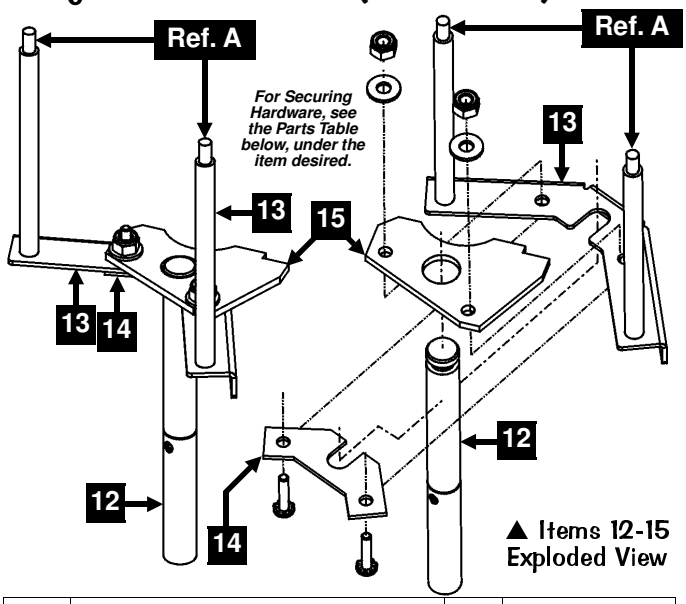


▲ Items 1-7 and Associated Parts
AP-B — AP-G Exploded View ▲

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

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





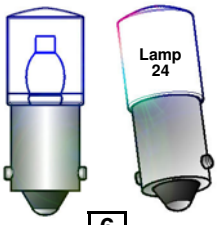
Nr.	SAFE BOTTOM PARTS	QTY.	SPI PART Nr.
1	Plate Mounting Bracket, Safe Bottom	1	535-9561-00
	Item 1 is secured below the playfield by: #8 X 1/2" SHWH AB (Zc) (Qty. 4) (234-5101-00) **and** #8-32 X 5/8" SLT HWH Swage (Serr) Zinc Wax (Qty. 2) (237-5975-03)		
2	Bushing (**Red** Plastic) .281" I.D.	2	545-5070-01
	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" Unslt HWH #4 Hex HD TR3 Blk (Qty. 2) (237-5937-02) (ASM. REF. 500-6865-00, Items 1-24)		

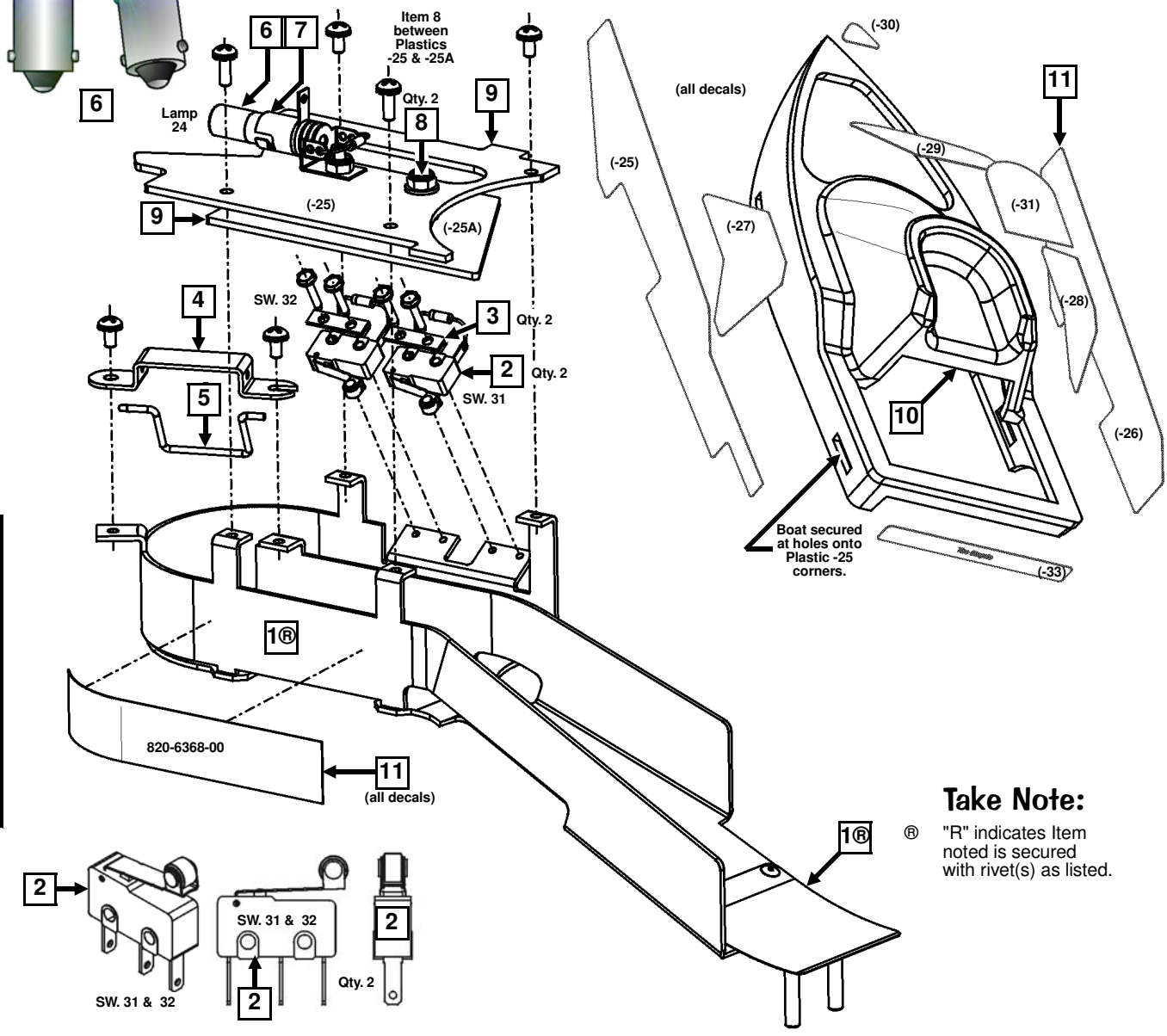
Right (Steel) Boat Ramp Individual Parts Only (Items 1-11)

Nr.	RT. RAMP & BOAT PARTS	QTY.	SPI PART Nr.
1®	Right Steel Ramp (Riveted Assembly)	1	515-7459-00
	A*ssembly Parts Included* : Steel Ramp (Right) (**535-7458-00**), Ramp Flap (**535-9548-00**), Rivet, 1/8" ø 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
	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
	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
5	Wire Form *(for above gate bracket)*		535-5307-03
	Items 4 & 5 are secured to Item 1 by: #6-32 X 1/4" PPH MS Sems (Zinc) (Qty. 2) (232-5200-00)		

Nr.	RT. RAMP & BOAT PARTS	QTY.	SPI PART Nr.
6	LED Module (White) **(12.8v 20-25mA)**	1	112-5023-08
7	Sm. Bayonet (3-Lug Laydown, 2 bent) Sckt.	1	077-5032-00
	Socket has a Diode (1N4004) (112-5003-00). *Can be replaced with (1N4001) (112-5001-00).*		
8	1/4" X 3/8" Plastic Spacer Gray	2	254-5000-02
	Items 7 & 8 are secured to Item 9 by: #6-32 X 3/4" PPH MS (Zinc) (Qty. 2), #6 Washer (Qty. 3) (242-5001-00) **and** #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00)		
	Washer Usage Note: *Place washer between Screw Head and Plastic -25A (bottom) and between Nut and Plastic -25 (top). Not required on socket bracket side.*		
9	***Kit:* Plastics** *(incl. Plastic -25 & -25A)*	1	803-5000-85
	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))		
	Item 9 (-25) is secured to Item 1 @ left by: #6-32 X 3/8" PPH MS Sems (Zinc) (Qty. 2) (232-5201-00) **and @ right 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
11	***Kit:* Decals** *(incl. Dcl. -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****.*		

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.

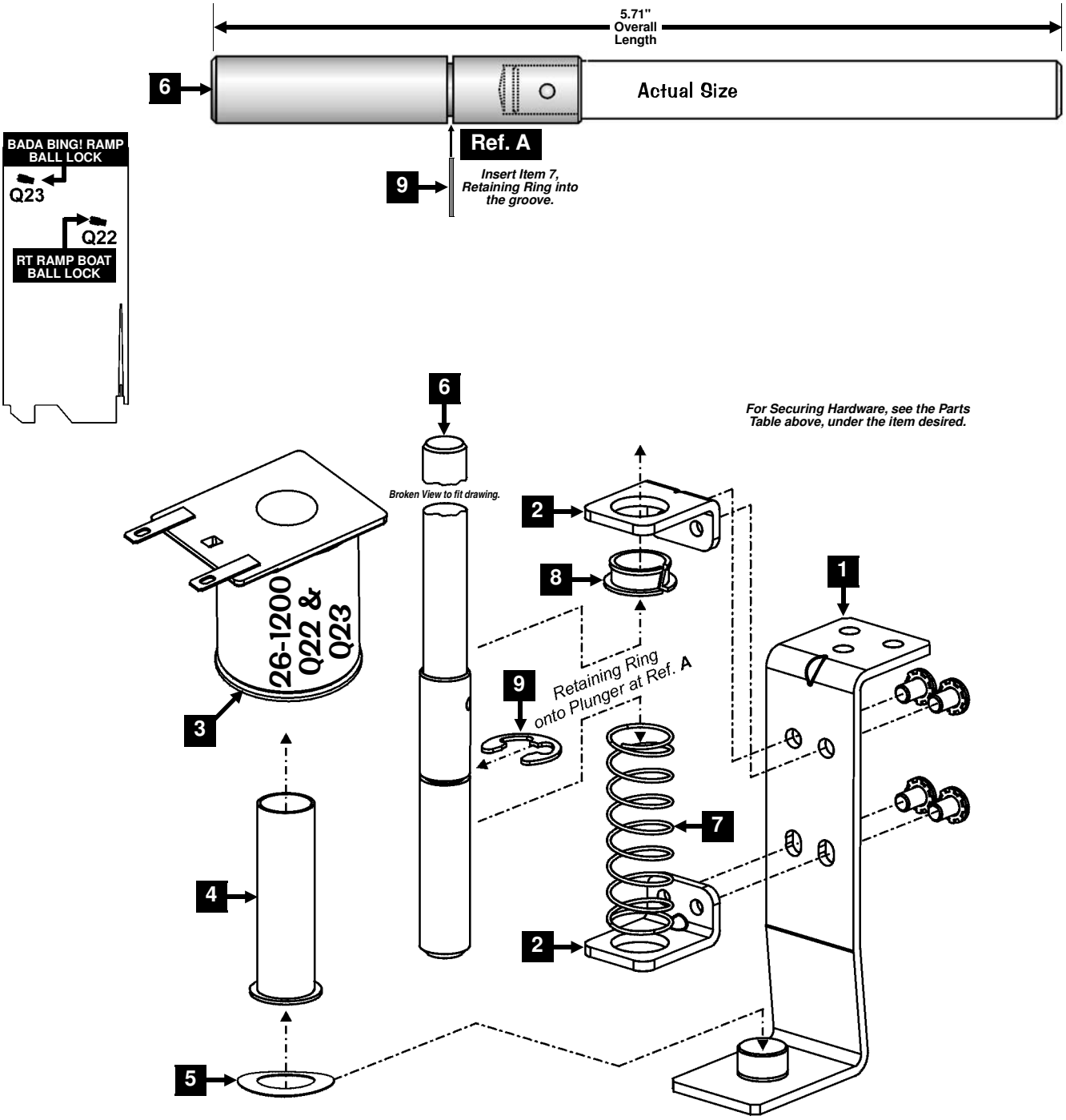
For Securing Hardware, see the Parts Table above, under the item desired.

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.
1	Ball Lock Mounting Bracket Assembly	1/per	515-7132-00
	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/per	535-5203-03
	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, 26-1200	1/per	090-5044-00T
	Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).		
4	Coil Sleeve	1/per	545-5411-00

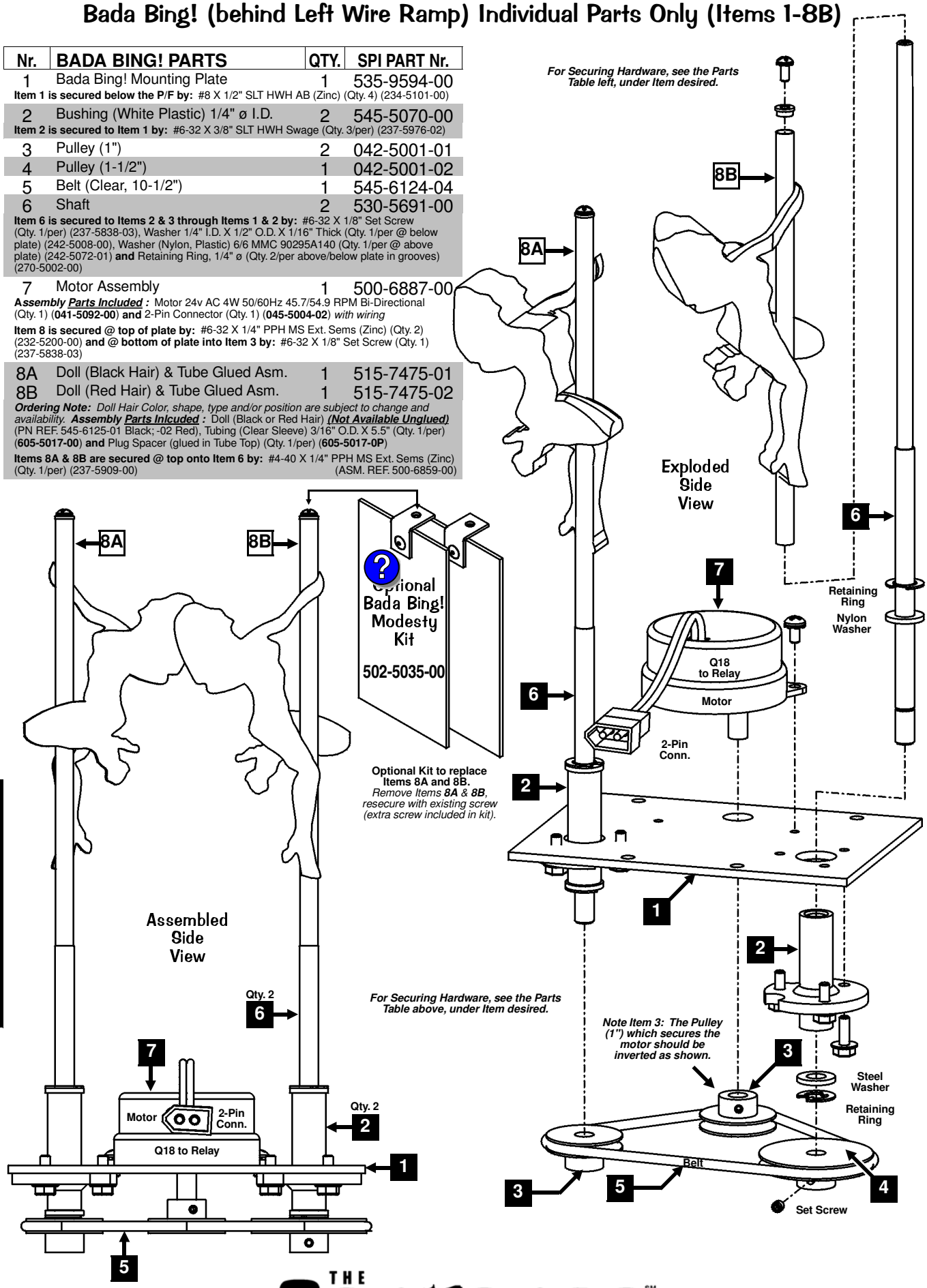
Nr.	UP/DOWN POST PARTS	QTY.	SPI PART Nr.
5	Spring Washer (17/32" ID X 3/4" X 1")	1/per	269-5002-00
6	Plunger, 5.71" Lg. *(w/ Nylon Tip)* Asm.	1/per	515-6119-04
7	Compression (Relay) Spring	1/per	266-5020-00
8	Nyliner 7/16" Shaft (7L2-FF)	1/per	545-5418-01
9	Retaining Ring, 7/16" ø Shaft	1/per	270-5005-00

Ordering Note: *If* ***500-5867-09*** *is unavailable*, order the individual part(s) actually required.

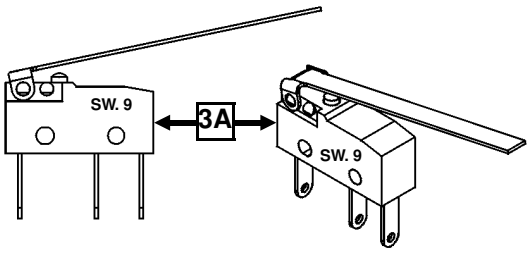


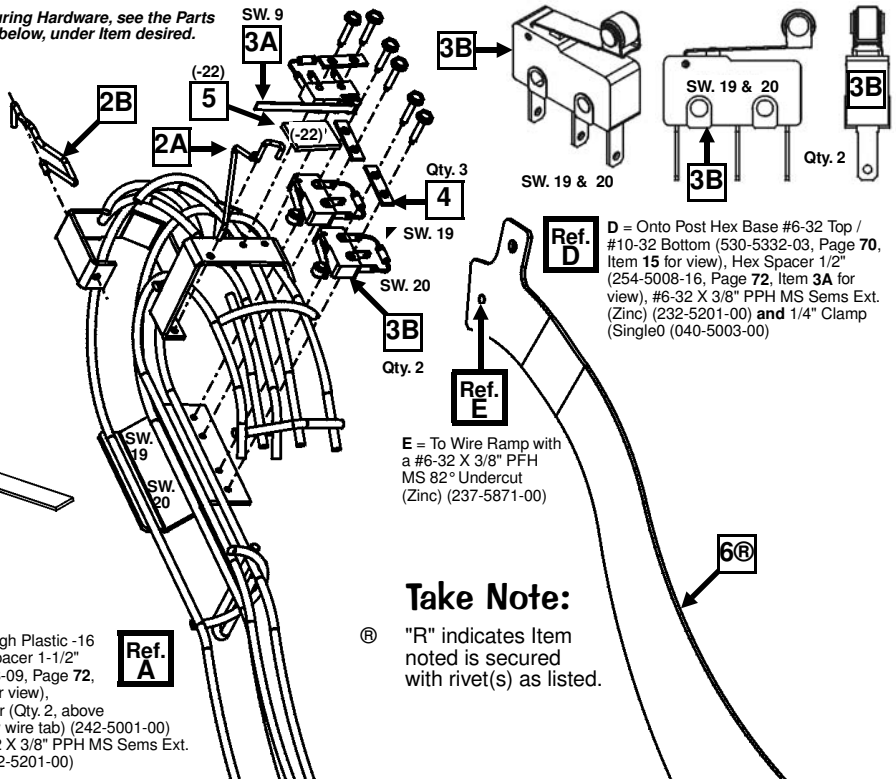
Bada Bing! (behind Left Wire Ramp) Individual Parts Only (Items 1-8B)

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 Inlcuded :*** 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)		



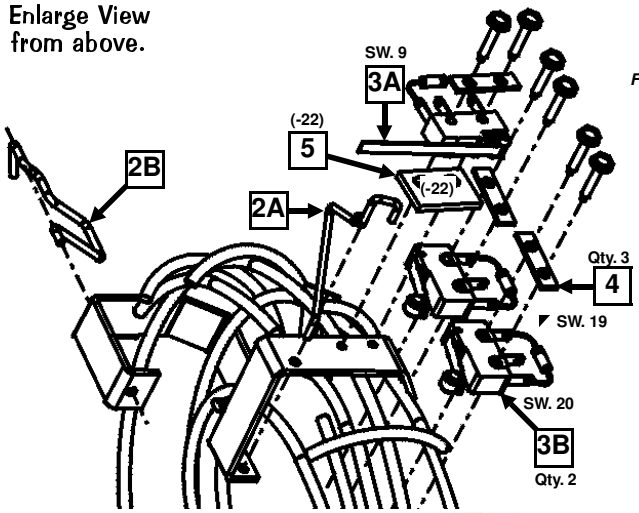
Left Wire Ramp Individual Parts Only (Items 1-5) and Left Steel Ramp 515-7464-00 (Item 6)





Nr.	LEFT RAMP PARTS	QTY.	SPI PART Nr.
1	Wire Ramp (Left) *No Parts*	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 (1⅝" 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* ***Playfield Top - Plastics (Screened & Clear) Kit, ..., 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.

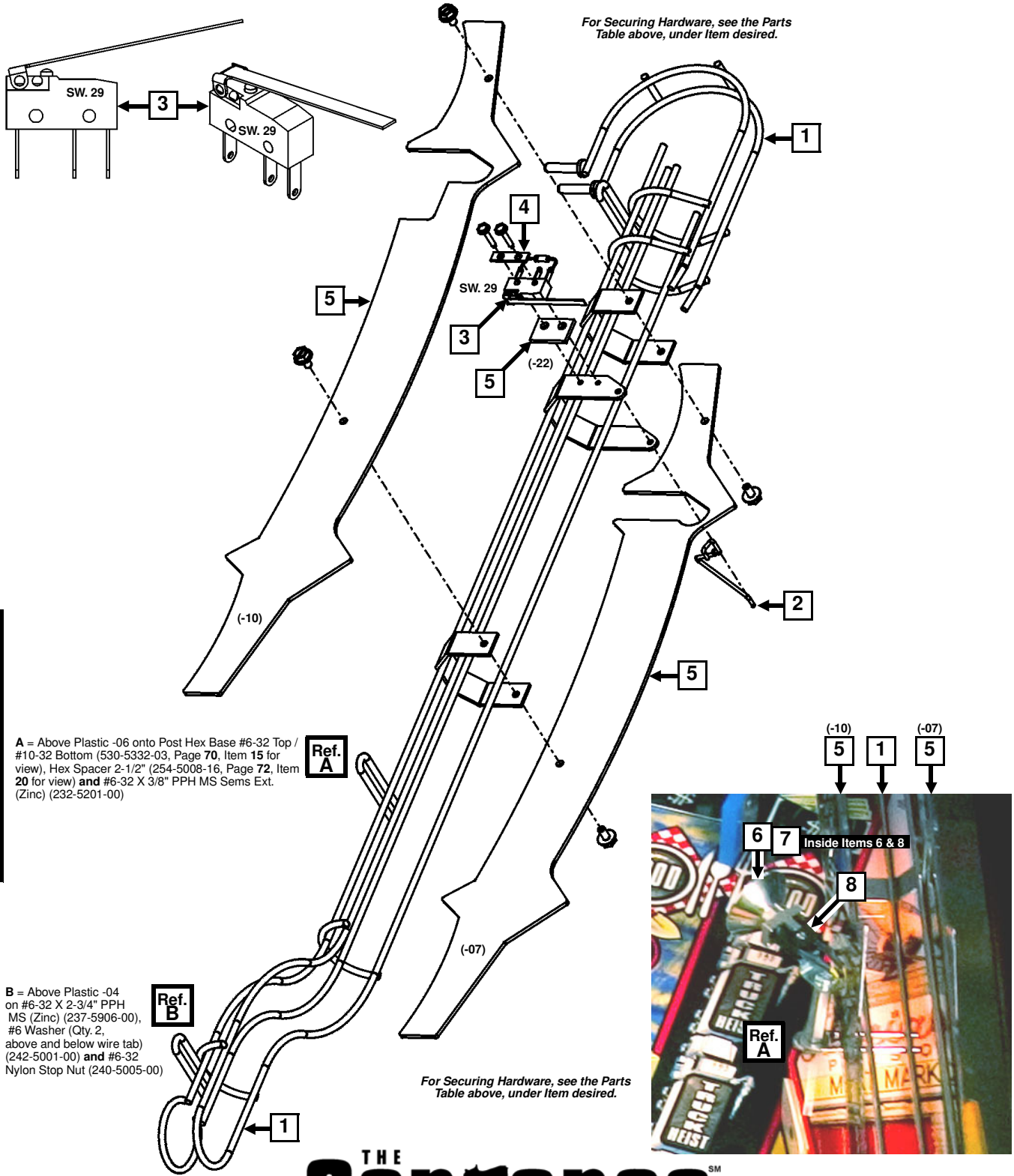


For Securing Hardware, see the Parts Table above, under Item desired.

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

Nr.	RIGHT WIRE RAMP PARTS	QTY.	SPI PART Nr.
1	Wire Ramp (Right) *No Parts*	1	515-7449-00
	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) ***Ramp secured at Ref. A & B (see drawing).***		
2	Wire Form (Right Style) *(Gate Sw. 29)*	1	535-9375-01
3	Switch (1⅝" Actuator) *(for Wire Gates)*	1	180-5010-01
	Switch has a Diode (1N4004) (112-5003-00). *Can be replaced with (1N4001) (112-5001-00).*		
4	Switch Body Protect Plate	1	535-6539-00
	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)		

Nr.	RIGHT WIRE RAMP PARTS	QTY.	SPI PART Nr.
5	***Kit:* Plastics** *(incl. Pl. -07, -10 & -22)*	1	803-5000-85
	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)		
6	Light Reflector (Silver Color Plastic)	1	545-5409-01
7	#555 Wedge Base Bulb (Clear)	1	165-5002-00
8	Wedge Base Socket (Laydown)	1	077-5026-01
	Item 8 is secured to Item 1 by: *(See* ***Ref. A*** *drawing & photo below.)*		



Back Panel Individual Parts Only (Items 1-11)

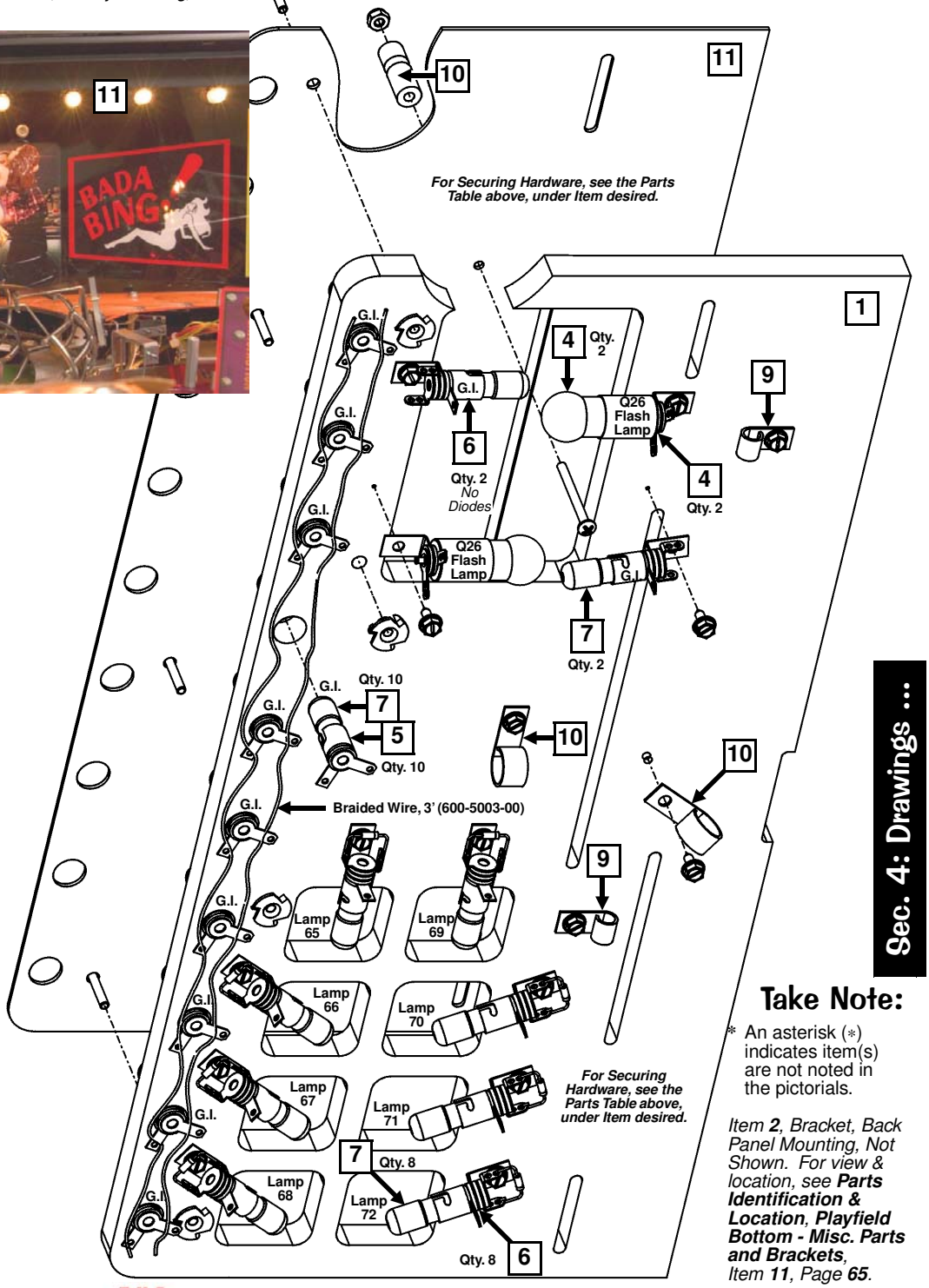
Nr.	BACK PANEL PARTS	QTY.	SPI PART Nr.
1	Back Panel (Black, Wood) *No Parts*	1	525-5640-00
	Item 1 is secured below the Playfield with Item 2 by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5101-00)		
2*	Bracket, Back Panel Mounting	2	535-8964-00
	Item 2 is secured to Item 2 by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5101-00)		
3	Lg. Bayonet (2-Lug Laydown Std.) Socket	2	077-5100-00
4	#89 Bulb *Heavy Filament*	2	**165-5000-89-HF**
5	Sm. Bayonet (2-Lug Staple Down) Socket	10	077-5000-00
6	Sm. Bayonet (3-Lug Laydown, 2 bent) Sckt.	10	077-5032-00

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**).*

Nr.	BACK PANEL PARTS	QTY.	SPI PART Nr.
7	#44 Bulb (Clear) *Heavy Filament*	20	**165-5000-44-HF**
8	1/2" Cable Clamp	2	040-5000-06
9	1/4" Cable Clamp	2	040-5000-03
	Items 3, 5, 6, 8 & 9 are secured to Item 1 by: #6 X 3/8" SHWH (Qty. 1/per) (234-5000-00)		
10	1-1/16" 1-Groove Plastic Post (Clear)	1	550-5059-01
	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)		
11	***Kit:* Plastics** *(includes Plastic -21)*	1	803-5000-85
	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)		



For Bada Bing! Parts, see Page 98.



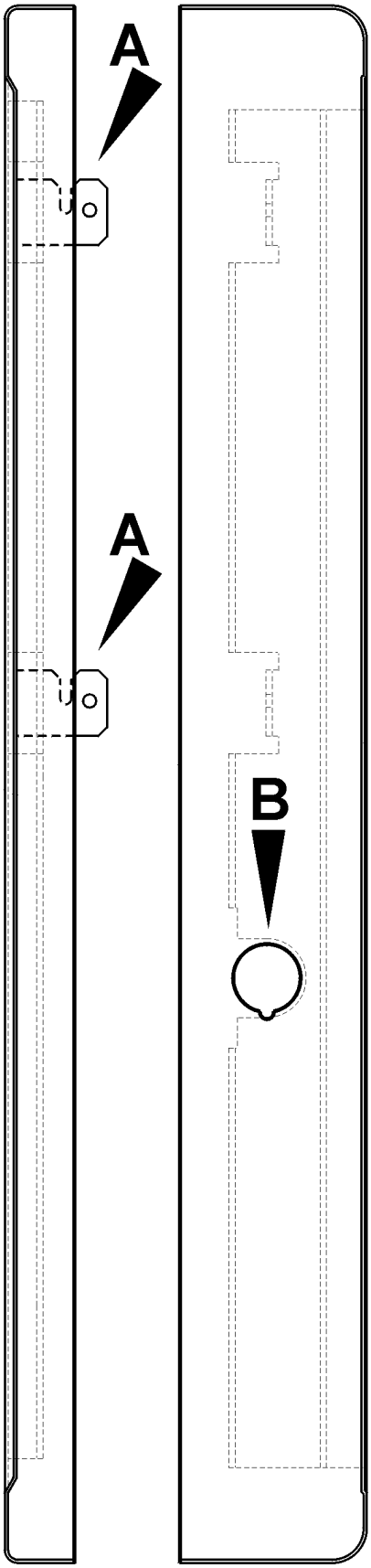
Take Note:

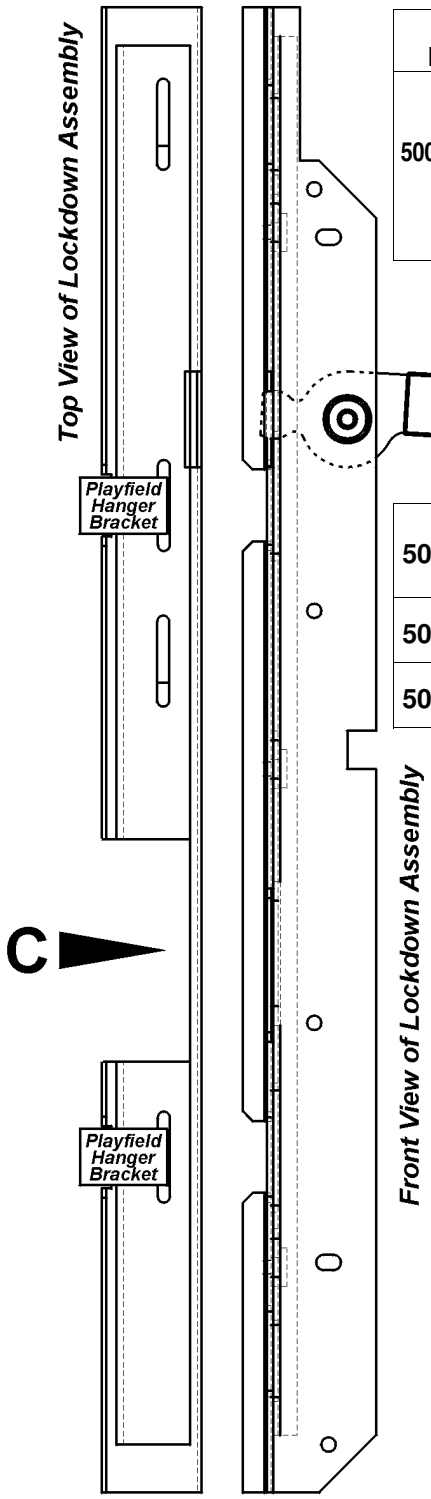
* An asterisk (*) indicates item(s) are not noted in the pictorials.

*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.

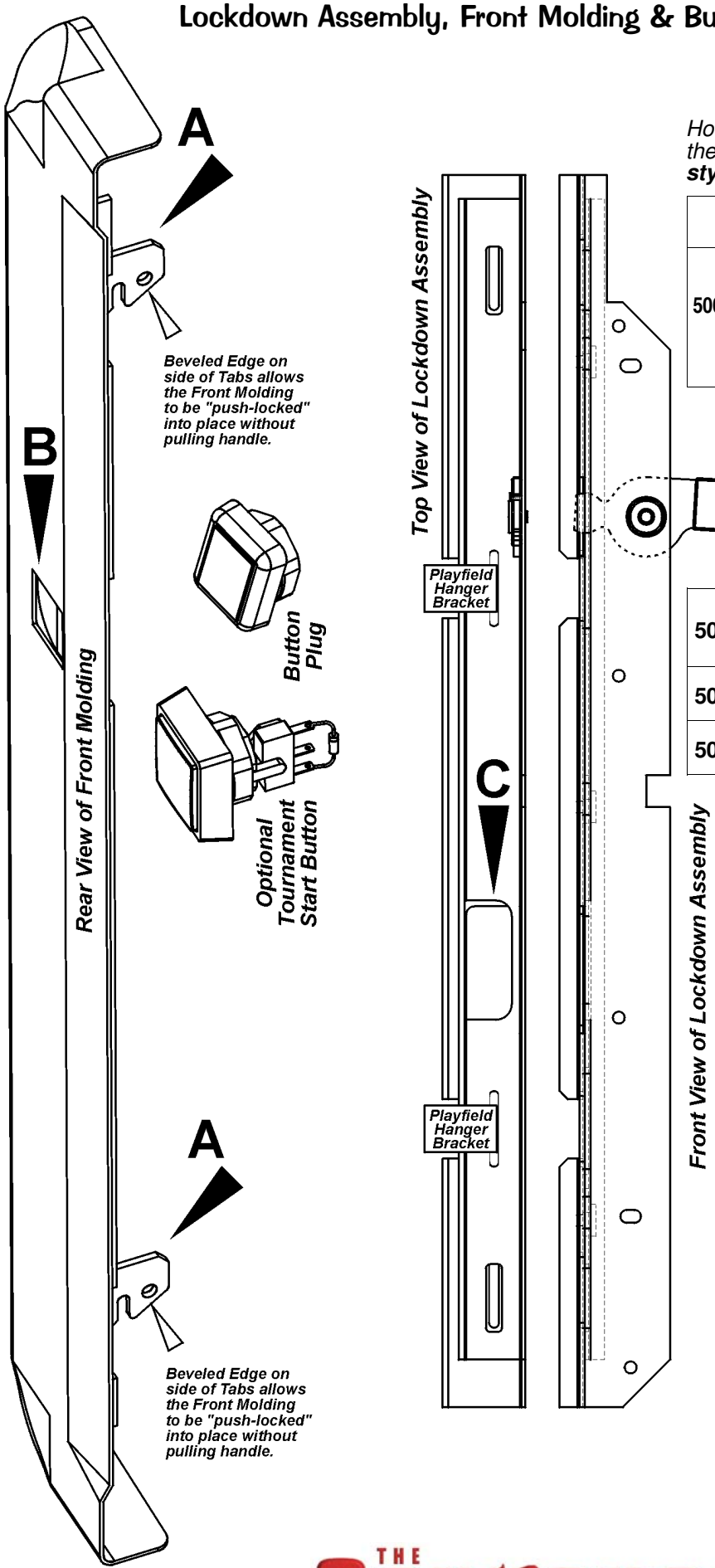
** Will only fit on 500-6509-00 Lockdown Assembly*

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*

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

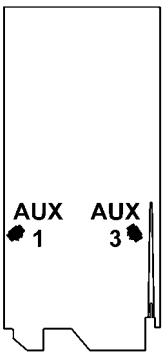
Note: The Front Molding will only work with this Lockdown Assembly, the Button Plug & ToPS™ Start Button will only work with this Front Molding.

UK ONLY OPTIONAL

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

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)		

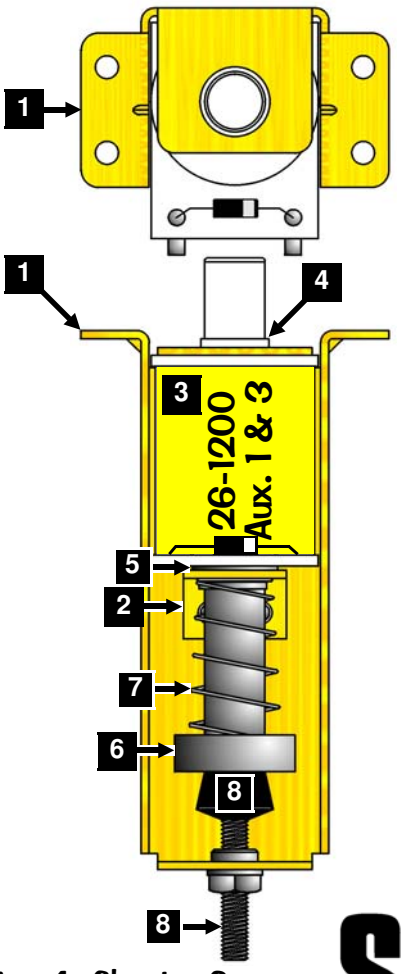
Ordering Note: *If* ***500-5788-02*** *is unavailable*, order the individual part(s) actually required.



Take Note:

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

Top View



UK ONLY OPTIONAL

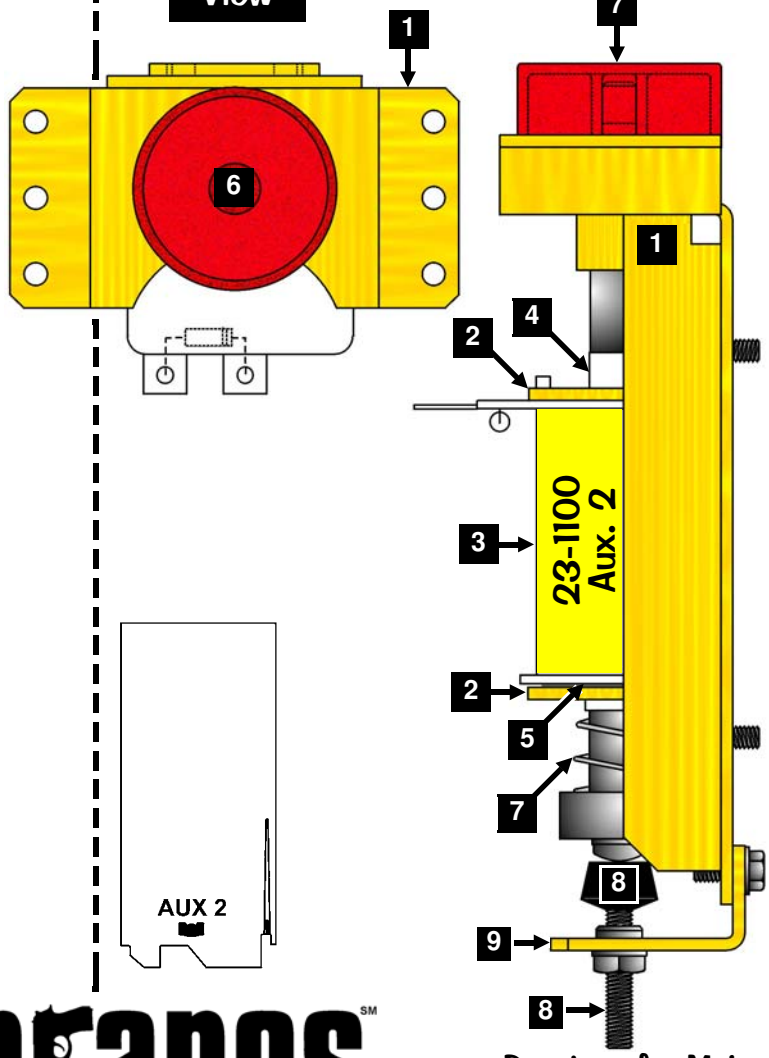
Up/Down Post Assy., 500-6293-00 (Items 1-9)

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* **515-6844-00** *is unavailable*, order the individual part(s) actually required.		
7	Compression (Relay) Spring	1	266-5022-01
8	#10-32 Adj. Spindle Stop w/Rubber Tip	1	280-5014-00
	Item 9 is secured by: #10-32 Keps Nut (Qty. 1) (240-5208-00)		
9	Adjustment Spindle Stop Bracket	1	535-8303-00
	Ordering Note: *If* ***500-6293-00*** *is unavailable*, order the individual part(s) actually required.		

Take Note:

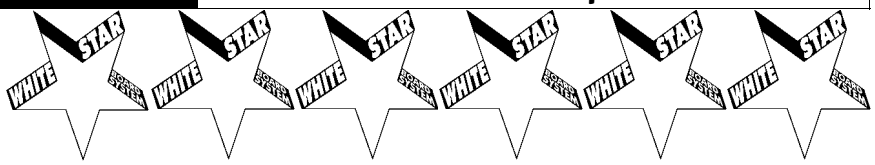
↻ **Coil Note:** ↻ Either -00**B** *or* -00**T** can be used for coil replacements. *B/T listed is preferable for easier diode access and may differ on game.*

Top View



Sec. 4: Drawings ...

Backbox Wiring
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Visit **www.SternPinball.com/schematics.htm** for the latest 11" X 17" Schematics (or "Split 8-1/2" X 11") for the **Display Power Supply, Display Controller, I/O Power Driver & CPU/Sound Boards** (White Star™ System Only). Along with the schematics you'll find the component layout and theory of operation. Keep visiting as these files are continuously improved with more search links in the documents. The files are in PDF format (Adobe® Reader required). They may be slow to open in the website only, so you can download them to your hardrive first. Inside the schematics you can use e-mail links to address questions directly to a service technician. For further instructions within documents). To "download" once open, in your browser click "File" "Send" "Page by eMail". It will be sent to your eMail Address, where there you can save the file to your hardrive.

All 11 X 17 Schematics and other PDF files are also available on CD-ROM.

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

COILS DETAILED CHART TABLE

	High Current Coils Group 1	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BRN-BLK	J8-P1	26-1200 ↻ 090-5044-00T
#2	AUTO LAUNCH	Q2		YEL-VIO	J10-P4/5	50v DC	BRN-RED	J8-P3	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 Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#9	LEFT BUMPER	Q9	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BLU-BRN	J9-P1	26-1200 ↻ 090-5044-00T
#10	RIGHT BUMPER	Q10		YEL-VIO	J10-P4/5	50v DC	BLU-RED	J9-P2	26-1200 ↻ 090-5044-00T
#11	BOTTOM BUMPER	Q11		YEL-VIO	J10-P4/5	50v DC	BLU-ORG	J9-P4	26-1200 ↻ 090-5044-00B
#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 Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#17	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

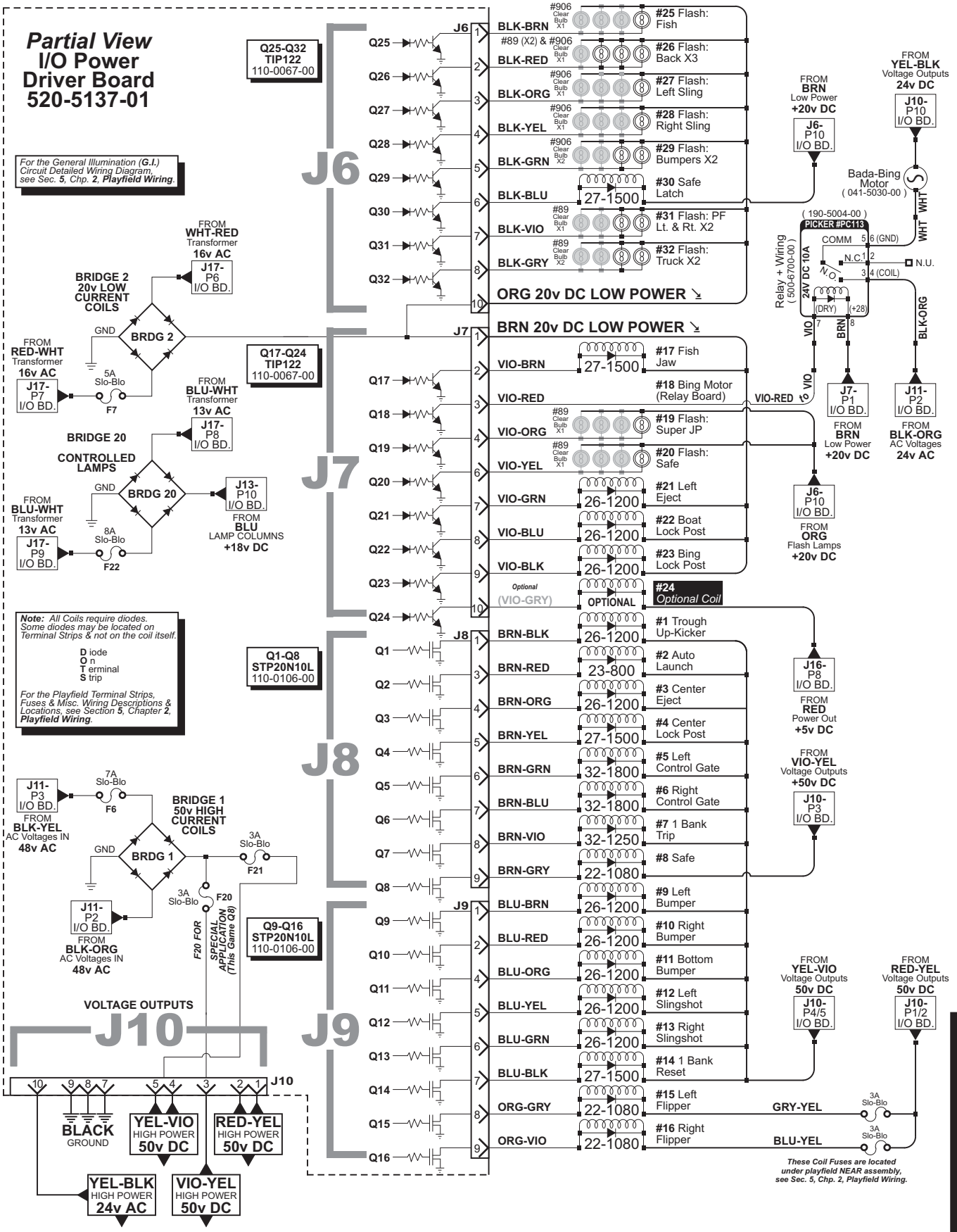
D iode O n T erminal S trip (if noted)

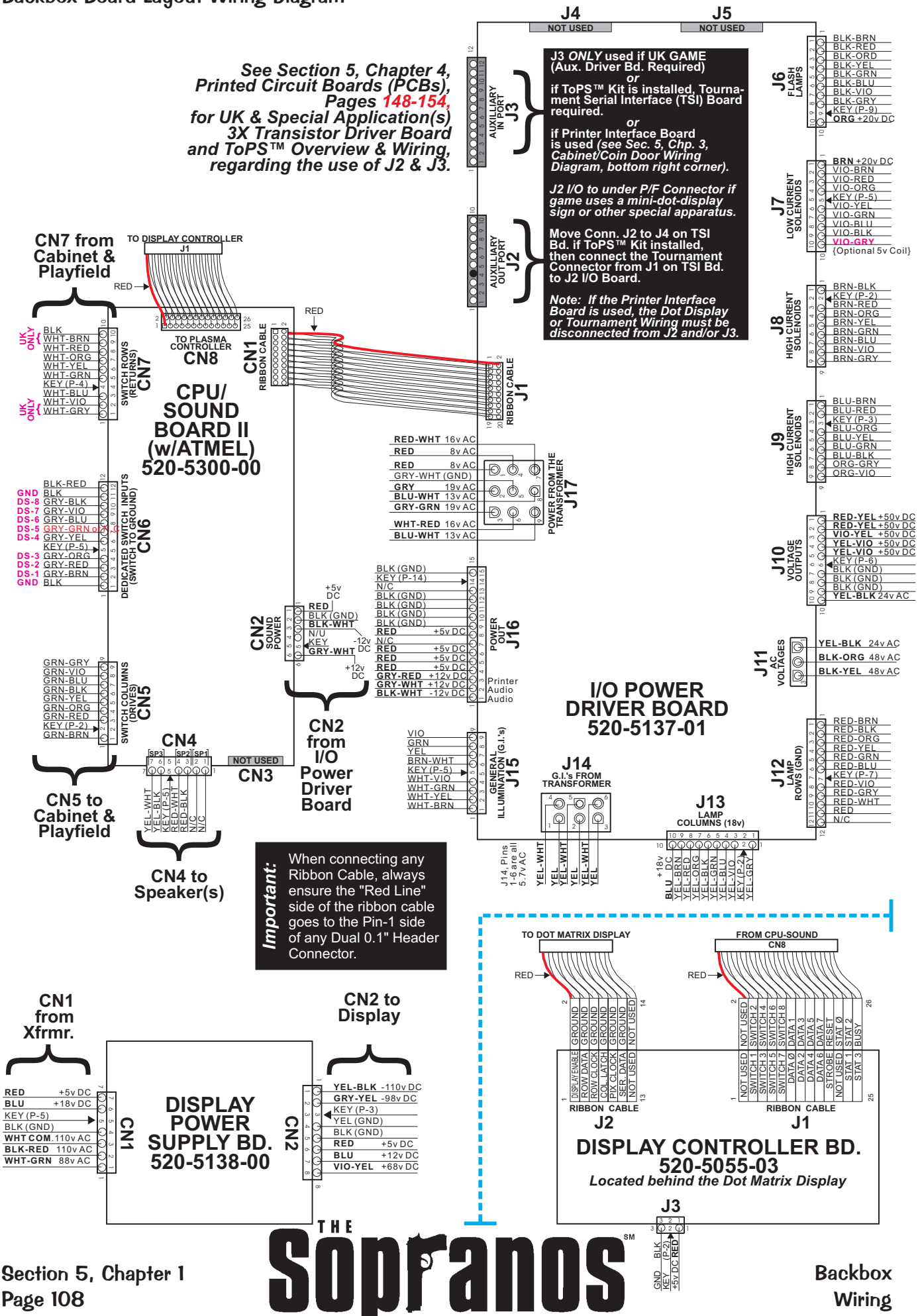
	Low Current Coils Group 2	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#25	FLASH: FISH	Q25	▲ I/O Power Driver ▼	ORANGE	J6-P10	20v DC	BLK-BRN	J6-P1	#44 LED 112-5023-08
#26	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 Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn
	AUX 1: LEFT UP/DOWN POST	Q1	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 -00**B** *or* -00**T** can be used for coil replacements. *B/T listed is preferable for easier diode access & may differ on game.*


Partial View
I/O Power
Driver Board
520-5137-01
For the General Illumination (G.I.) Circuit Detailed Wiring Diagram, see Sec. 5, Chp. 2, Playfield Wiring.
Q25-Q32
TIP122
110-0067-00
Q17-Q24
TIP122
110-0067-00
Q1-Q8
STP20N10L
110-0106-00
Q9-Q16
STP20N10L
110-0106-00
J6
J7
J8
J9
J10
BRN 20v DC LOW POWER
ORG 20v DC LOW POWER
BLK-BRN #25 Flash: Fish
BLK-RED #26 Flash: Back X3
BLK-ORG #27 Flash: Left Sling
BLK-YEL #28 Flash: Right Sling
BLK-GRN #29 Flash: Bumpers X2
BLK-BLU #30 Safe Latch
BLK-VIO #31 Flash: PF Lt. & Rt. X2
BLK-GRY #32 Flash: Truck X2
VIO-BRN #17 Fish Jaw
VIO-RED #18 Bing Motor (Relay Board)
VIO-ORG #19 Flash: Super JP
VIO-YEL #20 Flash: Safe
VIO-GRN #21 Left Eject
VIO-BLU #22 Boat Lock Post
VIO-BLK #23 Bing Lock Post
(VIO-GRY) #24 Optional Coil
BRN-BLK #1 Trough Up-Kicker
BRN-RED #2 Auto Launch
BRN-ORG #3 Center Eject
BRN-YEL #4 Center Lock Post
BRN-GRN #5 Left Control Gate
BRN-BLU #6 Right Control Gate
BRN-VIO #7 1 Bank Trip
BRN-GRY #8 Safe
BLU-BRN #9 Left Bumper
BLU-RED #10 Right Bumper
BLU-ORG #11 Bottom Bumper
BLU-YEL #12 Left Slingshot
BLU-GRN #13 Right Slingshot
BLU-BLK #14 1 Bank Reset
ORG-GRY #15 Left Flipper
ORG-VIO #16 Right Flipper
27-1500
23-800
26-1200
32-1800
32-1250
22-1080
#906 Clear Bulb X1
#906 Clear Bulb X2
#89 Clear Bulb X1
#89 Clear Bulb X2
#89 (X2) & #906 Clear Bulb X1
Optional
OPTIONAL
BRIDGE 2
20v LOW CURRENT COILS
BRDG 2
FROM WHT-RED Transformer 16v AC
J17-P6 I/O BD.
FROM RED-WHT Transformer 16v AC
J17-P7 I/O BD.
5A Slo-Blo
F7
FROM BLU-WHT Transformer 13v AC
J17-P8 I/O BD.
BRIDGE 20
CONTROLLED LAMPS
BRDG 20
J13-P10 I/O BD.
FROM BLU LAMP COLUMNS +18v DC
FROM BLU-WHT Transformer 13v AC
J17-P9 I/O BD.
8A Slo-Blo
F22
GND
Note: All Coils require diodes. Some diodes may be located on Terminal Strips & not on the coil itself.
Diode On Terminal Strip
For the Playfield Terminal Strips, Fuses & Misc. Wiring Descriptions & Locations, see Section 5, Chapter 2, Playfield Wiring.
J11-P3 I/O BD.
FROM BLK-YEL AC Voltages IN 48v AC
7A Slo-Blo
F6
BRIDGE 1
50v HIGH CURRENT COILS
BRDG 1
3A Slo-Blo
F21
3A Slo-Blo
F20
F20 FOR SPECIAL APPLICATION (This Game Q8)
J11-P2 I/O BD.
FROM BLK-ORG AC Voltages IN 48v AC
VOLTAGE OUTPUTS
J10
BLACK GROUND
YEL-VIO HIGH POWER 50v DC
RED-YEL HIGH POWER 50v DC
YEL-BLK HIGH POWER 24v AC
VIO-YEL HIGH POWER 50v DC
FROM BRN Low Power +20v DC
J6-P10 I/O BD.
FROM YEL-BLK Voltage Outputs 24v DC
J10-P10 I/O BD.
Bada-Bing Motor (041-5030-00)
WHT
(190-5004-00)
PICKER #PC113
COMM 5 6 (GND)
N.C. 1 2
N.U.
3 4 (COIL)
Relay + Wiring (500-6700-00)
24V DC 10A
(DRY) (+28)
VIO 7
BRN 8
BLK-ORG
VIO-RED
J7-P1 I/O BD.
FROM BRN Low Power +20v DC
J11-P2 I/O BD.
FROM BLK-ORG AC Voltages 24v AC
J6-P10 I/O BD.
FROM ORG Flash Lamps +20v DC
J16-P8 I/O BD.
FROM RED Power Out +5v DC
FROM VIO-YEL Voltage Outputs +50v DC
J10-P3 I/O BD.
FROM YEL-VIO Voltage Outputs 50v DC
J10-P4/5 I/O BD.
FROM RED-YEL Voltage Outputs 50v DC
J10-P1/2 I/O BD.
GRY-YEL
BLU-YEL
3A Slo-Blo
These Coil Fuses are located under playfield NEAR assembly, see Sec. 5, Chp. 2, Playfield Wiring.



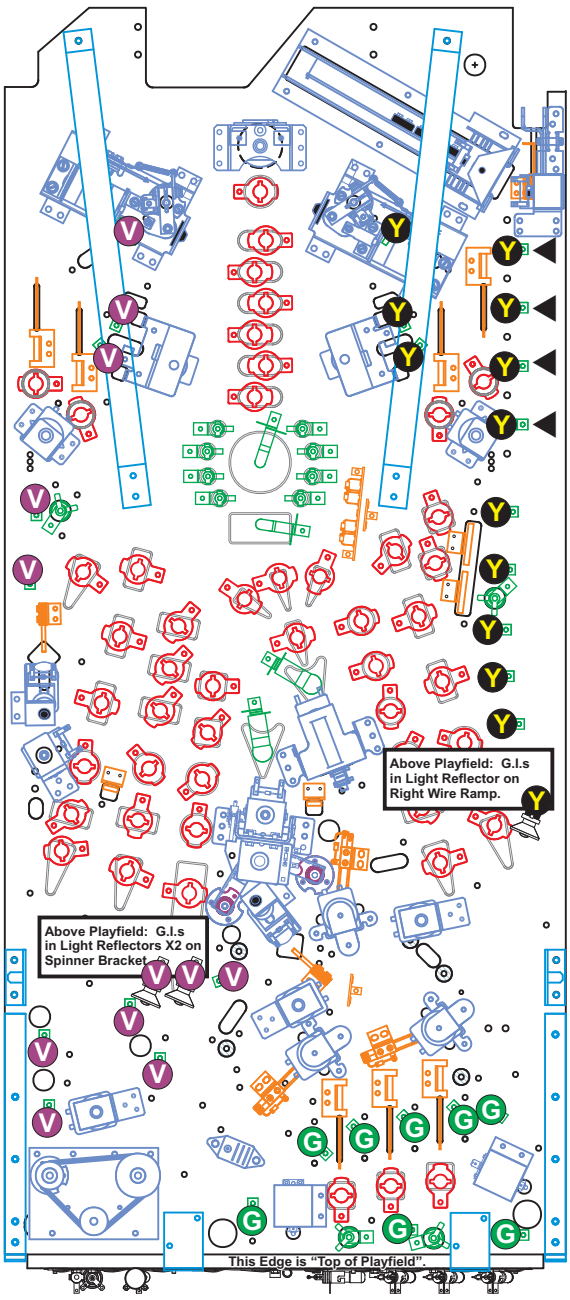
Sec. 5: Backbox ...

THE Sopranos SM

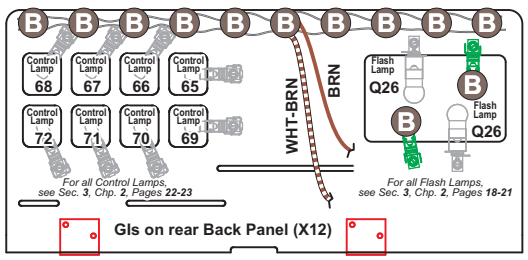
Playfield Wiring

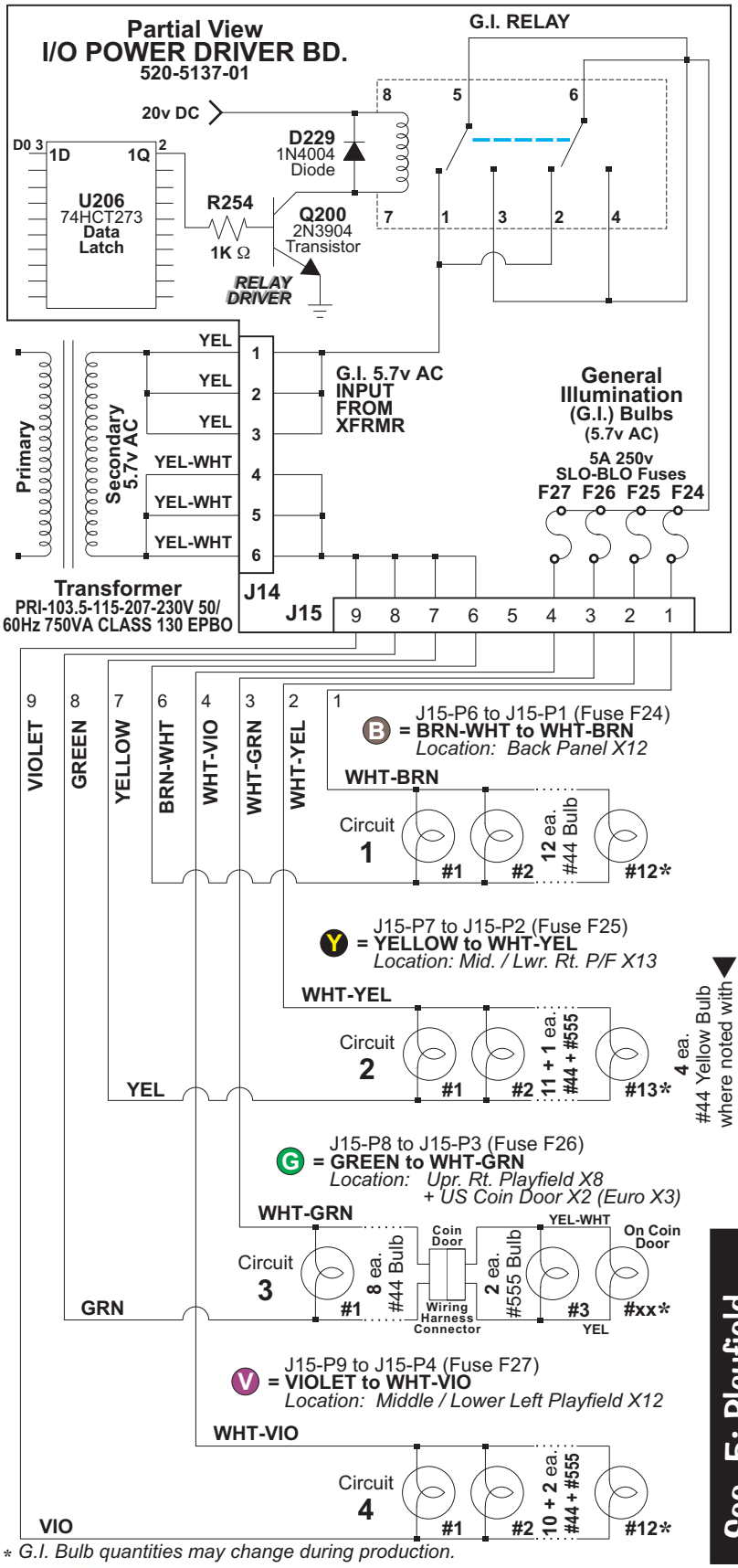
General Illumination Circuit Detailed Wiring Diagram

Below: Bottom of Playfield shown as if leaning up against the Backbox.



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





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

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***

DOTS Diode On Terminal Strip -***or***- DODB Diode On Diode Board

Switch Drive Transistor Source №: **2N3904**

COLUMN DRIVE	SWITCH DRIVE Wire & Transistor	CN5 PIN
1	GRN-BRN Q1	1
2	GRN-RED Q2	3
3	GRN-ORG Q3	4
4	GRN-YEL Q4	5
5	GRN-BLK Q5	6
6	GRN-BLU Q6	7
7	GRN-VIO Q7	8
8	GRN-GRY Q8	9

CPU/Sound Board

N/C → 10

ROW RETURN	Wire & IC SWITCH RETURN	CN7 PIN
1	WHT-BRN U400	9
2	WHT-RED U400	8
3	WHT-ORG U400	7
4	WHT-YEL U400	6
5	WHT-GRN U401	5
6	WHT-BLU U401	3
7	WHT-VIO U401	2
8	WHT-GRY U401	1

Switch Return IC Source №: **LM339AN**

Switch 1 Left Button (UK ONLY)	Switch 9 Left Ramp	Switch 17 Left Eject	Switch 25 Right Ramp	Switch 33 Right Orbit	Switch 41 Not Used	Switch 49 Left Bumper	Switch 57 Left Outlane
Switch 2 4th Coin Slot	Switch 10 Safe Limit	Switch 18 Left Orbit	Switch 26 Drop Target	Switch 34 Left Standup	Switch 42 Not Used	Switch 50 Right Bumper	Switch 58 Left Return Lane
Switch 3 ✻ Future Expansion 6th Coin Slot ✻	Switch 11 4-Ball Trough #1 (Left)	Switch 19 Bing 1	Switch 27 Spinner	Switch 35 Center Standup	Switch 43 Not Used	Switch 51 Bottom Bumper	Switch 59 Left Slingshot
Switch 4 Right Coin Slot	Switch 12 4-Ball Trough #2	Switch 20 Bing 2	Switch 28 Center Eject	Switch 36 R. 2-Bank Top	Switch 44 Not Used	Switch 52 Not Used	Switch 60 Right Outlane
Switch 5 Center Coin Slot / DBA	Switch 13 4-Ball Trough #3	Switch 21 Safe Hit Left	Switch 29 Right Ramp Exit	Switch 37 R. 2-Bank Bottom	Switch 45 Not Used	Switch 53 Slam Tilt (Optional)	Switch 61 Right Return Lane
Switch 6 Left Coin Slot	Switch 14 4-Ball Trough VUK Opto	Switch 22 Center Lock 1	Switch 30 Not Used	Switch 38 Left Top Lane	Switch 46 Not Used	Switch 54 Start Button	Switch 62 Right Slingshot
Switch 7 ✻ Future Expansion 5th Coin Slot ✻	Switch 15 4-Ball Stacking Opto	Switch 23 Center Lock 2	Switch 31 Boat Lock 1	Switch 39 Middle Top Lane	Switch 47 Not Used	Switch 55 Tournament Start	Switch 63 Not Used
Switch 8 Right Button (UK ONLY)	Switch 16 Shooter Lane	Switch 24 Safe Hit Right	Switch 32 Boat Lock 2	Switch 40 Right Top Lane	Switch 48 Not Used	Switch 56 Plumb Bob Tilt	Switch 64 Not Used

Playfield Lamp Wiring Diagram

Please Note: *Switch & Lamp Descriptions may differ slightly than that of the Dot Display due to space restraints.*

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***

DOTS Diode On Terminal Strip -***or***- DODB Diode On Diode Board

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

COLUMN DRIVE	Wire & IC LAMP DRIVE	PIN J13
1	YEL-BRN U17	9
2	YEL-RED U16	8
3	YEL-ORG U15	7
4	YEL-BLK U14	6
5	YEL-GRN U13	5
6	YEL-BLU U12	4
7	YEL-VIO U11	3
8	YEL-GRY U10	1

Lamp Drive IC Source №: **VN02N**

Lamp Return Transistor Source №: **STP19N06L**

I/O Power Driver Board

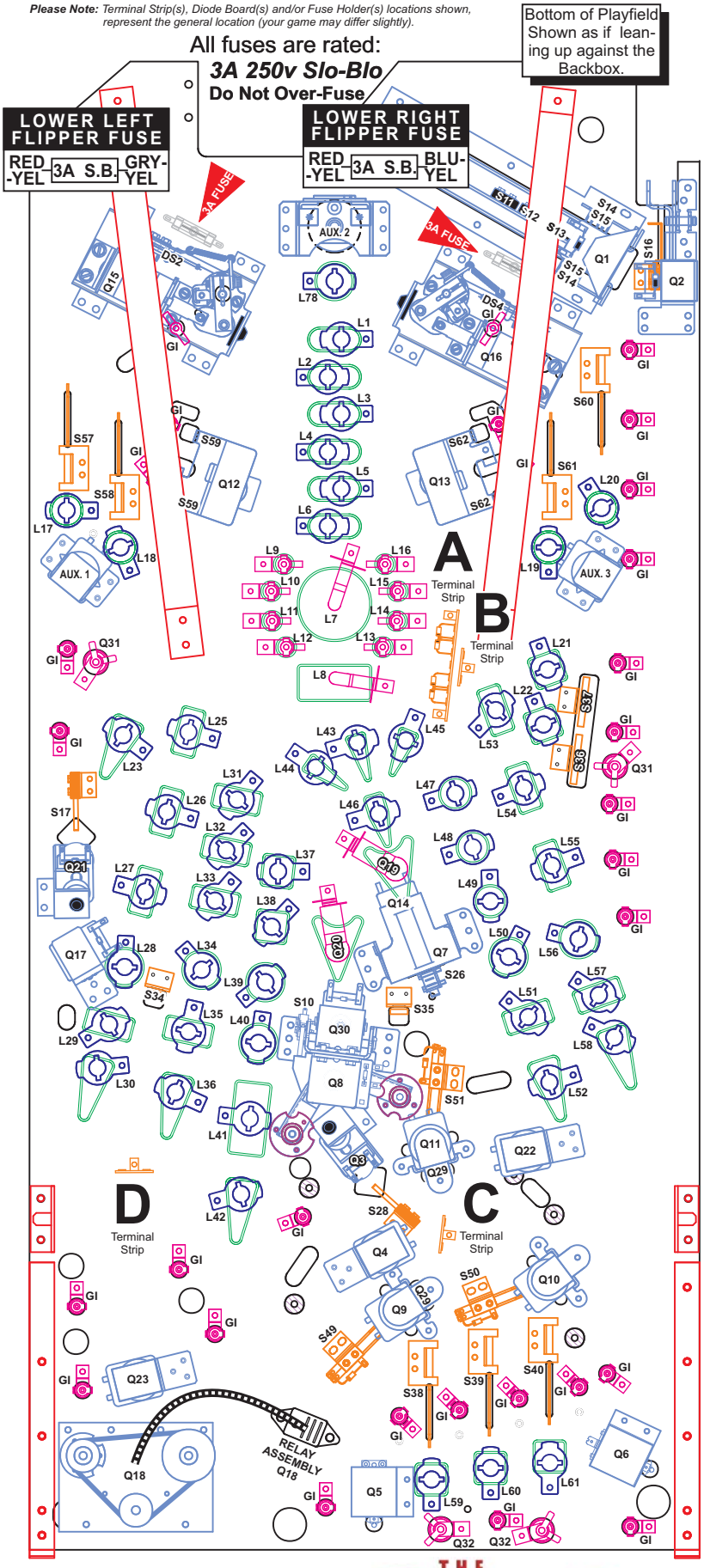
ROW RETURN	LAMP RETURN Wire & Transistor	J12 PIN
1	RED-BRN Q33	1
2	RED-BLK Q34	2
3	RED-ORG Q35	3
4	RED-YEL Q36	4
5	RED-GRN Q37	5
6	RED-BLU Q38	6
7	RED-VIO Q39	8
8	RED-GRY Q40	9
9	RED-WHT Q41	10
10	RED Q42	11

From I/O Pwr. Driver Board **J16-Pins 9-15** ← N/C 12

Lamp 1 (Ranks) Associate	Lamp 2 (Ranks) Soldier	Lamp 3 (Ranks) Good Earner	Lamp 4 (Ranks) Acting Capo	Lamp 5 (Ranks) Capo	Lamp 6 (Ranks) Consigliere	Lamp 7 (Ranks) Under Boss	Lamp 8 Boss
Lamp 9 Boss: Food	Lamp 10 Boss: Truck Heist	Lamp 11 Boss: Bada Bing	Lamp 12 Boss: Episodes	Lamp 13 Boss: Safe	Lamp 14 Boss: RIP	Lamp 15 Boss: Super Jackpot	Lamp 16 Boss: Meadowlands
Lamp 17 (F) Left Outlane	Lamp 18 (I) Lt. Return Lane	Lamp 19 (S) Rt. Return Lane	Lamp 20 (H) Right Outlane	Lamp 21 Pork Store Standup	Lamp 22 Light Standup	Lamp 23 Fish	Lamp 24 The Stugots
Lamp 25 Left Truck Heist 1	Lamp 26 Left Truck Heist 2	Lamp 27 Left Truck Heist 3	Lamp 28 L. Orbit Food	Lamp 29 L. Orbit Envelope	Lamp 30 Left Orbit Arrow	Lamp 31 Bada Bing 1	Lamp 32 Bada Bing 2
Lamp 33 Bada Bing 3	Lamp 34 L. Ramp Food	Lamp 35 L. Ramp Envelope	Lamp 36 Left Ramp Arrow	Lamp 37 Start Episode	Lamp 38 Pork Store	Lamp 39 Special	Lamp 40 Extra Ball
Lamp 41 Advance Rank	Lamp 42 Center Arrow	Lamp 43 Light Lock	Lamp 44 Lock 1	Lamp 45 Lock 2	Lamp 46 Jackpot	Lamp 47 Meadowlands 1	Lamp 48 Meadowlands 2
Lamp 49 Meadowlands 3	Lamp 50 R. Ramp Food	Lamp 51 R. Ramp Envelope	Lamp 52 Right Ramp Arrow	Lamp 53 Right Truck Heist 1	Lamp 54 Right Truck Heist 2	Lamp 55 Right Truck Heist 3	Lamp 56 R. Orbit Food
Lamp 57 R. Orbit Envelope	Lamp 58 Right Orbit Arrow	Lamp 59 (R.) Left Top Lane	Lamp 60 (I.) Mid. Top Lane	Lamp 61 (P.) Right Top Lane	Lamp 62 Not Used	Lamp 63 Not Used	Lamp 64 Not Used
Lamp 65 RIP 1 (Top Left)	Lamp 66 RIP 2	Lamp 67 RIP 3	Lamp 68 RIP 4	Lamp 69 RIP 5 (Bottom Left)	Lamp 70 RIP 6	Lamp 71 RIP 7	Lamp 72 RIP 8
Lamp 73 DOTS Episodes: Arson	Lamp 74 DOTS Episodes: Exterminate	Lamp 75 DOTS Episodes: Horse Race	Lamp 76 DOTS Episodes: Exec. Game	Lamp 77 DOTS E.: Satisfaction	Lamp 78 Shoot Again	Lamp 79 Tournament Button	Lamp 80 Start Button

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

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

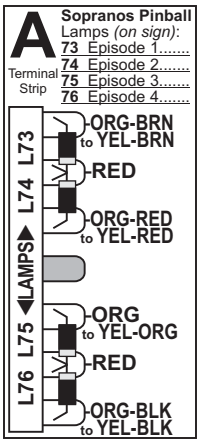


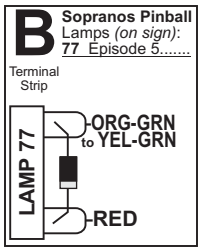
Explanation:

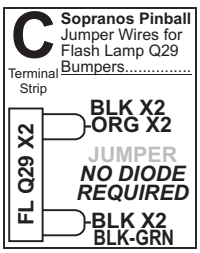
All Switch, Lamp & Coil assemblies require diodes. Some diodes are ***located under the playfield*** on Terminal Strips ***or*** Diode Boards and not on the assemblies. The Switch and Lamp Matrix Grids also note which Switch or Lamp has a diode on a Terminal Strip *(noted by **"DOTS"** meaning: "**D**iode **O**n **T**erminal **S**trip") or on a Diode Board (noted by **"DODB"** meaning: "**D**iode **O**n **D**iode **B**oard").*

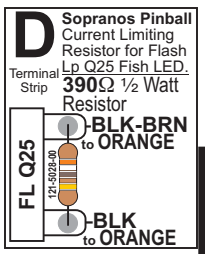
Legend:

***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)*



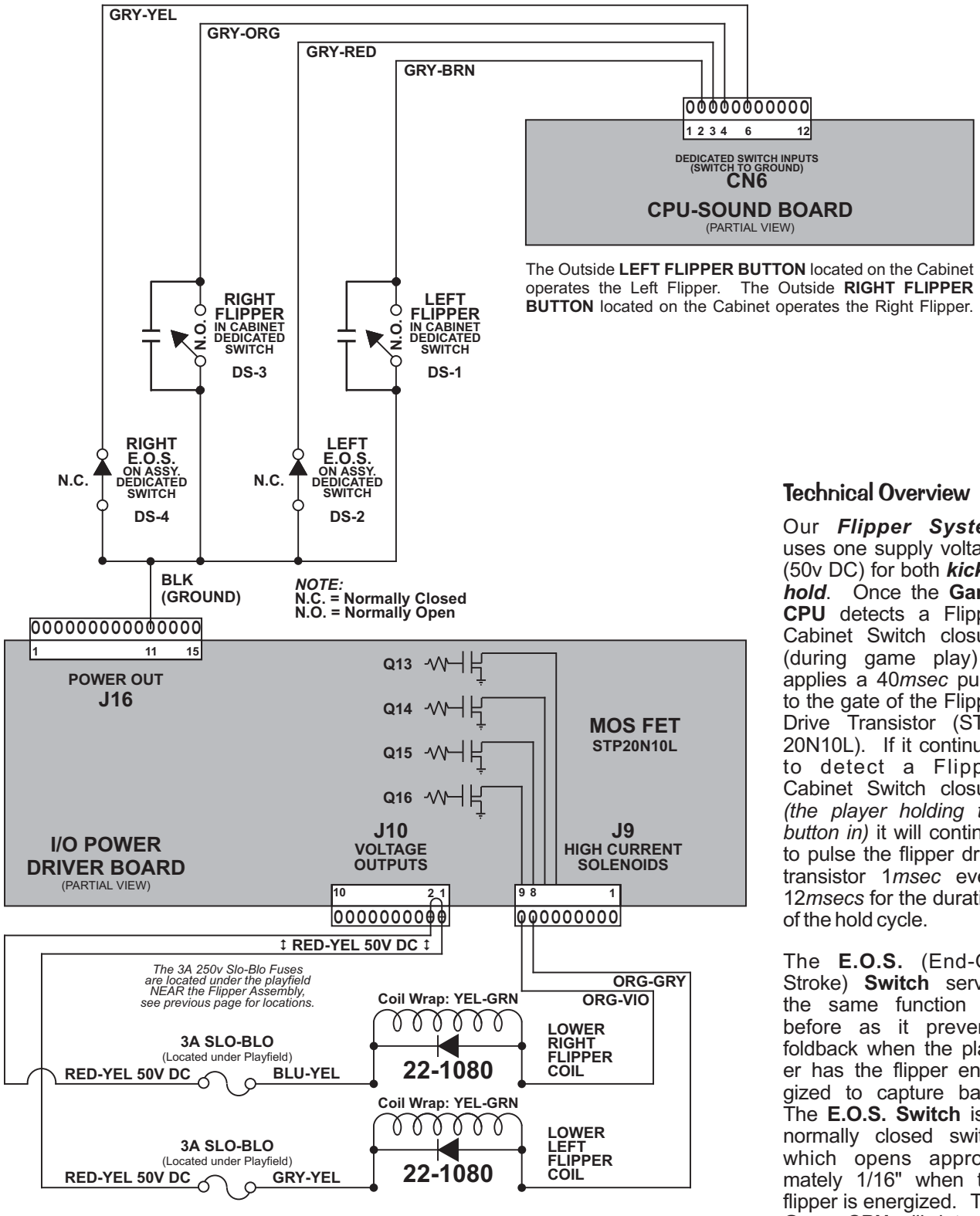






See the Pink Pages, Playfield Bottom - Switches (Stand-Alone) and Switches (on Assemblies) (Below) (Page 67) for Terminal Strips, Diodes, Fuses and Fuse Holders Part Numbers.

2-Flipper Circuit Wiring Diagram



The Outside **LEFT FLIPPER BUTTON** located on the Cabinet operates the Left Flipper. The Outside **RIGHT FLIPPER BUTTON** located on the Cabinet operates the Right Flipper.

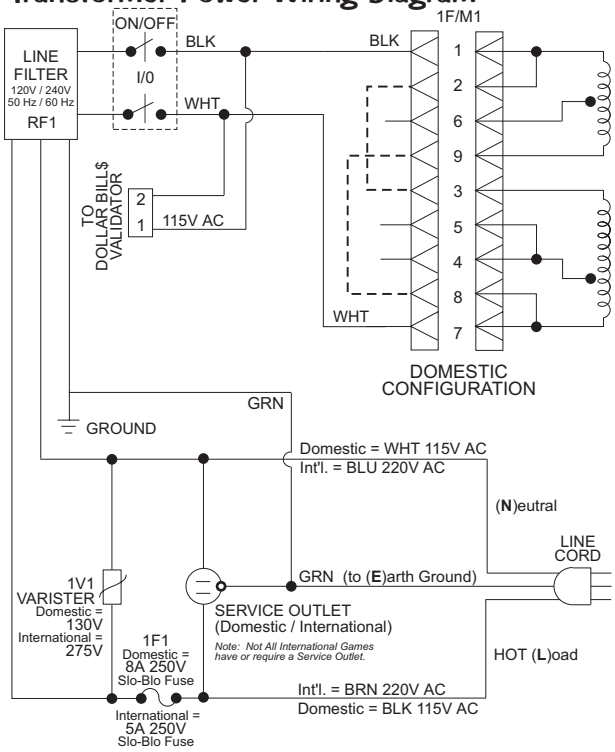
Technical Overview

Our ***Flipper System*** uses one supply voltage (50v DC) for both ***kick*** & ***hold***. Once the **Game CPU** detects a Flipper Cabinet Switch closure (during game play) it applies a 40*msec* pulse to the gate of the Flipper Drive Transistor (STP-20N10L). If it continues to detect a Flipper Cabinet Switch closure *(the player holding the button in)* it will continue to pulse the flipper drive transistor 1*msec* every 12*msecs* for the duration of the hold cycle.

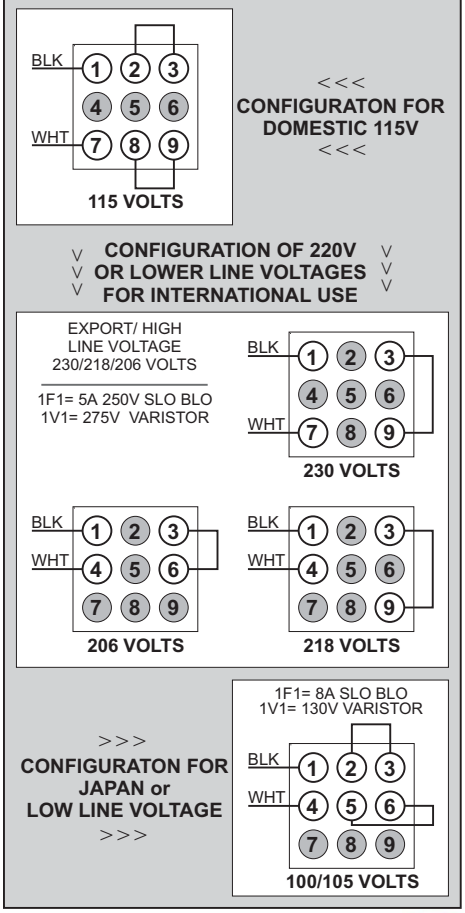
The **E.O.S.** (End-Of-Stroke) **Switch** serves the same function as before as it prevents foldback when the player has the flipper energized to capture balls. The **E.O.S. Switch** is a normally closed switch which opens approximately 1/16" when the flipper is energized. The **Game CPU** will detect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

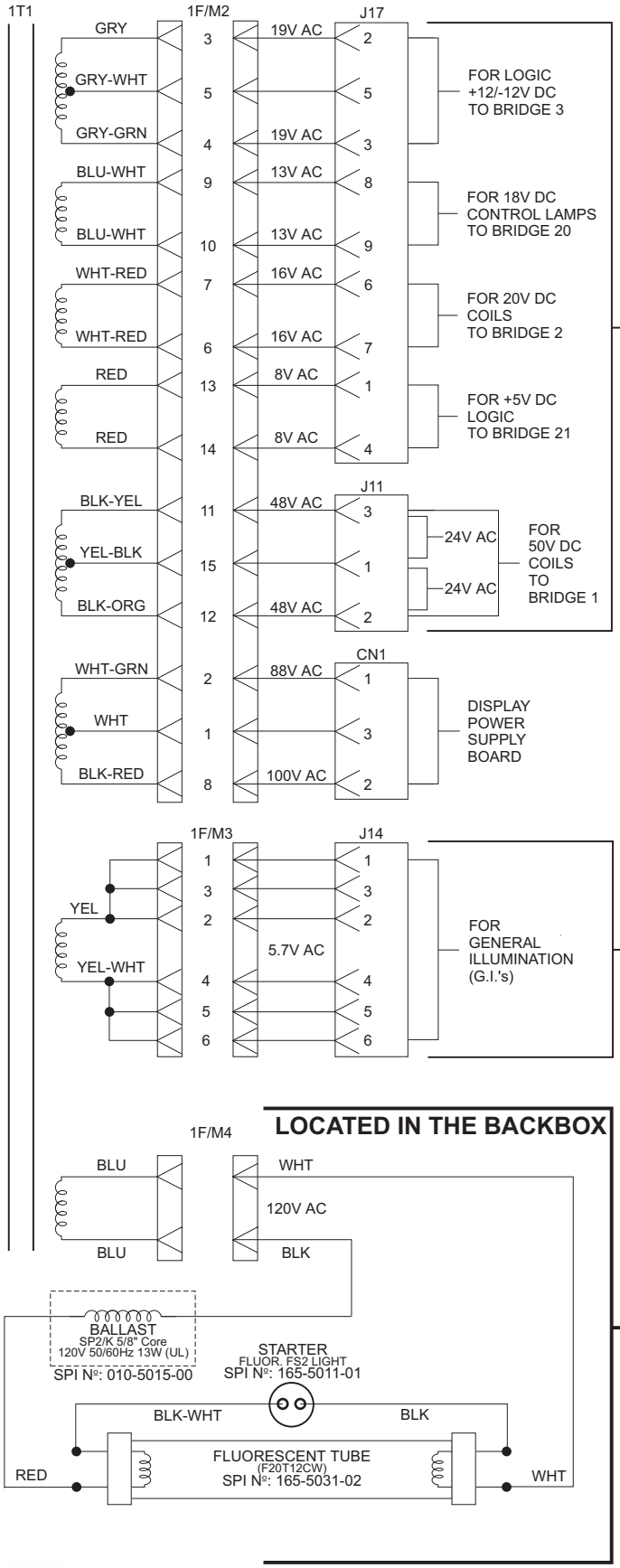
Cabinet Wiring

Transformer Power Wiring Diagram

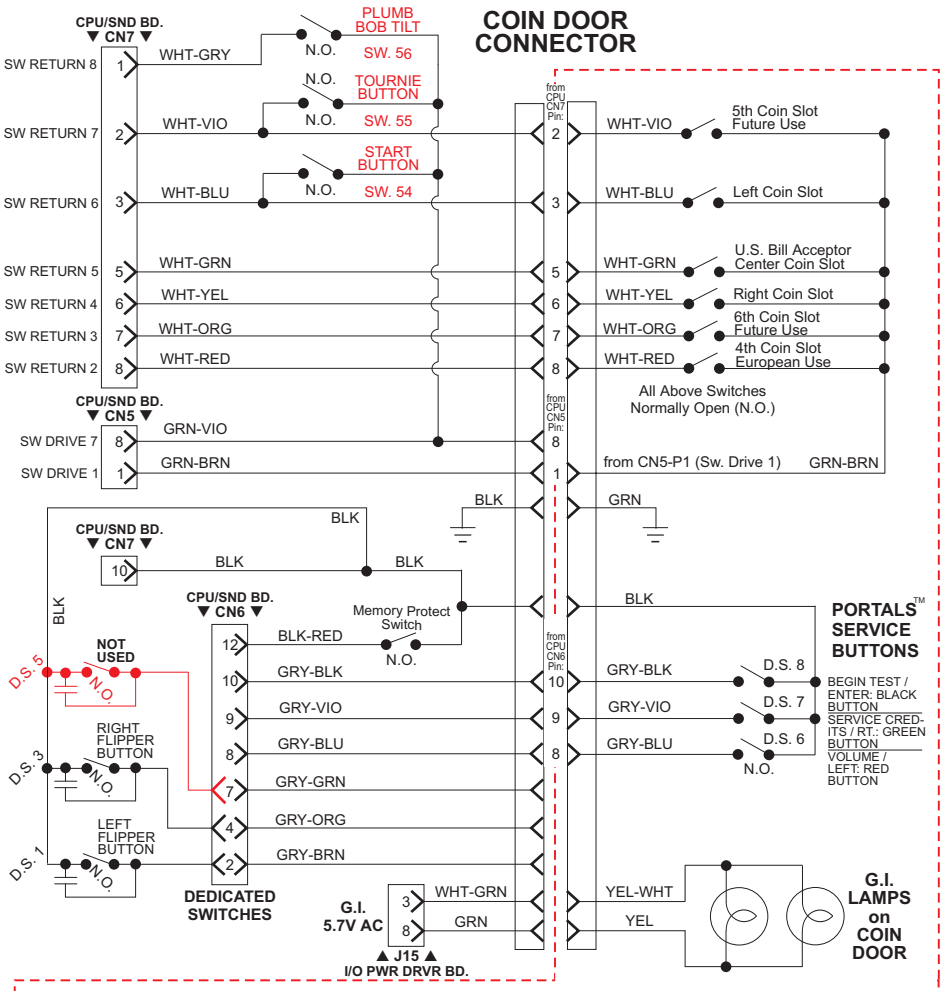


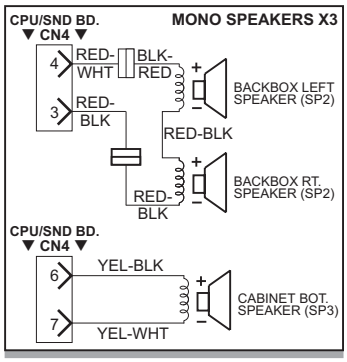
JUMPERS FOR VOLTAGE VARIATION

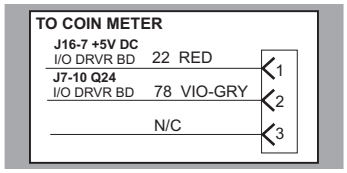


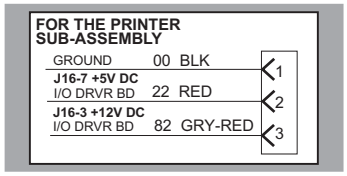


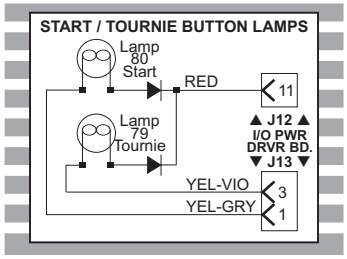
Cabinet / Coin Door Wiring Diagram



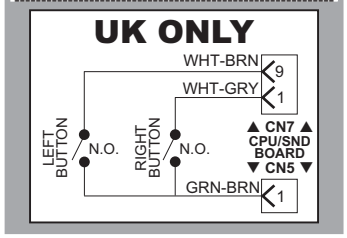


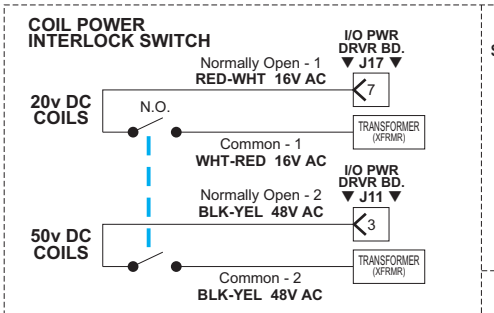


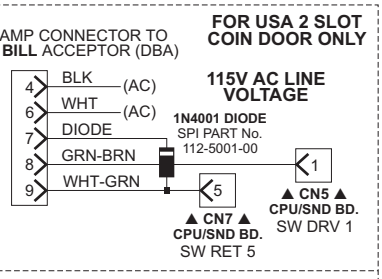


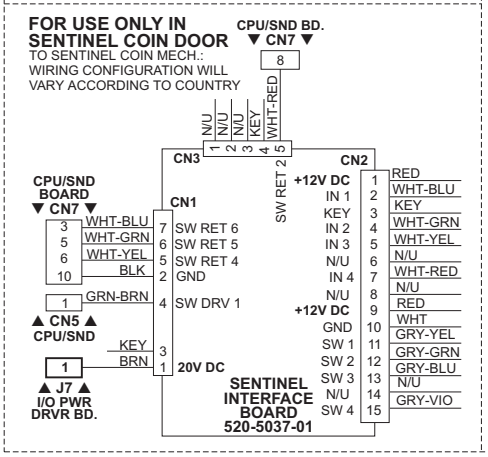


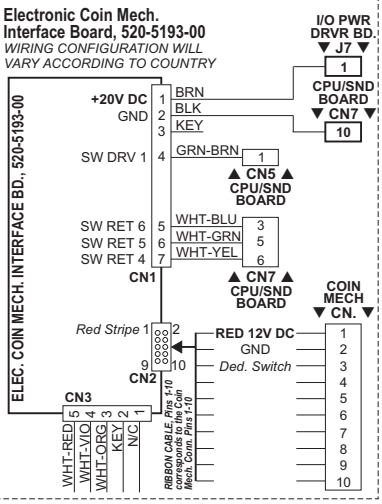
UK ONLY: 2 Extra Cabinet Buttons for the Post Save™ Feature are used. The Left Button operates the Left Outlane Ball Deflector. The Right Button operates the Right Outlane Ball Deflector. Both buttons pushed together operate the Center Up/Down Post. Both buttons are located under the Flipper Buttons.









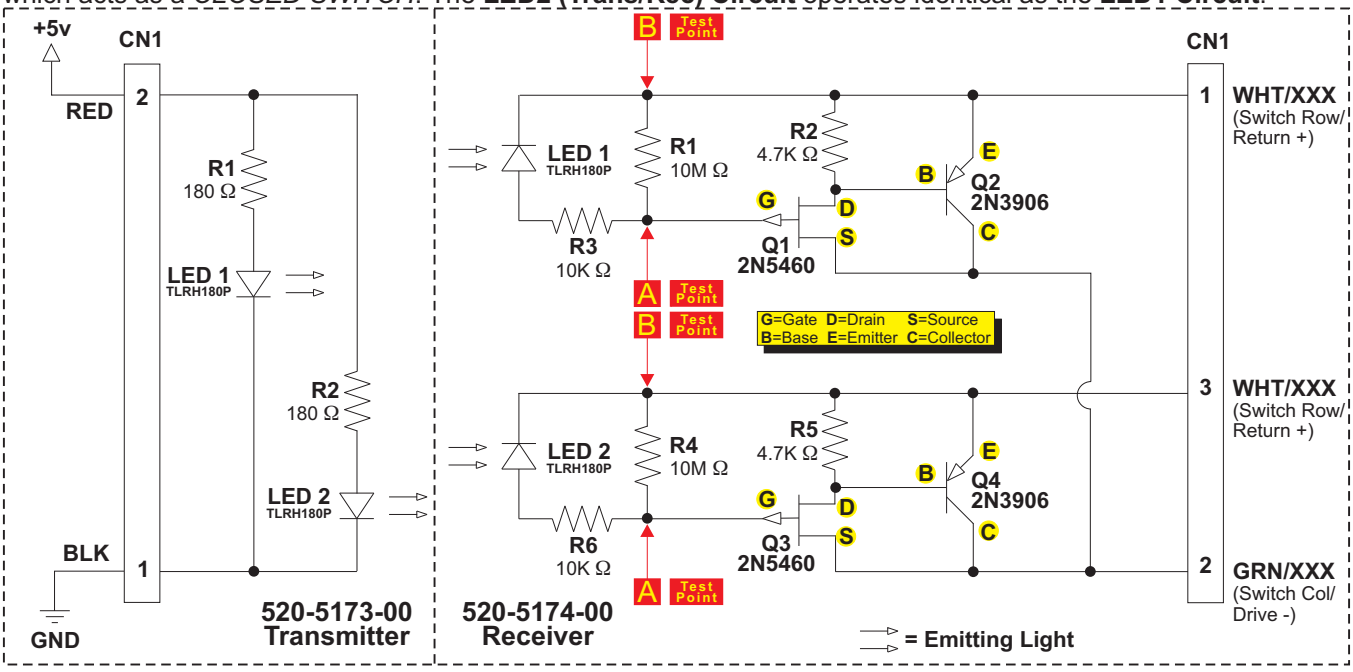


COIN DOOR

Printed Circuit Boards (PCBs)

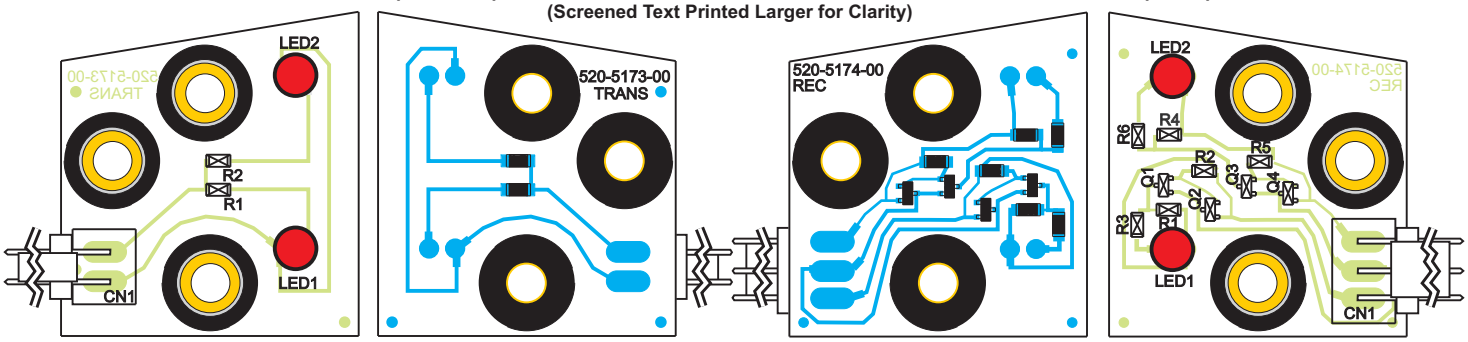
Trough Up-Kicker Dual OPTO Boards Theory of Operation & Schematic

As light from the **Transmitter LED1** falls on the **Receiver LED1**, it generates a Positive Bias Voltage (0.7v to 1.5v) which is applied to the **Gate** (**G**) of **Q1 (Fet 2N5460)** turning **Q1** off. When **Q1** is held off, no current flows through **Q2**'s **(2N3906) Base** (**B**). With no *base current,* **Q2** is off and acts as an *OPEN SWITCH*. When the light is interrupted *(BLOCKED)* **R1** (Rec. Bd.) bleeds the gate voltage off of **Q1** allowing it to conduct, switching **Q2** on, which acts as a *CLOSED SWITCH*. The **LED2 (Trans/Rec) Circuit** operates identical as the **LED1 Circuit**.



Trough Up-Kicker Dual OPTO Boards Component Layout & Parts

520-5173-00 (TRANS) Boards Actual Size (Screened Text Printed Larger for Clarity) 520-5174-00 (REC)



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

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



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

OPTO Troubleshooting

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

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

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

2. Oscilloscope Test (indicates normal operating condition):

Fig. A

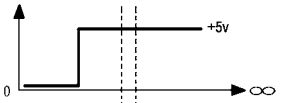
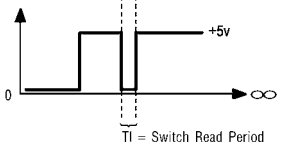


Fig. B



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

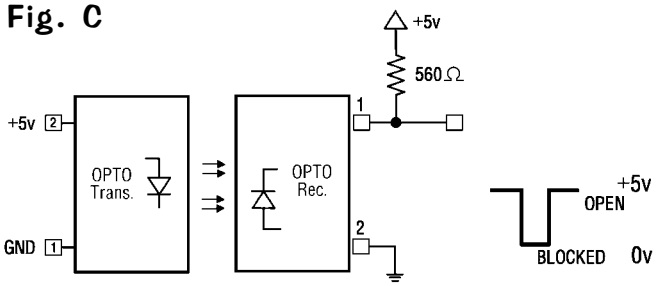
B. **CLOSED OPTO** (Light Blocked) = *SWITCH CLOSED*. Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (see Schematic). The Scope should display a **PULSE STREAM** indicating **Q2** has switched "On" as shown in **Fig. B**, Wave Form Diagram. This is your Switch Drive Pulse.

3. Bench Test (See Fig. C):

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

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

Fig. C



Trough Dual OPTO Boards Alignment / Test for LED1

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

Fig. 1

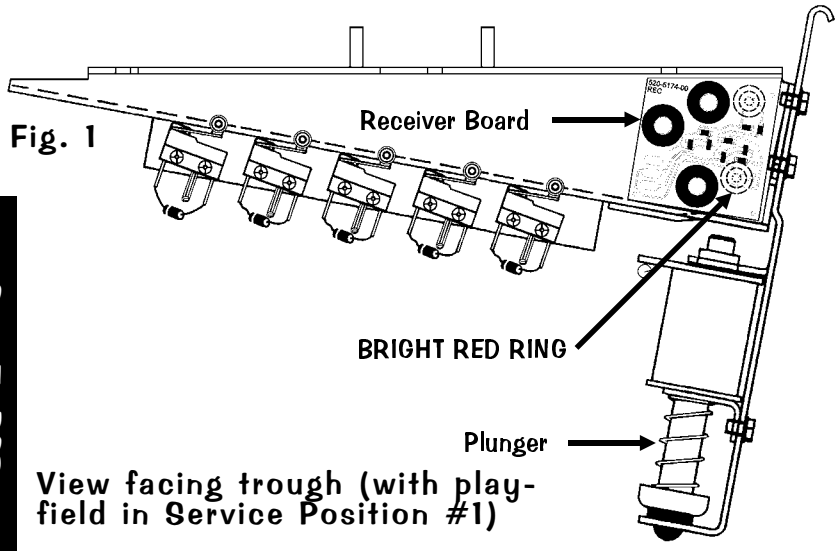
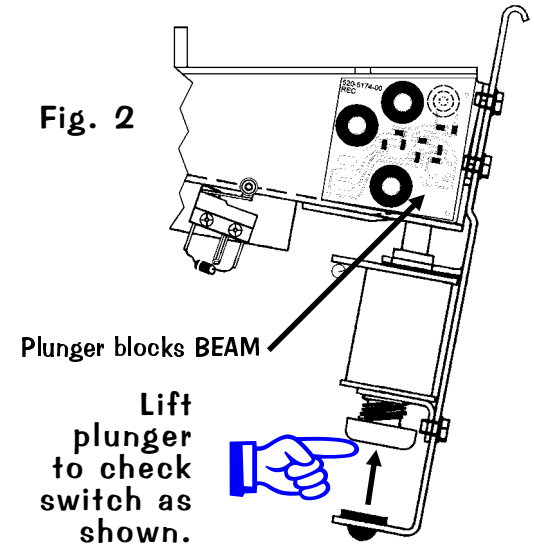
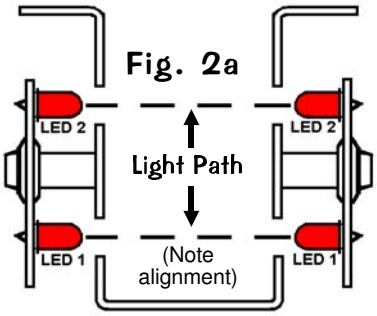
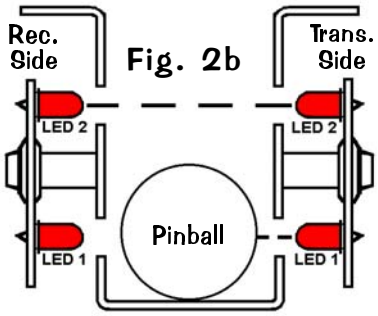


Fig. 2



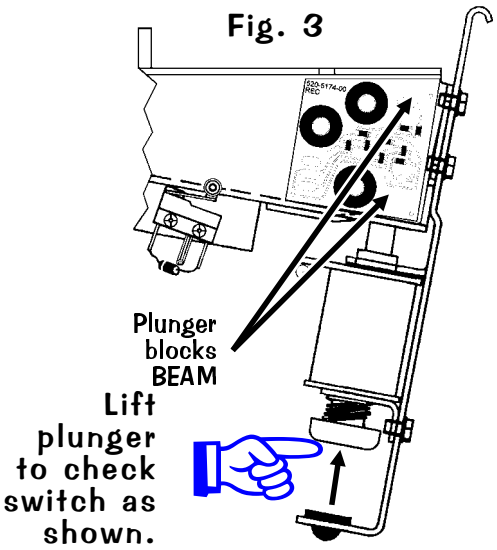
Sectional view from right (Fig. 2a & 2b)

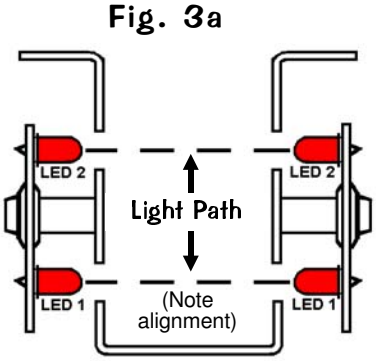


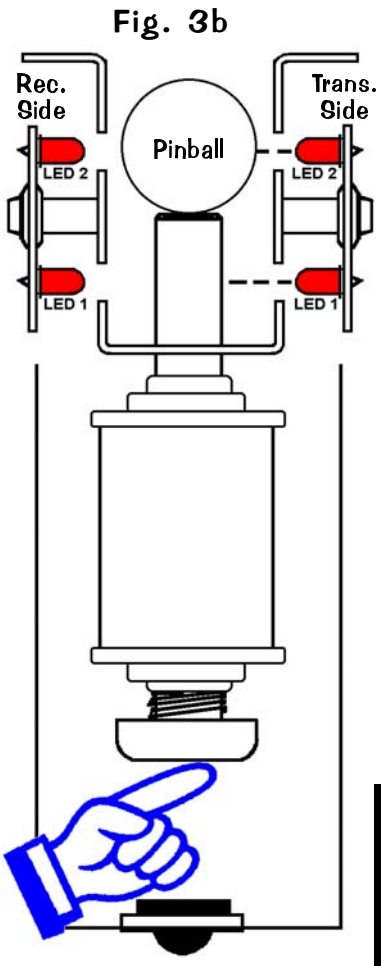


Trough Dual OPTO Boards Alignment / Test for LED2

When a working **OPTO** is installed and connected in a game, the transmitter should light *(LED1 lower & LED2 upper)* when the power is switched on. With the playfield in **Service Position #1** *(playfield lifted up and resting on 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**).*

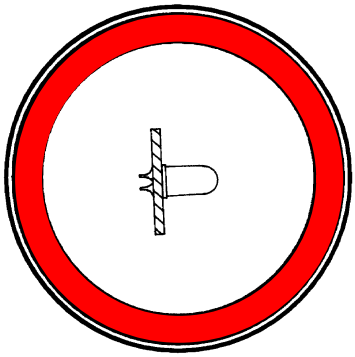


Fig. 4a
Correct Position

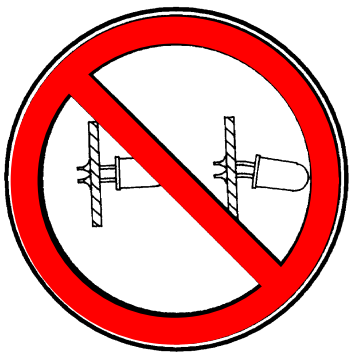
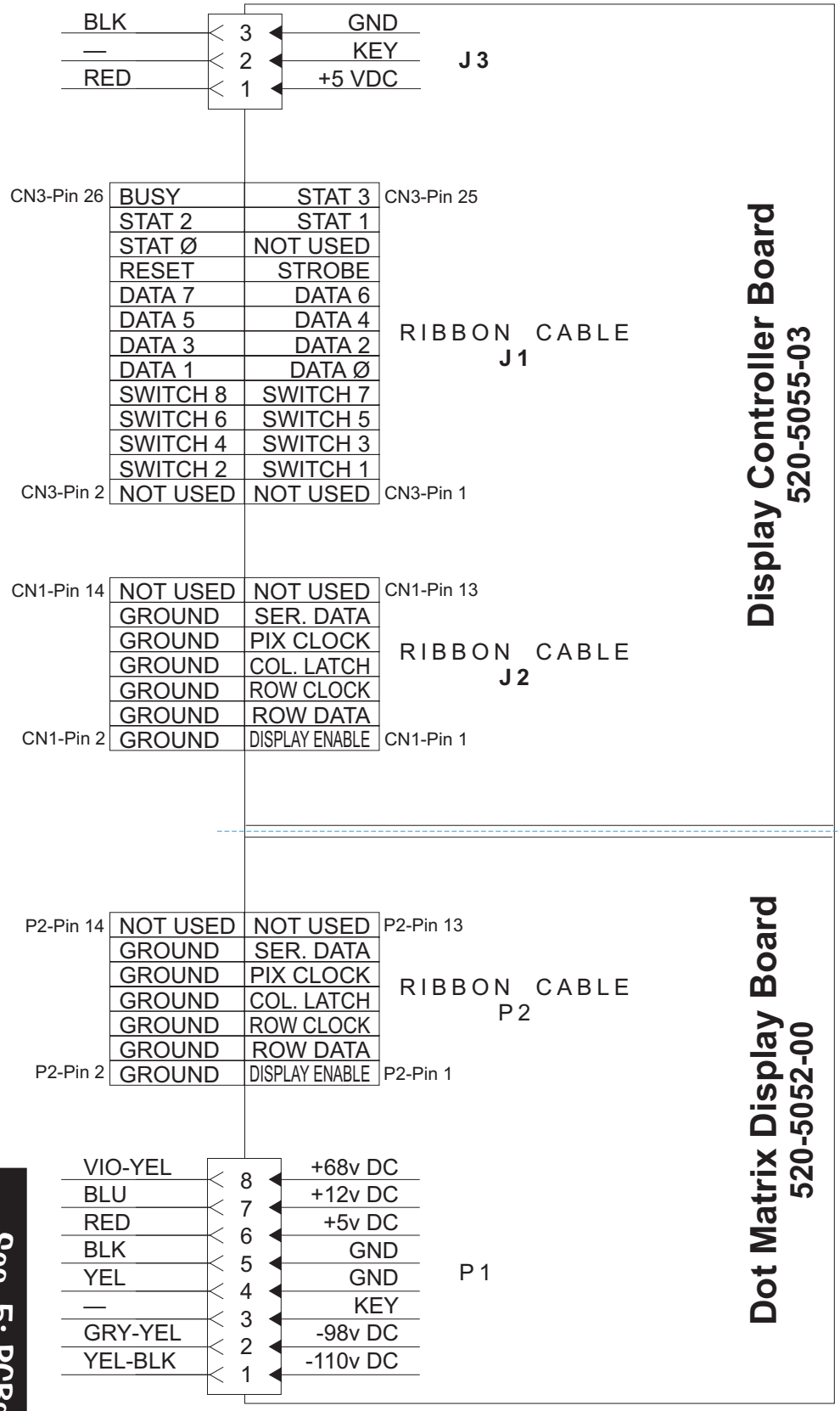


Fig. 4b
Incorrect Position

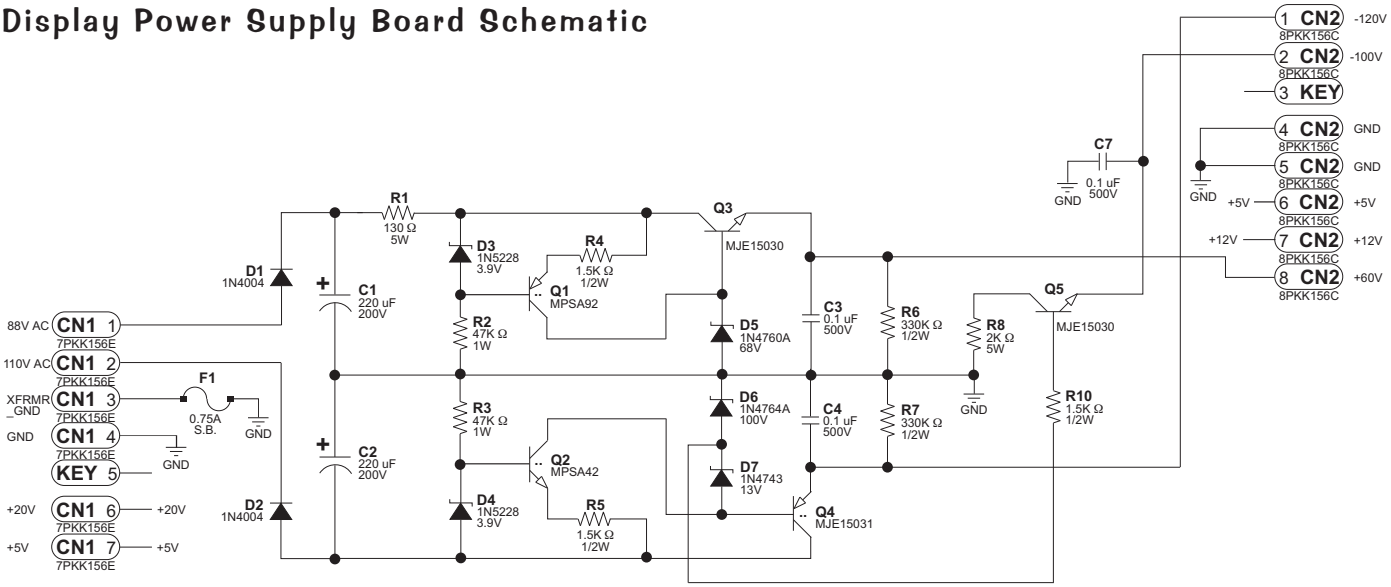


Dot Matrix Display Explained

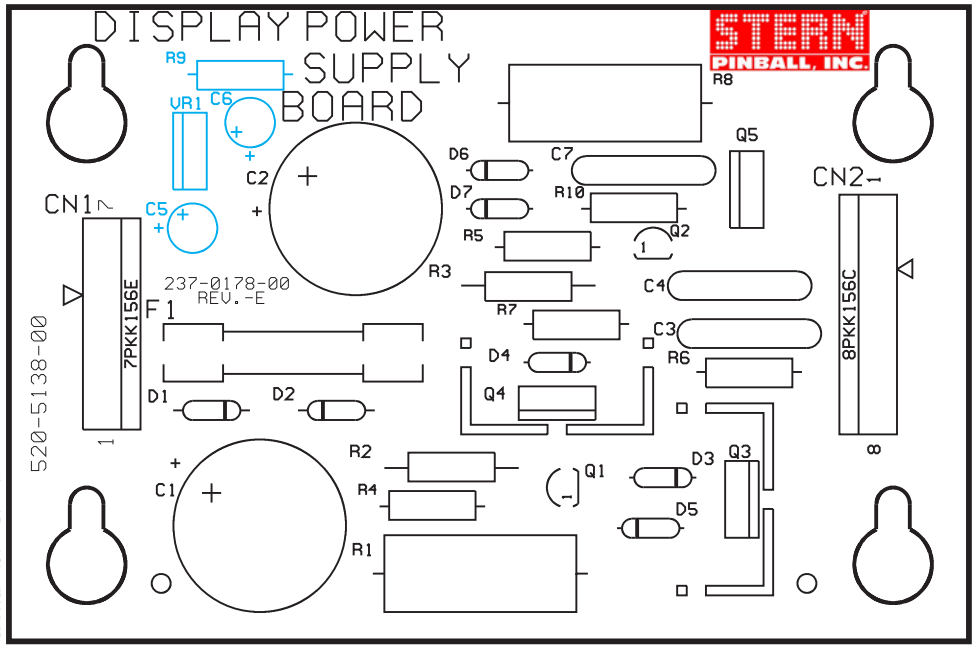
The display utilizes a Micro-Processor Control Board mounted in piggyback fashion to the Dot Matrix Display (128 X 32) Driver Board. The purpose behind this board is to provide more information to the operator as well as displaying graphics to the player.

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

Display Power Supply Board Schematic

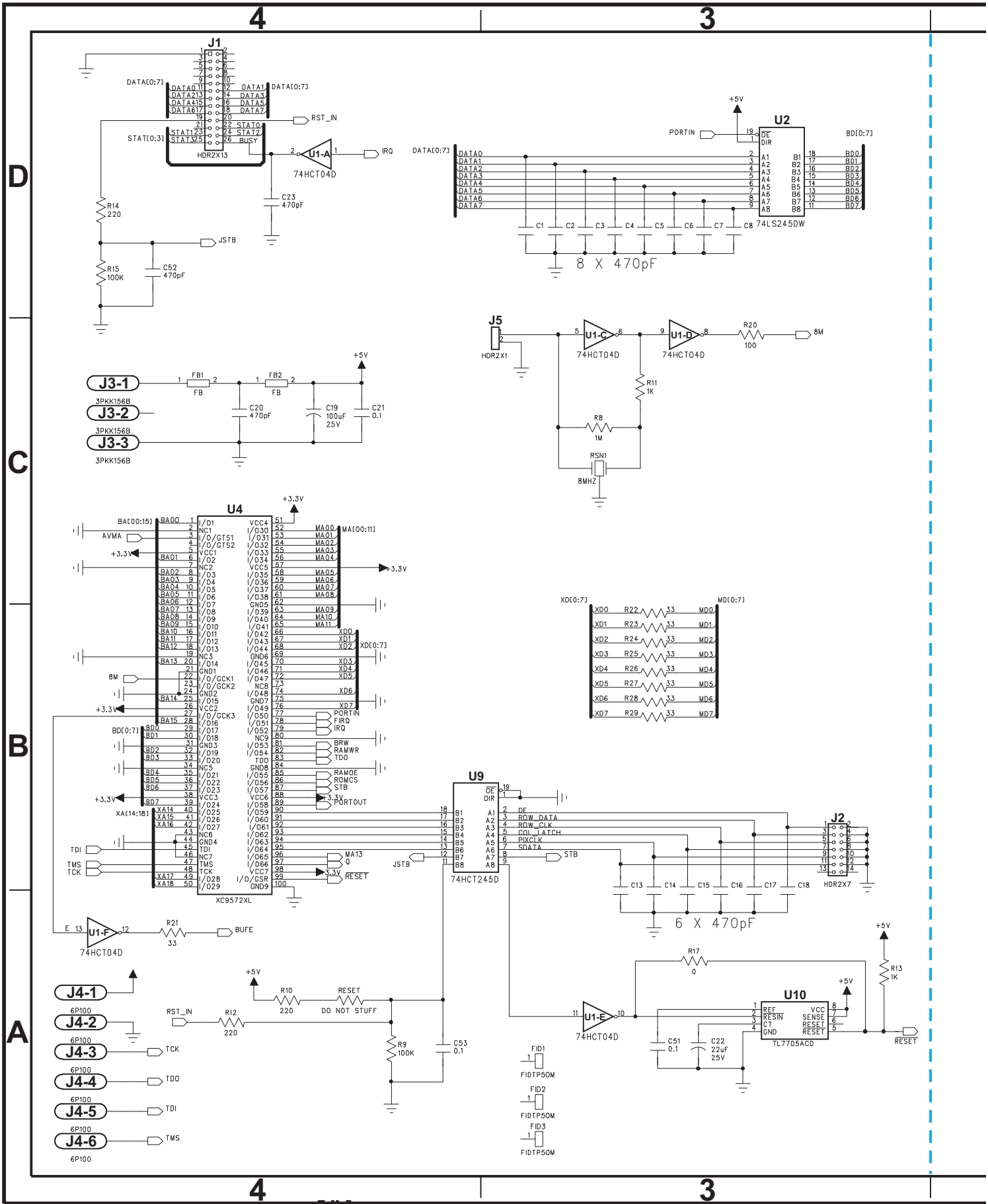


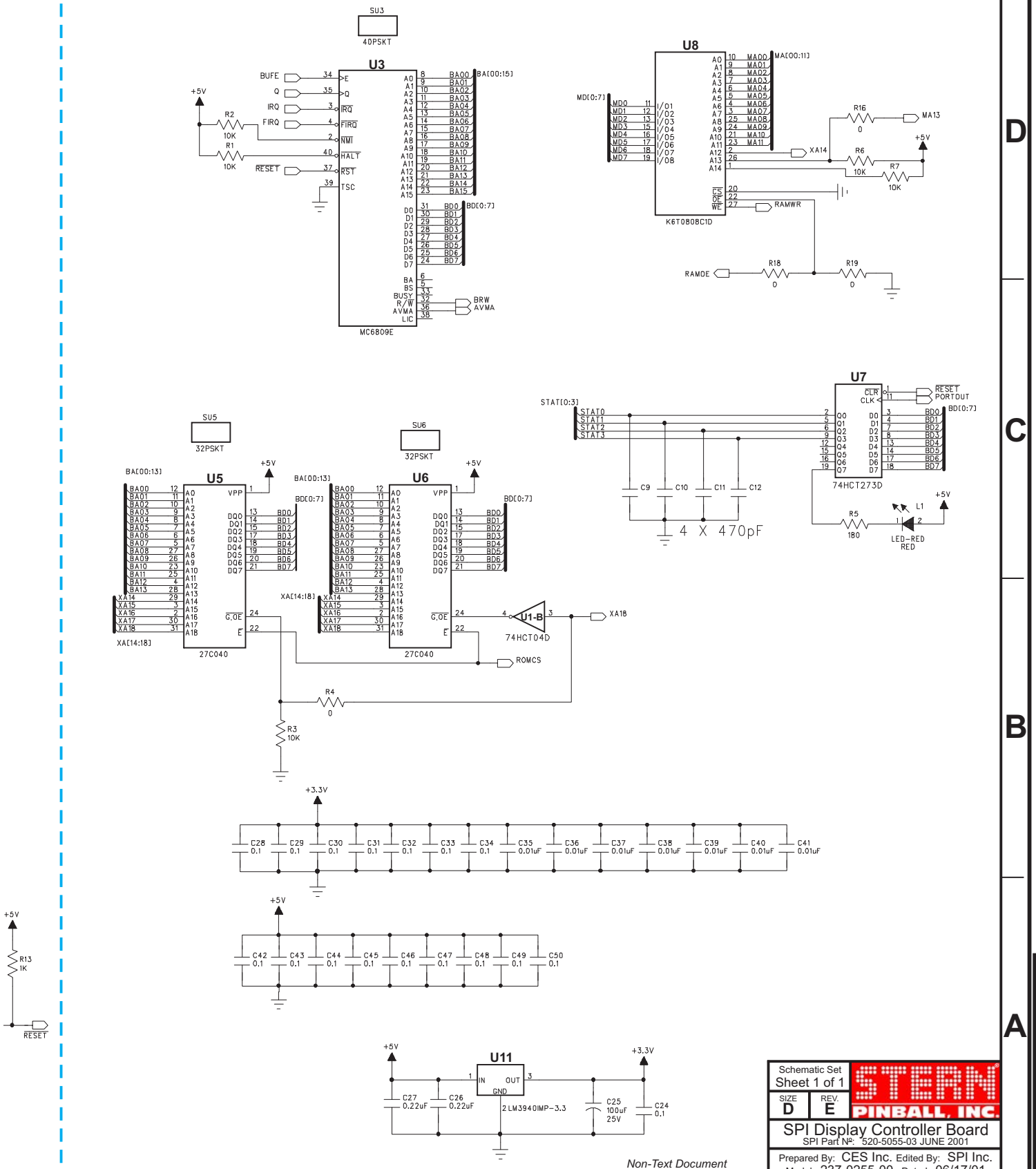
Display Power Supply Board Component Layout & Parts



Actual Board Size 5" X 3.3"

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	**1**	**520-5138-00**	**Display Power Supply Board**	**Complete PCB Assembly**
01	2	125-5044-00	C1, C2	220uF, 200v, Radial Lytic Cap.
02	3	125-5035-00	C3, C4, C7	0.1uF, 500v, Ceramic Disk Cap.
03	0	125-5003-00	(C5, C6: NS)	22uF, 35v, Rad Lytic Cap
04	1	045-5015-07	CN1	7PKK156E (PIN5=KEY)
05	1	045-5015-08	CN2	8PKK156 (PIN3=KEY)
06	2	112-5003-00	D1, D2	1N4004, Diode
07	2	112-0053-00	D3, D4	1N5228, 3.9v, Diode
08	1	112-0062-00	D5	1N4760A, 68v, Diode
09	1	112-0049-00A	D6	1N4764A, 100v, Diode
10	1	112-0061-00	D7	1N4743, 13v, Diode
11	1	200-5000-17	F1	3/4A (0.75A) S.B. Fuse
12	2	205-0004-00	F1	Fuse Clip
13	1	110-0100-00	Q1	MPSA92, Transistor
14	1	110-0082-00	Q2	MPSA42, Transistor
15	2	110-0101-00	Q3, Q5	MJE15030, Transistor
16	2	535-5000-11	Q3, Q4	Heatsinks - AAVID #563002
17	2	240-5008-00	Q3, Q4	#6-32 KEPS Nut
18	2	237-5501-00	Q3, Q4	#6-32 X 3/8" PPH Screw
19	1	110-0103-00	Q4	MJE15031, Transistor
20	1	121-5061-00	R1	130 Ω 5W Res.
21	2	121-5060-00	R2, R3	47K Ω 1W Res.
22	3	121-5038-00	R4, R5, R10	1.5K Ω 1/2W Res. (R9: NS)
23	2	121-5059-00	R6, R7	330K Ω 1/2W Res.
24	1	121-5062-00	R8	2K Ω 5W Res.
25	0	124-5003-00	(VR1: NS)	7812CT


4
3
D
C
B
A
J1
DATA[0:7]
STAT[0:3]
HDR2X13
RST_IN
IRQ
JSTB
U1-A
74HCT04D
R14 220
R15 100K
C52 470pF
C23 470pF
U2
PORTIN
BD[0:7]
74LS245DW
8 X 470pF
J5
HDR2X1
U1-C
U1-D
R20 100
8M
R11 1K
R8 1M
RSN1
8MHZ
J3-1
J3-2
J3-3
3PKK156B
FB1
FB2
FB
C20 470pF
C19 100uF 25V
C21 0.1
+5V
+3.3V
U4
XC9572XL
BA[00:15]
AVMA
MA[00:11]
XD[0:7]
PORTIN
FIRQ
IRQ
BRW
RAMWR
TDO
RAMOE
ROMCS
STB
PORTOUT
MA13
Q
RESET
XA[14:18]
TDI
TMS
TCK
U9
74HCT245D
JSTB
STB
DF
ROW_DATA
ROW_CLK
COL_LATCH
PIXCLK
SDATA
J2
HDR2X7
6 X 470pF
XD0 R22 33 MD0
XD1 R23 33 MD1
XD2 R24 33 MD2
XD3 R25 33 MD3
XD4 R26 33 MD4
XD5 R27 33 MD5
XD6 R28 33 MD6
XD7 R29 33 MD7
U1-F
74HCT04D
R21 33
BUFE
J4-1
J4-2
J4-3
J4-4
J4-5
J4-6
6P100
TCK
TDO
TDI
TMS
RST_IN
R12 220
R10 220
RESET
DO NOT STUFF
R9 100K
C53 0.1
FID1
FID2
FID3
FIDTP50M
R17 0
U1-E
74HCT04D
U10
TL7705ACD
C51 0.1
C22 22uF 25V
R13 1K



Schematic Set Sheet 1 of 1

SIZE D REV. E

STERN PINBALL, INC.

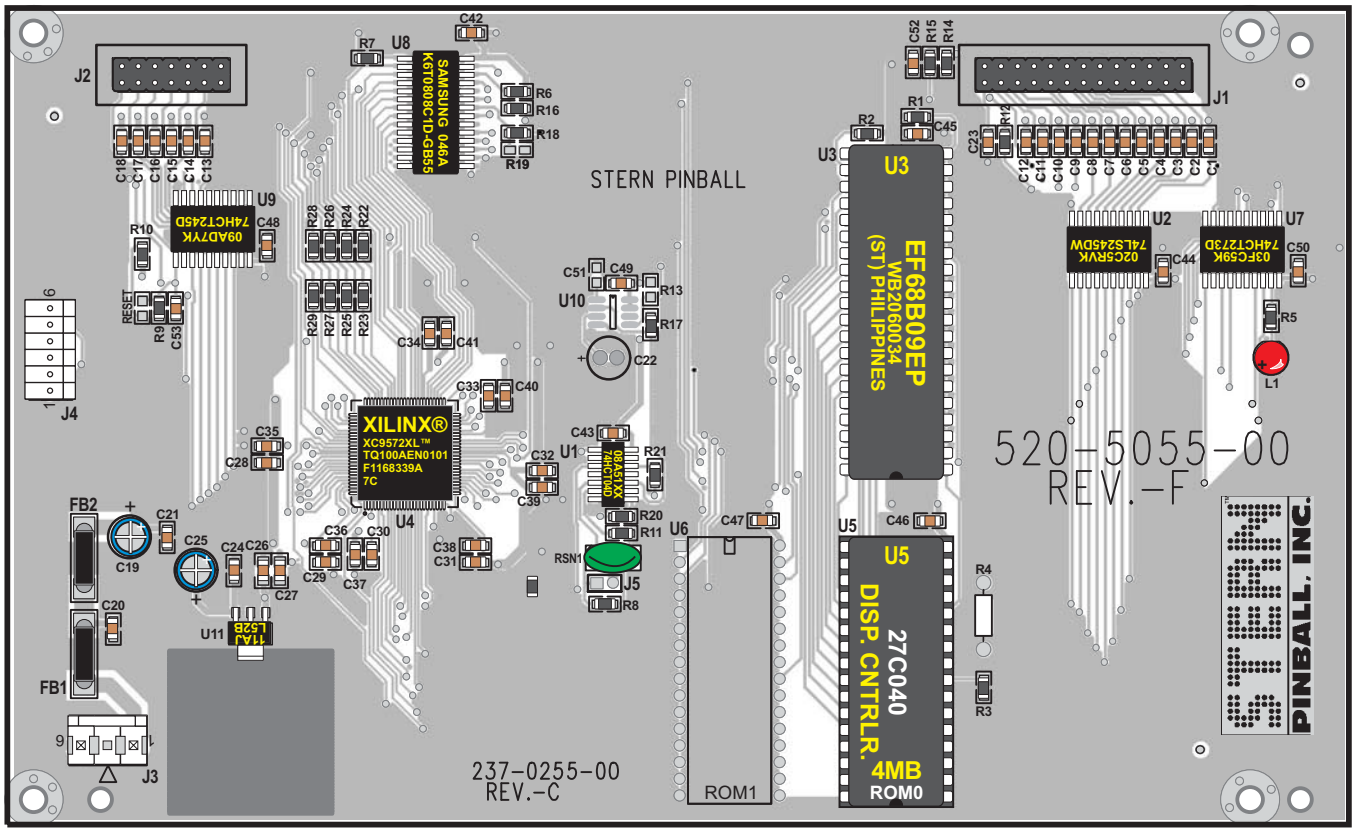
SPI Display Controller Board

SPI Part №: 520-5055-03 JUNE 2001

Prepared By: CES Inc. Edited By: SPI Inc.

Model: 237-0255-00 Dated: 06/17/01

Sec. 5: PCBs



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. ❶** 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).

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

+5v, +20v, +50v, +18v, & +12v LED Indicators:
These DC voltages are derived on the **I/O Board** by rectification and filtering. Each has a **LED** indicating that power is being supplied to each of these voltage sources. The **-12v** supply comes from the same transformer winding as the **+12v** thus it does not have a **LED** indicator.

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

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

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

LED L204 shows the reset state of the **I/O Board**. If this **LED** is not lit either the 5v DC is below 4.75v or the **CPU/Sound Board** is holding the **I/O** in reset. If the **LED** is flashing this means that the watchdog is not being feed by the **CPU/Sound Board** and the **I/O** is oscillating into and out of reset. If the **LED** is continuously on the board is out of reset and communication from the CPU to the lamp matrix is confirmed. ***Testpoint Blanking*** is the actual reset signal on the **I/O Board**. A low voltage indicates that it is in reset this will turn off all Solenoid *(Coil)* Drivers, Flash Lamps, Lamp Matrix Drivers, Auxiliary Outputs and Flipper Outputs. A high voltage indicates that it is out of reset and normal operation can take place.

Address Decoding:
All Address decoding is done by two **74LS138's (U204 & U205)** (3 of 8 decoder). Both of these must be in operation for the **I/O Board** to function properly.

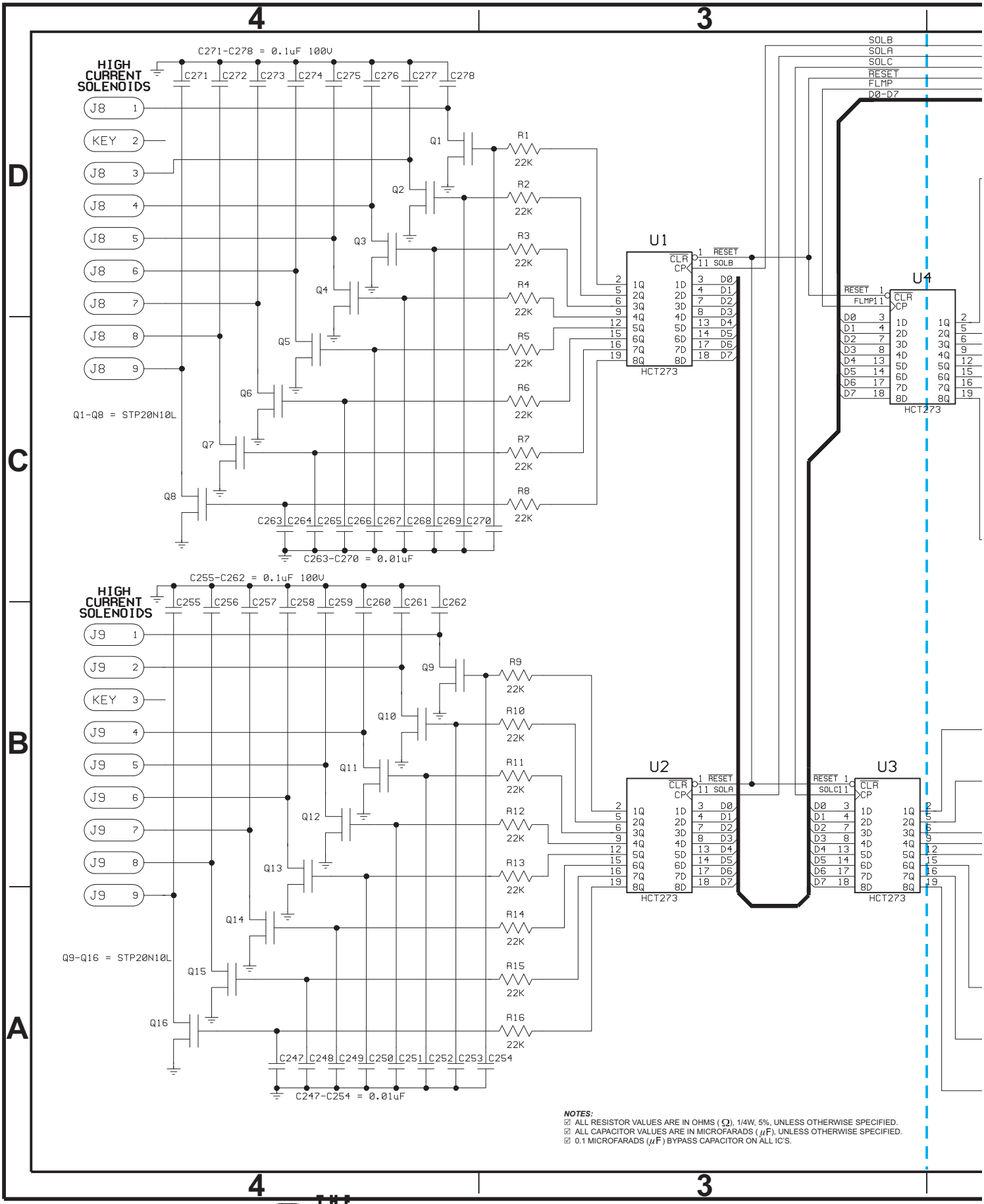
Solenoid (Coil) Drivers & Flash Lamps:
J8 & **J9** are high side drivers for driving solenoids and other heavy loads. Each connector has its own buffer driving 8 drivers. **J8** & **J9** consist of **MOSFET Drivers 20N10L** which can easily & safely be tested by clipping one end of a clip-lead to test point **FET TPL1** and then the other to the corresponding gate resistor **R1-R16** *(see Note 1).* This will apply 3.4v to the gate of the **MOSFET Transistor** thus switching it on. **J7** & **J6** each are a bank of 8 low side driver for driving lamps or other lower current solenoids *(coils).* They use a Bipolar Power Transistor **TIP122** which can also be tested by using **TEST POINT TIP TPL3** and the corresponding resistors **R17-R32*** *(see Note 1).*

***Note 1** • Clip on the resistor side with the white stripe. •• R1 controls Q1, R2 controls Q2, et cetera...*

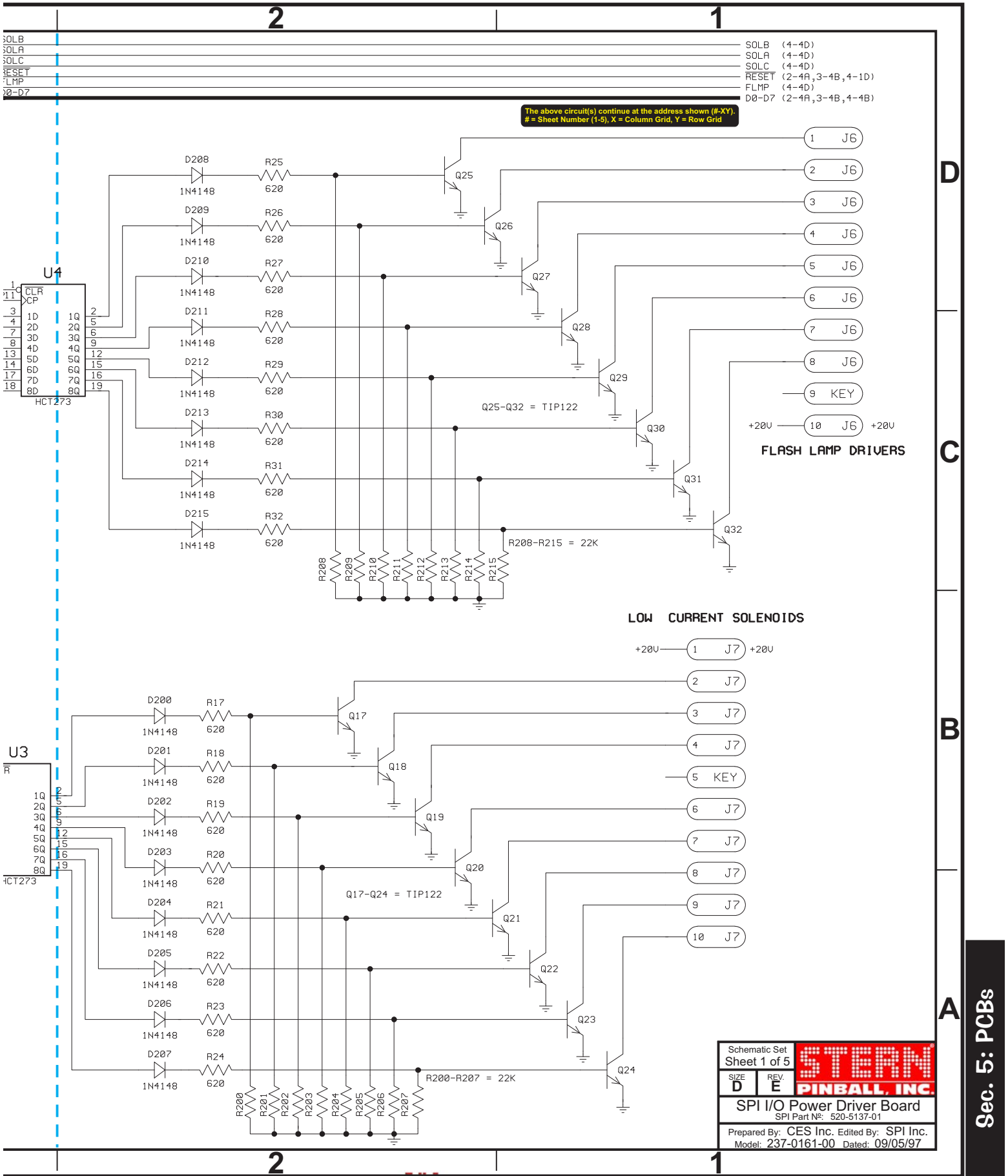
Auxiliary In & Out:
J2-8 CMOS Outputs sometimes used for a printer interface.
J3-8 CMOS Inputs general purpose inputs.

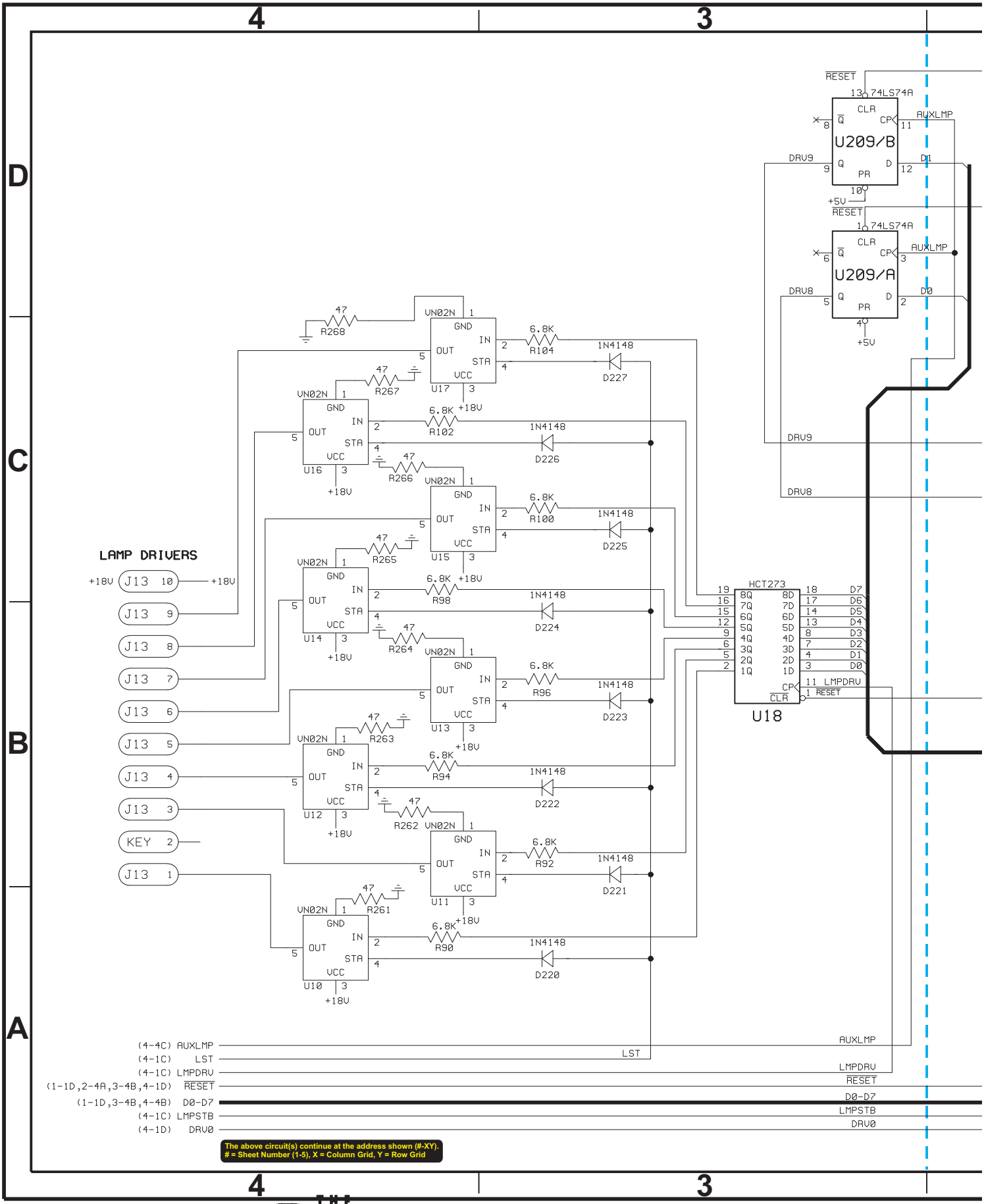
Lamp Matrix:
J12 has 10 low side drivers for the lamp strobes which consist of **19N06L MOSFETS**. Only one lamp strobe should be low at any time. Again the scanning of the lamp strobes keeps the **I/O** from resetting. **J13** has 8 high side drivers with each having a status indicator. All the status indicators are logically 'OR'ed together and fed back to the **CPU/Sound Board**. The status can identify open loads *(for example open lamp filaments or intermittent connections)* and short circuits. These drivers are also short-circuit protected.

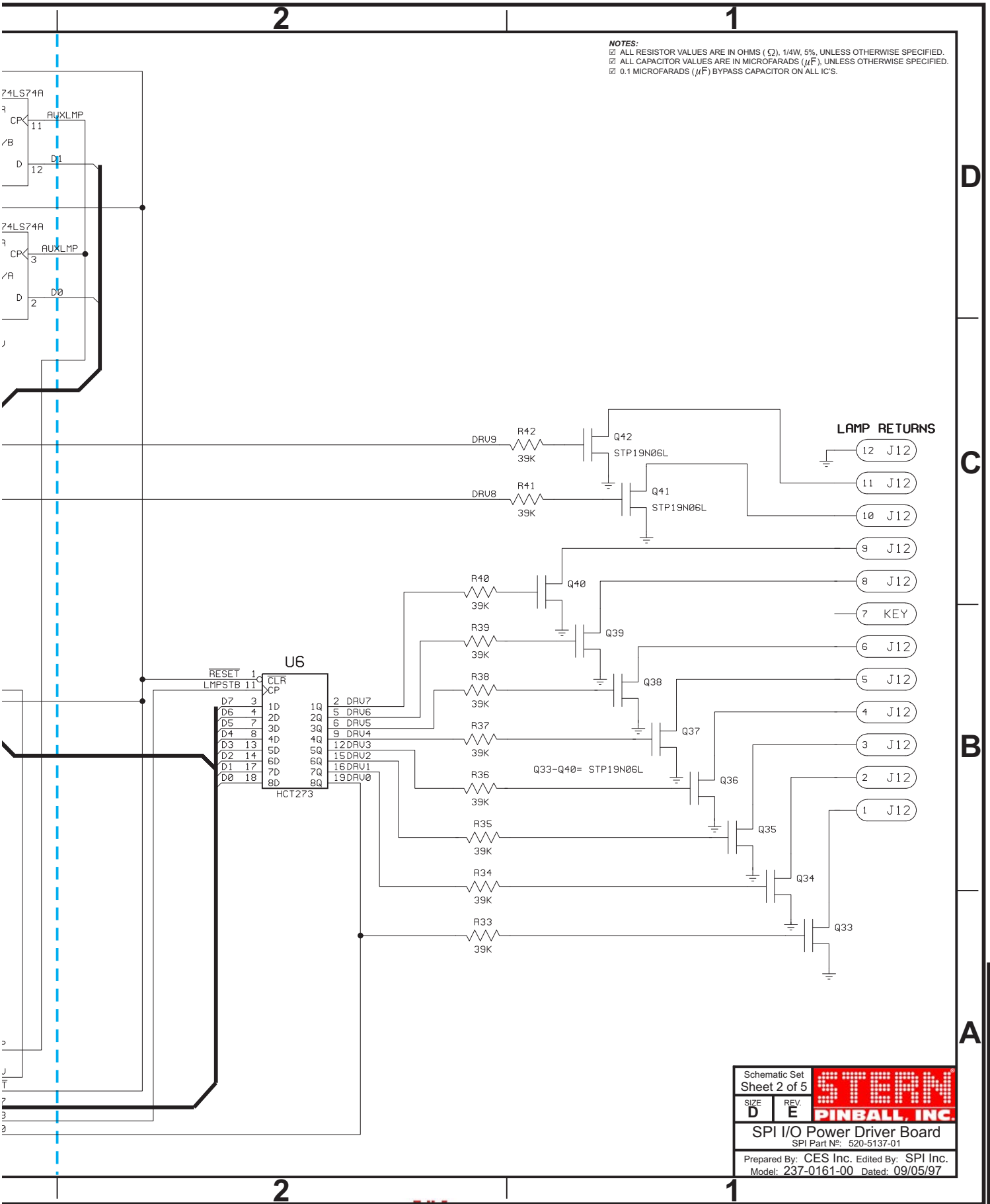
General Illumination (G.I.) Lights:
J15 has 6v AC switched on & off by a relay on the **I/O Board**. The relay is controlled by **Q200** which supplies power to the 24v coil winding to activate the relay. There are 4 taps on **J15** each fused at 5A for this 6v AC source.

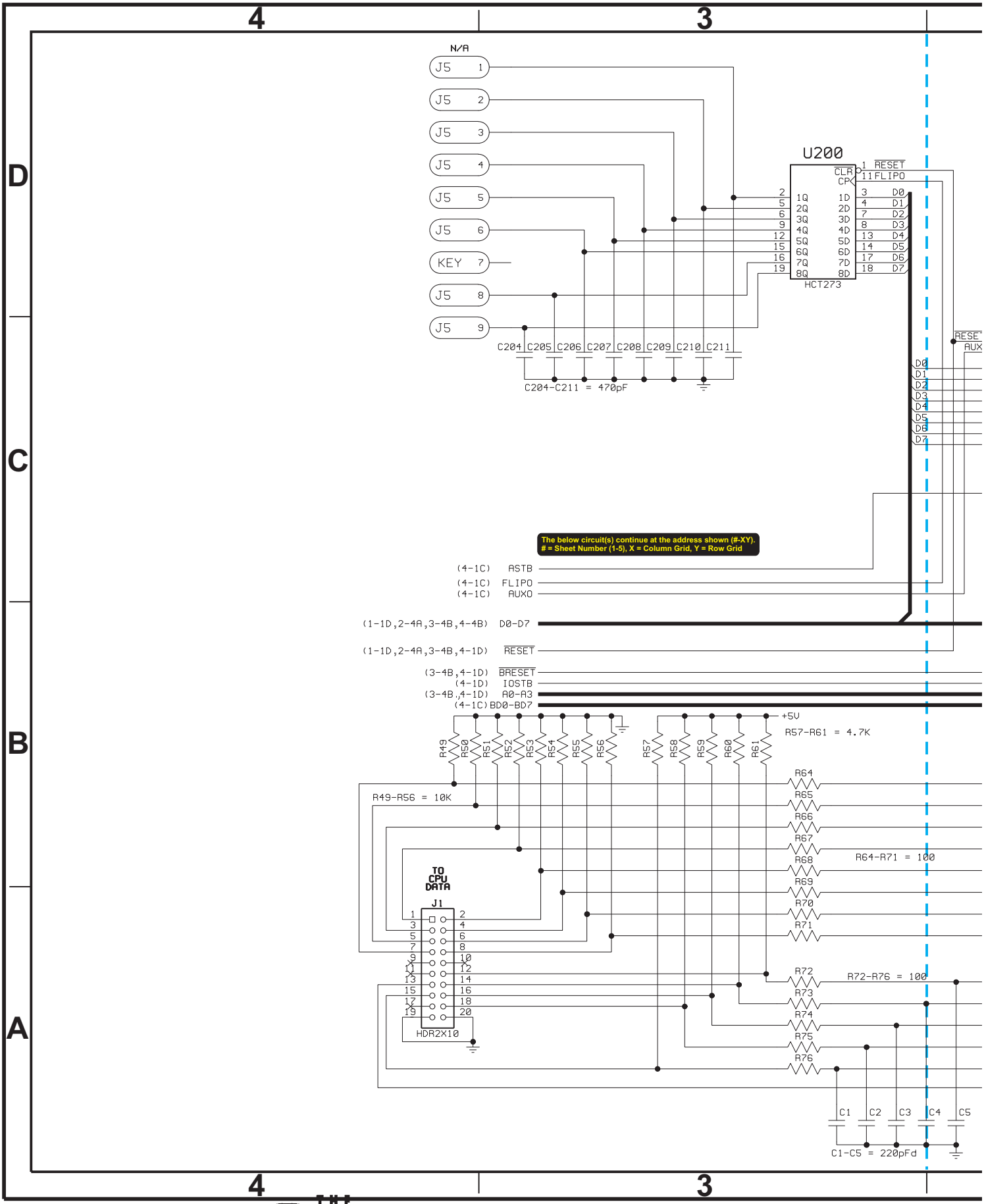


NOTES:
- ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
- ☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
- ☑ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.


SOLB (4-4D)
SOLA (4-4D)
SOLC (4-4D)
RESET (2-4A,3-4B,4-1D)
FLMP (4-4D)
D0-D7 (2-4A,3-4B,4-4B)
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
U4
HCT273
D208 R25 620 1N4148 Q25
D209 R26 620 1N4148 Q26
D210 R27 620 1N4148 Q27
D211 R28 620 1N4148 Q28
D212 R29 620 1N4148 Q29
D213 R30 620 1N4148 Q30
D214 R31 620 1N4148 Q31
D215 R32 620 1N4148 Q32
Q25-Q32 = TIP122
R208-R215 = 22K
R208 R209 R210 R211 R212 R213 R214 R215
1 J6
2 J6
3 J6
4 J6
5 J6
6 J6
7 J6
8 J6
9 KEY
+20V 10 J6 +20V
FLASH LAMP DRIVERS
LOW CURRENT SOLENOIDS
+20V 1 J7 +20V
2 J7
3 J7
4 J7
5 KEY
6 J7
7 J7
8 J7
9 J7
10 J7
U3
HCT273
D200 R17 620 1N4148 Q17
D201 R18 620 1N4148 Q18
D202 R19 620 1N4148 Q19
D203 R20 620 1N4148 Q20
D204 R21 620 1N4148 Q21
D205 R22 620 1N4148 Q22
D206 R23 620 1N4148 Q23
D207 R24 620 1N4148 Q24
Q17-Q24 = TIP122
R200-R207 = 22K
R200 R201 R202 R203 R204 R205 R206 R207
Schematic Set Sheet 1 of 5
SIZE D REV. E
STERN PINBALL, INC.
SPI I/O Power Driver Board
SPI Part №: 520-5137-01
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0161-00 Dated: 09/05/97

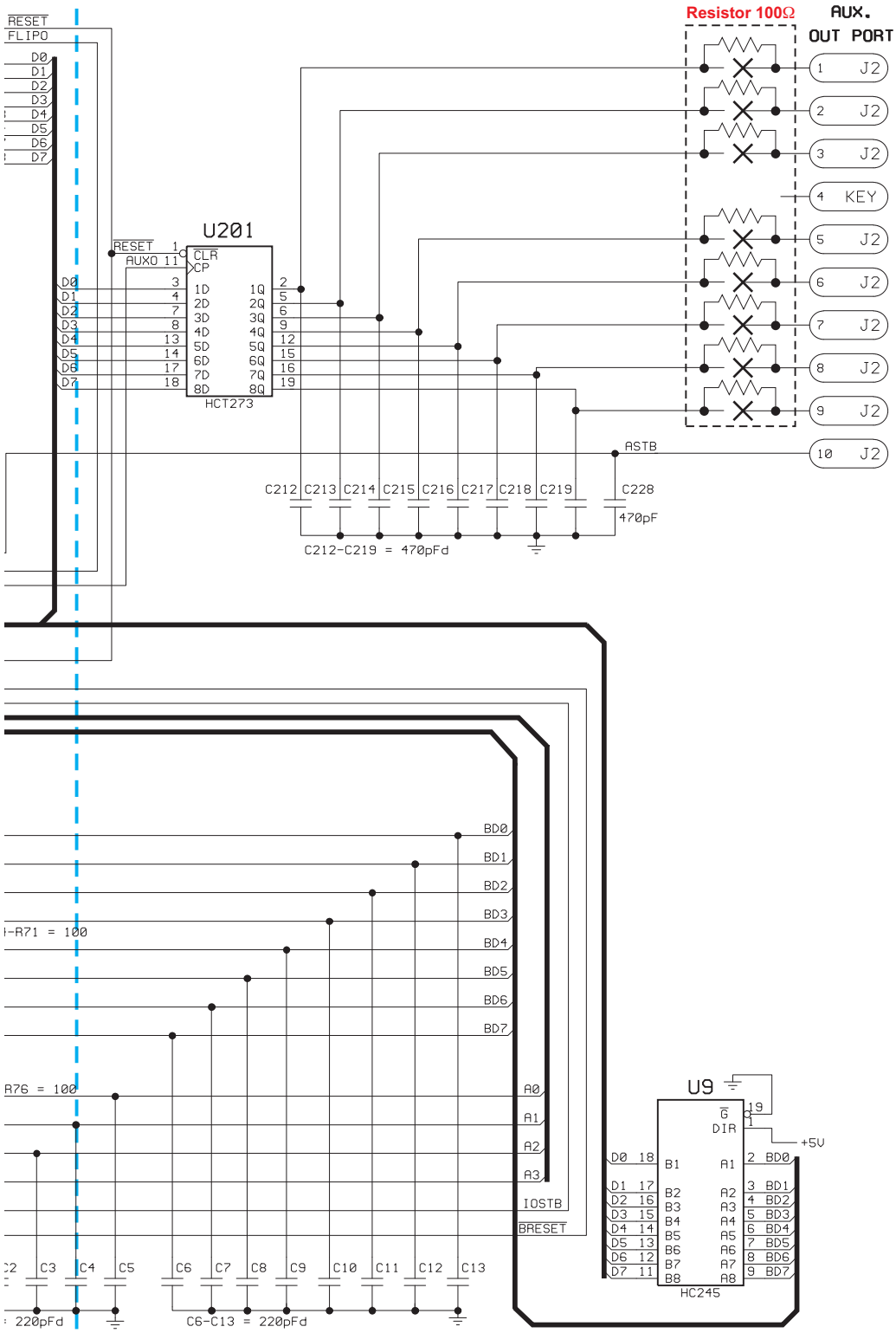

4
3
D
C
B
A
LAMP DRIVERS
+18V
J13 10
J13 9
J13 8
J13 7
J13 6
J13 5
J13 4
J13 3
KEY 2
J13 1
R268
R267
R266
R265
R264
R263
R262
R261
47
UN02N
GND
IN
OUT
STA
VCC
U17
U16
U15
U14
U13
U12
U11
U10
6.8K
R104
R102
R100
R98
R96
R94
R92
R90
1N4148
D227
D226
D225
D224
D223
D222
D221
D220
HCT273
U18
8D
7D
6D
5D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


NOTES:
☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
☑ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.
74LS74A
AUXLMP
D1
D0
U6
RESET
LMPSTB
CLR
CP
HCT273
DRV9
DRV8
R42
R41
R40
R39
R38
R37
R36
R35
R34
R33
39K
Q42
Q41
Q40
Q39
Q38
Q37
Q36
Q35
Q34
Q33
STP19N06L
Q33-Q40= STP19N06L
LAMP RETURNS
12 J12
11 J12
10 J12
9 J12
8 J12
7 KEY
6 J12
5 J12
4 J12
3 J12
2 J12
1 J12
Schematic Set
Sheet 2 of 5
SIZE D
REV. E
STERN PINBALL, INC.
SPI I/O Power Driver Board
SPI Part №: 520-5137-01
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0161-00 Dated: 09/05/97


4
3
D
C
B
A
N/A
J5 1
J5 2
J5 3
J5 4
J5 5
J5 6
KEY 7
J5 8
J5 9
U200
CLR
CP
1 RESET
11 FLIPO
1Q 2Q 3Q 4Q 5Q 6Q 7Q 8Q
1D 2D 3D 4D 5D 6D 7D 8D
D0 D1 D2 D3 D4 D5 D6 D7
HCT273
C204 C205 C206 C207 C208 C209 C210 C211
C204-C211 = 470pF
RESE
AUX
The below circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
(4-1C) ASTB
(4-1C) FLIPO
(4-1C) AUXO
(1-1D,2-4A,3-4B,4-4B) D0-D7
(1-1D,2-4A,3-4B,4-1D) RESET
(3-4B,4-1D) BRESET
(4-1D) IOSTB
(3-4B,4-1D) A0-A3
(4-1C) BD0-BD7
+5V
R49 R50 R51 R52 R53 R54 R55 R56
R57 R58 R59 R60 R61
R57-R61 = 4.7K
R49-R56 = 10K
R64 R65 R66 R67 R68 R69 R70 R71
R64-R71 = 100
R72 R73 R74 R75 R76
R72-R76 = 100
TO CPU DATA
J1
HDR2X10
C1 C2 C3 C4 C5
C1-C5 = 220pFd

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

DATE	DESCRIPTION OF CHANGES / REVISIONS	REQ.	BY.
JAN 2001	Cut trace on solder side at Aux. Out Port J2-PIN1 thru J2-PIN3 & J2-PIN5 thru J2-PIN9; Soldered **Resistor 100Ω** 1/4W 5% (SPI Nº: 121-5007-00). This Modification (highlighted below at J2 with a dotted-line box) was accomplished on boards produced after Jan. 1, 2001. This board is backwards compatible for the White Star™ Board System.	TS	JET

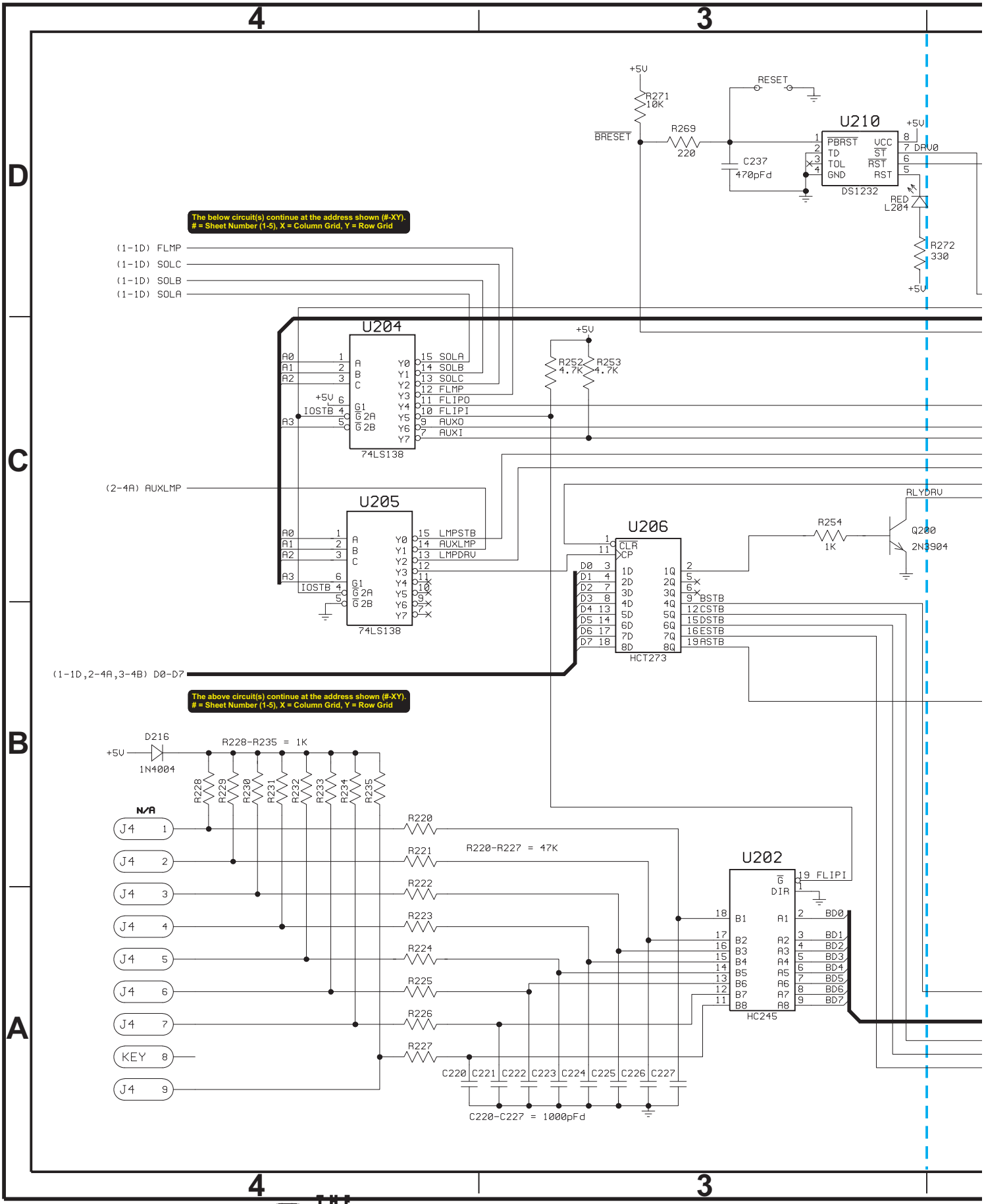


Schematic Set	Sheet 3 of 5
SIZE	D
REV.	E

STERN PINBALL, INC.

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

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


4
3
D
C
B
A
+5V
R271
10K
RESET
BRESET
R269
220
C237
470pFd
U210
PBRST
TD
TOL
GND
VCC
ST
RST
RST
DS1232
+5V
DRV0
RED
L204
R272
330
+5V
The below circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
(1-1D) FLMP
(1-1D) SOLC
(1-1D) SOLB
(1-1D) SOLA
U204
A0
A1
A2
A3
+5V
IOSTB
G1
G 2A
G 2B
Y0 SOLA
Y1 SOLB
Y2 SOLC
Y3 FLMP
Y4 FLIPO
Y5 FLIPI
Y6 AUXO
Y7 AUXI
74LS138
+5V
R252
4.7K
R253
4.7K
(2-4A) AUXLMP
U205
Y0 LMPSTB
Y1 AUXLMP
Y2 LMPDRV
74LS138
U206
CLR
CP
D0
D1
D2
D3
D4
D5
D6
D7
1D
2D
3D
4D
5D
6D
7D
8D
1Q
2Q
3Q
4Q
5Q
6Q
7Q
8Q
BSTB
CSTB
DSTB
ESTB
ASTB
HCT273
R254
1K
RLYDRV
Q200
2N3904
(1-1D,2-4A,3-4B) D0-D7
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
D216
+5V
1N4004
R228-R235 = 1K
R228
R229
R230
R231
R232
R233
R234
R235
N/A
J4 1
J4 2
J4 3
J4 4
J4 5
J4 6
J4 7
KEY 8
J4 9
R220
R221
R222
R223
R224
R225
R226
R227
R220-R227 = 47K
U202
G
DIR
FLIPI
B1
B2
B3
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
BD0
BD1
BD2
BD3
BD4
BD5
BD6
BD7
HC245
C220
C221
C222
C223
C224
C225
C226
C227
C220-C227 = 1000pFd

DATE	DESCRIPTION OF CHANGES / REVISIONS	REQ.	BY.
02-13-95	DELETE "-12V" NET FROM POSITIVE PIN OF C29. ADD "GND" NET TO POSITIVE PIN OF C29. MERGE UNNAMED NET FROM NEGATIVE PIN OF C29 WITH "-12V" NET.	BK	JHS
05-25-99	CUT PIN-3 TO GND ON U210 (4-3D)		

NOTES:
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- ☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
- ☑ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.

+5V R270 4.7K
RESET
BLANKING
RED L204
R272 330
DRV0
RST
RESET (1-1D,2-4A,3-4B,4-1D)
DRV0 (2-4A)
IOSTB (3-4B)
A0-A3 (3-4B)
BRESET (3-4B)

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

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

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

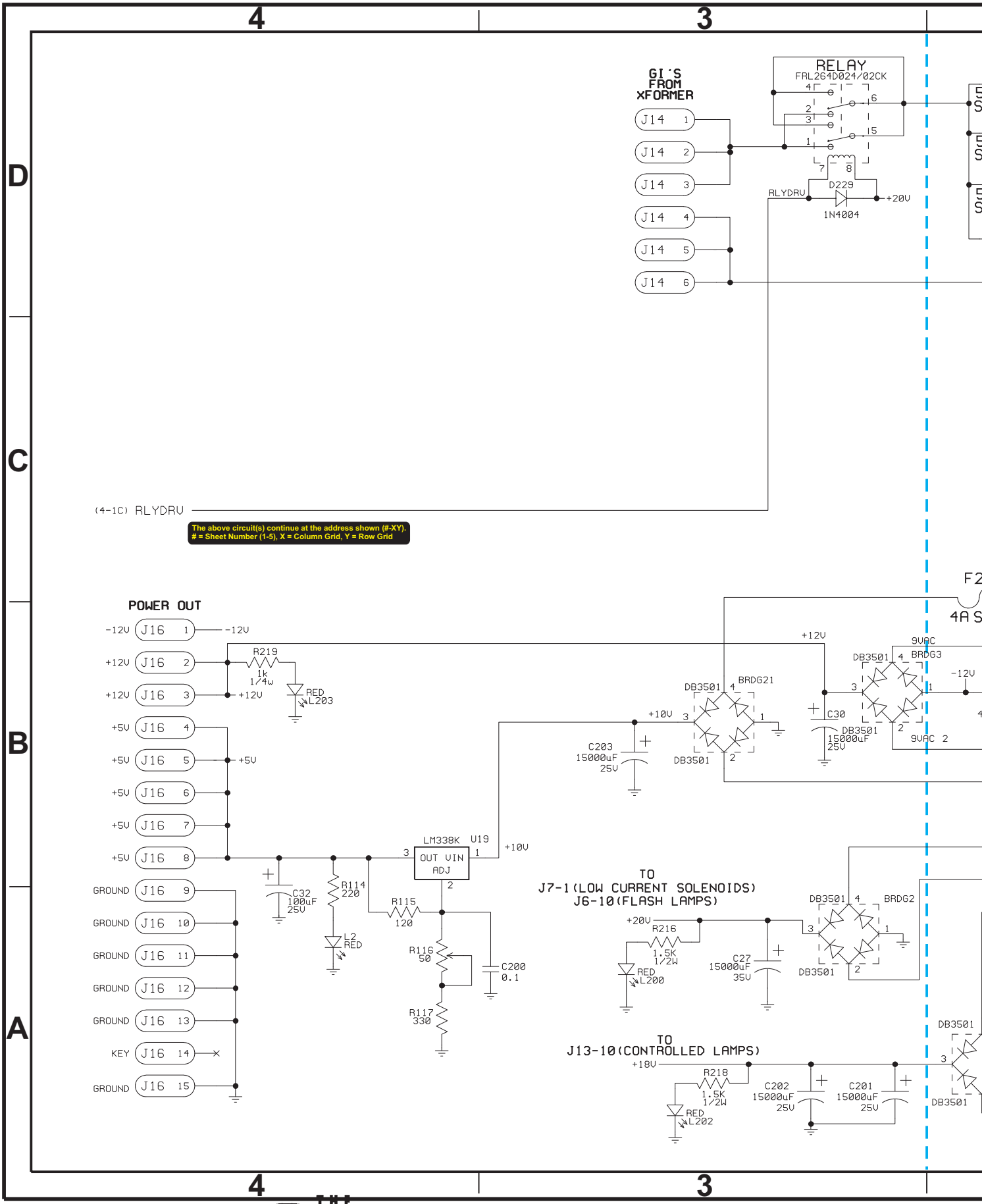
RLYDRV
Q200 2N3904
R256 4.7K
D228 1N4148
R255 10K
C236 470pF
R245-R251 = 1K
D217 1N4004
R245 R246 R247 R248 R249 R250 R251
AUX. IN PORT
1 J3
2 J3
3 J3
4 J3
5 J3
6 J3
7 J3
8 KEY
9 J3
10 J3
11 J3
12 J3
U203
AUXI 19
G
DIR
BD0 2
BD1 3
BD2 4
BD3 5
BD4 6
BD5 7
BD6 8
BD7 9
A1 A2 A3 A4 A5 A6 A7 A8
B1 B2 B3 B4 B5 B6 B7 B8
18 17 16 15 14 13 12 11
HC245
R236 R237 R238 R239 R240 R241 R242
R236-R243 = 39K
C229 C230 C231 C232 C233 C234 C235
C228-C235 = 470pFd
C243 C244 C245 C246
C243-C246 = 470pFd

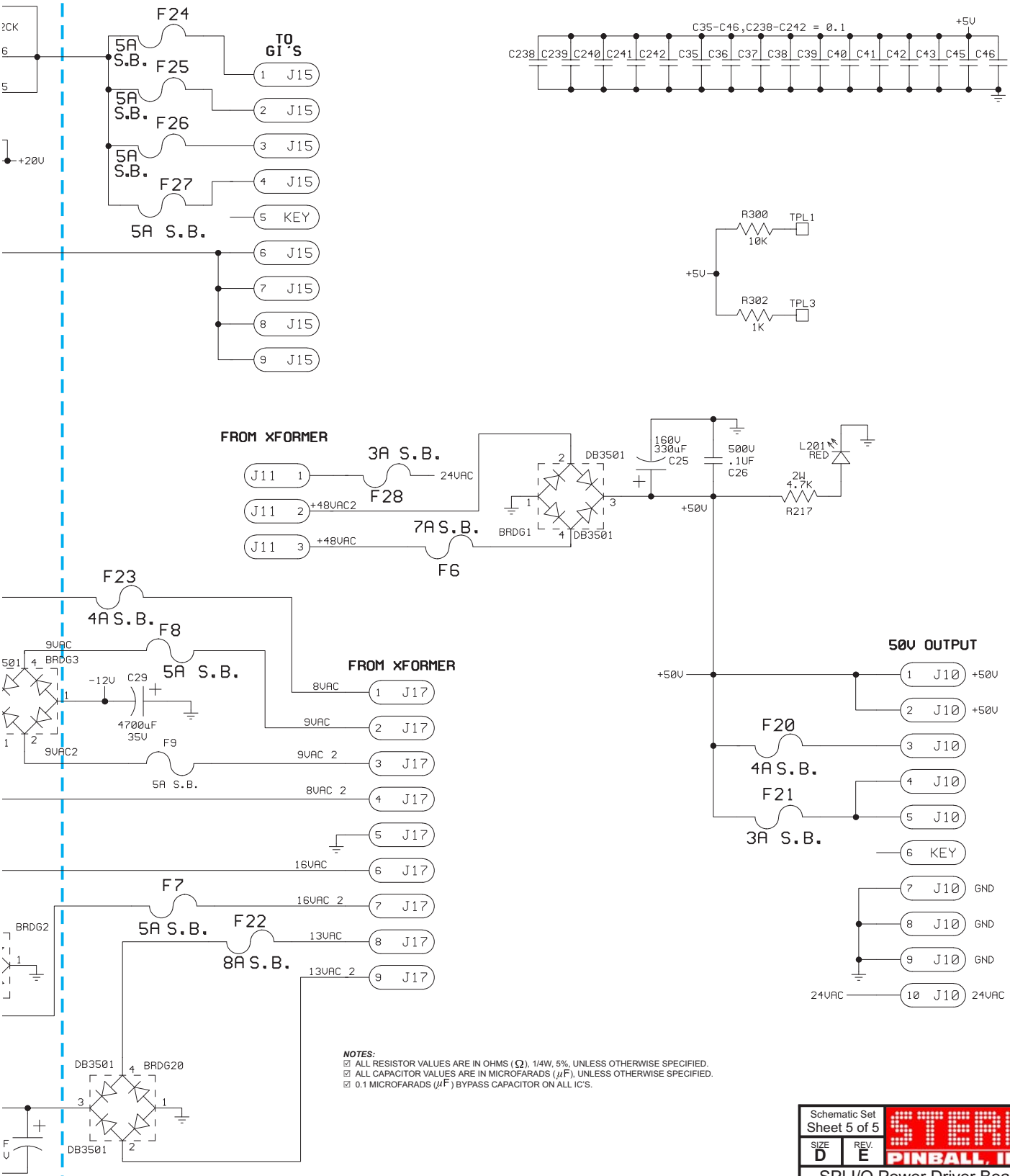
Schematic Set	Sheet 4 of 5
SIZE	D
REV.	E

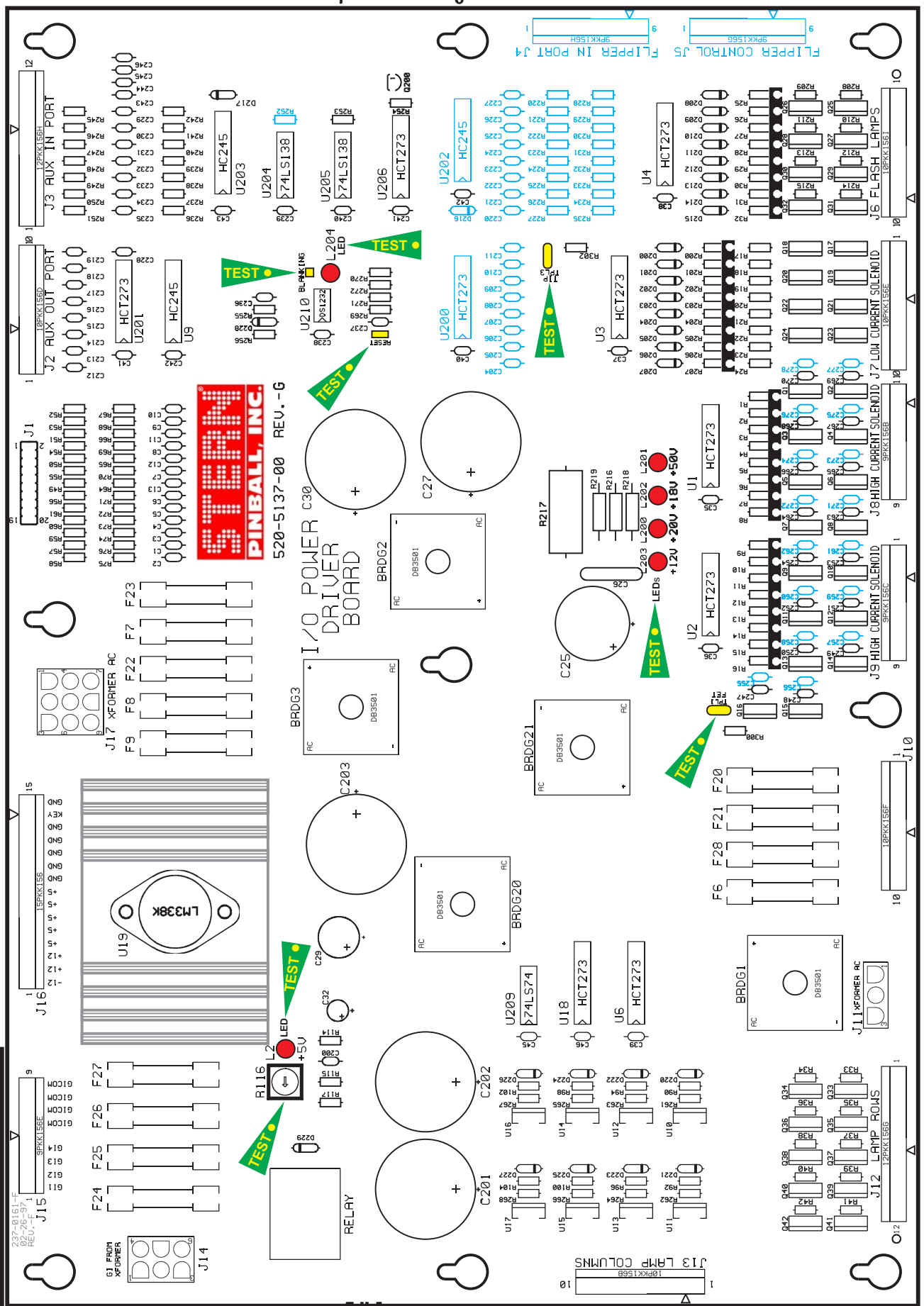
STERN PINBALL, INC.

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

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


4
3
D
C
B
A
GI'S FROM XFORMER
J14 1
J14 2
J14 3
J14 4
J14 5
J14 6
RELAY
FRL264D024/02CK
RLYDRV
D229
1N4004
+20V
(4-1C) RLYDRV
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
POWER OUT
-12V J16 1
+12V J16 2
+12V J16 3
+5V J16 4
+5V J16 5
+5V J16 6
+5V J16 7
+5V J16 8
GROUND J16 9
GROUND J16 10
GROUND J16 11
GROUND J16 12
GROUND J16 13
KEY J16 14
GROUND J16 15
R219
1k
1/4w
RED
L203
C32
100uF
25V
R114
220
L2
RED
R115
120
R116
50
R117
330
C200
0.1
LM338K U19
OUT VIN
ADJ
+10V
C203
15000uF
25V
DB3501 BRDG21
DB3501
C30
15000uF
25V
DB3501 BRDG3
9VAC
9VAC 2
-12V
TO
J7-1(LOW CURRENT SOLENOIDS)
J6-10(FLASH LAMPS)
R216
1.5K
1/2W
RED
L200
C27
15000uF
35V
DB3501 BRDG2
TO
J13-10(CONTROLLED LAMPS)
+18V
R218
1.5K
1/2W
RED
L202
C202
15000uF
25V
C201
15000uF
25V
DB3501
F2
4A S


2
1
D
C
B
A
F24
5A S.B.
F25
5A S.B.
F26
5A S.B.
F27
5A S.B.
TO GI'S
1 J15
2 J15
3 J15
4 J15
5 KEY
6 J15
7 J15
8 J15
9 J15
+20V
C35-C46,C238-C242 = 0.1
+5V
C238 C239 C240 C241 C242 C35 C36 C37 C38 C39 C40 C41 C42 C43 C45 C46
R300
10K
TPL1
+5V
R302
1K
TPL3
FROM XFORMER
J11 1
J11 2
J11 3
3A S.B.
24VAC
F28
+48VAC2
7A S.B.
+48VAC
F6
DB3501
BRDG1
160V
330uF
C25
500V
.1UF
C26
+50V
L201
RED
2W
4.7K
R217
F23
4A S.B.
F8
5A S.B.
9VAC
BRDG3
-12V
C29
4700uF
35V
9VAC2
F9
5A S.B.
FROM XFORMER
8VAC
9VAC
9VAC 2
8VAC 2
16VAC
16VAC 2
13VAC
13VAC 2
1 J17
2 J17
3 J17
4 J17
5 J17
6 J17
7 J17
8 J17
9 J17
F7
5A S.B.
F22
8A S.B.
BRDG2
DB3501
BRDG20
50V OUTPUT
+50V
F20
4A S.B.
F21
3A S.B.
1 J10 +50V
2 J10 +50V
3 J10
4 J10
5 J10
6 KEY
7 J10 GND
8 J10 GND
9 J10 GND
24VAC
10 J10 24VAC
NOTES:
☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
☑ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.
Schematic Set
Sheet 5 of 5
SIZE D
REV. E
STERN PINBALL, INC.
SPI I/O Power Driver Board
SPI Part №: 520-5137-01
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0161-00 Dated: 09/05/97


Test Points:
TEST
←TIP TPL3
←BLANKING
←L204 LED
←RESET
LEDs :
←L201+50v
←L202+18v
←L200+20v
←L203+12v
←FET TPL1
LED :
←L2+5V
←R116 POT
J4 FLIPPER IN PORT
J5 FLIPPER CONTROL
J3 AUX IN PORT
J2 AUX OUT PORT
J6 FLASH LAMPS
J7 LOW CURRENT SOLENOID
J8 HIGH CURRENT SOLENOID
J9 HIGH CURRENT SOLENOID
J10
J11 XFORMER AC
J12 LAMP ROWS
J13 LAMP COLUMNS
J14
J15
J16
J17 XFORMER AC
J1
PINBALL, INC.
520-5137-00 REV.-G
I/O POWER DRIVER BOARD
BRDG1
BRDG2
BRDG3
BRDG20
BRDG21
RELAY
U19
LM338K
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
	0	n/a	(J4, J5: NS)	
24	1	045-5013-00	J8 (Key Pin-2), J9 (Key Pin-3), J15 (Key Pin-5)	9PKK156
25	1	045-0014-03	J11	10-84-4030 (3-Pin MOLEX)
26	1	045-5015-00	J12 (Key Pin-7)	12PKK156
27	1	045-0014-06	J14	10-84-4060 (6-Pin MOLEX)
28	1	045-5016-00	J16 (Key Pin-14)	15PKK156
29	1	045-0014-09	J17	10-84-4090 (9-Pin MOLEX)
30	**6**	**165-5099-00**	**L2, L200, L201, L202, L203, L204**	**LED T1-3/4 DIFFUSER LED**
31	16	110-0106-00	Q1>Q16	22NE10L STP, Transistor
32	16	110-0067-00	Q17>Q24, Q25>Q32	TIP122
33	10	110-0088-00	Q33>Q42	19N06L STP, Transistor
34	1	110-0069-00	Q200	2N3904, Transistor.
35	32	121-5042-00	R1>R8, R9>R16, R200>R207, R208>R215	22K Ω 1/4W Res.
36	16	121-5003-00	R17>R24, R25>R32	620 Ω 1/4W Res.
37	17	121-5045-00	R33>R42, R236>R242	39K Ω 1/4W Res.
38	8	121-5021-00	R49, R57>R61, R253, R256, R270 (R252: NS)	4.7K Ω 1/4W Res.
39	11	121-5011-00	R50>R56, R255, R271, R300	10K Ω 1/4W Res.
40	13	121-5007-00	R64>R76	100 Ω 1/4W Res.
			Resistors on Solder Side @ J2-Pins: 1-3 & 5-9	
41	8	121-5029-00	R90, R92, R94, R96, R98, R100, R102, R104	6.8K Ω 1/4W Res.
42	2	121-5033-00	R114, R269	220 Ω 1/4W Res.
43	1	121-5030-00	R115	120 Ω 1/4W Res.
44	1	121-5039-00	R116	50 Ω Pot
45	2	121-5036-00	R117, R272	330 Ω 1/4W Res.
46	2	121-5038-00	R216, R218	1.5K Ω 1/2W Res.
47	1	121-5050-00	R217	4.7K Ω 2W Res. (SANDBAR)
48	1	121-5009-00	R219, 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*


BADA BING!
EPISODES
CHASE
ADVANCE # Rank
Extra Ball
Special
CRACK SAFE for ADVANCE Rank
FOOD
Start EPISODE
HBO
Super Jackpot
TO MEADOWLANDS
Boss
EPISODES
SAFE
BADA BING!
Under Boss
R. I. P.
TRUCK HEIST
SUPER JACKPOT
FOOD
MEADOWLANDS
Consigliere
Capo
Acting Capo
Good Earner
Soldier
Associate
Ranks
SHOOT AGAIN
HOLD EITHER FLIPPER FOR INSTANT INFO
HOLD EITHER FLIPPER FOR INSTANT INFO
50¢ = x1
SUPER VALUE
$2.00 = x5
THE Sopranos

CPU Section:
The **CPU** is a **68B09E** (**U209**) with up to 8 MBytes of **CPU** *Code Space* (**U210**). The **CPU** code is bank selected by the use of **U211** and each bank consists of 16 KBytes. 8 KBytes of **RAM** (**U212**) is available to the **CPU**. The RAM is battery backed and has a write protected area. Battery back up is accomplished by **3-AA Cells** (**BAT1**) Battery Pack which has a **TEST POINT (TP): VBATT** to check the battery voltage status. The write protected area consists of 512 Bytes used for storing game settings. This section of **RAM** can only be written to when the coin door is open. The Coin Door switch comes into the **CPU** on **CN6-12** and is fed into the address decoding **PAL U213**. When this memory protect signal is low writes to the protected **RAM** area are prohibited. Address decoding for the system is accomplished by one **PAL U213** and one 1-of-8 decoder **U214**.

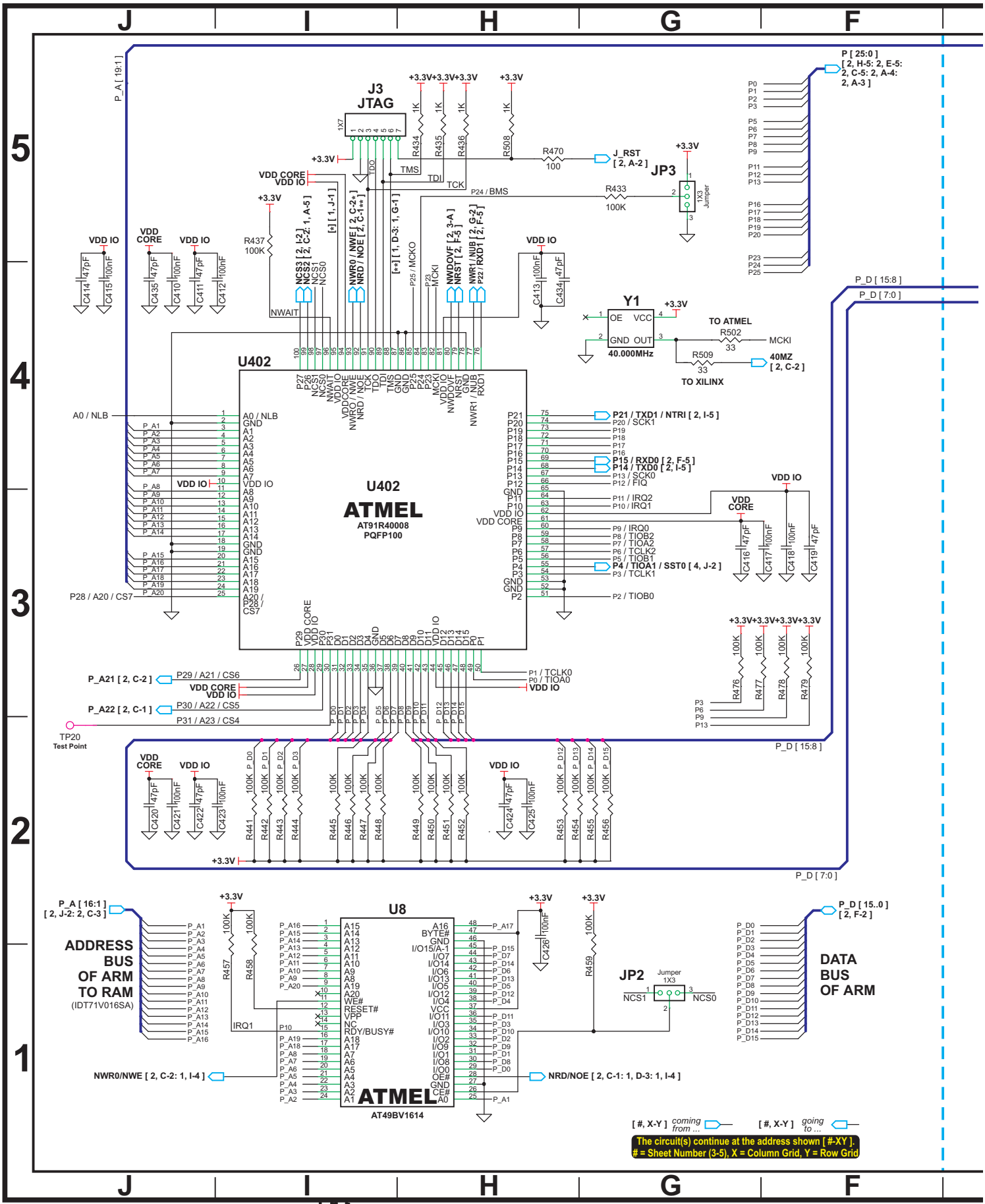
A watchdog is used to monitor the **CPU** and the 5v supply. If the 5v supply is below 4.75 the watchdog will hold the **CPU**/**Sound Board** & **I/O Board** in *reset*. The watchdog must be fed at a rate of ***250ms*** or faster. The signal used to feed the watchdog comes from the EPROM Bank select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

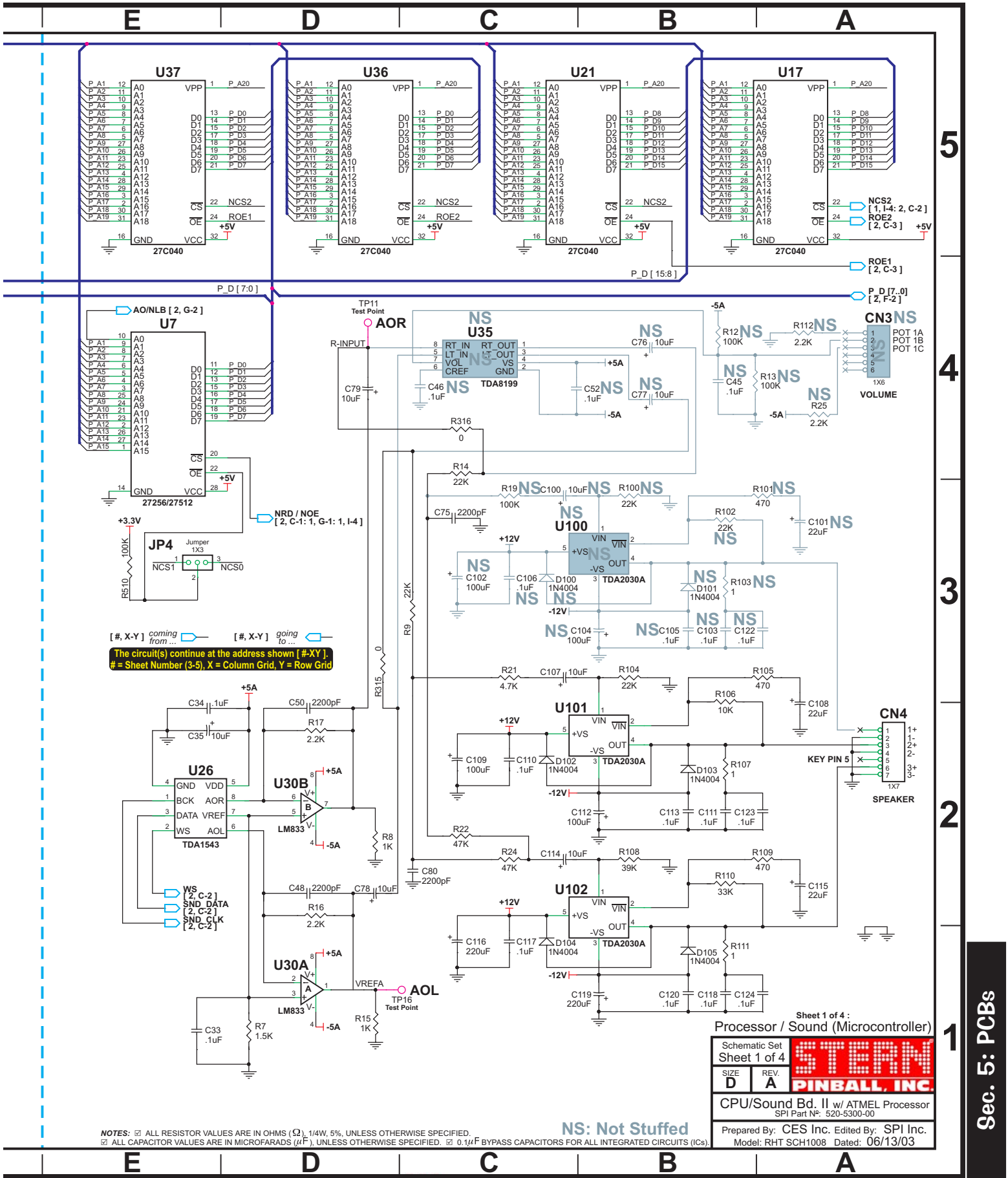
The **I/O** Interface **CN1** is buffered by two (2) **HC245** Chips (**U207 & U208**). The **CPU**'s reset line is buffered by **Q10** and fed over to the **I/O** through **CN1**. An I/*O Strobe Signal* is fed through **CN1-15** and is used to notify the **I/O** that a valid address is being sent.

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

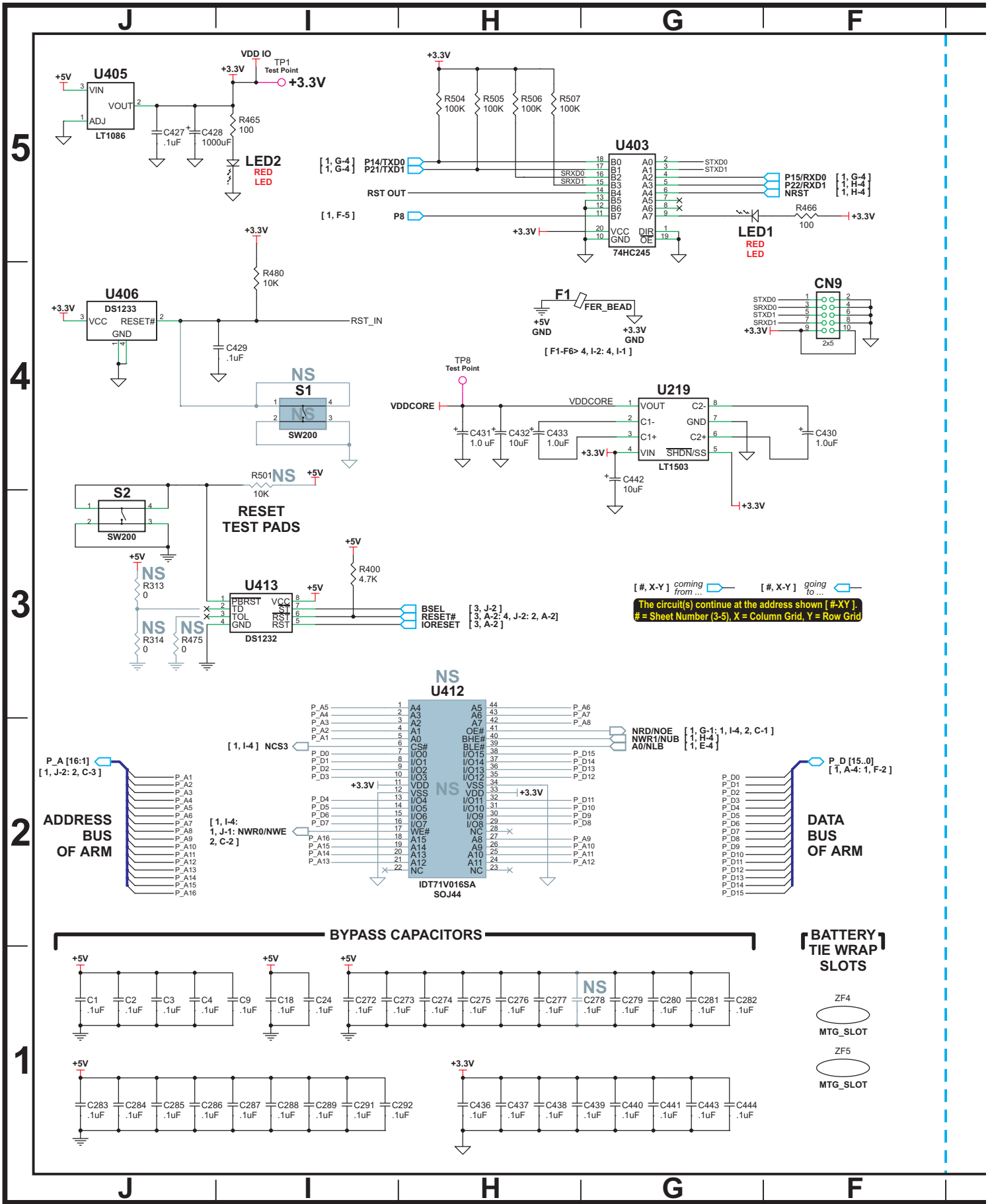
Plasma Interface:
The data path for communication to and from the **Plasma Controller Board** is 8 bits wide. There are separate *Input* and *Output Busses*. Data going out to the controller comes from the **CPU**'s *Data Bus* through **U201** and onto **CN8-Pins 11-18**. Status back from the Plasma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

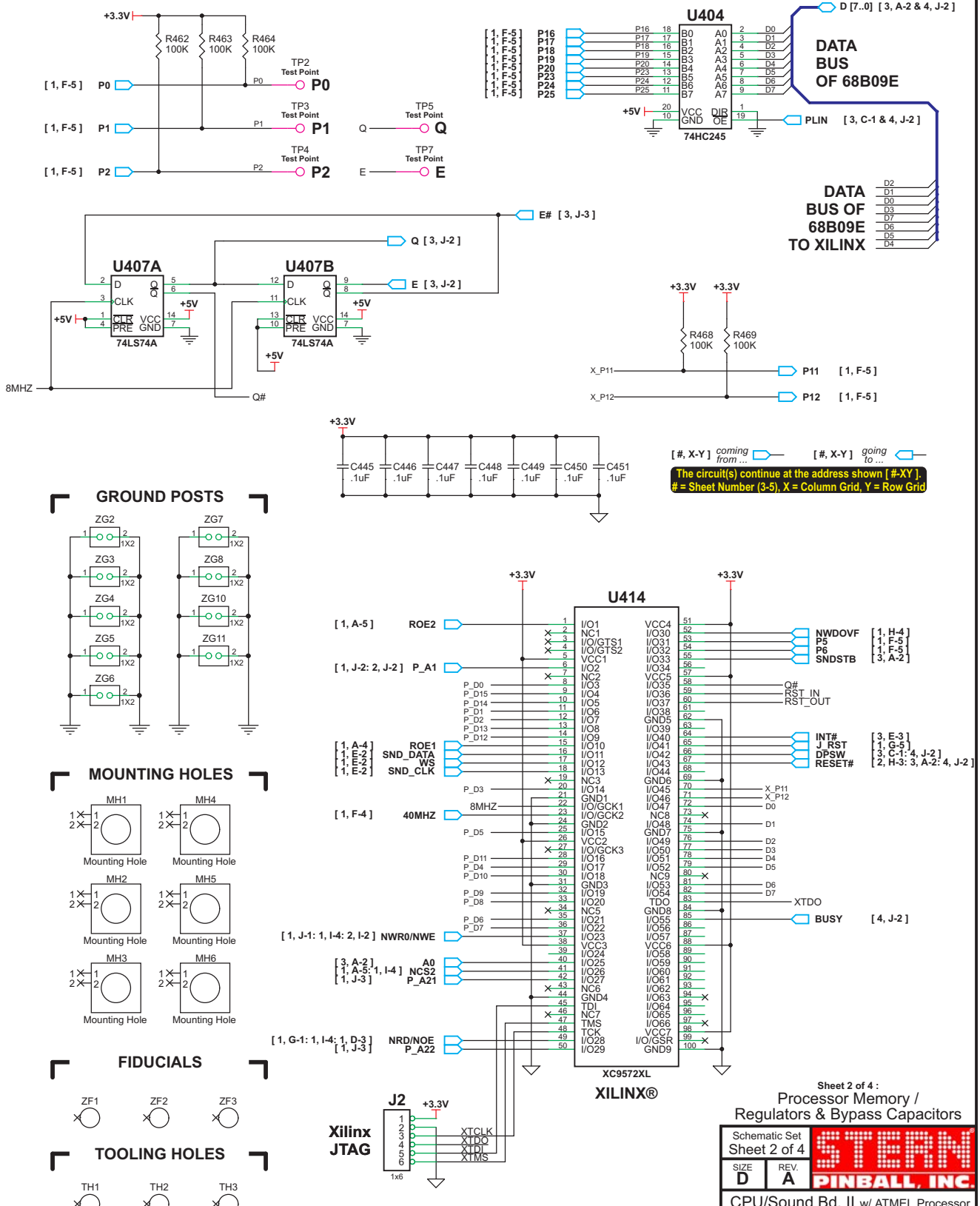
Other Test Points (TP):
TP 7: E & **TP5: Q** - The **CPU** signals for both **68B09E** processors. Should be at 2Mhz with **Q** leading **E** by ***500 nsec***. **TP2: P0. TP3: P1. TP4: P2. TP20:** *(near U402)***. TP8:** *(near U219)***. TP1: +3.3V.**


J3
JTAG
U402
ATMEL
AT91R40008
PQFP100
U8
ATMEL
AT49BV1614
JP3
JP2
Y1
40.000MHz
TO ATMEL
TO XILINX
ADDRESS BUS OF ARM TO RAM
(IDT71V016SA)
DATA BUS OF ARM
P_A [19:1]
P [25:0]
P_D [15:8]
P_D [7:0]
P_A [16:1]
P_D [15..0]
[#, X-Y] coming from ...
[#, X-Y] going to ...
The circuit(s) continue at the address shown [#-XY].
= Sheet Number (3-5), X = Column Grid, Y = Row Grid

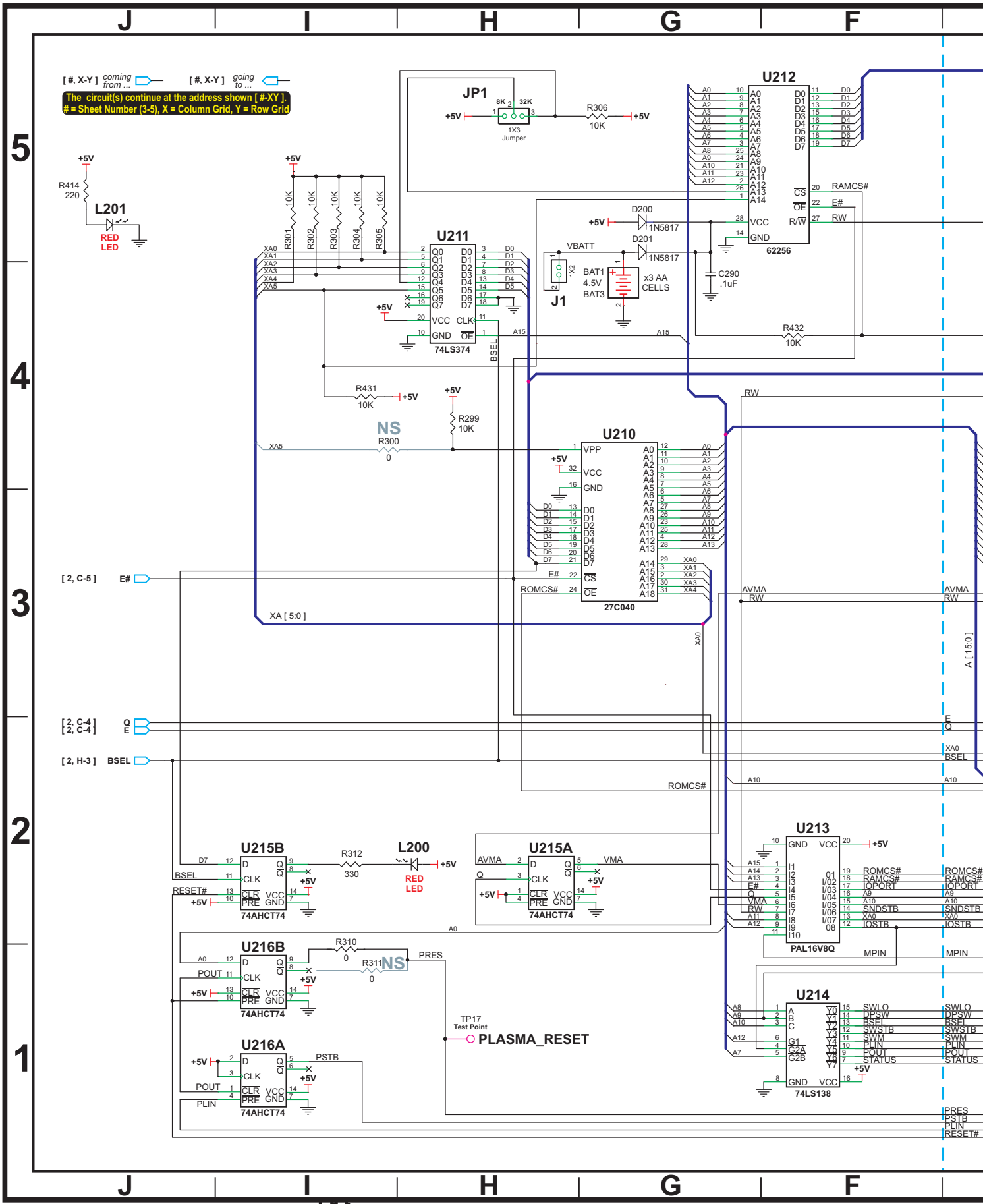


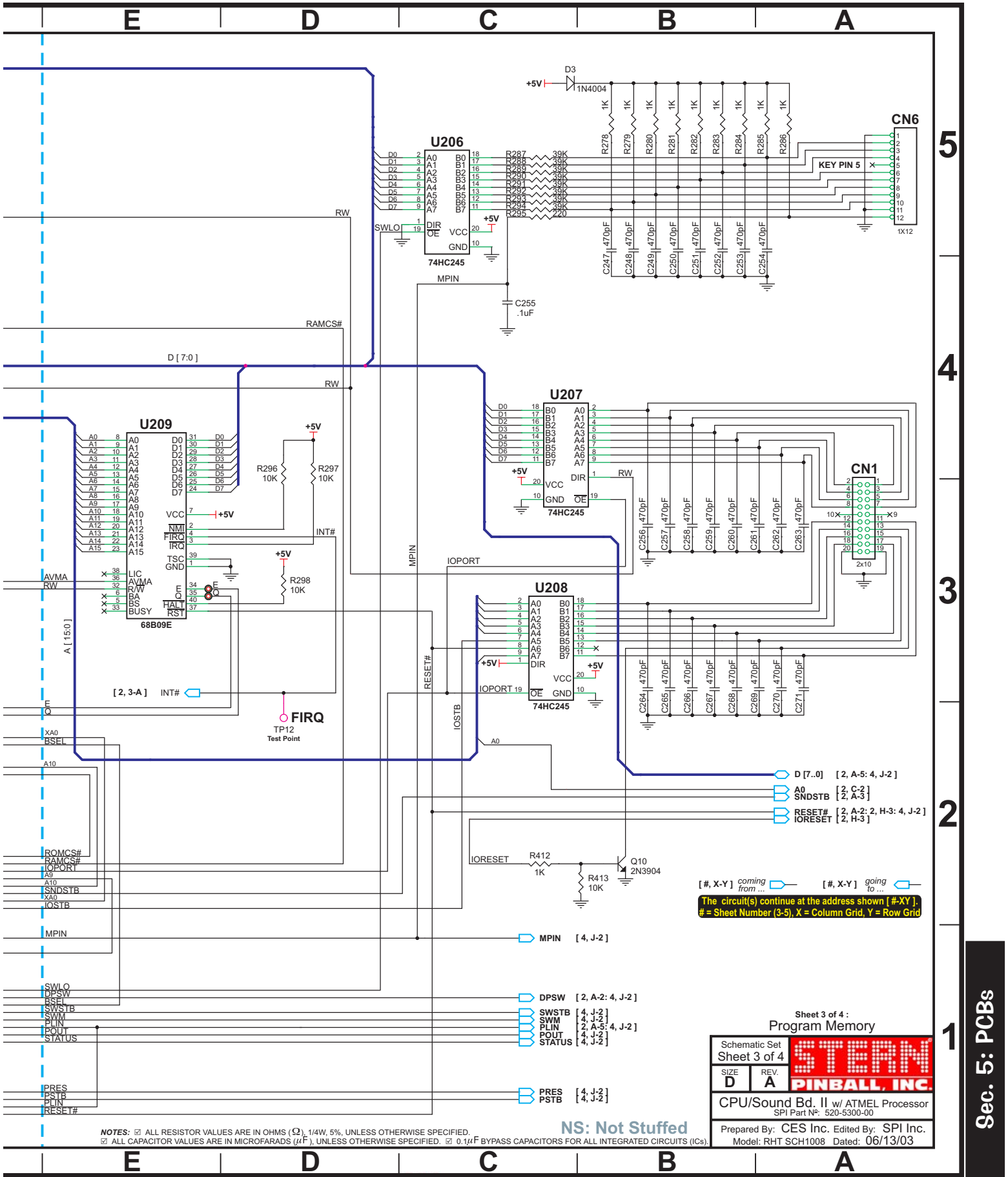
NOTES: ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED. ☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).

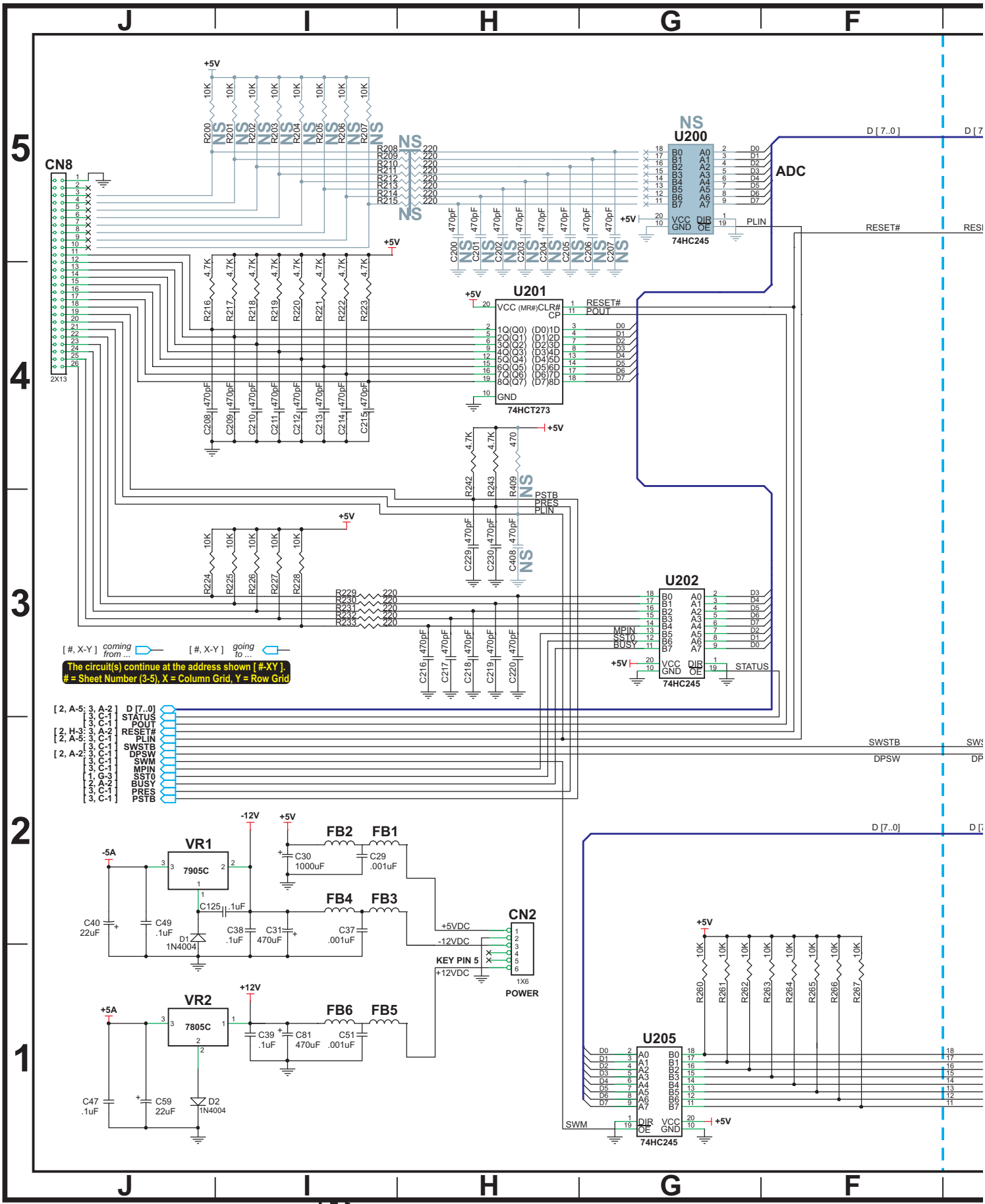

J I H G F
5
4
3
2
1
U405
LT1086
VDD IO
TP1
Test Point
+3.3V
R465
100
C427
.1uF
C428
1000uF
LED2
RED
LED
R504 100K
R505 100K
R506 100K
R507 100K
U403
74HC245
P14/TXD0
P21/TXD1
P15/RXD0
P22/RXD1
NRST
RST OUT
P8
R466
100
LED1
RED
LED
U406
DS1233
R480
10K
RST_IN
C429
.1uF
F1
FER_BEAD
CN9
2x5
S1
SW200
TP8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

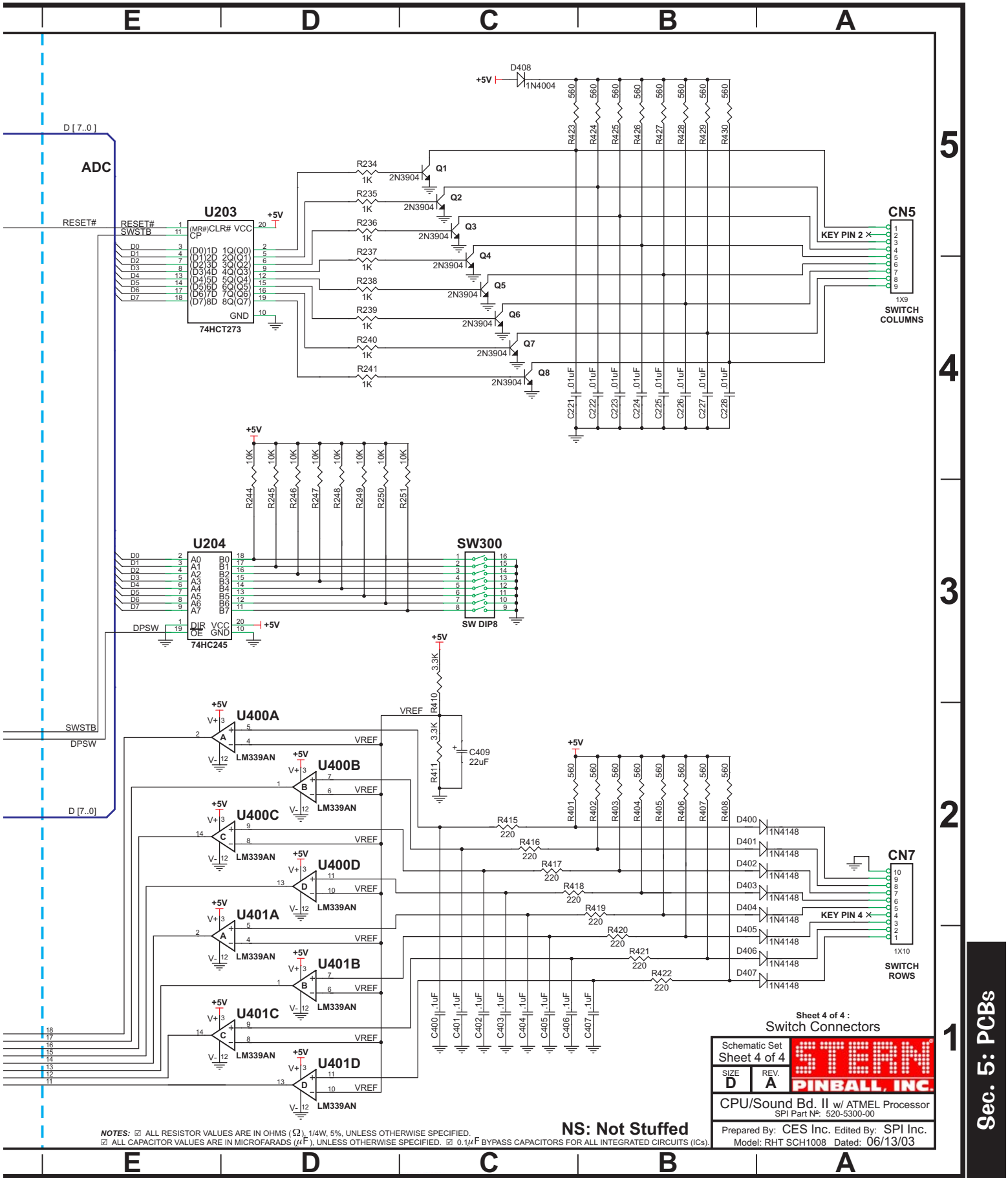


NOTES: ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED. ☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).

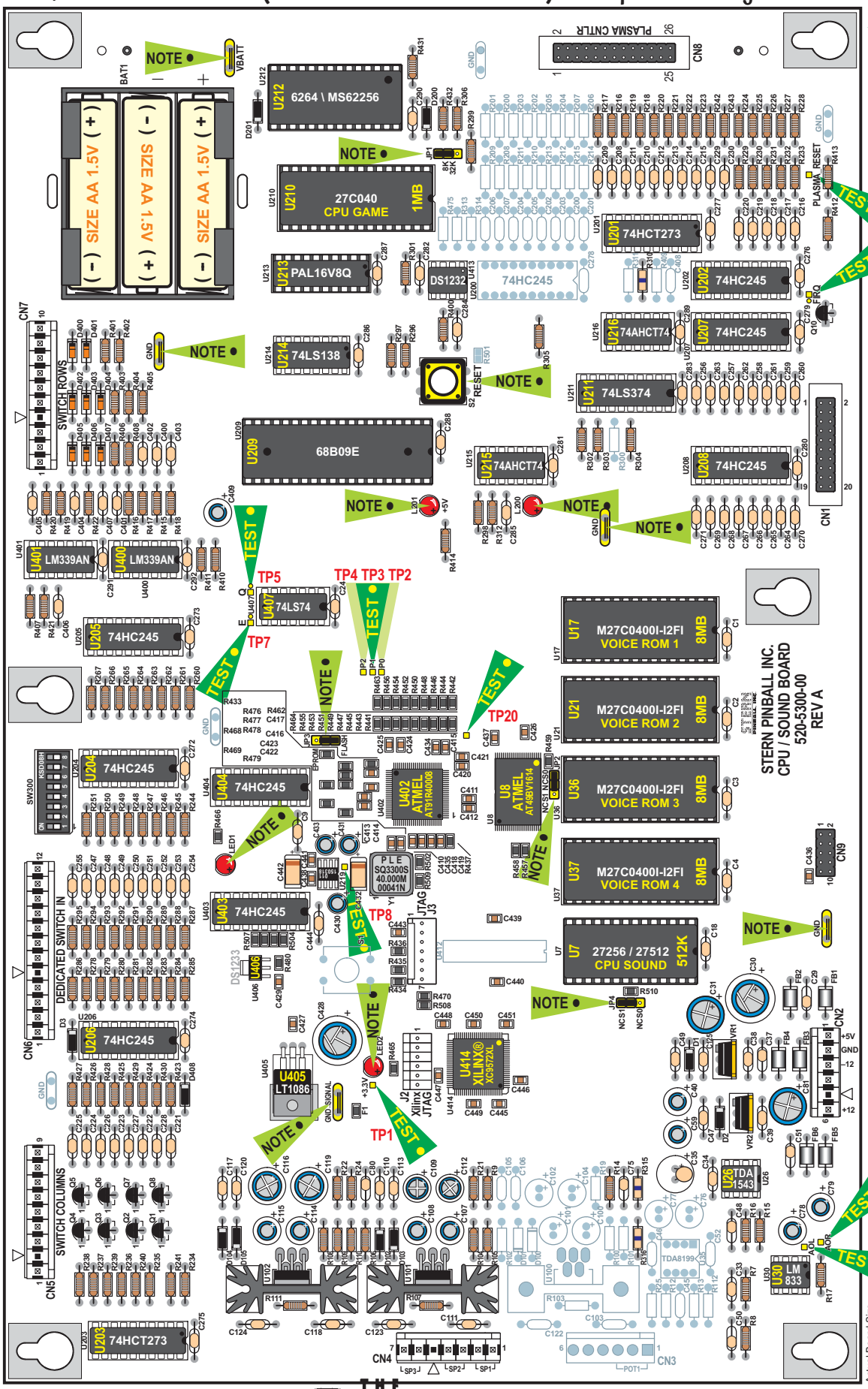

[#, X-Y] coming from ...
[#, X-Y] going to ...
The circuit(s) continue at the address shown [#-XY].
= Sheet Number (3-5), X = Column Grid, Y = Row Grid
J1
JP1
8K
32K
1X3 Jumper
R306 10K
U212
62256
RAMCS#
E#
RW
D200 1N5817
D201 1N5817
VBATT
BAT1 4.5V
BAT3
x3 AA CELLS
C290 .1uF
R432 10K
L201
R414 220
RED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


U206
74HC245
U207
74HC245
U208
74HC245
U209
68B09E
CN6
KEY PIN 5
1X12
CN1
2x10
D3
1N4004
+5V
R278 R279 R280 R281 R282 R283 R284 R285 R286
1K
R287 R288 R289 R290 R291 R292 R293 R294 R295
39K
220
C247 C248 C249 C250 C251 C252 C253 C254
470pF
C255
.1uF
SWLO
DIR
OE
VCC
GND
MPIN
RW
RAMCS#
D [7:0]
A [15:0]
R296 10K
R297 10K
R298 10K
INT#
AVMA
IOPORT
RESET#
IOSTB
A0
IORESET
R412 1K
R413 10K
Q10 2N3904
FIRQ
TP12
Test Point
[2, 3-A] INT#
D [7..0] [2, A-5: 4, J-2]
A0 [2, C-2]
SNDSTB [2, A-3]
RESET# [2, A-2: 2, H-3: 4, J-2]
IORESET [2, H-3]
[#, 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
ROMCS#
RAMCS#
IOPORT
SNDSTB
IOSTB
MPIN [4, J-2]
SWLO
DPSW
BSEL
SWSTB
SWM
PLIN
POUT
STATUS
DPSW [2, A-2: 4, J-2]
SWSTB [4, J-2]
SWM [4, J-2]
PLIN [2, A-5: 4, J-2]
POUT [4, J-2]
STATUS [4, J-2]
PRES
PSTB
PLIN
RESET#
PRES [4, J-2]
PSTB [4, J-2]
NS: Not Stuffed
NOTES: ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED. ☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).
Sheet 3 of 4 :
Program Memory
Schematic Set
Sheet 3 of 4
SIZE D
REV. A
STERN PINBALL, INC.
CPU/Sound Bd. II w/ ATMEL Processor
SPI Part №: 520-5300-00
Prepared By: CES Inc. Edited By: SPI Inc.
Model: RHT SCH1008 Dated: 06/13/03


J
I
H
G
F
5
4
3
2
1
CN8
2X13
U200
ADC
74HC245
U201
74HCT273
U202
74HC245
U205
74HC245
VR1
7905C
VR2
7805C
CN2
POWER
KEY PIN 5
1X6
D [7..0]
RESET#
PLIN
PSTB
PRES
SWSTB
DPSW
STATUS
POUT
SWM
MPIN
SST0
BUSY
+5V
-12V
-5A
+5A
+5VDC
-12VDC
+12VDC
[#, 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


E
D
C
B
A
5
4
3
2
1
D [7..0]
ADC
RESET#
SWSTB
DPSW
D [7..0]
U203
74HCT273
U204
74HC245
SW300
SW DIP8
CN5
KEY PIN 2
1X9
SWITCH COLUMNS
CN7
KEY PIN 4
1X10
SWITCH ROWS
D408
1N4004
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
2N3904
U400A
U400B
U400C
U400D
U401A
U401B
U401C
U401D
LM339AN
VREF
C409
22uF
D400
D401
D402
D403
D404
D405
D406
D407
1N4148
NS: Not Stuffed
NOTES: ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED. ☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).
Sheet 4 of 4 :
Switch Connectors
Schematic Set
Sheet 4 of 4
SIZE D
REV. A
STERN PINBALL, INC.
CPU/Sound Bd. II w/ ATMEL Processor
SPI Part №: 520-5300-00
Prepared By: CES Inc. Edited By: SPI Inc.
Model: RHT SCH1008 Dated: 06/13/03

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



Actual Board Size
14.67" X 9.125"

Test Points (TP):

TEST NOTE

←VBATT [3, G-4]

8K/32K
←JP1 [3, H-5]
←PLASMA_RESET
TP17: [3, H-1]

TP17

TP12

←FIRQ TP12: [3, D-2]

←GND

←S2 RESET [2, J-3]
SW200

LEDs
←L201 / L200
[3, J-5] & [3, H-2]
←GND

←Q TP5: [2, C-5]

←E TP7: [2, C-5]

←P2, P1, P0
TP4, TP3, TP2: [2, D-5]

←U402 TP20: [1, J-2]
JP3 [1, G-5]

←JP2 [1, G-1]

←U219 TP8: [2, H-4]

←LED1 [2, G-5]

←JTAG J3 [1, I-5]
←GND

←JP4 [1, E-3]
←JTAG J2 [2, C-1]
XILINX

←LED2 [2, I-5]
←+3.3V TP1: [2, I-5]
←GND_SIGNAL

TP11

←AOL & AOR
TP16: [1, C-1],
TP16 TP11: [1, D-4]

CPU/Sound II Board (with Atmel Processor) Parts

	ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
	—	1	520-5300-00	**CPU/Sound II Board (with Atmel Processor)**	**Complete PCB Assembly**
Connectors	01	4		JP1, JP2, JP3, JP4	3-Pin Jumper & 2-Pin Cover
	02	1	045-5015-06	CN2 (Key Pin-5)	6-Pin, 6PKK156
	03	1		J2 JTAG Xilinx®	6-Pin, ## Header
	04	1	045-5015-07	CN4 (Key Pin-5)	7-Pin, 7PKK156
	05	1		J3 JTAG	7-Pin, ## Header
	06	1	045-5013-00	CN5 (Key Pin-2)	9-Pin, 9PKK156
	07	1		CN9	10-Pin, 0.1 Header
	08	1	045-5014-01	CN7 (Key Pin-4)	10-Pin, 10PKK156
	09	1	045-5015-00	CN6 (Key Pin-5)	12-Pin, 12PKK156
	10	1	045-5015-01	CN1	20-Pin, 0.1 Header
	11	1	045-5015-26	CN8	26-Pin, 0.1 Header
	12	3	125-5043-00	C29, C37, C51	0.001uF (102), Cap.
	13	4	125-5039-00	C48, C50, C75, C80	0.0022uF *or* 2200pF, (222), Cap.
	14	8	125-5029-00	C221>C228	0.01uF (103), 100v Cap.
	15	52	125-5031-00	C1>C4, C9, C18, C24, C33, C34, C38, C39, C47, C49, C110, C111, C113, C117, C118, C120, C123, C124, C125, C255, C272>C277, C279>C292, C400>C407, C444 (C45, C46, C52, C103, C105, C106, C122, C278: NS)	0.1uF (104), Axial Cer. Cap.
	16	3		C430, C431, C433 *(near U403, U404)*	1.0uF, ##v, Radial Lytic Cap.
Capacitors*	17	1	125-5017-00	C35	10uF, 16v, Radial Tant. Cap.
	18	4	125-5017-00	C78, C79, C107, C114 (C76, C77, C100: NS)	10uF, 25v-35v, Radial Lytic Cap.
	19	2	125-5015-00	C109, C112 (C102, C104: NS)	100uF, 25v, Radial Lytic Cap.
	20	1	125-5014-00	C409	22uF, 16v, Radial Lytic Cap.
	21	4	125-5020-00	C40, C59, C108, C115 (C101: NS)	22uF, 25v, Radial Lytic Cap.
	22	2	125-5012-00	C116, C119	220uF, 25v, Radial Lytic Cap.
	23	2	125-5019-00	C31, C81	470uF, 25v, Radial Lytic Cap.
	24	39	125-5028-00	C208>C215, C216>C220, C229, C230, C247>C254, C256>C263, C264>C271 (C200>C207, C408: NS)	470pF (471), Cer. Cap.
	25	2	125-5037-00	C30, C428	1000uF, 16v, Radial Lytic Cap.
	26	17		C427, C429, C436>C441, C443, C445>C451	SMT .1uF Cap.
	27	2		C432, C442 *(near U403 & U404)*	SMT 10uF Cap.
	28	9		C411, C414, C416, C419, C420, C422, C424, C434, C435	SMT 47pF Cap.
	29	10		C410, C412, C413, C415, C417, C418, C421, C423, C425, C426	SMT 100nF Cap.
Diodes & LEDs*	30	7	112-5003-00	D1>D3, D102>D105, D408 (D100, D101: NS)	1N4004, Diode
	31	2	112-5008-00	D200, D201	1N5817, Diode
	32	8	112-0054-00	D400-D407	1N4148, Diode
	33	4	165-5099-00	**LED1, LED2, L200, L201**	**LED T1-3/4 DIFFUSER LED**
Resistors / Transistors*	34	3	124-5064-00	R310, R315, R316 (R300, R311, R313, R314, R475: NS)	0Ω Jumper Res. (1-Stripe)
	35	2	121-5041-00	R107, R111 (R103: NS)	1 Ω 1/4W Res.
	35	20	121-5009-00	R8, R15, R234>R241, R278>R286, R412	1K Ω 1/4W Res.
	36	1	121-5018-00	R7	1.5K Ω 1/4W Res.
	37	2	121-5043-00	R16, R17 (R25, R112: NS)	2.2K Ω 1/4W Res.
	38	2	121-5048-00	R410, R411	3.3K Ω 1/4W Res.
	39	12	121-5021-00	R21, R216>R223, R242, R243, R400	4.7K Ω 1/4W Res.
	40	36	121-5011-00	R106, R224>R228, R244>R251,R260>R267, R296>R299, R301>R306, R413, R431, R432 (R200>R207, R501: NS)	10K Ω 1/4W Res.
	41	3	121-5023-00	R9, R14, R104 (R100, R102: NS)	22K 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
ICs / RAMs / ROMs / EPROMs	56	1	100-5051-00	U402	**ATMEL**, AT91R40008
	57	1	100-5050-00	U8	**ATMEL**, AT49BV1614
	58	1	100-5044-00	U414	**XILINX®**, XC9572XL (programmed)
	59	1	(See Pg. DR. ❶ Table)	U7	**512K EPROM** Sound (27512)
	60	1	(See Pg. DR. ❶ Table)	U210 *(32-Pin, IC Socket, 077-5217-00)*	**1MB EPROM** CPU Game (27C040)
	61	4	(See Pg. DR. ❶ Table)	U17, U21, U36, U37 *(32-Pin, IC Socket, 077-5217-00)*	**8MB EPROM** Voice 1-4 (M27C0400I-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	74AHCT74 (14-Pin)
	66	8	100-0338-00	U202, U204, U205, U206, U207, U208, U403, U404 (U200: NS)	74HC245 (20-Pin)
	67	2	100-5012-00	U201, U203	74HCT273 (20-Pin)
	68	1	100-0037-00	U407	74LS74 (14-Pin)
	69	1	100-0148-00	U214	74LS138 (16-Pin)
	70	1	100-0064-00	U211	74LS374 (20-Pin)
	71	1	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)
Miscellaneous	81	1		Y1	40MHz Clock PLE SQ3300S
	82	1	181-5002-00	SW300	Dip Switch 8-Pos., (KSD08H Black)
	83		n/a	FB1>FB6	Ferrite Bead
	84		535-5000-10	HS2, HS3, (HS1: NS) *(over U101, U102)*	Heat Sink (AAVID 531102)
	85	1		S2 (Reset)	Push-Button Switch (B3F4000)
	86	1	545-5685-00	BAT1 HOLDER	*(Always replace all 3, Size AA 1.5v Cells, with new ones, when required)*

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

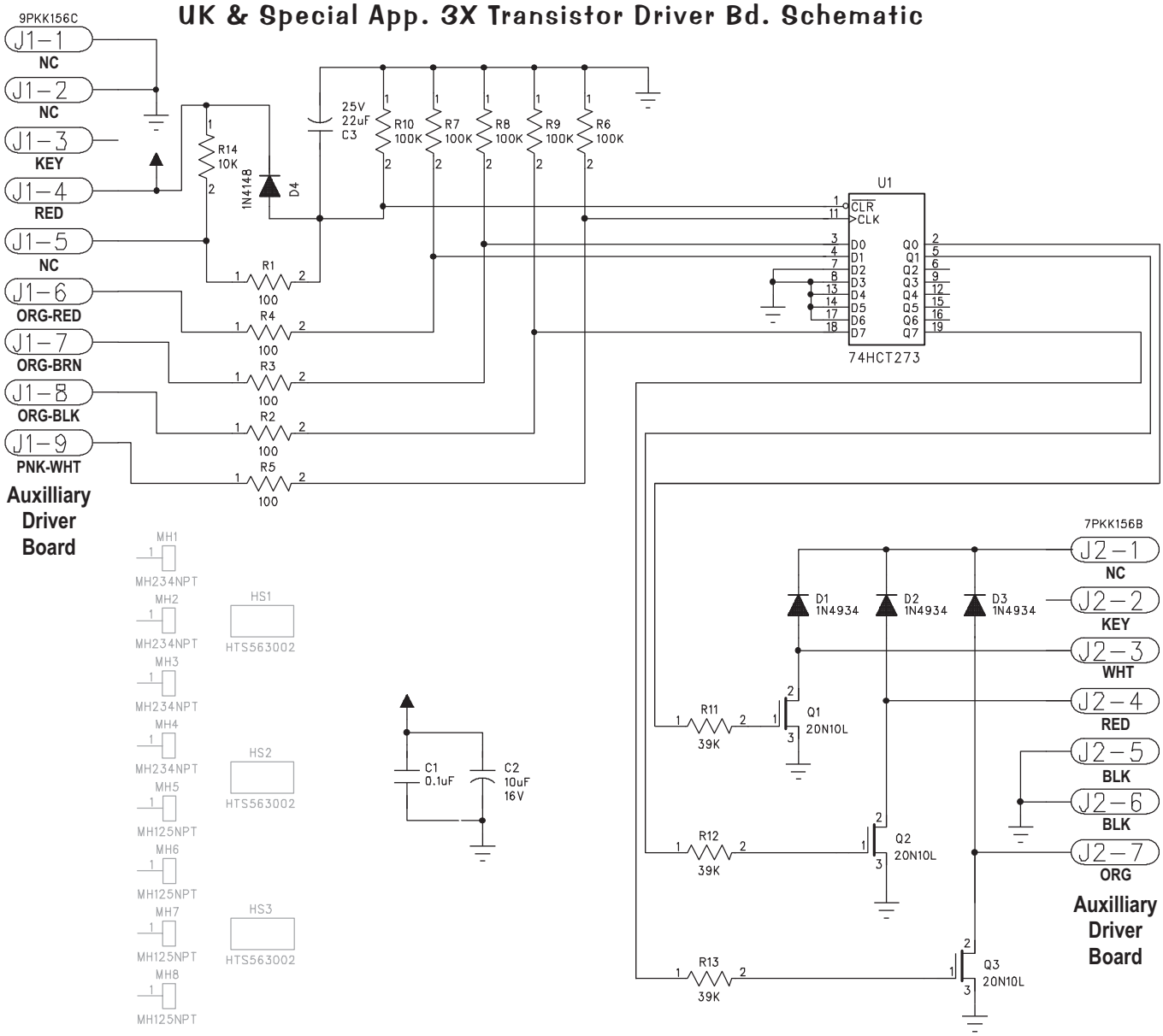
* *Surface Mounts (SMT) are not listed.*

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

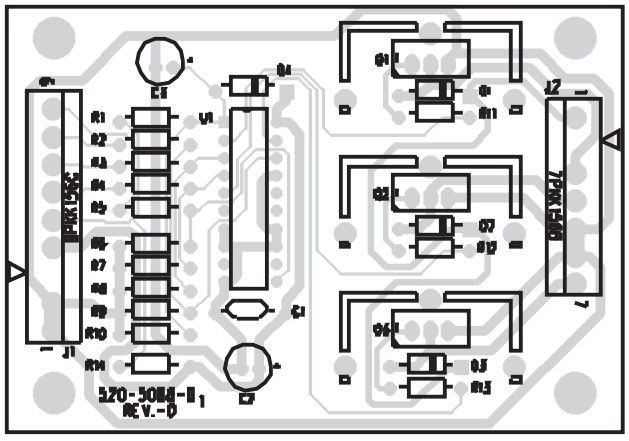
Test Point Pads:
TP1>TP5, TP7, TP8, TP11, TP12, TP16, TP17, TP20

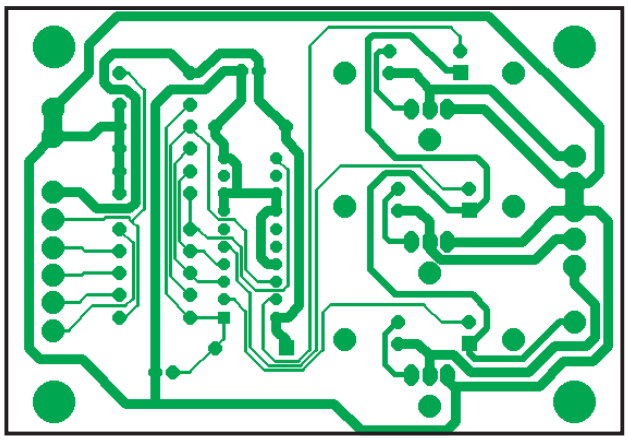
If a part is required where a part number is not provided, call Tech. Support (see back of cover).

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

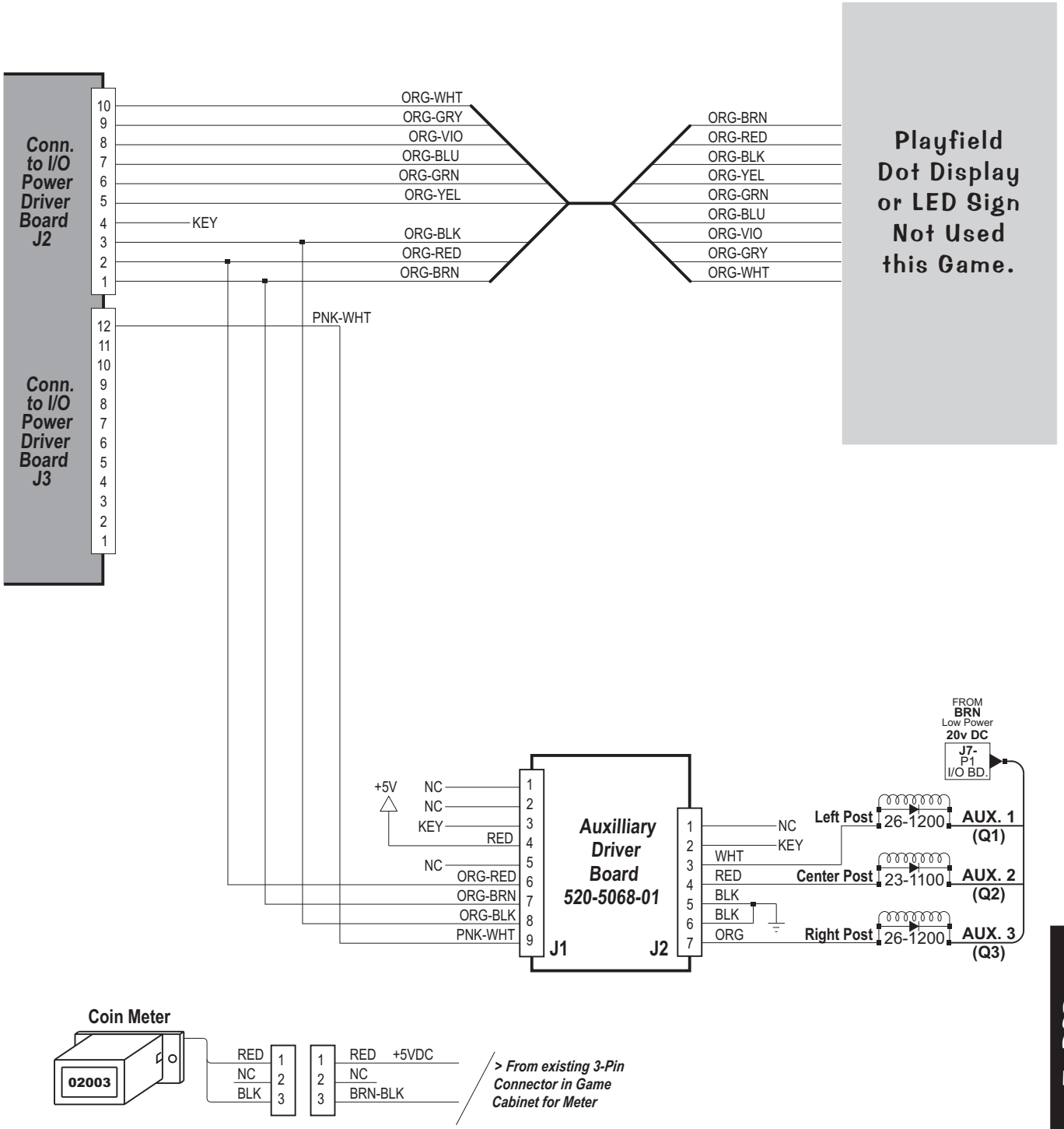


UK & Special App. 3X Transistor Driver Bd. Component Layout (Sol. Exp. Bd.)

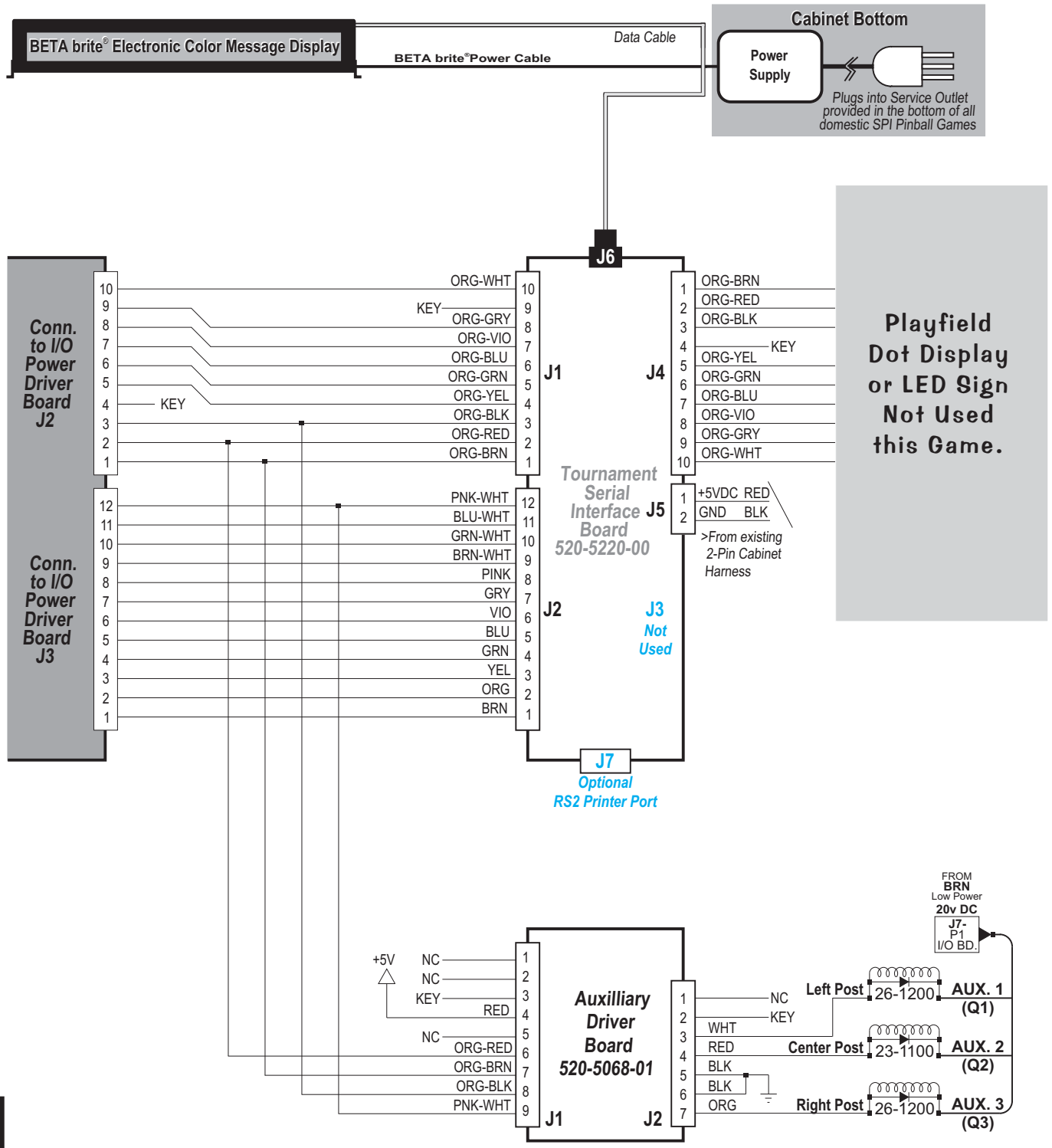




ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
—	1	520-5068-01	Solenoid Expander (x3 Transistor) PC Board	Complete PCB Assembly

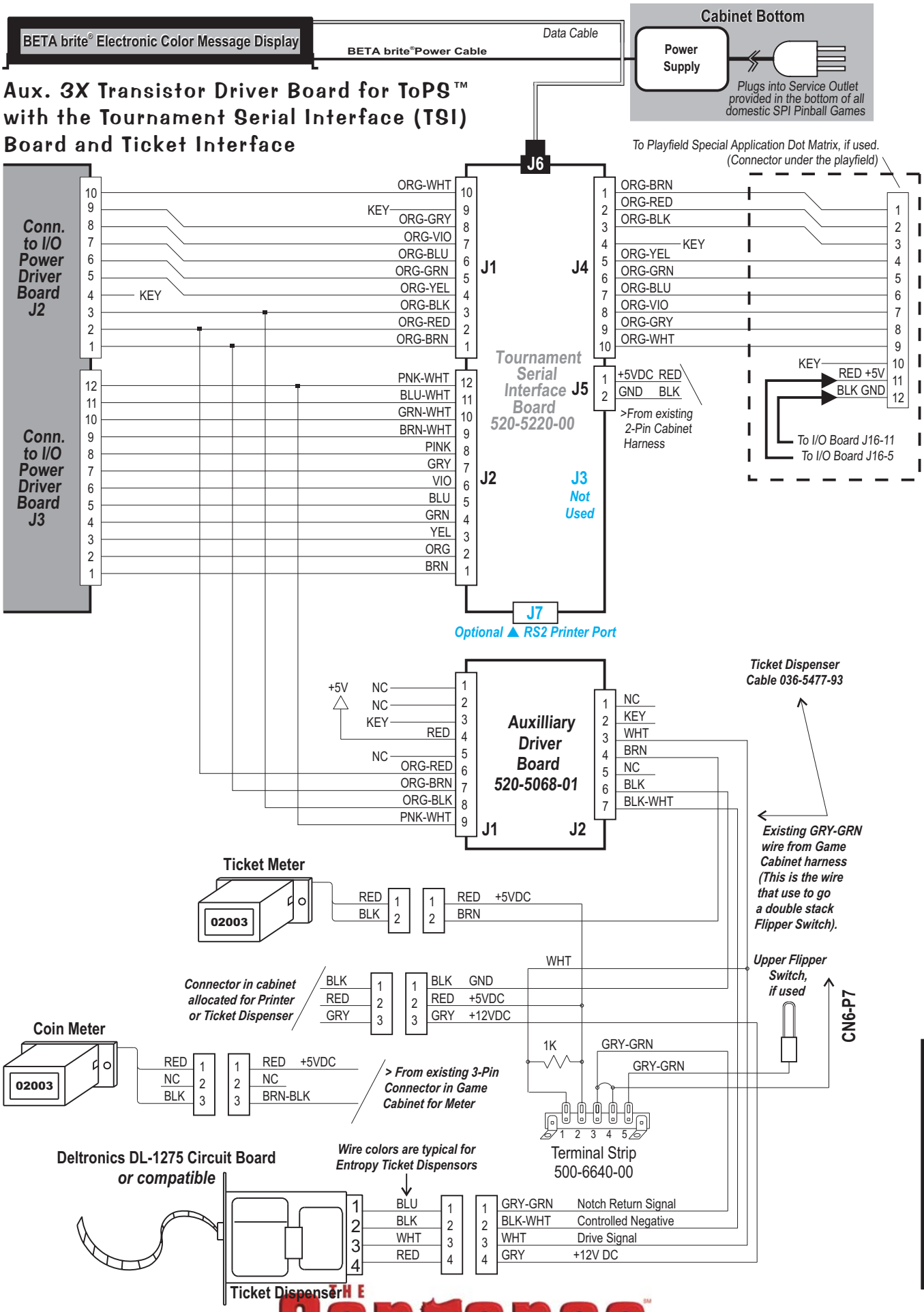

Conn. to I/O Power Driver Board J2
Conn. to I/O Power Driver Board J3
ORG-WHT
ORG-GRY
ORG-VIO
ORG-BLU
ORG-GRN
ORG-YEL
KEY
ORG-BLK
ORG-RED
ORG-BRN
PNK-WHT
ORG-BRN
ORG-RED
ORG-BLK
ORG-YEL
ORG-GRN
ORG-BLU
ORG-VIO
ORG-GRY
ORG-WHT
Playfield Dot Display or LED Sign Not Used this Game.
FROM BRN Low Power 20v DC J7-P1 I/O BD.
+5V
NC
NC
KEY
RED
NC
ORG-RED
ORG-BRN
ORG-BLK
PNK-WHT
Auxilliary Driver Board 520-5068-01
J1
J2
NC
KEY
WHT
RED
BLK
BLK
ORG
Left Post
26-1200
AUX. 1 (Q1)
Center Post
23-1100
AUX. 2 (Q2)
Right Post
26-1200
AUX. 3 (Q3)
Coin Meter
02003
RED
NC
BLK
RED +5VDC
NC
BRN-BLK
> From existing 3-Pin Connector in Game Cabinet for Meter

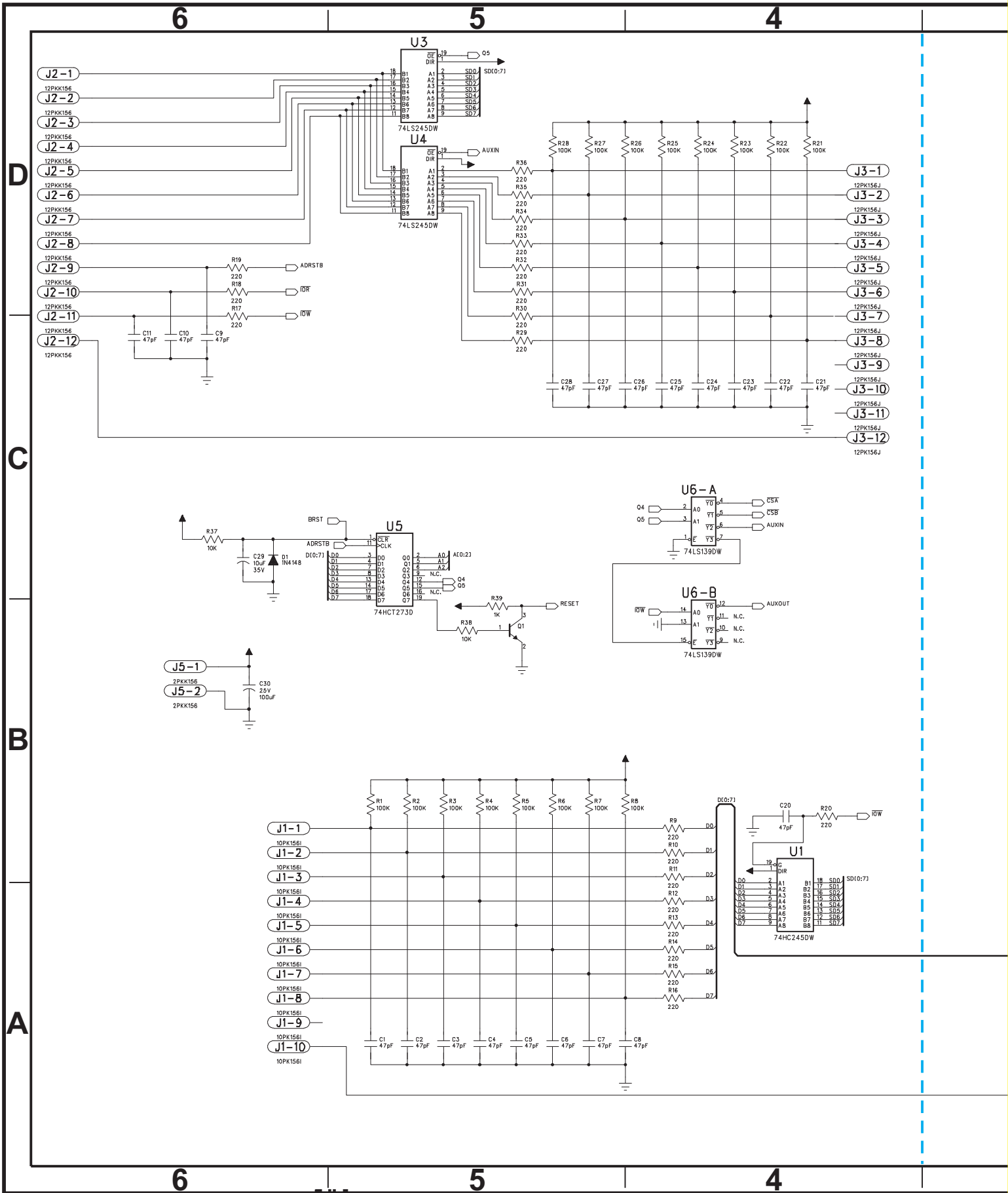
UK 3X Transistor Driver Board for Up-Posts & P/F Dot Display or LED Sign (if used) with the Tournament Serial Interface (TSI) Board

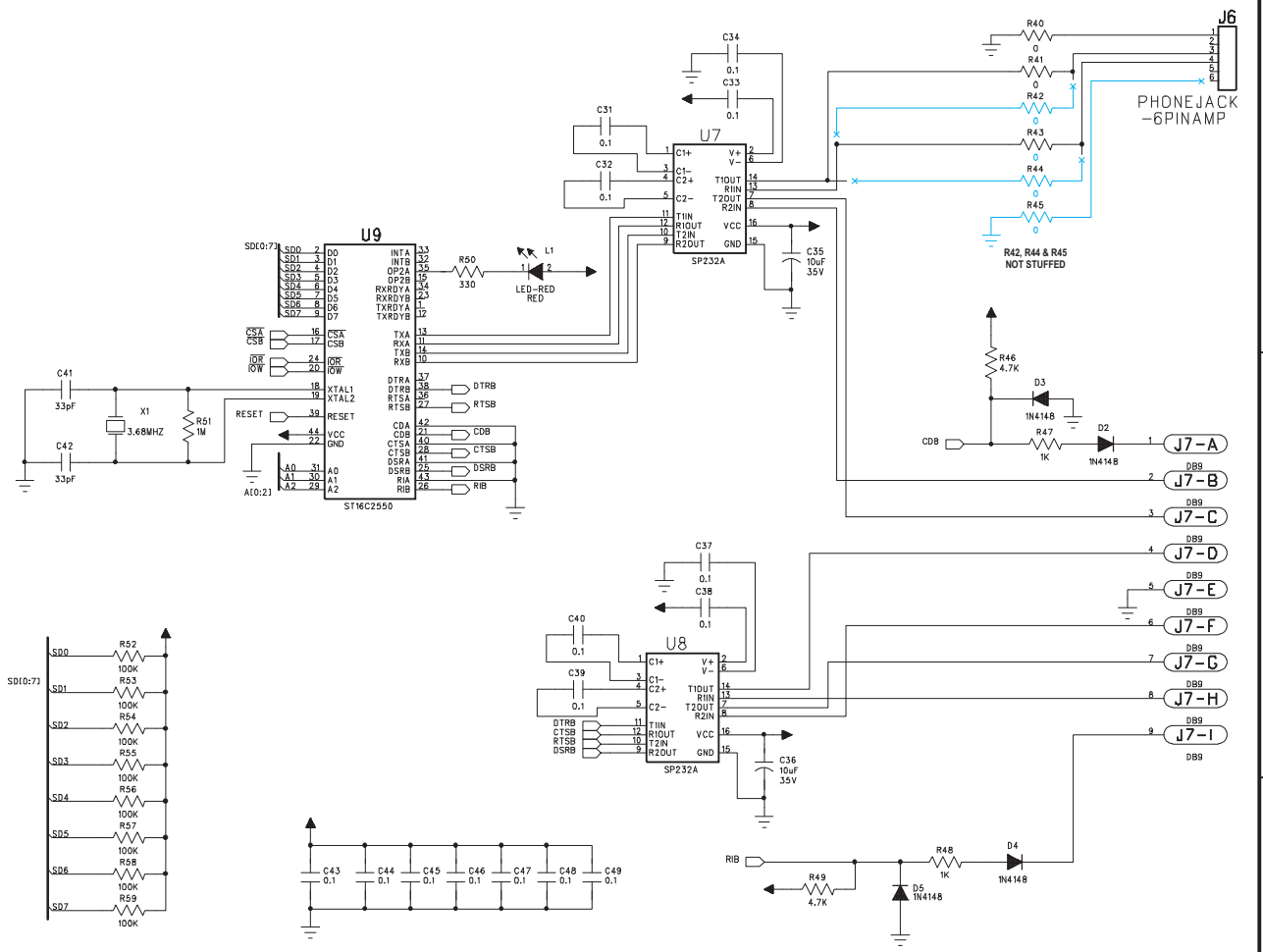


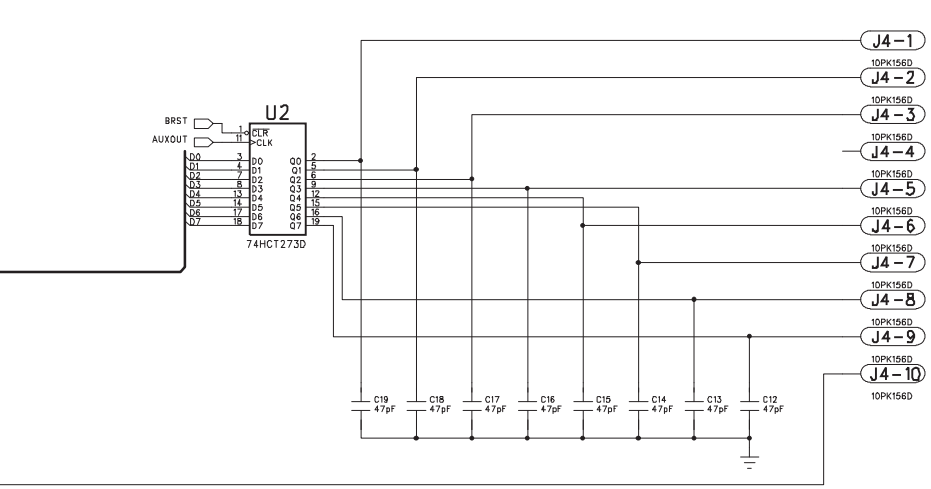
Order the Optional ToPS™ (Tournament Pinball System) Kit!
Call Technical Support at 1-800-542-5377 for more information
TOPS™ TOURNAMENT PINBALL SYSTEM

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




6
5
4
D
C
B
A
U3
74LS245DW
U4
74LS245DW
U5
74HCT273D
U6-A
74LS139DW
U6-B
74LS139DW
U1
74HC245DW
J2-1
J2-2
J2-3
J2-4
J2-5
J2-6
J2-7
J2-8
J2-9
J2-10
J2-11
J2-12
J3-1
J3-2
J3-3
J3-4
J3-5
J3-6
J3-7
J3-8
J3-9
J3-10
J3-11
J3-12
J1-1
J1-2
J1-3
J1-4
J1-5
J1-6
J1-7
J1-8
J1-9
J1-10
J5-1
J5-2
SD[0:7]
AUXIN
ADRSTB
RESET
AUXOUT
BRST
D[0:7]
A[0:2]





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

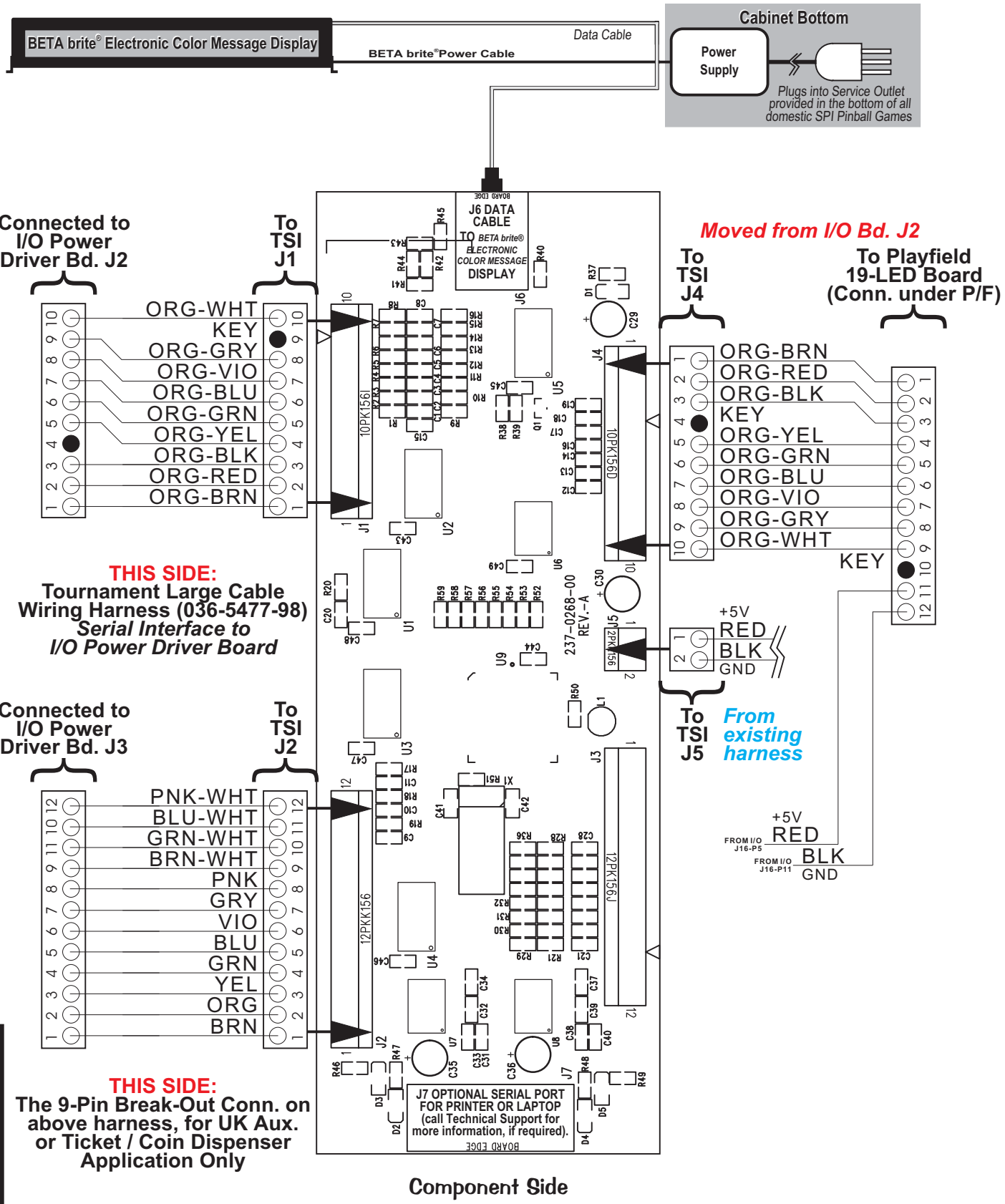
Non-Text Document

Schematic Set	Sheet 1 of 1
SIZE	D
REV.	A

STERN PINBALL, INC.

SPI Tournament Serial Interface Bd.
SPI Part №: 520-5220-00

Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0268-00 Dated: 08/2002



ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
--	1	520-5220-00	Tournament Serial Interface (TSI) Board	PCB Assembly

Appendixes A through J

Table of Contents for Appendixes

- **Appendix A : Pinball Game Firmware Table A1-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°, 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 Table E1-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 Nº	USA Ver. & Check Sum	Bd. Loc.	Raw Part Nº
Apollo 13 (Note 1)					
Game ROM	(1M)	965-0208-00	**A5.01 | $09FF**	**U210**	960-5009-00
Sound	(512K)	965-0212-00	1.00 | $5244	U7	960-7001-02
Display	(4M)	965-0213-00	**A5.00 | $B92B**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0209-00	1.00 | $7FC7	U17	n/a (masked)
Voice 2	(4M)	965-0210-00	1.00 | $8E55	U21	n/a (masked)
Voice 3	(4M)	965-0211-00	1.00 | $08EE	U36	n/a (masked)
Golden Eye (Note 1)					
Game ROM	(1M)	965-0214-42	**A4.04 | $3FFF**	**U210**	960-5009-00
Sound	(512K)	965-0217-42	1.00 | $D615	U7	960-7001-02
Display	(4M)	965-0218-42	**A4.00 | $E6ED**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0215-42	1.00 | $3E32	U17	n/a (masked)
Voice 2	(4M)	965-0216-42	1.00 | $71F0	U21	n/a (masked)
Twister (Note 2)					
Game ROM	(1M)	965-0219-41	**A4.05 | $E9FF**	**U210**	960-5009-00
Sound	(512K)	965-0221-41	1.00 | $1FFF	U7	960-7001-02
Display	(4M)	965-0222-41	**A4.00 | $FD01**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0220-41	1.00 | $3650	U17	960-5015-01
Voice 2	(4M)	965-0223-41	1.00 | $9300	U21	960-5015-01
ID4: Independence Day (Note 2)					
Game ROM	(1M)	965-0224-45	**A2.02 | $9CFF**	**U210**	960-5009-00
Sound	(512K)	965-0227-45	1.00 | $222B	U7	960-7001-02
Display	(4M)	965-0228-45	**A2.00 | $ABF7**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0225-45	1.00 | $3AE1	U17	960-5015-01
Voice 2	(4M)	965-0226-45	1.00 | $206E	U21	960-5015-01
Space Jam (Note 2)					
Game ROM	(1M)	965-0229-43	**A3.00 | $E6FF**	**U210**	960-5009-00
Sound	(512K)	965-0233-43	1.00 | $F1E7	U7	960-7001-02
Display	(4M)	965-0234-43	**A3.00 | $0057**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0230-43	1.00 | $DBA8	U17	960-5015-01
Voice 2	(4M)	965-0231-43	1.00 | $DDF1	U21	960-5015-01
Voice 3	(4M)	965-0232-43	1.00 | $F32A	U36	960-5015-01
The Star Wars Trilogy - Special Edition (S.E.) (Note 2)					
Game ROM	(1M)	965-0235-56	**A4.03 | $5EFF**	**U210**	960-5009-00
Sound	(512K)	965-0238-56	1.00 | $4A7D	U7	960-7001-02
Display	(4M)	965-0239-56	**A4.00 | $8817**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0236-56	1.00 | $E66B	U17	960-5015-01
Voice 2	(4M)	965-0237-56	1.00 | $8F54	U21	960-5015-01
The Lost World: Jurassic Park (Note 2)					
Game ROM	(1M)	965-0240-53	**A2.02 | $C8FF**	**U210**	960-5009-00
Sound	(512K)	965-0243-53	1.00 | $A35B	U7	960-7001-02
Display	(4M)	965-0244-53	**A2.01 | $7F46**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0241-53	1.00 | $1D27	U17	960-5015-01
Voice 2	(4M)	965-0242-53	1.00 | $8DA4	U21	960-5015-01
The X-Files (Note 2)					
Game ROM	(1M)	965-0245-46	**A3.03 | $A2FF**	**U210**	960-5009-00
Sound	(512K)	965-0248-46	1.00 | $6648	U7	960-7001-02
Display	(4M)	965-0249-46	**A3.00 | $66D0**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0246-46	1.00 | $349D	U17	960-5015-01
Voice 2	(4M)	965-0247-46	1.00 | $629C	U21	960-5015-01
Starship Troopers (Note 3)					
Game ROM	(1M)	965-0250-59	**A2.00 | $85FF**	**U210**	960-5009-00
Sound	(512K)	965-0253-59	1.00 | $64B2	U7	960-7001-02
Display	(4M)	965-0254-59	**A2.00 | $E77B**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0251-59	1.00 | $152A	U17	960-5015-01
Voice 2	(4M)	965-0252-59	1.00 | $0291	U21	960-5015-01
Voice 3	(4M)	965-0255-59	1.00 | $95A7	U36	960-5015-01
Viper Night Drivin' (Note 4)					
Game ROM	(1M)	965-0266-35	**A2.01 | $C5FF**	**U210**	960-5009-00
Sound	(512K)	965-0271-35	1.00 | $4DF8	U7	960-7001-02
Display	(4M)	965-0272-35	**A2.01 | $C17D**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0267-35	1.00 | $8018	U17	960-5015-01
Voice 2	(4M)	965-0268-35	1.00 | $2157	U21	960-5015-01
Voice 3	(4M)	965-0269-35	1.00 | $B5A6	U36	960-5015-01
Voice 4	(4M)	965-0270-35	1.00 | $D01E	U37	960-5015-01
Lost In Space (Note 4)					
Game ROM	(1M)	965-0282-60	**A1.01 | $B2FF**	**U210**	960-5009-00
Sound	(512K)	965-0287-60	1.00 | $A6AF	U7	960-7001-02
Display	(4M)	965-0288-60	**A1.02 | $32AB**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0283-60	1.00 | $4391	U17	960-5015-01
Voice 2	(4M)	965-0284-60	1.00 | $8215	U21	960-5015-01
Voice 3	(4M)	965-0285-60	1.00 | $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 | $0CC8	U7	960-7001-02
Display	(4M)	965-0295-40	**A2.00 | $C929**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0290-40	1.00 | $0D75	U17	960-5015-01
Voice 2	(4M)	965-0291-40	1.00 | $CCCF	U21	960-5015-01
Voice 3	(4M)	965-0292-40	1.00 | $227F	U36	960-5015-01
Voice 4	(4M)	965-0293-40	1.00 | $DB69	U37	960-5015-01
South Park (Notes 4, 5)					
Game ROM	(1M)	965-0301-71	**A1.03 | $58FF**	**U210**	960-5009-00
Sound	(512K)	965-0306-71	1.00 | $1286	U7	960-7001-02
Display	(4M)	965-0307-71	**A1.01 | $166F**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0302-71	1.00 | $7BF8	U17	960-5016-00
Voice 2	(8M)	965-0303-71	1.00 | $9CCC	U21	960-5016-00
Voice 3	(8M)	965-0304-71	1.00 | $ADD9	U36	960-5016-00
Voice 4	(8M)	965-0305-71	1.00 | $6659	U37	960-5016-00
Harley-Davidson® (Notes 4, 5, 6) *Original (1999-2001)*					
Game ROM	(1M)	965-0319-67	**A1.03 | $3EFF**	**U210**	960-5009-00
Sound	(512K)	965-0320-67	1.00 | $F4FF	U7	960-7001-02
Display	(4M)	965-0321-67	**A1.04 | $FC7C**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0322-67	1.00 | $CD26	U17	960-5016-00
Voice 2	(8M)	965-0323-67	1.00 | $9396	U21	960-5016-00
Voice 3	(8M)	965-0324-67	1.00 | $FB72	U36	960-5016-00
Voice 4	(4M)	965-0325-67	1.00 | $6100	U37	960-5015-01
▶ **Harley-Davidson® (Notes 4, 5, 6, 8) *2nd Edition (2002-2003)***					
Game ROM	(1M)	965-0319-67**A**	**A1.08 | $23FF**	**U210**	960-5009-00
Display	(4M)	965-0321-67**A**	**A1.05 | $B594**	**ROM 0**	960-5015-01
▶ **Harley-Davidson® (Notes 4, 5, 6, 8) *3rd Edition (2004)***					
Game ROM	(1M)	965-0319-87	**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)	965-0334-72	1.01 | $9796	U7	960-7001-02
Display	(4M)	965-0335-72	**A2.01 | $6C33**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0336-72	1.00 | $58EA	U17	960-5016-00
Voice 2	(8M)	965-0337-72	1.00 | $272B	U21	960-5016-00
Voice 3	(8M)	965-0338-72	1.00 | $41AE	U36	960-5016-00
High Roller Casino (Notes 4, 5)					
Game ROM	(1M)	965-0346-65	**A3.00 | $90FF**	**U210**	960-5009-00
Sound	(512K)	965-0347-65	1.00 | $581C	U7	960-7001-02
Display	(4M)	965-0348-65	**A3.00 | $74B3**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0349-65	1.00 | $E12D	U17	960-5016-00
Voice 2	(8M)	965-0350-65	1.00 | $38F4	U21	960-5016-00
Voice 3	(8M)	965-0351-65	1.00 | $1B54	U36	960-5016-00
Voice 4	(8M)	965-0352-65	1.00 | $D720	U37	960-5016-00
Austin Powers™ (Notes 4, 5)					
Game ROM	(1M)	965-0353-74	**A3.02 | $5DFF**	**U210**	960-5009-00
Sound	(512K)	965-0354-74	1.00 | $DA7B	U7	960-7001-02
Display	(4M)	965-0035-74	**A3.00 | $6A34**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0356-74	1.00 | $D2B9	U17	960-5016-00
Voice 2	(8M)	965-0357-74	1.00 | $9E75	U21	960-5016-00
Voice 3	(8M)	965-0358-74	1.00 | $51F3	U36	960-5016-00
Voice 4	(8M)	965-0359-74	1.00 | $0AE5	U37	960-5016-00
MONOPOLY® (Notes 4, 5)					
Game ROM	(1M)	965-0360-75	**A3.20 | $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	1.00 | $04D7	U36	960-5016-00
Display	(4M)	965-0376-78	**A7.01 | $8DDB**	**U5** Disp. Cntrlr.	
The Simpsons™ Pinball Party (Notes 4, 5, 7)					
Sound	(512K)	965-0381-77	1.01 | $A7EE	U7	960-7001-02
Game ROM	(1M)	965-0382-77	**A4.00 | $4FFF**	**U210**	960-5009-00
Voice 1	(8M)	965-0383-77	1.00 | $9719	U17	960-5016-00
Voice 2	(8M)	965-0384-77	1.00 | $16ED	U21	960-5016-00
Voice 3	(8M)	965-0385-77	1.00 | $ADCE	U36	960-5016-00
Voice 4	(8M)	965-0386-77	1.00 | $E7E5	U37	960-5016-00
Display	(4M)	965-0387-77	**A4.00 | $8A03**	**U5** DC PCB	960-5015-01
Terminator® 3: Rise of the Machines™ (Notes 4, 5, 7)					
Sound	(512K)	965-0388-79	1.00 | $D2FD	U7	960-7001-02
Game ROM	(1M)	965-0389-79	**A4.00 | $F8FF**	**U210**	960-5009-00
Voice 1	(8M)	965-0390-79	1.00 | $1838	U17	960-5016-00
Voice 2	(8M)	965-0391-79	1.00 | $F0D5	U21	960-5016-00
Voice 3	(8M)	965-0392-79	1.00 | $89DA	U36	960-5016-00
Voice 4	(8M)	965-0393-79	1.00 | $1200	U37	960-5016-00
Display	(4M)	965-0394-79	**A4.00 | $6E49**	**U5** DC PCB	960-5015-01
The Lord of the Rings™ (Notes 7, 8)					
Sound	(512K)	965-0401-80	1.01 | $36BC	U7	960-7001-02
Game ROM	(1M)	965-0402-80	**A10.00 | $84FF**	**U210**	960-5009-00
Voice 1	(8M)	965-0403-80	1.00 | $1792	U17	960-5016-00
Voice 2	(8M)	965-0404-80	1.00 | $67F1	U21	960-5016-00
Voice 3	(8M)	965-0405-80	1.00 | $89B6	U36	960-5016-00
Voice 4	(8M)	965-0406-80	1.00 | $EA49	U37	960-5016-00
Display	(4M)	965-0407-80	**A10.00 | $1669**	**U5** DC PCB	960-5015-01

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

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

APPENDIX A

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

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

ROM	Chip Size	Program Part Nº	USA Ver. & Check Sum	Bd. Loc.	Raw Part Nº
Ripley's Believe It or Not!® (Notes 7, 8)					
Sound	(512K)	965-0408-81	1.00 | $D93D	U7	960-7001-02
Game ROM	(1M)	965-0409-81	**A3.20 | $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 Sopranos℠ (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 | $CE0E	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) *Call for more info if code update required.*					
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 №	USA Ver.	Bd. Loc.	Raw Part №
Laser War					
CPU	(256K)	965-0004-00	LWAR.C5	C5	960-5007-00
Sound (Old)	(256K)	965-0005-00		J5	960-5007-00
Sound (Old)	(256K)	965-0006-00		J6	960-5007-00
Sound (Old)	(256K)	965-0007-00		J7	960-5007-00
			- OR -		
Sound	(256K)	965-0008-00		7F	960-5007-00
Sound 1	(512K)	965-0009-00		6F	960-7001-02
Sound 2	(512K)	965-0010-00		4F	960-7001-02
Secret Service					
CPU	(256K)	965-0011-00	A4-6	B5	960-5007-00
CPU	(256K)	965-0012-00	A4-6	C5	960-5007-00
Voice 1	(512K)	965-0014-00		6F	960-7001-02
Voice 2	(512K)	965-0015-00		4F	960-7001-02
Sound	(256K)	965-0013-00		7F	960-5007-00
Torpedo Alley					
CPU	(256K)	965-0016-00	A2-1	B5	960-5007-00
CPU	(256K)	965-0017-00	A2-1	C5	960-5007-00
Voice 1	(512K)	965-0019-00		6F	960-7001-02
Voice 2	(512K)	965-0020-00		4F	960-7001-02
Sound	(256K)	965-0018-00		7F	960-5007-00
Time Machine					
CPU	(128K)	965-0021-00	A2-4	B5	960-5006-00
CPU	(256K)	965-0022-00	A2-4	C5	960-5007-00
Voice 1	(512K)	965-0024-00		6F	960-7001-02
Voice 2	(512K)	965-0025-00		4F	960-7001-02
Sound	(256K)	965-0023-00		7F	960-5007-00
Playboy 35th Anniversary					
CPU	(256K)	965-0046-00	A2-4	B5	960-5007-00
CPU	(256K)	965-0047-00	A2-4	C5	960-5007-00
Voice 1	(512K)	965-0049-00		6F	960-7001-02
Voice 2	(512K)	965-0050-00		4F	960-7001-02
Sound	(256K)	965-0048-00		7F	960-5007-00
ABC Monday Night Football					
CPU	(128K)	965-0031-00	A2-7	B5	960-5006-00
CPU	(256K)	965-0032-00	A2-7	C5	960-5007-00
Voice 1	(512K)	965-0034-00		6F	960-7001-02
Voice 2	(512K)	965-0035-00		4F	960-7001-02
Sound	(256K)	965-0033-00		7F	960-5007-00
Robocop					
CPU	(256K)	965-0036-00	A3-4	B5	960-5007-00
CPU	(256K)	965-0037-00	A3-4	C5	960-5007-00
Voice 1	(512K)	965-0039-00		6F	960-7001-02
Voice 2	(512K)	965-0040-00		4F	960-7001-02
Sound	(256K)	965-0038-00		7F	960-5007-00
Phantom of the Opera					
CPU	(128K)	965-0026-00	A3-2	B5	960-5006-00
CPU	(256K)	965-0027-00	A3-2	C5	960-5007-00
Voice 1	(512K)	965-0029-00		6F	960-7001-02
Voice 2	(512K)	965-0030-00		4F	960-7001-02
Sound	(256K)	965-0028-00		7F	960-5007-00
Back to the Future					
CPU	(256K)	965-0041-00	A2-0	B5	960-5007-00
CPU	(256K)	965-0042-00	A2-0	C5	960-5007-00
Voice 1	(512K)	965-0044-00		6F	960-7001-02
Voice 2	(512K)	965-0045-00		4F	960-7001-02
Sound	(256K)	965-0043-00		7F	960-5007-00
The Simpsons					
CPU	(128K)	965-0051-00	A2-7	B5	960-5006-00
CPU	(256K)	965-0052-00	A2-7	C5	960-5007-00
Voice 1	(512K)	965-0054-00		6F	960-7001-02
Voice 2	(512K)	965-0055-00		4F	960-7001-02
Sound	(256K)	965-0053-00		7F	960-5007-00
Checkpoint					
CPU	(128K)	965-0056-00	A1-7	B5	960-5006-00
CPU	(256K)	965-0134-00	A1-7	C5	960-5007-00
Voice 1	(1M)	965-0057-00		F7	960-5009-00
Voice 2	(1M)	965-0058-00		F5	960-5009-00
Sound	(256K)	965-0059-00		F4	960-5007-00
Display	(512K)	965-0060-00	CP80	U8	960-7001-02
Teenage Mutant Ninja Turtles					
CPU	(128K)	965-0061-00	A1.04	B5	960-5006-00
CPU	(256K)	965-0062-00	A1.04	C5	960-5007-00
Voice 1	(1M)	965-0063-00		F5/6	960-5009-00
Voice 2	(1M)	965-0064-00		F4/5	960-5009-00
Sound	(256K)	965-0065-00		F7	960-5007-00
Display	(512K)	965-0066-00	A1.04	U8	960-7001-02
Batman					
CPU	(128K)	965-0067-00	A1.06	B5	960-5006-00
CPU	(256K)	965-0135-00	A1.06	C5	960-5007-00
Voice 1	(2M)	965-0068-00		U17	960-5010-00
Voice 2	(1M)	965-0069-00		U21	960-5009-00
Sound	(256K)	965-0070-00		U7	960-5007-00
Display	(1M)	965-0071-00	A1.06	U8	960-5009-00
Star Trek 25th Anniversary					
CPU	(512K)	965-0072-00	A2.01	C5	960-7001-02
Voice 1	(2M)	965-0073-00		U17	960-5010-00
Voice 2	(2M)	965-0074-00		U21	960-5010-00
Sound	(256K)	965-0075-00		U7	960-5007-00
Display	(1M)	965-0076-00	A1.09	U8	960-5009-00
Hook					
CPU	(512K)	965-0077-00	A4.08	C5	960-7001-02
Voice 1	(2M)	965-0078-00		U17	960-5010-00
Voice 2	(2M)	965-0079-00		U21	960-5010-00
Sound	(256K)	965-0080-00		U7	960-5007-00
Display	(1M)	965-0081-00	A4.01	U8	960-5009-00
Lethal Weapon 3					
CPU	(512K)	965-0082-00	A2.08	C5	960-7001-02
Voice 1	(2M)	965-0083-00		U17	960-5010-00
Voice 2	(2M)	965-0084-00		U21	960-5010-00
Sound	(256K)	965-0085-00		U7	960-5007-00
Display	(2M)	965-0086-00	A2.06	ROM 0	960-5010-00
Display	(2M)	965-0087-00	A2.06	ROM 1	960-5010-00
	(Used on Display PCB 520-5055-00)				
			-OR-		
Display	(4M)	965-0087-04	A2.06	ROM 0	960-5015-00
	(Used on Display PCB 520-5055-01)				
Star Wars					
CPU	(512K)	965-0119-00	A1.03	C5	960-7001-02
Voice 0	(4M)	965-0132-00		U17	960-5015-00
Voice 1	(2M)	965-0133-00		U21	960-5010-00
Sound	(256K)	965-0131-00		U7	960-5007-00
Display	(2M)	965-0120-00	A1.04	ROM 0	960-5010-00
Display	(2M)	965-0121-00	A1.04	ROM 1	960-5010-00
	(Used on Display PCB 520-5055-00)				
			-OR-		
Display	(4M)	965-0122-00	A1.05	ROM 0	960-5015-00
	(Used on Display PCB 520-5055-01)				
Rocky & Bullwinkle & Friends					
CPU	(512K)	965-0138-00	A1.30	C5	960-7001-02
Voice 0	(4M)	965-0139-00		U17	960-5015-00
Voice 1	(2M)	965-0140-00		U21	960-5010-00
Sound	(256K)	965-0141-00		U7	960-5007-00
Display	(4M)	965-0142-00	A1.30	ROM 0	960-5015-00
Jurassic Park					
CPU	(512K)	965-0143-00	A5.13	C5	960-7001-02
Voice 0	(4M)	965-0144-00		U17	960-5015-00
Voice 1	(2M)	965-0145-00		U21	960-5010-00
Sound	(256K)	965-0146-00		U7	960-5007-00
Display	(4M)	965-0147-00	A5.10	ROM 0	960-5015-00
Last Action Hero					
CPU	(512K)	965-0148-00	A1.12	C5	960-7001-02
Voice 0	(4M)	965-0149-00		U17	960-5015-00
Voice 1	(2M)	965-0150-00		U21	960-5010-00
Sound	(256K)	965-0151-00		U7	960-5007-00
Display	(4M)	965-0152-00	A1.06	ROM 0	960-5015-00
Tales from the Crypt					
CPU	(512K)	965-0157-00	A3.03	C5	960-7001-02
Voice 0	(4M)	965-0158-00		U17	960-5015-00
Voice 1	(2M)	965-0159-00		U21	960-5010-00
Sound	(256K)	965-0160-00		U7	960-5007-00
Display	(4M)	965-0161-00	A3.01	ROM 0	960-5015-00
The Who's Tommy					
CPU	(512K)	965-0162-00	A4.00	C5	960-7001-02
Voice 1	(4M)	965-0165-00		U17	960-5015-00
Voice 2	(4M)	965-0166-00		U21	960-5015-00
Voice 3	(4M)	965-0167-00		U36	960-5015-00
Voice 4	(4M)	965-0168-00		U37	960-5015-00
Sound	(512K)	965-0164-00		U7	960-7001-02
Display	(4M)	965-0163-00	A4.00	ROM 0	960-5015-00
WWF Royal Rumble					
CPU	(512K)	965-0169-00	A1.06	C5	960-7001-02
Voice 1	(4M)	965-0172-00		U17	960-5015-00
Voice 2	(4M)	965-0173-00		U21	960-5015-00
Voice 3	(4M)	965-0174-00		U36	960-5015-00
Sound	(512K)	965-0171-00		U7	960-7001-02
Display	(4M)	965-0170-00	A1.02	ROM 0	960-5015-00
Guns N' Roses					
CPU	(512K)	965-0175-00	A3.00	C5	960-7001-02
Voice 1	(4M)	965-0178-00		U17	960-5015-00
Voice 2	(4M)	965-0179-00		U21	960-5015-00
Voice 3	(4M)	965-0180-00		U36	960-5015-00
Voice 4	(4M)	965-0181-00		U37	960-5015-00
Sound	(512K)	965-0177-00		U7	960-7001-02
Display	(4M)	965-0176-00	A3.00	ROM 0	960-5015-00
Maverick *					
CPU	(512K)	965-0182-00	A4.04	C5	960-7001-02
Voice 1	(4M)	965-0186-00		U17	960-5015-00
Voice 2	(4M)	965-0187-00		U21	960-5015-00
Voice 3	(4M)	965-0187-01		U36	960-5015-00
Sound	(512K)	965-0185-00		U7	960-7001-02
Display*	(4M)	965-0183-00	A4.01	ROM 0	960-5015-00
Display*	(4M)	965-0184-00	A4.01	ROM 3	960-5015-00
Mary Shelley's Frankenstein *					
CPU	(512K)	965-0188-00	A1.03	C5	960-7001-02
Voice 1	(4M)	965-0192-00		U17	960-5015-00
Voice 2	(4M)	965-0193-00		U21	960-5015-00
Voice 3	(4M)	965-0194-00		U36	960-5015-00
Sound	(512K)	965-0191-00		U7	960-7001-02
Display*	(4M)	965-0189-00	A1.03	ROM 0	960-5015-00
Display*	(4M)	965-0190-00	A1.03	ROM 3	960-5015-00
Baywatch *	(CPU Board 520-5003-04)				
CPU	(512K)	965-0195-00	A4.00	C5	960-7001-02
Voice 1	(4M)	965-0196-00		U17	960-5015-00
Voice 2	(4M)	965-0197-00		U21	960-5015-00
Sound	(512K)	965-0199-00		U7	960-7001-02
Display*	(4M)	965-0200-00	A4.00	ROM 0	960-5015-00
Display*	(4M)	965-0201-00	A4.00	ROM 3	960-5015-00
Batman Forever *	(CPU Board 520-5003-04)				
CPU	(512K)	965-0202-00	A3.02	C5	960-7001-02
Voice 1	(4M)	965-0203-00		U17	960-5015-00
Voice 2	(4M)	965-0204-00		U21	960-5015-00
Sound	(512K)	965-0205-00		U7	960-7001-02
Display*	(4M)	965-0206-00	A3.00	ROM 0	960-5015-00
Display*	(4M)	965-0207-00	A3.00	ROM 3	960-5015-00

* ***Note:*** *Display* ***EPROMS (4M)*** *for* ***Maverick*** *thru* ***Batman Forever*** *require an access time of* ***120 Nsec*** *or faster.*

APPENDIX B

Semi-Conductors / Integrated Circuits (I.C.) / Relays Cross-Reference Table

Table №	Type	Source Number	STERN® PINBALL	N T E®	E C G®	Radio Shack®	R C A®
	RECTIFICATION, BLOCKING, DAMPENING DIODES AND/OR LIGHT EMITTING DIODES (LEDs)						
1	Diode	1N4001	112-5001-00	NTE552	ECG552	- — - — -	SK9000
	Diode	1N4004	112-5003-00	NTE116	ECG116	276-1103	SK3312
	Diode	1N5401	112-0056-00	NTE5801	ECG5801	276-1143	SK9004
	Diode	1N5404	112-5004-00	NTE5804	ECG5804	276-1144	SK9007
	Diode	T6A10L	112-5006-01	NTE5812	ECG5812	- — - — -	- — - — -
	Diode	FR302	112-5009-00	NTE588	ECG588	- — - — -	SK5014
	Diode, Signal	1N914	112-5014-00	- — - — -	- — - — -	- — - — -	- — - — -
	LED	**MT5000UR** or **TLRH180P** (T1-3/4 GaAlAs)	165-5052-00 *(old SPI Part №: 165-5100-00)*	- — - — -	- — - — -	276-066B	- — - — -
	ZENER DIODES						
2	Diode	1N4742A 12v	112-0061-00	NTE142A	ECG142A	276-563	SK12V
	Diode	1N4760B 68v	112-0062-00B	NTE5092A	ECG5092A	- — - — -	SK68V
	Diode	1N4764A 100v	112-0049-00A	NTE5096A	ECG5096A	- — - — -	SK100V
	Diode	1N5228 3.9v	112-0053-00	NTE5007A	ECG5007A	- — - — -	SK3A9
	Diode	1N5234B 6.2v	112-0047-00B	NTE5013A	ECG5013A	276-561	SK6A2
	Diode	1N5379 110v	112-0072-00	NTE5157	ECG5157	- — - — -	SK110X
	Diode	1N6267A 6.8v	112-5011-00	NTE4902	ECG4902	- — - — -	- — - — -
	Diode	1N4752A 33v	112-5010-00A	NTE147A	ECG147A	- — - — -	SK33V
	Diode	1N4736 6.8v 1w	112-5007-00	NTE5071A	ECG5071A	- — - — -	- — - — -
	TRANSISTORS - TYPE FET, NPN, PNP AND/OR SCR						
3	FET Trans.	STP20N10L	110-0106-00	NTE2987	ECG2987	- — - — -	- — - — -
	FET Trans.	STP19N06L	110-0088-00	NTE2985	ECG2985	- — - — -	- — - — -
	FET Trans.	VN02N	110-0089-00	- — - — -	- — - — -	- — - — -	- — - — -
	NPN Trans.	2N4401	110-0073-00	NTE85	ECG85	276-2009	SK3124A
	NPN Trans.	2N6427	110-0070-00	NTE48	ECG48	- — - — -	SK4906
	NPN Trans.	MJE340	110-0071-00	NTE157	ECG157	- — - — -	SK3747
	NPN Trans.	MPSA42	110-0082-00	NTE287	ECG287	- — - — -	SK3232
	NPN Trans.	2N3904	110-0069-00	NTE123AP	ECG123AP	276-2009	- — - — -
	NPN Trans.	TIP122	110-0067-00	NTE261	ECG261	276-2068	SK3896
	NPN Trans.	MJE15030	110-0101-00	NTE375	ECG375	- — - — -	SK9118
	PNP Trans.	2N5401	110-0078-00	NTE288	ECG288	- — - — -	SK3434
	PNP Trans.	MJE15031	110-0103-00	NTE292	ECG292	- — - — -	SK3441
	PNP Trans.	MJE350	110-0072-00	NTE374	ECG374	- — - — -	SK9042
	PNP Trans.	MPSA92	110-0100-00	NTE288	ECG278	- — - — -	SK3434
	PNP Trans.	TIP42	110-0068-00	NTE332	ECG332	- — - — -	SK9236
	PNP Trans.	TIP32C	110-0081-00	NTE292	ECG292	- — - — -	SK3441
	PNP Trans.	TIP36C	110-0077-00	NTE393	ECG393	- — - — -	SK3961
	SCR Trans.	2N5060	110-0074-00	NTE5400	ECG5400	276-1067	SK3950
	SCR Trans.	SCR2800B	110-0083-00	NTE5461-8	ECG5461-8	- — - — -	- — - — -
	BRIDGE RECTIFIERS (BR)			**Comments:**			
4	BR (Present)	DB3501 or CM3501	112-5000-00	For White Star I/O Bds., BR = 35 Amp @ 100v P.I.V.			
	RELAYS			**Comments:**			
5	Relay	FRL-264 D024/02CK	190-5002-00	For PPB, Power Supply, & White Star I/O Boards, Relay = 24v DC 10 Amp DPDT			
	Relay	FRL-264 D006/04CV	190-5001-00	For CPU Boards, Relay = 6v DC 5 Amp 4 Pole DT			

APPENDIX C

Production Start Date, Manual Part Nº, ROM Size & Positions and Jumper W6 Installed Note‡ (White Star Board System & 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:** U17	U21	U36	U37	Jumper Installed (‡ see Note)
*** Note:**	*For complete Appendix Information for Games **Laser War** through **Batman Forever**, see any Service Game Manual between **Apollo 13** through **Ripley's Believe It or Not!** or on-line at our website www.sternpinball.com/parts.htm; also available on CD-R, 970-2003-00 (**The Simpsons™ Pinball Party**, **T3®** and **The Lord of the Rings™**).*						
29	Apollo 13 (A13)	NOV 95 780-5044-00	4MB	4MB	4MB	Not Used	n / a
30	Golden Eye	FEB 96 780-5042-00	4MB	4MB	Not Used	Not Used	n / a
31	Twister	APR 96 780-5041-00	4MB	4MB	Not Used	Not Used	n / a
32	ID4: Independence Day	JUL 96 780-5045-00	4MB	4MB	Not Used	Not Used	n / a
33	Space Jam	OCT 96 780-5043-00	4MB	4MB	4MB	Not Used	n / a
34	The Star Wars Trilogy - Sp. Ed.	FEB 97 780-5056-00	4MB	4MB	Not Used	Not Used	n / a
35	The Lost World: Jurassic Park	JUN 97 780-5053-00	4MB	4MB	Not Used	Not Used	n / a
36	The X-Files	AUG 97 780-5046-00	4MB	4MB	Not Used	Not Used	n / a
37	Starship Troopers	NOV 97 780-5059-00	4MB	4MB	4MB	Not Used	n / a
38	Viper Night Drivin'	FEB 98 780-5035-00	4MB	4MB	4MB	4MB	n / a
39	Lost In Space	JUN 98 780-5060-00	4MB	4MB	4MB	4MB	n / a
40	Godzilla	SEP 98 780-5040-00	4MB	4MB	4MB	4MB	n / a
41	South Park	JAN 99 780-5071-00	8MB	8MB	8MB	8MB	W6
42 a	Harley-Davidson®	AUG 99 780-5067-01	8MB	8MB	8MB	8MB	W6
42 b	Harley-Davidson®2nd Ed.	SEP 02 780-5067-10	8MB	8MB	8MB	8MB	W6
42 c	Harley-Davidson® 3rd Ed.	OCT 04 780-5087-00	8MB	8MB	8MB	8MB	W6
43 a	Striker Xtreme	MAR 00 780-5068-01	8MB	8MB	8MB	8MB	W6
43 b	NFL	OCT 00 780-5073-00	8MB	8MB	8MB	8MB	W6
44	Sharkey's Shootout	JUL/OCT 00 780-5072-01	8MB	8MB	8MB	Not Used	W6
45	High Roller Casino	JAN 01 780-5065-00	8MB	8MB	8MB	8MB	W6
46	Austin Powers™	MAY 01 780-5074-00	8MB	8MB	8MB	8MB	W6
47	MONOPOLY®	SEP 01 780-5075-00	8MB	8MB	8MB	Not Used	W6
48	Playboy	FEB 02 780-5076-00	8MB	8MB	8MB	8MB	W6
49	RollerCoaster Tycoon™	AUG 02 780-5078-00	8MB	8MB	8MB	Not Used	W6
50	The Simpsons™ Pinball Party	JAN 03 780-5077-00	8MB	8MB	8MB	8MB	W6
51	T3®: Rise of the Machines™	MAY 03 780-5079-00	8MB	8MB	8MB	8MB	W6
52	The Lord of the Rings™	NOV 03 780-5080-00	8MB	8MB	8MB	8MB	
53	Ripley's Believe It or Not!®	APR 04 780-5081-00	8MB	8MB	8MB	8MB	

‡ *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			

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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 Trilolgy - 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
	MiscellaneousPC Boards:	DC Relay Bd. 520-5066-00	Shaker Mtr. Bd. 520-5065-00						
The X-Files	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32 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
	MiscellaneousPC Boards:	Relay Board 520-5010-00	Sol. Exp. Bd. 520-5192-00						
High Roller Casino	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32 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
						520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Ball Lock under Roulette	
	Miscellaneous PC Boards:	Dot Display (5X7) in Slot Mach. 520-5197-00			for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5196-00 3-Pos. OPTO	520-5195-00 3-Pos. OPTO	Up/Dn Ramp in Slot Mach.	
Austin Powers™	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32 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
	MiscellaneousPC Boards:	Relay Bd. (X3) 520-5010-00			for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Time Machine Ramp	
MONOPOLY®	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	MiscellaneousPC Boards:	DC Relay Bd. 520-5066-00	Mini-Dot Display (3 by 5X7) 520-5197-00 (Electric C° Sign)		for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5218-00 4-Pos. OPTO	520-5210-00 4-Pos. OPTO	Bank Door	

Table continued on the next page.

APPENDIX D

Board Type (White Star Board System* & 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
	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		520-5252-04 'U' 4/per PCB Drop Targets 4- & 8- Banks
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
		511-5046-00 : Mini Playfield Lamp PCB						
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**	***initial:*** 520-5002-00 ***replaced with:*** 520-5002-02 *520-5002-01 was not used.*	520-5000-00	Master: 520-5004-00 plus: 520-5005-00 (Qty. 2): 7 Digit Alpha/Numeric 520-5006-00 (Qty. 2): 7 Digit Numeric 520-5007-00 (Qty. 1): 4 Digit Numeric
• Secret Service • Torpedo Alley	3-Flipper **Board Not Required**	520-5002-02		520-5014-01 7 Digit Alpha/Numeric Combined
• Time Machine	2-Flipper **Board Not Required**			
• Playboy 35th Anniversary * • ABC Monday Night Football * • *Robocop* • *Phantom of the Opera* • *Back to the Future*	520-5033-00 2-Flipper *(*only for 100 games of Playboy 35th Anniv. & ABC Mon. Night Football)*			520-5030-00 16 Digit Alpha/Numeric Combined
• The Simpsons		520-5002-**03**		

Game Name	Flipper	Sound	Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Apllication
• Checkpoint • Teenage Mutant Ninja Turtles	520-5033-00 2-Flipper	520-5002-03	520-5047-00	520-5042-00 128 X 16				
• Batman • Star Trek 25th Anniv. • Hook		520-5050-01						
• Lethal Weapon 3			520-5047-01	520-5052-00 128 X 32	520-5055-00			
• Star Wars • Rocky & Bull-winkle & Friends		520-5050-02						
• Jurassic Park	520-5076-00 3-Flipper		520-5047-02					
• Last Action Hero	520-5070-00 2-Flipper	520-5050-03						
• Tales from the Crypt	520-5076-00 3-Flipper				520-5055-01			
• The Who's Tommy		520-5077-00						
• WWF Royal Rumble	**520-5070 / 5080 -00** 4-Flipper (2X2)							
• Guns N' Roses	520-5076-00 3-Flipper							
• Maverick		520-5050-03	520-5047-03	520-5075-00 192 X 64	520-5092-01	520-5102-00 Single OPTO	520-5103-00 Single OPTO	Paddle Boat Wheel Enter
• Mary Shelley's Frankenstein	520-5076-00 3-Flipper	520-5077-00						
• Baywatch	**520-5070 / 5080 -00** 4-Flipper (2X2)	520-5126-02				520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker
• Batman Forever	520-5076-00 3-Flipper					520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker

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

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)		
Ga.-Turn	**Res (Ω)**	**SPI Part Number and Comments**
20-400	1.0 Ω	090-5021-*use* : **-00** Diode Top
22-500	1.7 Ω	090-5017-*use* : -00 Diode Top
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
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
23-840	4.0 Ω	090-5005-*use* : -00 Diode Top
23.5-765	3.6 Ω	090-5037-*use* : -03 Diode Top
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
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
27-1300	14.2 Ω	090-5003-*use* : -0T Diode Top
27-1400	14.7 Ω	090-5015-*use* : -00 Diode Below
27-1400		**511-5031-00** *Special App.: No Diode / Lugs + Conn.*
27-1500	16.3 Ω	090-5004-*use* : -0B Diode Below // **-0T** Diode Top
29-2000	33.6 Ω	090-5016-*use* : -00 Diode Top

LARGE, MEDIUM & MINI COILS (MAGNET APPLICATIONS)		
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
24-780	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
31-1500	52.0 Ω	090-5**054**-00 : Straight Lugs + Diode + Mag Core // Mini 090-5**055**-00 : 90° Lugs + Diode + Magnet Core // Mini

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.*

LARGE COILS (FLIPPERS & SPECIAL APPLICATIONS)		
Ga.-Turn	**Res (Ω)**	**SPI Part Number and Comments**
21-900	*call* Ω	090-5020-*use* : **-01** 3-Lugs + 1N4004 & 1N5404 Diodes **-10** Diode Top <BROWN><RED>
22-750 / 30-2600	2.6 Ω / 92.0 Ω	090-5011-*use* : **-00 DUAL WND COIL** // 3-Lugs Diode x2
22-900	3.45 Ω	090-5020-*use* : -20T Diode Top <YELLOW> // **-20-ND** No Diode
22-1080	4.2 Ω	090-5032-*use* : -0B D. Below // **-0T** D. Top <YEL-GRN> **-NL** No Diode
23-620 / 30-2600	2.4 Ω / 75.0 Ω	090-5006-*use* : -00 **DUAL WND COIL** // 3-Lugs Diode x2
23-700 / 30-2600	3.0 Ω / 83.5 Ω	090-5013-*use* : -00 **DUAL WOUND COIL** // Diode Top
23-800 / 30-2600	2.4 Ω / 90.5 Ω	090-5012-*use* : -00 **DUAL WOUND COIL** // Diode Top
23-900	4.05 Ω	090-5020-*use* : -30 Diode Top <GREEN>
23-1100	5.1 Ω	090-5030-*use* : -0T Diode Top <ORANGE> **-ND** No Diode
23-1200	7.1 Ω	090-5008-*use* : -00 Diode Top <BLACK>
23-1500	4.4 Ω	090-5062-*use* : -00 Diode Top <BLUE>
24-1570	9.5 Ω	090-5025-*use* : -00 Diode Top <BLUE>
25-1400	*call* Ω	090-5067-*use* : -0T Diode Top <RED>
25-1600	*call* Ω	090-5068-*use* : -0T Diode Top <WHITE>
25-1800	13.8 Ω	090-5041-*use* : -0T Diode Top <BLUE-GREEN>

MINI COILS (RESET / TRIP APPLICATIONS)		
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.
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* (515-6110-00) : -0B Diode Below // **-0T** Diode Top *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
* **Note:** *For complete Appendix Information for Games **Laser War** through **Batman Forever**, see any Service Game Manual between **Apollo 13** through **Ripley's Believe It or Not!**; or order CD-R, 970-2003-00 (**The Simpsons™ Pinball Party**, **Terminator® 3** and **The Lord of the Rings™**).*					
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	Nº of Flippers	FLIPPERS w/E.O.S. Switch SPI Nº / GAUGE-TURNS / Color		FLIPPERS no E.O.S. Switch SPI Nº / GAUGE-TURNS / Color	
		LOWER LEFT	LOWER RIGHT	UPPER LEFT	UPPER RIGHT
Harley-Davidson® † *and 1st through 3rd Editions*	2	090-5032-0T **22-1080 -YEL-GRN-**	090-5030-0T **23-1100 -ORANGE-**	Not Used	Not Used
Striker Xtreme (NFL) †	3	090-5032-0T **22-1080 -YEL-GRN-**	090-5030-0T **23-1100 -ORANGE-**	090-5030-0T **23-1100 -ORANGE-**	Not Used
Sharkey's Shootout †	3	090-5030-0T **23-1100 -ORANGE-**	SAME	090-5030-0T **23-1100 -ORANGE-**	Not Used
High Roller Casino †	2	090-5020-20T **22-900 -YELLOW-**	090-5032-0T **22-1080 -YEL-GRN-**	Not Used	Not Used
Austin Powers™ †	2	090-5020-30 **23-900 -GREEN-**	090-5030-0T **23-1100 -ORANGE-**	Not Used	Not Used
MONOPOLY® †	3	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	090-5062-0T **23-1500 -BLUE-**
Playboy †	2	090-5030-0T **23-1100 -ORANGE-**	SAME	Not Used	Not Used
RollerCoaster Tycoon™ †	4	090-5032-0T **22-1080 -YEL-GRN-**	SAME	090-5067-0T **25-1400 -RED-**	090-5068-0T **25-1600 -WHITE-**
The Simpsons™ Pinball Party †	6** (5 with Flipper Bats)	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	090-5030-0T **23-1100 -ORANGE-**
		*** The Homer Head Assembly is affixed to an Upr. Rt. Style Flipper (no E.O.S. Switch):*	** 090-5020-20T **22-900 -YELLOW-**	**Flippers (Mini-Bats) on 2nd Level Playfield:** 090-5041-00T **25-1800 -BLU-GRN-**	090-5025-00 **24-1570 -BLUE-**
Terminator® 3: Rise of the Machines™ †	2	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
The Lord of the Rings™ †	2	090-5020-20T **22-900 -YELLOW-**	SAME	Not Used	Not Used
Ripley's Believe It or Not!® †	3	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	090-5067-00T **25-1400 -RED-**
Elvis® †	4	090-5020-20T **22-900 -YELLOW-**	SAME	090-5020-30 **23-900 -GREEN-**	SAME
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	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
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 Upr. Rt. Style Flipper (no E.O.S. Switch):*	* 090-5020-20T **22-900 -YEL-YEL-**	**Flippers (Mini-Bats) on 2nd Level Playfield:** 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 Nºs ending with a "T" signifies the Diode is on the top of the lug (on the coil-winding side); Coil Part Nºs ending with a "B" signifies the Diode is on the bottom of the lugs.

APPENDIX F

Motor Specification (White Star Board System* Only) Table

Game Name	Function	Specifications	Part Numer
Apollo 13	Rocket Up/Down Movement	Bowman Motor 24VAC 60Hz 3W 6 RPM CCW	515-6383-00 *incl. Connector*
	Moon Unit Rotational Orbit	Multi Products Motor 24VAC 50/60Hz 3W 6 RPM CCW	515-6487-00 *incl. Connector*
	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 *incl. Connector*
Twister	Spinning Disc with Magnet	Multi Products Motor 24VAC *(041-5026-00)* 50/60Hz 3W 325 RPM CCW	515-6347-00 *incl. Connector*
	Backbox Fan (Tornado Wind)	Multi Products Motor 24VAC *(041-5052-00)* 50/60Hz 3W 3600 RPM CW	515-6531-00 *incl. Connector*
ID4: Independence Day	Alien Head Open/Close Movement	Servo Motor *(94322)*	041-5045-00 *MOTOR ONLY*
SPACE JAM (NO MOTOR USED)			
The Star Wars Trilogy - S.E.	X-Wing Left/Right Movement	Bowman Motor 24VAC *(041-5058-00)* 60Hz 3W 10 RPM CCW	515-6383-01 *incl. Connector*
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 *incl. Connector*
	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 *incl. Connector* **Requires 7" Shaft:** 530-5503-00
VIPER NIGHT DRIVIN' (NO MOTOR USED)			
Lost In Space	Spinning Disc with Magnet	Multi Products Motor 24VAC *(041-5046-00)* 50/60Hz 3W 325 RPM CCW	515-6347-00 *incl. Connector*
Godzilla	Shaker ‡	Multi #3811 0630 Motor (Vibrator) 12VDC 3100 RPM CW *(w/DRL PTS)* ‡	041-5029-**01** *MOTOR ONLY*
SOUTH PARK (NO MOTOR USED)			
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 *incl. Connector*
Striker Xtreme (NFL)	Goalie (Linebacker) Left to Right Movement	Multi #3590 12VDC *(041-5075-00)* 60 RPM	515-7071-00 *incl. Connector*
Sharkey's Shootout	Mystery Ball Rotating Movement	Hankscraft Motor Model-E 24VAC *(041-5076-00)* 50/60Hz 3W 20 RPM CW	515-7095-00 *incl. Connector*
High Roller Casino	Roulette Wheel Rotating Movement	Multi Products Motor 20VDC *(041-5078-00)* 17 RPM CCW	515-7153-00 *incl. Connector*
	Up/Dn. Ramp in Slot Mach. Lift Up/Down Movement	Haydon Switch & Instrument, Inc. Stepper Motor 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 *incl. Connector* **Requires Shaft 4¼":** 530-5503-01
Austin Powers™	Time Machine Rotating Movement	Multi Products Motor 24VAC *(041-5079-00)* 50/60Hz 20RPM CCW	515-7141-00 *incl. Connector*
	Laser Beam Left to Right Directional	Autotrol Motor 24VAC *(041-5081-00)* 50/60Hz 4W 10RPM Bi-Directional	515-7171-00 *incl. Connector*
	Dr. Evil Target Lift Up/Down Movement	Hankscraft Motor Model-E 24VAC *(041-5030-00)* 50/60Hz 6RPM CCW	515-5900-00 *incl. Connector*
Monopoly®	Mini-Flipper (Waterworks) Rotating Movement	Multi Prod. Motor & Gear Box #7000 EX00159A 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 *incl. Connector* **Requires 7" Shaft:** 530-5503-00

‡ ***Please Note:*** *"-01" Shaker Motor is **Not Compatible** with old Shaker Motor 041-5029-**00** (Shaker Motor Assy. 515-5893-00). THIS NEW MOTOR CAN ONLY BE USED IN NEW SHAKER MOTOR ASSY. 515-5893-**01**.*

Table continued on the next page.

Game Name	Function	Specifications	Part 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 *incl. Connector*
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 *incl. Connector* **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 *incl. Connector*
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 **w/1" Shaft + 12" Leads**
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 Simpons™ 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 *incl. Connector*
	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 *incl. Connector*
	Shaker *(details in SKC Manual, Page **24**)*	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 #3811**R** 0630 Motor *(Vibrator)* 12VDC *(041-5029-**04**)* 3100 RPM *(w/DRL PTS)* *-04 is RoHS compliant; can substitute with -01 domestic*	511-5024-04 *incl. Connector*
	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 *incl. Connector*
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 *incl. Connector*
	▶▶▶ OPTIONAL ◀◀◀ **Shaker Motor Kit** 502-5027-00	Multi #3811**R** 0630 Motor *(Vibrator)* 12VDC *(041-5029-**04**) 3100 RPM (w/DRL PTS)* *-04 is RoHS compliant; can substitute with -01 domestic*	515-5893-01 *incl. Connector*

APPENDIX F

Motor Specification Table

The following table only list games that used motors. *Part Numbers starting with "515-" will include the Wiring Harness & Connector.*

Game Name	Function	Specifications	Part №
ABC Monday Night Football	Goal Post Up/Down Movement	Motor 24v A.C. 60 RPM CW	515-5222-00
Phantom of the Opera	Organ Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Checkpoint	Mag Wheel (in Backbox)	Motor D.C. (KEN)	041-5005-00
	Shaker	Johnson Motor (Vibrator)	041-5002-00
Teenage Mutant Ninja Turtles	Spinning Pizza Ball Deflector	Gear Motor 24v A.C. 325 RPM CW	515-5397-00
Batman	Bar Target Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Star Trek 25th Anniversary	Swinging Target	Bowman Motor 24v 22½ RPM	515-5534-00
	Transporter F/X	Gear Motor 24v A.C. 3½ RPM	500-5421-00
	Cooling Fan (for Transporter F/X)	4½" Motor 12v	041-5014-00
Lethal Weapon 3	Spinning Light	Motor 2½ v A.C. 4000 RPM CCW	041-5017-00
Star Wars	Bar Target Up/Down Movement	Bowman Motor 24v 60hz 3W 11 RPM CCW	515-5256-00
	R2D2 Robot Left/Right Movement	Bowman Motor 24v A.C. 22½ RPM CW	515-5571-00
	Death Star Rotation	Bowman "G" Motor 24v A.C. 60Hz 6 RPM CW	515-5570-00
Rocky & Bullwinkle & Friends	Nell Log "Cutting Blade" Forward/Back Movement	Autotrol Model E Motor 24v 60hz 4W 3 RPM CCW	041-5023-00
Jurassic Park	T-Rex Left/Right Movement	Multi Motor 5v D.C.	041-5025-00
	T-Rex Up/Down Movement	Bowman Motor 24v 11 RPM CW	041-5026-00
	Shaker	Johnson Motor (Vibrator)	041-5002-00
Last Action Hero	Crane Left/Right Movement	Multi Products Motor 12v D.C. #3312 OSC	041-5027-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Tales from the Crypt	Tombstone Up/Down Movement	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
The Who's Tommy	Mirror Up/Down Movement	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
	Flipper Blinders	Servo Motor (94102)	041-5032-00
	Spinning Airplane Propellers	Motor D.C.	041-5033-00
WWF Royal Rumble	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Maverick, The Movie	Turning Paddle Wheel	Motor 24v A.C. 10 RPM	041-5036-00
Mary Shelley's Frankenstein	Creature Head Left/Right Movement	Servo Motor (94102)	041-5032-00
Batman Forever	Cannon Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CCW	515-6383-00

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 (Tecates & 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- Nyliners
- 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 Nyliners
- 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** 5/8" ø **550-5000-XX**	**STARBURST CIRCULAR** 3/4" ø **550-5001-XX**	**STARBURST CIRCULAR** 1" ø **550-5002-XX**	**STARBURST CIRCULAR** 1-3/16" ø **550-5003-XX**	**STARBURST CIRCULAR** 1-1/2" ø **550-5004-XX**
STARBURST CIRCULAR 2-1/4" ø **550-5005-XX**	**STARBURST CIRCULAR** 2-3/4" ø **550-5006-XX**	**PLAIN CIRCULAR** 3/4" ø **550-5007-XX**	**PLAIN CIRCULAR** 1" ø **550-5008-XX**	**PLAIN CIRCULAR** 1-3/16" ø **550-5009-XX**	**PLAIN CIRCULAR** 1-1/2" ø **550-5010-XX**
PLAIN CIRCULAR 2-1/4" ø **550-5011-XX**	**PLAIN CIRCULAR** 2-3/4" ø **550-5012-XX**	**STIPPLE CIRCULAR** 1" ø **550-5048-XX**	**STIPPLE 1" SQUARE** 1" **550-5019-XX**	**ROLLOVER BUTTON BASE** **550-5026-XX**	**WHITE STAR** *(only in white)* **545-5015-00**
STIPPLE RECTANGULAR 1-1/2" X 3/4" **550-5018-XX**	**STIPPLE RECTANGULAR** 1-5/8" X 1-1/2" **550-5051-XX**	**STARBURST RECTANGULAR** 2-1/4" X 1-1/8" **550-5044-XX**	**PLAIN RECTANGULAR** 2-1/4" X 1-1/8" **550-5049-XX**	**PLAIN RECTANGULAR** 1-1/4" X 1-1/2" **550-5050-XX**	**PLAIN RECTANGULAR** 2" X 2-1/2" **550-5063-XX**
STARBURST MINI SHIELD 1" X 1" **550-5024-XX**	**STARBURST LARGE SHIELD** **550-5025-XX**	**MINI HOT DOG** 1-5/8" **550-5020-XX**	**BEVEL HOT DOG** 3-1/2" **550-5021-XX**	**PLAIN HOT DOG** 3-1/2" **550-5022-XX**	**BANANA** **550-5023-XX**
STARBURST ARROW-SMALL **550-5013-XX**	**STARBURST ARROW-LARGE** **550-5070-XX**	**STARBURST ARROW-HEAD SMALL** **550-5014-XX**	**STARBURST ARROW-HEAD LARGE** **550-5015-XX**	**STARBURST BULLET** **550-5016-XX**	**STARBURST TRIANGLE** **550-5017-XX**

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

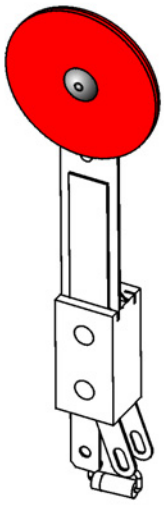
Instructions: Parts which may come in various colors (i.e. targets, some posts, playfield inserts, etc.) end in a 2-digit number which correspond to the color of that part. The "**-XX**" in part number which may come in various colors should be replaced with the desired 2-Digit number corresponding to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

PLASTIC PART COLOR CHART

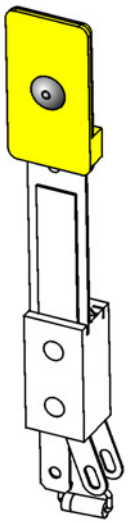
Nº	Color	Nº	Color	Nº	Color	Nº	Color	Nº	Color	Nº	Color
-00	**Black** or Solid Clear	**-03**	Amber	**-06**	Yellow	**-09**	Purple	**-12**	Fluor. Blue	**-15**	Luminescent
-01	Clear	**-04**	Green	**-07**	Orange	**-10**	Fluor. Orange	**-13**	Teal Green	**-16**	Gold
-02	Red	**-05**	Blue	**-08**	White	**-11**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

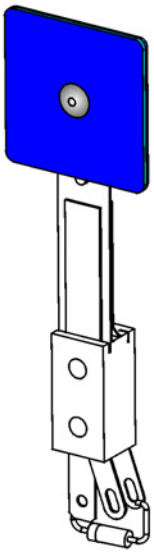
APPENDIX I

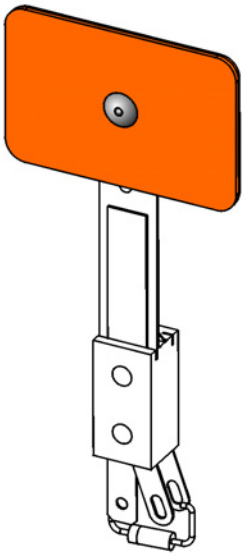
Stand-Up Targets



112-5003-00
Switch Diode, 1N4004
(all Stand-Up Targets)







515-5966-XX
1" ROUND STAND-UP
SWITCH & TARGET
RIVETED ASSEMBLY*

STANDARD ANTI-LOFT
515-5967-XX *or* **515-7581-XX**
1" X 1/2" NARROW STAND-UP
SWITCH & TARGET
RIVETED ASSEMBLY*

515-5162-XX
1" X 1" SQUARE STAND-UP
SWITCH & TARGET
RIVETED ASSEMBLY*

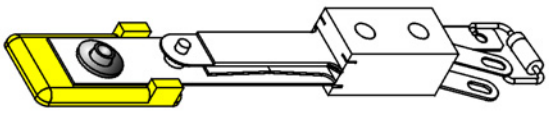
515-6027-XX
1" X 1-1/2" RECTANGLE STAND-UP
SWITCH & TARGET
RIVETED ASSEMBLY*

**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
500-6985-XX : 1" X 1/2" ANTI-LOFT 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



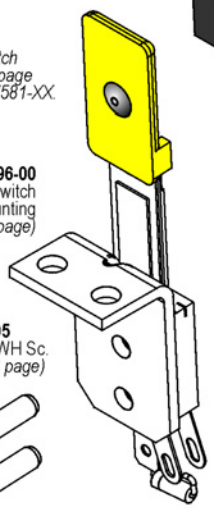
SHOWN BELOW : 500-5857-06
1" X 1/2" NARROW STAND-UP
TARGET ASSEMBLY COMPLETE

626-50**29**-00
Foam Pad, Square
.44" X .44" X .125" Thick (Self-Adhesive)**



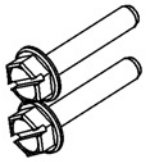
*** Note:*
Use with all Switch & Targets THIS page except for 515-7581-XX.

535-6896-00
Bracket, Switch Mounting
(all targets THIS page)



535-**6452-00**
Switch Back Plate**

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*

-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.

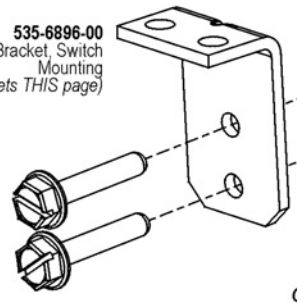
SHOWN BELOW : 500-6985-04
1" X 1/2" NARROW ANTI-LOFT
STAND-UP TARGET
ASSEMBLY COMPLETE

626-**5069**-00
Foam Pad, Rectangle
.6" X .4" X .25" Thick (Self-Adhesive) ‡

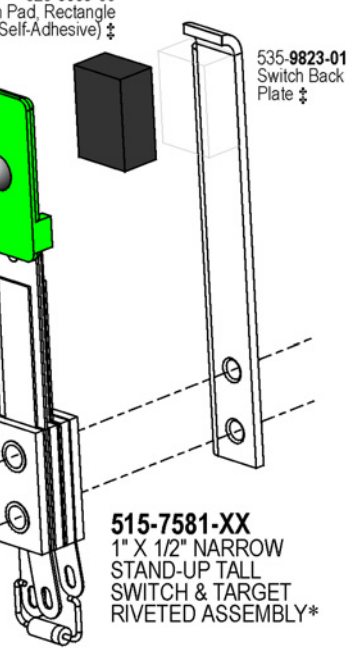
535-**9823-01**
Switch Back Plate ‡

‡ ***Note:*** *Use only with 515-7581-XX Switch & Target Assembly unless otherwise noted.*

535-6896-00
Bracket, Switch Mounting
(all targets THIS page)



237-5976-05
#6-32 X 3/4" SHWH Sc.
(all targets THIS page)

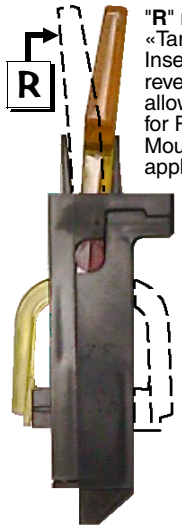


515-7581-XX
1" X 1/2" NARROW
STAND-UP TALL
SWITCH & TARGET
RIVETED ASSEMBLY*

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.*



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











-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.

Take Note:

1. **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)
2. *For location(s) and type of Stand-Up Targets used, if any, see Section **4**, Chapter **1**, Parts Identification & Location.*

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 :

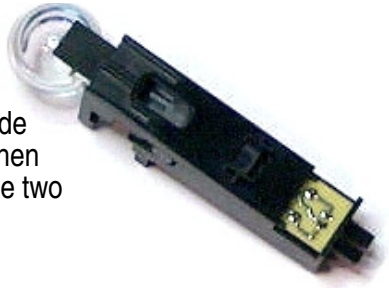
Items A-E Note: For the Target Assembly use the **"500-"** SPI Part Number(s) shown in the Parts Table below. To receive the Target Assembly with the « Target Insert » « ***R**eversed » simply add a **"R"** at the end of the Part Number. See Side View picture left to compare (dashed line shows target reversed).* For just the «Target Insert» use the **"545-"** SPI Part Number.

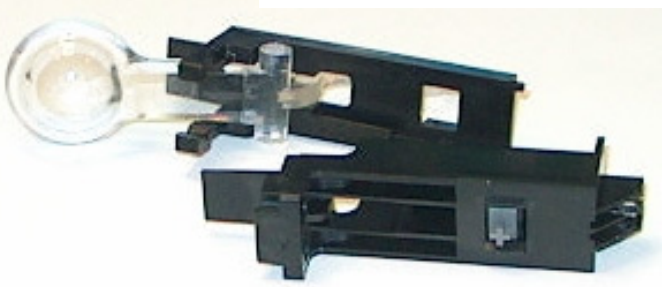


To reverse it yourself or to just change the insert:

1. 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.

2. 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.





3. 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.*

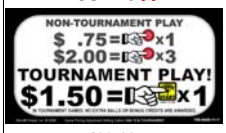
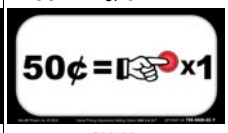
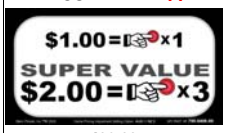
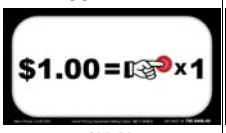
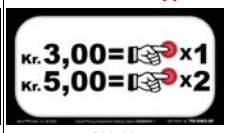
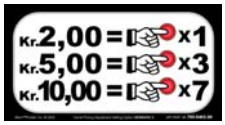
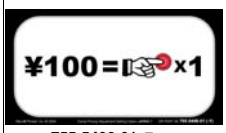
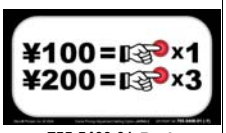
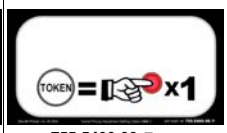
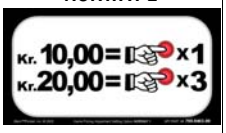
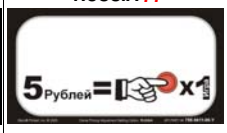
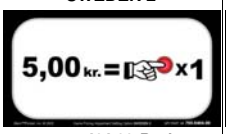
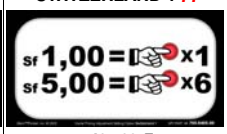
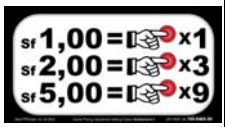
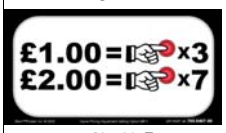
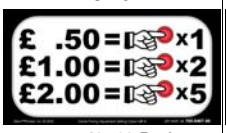
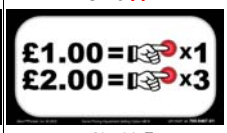
APPENDIX J

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.**	USA 10	USA 2-7 *or* CANADA	*FOR CUSTOM PRICING* †	USA 3 *with* ToPS™	USA 5 *with* ToPS™
			Backside is Blank (Border Only) *Typeset your Custom Pricing*		
755-5400-11 *Front*	755-5400-11 *Back*	755-5400-02 *Front*	755-5400-01, -02 *or* -04 *Back*	755-5400-03 *or* -09 *Front*	755-5400-03 *Back* / -08 *Front*
AUSTRALIA 1 *F.*	**AUSTRALIA 2**	**CROATIA**	*FOR CUSTOM PRICING* †	**DENMARK 1 *F.***	**DENMARK 2**
			Backside is Blank (Border Only) *Typeset your Custom Pricing*		
755-5406-00 *Front*	755-5406-00 *Back*	755-5410-00 *Front*	755-5410-00 *Back*	755-5402-00 *Front*	755-5402-00 *Back*
JAPAN 1	**JAPAN 2 *F.***	**MIDDLE EAST**	*ANY COUNTRY CAN USE*	**NEW ZEALAND 1 *F.***	**NEW ZEALAND 2**
					
755-5408-01 *Front*	755-5408-01 *Back*	755-5400-06 *Front*	*755-5400-06 Back*	*755-5406-00 Back*	755-5406-00 *Front*
NORWAY 1 *F.*	**NORWAY 2**	**RUSSIA *F.***	**RUSSIA (ALTERNATE)**	**SOUTH AFRICA**	*FOR CUSTOM PRICING* †
					Backside is Blank (Border Only) *Typeset your Custom Pricing*
755-5403-01 *Front*	755-5403-01 *Back*	755-5411-00 *Front*	755-5411-00 *Back*	755-5409-01 *Front*	755-5409-01 *Back*
SWEDEN 1 *F.*	**SWEDEN 2**	**SWITZERLAND 1 *F.***	**SWITZERLAND 2**	**TAIWAN**	*FOR CUSTOM PRICING* †
					Backside is Blank (Border Only) *Typeset your Custom Pricing*
755-5404-00 *Front*	755-5404-00 *Back*	755-5405-00 *Front*	755-5405-00 *Back*	755-5412-00 *Front*	755-5412-00 *Back*
UK 1	**UK 3**	**UK 5 *F.***	*FOR CUSTOM PRICING* †		
			Backside is Blank (Border Only) *Typeset your Custom Pricing*		
755-5407-00 *Front*	755-5407-00 *Back*	755-5407-01 *Front*	755-5407-01 *Back*		

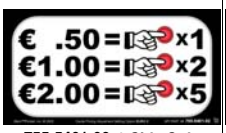
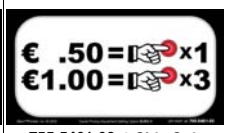
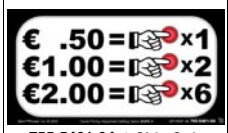
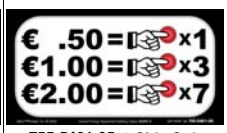
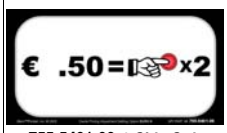
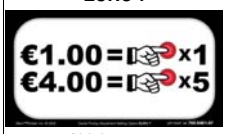
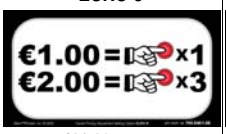
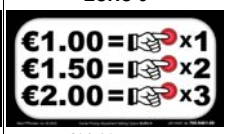
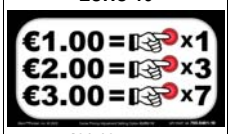
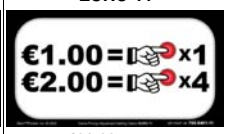
Appendix J Notes:

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	EURO 2	EURO 3	EURO 4	EURO 5	EURO 6
					
755-5401-01 *1-Side Only*	755-5401-02 *1-Side Only*	755-5401-03 *1-Side Only*	755-5401-04 *1-Side Only*	755-5401-05 *1-Side Only*	755-5401-06 *1-Side Only*
EURO 7	**EURO 8**	**EURO 9**	**EURO 10**	**EURO 11**	**EURO 12**
					
755-5401-07 *1-Side Only*	755-5401-08 *1-Side Only*	755-5401-09 *1-Side Only*	755-5401-10 *1-Side Only*	755-5401-11 *1-Side Only*	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 Nº	USA Ver. & Check Sum	Bd. Loc.	Raw Part Nº
Apollo 13 (Note 1)					
Game ROM	(1M)	965-0208-00	**A5.01 | $09FF**	**U210**	960-5009-00
Sound	(512K)	965-0212-00	1.00 | $5244	U7	960-7001-02
Display	(4M)	965-0213-00	**A5.00 | $B92B**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0209-00	1.00 | $7FC7	U17	n/a (masked)
Voice 2	(4M)	965-0210-00	1.00 | $8E55	U21	n/a (masked)
Voice 3	(4M)	965-0211-00	1.00 | $08EE	U36	n/a (masked)
Golden Eye (Note 1)					
Game ROM	(1M)	965-0214-42	**A4.04 | $3FFF**	**U210**	960-5009-00
Sound	(512K)	965-0217-42	1.00 | $D615	U7	960-7001-02
Display	(4M)	965-0218-42	**A4.00 | $E6ED**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0215-42	1.00 | $3E32	U17	n/a (masked)
Voice 2	(4M)	965-0216-42	1.00 | $71F0	U21	n/a (masked)
Twister (Note 2)					
Game ROM	(1M)	965-0219-41	**A4.05 | $E9FF**	**U210**	960-5009-00
Sound	(512K)	965-0221-41	1.00 | $1FFF	U7	960-7001-02
Display	(4M)	965-0222-41	**A4.00 | $FD01**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0220-41	1.00 | $3650	U17	960-5015-01
Voice 2	(4M)	965-0223-41	1.00 | $9300	U21	960-5015-01
ID4: Independence Day (Note 2)					
Game ROM	(1M)	965-0224-45	**A2.02 | $9CFF**	**U210**	960-5009-00
Sound	(512K)	965-0227-45	1.00 | $222B	U7	960-7001-02
Display	(4M)	965-0228-45	**A2.00 | $ABF7**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0225-45	1.00 | $3AE1	U17	960-5015-01
Voice 2	(4M)	965-0226-45	1.00 | $206E	U21	960-5015-01
Space Jam (Note 2)					
Game ROM	(1M)	965-0229-43	**A3.00 | $E6FF**	**U210**	960-5009-00
Sound	(512K)	965-0233-43	1.00 | $F1E7	U7	960-7001-02
Display	(4M)	965-0234-43	**A3.00 | $0057**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0230-43	1.00 | $DBA8	U17	960-5015-01
Voice 2	(4M)	965-0231-43	1.00 | $DDF1	U21	960-5015-01
Voice 3	(4M)	965-0232-43	1.00 | $F32A	U36	960-5015-01
The Star Wars Trilogy - Special Edition (S.E.) (Note 2)					
Game ROM	(1M)	965-0235-56	**A4.03 | $5EFF**	**U210**	960-5009-00
Sound	(512K)	965-0238-56	1.00 | $4A7D	U7	960-7001-02
Display	(4M)	965-0239-56	**A4.00 | $8817**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0236-56	1.00 | $E66B	U17	960-5015-01
Voice 2	(4M)	965-0237-56	1.00 | $8F54	U21	960-5015-01
The Lost World: Jurassic Park (Note 2)					
Game ROM	(1M)	965-0240-53	**A2.02 | $C8FF**	**U210**	960-5009-00
Sound	(512K)	965-0243-53	1.00 | $A35B	U7	960-7001-02
Display	(4M)	965-0244-53	**A2.01 | $7F46**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0241-53	1.00 | $1D27	U17	960-5015-01
Voice 2	(4M)	965-0242-53	1.00 | $8DA4	U21	960-5015-01
The X-Files (Note 2)					
Game ROM	(1M)	965-0245-46	**A3.03 | $A2FF**	**U210**	960-5009-00
Sound	(512K)	965-0248-46	1.00 | $6648	U7	960-7001-02
Display	(4M)	965-0249-46	**A3.00 | $66D0**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0246-46	1.00 | $349D	U17	960-5015-01
Voice 2	(4M)	965-0247-46	1.00 | $629C	U21	960-5015-01
Starship Troopers (Note 3)					
Game ROM	(1M)	965-0250-59	**A2.00 | $85FF**	**U210**	960-5009-00
Sound	(512K)	965-0253-59	1.00 | $64B2	U7	960-7001-02
Display	(4M)	965-0254-59	**A2.00 | $E77B**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0251-59	1.00 | $152A	U17	960-5015-01
Voice 2	(4M)	965-0252-59	1.00 | $0291	U21	960-5015-01
Voice 3	(4M)	965-0255-59	1.00 | $95A7	U36	960-5015-01
Viper Night Drivin' (Note 4)					
Game ROM	(1M)	965-0266-35	**A2.01 | $C5FF**	**U210**	960-5009-00
Sound	(512K)	965-0271-35	1.00 | $4DF8	U7	960-7001-02
Display	(4M)	965-0272-35	**A2.01 | $C17D**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0267-35	1.00 | $8018	U17	960-5015-01
Voice 2	(4M)	965-0268-35	1.00 | $2157	U21	960-5015-01
Voice 3	(4M)	965-0269-35	1.00 | $B5A6	U36	960-5015-01
Voice 4	(4M)	965-0270-35	1.00 | $D01E	U37	960-5015-01
Lost In Space (Note 4)					
Game ROM	(1M)	965-0282-60	**A1.01 | $B2FF**	**U210**	960-5009-00
Sound	(512K)	965-0287-60	1.00 | $A6AF	U7	960-7001-02
Display	(4M)	965-0288-60	**A1.02 | $32AB**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0283-60	1.00 | $4391	U17	960-5015-01
Voice 2	(4M)	965-0284-60	1.00 | $8215	U21	960-5015-01
Voice 3	(4M)	965-0285-60	1.00 | $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 | $0CC8	U7	960-7001-02
Display	(4M)	965-0295-40	**A2.00 | $C929**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0290-40	1.00 | $0D75	U17	960-5015-01
Voice 2	(4M)	965-0291-40	1.00 | $CCCF	U21	960-5015-01
Voice 3	(4M)	965-0292-40	1.00 | $227F	U36	960-5015-01
Voice 4	(4M)	965-0293-40	1.00 | $DB69	U37	960-5015-01
South Park (Notes 4, 5)					
Game ROM	(1M)	965-0301-71	**A1.03 | $58FF**	**U210**	960-5009-00
Sound	(512K)	965-0306-71	1.00 | $1286	U7	960-7001-02
Display	(4M)	965-0307-71	**A1.01 | $166F**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0302-71	1.00 | $7BF8	U17	960-5016-00
Voice 2	(8M)	965-0303-71	1.00 | $9CCC	U21	960-5016-00
Voice 3	(8M)	965-0304-71	1.00 | $ADD9	U36	960-5016-00
Voice 4	(8M)	965-0305-71	1.00 | $6659	U37	960-5016-00
Harley-Davidson® (Notes 4, 5, 6) *Original (1999-2001)*					
Game ROM	(1M)	965-0319-67	**A1.03 | $3EFF**	**U210**	960-5009-00
Sound	(512K)	965-0320-67	1.00 | $F4FF	U7	960-7001-02
Display	(4M)	965-0321-67	**A1.04 | $FC7C**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0322-67	1.00 | $CD26	U17	960-5016-00
Voice 2	(8M)	965-0323-67	1.00 | $9396	U21	960-5016-00
Voice 3	(8M)	965-0324-67	1.00 | $FB72	U36	960-5016-00
Voice 4	(4M)	965-0325-67	1.00 | $6100	U37	960-5015-01
▶ **Harley-Davidson® (Notes 4, 5, 6, 8) *2nd Edition (2002-2003)***					
Game ROM	(1M)	965-0319-67**A**	**A1.08 | $23FF**	**U210**	960-5009-00
Display	(4M)	965-0321-67**A**	**A1.05 | $B594**	**ROM 0**	960-5015-01
▶ **Harley-Davidson® (Notes 4, 5, 6, 8) *3rd Edition (2004)***					
Game ROM	(1M)	965-0319-87	**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)	965-0334-72	1.01 | $9796	U7	960-7001-02
Display	(4M)	965-0335-72	**A2.01 | $6C33**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0336-72	1.00 | $58EA	U17	960-5016-00
Voice 2	(8M)	965-0337-72	1.00 | $272B	U21	960-5016-00
Voice 3	(8M)	965-0338-72	1.00 | $41AE	U36	960-5016-00
High Roller Casino (Notes 4, 5)					
Game ROM	(1M)	965-0346-65	**A3.00 | $90FF**	**U210**	960-5009-00
Sound	(512K)	965-0347-65	1.00 | $581C	U7	960-7001-02
Display	(4M)	965-0348-65	**A3.00 | $74B3**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0349-65	1.00 | $E12D	U17	960-5016-00
Voice 2	(8M)	965-0350-65	1.00 | $38F4	U21	960-5016-00
Voice 3	(8M)	965-0351-65	1.00 | $1B54	U36	960-5016-00
Voice 4	(8M)	965-0352-65	1.00 | $D720	U37	960-5016-00
Austin Powers™ (Notes 4, 5)					
Game ROM	(1M)	965-0353-74	**A3.02 | $5DFF**	**U210**	960-5009-00
Sound	(512K)	965-0354-74	1.00 | $DA7B	U7	960-7001-02
Display	(4M)	965-0035-74	**A3.00 | $6A34**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0356-74	1.00 | $D2B9	U17	960-5016-00
Voice 2	(8M)	965-0357-74	1.00 | $9E75	U21	960-5016-00
Voice 3	(8M)	965-0358-74	1.00 | $51F3	U36	960-5016-00
Voice 4	(8M)	965-0359-74	1.00 | $0AE5	U37	960-5016-00
MONOPOLY® (Notes 4, 5)					
Game ROM	(1M)	965-0360-75	**A3.20 | $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	1.00 | $04D7	U36	960-5016-00
Display	(4M)	965-0376-78	**A7.01 | $8DDB**	**U5** Disp. Cntrlr.	
The Simpsons™ Pinball Party (Notes 4, 5, 7)					
Sound	(512K)	965-0381-77	1.01 | $A7EE	U7	960-7001-02
Game ROM	(1M)	965-0382-77	**A4.00 | $4FFF**	**U210**	960-5009-00
Voice 1	(8M)	965-0383-77	1.00 | $9719	U17	960-5016-00
Voice 2	(8M)	965-0384-77	1.00 | $16ED	U21	960-5016-00
Voice 3	(8M)	965-0385-77	1.00 | $ADCE	U36	960-5016-00
Voice 4	(8M)	965-0386-77	1.00 | $E7E5	U37	960-5016-00
Display	(4M)	965-0387-77	**A4.00 | $8A03**	**U5** DC PCB	960-5015-01
Terminator® 3: Rise of the Machines™ (Notes 4, 5, 7)					
Sound	(512K)	965-0388-79	1.00 | $D2FD	U7	960-7001-02
Game ROM	(1M)	965-0389-79	**A4.00 | $F8FF**	**U210**	960-5009-00
Voice 1	(8M)	965-0390-79	1.00 | $1838	U17	960-5016-00
Voice 2	(8M)	965-0391-79	1.00 | $F0D5	U21	960-5016-00
Voice 3	(8M)	965-0392-79	1.00 | $89DA	U36	960-5016-00
Voice 4	(8M)	965-0393-79	1.00 | $1200	U37	960-5016-00
Display	(4M)	965-0394-79	**A4.00 | $6E49**	**U5** DC PCB	960-5015-01
The Lord of the Rings™ (Notes 7, 8)					
Sound	(512K)	965-0401-80	1.01 | $36BC	U7	960-7001-02
Game ROM	(1M)	965-0402-80	**A10.00 | $84FF**	**U210**	960-5009-00
Voice 1	(8M)	965-0403-80	1.00 | $1792	U17	960-5016-00
Voice 2	(8M)	965-0404-80	1.00 | $67F1	U21	960-5016-00
Voice 3	(8M)	965-0405-80	1.00 | $89B6	U36	960-5016-00
Voice 4	(8M)	965-0406-80	1.00 | $EA49	U37	960-5016-00
Display	(4M)	965-0407-80	**A10.00 | $1669**	**U5** DC PCB	960-5015-01

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

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

APPENDIX A

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

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

ROM	Chip Size	Program Part Nº	USA Ver. & Check Sum	Bd. Loc.	Raw Part Nº
Ripley's Believe It or Not!® (Notes 7, 8)					
Sound	(512K)	965-0408-81	1.00 | $D93D	U7	960-7001-02
Game ROM	(1M)	965-0409-81	**A3.20 | $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 Sopranos℠ (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 | $CE0E	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) *Call for more info if code update required.*					
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 №	USA Ver.	Bd. Loc.	Raw Part №
Laser War					
CPU	(256K)	965-0004-00	LWAR.C5	C5	960-5007-00
Sound (Old)	(256K)	965-0005-00		J5	960-5007-00
Sound (Old)	(256K)	965-0006-00		J6	960-5007-00
Sound (Old)	(256K)	965-0007-00		J7	960-5007-00
			- OR -		
Sound	(256K)	965-0008-00		7F	960-5007-00
Sound 1	(512K)	965-0009-00		6F	960-7001-02
Sound 2	(512K)	965-0010-00		4F	960-7001-02
Secret Service					
CPU	(256K)	965-0011-00	A4-6	B5	960-5007-00
CPU	(256K)	965-0012-00	A4-6	C5	960-5007-00
Voice 1	(512K)	965-0014-00		6F	960-7001-02
Voice 2	(512K)	965-0015-00		4F	960-7001-02
Sound	(256K)	965-0013-00		7F	960-5007-00
Torpedo Alley					
CPU	(256K)	965-0016-00	A2-1	B5	960-5007-00
CPU	(256K)	965-0017-00	A2-1	C5	960-5007-00
Voice 1	(512K)	965-0019-00		6F	960-7001-02
Voice 2	(512K)	965-0020-00		4F	960-7001-02
Sound	(256K)	965-0018-00		7F	960-5007-00
Time Machine					
CPU	(128K)	965-0021-00	A2-4	B5	960-5006-00
CPU	(256K)	965-0022-00	A2-4	C5	960-5007-00
Voice 1	(512K)	965-0024-00		6F	960-7001-02
Voice 2	(512K)	965-0025-00		4F	960-7001-02
Sound	(256K)	965-0023-00		7F	960-5007-00
Playboy 35th Anniversary					
CPU	(256K)	965-0046-00	A2-4	B5	960-5007-00
CPU	(256K)	965-0047-00	A2-4	C5	960-5007-00
Voice 1	(512K)	965-0049-00		6F	960-7001-02
Voice 2	(512K)	965-0050-00		4F	960-7001-02
Sound	(256K)	965-0048-00		7F	960-5007-00
ABC Monday Night Football					
CPU	(128K)	965-0031-00	A2-7	B5	960-5006-00
CPU	(256K)	965-0032-00	A2-7	C5	960-5007-00
Voice 1	(512K)	965-0034-00		6F	960-7001-02
Voice 2	(512K)	965-0035-00		4F	960-7001-02
Sound	(256K)	965-0033-00		7F	960-5007-00
Robocop					
CPU	(256K)	965-0036-00	A3-4	B5	960-5007-00
CPU	(256K)	965-0037-00	A3-4	C5	960-5007-00
Voice 1	(512K)	965-0039-00		6F	960-7001-02
Voice 2	(512K)	965-0040-00		4F	960-7001-02
Sound	(256K)	965-0038-00		7F	960-5007-00
Phantom of the Opera					
CPU	(128K)	965-0026-00	A3-2	B5	960-5006-00
CPU	(256K)	965-0027-00	A3-2	C5	960-5007-00
Voice 1	(512K)	965-0029-00		6F	960-7001-02
Voice 2	(512K)	965-0030-00		4F	960-7001-02
Sound	(256K)	965-0028-00		7F	960-5007-00
Back to the Future					
CPU	(256K)	965-0041-00	A2-0	B5	960-5007-00
CPU	(256K)	965-0042-00	A2-0	C5	960-5007-00
Voice 1	(512K)	965-0044-00		6F	960-7001-02
Voice 2	(512K)	965-0045-00		4F	960-7001-02
Sound	(256K)	965-0043-00		7F	960-5007-00
The Simpsons					
CPU	(128K)	965-0051-00	A2-7	B5	960-5006-00
CPU	(256K)	965-0052-00	A2-7	C5	960-5007-00
Voice 1	(512K)	965-0054-00		6F	960-7001-02
Voice 2	(512K)	965-0055-00		4F	960-7001-02
Sound	(256K)	965-0053-00		7F	960-5007-00
Checkpoint					
CPU	(128K)	965-0056-00	A1-7	B5	960-5006-00
CPU	(256K)	965-0134-00	A1-7	C5	960-5007-00
Voice 1	(1M)	965-0057-00		F7	960-5009-00
Voice 2	(1M)	965-0058-00		F5	960-5009-00
Sound	(256K)	965-0059-00		F4	960-5007-00
Display	(512K)	965-0060-00	CP80	U8	960-7001-02
Teenage Mutant Ninja Turtles					
CPU	(128K)	965-0061-00	A1.04	B5	960-5006-00
CPU	(256K)	965-0062-00	A1.04	C5	960-5007-00
Voice 1	(1M)	965-0063-00		F5/6	960-5009-00
Voice 2	(1M)	965-0064-00		F4/5	960-5009-00
Sound	(256K)	965-0065-00		F7	960-5007-00
Display	(512K)	965-0066-00	A1.04	U8	960-7001-02
Batman					
CPU	(128K)	965-0067-00	A1.06	B5	960-5006-00
CPU	(256K)	965-0135-00	A1.06	C5	960-5007-00
Voice 1	(2M)	965-0068-00		U17	960-5010-00
Voice 2	(1M)	965-0069-00		U21	960-5009-00
Sound	(256K)	965-0070-00		U7	960-5007-00
Display	(1M)	965-0071-00	A1.06	U8	960-5009-00
Star Trek 25th Anniversary					
CPU	(512K)	965-0072-00	A2.01	C5	960-7001-02
Voice 1	(2M)	965-0073-00		U17	960-5010-00
Voice 2	(2M)	965-0074-00		U21	960-5010-00
Sound	(256K)	965-0075-00		U7	960-5007-00
Display	(1M)	965-0076-00	A1.09	U8	960-5009-00
Hook					
CPU	(512K)	965-0077-00	A4.08	C5	960-7001-02
Voice 1	(2M)	965-0078-00		U17	960-5010-00
Voice 2	(2M)	965-0079-00		U21	960-5010-00
Sound	(256K)	965-0080-00		U7	960-5007-00
Display	(1M)	965-0081-00	A4.01	U8	960-5009-00
Lethal Weapon 3					
CPU	(512K)	965-0082-00	A2.08	C5	960-7001-02
Voice 1	(2M)	965-0083-00		U17	960-5010-00
Voice 2	(2M)	965-0084-00		U21	960-5010-00
Sound	(256K)	965-0085-00		U7	960-5007-00
Display	(2M)	965-0086-00	A2.06	ROM 0	960-5010-00
Display	(2M)	965-0087-00	A2.06	ROM 1	960-5010-00
	(Used on Display PCB 520-5055-00)				
			-OR-		
Display	(4M)	965-0087-04	A2.06	ROM 0	960-5015-00
	(Used on Display PCB 520-5055-01)				
Star Wars					
CPU	(512K)	965-0119-00	A1.03	C5	960-7001-02
Voice 0	(4M)	965-0132-00		U17	960-5015-00
Voice 1	(2M)	965-0133-00		U21	960-5010-00
Sound	(256K)	965-0131-00		U7	960-5007-00
Display	(2M)	965-0120-00	A1.04	ROM 0	960-5010-00
Display	(2M)	965-0121-00	A1.04	ROM 1	960-5010-00
	(Used on Display PCB 520-5055-00)				
			-OR-		
Display	(4M)	965-0122-00	A1.05	ROM 0	960-5015-00
	(Used on Display PCB 520-5055-01)				
Rocky & Bullwinkle & Friends					
CPU	(512K)	965-0138-00	A1.30	C5	960-7001-02
Voice 0	(4M)	965-0139-00		U17	960-5015-00
Voice 1	(2M)	965-0140-00		U21	960-5010-00
Sound	(256K)	965-0141-00		U7	960-5007-00
Display	(4M)	965-0142-00	A1.30	ROM 0	960-5015-00
Jurassic Park					
CPU	(512K)	965-0143-00	A5.13	C5	960-7001-02
Voice 0	(4M)	965-0144-00		U17	960-5015-00
Voice 1	(2M)	965-0145-00		U21	960-5010-00
Sound	(256K)	965-0146-00		U7	960-5007-00
Display	(4M)	965-0147-00	A5.10	ROM 0	960-5015-00
Last Action Hero					
CPU	(512K)	965-0148-00	A1.12	C5	960-7001-02
Voice 0	(4M)	965-0149-00		U17	960-5015-00
Voice 1	(2M)	965-0150-00		U21	960-5010-00
Sound	(256K)	965-0151-00		U7	960-5007-00
Display	(4M)	965-0152-00	A1.06	ROM 0	960-5015-00
Tales from the Crypt					
CPU	(512K)	965-0157-00	A3.03	C5	960-7001-02
Voice 0	(4M)	965-0158-00		U17	960-5015-00
Voice 1	(2M)	965-0159-00		U21	960-5010-00
Sound	(256K)	965-0160-00		U7	960-5007-00
Display	(4M)	965-0161-00	A3.01	ROM 0	960-5015-00
The Who's Tommy					
CPU	(512K)	965-0162-00	A4.00	C5	960-7001-02
Voice 1	(4M)	965-0165-00		U17	960-5015-00
Voice 2	(4M)	965-0166-00		U21	960-5015-00
Voice 3	(4M)	965-0167-00		U36	960-5015-00
Voice 4	(4M)	965-0168-00		U37	960-5015-00
Sound	(512K)	965-0164-00		U7	960-7001-02
Display	(4M)	965-0163-00	A4.00	ROM 0	960-5015-00
WWF Royal Rumble					
CPU	(512K)	965-0169-00	A1.06	C5	960-7001-02
Voice 1	(4M)	965-0172-00		U17	960-5015-00
Voice 2	(4M)	965-0173-00		U21	960-5015-00
Voice 3	(4M)	965-0174-00		U36	960-5015-00
Sound	(512K)	965-0171-00		U7	960-7001-02
Display	(4M)	965-0170-00	A1.02	ROM 0	960-5015-00
Guns N' Roses					
CPU	(512K)	965-0175-00	A3.00	C5	960-7001-02
Voice 1	(4M)	965-0178-00		U17	960-5015-00
Voice 2	(4M)	965-0179-00		U21	960-5015-00
Voice 3	(4M)	965-0180-00		U36	960-5015-00
Voice 4	(4M)	965-0181-00		U37	960-5015-00
Sound	(512K)	965-0177-00		U7	960-7001-02
Display	(4M)	965-0176-00	A3.00	ROM 0	960-5015-00
Maverick *					
CPU	(512K)	965-0182-00	A4.04	C5	960-7001-02
Voice 1	(4M)	965-0186-00		U17	960-5015-00
Voice 2	(4M)	965-0187-00		U21	960-5015-00
Voice 3	(4M)	965-0187-01		U36	960-5015-00
Sound	(512K)	965-0185-00		U7	960-7001-02
Display*	(4M)	965-0183-00	A4.01	ROM 0	960-5015-00
Display*	(4M)	965-0184-00	A4.01	ROM 3	960-5015-00
Mary Shelley's Frankenstein *					
CPU	(512K)	965-0188-00	A1.03	C5	960-7001-02
Voice 1	(4M)	965-0192-00		U17	960-5015-00
Voice 2	(4M)	965-0193-00		U21	960-5015-00
Voice 3	(4M)	965-0194-00		U36	960-5015-00
Sound	(512K)	965-0191-00		U7	960-7001-02
Display*	(4M)	965-0189-00	A1.03	ROM 0	960-5015-00
Display*	(4M)	965-0190-00	A1.03	ROM 3	960-5015-00
Baywatch *	(CPU Board 520-5003-04)				
CPU	(512K)	965-0195-00	A4.00	C5	960-7001-02
Voice 1	(4M)	965-0196-00		U17	960-5015-00
Voice 2	(4M)	965-0197-00		U21	960-5015-00
Sound	(512K)	965-0199-00		U7	960-7001-02
Display*	(4M)	965-0200-00	A4.00	ROM 0	960-5015-00
Display*	(4M)	965-0201-00	A4.00	ROM 3	960-5015-00
Batman Forever *	(CPU Board 520-5003-04)				
CPU	(512K)	965-0202-00	A3.02	C5	960-7001-02
Voice 1	(4M)	965-0203-00		U17	960-5015-00
Voice 2	(4M)	965-0204-00		U21	960-5015-00
Sound	(512K)	965-0205-00		U7	960-7001-02
Display*	(4M)	965-0206-00	A3.00	ROM 0	960-5015-00
Display*	(4M)	965-0207-00	A3.00	ROM 3	960-5015-00

* ***Note:*** *Display* ***EPROMS (4M)*** *for* ***Maverick*** *thru* ***Batman Forever*** *require an access time of* ***120 Nsec*** *or faster.*

APPENDIX B

Semi-Conductors / Integrated Circuits (I.C.) / Relays Cross-Reference Table

Table №	Type	Source Number	STERN® PINBALL	N T E®	E C G®	Radio Shack®	R C A®
	RECTIFICATION, BLOCKING, DAMPENING DIODES AND/OR LIGHT EMITTING DIODES (LEDs)						
1	Diode	1N4001	112-5001-00	NTE552	ECG552	- — - — -	SK9000
	Diode	1N4004	112-5003-00	NTE116	ECG116	276-1103	SK3312
	Diode	1N5401	112-0056-00	NTE5801	ECG5801	276-1143	SK9004
	Diode	1N5404	112-5004-00	NTE5804	ECG5804	276-1144	SK9007
	Diode	T6A10L	112-5006-01	NTE5812	ECG5812	- — - — -	- — - — -
	Diode	FR302	112-5009-00	NTE588	ECG588	- — - — -	SK5014
	Diode, Signal	1N914	112-5014-00	- — - — -	- — - — -	- — - — -	- — - — -
	LED	**MT5000UR** or **TLRH180P** (T1-3/4 GaAlAs)	165-5052-00 *(old SPI Part №: 165-5100-00)*	- — - — -	- — - — -	276-066B	- — - — -
	ZENER DIODES						
2	Diode	1N4742A 12v	112-0061-00	NTE142A	ECG142A	276-563	SK12V
	Diode	1N4760B 68v	112-0062-00B	NTE5092A	ECG5092A	- — - — -	SK68V
	Diode	1N4764A 100v	112-0049-00A	NTE5096A	ECG5096A	- — - — -	SK100V
	Diode	1N5228 3.9v	112-0053-00	NTE5007A	ECG5007A	- — - — -	SK3A9
	Diode	1N5234B 6.2v	112-0047-00B	NTE5013A	ECG5013A	276-561	SK6A2
	Diode	1N5379 110v	112-0072-00	NTE5157	ECG5157	- — - — -	SK110X
	Diode	1N6267A 6.8v	112-5011-00	NTE4902	ECG4902	- — - — -	- — - — -
	Diode	1N4752A 33v	112-5010-00A	NTE147A	ECG147A	- — - — -	SK33V
	Diode	1N4736 6.8v 1w	112-5007-00	NTE5071A	ECG5071A	- — - — -	- — - — -
	TRANSISTORS - TYPE FET, NPN, PNP AND/OR SCR						
3	FET Trans.	STP20N10L	110-0106-00	NTE2987	ECG2987	- — - — -	- — - — -
	FET Trans.	STP19N06L	110-0088-00	NTE2985	ECG2985	- — - — -	- — - — -
	FET Trans.	VN02N	110-0089-00	- — - — -	- — - — -	- — - — -	- — - — -
	NPN Trans.	2N4401	110-0073-00	NTE85	ECG85	276-2009	SK3124A
	NPN Trans.	2N6427	110-0070-00	NTE48	ECG48	- — - — -	SK4906
	NPN Trans.	MJE340	110-0071-00	NTE157	ECG157	- — - — -	SK3747
	NPN Trans.	MPSA42	110-0082-00	NTE287	ECG287	- — - — -	SK3232
	NPN Trans.	2N3904	110-0069-00	NTE123AP	ECG123AP	276-2009	- — - — -
	NPN Trans.	TIP122	110-0067-00	NTE261	ECG261	276-2068	SK3896
	NPN Trans.	MJE15030	110-0101-00	NTE375	ECG375	- — - — -	SK9118
	PNP Trans.	2N5401	110-0078-00	NTE288	ECG288	- — - — -	SK3434
	PNP Trans.	MJE15031	110-0103-00	NTE292	ECG292	- — - — -	SK3441
	PNP Trans.	MJE350	110-0072-00	NTE374	ECG374	- — - — -	SK9042
	PNP Trans.	MPSA92	110-0100-00	NTE288	ECG278	- — - — -	SK3434
	PNP Trans.	TIP42	110-0068-00	NTE332	ECG332	- — - — -	SK9236
	PNP Trans.	TIP32C	110-0081-00	NTE292	ECG292	- — - — -	SK3441
	PNP Trans.	TIP36C	110-0077-00	NTE393	ECG393	- — - — -	SK3961
	SCR Trans.	2N5060	110-0074-00	NTE5400	ECG5400	276-1067	SK3950
	SCR Trans.	SCR2800B	110-0083-00	NTE5461-8	ECG5461-8	- — - — -	- — - — -
	BRIDGE RECTIFIERS (BR)			**Comments:**			
4	BR (Present)	DB3501 or CM3501	112-5000-00	For White Star I/O Bds., BR = 35 Amp @ 100v P.I.V.			
	RELAYS			**Comments:**			
5	Relay	FRL-264 D024/02CK	190-5002-00	For PPB, Power Supply, & White Star I/O Boards, Relay = 24v DC 10 Amp DPDT			
	Relay	FRL-264 D006/04CV	190-5001-00	For CPU Boards, Relay = 6v DC 5 Amp 4 Pole DT			

APPENDIX C

Production Start Date, Manual Part Nº, ROM Size & Positions and Jumper W6 Installed Note‡ (White Star Board System & 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:** U17	U21	U36	U37	Jumper Installed (‡ see Note)
*** Note:**	*For complete Appendix Information for Games **Laser War** through **Batman Forever**, see any Service Game Manual between **Apollo 13** through **Ripley's Believe It or Not!** or on-line at our website www.sternpinball.com/parts.htm; also available on CD-R, 970-2003-00 (**The Simpsons™ Pinball Party**, **T3®** and **The Lord of the Rings™**).*						
29	Apollo 13 (A13)	NOV 95 780-5044-00	4MB	4MB	4MB	Not Used	n / a
30	Golden Eye	FEB 96 780-5042-00	4MB	4MB	Not Used	Not Used	n / a
31	Twister	APR 96 780-5041-00	4MB	4MB	Not Used	Not Used	n / a
32	ID4: Independence Day	JUL 96 780-5045-00	4MB	4MB	Not Used	Not Used	n / a
33	Space Jam	OCT 96 780-5043-00	4MB	4MB	4MB	Not Used	n / a
34	The Star Wars Trilogy - Sp. Ed.	FEB 97 780-5056-00	4MB	4MB	Not Used	Not Used	n / a
35	The Lost World: Jurassic Park	JUN 97 780-5053-00	4MB	4MB	Not Used	Not Used	n / a
36	The X-Files	AUG 97 780-5046-00	4MB	4MB	Not Used	Not Used	n / a
37	Starship Troopers	NOV 97 780-5059-00	4MB	4MB	4MB	Not Used	n / a
38	Viper Night Drivin'	FEB 98 780-5035-00	4MB	4MB	4MB	4MB	n / a
39	Lost In Space	JUN 98 780-5060-00	4MB	4MB	4MB	4MB	n / a
40	Godzilla	SEP 98 780-5040-00	4MB	4MB	4MB	4MB	n / a
41	South Park	JAN 99 780-5071-00	8MB	8MB	8MB	8MB	W6
42 a	Harley-Davidson®	AUG 99 780-5067-01	8MB	8MB	8MB	8MB	W6
42 b	Harley-Davidson®2nd Ed.	SEP 02 780-5067-10	8MB	8MB	8MB	8MB	W6
42 c	Harley-Davidson® 3rd Ed.	OCT 04 780-5087-00	8MB	8MB	8MB	8MB	W6
43 a	Striker Xtreme	MAR 00 780-5068-01	8MB	8MB	8MB	8MB	W6
43 b	NFL	OCT 00 780-5073-00	8MB	8MB	8MB	8MB	W6
44	Sharkey's Shootout	JUL/OCT 00 780-5072-01	8MB	8MB	8MB	Not Used	W6
45	High Roller Casino	JAN 01 780-5065-00	8MB	8MB	8MB	8MB	W6
46	Austin Powers™	MAY 01 780-5074-00	8MB	8MB	8MB	8MB	W6
47	MONOPOLY®	SEP 01 780-5075-00	8MB	8MB	8MB	Not Used	W6
48	Playboy	FEB 02 780-5076-00	8MB	8MB	8MB	8MB	W6
49	RollerCoaster Tycoon™	AUG 02 780-5078-00	8MB	8MB	8MB	Not Used	W6
50	The Simpsons™ Pinball Party	JAN 03 780-5077-00	8MB	8MB	8MB	8MB	W6
51	T3®: Rise of the Machines™	MAY 03 780-5079-00	8MB	8MB	8MB	8MB	W6
52	The Lord of the Rings™	NOV 03 780-5080-00	8MB	8MB	8MB	8MB	
53	Ripley's Believe It or Not!®	APR 04 780-5081-00	8MB	8MB	8MB	8MB	

‡ *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 Trilolgy - 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
	MiscellaneousPC Boards:	DC Relay Bd. 520-5066-00	Shaker Mtr. Bd. 520-5065-00						
The X-Files	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32 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
	MiscellaneousPC Boards:	Relay Board 520-5010-00	Sol. Exp. Bd. 520-5192-00						
High Roller Casino	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32 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
						520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Ball Lock under Roulette	
	Miscellaneous PC Boards:	Dot Display (5X7) in Slot Mach. 520-5197-00			for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5196-00 3-Pos. OPTO	520-5195-00 3-Pos. OPTO	Up/Dn Ramp in Slot Mach.	
Austin Powers™	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32 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
	MiscellaneousPC Boards:	Relay Bd. (X3) 520-5010-00			for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Time Machine Ramp	
MONOPOLY®	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32 Dots	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	MiscellaneousPC Boards:	DC Relay Bd. 520-5066-00	Mini-Dot Display (3 by 5X7) 520-5197-00 (Electric C° Sign)		for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5218-00 4-Pos. OPTO	520-5210-00 4-Pos. OPTO	Bank Door	

Table continued on the next page.

APPENDIX D

Board Type (White Star Board System* & 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
	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		520-5252-04 'U' 4/per PCB Drop Targets 4- & 8- Banks
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
		511-5046-00 : Mini Playfield Lamp PCB						
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**	***initial:*** 520-5002-00 ***replaced with:*** 520-5002-02 *520-5002-01 was not used.*	520-5000-00	Master: 520-5004-00 plus: 520-5005-00 (Qty. 2): 7 Digit Alpha/Numeric 520-5006-00 (Qty. 2): 7 Digit Numeric 520-5007-00 (Qty. 1): 4 Digit Numeric
• Secret Service • Torpedo Alley	3-Flipper **Board Not Required**	520-5002-02		520-5014-01 7 Digit Alpha/Numeric Combined
• Time Machine	2-Flipper **Board Not Required**			
• Playboy 35th Anniversary * • ABC Monday Night Football * • *Robocop* • *Phantom of the Opera* • *Back to the Future*	520-5033-00 2-Flipper *(*only for 100 games of Playboy 35th Anniv. & ABC Mon. Night Football)*			520-5030-00 16 Digit Alpha/Numeric Combined
• The Simpsons		520-5002-**03**		

Game Name	Flipper	Sound	Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Apllication
• Checkpoint • Teenage Mutant Ninja Turtles	520-5033-00 2-Flipper	520-5002-03	520-5047-00	520-5042-00 128 X 16				
• Batman • Star Trek 25th Anniv. • Hook		520-5050-01						
• Lethal Weapon 3			520-5047-01	520-5052-00 128 X 32	520-5055-00			
• Star Wars • Rocky & Bull-winkle & Friends		520-5050-02						
• Jurassic Park	520-5076-00 3-Flipper		520-5047-02					
• Last Action Hero	520-5070-00 2-Flipper	520-5050-03						
• Tales from the Crypt	520-5076-00 3-Flipper				520-5055-01			
• The Who's Tommy		520-5077-00						
• WWF Royal Rumble	**520-5070 / 5080 -00** 4-Flipper (2X2)							
• Guns N' Roses	520-5076-00 3-Flipper							
• Maverick		520-5050-03	520-5047-03	520-5075-00 192 X 64	520-5092-01	520-5102-00 Single OPTO	520-5103-00 Single OPTO	Paddle Boat Wheel Enter
• Mary Shelley's Frankenstein	520-5076-00 3-Flipper	520-5077-00						
• Baywatch	**520-5070 / 5080 -00** 4-Flipper (2X2)	520-5126-02				520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker
• Batman Forever	520-5076-00 3-Flipper					520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker

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

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)		
Ga.-Turn	**Res (Ω)**	**SPI Part Number and Comments**
20-400	1.0 Ω	090-5021-*use* : **-00** Diode Top
22-500	1.7 Ω	090-5017-*use* : -00 Diode Top
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
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
23-840	4.0 Ω	090-5005-*use* : -00 Diode Top
23.5-765	3.6 Ω	090-5037-*use* : -03 Diode Top
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
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
27-1300	14.2 Ω	090-5003-*use* : -0T Diode Top
27-1400	14.7 Ω	090-5015-*use* : -00 Diode Below
27-1400		**511-5031-00** *Special App.: No Diode / Lugs + Conn.*
27-1500	16.3 Ω	090-5004-*use* : -0B Diode Below // **-0T** Diode Top
29-2000	33.6 Ω	090-5016-*use* : -00 Diode Top

LARGE, MEDIUM & MINI COILS (MAGNET APPLICATIONS)		
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
24-780	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
31-1500	52.0 Ω	090-5**054**-00 : Straight Lugs + Diode + Mag Core // Mini 090-5**055**-00 : 90° Lugs + Diode + Magnet Core // Mini

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.*

LARGE COILS (FLIPPERS & SPECIAL APPLICATIONS)		
Ga.-Turn	**Res (Ω)**	**SPI Part Number and Comments**
21-900	*call* Ω	090-5020-*use* : **-01** 3-Lugs + 1N4004 & 1N5404 Diodes **-10** Diode Top <BROWN><RED>
22-750 / 30-2600	2.6 Ω / 92.0 Ω	090-5011-*use* : **-00 DUAL WND COIL** // 3-Lugs Diode x2
22-900	3.45 Ω	090-5020-*use* : -20T Diode Top <YELLOW> // **-20-ND** No Diode
22-1080	4.2 Ω	090-5032-*use* : -0B D. Below // **-0T** D. Top <YEL-GRN> **-NL** No Diode
23-620 / 30-2600	2.4 Ω / 75.0 Ω	090-5006-*use* : -00 **DUAL WND COIL** // 3-Lugs Diode x2
23-700 / 30-2600	3.0 Ω / 83.5 Ω	090-5013-*use* : -00 **DUAL WOUND COIL** // Diode Top
23-800 / 30-2600	2.4 Ω / 90.5 Ω	090-5012-*use* : -00 **DUAL WOUND COIL** // Diode Top
23-900	4.05 Ω	090-5020-*use* : -30 Diode Top <GREEN>
23-1100	5.1 Ω	090-5030-*use* : -0T Diode Top <ORANGE> **-ND** No Diode
23-1200	7.1 Ω	090-5008-*use* : -00 Diode Top <BLACK>
23-1500	4.4 Ω	090-5062-*use* : -00 Diode Top <BLUE>
24-1570	9.5 Ω	090-5025-*use* : -00 Diode Top <BLUE>
25-1400	*call* Ω	090-5067-*use* : -0T Diode Top <RED>
25-1600	*call* Ω	090-5068-*use* : -0T Diode Top <WHITE>
25-1800	13.8 Ω	090-5041-*use* : -0T Diode Top <BLUE-GREEN>

MINI COILS (RESET / TRIP APPLICATIONS)		
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.
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* (515-6110-00) : -0B Diode Below // **-0T** Diode Top *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
* **Note:** *For complete Appendix Information for Games **Laser War** through **Batman Forever**, see any Service Game Manual between **Apollo 13** through **Ripley's Believe It or Not!**; or order CD-R, 970-2003-00 (**The Simpsons™ Pinball Party**, **Terminator® 3** and **The Lord of the Rings™**).*					
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	Nº of Flippers	FLIPPERS w/E.O.S. Switch SPI Nº / GAUGE-TURNS / Color		FLIPPERS no E.O.S. Switch SPI Nº / GAUGE-TURNS / Color	
		LOWER LEFT	LOWER RIGHT	UPPER LEFT	UPPER RIGHT
Harley-Davidson® † *and 1st through 3rd Editions*	2	090-5032-0T **22-1080 -YEL-GRN-**	090-5030-0T **23-1100 -ORANGE-**	Not Used	Not Used
Striker Xtreme (NFL) †	3	090-5032-0T **22-1080 -YEL-GRN-**	090-5030-0T **23-1100 -ORANGE-**	090-5030-0T **23-1100 -ORANGE-**	Not Used
Sharkey's Shootout †	3	090-5030-0T **23-1100 -ORANGE-**	SAME	090-5030-0T **23-1100 -ORANGE-**	Not Used
High Roller Casino †	2	090-5020-20T **22-900 -YELLOW-**	090-5032-0T **22-1080 -YEL-GRN-**	Not Used	Not Used
Austin Powers™ †	2	090-5020-30 **23-900 -GREEN-**	090-5030-0T **23-1100 -ORANGE-**	Not Used	Not Used
MONOPOLY® †	3	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	090-5062-0T **23-1500 -BLUE-**
Playboy †	2	090-5030-0T **23-1100 -ORANGE-**	SAME	Not Used	Not Used
RollerCoaster Tycoon™ †	4	090-5032-0T **22-1080 -YEL-GRN-**	SAME	090-5067-0T **25-1400 -RED-**	090-5068-0T **25-1600 -WHITE-**
The Simpsons™ Pinball Party †	6** (5 with Flipper Bats)	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	090-5030-0T **23-1100 -ORANGE-**
		*** The Homer Head Assembly is affixed to an Upr. Rt. Style Flipper (no E.O.S. Switch):*	** 090-5020-20T **22-900 -YELLOW-**	**Flippers (Mini-Bats) on 2nd Level Playfield:** 090-5041-00T **25-1800 -BLU-GRN-**	090-5025-00 **24-1570 -BLUE-**
Terminator® 3: Rise of the Machines™ †	2	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
The Lord of the Rings™ †	2	090-5020-20T **22-900 -YELLOW-**	SAME	Not Used	Not Used
Ripley's Believe It or Not!® †	3	090-5032-0T **22-1080 -YEL-GRN-**	SAME	Not Used	090-5067-00T **25-1400 -RED-**
Elvis® †	4	090-5020-20T **22-900 -YELLOW-**	SAME	090-5020-30 **23-900 -GREEN-**	SAME
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	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
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 Upr. Rt. Style Flipper (no E.O.S. Switch):*	* 090-5020-20T **22-900 -YEL-YEL-**	**Flippers (Mini-Bats) on 2nd Level Playfield:** 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 Nºs ending with a "T" signifies the Diode is on the top of the lug (on the coil-winding side); Coil Part Nºs ending with a "B" signifies the Diode is on the bottom of the lugs.

APPENDIX F

Motor Specification (White Star Board System* Only) Table

Game Name	Function	Specifications	Part Numer
Apollo 13	Rocket Up/Down Movement	Bowman Motor 24VAC 60Hz 3W 6 RPM CCW	515-6383-00 *incl. Connector*
	Moon Unit Rotational Orbit	Multi Products Motor 24VAC 50/60Hz 3W 6 RPM CCW	515-6487-00 *incl. Connector*
	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 *incl. Connector*
Twister	Spinning Disc with Magnet	Multi Products Motor 24VAC *(041-5026-00)* 50/60Hz 3W 325 RPM CCW	515-6347-00 *incl. Connector*
	Backbox Fan (Tornado Wind)	Multi Products Motor 24VAC *(041-5052-00)* 50/60Hz 3W 3600 RPM CW	515-6531-00 *incl. Connector*
ID4: Independence Day	Alien Head Open/Close Movement	Servo Motor *(94322)*	041-5045-00 *MOTOR ONLY*
SPACE JAM (NO MOTOR USED)			
The Star Wars Trilogy - S.E.	X-Wing Left/Right Movement	Bowman Motor 24VAC *(041-5058-00)* 60Hz 3W 10 RPM CCW	515-6383-01 *incl. Connector*
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 *incl. Connector*
	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 *incl. Connector* **Requires 7" Shaft:** 530-5503-00
VIPER NIGHT DRIVIN' (NO MOTOR USED)			
Lost In Space	Spinning Disc with Magnet	Multi Products Motor 24VAC *(041-5046-00)* 50/60Hz 3W 325 RPM CCW	515-6347-00 *incl. Connector*
Godzilla	Shaker ‡	Multi #3811 0630 Motor (Vibrator) 12VDC 3100 RPM CW *(w/DRL PTS)* ‡	041-5029-**01** *MOTOR ONLY*
SOUTH PARK (NO MOTOR USED)			
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 *incl. Connector*
Striker Xtreme (NFL)	Goalie (Linebacker) Left to Right Movement	Multi #3590 12VDC *(041-5075-00)* 60 RPM	515-7071-00 *incl. Connector*
Sharkey's Shootout	Mystery Ball Rotating Movement	Hankscraft Motor Model-E 24VAC *(041-5076-00)* 50/60Hz 3W 20 RPM CW	515-7095-00 *incl. Connector*
High Roller Casino	Roulette Wheel Rotating Movement	Multi Products Motor 20VDC *(041-5078-00)* 17 RPM CCW	515-7153-00 *incl. Connector*
	Up/Dn. Ramp in Slot Mach. Lift Up/Down Movement	Haydon Switch & Instrument, Inc. Stepper Motor 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 *incl. Connector* **Requires Shaft 4¼":** 530-5503-01
Austin Powers™	Time Machine Rotating Movement	Multi Products Motor 24VAC *(041-5079-00)* 50/60Hz 20RPM CCW	515-7141-00 *incl. Connector*
	Laser Beam Left to Right Directional	Autotrol Motor 24VAC *(041-5081-00)* 50/60Hz 4W 10RPM Bi-Directional	515-7171-00 *incl. Connector*
	Dr. Evil Target Lift Up/Down Movement	Hankscraft Motor Model-E 24VAC *(041-5030-00)* 50/60Hz 6RPM CCW	515-5900-00 *incl. Connector*
Monopoly®	Mini-Flipper (Waterworks) Rotating Movement	Multi Prod. Motor & Gear Box #7000 EX00159A 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 *incl. Connector* **Requires 7" Shaft:** 530-5503-00

‡ ***Please Note:*** *"-01" Shaker Motor is **Not Compatible** with old Shaker Motor 041-5029-**00** (Shaker Motor Assy. 515-5893-00). THIS NEW MOTOR CAN ONLY BE USED IN NEW SHAKER MOTOR ASSY. 515-5893-**01**.*

Table continued on the next page.

Game Name	Function	Specifications	Part 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 *incl. Connector*
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 *incl. Connector* **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 *incl. Connector*
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 **w/1" Shaft + 12" Leads**
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 Simpons™ 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 *incl. Connector*
	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 *incl. Connector*
	Shaker *(details in SKC Manual, Page **24**)*	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 #3811**R** 0630 Motor *(Vibrator)* 12VDC *(041-5029-**04**)* 3100 RPM *(w/DRL PTS)* *-04 is RoHS compliant; can substitute with -01 domestic*	511-5024-04 *incl. Connector*
	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 *incl. Connector*
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 *incl. Connector*
	▶▶▶ OPTIONAL ◀◀◀ **Shaker Motor Kit** 502-5027-00	Multi #3811**R** 0630 Motor *(Vibrator)* 12VDC *(041-5029-**04**) 3100 RPM (w/DRL PTS)* *-04 is RoHS compliant; can substitute with -01 domestic*	515-5893-01 *incl. Connector*

APPENDIX F

Motor Specification Table

The following table only list games that used motors. *Part Numbers starting with "515-" will include the Wiring Harness & Connector.*

Game Name	Function	Specifications	Part №
ABC Monday Night Football	Goal Post Up/Down Movement	Motor 24v A.C. 60 RPM CW	515-5222-00
Phantom of the Opera	Organ Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Checkpoint	Mag Wheel (in Backbox)	Motor D.C. (KEN)	041-5005-00
	Shaker	Johnson Motor (Vibrator)	041-5002-00
Teenage Mutant Ninja Turtles	Spinning Pizza Ball Deflector	Gear Motor 24v A.C. 325 RPM CW	515-5397-00
Batman	Bar Target Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Star Trek 25th Anniversary	Swinging Target	Bowman Motor 24v 22½ RPM	515-5534-00
	Transporter F/X	Gear Motor 24v A.C. 3½ RPM	500-5421-00
	Cooling Fan (for Transporter F/X)	4½" Motor 12v	041-5014-00
Lethal Weapon 3	Spinning Light	Motor 2½ v A.C. 4000 RPM CCW	041-5017-00
Star Wars	Bar Target Up/Down Movement	Bowman Motor 24v 60hz 3W 11 RPM CCW	515-5256-00
	R2D2 Robot Left/Right Movement	Bowman Motor 24v A.C. 22½ RPM CW	515-5571-00
	Death Star Rotation	Bowman "G" Motor 24v A.C. 60Hz 6 RPM CW	515-5570-00
Rocky & Bullwinkle & Friends	Nell Log "Cutting Blade" Forward/Back Movement	Autotrol Model E Motor 24v 60hz 4W 3 RPM CCW	041-5023-00
Jurassic Park	T-Rex Left/Right Movement	Multi Motor 5v D.C.	041-5025-00
	T-Rex Up/Down Movement	Bowman Motor 24v 11 RPM CW	041-5026-00
	Shaker	Johnson Motor (Vibrator)	041-5002-00
Last Action Hero	Crane Left/Right Movement	Multi Products Motor 12v D.C. #3312 OSC	041-5027-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Tales from the Crypt	Tombstone Up/Down Movement	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
The Who's Tommy	Mirror Up/Down Movement	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
	Flipper Blinders	Servo Motor (94102)	041-5032-00
	Spinning Airplane Propellers	Motor D.C.	041-5033-00
WWF Royal Rumble	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Maverick, The Movie	Turning Paddle Wheel	Motor 24v A.C. 10 RPM	041-5036-00
Mary Shelley's Frankenstein	Creature Head Left/Right Movement	Servo Motor (94102)	041-5032-00
Batman Forever	Cannon Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CCW	515-6383-00

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 (Tecates & 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- Nyliners
- 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 Nyliners
- 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** 5/8" ø **550-5000-XX**	**STARBURST CIRCULAR** 3/4" ø **550-5001-XX**	**STARBURST CIRCULAR** 1" ø **550-5002-XX**	**STARBURST CIRCULAR** 1-3/16" ø **550-5003-XX**	**STARBURST CIRCULAR** 1-1/2" ø **550-5004-XX**
STARBURST CIRCULAR 2-1/4" ø **550-5005-XX**	**STARBURST CIRCULAR** 2-3/4" ø **550-5006-XX**	**PLAIN CIRCULAR** 3/4" ø **550-5007-XX**	**PLAIN CIRCULAR** 1" ø **550-5008-XX**	**PLAIN CIRCULAR** 1-3/16" ø **550-5009-XX**	**PLAIN CIRCULAR** 1-1/2" ø **550-5010-XX**
PLAIN CIRCULAR 2-1/4" ø **550-5011-XX**	**PLAIN CIRCULAR** 2-3/4" ø **550-5012-XX**	**STIPPLE CIRCULAR** 1" ø **550-5048-XX**	**STIPPLE 1" SQUARE** 1" **550-5019-XX**	**ROLLOVER BUTTON BASE** **550-5026-XX**	**WHITE STAR** *(only in white)* **545-5015-00**
STIPPLE RECTANGULAR 1-1/2" X 3/4" **550-5018-XX**	**STIPPLE RECTANGULAR** 1-5/8" X 1-1/2" **550-5051-XX**	**STARBURST RECTANGULAR** 2-1/4" X 1-1/8" **550-5044-XX**	**PLAIN RECTANGULAR** 2-1/4" X 1-1/8" **550-5049-XX**	**PLAIN RECTANGULAR** 1-1/4" X 1-1/2" **550-5050-XX**	**PLAIN RECTANGULAR** 2" X 2-1/2" **550-5063-XX**
STARBURST MINI SHIELD 1" X 1" **550-5024-XX**	**STARBURST LARGE SHIELD** **550-5025-XX**	**MINI HOT DOG** 1-5/8" **550-5020-XX**	**BEVEL HOT DOG** 3-1/2" **550-5021-XX**	**PLAIN HOT DOG** 3-1/2" **550-5022-XX**	**BANANA** **550-5023-XX**
STARBURST ARROW-SMALL **550-5013-XX**	**STARBURST ARROW-LARGE** **550-5070-XX**	**STARBURST ARROW-HEAD SMALL** **550-5014-XX**	**STARBURST ARROW-HEAD LARGE** **550-5015-XX**	**STARBURST BULLET** **550-5016-XX**	**STARBURST TRIANGLE** **550-5017-XX**

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

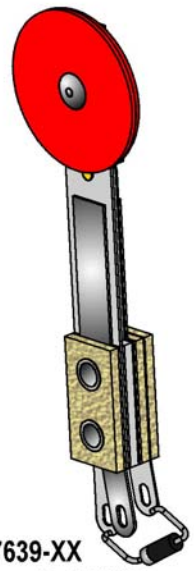
Instructions: Parts which may come in various colors (i.e. targets, some posts, playfield inserts, etc.) end in a 2-digit number which correspond to the color of that part. The "**-XX**" in part number which may come in various colors should be replaced with the desired 2-Digit number corresponding to 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



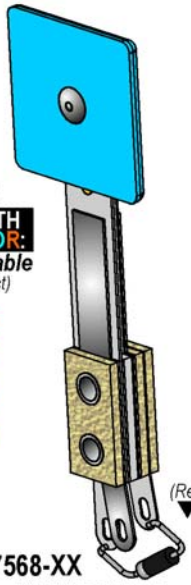
515-7639-XX
1" ø ROUND
ANTI-LOFT STAND-UP
SWITCH & TARGET
RIVETED ASSEMBLY*



515-7581-XX
1" X 1/2" NARROW RECTANGLE
ANTI-LOFT STAND-UP
SWITCH & TARGET
RIVETED ASSEMBLY*

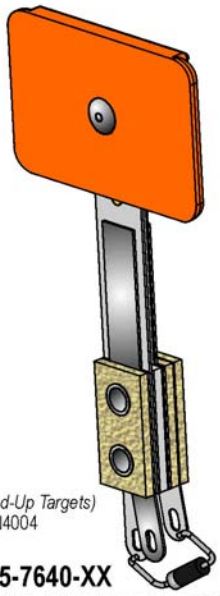
Ordering Note:
-XX REPLACE WITH 2-DIGIT FOR COLOR:
Not all colors available
(colors shown not exact)

-02	Red
-03	Amber
-04	Green
-05	Blue
-06	Yellow
-07	Orange
-08	White



515-7568-XX
1" X 1" SQUARE
ANTI-LOFT STAND-UP
SWITCH & TARGET
RIVETED ASSEMBLY*

(Required on all Stand-Up Targets)
▼ Switch Diode, 1N4004
112-5003-00



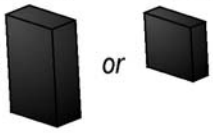
515-7640-XX
1" X 1-1/2" WIDE RECTANGLE
ANTI-LOFT STAND-UP
SWITCH & TARGET
RIVETED ASSEMBLY*

*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

Foam Pads have self-adhesive backing

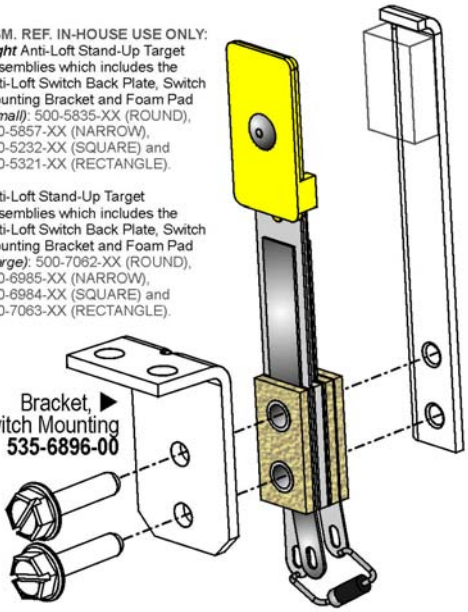


or

Anti-Loft Switch Back Plate ▼
535-9823-01

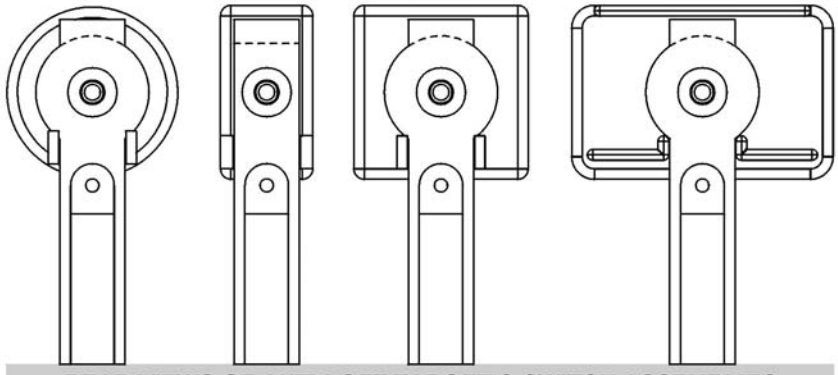
ASM. REF. IN-HOUSE USE ONLY:
Light Anti-Loft Stand-Up Target Assemblies which includes the Anti-Loft Switch Back Plate, Switch Mounting Bracket and Foam Pad *(Small)*: 500-5835-XX (ROUND), 500-5857-XX (NARROW), 500-5232-XX (SQUARE) and 500-5321-XX (RECTANGLE).

Anti-Loft Stand-Up Target Assemblies which includes the Anti-Loft Switch Back Plate, Switch Mounting Bracket and Foam Pad *(Large)*: 500-7062-XX (ROUND), 500-6985-XX (NARROW), 500-6984-XX (SQUARE) and 500-7063-XX (RECTANGLE).



Bracket, ▶
Switch Mounting
535-6896-00

▲ #6-32 X 5/8" Slotted HWH Swage (Zinc) Screws (Qty. 2/per) **237-5976-04**



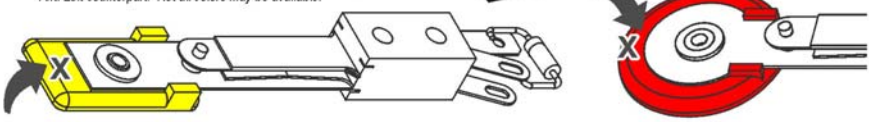
REAR VIEWS OF ANTI-LOFT TARGET & SWITCH ASSEMBLIES

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).*

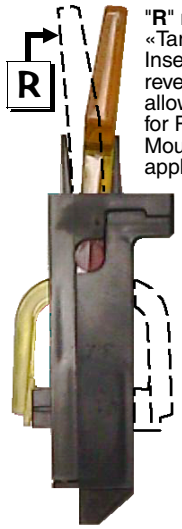
APPENDIX REFERENCE FOR PINBALL GAMES WHICH USED THE BELOW SWITCH & TARGET ASSEMBLIES NOTE:

*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.*



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











-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.

Take Note:

1. **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)
2. *For location(s) and type of Stand-Up Targets used, if any, see Section **4**, Chapter **1**, Parts Identification & Location.*

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 :

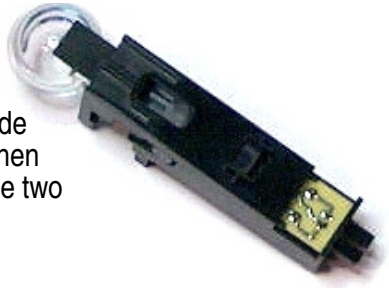
Items A-E Note: For the Target Assembly use the **"500-"** SPI Part Number(s) shown in the Parts Table below. To receive the Target Assembly with the « Target Insert » « ***R**eversed » simply add a **"R"** at the end of the Part Number. See Side View picture left to compare (dashed line shows target reversed).* For just the «Target Insert» use the **"545-"** SPI Part Number.

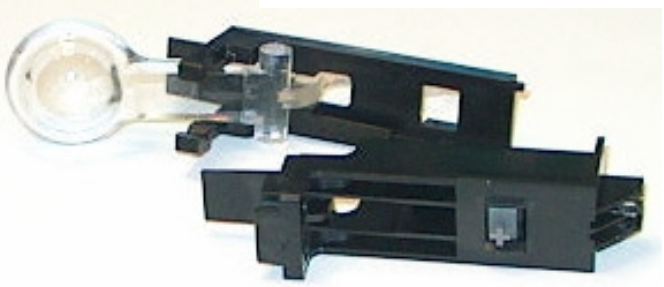


To reverse it yourself or to just change the insert:

1. 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.

2. 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.





3. 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.*

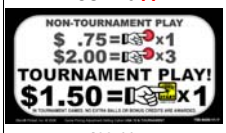
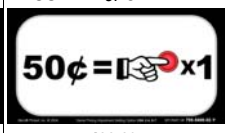
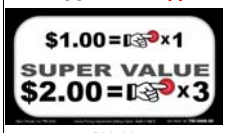
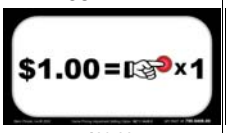
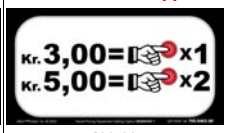
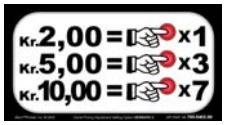
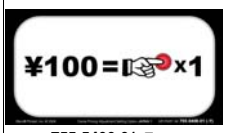
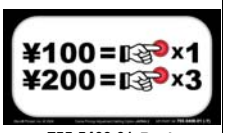
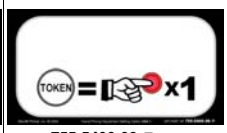
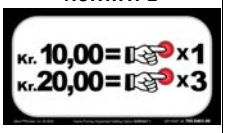
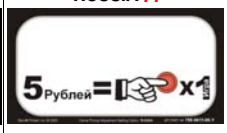
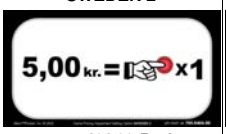
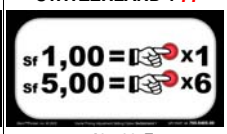
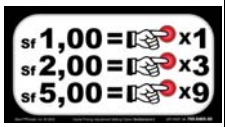
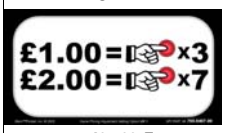
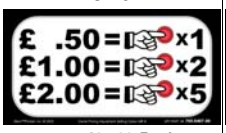
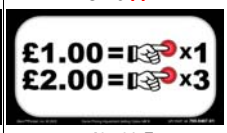
APPENDIX J

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.**	USA 10	USA 2-7 *or* CANADA	*FOR CUSTOM PRICING* †	USA 3 *with* ToPS™	USA 5 *with* ToPS™
			Backside is Blank (Border Only) *Typeset your Custom Pricing*		
755-5400-11 *Front*	755-5400-11 *Back*	755-5400-02 *Front*	755-5400-01, -02 *or* -04 *Back*	755-5400-03 *or* -09 *Front*	755-5400-03 *Back* / -08 *Front*
AUSTRALIA 1 *F.*	**AUSTRALIA 2**	**CROATIA**	*FOR CUSTOM PRICING* †	**DENMARK 1 *F.***	**DENMARK 2**
			Backside is Blank (Border Only) *Typeset your Custom Pricing*		
755-5406-00 *Front*	755-5406-00 *Back*	755-5410-00 *Front*	755-5410-00 *Back*	755-5402-00 *Front*	755-5402-00 *Back*
JAPAN 1	**JAPAN 2 *F.***	**MIDDLE EAST**	*ANY COUNTRY CAN USE*	**NEW ZEALAND 1 *F.***	**NEW ZEALAND 2**
					
755-5408-01 *Front*	755-5408-01 *Back*	755-5400-06 *Front*	*755-5400-06 Back*	*755-5406-00 Back*	755-5406-00 *Front*
NORWAY 1 *F.*	**NORWAY 2**	**RUSSIA *F.***	**RUSSIA (ALTERNATE)**	**SOUTH AFRICA**	*FOR CUSTOM PRICING* †
					Backside is Blank (Border Only) *Typeset your Custom Pricing*
755-5403-01 *Front*	755-5403-01 *Back*	755-5411-00 *Front*	755-5411-00 *Back*	755-5409-01 *Front*	755-5409-01 *Back*
SWEDEN 1 *F.*	**SWEDEN 2**	**SWITZERLAND 1 *F.***	**SWITZERLAND 2**	**TAIWAN**	*FOR CUSTOM PRICING* †
					Backside is Blank (Border Only) *Typeset your Custom Pricing*
755-5404-00 *Front*	755-5404-00 *Back*	755-5405-00 *Front*	755-5405-00 *Back*	755-5412-00 *Front*	755-5412-00 *Back*
UK 1	**UK 3**	**UK 5 *F.***	*FOR CUSTOM PRICING* †		
			Backside is Blank (Border Only) *Typeset your Custom Pricing*		
755-5407-00 *Front*	755-5407-00 *Back*	755-5407-01 *Front*	755-5407-01 *Back*		

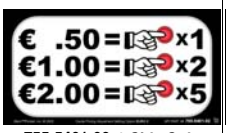
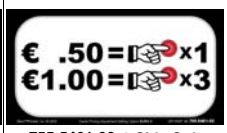
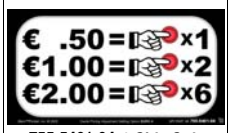
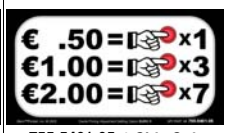
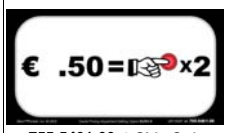
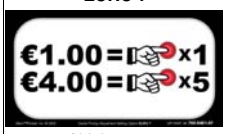
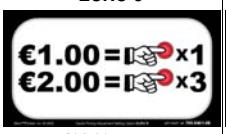
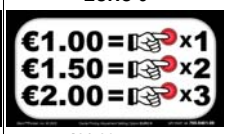
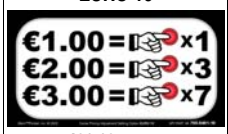
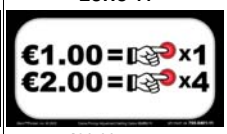
Appendix J Notes:

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	EURO 2	EURO 3	EURO 4	EURO 5	EURO 6
					
755-5401-01 *1-Side Only*	755-5401-02 *1-Side Only*	755-5401-03 *1-Side Only*	755-5401-04 *1-Side Only*	755-5401-05 *1-Side Only*	755-5401-06 *1-Side Only*
EURO 7	**EURO 8**	**EURO 9**	**EURO 10**	**EURO 11**	**EURO 12**
					
755-5401-07 *1-Side Only*	755-5401-08 *1-Side Only*	755-5401-09 *1-Side Only*	755-5401-10 *1-Side Only*	755-5401-11 *1-Side Only*	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.*







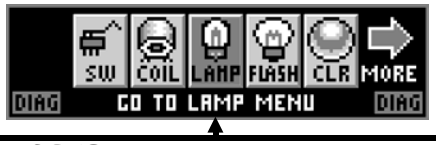
SWITCH MENU: SWITCH, ACTIVE & DEDICATED

SWITCH MATRIX GRID & DEDICATED SWITCHES (for notes & locations, see Page DR. 4 or 17)

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

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





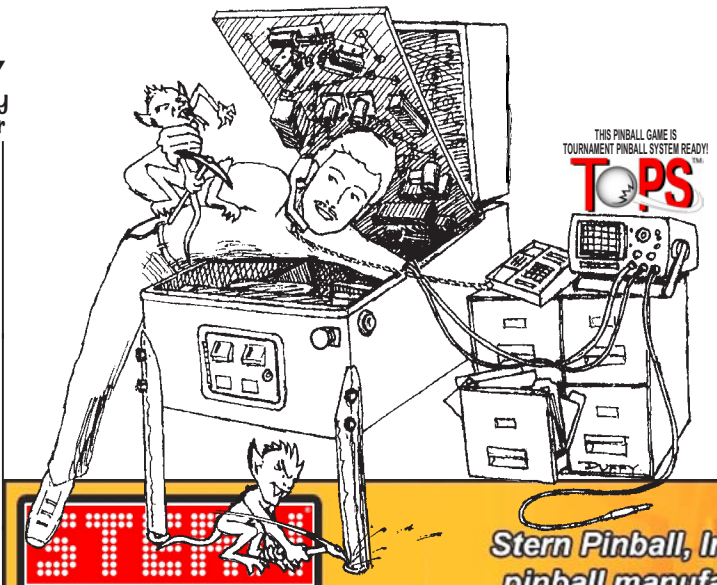


LAMP MENU: ONE, ALL, ROW & COLUMN

LAMP MATRIX GRID (for notes & locations, see Page DR. 5 or 23)

Column (18v) / Row (Ground)	1: U17 YEL-BRN J13-P9	2: U16 YEL-RED J13-P8	3: U15 YEL-ORG J13-P7	4: U14 YEL-BLK J13-P6	5: U13 YEL-GRN J13-P5	6: U12 YEL-BLU J13-P4	7: U11 YEL-VIO J13-P3	8: U10 YEL-GRY J13-P1
1: Q33 RED-BRN J12-P1	1 #555 Clear Bulb: (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 RED-BLK J12-P2	9 #44 Clear Bulb: 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 RED-ORG J12-P3	17 #555 Clear Bulb: (**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 RED-YEL J12-P4	25 #555 Clear Bulb: 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 ($) ENVELOPE	30 #555 Clear Bulb: LEFT ORBIT ARROW	31 #555 Clear Bulb: BADA BING 1 (BOT)	32 #555 Clear Bulb: BADA BING 2
5: Q37 RED-GRN J12-P5	33 #555 Clear Bulb: BADA BING 3	34 #555 Clear Bulb: L. RAMP FOOD	35 #555 Clear Bulb: L. RAMP ($) 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 RED-BLU J12-P6	41 #555 Clear Bulb: 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 RED-VIO J12-P8	49 #555 Clear Bulb: MEADOWLANDS 3	50 #555 Clear Bulb: R. RAMP FOOD	51 #555 Clear Bulb: R. RAMP ($) ENVELOPE	52 #555 Clear Bulb: RIGHT RAMP ARROW	53 #555 Clear Bulb: RIGHT TRUCK HEIST 1 (BOT)	54 #555 Clear Bulb: RIGHT TRUCK HEIST 2	55 #555 Clear Bulb: RIGHT TRUCK HEIST 3	56 #555 Clear Bulb: R. ORBIT FOOD
8: Q40 RED-GRY J12-P9	57 #555 Clear Bulb: R. ORBIT ($) 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 NOT USED	63 NOT USED	64 NOT USED
9: Q41 RED-WHT J12-P10	65 #44 Clear Bulb: 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 RED J12-P11	73 #555 Yel. Bulb: EPISODES: ARSON [bolts]	74 #555 Yel. Bulb: EPISODES: EXTERMINATE [bolts]	75 #555 Yel. Bulb: EPISODES: HORSE RACE [bolts]	76 #555 Yel. Bulb: EPISODES: EXEC. GAME [bolts]	77 #555 Yel. Bulb: EPISODES: SATISFACTION [bolts]	78 #555 Clear Bulb: SHOOT AGAIN	79 ***OPTIONAL*** *TOURNAMENT BUTTON*	80 #555 Clear Bulb: START BUTTON

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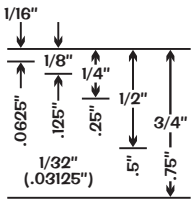
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Metric Conversion



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"**

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