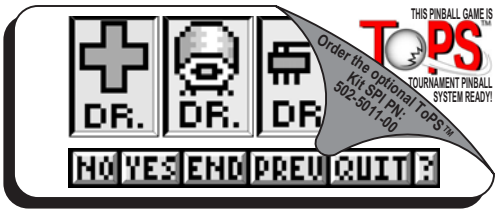
Find-It-In-Front: Dr. Pinball Section

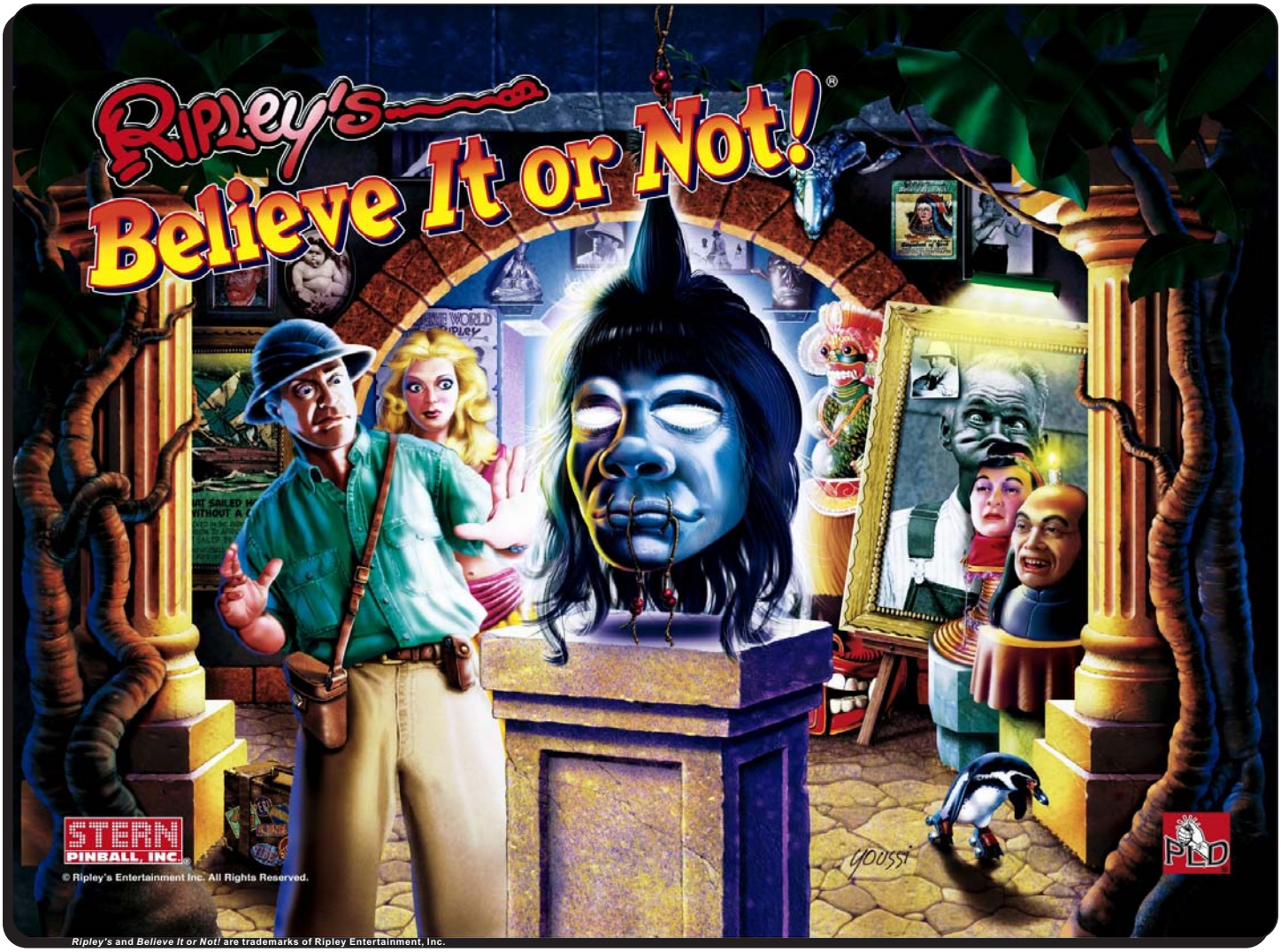
The inside cover & the front pages DR. ❶ thru DR. ❿ covers the basics...

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

STERN PINBALL, INC.



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



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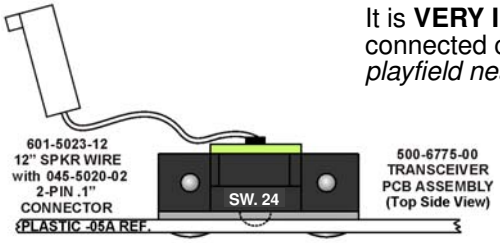
April 2004

SPI Part Number
780-5081-00

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

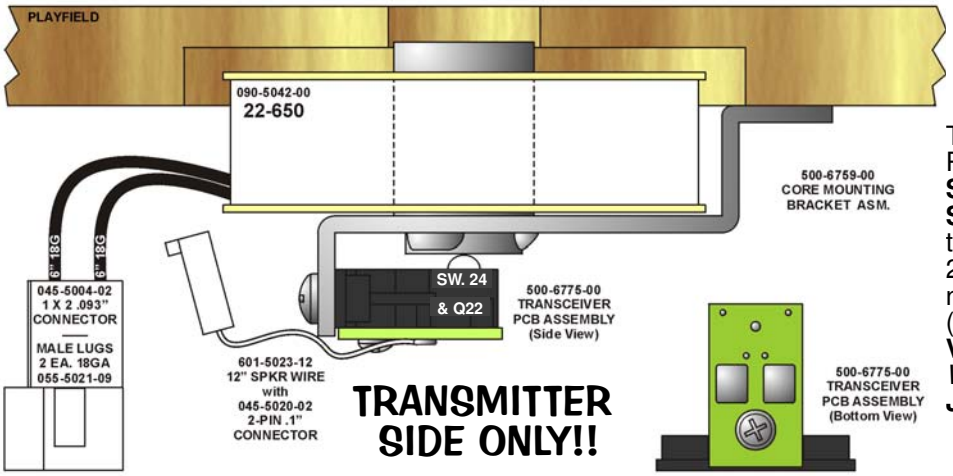
Lower Magnet OPTO (Transceiver) Board Proper Connection IMPORTANT!



RECEIVER SIDE

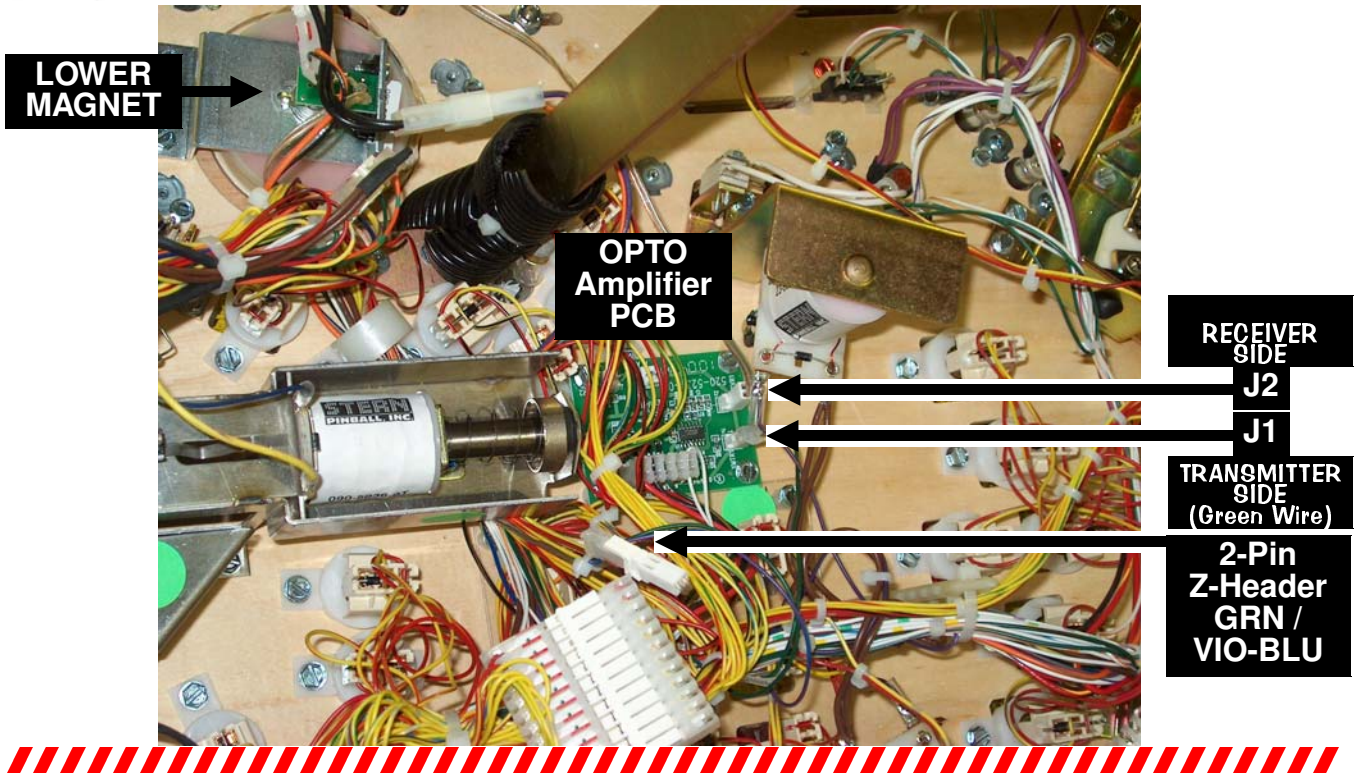
It is **VERY IMPORTANT** that the **OPTO (Transceiver) Boards** are connected correctly to the Lower Amplifier Board *(under the playfield nearest the lower magnet)* ***for this apllication***.

The **OPTO Board** *above the Playfield* is the **RECEIVER SIDE (Sw. 24).** The 2-Pin Connector should plug directly onto the OPTO Amplifier Board at Conn. **J2** ***!***



TRANSMITTER SIDE ONLY!!

The **OPTO Board** below the Playfield is the f**TRANSMITTER SIDE (Sw. 24)** and also has a **SWITCHED GROUND (Q22)** on the I/O Power Driver Board. The 2-Pin Connector should get connected to the Playfield Harness (Z-Header) Conn. **GREEN** and **VIOLET-BLUE** Wires. The *GREEN Wire* then should get connected to **J1** on the OPTO Amplifier Board ***!!***



New to our Pinball Games?

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

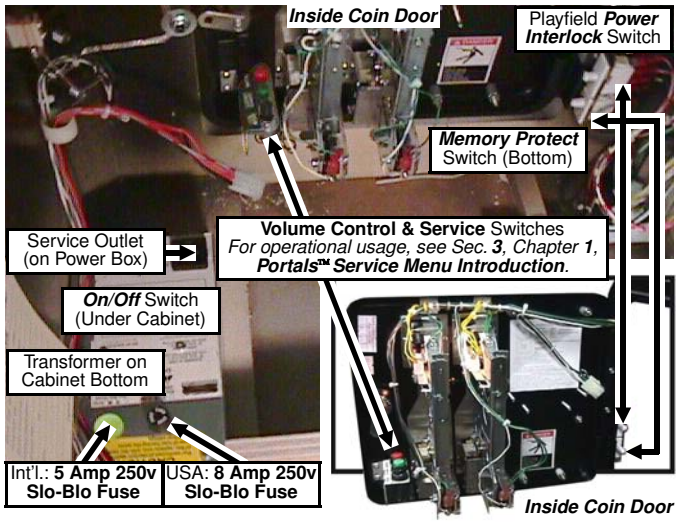
Backbox PCB Fuses, ROMs, Bridges, Relays, P/F & Cabinet Fuses, Cab. Switches

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

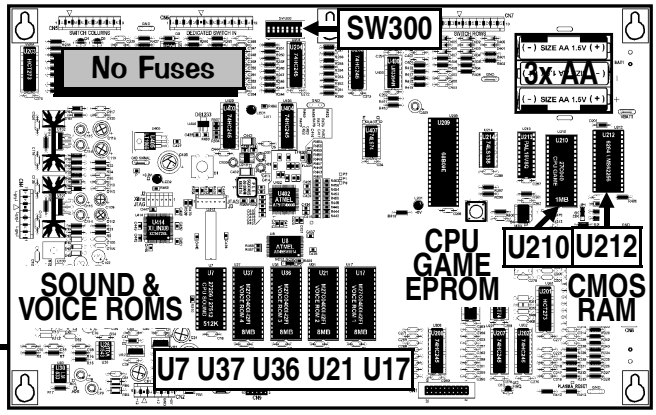
QUICK REFERENCE FUSE CHART

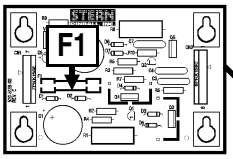
Backbox Fuses			
LOC:	**DISPLAY POWER SUPPLY (P.S.) BOARD**		
F1	¾A 250v S.B.	90v DC	High Voltage Display
LOC:	**I / O POWER DRIVER BOARD**		
F6	7A 250v S.B.	50v DC	Primary High Power Coils/Flippers
F7	5A 250v S.B.	20v DC	Low Power Coils
F8	5A 250v S.B.	12v DC	Logic Power
F9	5A 250v S.B.	12v DC	Logic Power
F20	**4A 250v S.B.**	50v DC	Magnets ◀◀◀ **THIS GAME ONLY**
F21	3A 250v S.B.	50v DC	Coils
F22	8A 250v S.B.	18v DC	Controlled Lamps
F23	4A 250v S.B.	5v DC	Logic
F24	5A 250v S.B.	6.3v AC	G.I. Lamps (BRN-WHT to WHT-BRN)
F25	5A 250v S.B.	6.3v AC	G.I. Lamps (YEL to WHT-YEL)
F26	5A 250v S.B.	6.3v AC	G.I. Lamps (GRN to WHT-GRN)
F27	5A 250v S.B.	6.3v AC	G.I. Lamps (VIO to WHT-VIO)
F28	3A 250v S.B.	24v AC	**Not Used / Spare**
Cabinet Fuses			
LOC:	**SERVICE (AC) OUTLET BOX (Cabinet Bottom)**		
n/a	8A 250v S.B.	115v AC	Main Fuse Line (Domestic or USA)
n/a	5A 250v S.B.	220v AC	Main Fuse Line (International)
Playfield (P/F) Fuses			
LOC:	**UNDER PLAYFIELD (near Flippers)**		
n/a	3A 250v S.B.	50v DC	Right Flipper (BLU-YEL⇆RED-YEL)
n/a	3A 250v S.B.	50v DC	Left Flipper (GRY-YEL⇆RED-YEL)
n/a	3A 250v S.B.	50v DC	Upr. Rt. Flip. (BLU-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	965-0408-81
CPU Game	U210	1 MB	965-0409-81
CPU Voice ROM 1	U17	8 MB	965-0410-81
CPU Voice ROM 2	U21	8 MB	965-0411-81
CPU Voice ROM 3	U36	8 MB	965-0412-81
CPU Voice ROM 4	U37	8 MB	965-0413-81
DISPLAY Controller	U5	4 MB	965-0414-81





◀ Display Power Supply Bd.

Solenoid Expander Board ‡

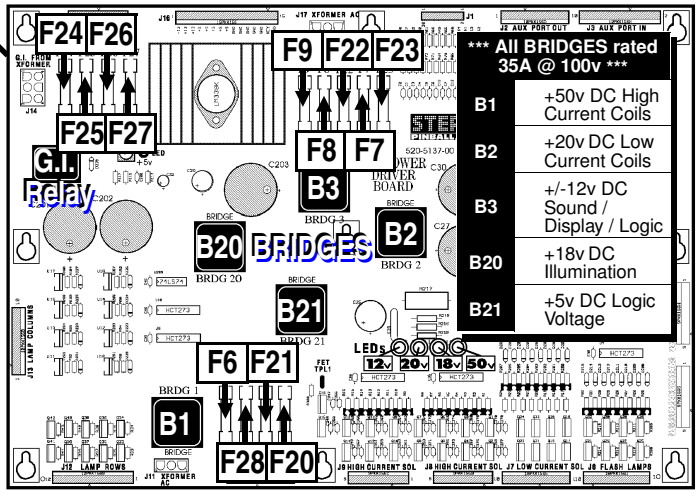
Tournament Interface Board ‡

‡ 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).

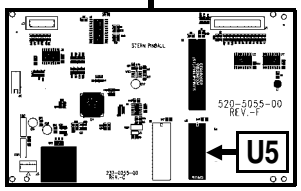
CPU/Sound Bd. II w/ATMEL ▲

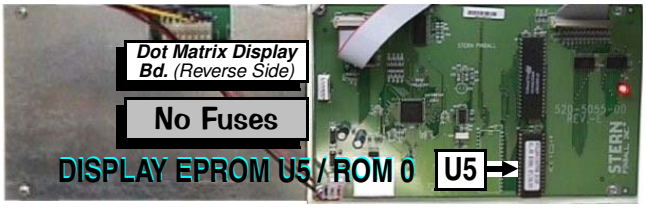
I/O Power Driver Board ▼



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

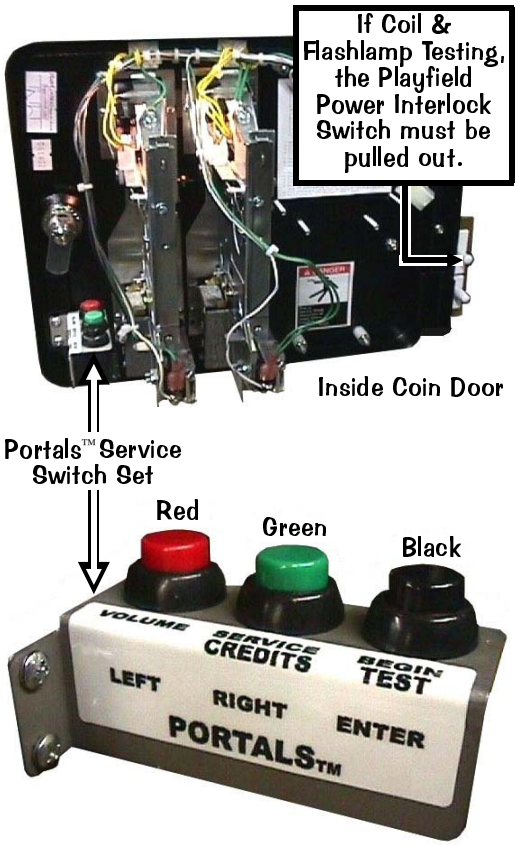
How It Works

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

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

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

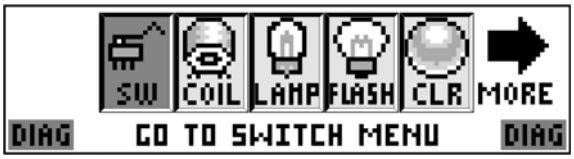
Step 3: Select or activate the *Icons* by pushing the **Black "ENTER" Button**.



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

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

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



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

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

DIAGNOSTIC AIDS

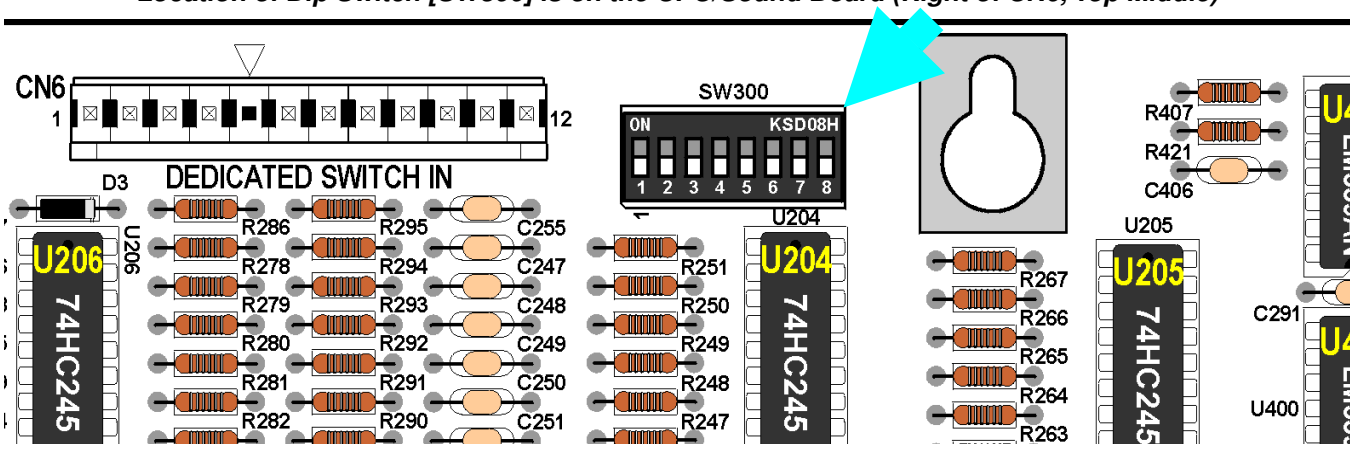
If this ***display flashes***, the game is indicating that **CMOS RAM** memory *(CPU Loc. **U212**)* has been corrupted. This is caused be either failure in memory *(e.g. batteries are dead and/or faulty **RAM**)* or upon installation of updated version of game code. Opening the **Coin Door** will initiate 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
Austria	ON	▲							
	OFF		▼	▼	▼	▼	▼	▼	▼

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

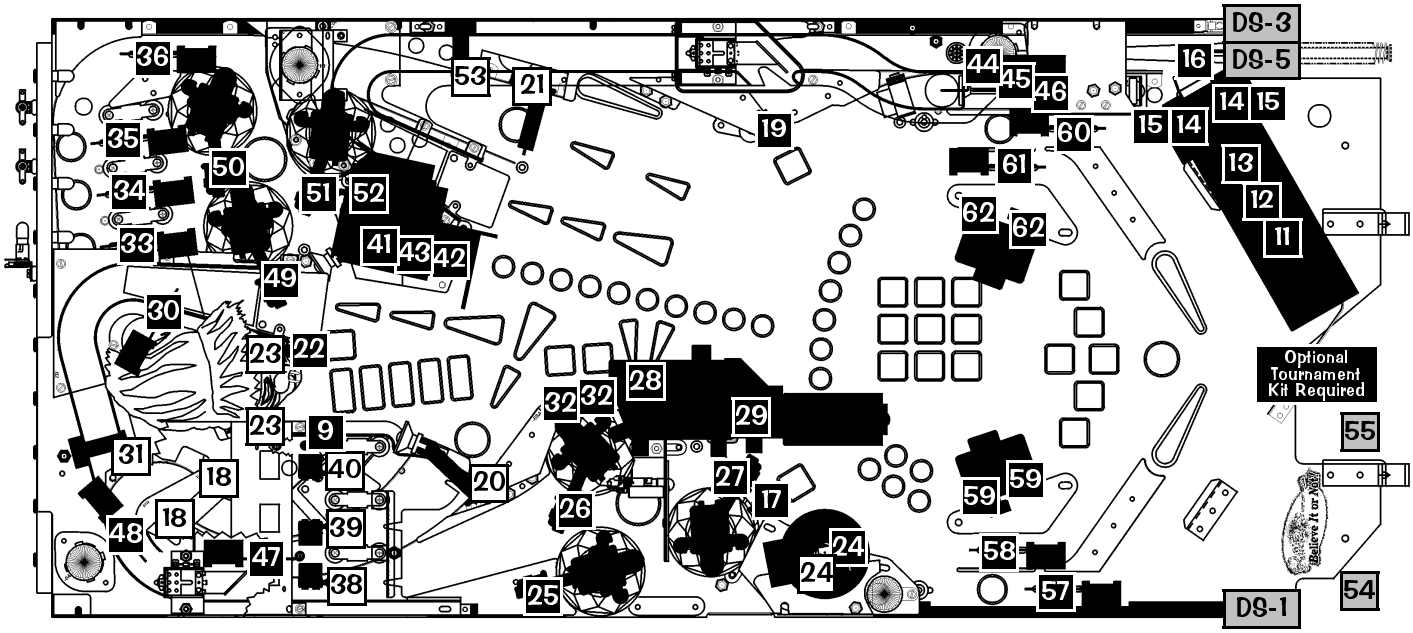
In SWITCH MENU also select:

ACTIVE and DEDICATED SWITCH TESTS

SWITCH MATRIX GRID, DEDICATED SWITCHES & 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 Below P/F: HEAD STAND-UP	17 Below P/F: TOMBSTONE 1	25 Below P/F: LOWER LEFT POP	33 Below P/F: BONUS X INLANE - LFT	41 Below P/F: VARI-TARGET OPTO 1	49 Below P/F: UPPER LEFT POP	57 Below P/F: LEFT OUTLANE
Sw. Part Number:	180-5160-00	515-5162-08	515-5162-08	180-5015-03	500-6227-02	*See Sw. 41 Note*	180-5015-03	500-6227-02
2: U400 WHT-RED CN7-P8	2 Coin Door: 4TH COIN SLOT	10: NOT USED	18 ~ P/F: SUPER JACKPOT OPTO	26 Below P/F: LOWER RIGHT POP	34 Below P/F: BONUS X INLANE - MID	42 Below P/F: VARI-TARGET OPTO 2	50 Below P/F: UPPER RIGHT POP	58 Below P/F: LEFT RETURN LANE
Sw. Part Number:	180-5204-00		*See Sw. 18 Note*	180-5015-03	500-6227-02	*See Sw. 42 Note*	180-5015-03	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 Below P/F: TOMBSTONE 5	27 Below P/F: LOWER BOTTOM POP	35 Below P/F: BONUS X INLANE - RT	43 Below P/F: VARI-TARGET OPTO 3	51 Below P/F: UPPER BOTTOM POP	59 Below P/F: LEFT SLINGSHOT
Sw. Part Number:	*Future Use*	180-5119-02	515-5162-08	180-5015-03	500-6227-02	*See Sw. 43 Note*	180-5015-03	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 Below P/F: LEFT SPINNER	28 Below P/F: SIDE SCOOP ENTRY (DOTS)	36 Below P/F: RIGHT ORBIT	44 Below P/F: LOCK 1 - TOP	52 Below P/F: VARI-TARGET VUK	60 Below P/F: RIGHT OUTLANE
Sw. Part Number:	180-5204-00	180-5119-02	180-5010-04	180-5183-00	500-6227-02	180-5180-00	180-5116-01	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 Below P/F: RIGHT SPINNER	29 Below P/F: SCOOP VUK (DOTS)	37: NOT USED	45 Below P/F: LOCK 1 - MIDDLE	53 Above P/F: RIGHT RAMP	61 Below P/F: RIGHT RETURN LANE
Sw. Part Number:	180-5204-00	180-5119-02	180-5010-04	180-5183-00		180-5179-00	180-5190-28	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 Below P/F: TOMBSTONE 4	30 Below P/F: BEHIND HEAD	38 Above P/F: MINI PLAYFIELD LEFT	46 Below P/F: LOCK 1 - BOTTOM	54 In Cabinet: START BUTTON	62 Below P/F: RIGHT SLINGSHOT
Sw. Part Number:	180-5204-00	*See Sw. 14 Note*	515-5967-06	500-6227-02	180-5183-00	180-5178-00	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 Below P/F: SHRUNKEN HEAD OPTO	31 Above P/F: LEFT RAMP MAKE	39 Above P/F: MINI PLAYFIELD CENTER	47 Below P/F: LEFT JACKPOT LOOP	55 In Cabinet: TOURNAMENT START	63: NOT USED
Sw. Part Number:	*Future Use*	*See Sw. 15 Note*	See Sw. 23 Note	180-5190-28	180-5183-00	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 Below P/F: IDOL EYE OPTO	32 Below P/F: TOMBSTONE 2+3	40 Above P/F: MINI PLAYFIELD RIGHT	48 Below P/F: LEFT ORBIT	56 In Cabinet: PLUMB BOB TILT	64: NOT USED
Sw. Part Number:	180-5160-00	180-5157-00	*See Sw. 23 Note*	515-5162-08	180-5183-00	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:	180-5164-00 *Doubled*
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 on Cabinet Side: #5 UPPER RT. FLIPPER BUTTON
Sw. Part Number:	*Same as DS-3 above.*
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, 18, 23, 24, 41, 42 & 43 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); Transceiver: 500-6775-00 (Qty. 2/per) (Sw. 18, 23 & 24); Transceiver: 520-5234-00 (Sw. 41-43)*
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 Sec.* ***5****, Chp.****2****,* ***Playfield Wiring****.*

Ripley's Believe It or Not!

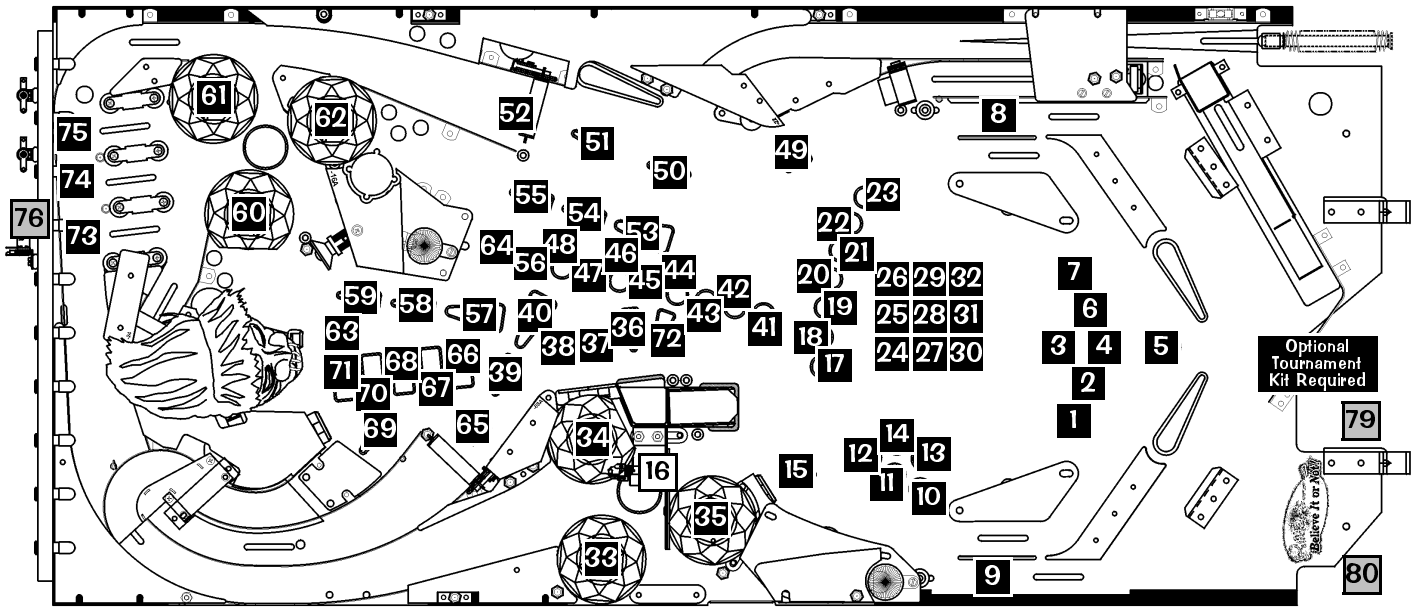
Find-It-In-Front: Dr. Pinball

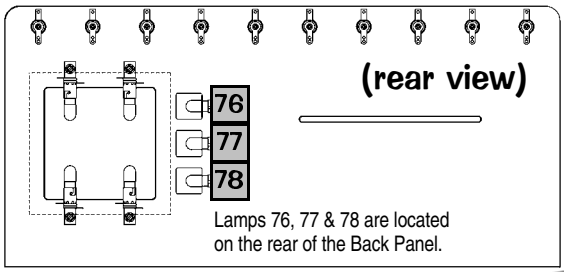
In LAMP MENU also select:

TEST ALL LAMPS, ROW & COLUMN LAMP TESTS

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 Bulb SUPER JACKPOT 2 MIL	2 #555 Bulb SUPER JACKPOT 3 MIL	3 #555 Bulb SUPER JACKPOT 1 MIL	4 #555 Bulb SUPER JACKPOT 4 MIL	5 #555 Bulb SHOOT AGAIN	6 #555 Bulb SUPER JACKPOT 5 MIL	7 #555 Bulb SUPER JACKPOT 6 MIL	8 #555 Bulb RIGHT SPECIAL
2: Q34 RED-BLK J12-P2	9 #555 Bulb LEFT SPECIAL	10 #555 Bulb 1 IDOL COUNTER	11 #44 Bulb 2 IDOL COUNTER	12 #555 Bulb 3 IDOL COUNTER	13 #555 Bulb 4 IDOL COUNTER	14 #555 Bulb 5 IDOL COUNTER	15 #555 Bulb TOMBSTONE 1	16 #44 Bulb SCOOP ARROW
3: Q35 RED-ORG J12-P3	17 #555 Bulb (R) IPLEYS	18 #555 Bulb R (I) PLEYS	19 #555 Bulb RI (P) LEYS	20 #555 Bulb RIP (L) EYS	21 #555 Bulb RIPL (E) YS	22 #555 Bulb RIPLE (Y) S	23 #555 Bulb RIPLEY (S)	24 #555 Bulb GRID A1 (UPPER LEFT)
4: Q36 RED-YEL J12-P4	25 #555 Bulb GRID B1	26 #555 Bulb GRID C1	27 #555 Bulb GRID A2	28 #555 Bulb GRID B2	29 #555 Bulb GRID C2	30 #555 Bulb GRID A3	31 #555 Bulb GRID B3	32 #555 Bulb GRID C3
5: Q37 RED-GRN J12-P5	33 #555 Bulb LOWER LEFT POP DIODE	34 #555 Bulb LOWER RIGHT POP DIODE	35 #555 Bulb LOWER BOT POP DIODE	36 #555 Bulb SKILL SHOT	37 #555 Bulb TOMBSTONE 2	38 #555 Bulb TOMBSTONE 3	39 #555 Bulb MILLION PLUS	40 #555 Bulb LOOP JACKPOT
6: Q38 RED-BLU J12-P6	41 #555 Bulb VARI-TARGET SPECIAL	42 #555 Bulb VARI-TARGET EB	43 #555 Bulb VARI-TARGET ? (MYSTERY)	44 #555 Bulb VARI-TARGET S.A.	45 #555 Bulb VARI-TARGET N.A.	46 #555 Bulb VARI-TARGET EUROPE	47 #555 Bulb VARI-TARGET AUSTR.	48 #555 Bulb VARI-TARGET ASIA
7: Q39 RED-VIO J12-P8	49 #555 Bulb TOMBSTONE 5	50 #44 Bulb PENGUIN	51 #44 Bulb ADVANCE TOMBSTONE	52 #44 Bulb RIGHT SPINNER	53 #555 Bulb RIGHT JACKPOT	54 #555 Bulb LOCK	55 #555 Bulb RIPOFF	56 #555 Bulb VARI-TARGET ANTAR.
8: Q40 RED-GRY J12-P9	57 #555 Bulb CENTER JACKPOT	58 #555 Bulb LITE HEAD	59 #555 Bulb GATE OPEN	60 #555 Bulb UPPER LEFT POP DIODE	61 #555 Bulb UPPER RIGHT POP DIODE	62 #555 Bulb UPPER BOT POP DIODE	63 #44 Bulb TOMBSTONE 4	64 #555 Bulb VARI-TARGET AFRICA
9: Q41 RED-WHT J12-P10	65 #44 Bulb LEFT SPINNER	66 #555 Bulb MULTIBALL	67 #555 Bulb LIGHT LOCKS	68 #555 Bulb COLLECT BIG-FOOT BONUS	69 #555 Bulb SUPER JACKPOT	70 #555 Bulb ODDITORIUM	71 #555 Bulb THE HEAD KNOWS	72 #555 Bulb BOZO
10: Q42 RED J12-P11	73 #555 Bulb BONUS X INLANE LEFT	74 #555 Bulb BONUS X INLANE CTR	75 #555 Bulb BONUS X INLANE RT	76 #44 Bulb BACK PANEL A	77 #44 Bulb BACK PANEL B	78 #44 Bulb BACK PANEL C	79 #555 Bulb TOURNAMENT BUTTON	80 #555 Bulb START BUTTON





Lamps 76, 77 & 78 are located on the rear of the Back Panel.

Playfield ▲
◀ Backpanel

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

Lamp Part Notes: *#555 Bulb Clear = 165-5002-00. #44 Bulb Clear = 165-5000-44. 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****.*

In COIL MENU also select:

CYCLING COIL TEST

COILS DETAILED CHART TABLE

	High Current Coils Group 1	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#1	TROUGH UPKICKER	Q1	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BRN-BLK	J8-P1	26-1200 ↻ 090-5044-00B
#2	AUTOLAUNCH	Q2		YEL-VIO	J10-P4/5	50v DC	BRN-RED	J8-P3	23-800 ↻ 090-5001-00B
#3	VARI VUK	Q3		YEL-VIO	J10-P4/5	50v DC	BRN-ORG	J8-P4	24-940 ↻ 090-5036-00T
#4	LEFT RAMP DIVERTER	Q4		YEL-VIO	J10-P4/5	50v DC	BRN-YEL	J8-P5	32-1800 ↻ 090-5031-00
#5	RIGHT RAMP DIVERTER	Q5		YEL-VIO	J10-P4/5	50v DC	BRN-GRN	J8-P6	32-1800 ↻ 090-5031-00
#6	LOWER LEFT POP	Q6		YEL-VIO	J10-P4/5	50v DC	BRN-BLU	J8-P7	26-1200 ↻ 090-5044-00T
#7	LOWER RIGHT POP	Q7		YEL-VIO	J10-P4/5	50v DC	BRN-VIO	J8-P8	26-1200 ↻ 090-5044-00T
#8	LOWER BOTTOM POP	Q8		YEL-VIO	J10-P4/5	50v DC	BRN-GRY	J8-P9	26-1200 ↻ 090-5044-00T

	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	UPPER LEFT POP	Q9	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BLU-BRN	J9-P1	26-1200 ↻ 090-5044-00T
#10	UPPER RIGHT POP	Q10		YEL-VIO	J10-P4/5	50v DC	BLU-RED	J9-P2	26-1200 ↻ 090-5044-00T
#11	UPPER BOTTOM POP DOTS	Q11		YEL-VIO	J10-P4/5	50v DC	BLU-ORG	J9-P4	26-1200 ↻ 090-5044-NL
#12	SCOOP VUK	Q12		YEL-VIO	J10-P4/5	50v DC	BLU-YEL	J9-P5	24-940 ↻ 090-5036-00T
#13	LOCK KICKER	Q13		YEL-VIO	J10-P4/5	50v DC	BLU-GRN	J9-P6	23-800 ↻ 090-5001-00B
#14	UPPER RIGHT FLIPPER	Q14		BLU-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	BLU-BLK	J9-P7	25-1400 ↻ 090-5067-00T
#15	LEFT FLIPPER (50v RED/YEL)	Q15		GRY-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	ORG-GRY	J9-P8	22-1080 ↻ 090-5032-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16		BLU-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	ORG-VIO	J9-P9	22-1080 ↻ 090-5032-00T

	Low Current Coils Group 1	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#17	LEFT SLINGSHOT	Q17	▲ I/O Power Driver ▼	BRN	J7-P1	20v DC	VIO-BRN	J7-P2	23-800 ↻ 090-5001-00T
#18	RIGHT SLINGSHOT	Q18		BRN	J7-P1	20v DC	VIO-RED	J7-P3	23-800 ↻ 090-5001-00T
#19	AUX - IDOL MAGNET	Q19		VIO-YEL~AUX. BD.~VIO-RED	J10-P3	50v DC	ORG to VIO-ORG	J7-P4	22-650 ↻ 090-5042-00
#20	AUX - HEAD MAGNET	Q20		VIO-YEL~AUX. BD.~VIO-RED	J10-P3	50v DC	ORG-YEL to VIO-YEL	J7-P6	22-650 ↻ 090-5042-00
#21	AUX - VARI RESET	Q21		VIO-YEL~AUX. BD.~VIO-RED	J10-P3	50v DC	ORG-GRN to VIO-GRN	J7-P7	32-1800 ↻ 090-5031-00-ND
#22	IDOL OPTO LED	Q22		BRN	J7-P1	20v DC	VIO-BLU	J7-P8	SWITCHED GROUND
#23	TOP POST	Q23		BRN	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

Diode On Terminal Strip (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: LWR POPS/LWR LT X2	Q25	▲ I/O Power Driver ▼	ORG	J6-P10	20v DC	BLK-BRN	J6-P1	#89 Bulb 165-5000-89
#26	FLASH: LEFT SPINNER	Q26		ORG	J6-P10	20v DC	BLK-RED	J6-P2	#89 Bulb 165-5000-89
#27	FLASH: UPPER LEFT	Q27		ORG	J6-P10	20v DC	BLK-ORG	J6-P3	#906 Bulb 165-5004-00
#28	FLASH: HEAD	Q28		ORG	J6-P10	20v DC	BLK-YEL	J6-P4	#906 Red 165-5004-02
#29	FLASH: VARI-TARGET	Q29		ORG	J6-P10	20v DC	BLK-GRN	J6-P5	#89 Bulb 165-5000-89
#30	FLASH: UPR POPS/RT RMP X2	Q30		ORG	J6-P10	20v DC	BLK-BLU	J6-P6	#89 under PF #906 Ramp
#31	FLASH: RIGHT SPINNER	Q31		ORG	J6-P10	20v DC	BLK-VIO	J6-P7	#89 Bulb 165-5000-89
#32	FLASH: RIGHT RAMP LOWER	Q32		ORG	J6-P10	20v DC	BLK-GRY	J6-P8	#906 Bulb 165-5004-00

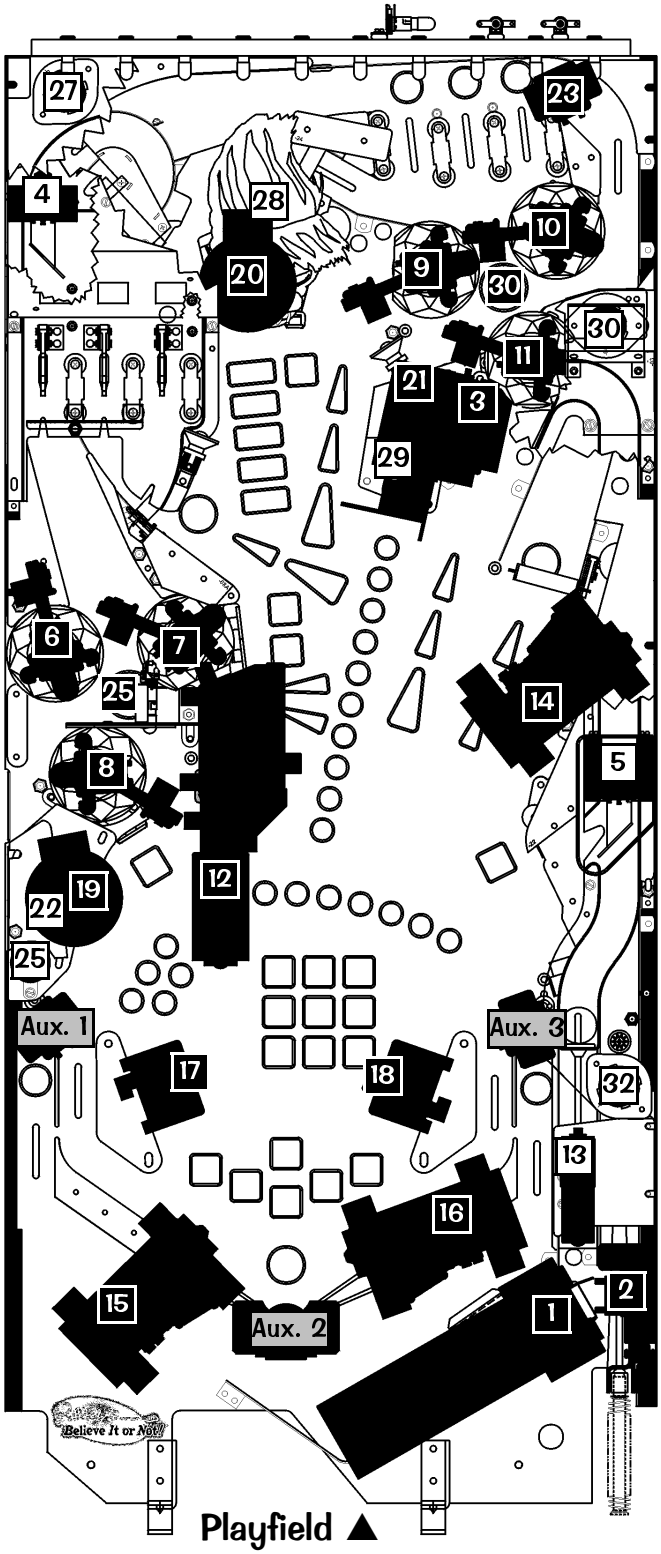
Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: Q25-Q32)

	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	BRN	J7-P1	20v DC	WHT	J2-P3	26-1200 ↻ 090-5044-00T
	AUX 2: CENTER UP/DOWN POST	Q2		BRN	J7-P1	20v DC	RED	J2-P4	23-1100 ↻ 090-5030-00T
	AUX 3: RIGHT UP/DOWN POST	Q3		BRN	J7-P1	20v DC	ORG	J2-P7	26-1200 ↻ 090-5044-00T

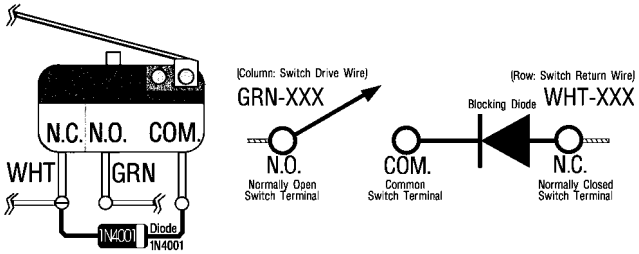
↻ **Coil Note:** ↻ Either -00**B** *or* -00**T** can be used for coil replacements. *B/T listed is preferable for easier diode access & may differ on game.*

Ripley's Believe It or Not!

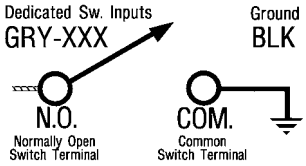
COIL & FLASH LAMP LOCATIONS



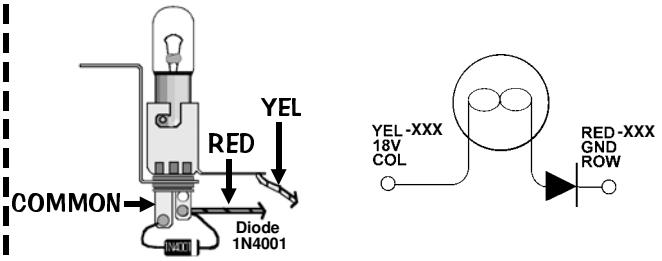
Typical Switch Wiring & Schematic



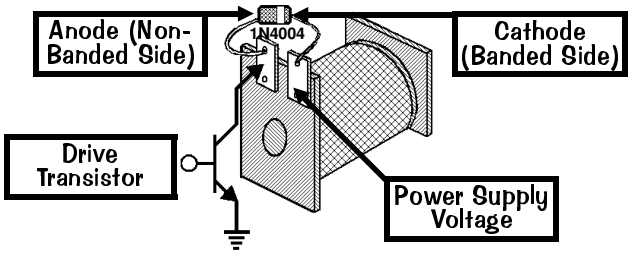
Dedicated Switch Schematic



Typical Lamp Wiring & Schematic



Typical Coil Wiring



= Coils / Flash Lamps above Playfield.

= Coils / Flash Lamps below Playfield.

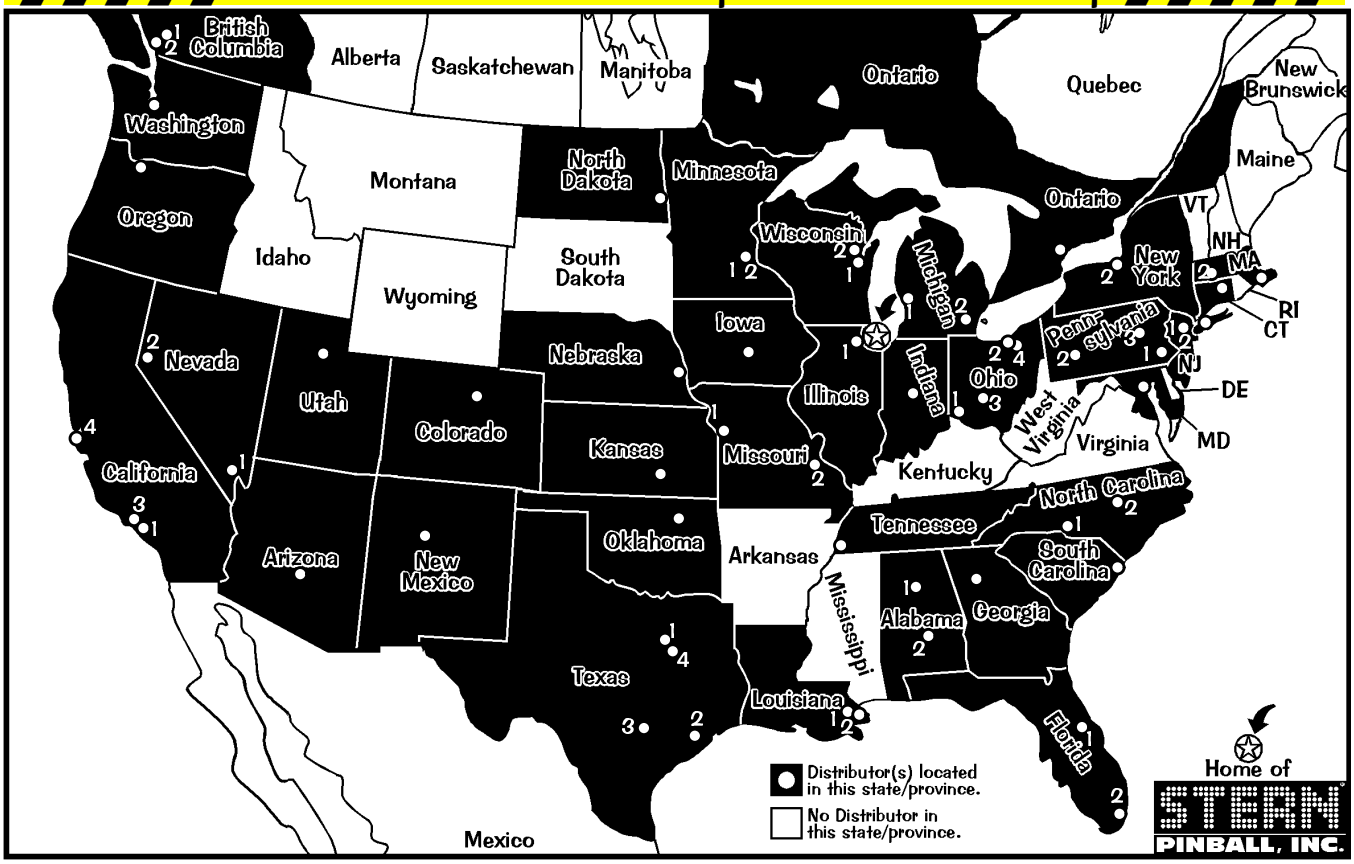
= Coils / Flash Lamps not on Playfield.

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

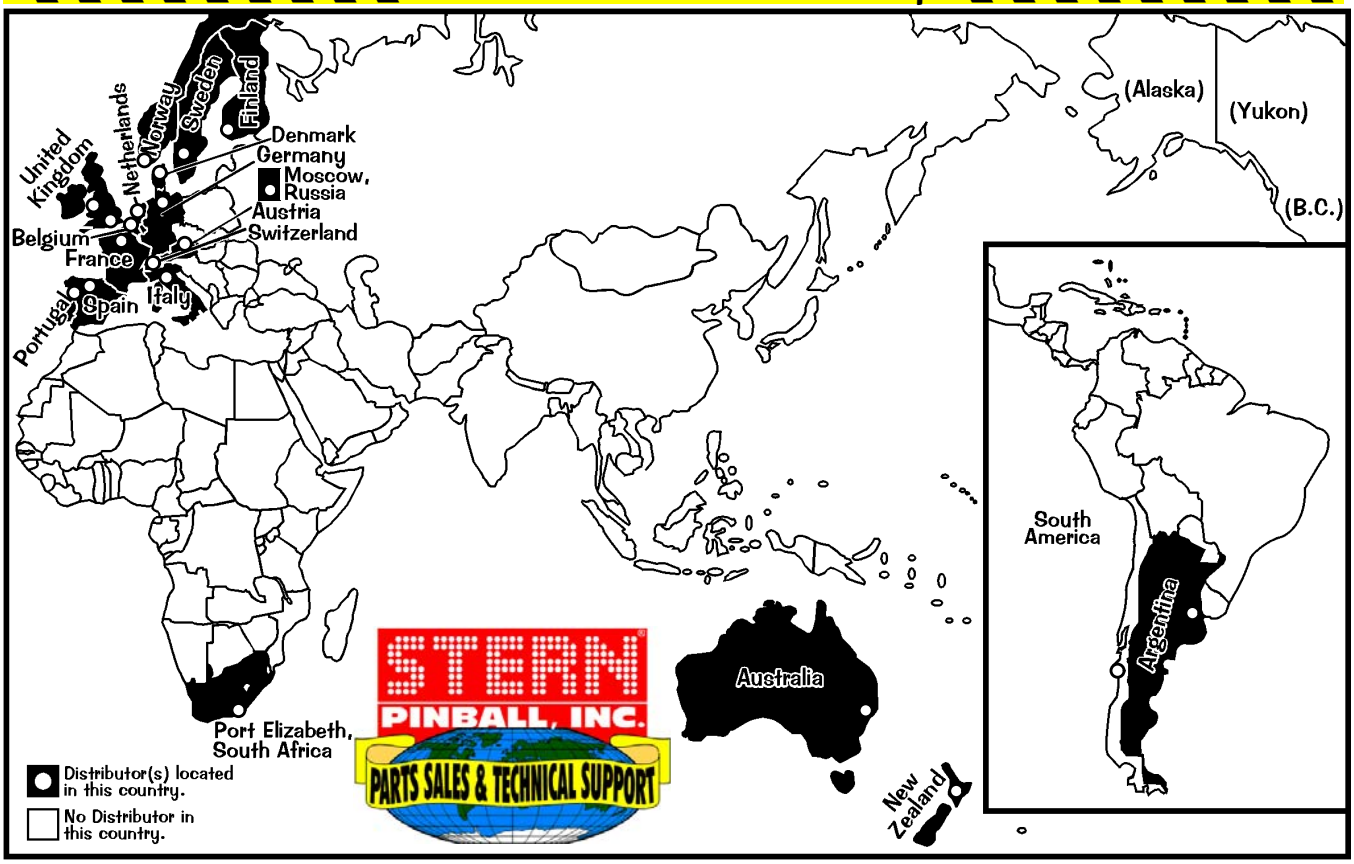
Some Coil or Flash Lamp Diodes may be located under the playfield, in the Cabinet or Backbox *on Terminal Strips* ***or*** *Diode Boards and not on the assemblies.*
DOTS: **D**iode **O**n **T**erminal **S**trip *See Section* ***5****, Chapter* ***2****,* ***Playfield Wiring****.*

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.

Ripley's Believe It or Not!®

Find-It-In-Front:
Dr. Pinball

Domestic Pinball & Redemption Distributors Directory

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

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

ARIZONA
Betson West
Phoenix
1-480-380-8857

Mountain Coin
Phoenix
1-602-269-7596

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

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

COLORADO
Mountain Coin
Denver
1-303-427-2133

CONNECTICUT
TDM Distributing
Williamantic
1-860-423-1403

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

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

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

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

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

World Wide Distributing
Elk Grove Village
847-434-0400

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

Moss Distributing
Des Moines
1-515-266-6422

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

Shaffer Distributing
Indianapolis
1-317-899-2530

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

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

Parts & Service Only:

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

MARYLAND
Betson Enterprises
Baltimore
1-410-646-4100

Parts & Service Only:

Weiner Distributing
Baltimore
1-410-525-2600

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

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

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

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

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

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

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

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

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

NEBRASKA
Central Dist.
Omaha
1-402-493-5600

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

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

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

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

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

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

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

Parts & Service Only:

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

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

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

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

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

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

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

OKLAHOMA
Galaxy Distributing
Tulsa
1-918-835-1166

OREGON
Betson West
Portland
1-503-772-4567

Mountain Coin
Portland
1-503-234-5491

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

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

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

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

SOUTH CAROLINA
Parts & Service Only:

Green Coin
Mrytle Beach
1-843-626-1900

TENNESSEE
Brady Distributing
Memphis
1-901-345-7811

Parts & Service Only:

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

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

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

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

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

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

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

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

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

WASHINGTON
Mountain Coin
Seattle
1-206-682-5700

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

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

CANADA

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

BRITISH COLUMBIA
Parts & Service Only:

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

Parts & Service Only:

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

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

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

International Distributors Directory

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

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

AUSTRIA

Parts & Service Only:

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

Parts & Service Only:

TAB
Ansfelden
[43] 7229-7-8040

BELGIUM
NAMUSCO
Brussels
[32] 2414-4596

Belgium Continued
Parts & Service Only:

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

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

ENGLAND
see UNITED KINGDOM

FINLAND
Pelika Ray-Oy
Espoo
[35] 5894-370-2925

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

Note: *From inside the US, use prefix 011-.*

POWER REQUIREMENTS

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

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

TRANSPORTATION

BEFORE TRANSPORTING

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

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

SAVE AND RETAIN ALL PRINTED INFORMATION INSIDE THE CABINET !

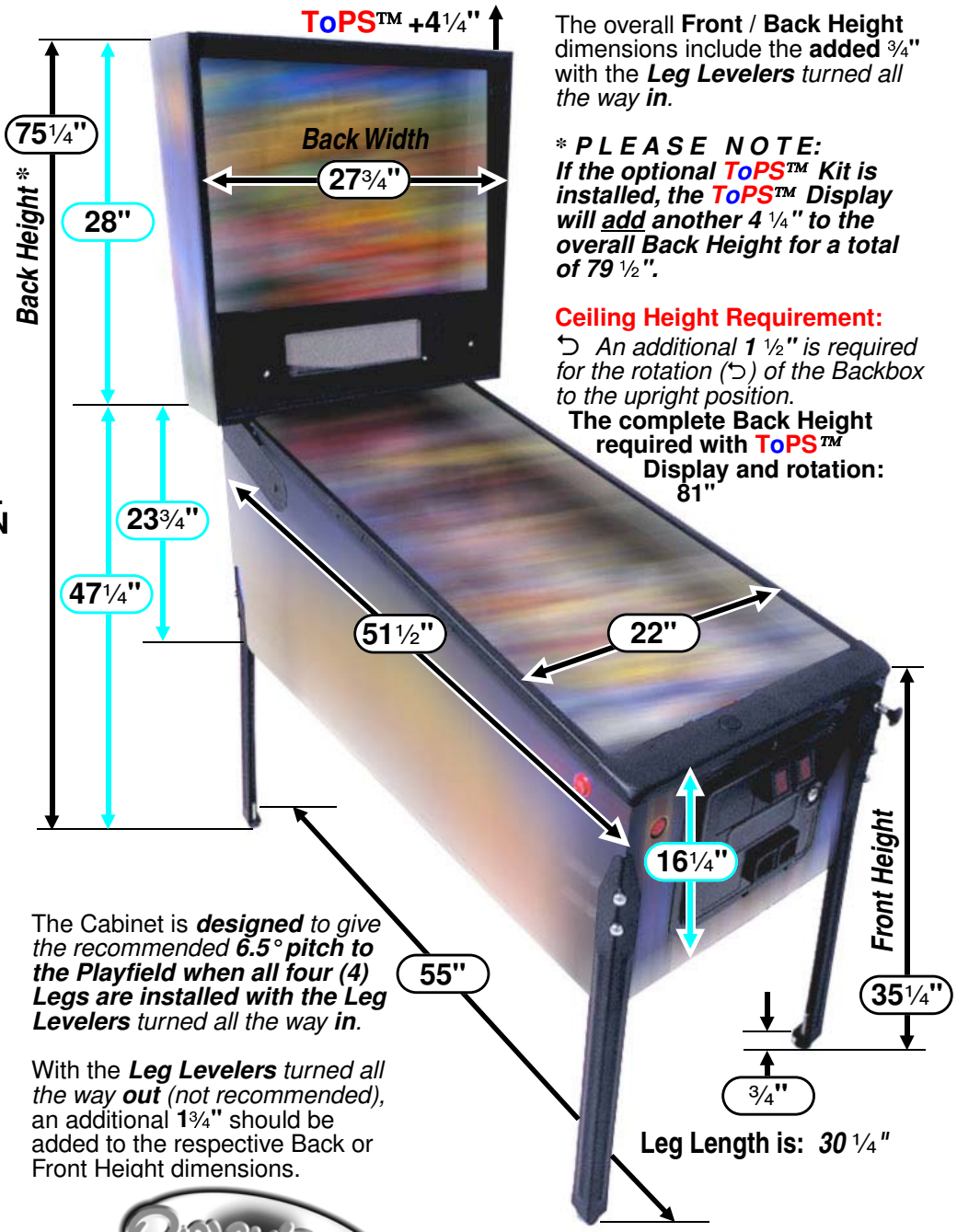
Shipping Box Dimensions

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

C A U T I O N

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

GAME DIMENSIONS



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

**** P L E A S E N O T E:***
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"*

Ripley's Believe It or Not!

Find-It-In-Front: Dr. Pinball

The Ripley's Believe It or Not!® Pinball Game Service Manual General Table of Contents

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

Lower Magnet OPTO (Transceiver) Board Proper Connection IMPORTANT!... Inside Front

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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 detail. Links in the documents. The files are in Pdf format (Adobe® Reader required). They may be slow to open in the website only, so save to your hardrive where they load fast. Inside the schematics, you can use email links where addresses are already direct to you. Use the same email address set (further instructions within documents). To "download" once open, in your browser click "File" "Send" "Page by eMail". It will be sent to your eMail Address, where there you can save the file to your hardrive.

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 UPKICKER	Q1	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BRN-BLK	J8-P1	26-1200 ↻ 090-5044-00B
#2	AUTOLAUNCH	Q2		YEL-VIO	J10-P4/5	50v DC	BRN-RED	J8-P3	23-800 ↻ 090-5001-00B
#3	VARI VUK	Q3		YEL-VIO	J10-P4/5	50v DC	BRN-ORG	J8-P4	26-1200 ↻ 090-5044-00B
#4	LEFT RAMP DIVERTER	Q4		YEL-VIO	J10-P4/5	50v DC	BRN-YEL	J8-P5	32-1800 ↻ 090-5031-00
#5	RIGHT RAMP DIVERTER	Q5		YEL-VIO	J10-P4/5	50v DC	BRN-GRN	J8-P6	32-1800 ↻ 090-5031-00
#6	LOWER LEFT POP	Q6		YEL-VIO	J10-P4/5	50v DC	BRN-BLU	J8-P7	26-1200 ↻ 090-5044-00T
#7	LOWER RIGHT POP	Q7		YEL-VIO	J10-P4/5	50v DC	BRN-VIO	J8-P8	26-1200 ↻ 090-5044-00T
#8	LOWER BOTTOM POP	Q8		YEL-VIO	J10-P4/5	50v DC	BRN-GRY	J8-P9	26-1200 ↻ 090-5044-00T

	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	UPPER LEFT POP	Q9	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BLU-BRN	J9-P1	26-1200 ↻ 090-5044-00T
#10	UPPER RIGHT POP	Q10		YEL-VIO	J10-P4/5	50v DC	BLU-RED	J9-P2	26-1200 ↻ 090-5044-00T
#11	UPPER BOTTOM POP [DOT9]	Q11		YEL-VIO	J10-P4/5	50v DC	BLU-ORG	J9-P4	26-1200 ↻ 090-5044-NL
#12	SCOOP VUK	Q12		YEL-VIO	J10-P4/5	50v DC	BLU-YEL	J9-P5	23-800 ↻ 090-5001-00T
#13	LOCK KICKER	Q13		YEL-VIO	J10-P4/5	50v DC	BLU-GRN	J9-P6	23-800 ↻ 090-5001-00B
#14	UPPER RIGHT FLIPPER	Q14		BLU-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	BLU-BLK	J9-P7	25-1400 ↻ 090-5067-00T
#15	LEFT FLIPPER (50v RED/YEL)	Q15		GRY-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	ORG-GRY	J9-P8	22-1080 ↻ 090-5032-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16		BLU-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	ORG-VIO	J9-P9	22-1080 ↻ 090-5032-00T

	Low Current Coils Group 1	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#17	LEFT SLINGSHOT	Q17	▲ I/O Power Driver ▼	BRN	J7-P1	20v DC	VIO-BRN	J7-P2	23-800 ↻ 090-5001-00T
#18	RIGHT SLINGSHOT	Q18		BRN	J7-P1	20v DC	VIO-RED	J7-P3	23-800 ↻ 090-5001-00T
#19	AUX - IDOL MAGNET	Q19		VIO-YEL~AUX. BD.~VIO-RED	J10-P3	50v DC	ORG to VIO-ORG	J7-P4	22-650 ↻ 090-5042-00
#20	AUX - HEAD MAGNET	Q20		VIO-YEL~AUX. BD.~VIO-RED	J10-P3	50v DC	ORG-YEL to VIO-YEL	J7-P6	22-650 ↻ 090-5042-00
#21	AUX - VARI RESET	Q21		VIO-YEL~AUX. BD.~VIO-RED	J10-P3	50v DC	ORG-GRN to VIO-GRN	J7-P7	32-1800 ↻ 090-5031-00-ND
#22	IDOL OPTO LED	Q22		BRN	J7-P1	20v DC	VIO-BLU	J7-P8	SWITCHED GROUND
#23	TOP POST	Q23		BRN	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: LWR POPS/LWR LT X2	Q25	▲ I/O Power Driver ▼	ORG	J6-P10	20v DC	BLK-BRN	J6-P1	#89 Bulb 165-5000-89
#26	FLASH: LEFT SPINNER	Q26		ORG	J6-P10	20v DC	BLK-RED	J6-P2	#89 Bulb 165-5000-89
#27	FLASH: UPPER LEFT	Q27		ORG	J6-P10	20v DC	BLK-ORG	J6-P3	#906 Bulb 165-5004-00
#28	FLASH: HEAD	Q28		ORG	J6-P10	20v DC	BLK-YEL	J6-P4	#906 Red 165-5004-02
#29	FLASH: VARI-TARGET	Q29		ORG	J6-P10	20v DC	BLK-GRN	J6-P5	#89 Bulb 165-5000-89
#30	FLASH: UPR POPS/RT RMP X2	Q30		ORG	J6-P10	20v DC	BLK-BLU	J6-P6	#89 Bulb 165-5000-89
#31	FLASH: RIGHT SPINNER	Q31		ORG	J6-P10	20v DC	BLK-VIO	J6-P7	#89 Bulb 165-5000-89
#32	FLASH: RIGHT RAMP LOWER	Q32		ORG	J6-P10	20v DC	BLK-GRY	J6-P8	#906 Bulb 165-5004-00

Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: Q25-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	BRN	J7-P1	20v DC	WHT	J2-P3	26-1200 ↻ 090-5044-00T
	AUX 2: CENTER UP/DOWN POST	Q2		BRN	J7-P1	20v DC	RED	J2-P4	23-1100 ↻ 090-5030-00T
	AUX 3: RIGHT UP/DOWN POST	Q3		BRN	J7-P1	20v DC	ORG	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.*

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."

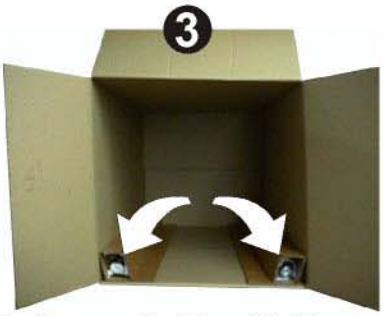
Pinball Game Set-Up Future Reference

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

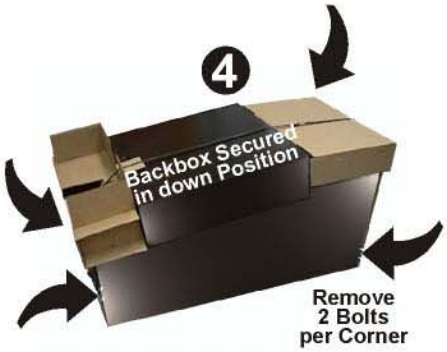
CAUTION: At least 2 people are required to move and maneuver game.
Use proper moving equipment & extreme care while handling. Pinball game is 260lbs (+/- 10).
Refer to Game Manual for further Game Set-Up Procedures (Sec. 1, Chp. 1) and other important information!
TOOLS REQUIRED: 5/8" Socket Wrench &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

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).*

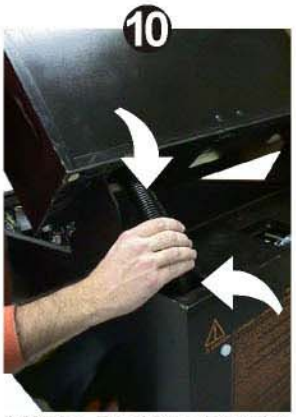
6. Install **FRONT LEGS** using the bolts removed from ***Step 4***. *Secure tightly.* ***Take care not to scratch the Black Finish on any of the Legs.***

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

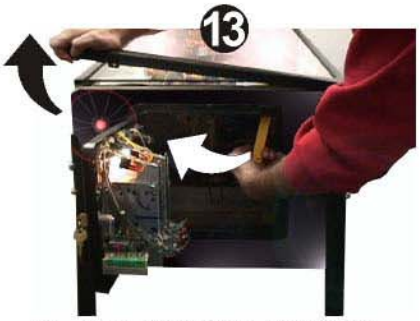


10. Lift the Backbox into the **UPRIGHT POSITION** *(Ensure the cables do not get pinched).*

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.

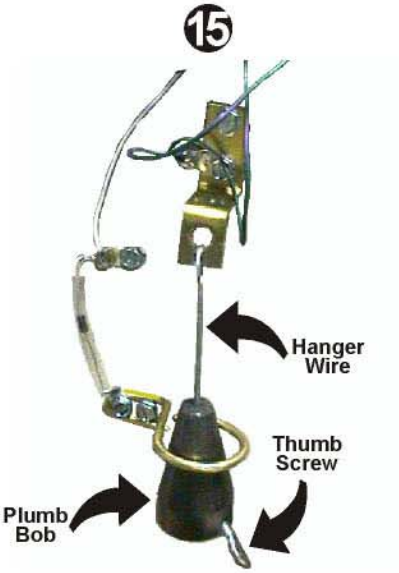
12. The next step you will remove the **PLAYFIELD GLASS** & **BACK GLASS** to access the inside of the cabinet & Backbox.

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.*

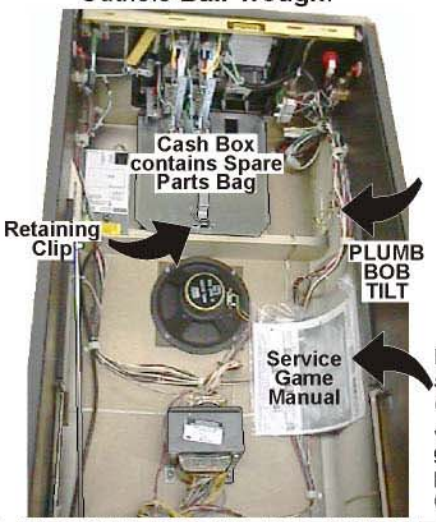


13. Open the Coin Door and pull the **YELLOW HANDLE** to the **LEFT** and at the same time pull up on the **FRONT TOP MOLDING** and remove. The **GLASS** can now be pulled out towards you and removed. ***TAKE CARE*** *while moving; set glass on a safe surface.*

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.

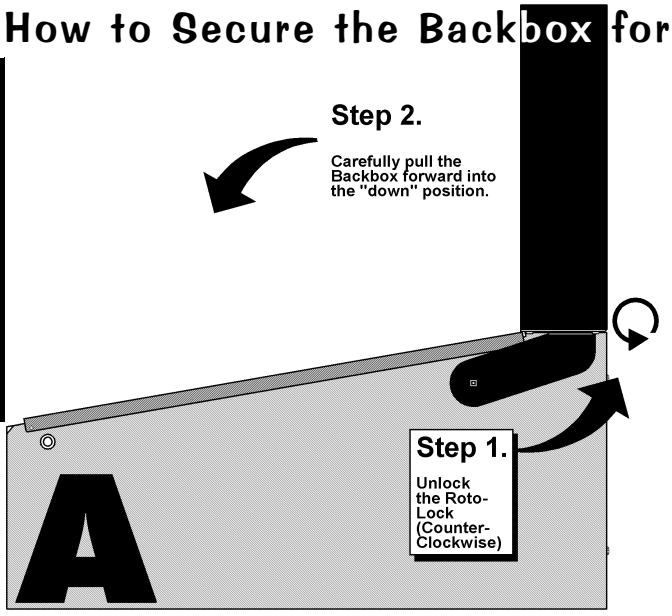


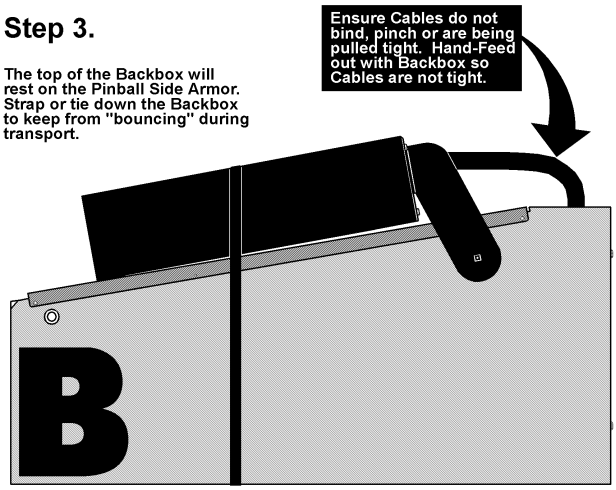
Remove the **PINBALL GAME MANUAL** *(stapled to side of the left wall of the cabinet). Review Section 1, Chapter 1, which describes how to lift the playfield to access the Plumb Bob Tilt Assembly.* The manual gives you all the important information you need to prepare for final set-up and other important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

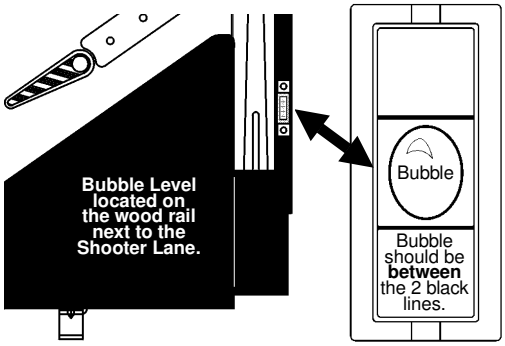
*For more Backbox details & part numbers, see Section **4**, Chapter **1**, **Backbox Assembly**, Pages 60-61.*





Leg Leveler Adjustment

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

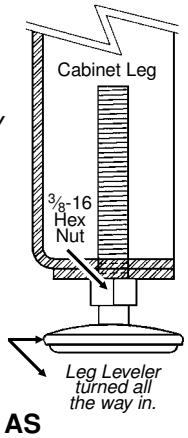


Start adjustment with the leg levelers *turned all the way in*.

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.



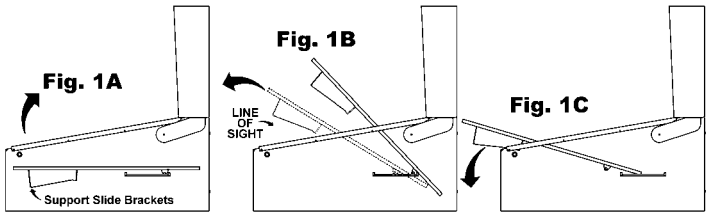
YOUR PLAYFIELD PITCH IS NOW AT 6.5° AS REQUIRED FOR PROPER GAME PLAY!

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

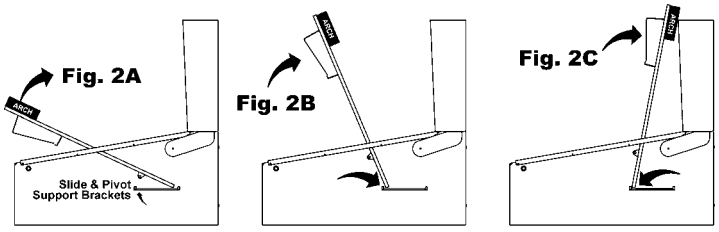
Easy Access Service System - 2 Positions

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 Nº: 755-5181-00 USA) which is included with every game. If your card is lost or damaged, simply **COPY** this page and *cut out* the Instruction Card as a *temporary replacement* until a *new card is ordered.*

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

COPY & CUT

Ripley's Believe It or Not!®

For more detailed game rules, visit our website @ www.SternPinball.com and click on the "Ripley's Believe It or Not!®" or "Game Archive" Pop Bumper Link.

FOLD HERE

OBJECT: Join Robert Ripley on his quest to visit the seven continents of the world and collect strange objects.

VISIT CONTINENTS: Shoot the ball into the ***Variable Push Target*** to visit continents. *Watch the display for instructions on collecting items.*

TEMPLE CODE: Shoot the ball into the **Temple** *(Center Ramp)* to turn on lights in the ***Tic-Tac-Toe panel*** on the playfield. Completing any 3 in a row will give you the indicated reward.

MULTIBALL: Shoot for the *Shrunken Head* until **LOCK** is lit on the ***Right Ramp***. **LOCK 2** balls by shooting the right ramp. After 2 balls are **LOCKED**, start ***Multiball*** by shooting for the *Shrunken Head.*

JACKPOTS: While in ***Multiball***, shoot for the *ramps* and the *side loop shot*.

SUPER JACKPOT: After 2 Jackpots are collected, ***Super Jackpot*** will light on the *upper side shot.*

RIPLEYS LETTERS: Collect R-I-P-L-E-Y-S Letters by collecting objects while visiting continents.

HINT: Collect all 7 R-I-P-L-E-Y-S Letters to visit the *Mystery 8th Continent!*

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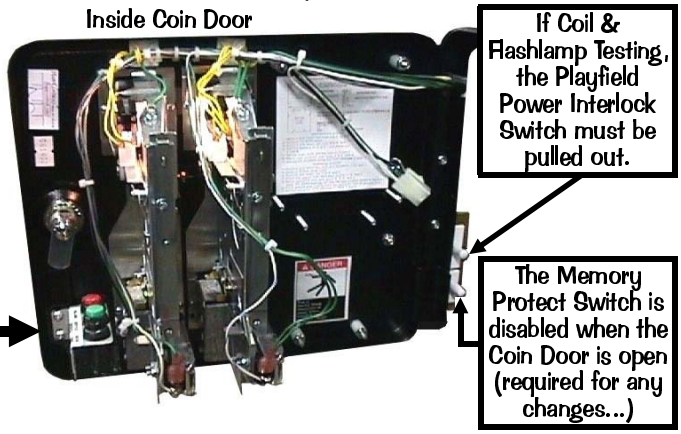
SPI PART Nº: 755-5181-00 USA

Click on card to open the Instruction Card for printing.

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

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



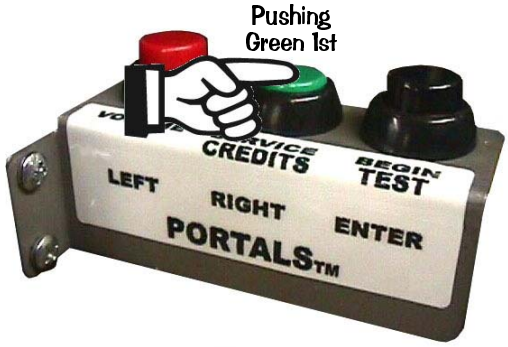
To access any of these ***three (3) functions*** you must first open the **Coin Door** (see pictorial above) with the Game in the ***Attract Mode*** *(not already in any Function or Menu stated below).*

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.*

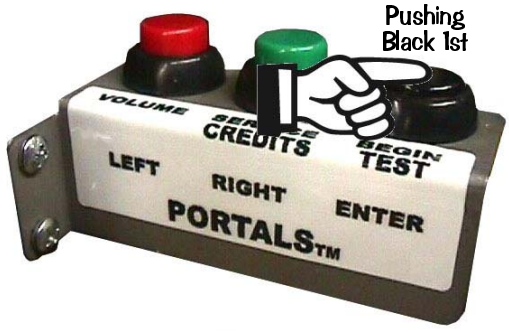
Set between **0-31**; Once your adjustments are made, this menu will ***automatically exit*** a few seconds after the last button depression.



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.).*



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!***

open Adjustments

back to Page 8

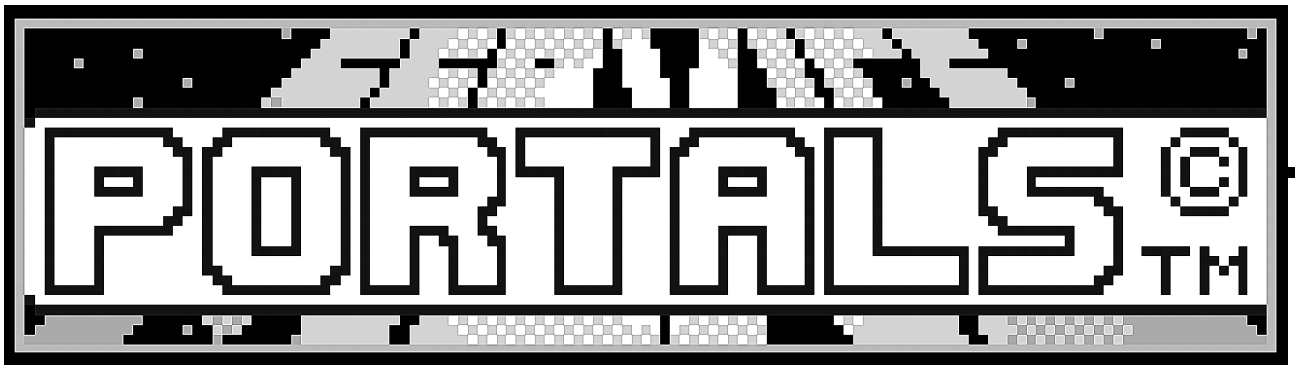
Portals™ Service Menu Introduction

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 MORE MORE symbols indicates that there are more *Icons* to select in each direction. The *Icon* selected will blink. Pushing the **Black "ENTER" Button** (or **Start Button**) will select the *Icon* and the Menu Screen will change to the menu selected. Select the **"PREV"** *Icons* to move backwards through the menu levels. Select the **"QUIT"** *Icon* to completely exit the Service Mode.

View the **Portals™ Service Menu Icon Tree** on the next pages for a complete overview of all menus used in this system. The "HELP" *Icon* & "?" *Mini-Icon* provide explanation of **ICON** usage in the Menu where the "HELP" *Icon* or "?" *Mini-Icon* was selected. View **QUIT THIS SESSION** (**Exiting the Portals™ Service Menu**) at the end of this chapter *(reference Section **3**, Chapter **1**, **Portals™ Service Menu Introduction**)*.

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

Portals™ Service Menu Icon Tree

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 (DIAG) | GO TO AUDITS MENU (AUD) | GO TO ADJUSTMENTS MENU (ADJ) | GO TO INSTALLS MENU (INST) | GO TO RESET MENU (RESET) | GO TO TOURNAMENT MENU (TOUR) | QUIT THIS SESSION (QUIT)

MORE ⬅ ➡ MORE

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.

CONTINUED NEXT PAGE.

DIAGNOSTICS MENU

GO TO SWITCH MENU (SW) | GO TO COIL MENU (COIL) * | GO TO LAMP MENU (LAMP) | TEST FLASH LAMPS (FLASH) * | CLEAR BALL TROUGH (CLR) * | TECHNICIAN ALERTS (TECH) | SERVICE PHONE # (SERV) | BEGIN PLAY TEST (PLAY) * | FIRE KNOCKER (KNOCKER) | SOUND/SPEAKER TEST (SPKR) | BEGIN BURN IN (BURN) | DOT MATRIX TEST (DOT TEST) | RIPLEY SPECIFIC (BION) | GO TO FUSE TABLE (FUSES) | DR. PINBALL (DR.)

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

SWITCH MENU

SWITCH TEST (TEST) | ACTIVE SWITCH TEST (ACT) | DEDICATED SWITCH TEST (DED)

COIL MENU

SINGLE COIL TEST (TEST) | CYCLING COIL TEST (CYC)

LAMP MENU

SINGLE LAMP TEST (ONE) | TEST ALL LAMPS (ALL) | ROW LAMP TEST (ROW) | COLUMN LAMP TEST (COL)

BION MENU

LED TEST (LED TEST) | VARI-TARGET TEST (VARI)

DR. PINBALL MENU

COIL FLOW CHART (DR.) | SWITCH FLOW CHART (DR.) | LAMP FLOW CHART (DR.)

AUDITS MENU

EARNINGS AUDITS (EARN) | STANDARD AUDITS (S.P.I.) | FEATURE AUDITS (BION) | GO TO PRINTER MENU (PRNT)

ADJUSTMENTS MENU

STANDARD ADJUSTMENTS (S.P.I.) | FEATURE ADJUSTMENTS (BION) | CUSTOM MESSAGE (ABCD CUST MSG)

PRINTER MENU

QUICK PRINTOUT (QUIK) | FULL PRINTOUT (ALL-SUM) | RESET PRINTER (RESET)

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

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 — *Return to the* **PREVIOUS** Menu.

QUIT — **QUIT**, *exits & returns to the* ***Attract Mode***.

HELP — *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.*

◀◀ ▶▶ — *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.*

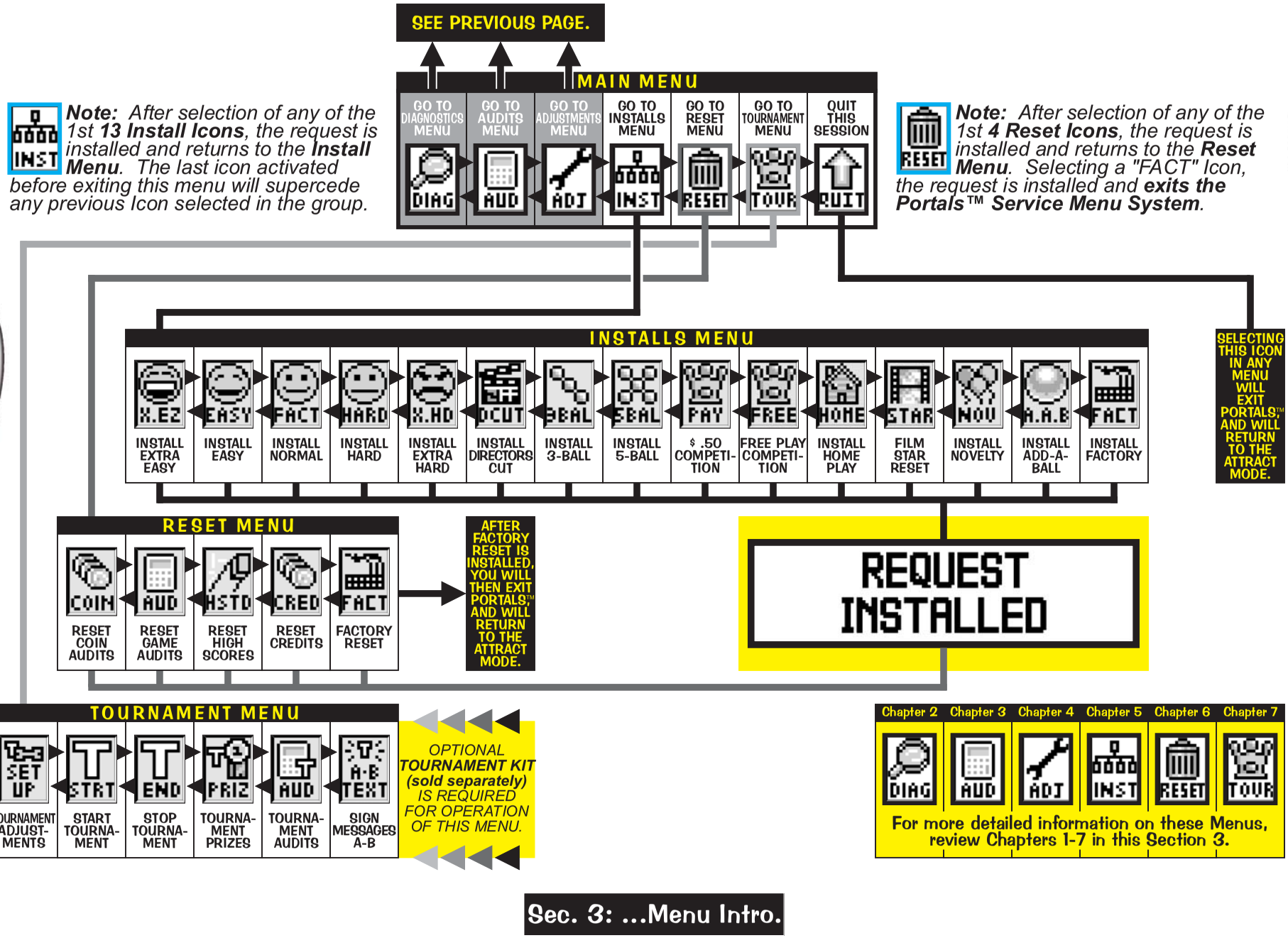
PULSE — **PULSE** *coil.*

DRAW — *View the schematic (***DRAW***ing) 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.*

Portals™ Service Menu Icon Tree Continued



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.*

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

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

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

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

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

Select and activate to:

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

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

RUN *(or activate) selected test or coil*

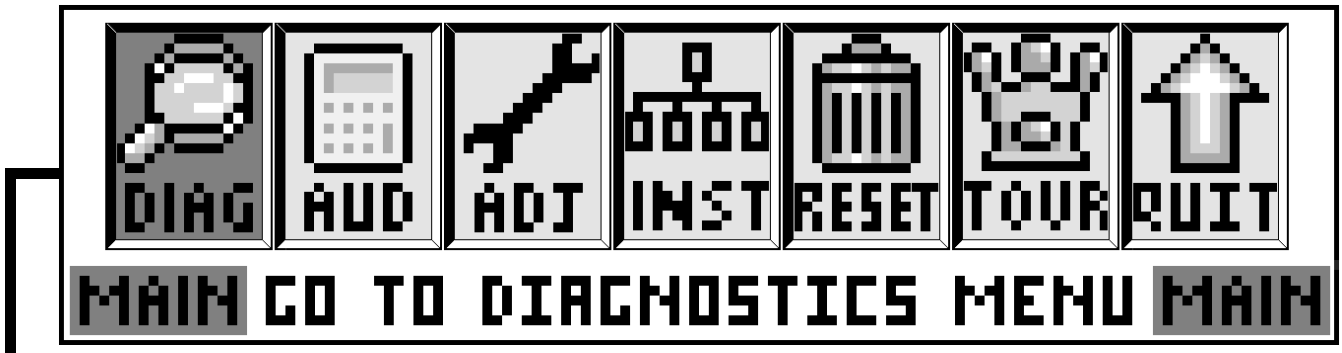
PULSE *coil.*

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

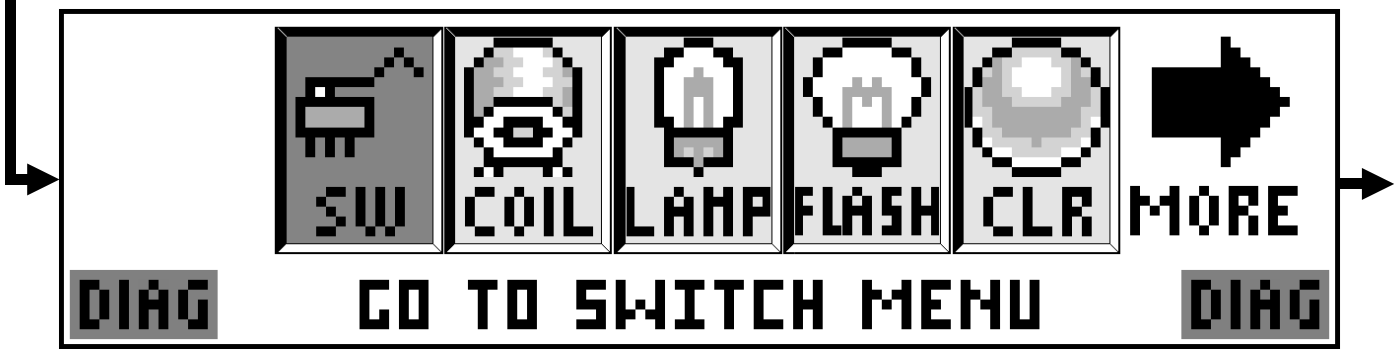
**** Help Note: An explanation of each Mini-Icon at that menu level will cycle continuously. To exit a display where no Mini-Icons are available for selection, pressing any button will exit the display.***

Example:

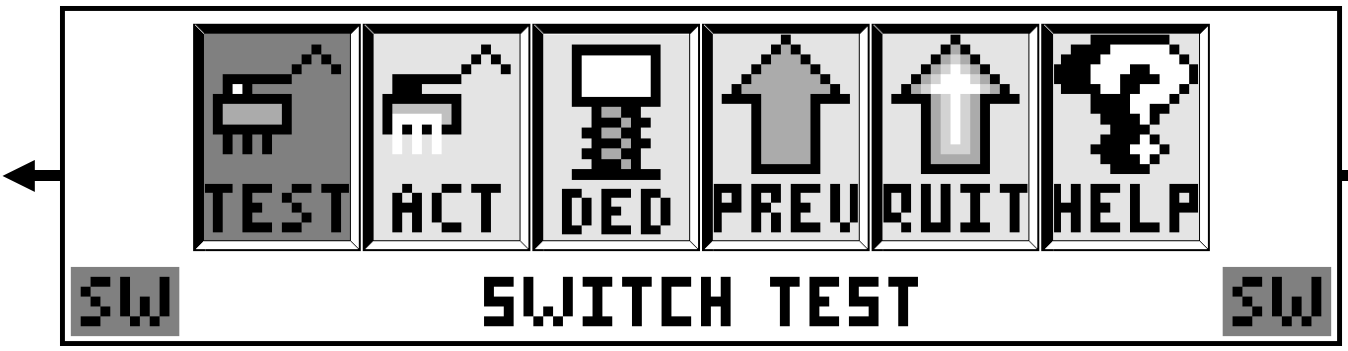
After entering **Portals™**, the **MAIN MENU** now appears with the **"DIAG"** *Icon* (**GO TO DIAGNOSTICS MENU**) flashing:



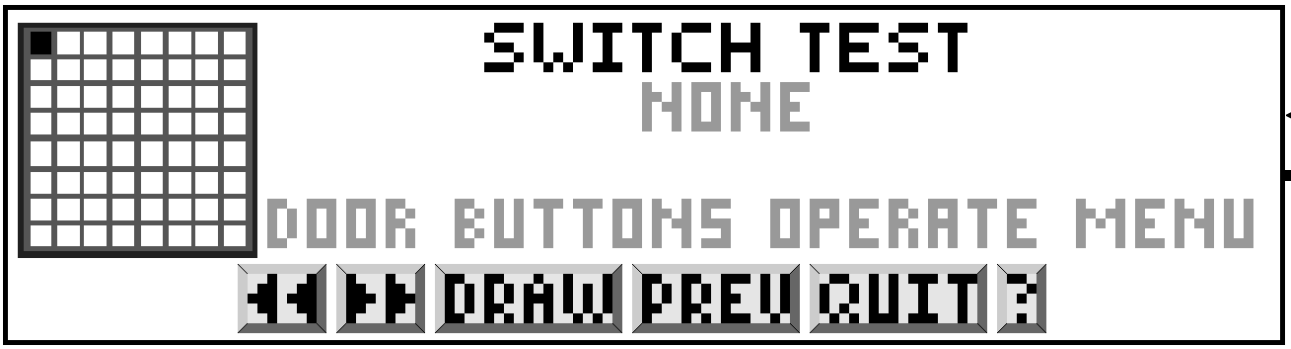
Press the **Black "ENTER" Button** to *activate* this **ICON**. The **DIAGNOSTICS MENU** now appears with the "SW" *Icon* (**GO TO SWITCH MENU**) flashing:



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

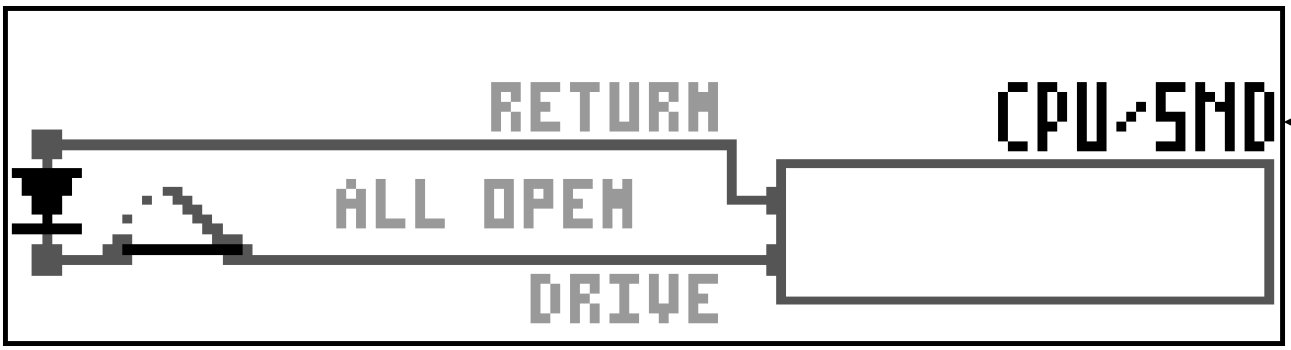


Press the **Black "ENTER" Button** to *activate* this icon. The **Switch Test Display** now appears.



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

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



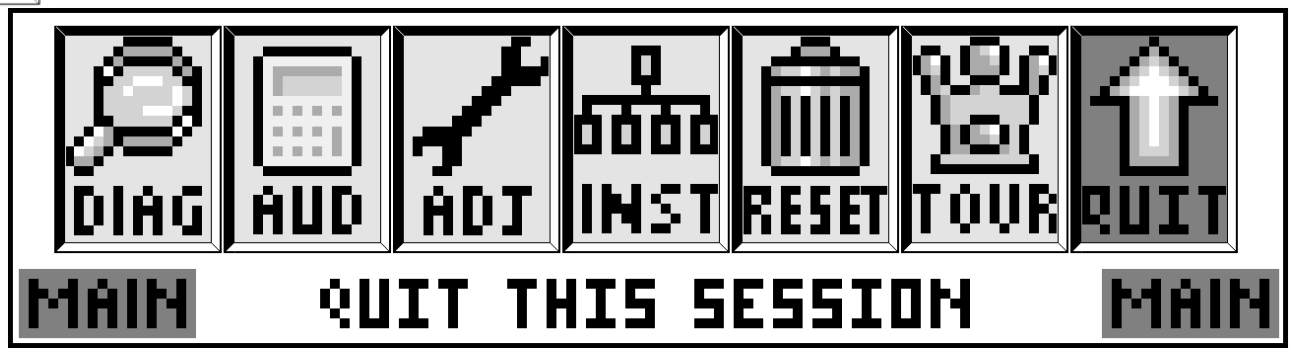
To ***exit any display where there are no Mini-Icons*** *(Schematics or Help Displays)*, ***press any button*** to return to the previous Menu.

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

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

QUIT THIS SESSION (Exiting the Portals™ Service Menu)

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



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

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

Problem / Solution Table

PROBLEM	SOLUTION
Will not enter the **Service Mode** after depressing the **Black "BEGIN TEST" Button**.	• Check the Service Switch(es) (**Red, Green & Black Buttons**) for loose connections or bad Ground. • Check the associated wiring harness to/from the CPU/Sound Board, Connector **CN6**. • Check CPU/Sound Board for possible failure.
All Service Buttons (**Red, Green** and **Black**) appear nonfunctional.	• Check the Service Switches wiring harness for poor or no connection and/or broken wires.
The **Green Service Button** in the Attract Mode will not enter the **SERVICE CREDITS MENU** to add Service Credits.	• Check to make sure the Game is not in "**Free Play**." *If the game is set to Free Play, adding Service Credits is not required.* • Check the Service Switches wiring harness for poor or no connection and/or broken wires.
The **Display** "blanks out."	• Check the Dot Matrix Display for loose wiring harness for poor or no connection and/or broken wires. • Check **F1** (3/4A Fuse) on the Display Power Supply Board. Refer to 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*.*

Select and activate to:

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

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

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

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

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

GO TO DIAGNOSTICS MENU

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

Go To Switch Menu

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

Switch Test

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

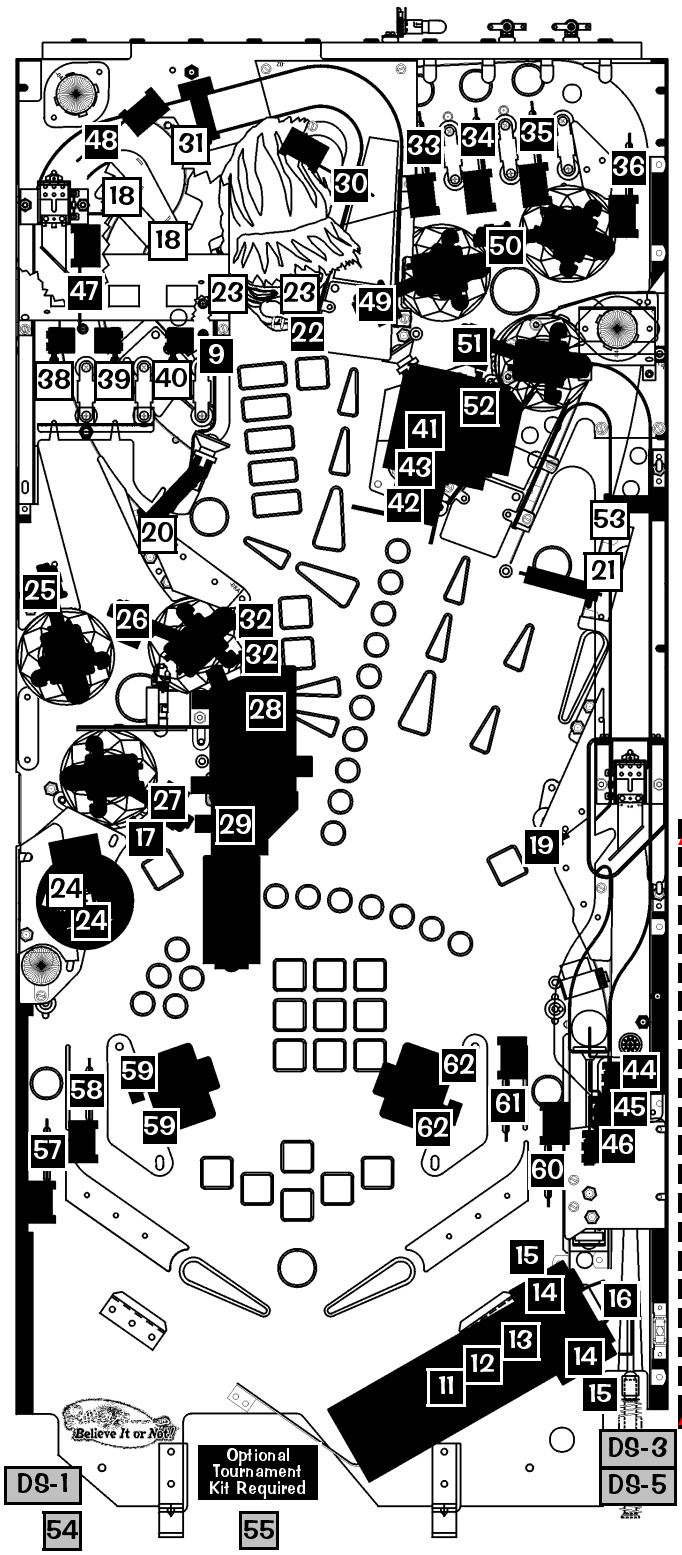
To initiate, from the **SWITCH MENU**, select the "DED" *Icon* with either **Flipper Button** & press the **Start Button** *(the Service Switches are deactivated during this test.).* In **Dedicated Switch Test**, the display will describe the switch which includes the Switch Name, Return (Row) Wire, 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) — 180-5160-00	9 Below P/F: HEAD STAND-UP — 515-5162-08	17 Below P/F: TOMBSTONE 1 — 515-5162-08	25 Below P/F: LOWER LEFT POP — 180-5015-03	33 Below P/F: BONUS X INLANE - LFT — 500-6227-02	41 Below P/F: VARI-TARGET OPTO 1 — See Sw. 41 Note	49 Below P/F: UPPER LEFT POP — 180-5015-03	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: NOT USED	18 ~ P/F: SUPER JACKPOT OPTO — *See Sw. 18 Note*	26 Below P/F: LOWER RIGHT POP — 180-5015-03	34 Below P/F: BONUS X INLANE - MID — 500-6227-02	42 Below P/F: VARI-TARGET OPTO 2 — See Sw. 42 Note	50 Below P/F: UPPER RIGHT POP — 180-5015-03	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 Below P/F: TOMBSTONE 5 — 515-5162-08	27 Below P/F: LOWER BOTTOM POP — 180-5015-03	35 Below P/F: BONUS X INLANE - RT — 500-6227-02	43 Below P/F: VARI-TARGET OPTO 3 — See Sw. 43 Note	51 Below P/F: UPPER BOTTOM POP — 180-5015-03	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 Below P/F: LEFT SPINNER — 180-5010-04	28 Below P/F: SIDE SCOOP ENTRY (BOTS) — 180-5183-00	36 Below P/F: RIGHT ORBIT — 500-6227-02	44 Below P/F: LOCK 1 - TOP — 180-5180-00	52 Below P/F: VARI-TARGET VUK — 180-5116-01	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 Below P/F: RIGHT SPINNER — 180-5010-04	29 Below P/F: SCOOP VUK (BOTS) — 180-5183-00	37: NOT USED	45 Below P/F: LOCK 1 - MIDDLE — 180-5179-00	53 Above P/F: RIGHT RAMP — 180-5190-28	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 Below P/F: TOMBSTONE 4 — 515-5967-06	30 Below P/F: BEHIND HEAD — 500-6227-02	38 Above P/F: MINI PLAYFIELD LEFT — 180-5183-00	46 Below P/F: LOCK 1 - BOTTOM — 180-5178-00	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 Below P/F: SHRUNKEN HEAD OPTO — See Sw. 23 Note	31 Above P/F: LEFT RAMP MAKE — 180-5190-28	39 Above P/F: MINI PLAYFIELD CENTER — 180-5183-00	47 Below P/F: LEFT JACKPOT LOOP — 500-6227-02	55 In Cabinet: TOURNAMENT START — 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 Below P/F: IDOL EYE OPTO — *See Sw. 23 Note*	32 Below P/F: TOMBSTONE 2+3 — 515-5162-08	40 Above P/F: MINI PLAYFIELD RIGHT — 180-5183-00	48 Below P/F: LEFT ORBIT — 500-6227-02	56 In Cabinet: PLUMB BOB TILT — *See Sw. 56 Note*	64: NOT USED

IC U206 INPUTS \ GROUND	GROUND
	BLK CN6-P1, -P11
1: U206 GRY-BRN CN6-P2	DS-1 on Cabinet Side: #1 LEFT FLIPPER BUTTON — 180-5160-00
2: U206 GRY-RED CN6-P3	DS-2 Below Playfield: #2 LEFT FLIPPER E.O.S (End-of-Stroke) — 180-5149-00 *on Flipper*
3: U206 GRY-ORG CN6-P4	DS-3 on Cabinet Side: #3 RIGHT FLIPPER BUTTON — 180-5164-00 *Doubled*
4: U206 GRY-YEL CN6-P6	DS-4 Below Playfield: #4 RIGHT FLIPPER E.O.S. (End-of-Stroke) — 180-5149-00 *on Flipper*
5: U206 GRY-GRN CN6-P7	DS-5 on Cabinet Side: #5 UPPER RT. FLIPPER BUTTON — *Same as DS-3 above.*
6: U206 GRY-BLU CN6-P8	DS-6 on Coin Door: #6 VOLUME (RED BUTTON) (In Test: LEFT) — 180-5192-02
7: U206 GRY-VIO CN6-P9	DS-7 on Coin Door: #7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) — 180-5192-04
8: U206 GRY-BLK CN6-P10	DS-8 on Coin Door: #8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) — 180-5192-00

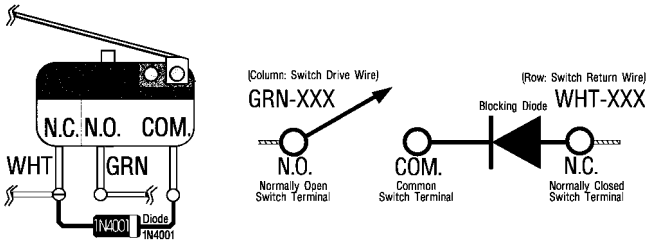
SWITCH MATRIX GRID LOCATIONS



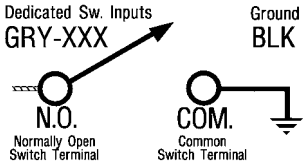
Playfield ▲

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

Typical Switch Wiring & Schematic



Dedicated Switch Schematic



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, 18, 23, 24, 41, 42 & 43 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); Transceiver: 500-6775-00 (Qty. 2/per) (Sw. 18, 23 & 24); Transceiver: 520-5234-00 (Sw. 41-43)

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 Sec. **5**, Chp.**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 UPKICKER	Q1	26-1200 ↻ 090-5044-00B
#2	AUTOLAUNCH	Q2	23-800 ↻ 090-5001-00B
#3	VARI VUK	Q3	24-940 ↻ 090-5036-00T
#4	LEFT RAMP DIVERTER	Q4	32-1800 ↻ 090-5031-00
#5	RIGHT RAMP DIVERTER	Q5	32-1800 ↻ 090-5031-00
#6	LOWER LEFT POP	Q6	26-1200 ↻ 090-5044-00T
#7	LOWER RIGHT POP	Q7	26-1200 ↻ 090-5044-00T
#8	LOWER BOTTOM POP	Q8	26-1200 ↻ 090-5044-00T

High Current Coils Group 2		Drive Transistor	Coil GA-Turn or Bulb Type
#9	UPPER LEFT POP	Q9	26-1200 ↻ 090-5044-00T
#10	UPPER RIGHT POP	Q10	26-1200 ↻ 090-5044-00T
#11	UPPER BOTTOM POP (D O T8)	Q11	26-1200 ↻ 090-5044-NL
#12	SCOOP VUK	Q12	24-940 ↻ 090-5036-00T
#13	LOCK KICKER	Q13	23-800 ↻ 090-5001-00B
#14	UPPER RIGHT FLIPPER	Q14	25-1400 ↻ 090-5067-00T
#15	LEFT FLIPPER (50v RED/YEL)	Q15	22-1080 ↻ 090-5032-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16	22-1080 ↻ 090-5032-00T

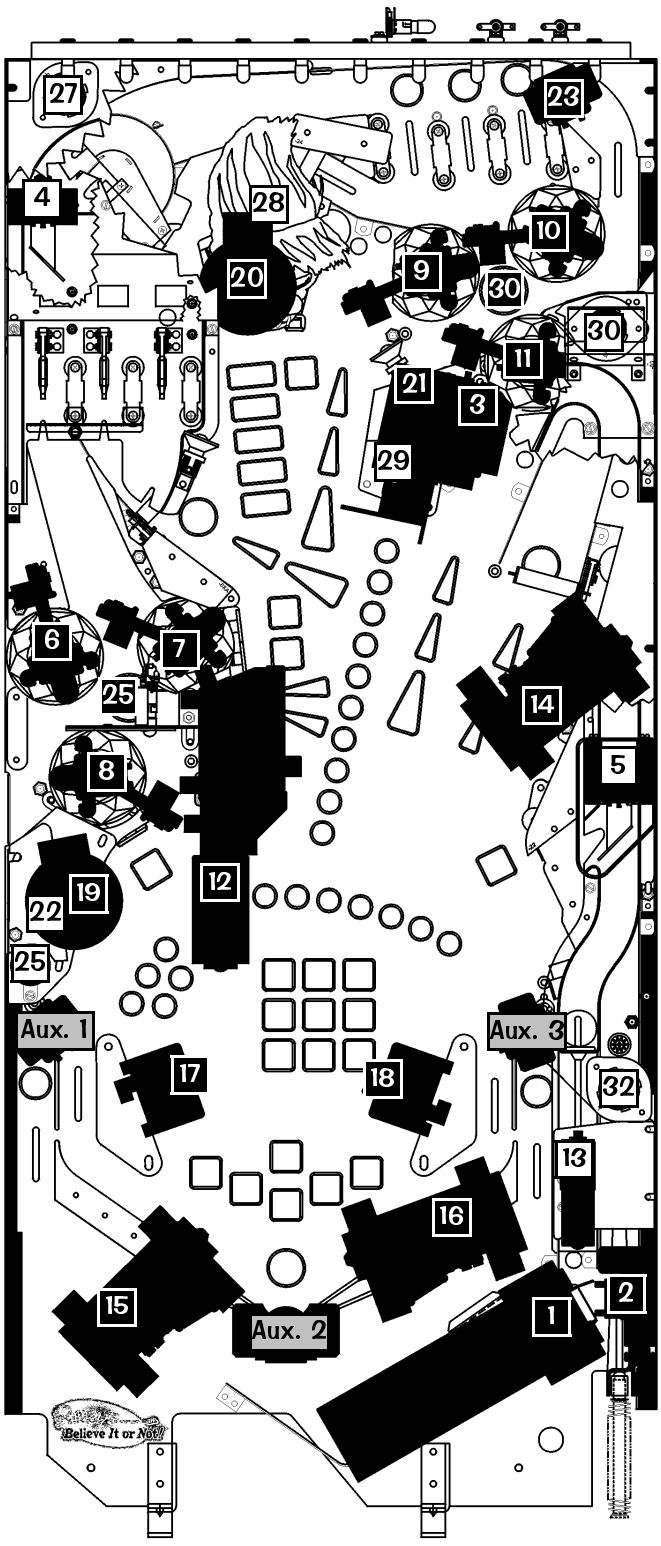
Low Current Coils Group 1		Drive Transistor	Coil GA-Turn or Bulb Type
#17	LEFT SLINGSHOT	Q17	23-800 ↻ 090-5001-00T
#18	RIGHT SLINGSHOT	Q18	23-800 ↻ 090-5001-00T
#19	AUX - IDOL MAGNET	Q19	22-650 ↻ 090-5042-00
#20	AUX - HEAD MAGNET	Q20	22-650 ↻ 090-5042-00
#21	AUX - VARI RESET	Q21	32-1800 ↻ 090-5031-00-ND
#22	IDOL OPTO LED	Q22	SWITCHED GROUND
#23	TOP 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: LWR POPS/LWR LT X2	Q25	#89 Bulb 165-5000-89
#26	FLASH: LEFT SPINNER	Q26	#89 Bulb 165-5000-89
#27	FLASH: UPPER LEFT	Q27	#906 Bulb 165-5004-00
#28	FLASH: HEAD	Q28	#906 Red 165-5004-02
#29	FLASH: VARI-TARGET	Q29	#89 Bulb 165-5000-89
#30	FLASH: UPR POPS/RT RMP X2	Q30	#89 under PF #906 Ramp
#31	FLASH: RIGHT SPINNER	Q31	#89 Bulb 165-5000-89
#32	FLASH: RIGHT RAMP LOWER	Q32	#906 Bulb 165-5004-00

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



Playfield ▲

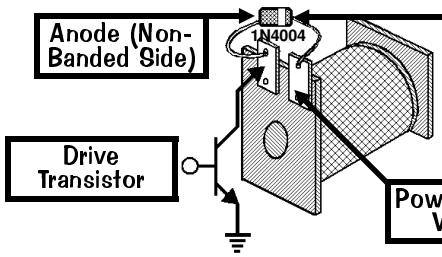
= Coils / Flash Lamps above Playfield.

= Coils / Flash Lamps below Playfield.

= Coils / Flash Lamps not on Playfield.

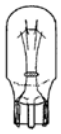
Color = Color of Mini-Mars of Flash Lamp Bulb.

Typical Coil Wiring



Bulb Types used for Flash Lamps

#89 Bulb
(Bayonet)
165-5000-89



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

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.*

In COIL MENU also select:

CYCLING COIL TEST

COILS DETAILED CHART TABLE

	High Current Coils Group 1	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#1	TROUGH UPKICKER	Q1	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BRN-BLK	J8-P1	26-1200 ↻ 090-5044-00B
#2	AUTOLAUNCH	Q2		YEL-VIO	J10-P4/5	50v DC	BRN-RED	J8-P3	23-800 ↻ 090-5001-00B
#3	VARI VUK	Q3		YEL-VIO	J10-P4/5	50v DC	BRN-ORG	J8-P4	24-940 ↻ 090-5036-00T
#4	LEFT RAMP DIVERTER	Q4		YEL-VIO	J10-P4/5	50v DC	BRN-YEL	J8-P5	32-1800 ↻ 090-5031-00
#5	RIGHT RAMP DIVERTER	Q5		YEL-VIO	J10-P4/5	50v DC	BRN-GRN	J8-P6	32-1800 ↻ 090-5031-00
#6	LOWER LEFT POP	Q6		YEL-VIO	J10-P4/5	50v DC	BRN-BLU	J8-P7	26-1200 ↻ 090-5044-00T
#7	LOWER RIGHT POP	Q7		YEL-VIO	J10-P4/5	50v DC	BRN-VIO	J8-P8	26-1200 ↻ 090-5044-00T
#8	LOWER BOTTOM POP	Q8		YEL-VIO	J10-P4/5	50v DC	BRN-GRY	J8-P9	26-1200 ↻ 090-5044-00T

	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	UPPER LEFT POP	Q9	▲ I/O Power Driver ▼	YEL-VIO	J10-P4/5	50v DC	BLU-BRN	J9-P1	26-1200 ↻ 090-5044-00T
#10	UPPER RIGHT POP	Q10		YEL-VIO	J10-P4/5	50v DC	BLU-RED	J9-P2	26-1200 ↻ 090-5044-00T
#11	UPPER BOTTOM POP DOT8	Q11		YEL-VIO	J10-P4/5	50v DC	BLU-ORG	J9-P4	26-1200 ↻ 090-5044-NL
#12	SCOOP VUK	Q12		YEL-VIO	J10-P4/5	50v DC	BLU-YEL	J9-P5	24-940 ↻ 090-5036-00T
#13	LOCK KICKER	Q13		YEL-VIO	J10-P4/5	50v DC	BLU-GRN	J9-P6	23-800 ↻ 090-5001-00B
#14	UPPER RIGHT FLIPPER	Q14		BLU-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	BLU-BLK	J9-P7	25-1400 ↻ 090-5067-00T
#15	LEFT FLIPPER (50v RED/YEL)	Q15		GRY-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	ORG-GRY	J9-P8	22-1080 ↻ 090-5032-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16		BLU-YEL~3A Fuse~RED-YEL	J10-P1/2	50v DC	ORG-VIO	J9-P9	22-1080 ↻ 090-5032-00T

	Low Current Coils Group 1	Drive Transistor	Driver Ouput Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#17	LEFT SLINGSHOT	Q17	▲ I/O Power Driver ▼	BRN	J7-P1	20v DC	VIO-BRN	J7-P2	23-800 ↻ 090-5001-00T
#18	RIGHT SLINGSHOT	Q18		BRN	J7-P1	20v DC	VIO-RED	J7-P3	23-800 ↻ 090-5001-00T
#19	AUX - IDOL MAGNET	Q19		VIO-YEL~AUX. BD.~VIO-RED	J10-P3	50v DC	ORG to VIO-ORG	J7-P4	22-650 ↻ 090-5042-00
#20	AUX - HEAD MAGNET	Q20		VIO-YEL~AUX. BD.~VIO-RED	J10-P3	50v DC	ORG-YEL to VIO-YEL	J7-P6	22-650 ↻ 090-5042-00
#21	AUX - VARI RESET	Q21		VIO-YEL~AUX. BD.~VIO-RED	J10-P3	50v DC	ORG-GRN to VIO-GRN	J7-P7	32-1800 ↻ 090-5031-00-ND
#22	IDOL OPTO LED	Q22		BRN	J7-P1	20v DC	VIO-BLU	J7-P8	SWITCHED GROUND
#23	TOP POST	Q23		BRN	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

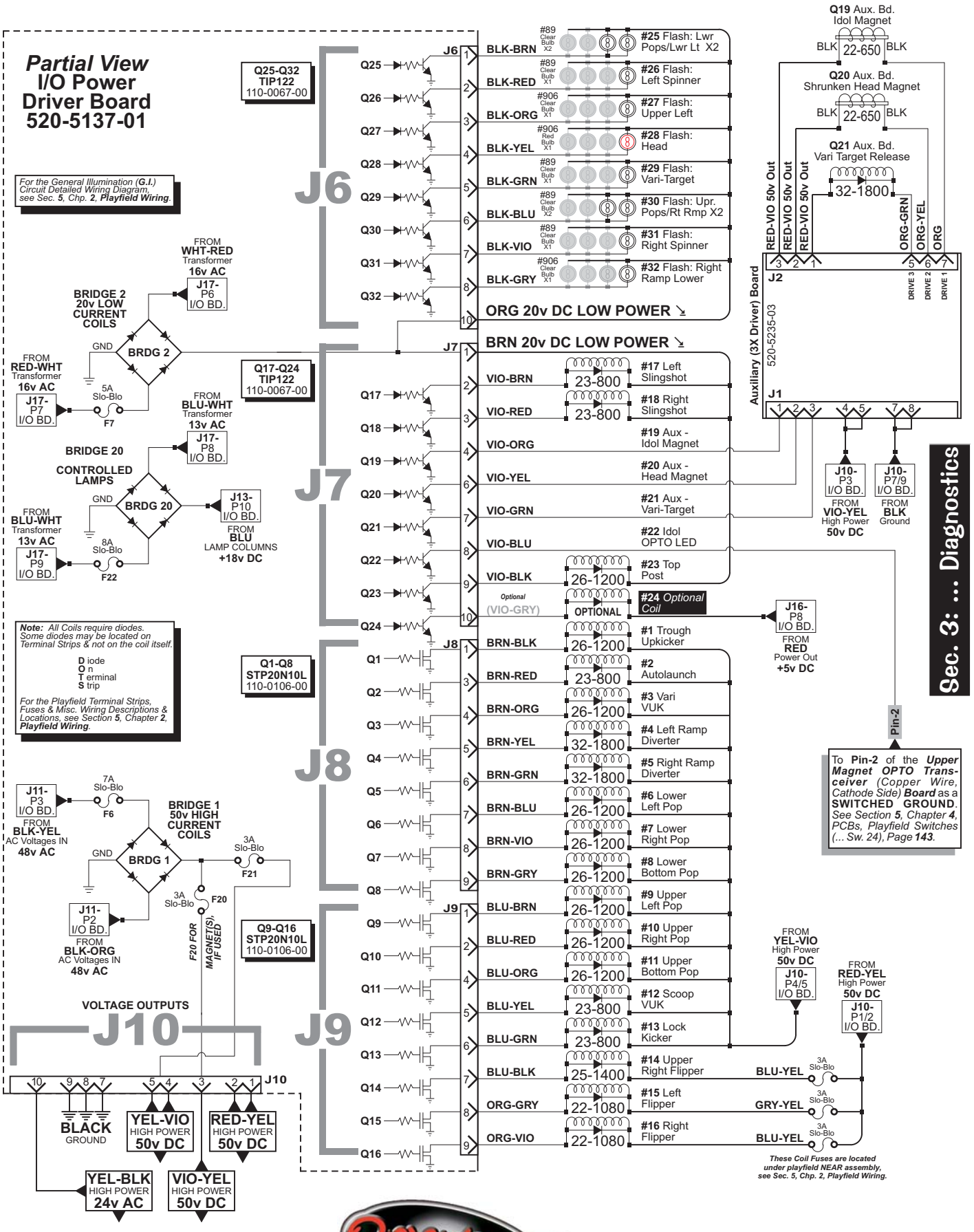
D iode O n T erminal S trip (if noted)

	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: LWR POPS/LWR LT X2	Q25	▲ I/O Power Driver ▼	ORG	J6-P10	20v DC	BLK-BRN	J6-P1	#89 Bulb 165-5000-89
#26	FLASH: LEFT SPINNER	Q26		ORG	J6-P10	20v DC	BLK-RED	J6-P2	#89 Bulb 165-5000-89
#27	FLASH: UPPER LEFT	Q27		ORG	J6-P10	20v DC	BLK-ORG	J6-P3	#906 Bulb 165-5004-00
#28	FLASH: HEAD	Q28		ORG	J6-P10	20v DC	BLK-YEL	J6-P4	#906 Red 165-5004-02
#29	FLASH: VARI-TARGET	Q29		ORG	J6-P10	20v DC	BLK-GRN	J6-P5	#89 Bulb 165-5000-89
#30	FLASH: UPR POPS/RT RMP X2	Q30		ORG	J6-P10	20v DC	BLK-BLU	J6-P6	#89 under PF #906 Ramp
#31	FLASH: RIGHT SPINNER	Q31		ORG	J6-P10	20v DC	BLK-VIO	J6-P7	#89 Bulb 165-5000-89
#32	FLASH: RIGHT RAMP LOWER	Q32		ORG	J6-P10	20v DC	BLK-GRY	J6-P8	#906 Bulb 165-5004-00

Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: Q25-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	BRN	J7-P1	20v DC	WHT	J2-P3	26-1200 ↻ 090-5044-00T
	AUX 2: CENTER UP/DOWN POST	Q2		BRN	J7-P1	20v DC	RED	J2-P4	23-1100 ↻ 090-5030-00T
	AUX 3: RIGHT UP/DOWN POST	Q3		BRN	J7-P1	20v DC	ORG	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
J6
Q25
Q26
Q27
Q28
Q29
Q30
Q31
Q32
BLK-BRN
#25 Flash: Lwr Pops/Lwr Lt X2
BLK-RED
#26 Flash: Left Spinner
BLK-ORG
#27 Flash: Upper Left
BLK-YEL
#28 Flash: Head
BLK-GRN
#29 Flash: Vari-Target
BLK-BLU
#30 Flash: Upr. Pops/Rt Rmp X2
BLK-VIO
#31 Flash: Right Spinner
BLK-GRY
#32 Flash: Right Ramp Lower
ORG 20v DC LOW POWER
BRN 20v DC LOW POWER
J7
Q17
Q18
Q19
Q20
Q21
Q22
Q23
Q24
VIO-BRN
#17 Left Slingshot
VIO-RED
#18 Right Slingshot
VIO-ORG
#19 Aux - Idol Magnet
VIO-YEL
#20 Aux - Head Magnet
VIO-GRN
#21 Aux - Vari-Target
VIO-BLU
#22 Idol OPTO LED
VIO-BLK
#23 Top Post
Optional
(VIO-GRY)
#24 Optional Coil
J8
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
BRN-BLK
#1 Trough Upkicker
BRN-RED
#2 Autolaunch
BRN-ORG
#3 Vari VUK
BRN-YEL
#4 Left Ramp Diverter
BRN-GRN
#5 Right Ramp Diverter
BRN-BLU
#6 Lower Left Pop
BRN-VIO
#7 Lower Right Pop
BRN-GRY
#8 Lower Bottom Pop
J9
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
BLU-BRN
#9 Upper Left Pop
BLU-RED
#10 Upper Right Pop
BLU-ORG
#11 Upper Bottom Pop
BLU-YEL
#12 Scoop VUK
BLU-GRN
#13 Lock Kicker
BLU-BLK
#14 Upper Right Flipper
ORG-GRY
#15 Left Flipper
ORG-VIO
#16 Right Flipper
#89 Clear Bulb X2
#89 Clear Bulb X1
#906 Clear Bulb X1
#906 Red Bulb X1
23-800
26-1200
32-1800
25-1400
22-1080
OPTIONAL
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.
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
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
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
J11-P2 I/O BD.
FROM BLK-ORG AC Voltages IN 48v AC
F20 FOR MAGNET(S), IF USED
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
Q19 Aux. Bd. Idol Magnet
BLK 22-650 BLK
Q20 Aux. Bd. Shrunken Head Magnet
BLK 22-650 BLK
Q21 Aux. Bd. Vari Target Release
32-1800
RED-VIO 50v Out
RED-VIO 50v Out
RED-VIO 50v Out
ORG-GRN
ORG-YEL
ORG
Auxiliary (3X Driver) Board
520-5235-03
J2
J1
DRIVE 3
DRIVE 2
DRIVE 1
J10-P3 I/O BD.
FROM VIO-YEL High Power 50v DC
J10-P7/9 I/O BD.
FROM BLK Ground
J16-P8 I/O BD.
FROM RED Power Out +5v DC
Pin-2
To Pin-2 of the Upper Magnet OPTO Transceiver (Copper Wire, Cathode Side) Board as a SWITCHED GROUND. See Section 5, Chapter 4, PCBs, Playfield Switches (... Sw. 24), Page 143.
FROM YEL-VIO High Power 50v DC
J10-P4/5 I/O BD.
FROM RED-YEL High Power 50v DC
J10-P1/2 I/O BD.
BLU-YEL
GRY-YEL
BLU-YEL
3A Slo-Blo
These Coil Fuses are located under playfield NEAR assembly, see Sec. 5, Chp. 2, Playfield Wiring.
Sec. 3: ... Diagnostics

Go To Lamp Menu

To initiate, from the **DIAGNOSTICS MENU**, select the "LAMP" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. Controlled lamps are configured in 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.

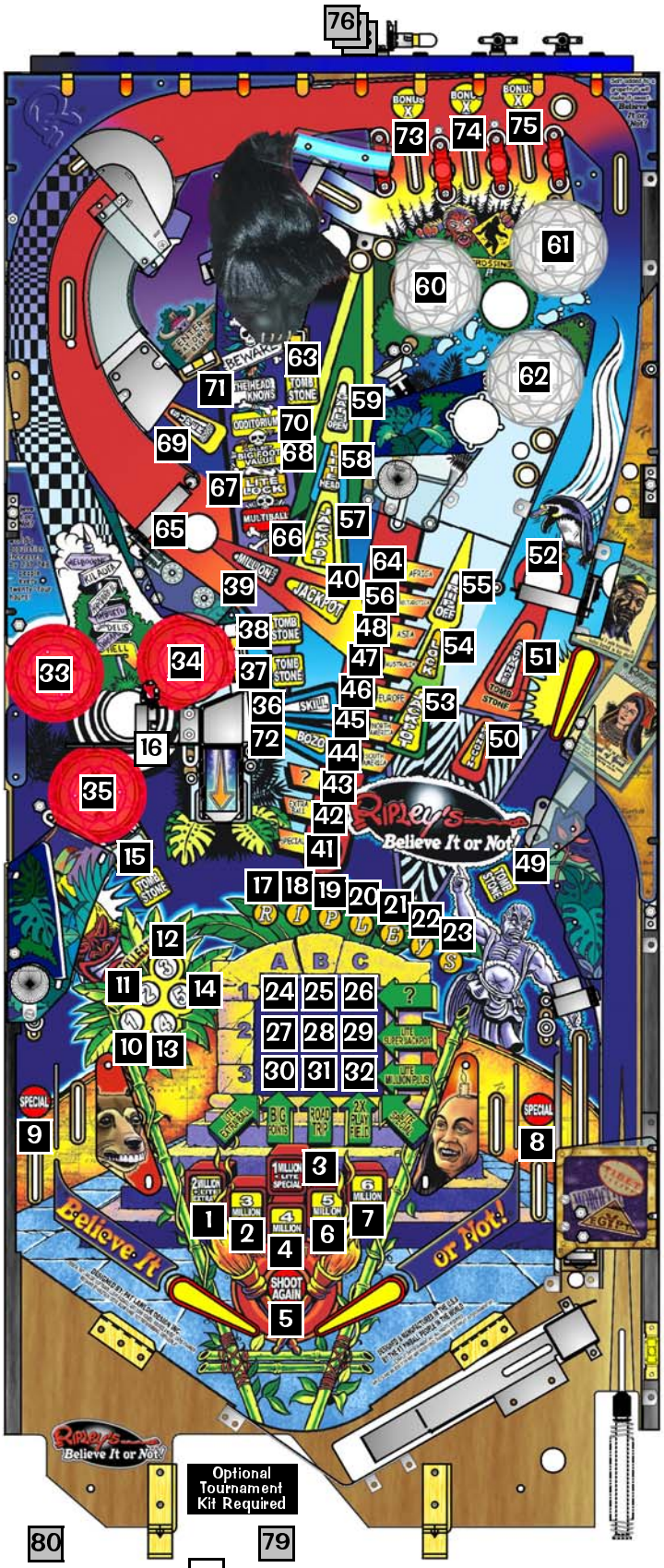
Row & Column Lamp Tests

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 Bulb SUPER JACKPOT 2 MIL	2 #555 Bulb SUPER JACKPOT 3 MIL	3 #555 Bulb SUPER JACKPOT 1 MIL	4 #555 Bulb SUPER JACKPOT 4 MIL	5 #555 Bulb SHOOT AGAIN	6 #555 Bulb SUPER JACKPOT 5 MIL	7 #555 Bulb SUPER JACKPOT 6 MIL	8 #555 Bulb RIGHT SPECIAL
2: Q34 RED-BLK J12-P2	9 #555 Bulb LEFT SPECIAL	10 #555 Bulb 1 IDOL COUNTER	11 #44 Bulb 2 IDOL COUNTER	12 #555 Bulb 3 IDOL COUNTER	13 #555 Bulb 4 IDOL COUNTER	14 #555 Bulb 5 IDOL COUNTER	15 #555 Bulb TOMBSTONE 1	16 #44 Bulb SCOOP ARROW
3: Q35 RED-ORG J12-P3	17 #555 Bulb (R) IPLEYS	18 #555 Bulb R (I) PLEYS	19 #555 Bulb RI (P) LEYS	20 #555 Bulb RIP (L) EYS	21 #555 Bulb RIPL (E) YS	22 #555 Bulb RIPLE (Y) S	23 #555 Bulb RIPLEY (S)	24 #555 Bulb GRID A1 (UPPER LEFT)
4: Q36 RED-YEL J12-P4	25 #555 Bulb GRID B1	26 #555 Bulb GRID C1	27 #555 Bulb GRID A2	28 #555 Bulb GRID B2	29 #555 Bulb GRID C2	30 #555 Bulb GRID A3	31 #555 Bulb GRID B3	32 #555 Bulb GRID C3
5: Q37 RED-GRN J12-P5	33 #555 Bulb LOWER LEFT POP bots	34 #555 Bulb LOWER RIGHT POP bots	35 #555 Bulb LOWER BOT POP bots	36 #555 Bulb SKILL SHOT	37 #555 Bulb TOMBSTONE 2	38 #555 Bulb TOMBSTONE 3	39 #555 Bulb MILLION PLUS	40 #555 Bulb LOOP JACKPOT
6: Q38 RED-BLU J12-P6	41 #555 Bulb VARI-TARGET SPECIAL	42 #555 Bulb VARI-TARGET EB	43 #555 Bulb VARI-TARGET ? (MYSTERY)	44 #555 Bulb VARI-TARGET S.A.	45 #555 Bulb VARI-TARGET N.A.	46 #555 Bulb VARI-TARGET EUROPE	47 #555 Bulb VARI-TARGET AUSTR.	48 #555 Bulb VARI-TARGET ASIA
7: Q39 RED-VIO J12-P8	49 #555 Bulb TOMBSTONE 5	50 #44 Bulb PENGUIN	51 #44 Bulb ADVANCE TOMBSTONE	52 #44 Bulb RIGHT SPINNER	53 #555 Bulb RIGHT JACKPOT	54 #555 Bulb LOCK	55 #555 Bulb RIPOFF	56 #555 Bulb VARI-TARGET ANTAR.
8: Q40 RED-GRY J12-P9	57 #555 Bulb CENTER JACKPOT	58 #555 Bulb LITE HEAD	59 #555 Bulb GATE OPEN	60 #555 Bulb UPPER LEFT POP bots	61 #555 Bulb UPPER RIGHT POP bots	62 #555 Bulb UPPER BOT POP bots	63 #44 Bulb TOMBSTONE 4	64 #555 Bulb VARI-TARGET AFRICA
9: Q41 RED-WHT J12-P10	65 #44 Bulb LEFT SPINNER	66 #555 Bulb MULTIBALL	67 #555 Bulb LIGHT LOCKS	68 #555 Bulb COLLECT BIG-FOOT BONUS	69 #555 Bulb SUPER JACKPOT	70 #555 Bulb ODDITORIUM	71 #555 Bulb THE HEAD KNOWS	72 #555 Bulb BOZO
10: Q42 RED J12-P11	73 #555 Bulb BONUS X INLANE LEFT	74 #555 Bulb BONUS X INLANE CTR	75 #555 Bulb BONUS X INLANE RT	76 #44 Bulb BACK PANEL A	77 #44 Bulb BACK PANEL B	78 #44 Bulb BACK PANEL C	79 #555 Bulb TOURNAMENT BUTTON	80 #555 Bulb START BUTTON

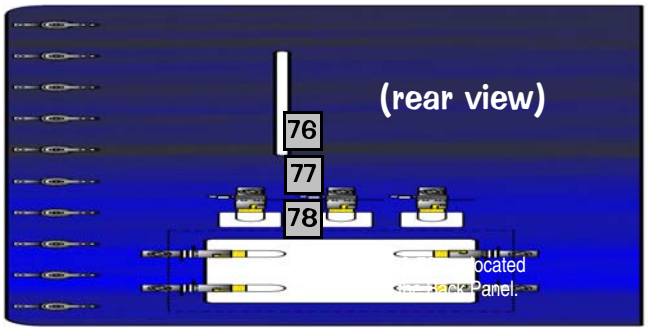
LAMP MATRIX GRID LOCATIONS



= Lamps above Playfield.

= Lamps below Playfield.

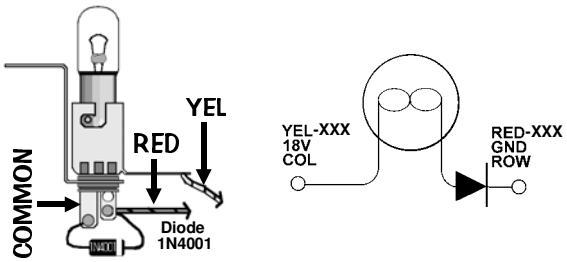
= Lamps not on Playfield.



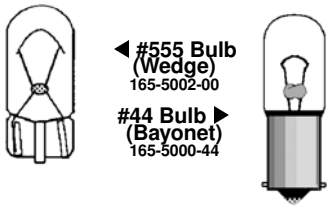
▲ Backpanel

◀ Playfield

Typical Lamp Wiring & Schematic



Bulb Types used for Lamps



Lamp Part Notes: *#555 Bulb Clear = 165-5002-00. #44 Bulb Clear = 165-5000-44. 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, s*ee Section* ***5****, Chapter* ***2****,* ***Playfield Wiring****.*

Test Flash Lamps

To initiate, from the **DIAGNOSTICS MENU**, select the "FLASH" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. After selecting this *Icon* the display will indicate **CYCLING FLASHERS**. The Flash Lamps will cycle continuously until the test is exited. This test allows the technician to easily spot any burned-out bulbs and replace them. Flashers tested are Flash Lamps in Positions: **Q1-Q32** and in this game Flash Lamp(s) are : **Q25-Q32.**

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

Clear Ball Trough

To initiate, from the **DIAGNOSTICS MENU**, select the "CLR" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. This Menu is provided to allow the technician a simple method of removing the balls from the trough and also, to test functionality of the trough, ensuring proper trough operation. After selecting this *Icon* the display will show a graphic of the ball trough with balls in the trough with it's corresponding switch number. Select the "RUN" *Mini-Icon* to eject the ball in the first position. Simultaneously, the display and the playfield will eject the ball to the Trough Up-Kicker, eject from the Trough Up-Kicker into the Shooter Lane and will be ejected onto the playfield where the technician can easily retrieve the pinball or allow the ball(s) to re-enter the trough to continue **Clear Ball Trough Test**.

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

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

Technician Alerts

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

After selecting this *Icon*, 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 replace 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.

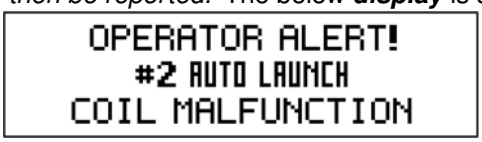
Note: *This detection and compensation will happen with every pinball, if each suffers the same fate of a ball trap. If* ***all*** *balls get trapped, the game cannot be played or started until the situation is rectified.*

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

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

Note: *For ROM 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.*

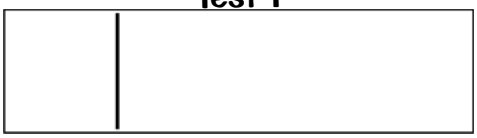
Begin Burn In

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

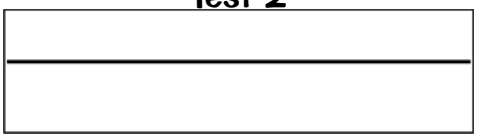
To initiate, from the **DIAGNOSTICS MENU**, select the "DOT TEST" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. After selecting this *Icon* the **Dot Matrix Test** immediately begins. ***Note:*** Pressing any button will exit the test & return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

Test 1



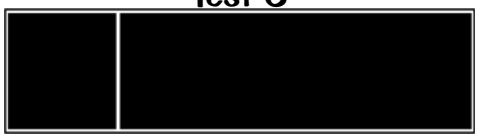
Illuminates **1 vertical column of dots**, turning it off & illuminating the *next column*, until each *column* has been individually lit, while the other *columns* are off.

Test 2



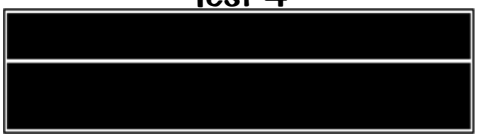
Illuminates **1 horizontal row of dots**, turning it off & illuminating the *next row*, until each *row* has been individually lit, while the other *rows* are off.

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 **every other dot lit**, in both the *rows and columns*.

Note: Pressing the **Red**, **Green**, **Black** or **Flipper Buttons** will exit the test & return to **DIAGNOSTICS MENU**.

Dot Matrix Display Explained

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

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

Ripley Specific

To initiate, from the **DIAGNOSTICS MENU**, select the "BION" *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 **RIPLEY TESTS MENU**, with the "LED TEST" *Icon* flashing. This Sub-Menu is used to test the operation of the **Playfield Dot Display (5X7) PCB** *(above the Upper Left Ramp)* and the **Vari-Taget Switch and Coil Reset Operation** *("VARI" Icon)*. To initiate, from the **RIPLEYS TESTS MENU**, select one of the 2 *Icons* with either the **Red** or **Green Buttons** and press the **Black Button**. After finishing the Test, select the "PREV" Icon to return to the Sub-Menu or select either "<<" or ">>" *Mini-Icons* to slip between the 2 Testing Menus.

LED Test

Selecting the"LED TEST" *Icon* will bring up the **LED TEST MENU** with the "+" *Mini-Icon* flashing and the **LED Test** set to **ALL OFF**. This test is provided to allow a method of testing the **5X7 x3 Dot Display**. ***Note:*** *These LEDs are not Controlled Lamps (i.e. not part of the Lamp Matrix).*

Select and *activate* the "+" *Mini-Icon* to cycle *(forward)* or the "-" Mini-Icon to cycle *(backwards)* between the **six (6) LED Tests**. Each ***LED TEST*** will cycle continuously until the next or previous test is chosen, or if the menu is exited.

Note: *For more details on the Playfield Dot Display (5X7) x3 LED Board, see the end of Section **5**, Chapter **4**, **Printed Circuit Boards (PCBS)**, ...Schematic, Component Layout & Parts, Pages **146-147**.*

Ripleys Specific continued on the next page.

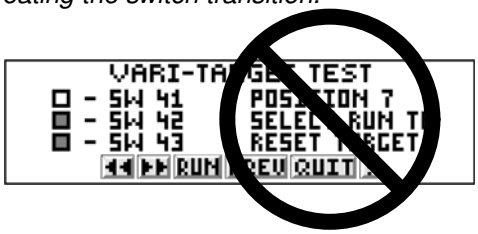
Vari-Target Test

Selecting the"VARI" *Icon* will bring up the **VARI-TARGET TEST MENU** with the "RUN" *Mini-Icon* flashing. ***Note:*** *Upon selection of the "VARI" Icon, (and with the Power Interlock Switched pulled out), the Reset Coil (**Q21**) will engergize, reseting the Target to to the **HOME POSITION** (all the way forward or Position 2).* This test is provided to allow a method of testing **Switch OPTOs 41-43** *(and combos thereof)* and **Aux.-Vari Reset (Q21)** operation.

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

Select and *activate* the "RUN" *Mini-Icon* to **RESET THE VARI-TARGET**. As you use your finger to push on the Vari-Target, *the display will change as shown in the Vari-Target Test Menus below. The bracket on the Vari-Target moves between the OPTOs on the 3-Switch U-Shaped OPTO PC Board creating the switch transition.*

>> CRITICAL SET-UP NOTE: With the target set-up properly, you should *not* see **Pos. 1** or **Pos. 7** *(if you see Position 7, but it does not lock into place, that's ok).*



To adjust: Loosen Target Front Stop Bracket (**A**), position target until it locks onto Position 2 (**A-1**). Now tighten bracket (**A**) into place (hand torque tight). Move target up a few notches, then reset target to ensure it goes back to Position 2 (**A-1**). To prevent locking into Position 7 (**B-1**), loosen Target Back Stop Bracket (**B**) and tighten when target no longer can lock into Pos. 7 (**B-1**).

Position 2 - Switch 41 is closed.

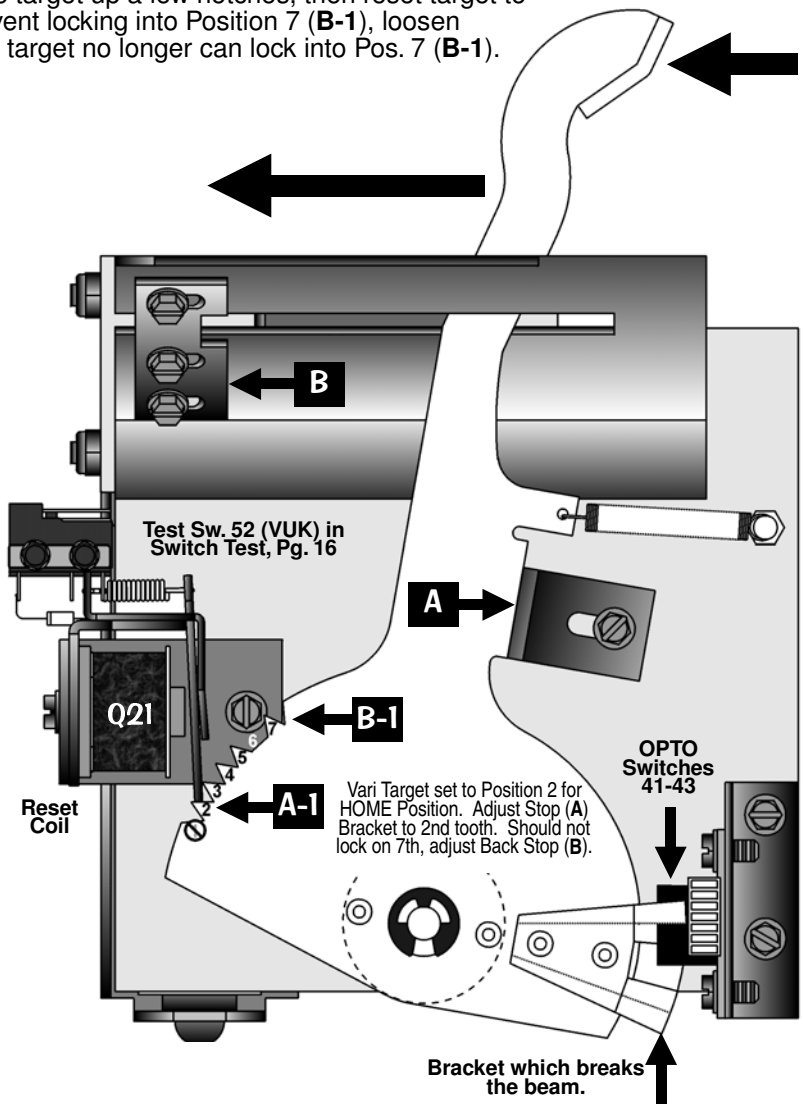
Position 3 - Switches 41 / 43 are closed.

Position 4 - Switch 43 is closed.

Position 5 - No Switches are closed.

Position 6 - Switch 42 is closed.

Tooth at Pos. 6 has been removed to prevent locking.



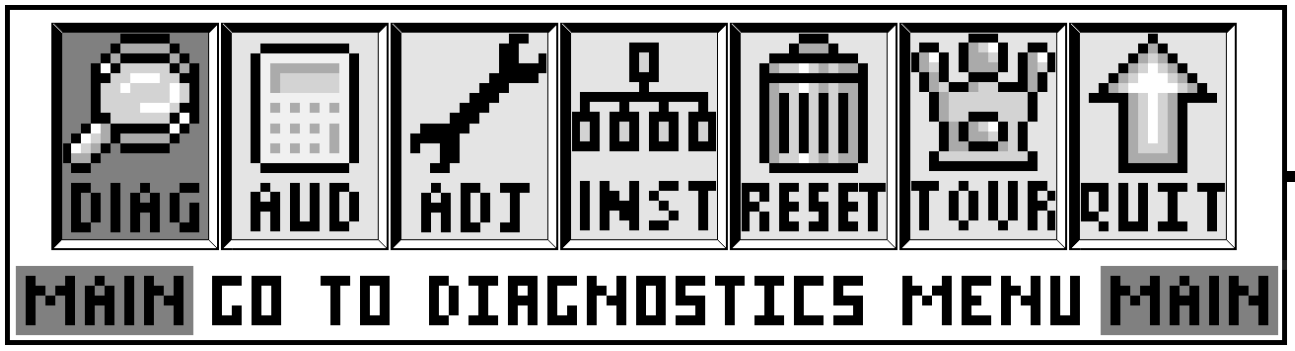
Note: *For more details on the 3-Switch U-Shaped OPTO PC Board, see the end of Section **5**, Chapter **4**, **Printed Circuit Boards (PCBS)**, ...Schematic, Component Layout & Parts, Pages **148**.*

Go To Fuse Table

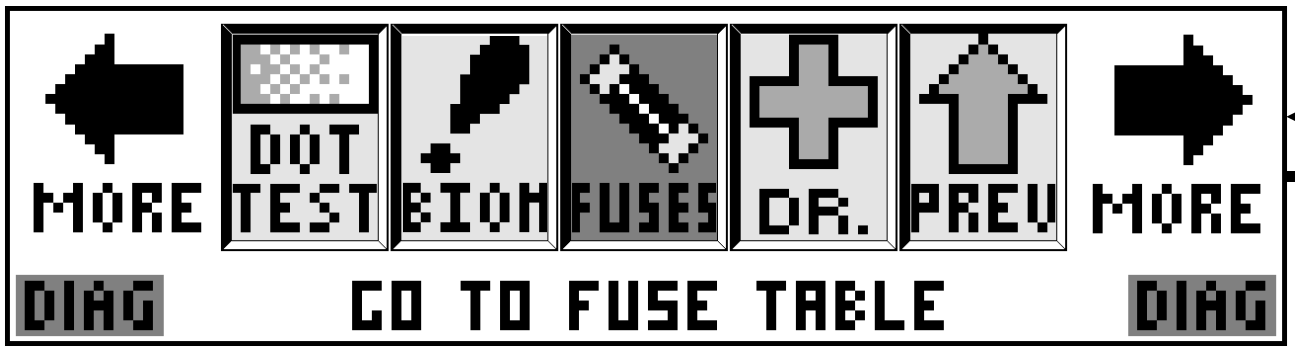
To initiate, from the **DIAGNOSTICS MENU**, select the "FUSES" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. The **FUSE TABLE MENU** now appears. This provides the technician with the current **Fuse Table** for this game *(also noted on a decal in the Backbox)*.The fuses are located in the Backbox *(on the **Display Power Supply Board** and the **I/O Power Driver Board**)*, and also in the Cabinet *(under the playfield by the Flippers and/or by any unique assembly requiring an additional fuse, such as magnets)*. For the complete **Fuse List** in the *Quick Reference Fuse Chart & Pictorials*, *see the next page or Page* **DR. ❶** *(front of this manual).*

Example:

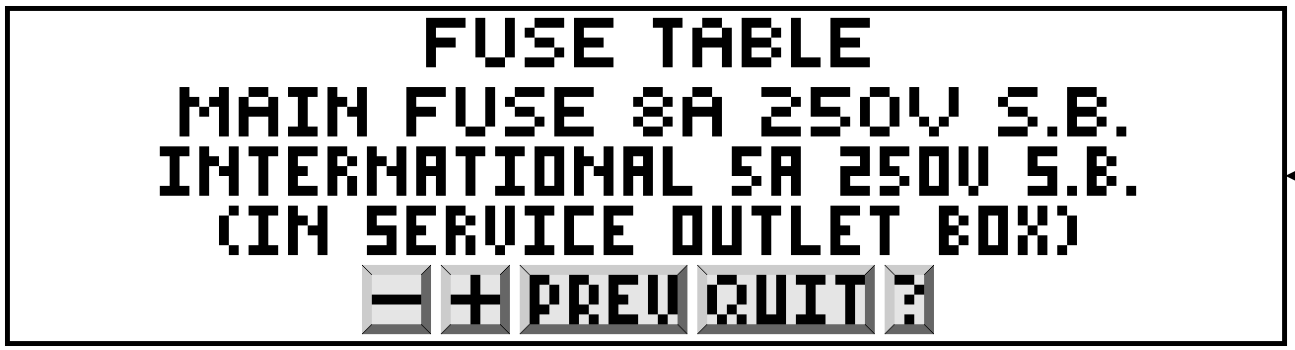
After entering **Portals™**, the **MAIN MENU** now appears with the "DIAG" *Icon* (**GO TO DIAGNOSTICS MENU**) flashing:



Press the **Black "ENTER" Button** to *activate* this **ICON**. The **DIAGNOSTICS MENU** now appears with the "SW" *Icon* (**GO TO SWITCH MENU**) flashing; use the **Red "LEFT"** or **Green "RIGHT" Buttons**, until the "FUSES" *Icon* (**GO TO FUSE TABLE**) is flashing:



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



Select and *activate* the "+" *Mini-Icon* to view the next fuse in the group. Continue to select either the "+" or "-" *Mini-Icons* to view each fuse one at a time. The display will describe the fuse identification number (e.g. Main, F1, F6, F7, etc.), rating of fuse (e.g. 5A 250v S.B. - i.e. 5 Amp, 250 volt, Slo-Blo), location of fuse (i.e. Backbox: Board Name located on; or Cabinet: Under the playfield or in Service Outlet), and 'use of fuse' (e.g. 90v DC High Voltage Power, etc.). The current fuse listed will remain in the display until the next fuse is chosen or when the Sub-Menu is exited by selecting & *activating* the "PREV" or "QUIT" *Mini-Icons*.

Go To Fuse Table continued on the next page.

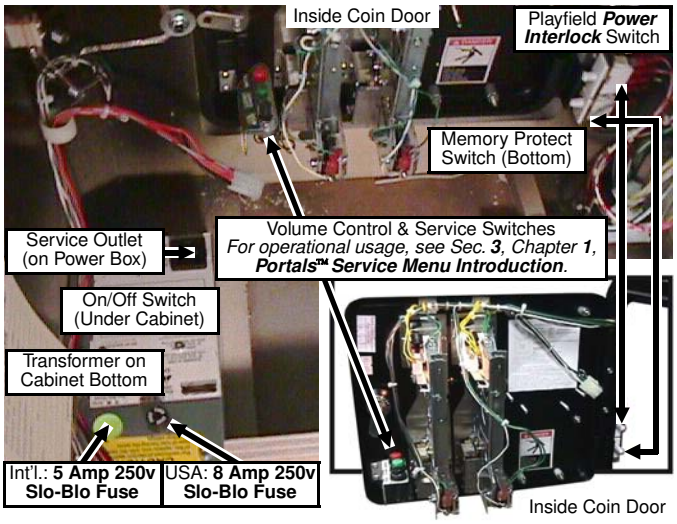
Backbox PCB Fuses, ROMs, Bridges, Relays, P/F & Cabinet Fuses, Cab. Switches

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

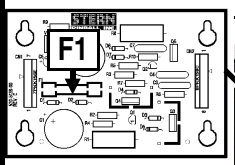
QUICK REFERENCE FUSE CHART

Backbox Fuses			
LOC:	**DISPLAY POWER SUPPLY (P.S.) BOARD**		
F1	¾A 250v S.B.	90v DC	High Voltage Display
LOC:	**I / O POWER DRIVER BOARD**		
F6	7A 250v S.B.	50v DC	Primary High Power Coils/Flippers
F7	5A 250v S.B.	20v DC	Low Power Coils
F8	5A 250v S.B.	12v DC	Logic Power
F9	5A 250v S.B.	12v DC	Logic Power
F20	**4A 250v S.B.**	50v DC	Magnets ◀◀◀ **THIS GAME ONLY**
F21	3A 250v S.B.	50v DC	Coils
F22	8A 250v S.B.	18v DC	Controlled Lamps
F23	4A 250v S.B.	5v DC	Logic
F24	5A 250v S.B.	6.3v AC	G.I. Lamps (BRN-WHT to WHT-BRN)
F25	5A 250v S.B.	6.3v AC	G.I. Lamps (YEL to WHT-YEL)
F26	5A 250v S.B.	6.3v AC	G.I. Lamps (GRN to WHT-GRN)
F27	5A 250v S.B.	6.3v AC	G.I. Lamps (VIO to WHT-VIO)
F28	3A 250v S.B.	24v AC	**Not Used / Spare**
Cabinet Fuses			
LOC:	**SERVICE (AC) OUTLET BOX (Cabinet Bottom)**		
n/a	8A 250v S.B.	115v AC	Main Fuse Line (Domestic or USA)
n/a	5A 250v S.B.	220v AC	Main Fuse Line (International)
Playfield (P/F) Fuses			
LOC:	**UNDER PLAYFIELD (near Flippers)**		
n/a	3A 250v S.B.	50v DC	Right Flipper (BLU-YEL⇆RED-YEL)
n/a	3A 250v S.B.	50v DC	Left Flipper (GRY-YEL⇆RED-YEL)
n/a	3A 250v S.B.	50v DC	Upr. Rt. Flip. (BLU-YEL⇆RED-YEL)

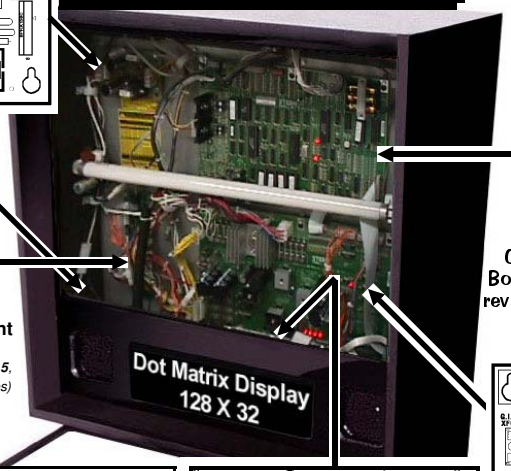
*For locations & more information on fuses, see Sec. **5**, Chapter **2**.*



ROM TYPE on BD	LOCATION	SIZE	PART NUMBER
CPU Sound	U7	512K	965-0408-81
CPU Game	U210	1 MB	965-0409-81
CPU Voice ROM 1	U17	8 MB	965-0410-81
CPU Voice ROM 2	U21	8 MB	965-0411-81
CPU Voice ROM 3	U36	8 MB	965-0412-81
CPU Voice ROM 4	U37	8 MB	965-0413-81
DISPLAY Controller	U5	4 MB	965-0414-81



◀ Display Power Supply Bd.

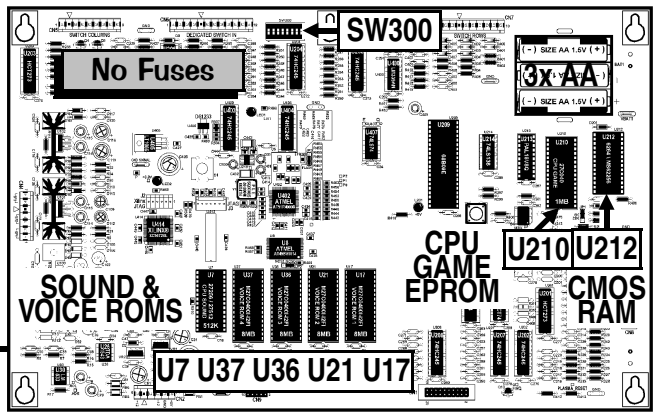


Solenoid Expander Board ‡

Tournament Interface Board ‡

‡ UK or Tournament GAMES ONLY

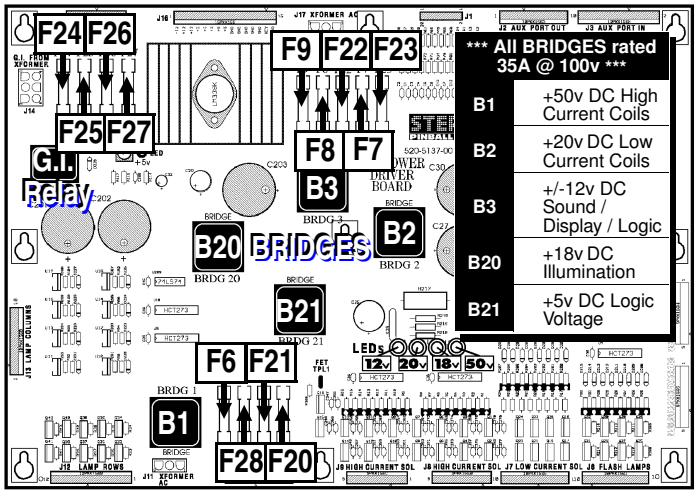
*For more info., see Section **5**, Chp. **4**, **PCBs** (Yellow Pages)*



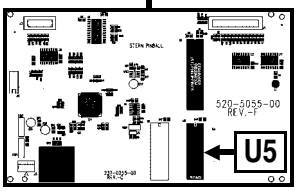
For Schematics and/or Component Parts on PC Boards shown on this page, review Section 5, Chapter 4, Printed Circuit Boards (The Yellow Pages).

CPU/Sound Bd. II w/ATMEL ▲

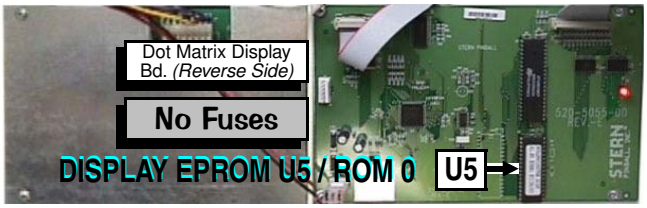
I/O Power Driver Board ▼



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.



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.

CLICK RED BOX ON THE NEXT PAGE TO RESET THIS PAGE. BE CAREFUL!

Copy this page for Field Audit Tracking Performance

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

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

EARNINGS & STANDARD AUDIT TABLES

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

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

STANDARD AUDITS
01-68 ✍ = ✎
Audit definitions follow in this Chapter.
To track Feature & Tournament Audits, see Pages 36 or 54.

Sec. 3: Go To Audits

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	0–499K SCORES
16	500K–999K SCORES
17	1M–1.9M SCORES
18	2M–2.9M SCORES
19	3M–3.9M SCORES
20	4M–5.9M SCORES
21	6M–7.9M SCORES
22	8M–9.9M SCORES
23	10M–11.9M SCORES
24	12M–13.9M SCORES
25	14M–15.9M SCORES
26	16M–17.9M SCORES
27	18M–19.9M SCORES
28	20M–24.9M SCORES
29	25M–29.9M SCORES
30	30M–39.9M SCORES
31	40M+ SCORES
32	AVERAGE SCORES
33	SERVICE CREDITS
34	BALL SEARCH STARTED
35	LOST BALL FEEDS
36	LOST BALL GAME STARTS
37	LEFT DRAINS
38	CENTER DRAINS
39	RIGHT DRAINS
40	TILTS
41	TOTAL BALLS SAVED
42	PROPRIETARY
43	PROPRIETARY
44	PROPRIETARY
45	PROPRIETARY
46	PROPRIETARY
47	PROPRIETARY
48	PROPRIETARY
49	PROPRIETARY
50	BASE REPLAY
51	LEFT FLIPPER USED
52	RIGHT FLIPPER USED
53	PROPRIETARY
54	PROPRIETARY
55	0–1 MINUTE GAMES
56	1 – 1.5 MINUTE GAMES
57	1.5 – 2 MINUTE GAMES
58	2 – 2.5 MINUTE GAMES
59	2.5 – 3 MINUTE GAMES
60	3 – 3.5 MINUTE GAMES
61	3.5 – 4 MINUTE GAMES
62	4 – 5 MINUTE GAMES
63	5 – 6 MINUTE GAMES
64	6 – 8 MINUTE GAMES
65	8 – 10 MINUTE GAMES
66	10 – 15 MINUTE GAMES
67	15+ MINUTE GAMES
68	RECENT REPLAY PERCENT

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

Go To Audits Menu

Overview

The **Portals™ Service Menu System** provides **115** 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 **01-33**). *For details on **Tournament Audits**, see Section **3**, Chapter **7**, **GO TO TOURNAMENT MENU**.* Audits which are named **Proprietary** are also for ***Future Expansion*** or ***Programming***. Game code may get upgraded during production; compare all Audits in the display with the manual and make any corrections to the Audit Table *(previous page)*, as necessary. Audits are subject to change *(with or without notice)*. To view Audits in the display, enter the **Portals™ Service Menu System**. *For how to **RESET** Audits, see Section **3**, Chapter **6**, **GO TO RESET MENU**.*

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

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

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

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

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

Select and activate to:

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

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

GO TO AUDITS MENU

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

Earnings Audits (01-14)

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

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 – 499K SCORES:** Provides the total number of games the Player's final score was **0** and **499,990** points.
16	**500K – 999K SCORES:** ... and the Player's final score was between **500,000** and **999,990** points.
17	**1M – 1.9M SCORES:** ... and the Player's final score was between **1,000,000** and **1,999,990** points.
18	**2M – 2.9M SCORES:** ... and the Player's final score was between **2,000,000** and **2,999,990** points.
19	**3M – 3.9M SCORES:** ... and the Player's final score was between **3,000,000** and **3,999,990** points.
20	**4M – 5.9M SCORES:** ... and the Player's final score was between **4,000,000** and **5,999,990** points.
21	**6M – 7.9M SCORES:** ... and the Player's final score was between **6,000,000** and **7,999,990** points.
22	**8M – 9.9M SCORES:** ... and the Player's final score was between **8,000,000** and **9,999,990** points.
23	**10M – 11.9M SCORES:** ... and the Player's final score was between **10,000,000** and **11,999,990** points.
24	**12M – 13.9M SCORES:** ... and the Player's final score was between **12,000,000** and **13,999,990** points.
25	**14M – 15.9M SCORES:** ... and the Player's final score was between **14,000,000** and **15,999,990** points.
26	**16M – 17.9M SCORES:** ... and the Player's final score was between **16,000,000** and **17,999,990** points.
27	**18M – 19.9M SCORES:** ... and the Player's final score was between **18,000,000** and **19,999,990** points.
28	**20M – 24.9M SCORES:** ... and the Player's final score was between **20,000,000** and **24,999,990** points.
29	**25M – 29.9M SCORES:** ... and the Player's final score was between **25,000,000** and **29,999,990** points.
30	**30M – 39.9M SCORES:** ... and the Player's final score was between **30,000,000** and **39,999,990** points.
31	**40M+ SCORES:** Provides the total number of games the Player's final score was **40,000,000** 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 (01-33)

To initiate, from the **AUDITS MENU**, select the "BION" *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
01-33 ✍ = ✎
***** PROGRAMMING USE ONLY *****
UNLABELED BOXES ARE FOR FUTURE EXPANSION.

01	LEFT RAMPS	
02	RIGHT RAMPS	
03	TEMPLE LEFT LANE	
04	TEMPLE CENTER LANE	
05	TEMPLE RIGHT LANE	
06	TEMPLE AWD EB LIT	
07	TEMPLE AWD ?	
08	TEMPLE AWD SJ LIT	
09	TEMPLE AWD MIL PLUS	
10	TEMPLE AWD SPEC LIT	
11	TEMPLE AWD 2X SCORING	
12	TEMPLE AWD ROAD TRIP	
13	TEMPLE AWD BIG POINTS	
14	CONTINENTS STARTED	
15	TEMPLE CODE SCRAMBLES	
16	VARI TARGET AWARDS	
17	1 BALL LOCKED	
18	2 BALLS LOCKED	
19	MULTIBALL STARTED	
20	MULTIBALL JACKPOTS	
21	MULTIBALL S. JACKPOTS	
22	BONUS X AWARDED	
23	BOZO AWARDS GIVEN	
24	PROPRIETARY 01	
25	PROPRIETARY 02	
26	PROPRIETARY 03	
27	PROPRIETARY 04	
28	PROPRIETARY 05	
29	PROPRIETARY 06	
30	PROPRIETARY 07	
31	PROPRIETARY 08	
32	PROPRIETARY 09	
33	PROPRIETARY 10	

01	LEFT RAMPS	
02	RIGHT RAMPS	
03	TEMPLE LEFT LANE	
04	TEMPLE CENTER LANE	
05	TEMPLE RIGHT LANE	
06	TEMPLE AWD EB LIT	
07	TEMPLE AWD ?	
08	TEMPLE AWD SJ LIT	
09	TEMPLE AWD MIL PLUS	
10	TEMPLE AWD SPEC LIT	
11	TEMPLE AWD 2X SCORING	
12	TEMPLE AWD ROAD TRIP	
13	TEMPLE AWD BIG POINTS	
14	CONTINENTS STARTED	
15	TEMPLE CODE SCRAMBLES	
16	VARI TARGET AWARDS	
17	1 BALL LOCKED	
18	2 BALLS LOCKED	
19	MULTIBALL STARTED	
20	MULTIBALL JACKPOTS	
21	MULTIBALL S. JACKPOTS	
22	BONUS X AWARDED	
23	BOZO AWARDS GIVEN	
24	PROPRIETARY 01	
25	PROPRIETARY 02	
26	PROPRIETARY 03	
27	PROPRIETARY 04	
28	PROPRIETARY 05	
29	PROPRIETARY 06	
30	PROPRIETARY 07	
31	PROPRIETARY 08	
32	PROPRIETARY 09	
33	PROPRIETARY 10	

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 **Tournament Serial Interface (TSI) Board** and a **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.* An optional Printer Kit is available for purchase *(contact your local distributor).*

Quick Printout

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

Full Printout

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

Reset Printer

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

FEATURE AUDIT ABBREVIATIONS USED IN THIS CHAPTER:

? Mystery		**AWD** Awarded		**EB** Extra Ball	
	S. Super		**SJ** Super Jackpot		**MIL** Million
VARI Variable		**X** Variable Number		**2X** Double	

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

CLICK THE RED BOX ON PAGE 33 TO RESET THIS PAGE. BE CAREFUL!

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 = ✎

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

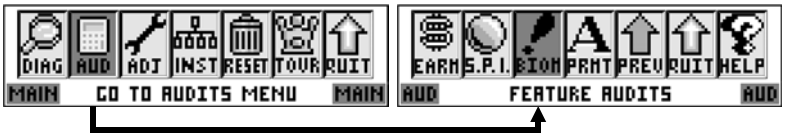
STANDARD AUDITS 01-68 = ✎

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	0–499K SCORES
16	500K–999K SCORES
17	1M–1.9M SCORES
18	2M–2.9M SCORES
19	3M–3.9M SCORES
20	4M–5.9M SCORES
21	6M–7.9M SCORES
22	8M–9.9M SCORES
23	10M–11.9M SCORES
24	12M–13.9M SCORES
25	14M–15.9M SCORES
26	16M–17.9M SCORES
27	18M–19.9M SCORES
28	20M–24.9M SCORES
29	25M–29.9M SCORES
30	30M–39.9M SCORES
31	40M+ 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).*

CLICK THE RED BOX ON PAGE 33 TO RESET THIS PAGE. BE CAREFUL!

FEATURE AUDIT TABLE



FEATURE AUDITS
01-33 ✍ = ✎
*** PROGRAMMING USE ONLY ***

UNLABELED BOXES ARE FOR FUTURE EXPANSION.

01	LEFT RAMPS	
02	RIGHT RAMPS	
03	TEMPLE LEFT LANE	
04	TEMPLE CENTER LANE	
05	TEMPLE RIGHT LANE	
06	TEMPLE AWD EB LIT	
07	TEMPLE AWD ?	
08	TEMPLE AWD SJ LIT	
09	TEMPLE AWD MIL PLUS	
10	TEMPLE AWD SPEC LIT	
11	TEMPLE AWD 2X SCORING	
12	TEMPLE AWD ROAD TRIP	
13	TEMPLE AWD BIG POINTS	
14	CONTINENTS STARTED	
15	TEMPLE CODE SCRAMBLES	
16	VARI TARGET AWARDS	
17	1 BALL LOCKED	
18	2 BALLS LOCKED	
19	MULTIBALL STARTED	
20	MULTIBALL JACKPOTS	
21	MULTIBALL S. JACKPOTS	
22	BONUS X AWARDED	
23	BOZO AWARDS GIVEN	
24	PROPRIETARY 01	
25	PROPRIETARY 02	
26	PROPRIETARY 03	
27	PROPRIETARY 04	
28	PROPRIETARY 05	
29	PROPRIETARY 06	
30	PROPRIETARY 07	
31	PROPRIETARY 08	
32	PROPRIETARY 09	
33	PROPRIETARY 10	

01	LEFT RAMPS	
02	RIGHT RAMPS	
03	TEMPLE LEFT LANE	
04	TEMPLE CENTER LANE	
05	TEMPLE RIGHT LANE	
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08	TEMPLE AWD SJ LIT	
09	TEMPLE AWD MIL PLUS	
10	TEMPLE AWD SPEC LIT	
11	TEMPLE AWD 2X SCORING	
12	TEMPLE AWD ROAD TRIP	
13	TEMPLE AWD BIG POINTS	
14	CONTINENTS STARTED	
15	TEMPLE CODE SCRAMBLES	
16	VARI TARGET AWARDS	
17	1 BALL LOCKED	
18	2 BALLS LOCKED	
19	MULTIBALL STARTED	
20	MULTIBALL JACKPOTS	
21	MULTIBALL S. JACKPOTS	
22	BONUS X AWARDED	
23	BOZO AWARDS GIVEN	
24	PROPRIETARY 01	
25	PROPRIETARY 02	
26	PROPRIETARY 03	
27	PROPRIETARY 04	
28	PROPRIETARY 05	
29	PROPRIETARY 06	
30	PROPRIETARY 07	
31	PROPRIETARY 08	
32	PROPRIETARY 09	
33	PROPRIETARY 10	

Comments:

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

Ripley's Believe It or Not!

CLICK THE RED BOX ON PAGE 33 TO RESET THIS PAGE. BE CAREFUL!

MULTI-WEEK TOURNAMENT AUDIT TABLES

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 :

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

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 :

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

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 :

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

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 :

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

STANDARD & FEATURE ADJUSTMENT TABLES

(Review Overview regarding changes)

STANDARD ADJUSTMENTS 01-52 ✍ = ✎

Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
01	REPLAY TYPE	AUTO	
02*	REPLAY PERCENTAGE	10%	
03	REPLAY AWARD	CREDIT	
04*	REPLAY LEVELS	1: 12,000,000	
05	REPLAY BOOST	YES	
06	SPECIAL AWARD	CREDIT	
07*	SPECIAL PERCENTAGE	0%	
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	50,000,000	
24*	DEFAULT HIGH SCORE #1	40,000,000	
25*	DEFAULT HIGH SCORE #2	35,000,000	
26*	DEFAULT HIGH SCORE #3	30,000,000	
27*	DEFAULT HIGH SCORE #4	25,000,000	
28	HSTD RESET COUNT	2,000	
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	OFF	
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	

**** 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 01-27 ✍ = ✎

Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
01	BONUS X CARRYOVER	NO	
02	INLANES AT GAME START	00	
03	POPS LIT AT GAME STRT	02	
04	TEMPLE JEWELS G. START	03	
05	MAX TEMPLE EBS LIT	03	
06	RIPLEYS LETTERS GSTRT	00	
07	EASY VARI TARGET	NO	
08	TEMPLE GATE TIMED	NO	
09	IDOL BALL SAVER	NO	
10	EXTRA BALL MEMORY	YES	
11	AFRICA HITS FOR LTR	05	
12	ANTAR. HITS FOR LTR	06	
13	ASIA SPINS FOR LTR	25	
14	AUSTR. HITS FOR LTR	06	
15	EUROPE HITS FOR LTR	07	
16	N. AMER HITS FOR LTR	05	
17	S. AMER HITS FOR LTR	06	
18	BION SCOOP DIFF	MODERATE	
19	SHARED BOZO LETTERS	YES	
20	TIMER SECONDS	30	
21	IDOL HITS FOR EB LIT	12	
22	IDOL HITS FOR SP. LIT	40	
	Read the Note on Page 45 in this Chapter regarding Proprietary Adjustments:		
23			
24			
25			
26			
27			

Go To Adjustments Menu

Overview

The **Portals™ Service Menu System** provides **79** Adjustments to vary Game Functions to customize for your particular needs. The Adjustments are divided into 2 groups: • **Standard Adjustments** (**01-52**) and • **Feature Adjustments** (**01-27**). 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 (01-52)

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.*
02	**REPLAY PERCENTAGE:** Set between **01% - 50**. Default is **10%**. This Adjustment is required if Standard Adjustment **1** is set to **AUTO** or **DYNAMIC**.

Standard Adjustments 03-11 continued on the next page.

STANDARD ADJUSTMENT NAME: Definition
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.
****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: 12,000,000**. 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 **0%**. 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.*

LEFT	CENTER	RIGHT	4TH	Example 1			LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:	ONE CREDIT:	BONUS 1:	BONUS 2:	BONUS 1:	BONUS 2:	LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:
25¢	$1.00	25¢	Not Used	1 /50¢	2 /75¢	3/ $1.00	3	12	3	1	4	0	0	0	0	1	4	1	1
Coin Mechanisms Used				Pricing Scheme Desired			PULSES	PULSES	PULSES	PULSE	PULSES	PULSES	PULSES	CREDITS	CREDITS	CLICK	CLICKS	CLICK	CLICK

In **Example 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	Example 2			LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:	ONE CREDIT:	BONUS 1:	BONUS 2:	BONUS 1:	BONUS 2:	LEFT COIN:	CENTER COIN:	RIGHT COIN:	FOURTH COIN:
25¢	$1.00	25¢	Not Used	1 /50¢	2 /75¢	7/ $2.00	3	12	3	1	4	24	0	1	0	1	4	1	1
Coin Mechanisms Used				Pricing Scheme Desired			PULSES	PULSES	PULSES	PULSE	PULSES	PULSES	PULSES	CREDIT	CREDITS	CLICK	CLICKS	CLICK	CLICK

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

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

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

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

STANDARD ADJUSTMENT NAME: Definition

USA & International 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									
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	For different Euro Pricing Scheme (other than below default), go to Adjustment 11 and scroll through Euro 1-12 for new setting (see end of table Euro 1-12).								
ON ▲	Austria **Euro 9**	€.50	€1.00	€2.00		1 /€1.00	2 /€1.50	3 /€2.00	755-5401-09
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼									
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▲ ▲	**Australia 1** «	20¢	$A1	$A2		» 1 /$A1	3 /$A2		755-5406-00 (Side 1)
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	Australia 2					1 /$A1			
Pos. 1 2 3 4 5 6 7 8	For different Euro Pricing Scheme (other than below default), go to Adjustment 11 and scroll through Euro 1-12 for new setting (see end of table Euro 1-12).								
ON ▲	Belgium **Euro 1**	€.50	€1.00	€2.00		1 /€.50			755-5401-01
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼									
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▲	**Canada**	Can$.25	Can$.25	Can$1	Can$2	1 /50¢	2 /75¢	3/ Can$1	755-5400-00 *or -01 or -02*
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼									
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▲	**Denmark 1** «	1 DKr	5 DKr	10 DKr	20 DKr	» 1 /3 DKr	2 /5 DKr		755-5402-00 (2-Sided)
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	Denmark 2					1 /2 DKr	3 /5 DKr	7 /10 DKr	
Pos. 1 2 3 4 5 6 7 8	For different Euro Pricing Scheme (other than below default), go to Adjustment 11 and scroll through Euro 1-12 for new setting (see end of table Euro 1-12).								
ON ▲ ▲	Finland **Euro 8**	€.50	€1.00	€2.00		1 /€1.00	3 /€2.00		755-5401-08
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼									
Pos. 1 2 3 4 5 6 7 8	For different Euro Pricing Scheme (other than below default), go to Adjustment 11 and scroll through Euro 1-12 for new setting (see end of table Euro 1-12).								
ON ▲ ▲	France **Euro 10**	0,50 €	1,00 €	2,00 €		1 /1,00 €	3 /2,00 €	7 /3,00 €	755-5401-10
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼									
Pos. 1 2 3 4 5 6 7 8	*Germany: For different Euro Pricing Scheme (other than below settings), go to Adjustment 11 and scroll to Custom for this Unique Coin Door & Mech.*								
ON ▲ ▲ ▲	Germany 1					1 /0,50¢			755-5401-01
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	**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
Pos. 1 2 3 4 5 6 7 8	For different Euro Pricing Scheme (other than below default), go to Adjustment 11 and scroll through Euro 1-12 for new setting (see end of table Euro 1-12).								
ON ▲ ▲ ▲ ▲	Greece **Euro 6**	€.50	€1.00	€2.00		2 /€.50			755-5401-06
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼									
Pos. 1 2 3 4 5 6 7 8	*Italy: For different Euro Pricing Scheme (other than below settings), go to Adjustment 11 and scroll to Custom for this Unique Coin Door & Mech.*								
ON ▲	**Italy 1** «	€.50		€.50		» 1 /.50¢			755-5401-01 &
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼	Italy 2					1 /€1.00	3 /€2.00		755-5401-08
Pos. 1 2 3 4 5 6 7 8	For different Euro Pricing Scheme (other than below default), go to Adjustment 11 and scroll through Euro 1-12 for new setting (see end of table Euro 1-12).								
ON ▲	Netherlands **Euro 3**	€.50	€1.00	€2.00		1 /€.50	3 /€1.00		755-5401-03
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼									
Pos. 1 2 3 4 5 6 7 8									
ON ▲	**New Zealand 1** «	$NZ1		$NZ2		» 1 /$NZ1			755-5406-00 (Side 2)
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼	New Zealand 2					1 /$NZ1	3 /$NZ2		
Pos. 1 2 3 4 5 6 7 8									
ON ▲ ▲	**Norway 1** «	10 NKr	5 NKr	20 NKr		» 1 /5 NKr			755-5403-00 (2-Sided)
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼	Norway 2					1 /10 NKr	3 /20 NKr		
Pos. 1 2 3 4 5 6 7 8	*Portugal: For different Euro Pricing Scheme (other than below settings), go to Adjustment 11 and scroll to Custom for this Unique Coin Door & Mech.*								
ON ▲ ▲	**Portugal**	€.50		€.50		1 /€.50			755-5401-01
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼									
Pos. 1 2 3 4 5 6 7 8	For different Euro Pricing Scheme (other than below default), go to Adjustment 11 and scroll through Euro 1-12 for new setting (see end of table Euro 1-12).								
ON ▲ ▲	Spain **Euro 3**	€.50	€1.00	€2.00		1 /€.50	3 /€1.00		755-5401-03
OFF ▼ ▼ ▼ ▼ ▼ ▼ ▼									
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						3 /£1	7 /£2		755-5407-00
OFF ▼	UK 2						4 /£1			755-5407-01*
	UK 3	10p	50p	£1	20p	£2	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).*

Std. Adj. 11, Custom Pricing, and Std. Adj. 12-31 continued on the next page.

STANDARD ADJUSTMENT NAME: Definition

Euro Summary Pricing Select Table

Pos.	1	2	3	4	5	6	7	8
ON	S	E	E	A	B	O	V	E
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.

Alternate Settings	LEFT	CENTER	RIGHT	4TH				
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

12 **MATCH AWARD:** Set to **CREDIT**, **TICKET*** or **TOKEN***. Default is **CREDIT**. **read note under Std. Adjustment 3.*

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**)*.

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 **50,000,000**. 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 **40,000,000**. 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 **35,000,000**. 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 **30,000,000**. 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.

Standard Adjustments 32-48 continued on the next page.

	STANDARD ADJUSTMENT NAME: Definition
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 **OFF**. 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.
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 PCB Style) Ticket Dispenser Installed. Unique CPU Sound Board Dip Switch (Sw. 300) Setting required, which also 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.

Standard Adjustments 49-52 continued on the next page.

	STANDARD ADJUSTMENT NAME: Definition
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.)*

Feature Adjustments (01-27)

To initiate, from the **ADJUSTMENTS MENU**, select the "BION" *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. ***Game Play, Rules, Settings and Explanation Subject to Change.***

Nr.	FEATURE ADJUSTMENT NAME: Definition
01	**BONUS X CARRYOVER:** Set to **YES** or **NO**. Default is **NO**. When set to **YES**, this feature bonus *(Bonus X) lit* will be retained in memory from *ball-to-ball* for the same player. When set to **NO**, this feature will go out at the end of each ball.
02	**INLANES AT GAME START:** Set between **01 - 02**. Default is **00**. *Note: This adjustment determines how many Bonus X Lamps are on at Game Start.*
03	**POPS LIT AT GAME START:** Set between **01 - 05**. Default is **02**. *Note: This adjustment determines how many Pop Bumper Lamps are on at Ball Start.*
04	**TEMPLE JEWELS GAME START:** Set between **01 - 05**. Default is **03**. *Note: This adjustment determines how many Jewels are lit at Game Start.*
05	**MAXIMUM TEMPLE EXTRA BALLS (EBS) LIT:** Set between **01 - 05**. Default is **03**. *Note: This adjustment determines how many Extra Balls can be lit from the Temple Award. After this number, a Bonus Score is given instead.*
06	**RIPLEYS LETTERS GAME START:** Set between **01 - 06**. Default is **00**. *Note: This adjustment determines how many R-I-P-L-E-Y-S Letters are lit at Game Start.*
07	**EASY VARI TARGET:** Set to **YES** or **NO**. Default is **NO**. When set to **YES**, the **Vari-Target** will *not reset* after a soft hit.
08	**TEMPLE GATE TIMED:** Set to **YES** or **NO**. Default is **NO**. When set to **YES**, the **Temple Gate** will only be open for a short time after the *Ramp Shot* lights it.
09	**IDOL BALL SAVER:** Set to **YES** or **NO**. Default is **NO**. When set to **YES**, the pinball will be returned to the player if the Idol throws the ball *out-of-play (ball drain).* ***OPERATOR NOTE: Setting this to YES WILL AFFECT your Ball Time and Earnings.***
10	**EXTRA BALL MEMORY:** Set to **YES** or **NO**. Default is **YES**. When set to **YES**, this feature bonus *(Extra Ball Lit)* will be retained in memory from *ball-to-ball* for the same player. When set to **NO**, this feature will go out at the end of each ball.
11	**AFRICA HITS FOR LETTER (LTR):** Set between **01 - 07**. Default is **05**. *Note: This adjustment determines how many number of JACKPOTS are needed to gain a R-I-P-L-E-Y-S Letter.*

Feature Adjustments 12-27 continued on the next page.

	FEATURE ADJUSTMENT NAME: Definition
12	**ANTARCTICA HITS FOR LETTER (LTR):** Set between **01 - 07**. Default is **06**. *Note: This adjustment determines how many number of ORBITS are needed to gain a R-I-P-L-E-Y-S Letter.*
13	**ASIA HITS FOR LETTER (LTR):** Set between **05 - 50**. Default is **25**. *Note: This adjustment determines how many number of SPINNER SPINS are needed to gain a R-I-P-L-E-Y-S Letter.*
14	**AUSTRALIA HITS FOR LETTER (LTR):** Set between **01 - 07**. Default is **06**. *Note: This adjustment determines how many number of VARI-TARGET HITS are needed to gain a R-I-P-L-E-Y-S Letter.*
15	**EUROPE HITS FOR LETTER (LTR):** Set between **01 - 07**. Default is **07**. *Note: This adjustment determines how many number of TOMBSTONES are needed to gain a R-I-P-L-E-Y-S Letter.*
16	**NORTH AMERICA HITS FOR LETTER (LTR):** Set between **01 - 07**. Default is **05**. *Note: This adjustment determines how many number of JACKPOTS are needed to gain a R-I-P-L-E-Y-S Letter.*
17	**SOUTH AMERICA HITS FOR LETTER (LTR):** Set between **01 - 08**. Default is **06**. *Note: This adjustment determines how many number of HEAD HITS are needed to gain a R-I-P-L-E-Y-S Letter.*
18	**BELIEVE IT OR NOT! (BION) SCOOP DIFFICULTY:** Set to **EASY, MODERATE** or **HARD**. Default is **MODERATE**. *Note: This adjustment controls how easy it is to relight the BELIEVE-IT-OR-NOT sequence.*
19	**SHARED BOZO LETTERS:** Set to **YES** or **NO**. Default is **YES**. When set to **YES**, the B-O-Z-O spellout will be retained in memory from *player-to-player*.
20	**TIMER SECONDS:** Set between **10 - 50**. Default is **30**. *Note: This adjustment determines the initial amount of seconds for a Continent Timer (Antarctica, Asia and Europe Continents)*
21	**IDOL HITS FOR EXTRA BALL LIT:** Set between **05 - 15**. Default is **12**. *Note: This adjustment determines how many number of IDOLS are needed to light the Extra Ball feature.*
22	**IDOL HITS FOR SPECIAL LIT:** Set between **16 - 60**. Default is **40**. *Note: This adjustment determines how many number of IDOLS are needed to light the Special feature.*

*The following adjustments are **Proprietary** and are to be used for **Future Expansion**. **IF ADJUSTMENTS WERE CREATED** after the printing of this manual, view the Dot Display and note them below.*

23	**PROPRIETARY 01:** Set between **01** - **100**. Default is **01**. Note: This adjustment is for Future Expansion.
24	**PROPRIETARY 02:** Set between **01** - **100**. Default is **01**. Note: This adjustment is for Future Expansion.
25	**PROPRIETARY 03:** Set between **01** - **100**. Default is **01**. Note: This adjustment is for Future Expansion.
26	**PROPRIETARY 04:** Set to **YES** or **NO**. Default is **NO**. Note: This adjustment is for Future Expansion.
27	**PROPRIETARY 05:** Set to **YES** or **NO**. Default is **NO**. Note: This adjustment is for Future Expansion.

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

Custom Message

To go directly to ***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**.

Sec. 3: Go To Installs

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

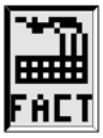
This setting is recommended where ***local laws restrict certain game features***.

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

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***.

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	30%	25%	20%	15%	10%		20%	10%
14	BALLS PER GAME							03	05
38	FREEZE TIME	0:12	0:10	0:08	OFF	OFF		0:08	AUTO

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			20%	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			5,000,000				
24	DEFAULT HIGH SCORE #1			4,000,000				
25	DEFAULT HIGH SCORE #2			3,000,000				
26	DEFAULT HIGH SCORE #3			2,000,000				
27	DEFAULT HIGH SCORE #4			1,000,000				
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	BONUS X CARRYOVER	YES	NO	NO	NO	NO		NO	NO
02	INLANES AT GAME START	01	00	00	00	00		00	00
03	POPS LIT AT GAME STRT	02	02	02	01	00		02	01
04	TEMPLE JEWELS G. START	03	03	03	02	01		03	02
05	MAX TEMPLE EBS LIT	02	01	00	00	00		00	00
06	RIPLEYS LETTERS GSTRT	02	01	00	00	00		00	00
07	EASY VARI TARGET	YES	NO	NO	NO	NO		NO	NO
08	TEMPLE GATE TIMED	NO	NO	NO	NO	YES		NO	NO
09	IDOL BALL SAVER	NO	NO	NO	NO	NO		NO	NO
10	EXTRA BALL MEMORY	YES	YES	YES	NO	NO		YES	NO

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	AFRICA HITS FOR LTR	02	04	05	06	06		05	06
12	ANTAR. HITS FOR LTR	03	04	06	07	07		06	07
13	ASIA SPINS FOR LTR	15	20	25	30	35		25	30
14	AUSTR. HITS FOR LTR	03	05	06	07	07		06	07
15	EUROPE HITS FOR LTR	04	05	07	08	09		07	08
16	N. AMER HITS FOR LTR	02	04	05	06	07		05	06
17	S. AMER HITS FOR LTR	02	04	06	07	07		06	07
18	BION SCOOP DIFF	EX. EASY	EASY	MODERATE	HARD	HARD		MODERATE	HARD
19	SHARED BOZO LETTERS	YES	YES	YES	NO	NO		YES	NO
20	TIMER SECONDS	45	40	30	25	20		30	25
21	IDOL HITS FOR EB LIT	12	12	12	15	18		12	20
22	IDOL HITS FOR SP. LIT	40	40	40	40	40		40	50

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

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	BONUS X CARRYOVER				YES			
02	INLANES AT GAME START				01			
03	POPS LIT AT GAME STRT				02			
04	TEMPLE JEWELS G. START				03			
05	MAX TEMPLE EBS LIT				02			
06	RIPLEYS LETTERS GSTRT				02			
07	EASY VARI TARGET				YES			
08	TEMPLE GATE TIMED				NO			
09	IDOL BALL SAVER				NO			
10	EXTRA BALL MEMORY				YES			
11	AFRICA HITS FOR LTR				02			
12	ANTAR. HITS FOR LTR				02			
13	ASIA SPINS FOR LTR				12			
14	AUSTR. HITS FOR LTR				03			
15	EUROPE HITS FOR LTR				04			
16	N. AMER HITS FOR LTR				03			
17	S. AMER HITS FOR LTR				02			
18	BION SCOOP DIFF				EASY			
19	SHARED BOZO LETTERS				YES			
20	TIMER SECONDS				40			
21	IDOL HITS FOR EB LIT				12			
22	IDOL HITS FOR SP. LIT				40			

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

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

Go To Reset Menu

Overview

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

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

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

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

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

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

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

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

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

GO TO RESET MENU

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

Reset Coin Audits

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

Reset Game Audits

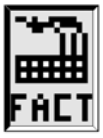
To initiate, from the **RESET MENU**, select the "AUD" *Icon* with either the **Red** or **Green Buttons** and press the **Black Button**. ⚠ **ONLY** the **Game Audits *(01-04)* & *Standard Audits (01-67)*** will be reset to zero (0), *Factory Default Settings.* ***Note: Coin Audits (05-13) & Software Meter Audit (14)*** *will not be reset.* **"REQUEST INSTALLED"** is indicated and returns to the **RESET MENU** with the "AUD" *Icon* flashing.

Reset High Scores

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

Reset Credits

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

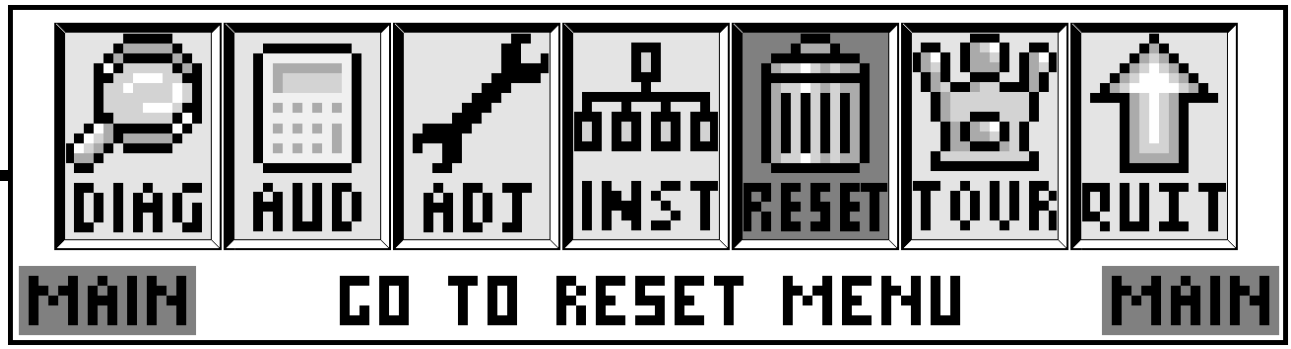


Factory Reset

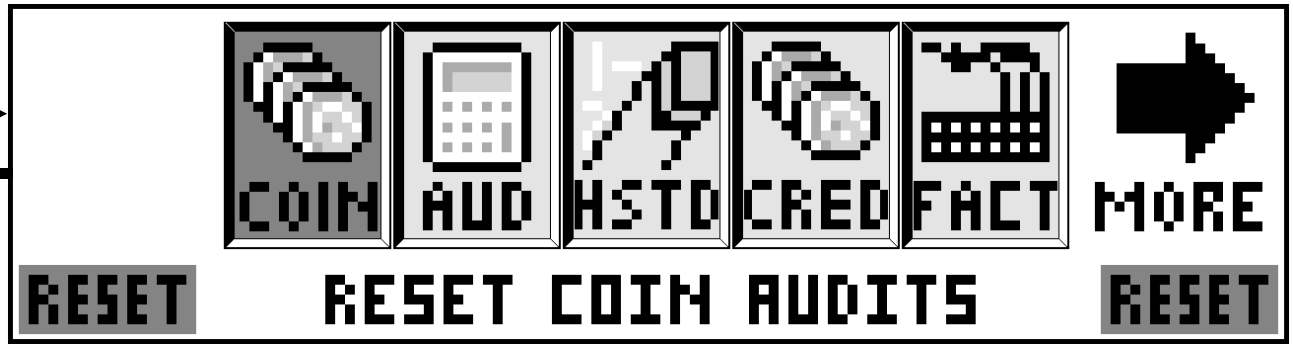
To initiate, from the **RESET MENU**, select the "FACT" *Icon* with either the **Red** or **Green Buttons** and press the **Black Button**. ⚠ All **Audits** *(except for Audit **14**, **Software Meter**)*, all **Adjustments** and **Installs** will be reset to the *Factory Default Settings.* ***Note:***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

Example:

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



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

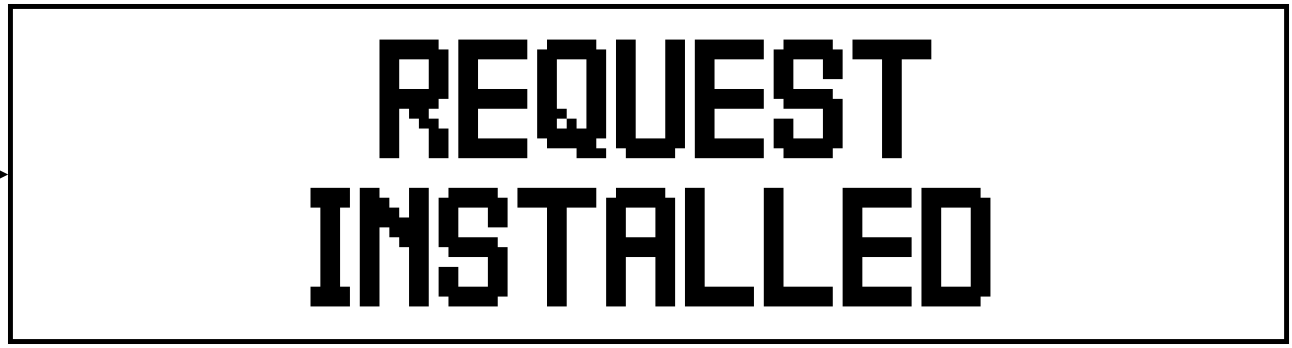


From the **RESET MENU**, select any of the *Icons* ("COIN", "AUD", "HSTD", "CRED") with either the **Red** or **Green Buttons** and press the **Black Button** to *activate* the **ICON** chosen. After the **ICON** is selected & *activated*, **"REQUEST INSTALLED"** is indicated and is returned to the **RESET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

Important:

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

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



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

Go To Tournament Menu

Overview

Tournament Operation Note:

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

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

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

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

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

For more details on the equipment & hardware required, Installation and Set-up, read the **ToPS™ Tournament Pinball System Kit Installation Manual** *(SPI Part Number: 780-6011-01)* 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: **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.*

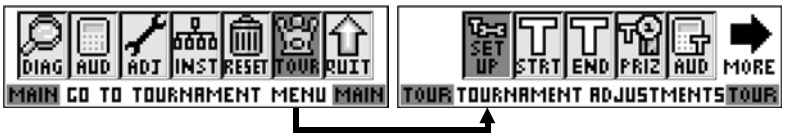
DECREMENT (-) or **INCREMENT (+)** *displayed value or select previous / next.*

**** 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.



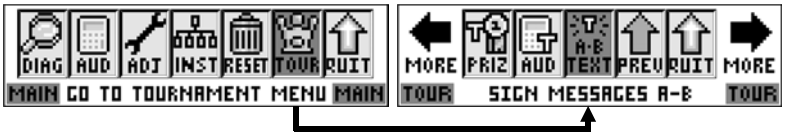
TOURNAMENT ADJUSTMENT TABLES

TOURNAMENT ADJUSTMENTS 01-13 ✍ = ✎

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	

Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
08	# OF PRIZES	03	
09	AWARD TYPE	CASH	
10	SHOW PLAYER'S CASH	YES	
11	TOURNAMENT TYPE	BUMP N' WIN	
12	BUMP N' WIN BASE	20,000,000	
13	BALLS PER TOURNAMENT	03	

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 14-15) ✍ = ✎

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

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

Sec. 3: Tournament ...

STARTING METER Reading :

STARTING METER Date (MM/DD/YR) :

AUDITOR'S NAME :

CURRENT VOLUME SETTING:

CURRENT METER Reading :

AUDIT Date (MM/DD/YR) :

CPU Version :

DISPLAY Version :

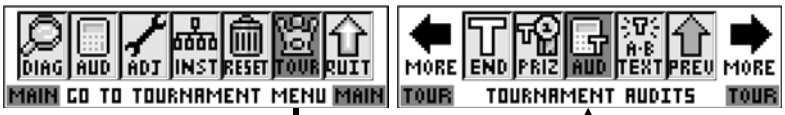
GAME LOCATION NAME :

See Adj. 06 & 07 above >>

TOURNAMENT START DATE :

TOURNAMENT END DATE :

TOURNAMENT AUDIT TABLE



TOURNAMENT AUDITS 01-12 ✍ = ✎

Audit definitions follow in this Chapter.

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

Tournament Adjustments (01-13)

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 :** Set to **01** 1 Winner **100%** (1) Prize Pool Set to **02** 2 Winners **65%** (1) **35%** (2) Set to **03** 3 Winners **50%** (1) **30%** (2) **20%** (3) Set to **04** 4 Winners **50%** (1) **25%** (2) **15%** (3) **10%** (4) Set to **05** 5 Winners **50%** (1) **20%** (2) **15%** (3) **10%** (4) **5%** (5) If Trn. Adj. 11 is set to **BUMP N' WIN** *(Default)* **:** *Cannot set to 01. Minimum of 2 winners required.* Set to **02** 2 Winners **65%** (1) **35%** (2) Set to **03** 3 Winners **50%** (1) **25%** (2) **25%** (3) Set to **04** 4 Winners **40%** (1) **20%** (2) **20%** (3) **20%** (4) 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**. ***This adjustment determines how the Prize Pool is to be represented in the Attract Mode on both the Normal and top Beta-Brite® Displays.*** Select **CASH** for the displays to represent the Prize Pool amount *(based on Jackpot Base and Max.)* in ***$Dollars***. Select **POINTS** for the displays to represent the Prize Pool amount in ***Points***. Select **TICKET** for the display to represent the Prize Pool amount in ***Tickets***. Select **NONE** ***NOT TO*** represent the Prize Pool amount *(if prize(s) to be awarded are not Cash, Points or Tickets)*. Select **PRIZE**, if applicable.
10	**SHOW PLAYER'S CASH:** Set to **YES** or **NO**. Default is **YES**. When set to **YES**, 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 adjustments only affects TOURNAMENT GAMES. Set between **02 - 09**. Default is **03**. Set the max. number of balls per game.

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 (01-12)

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

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

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

Tournament Audits 07-12 continued on the next page.

TOURNAMENT AUDIT NAME: Definition	

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

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

Sign Messages A-B (Tournie Adj. 14-15)

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

Nr.	TOURNAMENT ADJUSTMENT NAME: Definition
14	**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.
15	**PRIZE MESSAGE:** Set to **ON, CHANGE** or **OFF**. Default is **ON**. *Procedure identical to Tournament Adjustment **14, Location Message**.*

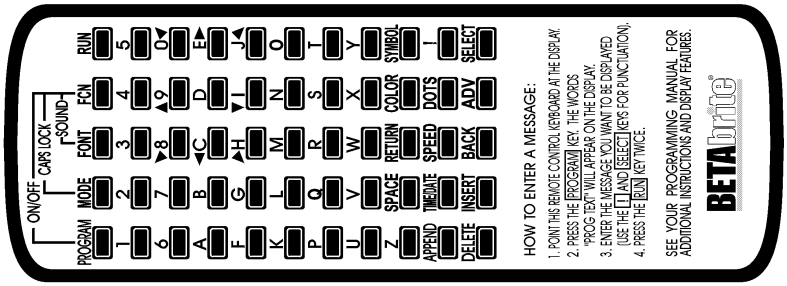
The ***DEFAULT LOCATION MESSAGE*** is:

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).*



Believe It or Not!
A. Scramble Temple Code
B. Wake Up Idol
C. Amazing Event!
A B C
Ripley's Believe It or Not!
BIG POINTS
ROAD TRIP
2X PLAY FIELD
SHOOT AGAIN
PRESS AND HOLD FLIPPER BUTTON FOR INFO.
PRESS AND HOLD FLIPPER BUTTON FOR INFO.
50¢ = x1
SUPER VALUE
$2.00 = x5

Parts Identification & Location (The Pink Pages)

Overview

This section provides the Part Nºs and locations of all the components in this Pinball Machine. The parts are arranged in 3 groups: **BACKBOX**, **CABINET** & **PLAYFIELD**. Generic parts which may change as production continues (qty. and/or size) are listed together. Quantities greater than "**0**" indicates that the part is used in this game. Since quantity changes *may occur*, an item indicating no quantity *may be used*. Compare the item which needs to be replaced with the drawings provided *(the Posts, Sockets, Bulbs & Rubber Rings are drawn actual size). Major Assemblies & Ramps are detailed in the* ***Blue Pages****, Pages* ***75-98****.*

Important: *Read all "**Take Note:**" items.*

Pinball Location Maint. Kit Available
502-6002-81
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.

Ask your distributor about the Deluxe Pinball Location Maintenance Kit which includes Flipper Rebuild Kits!

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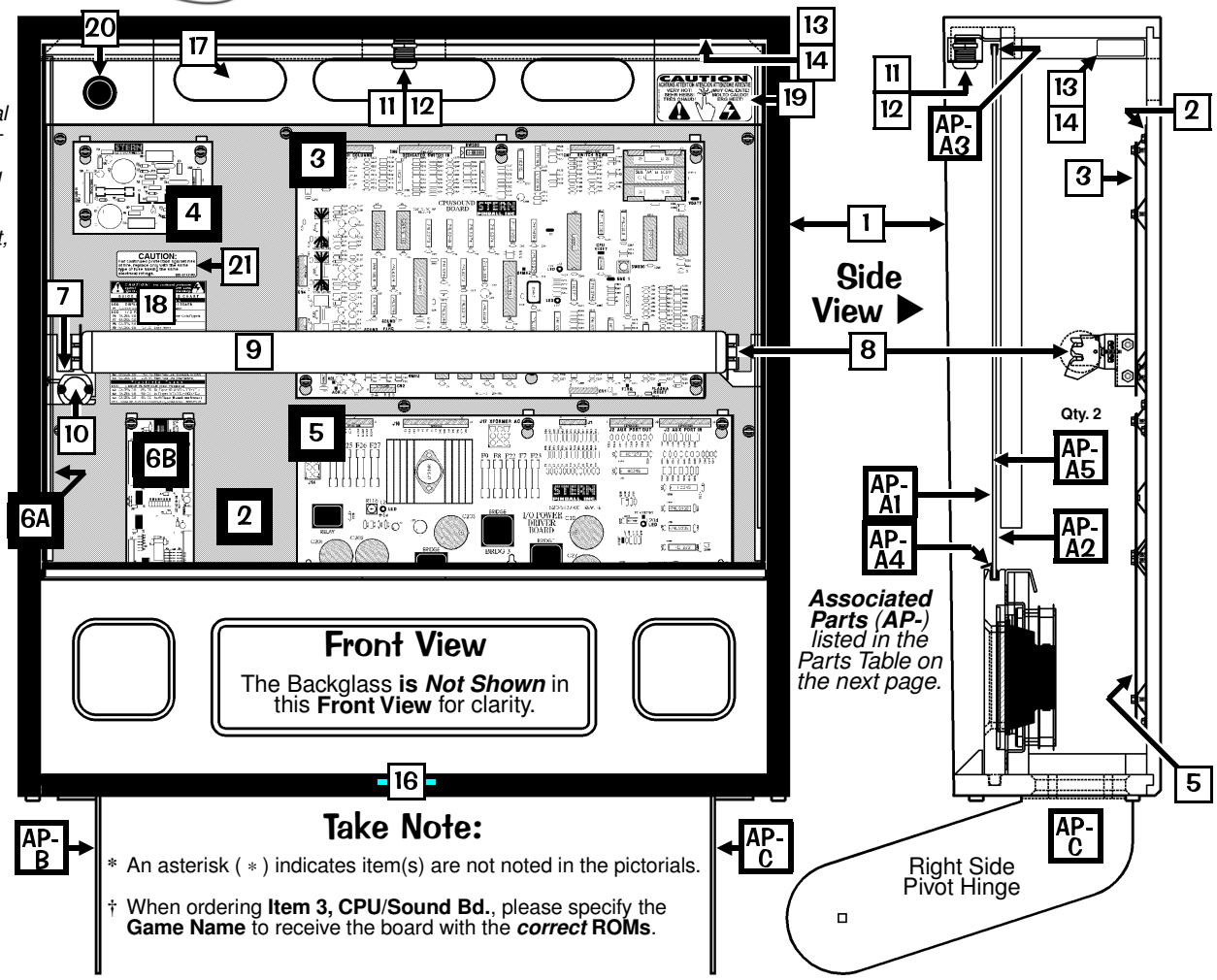
Not sold as an assembly, order the individual part(s) actually required.

Backbox Assembly, 505-6002-81-81 (Items 1-27)

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



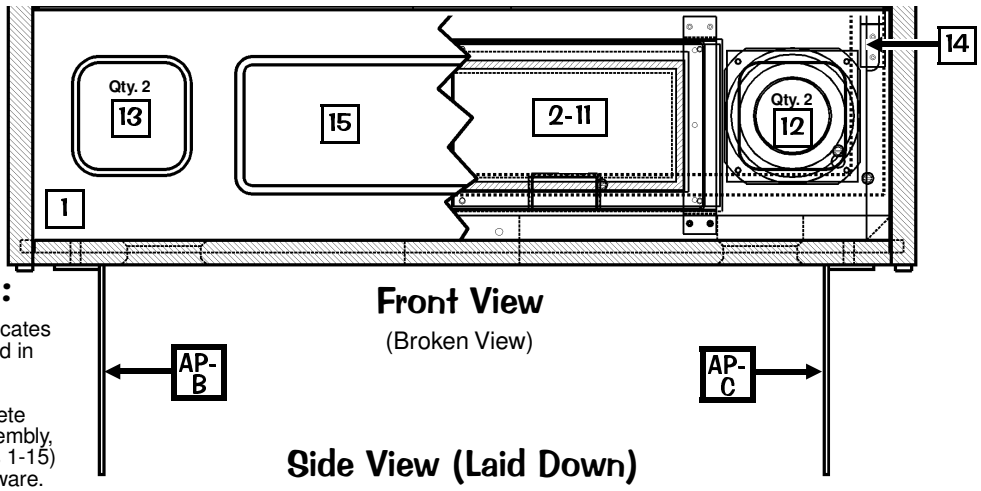
Sec. 4: Parts Id. ...

№	BACKBOX PART NAME	QTY.	SPI PART №
1	Backbox **RBION Screened No Parts**	1	**525-5631-00-81**
	Item 1 Note: *Black Textured T-Molding is installed and cannot be ordered separately.*		
2	PCB Metal Mounting Plate	1	535-5809-14
	Item 2 is secured to Item 1 by: #8 X 1/2" 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
	For Individual Items use : Fluorescent Light Bracket Left (**535-7739-00**), Lamp Holder** (Self-Locking) (**077-5214-00**) **and** Starter Base *(with Leads)**** (**077-5213-00**).		
8	Fluorescent Light Bracket Assy. Right	1	515-6545-01
	For Individual Items use : Fluorescent Light Bracket Right (**535-7739-01**), Lamp Holder** (Self-Locking) (**077-5214-00**) **and** Starter Base *(with Leads)**** (**077-5213-00**). ** **secured by:** #6-32 X 5/8" PPH MS (Sems) Zinc (Qty. 1) (232-5203-00) *** **secured by:** #4-40 X 1/2" PPH MS (Sems) Zinc (Qty. 2) (237-5813-00)		
	Items 7 & 8 are secured to Item 1 by: #10-24 X 1-1/4" Carriage Bolt Sq. Neck (Qty. 2/per) (231-5012-00), #10-24 Keps Nut (Qty. 2/per) (240-5207-00) **and** 3/4" X 3" Reinforced Strapping Tape (Qty. 1, Sold in 12" Lengths only) (626-5040-00)		
9	Fluorescent Tube 24" (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)		

№	BACKBOX PART NAME	QTY.	SPI PART №
13	Ballast Mounting Plate	1	535-8657-00
14	Ballast *CU45Z-W 1/2" Core 120v 60 Hz 13W*	1	010-5015-00
	Ballast, EU / UK Only 5/8" Core 50/60 Hz		*010-5015-01*
	Items 13 & 14 are secured to Item 1 by: #6 X 5/8" SLT HWH AB (Zc) (Qty. 2) (234-5102-04)		
15*	*#1 Roto Lock Male (on Cabinet)*	*1*	*355-5006-01*
16	#1 Roto Lock Female (R2-0002-02)	1	355-5006-02
	Item 16 is secured by: #10-24 X 1-3/4" CBSN (Qty. 2) (231-5022-00), #10-24 Keps Nut (Qty. 2) (240-5207-00) **and** #10 Washer 7/32" ID X .5" OD X 1/16" (Qty. 2) (242-5003-00)		
17	Back Vent Grill 2-1/2" X 18"	1	545-5072-02
	Item 17 is secured by: Staple 5/16" (Qty. 24) (631-5000-00)		
18	Fuse Description Decal (Generic)	1	820-6152-01
19	"CAUTION - VERY HOT" Decal	1	820-6266-00
20‡	Button Hole Plug (Blk) **(Happ #52-6214-00)**	1	500-6566-00
21	Fuse Label (UL)	1	820-6143-00
22*	Backbox Date Label	1	820-5091-00
23*	Ribbon Cable, 20-Pin (4")	1	036-5000-04
	***Item 23 (20-Pin) connects the** CPU/Sound Board to the I/O Power Driver Board.*		
24*	Ribbon Cable, 26-Pin (40")	1	036-5001-40
	***Item 24 (26-Pin) connects** the CPU/Sound Board to the Display Controller Board.*		
25*	1/4" Clamp (Double)	2	040-5000-23
26*	1/2", 3/4" & 1" Clamp (Single)	9	040-5000-XX
	Items 25-26 are secured to Item 1 by: #8 X 1/2" SLT HWH AB (Zc) (Qty. 13) (234-5101-00) ***-XX Note:*** for **1/2"** use **-06** (Qty. 1); for **3/4"** use **-08** (Qty. 2); for **1"** use **-09** (Qty. 6)		
27*	Ground Strap (5") *(by Item 12)*	1	600-5006-05

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

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)

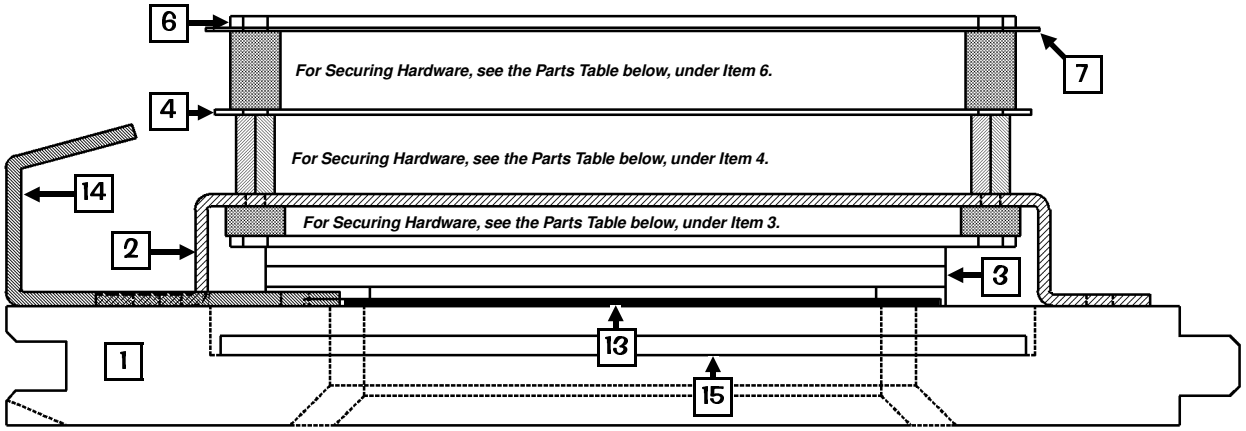
Take Note:

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

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

Side View (Laid Down)

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



№	SPEAKER PANEL PART NAME	QTY.	SPI PART №
1	Speaker Panel (Black Wood)	1	525-5515-00
2	Dot Matrix Disp. Bd. Mounting Bracket	2	535-8368-01
	Item 2 is secured to Item 1 by: #8 X 3/4" 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" HWH Swage (Serr) Zinc (Qty. 4) (237-5976-03) **Item 3 is secured to Item 4 (at the top center) by:** 3/4" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-04) **and** #6-32 X 1/4" PPH MS (Sems) Zinc (Qty. 1) (232-5200-00)		
4	Static Shield (Steel Plate)	1	535-6437-00
	Item 4 is secured to Item 2 by: 1/2" X 1/4" Hex Spacer #6-32 Tap (Qty. 4) (254-5008-03) **and** #6-32 X 1/2" PPH MS (Sems) Zinc (Qty. 2, on Left Side only) (232-5202-00)		
5∗	Edge Protector (on Item 4)	2	545-5592-01
6	Display Controller Board FCC-FEB98	1	520-5055-03
	Item 6 is secured to Item 4 by: 1/2" X 5/16" X .144 ID Spacer Tap (Qty. 3) (254-5014-00), #6-32 X 3/4" PPH MS (Sems) Zinc (Qty. 3) (237-5504-00), 1/2" X 1/4" Hex Spacer #6-32 Tap. (Qty. 1) (254-5008-03) **and** #6-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5200-00)		
7	RF Shield	1	820-5092-00
	Item 7 is secured inbetween: "Item 6" and its' mounting hardware described.		
8∗	Ground Strap (25") (on Items 4, 6, 12)	4	600-5006-25
9∗	1/2" Clamp (Single) (on Item 4)	1	040-5000-06
10∗	Ribbon Cable, 14-Pin	1	036-5260-00
	Item 10 Note: *The 14-Pin cable connects the Dot Matrix Disp. Bd. to the Disp. Controller Bd.*		
11∗	Foam 3/16" Thk. X 1/4" X 36"	6	626-5026-00
	Above Item 11 is self-adhesive. *Located between Items 3 & 17. Sold in 12" Lengths only.*		
12	Speaker (Shld.) 4" 8Ω MG Elec #4060SH	2	031-5004-01
13	Speaker Grill (Black w/no Artwork)	2	535-8081-01
14	Speaker Panel Hook Bracket	2	535-7009-02
	Items 12, 13 & 14 are secured by: #8 X 3/4" SLT HWH AB (Zinc) (**Items 12/13:** Qty. 4/per; **Item 14:** Qty. 2/per) (234-5103-00)		

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

№	ASSOC. BACKBOX PART NAME	QTY.	SPI PART №
AP-A	Backglass Assembly (Game № 81)	1	*See Parts Below*
	ORDER ONLY INDIVIDUAL PART(S) NEEDED:		
AP-A1	Clear Backglass 25.906" X 19.187"	1	660-5038-02
AP-A2	**RBION Film Art (#81)**	1	**830-5281-00**
AP-A3	Top Plastic Channel - 26"	1	545-5018-15
AP-A4	Bottom Plastic Lift Channel - 26-1/16"	1	545-5021-01
AP-A5	Plastic Edging (Left/Right) - 18-1/8"	2	545-5018-14
AP-A6∗	Tape (double-sided) (12" Length)	1	626-5005-00 *(only 6" required)*
	Note: AP-A6 secures AP-A3--A5 to AP-A1		
AP-B	Pivot Hinge Left	1	535-7999-00
AP-C	Pivot Hinge Right	1	535-7999-01
	Items AP-B & AP-C are secured to Backbox by: 1/4"-20 X 1-1/4" C.B. Sq. Neck (Qty. 4) (231-5003-00), 1/4"-20 Flange Nut (Qty. 4) (240-5300-00) **and** Fend Washer 1/4" I.D. X 1" O.D. (Qty. 1) (242-5009-00) **Items AP-B & AP-C are secured to Cabinet by:** 1/4"-20 X 7/8" Carriage Bolt Sq. Neck (Qty. 2) (231-5014-00), Hinge Spacer (Qty. 2) (530-5099-00), Washer 1/4" I.D. X 7/8" O.D. X 1/8" Yellow (Qty. 1/per) (242-5016-01), Fend Washer 1/4" I.D. X 1" O.D. (Qty. 1/per) (242-5009-00) **and** 1/4"-20 Flange Nut (Qty. 1/per) (240-5300-00)		

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

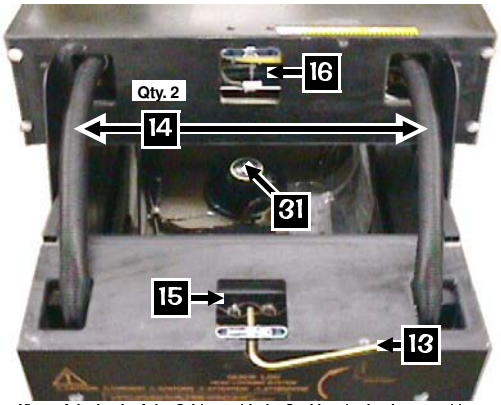
Cabinet - General Parts ■ & Switches □

For Backbox Parts see the previous two pages.

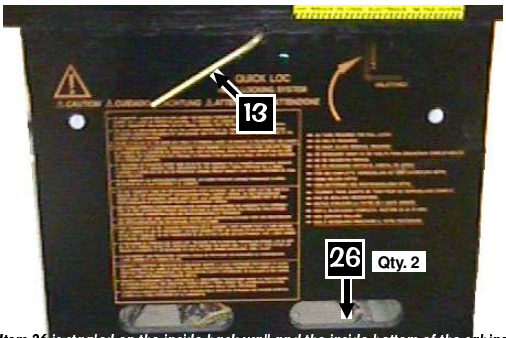
Enlarged View of Item 19 inside the Coin Door, Item 17. Buttons, Bracket & Decal sold separately. For usage, see Section 3, Chapter 1, Portals Service Menu Introduction, Page 8.

Take Note:

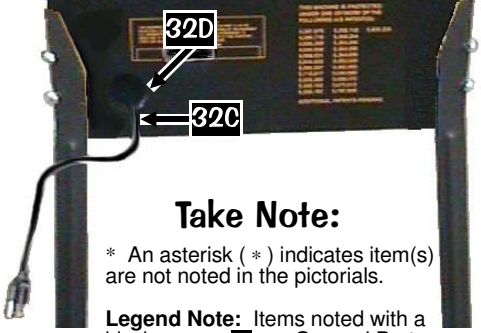
‡ **Item 11, Button Hole Plug (Blk)** is the *Optional Tournie Button* Access Hole. *If removing for the Optional Tournament Button, save with the game.*



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



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



View of the Coin Door Open, Item 17.

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

*Item 2 **ORDERING NOTE:** Leg comes with Leveler. Leveler can be purchased separately. Leg cannot be ordered **WITHOUT** Leveler. See Table below, Item 2.*

Take Note:

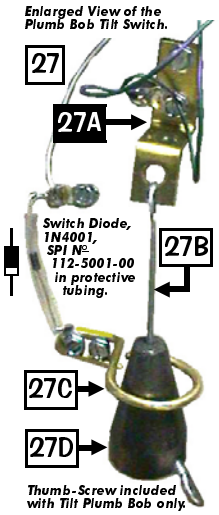
* An asterisk (*) indicates item(s) are not noted in the pictorials.

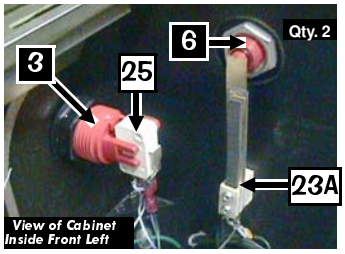
Legend Note: Items noted with a black square ■ are General Parts. Items noted with a white square □ are Switches.

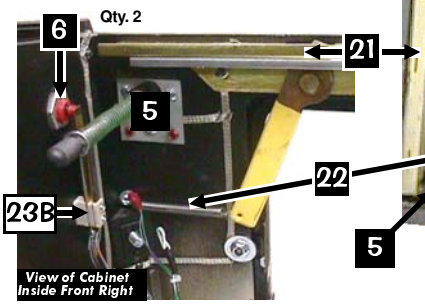
№	CABINET PART NAME	QTY.	SPI PART №
1	RBION Screened Cabinet (No Parts)		525-5395-15P-81
2	Black Leg with Leveler Asm.	4	500-5921-50
	Item 2 is secured by: Leg Bolt Back Plate (**535-5703-00**) **and** Leg Bolt 3/8" X 16 X 2-1/2" Hex 5/8" Hd. (2/per) (231-5001-01) *Leg Leveler ONLY (3/8"-16 X 3") (500-5017-00).*		
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 (White) Assembly	2	500-5026-38
	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. FOR SWITCHES ONLY *see Items 23A/B on the Next Page.***		
7	Rear Glass Channel 20-3/8" Length	1	545-5038-00
8	Plastic Channel 42-5/8" Lg. (Left/Rt.)	2	545-5017-00
9	Side Armor "with holes" (Left & Right)	2	535-7297-02
	Item 9 is secured by: Pem Stud 1/4 X 1" FH (Qty. 2/per) (237-6116-01), 1/4-20 Flange Nut (Qty. 2/per) (240-5300-00) **and** #8 X 5/8" T20 Tamper Proof (Qty. 2/per) (237-5947-00)		
10	Front Molding - Black	1	500-5757-02-00
	Item 10 requires: Self-Adhesive Foam Rubber 3/8" X 3/16" X 20-3/8" (626-5001-00).		

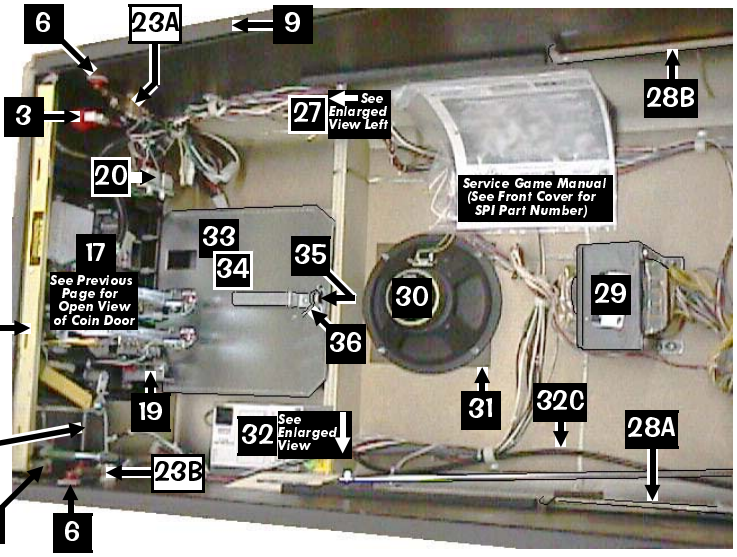
№	CABINET PART NAME	QTY.	SPI PART №
11‡	Button Hole Plug (Blk) **(Happ #52-6214-00)**	1	500-6566-00
12	P/F Glass (Tmprd.) 21" X 43" X 3/16"	1	660-5001-00
13	Hex Key Allen Wrench 5/16"	1	777-0001-00
14	Corrugated Tubing Black **1¼"ø X 2.6' Lg.**	2	605-5008-00
	*Above Item **14** covers the Cables Wiring Harnesses going into the Backbox from the Cab.*		
15	#1 Roto Lock Male (R2-0055-02)	1	355-5006-01
	Item 15 is secured by: #10-24 X 1-3/4" Carr. Bolt Sq. Neck (Qty. 2) (231-5022-00), #10-24 Nylon Stop Nut (Qty. 2) (240-5206-00) **and** #10 Washer 7/32" X .5" X 1/16" (Qty. 2) (242-5003-00)		
16	*#1 Roto Lock Female (on Backbox)*	*1*	*355-5006-02*
17	Coin Door (with Validator) USA only	1	500-5018-172
	Item 17 is secured by: 1/4"-20 X 1-1/4" Carriage Bolt Sq. Neck (Qty. 4) (231-5003-00) 1/4"-20 Flange Nut (Qty. 4) (240-5300-00) **and** Fend Washer 1/4" I.D. X 1" O.D. (Qty. 3) (242-5009-00) ***Note:** For Coin Door other than USA call Technical Support for SPI Part №.*		
18	Coin Door Sw. (USA) (Happ Control)	2	180-5024-**01**
	FYI: Coin Dr. Sw. (USA) (Coin Control)	0	180-5024-00
	FYI: Coin Door Switch (¥ Japan)	0	180-5091-00
19	Bracket for below Portals™ Switches	1	535-6860-03
19B	Push-Button Portals™ Switch (Black)	1	180-5192-00
19R	Push-Button Portals™ Switch (Red)	1	180-5192-02
19G	Push-Button Portals™ Switch (Green)	1	180-5192-04
	***Ordering Note:** Securing hardware for switches included. For Decal Kit, see Page **67**.*		

Parts Table & Views continue on the next page.





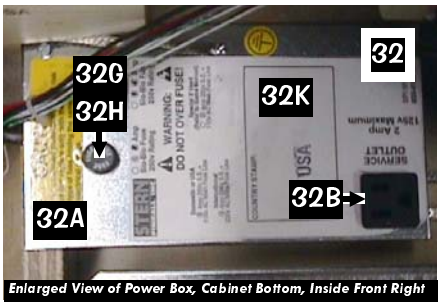




Take Note:

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

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



Cabinet Back Lights are located on the Wood Back Panel:

See the Blue Pages, Section 4, Chapter 2, Drawings for Major Assemblies ... , Pages 96-97.

For General Bulbs & Sockets:

See these Pink Pages, Section 4, Chapter 1, Parts Identification & Location, Pages 72-74

Pinball Rejuvenation Kit Available: 502-6002-81

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.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
Parts Table & Views continue on the previous page.			
20	Dual Switch Assembly	1	500-5808-00
ORDERING ABOVE (ITEM 20) ASSEMBLY PART № WILL INCLUDE:			
20A	Mounting Bracket	1	535-6958-00
20B	Playfield Power Interlock Sw. (Top)	1	180-5136-00
20C	Memory Protect Switch (Bottom)	1	180-5000-01
	Item 20 is secured to Cabinet by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5101-00)		
21	Front Molding Lockdown Assembly	1	500-6509-00
	Item 21 is secured by: #10-24 X 1-1/4" Carr. Bolt (Qty. 2) (231-5012-00), #10-24 Keps Nut (Qty. 2) (240-5207-00), #8 X 5/8" HWH AB Zinc (Qty. 4) (234-5102-04) **and** #10 Washer 7/32" ID X 1/2" OD X 1/16" (Qty. 2) (242-5003-00)		
22	Lockdown Spring *(connected to handle)*	1	265-5008-00
23A	Flipper Switch **- Self-Cleaning (Lt. Flipper)**	1	180-5160-00
23B	Flipper Sw. **- X2 Stack (Rt. & Upr. Flippers)**	1	180-5164-00
24*	Foam Strip *(For Item 23 - Noise Suppression)*	4	626-5042-00
25	Start Button Switch **(ONLY)**	1	180-5174-00
26	Grills 2-1/2" X 18" *(on Back & Bottom)*	2	545-5072-02
27	Cabinet Plumb Bob Tilt Switch	1	*See Parts Below*
	ORDER ONLY INDIVIDUAL PART(S) NEEDED:		
27A	Bracket for Hanger Wire	1	535-5221-00
27B	Hanger Wire	1	535-5319-00
27C	Contact Wire Form	1	535-7563-01
27D	Plumb Bob Weight *(includes Thumb-Screw)*	1	535-5029-00
	Items 27A & 27C are secured by: #8 X 1/2" 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 (3/per) (231-5012-00) **and** #10-24 KEPS Nut (3/per) (240-5207-00)		

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
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
ORDERING ABOVE (ITEM 32) SUB-ASSY. PART № WILL INCLUDE:			
32A	Power Box (Plain)	1	535-5932-00
32B	Service Outlet (for USA)	1	180-5008-01
32C	Line Cord 10' ROJ 3" Max.	1	034-5000-10
32D	Recessed Cup for Line Cord	1	545-5122-00
32E*	Line Filter	1	150-5000-00
32F*	Varistor TNR159211KM	1	150-5001-00
32G	Fuse 8 Amp 250v Slo-Blo (Domestic)	1	200-5000-05
32H	Fuse Holder	1	205-5001-00
32I*	On/Off Switch Bracket	1	535-8318-00
32J	On/Off Rocker Sw. (APEM R2101C5NBB)	1	180-5001-03
32K	Power Box Decal	1	820-6123-03
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
37*	Optional Meter **(+12v DC w/Diode & Bracket)**		**G-0053-013-102**
	Optional Meter **(+12v DC w/Diode, No Bracket)**		**G-0053-013-102A**

Playfield - General Parts ■, Metal Rails/Ball Guides ■ & Switches □ (Above)

№	ABOVE PLAYFIELD PART NAME	QTY.	SPI PART №
PF	P/F Screened **w/** Inserts & **NO** Parts	1	830-5100-81
	P/F Complete **w/** Inserts & **ALL** Parts	1	505-6004-**81-81**

General Items

1	Arch (Blk. Metal) **w/ Kickback on Rt Cutout**	1	535-8392-**05**

Item 1 is secured to the playfield by Item 17 and : #10-32 X 5/16" PH FL U/C MS STL Zinc (Qty. 2) (237-6013-00). ***Usage Note:*** *When replacing the Arch,* order new replacement **Nelson Protect Strips** *(not included)* (Qty. 2) (545-5212-02).

2	Instruction Card (USA) **RBION**	1	755-5181-00

Note: *Visit* ***www.sternpinball.com*** *for a PDF copy of the Game Instruction Card which will also have any translated Instruction Cards made for this game. Find Game Link or Archives.* ***Spanish*** *755-5181-**02**;* ***German*** *755-5181-**03**;* ***Italian*** *755-5181-**04**;* ***French*** *755-5181-**05**.*

3	Coin Card (2-Sided)	1	755-5400-00

Usage Notes: *Use* ***Item 3 (Back: 1 Play 50¢ - 5 Plays $2)*** *for Adj. 6, Game Pricing,* ***USA 5*** *Setting, or* ***(Front: 1 Play 50¢ - 3 Plays $1)*** *for Adj. 6, Game Pricing,* ***USA 8*** *Setting.*

4	Coin Card (2-Sided)	1	755-5400-02

Usage Notes: *Use* ***Item 4 (Front: 1 Play 50¢)*** *for Adj. 6, Game Pricing,* ***USA 2-7*** *Setting,* ***(Back: is Blank)*** *for Custom Settings.*
Availability: *See* ***Appendix J*** *(back of manual) for all current Coin Cards (****USA****,* ***Canada****,* ***Euro*** *& other* ***International****). If this is a non-US Game, Coin Card(s) provided will differ.*

5*	Light Reflector (Silver Color Plastic)	2	545-5409-01
6*	Mini-Mars Lite Cover **(Snap-In)** ***(Clear)***	3	550-5030-**01**

* ***Note:*** *Item 5 (Qty. 1) and Item 6 (Qty. 3) are located on the Plastic Ramp Assemblies, see Drawings for Major Assemblies & Ramps (* ***BLUE PAGES*** *), Pages* ***75-98****.*

7	Mini-Mars Lite Cover **(ALTERED)** ***(Clear)***	2	550-5088-01

Usage Notes: *Item 7 was made from 550-50**31**-01 (Altered Screw Down Lite Cover, 1-Tab, Clear). The cut-away is required for lamp placement.*

8	Level Assembly	1	515-7214-00

For Individual Items use : .882" 8MM **Vial Mtg. Flange** (545-6027-00), **Level** .8mm Empire #0224 (545-6001-01) or **Level Bracket** (535-9010-00). **Flange secured by:** #6-32 X 1/4" PPH MS (no Sems) Zinc (237-5500-00) **and** #6-32 Keps Nut (240-5008-00)
Item 7 is secured to the wood rail by: #6 X 1/2" HWH AB Zinc Red (Qty. 2) (234-5001-02)

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

* ***Note:*** *Item* ***10*** *should plug hole if a Center Post (@ Drain) is used, then removed.*

Spinners, Wire Gate & Flap Gates

11	Spinner Assembly	2	515-5553-00
	Bracket, Spinner Mounting	2	535-8952-01

Item 11 is secured by: #8-32 X 3/8" PFH 82ø Undercut (Zinc) (Qty. 1/per) (237-6030-00)

Note: *Individual Decals (-17 [x2] & -18 [x2])* ***are not available individually****, ordering of kit is required. For all pieces, see* ***Playfield - Plastics (Screened & Clear) & Decals****, Page* ***67****.*

12	1-Way Gate Mounting Bracket (small)	1	535-5269-03
	Wire Gate (for above)	1	535-5307-03

Item 12 is secured by: #6 X 1-1/2" PPH (Zinc) (Qty. 2) (232-5007-00) **and** #6 X 1/2" PTH A (Zinc) (Qty. 2) (237-5809-00)

13	Flap Gate Mounting Brckt. **(by Shooter)**	1	535-9334-00

Item 13 is secured by: #6 X 1-3/4" PPH (Zinc) (Qty. 2) (237-5511-00) **and** Washer, .187" ID X .875" OD X .048 Thk (Zinc) (Qty. 2) (242-5059-00)

14	Flap Gate Mounting Brckt. **(by Kicker)**	1	535-9335-00

Item 14 is secured to rail by: #8-32 X 3/8" PFH MS (Zinc) (Qty. 1) (237-6030-00) **and** #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5101-00)

15	Flap Gate (for above Items 13 & 14)	1	535-9333-00
	Hinge Pin (for above Items 13 & 14)	1	535-9336-00

Note: *Switch Gates are also located on the Plastic Ramp Assemblies, see Drawings for Major Assemblies & Ramps (* ***BLUE PAGES*** *), Pages* ***75-98****.*

Brackets for Mounting

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) Brackets	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)

18	Bracket, Ramp Mounting	3	515-6508-00

Item 18 is secured by: #6 X 1/2" PTH A (Zinc) (Qty. 2/per) (237-5809-00)

19	Bracket, Shrunken Hd. & Socket Mnt.	1	535-9395-00

Item 19 is secured by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5101-00)

20	Bracket, OPTO Mounting on Plastic	1	535-9400-00

Item 20 is secured to Plastic over -05 by: Rivet, 1/8" ø X 3/16" (Qty. 2) (249-5001-00) **and** #6 Riveting Lock Washer (Qty. 2) (246-5000-00)

21	Bracket, Plastic Arrow (-20) Mounting	1	535-9409-00

Item 21 is secured by: #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00)
Plastic -20 & Socket are secured to Item 21 by: Rivet, 1/8" ø X 3/16" (Qty. 2) (249-5001-00) **and** #6 Riveting Lock Washer (Qty. 2) (246-5000-00)

Note: *Individual Plastics (-05, -20)* ***are not available individually****, ordering of kit is required. For all pieces, see* ***Playfield - Plastics (Screened & Clear) & Decals****, Page* ***67****.*

Note: *For Mounting Brackets located on Major Assemblies and/or Plastic Ramp Assemblies, see Drawings for Major Assemblies & Ramps (* ***BLUE PAGES*** *), Pages* ***75-98****.*

Wood Rails

22	Wood Rail (Bot. Left, 6.69" Route) 14.25"	1	525-5635-00
23	Wood Rail (Middle Left) 4.69"	1	525-5007-61

Item 23 is secured by: #4 X 5/8" PFH (Black) (Qty. 2) (237-5833-00)

24	Wood Rail (Upper Left) 3.88"	1	525-5007-61
25	Wood Rail (Right) 42"	1	525-5007-59

Items 22-25 are secured by: #6 X 1-1/4" PFH A (Zinc) (Qty. 13 total) (237-5804-00)

Metal Flat Rails, Wire Forms & Ball Guides

26	Metal Rail **(Center Drain under Arch)**	1	535-8393-00
27	Metal Rail **(#1, Shooter Lane, Right)**	1	535-9319-00
28	Metal Rail **(#2, Shooter Lane / Flap Gate, Lt.)**	1	535-9320-00
29	Metal Rail **(#3, Lower Ball Lock, Left)**	1	535-9321-00
30	Metal Rail **(#4, above Metal Rail #1 above)**	1	535-9322-00
31	Metal Rail **(#5, Full Top Orbit [Loop])**	1	535-9323-00
32	Metal Rail **(#6, Top Orbit, Right Side Mid)**	1	535-9324-00
33	Metal Rail **(#7, Top Orbit, Right Side Top)**	1	535-9325-00
34	Metal Rail **(#8, under Upper Pops)**	1	535-9326-00
35	Metal Rail **(#9, S. Head, Rt. Side, OPTO Mnt.)**	1	535-9327-00
36	Metal Rail **(#10, S. Head, Lt. Side, OPTO Mnt.)**	1	535-9328-00
37	Metal Rail **(#11, Orbit Top, behind Head)**	1	535-9329-00
38	Metal Rail **(#12, Inner Left Orbit [Spinner])**	1	535-9330-00
39	Metal Rail **(#13, Lt. Orbit, Right Side)**	1	535-9331-00

Items 26-39 are secured by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 1/per Tab) (234-5101-00) **and Items 27 + 30 also require:** #6 X 1/2" PTH A (Zinc) (Qty. 1/per Tab) (237-5809-00)

40	Metal Rail **(#14, Left Side, Middle)**	1	535-9358-00

Item 40 is secured under the Plyfld by: #8 X 1/2" SLT HWH AB (Zc) (Qty. 2) (234-5101-00)

41	Metal Rail **(#15, under Metal Rail #8 above)**	1	535-9402-00

Item 41 is secured by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5101-00)

42	Ball Guide **(Ball Return to Flipper, Left & Rt.)**	2	535-9332-00

Item 42 is secured by: #6-32 X 3/8" PPH MS ext. Sems Zinc (Qty. 3/per) (232-5201-00)

43	Ball Guide Rail (.12" ø) 2.25"	2	535-5356-05

Note: *For Rails, Guides or Protectors located on Major Assemblies and/or Plastic Ramp Assemblies, see Drawings for Major Assemblies & Ramps (* ***BLUE PAGES*** *), Pages* ***75-98****.*

Steel & Wire Ramps

44	Steel Ramp & Flap Assembly	1	515-7328-00

For Individual Items use : Ramp with Mount Bracket and Sides (Welded) (**515-7327-00**), Ramp Flap (**535-9337-00**), Rivet, 1/8" ø X 3/16" (Qty. 2) (249-5001-00) **and** #6 Riveting Lock Washer (Qty. 2) (246-5000-00)
Item 44 is secured by: #4 X 5/8" PFH (Black) (Qty. 2) (237-5833-00)

45	Center Exit Wire Ramp	1	535-9303-00
46	Spiral Wire Ramp	1	535-9302-00
47	VUK Exit Wire Ramp	1	535-9306-00
48	Right Wire Ramp	1	535-9305-00

Note: *For Securing Hardware on Items 45-48, see Drawings for Major Assemblies & Ramps (* ***BLUE PAGES*** *), Pages* ***75-98****.*

Miscellaneous

49	Shrunken Head (Molded, Altered)	1	880-5081-01

Misc. Switches & PC Boards

A	Micro Switch, Spinner **(1 -1/4")**	2	180-5010-04

Item A requires a Switch Body Protect Plate (Qty. 1/ea.) (535-6539-00) & is secured by: #2-56 X 1/2" HWH Sr (Qty. 2) (237-5937-02) **and** #2-56 Hex Nut (Qty. 2) (240-5301-00).

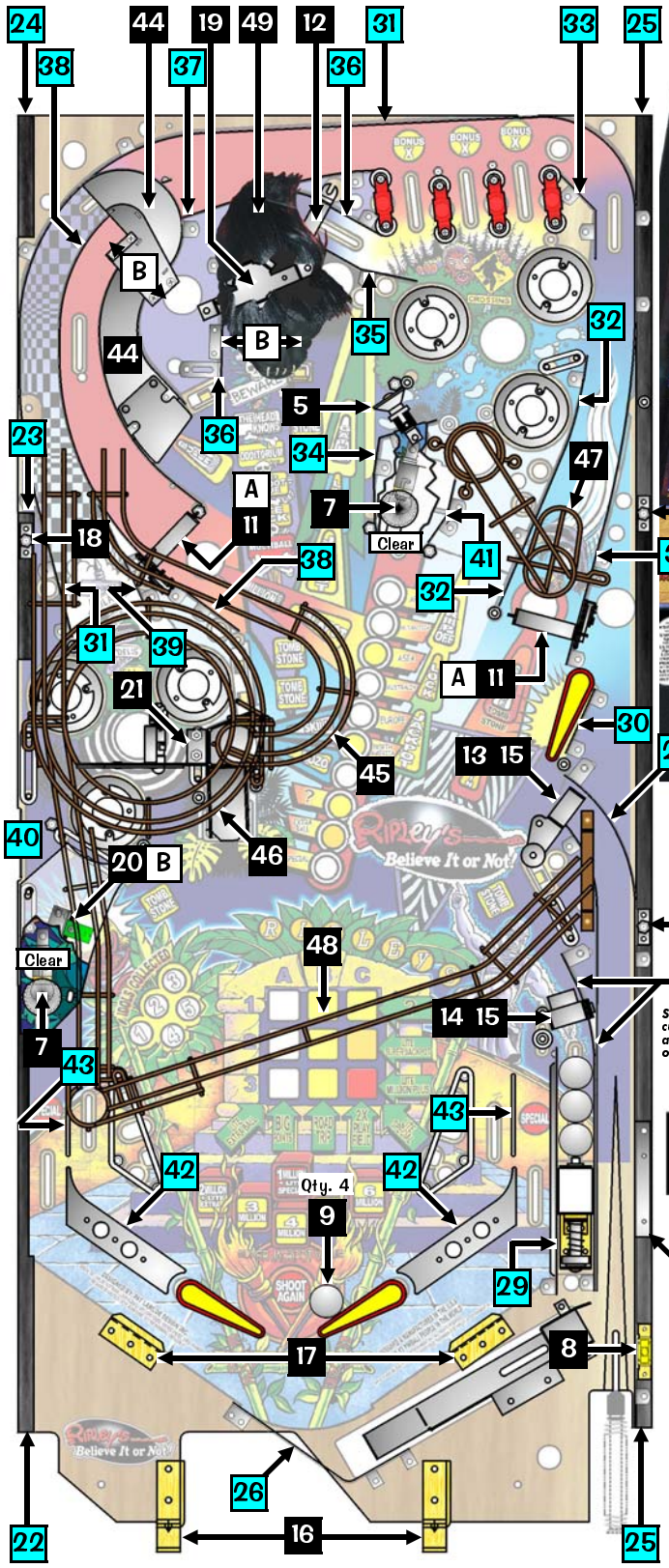
B	Transceiver Board Asm. (520-5237-00)	5	500-6775-00

Note: *For Switches and/or PCBs located on Major Assemblies and/or Plastic Ramp Assemblies, see Drawings for Major Assemblies & Ramps (* ***BLUE PAGES*** *), Pages* ***75-98****.*

Pinball Rejuvenation Kit Available: 502-6002-81
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.

Ask your distributor about the Deluxe Pinball Location Maintenance Kit which includes Flipper Rebuild Kits!

For Assemblies, Ramps, Switches on Assemblies, Back Panel Parts and other Individual Parts, not listed on this page, view the Blue Pages (75-98).



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

Take Note:

1. Some items or parts *may be included with* **or** *associated with* a Major Assembly or Ramp Assembly; **see the Blue Pages, Sec. 4, Chp. 2**. for parts required not appearing on this page. If you still cannot find the part required, Call Stern® Pinball, Inc. Technical Support, 1-800-542-5377 or 1-708-345-7700 (Opt. 1).
2. Items **1, 11, 21 & 44** have associated ***Individual Plastics and/or Decals.*** *These pieces are not available individually. For the Plastic and/or Decal Kits (or views), see the page after next,* ***Playfield - Plastics (Screened & Clear) & Decals****, Page 67.*
3. **Legend Note:** Items noted with a black square ■ are General Parts. Items noted with a cyan square ■ are Rails. Items noted with a white square □ are Switches and Misc. PC Board(s).

Playfield - General Parts ■ & Switches □ (Below)

№	BELOW PLAYFIELD PART NAME	QTY.	SPI PART №

General Items

1	Insulation Fiche Paper **(under Right Flipr.)**	1	545-5721-00
2	Diode Terminal Strip 3-Lug (813) Isolated	1	055-5204-03
3	Diode Terminal Strip 5-Lug (824) Isolated	4	055-5204-05

Items 2-3 are secured by: #6 X 1/2" SLT HWH AB Zinc (Qty. 1 per tab) (234-5001-02).
Note: *1N4004 Diodes (112-5003-00) are used in all Diode applications. 1N4001 Diodes can be used for Switches and/or Lamps. See Sec.* ***5****, Chp.* ***2****,* ***P/F Diode Terminal Strip****...*

4	3A 250v Slo-Blo Fuse	3	200-5000-08
	Fuse Clip Holder (Socket)	3	205-5000-01

Item 4 is secured by: #6 X 1/2" PPH AB (Qty. 1/per) (237-5805-00)
Note: *Item* ***4****, 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).*

5*	Diode Terminal Strip/Fuse Decals A-E		820-6221-81

Note: *For Decal Descriptions & Locations, see Sec.* ***5****, Chp.* ***2****,* ***Playfield Wiring****, Page 105.*

6	Metal Rail **(#14, Left Side, Middle)**	1	535-9358-00

Item 6 is secured by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5101-00)

Brackets for Mounting

7	Playfield Support Slide Bracket	2	535-6862-02

Item 7 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)

8	Edge Slide Bracket (Extended)	2	535-5988-01

Item 8 is secured by: #4 X 1/2" PFH (Zinc) (Qty. 5/per) (237-5840-00)

9	Pivot Pin Bracket Welded Assembly	2	500-5329-03
10	Bracket, Back Panel Mounting	2	535-8964-00

Item 10 is secured by: #8 X 1/2" SLT HWH AB (Zc) (Qty. 2/per) (234-5101-00)

11	Bracket, X3 Switch Mounting	1	535-8842-00

Item 11 is secured by: #8 X 1/2" SLT HWH AB (Zc) (Qty. 2) (234-5101-00)

12	Bracket, Sw. (Shooter Lane) Mounting	1	535-6173-00

Item 12 is secured by: #6 X 1/2" SLT HWH AB Zinc (Qty. 2) (234-5001-02)

Misc. Switches & PC Boards

A	Micro Switch **(at Shooter Lane)**	1	180-5157-00
B	Micro Switch **(Straight Wire Actuator)**	1	180-5178-00
C	Micro Switch **(Small Bend Wire Actuator)**	1	180-5179-00
D	Micro Switch **(Large Bend Wire Actuator)**	1	180-5180-00

Item A-D requires a Switch Body Protect Plate (Qty. 1/ea.) (535-6539-00) & is secured by: #2-56 X 1/2" HWH Sr (Qty. 2) (237-5937-02) **and** #2-56 Hex Nut (Qty. 2) (240-5301-00).

E	Micro Sw. Roll-Over Right Brkt. Assy.	11	500-6227-02

Item E is secured by: #6 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5001-02)

F	Switch & Target Assy. Narrow (Yel)	1	515-5967-06
G	Switch & Target Assy. Square (White)	5	515-5162-08

Items F-G are secured by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5101-00)
Note Items F-G: *For better view(s) or entire assembly, see* ***Appdx. I****,* ***Pg. I1*** *(end of manual).*

H	Playfield X3 (Triple) Driver Board	1	520-5235-03
I	OPTO Tran/Rec. Amplifier Bd.	2	520-5239-01

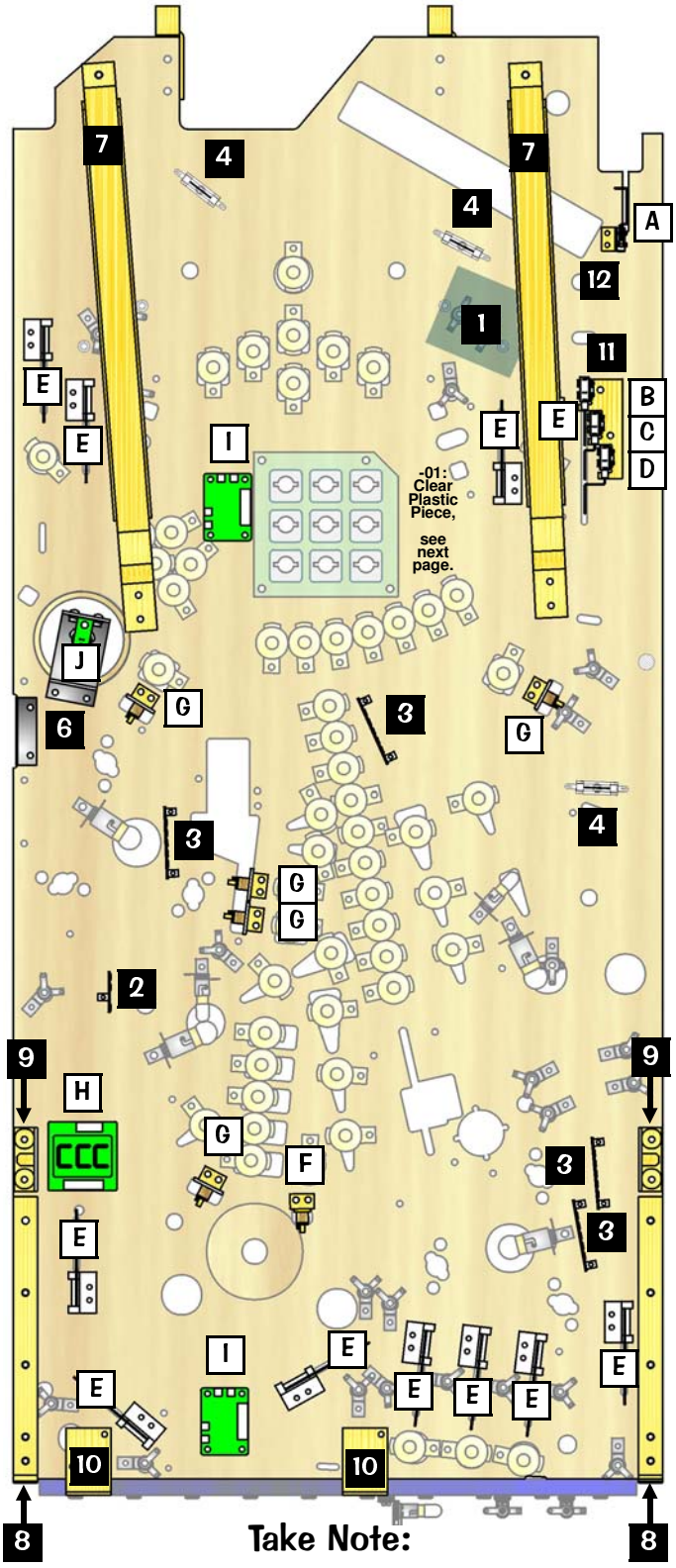
Items H & I are secured by: ¼" Slf. Rtn. Plastic Spacer White (Qty. 4/per) (254-5007-02) **and** #6 X 3/4" SLT HWH AB (Zinc) (Qty. 4/per) (234-5003-00)

J	OPTO Transceiver Bd. Assy. ***(on Magnet)***	1	500-6775-00

Item J is secured by: #6 X 3/8 PPH (ZInc) Type-25 (Qty. 2) (237-5880-00)

Note: *For more details on Items* ***H-J*** *and a break-down of parts, see Printed Circuit Boards (* ***YELLOW PAGES****), Page 142-144.*

Note: *For Switches and PCBs located on Major Assemblies, see Drawings for Major Assemblies & Ramps (* ***BLUE PAGES****), Pages* ***75-98****.*



Take Note:

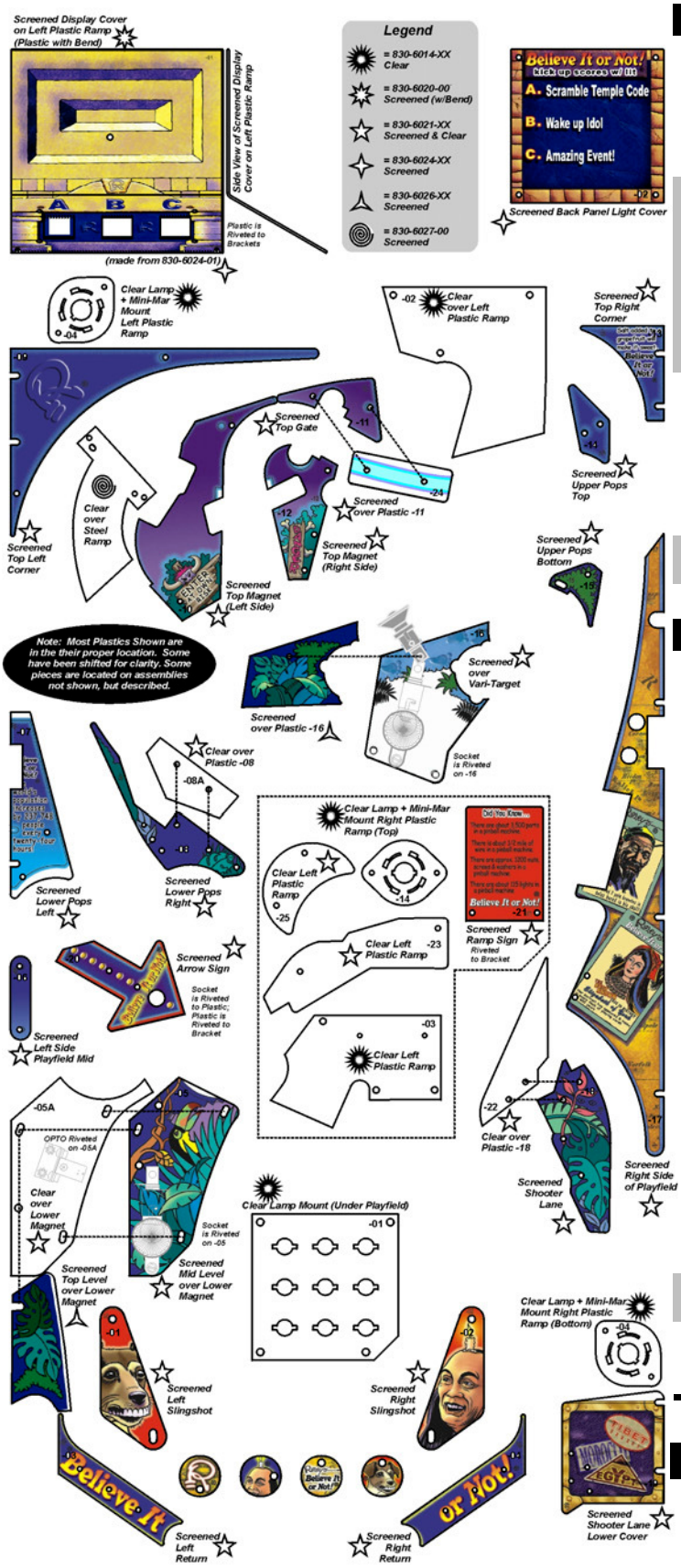
* An asterisk (*) indicates item(s) are not noted in the pictorials.

1. For Sockets & Bulbs (drawings & part numbers) see Pgs. **72-74**.
2. Some items or parts *may be included with* **or** *associated with* a Major Assembly or Ramp Assembly; **see the Blue Pages, Sec. 4, Chp. 2**. for parts required not appearing on this page. If you still cannot find the part required, Call Stern® Pinball, Inc. Technical Support, 1-800-542-5377 or 1-708-345-7700 (Opt. 1).
3. **Legend Note:** Items noted with a black square ■ are General Parts. Items noted with a white square □ are Switches and Miscellaneous PC Boards.

Pinball Location Maintenance Kit Available: 502-6002-81
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.

Ask your distributor about the Deluxe Pinball Location Maintenance Kit which includes Flipper Rebuild Kits!

Playfield - Plastics (Screened & Clear) & Decals



PLASTICS KIT — SPI PART Nº

Kit: **P/F Plastics (Screened & Clear) :**

803-5000-81 *Kit includes:*

Screened & Clear Set (830-6021-XX), Screened Set (830-6026-XX), Clear Set (830-6014-XX) ***and*** *Clear Piece (830-6027-00)*

803-5001-81 *Kit includes:

3X Dot Display Housing with Mounting Brackets

Screened Piece with Bend & Mounting Brackets (515-7355-00) Plastic Assembly includes Screened Piece Altered (830-6020-00), Mntg. Brackets (Qty. 2) (535-8941-02), Rivet, 1/8" ø X 3/16" (Qty. 2) (249-5001-00) ***&*** *#6 Riveting Lock Washer (Qty. 2) (246-5000-00)* ***and*** *Screened Piece (830-6024-02, Back Panel)*

Note: The following Plastics have various parts (brackets or sockets) riveted to them. If replacing these plastics, the rivets must be drilled out to replace. Items can be remounted with appropriate sized screw & nut combo.

-05 & -05A (*over Lower Magnet), -16 (Vari-Target Cover) and -20 (Arrow Sign)*

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

DECALS KIT — SPI PART Nº

Kit: **Game Specific Decals**

802-5000-81 *Kit includes:*

820-6341-XX Set

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

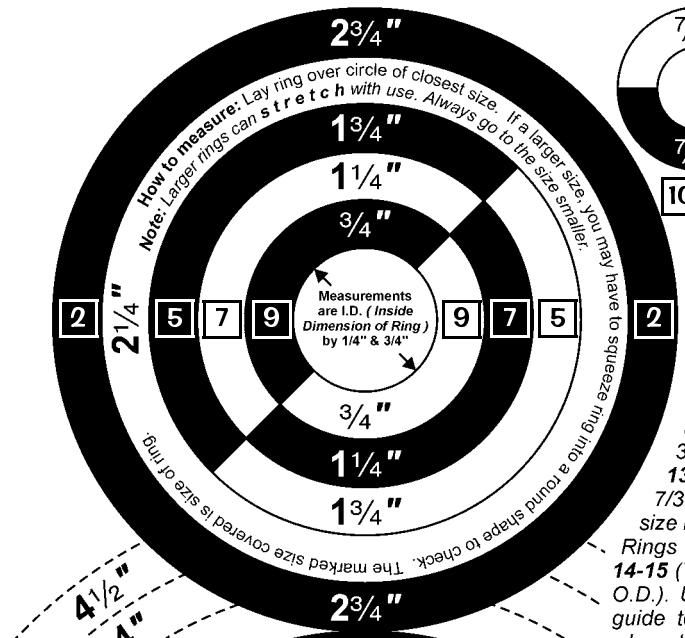
Other miscellaneous plastics and/or decals can be found on the Backbox & Speaker Panel Assemblies (Pages ***60-61***), Cabinet - General Parts (Pages ***62-63***) and Playfield - General Parts & Switches (Below) (Page ***66***).

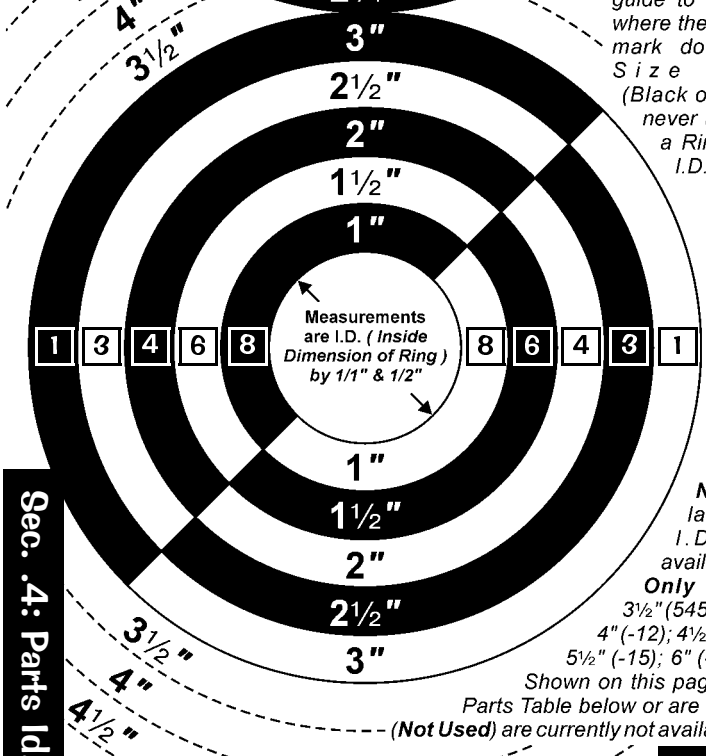
OPTIONAL MYLAR (Not Included) — SPI PART Nº

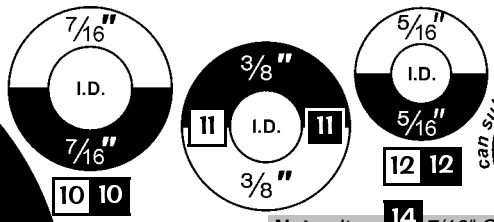
* ***Not included*** *in the Decals Kit (can be ordered separately):*

*** Full Playfield Clear Mylar Sheet, (820-5999-81)**

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

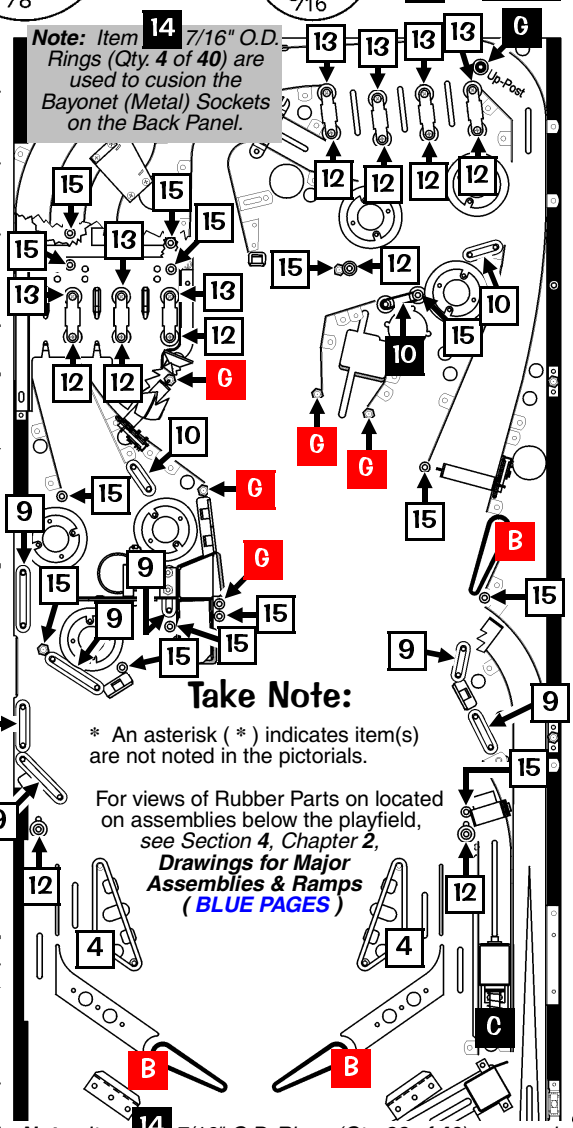






*Items **1-13** are measured by the Inside Diameter (I.D.). Items **1-9** and **11** are approximately 1/4" thick. Items **10**, **12-15** are approximately 3/16" thick. Item **13** can also be a 7/32" I.D Ring. The size is imprinted on all Rings except for Items **14-15** (7/16" O.D. & 3/8" O.D.). Use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

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



№	RUBBER PART NAME	QTY.	SPI PART №
A	Small Flipper **BLACK** Ring		545-5207-00
	Sm. Flipper **RED** (Soft Duro) Ring		545-5207-**22**
B	Large Flipper **BLK** (50 Duro) Ring		545-5277-00
	Lg. Flipper **RED** (Soft Duro) Ring	3	545-5277-**22**
C	Bumper (Deflector Pad) on Asm's 3 below / 1 above		545-5428-00
D*	Bumper (Grommet) 1138 (A60)		545-5105-00
E*	Bumper (Post)		545-5009-00
F*	Bumper (Post Sleeve, Short)		545-5151-00
G	Bumper **RED** (Post Sleeve, Tall)	5	545-5308-22
	Bumper **BLACK** (Post Sleeve, Tall)	1	545-5308-00
	Bumper **WHITE** (Post Sleeve, Tall)		545-5308-08
H*	O-Ring 11/32" X 7/32" X 1/16" (Located inside Cabinet by each Flipper Button Assembly)		545-5850-00

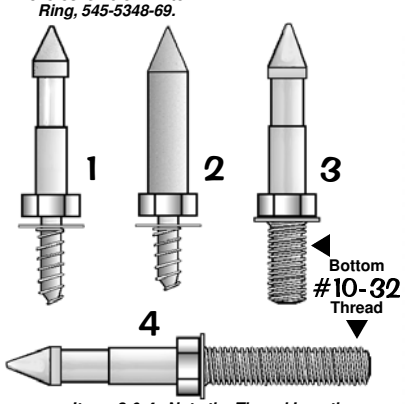
№	SPI PART №	QTY.	RUBBER PART NAME	QTY.	SPI PART №	№
1	545-5348-10		Black 3" I.D. Ring White		-60 N/U	1
2	545-5348-20		Black 2¾" I.D. Ring White		-70 N/U	2
3	545-5348-09		Black 2½" I.D. Ring White		545-5348-59	3
4	545-5348-08		Black 2" I.D. Ring White	2	545-5348-58	4
5	545-5348-21		Black 1¾" I.D. Ring White		-71 N/U	5
6	545-5348-07		Black 1½" I.D. Ring White		545-5348-57	6
7	545-5348-06		Black 1¼" I.D. Ring White		545-5348-56	7
8	545-5348-05		Black 1" I.D. Ring White		-55 N/U	8
9	545-5348-04		Black ¾" I.D. Ring White	7	545-5348-54	9
10	545-5348-18	1	Black 7/16" I.D. Ring White	2	-68 N/U	10
11	545-5348-03		Black ⅜" I.D. Ring White		-53 N/U	11
12	545-5348-02		Black 5/16" I.D. Ring White	9	545-5348-52	12
13	545-5348-01		Black 3/16" I.D. Ring White	8	545-5348-51	13
14	545-5348-17	40	Black 7/16" O.D. Ring White		-67 N/U	14
15	545-5348-19		Black ⅜" O.D. Ring White	15	545-5348-69	15

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

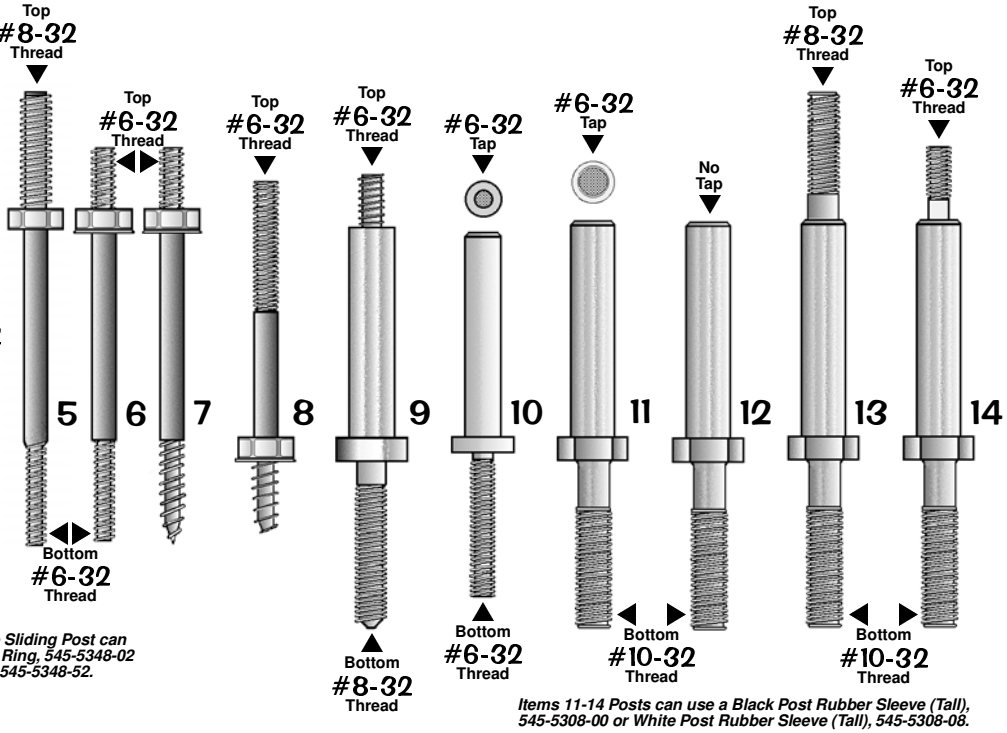
Sec. 4: Parts Id. ...

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

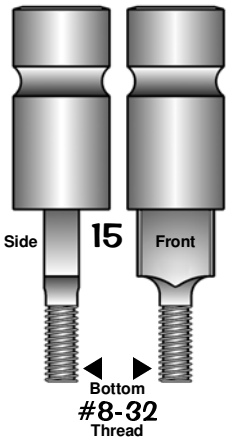
Items 1, 3 & 4 Posts can use 3/8" O.D. Black Ring, 545-5348-19 or White Ring, 545-5348-69.



Items 3 & 4: Note the Thread Lengths.



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



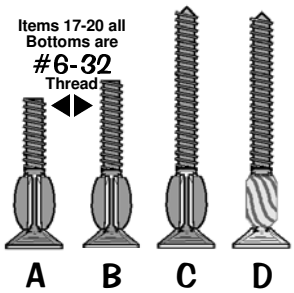
Item 15 Adjustable Sliding Post can use 5/16" I.D. Black Ring, 545-5348-02 or White Ring 545-5348-52.

Items A & B are typically used with Hex Spacers above the Playfield.

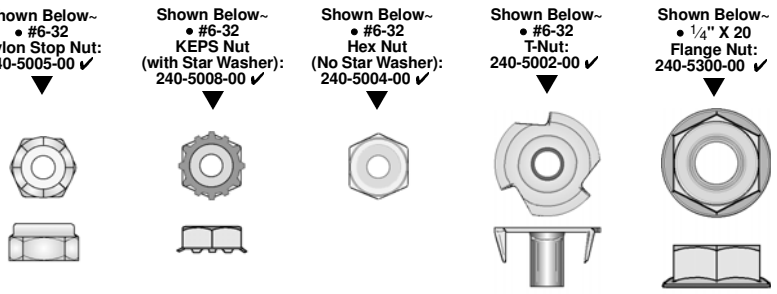
Item C is typically used with the bottom Cabinet Speaker (used with #6-32 Nylon Stop Nut, 240-5005-00).

Item D is typically used to secure "Item 15 (515-5939-00) in Bumper Bottom Assembly, 515-6459-04".

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



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



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

Top & Side Views

Nylon Stop Nuts *Not Shown:*

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

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

Bottom & Side Views

KEPS Nuts *Not Shown:*

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

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

Top View

Hex Nuts *Not Shown:*

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

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

Bottom & Side Views

T-Nuts *Not Shown:*

- #6-32 (w/Side Cut Off): 240-5002-01
- #8-32: 240-5101-00 ✔
- #10-32 (Black Oxide): 240-5007-00
- #10-32 (w/Side Cut Off): 240-5205-00
- #10-32 X 5/16" 240-5204-00
- #10-24: 240-5200-00

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

Top & Side Views

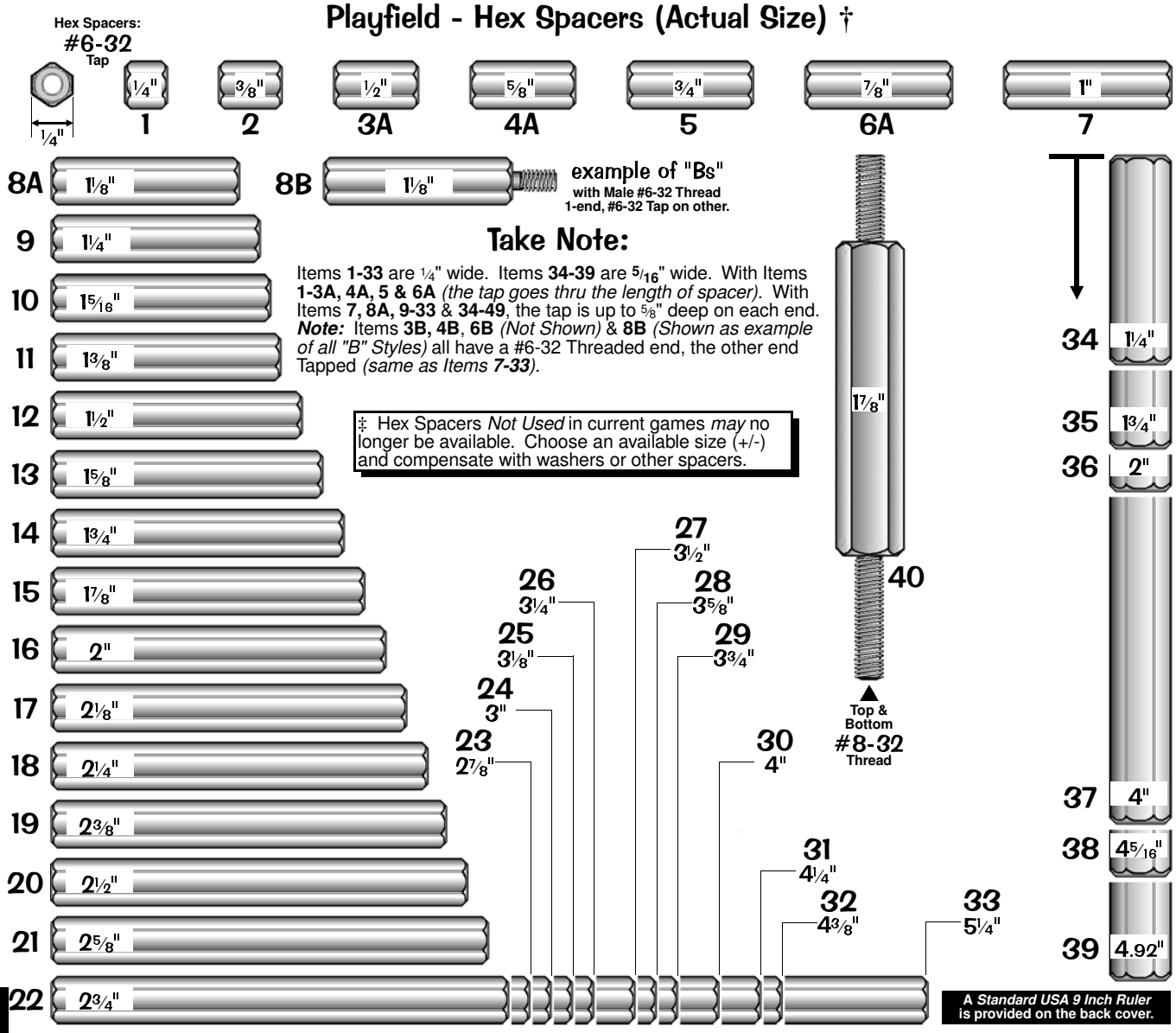
Miscellaneous Nuts *Not Shown:*

- Plastic Pal Nut (on Flipper Buttons): 240-5003-00
- Metal Pal Nut (on Flipper Buttons): 240-5003-01 ✔
- #6-32 Wing Nut: 240-5001-00
- #8-32 Wing Nut: 240-5100-00
- #10-24 Wing Nut: 240-5211-00
- 1/4"-20 Wing Nut: 240-5302-00
- 1/4"-20 Toggle Wing: 240-5324-00

№	METAL POST NAME	QTY.	SPI PART №
1	Mini-Post Wood Screw		530-5004-00
2	Mini-Post Wood Screw (no cut-away)	2	530-5004-01
3	Mini-Post MS / #10-32 Bot. .4" Thread	4	530-5005-01
4	Mini-Post MS / #10-32 Bot. .875" Thread	11	530-5005-00
5	Post Fasten #8-32 Top / #6-32 Bot.	1	530-5008-00
6	Post Fasten #6-32 Top / #6-32 Bot.	13	530-5012-02
7	Post Fstn. #6-32 Top / Wood Scr. Bot.	10	530-5010-02
8	Post #6-32 Top / Wood Screw Bottom		530-5263-01
9	Post Fasten #6-32 Top / #8-32 Bot.		530-5007-00
10	Post #6-32 Tap / #6-32 Bottom		530-5127-00
11	Post Hex Base #6-32 Tap/#10-32 Bot.		530-5332-01
12	Post Hex Base (No Tap)/#10-32 Bot.		530-5332-00
13	Post Hex Base #8-32 Top/#10-32 Bot.		530-5332-02
14	Post Hex Base #6-32 Top/#10-32 Bot.	5	530-5332-03
15	*Adjustable* Sliding Post (Brass) #8-32 Bot.	2	530-5621-00
A	#6-32 X 3/4" Fin Shank Screw		237-5921-02
B	#6-32 X 7/8" Fin Shank Screw		237-5921-04
C	#6-32 X 1 1/4" Fin Shank Screw	4	237-5883-00
D	#6-32 X 1 3/16" Spiral Fin Shank Screw	19	237-5957-00

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

Playfield - Hex Spacers (Actual Size) †



Take Note:

Items **1-33** are ¼" 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** & **34-49**, the tap is up to ⅝" 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**).*

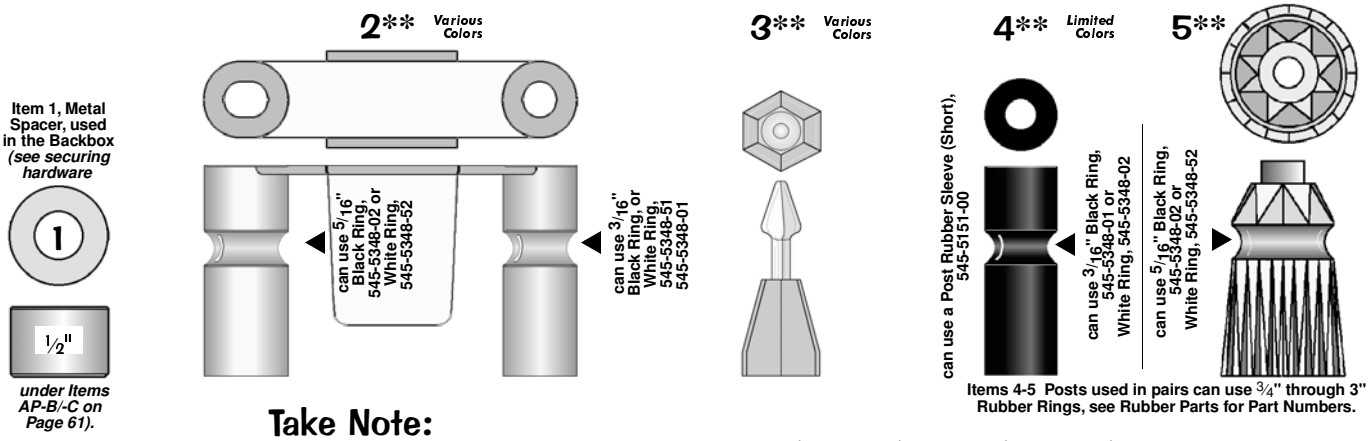
‡ Hex Spacers *Not Used* in current games *may* no longer be available. Choose an available size (+/-) and compensate with washers or other spacers.

№	HEX SPACER NAME		QTY.	SPI PART №
1	¼"	X ¼" : #6-32 Tap *(both ends)*		254-5008-00
2	⅜"	X ¼" : #6-32 Tap *(both ends)*		254-5008-12
3A	½"	X ¼" : #6-32 Tap *(both ends)*	9	254-5008-03
3B*	Identical to **3A** *with #6-32 Thread end*			254-5024-03
4A	⅝"	X ¼" : #6-32 Tap *(both ends)*		254-5008-02
4B*	Identical to **4A** *with #6-32 Thread end*			254-5024-02
5	¾"	X ¼" : #6-32 Tap *(both ends)*	6	254-5008-04
6A	⅞"	X ¼" : #6-32 Tap *(both ends)*		254-5008-05
6B*	Identical to **6A** *with #6-32 Thread end*			254-5024-05
7	1"	X ¼" : #6-32 Tap *(both ends)*		254-5008-06
8A	1⅛"	X ¼" : #6-32 Tap *(both ends)*		254-5008-17
8B	Identical to **8A** *with #6-32 Thread end*			254-5024-17
9	1¼"	X ¼" : #6-32 Tap *(both ends)*		254-5008-11
10	15/16"	X ¼" : #6-32 Tap *(both ends)*		254-5008-34
11 ‡	1⅜"	X ¼" : #6-32 Tap *(both ends)*		254-5008-33
12	1½"	X ¼" : #6-32 Tap *(both ends)*		254-5008-09
13 ‡	1⅝"	X ¼" : #6-32 Tap *(both ends)*	1	254-5008-13
14	1¾"	X ¼" : #6-32 Tap *(both ends)*		254-5008-10
15 ‡	1⅞"	X ¼" : #6-32 Tap *(both ends)*		254-5008-20
16	2"	X ¼" : #6-32 Tap *(both ends)*		254-5008-07
17	2⅛"	X ¼" : #6-32 Tap *(both ends)*	2	254-5008-32
18	2¼"	X ¼" : #6-32 Tap *(both ends)*		254-5008-18
19	2⅜"	X ¼" : #6-32 Tap *(both ends)*		254-5008-28
20	2½"	X ¼" : #6-32 Tap *(both ends)*		254-5008-16
21	2⅝"	X ¼" : #6-32 Tap *(both ends)*		254-5008-08
22	2¾"	X ¼" : #6-32 Tap *(both ends)*		254-5008-15
23	2⅞"	X ¼" : #6-32 Tap *(both ends)*		254-5008-31
24	3"	X ¼" : #6-32 Tap *(both ends)*		254-5008-14
25	3⅛"	X ¼" : #6-32 Tap *(both ends)*	1	254-5008-19
26	3¼"	X ¼" : #6-32 Tap *(both ends)*	1	254-5008-26
27	3½"	X ¼" : #6-32 Tap *(both ends)*	1	254-5008-27
28	3⅝"	X ¼" : #6-32 Tap *(both ends)*		254-5008-25
29	3¾"	X ¼" : #6-32 Tap *(both ends)*		254-5008-36
30	4"	X ¼" : #6-32 Tap *(both ends)*		254-5008-21
31	4¼"	X ¼" : #6-32 Tap *(both ends)*		254-5008-30
32	4⅜"	X ¼" : #6-32 Tap *(both ends)*		254-5008-29
33	5¼"	X ¼" : #6-32 Tap *(both ends)*		254-5008-35
34	1¼"	X 5/16" : #6-32 Tap *(both ends)*		254-5018-09
35	1¾"	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	45/16"	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	1⅞"	X ⅜" : #8-32 *Thread (both ends)*		***530***-5285-00

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

Sec. 4: Parts Id. ...

Playfield - Posts & Spacers (Actual Size) †

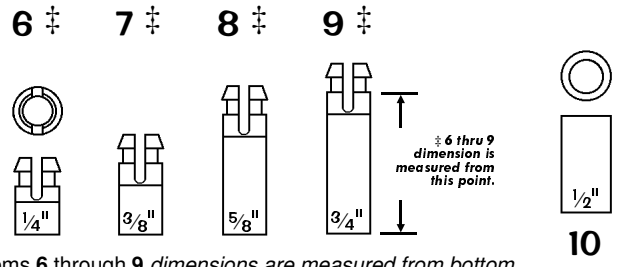


Items 4-5 Posts used in pairs can use 3/4" through 3" Rubber Rings, see Rubber Parts for Part Numbers.

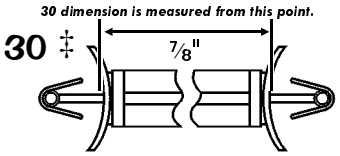
Take Note:

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

** Items **2, 4 & 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.*

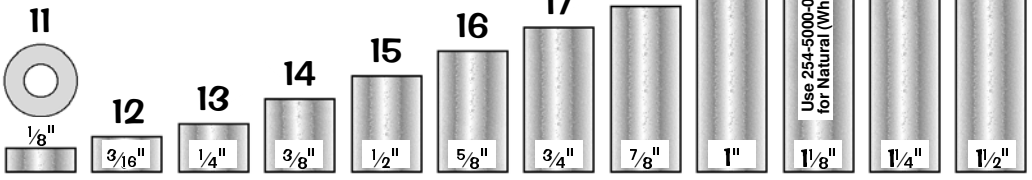


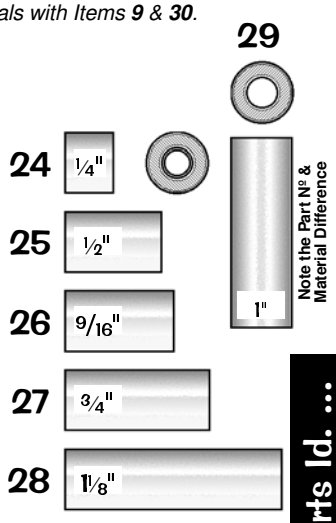
‡ Items **6** through **9** *dimensions are measured from bottom to just under the cut-away.* Item **30** *dimension* is measured from *top-to-top* of curve. *See pictorials with Items **9** & **30**.*



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



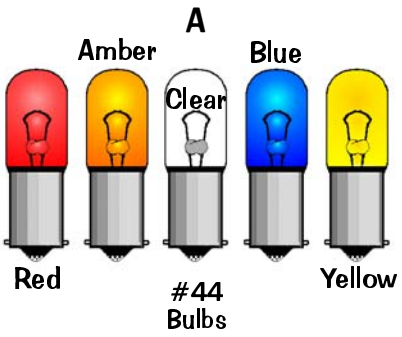


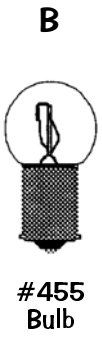
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

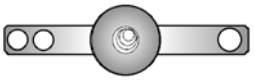
Nº	POST & SPACER NAME	QTY.	SPI PART Nº
1	3/8" X 1/2" Metal Spacer (Backbox)	2	530-5099-00
2**	Top Lane Plastic Mini-Lite Hood (Red)	7	550-5061-02
	Item 2 typically secured by: #6-32 X 1-3/4" PPH MS (Zinc) (Qty. 2/per) (237-5511-00) **and** Washer 9/64" X 5/16" OD X 1/32" (Qty. 2/per) (242-5017-00), if used.		
3**	Mini-Jewel Plastic Post (Clear)	13	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)	35	550-5059-01
5**	1-Groove Jewel Plastic Post (Clear)	4	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 ‡	1/4" Slf. Rtn. Plastic Spacer White	20	254-5007-02
7 ‡	3/8" Slf. Rtn. Plastic Spacer White		254-5007-01
8 ‡	5/8" Slf. Rtn. Plastic Spacer White		254-5007-00
9 ‡	3/4" Slf. Rtn. Plastic Spacer White		254-5007-03
10	1/2" X 1/4" Plastic Spacer White **(Narrow)**		254-5000-03
11	1/8" X 3/8" Plastic Spacer Gray		254-5000-19
12	3/16" X 3/8" Plastic Spacer Gray		254-5000-18
13	1/4" X 3/8" Plastic Spacer Gray	2	254-5000-02

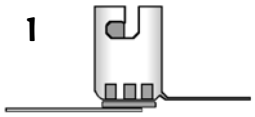
Nº	POST & SPACER NAME	QTY.	SPI PART Nº
14	3/8" X 3/8" Plastic Spacer Gray	6	254-5000-12
15	1/2" X 3/8" Plastic Spacer Gray	3	254-5000-01
16	5/8" X 3/8" Plastic Spacer Gray	6	254-5000-14
17	3/4" X 3/8" Plastic Spacer Gray	10	254-5000-07
18	7/8" X 3/8" Plastic Spacer Gray		254-5000-11
19	1" X 3/8" Plastic Spacer Gray *or* Black	1	254-5000-04
20	1 1/8" X 3/8" Plastic Spacer Gray		254-5000-06
	1 1/8" X 3/8" Plastic Spacer Natural		254-5000-06N
21	1 1/4" X 3/8" Plastic Spacer Gray	1	254-5000-05
22	1 1/2" X 3/8" Plastic Spacer Gray		254-5000-08
23	1 15/16" X 3/8" Plastic Spacer Gray		254-5000-15
24	1/4" X 5/16" X .144" I.D. Metal Spacer	1	254-5014-03
25	1/2" X 5/16" X .144" I.D. Metal Spacer		254-5014-00
26	9/16" X 5/16" X .144" I.D. Metal Spacer		254-5014-04
27	3/4" X 5/16" X .144" I.D. Metal Spacer		254-5014-01
28	1 1/8" 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‡	7/8" Plastic Spacer Support **(Dual-Locking)**		254-5039-14

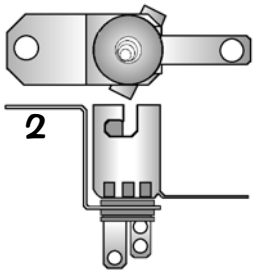
Playfield & Back Panel - Small Bayonet Type Bulbs & Sockets (Actual Size) †

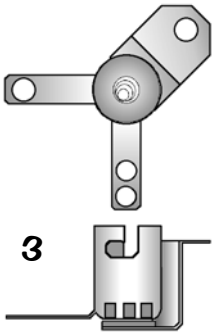


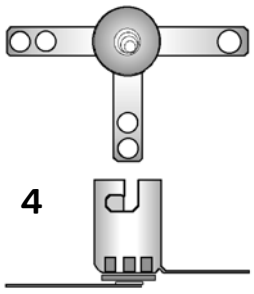


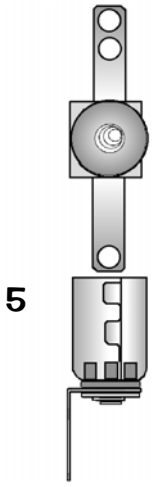


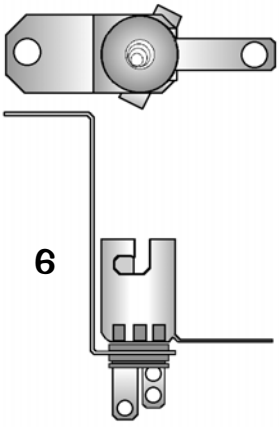


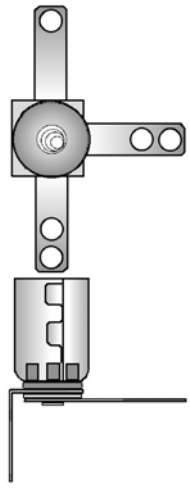


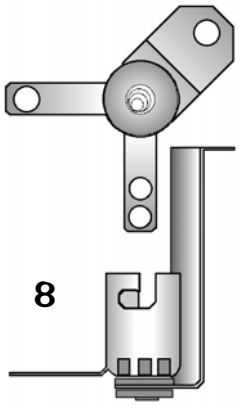


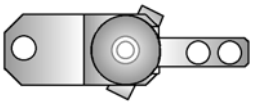


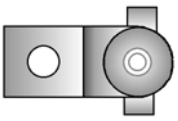


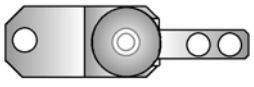


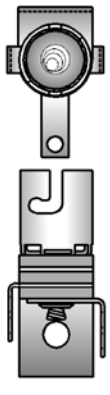










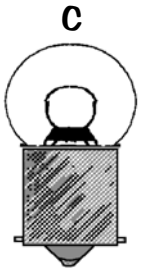


№	SMALL BULB or SOCKET NAME	QTY.	SPI PART №
A	#44 Bulb (Clear)	42	165-5000-44
A	#44 Bulb (Red)	5	165-5053-02
A	#44 Bulb (Amber)		165-5053-03
A	#44 Bulb (Blue)		165-5053-05
A	#44 Bulb (Yellow)	6	165-5053-06
B	#455 Twinkle Bulb		165-5003-00
1	2-Lug Staple Down Socket	12	077-5000-00
2	3-Lug Stand-Up Short Socket		077-5008-00
3	2-Lug Stand-Up Short Socket	17	077-5002-00
4	3-Lug Staple Down Socket		077-5001-00
5	2-Lug Laydown Socket	4	077-5003-00
6	3-Lug Stand-Up Long Socket	4	077-5009-00
7	3-Lug Laydown Socket (3 Lugs Flat)	5	077-5006-00
8	2-Lug Stand-Up Long Socket		077-5005-00
9	3-Lug Stand-Up Long Shell Socket		077-5013-00
10	2-Lug Stand-Up Lg. Shell Socket (GIs)	6	077-5031-00

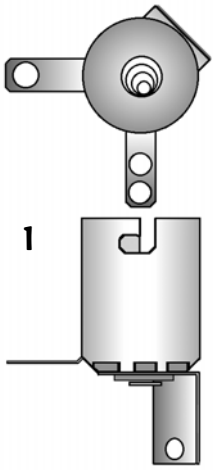
№	SOCKET NAME	QTY.	SPI PART №
11	1-Lug Stand-Up Long Shell Socket		077-5012-00
12	3-Lug Laydown Socket (2 Lugs Bent)	1	077-5032-00

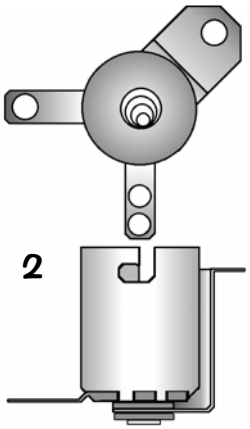
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

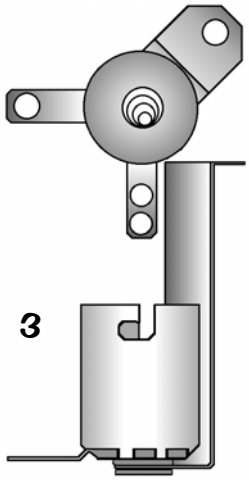
Playfield - Large Bayonet Type Bulb & Sockets (Actual Size) †

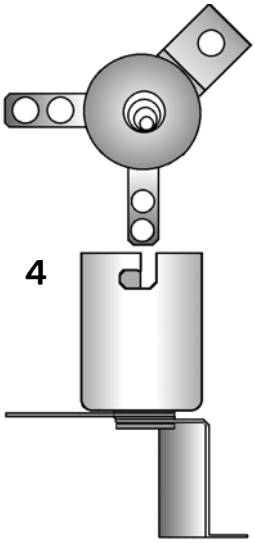


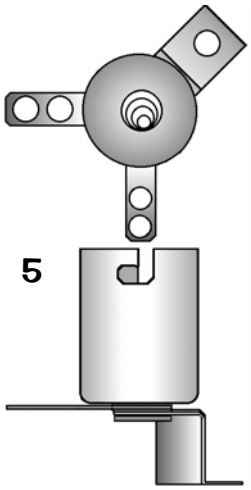
#89
Bulb

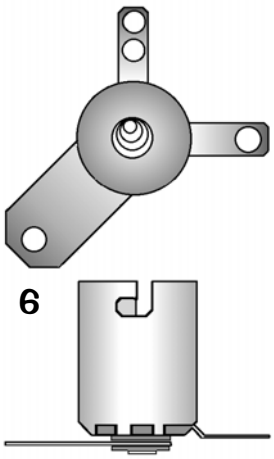








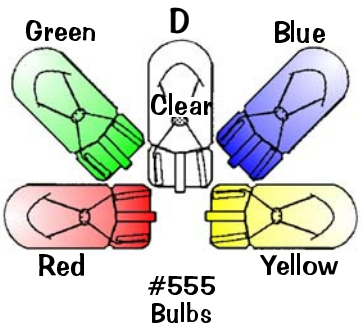


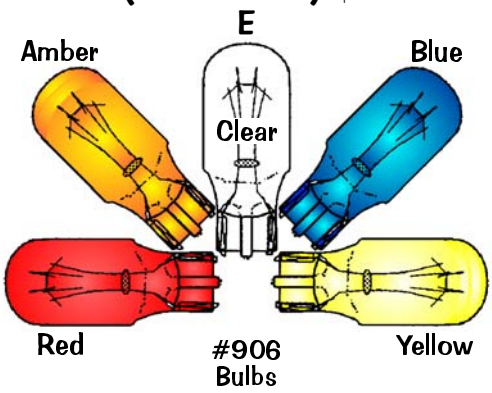


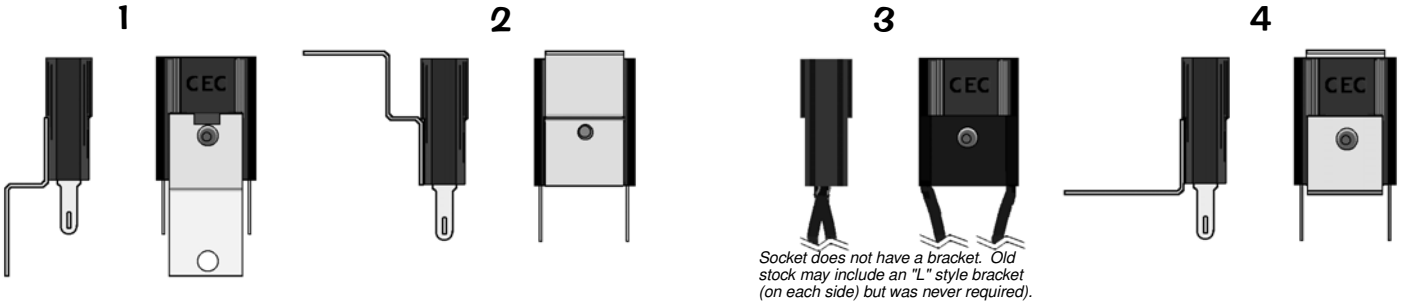
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

№	LARGE BULB & SOCKET NAME	QTY.	SPI PART №
C	#89 Bulb	6	165-5000-89
1	2-Lug Laydown Standard Socket	6	077-5100-00
2	2-Lug Stand-Up Short Socket		077-5101-00
3	2-Lug Stand-Up Long Socket		077-5102-00
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

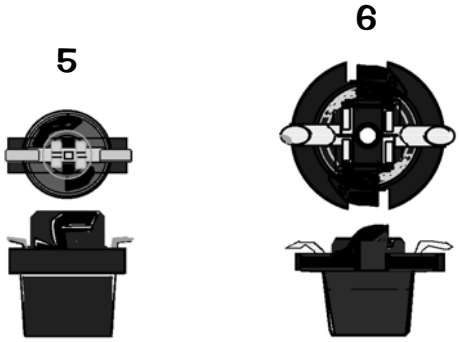
Playfield - Wedge Base Bulbs & Sockets (Actual Size) †



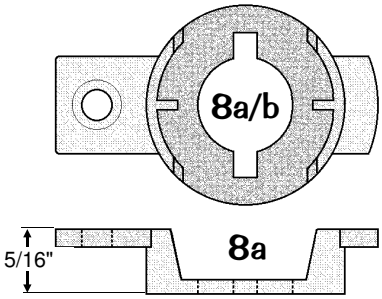




Socket does not have a bracket. Old stock may include an "L" style bracket (on each side) but was never required).



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



Take Special Note

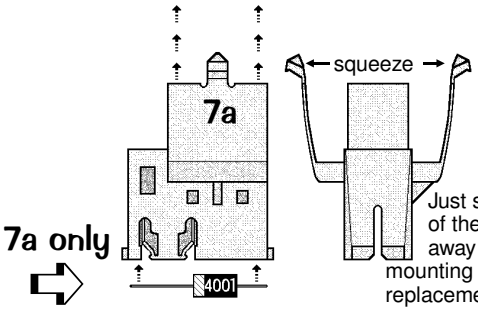
Item 7a is an **IDC** (Insulation Displacement Connection) Style Socket (this style is solderless). This socket is secured to the playfield or component by Items **8a** or **8b** Snap-On Socket Brackets, or *may* also be snapped into specially cut **Clear and/or Screened Plastic Pieces** *(used only when sockets are positioned closely together and/or in a special applications, e.g. on Ramps). If Plastic Pieces are used to mount some **7a** or **7b** Sockets, it will be noted on Page **67**, Playfield - Plastics & Decals.*

Take Note:

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

1. Item **3** Socket has 2 Wires attached are approximately 12" ea.
2. Item **5** Socket **was** used on PC Light Boards to position bulbs vertically; Item **5** Socket is secured by "twisting" into place.
3. Item **D** Bulb (#555) can be used in all sockets, *except Item **6***.
   Item **E** Bulb (#906) can be used in all sockets, *except Item **5***.
4. Item **7a** Socket is equipped with a *built-in* Diode, 1N4003 (112-5003-00), however, replacement can be made with a 1N4001 Diode (112-5001-00).
   Item **7b** Socket is ***NOT*** equipped with a diode *(Not Required)*.

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



7b is Yellow with No Diode

Just squeeze the "side arms" of the socket together & pull away from the bracket or mounting board for easy Bulb replacement.

№	WEDGE BULB & SOCKET NAME	QTY.	SPI PART №	№	WEDGE BULB & SOCKET NAME	QTY.	SPI PART №
D	#555 Wedge Base Bulb (Clear)	71	165-5002-00	1	Wedge Base Socket (Laydown)	2	077-5026-01
D	#555 Wedge Base Bulb (Red)		165-5054-02	2	Wedge Base Socket (Offset)		077-5029-00
D	#555 Wedge Base Bulb (Green)		165-5054-04	3	W.B. Socket (Bumpers/Special App.)	6	077-5206-00
D	#555 Wedge Base Bulb (Blue)		165-5054-05	4	Wedge Base Socket (Laydown GI)		077-5030-00
D	#555 Wedge Base Bulb (Yellow)		165-5054-06	5	#555 *only* Wedge Base Socket (Twist)		077-5007-00
E	#906 Wedge Base Bulb (Clear)		165-5004-00	6	#906 *only* Wedge Base Socket (Twist)		077-5016-00
E	#906 Wedge Base Bulb (Red)	2	165-5004-02	7a	IDC Snap-On Socket	63	077-5216-00
E	#906 Wedge Base Bulb (Amber)		165-5004-03	7b	IDC Snap-On Socket ***No Diode***	3	077-5216-**01**
E	#906 Wedge Base Bulb (Blue)		165-5004-05	8a	5/16" Ht. Snap-On Socket Bracket	55	545-5760-18
E	#906 Wedge Base Bulb (Yellow)		165-5004-06	8b*	19/32" Ht. Snap-On Socket Bracket		545-5760-19

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

Drawings for Major Assemblies & Ramps (The Blue Pages)

Overview

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

Important: Read all "**Take Note:**" items.

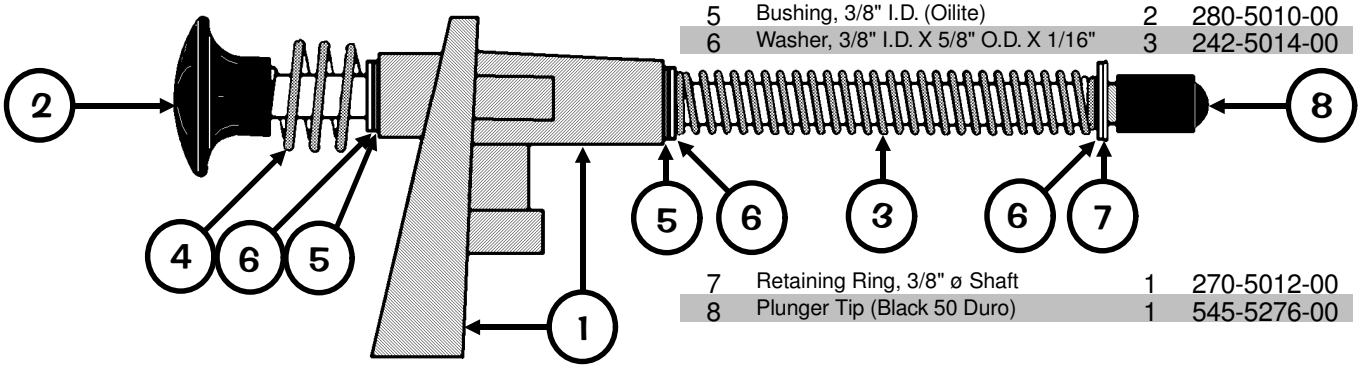
For ***Cabinet***, ***Backbox*** *and/or* ***General Playfield Parts*** *(not described herein), see the* ***Pink Pages***, ***59-74***.

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

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

Manually launch the ball into play.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Housing (Shooter Assembly)	1	535-5067-02
	Item 1 is secured to the Cabinet by: Support Plate (Qty. 1) (535-5027-00), #10-32 X 1/2" PPH (Sems) Zinc TF (Qty. 3) (237-6033-00), #10 Split Lock Washer (Qty. 3) (234-5003-00) **and** #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5002-00)		
2	Rod Assembly (w/Black Knob)	1	515-6557-00
3	Comp. Spring (**GREEN**, .035" ø)	1	266-5001-07
4	Compression Spring (Short Plunger)	1	266-5010-00
5	Bushing, 3/8" I.D. (Oilite)	2	280-5010-00
6	Washer, 3/8" I.D. X 5/8" O.D. X 1/16"	3	242-5014-00
7	Retaining Ring, 3/8" ø Shaft	1	270-5012-00
8	Plunger Tip (Black 50 Duro)	1	545-5276-00



Autoplunger Arm Weld Assembly, 500-6091-00 (Items 1-5)

Automatically launches the ball into play.

&

Autoplunger Coil Assembly, 500-6092-03B (Items 6-9)

Works in conjunction with the Arm Weld Asm.

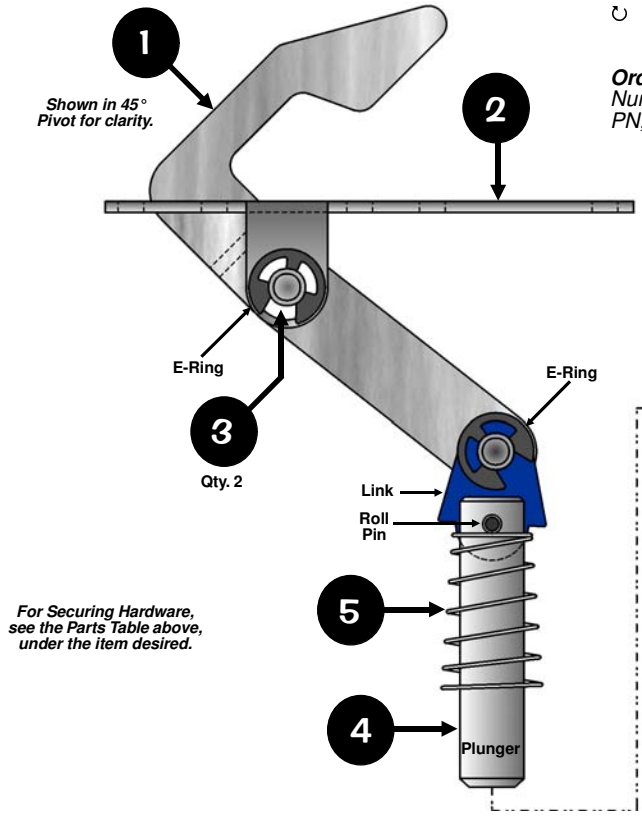
№	... ARM WELD PART NAME	QTY.	SPI PART №
1	Arm Weld Assembly	1	515-6526-00
	Item 1 is secured to Item 2 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)		
2	Autoplunger Fulcrum	1	535-7697-00
3	Nyliner, 1/4" (Thomson #4l1-FF)	2	545-5423-00
4	Plunger & Link Assembly	1	515-5338-00
	Item 4 is secured 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**)		
	Ordering Note: If **515-5338-00** *is unavailable*, order the individual part(s) actually required.		
5	Compression (Return) Spring	1	266-5020-00

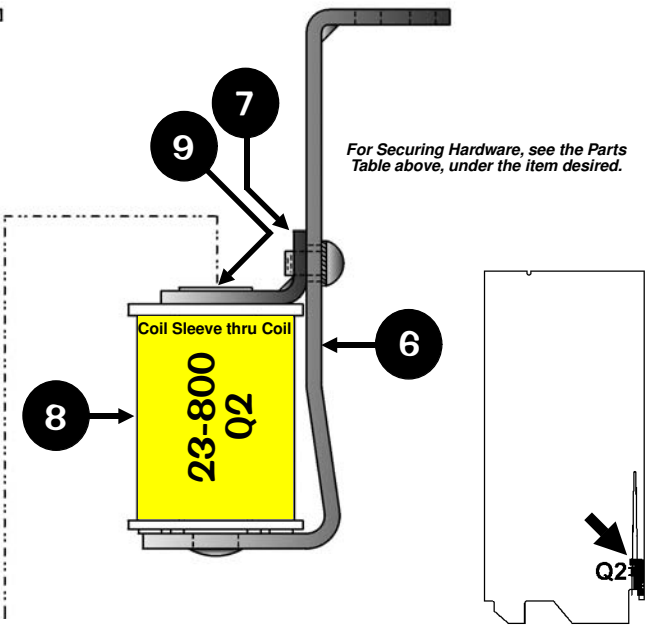
№	'PLUNGER COIL PART NAME	QTY.	SPI PART №
6	Autoplunger Coil Bracket Assembly	1	515-6527-00
	Items 1 & 6 are secured below the P/F by: #8 X 1/2" HWH AB (Zc.) (Qty. 9) (234-5101-00)		
7	Coil Retainer Bracket	1	535-5203-03
	Item 7 is secured to Item 6 by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)		
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
	Ordering Note: If either **500-6091-00** ***or*** **500-6092-03B** *are 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 & may differ on game.*

Ordering Note: *For* ***Items 1-5*** *assembled, use the Assembly Part Number,* ***500-6091-00****. For* ***Items 6-9*** *assembled, use the Assembly PN,* ***500-6092-03B****; or order the individual part(s) actually required.*





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

Ordering Note: Identical to 500-6318-14 with excepttions, see note below Item 13 (Parts Table).

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Ball Trough Outhole Mounting Bracket	1	515-6580-01
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 6) (234-5101-00)		
2	Micro Switch **(Roller Actuator, Lite-Force)**	3	180-5119-02
	Item 2 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	Sw. Body Protect Plate *Not Required*	0	535-6539-00
4	Coil Mounting Bracket	1	535-7330-01
	Item 4 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Sr.) Zinc (Qty. 4) (237-5975-00)		
5	Coil Retaining Bracket	1	535-5203-03
	Item 5 is secured to Item 4 by: #8-32 X 1/4" HWH MS (Serr) Zinc (Qty. 2) (237-5964-01)		
6	Coil, 26-1200	1	090-5044-00B
	Coil has a Diode (1N4004) (112-5003-00) positioned @ bot (below lugs opposite windings).		
7	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
8	Plunger Assembly	1	515-5941-01
	For Individual Items use : Plunger (**530-5210-00**) & Nylon Plunger (**530-5277-01**)		
9	Compression (Return) Spring	1	266-5020-00
10	Rubber Bumper (Grommet)	1	545-5105-00
11	Trough Ball Guide Plate	1	535-7801-00
	Item 11 is secured to Item 1 by: 1/4" X 5/16" X .144" I.D. Spacer Tap. (Qty. 1) (254-5014-03) **and** #2-56 X 1/2" HWH (Ser) UNS #4HD TR3 BO (Qty. 4) (237-5937-02)		
12	Dual OPTO TRANS Board Assembly	1	515-0173-00
13	Dual OPTO REC Board Assembly	1	515-0174-00
	Items 12 & 13 are by: #6-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 3/per) (237-5976-04)		
	For Individual Items use : Dual OPTO 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**)		

Ordering Note: If **500-6318-24** *is unavailable*, order the individual part(s) actually required. This assembly is identical to **500-6318-14**, **-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 not required when using **Item 11** *(req. for Magnet use).*

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

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

Take Note:

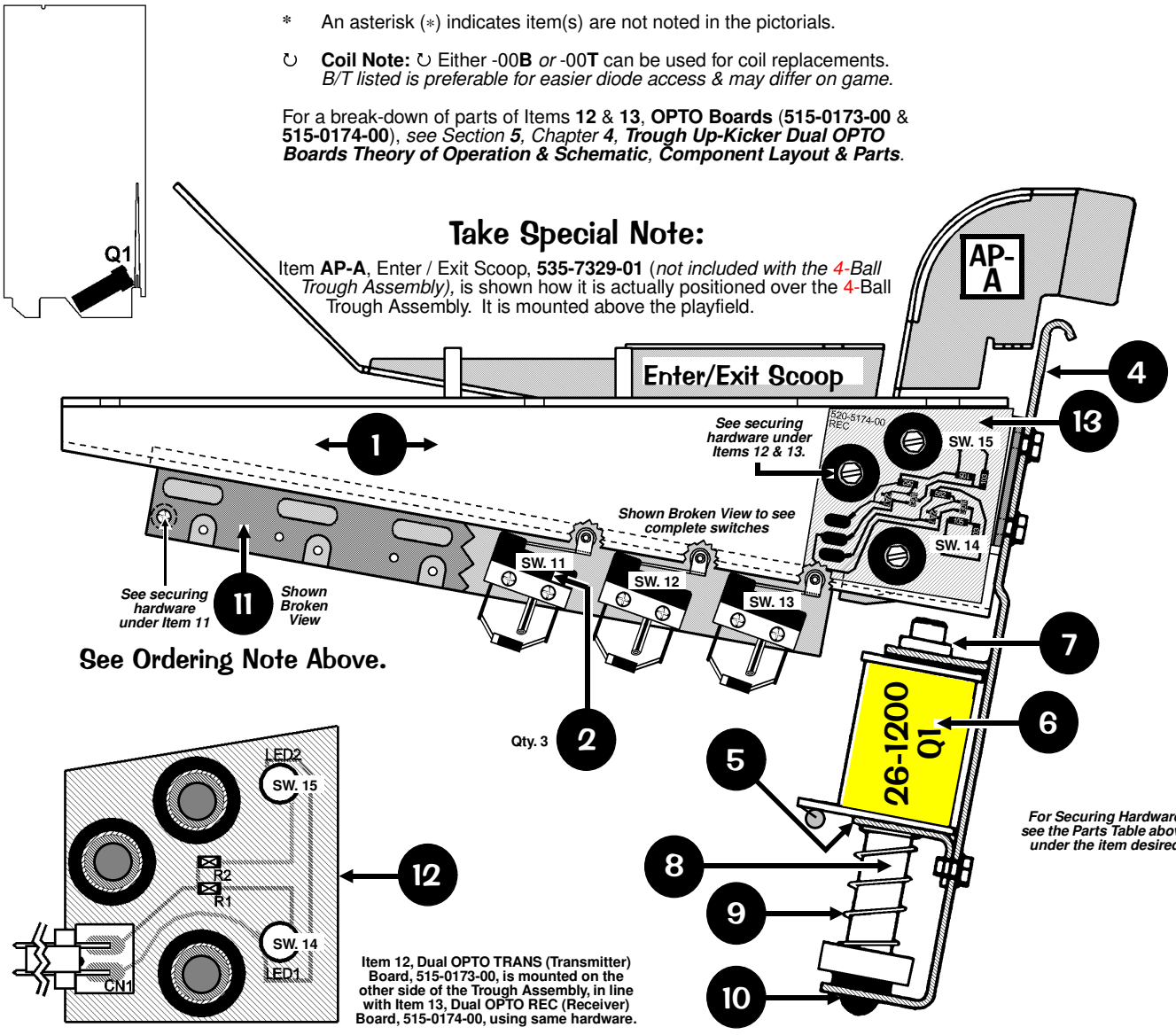
* An asterisk (*) indicates item(s) are not noted in the pictorials.

↻ **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: Yellow Flipper Bat & Shaft Assy., 515-5133-06-06 (Item AP-A/-B)

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Flipper Base Plate (**LEFT**)	1	**See FRP1**
	Item 1 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00) ***Ordering Note:*** *Use Item **FRP1**, see the end of this Parts Table.*		
2	Flipper Bat Bushing (White Plastic)	1	545-5070-00
	Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)		
3	Power (End of Stroke) Switch	1	180-5149-00
	Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)		
4	Sw. Plate/Spring Return Brkt. (**LEFT**)	1	535-7354-**01**
5	Flipper Return Spring	1	265-5035-00
6	Coil Stop Bracket Sub-Assembly	1	515-6308-01
	Item 6 is secured to Item 1 by: #10-32 X 3/8" SHWH Swage (Serr) Zinc (Qty. 2) (237-5985-00) **and** #10 Split Lock Washer (Qty. 2) (244-5003-00)		
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
8	Coil Support Bracket	1	535-7356-00
	Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)		
9	Coil, 22-1080 (YEL-GRN) (Left)	1	090-5032-00T
	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 with "Flat" (**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** Spirol Pin ø 5/32" X 3/4" Lg. (Qty. 1) (251-5015-02)		

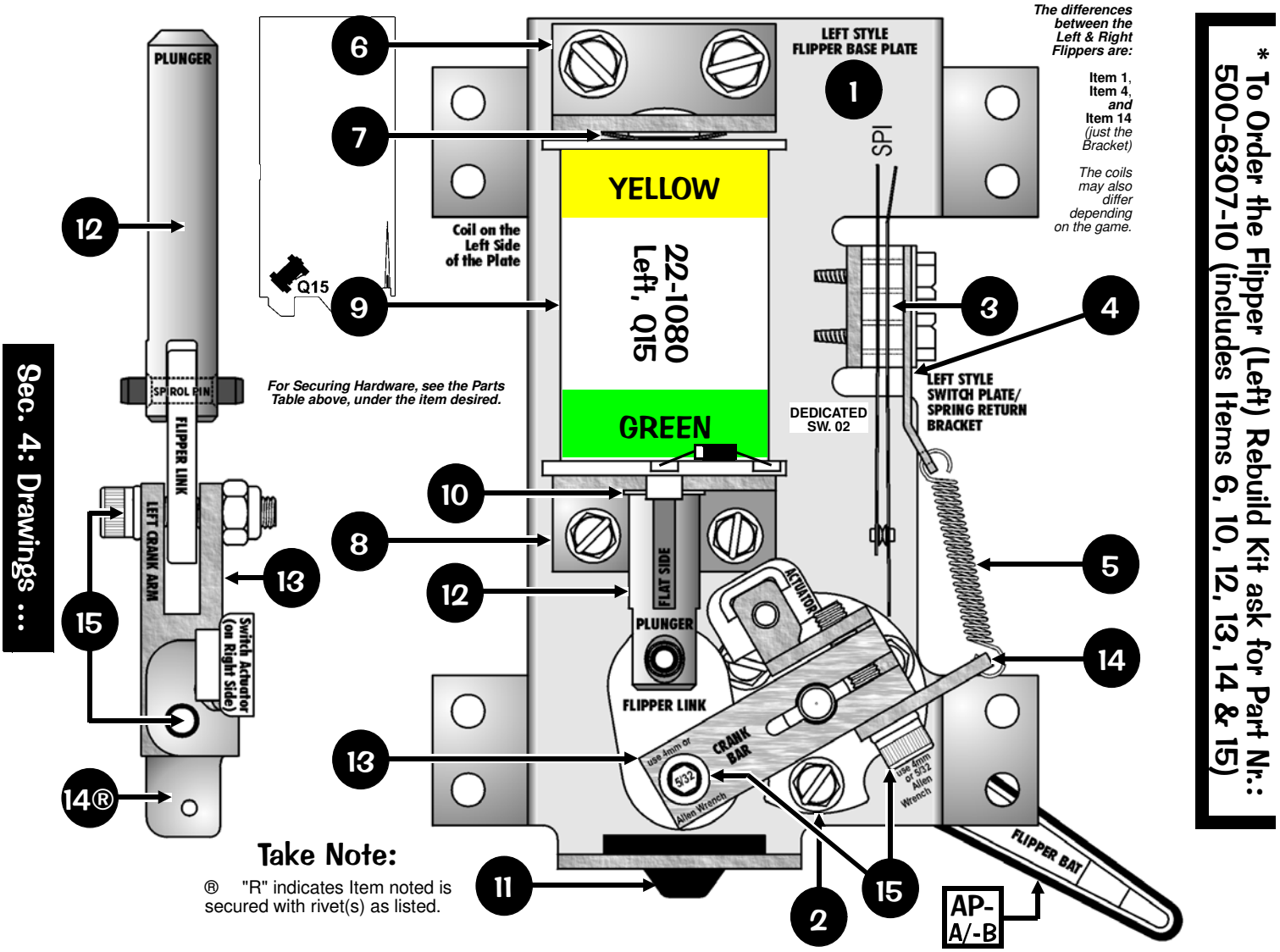
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
13	Crank Bar	1	530-5070-02
	Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)		
14	® Switch Actuator (**LEFT**) Sub-Assy.	1	515-7257-**01**
	For Individual Items use : Actuator & Spring Bracket (**LEFT**) (**530-9038-01**) **and** ® 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) **Tool Required for Item 15: 5/32" or 4mm Allen Wrench**		

Flipper Rebuild Parts for Easier Installation, $ave $:

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

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

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



Take Note:

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

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

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

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Flipper Base Plate (**RIGHT**)	1	**See FRP1**
	Item 1 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00) ***Ordering Note:*** *Use Item **FRP1**, see the end of this Parts Table.*		
2	Flipper Bat Bushing (White Plastic)	1	545-5070-00
	Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)		
3	Power (End of Stroke) Switch	1	180-5149-00
	Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)		
4	Sw. Plate/Spring Return Brkt. (**RIGHT**)	1	535-7354-**00**
5	Flipper Return Spring	1	265-5035-00
6*	Coil Stop Bracket Sub-Assembly	1	515-6308-01
	Item 6 is secured to Item 1 by: #10-32 X 3/8" SHWH Swage (Serr) Zinc (Qty. 2) (237-5985-00) **and** #10 Split Lock Washer (Qty. 2) (244-5003-00)		
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
8	Coil Support Bracket	1	535-7356-00
	Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)		
9	Coil, 22-1080 (YEL-GRN) (Right)	1	090-5032-00T
	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 with "Flat" (**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** Spirol Pin ø 5/32" X 3/4" Lg. (Qty. 1) (251-5015-02)		
13	Crank Bar	1	530-5070-02
	Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)		
14	® Switch Actuator (**RIGHT**) Sub-Assy.	1	515-7257-**00**
	For Individual Items use : Actuator & Spring Bracket (**RIGHT**) (**530-9038-00**) **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)		
	Tool Required for Item 15: 5/32" or 4mm Allen Wrench		

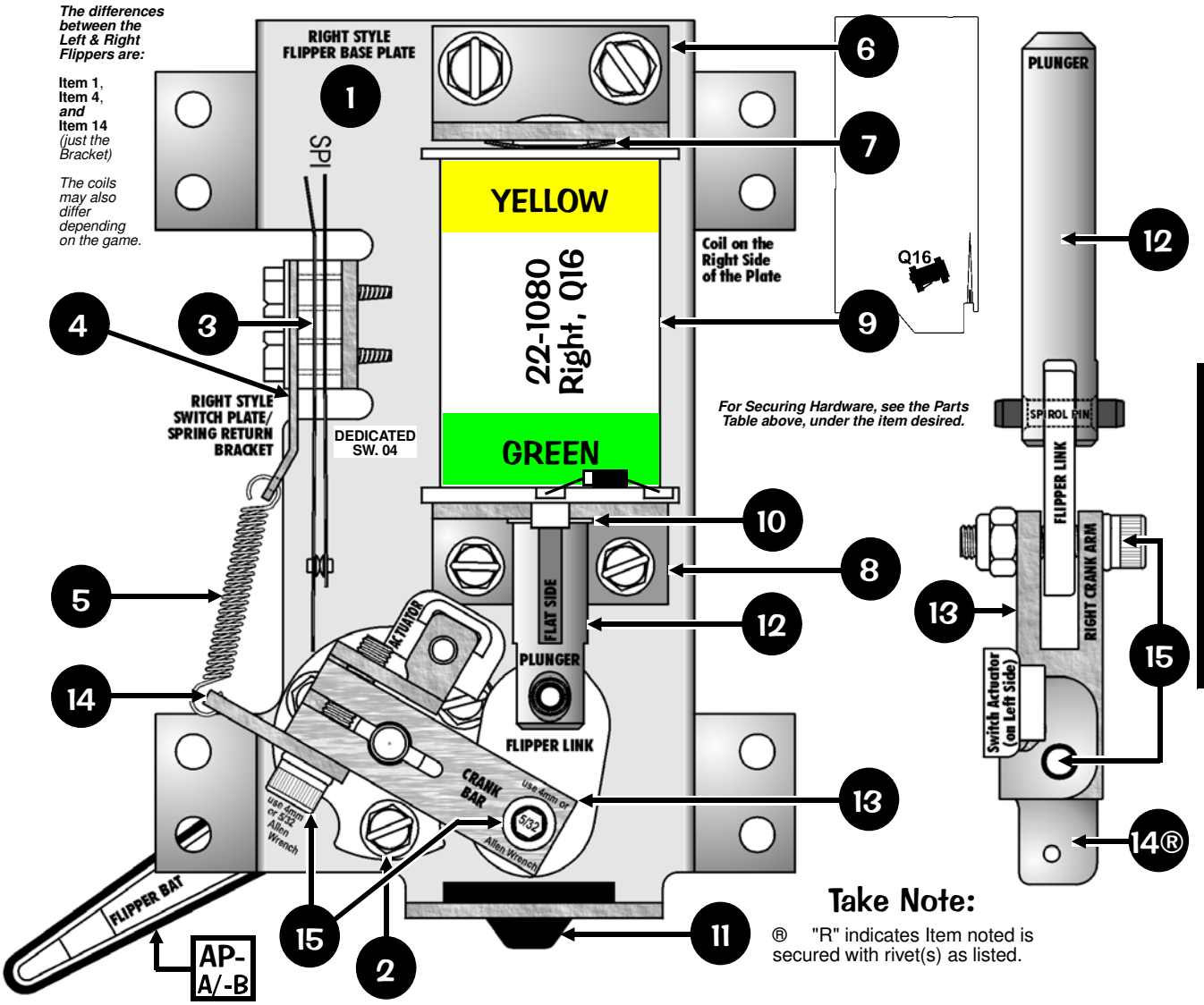
Flipper Rebuild Parts for Easier Installation, $ave $:

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

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

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

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



Take Note:

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

Flipper (Upper Right) Assembly, 500-6543-27 (Items 1-15)
and Assoc. Parts: Yellow Flipper Bat & Shaft Assy., 515-5133-06-06 (Item AP-A/-B)

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Flipper Base Plate (**RIGHT**)	1	**See FRP1**
	Item 1 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00) ***Ordering Note:*** *Use Item **FRP1**, see the end of this Parts Table.*		
2	Flipper Bat Bushing (White Plastic)	1	545-5070-00
	Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)		
3	1/4" X 3/8" Spacer Gray	2	254-5000-02
	Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Sw. (Ser.) Zc. (Qty. 1/per) (237-5976-04)		
4	Sw. Plate/Spring Return Brkt. (**RIGHT**)	1	535-7354-**00**
5	Flipper Return Spring	1	265-5035-00
6*	Coil Stop Bracket Sub-Assembly	1	515-6308-01
	Item 6 is secured to Item 1 by: #10-32 X 3/8" SHWH Swage (Serr) Zinc (Qty. 2) (237-5985-00) **and** #10 Split Lock Washer (Qty. 2) (244-5003-00)		
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
8	Coil Support Bracket	1	535-7356-00
	Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)		
9	Coil, 25-1400 (RED-RED) (Upr. Rt.)	1	090-5067-00T
	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 with "Flat" (**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** Spirol Pin ø 5/32" X 3/4" Lg. (Qty. 1) (251-5015-02)		

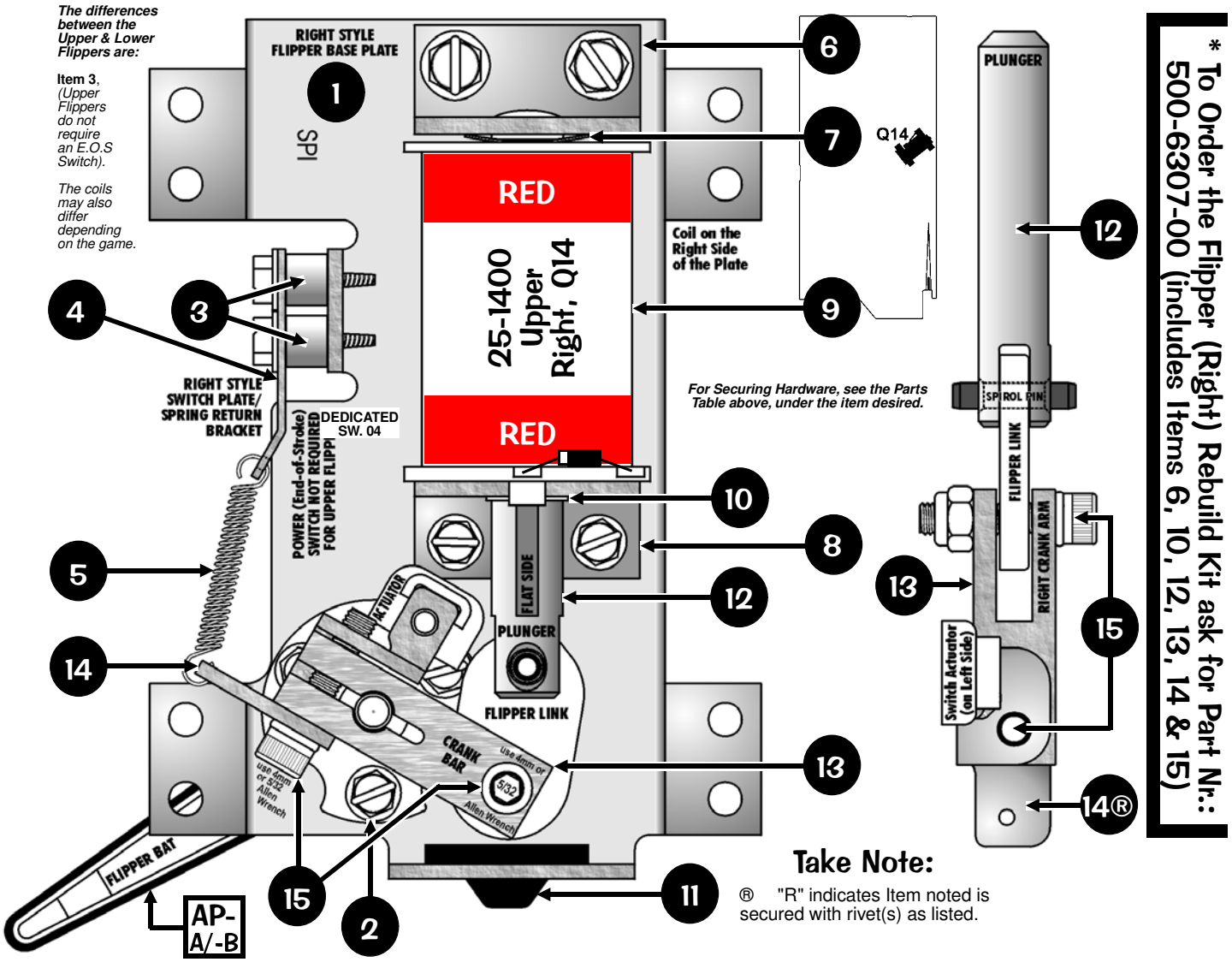
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
13*	Crank Bar	1	530-5070-02
	Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)		
14	® Switch Actuator (**RIGHT**) Sub-Assy.	1	515-7257-**00**
	For Individual Items use : Actuator & Spring Bracket (**RIGHT**) (**530-9038-00**) **and** ® 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) **Tool Required for Item 15: 5/32" or 4mm Allen Wrench**		

Flipper Rebuild Parts for Easier Installation, $ave $:

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

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

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



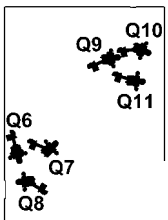
Take Note:

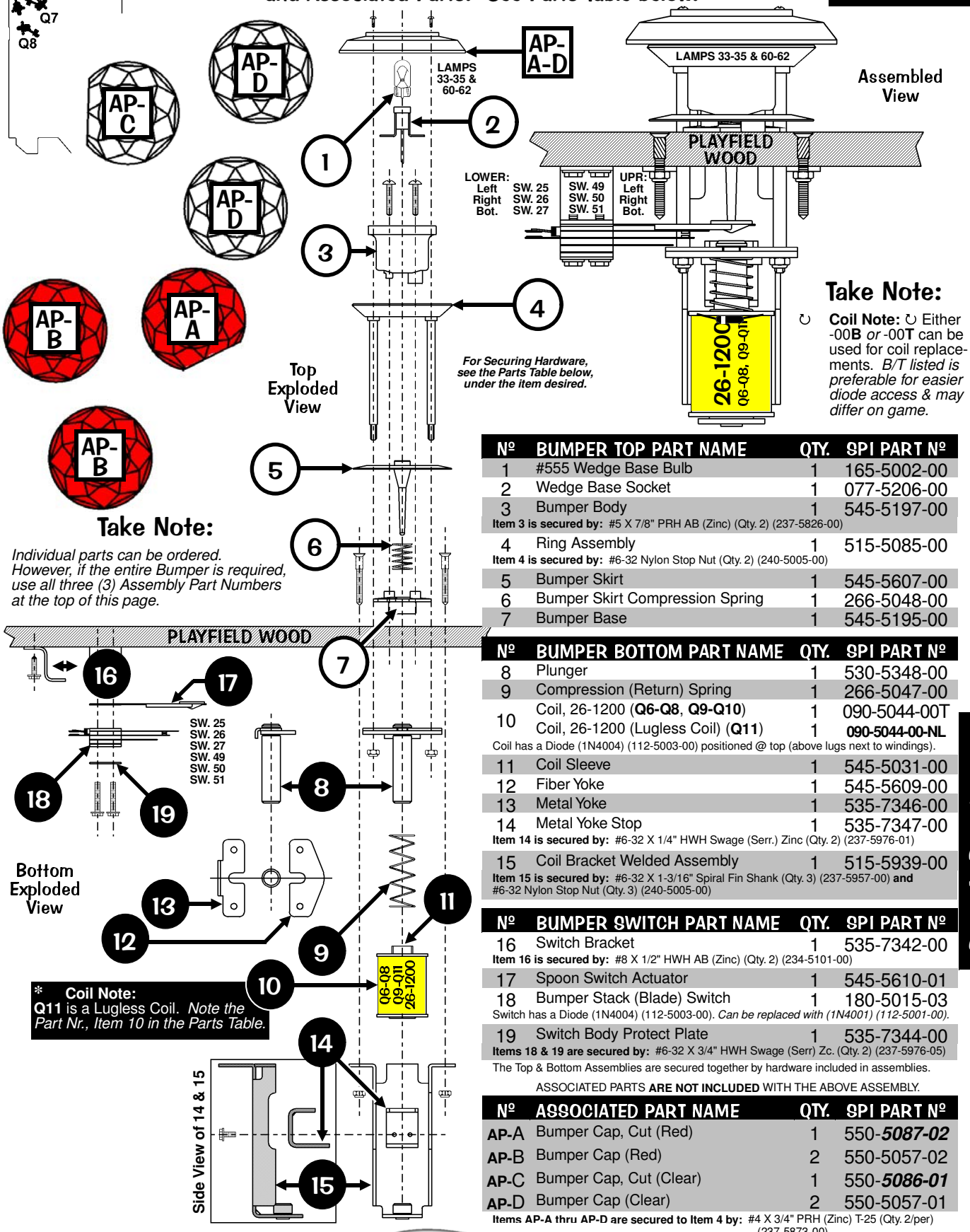
® "R" indicates Item noted is secured with rivet(s) as listed.

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

Bumper Top Assemblies, 515-6459-01 (Qty. 6) (Items 1-5), Bumper Bottom Assy., 515-6459-04* (Qty. 6) (Items 6-13), Bumper Switch Assy., 515-6459-03 (Qty. 6) (Items 14-17) and Associated Parts: See Parts Table below.

*** Coil Note:** **Q11** is a Lugless Coil. *For the Bumper Bottom Assy. with a Lugless Coil use SPI PN:* **515-6459-04-NL**





Take Note:

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

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.*

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

№	BUMPER BOTTOM PART NAME	QTY.	SPI PART №
8	Plunger	1	530-5348-00
9	Compression (Return) Spring	1	266-5047-00
10	Coil, 26-1200 (**Q6-Q8**, **Q9-Q10**)	1	090-5044-00T
	Coil, 26-1200 (Lugless Coil) (**Q11**)	1	**090-5044-00-NL**
	Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).		
11	Coil Sleeve	1	545-5031-00
12	Fiber Yoke	1	545-5609-00
13	Metal Yoke	1	535-7346-00
14	Metal Yoke Stop	1	535-7347-00
	Item 14 is secured by: #6-32 X 1/4" HWH Swage (Serr.) Zinc (Qty. 2) (237-5976-01)		
15	Coil Bracket Welded Assembly	1	515-5939-00
	Item 15 is secured by: #6-32 X 1-3/16" Spiral Fin Shank (Qty. 3) (237-5957-00) **and** #6-32 Nylon Stop Nut (Qty. 3) (240-5005-00)		

№	BUMPER SWITCH PART NAME	QTY.	SPI PART №
16	Switch Bracket	1	535-7342-00
	Item 16 is secured by: #8 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00)		
17	Spoon Switch Actuator	1	545-5610-01
18	Bumper Stack (Blade) Switch	1	180-5015-03
	Switch has a Diode (1N4004) (112-5003-00). *Can be replaced with (1N4001) (112-5001-00).*		
19	Switch Body Protect Plate	1	535-7344-00
	Items 18 & 19 are secured by: #6-32 X 3/4" HWH Swage (Serr) Zc. (Qty. 2) (237-5976-05)		

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

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

№	ASSOCIATED PART NAME	QTY.	SPI PART №
AP-A	Bumper Cap, Cut (Red)	1	550-***5087-02***
AP-B	Bumper Cap (Red)	2	550-5057-02
AP-C	Bumper Cap, Cut (Clear)	1	550-***5086-01***
AP-D	Bumper Cap (Clear)	2	550-5057-01

Items AP-A thru AP-D are secured to Item 4 by: #4 X 3/4" PRH (Zinc) T-25 (Qty. 2/per) (237-5873-00)

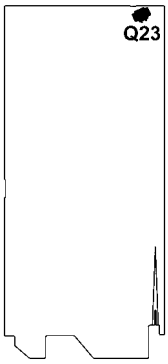
*** Coil Note:** **Q11** is a Lugless Coil. *Note the Part Nr., Item 10 in the Parts Table.*

Ball Deflector Assembly (Upper Right Orbit), 500-6433-00 (Items 1-9)

When energized, it deflects the pinball back down the Right Orbit to the Upper Right Flipper Bat.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Ball Deflector Coil Mounting Bracket	1	535-6857-02
	Item 1 is secured below playfield by: #8 X 1/2" SLT HWH AB (Zc) (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/per) (232-5300-00)		
3	Coil, 26-1200	1	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	545-5076-01
5	Spring Washer, 17/32" ID X 3/4" X 1"	1	269-5002-00
6	Solid Plunger Assembly (Tapered Top)	1	515-7089-00
7	Post Black Rubber (Sleeve Tall)	1	545-5308-00
8	Compression (Relay) Spring	1	266-5022-01
9	#10-32 Adj. Spindle Stop w/Rubber Tip	1	280-5014-00
	Item 9 is secured by: #10-32 Keps Nut (Qty. 1) (240-5208-00)		

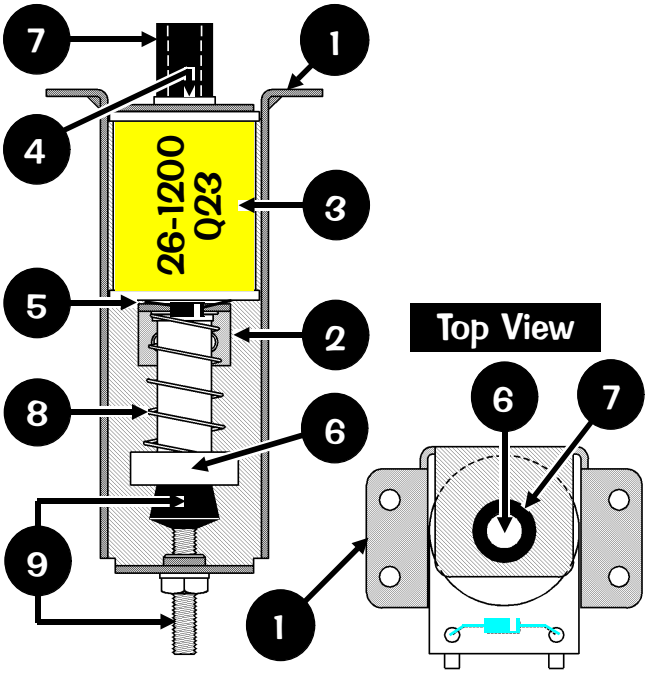
Ordering Note: If **500-6433-00** *is unavailable*, order the individual part(s) actually required. This assembly is identical to **500-5788-XX** with the exception of Item 6, Solid Plunger. Replace Plunger & Coil with above numbers. ***PERIODICALLY CHECK ITEM 7 FOR WEAR.***



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.*

IF CABLE WIRING (SOLDERED ON) IS REQUIRED WITH ASSEMBLY, ADD "-81" (500-6433-00-81). IF ONLY THE CABLE WIRING IS REQUIRED, USE SPI PART NUMBER 036-5493-20-81.

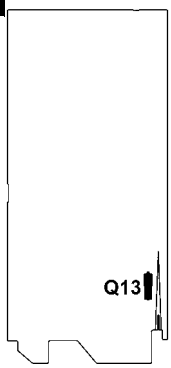


Lock Kicker (Laser Kick) Assembly, 500-5862-00 (Items 1-8)

When energized, it kicks the "locked" pinballs into play.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Coil Mounting Bracket (Frame)	1	535-6730-00
	Item 1 is secured below playfield by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 3) (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/per) (232-5300-00)		
3	Coil, 23-800	1	090-5001-00B
	Coil has a Diode (1N4004) (112-5003-00) positioned @ bot (below lugs opposite 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	Plunger Assembly	1	515-5000-02
7	Compression (Relay) Spring	1	266-5022-01
8	Rubber Bumper (Grommet)	1	545-5105-00

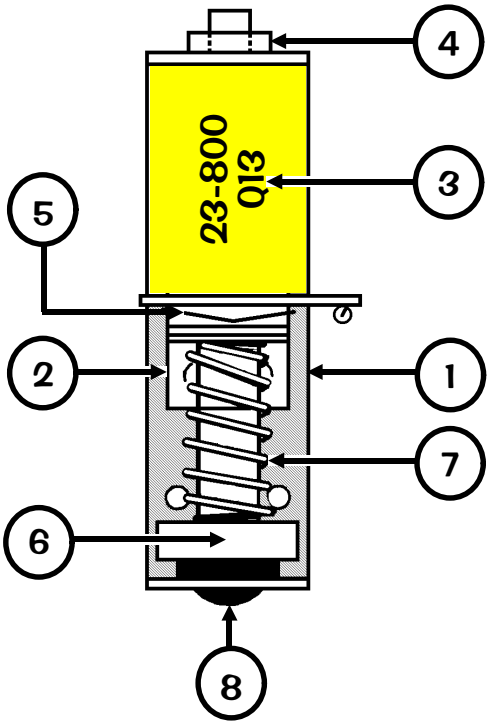
Ordering Note: If **500-5862-00** *is unavailable*, order the individual part(s) actually required. This assembly is identical to 500-5862-**01** (Coil Position: Lugs Face Left) and 500-5862-**02** (Coil Position: lugs face right). *Remove coil and put into same position.*



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.*

IF CABLE WIRING (SOLDERED ON) IS REQUIRED WITH ASSEMBLY, ADD "-81" (500-5862-00-81). IF ONLY THE CABLE WIRING IS REQUIRED, USE SPI PART NUMBER 036-5493-13-81.



Slingshot Assemblies, 500-5849-00 (Qty. 2) (Items 1-9)

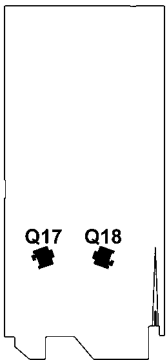
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Slingshot Bracket Assembly	1	515-5339-01
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 3) (234-5101-00)		
2	Coil Retaining Bracket	1	535-5203-03
	Item 2 is secured to Item 1 by: #8-32 X 3/8" PPH MS (Sems) (Qty. 2) (232-5301-00)		
3	Coil, 23-800	1	090-5001-00T
	Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).		
4	Coil Sleeve	1	545-5031-00
5	Plunger & Link Assembly	1	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.		

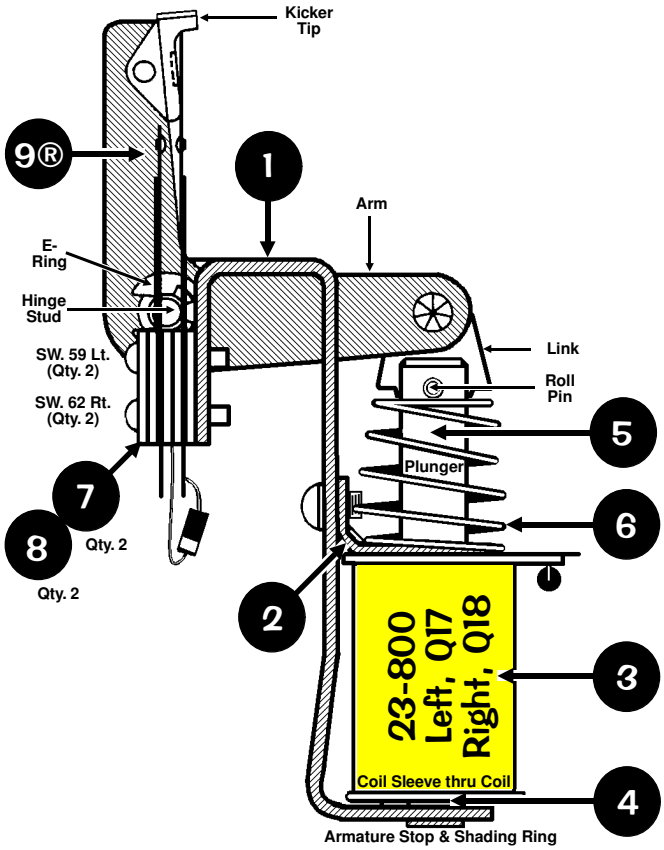
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
6	Compression (Return) Spring	1	266-5020-00
7	Slingshot Stack (Blade) Switch	2	180-5054-00
	Switch has a Diode (1N4004) (112-5003-00). *Can be replaced with (1N4001) (112-5001-00).*		
8	Switch Body Protect Plate	2	535-5045-00
	Items 7 & 8 are secured to Item 1 by: #6-32 X 5/8" HWH Swage (Qty. 4) (237-5976-04)		
9®	Riveted Arm & Tip Assembly	1	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 **500-5849-00** *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 & may differ on game.

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

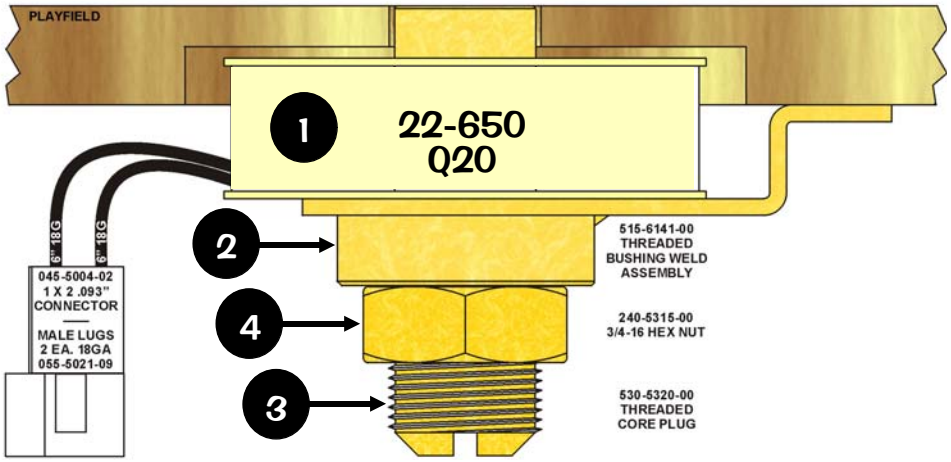


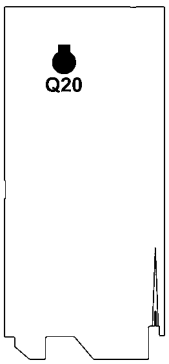


Magnet Coil, Bracket (with Threaded Bushing) and Miscellaneous Parts (Items 1-4)

When energized, holds the ball under the Shrunken Head and then throws it.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Magnet Coil, 22-650 **(6" Leads + Conn.)**	1	500-6791-00
	For Individual Items use : Magnet Coil (22-650) (**090-5042-00**), 1 X 2, .093" Connector Plug 03-09-2022 (**045-5004-02**) **and** Male Lugs 18ga (Qty. 2) (**055-5021-09**)		
2	Bracket, Mag. Core Mount (Threaded Bushing)	1	515-6141-00
	Item 2 is secured to the playfield by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 3) (234-5101-00)		
3	Threaded Core Plug	1	530-5320-00
4	3/4-16 Hex Nut	1	240-5315-00

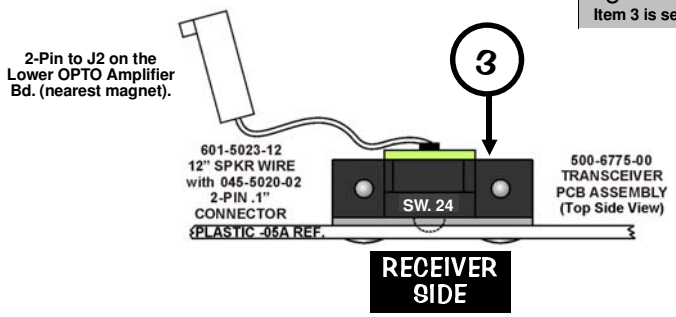




Magnet Coil, Bracket (with OPTO Hole) and Transceiver OPTO PCB (Items 1-3)

When the Dual OPTO Switch is closed, the coil is energized to throw the pinball.

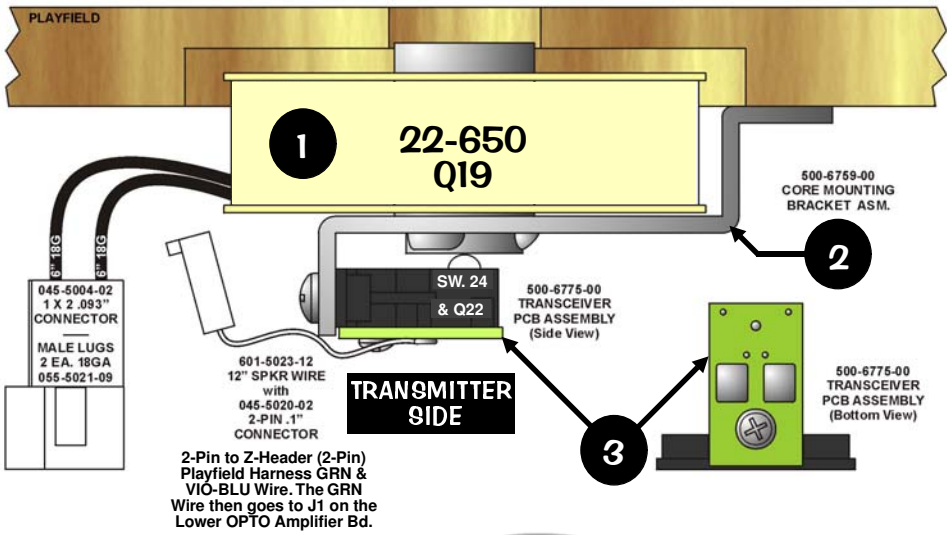
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Magnet Coil, 22-650 **(6" Leads + Conn.)**	1	500-6791-00
	For Individual Items use : Magnet Coil (22-650) (**090-5042-00**), 1 X 2, .093" Connector Plug 03-09-2022 (**045-5004-02**) **and** Male Lugs 18ga (Qty. 2) (**055-5021-09**)		
2	Bracket, Magnet Core Mount (w/ OPTO Hole)	1	515-6141-00
	Item 2 is secured to the playfield by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5101-00)		
3	Transceiver OPTO PCB Assembly	2	500-6775-00
	Item 3 is secured to Item 2 by: #6 X 3/8" PPH (Zinc) Type-25 (Qty. 2) (237-5880-00)		

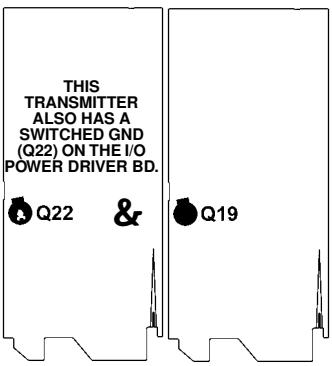


See the inside front cover for an under playfield photo.

Take Note:

For a break-down of parts of Item **3**, **Transceiver OPTO PCB** (**500-6775-00**), *see Section **5**, Chapter **4**, **Printed Circuit Boards** (**YELLOW PAGES**), Pages **142-143**.*





Scoop VUK Assembly, 500-6774-00 (Items 1-11)

When energized, the ball is kicked back out towards player (ball can enter from the front or side).

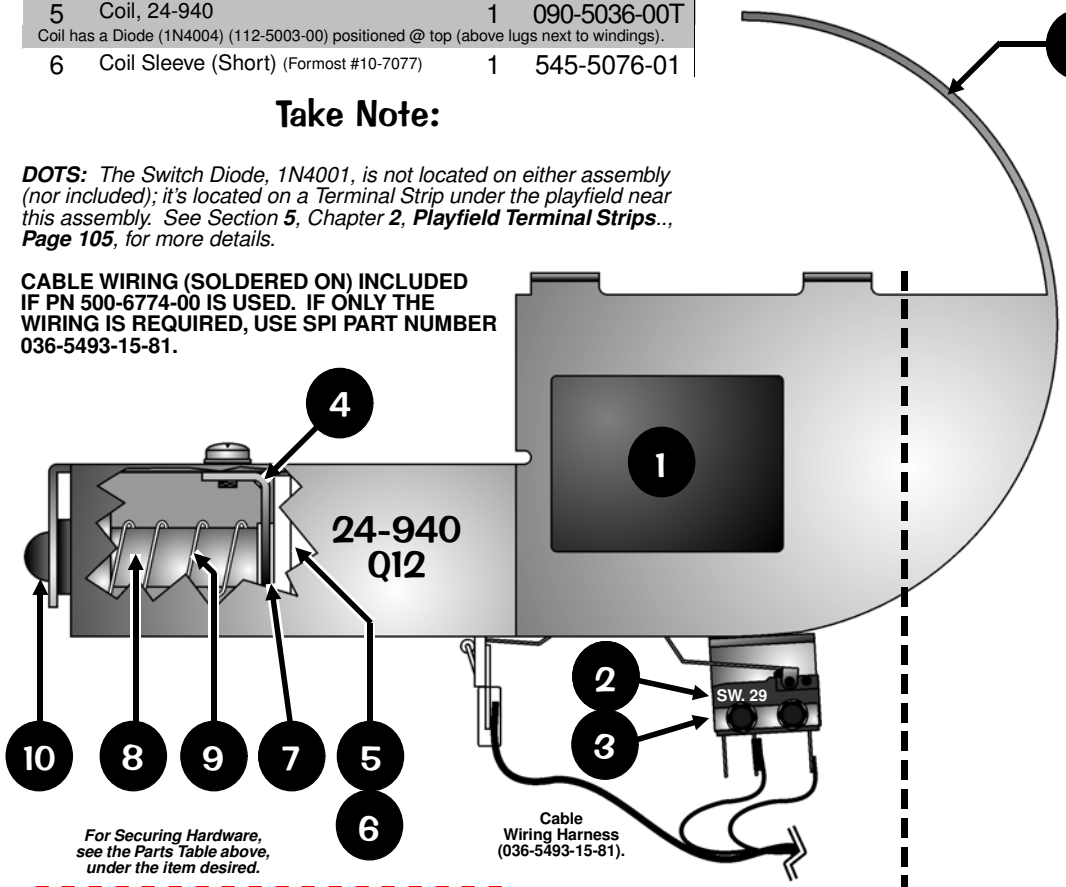
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Scoop / Coil Mounting Bracket (Welded)	1	515-7361-00
	Item 1 is secured below playfield by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 4) (234-5101-00)		
2	Micro Switch (Happ #95-1128-00)	1	180-5183-00
3	Switch Body Protect Plate	1	535-6539-00
	Items 2 & 3 are secured to Item 1 by: #2-56 X 1/2" HWH Ser Black (Qty. 2) (237-5937-02) **and** #2-56 Hex Nut (Qty. 2) (240-5301-00). Switch has Diode (1N4004) (112-5003-00). *Can be replaced with (1N4001) (112-5001-00).*		
4	Coil Retaining Bracket	1	535-5203-03
	Item 4 is secured by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2/per) (232-5300-00)		
5	Coil, 24-940	1	090-5036-00T
	Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).		
6	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
7	Spring Washer, 17/32" ID X 3/4" X 1"	1	269-5002-00
8	Plunger Assembly	1	515-5000-02
9	Compression (Relay) Spring	1	266-5020-00
10	Rubber Bumper (Grommet)	1	545-5105-00
11	***Kit:*** Decals (Screened) **-21**	1	802-5000-81
	Note: *Individual Decal (-21) is not available individually, ordering of kit is required. For all pieces, see* ***Playfield - Plastics (Screened & Clear) & Decals****, Page* ***67****.*		

Ordering Note: If **500-6774-00** *is unavailable*, order the individual part(s) actually required.

Take Note:

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

CABLE WIRING (SOLDERED ON) INCLUDED IF PN 500-6774-00 IS USED. IF ONLY THE WIRING IS REQUIRED, USE SPI PART NUMBER 036-5493-15-81.

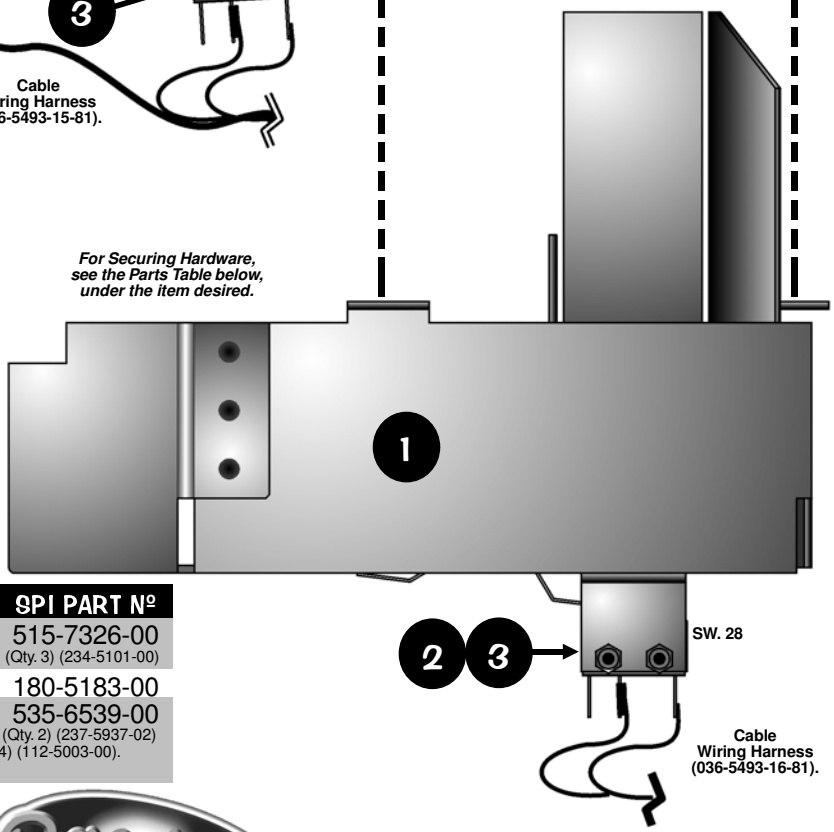


Side Scoop (Trough) Assy., 500-6713-00 (Items 1-3)

Take Note:

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

CABLE WIRING (SOLDERED ON) INCLUDED IF PN 500-6713-00 IS USED. IF ONLY THE WIRING IS REQUIRED, USE SPI PN. 036-5493-16-81.



№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Side Scoop Bracket (Welded)	1	515-7326-00
	Item 1 is secured below playfield by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 3) (234-5101-00)		
2	Micro Switch (Happ #95-1128-00)	1	180-5183-00
3	Switch Body Protect Plate	1	535-6539-00
	Items 2 & 3 are secured to Item 1 by: #2-56 X 1/2" HWH Ser Black (Qty. 2) (237-5937-02) **and** #2-56 Hex Nut (Qty. 2) (240-5301-00). Switch has Diode (1N4004) (112-5003-00). *Can be replaced with (1N4001) (112-5001-00).*		

Vari-Target Assembly, 515-7322-00 (Items 1-10)

Works in conjunction with the Vari-VUK (see next page) which is secured to the side.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Main Frame (Vari-Target Housing)	1	535-9308-00
	Item 1 is secured below playfield by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5101-00)		
2	Bracket, Target Stop (Front)	1	535-9312-00
	Item 2 is secured to Item 1 by: #8-32 X 1/2" SLT Ser HWH (Zinc) (Qty. 1) (237-5975-01) #8 Washer 1/4" ID X 7/8" OD X 1/8" (Qty. 1) (242-5015-01) **and** #8-32 Keps Nut (Qty. 1) (240-5104-00)		
3	Bracket, Target Stop (Back)	1	535-9317-00
	Item 3 is secured to Item 1 by: #8-32 X 3/8" SLT Ser HWH (Zinc) (Qty. 3) (237-5975-00)		
4®	Vari-Target Arm Riveted Assembly	1	515-7323-00
	For Individual Items use : Target Arm (No Parts) (**535-9309-00**), Hub (**530-5644-00**), OPTO Interrupter Single Blade (**535-9310-00**), OPTO Intrerupter Double Blade (**535-9311-00**), Rivet, 1/8" ø X 3/16" Lg. (Qty. 2) (**249-5001-00**) *<Secures Interrupters to Target Arm* **and** Rivet, 1/8" ø X 1/4" Lg. (Qty. 2) (**249-5003-00**) *<Secures Hub to Target Arm*		
	Item 4® is secured by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)		
5	Bracket, OPTO PCB Mount	1	535-9316-00
	Item 5 is secured to Item 1 by: #8-32 X 3/8" SLT Ser HWH (Zinc) (Qty. 2) (237-5975-00)		
6	Bracket, Mini-Coil Mount	1	535-9313-00
	Item 6 is secured to Item 1 by: #8-32 X 3/8" SLT Ser HWH (Zinc) (Qty. 2) (237-5975-00)		
7	Mini-Coil & Bracket Assembly	1	515-7329-00
	For Individual Items use : Mini-Coil, 32-1800 No Diode (**090-5031-00-ND**), Coil Armature (**535-9314-00**), Hanger Plate Frame (**535-6198-00**), Spring (**265-5024-00**)		
	Item 7 is secured to Item 6 by: #8-32 X 3/8" SLT Ser HWH (Zinc) (Qty. 1) (237-5975-00)		

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
8	3-Switch U-Shaped OPTO PCB	1	520-5234-00
	Item 8 is secured to Item 5 by: #8-32 X 3/8" SLT Ser HWH (Zinc) (Qty. 2) (237-5975-00)		
9	Spring, Target Return	1	265-5003-00
	Item 9 is secured onto Item 4 and onto Item 1 by: #6-32 X 1-3/16" Spiral Fin Shank Screw (Qty. 1) (237-5975-00) ***through a*** 1/2" X 1/4" Hex Spacer #6-32 Tap (254-5008-03) **and secured with** a #6-32 Keps Nut (Qty. 1) (240-5008-00)		
10	***Kit:*** Decals (Screened) ***-97***	1	802-5000-81
	Note: *Individual Decal (-97) is not available individually, ordering of kit is required. For all pieces, see* ***Playfield - Plastics (Screened & Clear) & Decals****, Page* ***67****.*		
	Ordering Note: If **515-7322-00** *is unavailable*, order the individual part(s) actually required.		

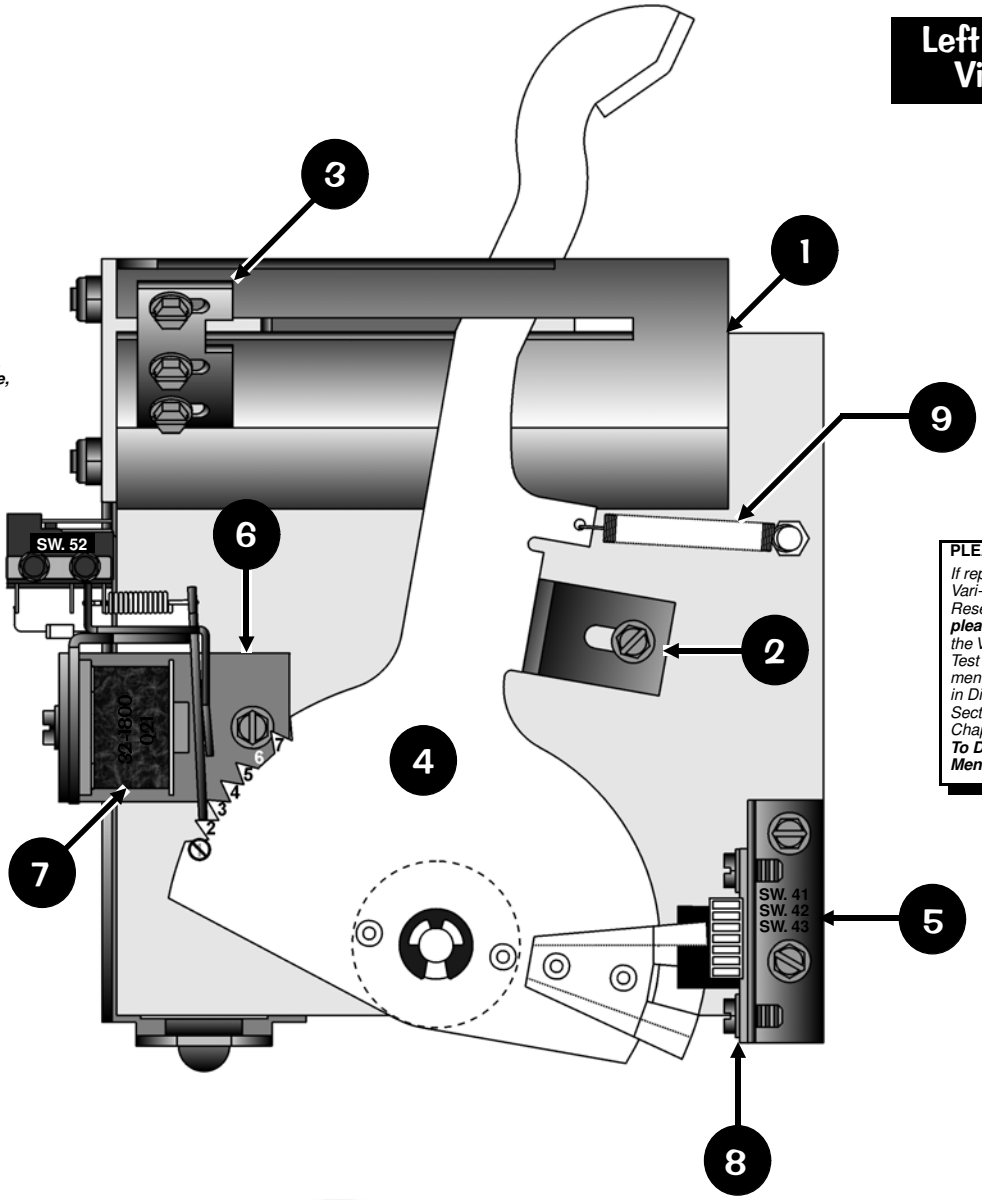
Take Note:

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

For a break-down of parts of Item **8**, **3-Switch U-Shaped OPTO PCB** (**520-5234-00**), *see Section **5**, Chapter **4**, **Printed Circuit Boards** (**YELLOW PAGES**), Page **148**.*

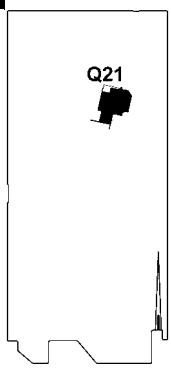
IF ONLY THE CABLE WIRING IS REQUIRED, USE SPI PART NUMBER 036-5493-17-81 (FOR BOTH THE VARI-TARGET & VARI-VUK ASSEMBLIES).

Left Side View



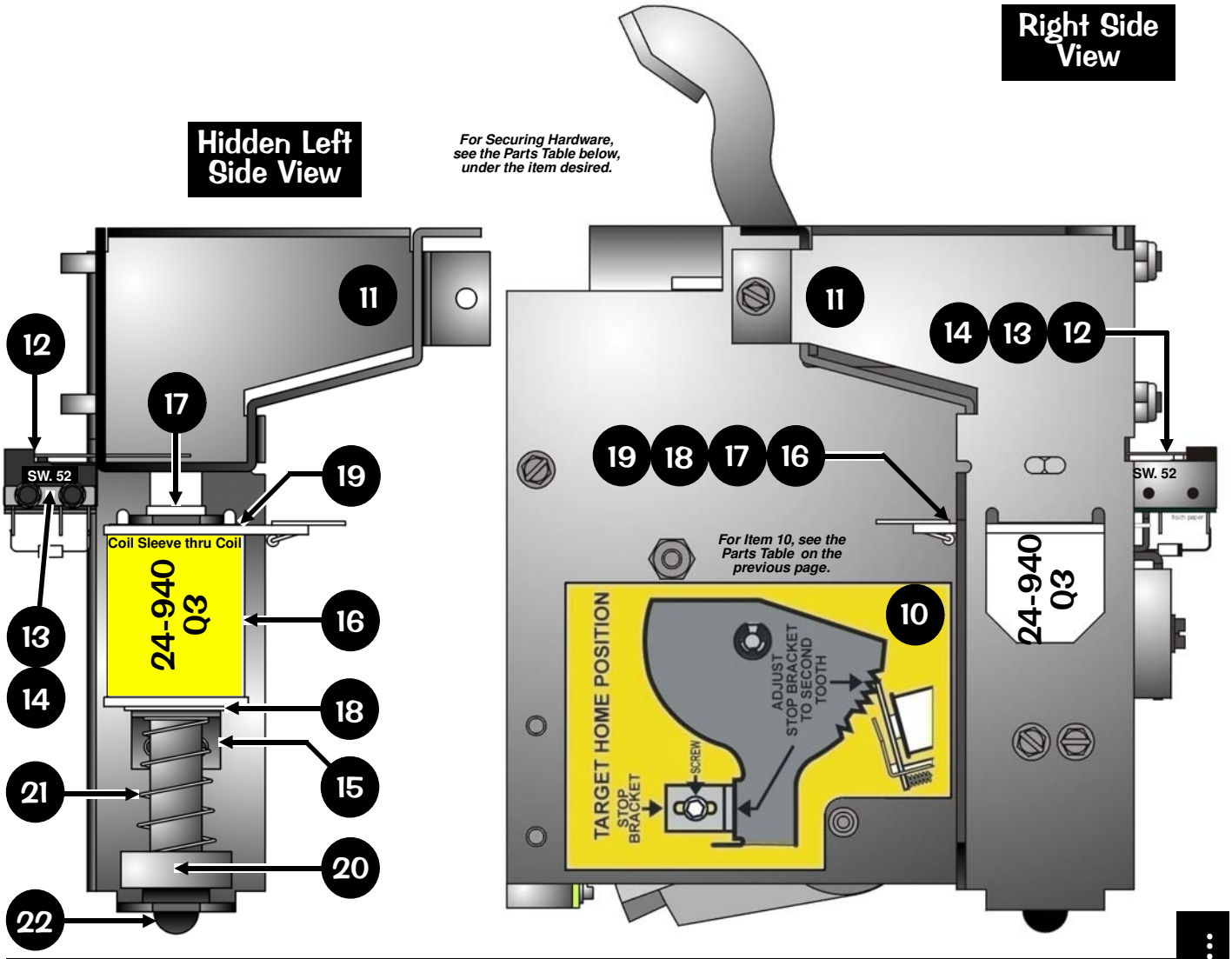
For Securing Hardware, see the Parts Table above, under the item desired.

PLEASE NOTE:
*If replacing the Vari-Target or Reset Coil, **please review** the Vari-Target Test & Adjustment Procedure in Diagnostics, Section **3**, Chapter **2**, **Go To Diagnostics Menu**, Page **28**.*



Vari-VUK (Popper) Assembly, 515-7325-00 (Items 11-22)

Works in conjunction with the Vari-Target (see previous page). Also shown separated for clarity.



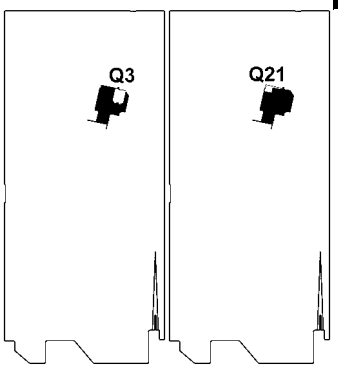
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
11	Bracket, Vari-VUK (Popper)	1	535-9318-00
	Item 11 is secured to Item 1 (previous page) by: #8-32 X 3/8" SLT Ser HWH (Zinc) (Qty. 2) (237-5975-00) **and** #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00)		
	Item 11 is secured below playfield by: #8 X 1/2" SLT HWH AB (Zc.) (Qty. 2) (234-5101-00)		
12	Micro Sw. "Y" (Happ #95-0418-00)	1	180-5116-01
13	Fische Paper (Switch Insulator)	1	545-5759-00
14	Switch Body Protect Plate	1	535-6539-00
	Items 12-14 are secured to Item 1 by: #2-56 X 1/2" HWH Ser Black (Qty. 2) (237-5937-02) **and** #2-56 Hex Nut (Qty. 2) (240-5301-00). Switch has Diode (1N4004) (112-5003-00). *Can be replaced with (1N4001) (112-5001-00).*		
15	Coil Retaining Bracket	1	535-5203-03
	Item 15 is secured to Item 11 by: #8-32 X 1/4" SLT Ser HWH (Zinc) (Qty. 2) (237-5975-04)		
16	Coil, 24-940	1	090-5036-00T
	Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).		
17	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
18	Spring Washer, 17/32" ID X 3/4" X 1"	1	269-5002-00
19	Fische Paper (Coil Insulator)	1	545-5431-00
20	Plunger Assembly	1	515-5941-01
	For Individual Items use : Plunger (**530-5210-00**) & Nylon Plunger (**530-5277-01**)		
21	Compression (Relay) Spring	1	266-5020-00
22	Rubber Bumper (Grommet)	1	545-5105-00
	Ordering Note: If **515-7325-00** *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 & may differ on game.*

IF ONLY THE CABLE WIRING IS REQUIRED, USE SPI PART NUMBER 036-5493-17-81 (FOR BOTH THE VARI-TARGET & VARI-VUK ASSEMBLIES).



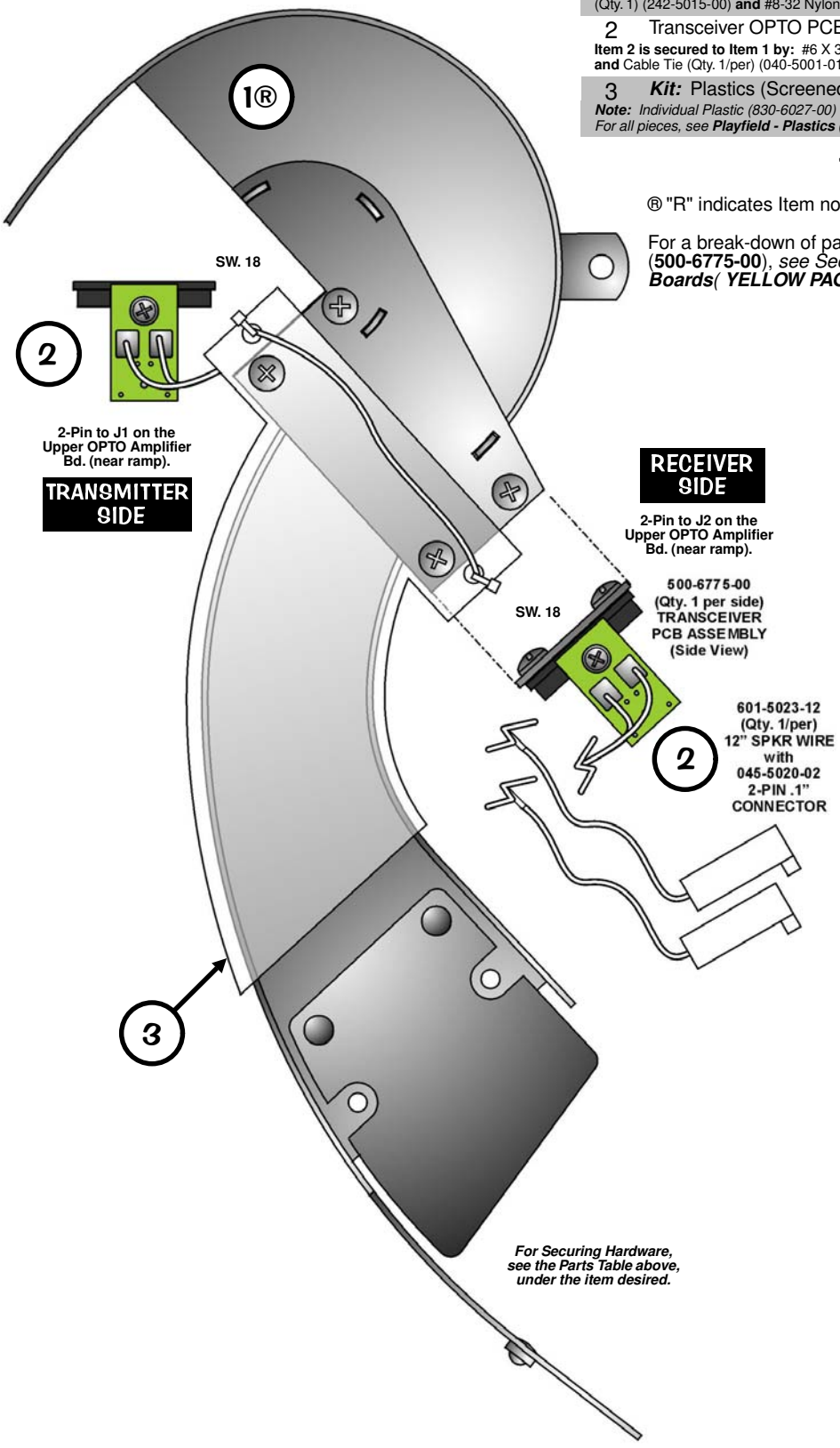
Steel (Metal) Ramp Individual Parts Only (Items 1-3)

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1®	Steel (Metal) Ramp Riveted Asm.	1	515-7328-00
	For Individual Items use : Steel Ramp Welded Asm. (No Parts) (**515-7327-00**), Ramp Flap (**535-9337-00**) **and** Rivet, 1/8" ø X 3/16" Lg. (Qty. 2) (**249-5001-00**).		
	Item 1 is secured above the playfield @ flap by: #4 X 5/8" PFH (Black) (Qty. 2) (237-5833-00) **and @ back tab by:** #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5101-00) **and is secured below the playfield @ pem by:** #8 Washer .17" ID X 1/2" OD X .042" THK (Qty. 1) (242-5015-00) **and** #8-32 Nylon Stop Nut (Qty. 1) (240-5102-00)		
2	Transceiver OPTO PCB Assembly	2	500-6775-00
	Item 2 is secured to Item 1 by: #6 X 3/8" PPH (Zinc) Type-25 (Qty. 2/per) (237-5880-00) **and** Cable Tie (Qty. 1/per) (040-5001-01)		
3	***Kit:*** Plastics (Screened & Clear) **-00**	1	803-5000-81
	Note: *Individual Plastic (830-6027-00) is not available individually, ordering of kit is required. For all pieces, see* ***Playfield - Plastics (Screened & Clear) & Decals****, Page* ***67****.*		

Take Note:

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

For a break-down of parts of Item **2**, **Transceiver OPTO PCB** (**500-6775-00**), *see Section* ***5****, Chapter* ***4****,* ***Printed Circuit Boards****(* ***YELLOW PAGES*** *), Pages* ***142-143****.*

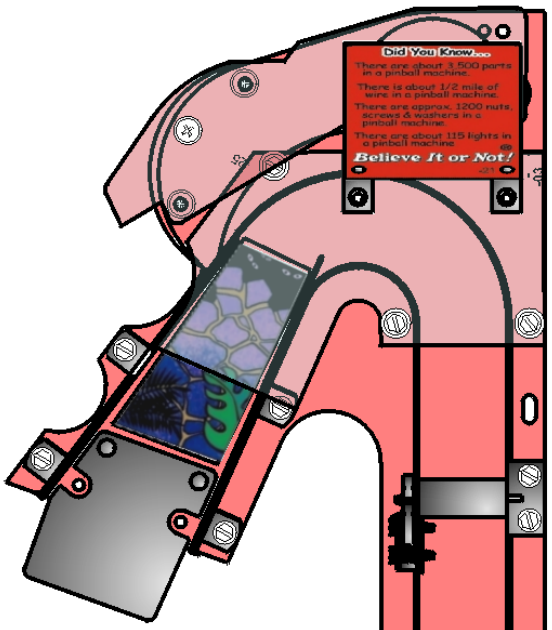


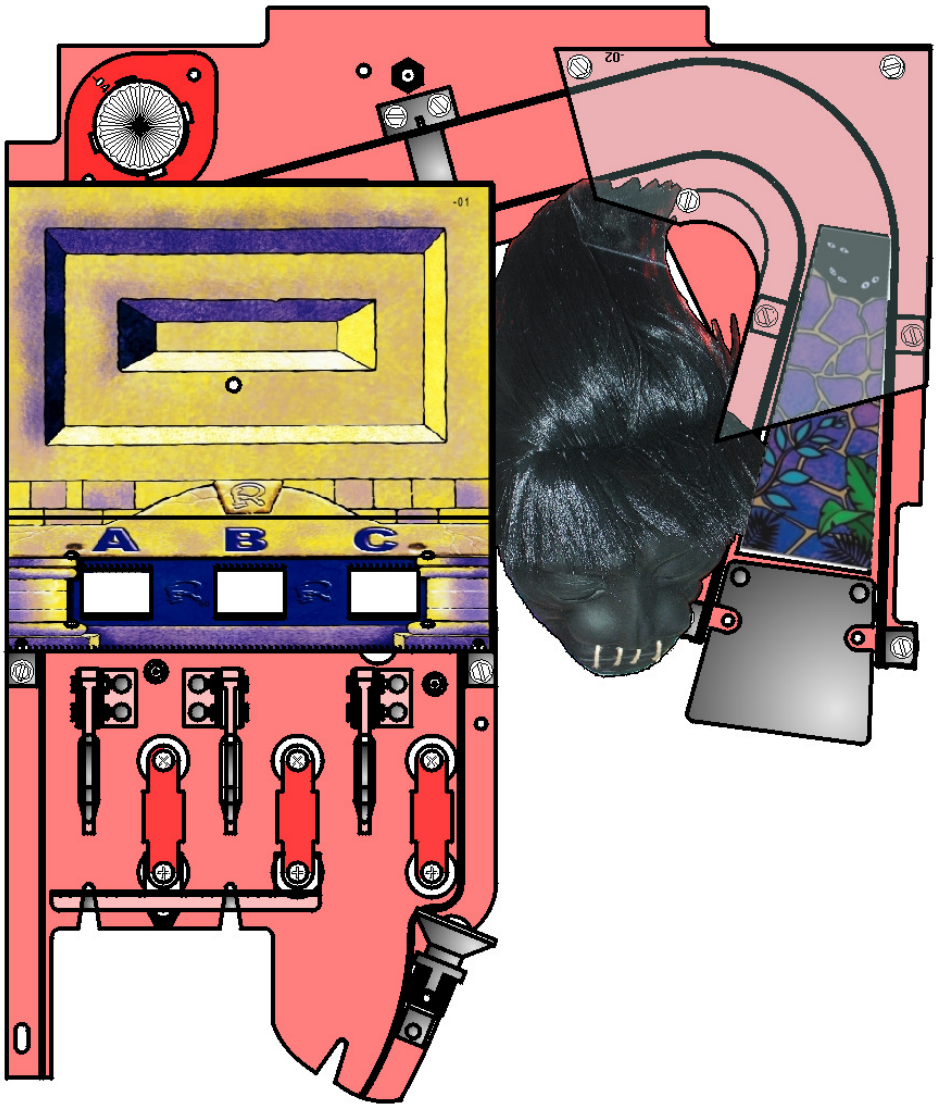
Plastic (Left & Right) Ramps Overview

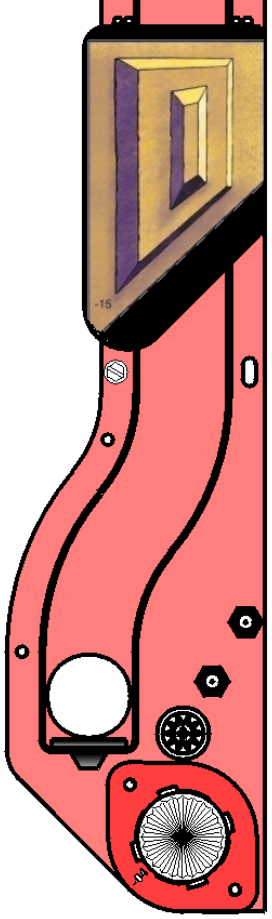
The drawings on this page show the Plastic Ramps assembled and "solid". For a breakdown of parts on the **Left Plastic Ramp**, see Pages **90-91**. For a breakdown of parts on the **Right Plastic Ramp**, see Pages **92-93**. For **Wire Ramps**, see Page **94**. For a breakdown of parts on the **Shrunken Head**, see Page **95**.

Ordering Note: *Plastic Pieces and Decals shown are for reference only. Plastics & Decals are not available individually. The entire Plastics Kit or Decals Kit needs to be ordered. For the Plastics Kit use SPI Part Number* ***803-5000-81****. For the " X3 Dot Display Cover, with brackets " on the Left Ramp use SPI Part Nr.* ***803-5001-81****. For the Decals Kit use SPI Part Nr.* ***802-5001-81****.*

The Plastic Ramps cannot be ordered assembled. Only order the parts required. Drilling out of rivets may be necessary ***(replace with appropriate sized screw and nut).***





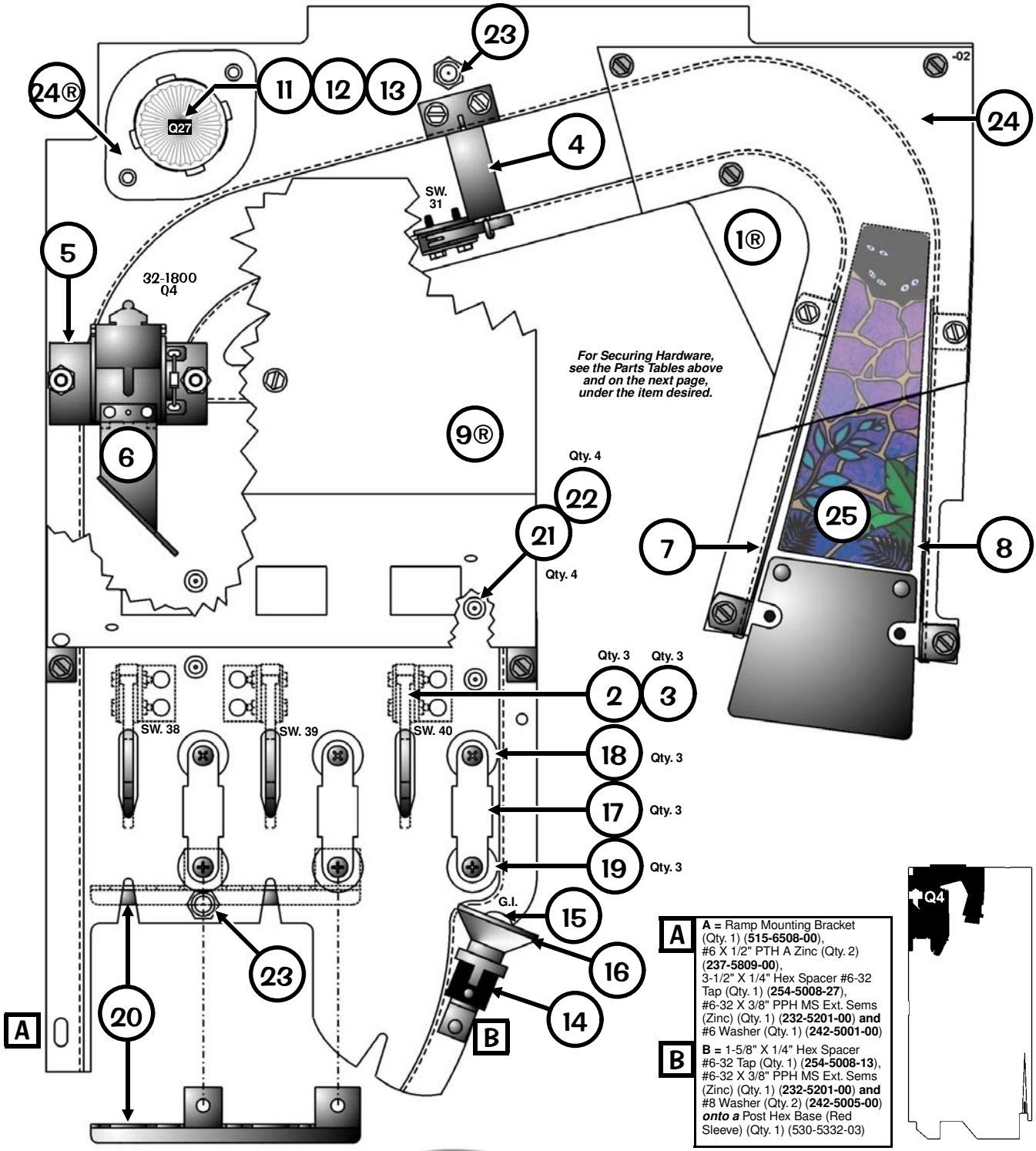


Left Plastic Ramp Individual Parts Only (Items 1-25)

Parts Table and Views continued on the next page.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1®	Left Plastic Ramp Riveted Assembly	1	**515-7320-00R**
	For Individual Items use : Left Plastic Ramp (No Parts) (**545-6089-00**), Ramp Flap (**535-9300-00**), Switch Bracket (Qty. 3) (**535-61373-00**), #6 Lock Washer (Qty. 8) (**246-5000-00**) **and** Rivet, 1/8" ø X 3/16" Lg. (Qty. 8) (**249-5001-00**).		
	Item 1 is secured above the playfield @ flap by: #4 X 5/8" PFH (Black) (Qty. 2) (237-5833-00) **and @ front exit by:** *see below Ref.* ***A*** *&* ***B***.		
2	Micro Switch (Happ #95-1128-00)	3	180-5183-00
3	Switch Body Protect Plate	3	535-6539-00
	Items 2 & 3 are secured by: #2-56 X 1/2" HWH Ser Black (Qty. 2/per) (237-5937-02) **and** #2-56 Hex Nut (Qty. 2/per) (240-5301-00). Switch has Diode (1N4004) (Qty. 1/per) (112-5003-00). *Can be replaced with (1N4001) (112-5001-00).*		
4	Ramp Gate Switch (Left)	1	500-6593-01
	For Individual Items use : Gate Bracket (Left) (**535-9171-01**), Wire Form (**535-9172-00**), Micro Switch (Qty. 1) (**180-5190-28**), #2-56 X 1/2" HWH Ser Black (Qty. 2) (**237-5937-02**), Switch Body Protect Plate (Qty. 1) (**535-6539-00**), #2-56 Hex Nut (Qty. 2) (240-5301-00), Switch Diode (1N4004) (Qty. 1) (**112-5003-00**)		
	Item 4 is secured to Item 1 by: #8-32 X 3/8" SLT HWH MS (Zinc) (Qty. 2) (237-5868-00) **and** #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00)		
5	Bracket, Mini-Coil Mount (Plate Divtr.)	1	535-9437-00
	Item 5 is secured to Item 1 by: #8-32 X 5/8" SLT Ser HWH (Zinc) (Qty. 2) (237-5975-03) **and** #8-32 Hex Nut *(between Plate & Ramp)* (Qty. 2) (240-5103-00)		

Parts Table continued on top of next page.



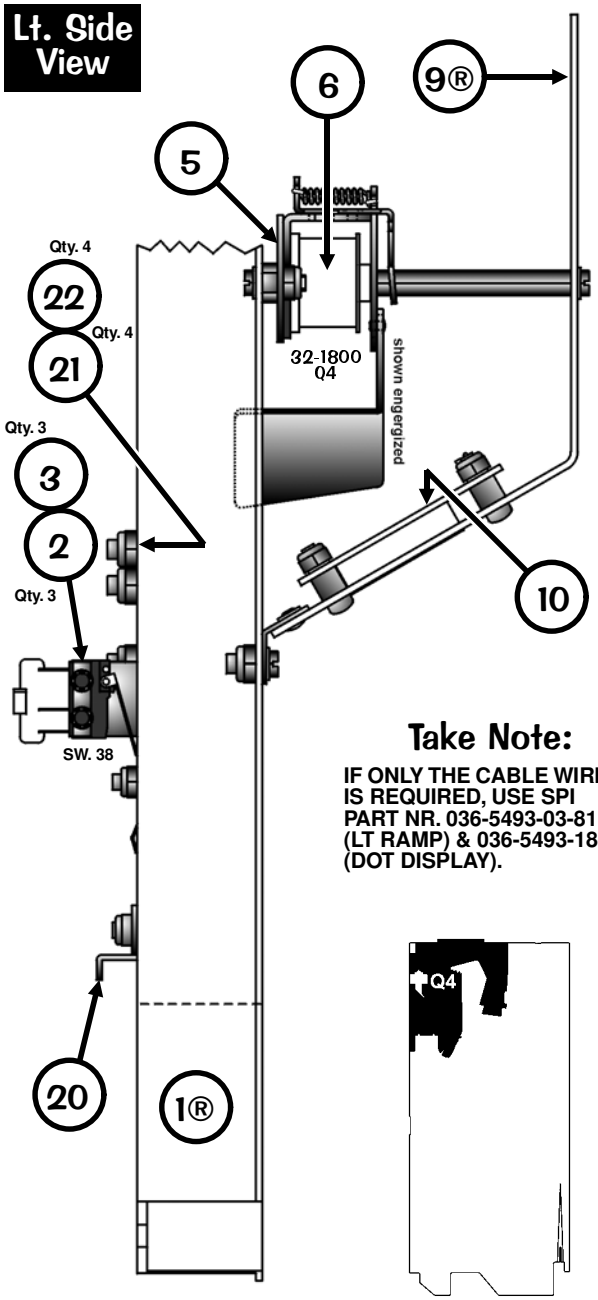
Left Plastic Ramp Individual Parts Only (Items 1-25) Continued
Parts Table and Views continued from the previous page.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
6	Mini-Coil & Bracket Assembly	1	515-7329-00
	For Individual Items use : Mini-Coil, 32-1800 (**090-5031-00**), Coil Armature Assembly (**515-7356-00 & -02**), Hanger Plate Frame (**535-6198-00**), Spring (**265-5024-00**)		
	Item 6 is secured to Item 5 by: #8-32 X 3/8" PFH 82ø Undercut (Zinc) (Qty. 1) (237-6030-00)		
7	Ramp Guard (Left Side)	1	535-9425-00
8	Ramp Guard (Right Side)	1	535-9425-01
	Items 7 & 8 are secured to Item 1 by: #8-32 X 3/8" SLT HWH MS (Zinc) (Qty. 2/per) (237-5868-00) **and** #8-32 Nylon Stop Nut (Qty. 2/per) (240-5102-00)		
9®	***Kit:*** Plastics (Scrnd. Display Cover)	1	803-5001-81
	Note: *Individual Plastic (830-6020-00) is available as an assembly only, ordering of kit is required. For all pieces, see* ***Playfield - Plastics (Screened & Clear) & Decals****, Page* ***67****.*		
	Item 9 is secured to Item 1 @ Top by: 3-1/8" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-19) **and** #6-32 X 3/8" HWH Swage (Qty. 2) (237-5976-02) **and secured to Item 1 @ brackets by:** #8-32 X 3/8" SLT HWH MS (Zinc) (Qty. 2) (237-5868-00) **and** #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00)		

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
10	P/F Dot Display (5X7) X3 LED PCB	1	520-5236-00
	Item 10 is secured to Item 9 by: #6-32 X 5/8" PPH MS (Zinc) (Qty. 4) (237-5503-00), 1/4" Slf. Rtn. Plastic Spacer White (Qty. 4) (254-5007-02) **and** #6-32 Nylon Stop Nut (Qty. 4) (240-5005-00)		
11	IDC Snap-On Socket ***No Diode***	1	077-5216-01
12	#906 Wedge Base Bulb (Clear)	1	165-5004-00
13	Mini-Mars (Snap-In) Clear	1	550-5030-01
14	Wedge Base Socket (Laydown)	1	077-5026-01
15	#555 Wedge Base Bulb (Clear)	1	165-5002-00
16	Light Reflector (Silver Plastic)	1	545-5409-01
17	Plastic Mini-Lite Hood (Red)	3	550-5061-02
18	Rubber Ring, 3/16" I.D. White *(back)*	3	545-5348-51
19	Rubber Ring, 5/16" I.D. White *(front)*	3	545-5348-52
20	Bracket, Wire Ramp Retainer	1	535-9429-00
	Items 17-20 are secured to Item 1 by: #6-32 X 1-1/2 PPH MS (Zinc) (Qty. 2/per) (237-5510-00) and #6-32 Nylon Stop Nut (Qty. 4) (240-5005-00)		

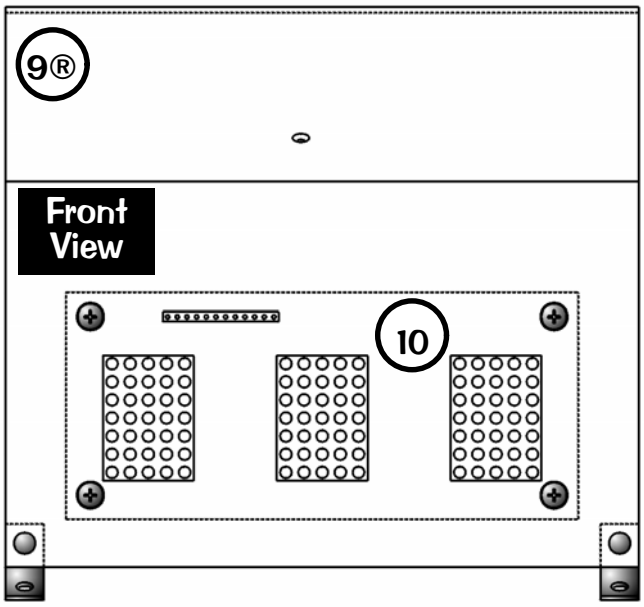
Parts Table continued at bottom of this page.

Lt. Side View



Take Note:

IF ONLY THE CABLE WIRING IS REQUIRED, USE SPI PART NR. 036-5493-03-81 (LT RAMP) & 036-5493-18-81 (DOT DISPLAY).



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
21	Mini-Post MS / #10-32 Bot. .4" Thread	4	530-5005-01
22	Rubber Ring, 3/8" O.D. White *(front)*	4	545-5348-69
	Items 21 & 22 are secured to Item 1 by: #10-32 Nylon Stop Nut (Qty. 4) (240-5203-00)		
23	Mini-Jewel Plastic Post (Clear)	2	550-5052-01
	Item 23 is secured to Item 1 by: #6 X 3/8" SLT HWH AB (Zinc) (Qty. 1/per) (234-5000-00)		
24®	***Kit:*** Plastics (Clear) **-02, -04**	1	803-5000-81
	Note: *Individual Plastics (830-6014-XX) are not available individually, ordering of kit is required. For all pieces, see* ***Playfield - Plastics (Screened & Clear) & Decals****, Page* ***67****.*		
	Item 24 (-02) is secured to Item 1 by: #6-32 X 3/4" HWH 23 (Zinc) (Qty. 3) (237-5893-00), 3/8" X 3/8" Plastic Spacer Gray (Qty. 3) (254-5000-12) **and** #6-32 Nylon Stop Nut (Qty. 4) (240-5005-00). **Item 24 (-04) is secured to Item 1 by:** Rivet, 1/8" ø X 1/4" Lg. (Qty. 2) (249-5003-00) and #6 Riveting Lock Washer (Qty. 2) (246-5000-00)		
25	***Kit:*** Decals (Screened) **-22**	1	802-5000-81
	Note: *Individual Decal (820-6341-22) is not available individually, ordering of kit is required. For all pieces, see* ***Playfield - Plastics (Screened & Clear) & Decals****, Page* ***67****.*		

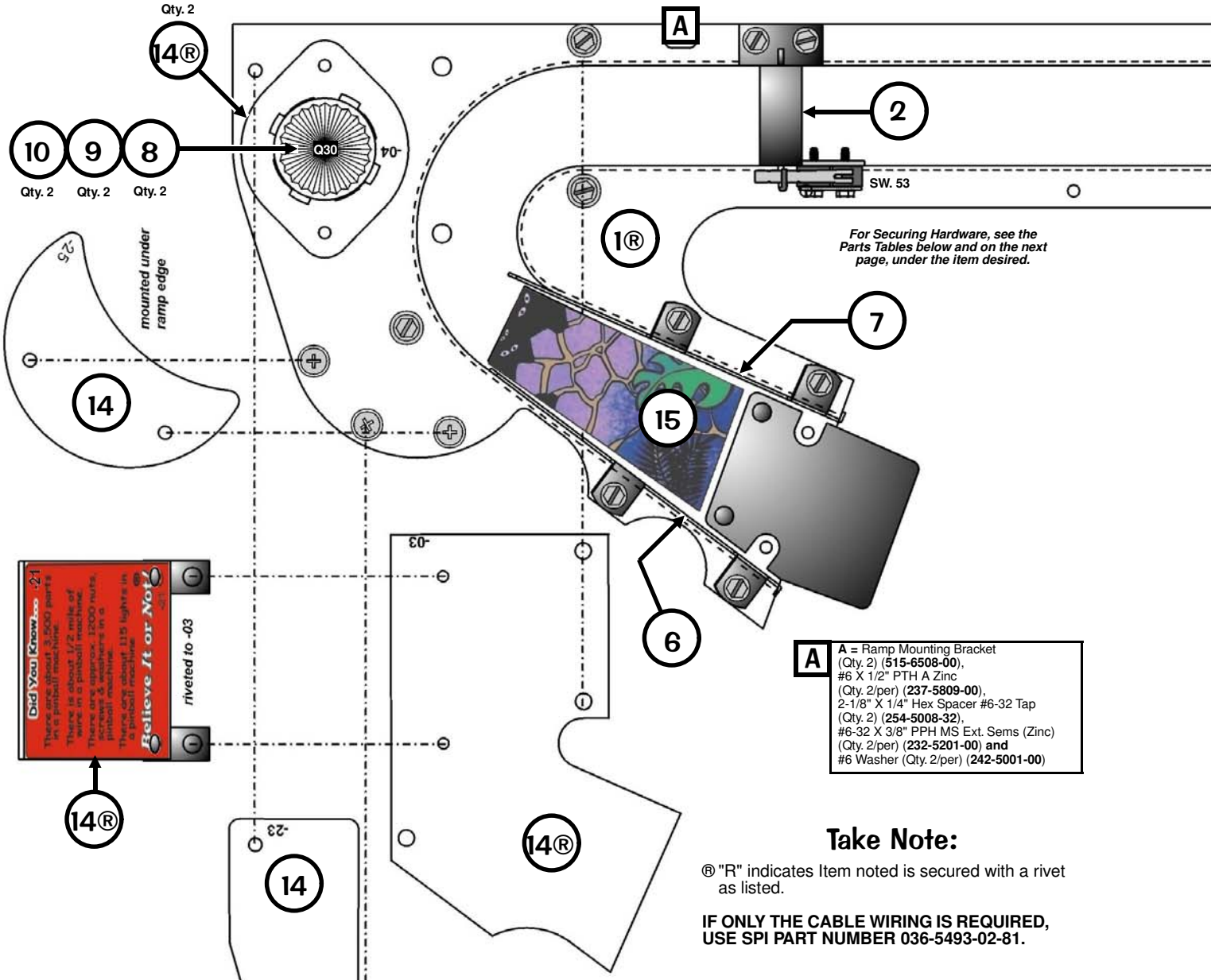
Take Note:

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

For a break-down of parts of Item **10**, **Playfield Dot Display (5X7) x3 LED PCB** (**520-5236-00**), *see Section* ***5****, Chapter* ***4****,* ***Printed Circuit Boards*** *(* ***YELLOW PAGES*** *), Pages* ***147****.*

Right Plastic Ramp Individual Parts Only (Items 1-15)

Parts Table and Bottom Half View on the next page.



A = Ramp Mounting Bracket (Qty. 2) (**515-6508-00**), #6 X 1/2" PTH A Zinc (Qty. 2/per) (**237-5809-00**), 2-1/8" X 1/4" Hex Spacer #6-32 Tap (Qty. 2) (**254-5008-32**), #6-32 X 3/8" PPH MS Ext. Sems (Zinc) (Qty. 2/per) (**232-5201-00**) **and** #6 Washer (Qty. 2/per) (**242-5001-00**)

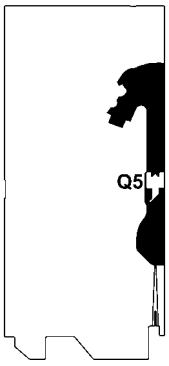
Take Note:

® "R" indicates Item noted is secured with a rivet as listed.

IF ONLY THE CABLE WIRING IS REQUIRED, USE SPI PART NUMBER 036-5493-02-81.

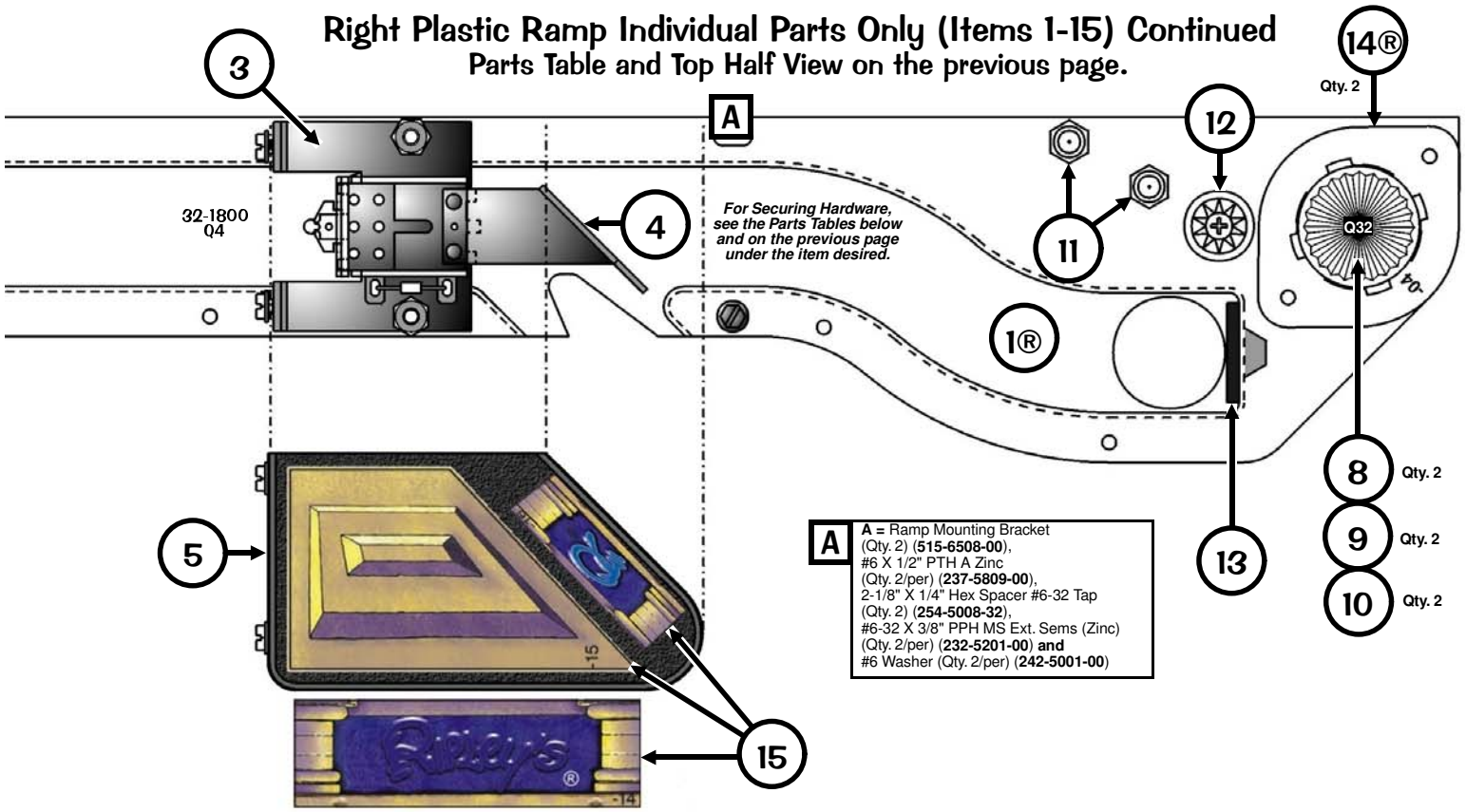
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1®	Right Plastic Ramp Riveted Assembly	1	**515-7321-00R**
	For Individual Items use : Right Plastic Ramp (No Parts) (**545-6090-00**), Ramp Flap (**535-9301-00**), #6 Lock Washer (Qty. 2) (**246-5000-00**) **and** Rivet, 1/8" ø X 3/16" Lg. (Qty. 2) (**249-5001-00**).		
	Item 1 is secured above the playfield @ flap by: #4 X 5/8" PFH (Black) (Qty. 2) (237-5833-00) **and @ sides by:** *see below Ref. **A** & **B**.*		
2	Ramp Gate Switch (Right)	1	500-6593-00
	For Individual Items use : Gate Bracket (Left) (**535-9171-00**), Wire Form (**535-9172-00**), Micro Switch (Qty. 1) (**180-5190-28**), #2-56 X 1/2" HWH Ser Black (Qty. 2) (**237-5937-02**), Switch Body Protect Plate (Qty. 1) (**535-6539-00**), #2-56 Hex Nut (Qty. 2) (240-5301-00), Switch Diode (1N4004) (Qty. 1) (**112-5003-00**)		
	Item 2 is secured to Item 1 by: #8-32 X 3/8" SLT HWH MS (Zinc) (Qty. 2) (237-5868-00) **and** #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00)		
3	Bracket, Mini-Coil Mount (Diverter)	1	535-8987-00
4	Mini-Coil & Bracket Assembly	1	515-7357-01
	For Individual Items use : Mini-Coil, 32-1800 (**090-5031-00**), Coil Armature Assembly (**515-7356-01 & -03**), Hanger Plate Frame (**535-6198-00**), Spring (**265-5024-00**)		
	Item 4 is secured to Item 3 by: #8-32 X 3/8" PFH 82ø Undercut (Zinc) (Qty. 1) (237-6030-00) **and secured to Item 1 by:** #8-32 X 5/8" SLT Ser HWH (Zinc) (Qty. 2) (237-5975-03) **and** #8-32 Hex Nut (between Plate & Ramp) (Qty. 2) (240-5103-00)		
5	Diverter Cover **(Black Plastic, Right Style)**	1	545-6000-00
	Item 5 is secured to Item 3 by: #8-32 X 1/4" SLT Ser HWH (Zinc) (Qty. 2) (237-5975-04)		
6	Ramp Guard (Left Side)	1	535-9426-00

Parts Table continued on bottom of next page.

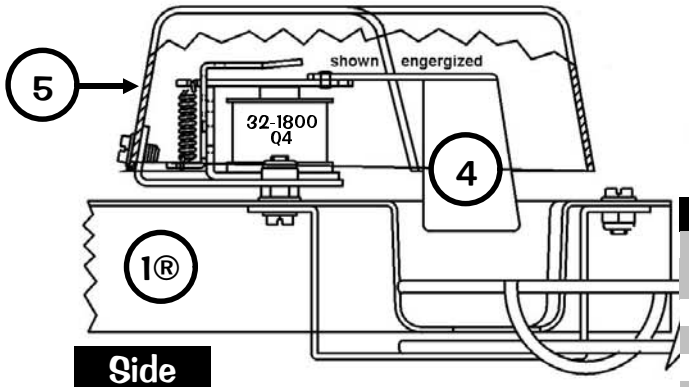


Right Plastic Ramp Individual Parts Only (Items 1-15) Continued

Parts Table and Top Half View on the previous page.



A = Ramp Mounting Bracket (Qty. 2) (**515-6508-00**), #6 X 1/2" PTH A Zinc (Qty. 2/per) (**237-5809-00**), 2-1/8" X 1/4" Hex Spacer #6-32 Tap (Qty. 2) (**254-5008-32**), #6-32 X 3/8" PPH MS Ext. Sems (Zinc) (Qty. 2/per) (**232-5201-00**) **and** #6 Washer (Qty. 2/per) (**242-5001-00**)



Side View

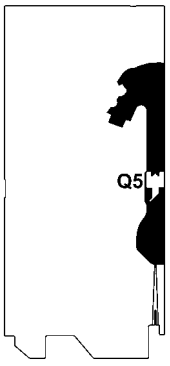
▲ ***Rt. Wire Ramp Ref.***
(see Page 94)
535-9305-00

Take Note:

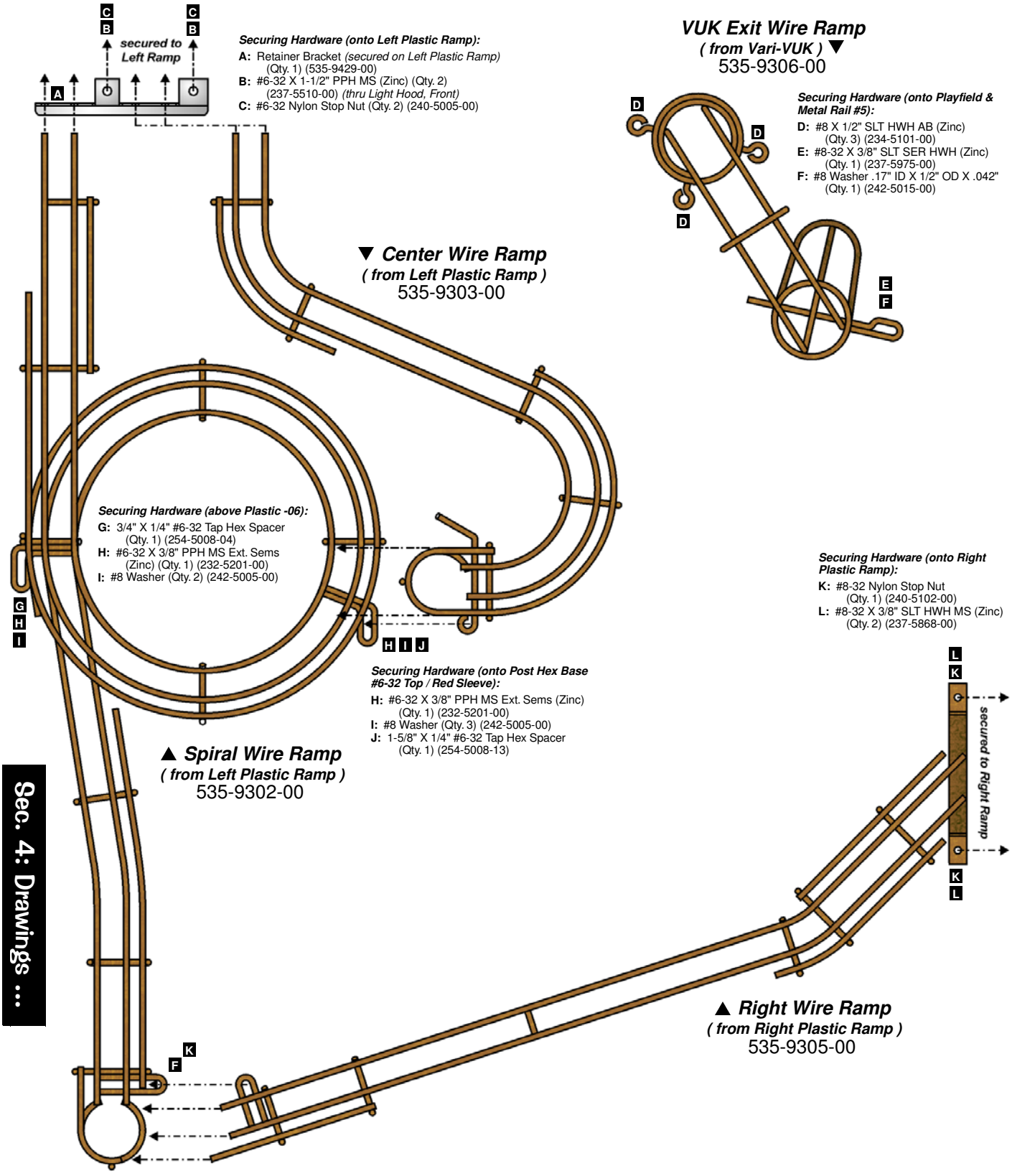
® "R" indicates Item noted is secured with a rivet as listed.

IF ONLY THE CABLE WIRING IS REQUIRED, USE SPI PART NUMBER 036-5493-02-81.

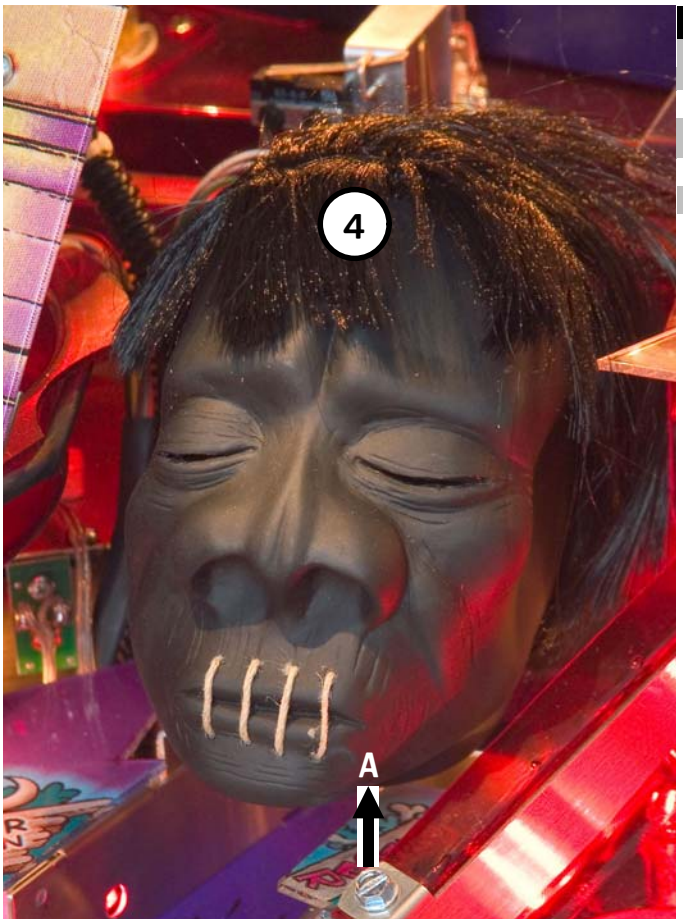
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
7	Ramp Guard (Right Side)	1	535-9426-01
	Items 6 & 7 are secured to Item 1 by: #8-32 X 3/8" SLT HWH MS (Zinc) (Qty. 2/per) (237-5868-00) **and** #8-32 Nylon Stop Nut (Qty. 2/per) (240-5102-00)		
8	IDC Snap-On Socket ***No Diode***	2	077-5216-01
9	#906 Wedge Base Bulb (Clear)	2	165-5004-00
10	Mini-Mars (Snap-In) Clear	2	550-5030-01
11	Mini-Jewel Plastic Post (Clear)	2	550-5052-01
	Item 11 is secured to Item 1 by: #6 X 3/8" SLT HWH AB (Zinc) (Qty. 1/per) (234-5000-00)		
12	1-Groove Jewel Plastic Post (Clear)	1	550-5034-01
	Item 12 is secured to Item 1 by: #6-32 X 1-3/4" PPH MS (Zinc) (Qty. 1) (237-5511-00) and #6-32 Nylon Stop Nut (Qty. 1) (240-5005-00)		
13	Bumper (Deflector Pad)	1	545-5428-00
14®	***Kit:*** Plastics (Screened & Clear)	1	803-5000-81
	Note: *Individual Plastics (830-6014-XX & 830-6021-XX) are not available individually, ordering of kit is required. For all pieces, see* ***Playfield - Plastics (Screened & Clear) & Decals****, Page* ***67****.*		
	Item 14® (-03) is secured to Item 1 by: #6-32 X 3/4" HWH 23 (Zinc) (Qty. 3) (237-5893-00), 3/8" X 3/8" Plastic Spacer Gray (Qty. 3) (254-5000-12) **and** #6-32 Nylon Stop Nut (Qty. 3) (240-5005-00). **Item 14 (-04 x2) is secured to Item 1 by:** Rivet, 1/8" ø X 1/4" Lg. (Qty. 2/per) (249-5003-00) **and** #6 Riveting Lock Washer (Qty. 2/per) (246-5000-00) **Item 14® (-21) is secured to Item 14® (-03) by:** Mounting Bracket (Qty. 2) (535-8941-03), Rivet, 1/8" ø X 1/4" Lg. (Qty. 4) (249-5003-00) **and** #6 Riv. Lock Wshr. (Qty. 4) (246-5000-00) **Item 14 (-23) to secured to Item 1 @ top right corner by:** 1" X 3/8" Plastic Spacer Gray (Qty. 1) (254-5000-04), #6-32 X 1-1/2" PPH MS (Zinc) (Qty. 1) (237-5510-00) **and** #6-32 Keps Nut (Qty. 1) **(240-5008-00) and @ top left corner by:** 3/4" X 3/8" Plastic Spacer Gray (Qty. 1) (254-5000-07), #6-32 X 1-1/4" PPH MS Ext. Sems (Zinc) (Qty. 1) (232-5207-00) **and** #6-32 Keps Nut (Qty. 1) (240-5008-00) **Item 14 (-25) to secured to Item 1 @ under top left corner by:** 3/4" X 3/8" Plastic Spacer Gray (Qty. 2) (254-5000-07), #6-32 X 1-1/4" PPH MS Ext. Sems (Zinc) (Qty. 2) (232-5207-00) **and** #6-32 Keps Nut (Qty. 2) (240-5008-00)		
15	***Kit:*** Decals (Screened) **-14, -15, -16 & -23**	1	802-5000-81
	Note: *Individual Decals (820-6341-XX) is not available individually, ordering of kit is required. For all pieces, see* ***Playfield - Plastics (Screened & Clear) & Decals****, Page* ***67****.*		



Wire Ramps Overview



Shrunken Head Individual Parts Only (Items 1-4)



№	IND. PART NAME	QTY.	SPI PART №
1	Bracket, Head & Lamp Mount	1	535-9395-00
	Item 1 is secured above the plfd. by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 4) (234-5101-00)		
2®	Wedge Base Socket (Laydown)	1	077-5026-01
	Item 2 is secured to Item 1 by: Rivet, 1/8" ø X 3/16" Lg. (Qty. 1) (249-5001-00) **and** #6 Riveting Lock Washer (Qty. 1) (246-5000-00)		
3	#906 Wedge Base Bulb (Red)	1	165-5004-02
4	Shrunken Head (Altered/Modified)	1	880-5081-01

Take Note:

® "R" indicates Item noted is secured with a rivet as listed.

IF ONLY THE CABLE WIRING IS REQUIRED, USE SPI PART NUMBER 036-5493-12-81.

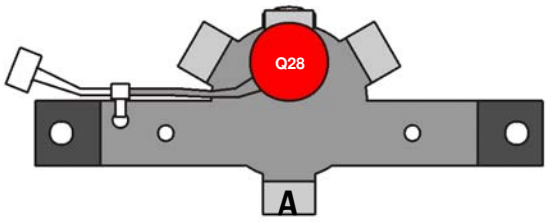
TO CHANGE BULB:

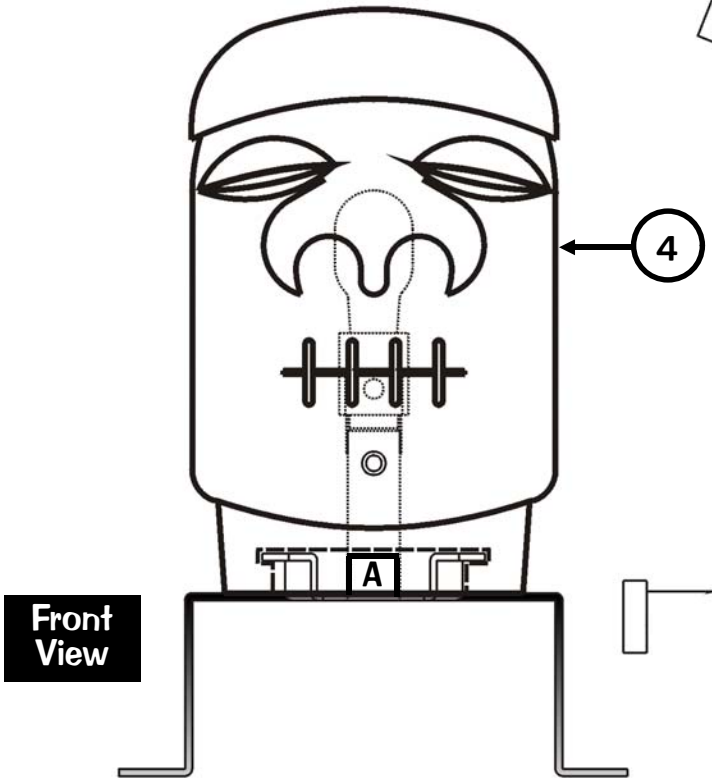
The Shrunken Head is only secured over the Mounting Bracket by a fold inside the neck.

To remove, pull the front of the neck forward and off of the front tab (**A**). Head can now be easily removed. To put back on, hook the back of the next at the rear tabs then pull the front of the neck over the front tab.

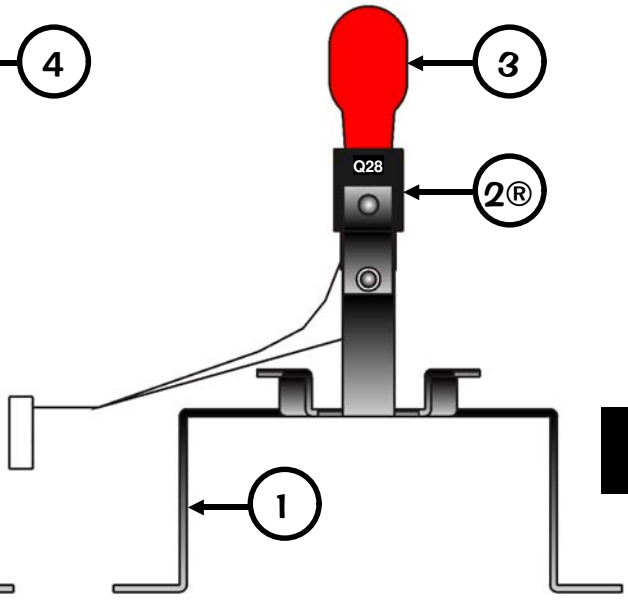
BE CAREFUL OF PLASTICS IN THE AREA OF THE SHRUNKEN HEAD!

Top View





Front View

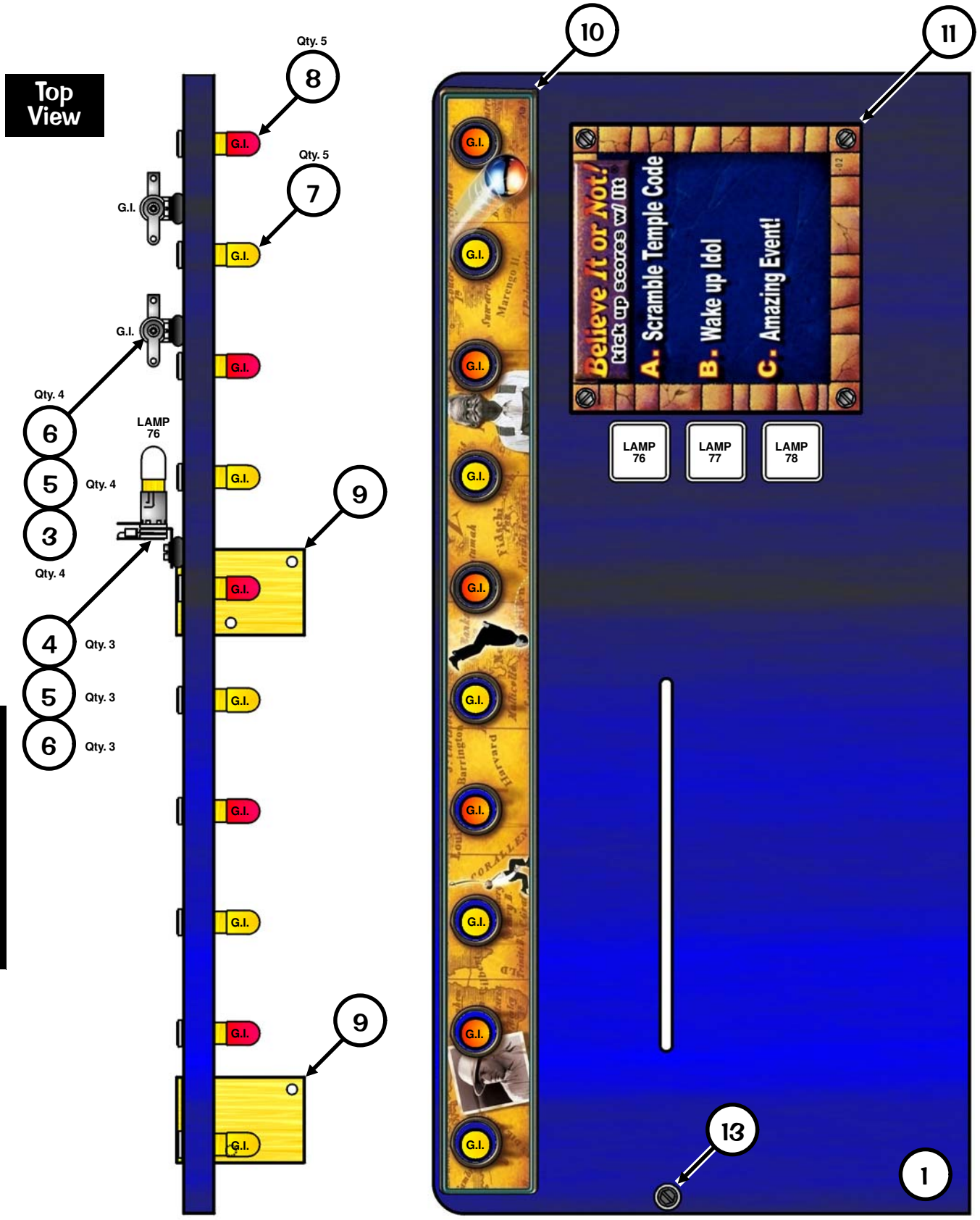


Rear View

Back Panel Individual Parts Only (Items 1-13)

Parts Table and Rear View on the next page.

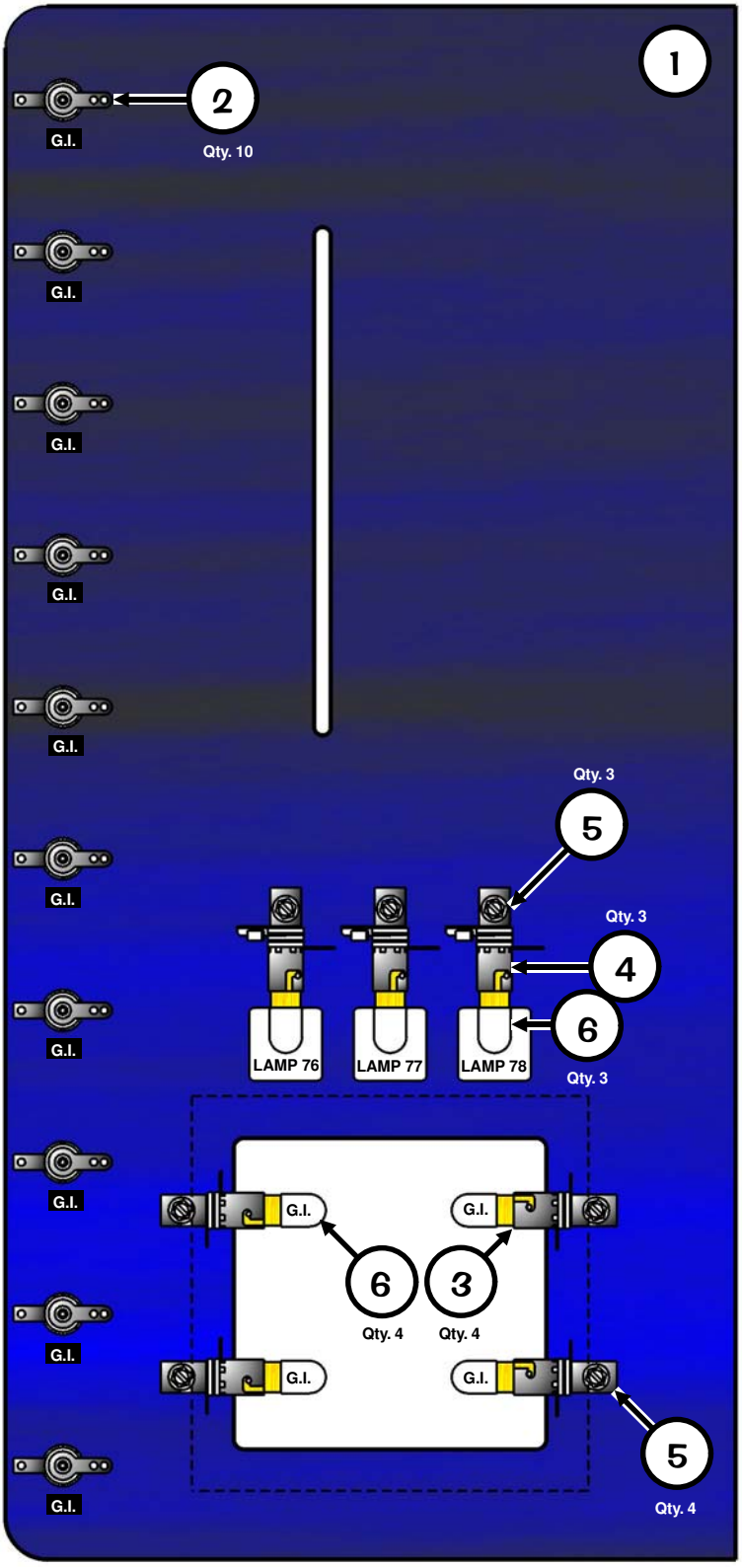
Ordering Note: *Plastic Pieces and Decals shown are for reference only. Plastics & Decals are not available individually. The entire Plastics Kit or Decals Kit needs to be ordered. For the Plastics Kit use SPI Part Number* ***803-5000-81****. For the Decals Kit use SPI Part Nr.* ***802-5001-81****.*



Back Panel Individual Parts Only (Items 1-13)

Top & Front Views on the previous page.

Rear View



№	IND. PART NAME	QTY.	SPI PART №
1	Wood (Blue) Back Panel Plain *(No Parts)*	1	525-5638-00
2	2-Lug Staple Down Socket	10	077-5000-00
3	2-Lug Laydown Socket	4	077-5003-00
4	3-Lug Laydown Socket (3 Lugs Flat)	3	077-5006-00
	Items 3 & 4 are secured by: #6 X 1/2" SLT HWH AB (Red) (Qty. 1/per) (234-5001-02) Control Lamps (Item 4) require a Diode (1N4004) (112-5003-00). *Can be replaced with (1N4001) (112-5001-00).*		
5	Black 7/16" O.D. Rubber Ring	7	545-5348-17
6	#44 Bulb (Clear)	7	165-5000-44
7	#44 Bulb (Yellow)	5	165-5053-06
8	#44 Bulb (Red)	5	165-5053-02
9	Bracket, Back Panel & Playfield Mount	2	535-8964-00
	Item 9 is secured below the playfield and to Item 1 by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 4) (234-5101-00)		
10	***Kit:*** Decals (Screened) **-13**	1	802-5000-81
11	***Kit:*** Plastics (Scrnd.) **-02**	1	803-5000-81
	Note: *Individual Plastic (830-6024-02) and Decal (820-6341-13) are not available individually, ordering of either kit is required. For all pieces, see* ***Playfield - Plastics (Screened & Clear) & Decals****, Page* ***67****.*		
12*	1/4" & 1/2" Clamp (Single)	4	040-5000-XX
	Item 12 is secured to Item 1 by: #8 X 1/2" SLT HWH AB (Zc) (Qty. 1/per) (234-5101-00) ***-XX Note:*** for **1/4"** use **-03** (Qty. 4); for **1/2"** use **-06** (Qty. 4);		
13	1/2" X 3/8" Gray Spacer	1	254-5000-01
	Item 13 is secured to Item 1 by: #6 X 1" SLT HWH AB (Zinc) (Qty. 1) (234-5005-00). *Used to prevent a ball trap.*		

Take Note:

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

IF THE BACK PANEL CABLE WIRING IS REQUIRED, USE SPI PART NUMBER 036-5493-04-81.

UK ONLY OPTIONAL

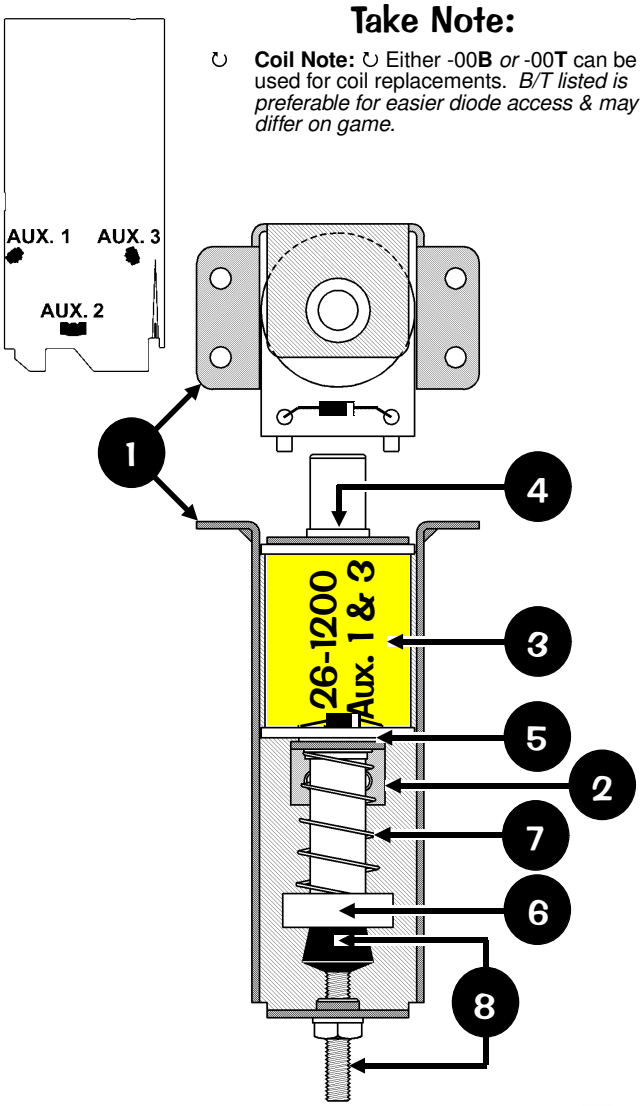
Ball Deflector Assemblies, 500-5788-02 (Qty. 2) (Items 1-8)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Ball Deflector Coil Mounting Bracket	1	535-6857-02
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5101-00)		
2	Coil Retaining Bracket	1	535-5203-03
	Item 2 is secured by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)		
3	Coil, 26-1200	1	090-5044-00T
	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 & may differ on game.*



UK ONLY OPTIONAL

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

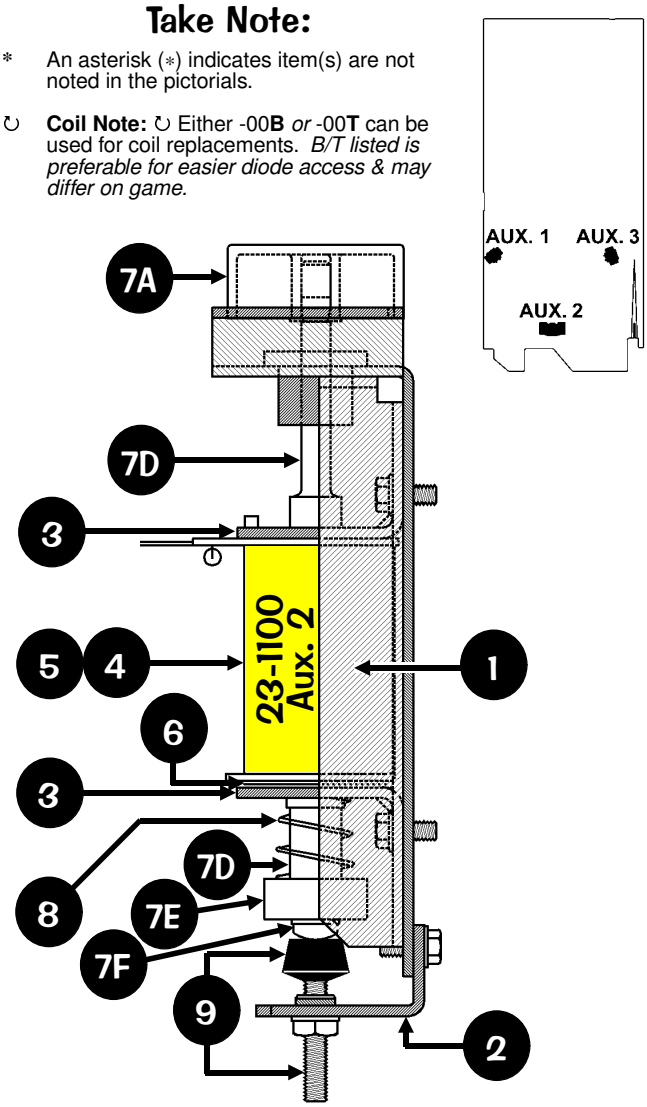
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Up/Down Post Coil Mounting Bracket	1	515-6840-00
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 6) (234-5101-00)		
2	Adjustment Spindle Stop Bracket	1	535-8303-00
3	Coil Retaining Bracket	2	535-7356-00
	Items 2 & 3 are secured by: #8-32 X 3/8" Swage (Serr) Zinc (Qty. 2/per) (237-5975-00)		
4	Coil, 23-1100 (ORG)	1	090-5030-00T
	Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).		
5	Coil Sleeve (with extension)	1	545-5847-00
6	Spring Washer, 17/32" ID X 3/4" X 1"	1	269-5002-00
7	Plunger & Shaft Assembly	1	515-6844-00
	ORDERING ABOVE (ITEM 7) SUB-ASSY. PART Nº WILL INCLUDE:		
7A	Ball Bumper Plastic (Top) Red	1	550-5029-02
7B*	Roll Pin, 3/32" ø X 1/2" Long	1	251-5002-00
7C*	Retaining Ring, 1/4" ø Shaft	1	270-5002-00
7D	Plunger & Shaft Sub-Assembly	1	515-6841-00
7E	Plunger Head	1	530-5511-00
7F	#10-32 X 3/8" PPH MS (Sems) Zinc	1	232-5401-00
	Ordering Note: *If **515-6844-00** is unavailable*, order the individual part(s) actually required. Item **7D**, part of Item **7**, Plunger & Shaft Sub-Assembly, is 1 piece and cannot be ordered separated.		
8	Compression (Relay) Spring	1	266-5022-01
9	#10-32 Adj. Spindle Stop w/Rubber Tip	1	280-5014-00
	Item 9 is secured by: #10-32 Keps Nut (Qty. 1) (240-5208-00)		

Ordering Note: *If **500-6293-00** is unavailable*, order the individual part(s) actually required.

Take Note:

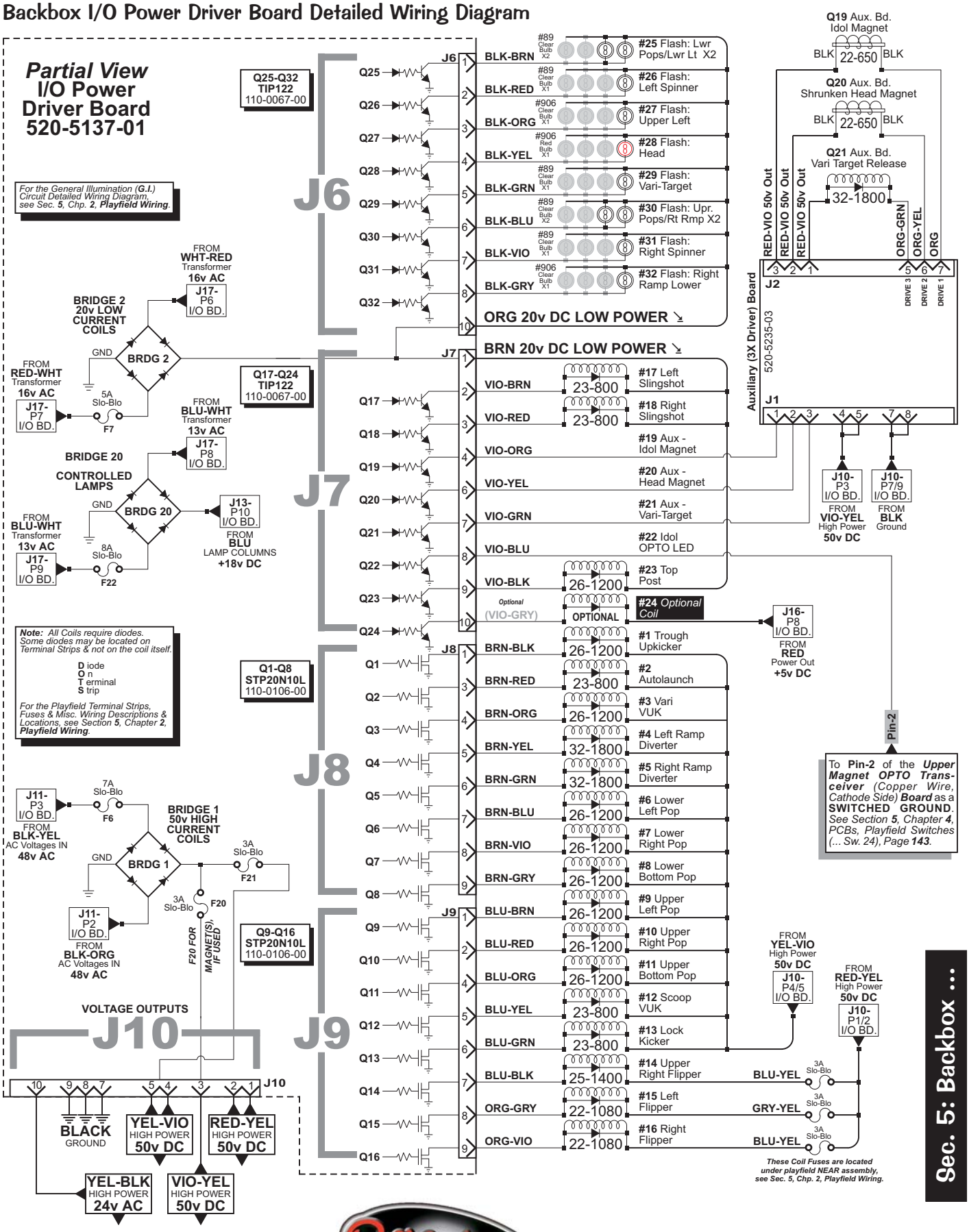
* An asterisk (*) indicates item(s) are not noted in the pictorials.

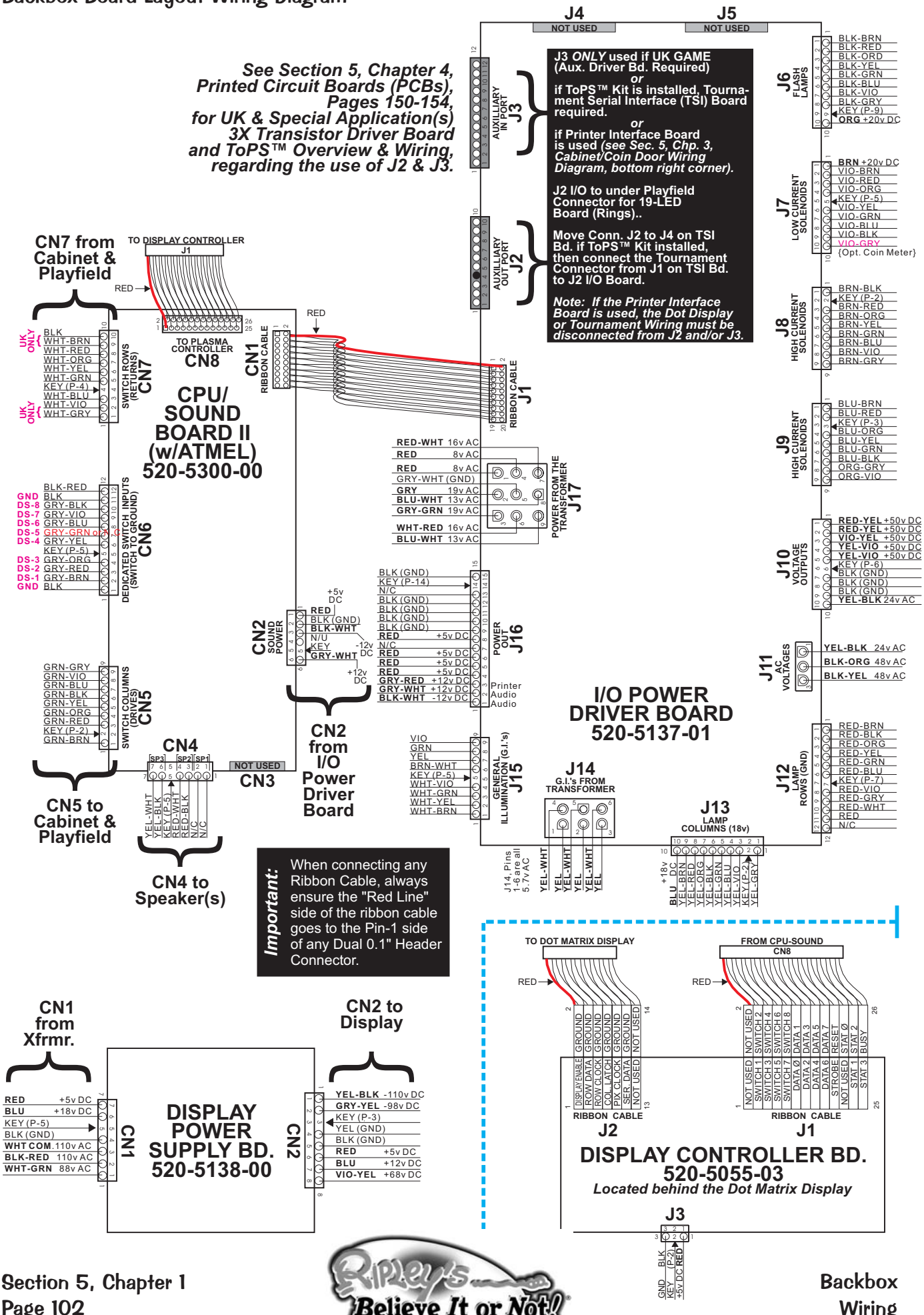
↻ **Coil Note:** ↻ Either -00**B** *or* -00**T** can be used for coil replacements. *B/T listed is preferable for easier diode access & may differ on game.*



Backbox Wiring

Backbox I/O Power Driver Board Detailed Wiring Diagram



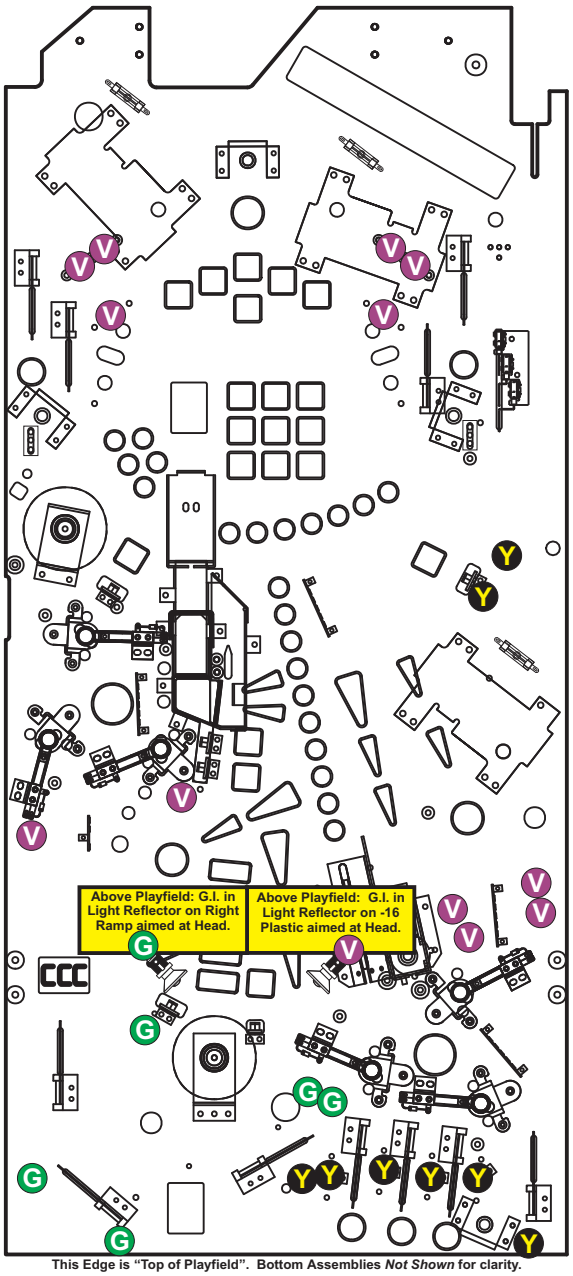


Sec. 5: Backbox ...

Playfield Wiring

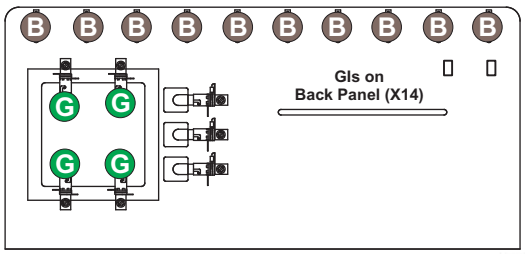
General Illumination Circuit Detailed Wiring Diagram

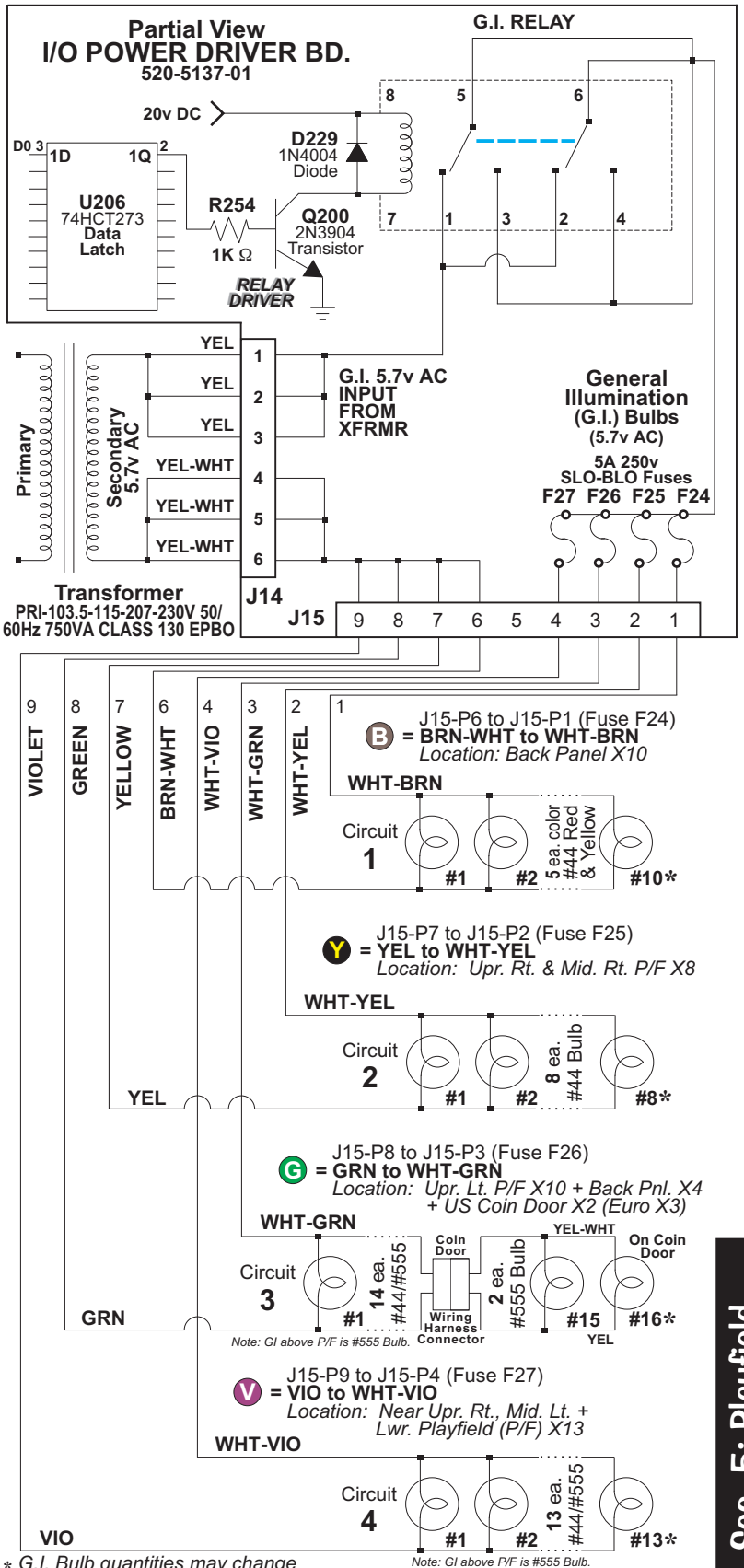
Below: Bottom of Playfield shown as if leaning up against the Backbox.



This Edge is "Top of Playfield". Bottom Assemblies *Not Shown* for clarity.

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

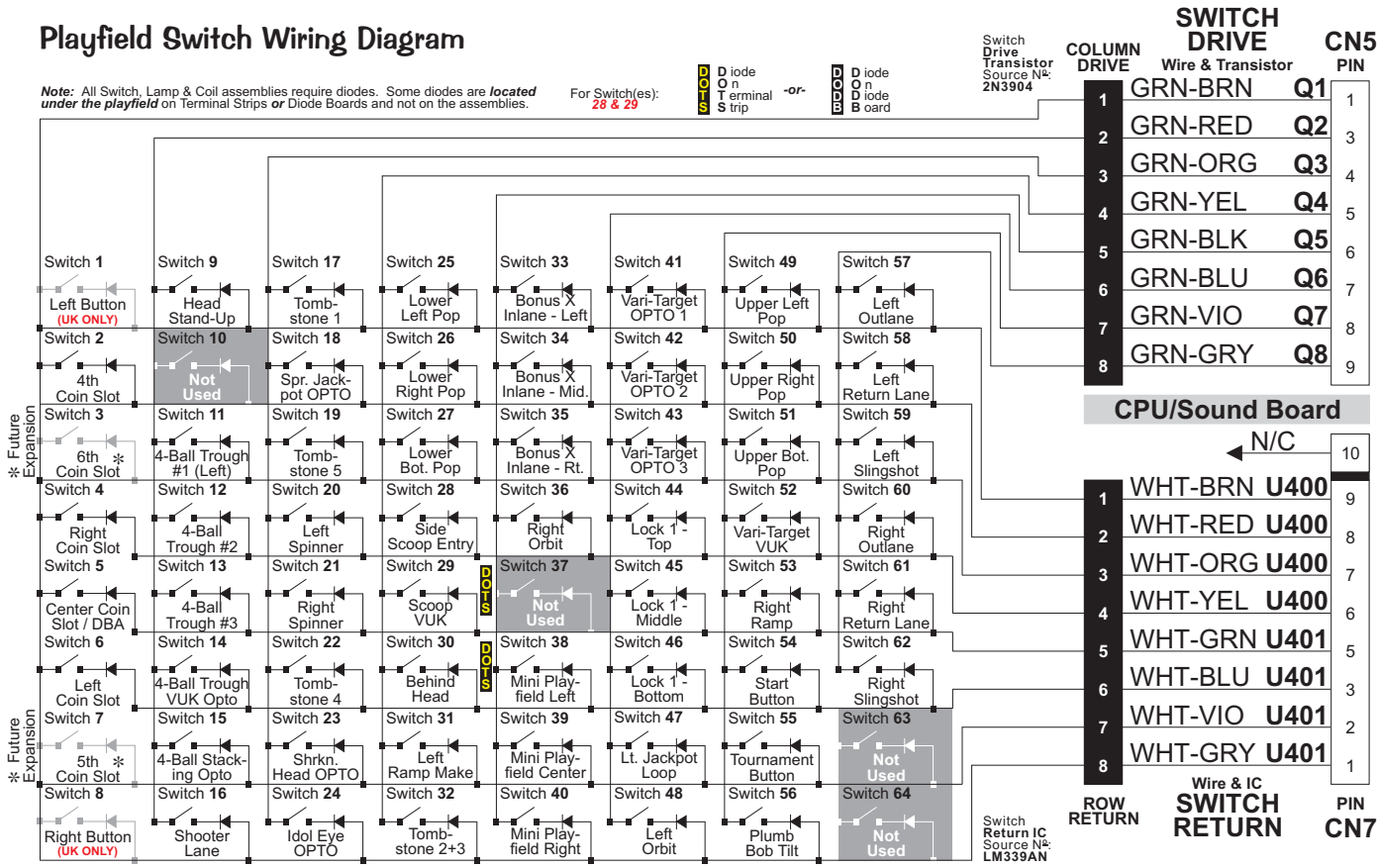




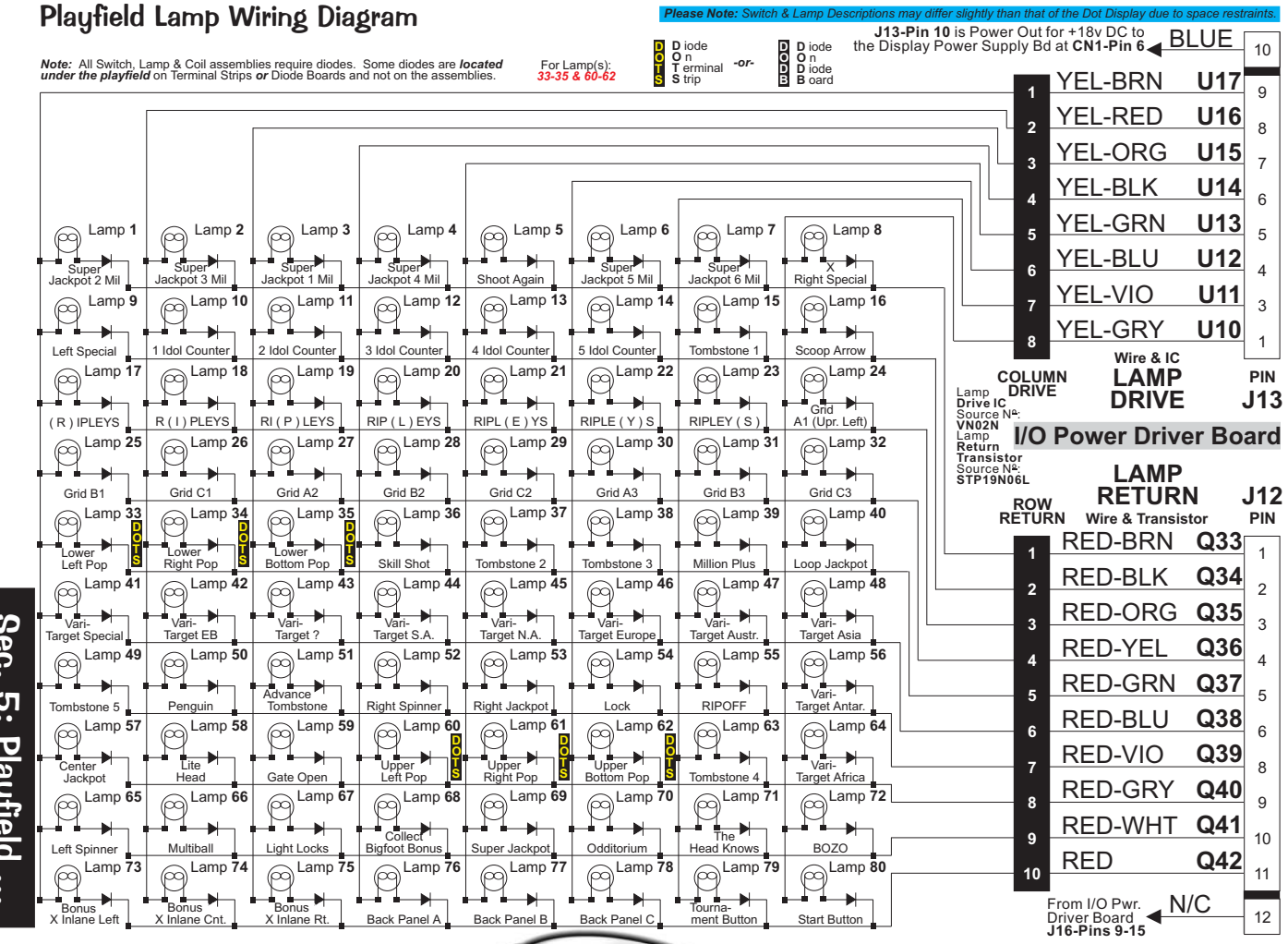
* *G.I. Bulb quantities may change during production.*

Sec. 5: Playfield ...

Playfield Switch Wiring Diagram



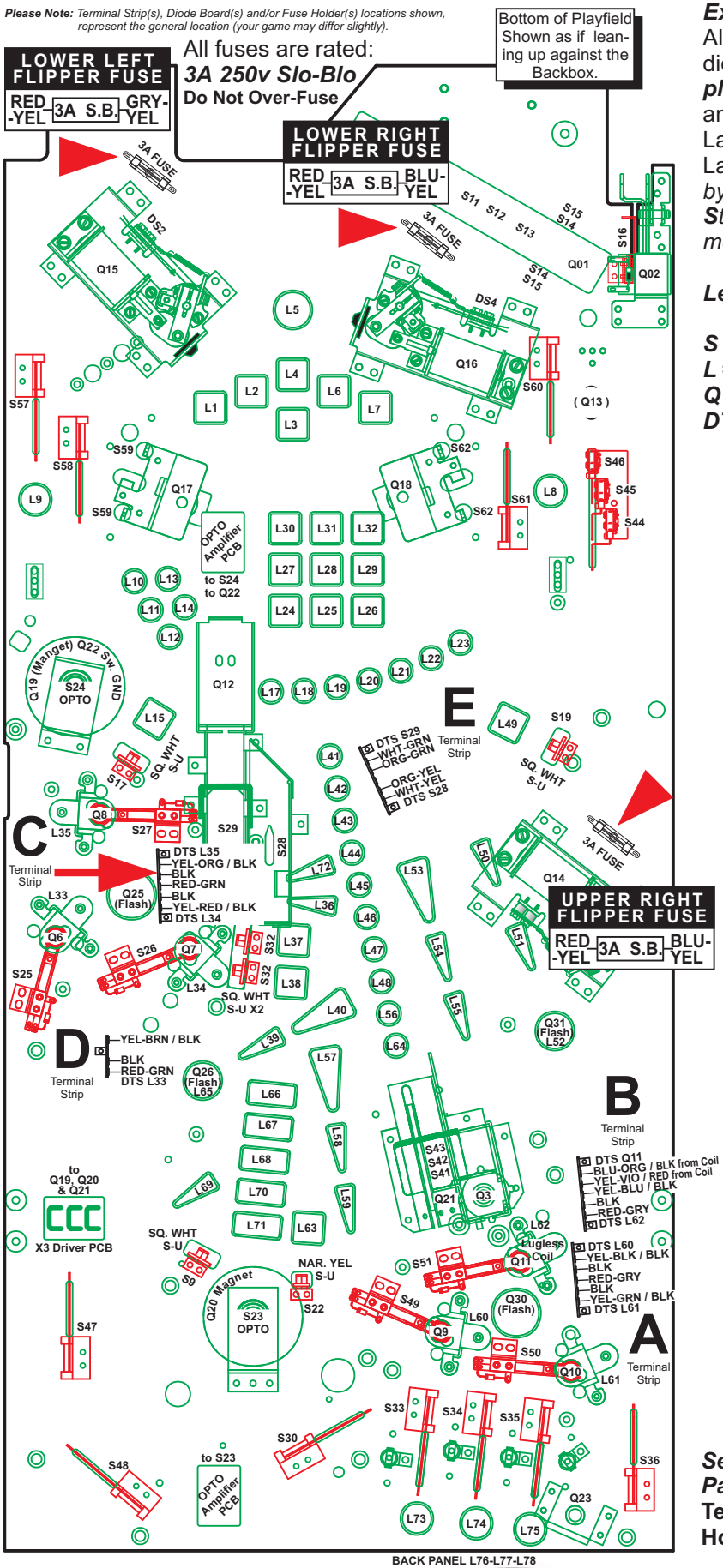
Playfield Lamp Wiring Diagram



Sec. 5: Playfield ...

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

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

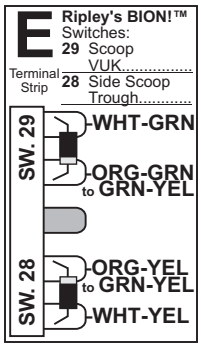


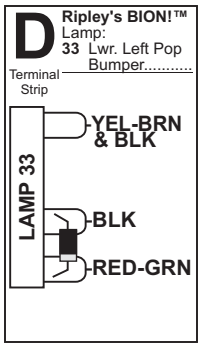
Explanation:

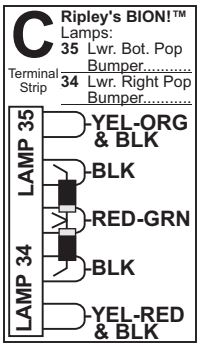
All Switch, Lamp & Coil assemblies require diodes. Some diodes are ***located under the playfield*** on Terminal Strips ***or*** Diode Boards and not on the assemblies. The Switch and Lamp Matrix Grids also note which Switch or Lamp has a diode on a Terminal Strip *(noted by **"DOTS"** meaning: "**D**iode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

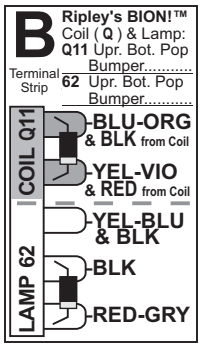
Legend:

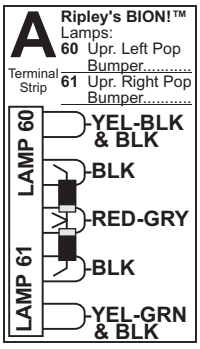
***S** = Switch Matrix Number (Below P/F Only)*
***L** = Lamp Matrix Number (Below P/F Only)*
***Q** = Coil / Flash (see Page 101)*
***DTS / TS** = (Diode) Terminal Strips (A-E)*





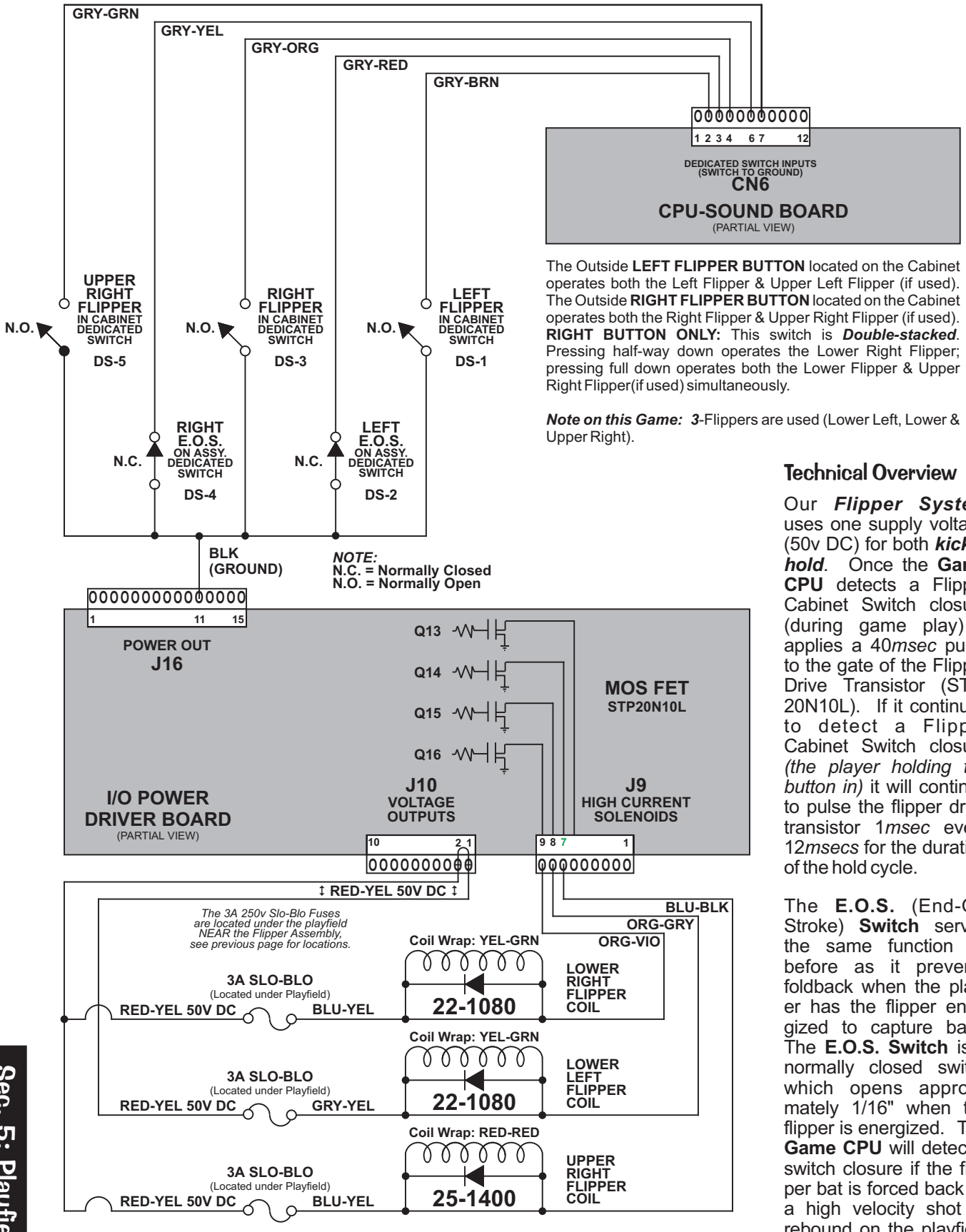






See the Pink Pages, Playfield - General Parts & Switches (Below) (Pg. 66) **for Terminal Strips, Diodes, Fuses and Fuse Holders Part Numbers.**

3- Flipper Circuit Wiring Diagram



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

Note on this Game: ***3***-Flippers are used (Lower Left, Lower & Upper Right).

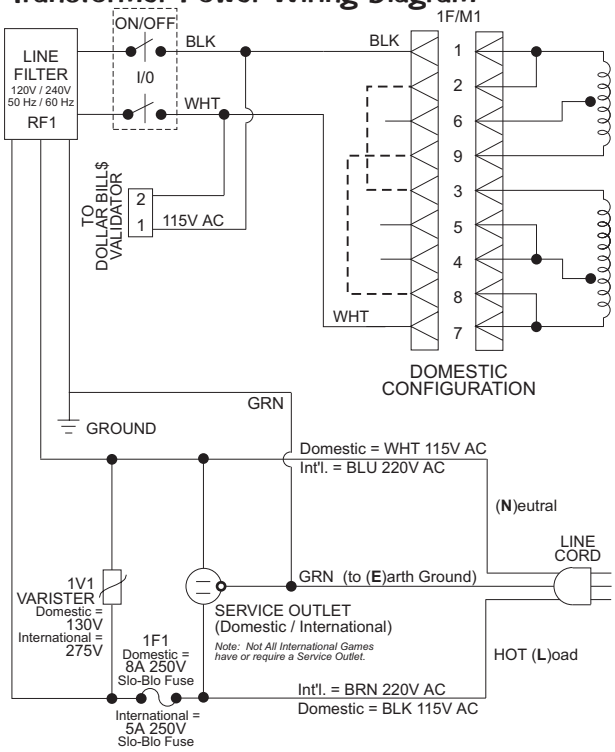
Technical Overview

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.

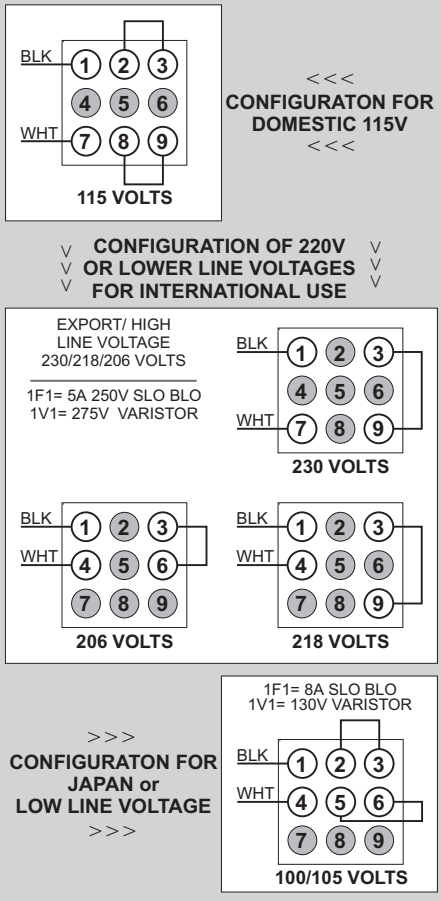
The **E.O.S.** (End-Of-Stroke) **Switch** serves the same function as before as it prevents foldback when the player has the flipper energized to capture balls. The **E.O.S. Switch** is a normally closed switch which opens approximately 1/16" when the flipper is energized. The **Game CPU** will detect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

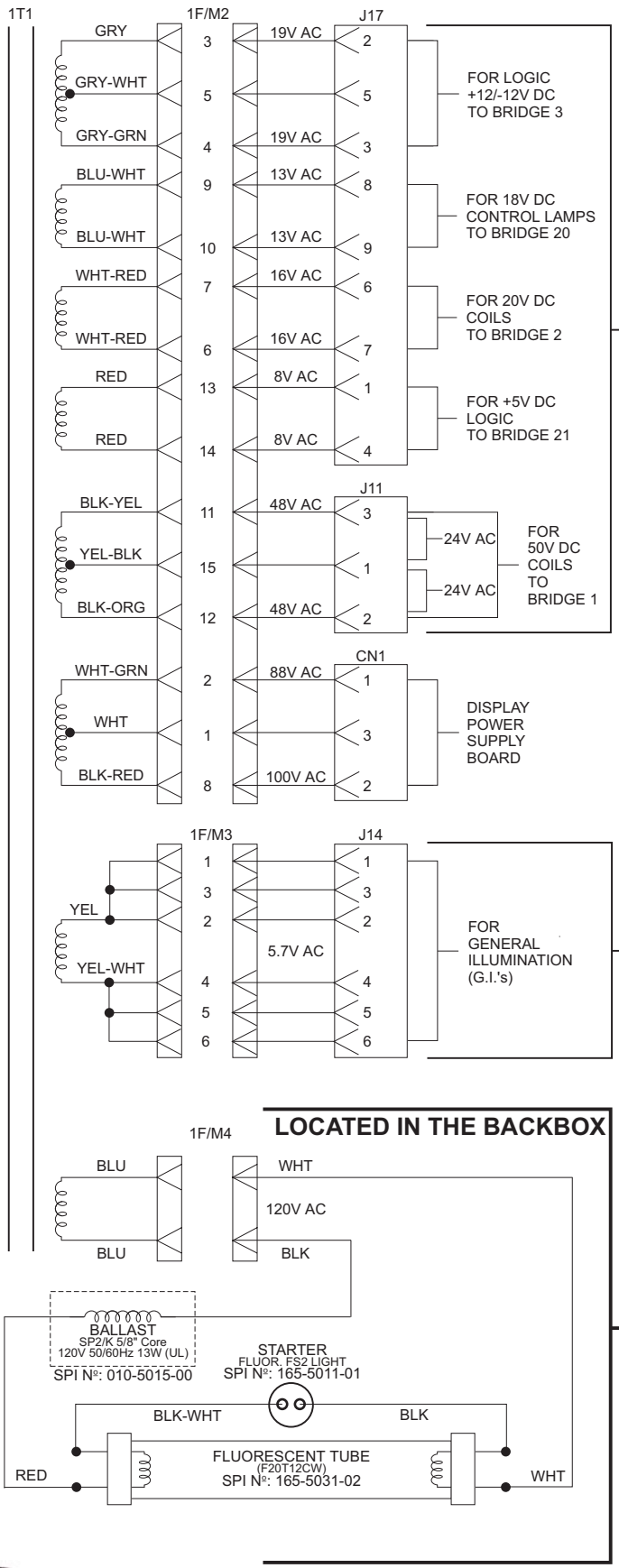
Cabinet Wiring

Transformer Power Wiring Diagram

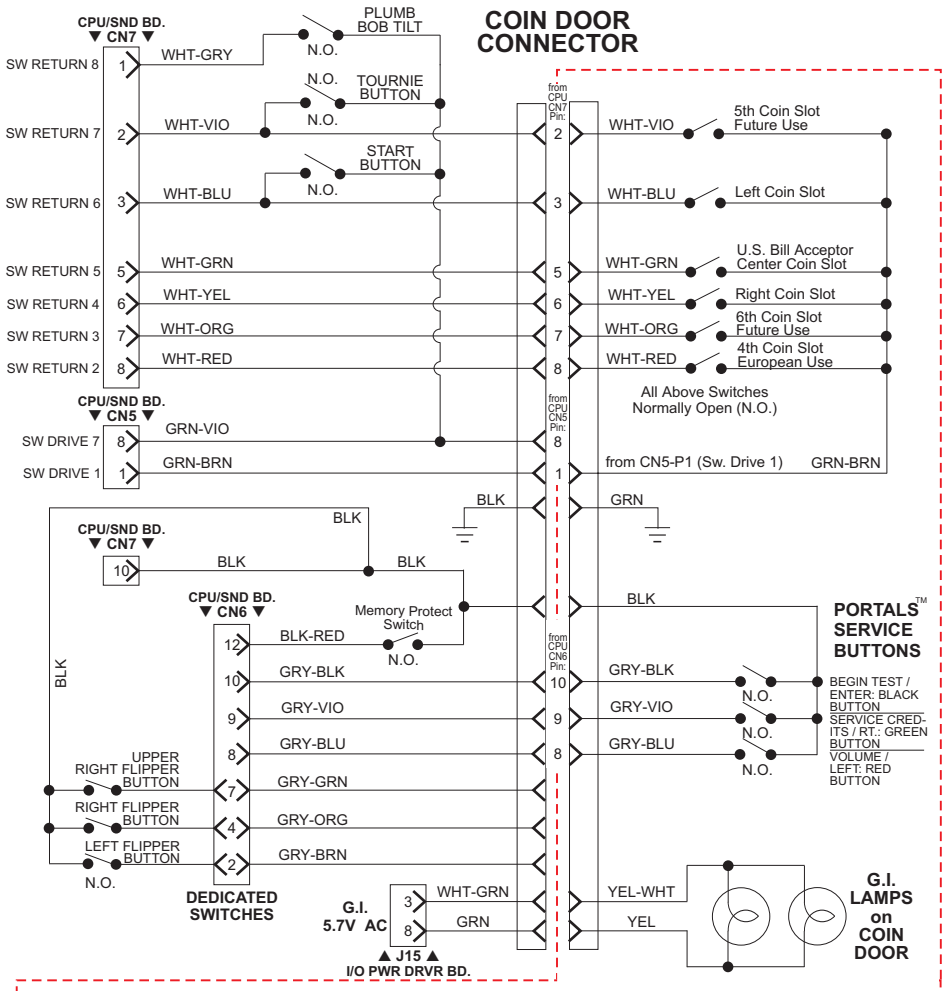


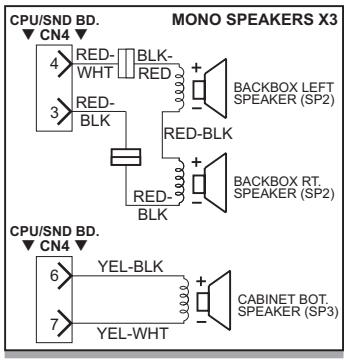
JUMPERS FOR VOLTAGE VARIATION

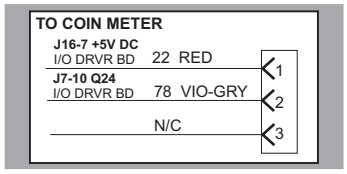


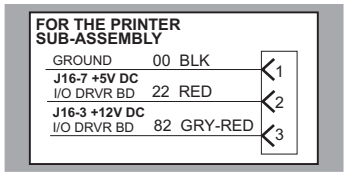


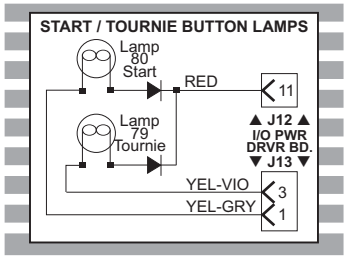
Cabinet / Coin Door Wiring Diagram



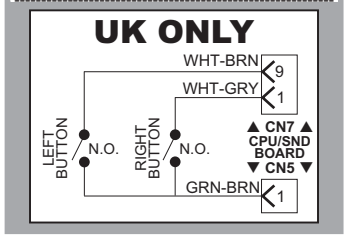


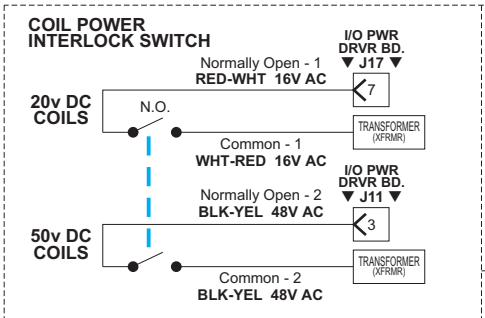


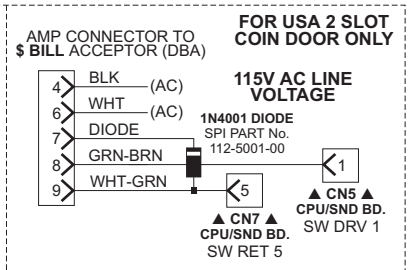


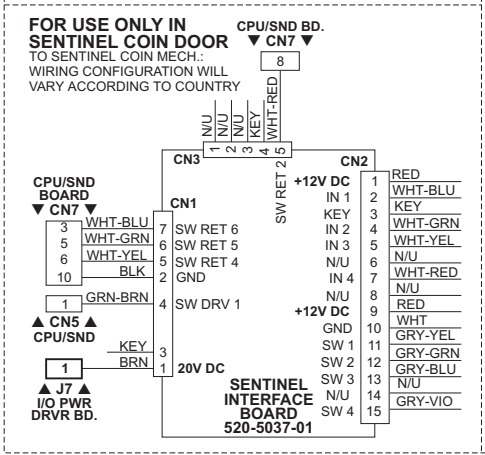


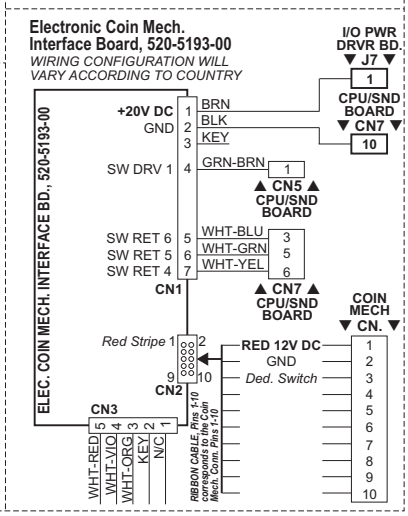
UK ONLY: 2 Extra Cabinet Buttons for the Post Save™ Feature are used. The Left Button operates the Left Outlane Ball Deflector. The Right Button operates the Right Outlane Ball Deflector. Both buttons pushed together operate the Center Up/Down Post. Both buttons are located under the Flipper Buttons.







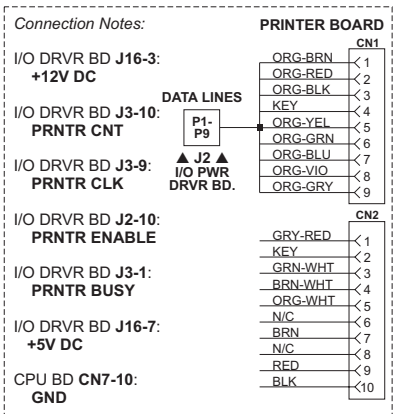




COIN DOOR

PRINTER INTERFACE OPTIONAL

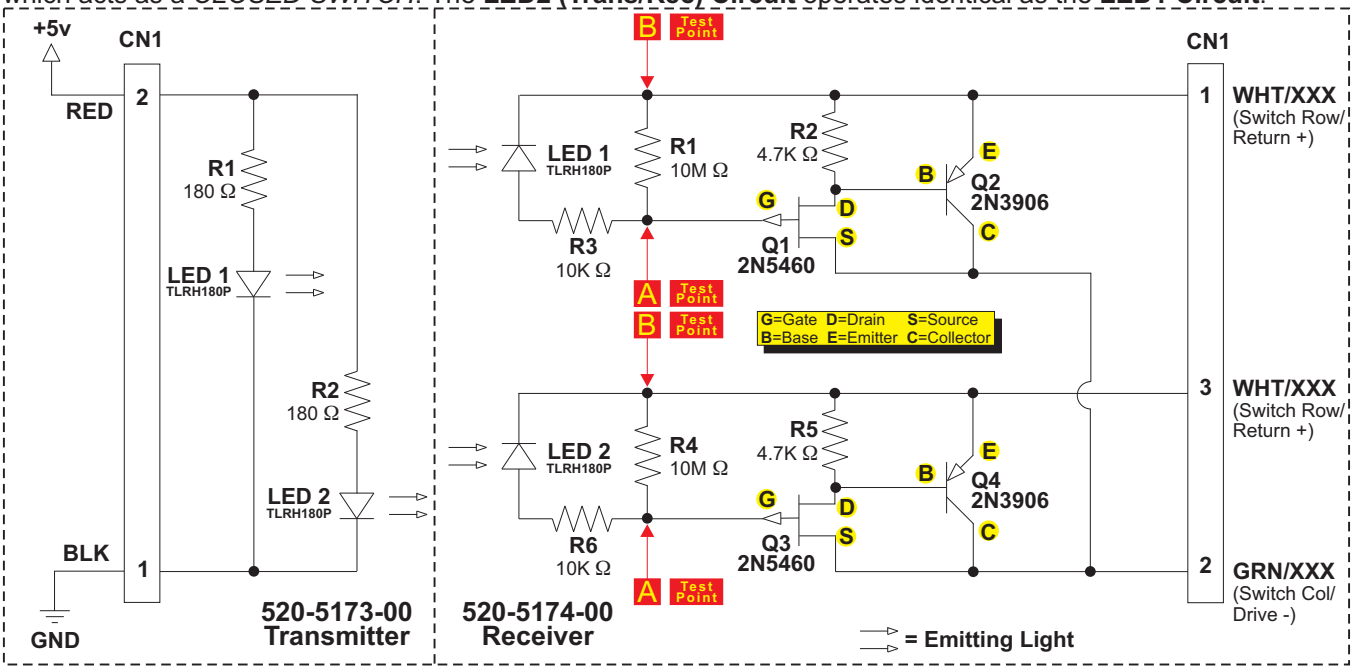
Cable Wiring Harness SPI Part Nº:
036-5408-00
RS-232 Printer Interface Board SPI Part Nº:
520-5069-00



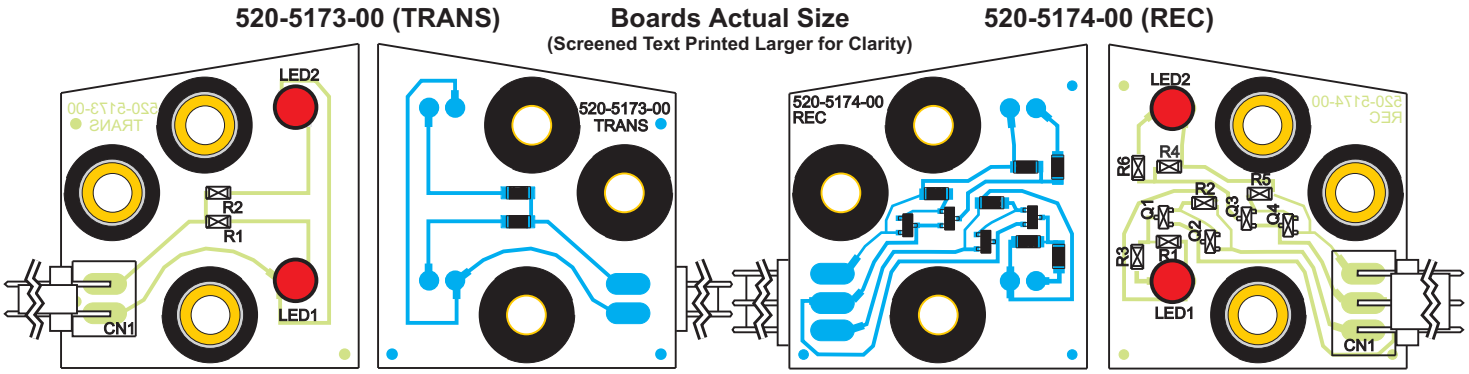
Printed Circuit Boards (PCBs)

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

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



Trough Up-Kicker Dual OPTO Boards Component Layout & Parts



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

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

DESCRIPTION

PCB Assy. (with all **Items 1-5**)
PCB Assy. (with Items **1-3** only)
2X, .156" Rt. Angle (26-60-5020) Conn.
LED TLRH180P (**Ultra Bright Red**)
180 Ω 1/8W Chip Res. (CRCW)
OPTO PCB Brass Tube Spacer
OPTO PCB Rubber Grommet
PCB Assy. (with all **Items 1-9**)
PCB Assy. (with **Items 1-7** only)
3X, .156" Rt. Angle (26-60-5030) Conn.
LED TLRH180P (**Ultra Bright Red**)
2N5460, Transistor (P-FET SOT-23)
2N3906, Transistor
10M Ω 1/8W Chip Res. (CRCW)
4.7K Ω 1/8W Chip Res. (CRCW)
10K Ω 1/8W Chip Res. (CRCW)
OPTO PCB Brass Tube Spacer
OPTO PCB Rubber Grommet

OPTO Troubleshooting

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

A. **OPEN OPTO** (Light Falling on LED) = *SWITCH OPEN*. Place meter leads across points **A** and **B** on the **LED1 Circuit** *(Refer to Schematic Drawing on 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

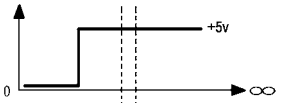
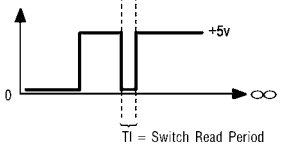


Fig. B



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.

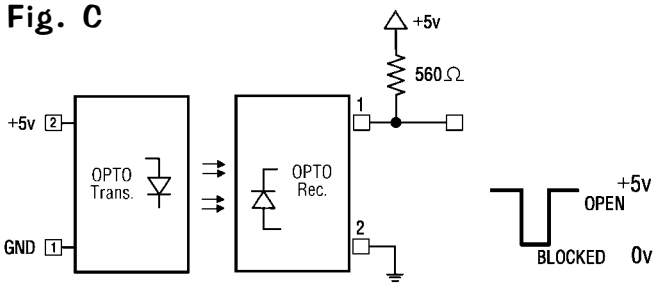
B. **CLOSED OPTO** (Light Blocked) = *SWITCH CLOSED*. Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (see Schematic). The Scope should display a **PULSE STREAM** indicating **Q2** has switched "On" as shown in **Fig. B**, Wave Form Diagram. This is your Switch Drive Pulse.

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

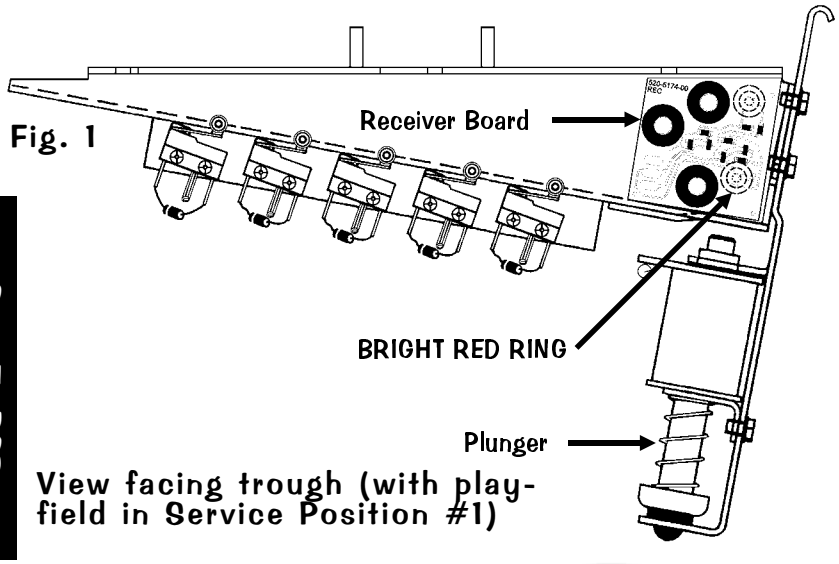
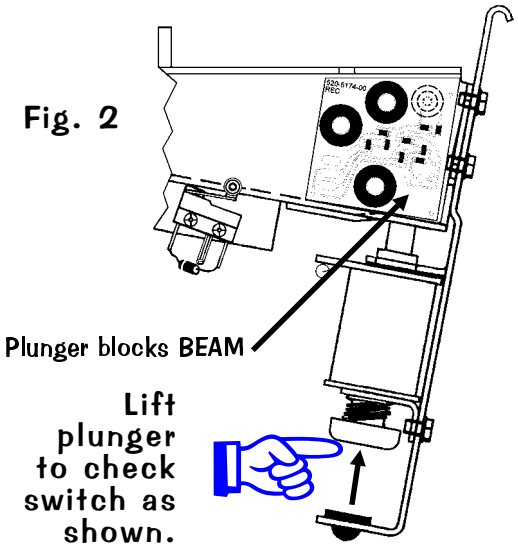
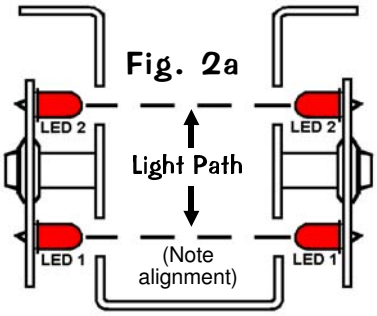
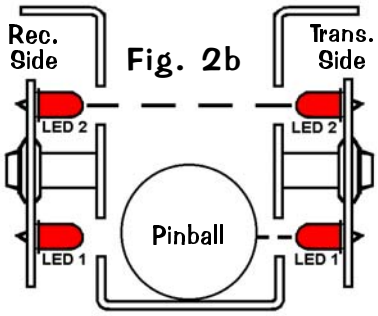


Fig. 2



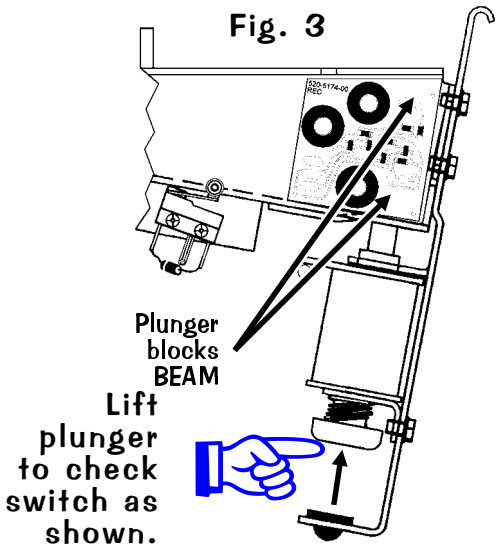
Sectional view from right (Fig. 2a & 2b)

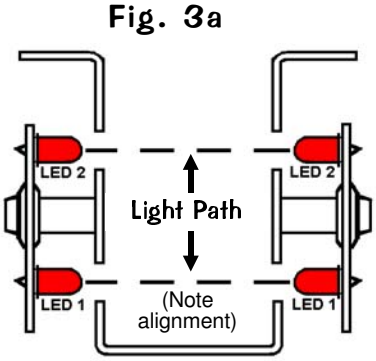


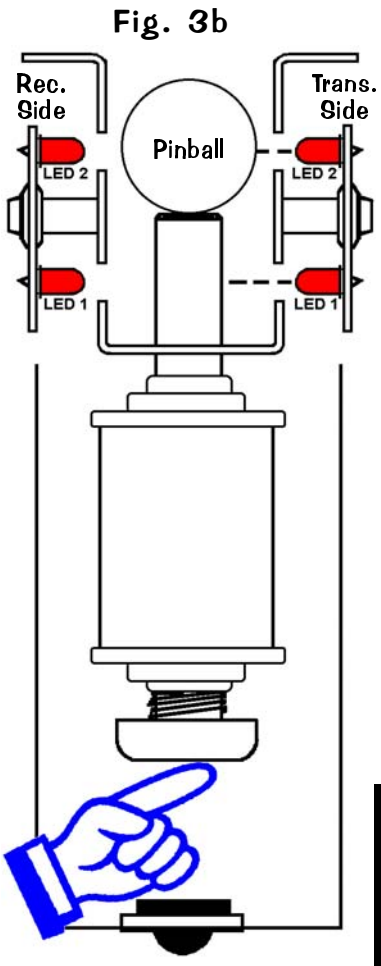


Trough Dual OPTO Boards Alignment / Test for LED2

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







I M P O R T A N T

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

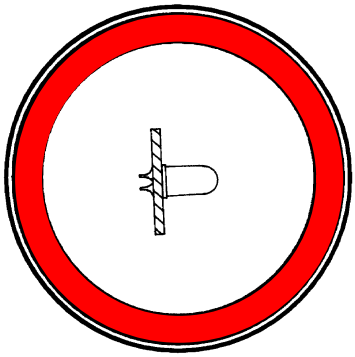


Fig. 4a
Correct Position

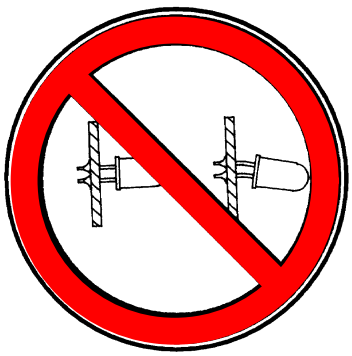
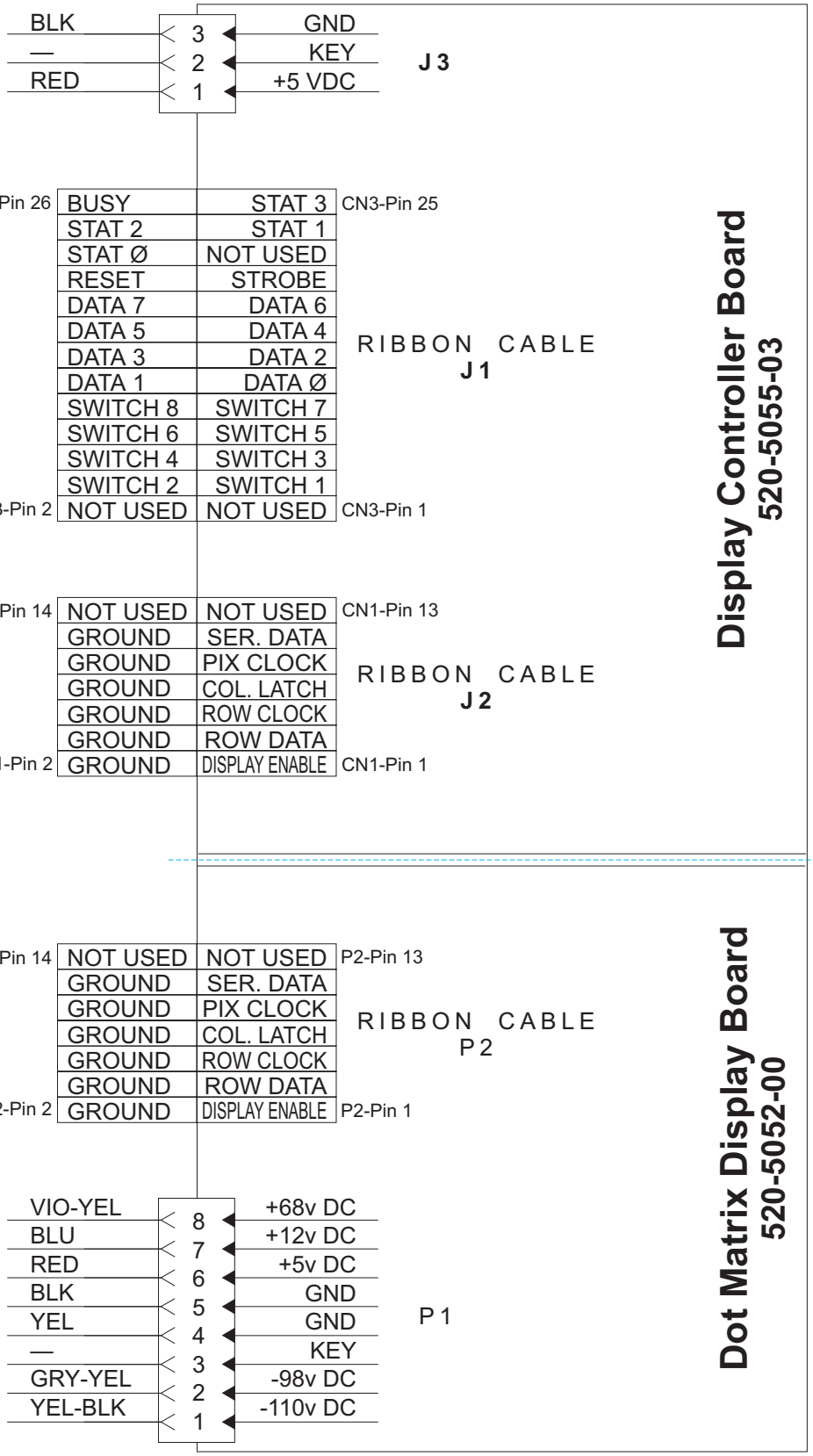


Fig. 4b
Incorrect Position

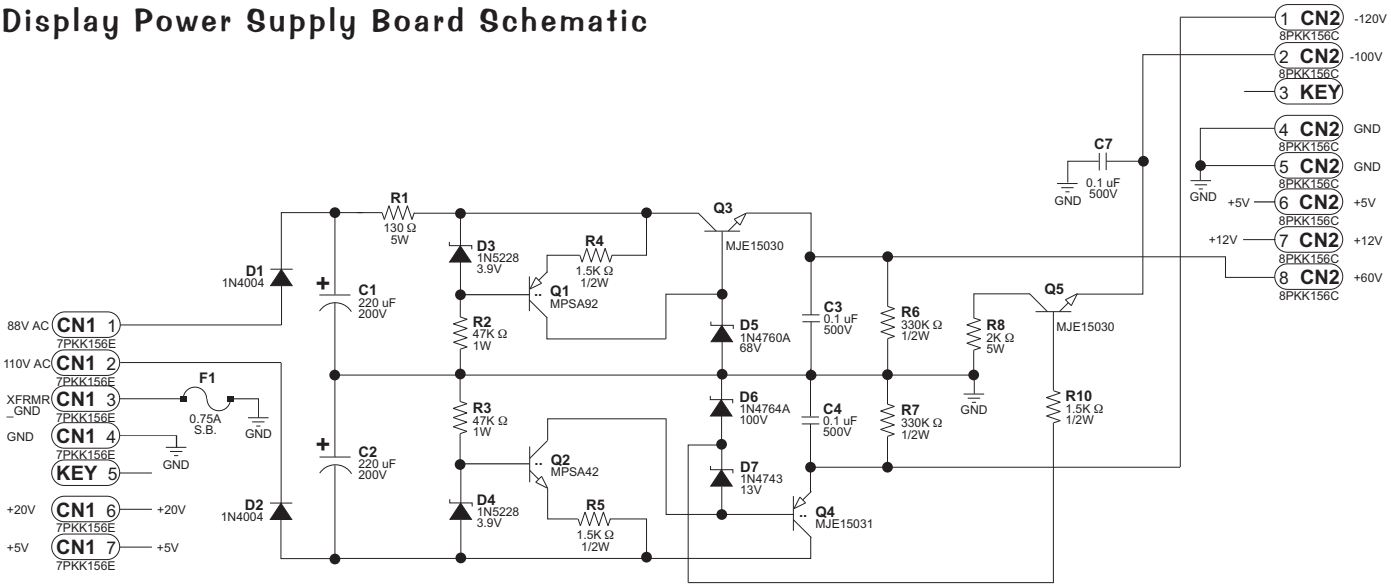


Dot Matrix Display Explained

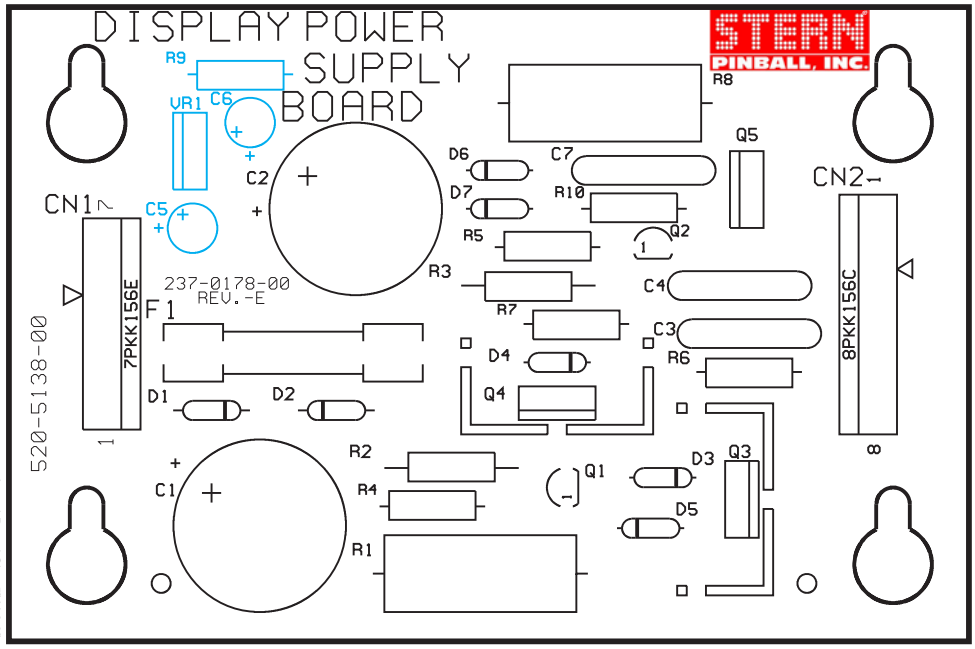
The display utilizes a Micro-Processor Control Board mounted in piggyback fashion to the Dot Matrix Display (128 X 32) Driver Board. The purpose behind this board is to provide more information to the operator as well as displaying graphics to the player.

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

Display Power Supply Board Schematic

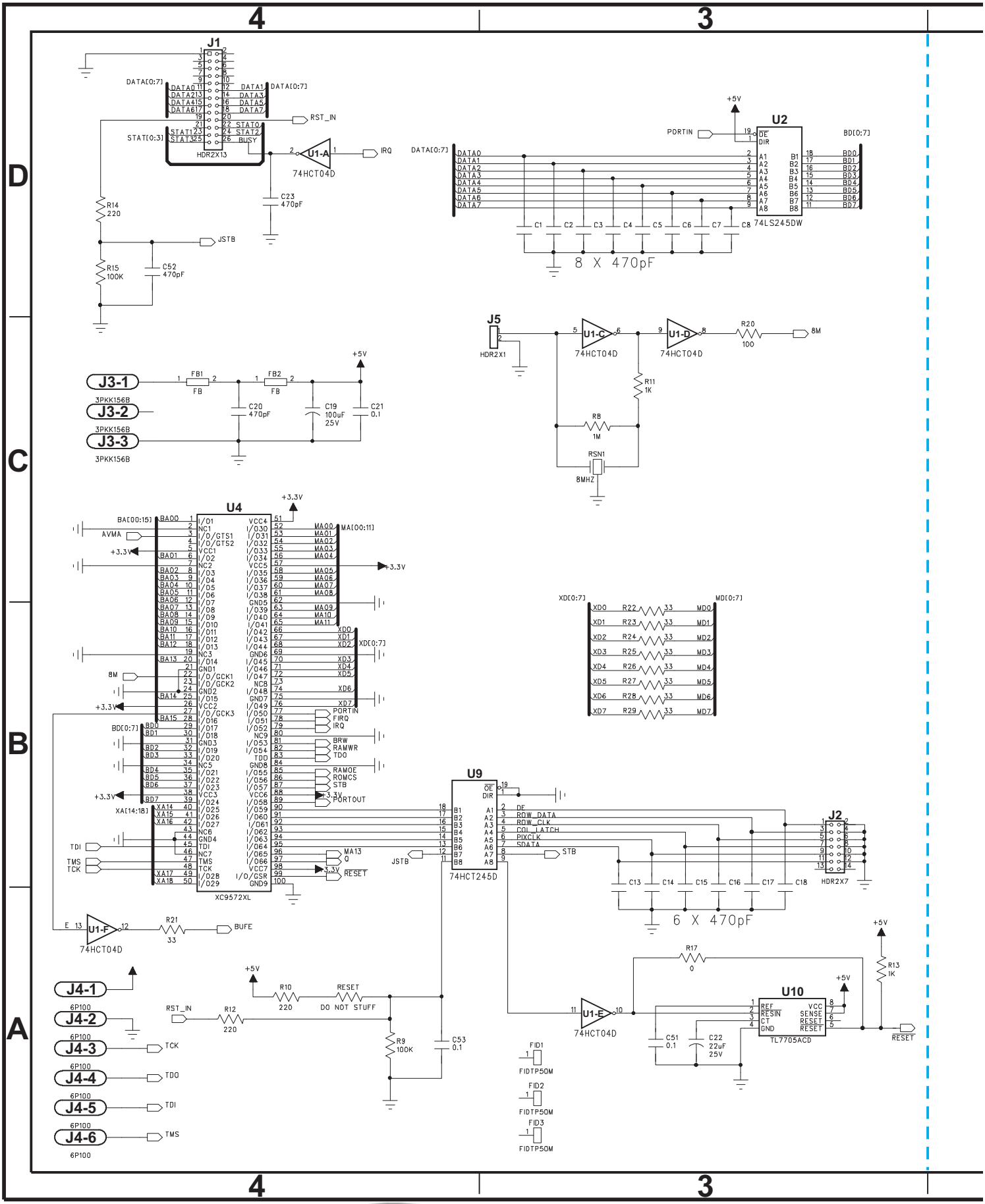


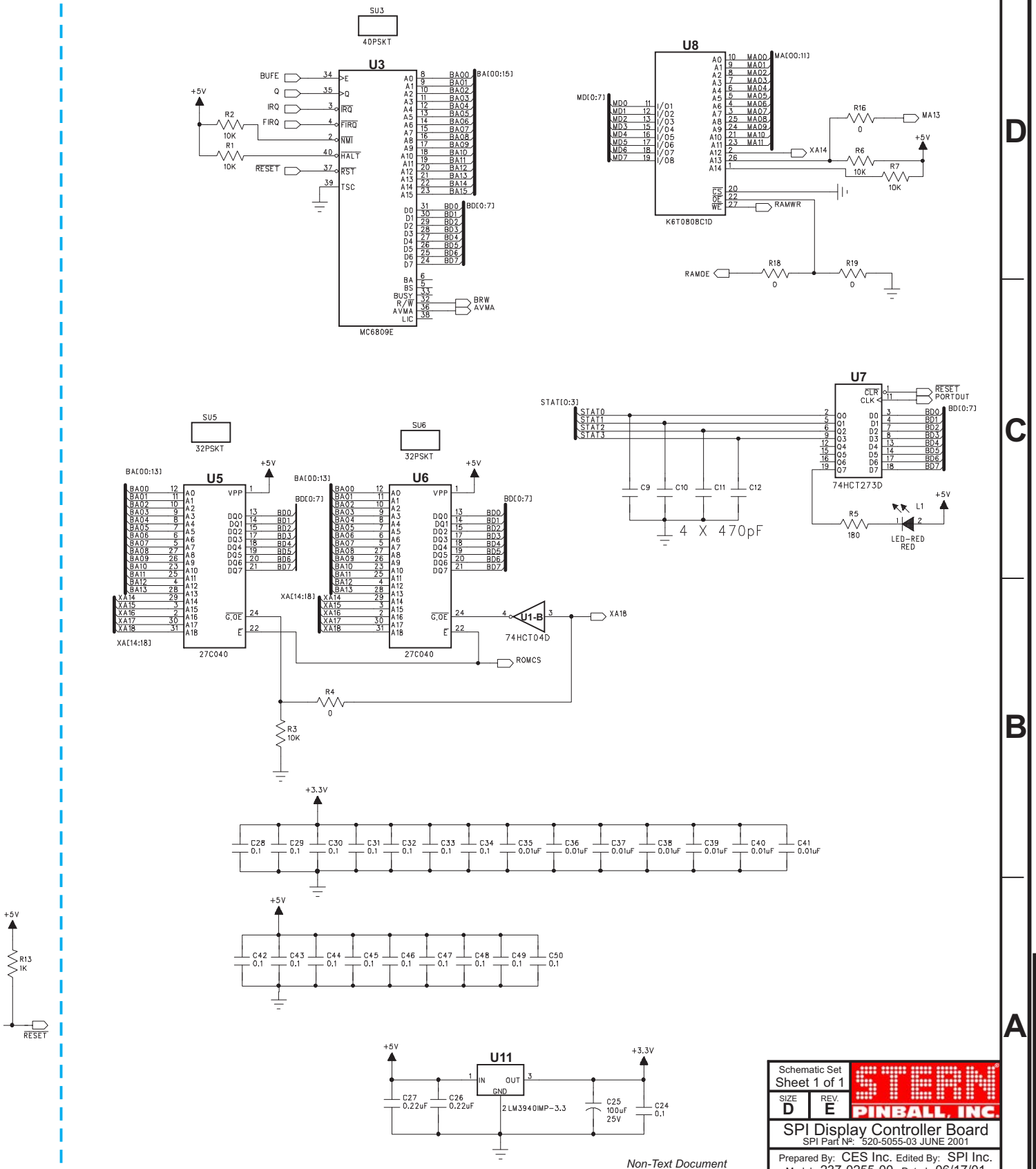
Display Power Supply Board Component Layout & Parts



Actual Board Size 5" X 3.3"

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


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



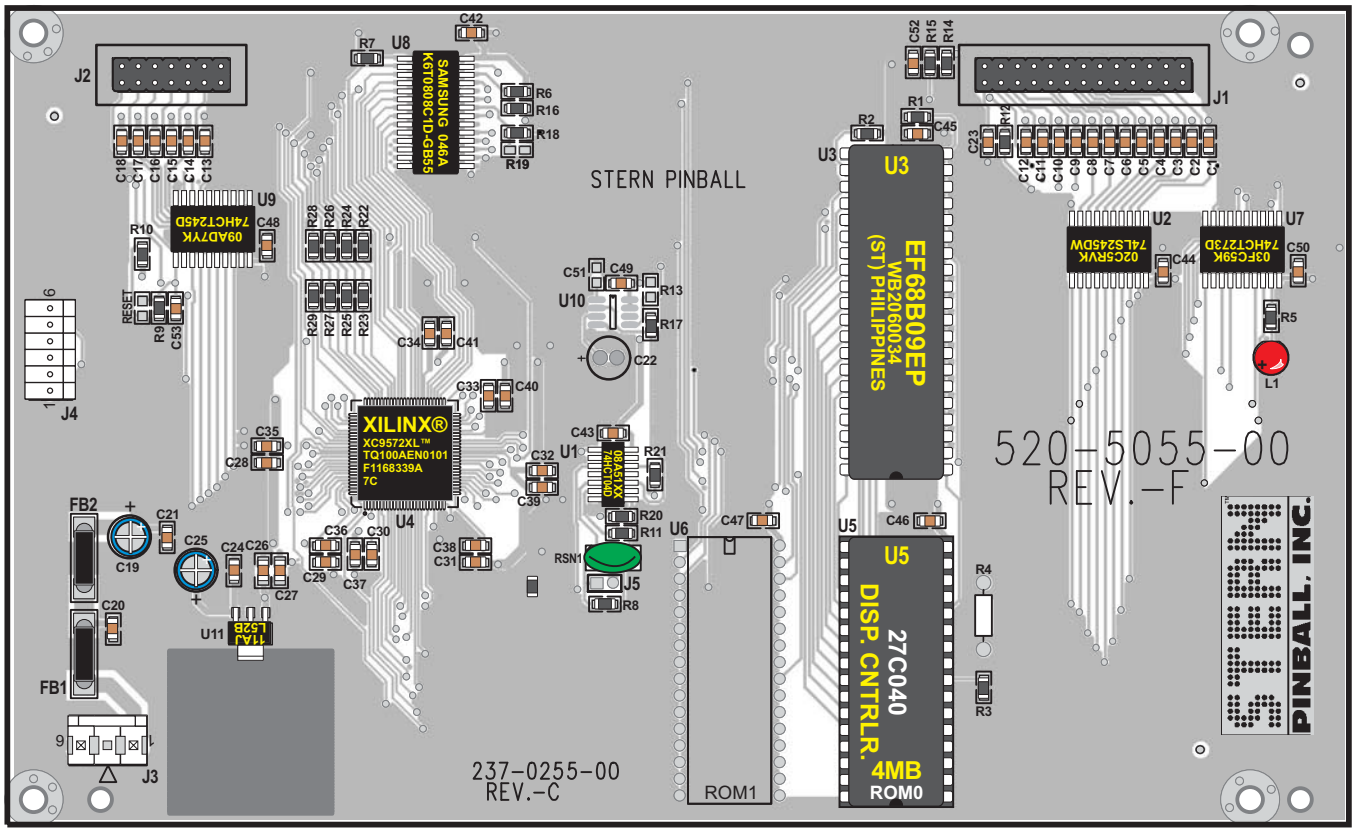
Schematic Set	Sheet 1 of 1
SIZE	D
REV.	E

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

Display Controller Board Component Layout & Parts



Actual Board Size 20.5cm X 12.5cm

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	**1**	**520-5055-03**	**Display Controller Bd. (FCC FEB98) Rev. E June 2001**	**Complete PCB Assembly**
01	1	045-5015-26	J1	13-Pin, Dual row .1" Hdr. Conn HDR2X13
02	1	045-5015-02	J2	7-Pin, Dual Row .1" Hdr. Conn HDR2X7
03	1	045-5015-03	J3	3-Pin, PKK156B Connector
04	1		J4	6-Pin (6P100)
05	7		C35-C39, C40, C41	SMT 0.01uF, 50v Cap. 103-0805-X7R
06	20		C21, C24, C28-C32, C33, C34, C42, C43, C44, C45, C46 C47, C48, C49, C50, C53 (C51: NS)	SMT 0.1uF, 50v Cap. 104-0805
07	2		C26, C27	SMT 0.22uF, 50v Cap. 224-1206-Z5U
08	21		C1-C12, C13-C18, C20, C23, C52	SMT 470pF, 50v Cap. 471-0805
09	2		C19, C25	100uF, 25v TCap.
10	**1**	**165-5099-00**	**L1**	**LED T1-3/4 DIFFUSER RED**
11	4		R16-R18 (R19: NS)	0 Ω 1/10W Resistor 0805
12	1	n/a	RESET	*DO NOT STUFF*
13	2		R11, R13	SMT 1K Ω 1/10W Resistor 0805
14	1		R8	SMT 1M Ω 1/10W Resistor 0805
15	5		R1, R2, R3, R7 (R6: NS)	SMT 10K Ω 1/10W Resistor 0805
16	9		R21, R22-R29	SMT 33 Ω 1/10W Resistor 0805
17	1		R20	SMT 100 Ω 1/10W Resistor 0805
18	2		R9, R15	SMT 100K Ω 1/10W Resistor 0805
19	1		R5	SMT 180 Ω 1/10W Resistor 0805
20	3		R10, R12, R14	SMT 220 Ω 1/10W Resistor 0805
21	1		U1	74HCT04D (74LS04)
22	1		U2	74LS245DW
23	1	100-0189-01	U3 *(40-Pin Socket, 077-X)*	MC6809E
24	1	100-5044-00	U4	XC9572XL, Int. Xilinx®
25	2 (See Pg. **DR.** ❶ Table)		U5 (ROM0) (U6: NS) *(32-Pin, IC Dip Socket, 077-5217-00)*	4MB ROM 27C040 (M27C401-100)
26	1		U7	74HCT273D
27	1	100-5045-00	U8	K6T0808C1D-GB55, Int. Samsung 046A
28	1		U9	74HCT245D
29	1		U11	LM3940IMP-3.3
30	1		RSN1	8MHZRSN (8Mhz) Crystal
31	2	n/a	FB1, FB2	Ferrite Bead, FB0370
32	0		FID1-3	FIDTP50M

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

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

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

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

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

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

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

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

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

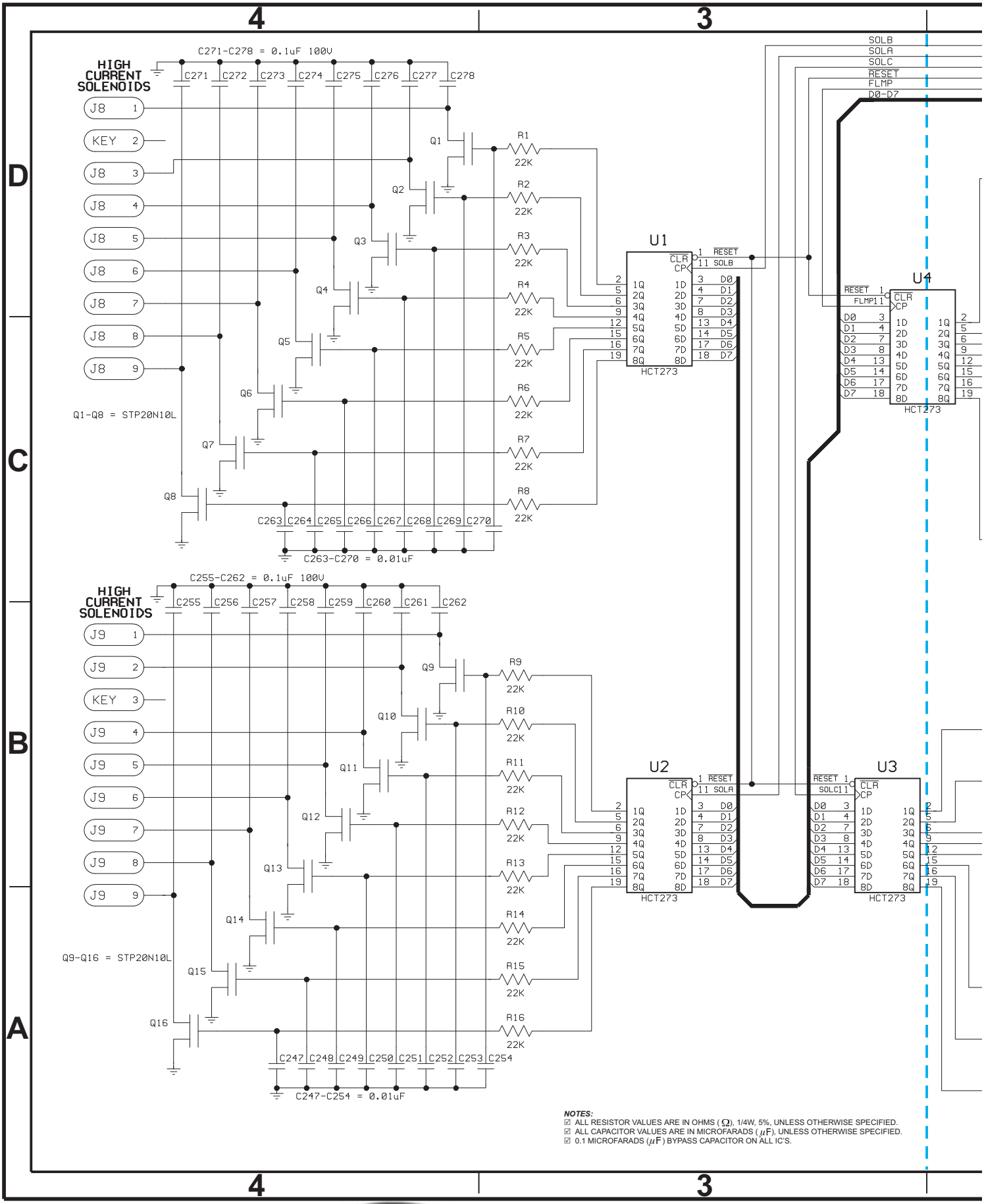
Solenoid (Coil) Drivers & Flash Lamps:
J8 & **J9** are high side drivers for driving solenoids and other heavy loads. Each connector has its own buffer driving 8 drivers. **J8** & **J9** consist of **MOSFET Drivers 20N10L** which can easily & safely be tested by clipping one end of a clip-lead to test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

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

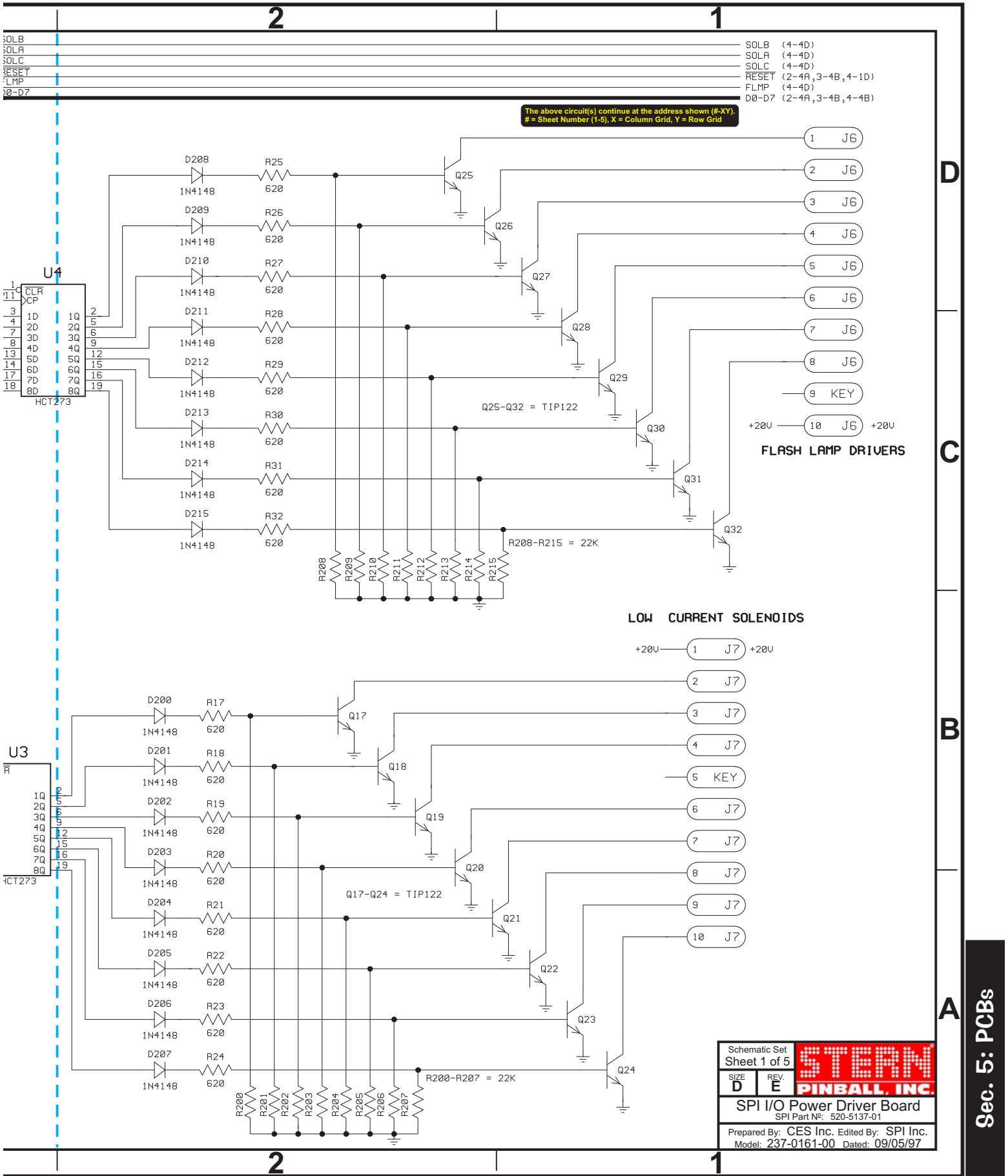
Auxiliary In & Out:
J2-8 CMOS Outputs sometimes used for a printer interface.
J3-8 CMOS Inputs general purpose inputs.

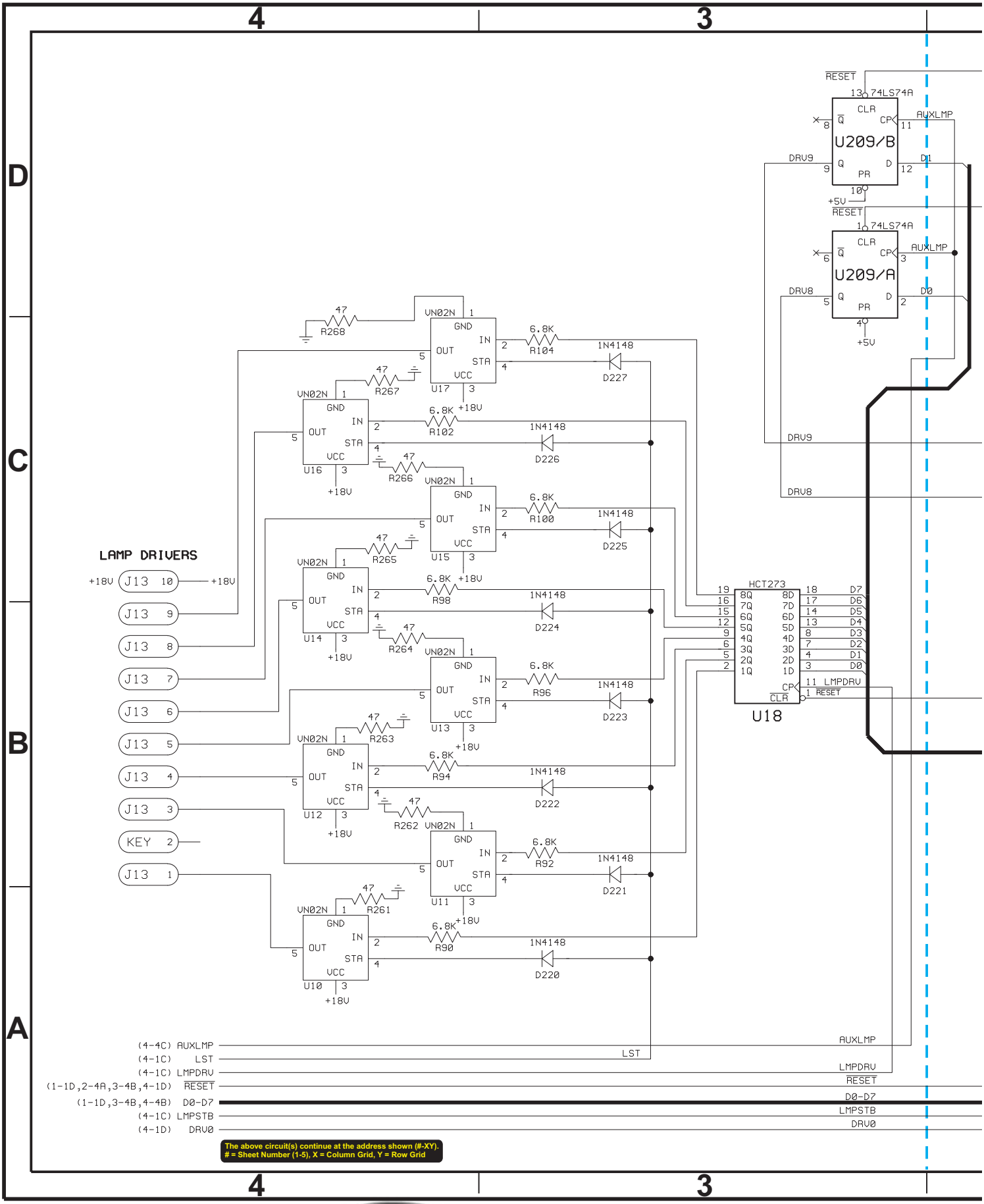
Lamp Matrix:
J12 has 10 low side drivers for the lamp strobes which consist of **19N06L MOSFETS**. Only one lamp strobe should be low at any time. Again the scanning of the lamp strobes keeps the **I/O** from resetting. **J13** has 8 high side drivers with each having a status indicator. All the status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

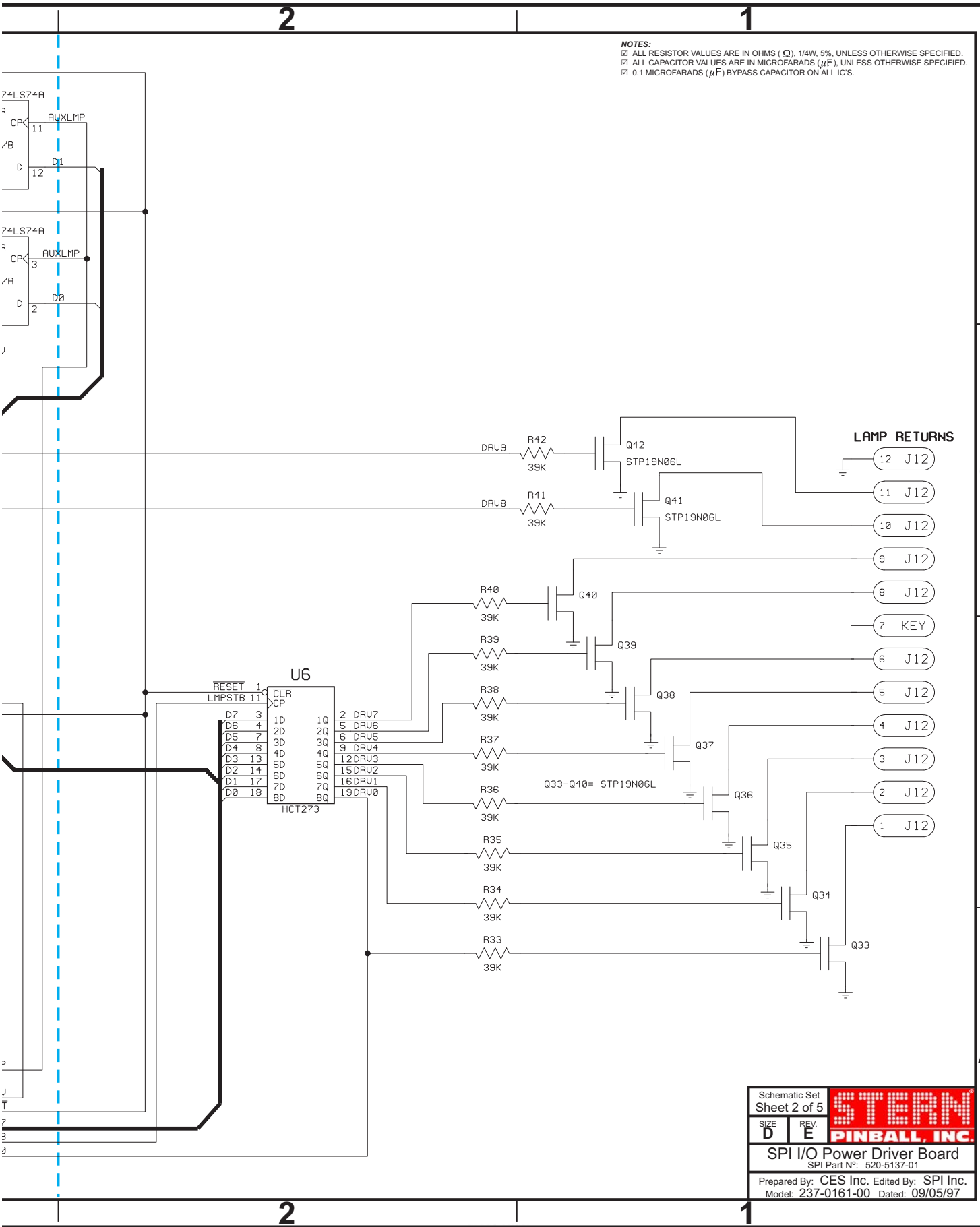
General Illumination (G.I.) Lights:
J15 has 6v AC switched on & off by a relay on the **I/O Board**. The relay is controlled by **Q200** which supplies power to the 24v coil winding to activate the relay. There are 4 taps on **J15** each fused at 5A for this 6v AC source.

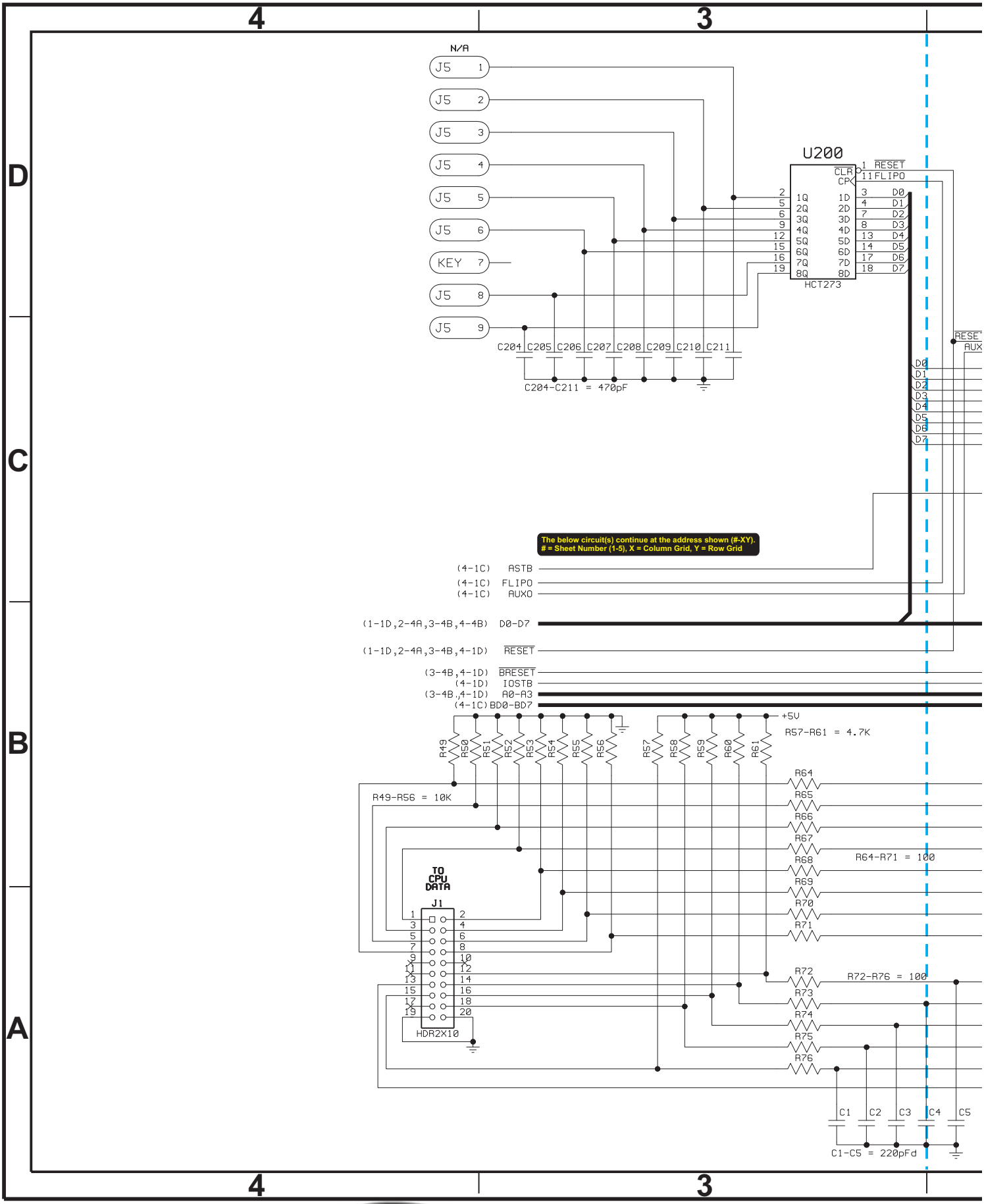


NOTES:
- ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
- ☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
- ☑ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.


SOLB (4-4D)
SOLA (4-4D)
SOLC (4-4D)
RESET (2-4A,3-4B,4-1D)
FLMP (4-4D)
D0-D7 (2-4A,3-4B,4-4B)
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
U4
HCT273
D208 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
RESET
74LS74A
CLR
CP
U209/B
U209/A
AUXLMP
DRV9
DRV8
D1
D0
HCT273
U18
LMPDRV
D7
D6
D5
D4
D3
D2
(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
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
J12
KEY
Schematic Set
Sheet 2 of 5
SIZE D
REV. E
STERN PINBALL, INC.
SPI I/O Power Driver Board
SPI Part №: 520-5137-01
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0161-00 Dated: 09/05/97


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

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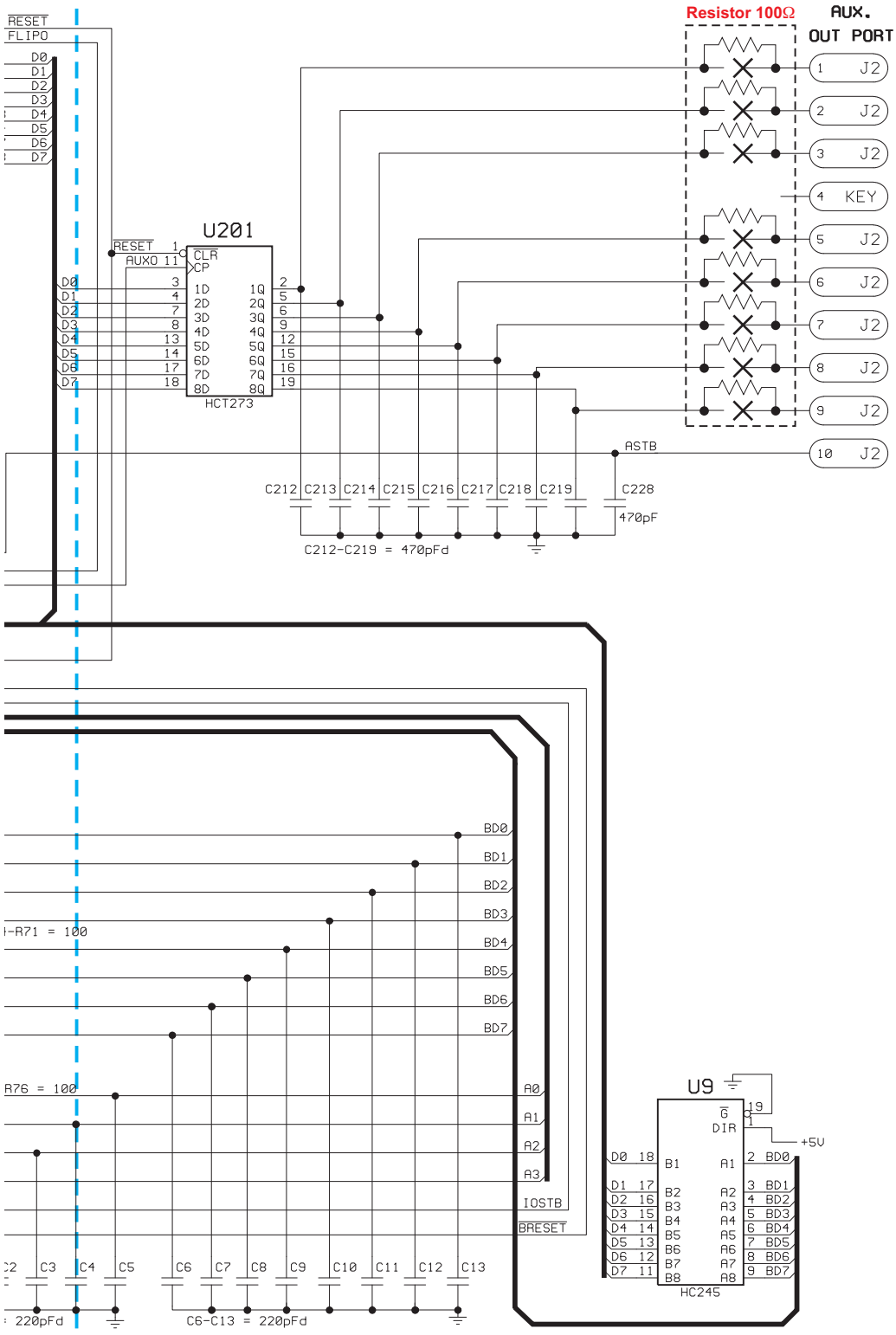
- ☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
- ☑ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.

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

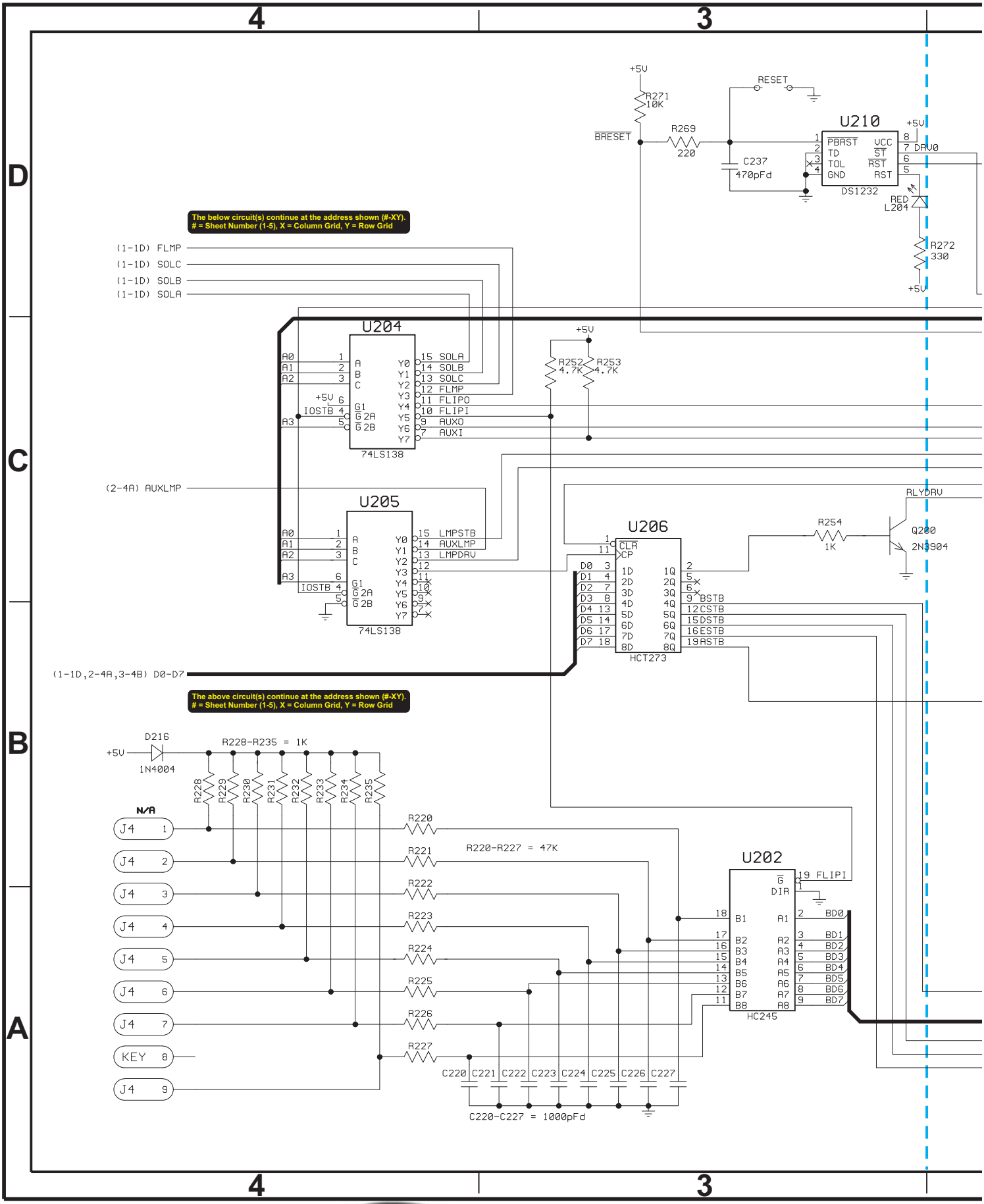


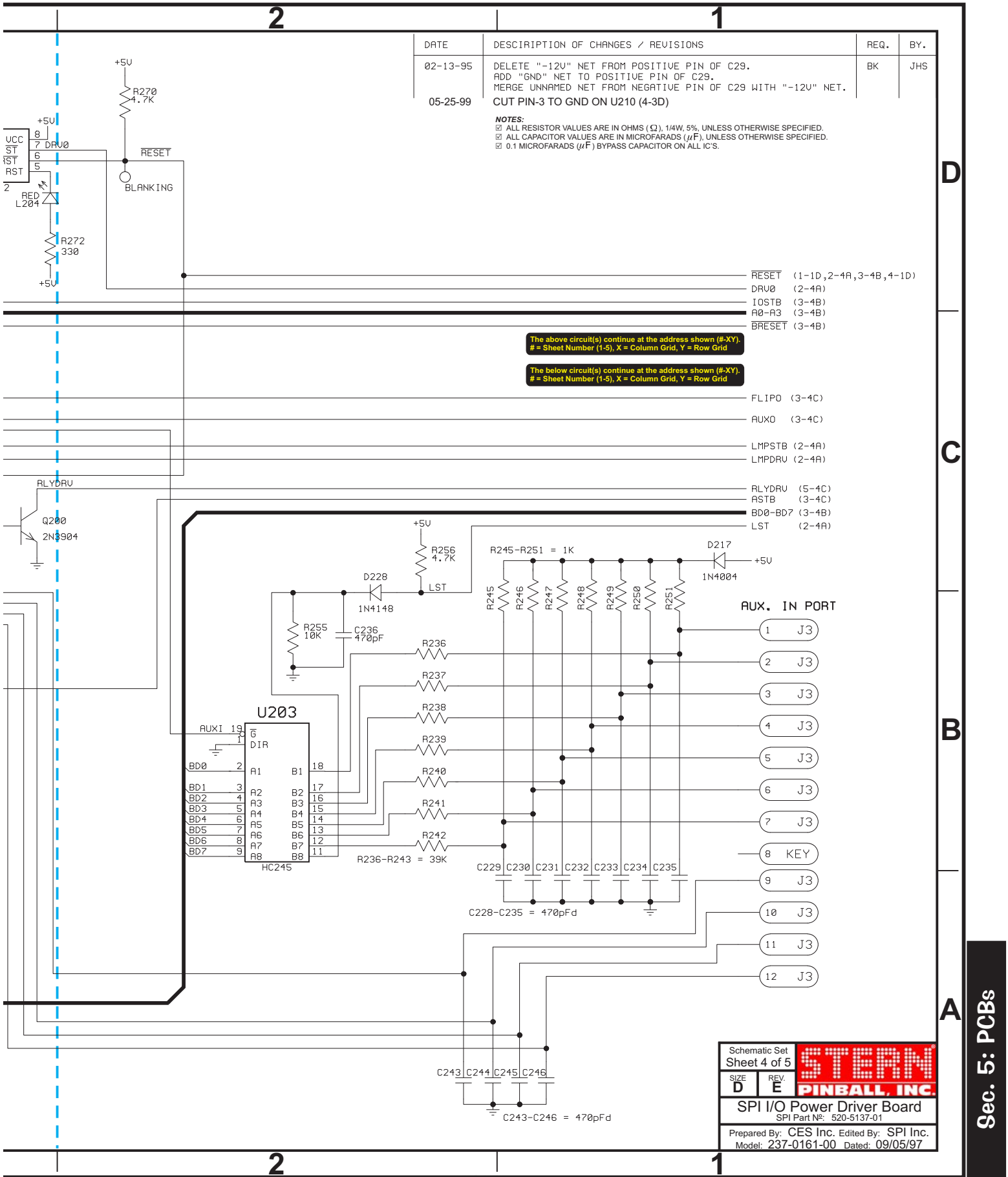
Schematic Set	Sheet 3 of 5
SIZE	D
REV.	E

STERN PINBALL, INC.

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

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


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


2
1
D
C
B
A
DATE
DESCIRIPTION 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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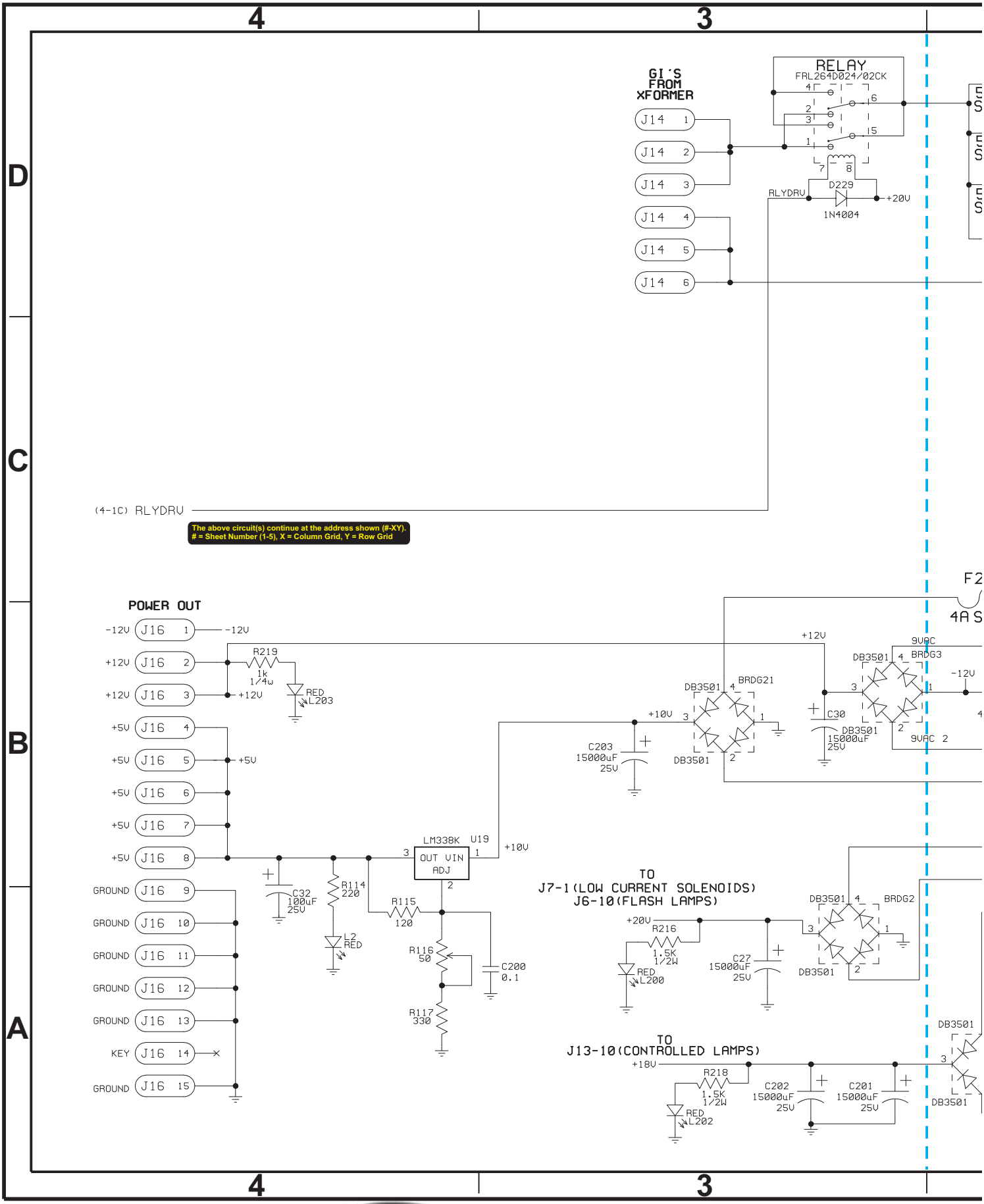
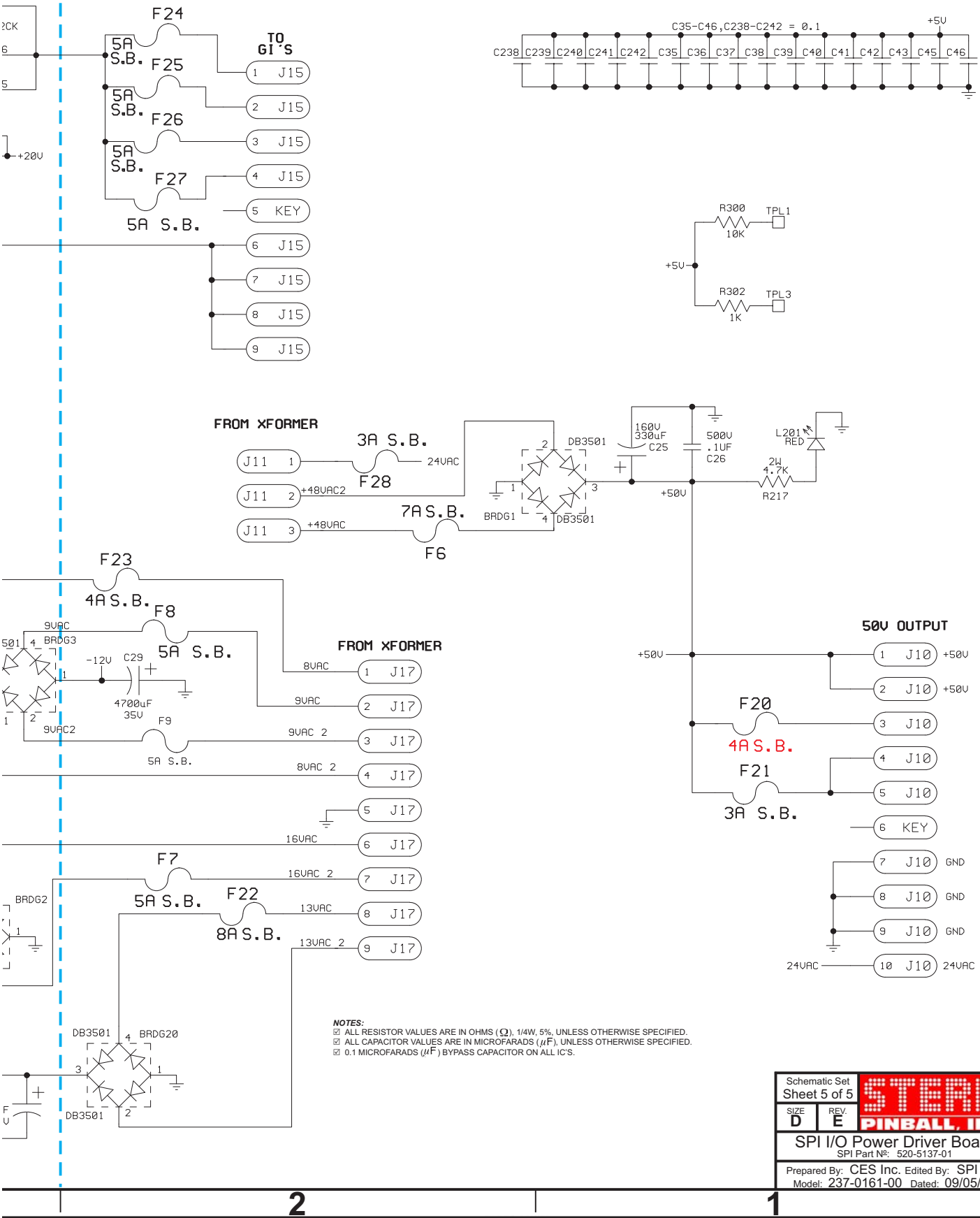
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
☑ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.
+5V
R270 4.7K
RESET
BLANKING
RED L204
R272 330
DRV0
RST
RESET (1-1D,2-4A,3-4B,4-1D)
DRV0 (2-4A)
IOSTB (3-4B)
A0-A3 (3-4B)
BRESET (3-4B)
The above circuit(s) continue at the 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
Q200 2N3904
RLYDRV (5-4C)
ASTB (3-4C)
BD0-BD7 (3-4B)
LST (2-4A)
R256 4.7K
D228 1N4148
R255 10K
C236 470pF
R245-R251 = 1K
D217 1N4004
R245 R246 R247 R248 R249 R250 R251
AUX. IN PORT
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
9VAC
DB3501 BRDG3
-12V
9VAC 2
F2
4A S
TO
J7-1(LOW CURRENT SOLENOIDS)
J6-10(FLASH LAMPS)
R216
1.5K
1/2W
RED
L200
C27
15000uF
25V
DB3501 BRDG2
TO
J13-10(CONTROLLED LAMPS)
+18V
R218
1.5K
1/2W
RED
L202
C202
15000uF
25V
C201
15000uF
25V
DB3501



NOTES:
- ☑ 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.

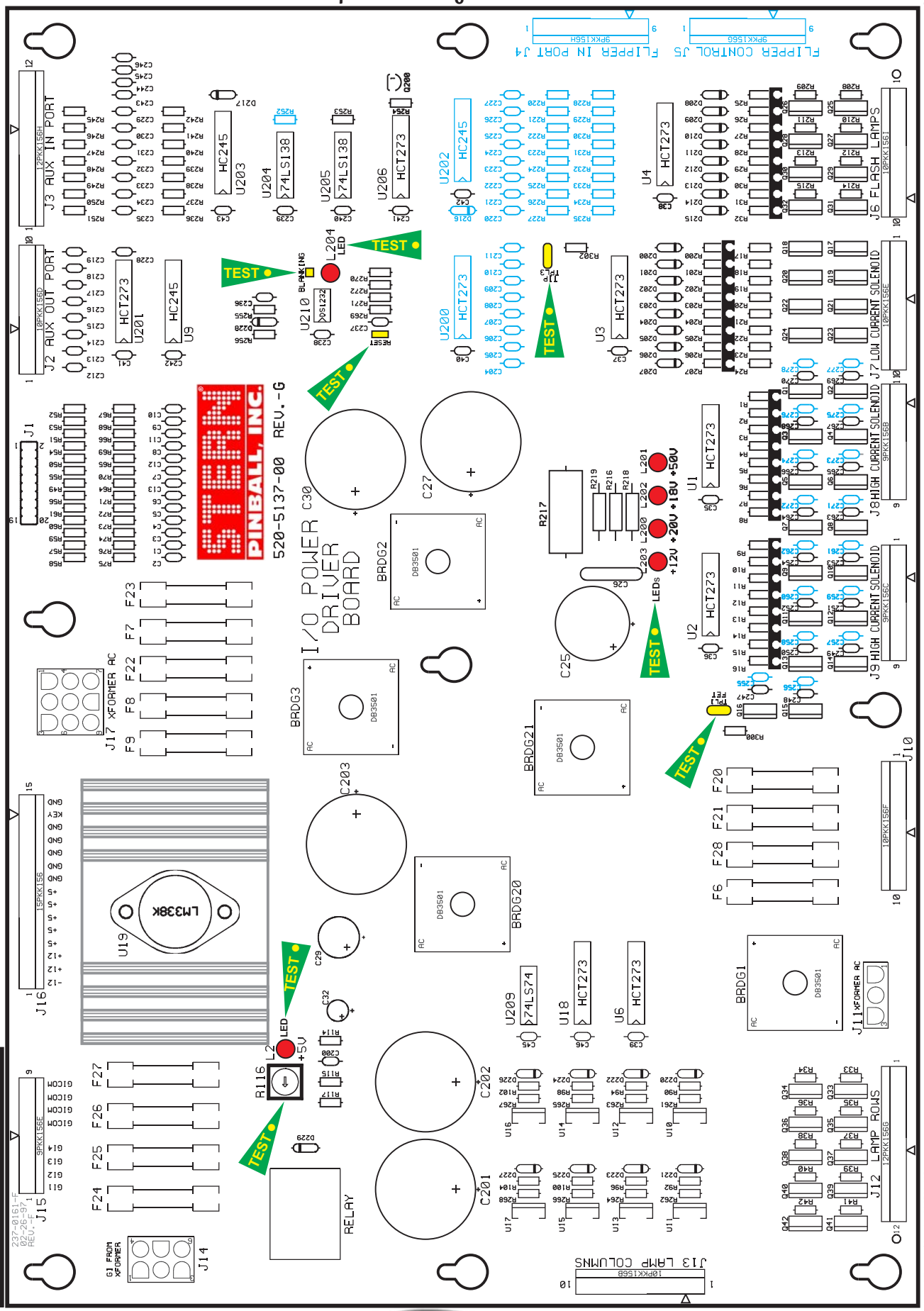
Schematic Set	Sheet 5 of 5
SIZE D	REV. E

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

I/O Power Driver Board Component Layout



Actual Board Size 15.698" X 11"

Ripley's Believe It or Not!

I/O Power Driver Board Parts

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	**1**	**520-5137-01**	**I/O Power Driver Board Rev. G**	**Complete PCB Assembly**
01	5	112-5000-00	BRDG1, BRDG2, BRDG3, BRDG20, BRDG21	DB3501
02	13	125-5030-00	C1, C2, C3>C6, C7, C8, C9>C10, C11, C12	220pF, (221), Cap.
03	1	125-5033-00	C25	100uF, 150v, Radial Lytic Cap.
04	1	125-5035-00	C26	.1UF, 500v, Ceramic Disk Cap.
05	5	125-5036-00	C27, C30, C201, C202, C203	15000uF, 25v, Radial Lytic Cap.
06	1	125-5034-00	C29	4700uF, 35v, Radial Lytic Cap.
07	1	125-5032-00	C32	100uF, 25v, Radial Lytic Cap.
08	17	125-5031-00	C35, C36, C37, C38, C39, C40, C41, C42, C43, C45, C46, C200, C238, C239, C240, C241, C242	0.1uF, (104), Cap.
09	22	125-5028-00	C212>C219, C228>C237, C243>C246 (C204-C211: NS)	470pF, (471), Axial Cap.
10	0	n/a	(C220>C227: NS)	
11	16	125-5029-00	C247>C254, C263>C270	0.01uF, (103), 100v Cap.
12	0	125-5027-00	(C255>C262, C271>C278: NS)	0.1uF, (104), 100v, Cap.
13	25	112-0054-00	D200>D207, D208>D215, D220, D221, D222, D223, D224, D225, D226, D227	1N4148, Diode
14	2	112-5003-00	D217, D229 (D216: NS)	1N4004, Diode
15	26	205-0004-00	F6, F7, F8, F9, F20, F21, F22, F23, F24> F27, F28	Fuse Clips
16	1	200-5000-03	F6	7A 250v S.B. Fuse
17	7	200-5000-01	F7, F8, F9, F24>F27	5A 250v S.B. Fuse
18	2	200-5000-08	F21, F28	3A 250v S.B. Fuse
19	1	200-5000-05	F22	8A 250v S.B. Fuse
20	2	200-5000-06	F20, F23	4A 250v S.B. Fuse
21	1	045-5015-01	J1	20-Pin, 0.1 Dual Row Header
22	1	045-5014-01	J2 (Key Pin-4), J6 (Key Pin-9), J7 (Key Pin-5) J10 (Key Pin-6), J13 (Key Pin-2)	10PKK156
23	1	045-5015-00	J3 (Key Pin-8)	12PKK156
	0	n/a	(J4, J5: NS)	
24	1	045-5013-00	J8 (Key Pin-2), J9 (Key Pin-3), J15 (Key Pin-5)	9PKK156
25	1	045-0014-03	J11	10-84-4030 (3-Pin MOLEX)
26	1	045-5015-00	J12 (Key Pin-7)	12PKK156
27	1	045-0014-06	J14	10-84-4060 (6-Pin MOLEX)
28	1	045-5016-00	J16 (Key Pin-14)	15PKK156
29	1	045-0014-09	J17	10-84-4090 (9-Pin MOLEX)
30	**6**	**165-5099-00**	**L2, L200, L201, L202, L203, L204**	**LED T1-3/4 DIFFUSER LED**
31	16	110-0106-00	Q1>Q16	22NE10L STP, Transistor
32	16	110-0067-00	Q17>Q24, Q25>Q32	TIP122
33	10	110-0088-00	Q33>Q42	19N06L STP, Transistor
34	1	110-0069-00	Q200	2N3904, Transistor.
35	32	121-5042-00	R1>R8, R9>R16, R200>R207, R208>R215	22K Ω 1/4W Res.
36	16	121-5003-00	R17>R24, R25>R32	620 Ω 1/4W Res.
37	17	121-5045-00	R33>R42, R236>R242	39K Ω 1/4W Res.
38	8	121-5021-00	R49, R57>R61, R253, R256, R270 (R252: NS)	4.7K Ω 1/4W Res.
39	11	121-5011-00	R50>R56, R255, R271, R300	10K Ω 1/4W Res.
40	13	121-5007-00	R64>R76 Resistors on Solder Side @ J2-Pins: 1-3 & 5-9	100 Ω 1/4W Res.
41	8	121-5029-00	R90, R92, R94, R96, R98, R100, R102, R104	6.8K Ω 1/4W Res.
42	2	121-5033-00	R114, R269	220 Ω 1/4W Res.
43	1	121-5030-00	R115	120 Ω 1/4W Res.
44	1	121-5039-00	R116	50 Ω Pot
45	2	121-5036-00	R117, R272	330 Ω 1/4W Res.
46	2	121-5038-00	R216, R218	1.5K Ω 1/2W Res.
47	1	121-5050-00	R217	4.7K Ω 2W Res. (SANDBAR)
48	1	121-5009-00	R219, R245>R251, R254, R302 (R228>R235: NS)	1K Ω 1/4W Res.
49	8	121-5016-00	R261, R262, R263, R264, R265, R266, R267, R268	47 Ω 1/4W Res.
50	1	190-5002-00	RELAY	FRL264D024/02CK Relay
51	2	n/a	TPL1, TPL3	*Test Point Wire (24ga.) Loops*
52	8	100-5012-00	U1, U2, U3, U4, U6, U18, U201, U206 (U200: NS)	74HCT273
53	1	110-0058-00	U9	74LS245
54	1	100-5023-00	U210	DS1232
55	8	110-0089-00	U10, U11, U12, U13, U14, U15, U16, U17	VN02N
56	1	100-0356-00	U19	LM338K
57	1	n/a	U19	Heatsink (5v Reg.)
58	1	100-0338-00	U203 (U202: NS)	74HC245
59	2	100-0148-00	U204, U205	74LS138
60	1	100-0037-00	U209	74LS74
61	1	n/a	BLANKING, RESET	*Test Points*

To view Playfields (above & below), click this box.

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

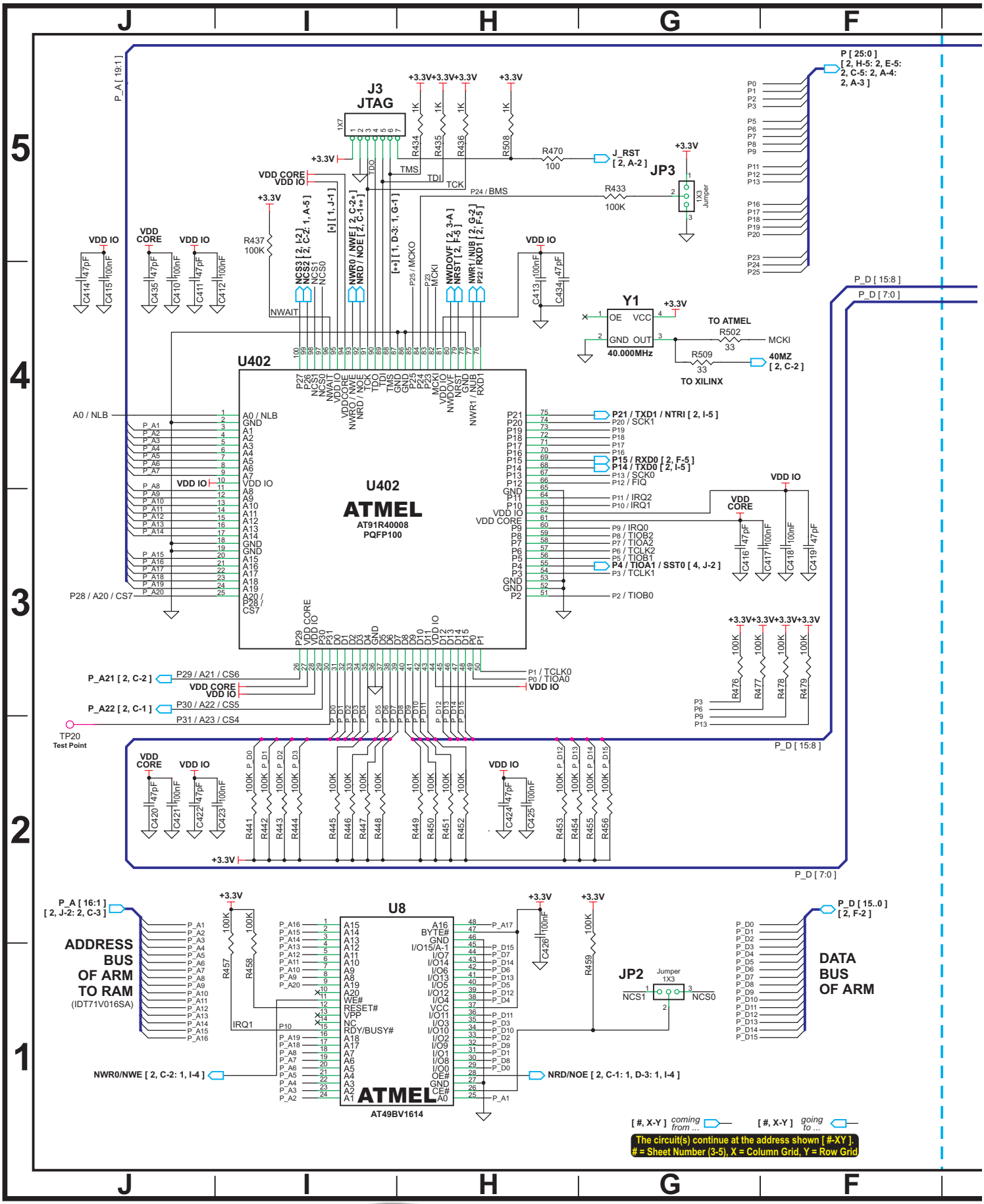
A watchdog is used to monitor the **CPU** and the 5v supply. If the 5v supply is below 4.75 the watchdog will hold the **CPU**/**Sound Board** & **I/O Board** in *reset*. The watchdog must be fed at a rate of ***250ms*** or faster. The signal used to feed the watchdog comes from the EPROM Bank select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

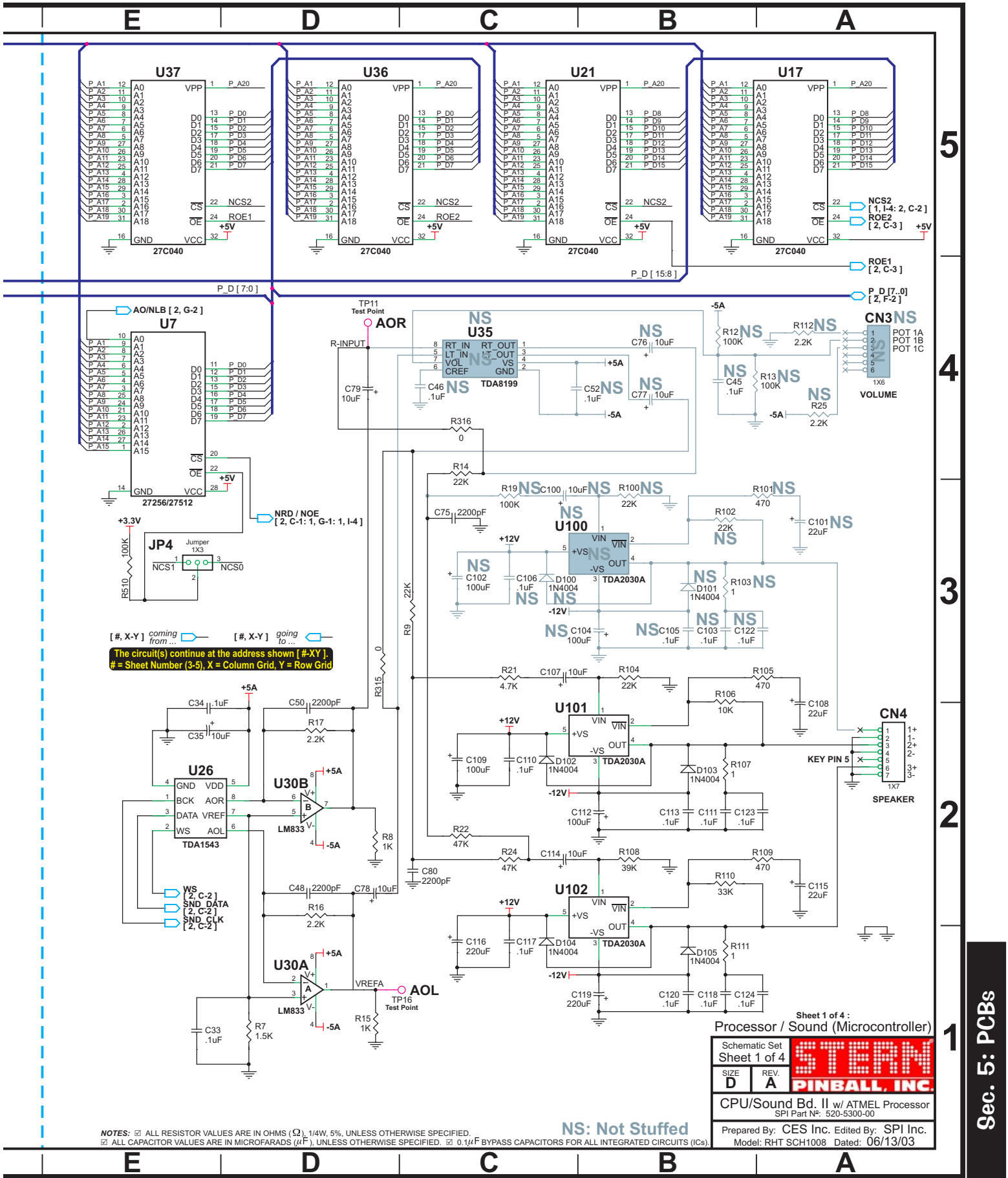
The **I/O** Interface **CN1** is buffered by two (2) **HC245** Chips (**U207 & U208**). The **CPU**'s reset line is buffered by **Q10** and fed over to the **I/O** through **CN1**. An I/*O Strobe Signal* is fed through **CN1-15** and is used to notify the **I/O** that a valid address is being sent.

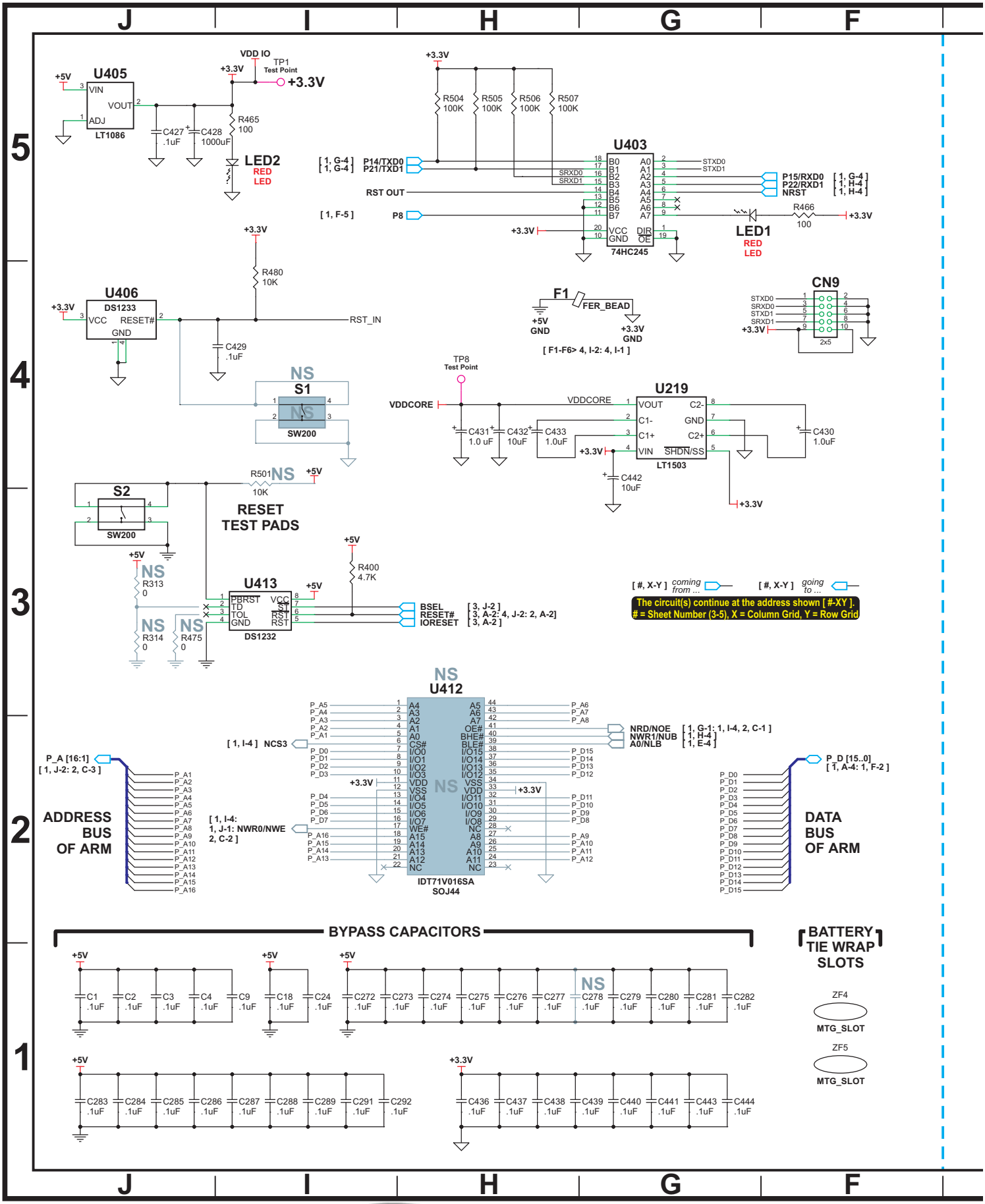
Switches:
The Switch Matrix consists of eight (8) **2N3904** Transistors(**Q1-Q8**) which pull one of 8 strobes 'low' to *activate* a Single Column of switches. The *Switch Return Signals* are fed into **CN7** [SWITCH ROWS] and are highly filtered and compared to a 2.5v *reference voltage*. The *Switch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

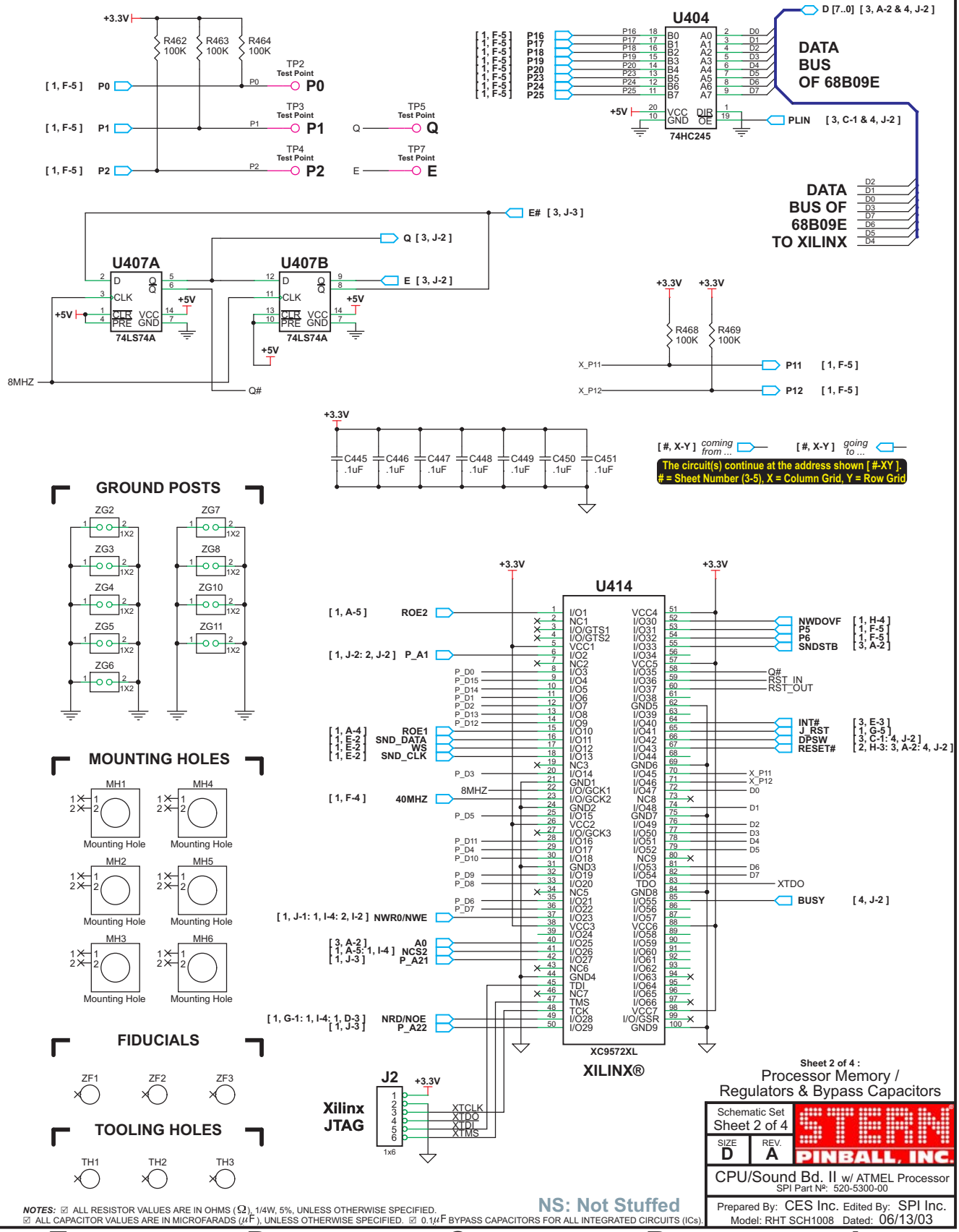
Plasma Interface:
The data path for communication to and from the **Plasma Controller Board** is 8 bits wide. There are separate *Input* and *Output Busses*. Data going out to the controller comes from the **CPU**'s *Data Bus* through **U201** and onto **CN8-Pins 11-18**. Status back from the Plasma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

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


J3
JTAG
U402
ATMEL
AT91R40008
PQFP100
U8
ATMEL
AT49BV1614
Y1
40.000MHz
JP3
JP2
TO ATMEL
TO XILINX
MCKI
40MZ
[2, C-2]
J_RST
[2, A-2]
P_A [19:1]
P [25:0]
[2, H-5: 2, E-5: 2, C-5: 2, A-4: 2, A-3]
P_D [15:8]
P_D [7:0]
P_A [16:1]
[2, J-2: 2, C-3]
ADDRESS BUS OF ARM TO RAM
(IDT71V016SA)
DATA BUS OF ARM
P_D [15..0]
[2, F-2]
TP20
Test Point
P21 / TXD1 / NTRI [2, I-5]
P15 / RXD0 [2, F-5]
P14 / TXD0 [2, I-5]
P4 / TIOA1 / SST0 [4, J-2]
P28 / A20 / CS7
P29 / A21 / CS6
P30 / A22 / CS5
P31 / A23 / CS4
P_A21 [2, C-2]
P_A22 [2, C-1]
NWR0/NWE [2, C-2: 1, I-4]
NRD/NOE [2, C-1: 1, D-3: 1, I-4]
[#, 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

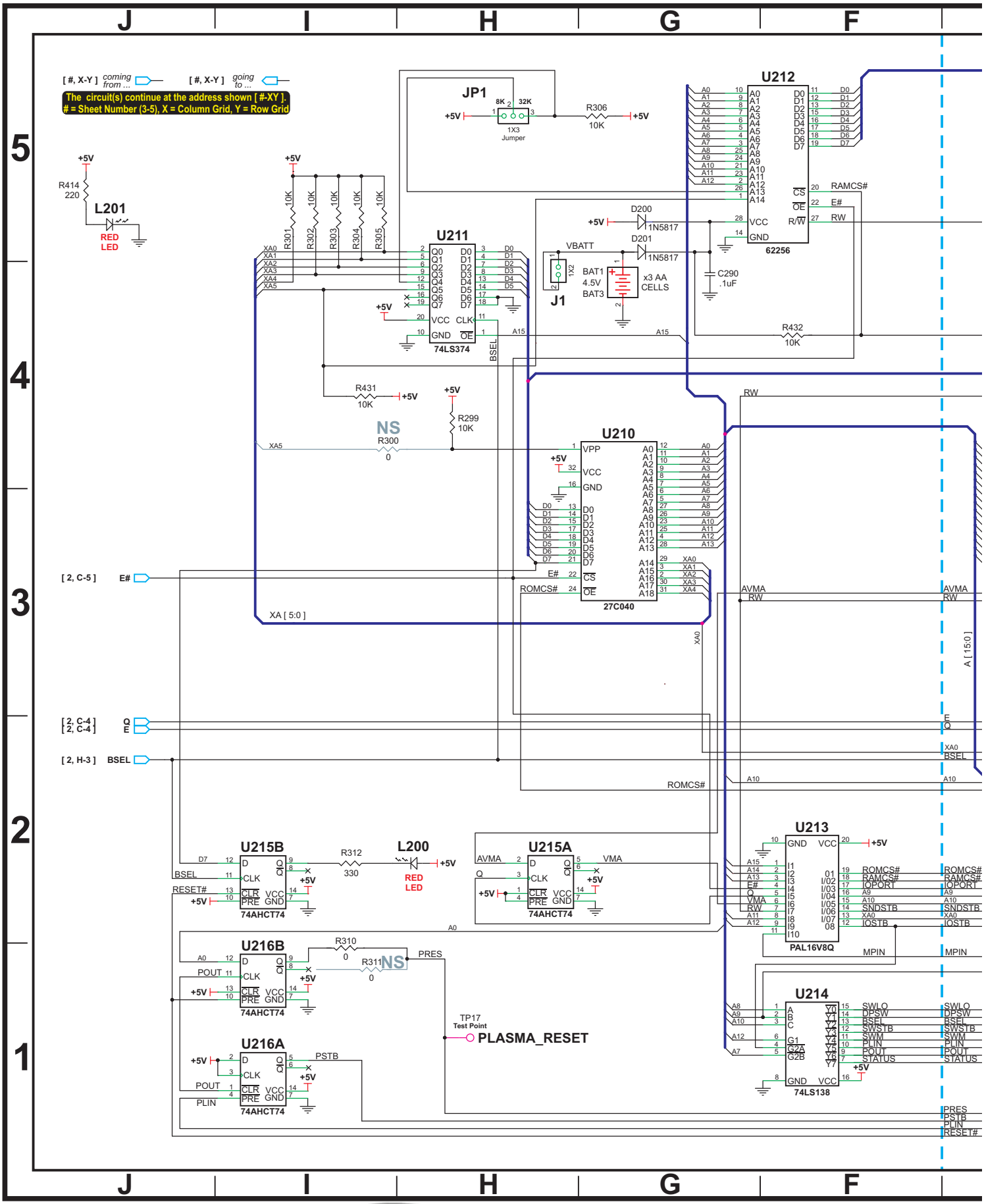

E
D
C
B
A
5
4
3
2
1
U37
U36
U21
U17
27C040
P_D [15:8]
P_D [7:0]
P_D [7..0] [2, F-2]
NCS2 [1, I-4: 2, C-2]
ROE2 [2, C-3]
ROE1 [2, C-3]
AO/NLB [2, G-2]
U7
27256/27512
NRD / NOE [2, C-1: 1, G-1: 1, I-4]
JP4
Jumper 1X3
TP11 Test Point
AOR
R-INPUT
U35
TDA8199
CN3
POT 1A
POT 1B
POT 1C
VOLUME
U100
U101
U102
TDA2030A
CN4
KEY PIN 5
SPEAKER
U26
TDA1543
U30B
U30A
LM833
AOL
TP16 Test Point
WS [2, C-2]
SND_DATA [2, C-2]
SND_CLK [2, C-2]
[#, X-Y] coming from ...
[#, X-Y] going to ...
The circuit(s) continue at the address shown [#-XY].
= Sheet Number (3-5), X = Column Grid, Y = Row Grid
NS: Not Stuffed
NOTES: ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED. ☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).
Sheet 1 of 4 :
Processor / Sound (Microcontroller)
Schematic Set Sheet 1 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

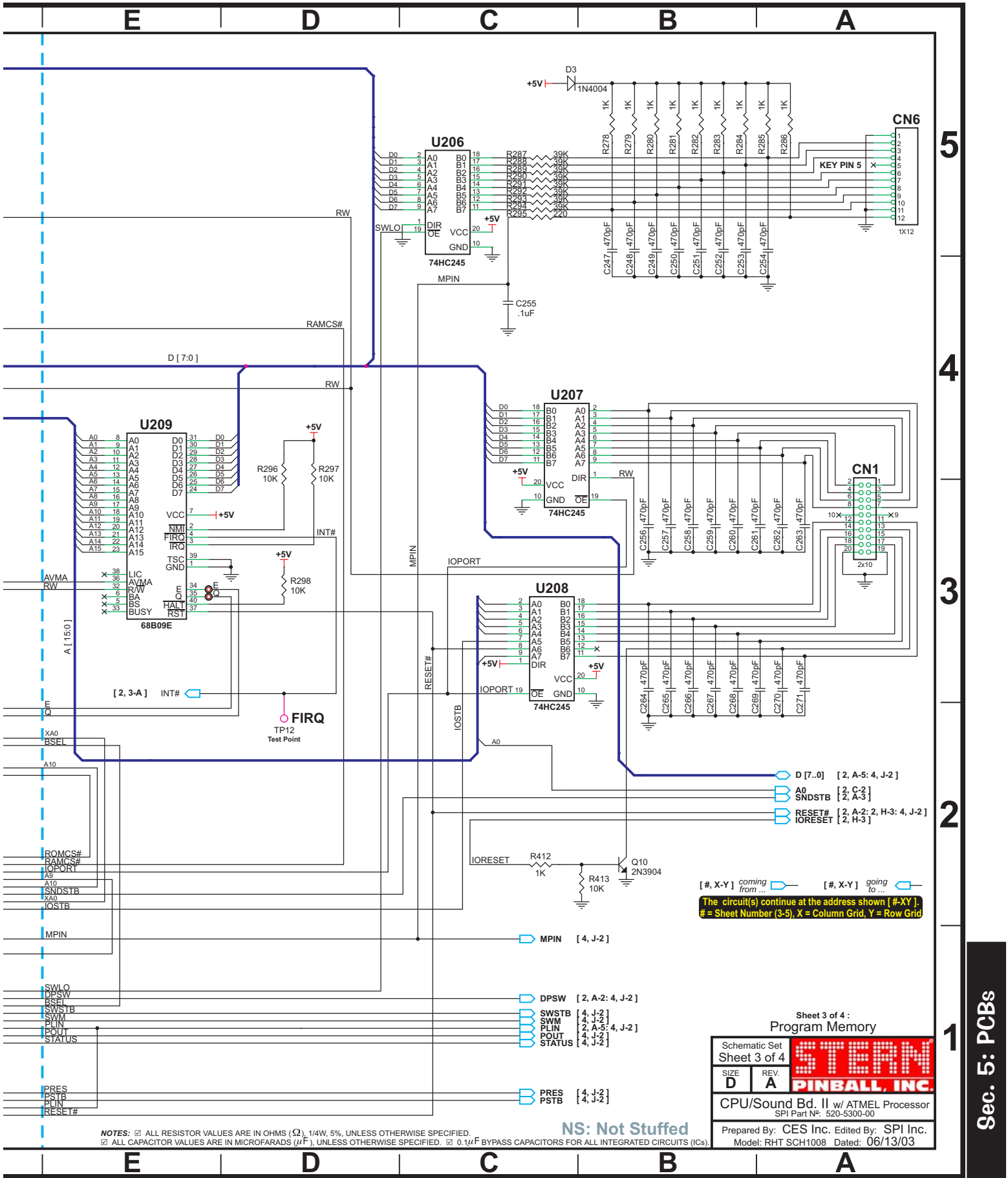

J I H G F
5
4
3
2
1
U405
LT1086
VDD IO
TP1
Test Point
+3.3V
R465
100
C427
.1uF
C428
1000uF
LED2
RED
LED
R504 100K
R505 100K
R506 100K
R507 100K
U403
74HC245
P14/TXD0
P21/TXD1
P15/RXD0
P22/RXD1
NRST
RST OUT
P8
R466
100
LED1
RED
LED
U406
DS1233
R480
10K
RST_IN
C429
.1uF
F1
FER_BEAD
CN9
2x5
S1
SW200
TP8
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
[#, 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
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



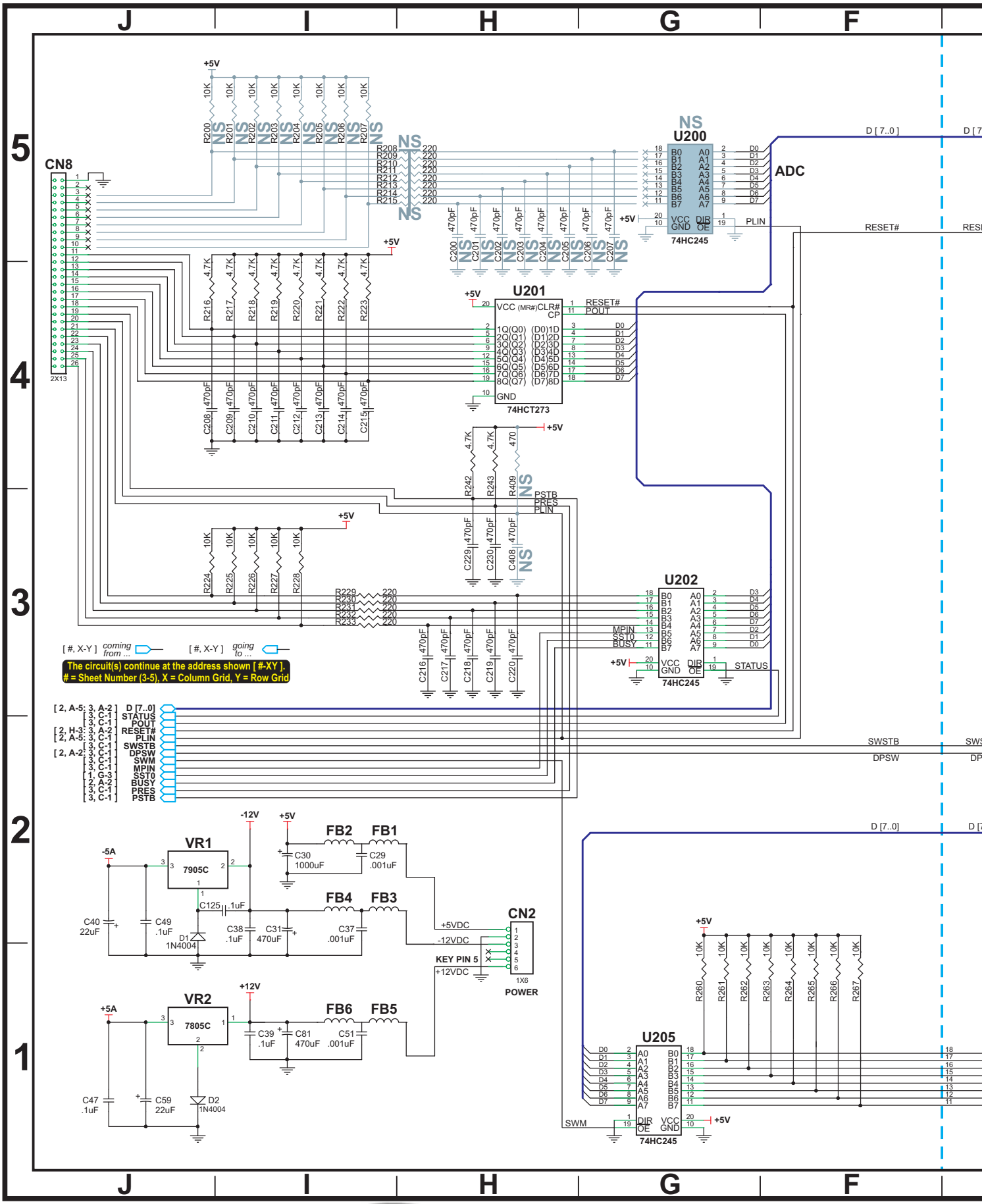
NOTES: ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED. ☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).

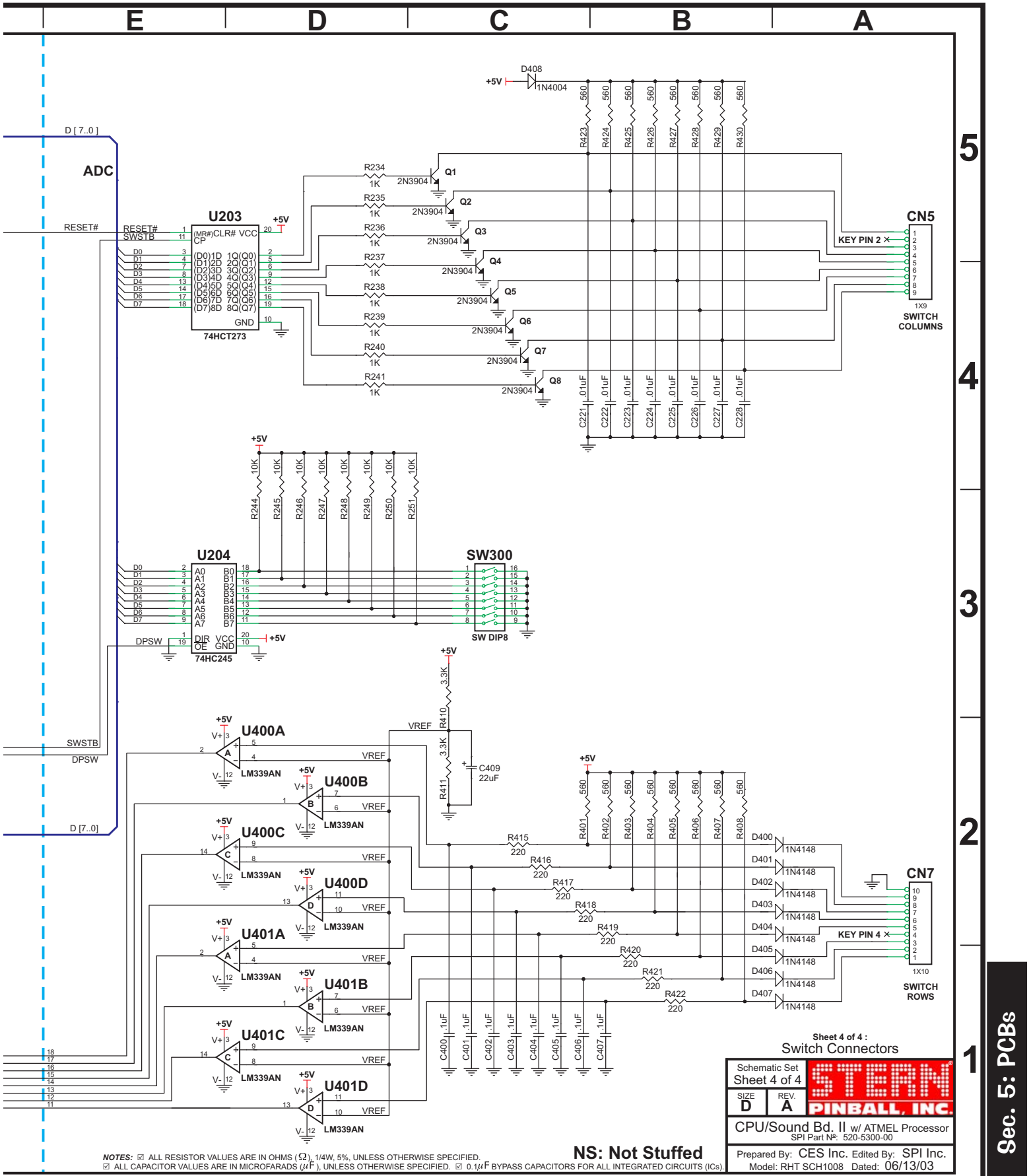
CPU/Sound Board II (with ATMEL Processor) Schematic (Sheet 3 of 4)




E
D
C
B
A
5
4
3
2
1
U206
74HC245
U207
74HC245
U208
74HC245
U209
68B09E
CN6
KEY PIN 5
1X12
CN1
2x10
D3
1N4004
+5V
RW
RAMCS#
D [7:0]
MPIN
IOPORT
IOSTB
RESET#
A [15:0]
AVMA
INT#
FIRQ
TP12
Test Point
IORESET
R412
1K
R413
10K
Q10
2N3904
R296
10K
R297
10K
R298
10K
C255
.1uF
[2, 3-A]
[#, 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
D [7..0] [2, A-5: 4, J-2]
A0 [2, C-2]
SNDSTB [2, A-3]
RESET# [2, A-2: 2, H-3: 4, J-2]
IORESET [2, H-3]
MPIN [4, J-2]
DPSW [2, A-2: 4, J-2]
SWSTB [4, J-2]
SWM [4, J-2]
PLIN [2, A-5: 4, J-2]
POUT [4, J-2]
STATUS [4, J-2]
PRES [4, J-2]
PSTB [4, J-2]
ROMCS#
RAMCS#
IOPORT
SNDSTB
IOSTB
SWLO
DPSW
BSEL
SWSTB
SWM
PLIN
POUT
STATUS
PRES
PSTB
PLIN
RESET#
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
NS: Not Stuffed
NOTES: ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED. ☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).

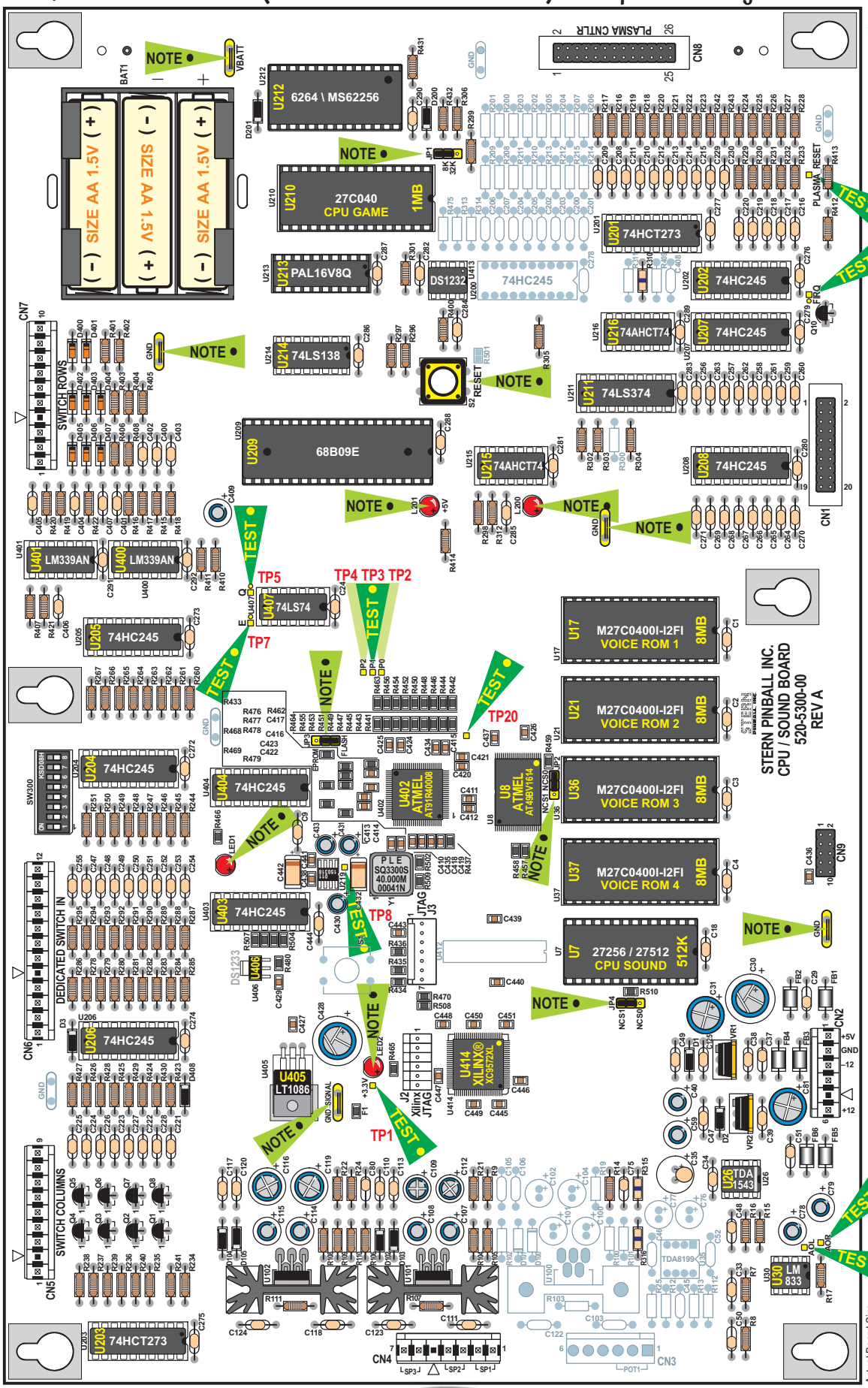
CPU/Sound Board II (with ATMEL Processor) Schematic (Sheet 4 of 4)





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

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



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 XILINX [2, C-1]
- ←LED2 [2, I-5]
- ←+3.3V TP1: [2, I-5]
- ←GND_SIGNAL
- TP11
- ←AOL & AOR
- TP16: [1, C-1],
- TP16 TP11: [1, D-4]

Actual Board Size
14.67" X 9.125"

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		U402	**ATMEL**, AT91R40008
	57	1		U8	**ATMEL**, AT49BV1614
	58	1		U414	**XILINX®**, XC9572XL
	59	1	(See Pg. DR. ❶ Table)	U7	**512K EPROM** Sound (27512)
	60	1	(See Pg. DR. ❶ Table)	U210 *(32-Pin, IC Socket, 077-5217-00)*	**1MB EPROM** CPU Game (27C040)
	61	4	(See Pg. DR. ❶ Table)	U17, U21, U36, U37 *(32-Pin, IC Socket, 077-5217-00)*	**8MB EPROM** Voice 1-4 (M27C0400l-12Fl)
	62	1	965-6504-00	U213 (**BLUE DOT**)	**PAL16V8Q (Programmed) BLUE DOT**
	63	1	105-5046-00	U212 *(28-Pin, IC Dip Socket, 077-5208-00)*	6264/MS62256 (MS6264A) (28-Pin)
	64	1	100-0189-01	U209 *(40-Pin, IC Socket, 077-5209-00)*	68B09E (40-Pin)
	65	2	100-5015-00	U215, U216	74AHCT74 (14-Pin)
	66	8	100-0338-00	U202, U204, U205, U206, U207, U208, U403, U404 (U200: NS)	74HC245 (20-Pin)
	67	2	100-5012-00	U201, U203	74HCT273 (20-Pin)
	68	1	100-0037-00	U407	74LS74 (14-Pin)
	69	1	100-0148-00	U214	74LS138 (16-Pin)
	70	1	100-0064-00	U211	74LS374 (20-Pin)
	71	1		U406	3.3v Watchdog, DS1233 (3-Pin)
	72	1	100-5023-00	U413	5.0v Watchdog, DS1232 (8-Pin)
	73	1		U219	1.8v Volt. Regulator LT1503 (8-Pin)
	74	1		U405	3.3v Volt. Regulator LT1086 (3-Pin)
	75	1	124-5002-00	VR1	-5v Regulator, LM7905CT
	76	1	124-5001-00	VR2	+5v Regulator, LM7805CT
	77	2	100-0377-00	U400, U401	LM339AN (14-Pin)
	78	1	100-0375-00	U30	LM833 (8-Pin)
	79	1	100-5018-00	U26	TDA1543 (8-Pin)
	80	2	100-5016-20	U101, U102 (U100: NS)	TDA2030A (5-Pin)
Miscellaneous	81	1		Y1	40MHz Clock PLE SQ3300S
	82	1	181-5002-00	SW300	Dip Switch 8-Pos., (KSD08H Black)
	83		n/a	FB1>FB6	Ferrite Bead
	84		535-5000-10	HS2, HS3, (HS1: NS) *(over U101, U102)*	Heat Sink (AAVID 531102)
	85	1		S2 (Reset)	Push-Button Switch (B3F4000)
	86	1	545-5685-00	BAT1 HOLDER	***(Always replace all 3, Size AA 1.5v Cells, with new ones, when required)***

* Surface Mounts (SMT) are not listed.

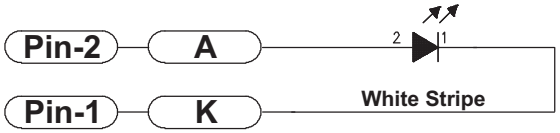
* Surface Mounts (SMT) are not listed.

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

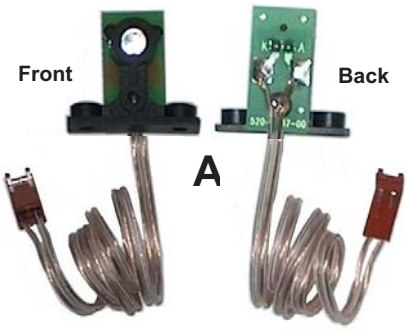
Test Point Pads:
TP1>TP5, TP7, TP8, TP11, TP12, TP16, TP17, TP20

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

Playfield Switches OPTO Transceiver Boards Schematic, Component Layout & Parts

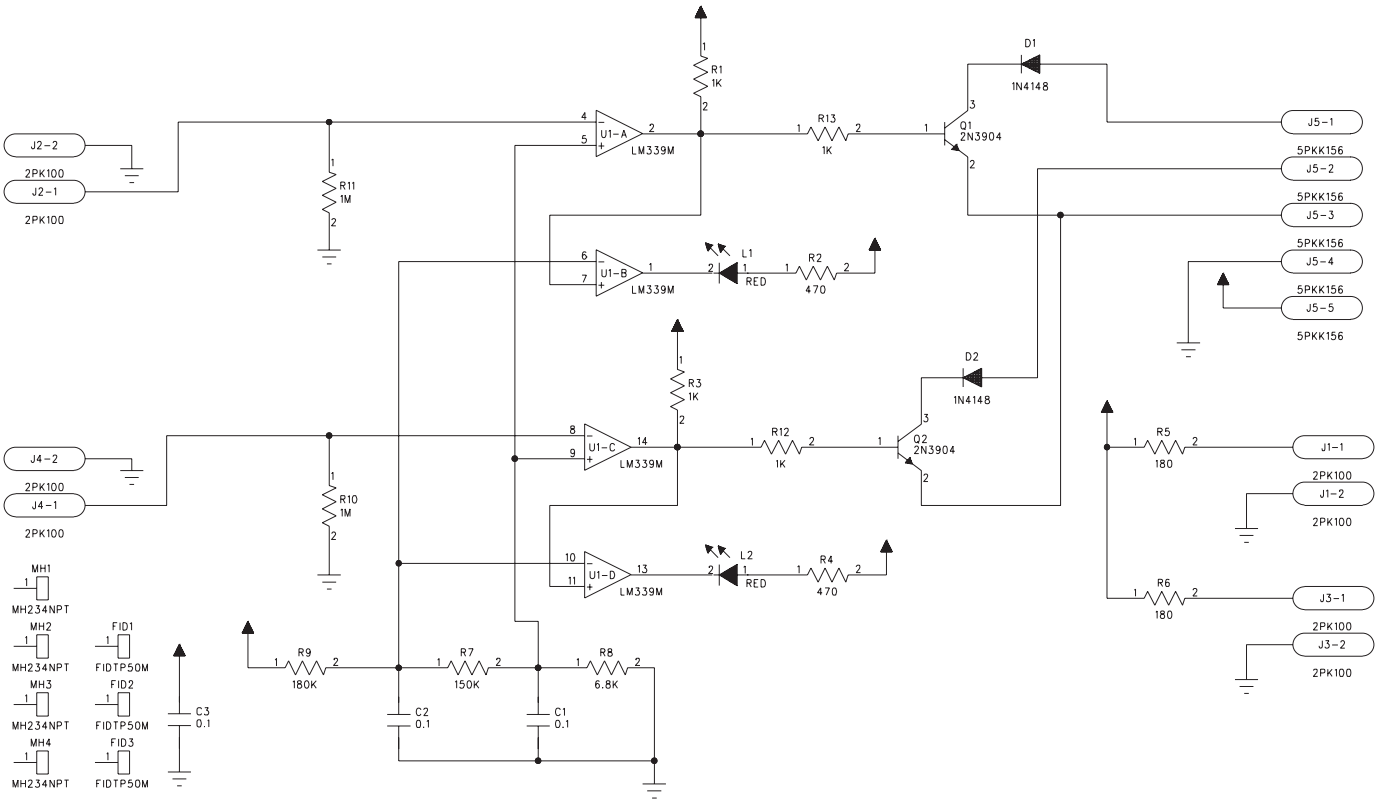


Mini PCB OPTO 12" Lead (Black Bracket) 500-6775-00



ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
A	6	**500-6775-00**	**MINI PCB OPTO ASM WHT / 12" LEAD**	**PCB Assy.** (with all **Items 1-5**)
—	**1**	520-5237-00	**Mini OPTO Trans. or Rec. Board**	**PCB Only Plain**
01	1	545-6092-00		Black Bracket (Plastic) Holder
02	1	237-5909-00		#4-40 X 1/4 PPH Screw
03	**1**	**165-5052-00**		**LED (Ultra Bright Red)**
04	1	601-5023-12	K, A	12" Speaker Wire (1-Side White Stripe)
05	1	045-5020-02	*Note White Strip to Pin-1*	2-Pin Cn., .100 **KK Cmp Trm** Molex 08-50-0113

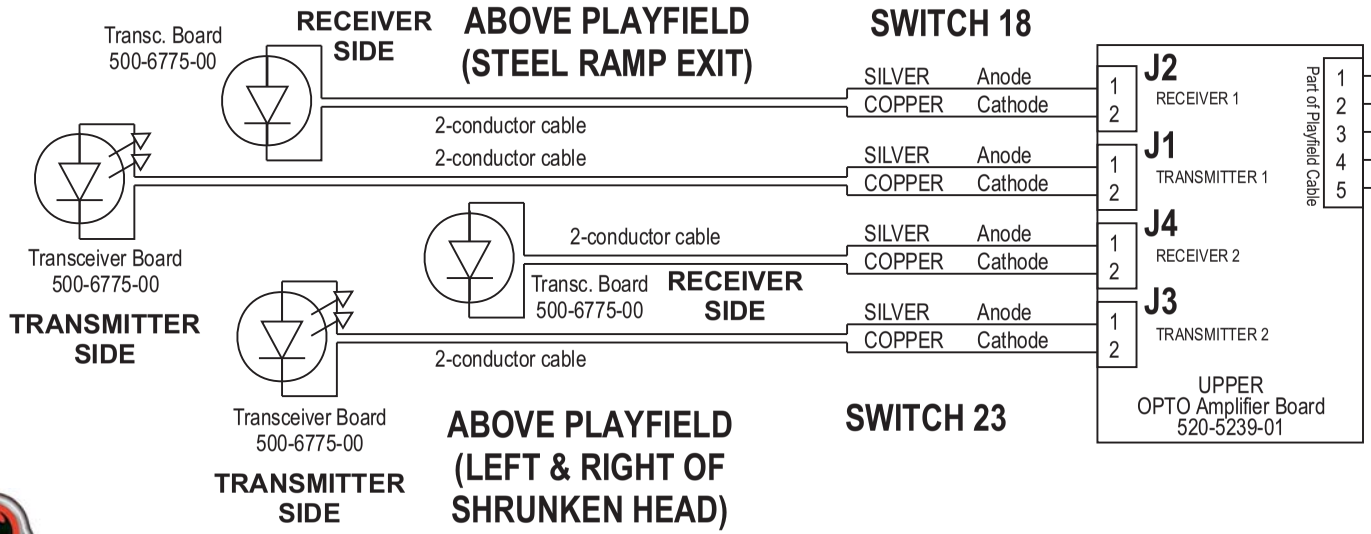
Playfield OPTO Transmitter / Receiver Amplifier Board Schematic

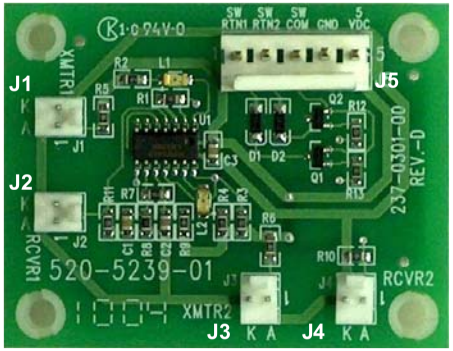


P/F OPTO Transmitter / Receiver Amplifier Bd. Parts (Comp. Layout next Page)

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
—	**2**	**520-5239-01**	**OPTO Transmitter/Receiver Amplifier Board**	**Complete PCB Assembly**
01	1		R7	SMT 150K Ω 1/10W Resistor 805, 5%
02	2		R5, R6	SMT 180 Ω 1/10W Resistor 805, 5%
03	1		R9	SMT 180K Ω 1/10W Resistor 805, 5%
04	4		R1, R3, R12, R13	SMT 1K Ω 1/10W Resistor 805, 5%
05	2		R10, R11	SMT 1M Ω 1/10W Resistor 805, 5%
06	2		R2, R4	SMT 470 Ω 1/10W Resistor 805, 5%
07	1		R8	SMT 6.8K Ω 1/10W Resistor 805, 5%
08	3		C1, C2, C3	SMT Cer. .1uF 50v Cap., 10% X7R
09	2		D1, D2	1N4148W, Diode, 100v, 350MW
10	2		Q1, Q2	MMST3904, NPN, 40v, .02A
11	1		U1	LM339M, Low Power Offset QUA
12	4	Mfg. 22-23-2021	J1, J2, J3, J4	2-Pin, 0.1 Header (1 Row, VT, Tin)
13	1	Mfg. 640445-5	J5	5-Pin, .156 Header (1 Row, VT, Tin)
14	2	Mfg. **APT3216SURC**	L1, L2	LEDD-SMT, Red 1206
15	4		n/a	**Spacer (Nylon), .153" ID X 9/32" OD X 3/8"**

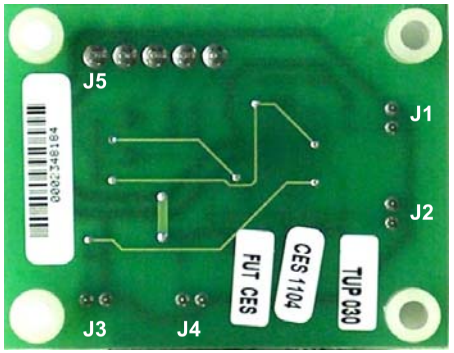
P/F OPTO Tr./Rcv. Amplifier Bd. Comp. Layout & Wiring (with Sw. 18/23/24 & Q22)



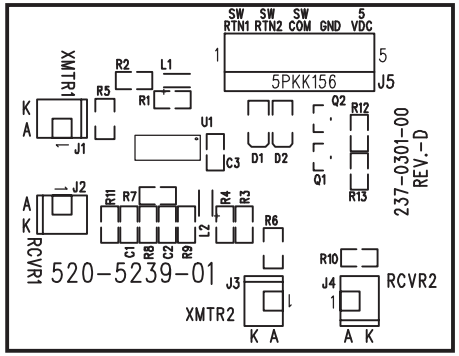


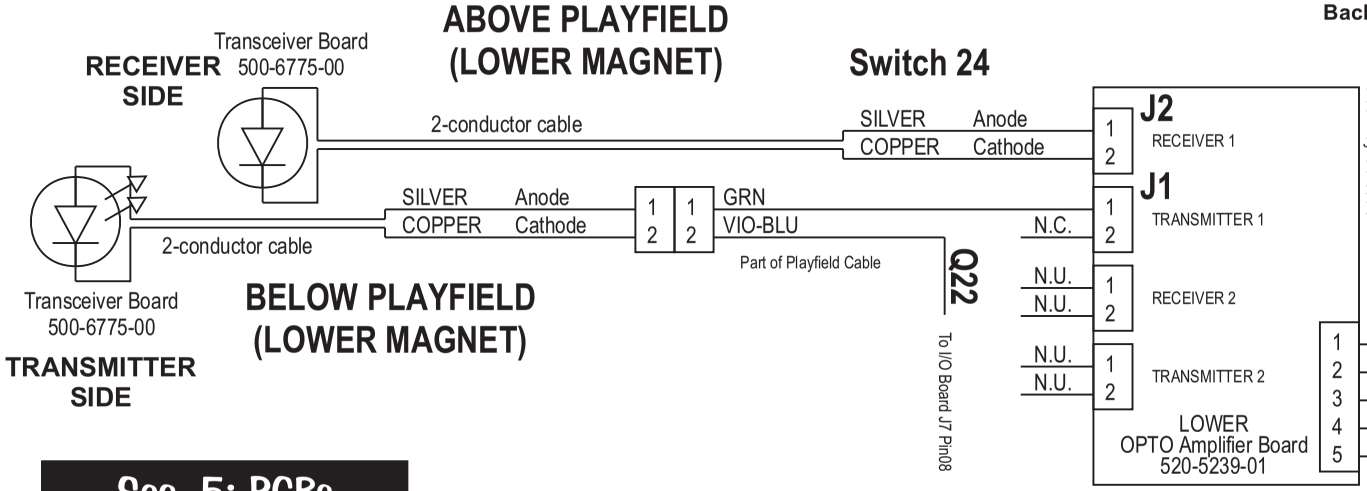
Front

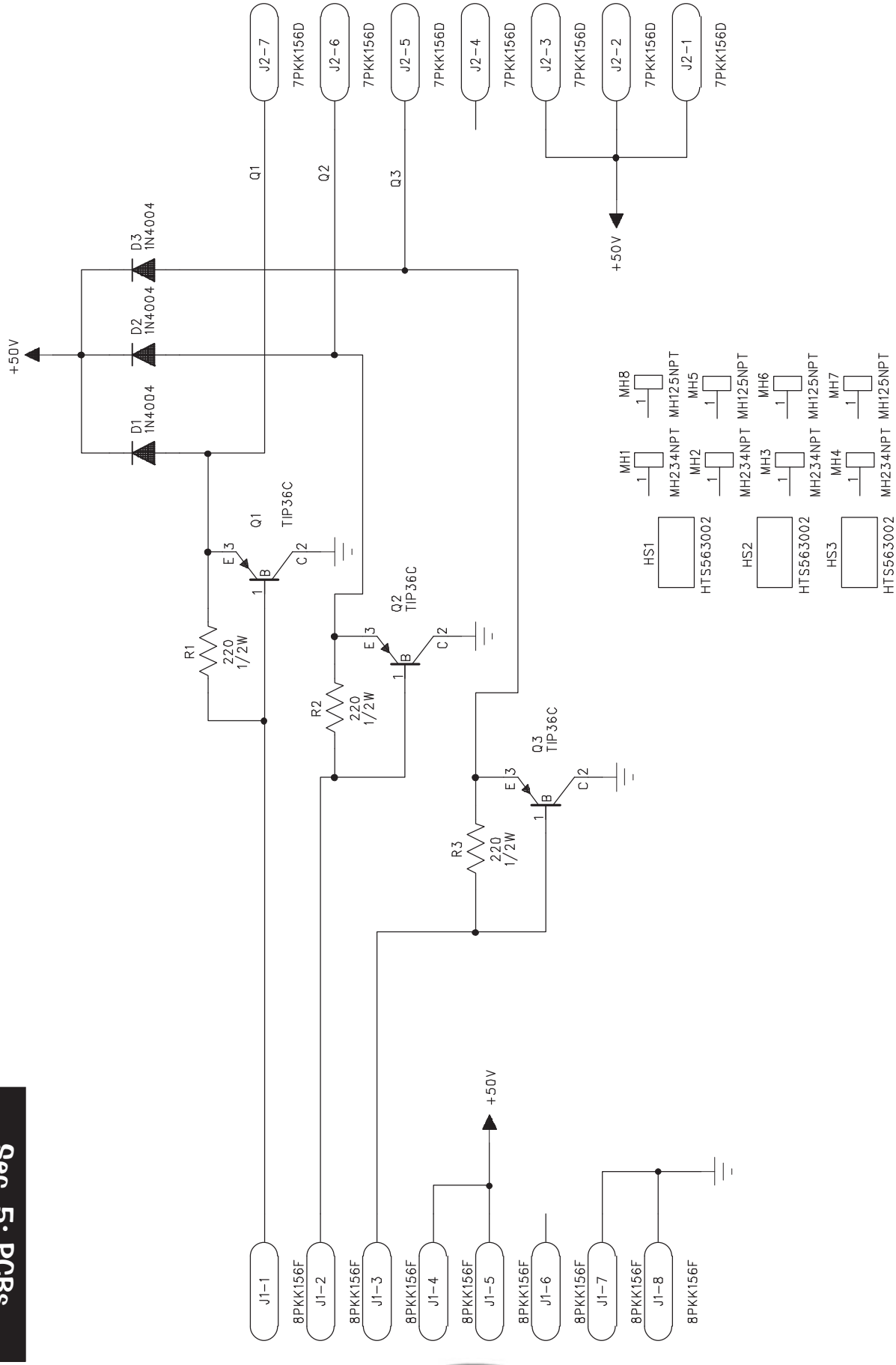
OPTO Transmitter / Receiver Amplifier PCB 520-5239-01

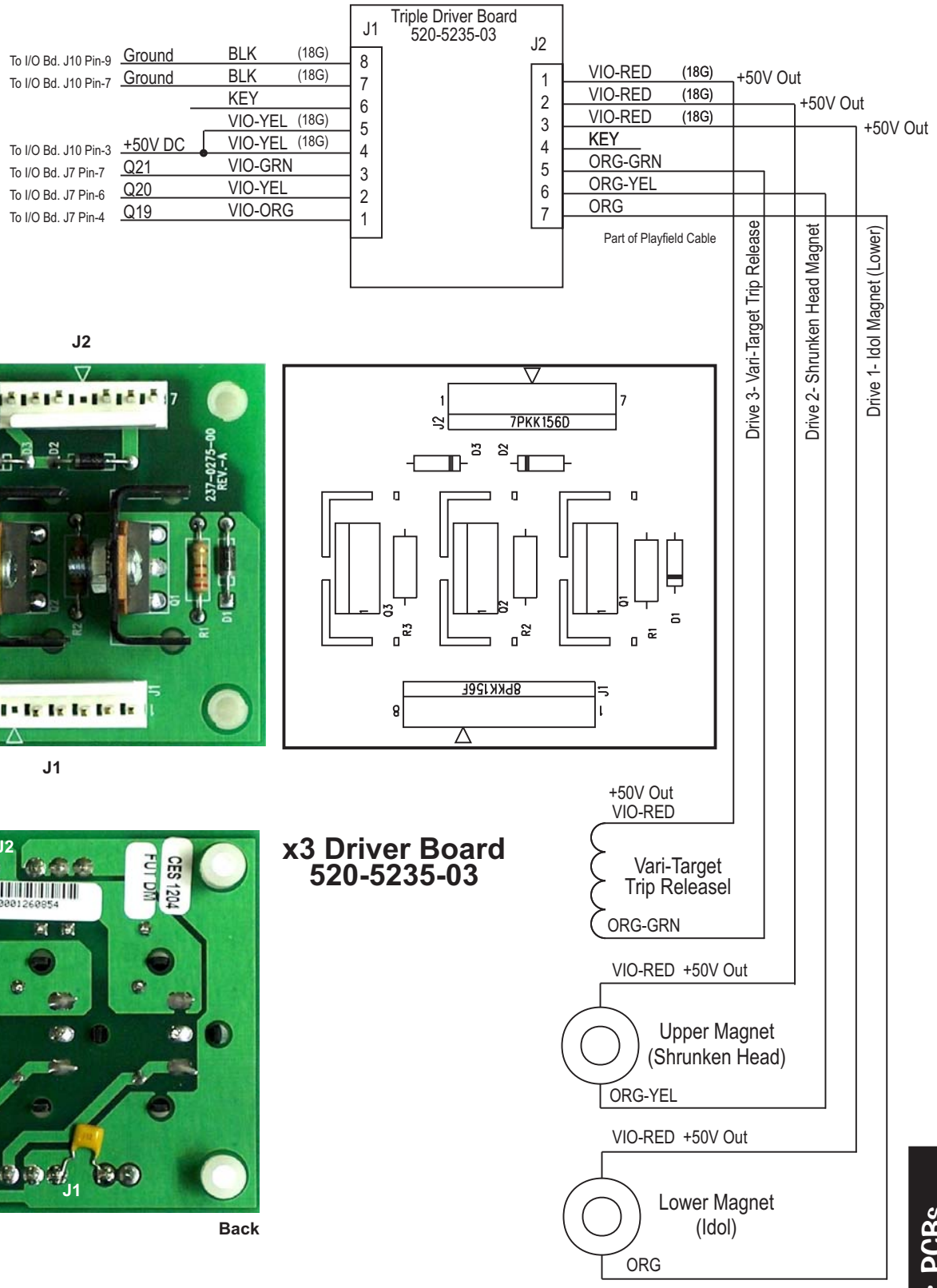


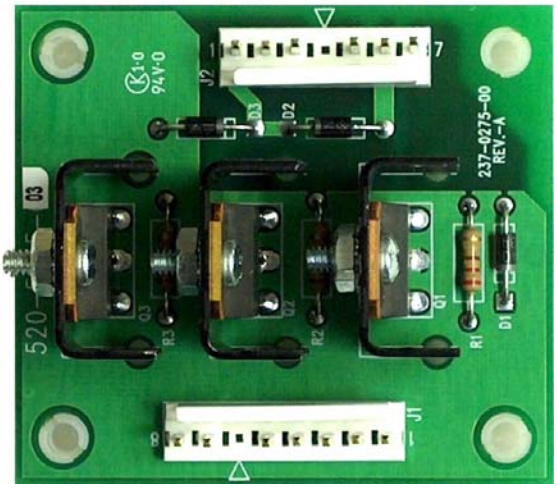
Back

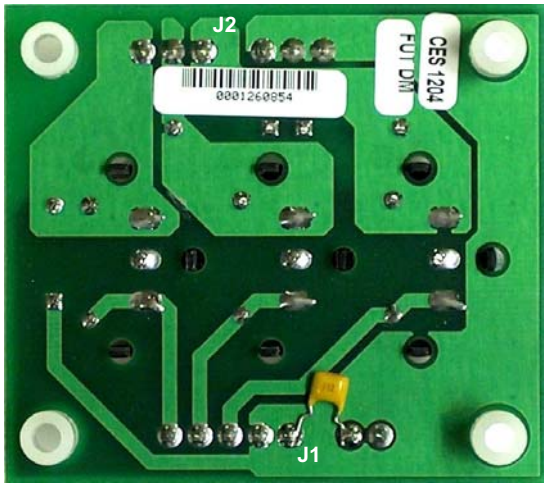





J2-7
J2-6
J2-5
J2-4
J2-3
J2-2
J2-1
7PKK156D
Q1
Q2
Q3
+50V
D1 1N4004
D2 1N4004
D3 1N4004
Q1 TIP36C
Q2 TIP36C
Q3 TIP36C
R1 220 1/2W
R2 220 1/2W
R3 220 1/2W
MH1
MH2
MH3
MH4
MH5
MH6
MH7
MH8
MH234NPT
MH125NPT
HS1
HS2
HS3
HTS563002
J1-1
J1-2
J1-3
J1-4
J1-5
J1-6
J1-7
J1-8
8PKK156F

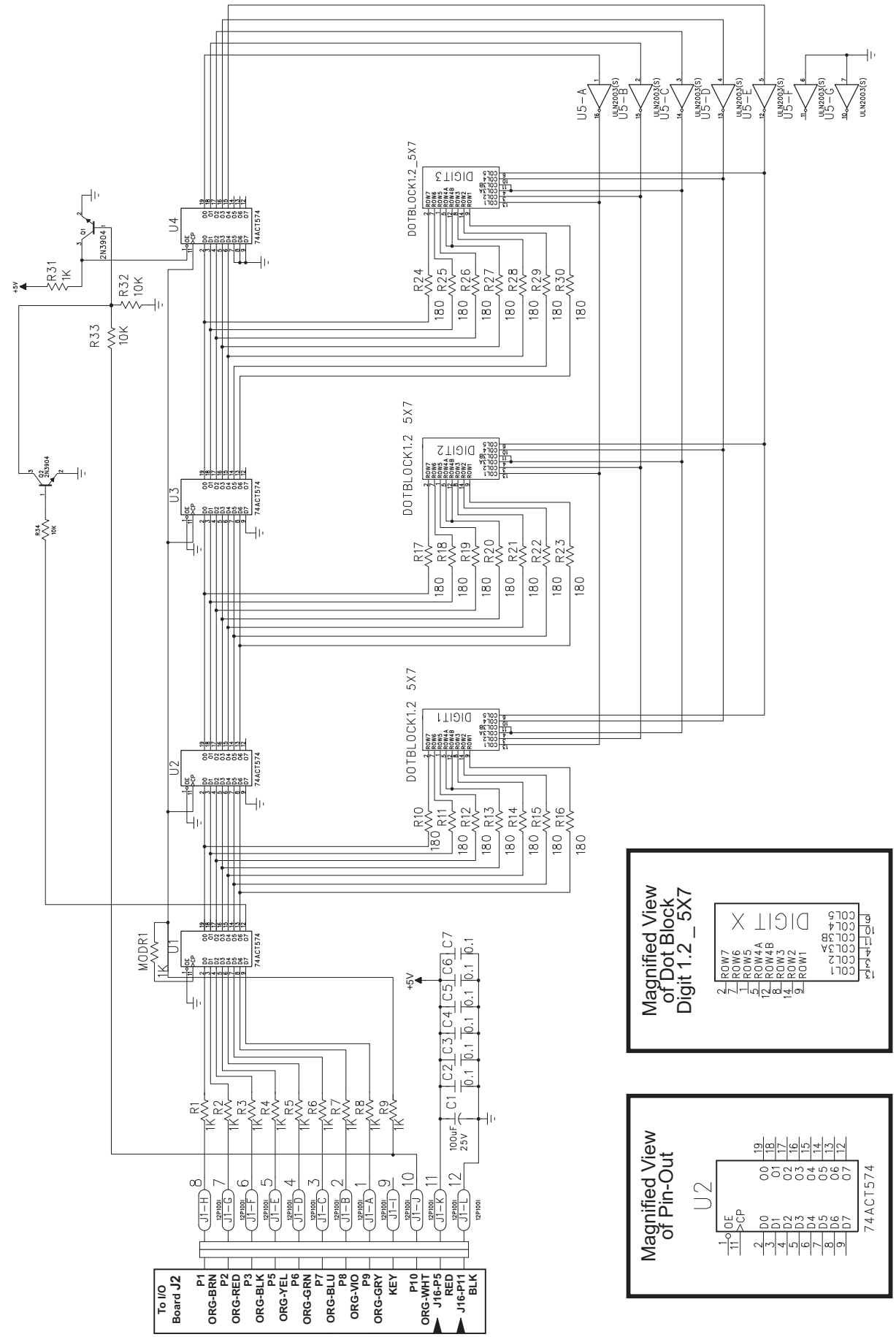






x3 Driver Board
520-5235-03

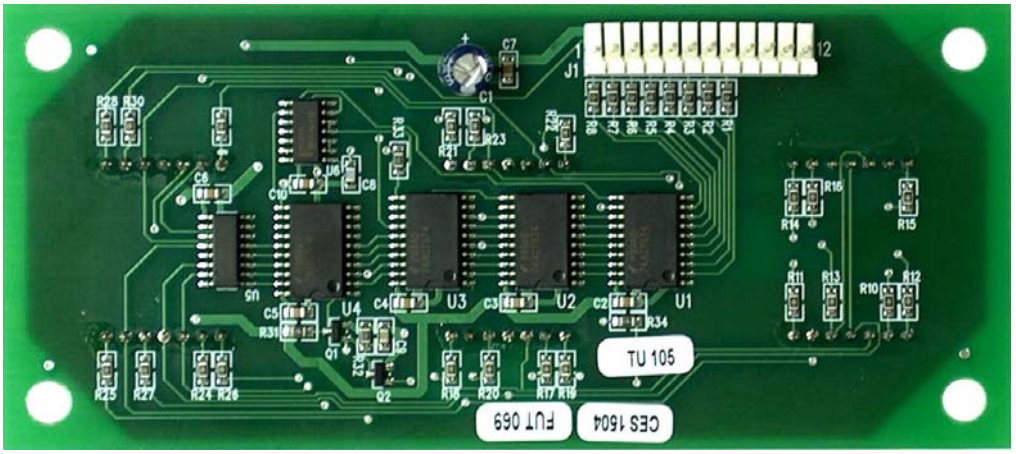
ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
—	1	520-5235-03	Playfield X3 (Triple) Driver PC Board	Complete PCB Assembly

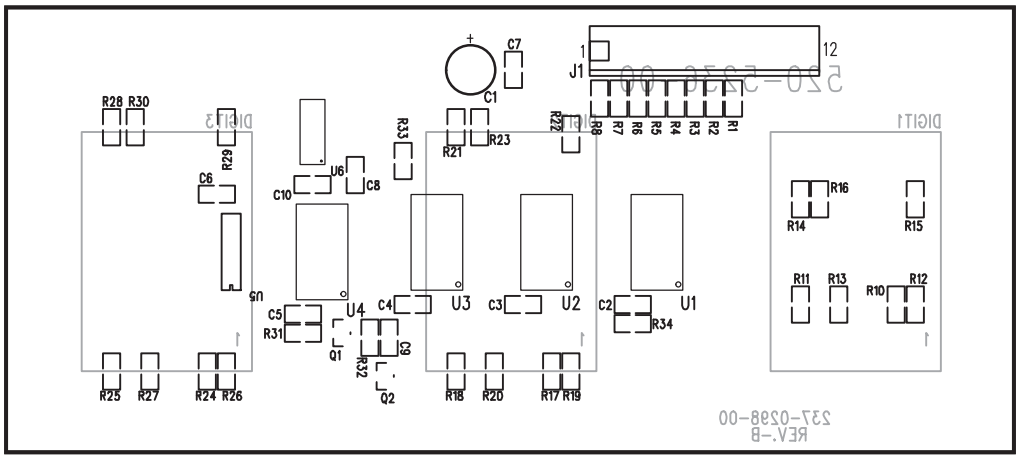

U5-A
U5-B
U5-C
U5-D
U5-E
U5-F
U5-G
ULN2003(S)
U4
U3
U2
U1
74ACT574
DOTBLOCK1.2_5X7
DIGIT3
DOTBLOCK1.2 5X7
DIGIT2
DOTBLOCK1.2 5X7
DIGIT1
Q1
2N3904
Q2
2N3904
R31 1K
R32 10K
R33 10K
R34 10K
MODR1 1K
R1 1K
R2 1K
R3 1K
R4 1K
R5 1K
R6 1K
R7 1K
R8 1K
R9 1K
R10 180
R11 180
R12 180
R13 180
R14 180
R15 180
R16 180
R17 180
R18 180
R19 180
R20 180
R21 180
R22 180
R23 180
R24 180
R25 180
R26 180
R27 180
R28 180
R29 180
R30 180
C1 100uF 25V
C2 0.1
C3 0.1
C4 0.1
C5 0.1
C6 0.1
C7 0.1
+5V
To I/O Board J2
P1
ORG-BRN
P2
ORG-RED
P3
ORG-BLK
P5
ORG-YEL
P6
ORG-GRN
P7
ORG-BLU
P8
ORG-VIO
P9
ORG-GRY
KEY
P10
ORG-WHT
J16-P5
RED
J16-P11
BLK
J1-H
J1-G
J1-F
J1-E
J1-D
J1-C
J1-B
J1-A
J1-I
J1-J
J1-K
J1-L
12P100I

Magnified View of Dot Block Digit 1.2 _ 5X7
DIGIT X
ROW7
ROW6
ROW5
ROW4A
ROW4B
ROW3
ROW2
ROW1
COL1
COL2
COL3
COL4
COL5

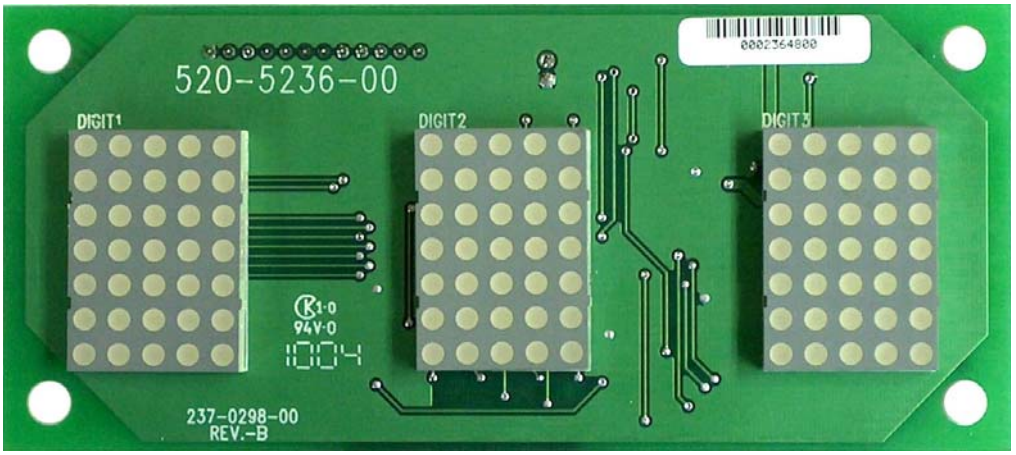
Magnified View of Pin-Out
U2
OE
CP
D0
D1
D2
D3
D4
D5
D6
D7
74ACT574

Back Side





Front (Dot Block) Side

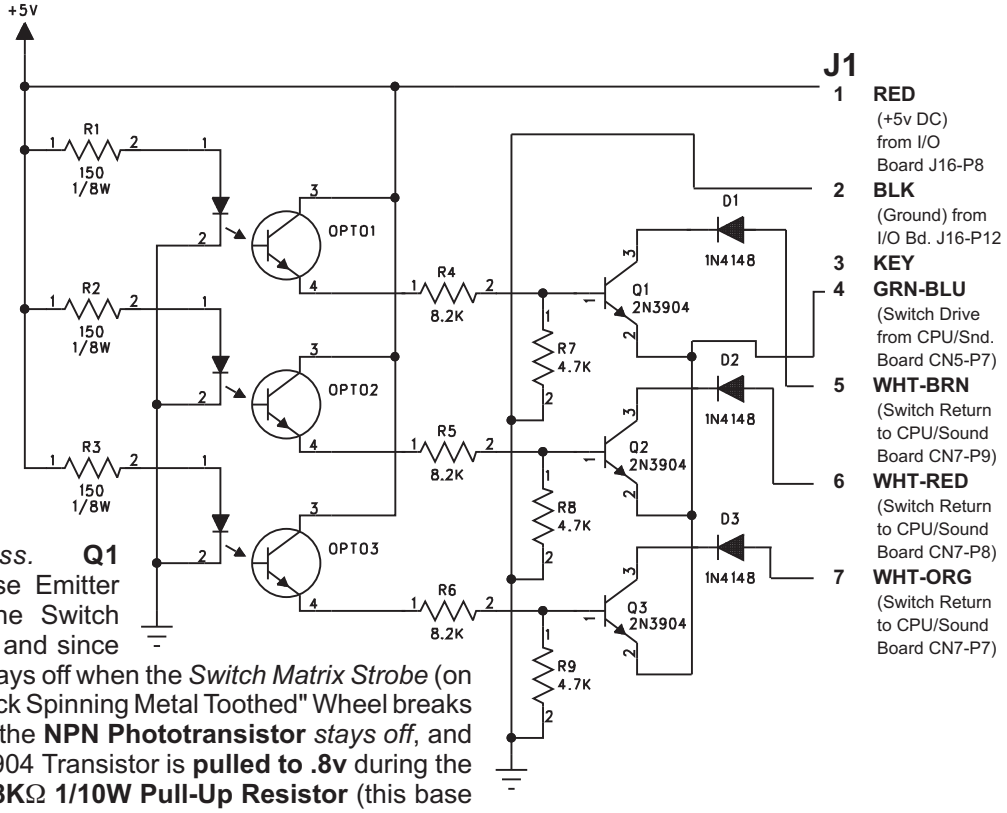


Note: *The Housing (cover) is not included with this PC Bd. Assembly. See Section* **4**, *Chapter* **2** (***Blue Pages***), *Pages* ***90-91*** *for more details.*

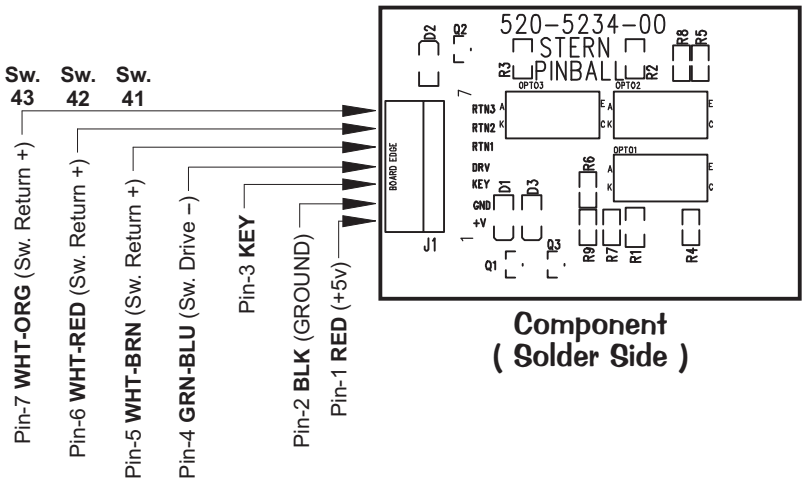
ITEM	QTY	PART NUMBER	REF-DESIGNATOR		DESCRIPTION
--	**1**	**520-5236-00**	**Dot Display (5X7) x3 PC Board**		**PCB Assembly**
1	1	045-5107-12	J1		Connector, 12-Pin .1" Header.
2	2	112-5017-00	Q1, Q2	(Manex Nº: 211-0003589)	MMST3904 NPN 40V 0.2A
3	4	100-5036-00	U1, U2, U3, U4	(Manex Nº: 221-0006048)	74ACT574SC
4	7	100-5039-00	C2-C7, C10	(Manex Nº: 121-0004238)	Cap. 104-0805 0.1uF 50V 10% X7R
5	1	100-	C9		Cer. Cap 1000pF 50V 10% X7R
6	1	100-	C8		Cer. Cap 47pF 50V 5% NPO
7	3	100-5040-00	DIGIT1, DIGIT2, DIGIT3	(Manex Nº: 430-0006059)	Dot Block 1.2: 5X7 LTP-1557AC
8	3	121-5084-00	R32-R34	(Manex Nº: 101-0001827)	10KΩ 1/10W 5% SMT Res., 0805
9	9	121-5088-00	R1-R8, R31	(Manex Nº: 101-0001905)	1KΩ 1/10W 5% SMT Res., 0805
10	21	121-5086-00	R10-R30	(Manex Nº: 101-0001897)	180Ω 1/10W 5% SMT Res., 0805
11	1	100-5037-00	C1	(Manex Nº: 131-0003773)	100uF 25V T. Cap.
12	1	100-5038-00	U5	(Manex Nº: 225-0005340)	ULN2003(S)
13	1	100-	U6		74HC04 Hex Inverter 74HC04AD
14	1	121-5089-00	MOD1	(Manex Nº: 105-0002703)	1KΩ 1/8W 5CF Res.

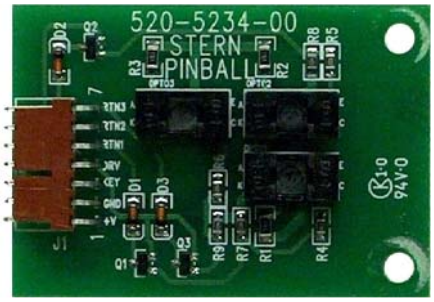
3-Position OPTO PC Board (Vari-Target) Theory of Operation & Schematic

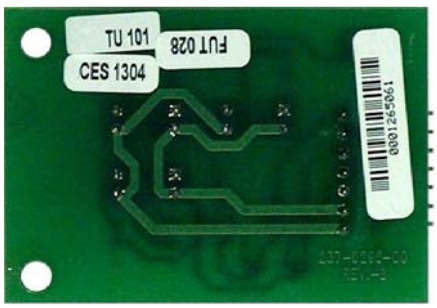
The **OPTO Printed Circuit Board** (SPI PN: 520-5234-00) used in the ***Vari-Target Assembly***, is an ordinary Photo-Interrupter designed to signal **Switches #41**, **#42** & **#43** (**OP1**) back to the **CPU/ Snd Bd.** *(Switch Matrix Grid)*. The slotted OPTO (U-Shaped), location **OP1** contains a small infrared **LED** that beams light across the slot to an **NPN Phototransistor.** This causes the **Phototransistor** to *conduct* and *pull down the voltage* at the base of **Q1** (2N3904 Transistor) to **.3v** *or less.* **Q1** (transistor) requires the Base Emitter Drop Voltage (**.7v**) **plus** the Switch Drive Drop (**.1v**) to *conduct,* and since **.3v** *is less* than this **.8v**, **Q1** stays off when the *Switch Matrix Strobe* (on Pin-4 of J1) polls it. If the "Black Spinning Metal Toothed" Wheel breaks the beam in the **OPTO Slot**, the **NPN Phototransistor** *stays off*, and the *base voltage* on the 2N3904 Transistor is **pulled to .8v** during the *Switch Strobe* through the **68KΩ 1/10W Pull-Up Resistor** (this base voltage will be higher when the switch is not being polled). With the **.8v** applied to the base, **Q1** conducts through **D1**. This Diode (1N4004) prevents certain kinds of *Matrix-Related leakages* which show up as a "Phantom Switch" that completes the corners of a square in the Matrix.



3-Position OPTO PC Board (Vari-Target) Component Layout & Parts



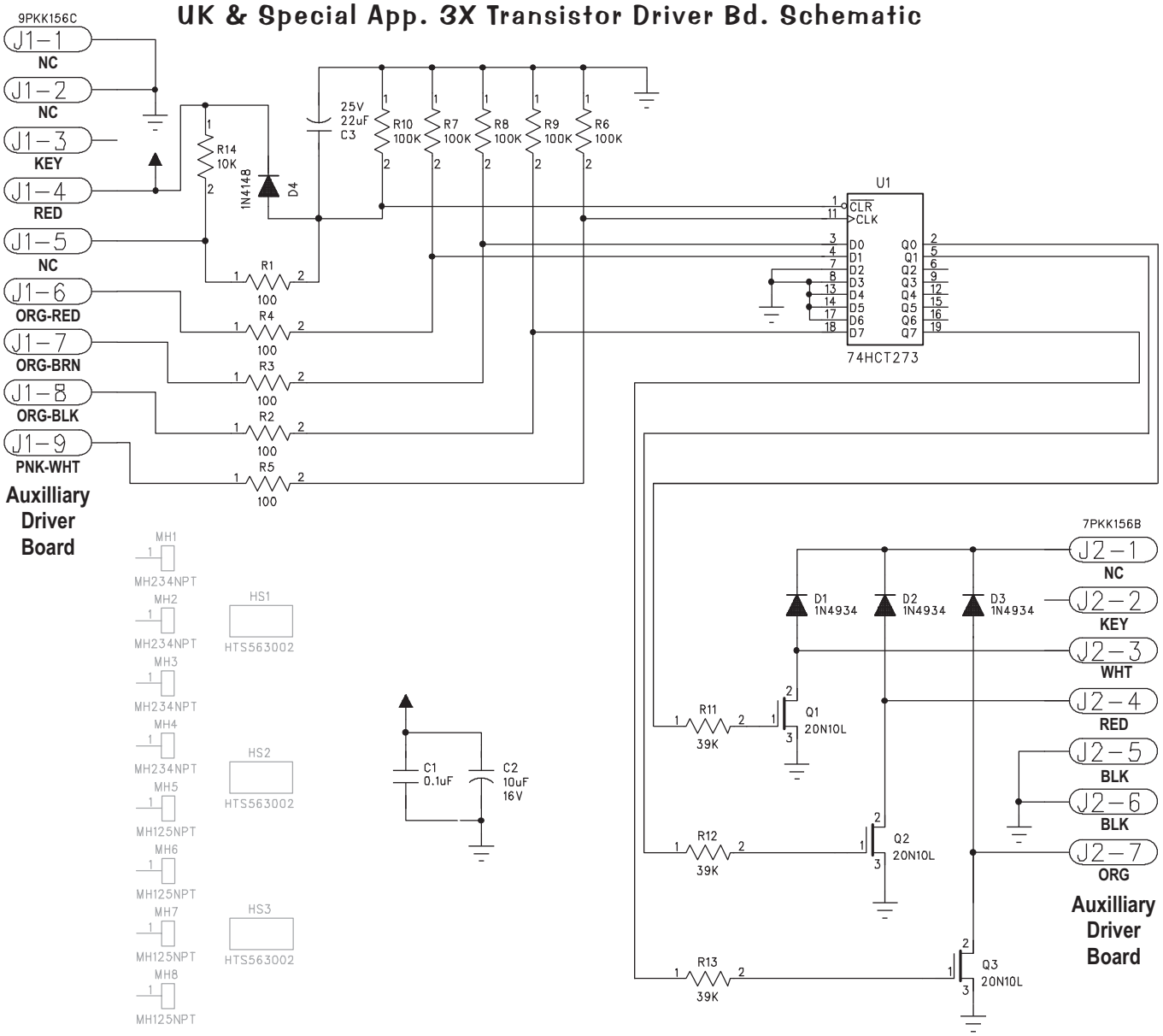




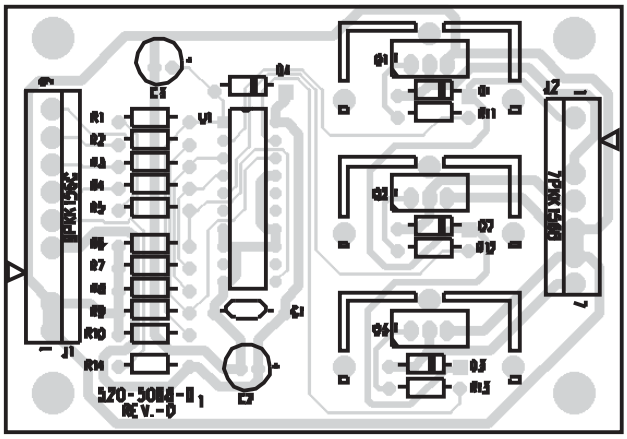
Note: *In this game, this OPTO Board is used as a Playfield Detection Switch for the "Vari-Target" Assembly. See the Switch Matrix Grid (Pgs. 16-17 or 104). PCB is used for Sw. 41-43, (GRN-BLU, WHT-XXX).*

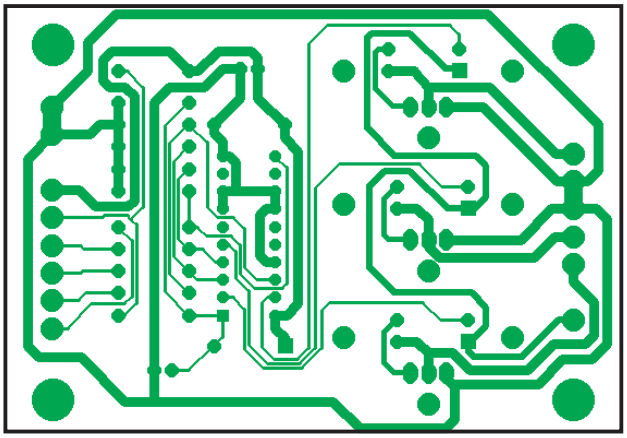
ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
--	1	**520-5234-00**	**3-Position U-Shaped OPTO PC Board**	**PCB Assembly**
1	1	045-5107-07	J1	Connector, 7-Pin .1" Header.
2	3	121-	R1, R2, R3	**150Ω 1/8W 5% SMT Resistor, 1206 case**
3	3	121-	R4, R5, R6	**8.2K, 1/10W 5% SMT Resistor, 0805 case**
4	3	121-	R7, R8, R9	**4.7K, 1/10W 5% SMT Resistor, 0805 case**
5	3	112-	D1, D2, D3	DL/LL4148 100v 500mW SMT Diode
6	3	110-	Q1, Q2, Q3	**MMST3904, NPN, 40V, 0.2A SOT-23 Transistor**
7	3	165-	OP1, OP2, OP3	(Slotted) QVE11233 OPTO Sensor Interrupt

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

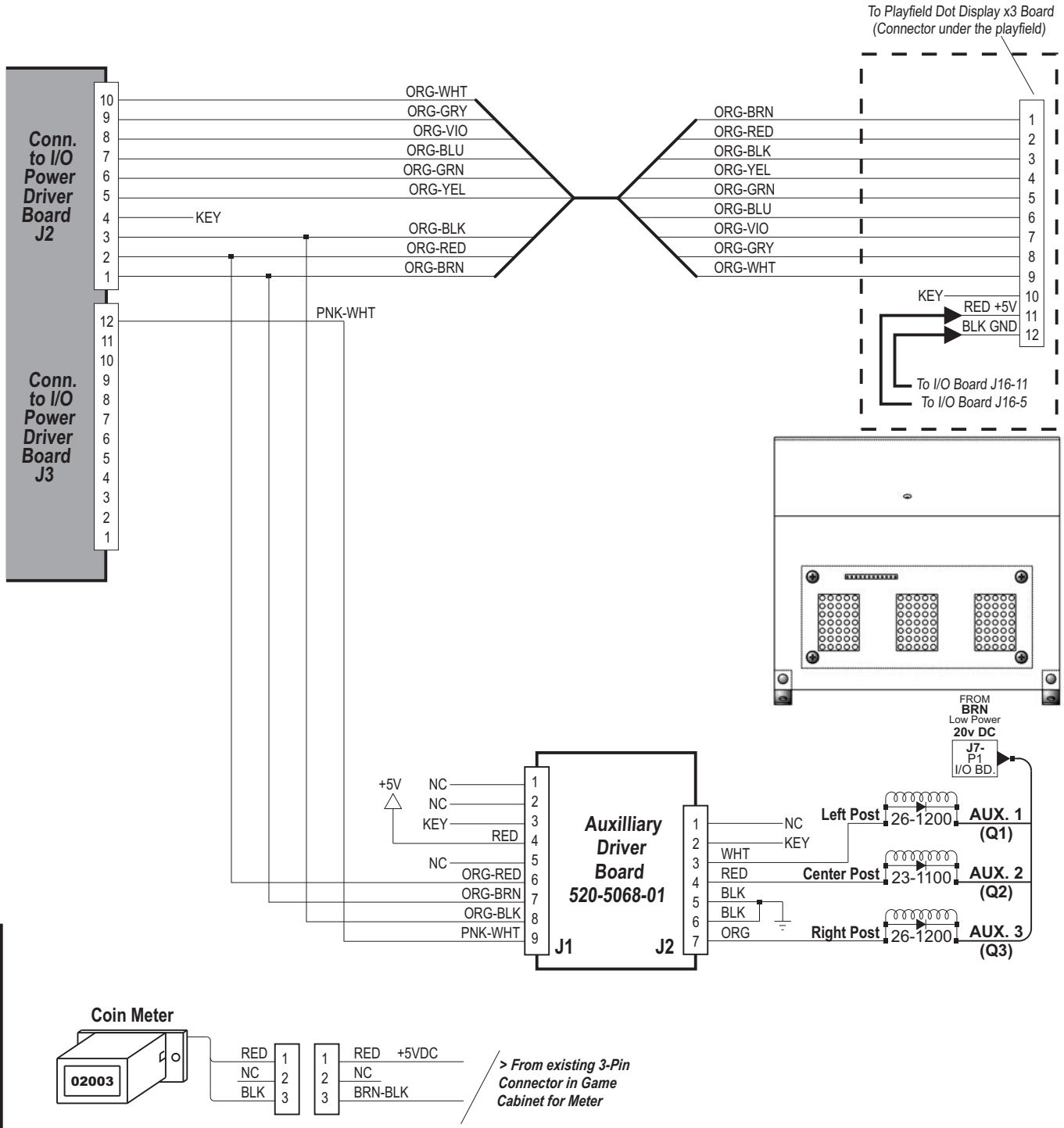


UK & Special App. 3X Transistor Driver Bd. Component Layout (Sol. Exp. Bd.)

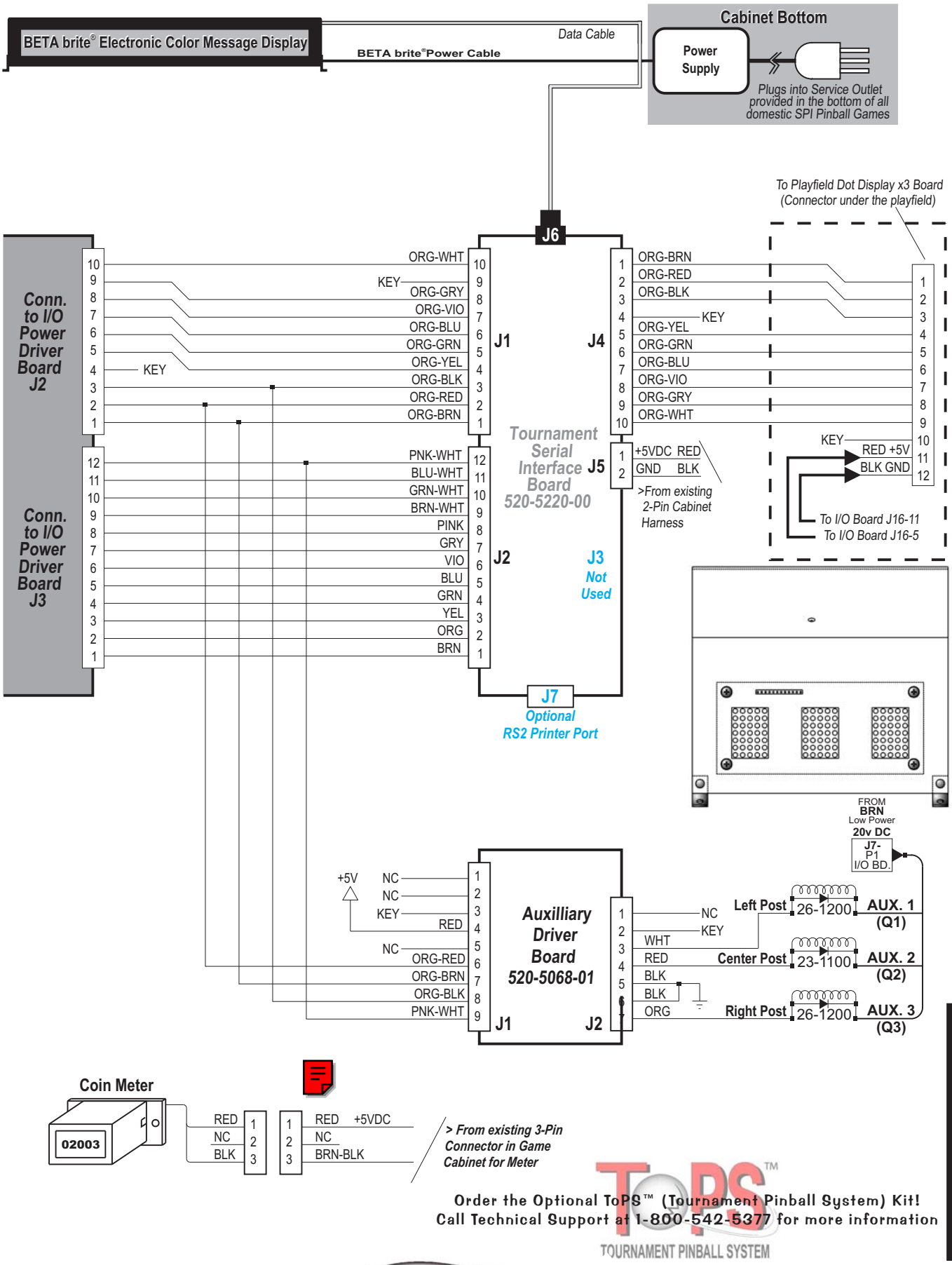




ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
—	1	520-5068-01	Solenoid Expander (x3 Transistor) PC Board	Complete PCB Assembly


To Playfield Dot Display x3 Board
(Connector under the playfield)
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
KEY
RED +5V
BLK GND
To I/O Board J16-11
To I/O Board J16-5
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

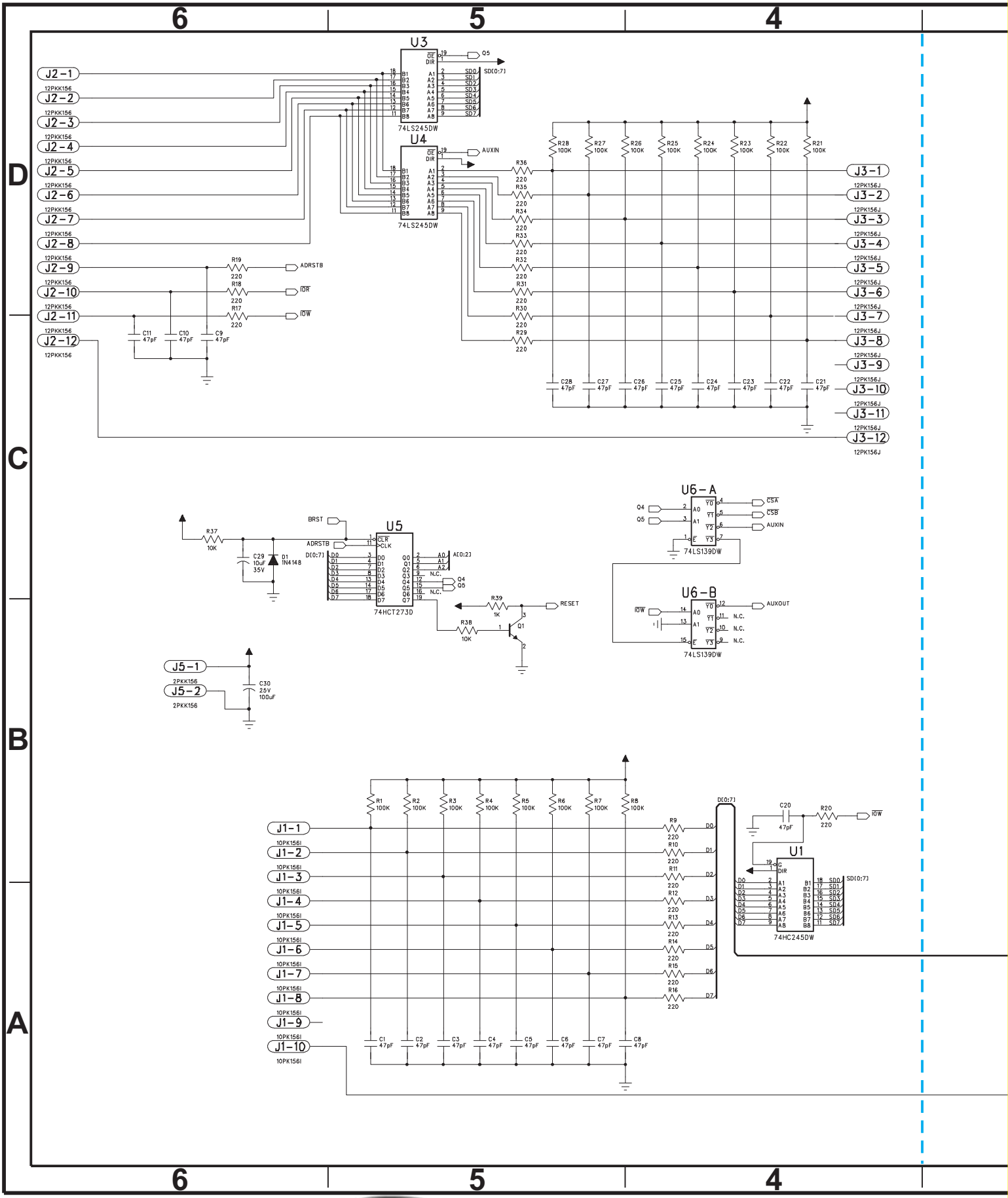
UK 3X Transistor Driver Bd. for Up-Posts & Dot Display X3 LED Overview & Wiring with the Tournament Serial Interface (TSI) Board

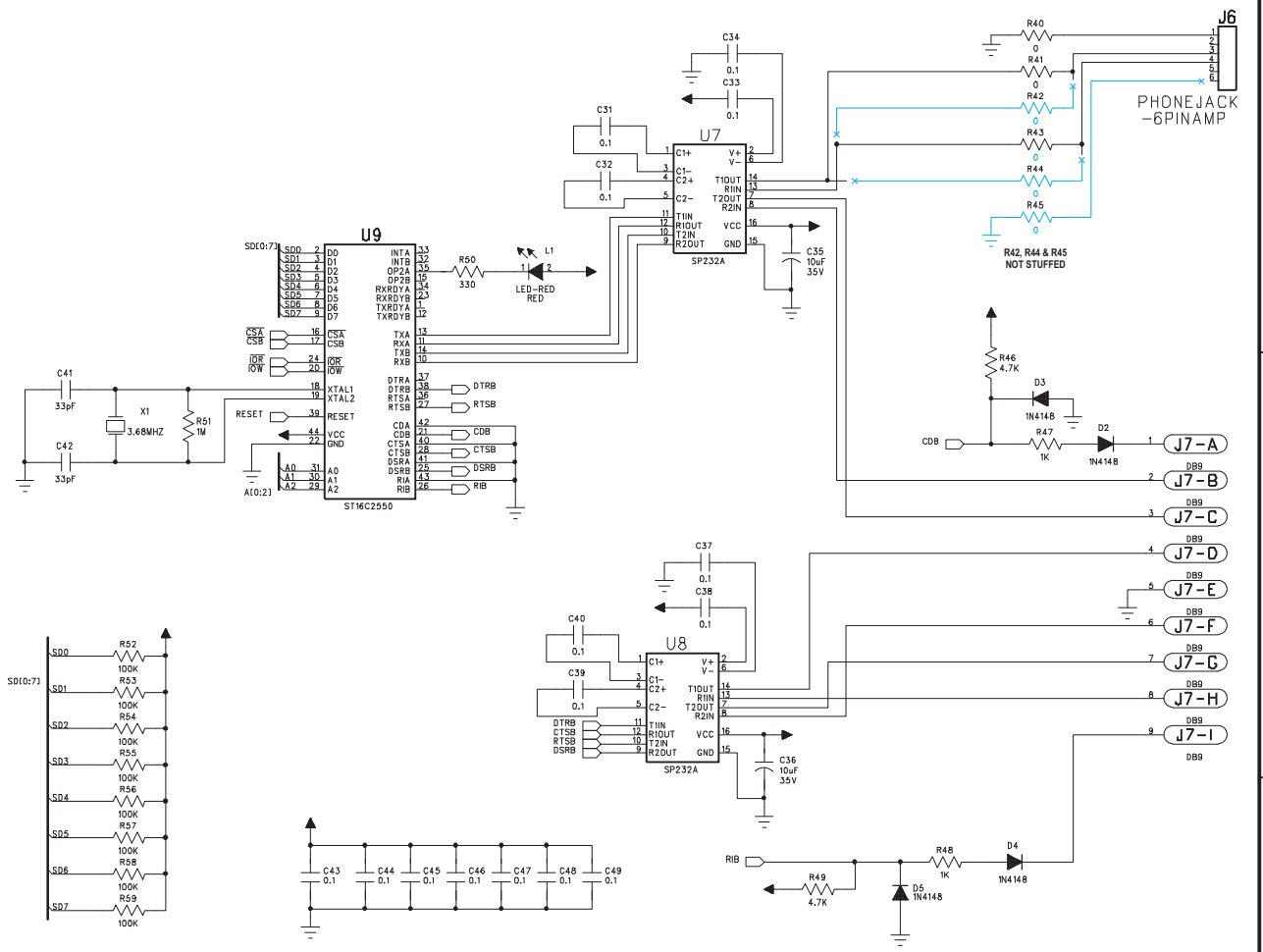


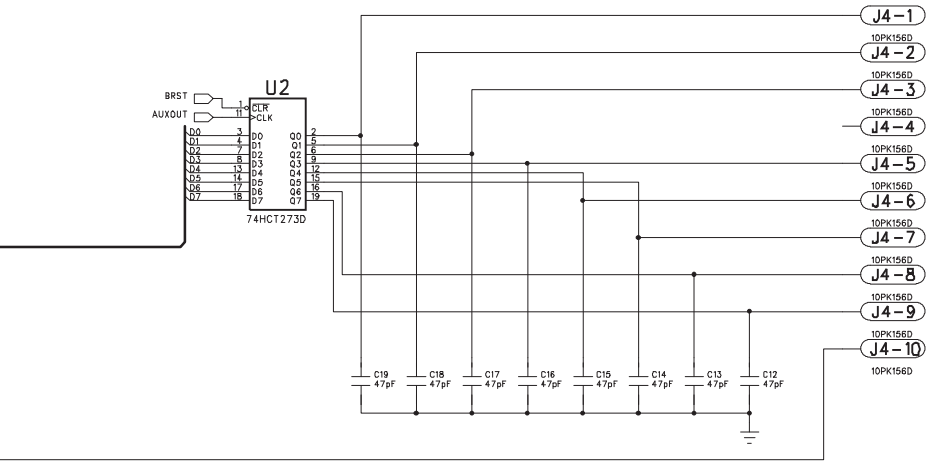
Order the Optional ToPS™ (Tournament Pinball System) Kit!
Call Technical Support at 1-800-542-5377 for more information

TOURNAMENT PINBALL SYSTEM

Sec. 5: PCBs


6
5
4
D
C
B
A
U3
74LS245DW
U4
74LS245DW
J2-1
J2-2
J2-3
J2-4
J2-5
J2-6
J2-7
J2-8
J2-9
J2-10
J2-11
J2-12
12PKK156
R19
R18
R17
220
ADRSTB
IOR
IOW
C11
C10
C9
47pF
R28
R27
R26
R25
R24
R23
R22
R21
100K
R36
R35
R34
R33
R32
R31
R30
R29
AUXIN
C28
C27
C26
C25
C24
C23
C22
C21
J3-1
J3-2
J3-3
J3-4
J3-5
J3-6
J3-7
J3-8
J3-9
J3-10
J3-11
J3-12
12PK156J
U5
74HCT273D
BRST
R37
10K
C29
10uF
35V
D1
IN4148
D[0:7]
A[0:2]
Q4
Q5
R39
1K
R38
10K
RESET
Q1
U6-A
U6-B
74LS139DW
CSA
CSB
AUXIN
AUXOUT
N.C.
J5-1
J5-2
2PKK156
C30
25V
100uF
J1-1
J1-2
J1-3
J1-4
J1-5
J1-6
J1-7
J1-8
J1-9
J1-10
10PK156I
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
D0
D1
D2
D3
D4
D5
D6
D7
C1
C2
C3
C4
C5
C6
C7
C8
C20
R20
U1
74HC245DW
SD[0:7]





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

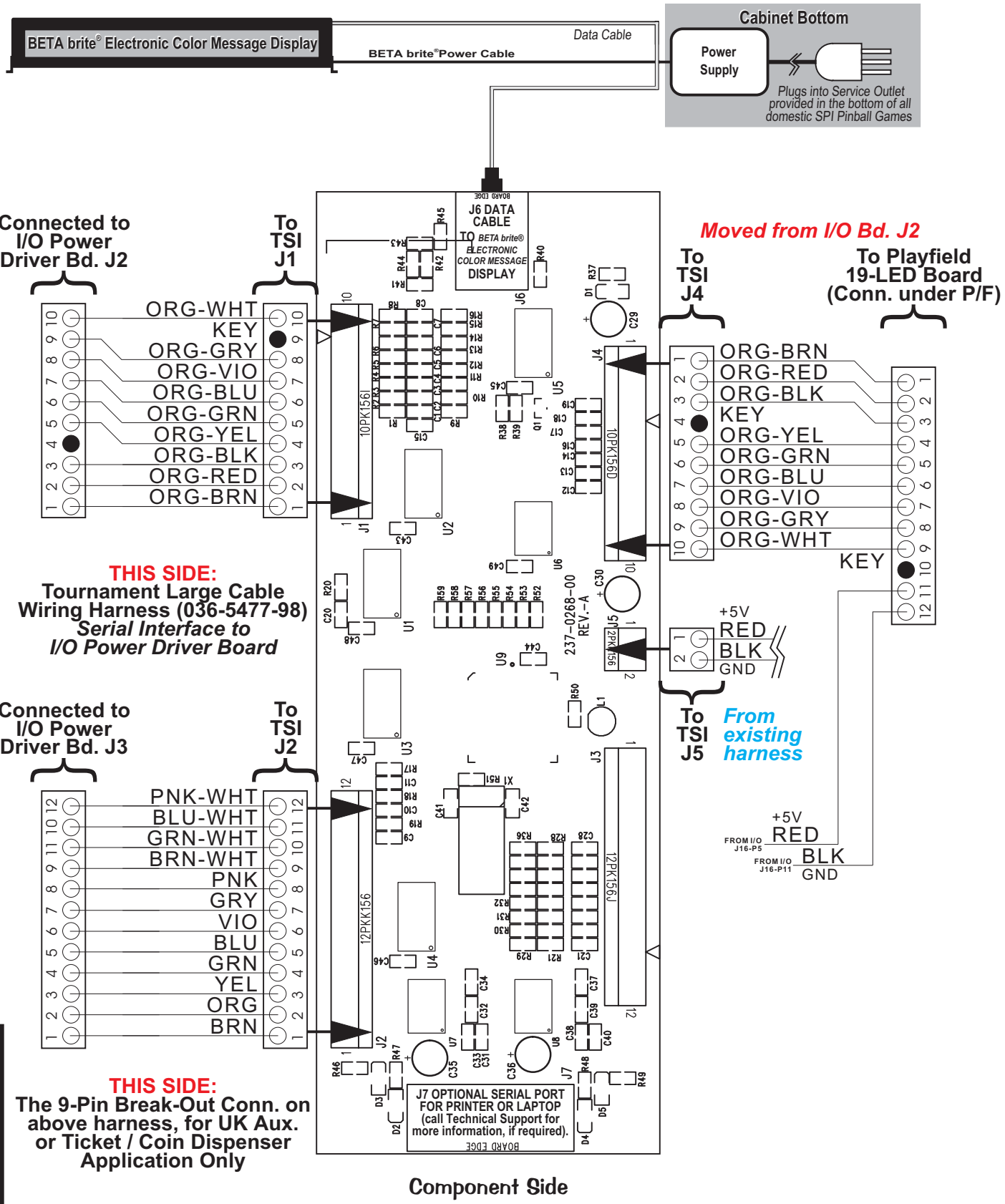
Non-Text Document

Schematic Set	Sheet 1 of 1
SIZE	D
REV.	A

STERN PINBALL, INC.

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

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



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

Appendixes A through J

Appendix
Table of Contents

- **Appendix A**

Pinball Game Firmware Table A1-A2

...describes the EPROM and chip size, the Stern™ Pinball, Inc. (SPI) Part Nº, version *(if applicable),* and CPU Board and CPU/Sound Board ROM locations.

- **Appendix B**

Semi-Conductors / I.C.'s / Relays Cross-Reference Table B1

...describes diodes and transistors with Source Nº, SPI Part Nº, NTE Nº, ECG Nº, Radio Shack Nº & RCA Part Nº *(If applicable).*

- **Appendix C**

Production Start Date, Manual Part Nº, EPROM Position(s) & CPU Jumper Info C1

...provides the Production Start Date, Manual Part Nº, EPROM Position(s), Jumpers Installed and Jumpers Removed *(games specified).*

- **Appendix D**

Board Type Table D1-D2

...provides Board Part Nºs for Games Laser War through Batman Forever (*Flipper, Sound, Power Supply, Dot Matrix Display, Display Controller & OPTOs)* and the White Star Board System, Games Apollo 13 through current *(Flipper*, I/O Power Driver, CPU/Sound, Display Power Supply, Dot Matrix Display, Display Controller & OPTOs; *Flipper Board with the White Star Bd. System for A13 & Golden Eye only.)*

- **Appendix E**

Generic Coil Cross-Reference Guide & Flipper Coil Table E1-E2

...provides the Coils used with Part Nº and Gauge-Turns *(of the coil).*

- **Appendix F**

Motor Specification Table F1-F2

...provides all the Motor Function, Specifications and Part Nº.

- **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 Nº of all the inserts used *(with Color Code Chart).*

- **Appendix I**

Stand-Up Targets (Happ Modular & Regular) I1

...gives a pictoral view with the name and Part Nº 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 Nº of all the current Coin Cards for USA, Canada, Euro and other International Countries.

- **Glossary of Terms ..... Last Page**

...gives definitions or explanations of some pinball terms and acronyms.

- **Limited Warranty, Cautions, Warnings & Notices ..... Last Page**

Appendixes A-J
Table of Contents

APPENDIX A

Pinball Game Firmware Table

EPROM	Chip Size	Program Part №	USA Ver.	Bd. Loc.	Raw Part №
Laser War					
CPU	(256K)	965-0004-00	LWAR.C5	C5	960-5007-00
Sound (Old)	(256K)	965-0005-00		J5	960-5007-00
Sound (Old)	(256K)	965-0006-00		J6	960-5007-00
Sound (Old)	(256K)	965-0007-00		J7	960-5007-00
			- OR -		
Sound	(256K)	965-0008-00		7F	960-5007-00
Sound 1	(512K)	965-0009-00		6F	960-7001-02
Sound 2	(512K)	965-0010-00		4F	960-7001-02
Secret Service					
CPU	(256K)	965-0011-00	A4-6	B5	960-5007-00
CPU	(256K)	965-0012-00	A4-6	C5	960-5007-00
Voice 1	(512K)	965-0014-00		6F	960-7001-02
Voice 2	(512K)	965-0015-00		4F	960-7001-02
Sound	(256K)	965-0013-00		7F	960-5007-00
Torpedo Alley					
CPU	(256K)	965-0016-00	A2-1	B5	960-5007-00
CPU	(256K)	965-0017-00	A2-1	C5	960-5007-00
Voice 1	(512K)	965-0019-00		6F	960-7001-02
Voice 2	(512K)	965-0020-00		4F	960-7001-02
Sound	(256K)	965-0018-00		7F	960-5007-00
Time Machine					
CPU	(128K)	965-0021-00	A2-4	B5	960-5006-00
CPU	(256K)	965-0022-00	A2-4	C5	960-5007-00
Voice 1	(512K)	965-0024-00		6F	960-7001-02
Voice 2	(512K)	965-0025-00		4F	960-7001-02
Sound	(256K)	965-0023-00		7F	960-5007-00
Playboy 35th Anniversary					
CPU	(256K)	965-0046-00	A2-4	B5	960-5007-00
CPU	(256K)	965-0047-00	A2-4	C5	960-5007-00
Voice 1	(512K)	965-0049-00		6F	960-7001-02
Voice 2	(512K)	965-0050-00		4F	960-7001-02
Sound	(256K)	965-0048-00		7F	960-5007-00
ABC Monday Night Football					
CPU	(128K)	965-0031-00	A2-7	B5	960-5006-00
CPU	(256K)	965-0032-00	A2-7	C5	960-5007-00
Voice 1	(512K)	965-0034-00		6F	960-7001-02
Voice 2	(512K)	965-0035-00		4F	960-7001-02
Sound	(256K)	965-0033-00		7F	960-5007-00
Robocop					
CPU	(256K)	965-0036-00	A3-4	B5	960-5007-00
CPU	(256K)	965-0037-00	A3-4	C5	960-5007-00
Voice 1	(512K)	965-0039-00		6F	960-7001-02
Voice 2	(512K)	965-0040-00		4F	960-7001-02
Sound	(256K)	965-0038-00		7F	960-5007-00
Phantom of the Opera					
CPU	(128K)	965-0026-00	A3-2	B5	960-5006-00
CPU	(256K)	965-0027-00	A3-2	C5	960-5007-00
Voice 1	(512K)	965-0029-00		6F	960-7001-02
Voice 2	(512K)	965-0030-00		4F	960-7001-02
Sound	(256K)	965-0028-00		7F	960-5007-00
Back to the Future					
CPU	(256K)	965-0041-00	A2-0	B5	960-5007-00
CPU	(256K)	965-0042-00	A2-0	C5	960-5007-00
Voice 1	(512K)	965-0044-00		6F	960-7001-02
Voice 2	(512K)	965-0045-00		4F	960-7001-02
Sound	(256K)	965-0043-00		7F	960-5007-00
The Simpsons					
CPU	(128K)	965-0051-00	A2-7	B5	960-5006-00
CPU	(256K)	965-0052-00	A2-7	C5	960-5007-00
Voice 1	(512K)	965-0054-00		6F	960-7001-02
Voice 2	(512K)	965-0055-00		4F	960-7001-02
Sound	(256K)	965-0053-00		7F	960-5007-00
Checkpoint					
CPU	(128K)	965-0056-00	A1-7	B5	960-5006-00
CPU	(256K)	965-0134-00	A1-7	C5	960-5007-00
Voice 1	(1M)	965-0057-00		F7	960-5009-00
Voice 2	(1M)	965-0058-00		F5	960-5009-00
Sound	(256K)	965-0059-00		F4	960-5007-00
Display	(512K)	965-0060-00	CP80	U8	960-7001-02
Teenage Mutant Ninja Turtles					
CPU	(128K)	965-0061-00	A1.04	B5	960-5006-00
CPU	(256K)	965-0062-00	A1.04	C5	960-5007-00
Voice 1	(1M)	965-0063-00		F5/6	960-5009-00
Voice 2	(1M)	965-0064-00		F4/5	960-5009-00
Sound	(256K)	965-0065-00		F7	960-5007-00
Display	(512K)	965-0066-00	A1.04	U8	960-7001-02
Batman					
CPU	(128K)	965-0067-00	A1.06	B5	960-5006-00
CPU	(256K)	965-0135-00	A1.06	C5	960-5007-00
Voice 1	(2M)	965-0068-00		U17	960-5010-00
Voice 2	(1M)	965-0069-00		U21	960-5009-00
Sound	(256K)	965-0070-00		U7	960-5007-00
Display	(1M)	965-0071-00	A1.06	U8	960-5009-00
Star Trek 25th Anniversary					
CPU	(512K)	965-0072-00	A2.01	C5	960-7001-02
Voice 1	(2M)	965-0073-00		U17	960-5010-00
Voice 2	(2M)	965-0074-00		U21	960-5010-00
Sound	(256K)	965-0075-00		U7	960-5007-00
Display	(1M)	965-0076-00	A1.09	U8	960-5009-00
Hook					
CPU	(512K)	965-0077-00	A4.08	C5	960-7001-02
Voice 1	(2M)	965-0078-00		U17	960-5010-00
Voice 2	(2M)	965-0079-00		U21	960-5010-00
Sound	(256K)	965-0080-00		U7	960-5007-00
Display	(1M)	965-0081-00	A4.01	U8	960-5009-00
Lethal Weapon 3					
CPU	(512K)	965-0082-00	A2.08	C5	960-7001-02
Voice 1	(2M)	965-0083-00		U17	960-5010-00
Voice 2	(2M)	965-0084-00		U21	960-5010-00
Sound	(256K)	965-0085-00		U7	960-5007-00
Display	(2M)	965-0086-00	A2.06	ROM 0	960-5010-00
Display	(2M)	965-0087-00	A2.06	ROM 1	960-5010-00
	(Used on Display PCB 520-5055-00)				
			-OR-		
Display	(4M)	965-0087-04	A2.06	ROM 0	960-5015-00
	(Used on Display PCB 520-5055-01)				
Star Wars					
CPU	(512K)	965-0119-00	A1.03	C5	960-7001-02
Voice 0	(4M)	965-0132-00		U17	960-5015-00
Voice 1	(2M)	965-0133-00		U21	960-5010-00
Sound	(256K)	965-0131-00		U7	960-5007-00
Display	(2M)	965-0120-00	A1.04	ROM 0	960-5010-00
Display	(2M)	965-0121-00	A1.04	ROM 1	960-5010-00
	(Used on Display PCB 520-5055-00)				
			-OR-		
Display	(4M)	965-0122-00	A1.05	ROM 0	960-5015-00
	(Used on Display PCB 520-5055-01)				
Rocky & Bullwinkle & Friends					
CPU	(512K)	965-0138-00	A1.30	C5	960-7001-02
Voice 0	(4M)	965-0139-00		U17	960-5015-00
Voice 1	(2M)	965-0140-00		U21	960-5010-00
Sound	(256K)	965-0141-00		U7	960-5007-00
Display	(4M)	965-0142-00	A1.30	ROM 0	960-5015-00
Jurassic Park					
CPU	(512K)	965-0143-00	A5.13	C5	960-7001-02
Voice 0	(4M)	965-0144-00		U17	960-5015-00
Voice 1	(2M)	965-0145-00		U21	960-5010-00
Sound	(256K)	965-0146-00		U7	960-5007-00
Display	(4M)	965-0147-00	A5.10	ROM 0	960-5015-00
Last Action Hero					
CPU	(512K)	965-0148-00	A1.12	C5	960-7001-02
Voice 0	(4M)	965-0149-00		U17	960-5015-00
Voice 1	(2M)	965-0150-00		U21	960-5010-00
Sound	(256K)	965-0151-00		U7	960-5007-00
Display	(4M)	965-0152-00	A1.06	ROM 0	960-5015-00
Tales from the Crypt					
CPU	(512K)	965-0157-00	A3.03	C5	960-7001-02
Voice 0	(4M)	965-0158-00		U17	960-5015-00
Voice 1	(2M)	965-0159-00		U21	960-5010-00
Sound	(256K)	965-0160-00		U7	960-5007-00
Display	(4M)	965-0161-00	A3.01	ROM 0	960-5015-00
The Who's Tommy					
CPU	(512K)	965-0162-00	A4.00	C5	960-7001-02
Voice 1	(4M)	965-0165-00		U17	960-5015-00
Voice 2	(4M)	965-0166-00		U21	960-5015-00
Voice 3	(4M)	965-0167-00		U36	960-5015-00
Voice 4	(4M)	965-0168-00		U37	960-5015-00
Sound	(512K)	965-0164-00		U7	960-7001-02
Display	(4M)	965-0163-00	A4.00	ROM 0	960-5015-00
WWF Royal Rumble					
CPU	(512K)	965-0169-00	A1.06	C5	960-7001-02
Voice 1	(4M)	965-0172-00		U17	960-5015-00
Voice 2	(4M)	965-0173-00		U21	960-5015-00
Voice 3	(4M)	965-0174-00		U36	960-5015-00
Sound	(512K)	965-0171-00		U7	960-7001-02
Display	(4M)	965-0170-00	A1.02	ROM 0	960-5015-00
Guns N' Roses					
CPU	(512K)	965-0175-00	A3.00	C5	960-7001-02
Voice 1	(4M)	965-0178-00		U17	960-5015-00
Voice 2	(4M)	965-0179-00		U21	960-5015-00
Voice 3	(4M)	965-0180-00		U36	960-5015-00
Voice 4	(4M)	965-0181-00		U37	960-5015-00
Sound	(512K)	965-0177-00		U7	960-7001-02
Display	(4M)	965-0176-00	A3.00	ROM 0	960-5015-00
Maverick *					
CPU	(512K)	965-0182-00	A4.04	C5	960-7001-02
Voice 1	(4M)	965-0186-00		U17	960-5015-00
Voice 2	(4M)	965-0187-00		U21	960-5015-00
Voice 3	(4M)	965-0187-01		U36	960-5015-00
Sound	(512K)	965-0185-00		U7	960-7001-02
Display*	(4M)	965-0183-00	A4.01	ROM 0	960-5015-00
Display*	(4M)	965-0184-00	A4.01	ROM 3	960-5015-00
Mary Shelley's Frankenstein *					
CPU	(512K)	965-0188-00	A1.03	C5	960-7001-02
Voice 1	(4M)	965-0192-00		U17	960-5015-00
Voice 2	(4M)	965-0193-00		U21	960-5015-00
Voice 3	(4M)	965-0194-00		U36	960-5015-00
Sound	(512K)	965-0191-00		U7	960-7001-02
Display*	(4M)	965-0189-00	A1.03	ROM 0	960-5015-00
Display*	(4M)	965-0190-00	A1.03	ROM 3	960-5015-00
Baywatch *	(CPU Board 520-5003-04)				
CPU	(512K)	965-0195-00	A4.00	C5	960-7001-02
Voice 1	(4M)	965-0196-00		U17	960-5015-00
Voice 2	(4M)	965-0197-00		U21	960-5015-00
Sound	(512K)	965-0199-00		U7	960-7001-02
Display*	(4M)	965-0200-00	A4.00	ROM 0	960-5015-00
Display*	(4M)	965-0201-00	A4.00	ROM 3	960-5015-00
Batman Forever *	(CPU Board 520-5003-04)				
CPU	(512K)	965-0202-00	A3.02	C5	960-7001-02
Voice 1	(4M)	965-0203-00		U17	960-5015-00
Voice 2	(4M)	965-0204-00		U21	960-5015-00
Sound	(512K)	965-0205-00		U7	960-7001-02
Display*	(4M)	965-0206-00	A3.00	ROM 0	960-5015-00
Display*	(4M)	965-0207-00	A3.00	ROM 3	960-5015-00

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

APPENDIX A

Pinball Game Firmware (for White Star Board System) Table

ROM	Chip Size	Program Part 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 | $A6AE	U7	960-7001-02
Display	(4M)	965-0288-60	**A1.02** | **$32AB**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0283-60	1.00 | $4391	U17	960-5015-01
Voice 2	(4M)	965-0284-60	1.00 | $8215	U21	960-5015-01
Voice 3	(4M)	965-0285-60	1.00 | $5832	U36	960-5015-01
Voice 4	(4M)	965-0286-60	1.00 | $8971	U37	960-5015-01
Godzilla (Note 4)					
Game ROM	(1M)	965-0289-40	**A2.05**| **$B1FF**	**U210**	960-5009-00
Sound	(512K)	965-0294-40	1.00 | $0CC8	U7	960-7001-02
Display	(4M)	965-0295-40	**A2.00** | **$C929**	**ROM 0**	960-5015-01
Voice 1	(4M)	965-0290-40	1.00 | $0D75	U17	960-5015-01
Voice 2	(4M)	965-0291-40	1.00 | $CCCF	U21	960-5015-01
Voice 3	(4M)	965-0292-40	1.00 | $227F	U36	960-5015-01
Voice 4	(4M)	965-0293-40	1.00 | $DB69	U37	960-5015-01
South Park (Notes 4, 5)					
Game ROM	(1M)	965-0301-71	**A1.03** | **$58FF**	**U210**	960-5009-00
Sound	(512K)	965-0306-71	1.00 | $1286	U7	960-7001-02
Display	(4M)	965-0307-71	**A1.01** | **$166F**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0302-71	1.00 | $7BF8	U17	960-5016-00
Voice 2	(8M)	965-0303-71	1.00 | $9CCC	U21	960-5016-00
Voice 3	(8M)	965-0304-71	1.00 | $ADD9	U36	960-5016-00
Voice 4	(8M)	965-0305-71	1.00 | $6659	U37	960-5016-00
Harley-Davidson® (Notes 4, 5, 6) *Original (1999-2001)*					
Game ROM	(1M)	965-0319-67	**A1.03** | **$3EFF**	**U210**	960-5009-00
Sound	(512K)	965-0320-67	1.00 | $F4FF	U7	960-7001-02
Display	(4M)	965-0321-67	**A1.04** | **$FC7C**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0322-67	1.00 | $CD26	U17	960-5016-00
Voice 2	(8M)	965-0323-67	1.00 | $9396	U21	960-5016-00
Voice 3	(8M)	965-0324-67	1.00 | $FB72	U36	960-5016-00
Voice 4	(4M)	965-0325-67	1.00 | $6100	U37	960-5015-01
▶ Harley-Davidson® (Notes 4, 5, 6, 8) *2nd Edition (2002-2003)*					
Game ROM	(1M)	965-0319-67**A**	**A1.06** | **$23FF**	**U210**	960-5009-00
Display	(4M)	965-0321-67**A**	**A1.05** | **$B594**	**ROM 0**	960-5015-01
Striker Xtreme (Notes 4, 5)					
Game ROM	(1M)	965-0326-68	**A1.02** | **$E4FF**	**U210**	960-5009-00
Sound	(512K)	965-0327-68	1.00 | $3BCA	U7	960-7001-02
Display	(4M)	965-0328-68	**A1.03** | **$1957**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0329-68	1.00 | $482A	U17	960-5016-00
Voice 2	(8M)	965-0330-68	1.00 | $7312	U21	960-5016-00
Voice 3	(8M)	965-0331-68	1.00 | $DE2F	U36	960-5016-00
Voice 4	(8M)	965-0332-68	1.00 | $C508	U37	960-5016-00
NFL (Notes 4, 5) *Not on CD-R or Website: Code through Distributor Only.*					
Game ROM	(1M)	965-0339-73	**A1.00** | **$D2FF**	**U210**	960-5009-00
Sound	(512K)	965-0340-73	1.00 | $	U7	960-7001-02
Display	(4M)	965-0341-73	**A1.01** | **$845A**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0342-73	1.00 | $	U17	960-5016-00
Voice 2	(8M)	965-0343-73	1.00 | $	U21	960-5016-00
Voice 3	(8M)	965-0344-73	1.00 | $	U36	960-5016-00
Voice 4	(8M)	965-0345-73	1.00 | $	U37	960-5016-00
Sharkey's Shootout (Notes 4, 5)					
Game ROM	(1M)	965-0333-72	**A2.11** | **$49FF**	**U210**	960-5009-00
Sound	(512K)	965-0334-72	1.01 | $9796	U7	960-7001-02
Display	(4M)	965-0335-72	**A2.01** | **$6C33**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0336-72	1.00 | $58EA	U17	960-5016-00
Voice 2	(8M)	965-0337-72	1.00 | $272B	U21	960-5016-00
Voice 3	(8M)	965-0338-72	1.00 | $41AE	U36	960-5016-00
High Roller Casino (Notes 4, 5)					
Game ROM	(1M)	965-0346-65	**A3.00** | **$90FF**	**U210**	960-5009-00
Sound	(512K)	965-0347-65	1.00 | $581C	U7	960-7001-02
Display	(4M)	965-0348-65	**A3.00** | **$74B3**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0349-65	1.00 | $E12D	U17	960-5016-00
Voice 2	(8M)	965-0350-65	1.00 | $38F4	U21	960-5016-00
Voice 3	(8M)	965-0351-65	1.00 | $1B54	U36	960-5016-00
Voice 4	(8M)	965-0352-65	1.00 | $D720	U37	960-5016-00
Austin Powers™ (Notes 4, 5)					
Game ROM	(1M)	965-0353-74	**A3.02** | **$5DFF**	**U210**	960-5009-00
Sound	(512K)	965-0354-74	1.00 | $DA7B	U7	960-7001-02
Display	(4M)	965-0035-74	**A3.00** | **$6A34**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0356-74	1.00 | $D2B9	U17	960-5016-00
Voice 2	(8M)	965-0357-74	1.00 | $9E75	U21	960-5016-00
Voice 3	(8M)	965-0358-74	1.00 | $51F3	U36	960-5016-00
Voice 4	(8M)	965-0359-74	1.00 | $0AE5	U37	960-5016-00
Monopoly® (Notes 4, 5)					
Game ROM	(1M)	965-0360-75	**A3.03** | **$5EFF**	**U210**	960-5009-00
Sound	(512K)	965-0361-75	1.00 | $8C18	U7	960-7001-02
Display	(4M)	965-0362-75	**A3.01** | **$A381**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0363-75	1.00 | $35E6	U17	960-5016-00
Voice 2	(8M)	965-0364-75	1.00 | $B35A	U21	960-5016-00
Voice 3	(8M)	965-0365-75	1.00 | $8A9F	U36	960-5016-00
Voice 4			***Not Used***	U37	
Playboy (Notes 4, 5, 7)					
Game ROM	(1M)	965-0367-76	**A5.00** | **$7DFF**	**U210**	960-5009-00
Sound	(512K)	965-0368-76	1.02 | $E7C2	U7	960-7001-02
Display	(4M)	965-0369-76	**A5.00** | **$A5FF**	**ROM 0**	960-5015-01
Voice 1	(8M)	965-0370-76	1.00 | $9ABE	U17	960-5016-00
Voice 2	(8M)	965-0371-76	1.00 | $9F34	U21	960-5016-00
Voice 3	(8M)	965-0372-76	1.00 | $374B	U36	960-5016-00
Voice 4	(8M)	965-0373-76	1.00 | $237A	U37	960-5016-00
RollerCoaster Tycoon™ (Notes 4, 5, 7)					
Sound	(512K)	965-0374-78	1.00 | $F663	U7	960-7001-02
Game ROM	(1M)	965-0375-78	**A7.01**| **$40FF**	**U210**	960-5009-00
Voice 1	(8M)	965-0377-78	1.00 | $3C4A	U17	960-5016-00
Voice 2	(8M)	965-0378-78	1.00 | $057A	U21	960-5016-00
Voice 3	(8M)	965-0379-78	1.00 | $04D7	U36	960-5016-00
Display	(4M)	965-0376-78	**A7.00** | **$8E23**	**U5** Disp. Cntrlr.	960-5015-01
The Simpsons™ Pinball Party (Notes 4, 5, 7)					
Sound	(512K)	965-0381-77	1.01 | $A7EE	U7	960-7001-02
Game ROM	(1M)	965-0382-77	**A4.00** | **$4FFF**	**U210**	960-5009-00
Voice 1	(8M)	965-0383-77	1.00 | $9719	U17	960-5016-00
Voice 2	(8M)	965-0384-77	1.00 | $16ED	U21	960-5016-00
Voice 3	(8M)	965-0385-77	1.00 | $ADCE	U36	960-5016-00
Voice 4	(8M)	965-0386-77	1.00 | $E7E5	U37	960-5016-00
Display	(4M)	965-0387-77	**A4.00** | **$8A03**	**U5** Disp. Cntrlr.	960-5015-01
Terminator® 3: Rise of the Machines™ (Notes 4, 5, 7)					
Sound	(512K)	965-0388-79	1.00 | $D2FD	U7	960-7001-02
Game ROM	(1M)	965-0389-79	**A4.00** | **$F8FF**	**U210**	960-5009-00
Voice 1	(8M)	965-0390-79	1.00 | $1838	U17	960-5016-00
Voice 2	(8M)	965-0391-79	1.00 | $F0D5	U21	960-5016-00
Voice 3	(8M)	965-0392-79	1.00 | $89DA	U36	960-5016-00
Voice 4	(8M)	965-0393-79	1.00 | $1200	U37	960-5016-00
Display	(4M)	965-0394-79	**A4.00** | **$6E49**	**U5** Disp. Cntrlr.	960-5015-01
The Lord of the Rings™ (Notes 5, 7, 8)					
Sound	(512K)	965-0401-80	1.01 | $36BC	U7	960-7001-02
Game ROM	(1M)	965-0402-80	**A8.00** | **$94FF**	**U210**	960-5009-00
Voice 1	(8M)	965-0403-80	1.00 | $1792	U17	960-5016-00
Voice 2	(8M)	965-0404-80	1.00 | $67F1	U21	960-5016-00
Voice 3	(8M)	965-0405-80	1.00 | $89B6	U36	960-5016-00
Voice 4	(8M)	965-0406-80	1.00 | $EA49	U37	960-5016-00
Display	(4M)	965-0407-80	**A8.00** | **$3C88**	**U5** Disp. Cntrlr.	960-5015-01
Ripley's Believe It or Not!® *(see website)*					
VIEW ROM LABEL for current version & checksums					

footnotes:

1 ROMs on CPU/Sound Bd.: 520-5136-**00** (Stereo) & Display Cont. Bd.: 520-5055-01
2 ROMs on CPU/Sound Bd.: 520-5136-**10** (Mono) & Display Cont. Bd.: 520-5055-01
3 ROMs on CPU/Sound Board: 520-5136-**15*** (Mono) (*FCC 11-97) & Display Controller Board: 520-5055-**02*** (*FCC 11-97)
4 ROMs on CPU/Sound Bd.: 520-5136-**16**† (Mono) (†FCC 02-98) & Display Controller Board: 520-5055-**03**‡ (‡FCC 02-98)
5 This game uses **8MB** VOICE ROMS at U17, U21, U36 & U37 *(if 3 ROMs use U37 will be unused)* requiring a **Jumper at Loc. W6**. Refer to CPU/Snd. Bd. Schematic (2 of 3).
6 **Harley-Davidson® 2nd Edition:** For Game ROM, Sound & Display info (version, check sums, part numbers) call Tech Support or check our website (see back cover) for current versions or other info. Raw Part numbers are identical to the H-D® original.
7 **ToPS™ (Tournament Pinball System) READY!**
8 ROMs on **CPU/Sound Board II (with ATMEL Processor)**: **520-5300-00** & Display Controller Board: 520-5055-03‡ (‡FCC 02-98)

Game Revisions can be updated after the Production Run. This Table is accurate as of the printing of this manual. If any changes occurred, the next game manual will include the updated information. The version stated is USA. If there is a question of as to the latest Code Revision & Check Sum call our Technical Support Department, 1-800-542-5377 or 1-708-345-7700 *(Select Option 1)*. Visit our website **www.SternPinball.com** where code can be downloaded *(an EPROM Burner is required)*.

APPENDIX B

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

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

APPENDIX C

Game Name, Production Start Date, Manual Part Nº & CPU Jumper Info†

	Game Name	Production Start Date and Manual PNº	CPU Ver.	EPROM Position	Jumpers Installed († see Note)	Jumpers Removed († see Note)
1	Laser War	MAY 87 780-5001-00	1* 2*	5C 5B, 5C	J4 J6a J7a J4 J5a J6a	J5 J6 J7b J5 J5b J6b
2	Secret Service	MAR 88 780-5002-00	2*	5B, 5C	J4	J5
3	Torpedo Alley	AUG 88 780-5003-00	2*	5B, 5C	J4	J5
4	Time Machine	DEC 88 780-5004-00	2*	5B, 5C	J4	J5
5	Playboy 35th Anniversary	MAY 89 780-5005-00	2*	5B, 5C	J4	J5
6	ABC Monday Night Football	SEP 89 780-5007-00	2*	5B, 5C	J4	J5
7	Robocop	NOV 89 780-5006-00	2*	5B, 5C	J4	J5
8	Phantom of the Opera	JAN 90 780-5008-00	2*	5B, 5C	J4	J5
9	Back to the Future	JUN 90 780-5009-00	3*	5B, 5C	J4	J5
10	The Simpsons	SEP 90 780-5012-00	3*	5B, 5C	J4	J5
11	Checkpoint	FEB 91 780-5010-00	3*	5B, 5C	J4	J5
12	Teenage Mutant Ninja Turtles	MAY 91 780-5017-00	3*	5B, 5C	J4	J5
13	Batman	JUL 91 780-5011-00	3*	5B, 5C	J4	J5
14	Star Trek 25th Anniversary	OCT 91 780-5014-00	3*	5C	J5	J4
15	Hook	JAN 92 780-5019-00	3*	5C	J5	J4
16	Lethal Weapon 3	JUN 92 780-5026-00	3*	5C	J5	J4
17	Star Wars	OCT 92 780-5024-00	3*	5C	J5	J4
18	Rocky & Bullwinkle & Friends	FEB 93 780-5022-00	3*	5C	J5	J4
19	Jurassic Park	APR 93 780-5020-00	3*	5C	J5	J4
20	Last Action Hero	AUG 93 780-5027-00	3*	5C	J5	J4
21	Tales from the Crypt	NOV 93 780-5018-00	3*	5C	J5	J4
22	The Who's Tommy	FEB 94 780-5028-00	3*	5C	J5	J4
23	WWF Royal Rumble	MAY 94 780-5023-00	3*	5C	J5	J4
24	Guns-N'-Roses	JUL 94 780-5029-00	3*	5C	J5	J4
25	Maverick	SEP 94 780-5031-00	3*	5C	J5	J4
26	Mary Shelley's Frankenstein	DEC 94 780-5036-00	3*	5C	J5	J4
27	Baywatch	MAR 95 780-5033-00	3*	5C	J5	J4
28	Batman Forever	JUL 95 780-5038-00	3*	5C	J5	J4

† *Additional Info. for **Installed** / **Removed** Jumpers (above 1-28 only):*

Game 1, Ver. 1, Board Combinations with **ROM** at Location **5C**
- **Installed** J1b, J3, J4, J6a, **J7a** & J8
- **Removed** J1a, J2, J5, **J6** & **J7b**

* Version 1 above has a 2K RAM which is a 24-pin IC in Position 5D; Versions 2/3 below have a 8K RAM which is a 28-PIN IC in Position 5D.

Game 1, Ver. 2, Board Combinations w/ **ROM** at Locations **5B**, **5C**
- **Installed** J1b, J3, J4, **J5a, J6a, J7b** & J8
- **Removed** J1a, J2, J5, **J5b, J6b,** & **J7a**

Games 2-12, Ver. 2 **or** 3, Bd. Combinations w/ **ROM** at Locations **5B**, **5C**
- **Installed** J1b, J3, **J4**, **J5b**, **J6b,** J7b & J8
- **Removed** J1a, J2, **J5, J5a, J6a** & J7a

Games 14-28, Ver. 3, Board Combinations with **ROM** at Locations **5C**
Installed J1b, J3, **J5,** J5b, J6b, J7b & J8
Removed J1a, J2, **J4,** J5a, J6a & J7a

	Game Name White Star Board System™	Production Start Date and Manual PNº	CPU/Sound Board **Sound U7 512K** CPU/Sound Board **Game U210 1MB** CPU/Sound Board **Voice ROMS:** U17	U21	U36	U37	Jumpers Installed (‡ see Note)
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 - Special Edition	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 Edition	SEP 02 780-5067-**10**	8MB	8MB	8MB	8MB	W6
43 **a**	Striker Xtreme	MAR 00 780-5068-01	8MB	8MB	8MB	8MB	W6
43 **b**	NFL	OCT 00 780-50**73**-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	Terminator® 3: 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. Game 52 - current has a new CPU/Sound Board (see Pages 131-141).*

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

APPENDIX D

Board Type Table

Game Name	Flipper	Sound	Power Supply	Display X-Digit
• Laser War	2-Flipper **Board Not Required**	***initial:*** 520-5002-00 ***replaced with:*** 520-5002-02 *520-5002-01 was not used.*	520-5000-00	Master: 520-5004-00 plus: 520-5005-00 (Qty. 2): 7 Digit Alpha/Numeric 520-5006-00 (Qty. 2): 7 Digit Numeric 520-5007-00 (Qty. 1): 4 Digit Numeric
• Secret Service • Torpedo Alley	3-Flipper **Board Not Required**	520-5002-02		520-5014-01 7 Digit Alpha/Numeric Combined
• Time Machine	2-Flipper **Board Not Required**			
• Playboy 35th Anniversary * • ABC Monday Night Football * • *Robocop* • *Phantom of the Opera* • *Back to the Future*	520-5033-00 2-Flipper *(*only for 100 games of Playboy 35th Anniv. & ABC Mon. Night Football)*			520-5030-00 16 Digit Alpha/Numeric Combined
• The Simpsons		520-5002-**03**		

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

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

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

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

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

Game Name	I/O Power Driver	CPU/Sound Mono	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Apllication	Misc OPTO & App.
Twister	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Light Boards 520-5145-01 through -07		Mag. Drv. Bd. 520-5143-00	Relay Board 520-5010-00				
Independence Day (ID4)	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Light Boards 520-5149-01 through -10		Servo Mtr. Bd. 520-5152-00		520-5082-00 Long Hop OPTO	520-5083-00 Long Hop OPTO	Alien Head Enter	
Space Jam	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	2X 7-Segment Display Board 520-5153-00							
The Star Wars Trilolgy - Special Ed.	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00							

Table continued on the next page.

APPENDIX D

Board Type 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.
The Lost World: J.P.	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	520-5162-00 2-Pos. Motor Sensor on Snagger Motor
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Shaker Mtr. Bd. 520-5065-00						
The X-Files	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	520-5155-00 3-Pos. Motor Sensor on File Cab. Motor
	Miscellaneous PC Boards:					520-5082-00 Long Hop OPTO	520-5083-00 Long Hop OPTO	File Cabinet Enter	
Starship Troopers	520-5137-01	520-5136-15	520-5138-00	520-5052-00 128 X 32	520-5055-02	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	4X 7-Segment Display Board 520-5166-00				520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	L/R Orbit Lane Enter	
Viper Night Drivin'	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00				520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Jump Ramp	
Lost In Space	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00							
Godzilla	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Shaker Mtr. Bd. 520-5065-00							
South Park	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:					520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Kenny Under Trough Enter	
Harley-Davidson® *and* Harley-Davidson® 2nd Edition	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00	Shaker Mtr. Bd. 520-5065-00	Diode Board 520-5146-00		520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Motorcycle Enter	
Striker Xtreme (NFL)	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5155-00 3-Pos. Motor Sensor on Goalie Motor
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Relay Board 520-5010-00	Diode Board 520-5146-00	for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Goalie Under-Trough Enter	
Sharkey's Shootout	520-5137-64	520-5136-64	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5194-00 4-Pos. Motor Sensor on ?-Ball Motor
	Miscellaneous PC Boards:	Relay Board 520-5010-00	Sol. Exp. Bd. 520-5192-00						
High Roller Casino	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5194-00 4-Pos. Motor Sensor on Roulette Wheel Motor
						520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Ball Lock under Roulette	
	Miscellaneous PC Boards:	Dot Display (5X7) in Slot Mach. 520-5197-00			for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5196-00 3-Pos. OPTO	520-5195-00 3-Pos. OPTO	Up/Dn Ramp in Slot Mach.	
Austin Powers™	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5212-00 Pulse-Stretcher OPTO on Spini-Me
	Miscellaneous PC Boards:	Relay Bd. (X3) 520-5010-00			for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Time Machine Ramp	
Monopoly®	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Mini-Dot Display (3 by 5X7) 520-5197-00 (Electric C Sign)		for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5218-00 4-Pos. OPTO	520-5210-00 4-Pos. OPTO	Bank Door	
Playboy	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Relay Bd. 520-5010-00		for UK ONLY> Solenoid Expander Bd. 520-5192-00				
RollerCoaster Tycoon™	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5222-00 1-Position Switch Detect on Wheel Spin
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Mini-Dot Display (3 by 5X7) 520-5221-00 (Ramp Enter Sign)		for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Behind 1-Bank Drop Target	
The Simpsons™ Pinball Party	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	LED Bd. 520-5219-00	Color Dot Display (4 by 5X7) 520-5225-00 (TV Set)		for UK ONLY> Solenoid Expander Bd. 520-5068-01				
Terminator® 3: Rise of the Machines™	520-5137-01	**520-5136-16**	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:				for UK ONLY> Solenoid Expander Bd. 520-5068-01	515-7307-00 Single OPTO	515-7308-00 Single OPTO	TXCannon Trough	
The Lord of the Rings™	520-5137-01	***New* 520-5300-00**	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	500-6746-00 (White Trans.) 500-6747-00 (Black Rec.)
	Miscellaneous PC Boards:	19-LED PCB 520-5242-00	OPTO Transmitter / Receiver Amplifier PCB 520-5239-00		for UK ONLY> Solenoid Expander Bd. 520-5068-01	515-7307-00 Single OPTO	515-7308-00 Single OPTO	Orthanc Tower Trough	
Ripley's Believe It or Not!®	520-5137-01	520-5300-00	520-5138-00	520-5052-00 128 X 32	520-5055-03	515-0173-00 Dual OPTO	515-0174-00 Dual OPTO	4-Ball Trough over Up-Kicker	500-6775-00 OPTO Trnscvr
	Miscellaneous PC Boards:	520-5236-00 X3 Dot Display	OPTO Transmitter / Receiver Amplifier PCB 520-5239-01		for UK ONLY> Solenoid Expander Bd. 520-5068-01	520-5234-00 3-Pos. OPTO	520-5234-00 3-Pos. OPTO	Vari-Target	520-5235-03 X3 Aux. Drvr

APPENDIX E

Generic Coil Cross-Reference Guide † ‡

STANDARD COILS						FLIPPER COILS			
GA-TURNS	Res. (Ω)	SPI PART Nº	GA-TURNS	Res. (Ω)	SPI PART Nº	GAUGE-TURNS	Res. (Ω)	Coil Wrap	SPI PART Nº
20-400	1.0 Ω	090-5021-00	**24-900**	5.0 Ω	090-5002-00	**21-900** †	Ω	RED-RED*	090-5020-10†
22-500	1.7 Ω	090-5017-00	**24-940** †	5.5 Ω	090-5036-00†	**22-750**/30-2600 ‡	2.6 / 92.0 Ω	N/A	090-5011-00
22-600	2.2 Ω	090-5023-00	**25-1240**	9.3 Ω	090-5034-00	**22-900** †	3.4 Ω	YEL-YEL	090-5020-20†
23-700	3.1 Ω	090-5022-00	**26-1200** †	10.3 Ω	090-5044-00†	**22-1080** †	4.3 Ω	YEL-GRN	090-5032-00†
23-750	3.4 Ω	090-5019-00	**27-1300**	14.2 Ω	090-5003-00	**23-620**/30-2600 ‡	2.4 / 75.0 Ω	N/A	090-5006-00
23-800 †	3.6 Ω	090-5001-00†	**27-1400**	14.7 Ω	090-5015-00	**23-700**/30-2600 ‡	3.0 / 83.5 Ω	N/A	090-5013-00
23-840	4.0 Ω	090-5005-00	**27-1500** †	16.3 Ω	090-5004-00†	**23-800**/30-2600 ‡	2.8 / 90.5 Ω	N/A	090-5012-00
23-1200	7.1 Ω	090-5008-00	**28-1050**	11.5 Ω	090-5046-00	**23-900**	3.8 Ω	GRN-GRN	090-5020-30
23½-765	3.6 Ω	090-5037-03	**29-2000**	33.6 Ω	090-5016-00	**23-1100**	5.1 W	ORG-ORG	090-5030-00
						23-1500*	4.4 Ω	BLU-BLU*	090-5062-00†
						24-1570*	9.5 Ω	BLU-BLU*	090-5025-00
						25-1400	Ω	RED-RED*	090-5067-00†
						25-1600	Ω	WHT-WHT	090-5068-00†
						25-1800	13.8 Ω	BLU-GRN	090-5041-00

† Coil Part Numbers ending with a " **T** " signifies the Diode is on the top of the lug;
Coil Part Numbers ending with a " **B** " signifies the Diode is on the bottom of the lug.
‡ Coils noted with two "Gauge-Turns" are dual-wound.

Order Note: All Coil Part Nºs listed ***Do Not Include*** Coil Sleeves *(For the correct Coil Sleeve, refer to the Assembly Drawing the coil exists on and order separately).*

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

* ***Flipper Coils: 23-1500*** / ***24-1570*** *have Color Wrap of "Blue-Blue", note the PNs.* ***21-900*** / ***25-1400*** *have a Color Wrap of "Red-Red", note the PNs.*

MAGNET COILS w/12" leads			TRIP COILS (Miniature)						LUGLESS COILS	
GA-TURNS	Res. (Ω)	SPI PART Nº	GA-TURNS	Res. (Ω)	SPI PART Nº	GA-TURNS	Res. (Ω)	SPI PART Nº	GA-TURNS	Res. (Ω)
22-650	4.3 Ω	090-5042-01	**29-1000**	15.2 Ω	090-5059-00	**33-1590**	59.0 Ω	515-6916-00	SPI PART Nº	
24-780	8.0 Ω	090-5061-00	**31-1500**	52.0 Ω	090-5054-00	**32-1250**	35.0 Ω	515-6916-**01**	**23-800**	3.6 Ω
20½-480	2.9 Ω	090-5064-02	**32-1800**	50.2 Ω	090-5031-00	*Note: 33-1590 WHT & 32-1250 YEL*			090-5053-00	

Flipper Coil Table ‡ ††

GAME NAME	Nº of Flippers	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
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 Table

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

Game Name	Function	Specifications	Part №
ABC Monday Night Football	Goal Post Up/Down Movement	Motor 24v A.C. 60 RPM CW	515-5222-00
Phantom of the Opera	Organ Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Checkpoint	Mag Wheel (in Backbox)	Motor D.C. (KEN)	041-5005-00
	Shaker	Johnson Motor (Vibrator)	041-5002-00
Teenage Mutant Ninja Turtles	Spinning Pizza Ball Deflector	Gear Motor 24v A.C. 325 RPM CW	515-5397-00
Batman	Bar Target Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Star Trek 25th Anniversary	Swinging Target	Bowman Motor 24v 22½ RPM	515-5534-00
	Transporter F/X	Gear Motor 24v A.C. 3½ RPM	500-5421-00
	Cooling Fan (for Transporter F/X)	4½" Motor 12v	041-5014-00
Lethal Weapon 3	Spinning Light	Motor 2½ v A.C. 4000 RPM CCW	041-5017-00
Star Wars	Bar Target Up/Down Movement	Bowman Motor 24v 60hz 3W 11 RPM CCW	515-5256-00
	R2D2 Robot Left/Right Movement	Bowman Motor 24v A.C. 22½ RPM CW	515-5571-00
	Death Star Rotation	Bowman "G" Motor 24v A.C. 60Hz 6 RPM CW	515-5570-00
Rocky & Bullwinkle & Friends	Nell Log "Cutting Blade" Forward/Back Movement	Autotrol Model E Motor 24v 60hz 4W 3 RPM CCW	041-5023-00
Jurassic Park	T-Rex Left/Right Movement	Multi Motor 5v D.C.	041-5025-00
	T-Rex Up/Down Movement	Bowman Motor 24v 11 RPM CW	041-5026-00
	Shaker	Johnson Motor (Vibrator)	041-5002-00
Last Action Hero	Crane Left/Right Movement	Multi Products Motor 12v D.C. #3312 OSC	041-5027-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Tales from the Crypt	Tombstone Up/Down Movement	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
The Who's Tommy	Mirror Up/Down Movement	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
	Flipper Blinders	Servo Motor (94102)	041-5032-00
	Spinning Airplane Propellers	Motor D.C.	041-5033-00
WWF Royal Rumble	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Maverick, The Movie	Turning Paddle Wheel	Motor 24v A.C. 10 RPM	041-5036-00
Mary Shelley's Frankenstein	Creature Head Left/Right Movement	Servo Motor (94102)	041-5032-00
Batman Forever	Cannon Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CCW	515-6383-00
Apollo 13	Rocket Up/Down Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CCW	515-6383-00
	Moon Unit Rotational Orbit	Multi Products Motor 24v A.C. 50/60Hz 3W 6 RPM CCW	515-6487-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Golden Eye	Satellite Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CW	515-6528-00

Table continued on the next page.

APPENDIX F

Motor Specification Table

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

Game Name	Function	Specifications	Part Nº
Twister	Spinning Disc with Magnet	Multi Products Motor 24v A.C. (041-5026-00) 50/60Hz 3W 325 RPM CCW	515-6347-00
	Backbox Fan (Tornado Wind)	Multi Products Motor 24v A.C. (041-5052-00) 50/60Hz 3W 3600 RPM CW	515-6531-00
ID4: Independence Day	Alien Head Open/Close Movement	Servo Motor (94322)	041-5045-00
The Star Wars Trilogy - S.E.	X-Wing Left/Right Movement	Bowman Motor 24v A.C. (041-5058-00) 60Hz 3W 10 RPM CCW	515-6383-01
The Lost World: J.P.	Snagger & Center Link Lift Up/Down Movement	Multi Products Motor 20v D.C. (041-5059-03) 9 RPM Non-Directional	515-6715-03
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
The X-Files	X-File Cabinet Lift Up/Down Movement	Multi Products Motor 20v D.C. 9 RPM CCW	041-5057-00
Starship Troopers	Warrior Bug Forward/Reverse Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12v D.C. 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not incl.) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 **Requires 7" Shaft:** 530-5503-00
Lost In Space	Spinning Disc with Magnet	Multi Products Motor 24v A.C. (041-5046-00) 50/60Hz 3W 325 RPM CCW	515-6347-00
Godzilla	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW ‡	041-5029-**01**
Harley-Davidson®	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW ‡	041-5029-**01**
	Motorcycle Lift Up/Down Movement	Autotrol 24v A.C. (041-5072-02) 20 RPM CCW	515-7025-00
Striker Xtreme (NFL)	Goalie (Linebacker) Left to Right Movement	Multi #3590 12v D.C. (041-5075-00) 60 RPM	515-7071-00
Sharkey's Shootout	Mystery Ball Rotating Movement	Hankscraft Motor Model-E 24v A.C. (041-5076-00) 50/60Hz 3W 20 RPM CW	515-7095-00
High Roller Casino	Roulette Wheel Rotating Movement	Multi Products Motor 20V D.C. (041-5078-00) 17 RPM CCW	515-7153-00
	Up/Dn. Ramp in Slot Mach. Lift Up/Down Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12v D.C. 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not incl.) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 **Requires Shaft 4¼":** 530-5503-01
Austin Powers™	Time Machine Rotating Movement	Multi Products Motor 24v A.C. (041-5079-00) 50/60Hz 20RPM CCW	515-7141-00
	Laser Beam Left to Right Directional	Autotrol Motor 24V A.C. (041-5081-00) 50/60Hz 4W 10RPM Bi-Directional	515-7171-00
	Dr. Evil Target Lift Up/Down Movement	Hankscraft Motor Model-E 24v A.C. (041-5030-00) 50/60Hz 6RPM CCW	515-5900-00
Monopoly®	Mini-Flipper (Waterworks) Rotating Movement	Multi Prod. Motor & Gear Box #7000 EX00159A 20v D.C. 50/60Hz 85RPM CC/CCW	041-5083-00
Playboy	Triangular Billboard Rotating Movement	Autotrol Motor (BD511 150-1387) 24v A.C. 50/60Hz 12RPM Bi-Directional	041-5086-02
	Centerfold Mechanism Open/Close Movement	Multi Products (3680) Motor 12v DC 10/12 RPM CC/CCW	041-5075-04
	Tease Drop Screen Lift Up/Down Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12v D.C. 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not incl.) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 **Requires 7" Shaft:** 530-5503-00
Terminator® 3: Rise of the Machines™	Backbox Ball Shooter Up/Down Movement	Multi Products Motor 24V A.C. (041-5079-01) 21 RPM CW	515-7317-00
The Lord of the Rings™	Balrog (Motor & Gate) Open/Close Movement	Multi Prod. Motor 20V D.C. Series 600B *(or equiv.)* 50/60Hz 10 RPM Bi-Directional	041-5088-01

No motors were used on the following games: Laser War, Secret Service, Torpedo Alley, Time Machine, Playboy 35th Anniversary, Robocop, Back to the Future, The Simpsons, Hook, Guns N' Roses, Baywatch, Space Jam, Viper Night Drivin', South Park, RollerCoaster Tycoon™, The Simpsons™ Pinball Party ***and*** Ripley's Believe It or Not!®

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

APPENDIX G

Part Number Prefix Classification Codes

I. Electrical Source, Energy & Signal Converters
- 010- Transformers
- 031- Speakers
- 090- Solenoids (Coils)

II. Conductors, Connectors & Insulators
- 034- Line Cords
- 036- Cable and Harness Assemblies
- 041- Motors
- 045- Connectors (All Types)
- 077- Lamp Sockets

III. Circuits & Circuit Elements
- 100- ICs
- 110- Transistors
- 112- Diodes
- 121- Resistors
- 123- Resistors (Variable & Adjustable)
- 124- Regulators & Bridge Rectifiers
- 125- CAPS
- 140- Crystals
- 165- Light Bulbs
- 180- Switches
- 190- Relays

IV. Bolts, Screws, Nuts & Washers
- 231- Bolts
- 232- Screws (Pan Head)
- 234- Screws (HWH)
- 237- Screws (Misc.)
- 240- Nuts (Misc.)
- 242- Washers (Flat, Round)
- 244- Washers (Split Lock)
- 246- Washers (Lockers, External Tooth)

V. Mechanical Components
- 249- Rivets
- 251- Pins (Dowel)
- 254- Stand-Offs, Spacers and Shims
- 260- Steel Ball
- 265- Springs (Extension)
- 266- Springs (Compression)
- 269- Springs (Washers - Belleville, Wave)
- 280- Grommets and Bushing

VI. Handles, Locks, Catches & Latches, Keys & Hinges
- 355- Handles, Locks, Catches & Latches and Keys
- 390- Hinges

VII. Fabricated Parts (In-House Assemblies)
- 500- End Product (Systems and Models)
- 515- Sub-Assemblies
- 520- Printed Circuit Boards (PCBs)
- 522- Display Glass
- 525- Wood Parts
- 530- Screw Machined Parts
- 535- Fabricated Parts
- 545- Molded (Extruded) Plastic/Rubber Parts
- 550- Molded (Inserts)

VIII. Bulk Materials
- 600- Braided Ground Wire
- 601- Stranded Wire
- 602- Ribbon Cable
- 605- Sleeving (Shrink Tubing)
- 626- Foam Rubber

IX. Miscellaneous
- 705- Packing & Shipping Items
- 820- Decals and Labels (Sets & Misc.)
- 830- Butyrate (Plastic Pieces)
- 900- Game Posters
- 960- EPROM (Raw Part)
- 965- EPROM (Programmed Part)

APPENDIX H

Playfield Inserts (Plastic Light Covers)

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

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

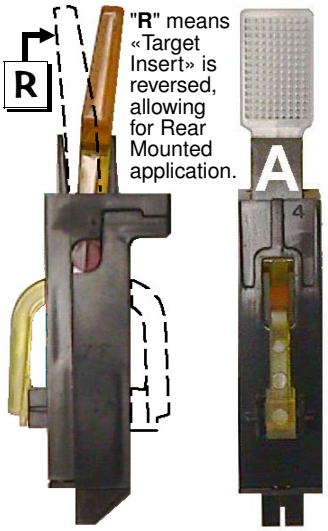
Instructions: Parts which may come in various colors (i.e. targets, some posts, playfield inserts, etc.) end in a 2-digit Nº which correspond to the color of that part. The "**-XX**" in Part Nºs which may come in various colors should be replaced with the desired 2-Digit Nº. corresponding to the color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

PLASTIC PART COLOR CHART

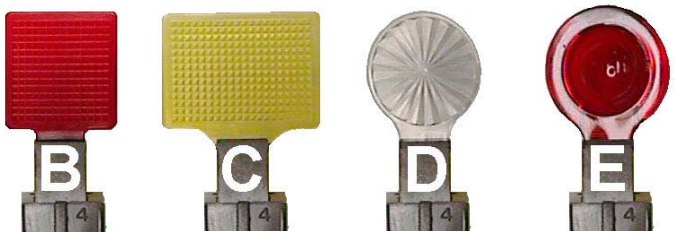
Nº	Color	Nº	Color	Nº	Color	Nº	Color	Nº	Color	Nº	Color
-00	**Black** or Solid Clear	**-03**	Amber	**-06**	Yellow	**-09**	Purple	**-12**	Fluor. Blue	**-15**	Luminescent
-01	Clear	**-04**	Green	**-07**	Orange	**-10**	Fluor. Orange	**-13**	Teal Green	**-16**	Gold
-02	Red	**-05**	Blue	**-08**	White	**-11**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

APPENDIX I

Stand-Up Targets



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



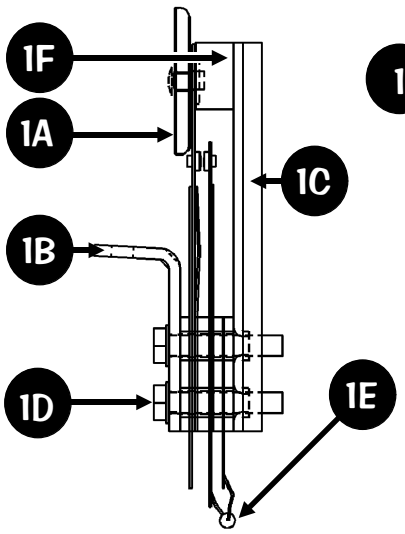
Take Note:

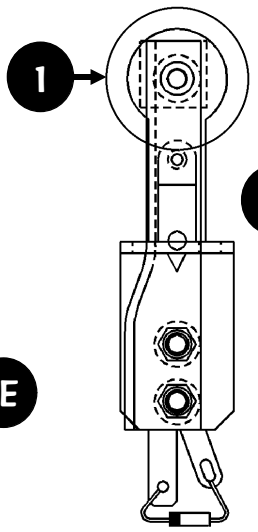
1. For **Items A-E**, for the Target Assembly use the **"500-"** SPI Nº; For the Target Assy. with Rear Mount add **"R"** to **"500-"** SPI Nº; For just the «Target Insert» use the **"545-"** SPI Nº.
2. **Items A-E** come in various colors. *These targets may not be available in every color.* The **"-XX"** in should be replaced with the desired 2-Digit Nº for the color desired described in the Chart ➶. ***As of date of print, the following colors were used for Items A-E:***
   -01 Clear **(A, D); -02** Red **(A, B, C, D, E); -03** Amber **(D, E); -04** Green **(A, B); -05** Blue **(C); -06** Yellow **(A, C), -09** Purple **(B, D); -11** Fluorescent Green **(A, B, D).**
3. *See Section **3**, Chapter **2**, **Go To Diagnostics Menu**, for switches used corresponding to the Switch Matrix Grid of this game.*

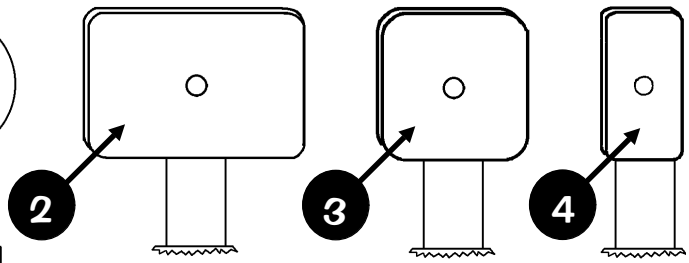
PLASTIC PART COLOR CHART	
Nº	Color
-00	Black
-01	Clear
-02	Red
-03	Amber
-04	Green
-05	Blue
-06	Yellow
-07	Orange
-08	White
-09	Purple
-10	Fluor. Orange
-11	Fluor. Green
-12	Fluor. Blue
-13	Teal Green
-14	Gray
-15	Luminescent
-16	Gold

Nº	STAND-UP TARGET NAME	SPI PART Nº
A	Modular Stand-Up Target Narrow Assy.	500-6138-XX
	Stand-Up Target Narrow (Insert)	545-6138-XX
B	Modular Stand-Up Target Square Assy.	500-6139-XX
	Stand-Up Target Square (Insert)	545-6139-XX
C	Modular Stand-Up Target Rectangle Assy.	500-6228-XX
	Stand-Up Target Rectangle (Insert)	545-6228-XX
D	Modular Stand-Up Target Round Assy.	500-6075-XX
	Stand-Up Target Round (Insert)	545-6075-XX
E	Mod. Stand-Up Target 1" Spherical Assy.	500-6189-XX
	Stand-Up Target 1" Spherical (Insert)	545-6189-XX

***Note:** To receive the Target Assembly with the « Target Insert » « **R**eversed » simply add a **"R"** at the end of the Part Nº. See Side View picture above to compare (dashed line shows target reversed).*







Take Note:

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

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

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

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

Item 2 Table Note continued in the next column.

‡ ***Note:*** Item **2A**, is a riveted Sub-Assy. which includes the following items for reference: **A1**— Stack Switch Radius End (180-5133-00), **A2**— Washer 5/16" (242-5017-00), **A3**— Rivet 1/8" ø X 3/16" (249-5001-00) **and A4**— Rectangular Target (545-5145-XX).

3	1" Sq. Stand-Up Target Assy.	500-5232-**XX**
ORDERING ABOVE (ITEM 3) ASSY. PART Nº WILL INCLUDE:		
3A‡	Sw. & Target Assy. 1" Square	515-5162-**XX**
	Items 3B-F are identical to 1B-F	Same as 1B-F

‡ ***Note:*** Item **3A**, is a riveted Sub-Assy. which includes the following items for reference: **A1**— Stack Switch Radius End (180-5133-00), **A2**— Washer 5/16" (242-5017-00), **A3**— Rivet 1/8" ø X 3/16" (249-5001-00) **and A4**— 1" Square Target (545-5470-XX).

4	Narrow Stand-Up Target Assy.	500-5857-**XX**
ORDERING ABOVE (ITEM 4) ASSY. PART Nº WILL INCLUDE:		
4A‡	Sw. & Target Assy. Narrow	515-5967-**XX**
	Items 4B-F are identical to 1B-F	Same as 1B-F

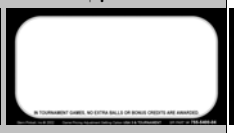
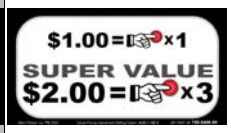
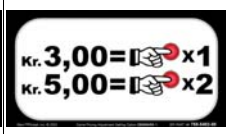
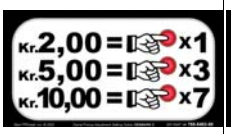
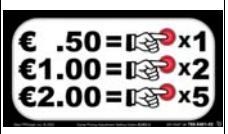
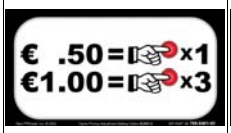
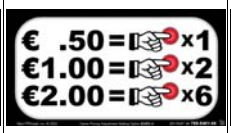
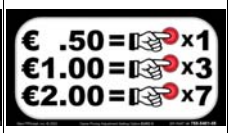
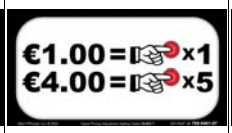
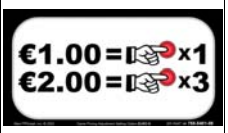
‡ ***Note:*** Item **4A**, is a riveted Sub-Assy. which includes the following items for reference: **A1**— Stack Switch Square End (180-5132-00), **A2**— Washer 5/16" (242-5017-00), **A3**— Rivet 1/8" ø X 3/16" (249-5001-00) **and A4**— Narrow Target (545-5210-XX).

to open Coin Card Files, insert Disc 2

APPENDIX J

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

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

USA 8 *or* CANADA	USA 5	USA 1* *(optional)*	USA *or* CANADA Custom *†	USA 2-7 *or* CANADA	USA *or* CANADA Custom †
Front 755-5400-00	Back 755-5400-00	Front 755-5400-01 *	Back 755-5400-01 *†	Front 755-5400-02	Back 755-5400-02 †
ToPS™USA *or* CANADA *‡	ToPS™ USA *‡	ToPS™USA, CANADA, AUSTRALIA *or* NEW ZEALAND Custom *†‡		AUSTRALIA 1 *or* NEW ZEALAND 2	AUSTRALIA 2 *or* NEW ZEALAND 1
					
Front 755-5400-03 *‡	Back 755-5400-03 *‡	Front 755-5400-04 *‡	Back 755-5400-04 *†‡	Front 755-5406-00	Back 755-5406-00
CROATIA	CROATIA Custom †	DENMARK 1	DENMARK 2	EURO 1	EURO 2
					
Front 755-5410-00	Back 755-5410-00	Front 755-5402-00	Back 755-5402-00	1-Sided 755-5401-01	1-Sided 755-5401-02
EURO 3	EURO 4	EURO 5	EURO 6	EURO 7	EURO 8
					
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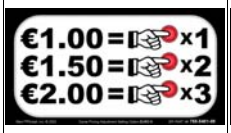
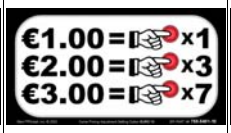
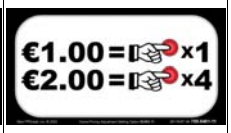
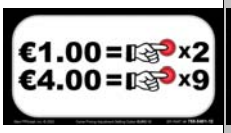
EURO 9	EURO 10	EURO 11	EURO 12	ToPS™EURO Custom *‡	ToPS™EURO Custom *†‡
					
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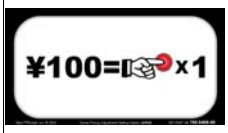
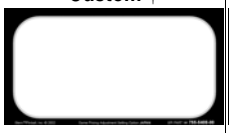
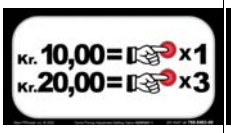
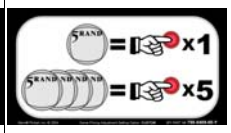
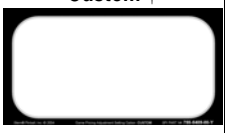
JAPAN	JAPAN Custom †	NORWAY 1	NORWAY 2	Republic of S. AFRICA	Republic of S. AFRICA Custom †
					
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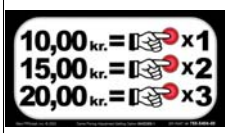
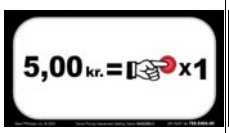
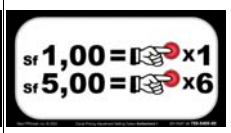
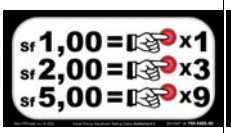
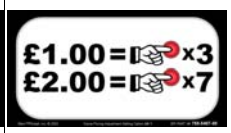
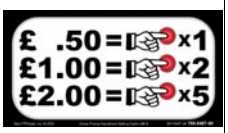
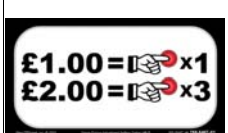
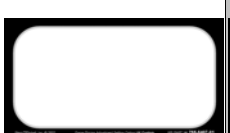
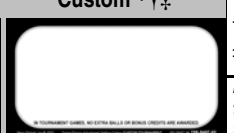
SWEDEN 1	SWEDEN 2	SWITZERLAND 1	SWITZERLAND 2	UK 1	UK 3
					
Front 755-5404-00	Back 755-5404-00	Front 755-5405-00	Back 755-5405-00	Front 755-5407-00	Back 755-5407-00
UK 5	UK Custom †	ToPS™UK Custom *‡	ToPS™UK Custom *†‡		
					
Front 755-5407-01	Back 755-5407-01 †	Front 755-5407-02 *‡	Back 755-5407-02 *†‡		

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

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

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

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

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

Parts Order Checklist Notes

Date Ordered	Part Nº	Qty.	Description	Date Received

GLOSSARY OF TERMS

A Followed after a number means "Amp." or Ampage in an expression relating to an electrical object. (e.g. 8**A**).

AC (Acronym) **A**lternating **C**urrent.

Adj. (Abbreviation) Adjustment(s).

Assy. (Abbreviation) Assembly.

Au. (Abbreviation) Audit(s).

Bd. (Abbreviation) Board.

BOT (Abbreviation) Bottom.

Brkt. (Abbreviation) Bracket.

Bridge Rectifier A configuration of a diode that allows current to flow in one direction producing both positive and negative pulsating DC Voltages.

Color Coding See Appendix H or I, Plastic Part Color Chart or Section 4, Chapter 1, Playfield - Plastic Posts & Spacers.

Combination (Combo) [Shot] Any variable pinball shot(s) made successively.

Conn. (Abbreviation) Connector.

CMOS Short for COSMOS (Complementary Symmetry M.O.S.); Complementary Metal-Oxide Semi-Conductor.

CN (Abbreviation) Connector (e.g. **CN**5-P3).

CT (Abbreviation) Center.

DC (Abbreviation) Direct Current.

DT (Abbreviation) Drop Target(s).

DOTS (Acronym) **D**iode **O**n **T**erminal **S**trip.

EB (Abbreviation) Extra Ball.

Eject Playfield surface device to kick ball back into play; Saucer.

EPROM (Acronym) **E**rasable **P**rogrammable **R**ead **O**nly **M**emory. Can be erased using UV Light and re-programmed.

e.g. (Abbreviation) Latin- Exempli gratia. For Example.

EOS (Acronym) **E**nd-**O**f-**S**troke (i.e. Switch for flipper).

F (Abbreviation) Fuse (i.e. F23).

GA-Turn Gauge & Turn describing the windings on a coil (e.g. 23-800, 23 is the gauge of wire and 800 is the amount of windings.

G.I. (Abbreviation) General Illumination (Lamps).

HWH (Abbreviation) Hex Washer Head.

IC (Acronym) **I**ntegrated **C**ircuit (As in after 24-Pin IC).

ID or I.D. (Acronym) **I**nside **D**imension.

i.e. (Abbreviation) Latin- Id est. That is.

IO or I/O (Abbreviation) Input / Output (e.g. I/O Power Driver Bd.)

LT, Lt. or L. (Abbreviation) Left.

Laser Kick A coil/plunger used above the playfield to kick pinball back into play.

LED (Acronym) **L**ight **E**mitting **D**iode.

Loop [Shot] Continuously up a ramp and back to the flipper.

Lwr. (Abbreviation) Lower.

Orbit [Shot] From the left or right flipper around the back rail of the playfield back to the flipper.

MB (Abbreviation) Magnet Board.

M-BALL or MBALL (Abbreviation) Multiball™ More than 1 ball in game play.

MID (Abbreviation) Middle

Non-Reflexive See Reflexive.

No. or Nº or # (Abbreviation) Number

NPF (Acronym) **N**o **P**roblem **F**ound.

N.C. or NC (Abbreviation) Normally Closed.

N.O. or NO (Abbreviation) Normally Open.

NS (Abbreviation) Not Stuffed. (Use in Part Listings, Sec. 5)

OD or O.D. (Abbreviation) Outside Dimension.

P (Abbreviation) Pin (e.g. CN5-**P**3).

PCB (Acronym) **P**rinted **C**ircuit **B**oard

P/F (Abbreviation) Playfield.

PIA LED (Acronym) **P**eripheral **I**nterface **A**dapter **L**ight **E**mitting **D**iode.. This is a diagnostic LED on the CPU; it should not be lit during normal operation of a pinball game.

Plumb Bob Tilt Weight on Tilt Assembly.

PPH (Abbreviation) Phillips Pan Head.

Pop(s) Another term for Turbo Bumper(s).

PPB (Acronym) Playfield Power Board ("Popcorn-Popping Bd.").

PREV (Abbreviation) Previous.

PSB (Abbreviation) Power Supply Board

RAM (Acronym) **R**andom **A**ccess **M**emory. RAM **can** store input instructions and supply output information.

Reflexive/Non-Reflexive Reflexive—Solenoid Drive Transistor is enabled directly by a switch closure on the (Relating to CPU Boards) solenoid assembly (Ver. 1/2).
Non-Reflexive—Solenoid Drive Transistor is enabled by the CPU after reading a switch closure in the Switch Matrix (Ver. 3). Also note: All CPU Boards are backwards compatible (e.g. Jurassic Park/Ver. 3 to Time Machine/ Ver. 2). Swapping a Ver. 2 Board to a Ver. 3 is not possible due to the special solenoids section (i.e. Slingshots, Turbo Bumpers, etc.) changing from ***REFLEXIVE*** to ***NON-REFLEXIVE*** on Ver. 3 Boards.

Relay An automatic switch operated by current in a coil.

ROM (Acronym) **R**ead **O**nly **M**emory. ROM **canno**t store input instructions but can supply output information. ROM can be programmed only once.

RMA (Abbreviation) Return Merchandise Authorization Number

RT, Rt. or R. (Abbreviation) Right; ("**R**" at the end of Target Assy. Part Nº signifies Target Insert is **R**eversed.)

RO (Abbreviation) Rollover (switches).

Saucer See Eject.

Scoop A hole into the playfield. A metal scoop is in place to guide the ball into the kick-back under the playfield.

Slam Tilt A switch which closes when the game is slammed into or the Coin Door is slammed shut. Depending on adjustable settings, will cancel game in play when the number of closures required is achieved.

SMB (Abbreviation) Shaker Motor Board.

Solenoid A coil used for Electro Magnetic devices such as relays, flippers, slingshots, etc.

SSFB (Abbreviation) Solid State Flipper Board.

STEP Refers to the service switches on the coin door.

Sub-Assy. (Abbreviation) Sub-Assembly.

S-U or S/U (Abbreviation) Stand-Up (targets).

TM (Abbreviation) Trademark

Transfer [Shot] Maneuvering the ball in play from one flipper to the other. With flipper in the up position and the ball cradled by that flipper one would activate the flipper button in a quick repetitive manner to bounce the ball to the other side. Skilled players can rebound the ball off the slingshot.

Tri-Ball Three balls in play.

TTL (Abbreviation) Transistor-Transistor Logic

Upr. (Abbreviation) Upper.

V or v (Abbreviation) Volt(s).

Ver. (Abbreviation) Version.

VUK (Acronym) **V**ertical **U**p-**K**icker (Super or Standard).

X (Abbreviation) "Times" A multiplier; also used in dimensions.

X-Ball An undetermined number of ball(s) during game play.

Zener Diode A semi-conductor diode used for voltage regulation. Application depends on reverse break-down voltage.

"-00B" "B" at the end of Coil Part Numbers signifies that the diode is attached to the bottom of the lug.

"-00T" "T" at the end of Coil Part Numbers signifies that the diode is attached to the top of the lug (the side nearest the coil-winding).

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DOT MATRIX DISPLAY BOARDS:	9 MONTHS

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

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Designed by: Pat Lawlor Design, Inc.
Design: Pat Lawlor Software: Louis Koziarz
Art: John Youssi Sounds & Music: Chris Granner
Mechanix: John Krutsch Dots: Adam Rhine
Dot Programming: Gred Dunlap

In SWITCH MENU also select:

ACTIVE and DEDICATED SWITCH TESTS

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 Below P/F HEAD STAND-UP 515-5162-08	17 Below P/F TOMBSTONE 1 515-5162-08	25 Below P/F LOWER LEFT POP 180-5015-03	33 Below P/F BONUS X INLANE - LFT 500-6227-02	41 Below P/F VARI-TARGET OPTO 1 *See Sw. 41 Note*	49 Below P/F UPPER LEFT POP 180-5015-03	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 NOT USED	18 ~ P/F SUPER JACKPOT OPTO *See Sw. 18 Note*	26 Below P/F LOWER RIGHT POP 180-5015-03	34 Below P/F BONUS X INLANE - MID 500-6227-02	42 Below P/F VARI-TARGET OPTO 2 *See Sw. 42 Note*	50 Below P/F UPPER RIGHT POP 180-5015-03	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 Below P/F TOMBSTONE 5 515-5162-08	27 Below P/F LOWER BOTTOM POP 180-5015-03	35 Below P/F BONUS X INLANE - RT 500-6227-02	43 Below P/F VARI-TARGET OPTO 3 *See Sw. 43 Note*	51 Below P/F UPPER BOTTOM POP 180-5015-03	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 Below P/F LEFT SPINNER 180-5010-04	28 Below P/F SIDE SCOOP ENTRY DOTS 180-5183-00	36 Below P/F RIGHT ORBIT 500-6227-02	44 Below P/F LOCK 1 - TOP 180-5180-00	52 Below P/F VARI-TARGET VUK 180-5116-01	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 Below P/F RIGHT SPINNER 180-5010-04	29 Below P/F SCOOP VUK DOTS 180-5183-00	37 NOT USED	45 Below P/F LOCK 1 - MIDDLE 180-5179-00	53 Above P/F RIGHT RAMP 180-5190-28	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 Below P/F TOMBSTONE 4 515-5967-06	30 Below P/F BEHIND HEAD 500-6227-02	38 Above P/F MINI PLAYFIELD LEFT 180-5183-00	46 Below P/F LOCK 1 - BOTTOM 180-5178-00	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 Below P/F SHRUNKEN HEAD OPTO See Sw. 23 Note	31 Above P/F LEFT RAMP MAKE 180-5190-28	39 Above P/F MINI PLAYFIELD CENTER 180-5183-00	47 Below P/F LEFT JACKPOT LOOP 500-6227-02	55 In Cabinet TOURNAMENT START 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 Below P/F IDOL EYE OPTO *See Sw. 23 Note*	32 Below P/F TOMBSTONE 2+3 515-5162-08	40 Above P/F MINI PLAYFIELD RIGHT 180-5183-00	48 Below P/F LEFT ORBIT 500-6227-02	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 Sw. Part Number:	DS-1 on Cabinet Side #1 LEFT FLIPPER BUTTON 180-5160-00
2: U206 GRY-Grn. CN6-P3 Sw. Part Number:	DS-2 Below Playfield #2 LEFT FLIPPER E.O.S (End-of-Stroke) 180-5149-00 *on Flipper*
3: U206 GRY-ORG CN6-P4 Sw. Part Number:	DS-3 on Cabinet Side #3 RIGHT FLIPPER BUTTON 180-5164-00 *Doubled*
4: U206 GRY-YEL CN6-P6 Sw. Part Number:	DS-4 Below Playfield #4 RIGHT FLIPPER E.O.S. (End-of-Stroke) 180-5149-00 *on Flipper*
5: U206 GRY-GRN CN6-P7 Sw. Part Number:	DS-5 on Cabinet Side #5 UPPER RT. FLIPPER BUTTON 180-5164-00 *Doubled*
6: U206 GRY-BLU CN6-P8 Sw. Part Number:	DS-6 on Coin Door #6 VOLUME (Grn. BUTTON) (In Test: LEFT) 180-5192-02
7: U206 GRY-VIO CN6-P9 Sw. Part Number:	DS-7 on Coin Door #7 SERV. CGrn.. (GREEN BUTTON) (In Test: RIGHT) 180-5192-04
8: U206 GRY-BLK CN6-P10 Sw. Part Number:	DS-8 on Coin Door #8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) 180-5192-00

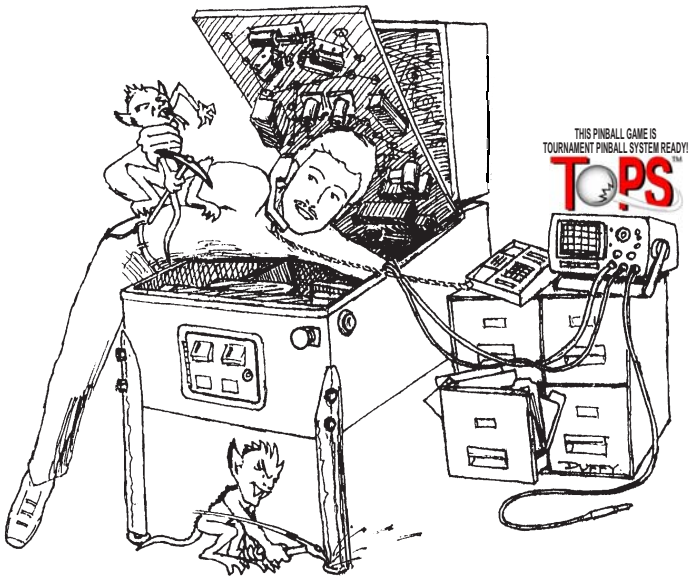
In LAMP MENU also select:

TEST ALL LAMPS, ROW & COLUMN LAMP TESTS

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 Bulb SUPER JACKPOT 2 MIL	2 #555 Bulb SUPER JACKPOT 3 MIL	3 #555 Bulb SUPER JACKPOT 1 MIL	4 #555 Bulb SUPER JACKPOT 4 MIL	5 #555 Bulb SHOOT AGAIN	6 #555 Bulb SUPER JACKPOT 5 MIL	7 #555 Bulb SUPER JACKPOT 6 MIL	8 #555 Bulb RIGHT SPECIAL
2: Q34 RED-BLK J12-P2	9 #555 Bulb LEFT SPECIAL	10 #555 Bulb 1 IDOL COUNTER	11 #44 Bulb 2 IDOL COUNTER	12 #555 Bulb 3 IDOL COUNTER	13 #555 Bulb 4 IDOL COUNTER	14 #555 Bulb 5 IDOL COUNTER	15 #555 Bulb TOMBSTONE 1	16 #44 Bulb SCOOP ARROW
3: Q35 RED-ORG J12-P3	17 #555 Bulb (R) IPLEYS	18 #555 Bulb R (I) PLEYS	19 #555 Bulb RI (P) LEYS	20 #555 Bulb RIP (L) EYS	21 #555 Bulb RIPL (E) YS	22 #555 Bulb RIPLE (Y) S	23 #555 Bulb RIPLEY (S)	24 #555 Bulb GRID A1 (UPPER LEFT)
4: Q36 RED-YEL J12-P4	25 #555 Bulb GRID B1	26 #555 Bulb GRID C1	27 #555 Bulb GRID A2	28 #555 Bulb GRID B2	29 #555 Bulb GRID C2	30 #555 Bulb GRID A3	31 #555 Bulb GRID B3	32 #555 Bulb GRID C3
5: Q37 RED-GRN J12-P5	33 #555 Bulb LOWER LEFT POP DOTS	34 #555 Bulb LOWER RIGHT POP DOTS	35 #555 Bulb LOWER BOT POP DOTS	36 #555 Bulb SKILL SHOT	37 #555 Bulb TOMBSTONE 2	38 #555 Bulb TOMBSTONE 3	39 #555 Bulb MILLION PLUS	40 #555 Bulb LOOP JACKPOT
6: Q38 RED-BLU J12-P6	41 #555 Bulb VARI-TARGET SPECIAL	42 #555 Bulb VARI-TARGET EB	43 #555 Bulb VARI-TARGET ? (MYSTERY)	44 #555 Bulb VARI-TARGET S.A.	45 #555 Bulb VARI-TARGET N.A.	46 #555 Bulb VARI-TARGET EUROPE	47 #555 Bulb VARI-TARGET AUSTR.	48 #555 Bulb VARI-TARGET ASIA
7: Q39 RED-VIO J12-P8	49 #555 Bulb TOMBSTONE 5	50 #44 Bulb PENGUIN	51 #44 Bulb ADVANCE TOMBSTONE	52 #44 Bulb RIGHT SPINNER	53 #555 Bulb RIGHT JACKPOT	54 #555 Bulb LOCK	55 #555 Bulb RIPOFF	56 #555 Bulb VARI-TARGET ANTAR.
8: Q40 RED-GRY J12-P9	57 #555 Bulb CENTER JACKPOT	58 #555 Bulb LITE HEAD	59 #555 Bulb GATE OPEN	60 #555 Bulb UPPER LEFT POP DOTS	61 #555 Bulb UPPER RIGHT POP DOTS	62 #555 Bulb UPPER BOT POP DOTS	63 #44 Bulb TOMBSTONE 4	64 #555 Bulb VARI-TARGET AFRICA
9: Q41 RED-WHT J12-P10	65 #44 Bulb LEFT SPINNER	66 #555 Bulb MULTIBALL	67 #555 Bulb LIGHT LOCKS	68 #555 Bulb COLLECT BIG-FOOT BONUS	69 #555 Bulb SUPER JACKPOT	70 #555 Bulb ODDITORIUM	71 #555 Bulb THE HEAD KNOWS	72 #555 Bulb BOZO
10: Q42 RED J12-P11	73 #555 Bulb BONUS X INLANE LEFT	74 #555 Bulb BONUS X INLANE CTR	75 #555 Bulb BONUS X INLANE RT	76 #44 Bulb BACK PANEL A	77 #44 Bulb BACK PANEL B	78 #44 Bulb BACK PANEL C	79 #555 Bulb TOURNAMENT BUTTON	80 #555 Bulb START BUTTON

▼ U.S. ▼
Customary
Inch Ruler



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