

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

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

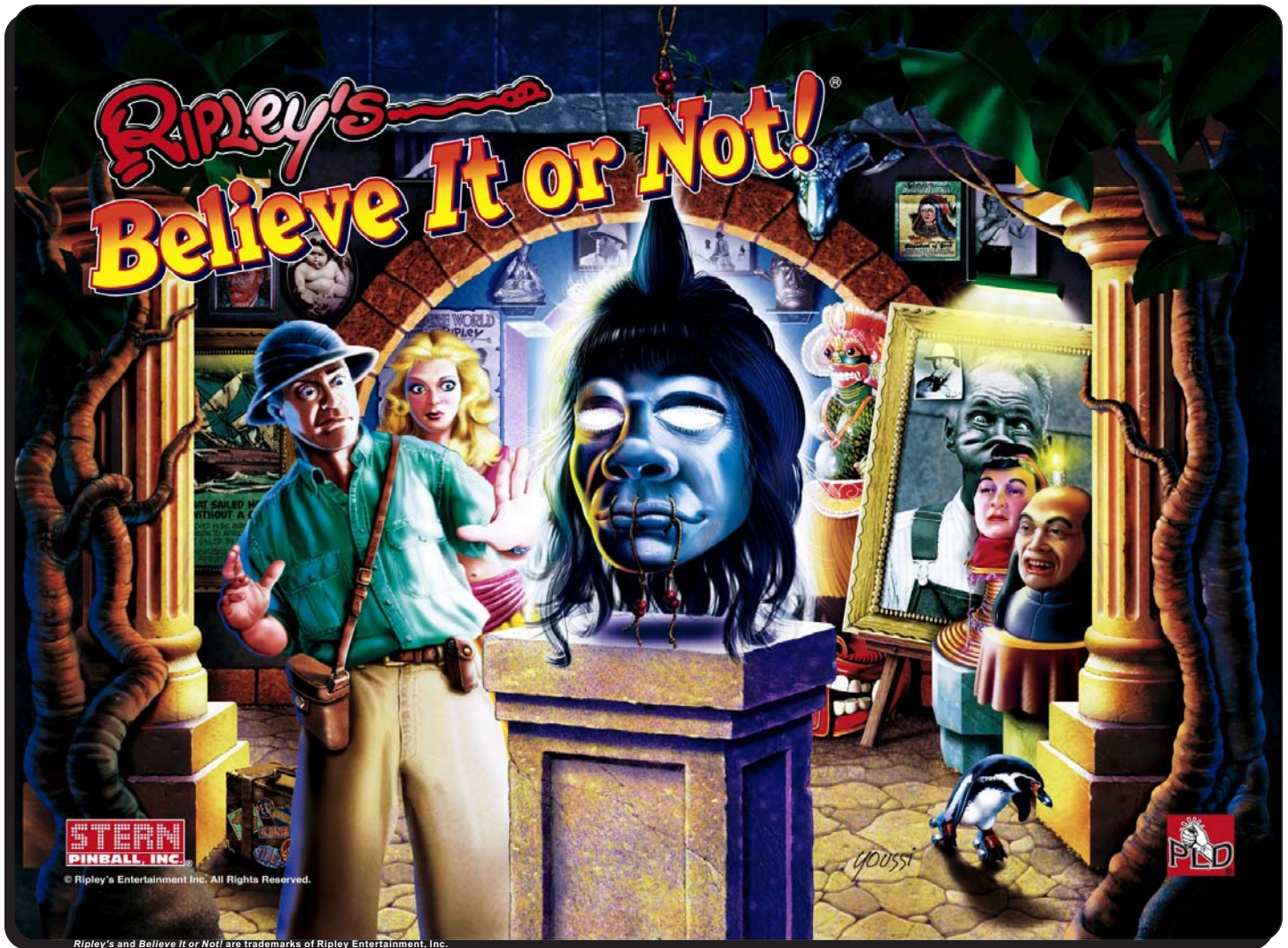
Find the answers to your questions here...
If you still need help, give us a call!



THIS PINBALL GAME IS
TOPS
TOURNAMENT PINBALL
SYSTEM READY!

Order the optional TOPS™
Kit, SP. PIN:
502-5011-00

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



STERN
PINBALL, INC.

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SPI Part Number
780-5081-00

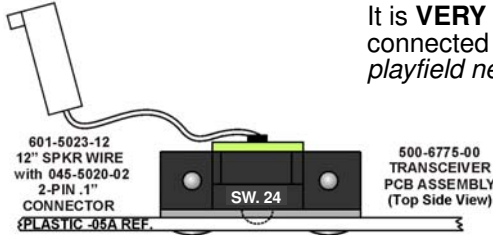
For Proper Operation of this Pinball Game, four (4) Pinballs must be installed!



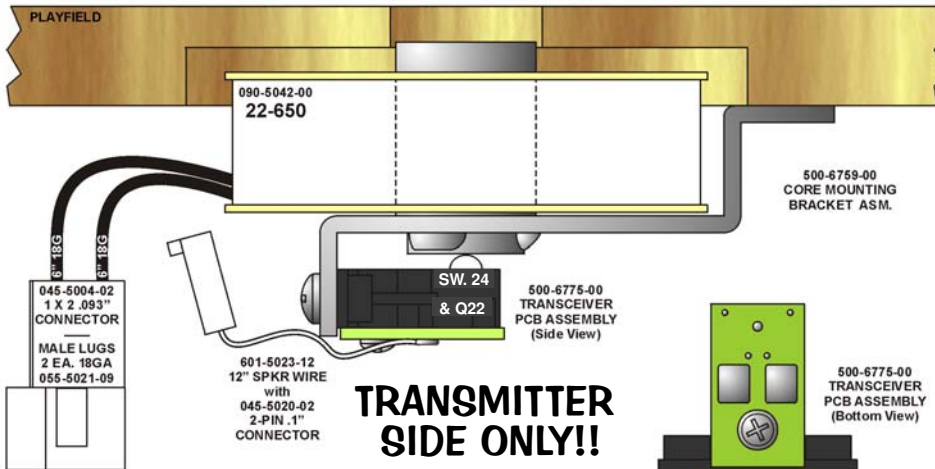
Lower Magnet OPTO (Transceiver) Board Proper Connection IMPORTANT!

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 application.**

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** !



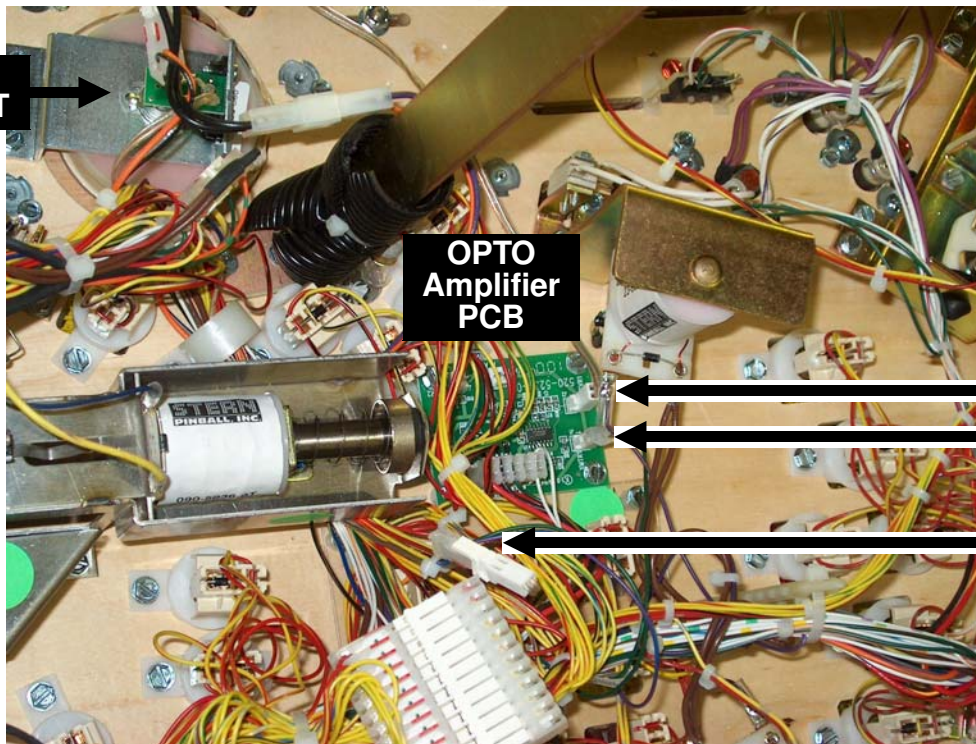
RECEIVER SIDE



TRANSMITTER SIDE ONLY!!

The **OPTO Board** below the Playfield is the **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 !!

LOWER MAGNET



OPTO Amplifier PCB

RECEIVER SIDE

J2

J1

TRANSMITTER SIDE (Green Wire)

2-Pin Z-Header GRN / VIO-BLU

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 3/4A 250v S.B. 90v DC High Voltage Display

LOC: I / O POWER DRIVER BOARD

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

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

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

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

F20 **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

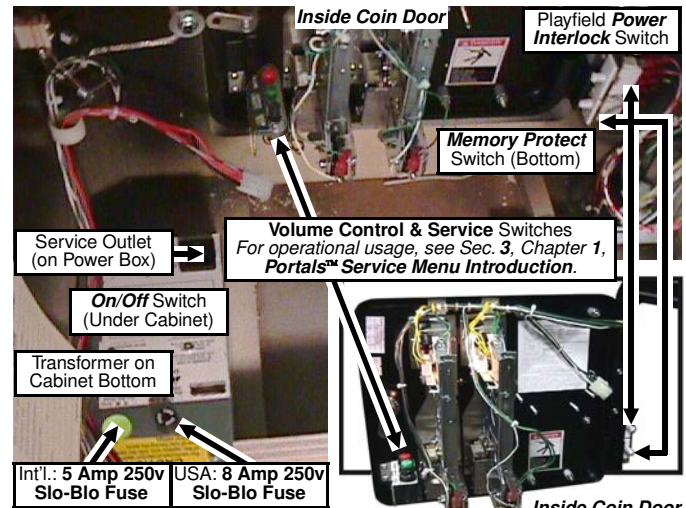
LOC: UNDER PLAYFIELD (near Flippers)

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

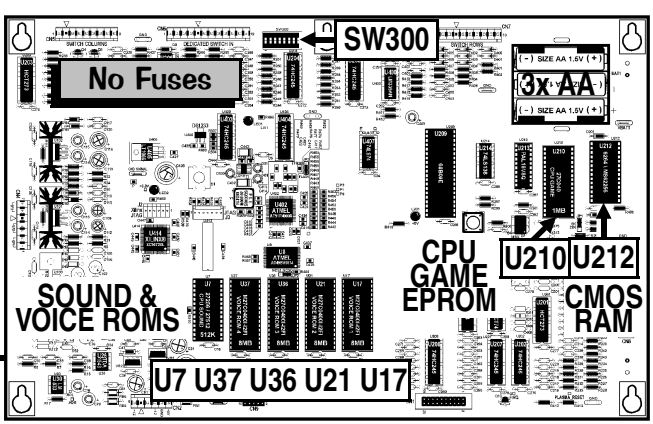
n/a 3A 250v S.B. 50v DC Left Flipper (GRY-YEL↔RED-YEL)

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

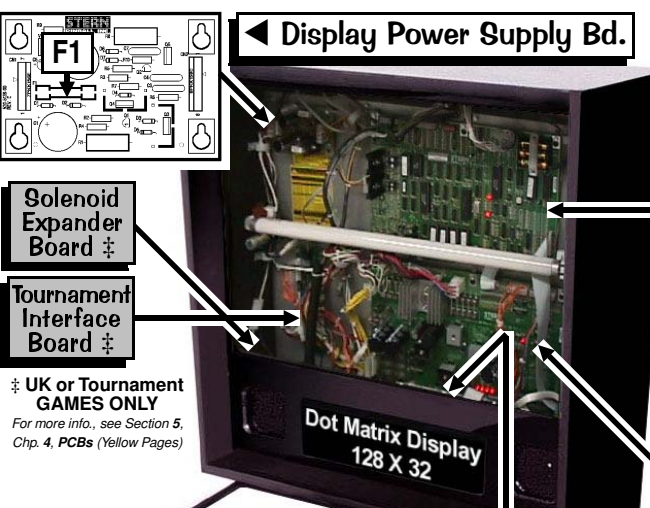
For locations & more information on fuses, see Sec. 5, Chapter 2.



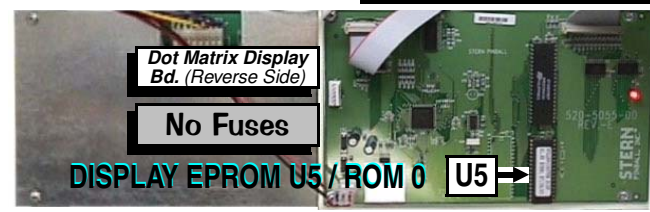
ROM TYPE on BD	LOCATION	SIZE	PART NUMBER
CPU Sound	U7	512K	965-0408-81
CPU Game	U210	1 MB	965-0409-81
CPU Voice ROM 1	U17	8 MB	965-0410-81
CPU Voice ROM 2	U21	8 MB	965-0411-81
CPU Voice ROM 3	U36	8 MB	965-0412-81
CPU Voice ROM 4	U37	8 MB	965-0413-81
DISPLAY Controller	U5	4 MB	965-0414-81



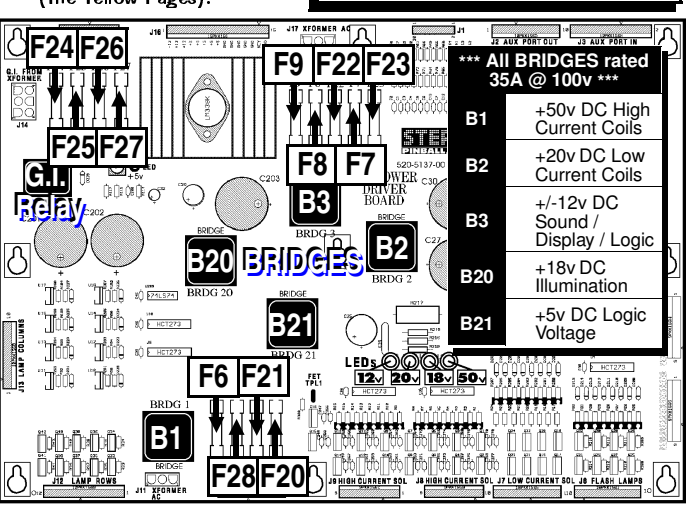
For Schematics and/or Component Parts on PC Boards shown on this page, review Section 5, Chapter 4, Printed Circuit Boards (The Yellow Pages).



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



I/O Power Driver Board



Find-It-In-Front:
Dr. Pinball



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

The key technical data from various parts of the manual were extracted and combined into the "Find- It-In-Front: Dr. Pinball Section." This section (pages DR. ① - ⑩) will assist the technician in locating important technical information needed to troubleshoot the Pinball Machine. **Dr. Pinball** is also available in a Flow Chart Help Format in the Game Display. To access, enter the **Portals™ Service Menu**.

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

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

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

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



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

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



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



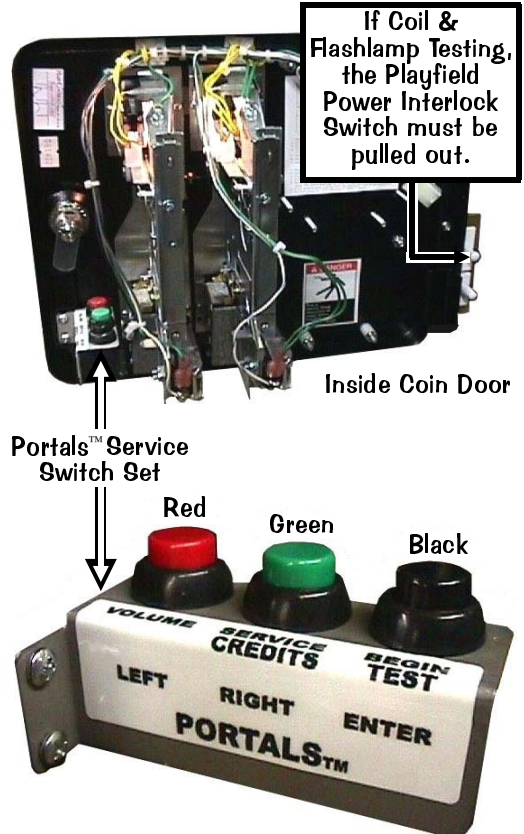
After entering **Portals™**, the **MAIN MENU** now appears with the "DIAG" *Icon* (GO TO DIAGNOSTICS MENU) flashing; press the **Black "ENTER" Button** to activate this **ICON**. The **DIAGNOSTICS MENU** now appears with the "SW" *Icon* (GO TO SWITCH MENU) flashing; use the **Red "LEFT"** or **Green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



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



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



DIAGNOSTIC AIDS

OPEN THE DOOR

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

OPERATOR ALERT! #2 AUTO LAUNCH COIL MALFUNCTION

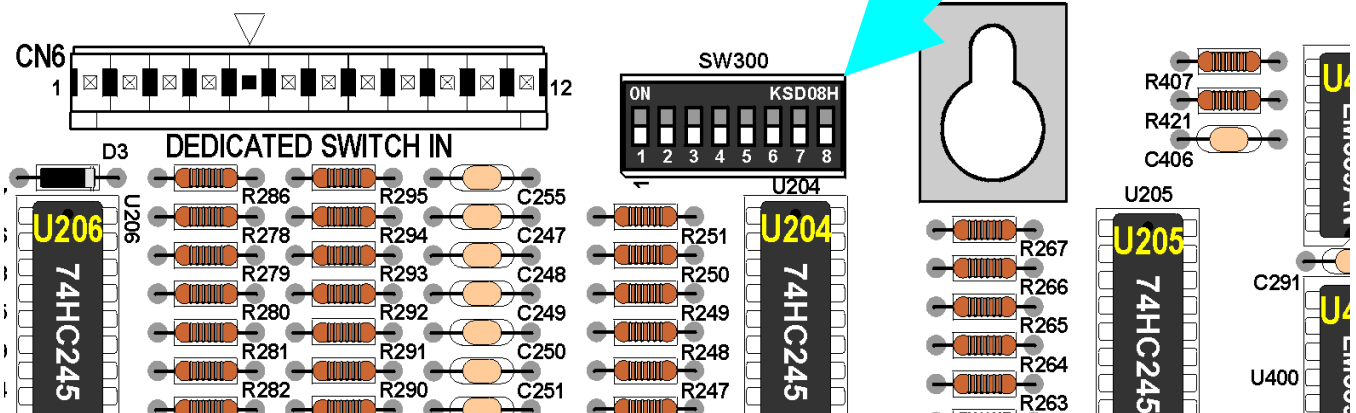
This **display** is shown momentarily during **Game Mode** or **Power-Up** to alert the operator of a coil malfunction (*coil doesn't energize or coil fires a multiple number of times*). **OPERATOR ALERT!** works by monitoring any **switch activated coil** that has the potential to trap a ball when disabled (*e.g. in the Auto Launch, Scoop, Eject, etc.*). This alert can also appear if a switch associated with a coil (*e.g. #16 Shooter Lane & #2 Auto Launch*) is stuck closed (*caused by a switch jam or stuck ball*); the **CPU/Sound Board** will activate the coil approximately ten times and if the switch remains closed, the game will report this switch in **Technician Alerts** & will indicate the *following display warning*:

PLEASE CHECK TECH REPORT PORTALS->DIAG->TECH

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

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	▼	▼	▼	▼	▼	▼	▼	▼

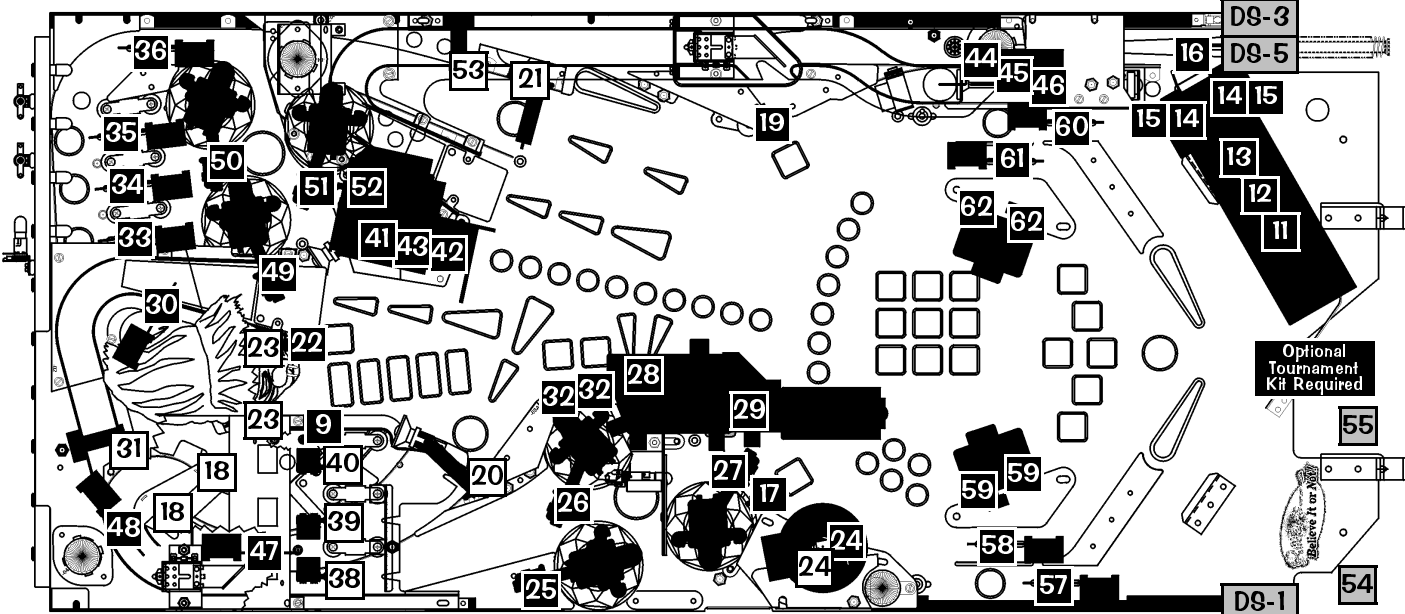


In SWITCH MENU also select:

ACTIVE and DEDICATED SWITCH TESTS

SWITCH MATRIX GRID, DEDICATED SWITCHES & LOCATIONS

Column (Drive)	1: Q1	2: Q2	3: Q3	4: Q4	5: Q5	6: Q6	7: Q7	8: Q8	GROUND	GROUND
Row (Return)	GRN-BRN CN5-P1	GRN-RED CN5-P3	GRN-ORG CN5-P4	GRN-YEL CN5-P5	GRN-BLK CN5-P6	GRN-BLU CN5-P7	GRN-VIO CN5-P8	GRN-GRY CN5-P9	IC U206 INPUT 8	BLK CN6-P1, -P11
1: U400	1 Cabinet Side WHT-BRN CN7-P9 LT BUTTON (UK ONLY) Sw. Part Number: 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	1: U206 GRY-BRN CN6-P2 Sw. Part Number: 180-5160-00	DS-1 on Cabinet Side #1 LEFT FLIPPER BUTTON
2: U400	2 Coin Door WHT-RED CN7-P8 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	2: U206 GRY-RED CN6-P3 Sw. Part Number: 180-5149-00 on Flipper	DS-2 Below Playfield #2 LEFT FLIPPER E.O.S (End-of-Stroke)
3: U400	3 Coin Door WHT-ORG CN7-P7 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)	3: U206 GRY-ORG CN6-P4 Sw. Part Number: 180-5149-00 on Flipper	DS-3 on Cabinet Side #3 RIGHT FLIPPER BUTTON
4: U400	4 Coin Door WHT-YEL CN7-P6 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 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	4: U206 GRY-YEL CN6-P6 Sw. Part Number: 180-5149-00 on Flipper	DS-4 Below Playfield #4 RIGHT FLIPPER E.O.S (End-of-Stroke)
5: U401	5 Coin Door WHT-GRN CN7-P5 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 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	5: U206 GRY-GRN CN6-P7 Sw. Part Number: Same as DS-3 above.	DS-5 on Cabinet Side #5 UPPER RT. FLIPPER BUTTON
6: U401	6 Coin Door WHT-BLU CN7-P3 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)	6: U206 GRY-BLU CN6-P8 Sw. Part Number: 180-5192-02	DS-6 on Coin Door #6 VOLUME (RED BUTTON) (In Test: LEFT)
7: U401	7 Coin Door WHT-VIO CN7-P2 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	7: U206 GRY-VIO CN6-P9 Sw. Part Number: 180-5192-02	DS-7 on Coin Door #7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT)
8: U401	8 Cabinet Side WHT-GRY CN7-P1 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	8: U206 GRY-BLK CN6-P10 Sw. Part Number: 180-5192-00	DS-8 on Coin Door #8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER)



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: □ Diode Q n T Terminal S Trip, see Sec. 5, Chp.2, Playfield Wiring.

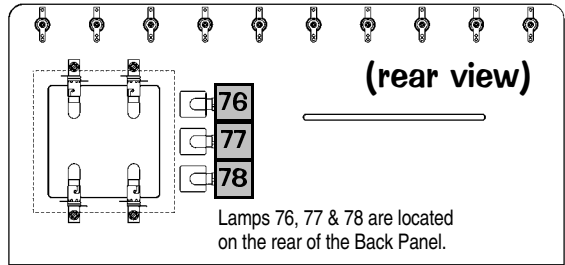
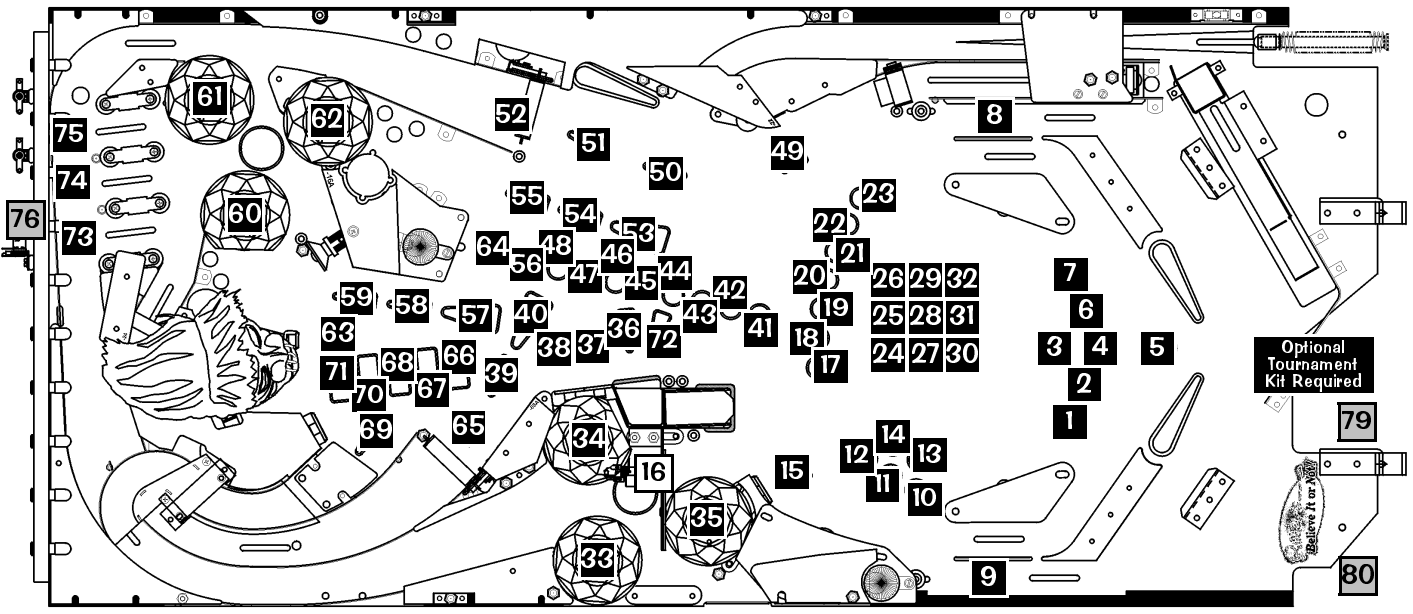




In LAMP MENU also select:
TEST ALL LAMPS, ROW & COLUMN LAMP TESTS

LAMP MATRIX GRID & LOCATIONS

Column (18v)	1: U17	2: U16	3: U15	4: U14	5: U13	6: U12	7: U11	8: U10
Row (Ground)	YEL-BRN J13-P9	YEL-RED J13-P8	YEL-ORG J13-P7	YEL-BLK J13-P6	YEL-GRN J13-P5	YEL-BLU J13-P4	YEL-VIO J13-P3	YEL-GRY J13-P1
1: Q33	1 #555 Bulb RED-BRN J12-P1 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	9 #555 Bulb RED-BLK J12-P2 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	17 #555 Bulb RED-ORG J12-P3 (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	25 #555 Bulb RED-YEL J12-P4 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	33 #555 Bulb RED-GRN J12-P5 LOWER LEFT POP	34 #555 Bulb LOWER RIGHT POP	35 #555 Bulb LOWER BOT POP	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	41 #555 Bulb RED-BLU J12-P6 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	49 #555 Bulb RED-VIO J12-P8 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	57 #555 Bulb RED-GRY J12-P9 CENTER JACKPOT	58 #555 Bulb LITE HEAD	59 #555 Bulb GATE OPEN	60 #555 Bulb UPPER LEFT POP	61 #555 Bulb UPPER RIGHT POP	62 #555 Bulb UPPER BOT POP	63 #44 Bulb TOMBSTONE 4	64 #555 Bulb VARI-TARGET AFRICA
9: Q41	65 #44 Bulb RED-WHT J12-P10 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	73 #555 Bulb RED J12-P11 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



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: □ diode □ n Terminal □ Strip, 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 Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#1	TROUGH 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 Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#9	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	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 Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#17	LEFT SLINGSHOT	Q17	▲ I/O Power Driver ▼	BRN	J7-P1	20v DC	VIO-BRN	J7-P2	23-800 ♂ 090-5001-00T
#18	RIGHT SLINGSHOT	Q18		BRN	J7-P1	20v DC	VIO-RED	J7-P3	23-800 ♂ 090-5001-00T
#19	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 Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#25	FLASH: 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

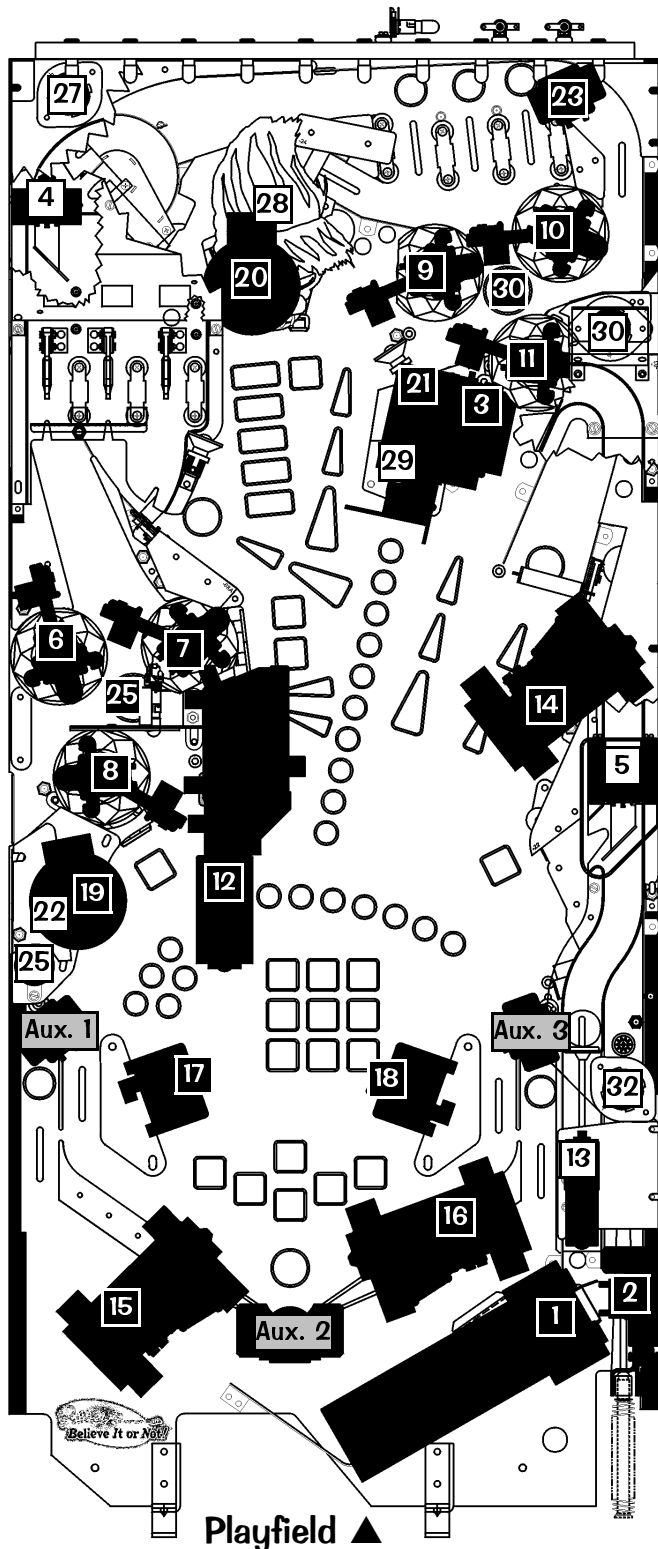
Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: Q25-Q32)

Auxiliary (UK ONLY)		Drive Transistor	Driver Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn
AUX 1: LEFT UP/DOWN POST		Q1	UK 3X Trans. Driver Board	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

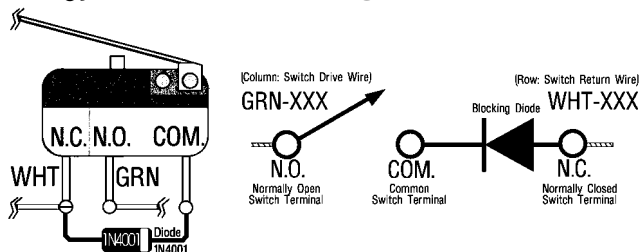
♂ Coil Note: ♂ Either -00B or -00T can be used for coil replacements. B/T listed is preferable for easier diode access & may differ on game.



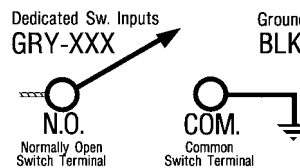
COIL & FLASH LAMP LOCATIONS



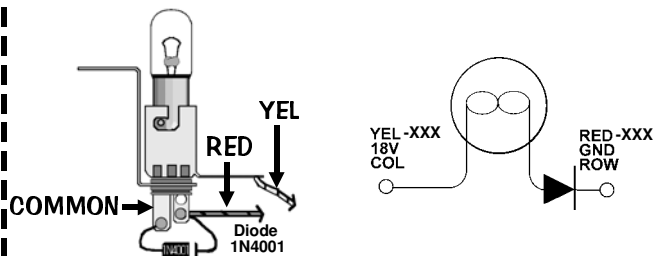
Typical Switch Wiring & Schematic



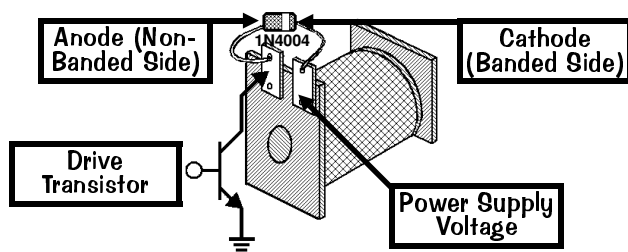
Dedicated Switch Schematic



Typical Lamp Wiring & Schematic



Typical Coil Wiring



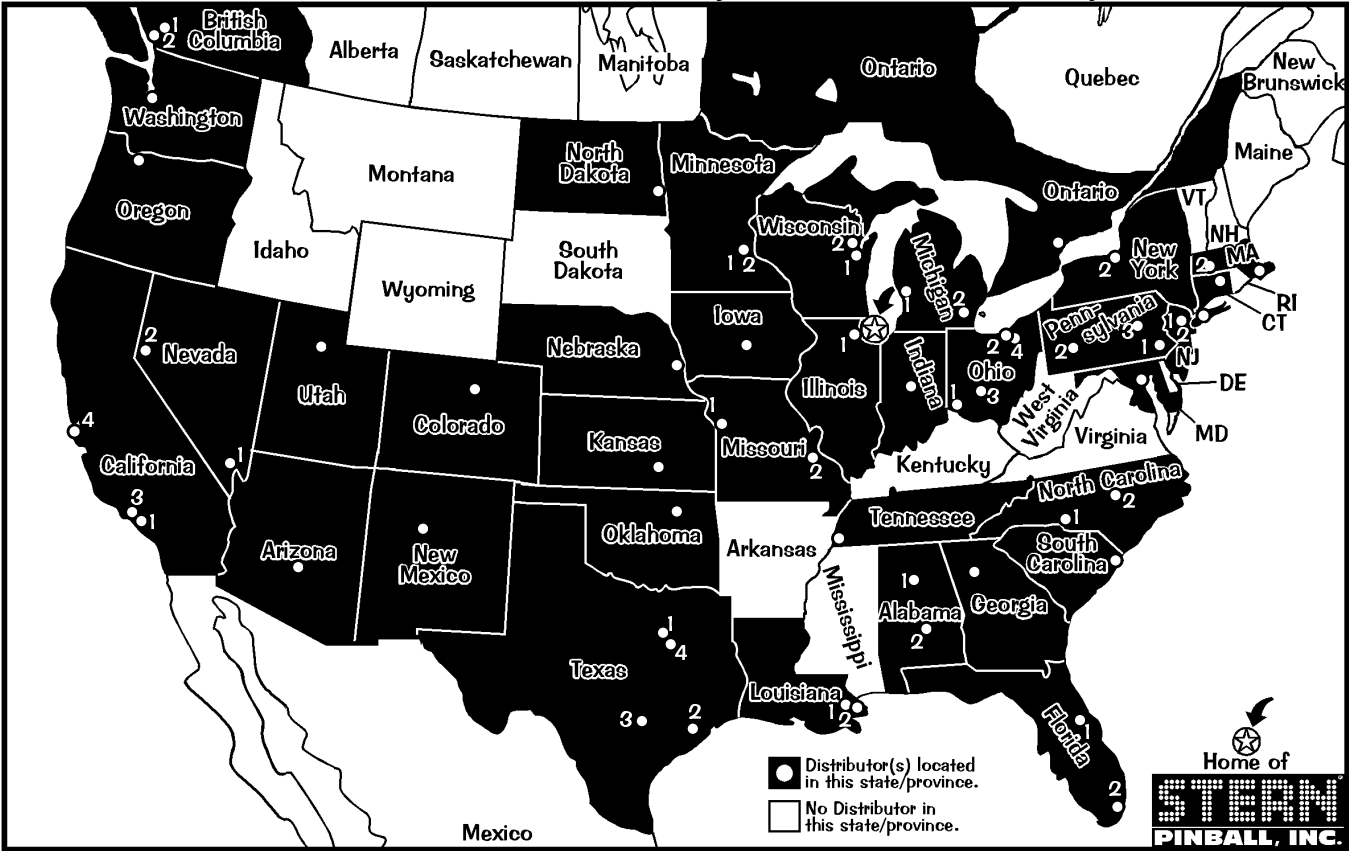
- = Coils / Flash Lamps above Playfield.
- = Coils / Flash Lamps below Playfield.
- = Coils / Flash Lamps not on Playfield.

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

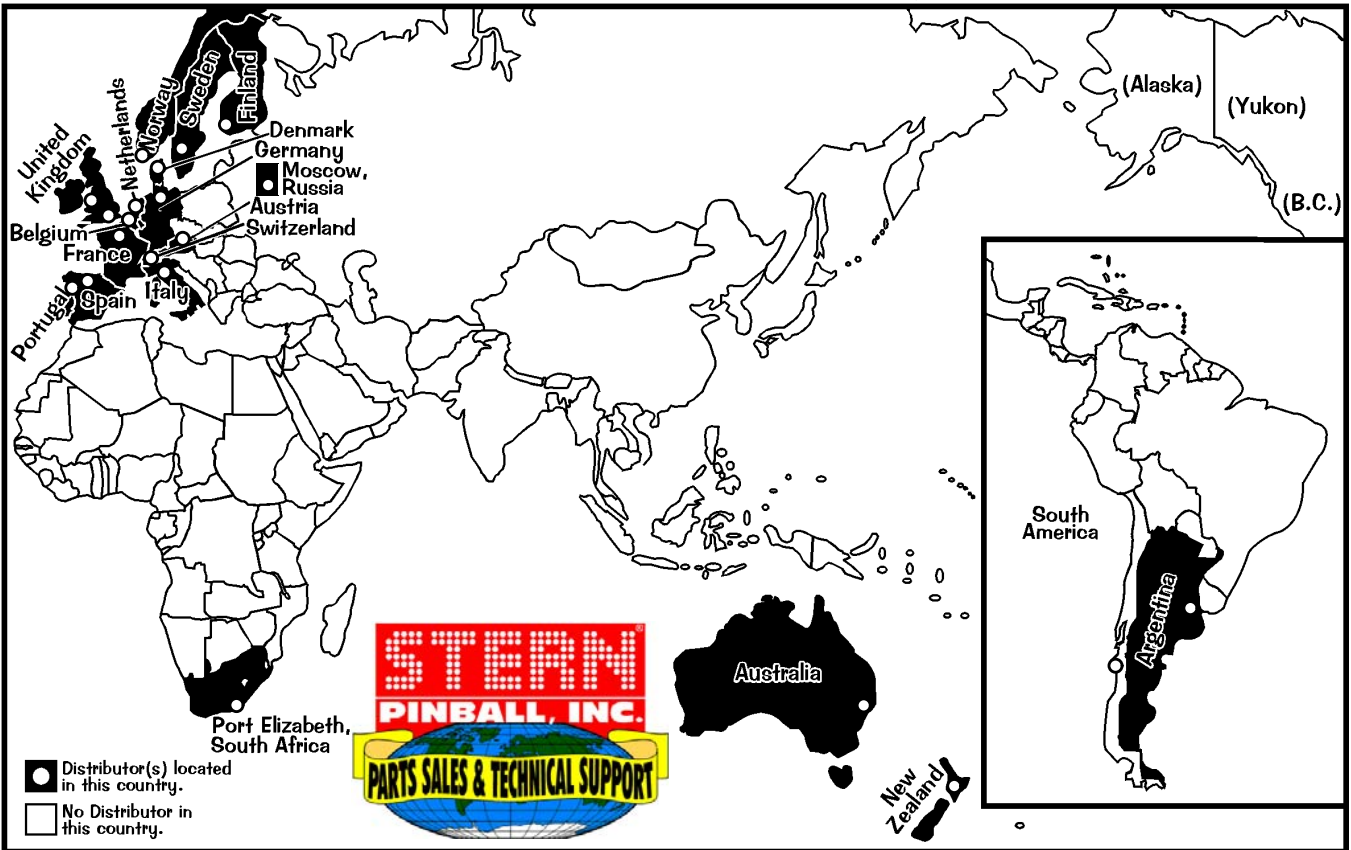
Some Coil or Flash Lamp Diodes may be located under the playfield, in the Cabinet or Backbox on Terminal Strips or Diode Boards and not on the assemblies. DOTS: Diode On Terminal Strip See Section 5, Chapter 2, Playfield Wiring.

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

Domestic Pinball & Redemption Distributors Map



International Distributors Map



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



Domestic Pinball & Redemption Distributors Directory

<p>ALABAMA</p> <p>Birmingham Vending Birmingham (1) 1-205-324-7526</p> <p>Franco Distributing Montgomery (2) 1-334-834-3455</p> <p>ARIZONA</p> <p>Betsom West Phoenix 1-480-380-8857</p> <p>Mountain Coin Phoenix 1-602-269-7596</p> <p>CALIFORNIA</p> <p>Betsom West Buena Park (1) 1-714-228-7500</p> <p>So. San Francisco (2) 1-650-952-4220</p> <p>C.A. Robinson Los Angeles (3) 1-323-735-3001</p> <p>San Francisco (4) 1-650-871-4280</p> <p>COLORADO</p> <p>Mountain Coin Denver 1-303-427-2133</p> <p>CONNECTICUT</p> <p>TDM Distributing Williamantic 1-860-423-1403</p> <p>FLORIDA</p> <p>Birmingham Vending Orlando (1) 1-407-425-1505</p> <p>Brady Distributing Miami [Miramar] (2) 1-954-874-1100</p> <p>Orlando (1) 1-407-872-1666</p> <p>GEORGIA</p> <p>Greater Southern Dist. Smyrna 1-770-803-3040</p> <p>ILLINOIS</p> <p>American Vending Elk Grove Village 1-847-439-9400</p> <p>Atlas Dist. International Elk Grove Village 1-847-952-7500</p> <p>World Wide Distributing Elk Grove Village 847-434-0400</p>	<p>IOWA</p> <p>Greater America Dist. Johnston 1-515-278-4455</p> <p>Moss Distributing Des Moines 1-515-266-6422</p> <p>INDIANA</p> <p>Atlas Dist. International Indianapolis 1-317-786-6892</p> <p>Shaffer Distributing Indianapolis 1-317-899-2530</p> <p>KANSAS</p> <p>United Dist., Inc. Wichita 1-316-263-6181</p> <p>LOUISIANA</p> <p>AMA Distributors, Inc. Metairie (1) 1-504-835-3232</p> <p>Parts & Service Only: New Orleans Novelty New Orleans (2) 1-504-888-3500</p> <p>MARYLAND</p> <p>Betsom Enterprises Baltimore 1-410-646-4100</p> <p>Parts & Service Only: Weiner Distributing Baltimore 1-410-525-2600</p> <p>MASSACHUSETTS</p> <p>Betsom Ent. (NECO) Norwood (1) 1-781-769-9760</p> <p>Gekay Sales E. Longmeadow (2) 1-413-525-2700</p> <p>MICHIGAN</p> <p>Atlas Dist. International Wyoming (1) 1-616-241-1472</p> <p>Cleveland Coin Machine Livonia (2) 1-734-432-1040</p> <p>MINNESOTA</p> <p>Lieberman Music Minneapolis (1) 1-952-887-5299</p> <p>Moss Distributing Richfield (2) 1-612-798-8030</p>	<p>MISSOURI</p> <p>Greater America Dist. Kansas City (1) 1-816-531-4300</p> <p>Moss Distributing Kansas City (1) 1-816-231-6600</p> <p>Shaffer Distributing St. Louis (2) 1-314-645-3393</p> <p>NEBRASKA</p> <p>Central Dist. Omaha 1-402-493-5600</p> <p>Greater America Dist. Omaha 1-402-553-2812</p> <p>NEVADA</p> <p>Mountain Coin Las Vegas (1) 1-702-798-0900</p> <p>Reno Game Sales Reno (2) 1-775-829-2080</p> <p>NEW JERSEY</p> <p>Betsom Enterprises Carlstadt (1) 1-201-438-1300</p> <p>Jack Guarneri Service Co., Inc. (Pinballsales.com) Lakewood (2) 1-732-364-9900</p> <p>NEW MEXICO</p> <p>Mountain Coin Albuquerque 1-505-345-7706</p> <p>NEW YORK</p> <p>Betsom Enterprises New Hyde Park (2) 1-516-354-4647</p> <p>Syracuse (3) 1-315-437-2400</p> <p>Parts & Service Only: Bay Coin Richmond Hill (1) 1-718-291-5757</p> <p>NORTH CAROLINA</p> <p>Brady Distributing Charlotte (1) 1-704-357-6284</p> <p>Operators Distributing Archdale (2) 1-336-884-5714</p>	<p>NORTH DAKOTA</p> <p>M.H. Associates, Inc. Fargo 1-701-282-7877</p> <p>OHIO</p> <p>Atlas Dist. International Cincinnati (1) 1-513-851-4100</p> <p>Cleveland Coin Cleveland (2) 1-216-692-0960</p> <p>Shaffer Distributing Columbus (3) 1-614-421-6800</p> <p>Macedonia (4) 1-330-467-4850</p> <p>OKLAHOMA</p> <p>Galaxy Distributing Tulsa 1-918-835-1166</p> <p>OREGON</p> <p>Betsom West Portland 1-503-772-4567</p> <p>Mountain Coin Portland 1-503-234-5491</p> <p>Specialty Coin Products Portland 1-503-786-9200</p> <p>Toll-Free 1-800-987-4946</p> <p>PENNSYLVANIA</p> <p>Betsom Enterprises King Of Prussia (1) 1-610-265-1155</p> <p>Pittsburgh (2) 1-412-331-8703</p> <p>Cleveland Coin Machine Pittsburgh (2) 1-412-920-1300</p> <p>Roth Novelty (Superior) Wilkes-Barre (3) 1-570-824-9994</p> <p>SOUTH CAROLINA</p> <p>Parts & Service Only: Green Coin Myrtle Beach 1-843-626-1900</p>	<p>TENNESSEE</p> <p>Brady Distributing Memphis 1-901-345-7811</p> <p>Parts & Service Only: Green G.A.M.E.S. Memphis 1-901-353-1000</p> <p>TEXAS</p> <p>Amusement Distributors San Antonio (3) 1-210-225-3844</p> <p>Betsom Texas Dallas (1) 1-214-638-4900</p> <p>Commercial Music Dallas (1) 1-214-741-6381</p> <p>Discount Arcade Games Crowley (1) 1-817-297-0440</p> <p>H.A. Franz, & Co. Houston (2) 1-713-523-7366</p> <p>San Antonio (3) 1-210-226-6322</p> <p>Master Sales Corsicana (4) 1-903-874-4740</p> <p>UTAH</p> <p>Mountain Coin Salt Lake City 1-801-262-5494</p> <p>Struve Distributing Salt Lake City 1-801-328-1636</p> <p>WASHINGTON</p> <p>Mountain Coin Seattle 1-206-682-5700</p> <p>WISCONSIN</p> <p>Pioneer Sales & Svc. Green Bay (1) 1-920-336-5800</p> <p>Menomonee Falls (2) 1-262-781-1420</p> <p>Lieberman/Viking Vend. Menomonee Falls (2) 1-262-703-4168</p>	<p>CANADA</p> <p>ONTARIO</p> <p>Starburst Coin Mach. Toronto 1-416-251-2122</p> <p>BRITISH COLUMBIA</p> <p>Parts & Service Only: Can. Coin Machine Burnaby (1) 1-604-420-4008</p> <p>Parts & Service Only: Pacific Vending Vancouver (2) 1-604-324-2164</p>
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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

<p>ARGENTINA</p> <p>South Company Mar Del Plata [54] 2234-95-5532</p> <p>AUSTRALIA</p> <p>Amusement Mach. Dist. Matraville [61] 2931-6-6000</p> <p>AUSTRIA</p> <p>Parts & Service Only: R. Rupp Leibnitz [43] 3452-8-6105</p> <p>Parts & Service Only: TAB Ansfelden [43] 7229-7-8040</p> <p>BELGIUM</p> <p>NAMUSCO Brussels [32] 2414-4596</p>	<p>Belgium Continued</p> <p>Parts & Service Only: Splin S.A. Liege [32] 4362-7677</p> <p>DENMARK</p> <p>JK Automater A/S Thisted [45] 9792-0925</p> <p>ENGLAND see UNITED KINGDOM</p> <p>FINLAND</p> <p>Pelika Ray-Oy Espoo [35] 5894-370-2925</p> <p>FRANCE</p> <p>Avranches Automatic Ducey [33] 2338-9-6162</p> <p>SFA Paris [33] 1532-6-8080</p>	<p>GERMANY</p> <p>ADP Gauselmann Espelkamp [49] 5741-27-3384</p> <p>Bergmann Int'l Gaming Rellingen [49] 4101-3-0240</p> <p>Witten [49] 2302-28-2540</p> <p>MEXIM Espelkamp [49] 5772-4-9422</p> <p>HOLLAND see THE NETHERLANDS</p> <p>ITALY (RSM)</p> <p>Tecnoplay S.A. San Marino [39] 5499-0-1508</p> <p>THE NETHERLANDS</p> <p>JVH Gaming Products Tilburg [31] 1359-5-3200</p>	<p>NEW ZEALAND</p> <p>Coin Cascade Ltd. Christchurch [64] 3338-1411</p> <p>Parts & Service Only: Amco Machine Supplies Auckland [64] 9846-7606</p> <p>NORWAY</p> <p>Vendomatic Oslo [47] 2291-8383</p> <p>PORTUGAL</p> <p>Jacinto & Martins, S.A. Belas [35] 1214-32-5624 or [35] 1214-32-5638</p> <p>RUSSIA</p> <p>O.D.A. Game Machines Moscow [095] 219-2949 or [095] 219-8917</p>	<p>SOUTH AFRICA</p> <p>K & W Amusements Port Elizabeth [27] 4148-4-3344 or [27] 4148-4-2940</p> <p>SPAIN</p> <p>Comercial Cocomatic Coslada (Madrid) [34] 9167-1-6980</p> <p>Parts & Service Only: Sente, S.A. Madrid [34] 9154-1-7112</p> <p>SWEDEN</p> <p>Bjuvia Fritid AB Bjuv [46] 4238-6900</p> <p>SWITZERLAND</p> <p>Novomat, A.G. Harkingon [41] 6238-8-8961</p>	<p>UNITED KINGDOM</p> <p>Electrocoin London, England [44] 2089-65-2055</p> <p>Parts & Service Only: Electrocoin AfterSales Cardiff, S. Glamorgan [44] 2920-45-0345</p>
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Note: From inside the US, use prefix 011-.



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



POWER REQUIREMENTS



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



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

England & Hong Kong use an 8A Fuse.

TRANSPORTATION GAME DIMENSIONS

BEFORE TRANSPORTING



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

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

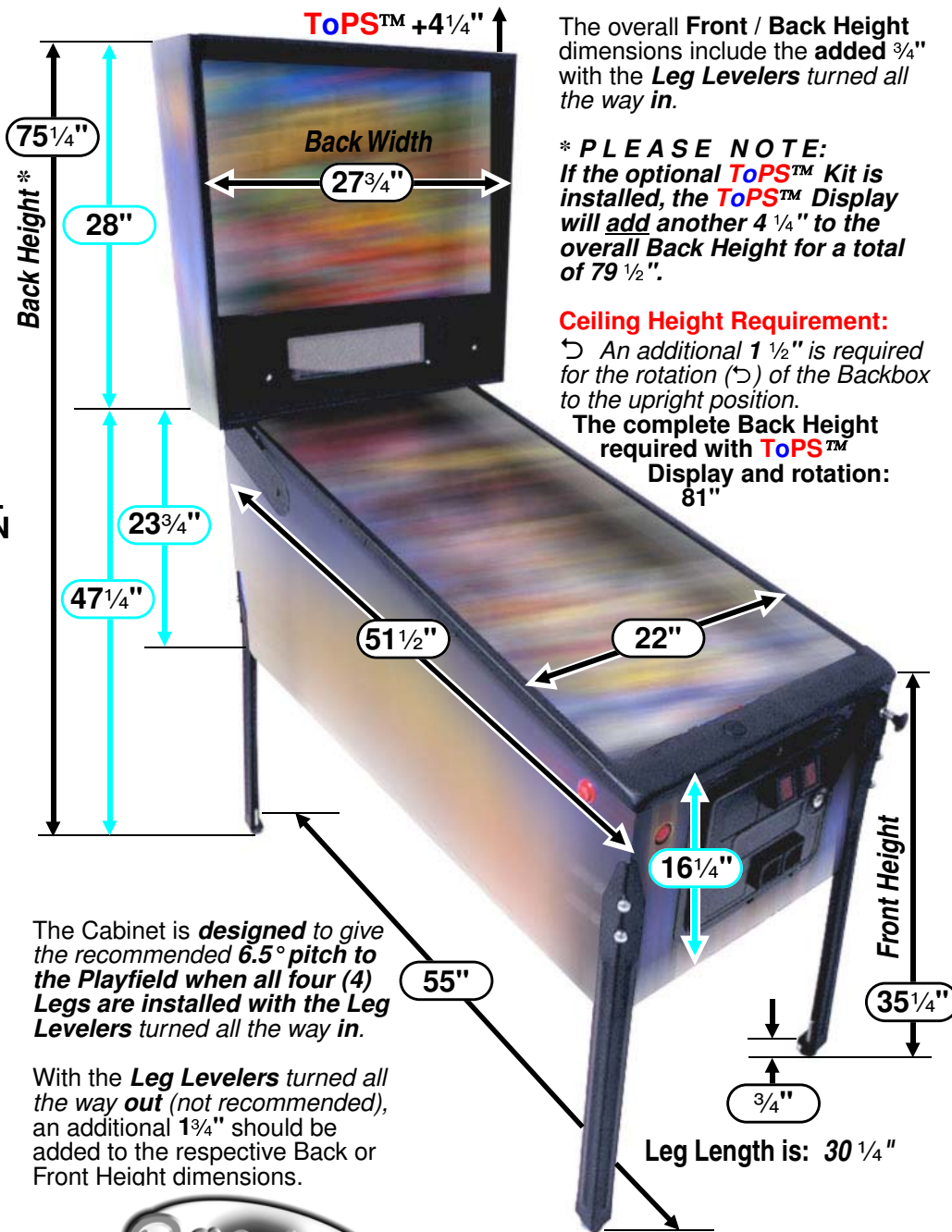
SAVE AND RETAIN ALL PRINTED INFORMATION INSIDE THE CABINET !

Shipping Box Dimensions

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

CAUTION

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



The overall **Front / Back Height** dimensions include the **added 3/4"** with the **Leg Levelers** turned all the way in.

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

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

The Cabinet is **designed** to give the recommended **6.5° pitch** to the **Playfield** when all four (4) **Legs** are installed with the **Leg Levelers** turned all the way in.

With the **Leg Levelers** turned all the way **out** (not recommended), an additional 1 3/4" should be added to the respective **Back** or **Front Height** dimensions.



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.

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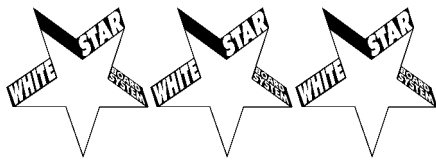
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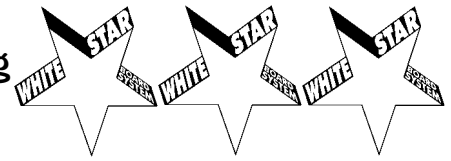
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Visit www.SternPinball.com/schematics.htm for the latest 11" X 17" Schematics (or "Split 8-1/2" X 11") for the Display Power Supply, Display Controller, I/O Power Driver & CPU/Sound Boards (White Star System Only). Along with the schematics you'll find the component layout and theory of operation. Keep visiting as these files are updated. If you find a typo or error in any of the schematics you can utilize the internal links where addresses may direct you to another sheet in this schematic set (further instructions within documents). To "download" once open, in your browser click "File" "Send" "Page by eMail". It will be sent to your eMail Address, where there you can save the file to your hardrive.

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 Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#1	TROUGH 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 Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#9	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	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 Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#17	LEFT SLINGSHOT	Q17	▲ I/O Power Driver ▼	BRN	J7-P1	20v DC	VIO-BRN	J7-P2	23-800 ♂ 090-5001-00T
#18	RIGHT SLINGSHOT	Q18		BRN	J7-P1	20v DC	VIO-RED	J7-P3	23-800 ♂ 090-5001-00T
#19	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 ermi n al S tri p (if noted)									
Low Current Coils Group 2		Drive Transistor	Driver Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#25	FLASH: 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 Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn
	AUX 1: LEFT UP/DOWN POST	Q1	UK 3X Trans. Driver Board	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 -00B or -00T can be used for coil replacements. B/T listed is preferable for easier diode access & may differ on game.

Sec. 5: Schematics...



After Set-Up

Pinball Game Set-Up Procedures

...after reading the Pinball Game Set-Up Instruction Sheet (SPI Part N^o 755-5310-00) included with your New Pinball Game, continue with the below procedures:

With the Back Glass Removed:

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

With the Playfield Glass Removed:

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

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

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

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

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

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

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

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

With the Coin Door Open:

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

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

Per CE: "The appliance has to be placed in a horizontal position." "This appliance is not to be cleaned by a Water Jet."



After Set-Up

PINBALL GAME SET-UP

CAUTION: At least 2 people are required to move and maneuver game. Use proper moving equipment & extreme care while handling. Pinball game is 200lbs (+/- 10). Refer to Game Manual for further Game Set-Up Procedures (Sec. 1, Chp. 1, and other important information).

TOOLS REQUIRED: 5/8" Socket Wrench & Utility Knife

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

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

SPI Part N^o 755-5310-00



Pinball Game Set-Up Future Reference

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

CAUTION: At least 2 people are required to move and maneuver game.

Use proper moving equipment & extreme care while handling. Pinball game is 260lbs (+/- 10).

Refer to Game Manual for further Game Set-Up Procedures (Sec. 1, Chp. 1) and other important information!

TOOLS REQUIRED: 5/8" Socket Wrench & Utility Knife

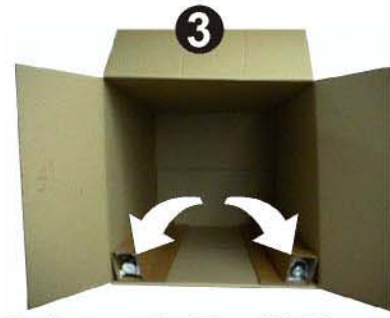
Sec. 1: After Set-Up



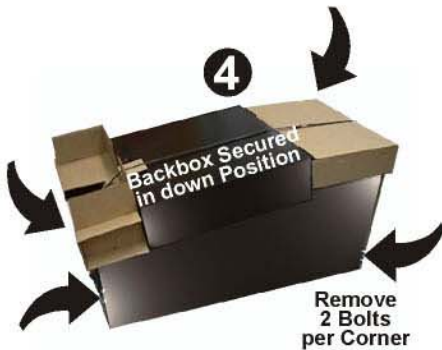
1. Before unpacking box, lay the box flat on its side with "TRUCK THIS SIDE ONLY" facing the floor.



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



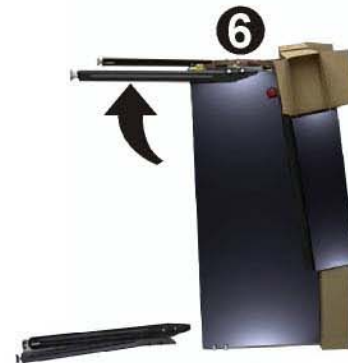
3. Remove the **Four (4) Identical Legs with Levelers** from the carton and set aside. (**SAVE!** all packing materials and information sheets related to this pinball until Set-Up is complete.)



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



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



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



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

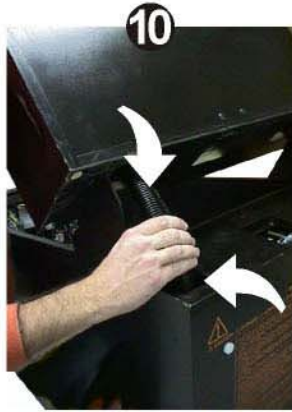


8. Using supports or two (2) people, prop the rear of the cabinet up and install **REAR LEGS**. Secure tightly.



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

Pinball Game Set-Up Future Reference Continued



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

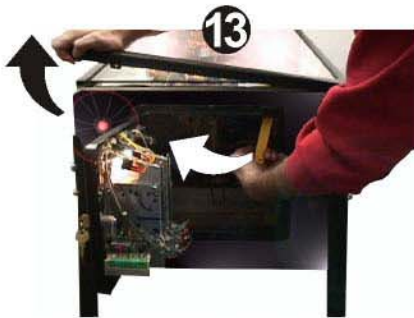


11. After the **BACKBOX** is in the **UPRIGHT POSITION**, locate the **5/16" HEX KEY**. While inserted, rotate **KEY** with a **3/4 turn** until latched & locked.



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

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



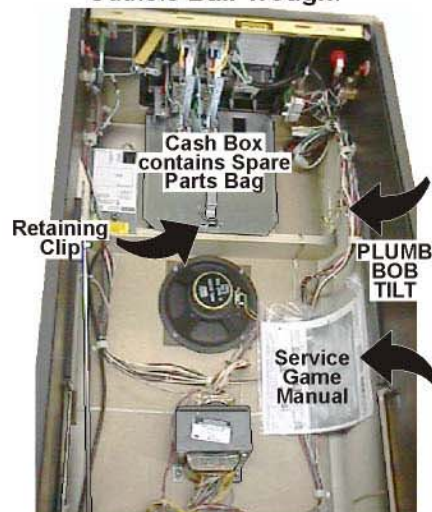
13. Open the **Coin Door** and pull the **YELLOW HANDLE** to the **LEFT** and at the same time pull up on the **FRONT TOP MOLDING** and remove. The **GLASS** can now be pulled out towards you and removed. **TAKE CARE** while moving; set glass on a safe surface.



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



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



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

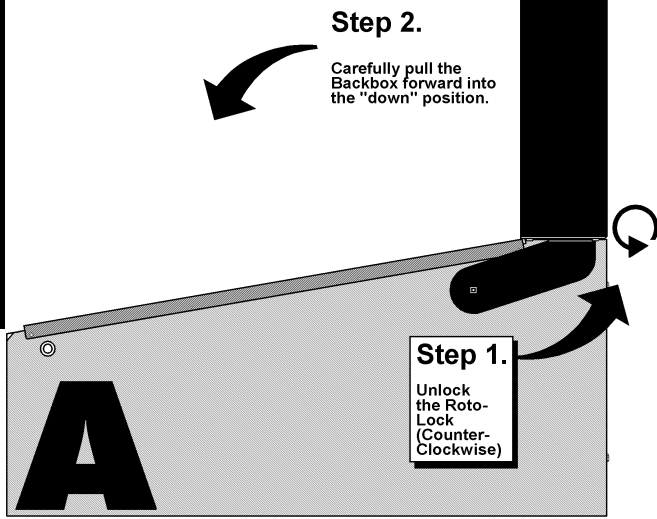
ALWAYS STORE THE MANUAL & INFORMATION SHEETS INSIDE THE CABINET WHEN NOT USING.



How to Secure the Backbox for Transporting

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

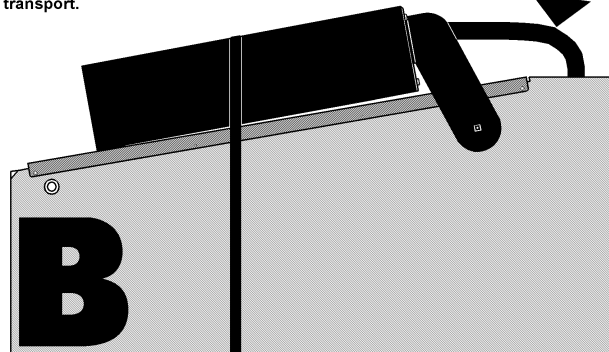
Sec. 1: After Set-Up



Step 3.

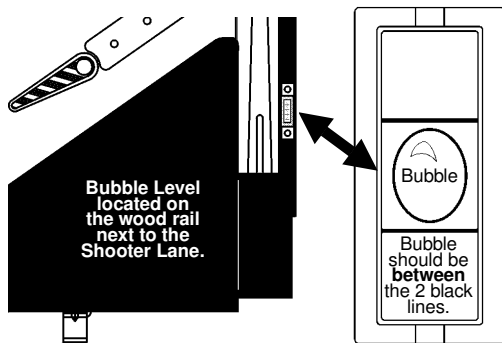
The top of the Backbox will rest on the Pinball Side Armor. Strap or tie down the Backbox to keep from "bouncing" during transport.

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



Leg Leveler Adjustment

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



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

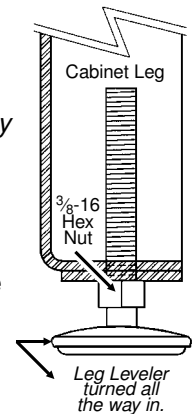
View the *bubble* in the level provided on the right side wood rail.

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

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

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

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

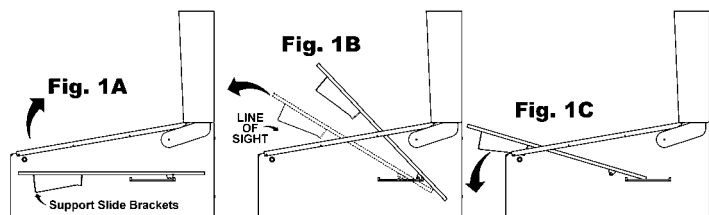


Easy Access Service System - 2 Positions

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

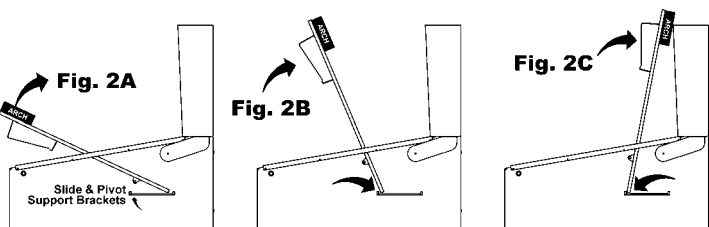
Position 1

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



Position 2

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



Game Operation & Features

Start of Game Features

Starting a Normal Game

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

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

Starting Team Play (Doubles!)

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

Starting Tournament Play with

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

Unlike a "Normal Game", the Tournament Game is started by depressing the **Tournament Start Button** (*located on the Front Molding, if installed*). If adequate credit(s) are posted **and a Tournament is started** via **Portals™** (*select the "TOUR" Icon in the Main Menu*), the **Tournament Start Button** will flash. *Any adjustments or installs changed will not be in affect. Starting a Tournament Game defaults to preprogrammed Tournament Rules (e.g. No Extra Balls, Specials or Bonus Credits are awarded); however, starting a Normal Game after a Tournament Game will then revert back to any unique adjustments or installs performed previously.* **During and End of Game Features** operate in the same manner (*differences in adjustment defaults are present*).

During Game Features

Feature Mode & Combination Shots

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

Multiball

Multiball is started after completion of certain features (*amount of balls used depends on game rules*).

Replay Feature

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

End of Game Features

Game Endings

When all player(s) have played all balls (including any Extra Balls), the game ends. If power is interrupted during the course of a game, it will end that game (**see Starting a Normal Game**). Closure of the Plumb Bob Tilt Switch according to the number of tilts set, **Standard Adj. 15, Tilt Warnings** (Default = **01**) or prolonged closure, will end the current Ball-In-Play. Closure of the Slam Tilt Switch on the Coin Door ends the current game(s).

Match Feature

At the end of each ball, earned bonuses are collected. At the end of the last ball of a game (including any extra balls, if applicable), earned bonuses are collected, then the system produces a random 2-digit number (a multiple of 10; 00 to 90). Matching the last 2 digits of the player's score with this number awards a credit. In **Std. Adj. 13, Match Percentage** (Default = **8%**) can be changed from 0-10%. Changing the percentage to **0% displays** the "Match Animation" at the end of the game, however, will never match nor award anything. Changing this adjustment to **OFF** will **not display** the "Match Animation" nor award anything.

Entering Initials/Name

If player achieved a new *High Score* in a game or achieved a *Special Feature (if given)* the player may enter 3 Initials. In **Std. Adj. 29, High Score Initials** (Default = **3 Initials**) can also be changed to **10-Letter Name**. Use the **Flipper Buttons** to choose a letter or character as seen on the Dot Display. Hitting the **Start Button** locks in the letter or character and proceeds to the next letter. The game then proceeds into the **Game-Over Mode** and then to the **Attract Mode**.

Note: **Standard Adj. 31, Custom Message** (Default = **ON**) can be displayed during the *Attract Mode*; enter letters in the same fashion.

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

Continued Next Page.



Auto Percentaging

This game is equipped with Auto Percentaging, **Standard Adj. 01, Replay Type** (Default = **AUTO**, adjustable). The *Replay Percent* is automatically adjusted, **Standard Adj. 02, Replay Percentage**, or you can set a *Fixed Replay Score*. Four levels may be selected. Adjustments allow awarding of a "CREDIT" (or your setting) as each level is exceeded. This can be adjusted with, **Standard Adj. 03, Replay Award** (Default = **CREDIT**). With the **Autopercentage Feature**, if the actual replay percentage is higher or lower than that desired, the game will automatically adjust for the new recommended percentage score(s). You may choose to make a different "score-to-beat" adjustment; this is done by utilizing **Standard Adj. 04, Replay Levels**. *For more details with Adjustments, see Section 3, Chapter 4, GO TO ADJUSTMENTS MENU; also, see see Section 3, Chapter 5, GO TO INSTALLS MENU for further customization of your Pinball Game.*

Sec. 2: Game Op.

Instruction Card

Below is a **COPY** of the Game Instruction Card (SPI N^o: 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



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

Click on card to open the Instruction Card for printing.

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.

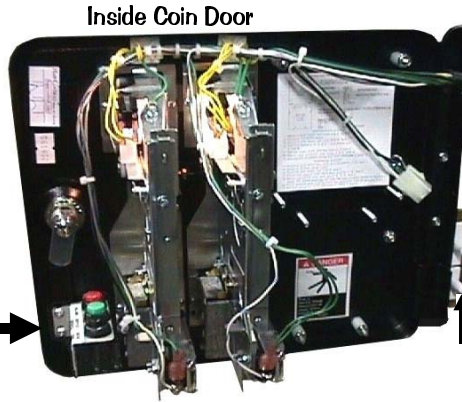
HINT: Collect all 7 R-I-P-L-E-Y-S Letters to visit the *Mystery 8th Continent!*

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

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



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

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

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

Sec. 3: ...Menu Intro.

Function 1, Volume Menu



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

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

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

Function 2, Service Credits Menu

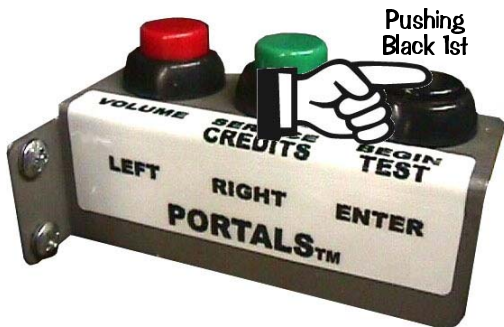


Pushing the **Green "SERVICE CREDITS" Button** first, adds **Service Credits** (will not affect your audits as "paid" credits). This is useful for the technician to test games in regular play without affecting the game audits. Each depression adds **1 credit**; up to **50 credits** can be applied. **Std. Adj. 16, Credit Limit**, determines this, however, it can be changed from 04-50; for details see **Chapter 4 of this Section 3**. Once your credits are added, this menu will **automatically exit** a few seconds after the last button depression.

*Note: This function is disabled if **Standard Adjustment 30, Free Play**, is set to **YES**. The Service Credits are limited to the Credit Limit in addition to any paid credits present in the game (e.g. If the Credit Limit is 30, and there are 8 paid credits present, only 22 Service Credits can be applied.)*

open
Adjustments

Function 3, Portals™ Service Menu



Pushing the **Black "BEGIN TEST" Button** first, enters the **Portals™ Service Menu**. Once in, navigate through all menus depressing the **Red "LEFT" or Green "RIGHT" Buttons**.

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

Select or activate the **Icon** chosen (the **Icon** will be "flashing") by pushing down or depressing the **Black "ENTER" Button**.

*Note: Pushing the **Start Button** operates the same as the **Black Button** of the Service Switch Set, while in this Service Mode.*

Please read the remainder of this Chapter for more information on the **Portals™ Service Menu**. The remaining six (6) Chapters of this Section explains all **Icons & Menus** in detail. **Read! Read! Read!**



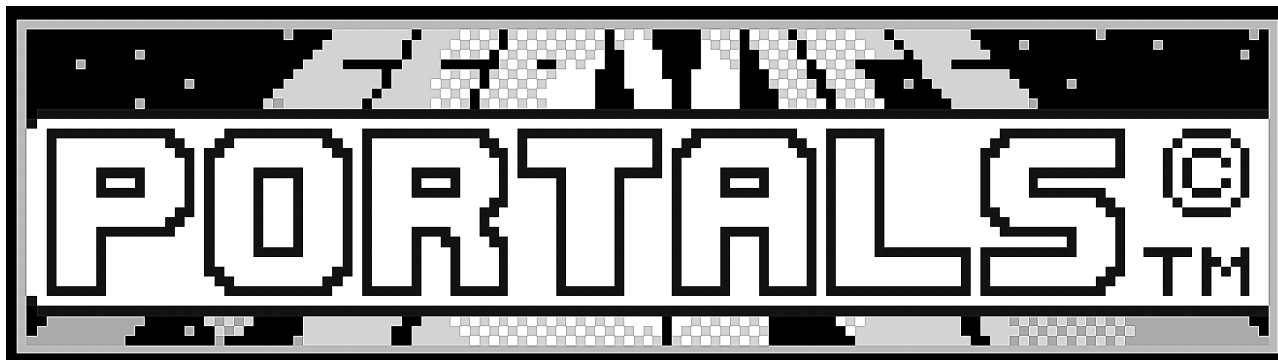
Portals™ Service Menu Introduction

Important: The *Dual Switch Bracket* holds the *Playfield Power Interlock & Memory Protect Switches*. It is located just inside the Coin Door frame (see pictorial of the *Coin Door* on the previous page). The Button Switch at the top is the *Playfield Power Interlock Switch*. It must be pulled out for electro-mechanical device testing or diagnostic purposes (this is required). If this button is pushed in, the *Playfield Power* is disabled while the *Coin Door* is **OPEN**. The Button Switch at the bottom is the *Memory Protect Switch*. It is enabled while the *Coin Door* is **CLOSED**; meaning any adjustment changes that are made **will not be written to memory**. If changing adjustments is required, ensure the *Coin Door* is **OPEN** to disable this switch, thus allowing for desired changes.

How to Use This Section

This section will cover all functions available in the **Portals™ Service Menu** in a *Step-By-Step* process. This section is divided into chapters which coincide with the **MAIN MENU**. The previous and following pages in this Chapter will instruct the operator on how to move through the Menus. It's simple, easy and fun to use!

To get into the **Service Menu Mode** review "**Function 3, Portals™ Service Menu**" on the previous page. After Power-Up, push down the **Black "BEGIN TEST" Button** to begin. Looking at the display you will momentarily see "**Service Menu**" with a *satellite flying from right to left pulling a banner "Portals©™"* followed by the **MAIN MENU**:



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

The **MAIN MENU** now appears with the "**DIAG**" *Icon* (**GO TO DIAGNOSTICS MENU**) flashing:



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

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

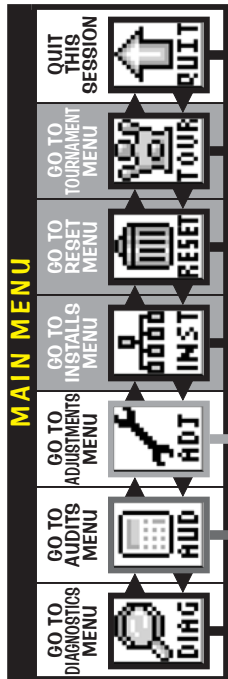
The **chapters** in this **section**, which coincide with the **MAIN MENU**, will also provide more detailed information. **Use both the manual and the display to help customize, troubleshoot and/or diagnose faults, if any.**



Portals™ Service Menu Icon Tree

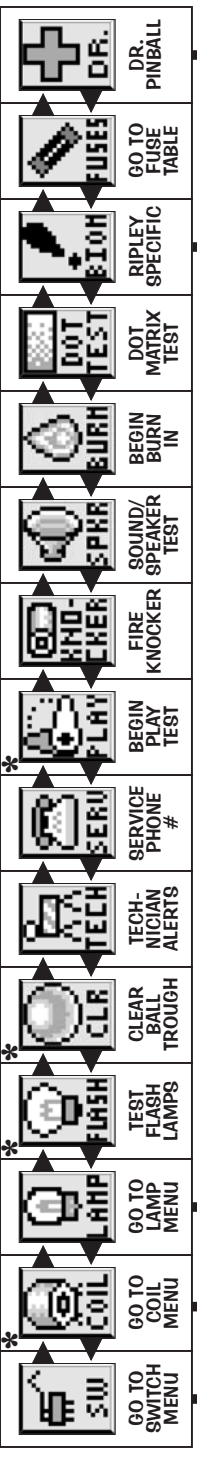
**COIN DOOR IS OPEN
PLAYFIELD HIGH POWER
DISABLED BY
COIN DOOR INTERLOCK**

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

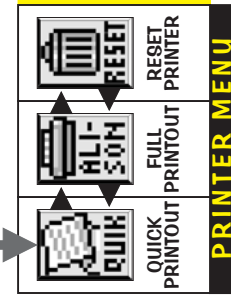
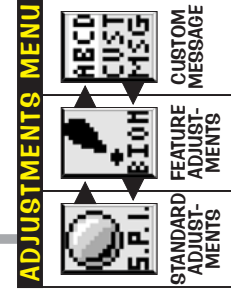
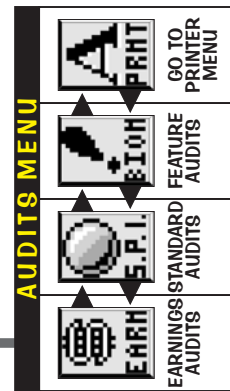
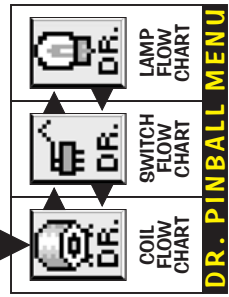
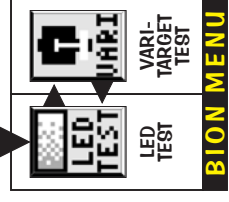
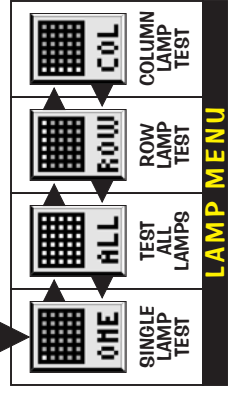
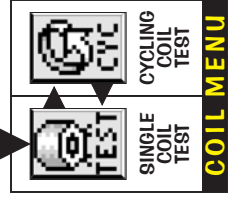
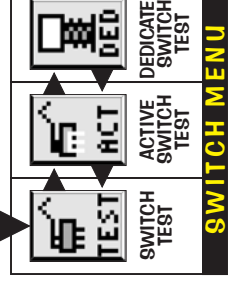


CONTINUED NEXT PAGE.

DIAGNOSTICS MENU



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



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

Note:
In Sub-Menu Tests or Displays, further action is required: select & 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 "P" icon for more information.

END current coil selection to select a new coil for diagnosing in Dr. Pinball Menu.

NO Answer NO or YES for Flow Chart Menu questions in Dr. Pinball Menu.

VIEW View the schematic (DRAWING) of current display. Select while current switch, lamp or coil is viewed.

RUN RUN (or activate) selected test or coil.

FILSE PULSE coil.

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

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

Explanation & usage of common Large & Mini-Icons used in various Menus & Sub-Menus:



Portals™ Service Menu Icon Tree Continued

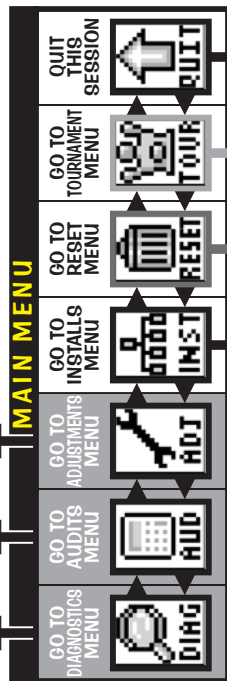


Note: After selection of any of the 1st 13 **Install Icons**, the request is installed and returns to the **Install Menu**. The last icon activated before exiting this menu will supersede any previous icon selected in the group.

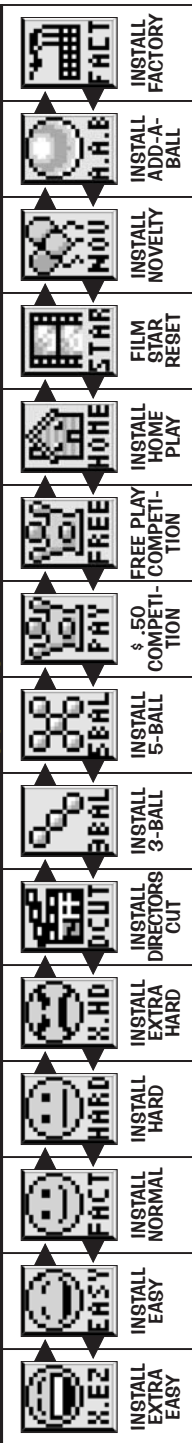


Note: After selection of any of the 1st 4 **Reset Icons**, the request is installed and returns to the **Reset Menu**. Selecting a "FACT" icon, the request is installed and exits the Portals™ Service Menu System.

SEE PREVIOUS PAGE.



INSTALLS MENU



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

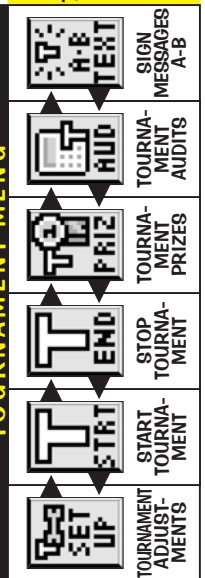
RESET MENU



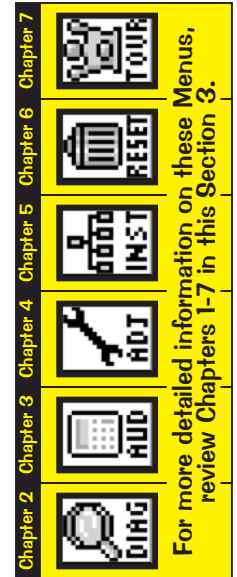
AFTER FACTORY RESET IS INSTALLED, YOU WILL THEN EXIT PORTALS™ AND WILL RETURN TO THE ATTRACT MODE.

REQUEST INSTALLED

TOURNAMENT MENU



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



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



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.

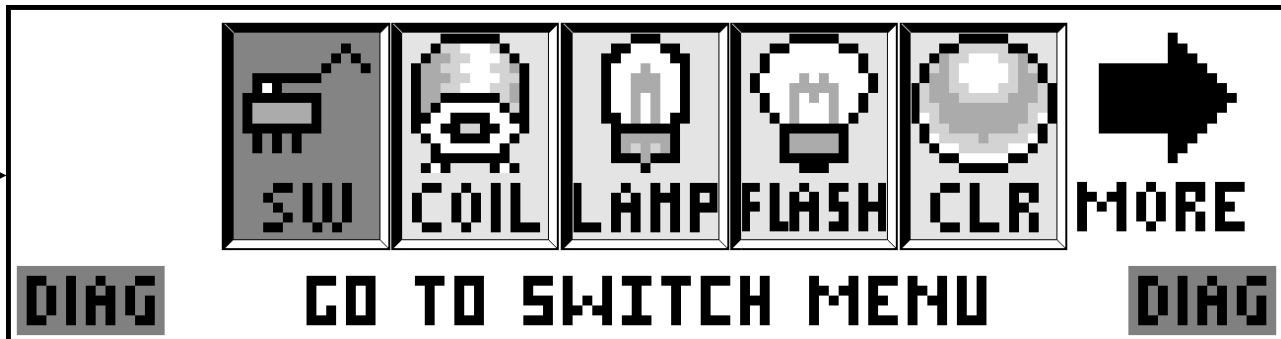
Sec. 3: ...Menu Intro.

Example:

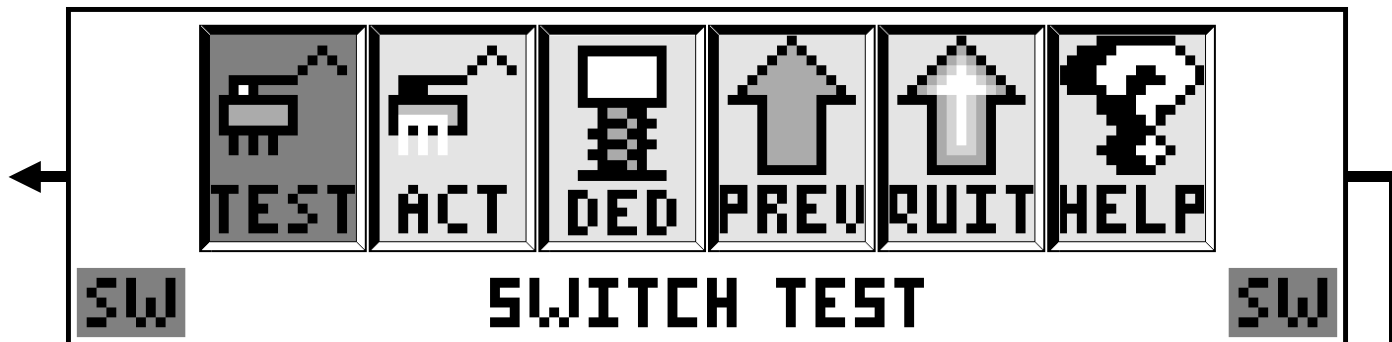
After entering **Portals™**, the **MAIN MENU** now appears with the "DIAG" *Icon* (**GO TO DIAGNOSTICS MENU**) flashing:



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



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

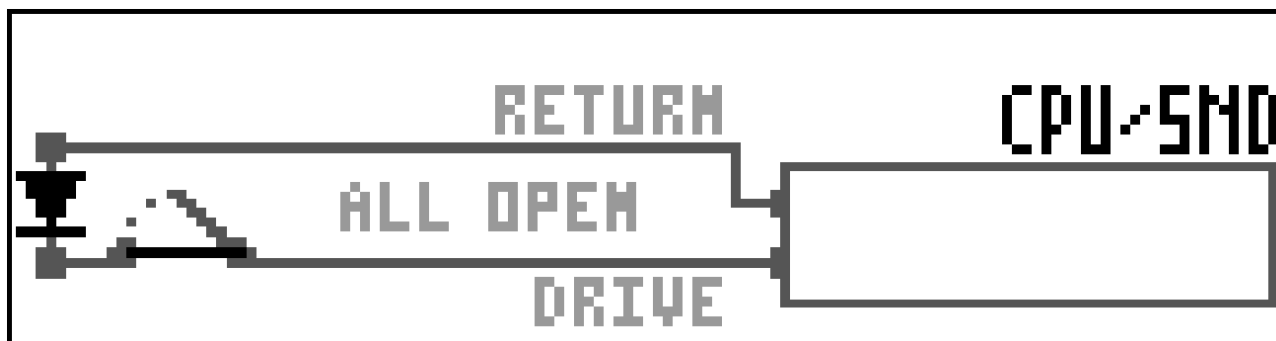


Press the **Black "ENTER" Button** to *activate* this icon. The **Switch Test Display** now appears.



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

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



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

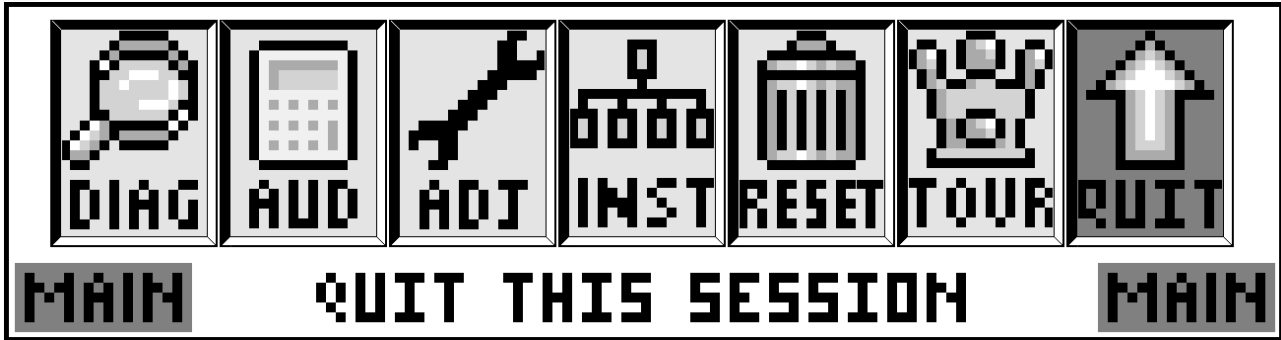
While in **Switch Test** or **Active Switch Test**, the **Flipper & Start Buttons** are deactivated (because they can be part of these tests). Use the **Red "LEFT," Green "RIGHT"** and/or **Black "ENTER" Buttons** to select and *activate* the "**MINI-ICONS**" at the bottom of the display. In **Switch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

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



QUIT THIS SESSION (Exiting the Portals™ Service Menu)

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



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

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

Problem / Solution Table

Sec. 3: ...Menu Intro.

PROBLEM	SOLUTION
Will not enter the Service Mode after depressing the Black "BEGIN TEST" Button .	<ul style="list-style-type: none"> Check the Service Switch(es) (Red, Green & Black Buttons) for loose connections or bad Ground. Check the associated wiring harness to/from the CPU/Sound Board, Connector CN6. Check CPU/Sound Board for possible failure.
All Service Buttons (Red, Green and Black) appear nonfunctional.	<ul style="list-style-type: none"> Check the Service Switches wiring harness for poor or no connection and/or broken wires.
The Green Service Button in the Attract Mode will not enter the SERVICE CREDITS MENU to add Service Credits.	<ul style="list-style-type: none"> Check to make sure the Game is not in "Free Play." <i>If the game is set to Free Play, adding Service Credits is not required.</i> Check the Service Switches wiring harness for poor or no connection and/or broken wires.
The Display "blanks out."	<ul style="list-style-type: none"> Check the Dot Matrix Display for loose wiring harness for poor or no connection and/or broken wires. Check F1 (3/4A Fuse) on the Display Power Supply Board. Refer to <i>Section 5, Chapter 4, SCHEMATICS & TROUBLESHOOTING</i>.
Icons " <i>scroll</i> " along continuously in the MAIN MENU .	<ul style="list-style-type: none"> Check for a stuck switch on the Green Button. If the Service Switch Set and/or the Coin Door was replaced, ensure the Locking Mechanism on the Green Button was removed. If the Green Button "clicks" and locks into an up/down position, the Green Button has this lock switch. Remove it. (Ref. to Svc. Bulletin #74.)
The Start and Flipper Buttons do not select or activate <i>Icons</i> in the SWITCH TEST MENU .	<ul style="list-style-type: none"> This is normal. These switches are deactivated, as they are a part of the Switch Test. Use the Red "LEFT" or Green "RIGHT" & Black "ENTER" Buttons in this Sub-Menu. Refer to <i>Section 3, Chapter 2, GO TO DIAGNOSTICS MENU, Switch Test</i>.
Can't move selection of <i>Icon</i> with the Left and/or Right Flipper Buttons .	<ul style="list-style-type: none"> Check the Flipper Buttons for loose connections or bad Ground and refer to <i>Section 5, Chapter 2, Playfield Wiring, #-Flipper Circuit Wiring Diagram</i>. This is normal <i>only</i> in <i>Diagnostic's Switch & Active Switch Tests</i> (see <i>previous Problem</i>).
Some <i>Icons</i> appear non-functional in the PRINTER MENU(S) .	<ul style="list-style-type: none"> If no printing equipment is connected, the "-" Icon, "+" Icon and "RUN" Icon will appear not to function. Refer <i>Section 3, Chapter 3, GO TO PRINTER MENU</i>.
Some <i>Icons</i> appear non-functional in the GAME SPECIFIC MENU under the DIAGNOSTICS MENU .	<ul style="list-style-type: none"> If there is no other test under this Menu, the "<<" & ">>" Mini-Icons will appear not to function. The remaining <i>Icons</i> should function as normal. Note: <i>If there is no "Go To (Game Name) Test(s), the "GAME NAME" Icon will not invoke another display.</i>
The display returns to the ATTRACT MODE exiting the Service Session after a FACTORY RESET .	<ul style="list-style-type: none"> This is normal. After a FACTORY RESET, the Service Session is automatically exited. Refer to <i>Section 3, Chapter 6, GO TO RESET MENU, Factory Reset</i>.
In COIL TEST MENU , the coils and flashlamps <i>do not</i> fire after activating the "RUN" Icon .	<ul style="list-style-type: none"> Ensure the POWER INTERLOCK SWITCH is pulled out (see the start of this Chapter).
In ADJUSTMENTS MENU , with the Coin Door CLOSED , adjustments are not getting changed as desired (using the Flipper & Start Buttons).	<ul style="list-style-type: none"> This is normal. The Memory Protect Switch is enabled when the Coin Door is CLOSED. Changes can be made with the Coin Door OPEN only.
In Portals™ Service Menu , the volume cannot be adjusted with the Red or Green Buttons .	<ul style="list-style-type: none"> The Volume adjustment can only be made when in the Attract Mode. The Volume Mode is entered by pressing the Red "VOLUME" Button. Then use the Red "LEFT" to decrease / decrement (-) or Green "RIGHT" Button to increase / increment (+) the volume.
In Portals™ Service Menu , the display seems to lock up, or the Help Display appears to be non-functional.	<ul style="list-style-type: none"> If you cannot clear the situation by exiting back one Menu, exit completely out of the Portals™ Service Menu, and re-enter. If the problem persists, call Technical Support for additional help.



Go To Diagnostics Menu

Overview

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

Important: Upon **Power-Up** (Game Reset) or opening the **Coin Door** watch the **Display** for any **Alerts**.*



If this **display flashes**, the game is indicating that **CMOS RAM** memory (CPU Loc. U212) has been corrupted. This is caused by either failure in memory (e.g. **batteries are dead and/or faulty RAM**) or upon installation of updated version of game code. Opening the **Coin Door** will initiate a **Factory Restore (Reset)**, by opening the **Memory Protect Switch**.

Check battery voltage at **VBATT Test Point** on the **CPU/Sound Bd.** (more details in *Sec. 5, Chp. 4, PCBs*).



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



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



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

CAUTION: Remove all pinballs from the Ball Trough prior to lifting the playfield to its full upright position for servicing. **PULL OUT** the **Power Interlock Switch** for operation. To eject pinballs, select the **"DIAG"** *Icon* from the **MAIN MENU** to go to the **DIAGNOSTICS MENU**, then select the **"CLR"** *Icon* to enter the **CLEAR BALL TROUGH MENU**. Select the **"RUN"** *Mini-Icon* and press the **Black "ENTER" Button** or **Start Button** to remove one pinball at a time (this feature also useful to retrieve a pinball for game testing in **Begin Play Test & Game Specific Tests**).



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

Select and activate to:

					Move LEFT or RIGHT , select previous / next or move backwards / forwards.
MORE MORE	PREU	RUIT	HELP		DECREMENT (-) or INCREMENT (+) displayed value or select previous / next.
These <i>non-selectable icons</i> appear in the selected <i>Menu</i> only when there are MORE icons to the LEFT or to the RIGHT available for selection.	Select and activate to return to the PREVIOUS Menu.	Select and activate to QUIT , exits & returns to the Attract Mode .	Select and activate to view HELP Screens of the current <i>Menu</i> *.		RUN (or activate) selected test or coil PULSE coil.
					View the schematic (DRAW ing) of current display. Select while current switch, lamp or coil is viewed.

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

GO TO DIAGNOSTICS MENU

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





Go To Switch Menu

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



Switch Test

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



Active Switch Test

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



Dedicated Switch Test

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

SWITCH MATRIX GRID & DEDICATED SWITCHES

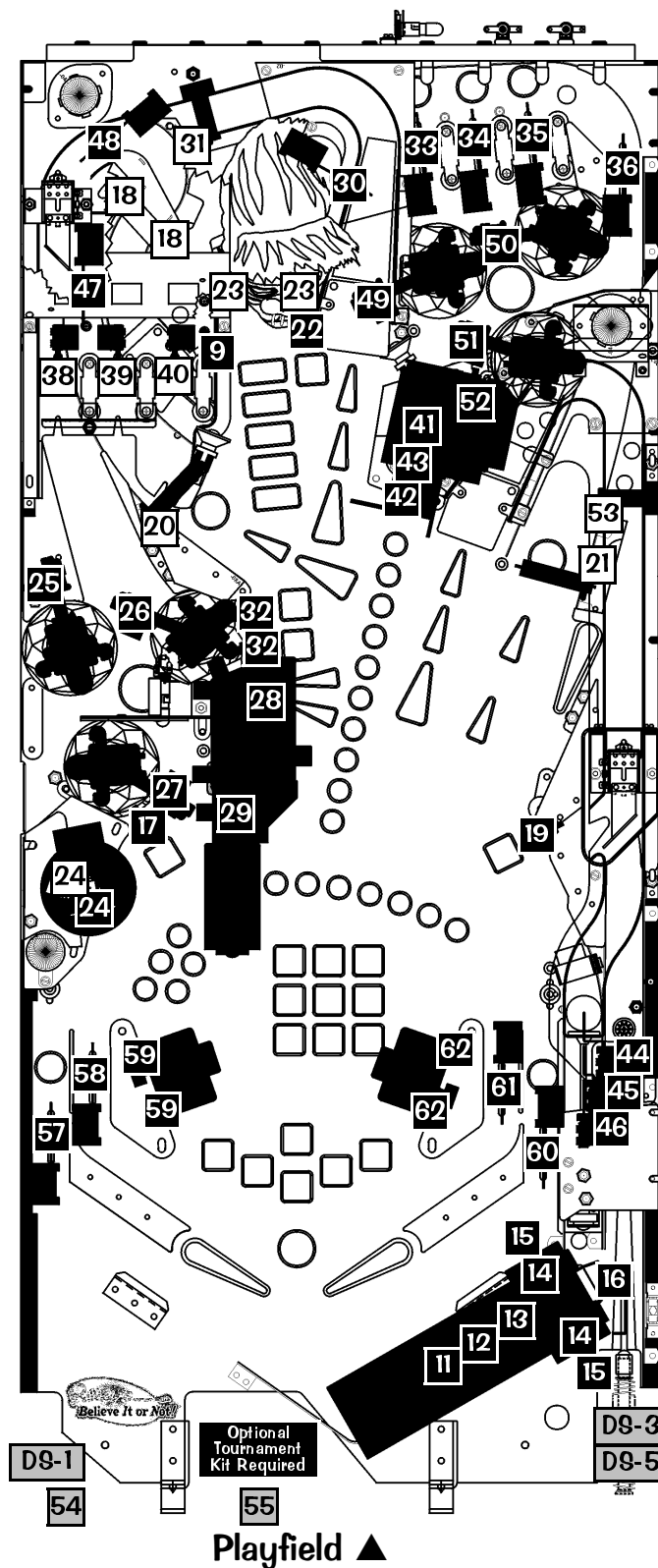
Column (Drive)	1: Q1	2: Q2	3: Q3	4: Q4	5: Q5	6: Q6	7: Q7	8: Q8
Row (Return)	GRN-BRN CN5-P1	GRN-RED CN5-P3	GRN-ORG CN5-P4	GRN-YEL CN5-P5	GRN-BLK CN5-P6	GRN-BLU CN5-P7	GRN-VIO CN5-P8	GRN-GRY CN5-P9
1: U400	1 Cabinet Side LT BUTTON (UK ONLY) Sw. Part Number: 180-5160-00	9 Below P/F HEAD STAND-UP 515-5162-08	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	2 Coin Door 4TH COIN SLOT Sw. Part Number: 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	3 Coin Door 6TH COIN SLOT Sw. Part Number: 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	4 Coin Door RIGHT COIN SLOT Sw. Part Number: 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 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	5 Coin Door CENTER COIN SLOT / DBA Sw. Part Number: 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 180-5183-00	37 NOT USED	45 Below P/F LOCK 1 - MIDDLE 180-5179-00	53 Below P/F RIGHT RAMP 180-5190-28	61 Below P/F RIGHT RETURN LANE 500-6227-02
6: U401	6 Coin Door LEFT COIN SLOT Sw. Part Number: 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	7 Coin Door 5TH COIN SLOT Sw. Part Number: 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	8 Cabinet Side RT BUTTON (UK ONLY) Sw. Part Number: 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	GROUND
IC U206 INPUTS	BLK CN6-P1, -P11
1: U206	DS-1 on Cabinet Side #1 LEFT FLIPPER BUTTON Sw. Part Number: 180-5160-00
2: U206	DS-2 Below Playfield #2 LEFT FLIPPER E.O.S (End-of-Stroke) Sw. Part Number: 180-5149-00 on Flipper
3: U206	DS-3 on Cabinet Side #3 RIGHT FLIPPER BUTTON Sw. Part Number: 180-5164-00 Doubled
4: U206	DS-4 Below Playfield #4 RIGHT FLIPPER E.O.S (End-of-Stroke) Sw. Part Number: 180-5149-00 on Flipper
5: U206	DS-5 on Cabinet Side #5 UPPER RT. FLIPPER BUTTON Sw. Part Number: Same as DS-3 above.
6: U206	DS-6 on Coin Door #6 VOLUME (RED BUTTON) (In Test: LEFT) Sw. Part Number: 180-5192-02
7: U206	DS-7 on Coin Door #7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) Sw. Part Number: 180-5192-04
8: U206	DS-8 on Coin Door #8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) Sw. Part Number: 180-5192-00

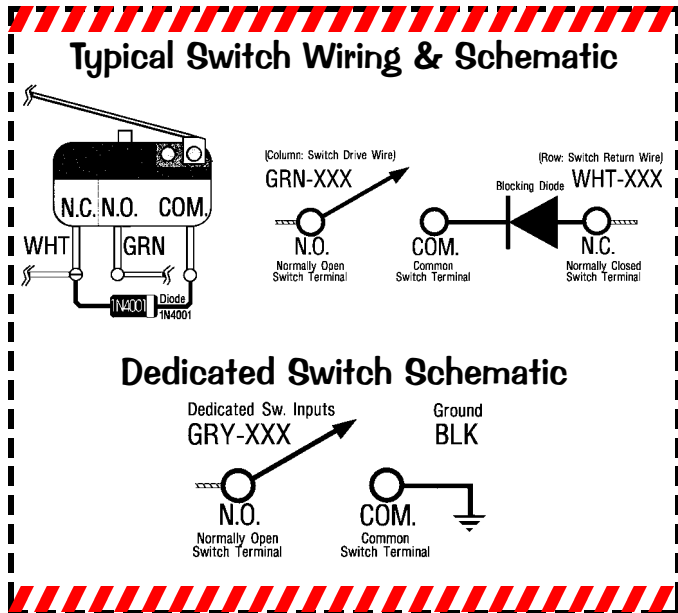
Sec. 3: ... Diagnostics



SWITCH MATRIX GRID LOCATIONS



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



Sec. 3: ... Diagnostics

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: Diode On Iterminal Strip, 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 -00B or -00T can be used for coil replacements. B/T listed is preferable for easier diode access & may differ on game.

PARTIAL COILS DETAILED CHART ...

High Current Coils Group 1		Drive Transistor	Coil GA-Turn or Bulb Type
#1	TROUGH 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	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

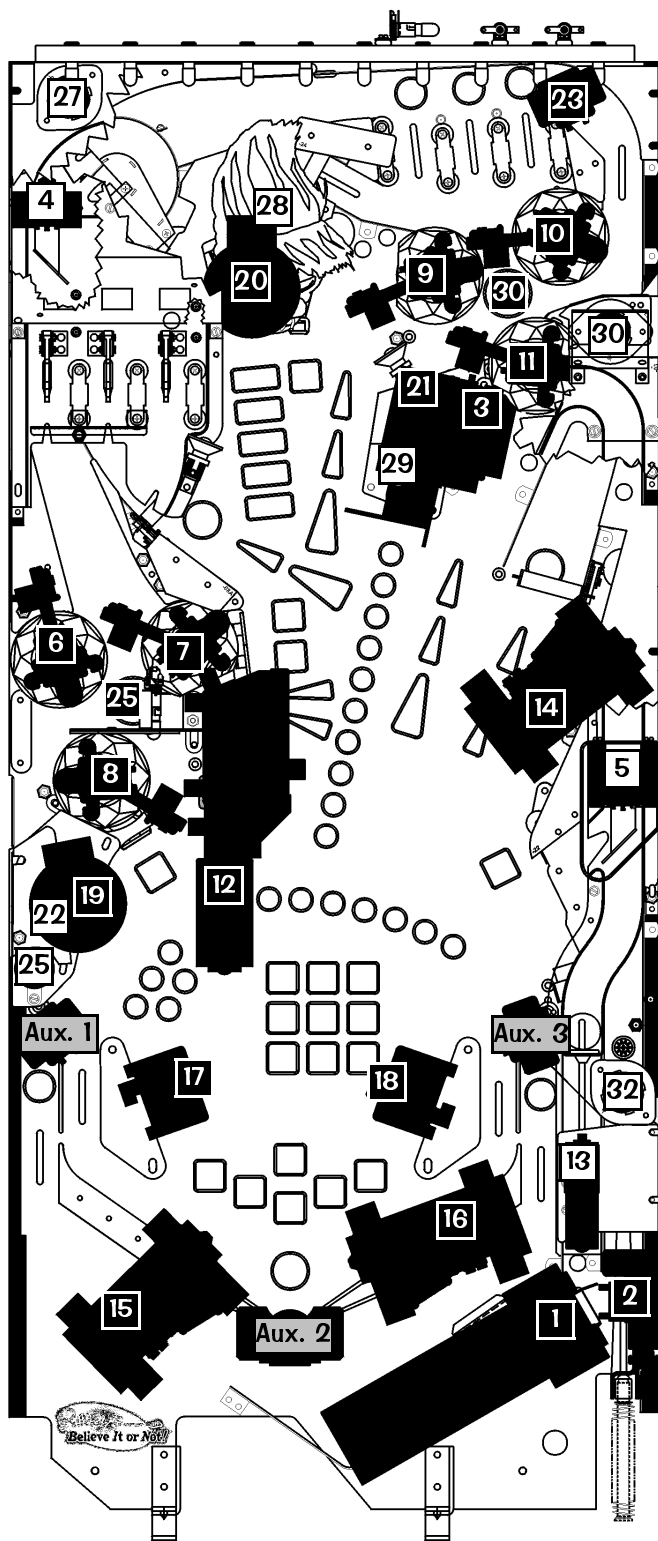
Low Current Coils Group 1		Drive Transistor	Coil GA-Turn or Bulb Type
#17	LEFT SLINGSHOT	Q17	23-800 ⊖ 090-5001-00T
#18	RIGHT SLINGSHOT	Q18	23-800 ⊖ 090-5001-00T
#19	AUX - IDOL MAGNET	Q19	22-650 ⊖ 090-5042-00
#20	AUX - HEAD MAGNET	Q20	22-650 ⊖ 090-5042-00
#21	AUX - VARI RESET	Q21	32-1800 ⊖ 090-5031-00-ND
#22	IDOL OPTO LED	Q22	SWITCHED GROUND
#23	TOP POST	Q23	26-1200 ⊖ 090-5044-00T
#24	OPTIONAL COIL	Q24	Opt. 5v

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	

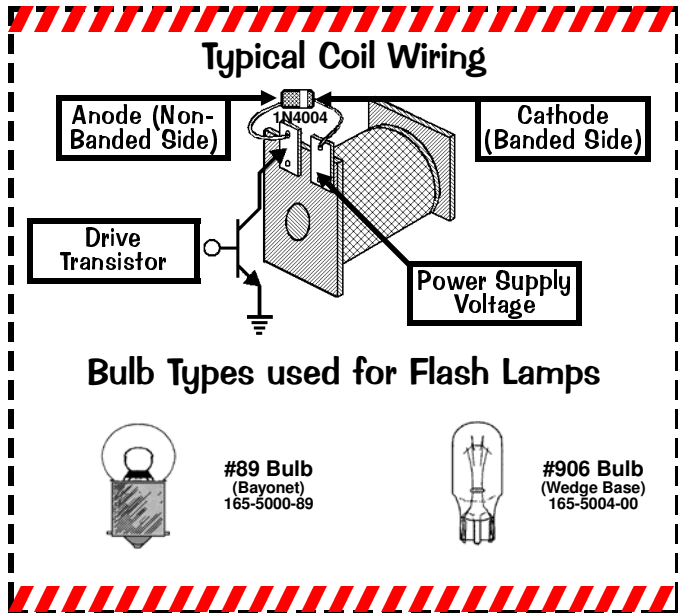


COIL & FLASH LAMP LOCATIONS



Playfield ▲

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



Sec. 3: ... Diagnostics

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

Coil Q24 is Optional. If either a Coin Meter, Token Dispenser or 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 Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#1	TROUGH UPKICKER	Q1	I/O Power Driver	YEL-VIO	J10-P4/5	50v DC	BRN-BLK	J8-P1	26-1200 \cup 090-5044-00B
#2	AUTOLAUNCH	Q2		YEL-VIO	J10-P4/5	50v DC	BRN-RED	J8-P3	23-800 \cup 090-5001-00B
#3	VARI VUK	Q3		YEL-VIO	J10-P4/5	50v DC	BRN-ORG	J8-P4	24-940 \cup 090-5036-00T
#4	LEFT RAMP DIVERTER	Q4		YEL-VIO	J10-P4/5	50v DC	BRN-YEL	J8-P5	32-1800 \cup 090-5031-00
#5	RIGHT RAMP DIVERTER	Q5		YEL-VIO	J10-P4/5	50v DC	BRN-GRN	J8-P6	32-1800 \cup 090-5031-00
#6	LOWER LEFT POP	Q6		YEL-VIO	J10-P4/5	50v DC	BRN-BLU	J8-P7	26-1200 \cup 090-5044-00T
#7	LOWER RIGHT POP	Q7		YEL-VIO	J10-P4/5	50v DC	BRN-VIO	J8-P8	26-1200 \cup 090-5044-00T
#8	LOWER BOTTOM POP	Q8		YEL-VIO	J10-P4/5	50v DC	BRN-GRY	J8-P9	26-1200 \cup 090-5044-00T

High Current Coils Group 2		Drive Transistor	Driver Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#9	UPPER LEFT POP	Q9	I/O Power Driver	YEL-VIO	J10-P4/5	50v DC	BLU-BRN	J9-P1	26-1200 \cup 090-5044-00T
#10	UPPER RIGHT POP	Q10		YEL-VIO	J10-P4/5	50v DC	BLU-RED	J9-P2	26-1200 \cup 090-5044-00T
#11	UPPER BOTTOM POP	Q11		YEL-VIO	J10-P4/5	50v DC	BLU-ORG	J9-P4	26-1200 \cup 090-5044-NL
#12	SCOOP VUK	Q12		YEL-VIO	J10-P4/5	50v DC	BLU-YEL	J9-P5	24-940 \cup 090-5036-00T
#13	LOCK KICKER	Q13		YEL-VIO	J10-P4/5	50v DC	BLU-GRN	J9-P6	23-800 \cup 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 \cup 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 \cup 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 \cup 090-5032-00T

Low Current Coils Group 1		Drive Transistor	Driver Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#17	LEFT SLINGSHOT	Q17	I/O Power Driver	BRN	J7-P1	20v DC	VIO-BRN	J7-P2	23-800 \cup 090-5001-00T
#18	RIGHT SLINGSHOT	Q18		BRN	J7-P1	20v DC	VIO-RED	J7-P3	23-800 \cup 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 \cup 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 \cup 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 \cup 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 \cup 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 Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn or Bulb Type
#25	FLASH: 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 Output Board	Power Line Color	Power Line Connection	Power Voltage	Drive Transistor Control Line Color	D.T. Control Line Connect	Coil GA-Turn
AUX 1: LEFT UP/DOWN POST		Q1	UK 3X Trans. Driver Board	BRN	J7-P1	20v DC	WHT	J2-P3	26-1200 \cup 090-5044-00T
AUX 2: CENTER UP/DOWN POST		Q2		BRN	J7-P1	20v DC	RED	J2-P4	23-1100 \cup 090-5030-00T
AUX 3: RIGHT UP/DOWN POST		Q3		BRN	J7-P1	20v DC	ORG	J2-P7	26-1200 \cup 090-5044-00T

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





Go To Lamp Menu

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



Single Lamp Test

To initiate, from the **LAMP MENU**, select the "ONE" *Icon* with either the **Red or Green Buttons** and press the **Black Button**. Select either the "-" or "+" *Mini-Icons*. Start with the "+" *Mini-Icon* to start the manual **Single Lamp Test** from Column 1, Row 1, Lamp 1. Press the **Black Button** on the "+" *Mini-Icon*, as each lamp is selected, the lamp will light at its location on the playfield as well as the display, indicating the Lamp Matrix Grid Position (*below*), lamp name with the corresponding number, Return (Row) Wire & Color, Drive (Column) Wire & Color, and associated drive transistors. Press the **Black Button** again to move forward in the test. To test and view a particular lamp, select the "RUN" *Mini-Icon* and press the **Black Button**. Each time the **Black Button** is pushed, the lamp will light-up on the playfield, with the display indicating the lamp information. *Continue with the same procedure to run through the entire test.*



Test All Lamps

To initiate, from the **LAMP MENU**, select the "ALL" *Icon* with either the **Red or Green Buttons** and press the **Black Button**. If still in **Single Lamp Test** (*or any 1 of the 4 tests*), select the "PREV" *Mini-Icon* to return to **LAMP MENU** or select either of the "<<" or ">>" *Mini-Icons* to move through the tests, keep activating until **Test All Lamps** is displayed. The display will indicate **ALL LAMPS ON** and the lamps on the playfield will be lit, alternating between the rows in the Lamp Matrix Grid.



Row & Column Lamp Tests

To initiate, from the **LAMP MENU**, select the "ROW" or "COL" *Icon* with either the **Red or Green Buttons** and press the **Black Button**. If still in a previous test, select the "PREV" *Mini-Icon* to return to **LAMP MENU** or select either of the "<<" or ">>" *Mini-Icons* to move through the tests, keep activating until **Row** or **Column Lamp Test** (*whichever desired*) is displayed. In this test, each set of lamps in each Row or Column of the Lamp Matrix Grid (*respective to each test*) will light-up on the playfield and is indicated in the display.

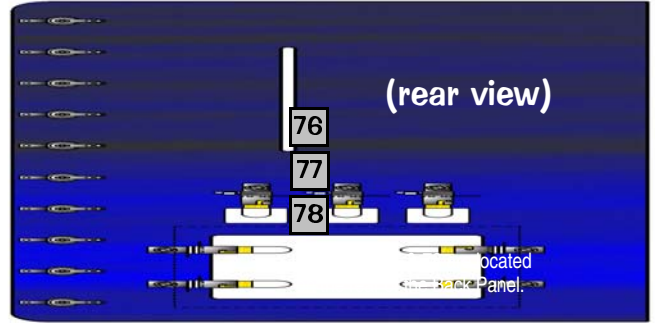
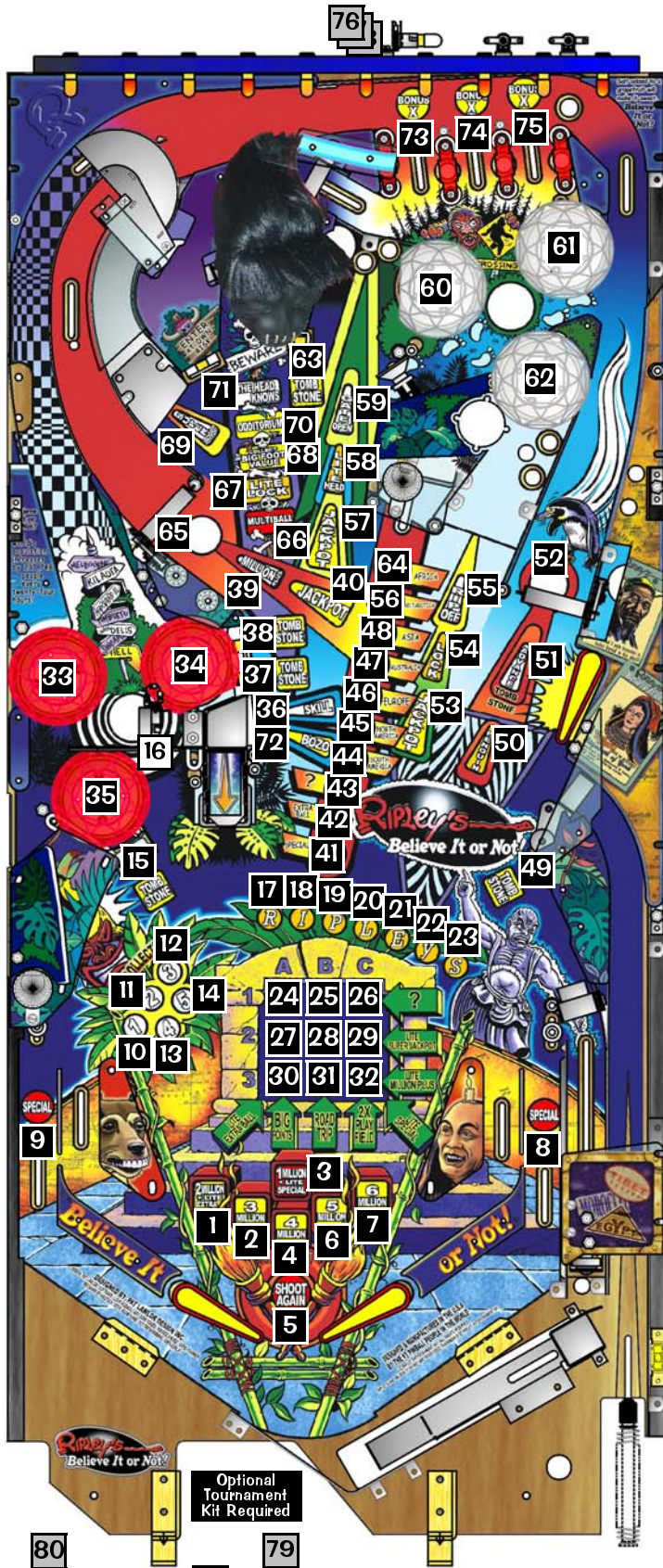
Sec. 3: ... Diagnostics

LAMP MATRIX GRID

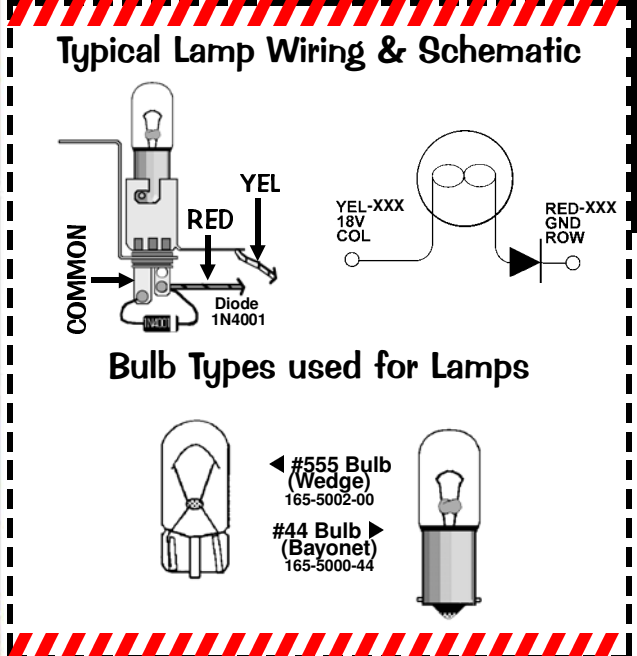
Column (18v)	1: U17	2: U16	3: U15	4: U14	5: U13	6: U12	7: U11	8: U10
Row (Ground)	YEL-BRN J13-P9	YEL-RED J13-P8	YEL-ORG J13-P7	YEL-BLK J13-P6	YEL-GRN J13-P5	YEL-BLU J13-P4	YEL-VIO J13-P3	YEL-GRY J13-P1
1: Q33	1 #555 Bulb RED-BRN J12-P1 SUPER JACKPOT 2 MIL	2 #555 Bulb YEL-RED J13-P8 SUPER JACKPOT 3 MIL	3 #555 Bulb YEL-ORG J13-P7 SUPER JACKPOT 1 MIL	4 #555 Bulb YEL-BLK J13-P6 SUPER JACKPOT 4 MIL	5 #555 Bulb YEL-GRN J13-P5 SHOOT AGAIN	6 #555 Bulb YEL-BLU J13-P4 SUPER JACKPOT 5 MIL	7 #555 Bulb YEL-VIO J13-P3 SUPER JACKPOT 6 MIL	8 #555 Bulb YEL-GRY J13-P1 RIGHT SPECIAL
2: Q34	9 #555 Bulb RED-BLK J12-P2 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	17 #555 Bulb RED-ORG J12-P3 (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	25 #555 Bulb RED-YEL J12-P4 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	33 #555 Bulb RED-GRN J12-P5 LOWER LEFT POP	34 #555 Bulb LOWER RIGHT POP	35 #555 Bulb LOWER BOT POP	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	41 #555 Bulb RED-BLU J12-P6 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	49 #555 Bulb RED-VIO J12-P8 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	57 #555 Bulb RED-GRY J12-P9 CENTER JACKPOT	58 #555 Bulb LITE HEAD	59 #555 Bulb GATE OPEN	60 #555 Bulb UPPER LEFT POP	61 #555 Bulb UPPER RIGHT POP	62 #555 Bulb UPPER BOT POP	63 #44 Bulb TOMBSTONE 4	64 #555 Bulb VARI-TARGET AFRICA
9: Q41	65 #44 Bulb RED-WHT J12-P10 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	73 #555 Bulb RED J12-P11 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



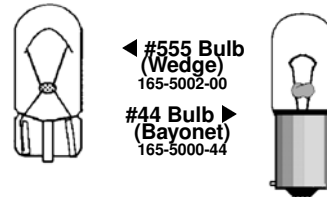
LAMP MATRIX GRID LOCATIONS



- ▲ Backpanel
- ◀ Playfield



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: Diode Qn Terminal Strip, see Section 5, Chapter 2, **Playfield Wiring**.

Sec. 3: ... Diagnostics





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.

Sec. 3: ... Diagnostics

After selecting this *Icon*, and if any of the below criteria is met, the display will indicate *any or all* of the following categories: **POSSIBLY BROKEN SWITCH**, **CHECK SWITCHES** and/or **HYPERSENSITIVE SWITCH** (*Sw. #16, Shooter Lane, is used as an example*). If more than one switch is reported, the Switch Number and Name will cycle within the category, and then will cycle the categories. To return to the **DIAGNOSTICS MENU**, select the "PREV" *Mini-Icon* and press the **Black "ENTER" Button**.

Switch Detection

During game play, activation of switches are monitored. In programming, every switch is given a minimum & maximum value based on the game. The switches are monitored every 5 minutes of game play with a "sliding window" of 15 minutes. If a switch is determined to be faulty, game play is compensated.

- Switches noted as **POSSIBLY BROKEN SWITCH** should be checked, then adjusted or replaced. **Important:** A switch reported as "possibly broken" may actually be an unused switch due to **lack of usage** and **not because they're broken**. This can happen, if a switch is located in a "hard" shot position, and the players are not making the shot. Game programming will still compensate for this unplayed switch.
- Switches noted as **CHECK SWITCHES** are determined to be stuck closed or open depending on switch usage. Free up the switch actuator adjust or replace if necessary.
- Switches noted as **HYPERSENSITIVE SWITCH** means just that, the switch should be readjusted or 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*).



Sec. 3: ... Diagnostics



Service Phone

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



Begin Play Test

To initiate, from the **DIAGNOSTICS MENU**, select the "PLAY" *Icon* with either the **Red "LEFT"** or **Green "RIGHT"** **Buttons** and press the **Black "ENTER"** **Button**. After selecting this *Icon* the technician can test certain play functions to insure all switch activated coils function without entering game play. For example, by rolling the ball over the *Shooter Lane* switch, the *Autoplunger* should fire. If it kicks to early or too late, the switch actuator should be adjusted to compensate for this error. If it fails to fire, use the **Switch Test** or **Coil Test** to help determine the cause of the failure. During this *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*.



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





Fire Knocker

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



Sound / Speaker Test

To initiate, from the **DIAGNOSTICS MENU**, select the "SPKR" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. The BSMT 2000 Sound System produces true digital stereo sound from Backbox & Cabinet Speakers or "Mono" on the Cabinet Speaker (when used by itself). After selecting this *Icon*, select the "-" or "+" *Mini-Icons* and press the **Black "ENTER" Button** to *activate* the first test. Repeat to visually see & hear all tests. Select the "RUN" *Mini-Icon* to *activate* the test chosen without moving to the next test.

Note: During Sound Tests, the display shows the speaker identification and the corresponding sound(s). The sound functions allow verification that both channels are functioning properly & that the speaker connections are correct.

Speaker Phase Testing

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

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

Sec. 3: ... Diagnostics

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

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

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



Begin Burn In

To initiate, from the **DIAGNOSTICS MENU**, select the "BURN" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. After selecting this *Icon* the **Begin Burn-In Test** will start. At this stage the game will exercise all CPU I/O Functions (**Dot Matrix Display Test, Coil Testing, Lamp Testing, Sound...**, etc.). This is provided to constantly exercise sounds, coils, etc... Cumulative Burn-In minutes will be displayed. **Note:** To reset Burn-In minutes to 00 see Section 3, Chapter 6, GO TO RESET MENU, Factory Reset. **Caution:** Performing a Factory Reset will reset all other information as well.



Dot Matrix Test

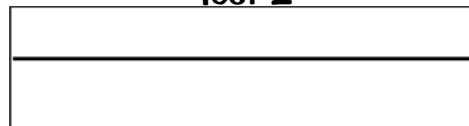
To initiate, from the **DIAGNOSTICS MENU**, select the "DOT TEST" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Buttons** and press the **Black "ENTER" Button**. After selecting this *Icon* the **Dot Matrix Test** immediately begins. **Note:** Pressing any button will exit the test & return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

Test 1



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

Test 2



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





Dot Matrix Test Continued

Test 3



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**.



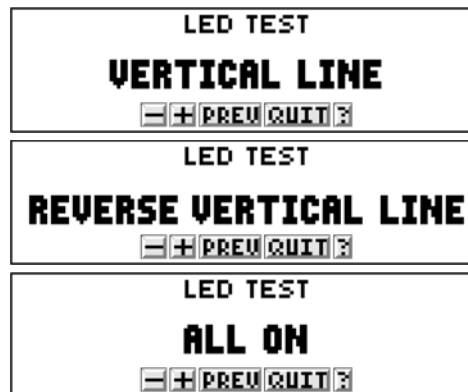
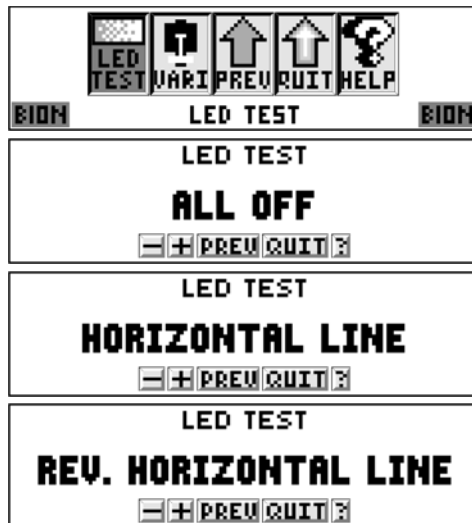
Ripley Specific

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.

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

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

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-Target 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.



Ripleys Specific Continued



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 energize, resetting 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.

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).

Sec. 3: ... Diagnostics

Position 2 - Switch 41 is closed.



Position 3 - Switches 41 / 43 are closed.



Position 4 - Switch 43 is closed.



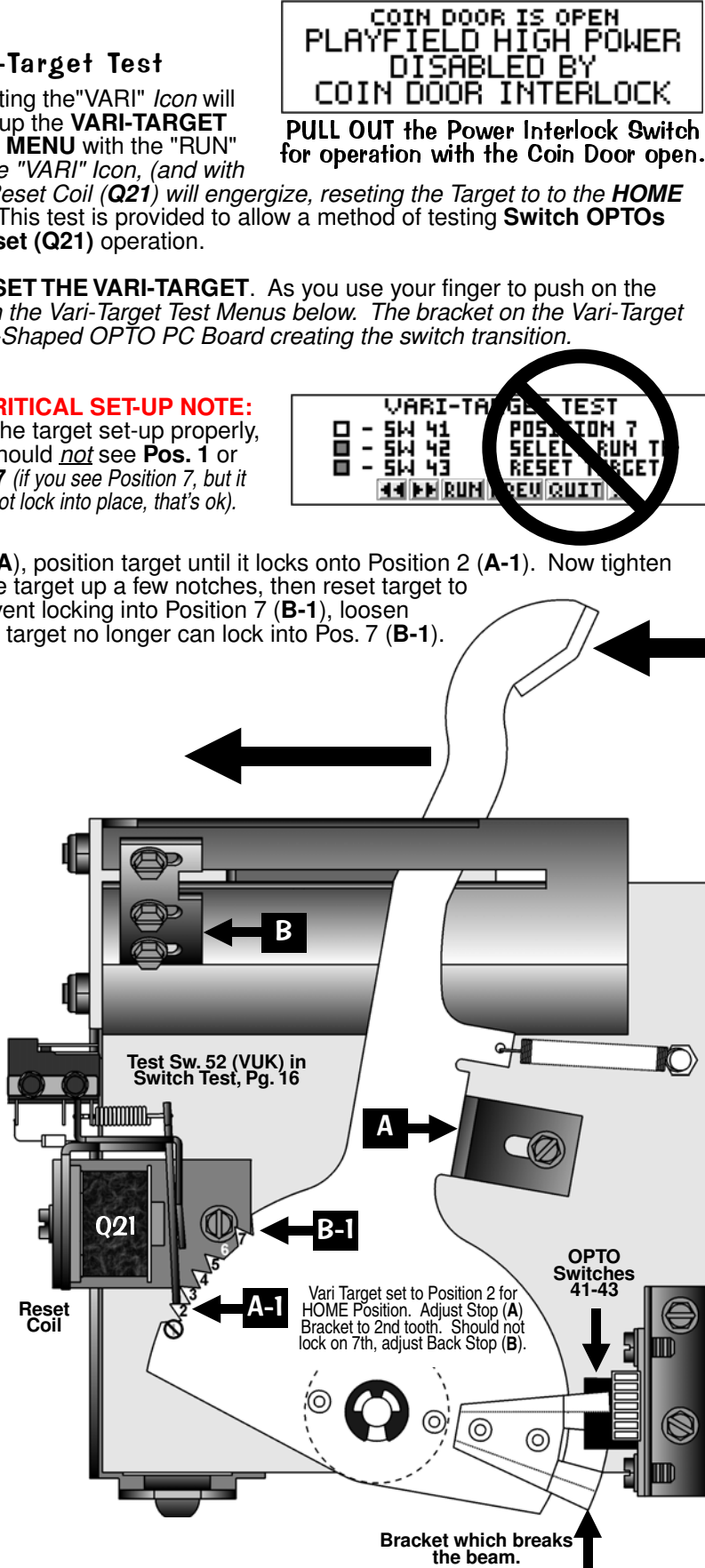
Position 5 - No Switches are closed.



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.



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

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

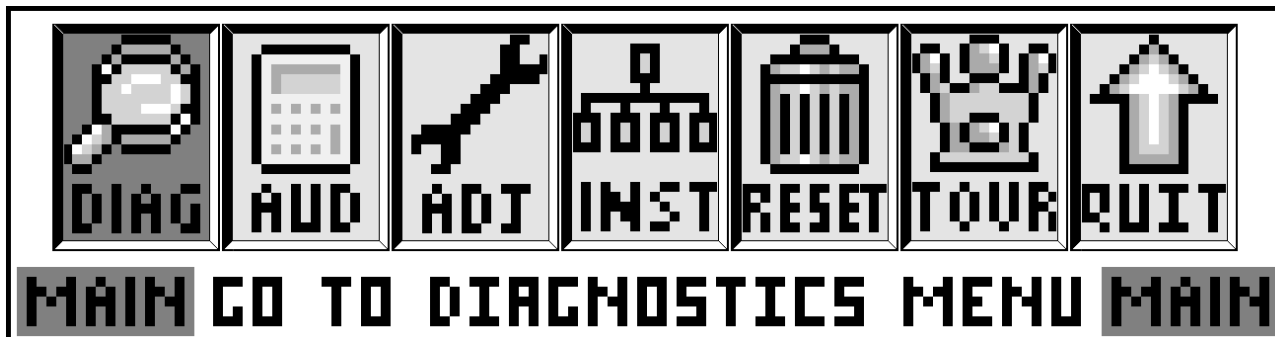


Go To Fuse Table

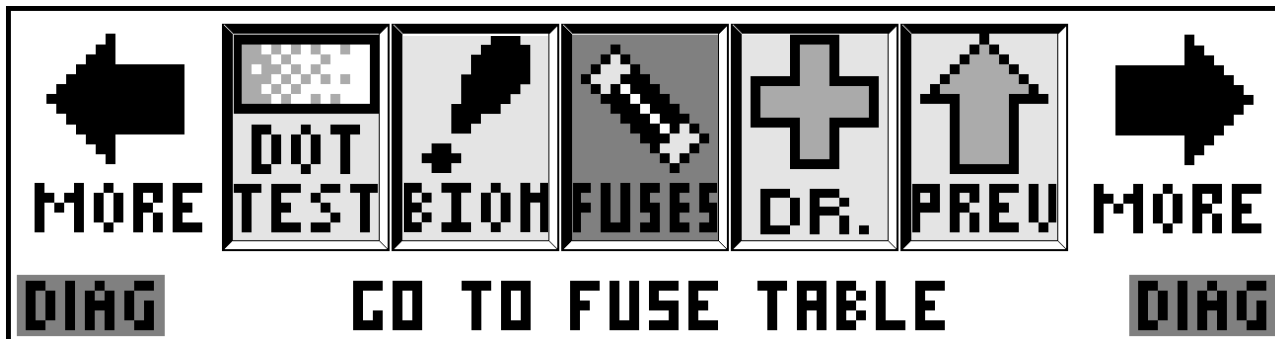
To initiate, from the **DIAGNOSTICS MENU**, select the "FUSES" *Icon* with either the Red "LEFT" or Green "RIGHT" Buttons and press the Black "ENTER" Button. The **FUSE TABLE MENU** now appears. This provides the technician with the current **Fuse Table** for this game (also noted on a decal in the Backbox). 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. 1 (front of this manual).

Example:

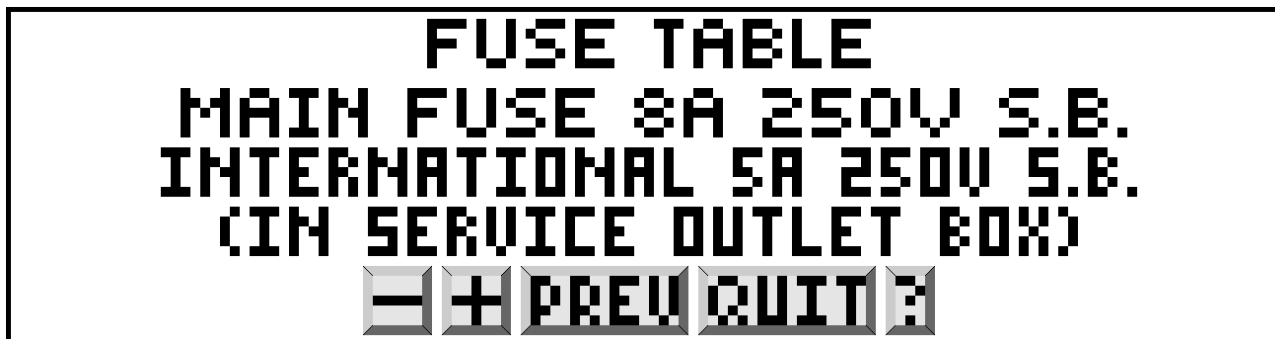
After entering **Portals™**, the **MAIN MENU** now appears with the "DIAG" *Icon* (GO TO DIAGNOSTICS MENU) flashing:



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



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

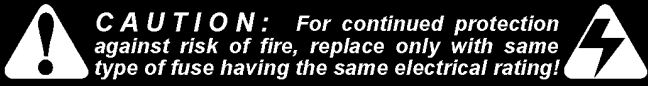


Select and *activate* the "+" *Mini-Icon* to view the next fuse in the group. Continue to select either the "+" or "-" *Mini-Icons* to view each fuse one at a time. The display will describe the fuse identification number (e.g. Main, F1, F6, F7, etc.), rating of fuse (e.g. 5A 250v S.B. - i.e. 5 Amp,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

Go To Fuse Table continued on the next page.



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



QUICK REFERENCE FUSE CHART

Backbox Fuses

LOC: DISPLAY POWER SUPPLY (P.S.) BOARD			
F1	3/4A 250v S.B.	90v DC	High Voltage Display
LOC: I / O POWER DRIVER BOARD			
F6	7A 250v S.B.	50v DC	Primary High Power Coils/Flippers
F7	5A 250v S.B.	20v DC	Low Power Coils
F8	5A 250v S.B.	12v DC	Logic Power
F9	5A 250v S.B.	12v DC	Logic Power
F20	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

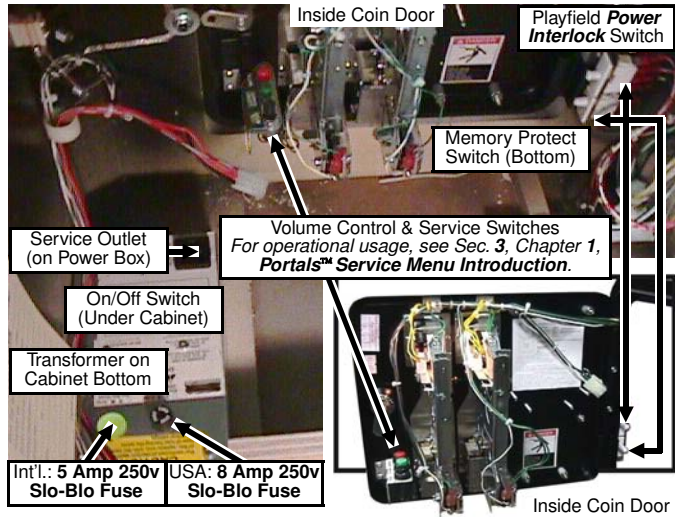
Cabinet Fuses

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

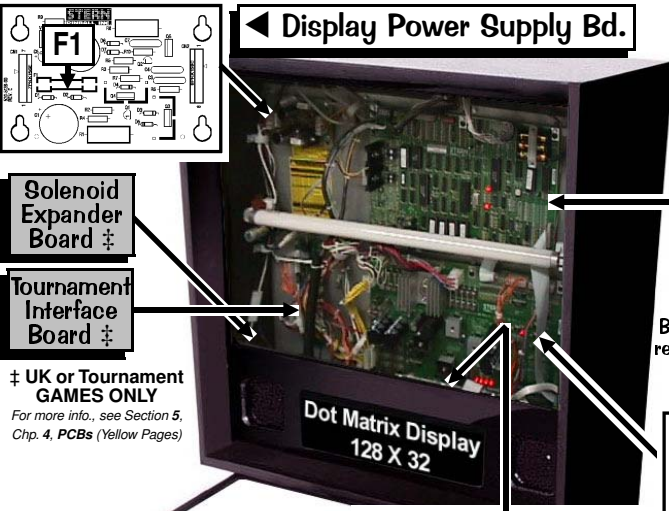
LOC: UNDER PLAYFIELD (near Flippers)			
n/a	3A 250v S.B.	50v DC	Right Flipper (BLU-YEL↔RED-YEL)
n/a	3A 250v S.B.	50v DC	Left Flipper (GRY-YEL↔RED-YEL)
n/a	3A 250v S.B.	50v DC	Upr. Rt. Flip. (BLU-YEL↔RED-YEL)

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

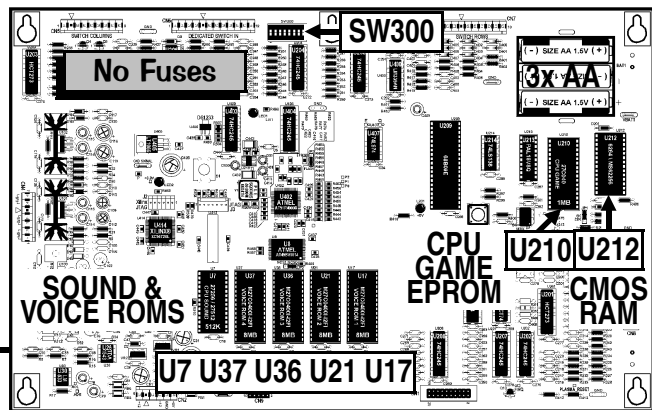
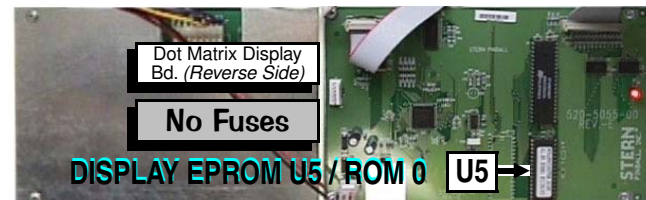
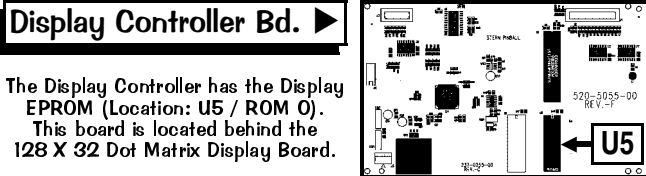


ROM TYPE on BD	LOCATION	SIZE	PART NUMBER
CPU Sound	U7	512K	965-0408-81
CPU Game	U210	1 MB	965-0409-81
CPU Voice ROM 1	U17	8 MB	965-0410-81
CPU Voice ROM 2	U21	8 MB	965-0411-81
CPU Voice ROM 3	U36	8 MB	965-0412-81
CPU Voice ROM 4	U37	8 MB	965-0413-81
DISPLAY Controller	U5	4 MB	965-0414-81

Sec. 3: ... Diagnostics



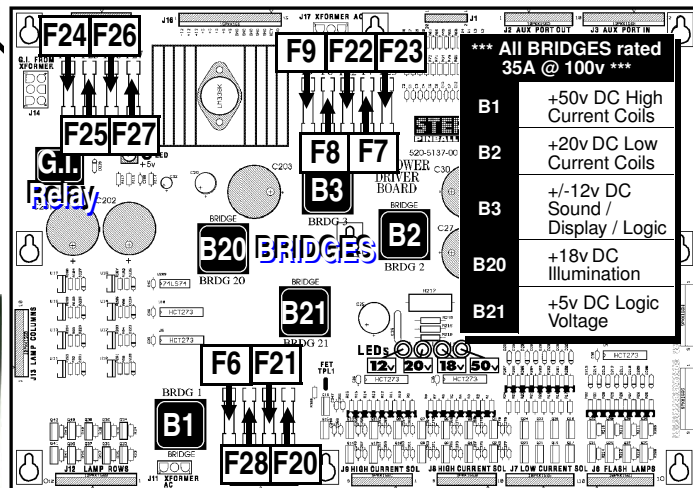
‡ UK or Tournament GAMES ONLY
For more info., see Section 5, Chp. 4, PCBs (Yellow Pages)



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

CPU/Sound Bd. II w/ATMEL ▲

I/O Power Driver Board ▼



*** All BRIDGES rated 35A @ 100v ***	
B1	+50v DC High Current Coils
B2	+20v DC Low Current Coils
B3	+/- 12v DC Sound / Display / Logic
B20	+18v DC Illumination
B21	+5v DC Logic Voltage





Dr. Pinball

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



Coil Flow Chart

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



Switch Flow Chart

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



Lamp Flow Chart

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

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



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



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



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



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

Copy this page for Field Audit Tracking Performance

STARTING METER Reading :

STARTING METER Date (MM/DD/YR) :

AUDITOR'S NAME :

CURRENT METER Reading :

AUDIT Date (MM/DD/YR) :

CPU Version :

DISPLAY Version :

CURRENT VOLUME SETTING:

GAME LOCATION NAME :

EARNINGS & STANDARD AUDIT TABLES

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

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

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

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

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

Sec. 3: Go To Audits



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*.



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

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



GO TO AUDITS MENU

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



Earnings Audits (01-14)

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

Nr.	EARNINGS AUDIT NAME: Definition
01	TOTAL PAID CREDITS: Provides the total number of <i>Paid Credits</i> .
02	FREE GAME PERCENTAGE: Provides the percentage total by dividing Standard Audit 13, TOTAL FREE PLAYS , by Standard Audit 14, TOTAL PLAYS .
03	AVERAGE BALL TIME: In seconds, the average ball time is derived from the total play time divided by Standard Audit 01, TOTAL BALLS PLAYED .
04	AVERAGE GAME TIME: The average game time is expressed in minutes and seconds (0:00).
05	COINS THRU LEFT SLOT: Provides the total number of times Coin Mechanism Switch 06 was closed.
06	COINS THRU RIGHT SLOT: Provides the total number of times Coin Mechanism Switch 04 was closed.
07	COINS THRU CENTER SLOT: Provides the total number of times Coin Mechanism Switch 05 was closed.
08	COINS THRU 4TH SLOT: Provides the total number of times Coin Mechanism Switch 02 was closed.
09	COINS THRU 5TH SLOT: Provides the total number of times Coin Mechanism Switch 07 was closed.
10	COINS THRU 6TH SLOT: Provides the total number of times Coin Mechanism Switch 03 was closed.
11	TOTAL COINS: Provides the total amount of coins registered through all the <i>Coin Slots</i> .
12	TOTAL EARNINGS: The total cash value accumulated since the last Factory Reset occurred. See Section 3, Chapter 6, GO TO RESET MENU , Reset Coin Audits .
13	METER CLICKS: Provides the total number of money clicks accumulated. <i>Based on the country's lowest coin denomination used for the game credit.</i>
14	SOFTWARE METER: Provides the continuing total of Meter Clicks. <i>This audit cannot be reset; the display shows the constant addition of Meter Clicks.</i>





Standard Audits (01-68)

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

Nr.	STANDARD AUDIT NAME: Definition
01	TOTAL BALLS PLAYED: Provides the total number of <i>Regular</i> and <i>Extra Balls</i> .
02	TOTAL EXTRA BALLS: Provides the total number of <i>Extra Balls</i> awarded.
03	EXTRA BALLS PERCENT: Provides the percentage total by dividing Standard Audit 02, TOTAL EXTRA BALLS , by Standard Audit 14, TOTAL PLAYS .
04	REPLAY 1 AWARDS: Provides the total <i>Awards (Credits, Extra Balls or Scores)</i> for Level 1.
05	REPLAY 2+ AWARDS: Provides the total <i>Awards (Credits, Extra Balls or Scores)</i> for Level 2 or higher.
06	TOTAL REPLAYS: Provides the total <i>Awards (Credits, Extra Balls or Scores)</i> for exceeding <i>Replay Score Levels</i> .
07	REPLAY PERCENT: Provides the percentage total from dividing Standard Audit 06, TOTAL REPLAYS , by Standard Audit 14, TOTAL PLAYS . The percentage reflects replay total awards for exceeding replay score levels.
08	TOTAL SPECIALS: Provides the total <i>Awards (Credits, Extra Balls, or Scores)</i> for making <i>Specials</i> .
09	SPECIAL PERCENT: Provides the percentage total by dividing Standard Audit 08, TOTAL SPECIALS , by Standard Audit 14, TOTAL PLAYS .
10	TOTAL MATCHES: Provides the total <i>Credits</i> awarded for matching the last two digits of the score with the <i>System-Generated Match Number</i> at the end of the game. Percentage of <i>Match Credits</i> is adjustable from 0% to 10% by Standard Adjustment 13, MATCH PERCENTAGE , if enabled. See Section 3, Chapter 4, GO TO ADJUSTMENTS MENU, Standard Adjustments .
11	HIGH SCORE AWARDS: Provides the total <i>Awards (Credits, Extra Balls, or Scores)</i> for exceeding the High-Score-To-Date scores.
12	HIGH SCORE PERCENT: Provides the percentage total by dividing Standard Audit 11, HIGH SCORE AWARDS , by Standard Audit 14, TOTAL PLAYS .
13	TOTAL FREE PLAYS: Provides the total <i>Free Credits</i> for <i>Replays, High-Score-To-Date, Specials and Match</i> .
14	TOTAL PLAYS: This total is derived by adding the sum of Earnings Audit 01, TOTAL PAID CREDITS , and Standard Audit 13, TOTAL FREE PLAYS . <i>Note: Free Credits are not recorded in the Audit until they are actually used.</i>
15	0 – 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 <i>Final Score</i> of each game to a table and dividing this sum by Standard Audit 14, TOTAL PLAYS .

Standard Audits 33-68 continued on the next page.



Sec. 3: Go To Audits



- 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 "N^o of copies printed" count total appearing in the display. **Operational Usage Note:** Activating the "QUIK" Icon (in the previous Quick Printout) **without the special equipment and unique software, will still provide a "count total" in this Reset Printer Menu, which does not affect the operation of the Portals™ Service Menu System in any way.** Activating this "RESET" Icon will reset the "count total" in the display to **00**.

Sec. 3: Go To Audits



FEATURE AUDIT ABBREVIATIONS USED IN THIS CHAPTER:

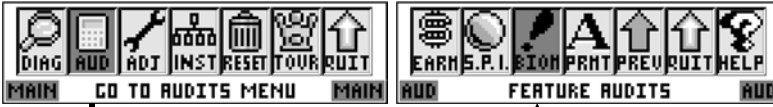
?		AWD		EB	
Mystery		Awarded		Extra Ball	
	S.		SJ		MIL
	Super		Super Jackpot		Million
VARI		X		2X	
Variable		Variable Number		Double	



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



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	

Comments:

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



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	

Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
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.

Sec. 3: Adjustments



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	

Nr.	ADJUSTMENT NAME	USA DEFAULT	YOUR SETTING
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.



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 Adjustment 46, Q24 Option, must be changed accordingly.*

04 **REPLAY LEVELS:** Set between **1 - 4** for the number of Replay Levels to be active. Default is **1: 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 Autopercentageing 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**.

Sec. 3: Adjustments

The Dip Switch Settings (Sw. 300) on the CPU/Sound Board for each Country **must match with what is shown in the USA & Int'l. Standard Pricing Select Tables** for your country to have correct operation (see the next page). For a **Standard Selection (USA or International)**: Select & activate either of the "-" or "+" Mini-Icons to move backward or forward in the Display; With your choice appearing in the display, select & activate the ">>" Mini-Icon to advance and "lock-in" the change (display will momentarily flash **REQUEST INSTALLED**).

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

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

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

In **Example 1**, note the **LEFT (and RIGHT) COIN: 3 PULSES** and **ONE CREDIT: 4 PULSES**. Since every Coin inserted produces 3 Pulses & every Credit requires 4 Pulses, 2 Coins (50c) will produce 6 Pulses (4 Pulses for the 1st Credit + 2 Pulses remains in escrow). The 3rd Coin (75c) provides another 3 Pulses for a total of 5 Pulses (4 Pulses for the 2nd Credit + 1 Pulse remains in escrow). The 4th Coin (\$1.00) provides another 3 Pulses for a total of 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:
25c	\$1.00	25c	Not Used	1 /50c	2 /75c	7 / \$2.00	3	12	3	1	4	24	0	1	0	1	1	4	1	1
Coin Mechanisms Used				Pricing Scheme Desired				PULSES	PULSES	PULSES	PULSE	PULSES	PULSES	PULSES	CREDIT	CREDITS	CLICK	CLICKS	CLICK	CLICK

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

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

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

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

In **Example 4**, a **Pricing Scheme** using a different currency (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.





USA & International Standard Pricing Select Tables

CPU/SOUND BOARD DIP SWITCH 300 SETTING	COUNTRY SETTING OPTION(S)	COIN MECHANISMS (SWITCHES)					PRICING SCHEME			Requires SPI Coin Card(s) Part Number
		COINS THRU ... SLOT:					Number of Plays (Credits) for Price Amount Shown See "Appendix J" for Coin Cards Examples & Info!			
		LEFT	CENTER	RIGHT	4TH	5TH				
Pos. 1 2 3 4 5 6 7 8 ON OFF	USA 1 USA 2 USA 3 USA 4 USA 5 » USA 6 USA 7 USA 8		\$.25	\$ 1.00	\$.25		1 /\$.25 1 /\$.50 1 /\$.50 1 /\$.50 1 /\$.50 1 /\$.50 1 /\$.50 1 /\$.50	2 /\$.75 3 /\$1.00		755-5400-01 755-5400-02 755-5400-02 755-5400-02 755-5400-00 755-5400-00 755-5400-00 755-5400-00
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).										
Pos. 1 2 3 4 5 6 7 8 ON OFF	Austria Euro 9	€ .50	€ 1.00	€ 2.00			1 /€1.00	2 /€1.50	3 /€2.00	755-5401-09
Pos. 1 2 3 4 5 6 7 8 ON OFF	Australia 1 « Australia 2	20¢	\$A1	\$A2			1 /\$A1 1 /\$A1	3 /\$A2		755-5406-00 (Side 1)
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).										
Pos. 1 2 3 4 5 6 7 8 ON OFF	Belgium Euro 1	€ .50	€ 1.00	€ 2.00			1 /€ .50			755-5401-01
Pos. 1 2 3 4 5 6 7 8 ON OFF	Canada	Can\$.25	Can\$.25	Can\$1	Can\$2		1 /50¢	2 /75¢	3 / Can\$1	755-5400-00 or -01 or -02
Pos. 1 2 3 4 5 6 7 8 ON OFF	Denmark 1 « Denmark 2	1 DKr	5 DKr	10 DKr	20 DKr		1 /3 DKr 1 /2 DKr	2 /5 DKr 3 /5 DKr	7 /10 DKr	755-5402-00 (2-Sided)
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).										
Pos. 1 2 3 4 5 6 7 8 ON OFF	Finland Euro 8	€ .50	€ 1.00	€ 2.00			1 /€1.00	3 /€2.00		755-5401-08
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).										
Pos. 1 2 3 4 5 6 7 8 ON OFF	France Euro 10	0,50 €	1,00 €	2,00 €			1 /1,00 €	3 /2,00 €	7 /3,00 €	755-5401-10
Germany: For different Euro Pricing Scheme (other than below settings), go to Adjustment 11 and scroll to Custom for this Unique Coin Door & Mech.										
Pos. 1 2 3 4 5 6 7 8 ON OFF	Germany 1 Germany 2 Germany 3	€ 0,50	€ 1,00	€ 2,00			1 /0,50¢ 1 /0,50¢ 1 /0,50¢	5 /€2.00 6 /€2.00		755-5401-01 755-5401-02 755-5401-04
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).										
Pos. 1 2 3 4 5 6 7 8 ON OFF	Greece Euro 6	€ .50	€ 1.00	€ 2.00			2 /€ .50			755-5401-06
Italy: For different Euro Pricing Scheme (other than below settings), go to Adjustment 11 and scroll to Custom for this Unique Coin Door & Mech.										
Pos. 1 2 3 4 5 6 7 8 ON OFF	Italy 1 « Italy 2	€ .50		€ .50			1 /.50¢ 1 /€1.00	3 /€2.00		755-5401-01 & 755-5401-08
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).										
Pos. 1 2 3 4 5 6 7 8 ON OFF	Netherlands Euro 3	€ .50	€ 1.00	€ 2.00			1 /€ .50	3 /€1.00		755-5401-03
Pos. 1 2 3 4 5 6 7 8 ON OFF	New Zealand 1 « New Zealand 2	\$NZ1		\$NZ2			1 /\$NZ1 1 /\$NZ1	3 /\$NZ2		755-5406-00 (Side 2)
Pos. 1 2 3 4 5 6 7 8 ON OFF	Norway 1 « Norway 2	10 NKr	5 NKr	20 NKr			1 /5 NKr 1 /10 NKr	3 /20 NKr		755-5403-00 (2-Sided)
Portugal: For different Euro Pricing Scheme (other than below settings), go to Adjustment 11 and scroll to Custom for this Unique Coin Door & Mech.										
Pos. 1 2 3 4 5 6 7 8 ON OFF	Portugal	€ .50		€ .50			1 /€ .50			755-5401-01
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).										
Pos. 1 2 3 4 5 6 7 8 ON OFF	Spain Euro 3	€ .50	€ 1.00	€ 2.00			1 /€ .50	3 /€1.00		755-5401-03
Pos. 1 2 3 4 5 6 7 8 ON OFF	Sweden 1 « Sweden 2	1 SKr	5 SKr	10 SKr			1 /10 SKr 1 /5 SKr	2 /15 SKr 3 /20 SKr		755-5404-00 (2-Sided)
Pos. 1 2 3 4 5 6 7 8 ON OFF	Switzerland 1 « Switzerland 2	1 SwF	2 SwF	5 SwF			1 /1 SwF 1 /1 SwF	6 /5 SwF 3 /2 SwF	9 /5 SwF	755-5405-00 (2-Sided)
Pos. 1 2 3 4 5 6 7 8 ON OFF	UK 1 UK 2 UK 3 UK 4 UK 5 « UK 6		10p	50p	£1	20p	£2			755-5407-00 755-5407-01* 755-5407-01 755-5407-01* 755-5407-01 755-5407-01*
UK also utilizes the 5th Coin Slot Switch (not available with Custom Pricing). *use blank side										

Sec. 3: Adjustments

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.





Euro Summary Pricing Select Table

Pos.	1	2	3	4	5	6	7	8	Alternate Settings	LEFT	CENTER	RIGHT	4TH			
ON	S	E	E	A	B	O	V	E	Euro 1					1 / €50		755-5401-01
OFF	S	E	T	T	I	N	G	S	Euro 2					1 / €50	5 / €2.00	755-5401-02
									Euro 3					1 / €50	3 / €1.00	755-5401-03
									Euro 4					1 / €50	6 / €2.00	755-5401-04
									Euro 5					1 / €50	3 / €1.00	755-5401-05
									Euro 6	€50	€1.00	€2.00	optional	2 / €50		755-5401-06
									Euro 7				optional	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	755-5401-09
									Euro 10					1 / €1.00	3 / €2.00	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 (High Score To Date)**. Set the number of games between "automatic resets of High Score Levels" to "Default Scores" for **ONLY** Standard Adj. 24-27, **Default High Score #1-#4**.

29 **HIGH SCORE INITIALS:** Set to **3 INITIALS** or **10 LETTER**. Default is **3 INITIALS**. When set to **3 INITIALS**, the player is allowed only 3 initials to input. When set to **10 LETTER NAME**, the player is allowed to enter 10 initials to input.

30 **FREE PLAY:** Set to **YES** or **NO**. Default is **NO**. When set to **YES**, no coins are required for **Game Play**.

31 **CUSTOM MESSAGE:** Set to **ON**, **CHANGE** or **OFF**. Default is **ON**. When set to **CHANGE**, a new message can be set or the old one can be edited (select the "+" Mini-Icon to change settings until "CHANGE" appears in the display, then select the ">>" Mini-Icon to access.). This adjustment can be accessed in two (2) ways by either selecting the "S.P.I." Icon and advancing to this Adjustment, or can be directly accessed by selecting the "ABCD CUST MSG" Icon in the **ADJUSTMENTS MENU**.

View the Custom Message Shortcut summary (end of this chapter) for how to enter text or symbols.

Standard Adjustments 32-48 continued on the next page.





- 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.**

Sec. 3: Adjustments

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 <u>ORBITS</u> 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 <u>SPINNER SPINS</u> 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 <u>VARI-TARGET HITS</u> 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 <u>TOMBSTONES</u> 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 <u>JACKPOTS</u> 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 <u>HEAD HITS</u> 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 <i>player-to-player</i> .
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 <u>IDOLS</u> 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 <u>IDOLS</u> 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.



Sec. 3: Adjustments



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



Go To Installs Menu

Overview

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



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



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

- 1.: **Manually** change the **Standard & Feature Adjustments** Settings (perform task in the **ADJUSTMENTS MENU**, see **Section 3, Chapter 4, GO TO ADJUSTMENTS MENU**).
- 2.: **Install Factory** (see opposite this page) on how to reset all of the **Standard & Feature Adjustments** back to the **Factory Default Settings**.

Multiple **Installs** can be set to vary game play; however, for **Installs** that have **one or more** Adjustments in common, the **last** "Install" selected & **activated**, will **supersede** any previously changed Adjustment(s) from any prior **Installs**. Any adjustments which you changed and are not affected by the **Install** will remain as set.

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

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



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



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



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



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

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

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



GO TO INSTALLS MENU

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

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



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

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



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 DIRECTOR'S 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 COMPETITION *	FREE PLAY COMP. *	INSTALL HOME PLAY	FILM STAR RESET	INSTALL NOVELTY	INSTALL ADD-A-BALL	INSTALL FACTORY
01	REPLAY TYPE					NONE		CAUTION! : Upon selection of Install Factory ("FACT" Icon), all Standard & Feature Adjustments which were changed in the INSTALLS or ADJUSTMENTS MENU are returned to the Factory Defaults (see the Adjustment Tables on Page 38 for details).
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***					

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

Sec. 3: Go To Installs

Overview of Feature Adjustment Changes upon selection of an Install:

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



Nr.	FEATURE ADJUSTMENT NAME	INSTALL EXTRA EASY	INSTALL EASY	INSTALL NORMAL (FACTORY)	INSTALL HARD	INSTALL EXTRA HARD	INSTALL DIRECTOR'S CUT	INSTALL 3-BALL	INSTALL 5-BALL
01	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 DIRECTOR'S 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 COMPETITION *	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).

Sec. 3: Go To Installs



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.

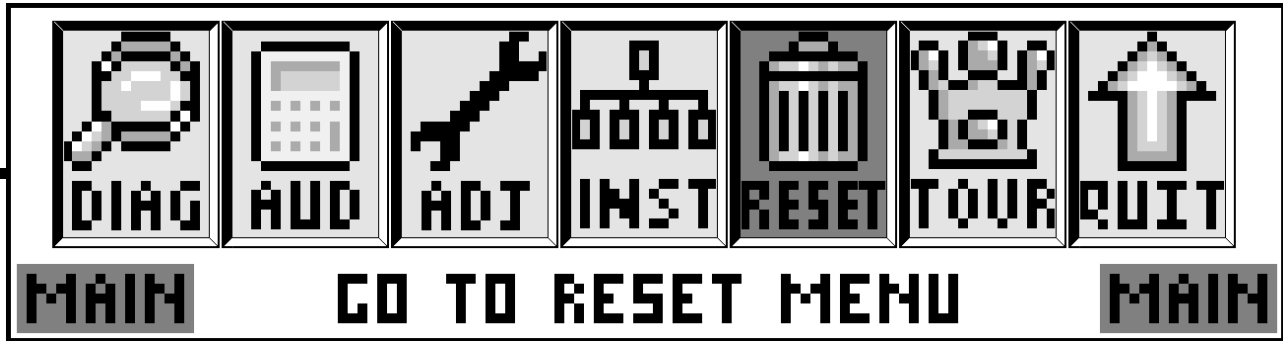


Factory Reset

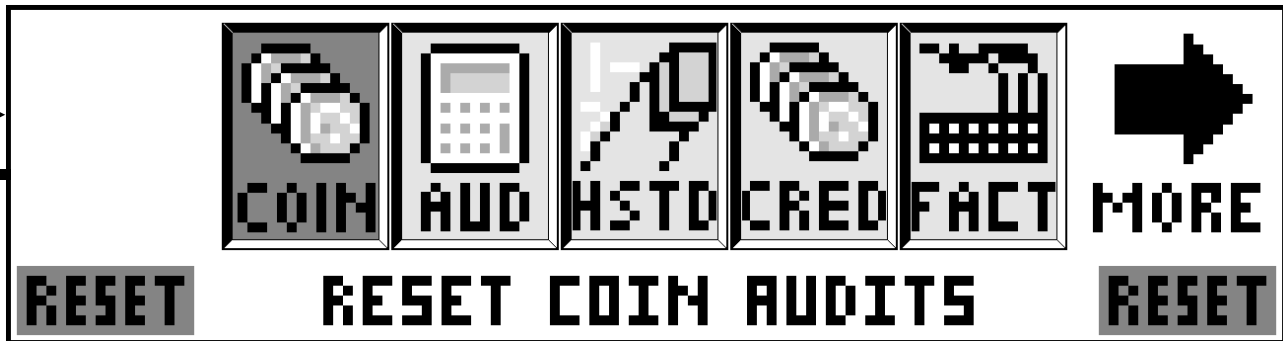
To initiate, from the **RESET MENU**, select the "**FACT**" icon with either the **Red** or **Green Buttons** and press the **Black Button**. **All Audits (except for Audit 14, Software Meter), all Adjustments and Installs** will be reset to the *Factory Default Settings*. **Note:** To **RESET ONLY** 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**).

**REQUEST
INSTALLED**

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

Sec. 3: Go To Reset





Go To Tournament Menu

Overview

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

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



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.

? For more details on the equipment & hardware required, Installation and Set-up, read the **ToPS™ Tournament Pinball System Kit Installation Manual** (SPI Part Number: 780-6011-01) provided in the **Optional Tournament Kit** (SPI Part Number: 502-5011-00), not included with this *ToPS™ Ready Pinball Game*.

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

To order, contact your local Distributor (*view Pages DR. 8 & 9 in the Find-It-In-Front: Dr. Pinball*). You can also call Technical Support or visit our website (*details on the back cover of this manual*).



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



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



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



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



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



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



Select and activate to:
Move **LEFT** or **RIGHT**, select previous / next or move backwards / forwards.
DECREMENT (-) or INCREMENT (+) displayed value or select previous / next.

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



GO TO TOURNAMENT MENU (OPTIONAL USE ONLY)

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

Tournament Adjustment & Audit Tables on the next page.





TOURNAMENT ADJUSTMENT TABLES

TOURNAMENT ADJUSTMENTS 01-13

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

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

11	ACCUM. JACKPOT
12	# TOURNAMENTS





Tournament Adjustments (01-13)

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

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

IMPORTANT FOR TOURNAMENT USERS: *Select the settings carefully.* Before allowing players to begin after you've started a Tournament, double-check the **Normal Mono-Color Dot Display** and **Top Multi-Color Dot (Beta Brite®) Display** to ensure everything you want is displayed correctly. Once a Tournament is started, no adjustments can be made until you end the Tournament (*by selecting the "END" Icon*). Allowing players to qualify, then ending a Tournament prematurely to make corrections will affect the outcome of the Tournament.

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

Nr.	TOURNAMENT ADJUSTMENT NAME: Definition	
01	CREDITS PER PLAY: Set between 01 - 10 . Default is 02 . Set the maximum number of <i>Credits</i> that may be accumulated per game.	
02	JACKPOT BASE: Set between \$00.00 - \$999,999.00 (<i>increments of \$1</i>). Default is \$20.00 . Set the initial <i>Prize Pool Amount</i> to be offered for the Tournament. Note: <i>The displays will present the words "PRIZE POOL" in lieu of the word "JACKPOT".</i>	
03	JACKPOT INCREMENT: Set between \$00.00 - \$999,999.99 (<i>increments of 1¢</i>). Default is \$00.50 . Set the <i>Prize Pool Increment</i> which will increase the <i>Prize Pool Amount</i> with each Tournament Game played.	
04	JACKPOT MAX.: Set between \$00.00 - \$999,999.00 (<i>increments of \$1</i>). Default is \$2,500.00 . Set the maximum cap to be placed on the <i>Prize Pool</i> during a Tournament. Note: <i>The displays will present the words "PRIZE POOL" in lieu of "JACKPOT".</i>	
05	CURRENT DATE/TIME: Set the current MONTH, DAY, YEAR, HOUR (AM/PM), MINUTE and SECOND . Default is JAN. 01, 2004 12:00:00 AM .	
06	START DATE: Set the desired MONTH, DAY, YEAR, HOUR (AM/PM), MINUTE and SECOND . Default is FEB. 01, 2004 12:00:00 AM .	
07	END DATE: Set the desired MONTH, DAY, YEAR, HOUR (AM/PM), MINUTE and SECOND . Default is MARCH 01, 2004 12:00:00 AM .	
08	# OF PRIZES: Set between 01 - 05 (<i>If Tournament Adj. 11 is set to REGULAR</i>) or 02 - 05 (<i>If Tournament Adj. 11 is set to BUMP N' WIN</i>). Default (for either) is 04 . Set the max. number of <i>Prize Positions</i> to be awarded during a Tournament. Selections are as follows (<i>percentage distribution cannot be changed</i>):	
	If below Tournament Adj. 11 is set to REGULAR : Set to 01 1 Winner 100% (1) <i>Prize Pool</i> 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) : <i>Cannot set to 01. Minimum of 2 winners required.</i> 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)
	AWARD TYPE: Set to CASH, POINTS, TICKET, NONE or PRIZE . Default is CASH . <i>This adjustment determines how the Prize Pool is to be represented in the Attract Mode on both the Normal and top Beta-Brite® Displays.</i>	
09	Select CASH for the displays to represent the <i>Prize Pool amount</i> (<i>based on Jackpot Base and Max.</i>) in \$Dollars . Select POINTS for the displays to represent the <i>Prize Pool amount</i> in Points . Select TICKET for the display to represent the <i>Prize Pool amount</i> in Tickets . Select NONE NOT TO represent the <i>Prize Pool amount</i> (<i>if prize(s) to be awarded are not Cash, Points or Tickets</i>). Select PRIZE , if applicable.	
10	SHOW PLAYER'S CASH: Set to YES or NO . Default is YES . When set to YES , the >>> previous <<< Tournament Winners & Cash amount will show in the Attract Mode on both Dot Displays.	
11	TOURNAMENT TYPE: Set to REGULAR or BUMP N' WIN . Default is BUMP N' WIN .	
12	BUMP N' WIN BASE: Set between X,000,000 - XX,000,000 (<i>increments of 1M</i>). Default is *varies* . Set the desired Bump N' Win Tournament base score. Tournament Adj. 11 must be set to BUMP N' WIN .	
13	BALLS PER TOURNAMENT: This 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.

Sec. 3: Tournament ...





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

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

If **Set-Up (Tournament Adjustments)** was not completed **OR** the **Tournament Audits were not recorded from the prior Tournament**, exit this Menu by activating the "NO" *Mini-Icon*. If **Set-Up** was completed and the **Tournament Audits** were recorded, select and activate the "YES" *Mini-Icon*.

The Pinball Game is set to **Tournament Ready**

Mode (the **Flashing Tournament Button** must be depressed for a *Tournament Game* after the proper credit is inserted). "REQUEST INSTALLED" is indicated and returns to the **TOURNAMENT MENU** with the "STRT" *Icon* flashing. **Note:** If the "STRT" *Icon* appears to be non-functioning, it is because a *Tournament* is in progress. The *Tournament* must first be stopped (select and activate the "END" *Icon* in the **TOURNAMENT MENU**).



Stop Tournament (select if no TIMEKEEPER is installed*)

* If *Timekeeper* is **NOT installed** or you have to end the *Tournament* prematurely, use this *Icon* to end it. To initiate, from the **TOURNAMENT MENU**, select the "END" *Icon* with either the **Red "LEFT"** or **Green "RIGHT"** Buttons and press the **Black "ENTER"** Button. The "END TOURNAMENT?" MENU appears with the "NO" *Mini-Icon* flashing.

If the *Tournament* was not completed, exit this Menu by activating the "NO" *Mini-Icon*. If the *Tournament* was completed (the *End Date* set has passed), select and activate the "YES" *Mini-Icon*. The Pinball Game is taken out of **Tournament Ready Mode** (to readjust

any *Tournament Adjustments*, the *Tournament* must be "stopped"). "REQUEST INSTALLED" is indicated and returns to the **TOURNAMENT MENU** with the "END" *Icon* flashing. **Record your Tournament Audits at this time as they will be reset (except for the "Accumulative Audits") if another Tournament is started!**



Sec. 3: Tournament ...



Tournament Prizes

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



Tournament Audits (01-12)

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

Tournament Audits 07-12 continued on the next page.





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

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



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

Nr.	TOURNAMENT ADJUSTMENT NAME: Definition
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 (<i>select the "+" Mini-Icon to change settings until "CHANGE" appears in the display, then select the ">>" Mini-Icon to access.</i>). At the top left corner of the Display, the letter A is indicated (<i>blinking</i>) in the first available position. Vary the letter(s) by operating the Left and Right Flipper Buttons (<i>or "RED" or "GREEN" Buttons</i>). With the desired letter indicated, depress the Start Button to lock in the letter and advance to the next character. Repeat this procedure until the desired message is completed in the display. Select the "<" or ">" characters to back-space (<i>erase</i>) and/or to move forward in an already typed message. After completion, press the "BLACK" Button , "REQUEST INSTALLED" is indicated and then exits this sub-menu.
15	PRIZE MESSAGE: Set to ON, CHANGE or OFF . Default is ON . <i>Procedure identical to Tournament Adjustment 14, Location Message.</i>

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*).

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

SEE YOUR PROGRAMMING MANUAL FOR ADDITIONAL INSTRUCTIONS AND DISPLAY FEATURES.

BETA Brite





Parts Identification & Location (The Pink Pages)

Overview

This section provides the Part N^os and locations of all the components in this Pinball Machine. The parts are arranged in 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!

Parts Identification & Location



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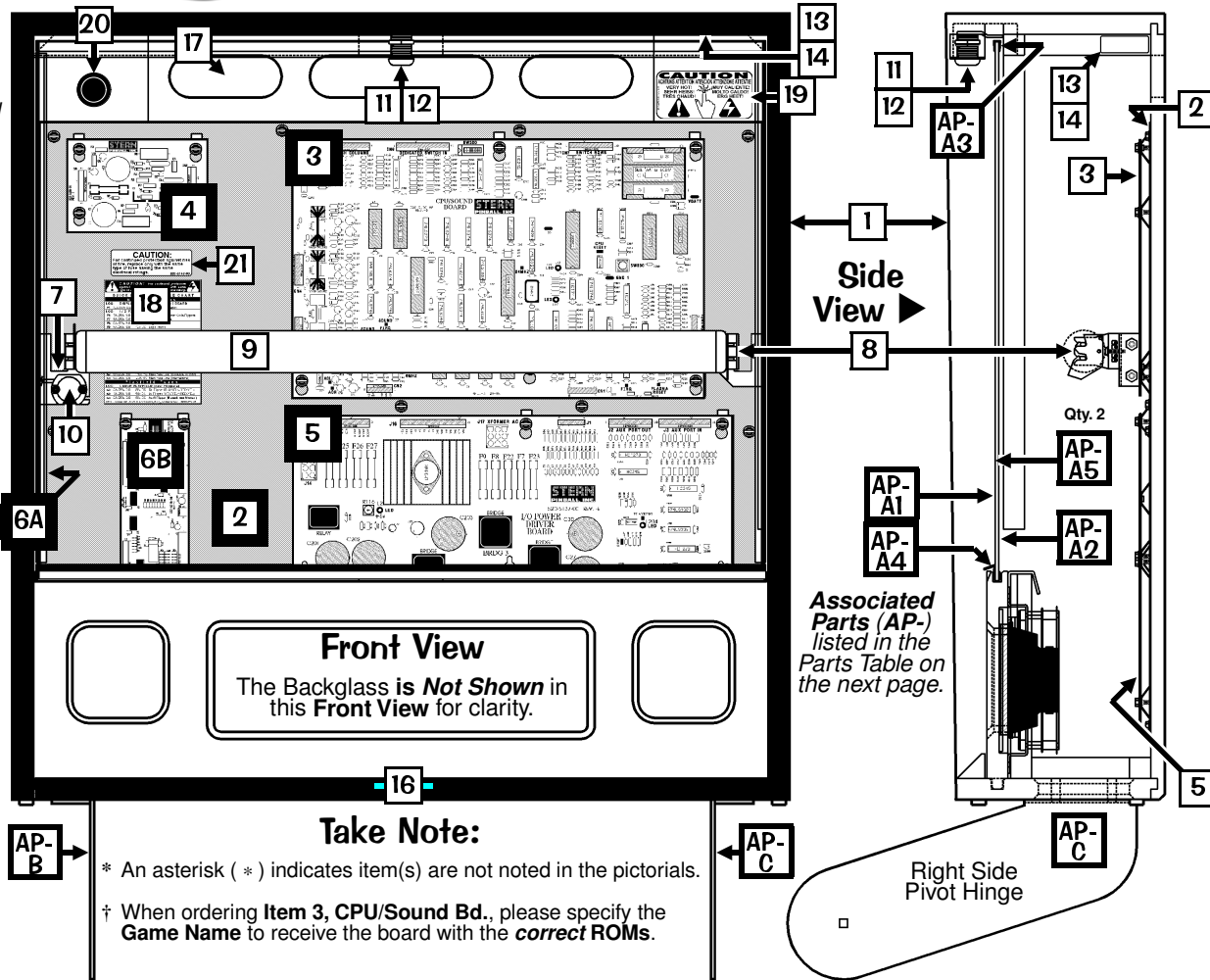
Sec. 4: Parts Id. ...

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.



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

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

Take Note:

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

Sec. 4: Parts Id. ...

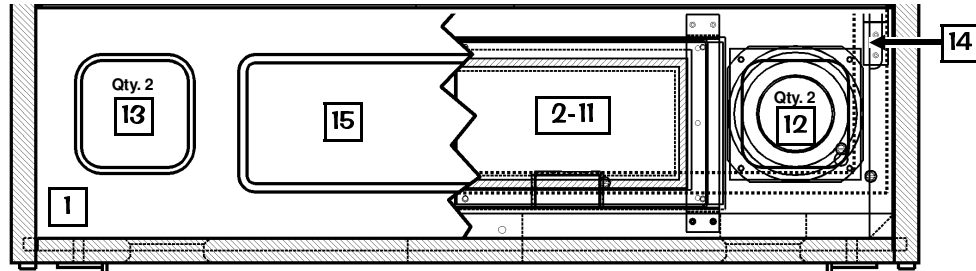
Nº	BACKBOX PART NAME	QTY.	SPI PART Nº	Nº	BACKBOX PART NAME	QTY.	SPI PART Nº
1	Backbox RBION Screened No Parts	1	525-5631-00-81	13	Ballast Mounting Plate	1	535-8657-00
<i>Item 1 Note: Black Textured T-Molding is installed and cannot be ordered separately.</i>							
2	PCB Metal Mounting Plate	1	535-5809-14	14	Ballast CU45Z-W 1/2" Core 120v 60 Hz 13W	1	010-5015-00
<i>Item 2 is secured to Item 1 by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 13) (234-5101-00) and #10 Washer 7/32" I.D. X .5" O.D. X 1/16" Thick (Qty. 4) (242-5003-00)</i>							
3 †	CPU/Snd. Bd. w/ATMEL Sound Processor	1	520-5300-00	<i>Ballast, EU / UK Only 5/8" Core 50/60 Hz 010-5015-01</i>			
4	Display Power Supply Board	1	520-5138-00	<i>Items 13 & 14 are secured to Item 1 by: #6 X 5/8" SLT HWH AB (Zc) (Qty. 2) (234-5102-04)</i>			
5	I/O Power Driver Board Rev. G or higher	1	520-5137-01	15*	#1 Roto Lock Male (on Cabinet)	1	355-5006-01
<i>Items 3, 4 & 5 are secured to Item 2 by: #8-32 X 3/8" HWH MS (Qty. 19) (237-5903-00)</i>							
6A	3X Trans. Drvr. Bd. (UK/Special Apps.Only)	1	520-5068-01	16	#1 Roto Lock Female (R2-0002-02)	1	355-5006-02
6B	ToPS™ Tournament Serial Interface (TSI) Board	1	520-5220-00	<i>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)</i>			
<i>**optional** Item 6A is required for UK Games to support Auxiliary assemblies listed under the Coil Matrix of Q1-Q32; also used for Special Applications such as Ticket / Coin Dispensers used in conjunction with **optional** Item 6B ToPS™ TSI Board.</i>							
7	Fluorescent Light Bracket Assy. Left	1	515-6545-00	17	Back Vent Grill 2-1/2" X 18"	1	545-5072-02
<i>For Individual Items use : Fluorescent Light Bracket Left (535-7739-01), Lamp Holder** (Self-Locking) (077-5214-00) and Starter Base (with Leads)*** (077-5213-00).</i>							
8	Fluorescent Light Bracket Assy. Right	1	515-6545-01	18	Fuse Description Decal (Generic)	1	820-6152-01
<i>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).</i>							
<i>** secured by: #6-32 X 5/8" PPH MS (Sems) Zinc (Qty. 1) (232-5203-00)</i>							
<i>*** secured by: #4-40 X 1/2" PPH MS (Sems) Zinc (Qty. 2) (237-5813-00)</i>							
<i>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)</i>							
9	Fluorescent Tube 24" (F20T9CW)	1	165-5061-00	19	"CAUTION - VERY HOT" Decal	1	820-6266-00
10	Starter - Fluorescent (FS2 Light)	1	165-5011-01	20‡	Button Hole Plug (Blk) (Happ #52-6214-00)	1	500-6566-00
11	Lock Mounting Plate	1	535-8128-01	21	Fuse Label (UL)	1	820-6143-00
12	Lock 5/8" Barrel, 3/4"Ø, 1.5" Flat Cam	1	355-5055-00	22*	Backbox Date Label	1	820-5091-00
<i>Items 11-12 are secured by: #8 X 5/8" TP Torx T20 (Qty. 4) (237-5947-00)</i>							
				23*	Ribbon Cable, 20-Pin (4")	1	036-5000-04
<i>Item 23 (20-Pin) connects the CPU/Sound Board to the I/O Power Driver Board.</i>							
				24*	Ribbon Cable, 26-Pin (40")	1	036-5001-40
<i>Item 24 (26-Pin) connects the CPU/Sound Board to the Display Controller Board.</i>							
				25*	1/4" Clamp (Double)	2	040-5000-23
				26*	1/2", 3/4" & 1" Clamp (Single)	9	040-5000-XX
<i>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)</i>							
				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)**

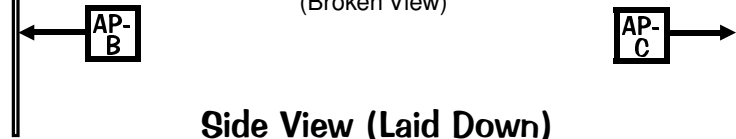


Take Note:

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

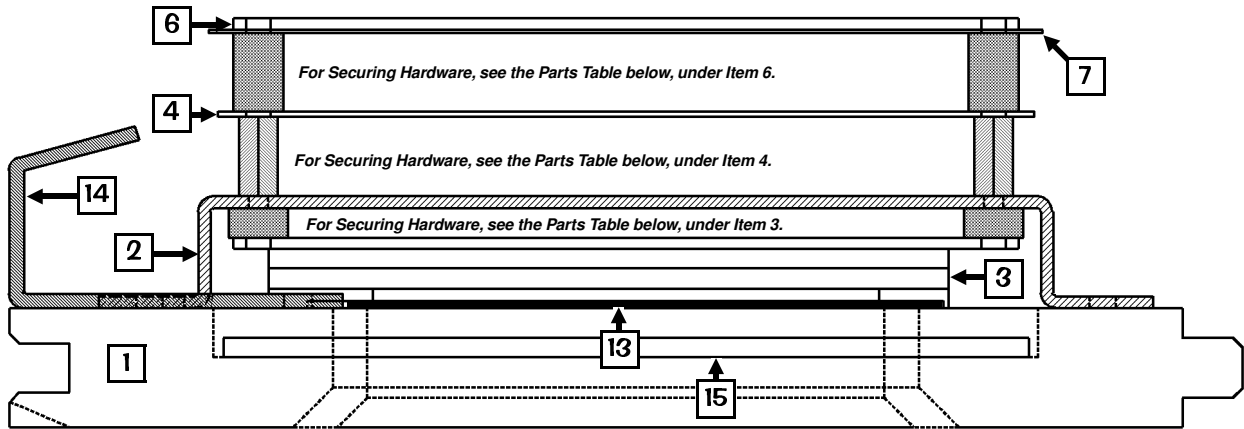
1. Ordering the complete Speaker Panel Assembly, 515-6888-03 (Items 1-15) will include all hardware.

Front View
(Broken View)



Side View (Laid Down)

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



Nº	SPEAKER PANEL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Speaker Panel (Black Wood)	1	525-5515-00	15	Plastic Shield (Display Cover)	1	545-5884-00
2	Dot Matrix Disp. Bd. Mounting Bracket	2	535-8368-01	Item 15 is secured to Item 2 by: #6 X 3/8" SLT HWH AB (Zinc) (Qty. 8) (234-5000-00)			
3	Dot Matrix Display Board 128 X 32	1	520-5052-00	The Associated Parts AP-A thru AP-C are also noted in the Backbox Assembly drawings on the previous page.			
4	Static Shield (Steel Plate)	1	535-6437-00	ASSOC. PARTS ARE NOT INCLUDED WITH BACKBOX/SPKR. PANEL ASSY'S.			
5*	Edge Protector (on Item 4)	2	545-5592-01	Nº	ASSOC. BACKBOX PART NAME	QTY.	SPI PART Nº
6	Display Controller Board FCC-FEB98	1	520-5055-03	AP-A	Backglass Assembly (Game Nº 81)	1	See Parts Below
7	RF Shield	1	820-5092-00	ORDER ONLY INDIVIDUAL PART(S) NEEDED:			
8*	Ground Strap (25") (on Items 4, 6, 12)	4	600-5006-25	AP-A1	Clear Backglass 25.906" X 19.187"	1	660-5038-02
9*	1/2" Clamp (Single) (on Item 4)	1	040-5000-06	AP-A2	RBION Film Art (#81)	1	830-5281-00
10*	Ribbon Cable, 14-Pin	1	036-5260-00	AP-A3	Top Plastic Channel - 26"	1	545-5018-15
11*	Foam 3/16" Thk. X 1/4" X 36"	6	626-5026-00	AP-A4	Bottom Plastic Lift Channel - 26-1/16"	1	545-5021-01
12	Speaker (Shld.) 4" 8Ω MG Elec #4060SH	2	031-5004-01	AP-A5	Plastic Edging (Left/Right) - 18-1/8"	2	545-5018-14
13	Speaker Grill (Black w/no Artwork)	2	535-8081-01	AP-A6*	Tape (double-sided) (12" Length)	1	626-5005-00
14	Speaker Panel Hook Bracket	2	535-7009-02	Note: AP-A6 secures AP-A3--A5 to AP-A1 (only 6" required)			
Items 12, 13 & 14 are secured by: #8 X 3/4" SLT HWH AB (Zinc) (Items 12/13: Qty. 4/per; Item 14: Qty. 2/per) (234-5103-00)				AP-B	Pivot Hinge Left	1	535-7999-00
Item 14 is self-adhesive. Located between Items 3 & 17. Sold in 12" Lengths only.				AP-C	Pivot Hinge Right	1	535-7999-01
Item 11 is secured inbetween: "Item 6" and its' mounting hardware described.				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)			
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)				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)			
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)				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

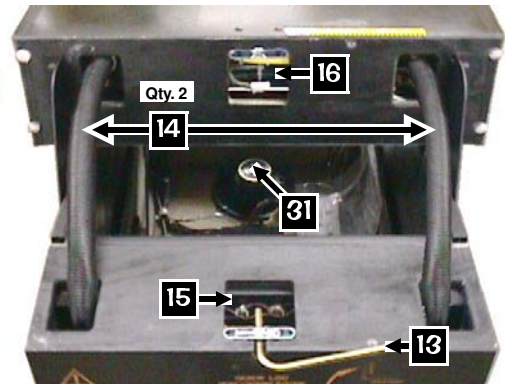
For Backbox Parts see the previous two pages.



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:

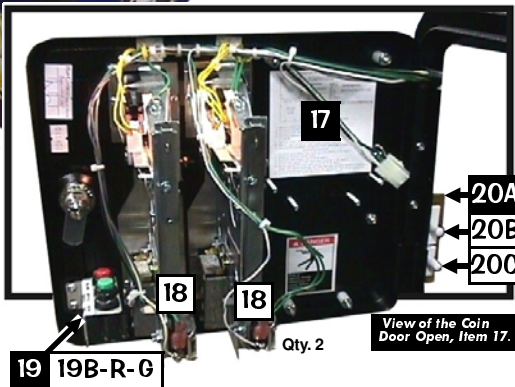
Item 11, Button Hole Plug (BIK) is the *Optional Tournie Button Access Hole*. If removing for the *Optional Tournament Button*, save with the game.



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.

Take Note:

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

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

Sec. 4: Parts Id. ...

Item 2 ORDERING NOTE: Leg comes with Leveler. Leveler can be purchased separately. Leg cannot be ordered WITH OUT Leveler. See Table below, Item 2.

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

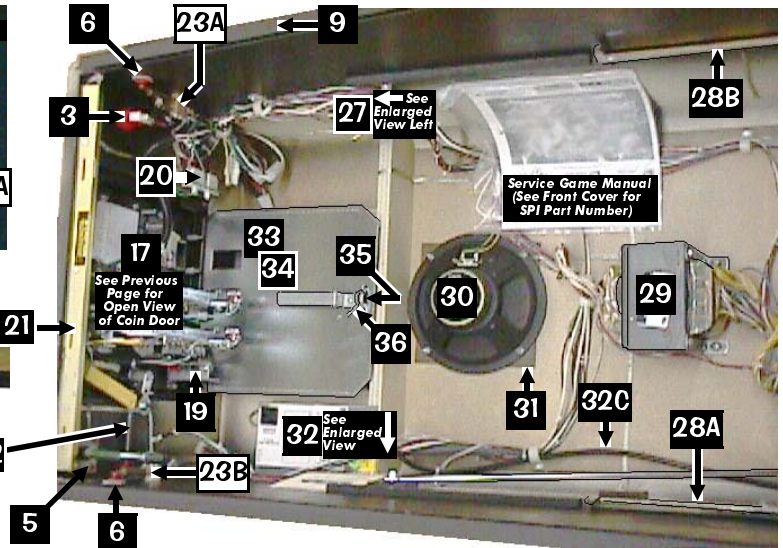
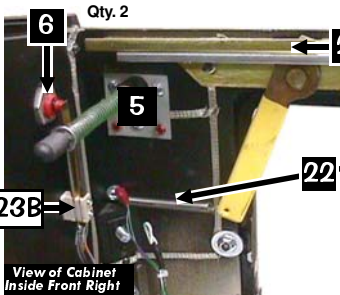
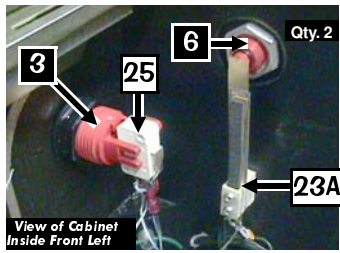
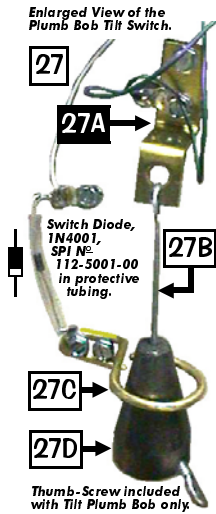
Nº	CABINET PART NAME	QTY.	SPI PART Nº
1	RBION Screened Cabinet (No Parts)	1	525-5395-15P-81
2	Black Leg with Leveler Asm.	4	500-5921-50
Item 2 is secured by: Leg Bolt Back Plate (535-5703-00) and Leg Bolt 3/8" X 16 X 2-1/2" Hex 5/8" Hd. (2/per) (231-5001-01) Leg Leveler ONLY (3/8"-16 X 3") (500-5017-00).			
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).			

Nº	CABINET PART NAME	QTY.	SPI PART Nº
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 1 1/4"ø X 2.6' Lg.	2	605-5008-00
Above Item 14 covers the Cables Wiring Harnesses going into the Backbox from the Cab.			
15	#1 Roto Lock Male (R2-0055-02)	1	355-5006-01
Item 15 is secured by: #10-24 X 1-3/4" Carr. Bolt Sq. Neck (Qty. 2) (231-5022-00), #10-24 Nylon Stop Nut (Qty. 2) (240-5206-00) and #10 Washer 7/32" X .5" X 1/16" (Qty. 2) (242-5003-00)			
16	#1 Roto Lock Female (on Backbox)	1	355-5006-02
17	Coin Door (with Validator) USA only	1	500-5018-172
Item 17 is secured by: 1/4"-20 X 1-1/4" Carriage Bolt Sq. Neck (Qty. 4) (231-5003-00) 1/4"-20 Flange Nut (Qty. 4) (240-5300-00) and Fend Washer 1/4" I.D. X 1" O.D. (Qty. 3) (242-5009-00) Note: For Coin Door other than USA call Technical Support for SPI Part Nº.			
	Coin Door Sw. (USA) (Happ Control)	2	180-5024-01
18	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.



Cabinet - General Parts & Switches Continued

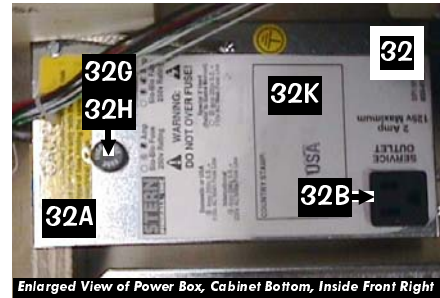


Take Note:

* 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.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
<i>Parts Table & Views continue on the previous page.</i>			
20	Dual Switch Assembly	1	500-5808-00
ORDERING ABOVE (ITEM 20) ASSEMBLY PART Nº WILL INCLUDE:			
20A	Mounting Bracket	1	535-6958-00
20B	Playfield Power Interlock Sw. (Top)	1	180-5136-00
20C	Memory Protect Switch (Bottom)	1	180-5000-01
<i>Item 20 is secured to Cabinet by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5101-00)</i>			
21	Front Molding Lockdown Assembly	1	500-6509-00
<i>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)</i>			
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
<i>Items 27A & 27C are secured by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 4) (234-5101-00)</i>			
28A	Slide & Pivot Support Bracket - Right	1	535-5990-00
28B	Slide & Pivot Support Bracket - Left	1	535-5989-00
<i>Items 28A & 28B are secured by: #10-24 X 1-1/4" Carriage Bolt Sq. Neck (3/پر) (231-5012-00) and #10-24 KEPS Nut (3/پر) (240-5207-00)</i>			

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
29	Transformer 5.7v AC (with Ballast Winding)	1	010-5012-01
<i>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)</i>			
30	Speaker 8" ø Rd. 8010 4Ω	1	031-5007-00
31	Speaker Grill 7" X 7"	1	545-5072-03
<i>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)</i>			
32	Power Input Box Sub-Assy.	1	515-5360-07
ORDERING ABOVE (ITEM 32) SUB-ASSY. PART Nº 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

Sec. 4: Parts Id. ...

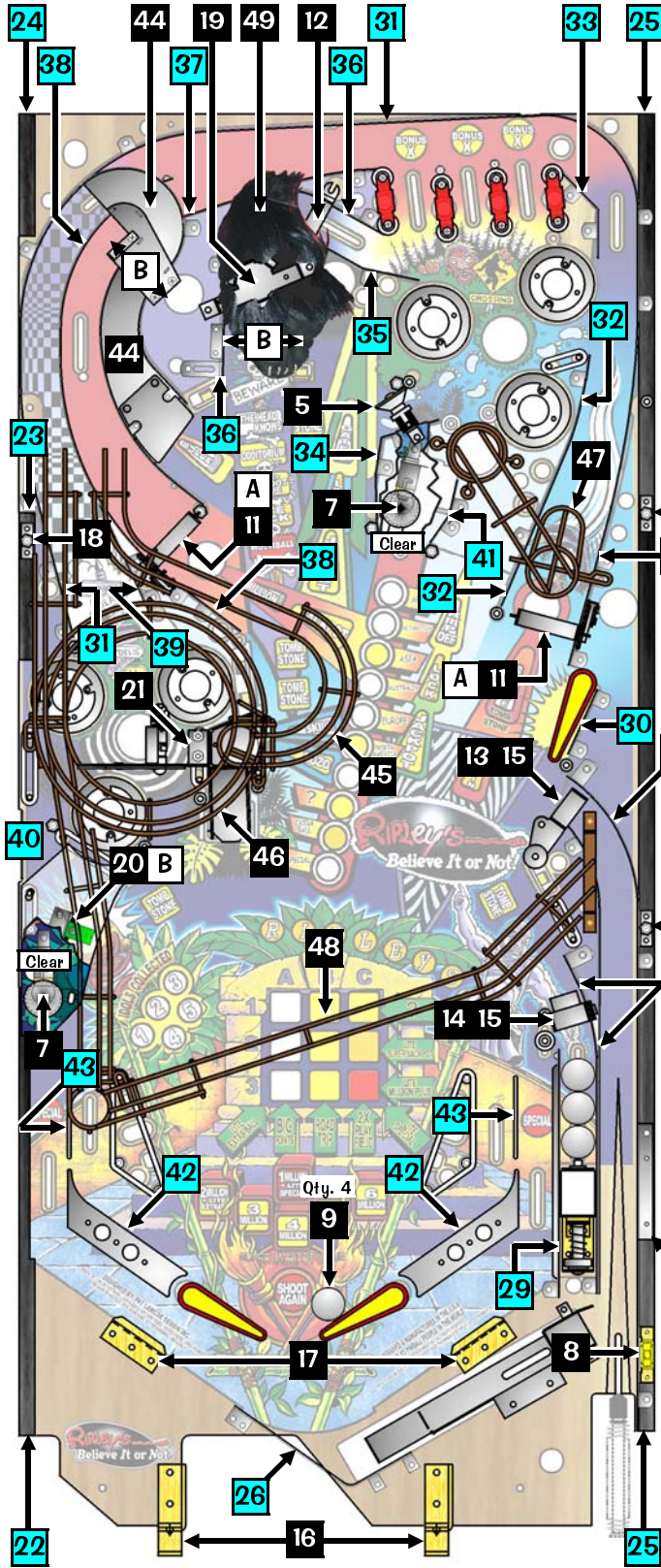


Playfield - General Parts ■, Metal Rails/Ball Guides ■ & Switches (Above)

Nº	ABOVE PLAYFIELD PART NAME	QTY.	SPI PART Nº	Nº	ABOVE PLAYFIELD PART NAME	QTY.	SPI PART Nº
PF	P/F Screened w/ Inserts & NO Parts	1	830-5100-81	Wood Rails			
	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	22	Wood Rail (Bot. Left, 6.69" Route) 14.25"	1	525-5635-00
<p>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).</p>				23	Wood Rail (Middle Left) 4.69"	1	525-5007-61
2	Instruction Card (USA) RBION	1	755-5181-00	Item 23 is secured by: #4 X 5/8" PFH (Black) (Qty. 2) (237-5833-00)			
<p>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.</p>				24	Wood Rail (Upper Left) 3.88"	1	525-5007-61
3	Coin Card (2-Sided)	1	755-5400-00	25	Wood Rail (Right) 42"	1	525-5007-59
<p>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.</p>				Items 22-25 are secured by: #6 X 1-1/4" PFH A (Zinc) (Qty. 13 total) (237-5804-00)			
4	Coin Card (2-Sided)	1	755-5400-02	Metal Flat Rails, Wire Forms & Ball Guides			
<p>Usage Notes: Use Item 4 (Front: 1 Play 50¢) for Adj. 6, Game Pricing, USA 2-7 Setting, (Back: is Blank) for Custom Settings.</p>				26	Metal Rail (Center Drain under Arch)	1	535-8393-00
<p>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.</p>				27	Metal Rail (#1, Shooter Lane, Right)	1	535-9319-00
5*	Light Reflector (Silver Color Plastic)	2	545-5409-01	28	Metal Rail (#2, Shooter Lane / Flap Gate, Lt.)	1	535-9320-00
6*	Mini-Mars Lite Cover (Snap-In) (Clear)	3	550-5030-01	29	Metal Rail (#3, Lower Ball Lock, Left)	1	535-9321-00
<p>* 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.</p>				30	Metal Rail (#4, above Metal Rail #1 above)	1	535-9322-00
7	Mini-Mars Lite Cover (ALTERED) (Clear)	2	550-5088-01	31	Metal Rail (#5, Full Top Orbit [Loop])	1	535-9323-00
<p>Usage Notes: Item 7 was made from 550-5031-01 (Altered Screw Down Lite Cover, 1-Tab, Clear). The cut-away is required for lamp placement.</p>				32	Metal Rail (#6, Top Orbit, Right Side Mid)	1	535-9324-00
8	Level Assembly	1	515-7214-00	33	Metal Rail (#7, Top Orbit, Right Side Top)	1	535-9325-00
<p>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)</p>				34	Metal Rail (#8, under Upper Pops)	1	535-9326-00
9	Pinball (Steel) 1 1/16" ø	4	260-5000-00	35	Metal Rail (#9, S. Head, Rt. Side, OPTO Mnt.)	1	535-9327-00
10*	Plug-Cap (3/16") Black Plastic	0	545-5232-01	36	Metal Rail (#10, S. Head, Lt. Side, OPTO Mnt.)	1	535-9328-00
<p>* Note: Item 10 should plug hole if a Center Post (@ Drain) is used, then removed.</p>				37	Metal Rail (#11, Orbit Top, behind Head)	1	535-9329-00
Spinners, Wire Gate & Flap Gates				38	Metal Rail (#12, Inner Left Orbit [Spinner])	1	535-9330-00
11	Spinner Assembly	2	515-5553-00	39	Metal Rail (#13, Lt. Orbit, Right Side)	1	535-9331-00
<p>Item 11 is secured by: #8-32 X 3/8" PFH 82ø Undercut (Zinc) (Qty. 1/per) (237-6030-00)</p>				<p>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)</p>			
<p>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.</p>				40	Metal Rail (#14, Left Side, Middle)	1	535-9358-00
12	1-Way Gate Mounting Bracket (small)	1	535-5269-03	Item 40 is secured under the Plyfld by: #8 X 1/2" SLT HWH AB (Zc) (Qty. 2) (234-5101-00)			
<p>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)</p>				41	Metal Rail (#15, under Metal Rail #8 above)	1	535-9402-00
13	Flap Gate Mounting Brckt. (by Shooter)	1	535-9334-00	Item 41 is secured by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5101-00)			
<p>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)</p>				42	Ball Guide (Ball Return to Flipper, Left & Rt.)	2	535-9332-00
14	Flap Gate Mounting Brckt. (by Kicker)	1	535-9335-00	Item 42 is secured by: #6-32 X 3/8" PPH MS ext. Sems Zinc (Qty. 3/per) (232-5201-00)			
<p>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)</p>				43	Ball Guide Rail (.12" ø) 2.25"	2	535-5356-05
15	Flap Gate (for above Items 13 & 14)	1	535-9333-00	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.			
<p>Item 15 is secured by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5101-00)</p>				Steel & Wire Ramps			
<p>Note: Switch Gates are also located on the Plastic Ramp Assemblies, see Drawings for Major Assemblies & Ramps (BLUE PAGES), Pages 75-98.</p>				44	Steel Ramp & Flap Assembly	1	515-7328-00
Brackets for Mounting				<p>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)</p>			
16	Playfield Hanger Bracket	2	535-8385-00	Item 44 is secured by: #4 X 5/8" PFH (Black) (Qty. 2) (237-5833-00)			
<p>Item 16 is secured to the P/F by: #8-32 X 7/8" HWH MS Zinc (Qty. 2/per) (237-5890-00)</p>				45	Center Exit Wire Ramp	1	535-9303-00
17	Arch Retaining (Hold-Down) Brackets	2	535-8394-00	46	Spiral Wire Ramp	1	535-9302-00
<p>Item 17 is secured to the P/F by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 3/per) (234-5101-00)</p>				47	VUK Exit Wire Ramp	1	535-9306-00
18	Bracket, Ramp Mounting	3	515-6508-00	48	Right Wire Ramp	1	535-9305-00
<p>Item 18 is secured by: #6 X 1/2" PTH A (Zinc) (Qty. 2/per) (237-5809-00)</p>				Note: For Securing Hardware on Items 45-48, see Drawings for Major Assemblies & Ramps (BLUE PAGES), Pages 75-98.			
19	Bracket, Shrunk Hd. & Socket Mnt.	1	535-9395-00	Miscellaneous			
<p>Item 19 is secured by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5101-00)</p>				49	Shrunk Head (Molded, Altered)	1	880-5081-01
20	Bracket, OPTO Mounting on Plastic	1	535-9400-00	Misc. Switches & PC Boards			
<p>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)</p>				A	Micro Switch, Spinner (1 -1/4")	2	180-5010-04
21	Bracket, Plastic Arrow (-20) Mounting	1	535-9409-00	<p>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).</p>			
<p>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)</p>				B	Transceiver Board Asm. (520-5237-00)	5	500-6775-00
<p>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.</p>				<p>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.</p>			
<p>Note: For Mounting Brackets located on Major Assemblies and/or Plastic Ramp Assemblies, see Drawings for Major Assemblies & Ramps (BLUE PAGES), Pages 75-98.</p>				<p>Pinball Rejuvenation Kit Available: 502-6002-81 This kit consists of 8 oz. Novus Wax #2 Fine (Red) (875-0003-01), cloth and all Rubber Rings & Bulbs used in this Pinball Machine.</p>			
				<p>Ask your distributor about the Deluxe Pinball Location Maintenance Kit which includes Flipper Rebuild Kits!</p>			
				<p>For Assemblies, Ramps, Switches on Assemblies, Back Panel Parts and other Individual Parts, not listed on this page, view the Blue Pages (75-98).</p>			

Sec. 4: Parts Id. ...





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).

Sec. 4: Parts Id. ...



Playfield - General Parts & Switches (Below)

Nº BELOW PLAYFIELD PART NAME QTY. SPI PART Nº

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

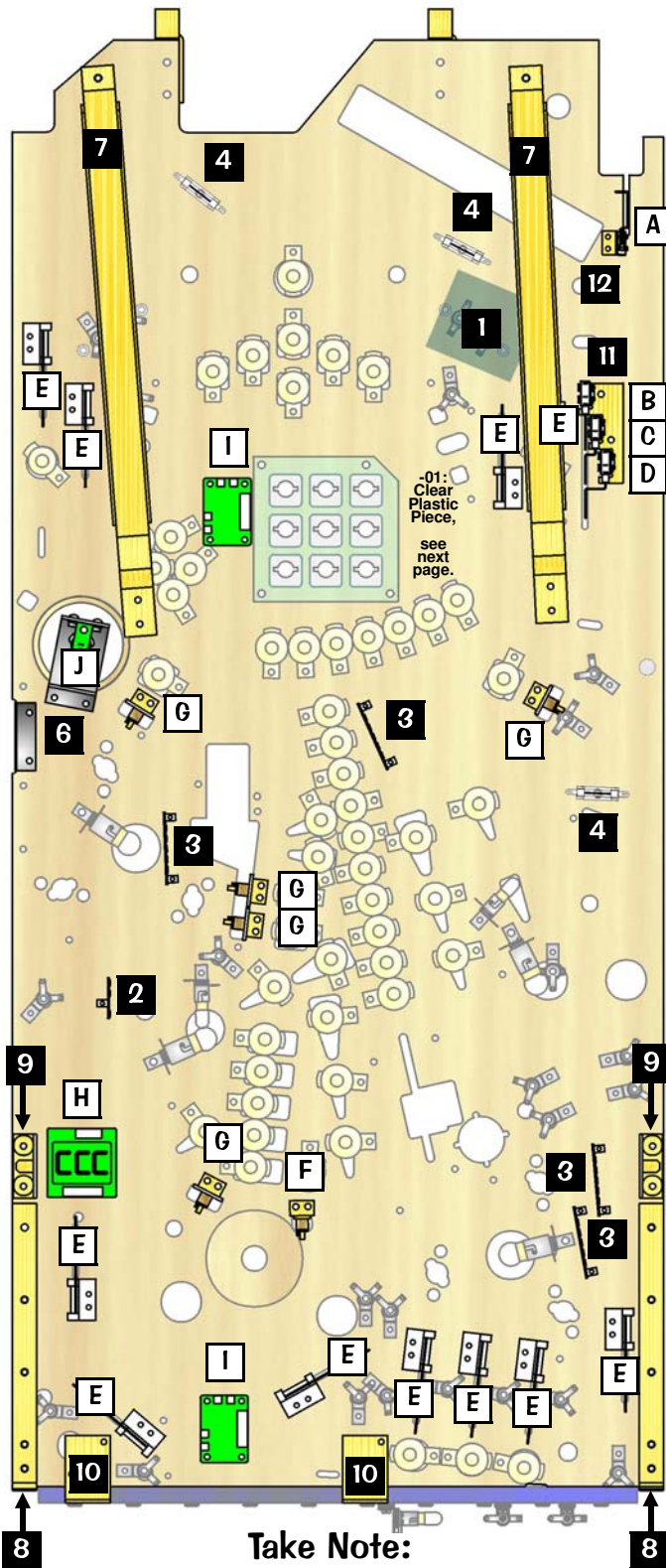
7	Playfield Support Slide Bracket	2	535-6862-02
Item 7 is secured by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2/per) (234-5101-00) and #8-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 1/per) (237-5975-03)			
8	Edge Slide Bracket (Extended)	2	535-5988-01
Item 8 is secured by: #4 X 1/2" PFH (Zinc) (Qty. 5/per) (237-5840-00)			
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: 1/4" Slt. 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.

- For Sockets & Bulbs (drawings & part numbers) see Pgs. 72-74. 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).
- Legend Note:** Items noted with a black square ■ are General Parts. Items noted with a white square □ are Switches and Miscellaneous PC Boards.

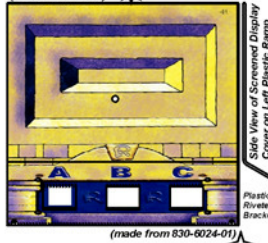
Pinball Location Maintenance Kit Available: 502-6002-81
This kit consists of 8 oz. Novus Wax #2 Fine (Red) (675-0003-01), cloth and all Rubber Rings & Bulbs used in this Pinball Machine.

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



Playfield - Plastics (Screened & Clear) & Decals

Screened Display Cover on Left Plastic Ramp (Plastic with Bend)



- Legend**
- = 830-6014-XX Clear
 - = 830-6020-00 Screened (w/Bend)
 - = 830-6021-XX Screened & Clear
 - = 830-6024-XX Screened
 - = 830-6026-XX Screened
 - = 830-6027-00 Screened
 - = 830-6027-00 Screened



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)

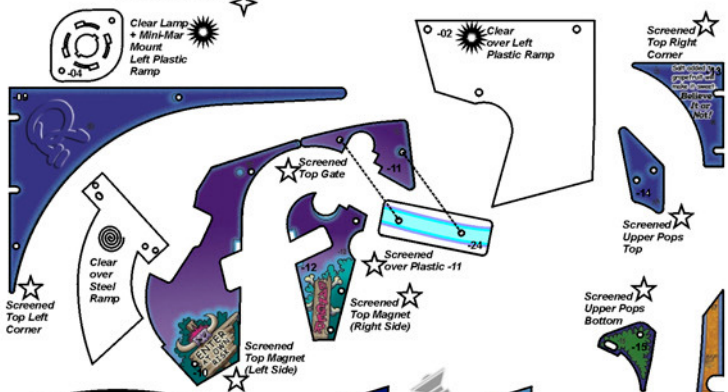
***803-5001-81 Kit includes:**

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. *



Note: Most Plastics Shown are in their proper location. Some have been shifted for clarity. Some pieces are located on assemblies not shown, but described.

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).

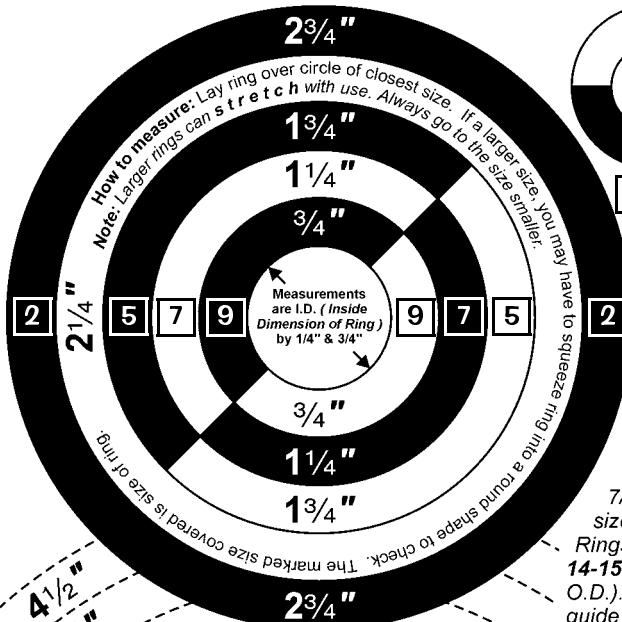
OPTIONAL MYLAR (Not Included) SPI PART Nº

* Not included in the Decals Kit (can be ordered separately):
 * Full Playfield Clear Mylar Sheet, (820-5999-81)

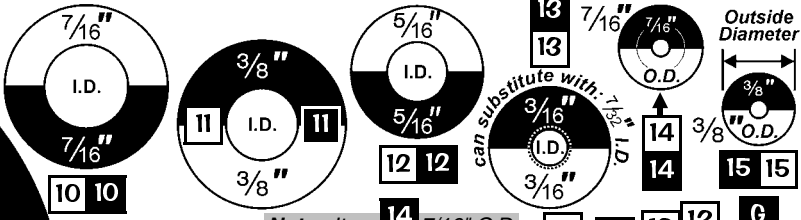


Sec. 4: Parts Id. ...

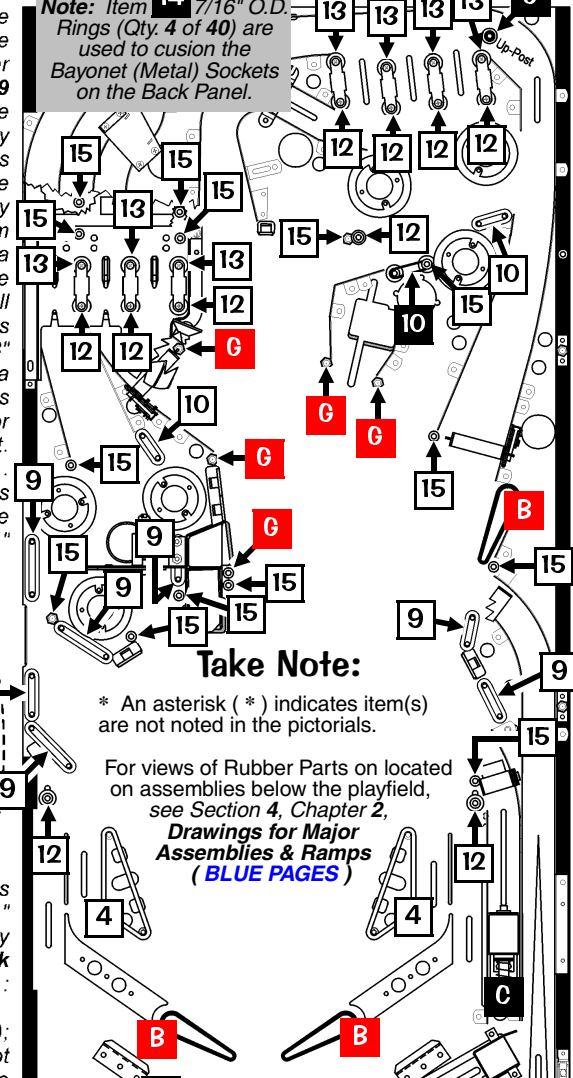
Playfield - Rubber Parts Red ■, Black ■ & White □ (Rings Actual Size) †



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



Note: Item 14 7/16" O.D. Rings (Qty. 4 of 40) are used to cushion the Bayonet (Metal) Sockets on the Back Panel.



Take Note:

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

For views of Rubber Parts on located on assemblies below the playfield, see Section 4, Chapter 2, Drawings for Major Assemblies & Ramps (BLUE PAGES)

Note: Item 14 7/16" O.D. Rings (Qty. 36 of 40) are used to cushion the Bayonet (Metal) Sockets under the playfield.

Sec. 4: Parts Id. ...

Note: Sizes larger than 3" I.D. currently available in Black Only (Not Used): 3 1/2" (545-5348-11); 4" (-12); 4 1/2" (-13); 5" (-14); 5 1/2" (-15); 6" (-16). Sizes Not Shown on this page, listed in the Parts Table below or are noted with N/U (Not Used) are currently not available.

Nº	RUBBER PART NAME	QTY.	SPI PART Nº
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
	Bumper RED (Post Sleeve, Tall)	5	545-5308-22
G	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"		545-5850-00

(Located inside Cabinet by each Flipper Button Assembly)

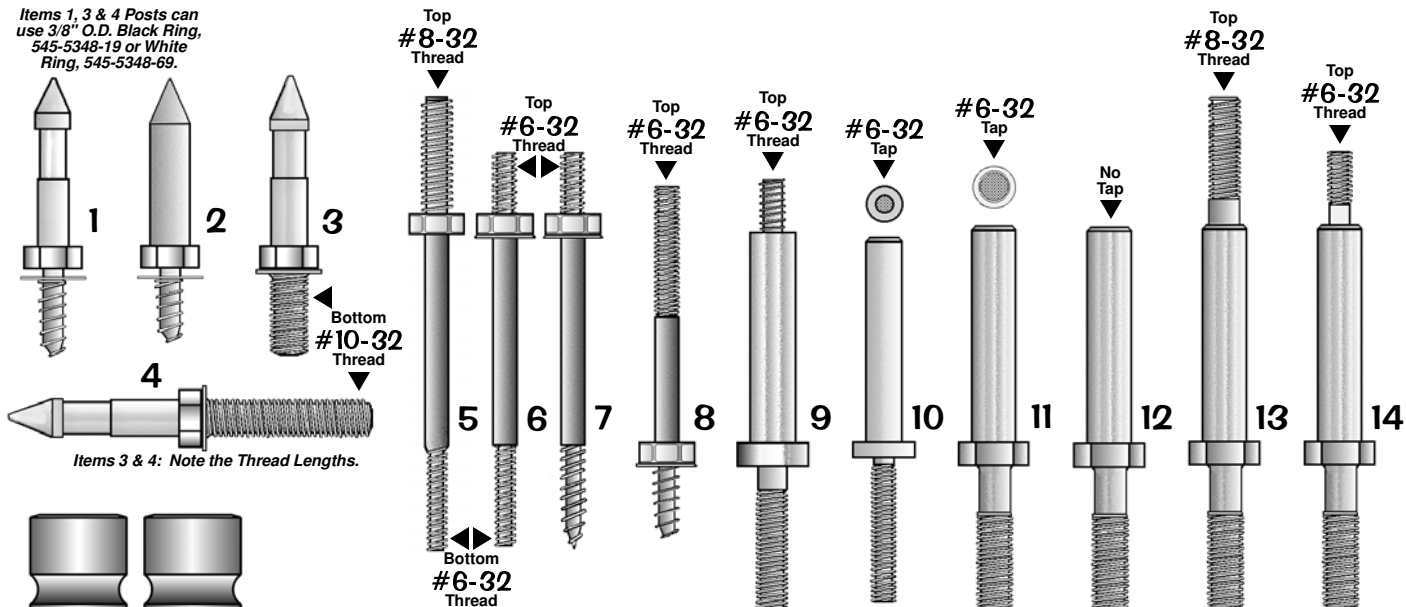
Nº	SPI PART Nº	QTY.	RUBBER PART NAME	QTY.	SPI PART Nº	Nº
1	545-5348-10		Black 3" I.D. Ring White		-60 N/U	1
2	545-5348-20		Black 2 3/4" I.D. Ring White		-70 N/U	2
3	545-5348-09		Black 2 1/2" I.D. Ring White		545-5348-59	3
4	545-5348-08		Black 2" I.D. Ring White	2	545-5348-58	4
5	545-5348-21		Black 1 3/4" I.D. Ring White		-71 N/U	5
6	545-5348-07		Black 1 1/2" I.D. Ring White		545-5348-57	6
7	545-5348-06		Black 1 1/4" I.D. Ring White		545-5348-56	7
8	545-5348-05		Black 1" I.D. Ring White		-55 N/U	8
9	545-5348-04		Black 3/4" I.D. Ring White	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 3/8" 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 3/8" 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.

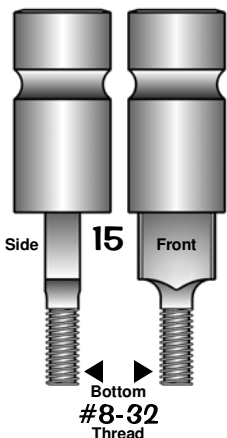


Playfield - Metal Posts (Screws) & Nuts (Actual Size) †

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.



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

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

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).

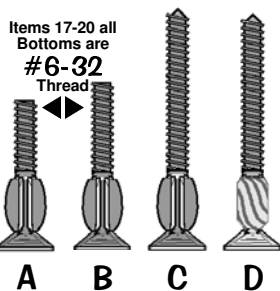
Shown Below~ • #6-32 Nylon Stop Nut: 240-5005-00 ✓	Shown Below~ • #6-32 KEPS Nut (with Star Washer): 240-5008-00 ✓	Shown Below~ • #6-32 Hex Nut (No Star Washer): 240-5004-00 ✓	Shown Below~ • #6-32 T-Nut: 240-5002-00 ✓	Shown Below~ • 1/4" X 20 Flange Nut: 240-5300-00 ✓
Top & Side Views	Bottom & Side Views	Top View	Bottom & Side Views	Top & Side Views
Nylon Stop Nuts Not Shown:	KEPS Nuts Not Shown:	Hex Nuts Not Shown:	T-Nuts Not Shown:	Miscellaneous Nuts Not Shown:
<ul style="list-style-type: none"> • #6-32 (w/ 1/4" Hex Body): 240-5010-00 • #8-32: 240-5102-00 ✓ • #10-32: 240-5203-00 ✓ • #10-24: 240-5206-00 ✓ • #4-40: 240-5303-00 • #4-40 (18/8 Stainless): 240-5303-01 • 5/16"-18: 240-5316-00 	<ul style="list-style-type: none"> • #6-32 (w/ 1/4" Hex Body): 240-5011-00 • #8-32: 240-5104-00 ✓ • #10-32: 240-5208-00 ✓ • #10-24: 240-5207-00 ✓ • #4-40: 240-5318-00 	<ul style="list-style-type: none"> • #8-32: 240-5103-00 ✓ • #10-32: 240-5201-00 • #10-24: 240-5202-00 ✓ • #10-32 X 3/8": 240-5209-00 • 3/4-16: 240-5315-00 ✓ • #2-56: 240-5301-00 ✓ • 7/8"-14: 240-5317-00 	<ul style="list-style-type: none"> • #6-32 (w/Side Cut Off): 240-5002-01 • #8-32: 240-5101-00 ✓ • #10-32 (Black Oxide): 240-5007-00 • #10-32 (w/Side Cut Off): 240-5205-00 • #10-32 X 5/16": 240-5204-00 • #10-24: 240-5200-00 	<ul style="list-style-type: none"> • Plastic Pal Nut (on Flipper Buttons): 240-5003-00 • Metal Pal Nut (on Flipper Buttons): 240-5003-01 ✓ • #6-32 Wing Nut: 240-5001-00 • #8-32 Wing Nut: 240-5100-00 • #10-24 Wing Nut: 240-5211-00 • 1/4"-20 Wing Nut: 240-5302-00 • 1/4"-20 Toggle Wing: 240-5324-00

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.



Items 17-20 all Bottoms are #6-32 Thread

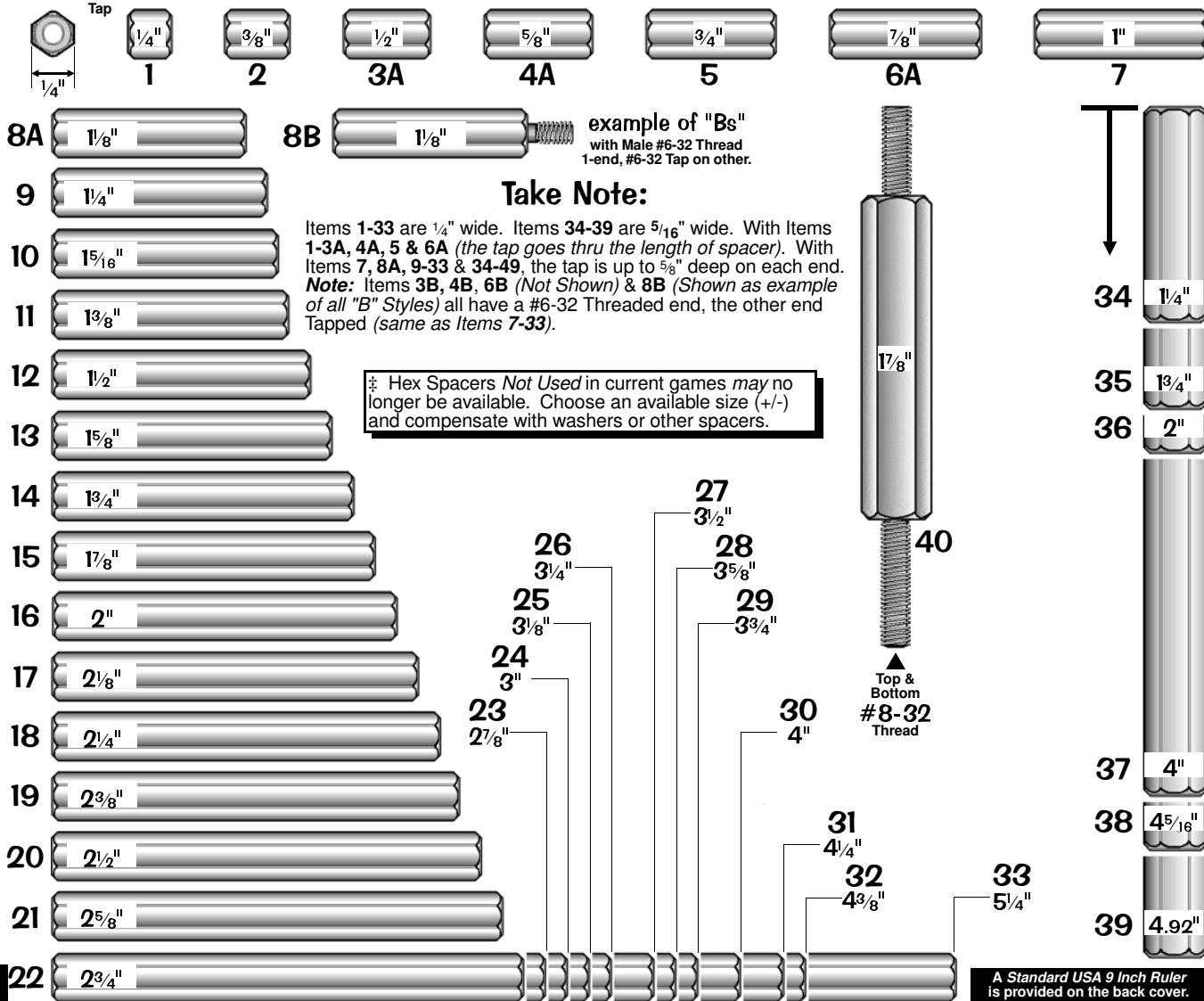
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

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



Playfield - Hex Spacers (Actual Size) †

Hex Spacers:
#6-32
Tap



Take Note:
Items 1-33 are 1/4" wide. Items 34-39 are 5/16" wide. With Items 1-3A, 4A, 5 & 6A (the tap goes thru the length of spacer). With Items 7, 8A, 9-33 & 34-49, the tap is up to 5/8" deep on each end. **Note:** Items 3B, 4B, 6B (Not Shown) & 8B (Shown as example of all "B" Styles) all have a #6-32 Threaded end, the other end Tapped (same as Items 7-33).

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

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

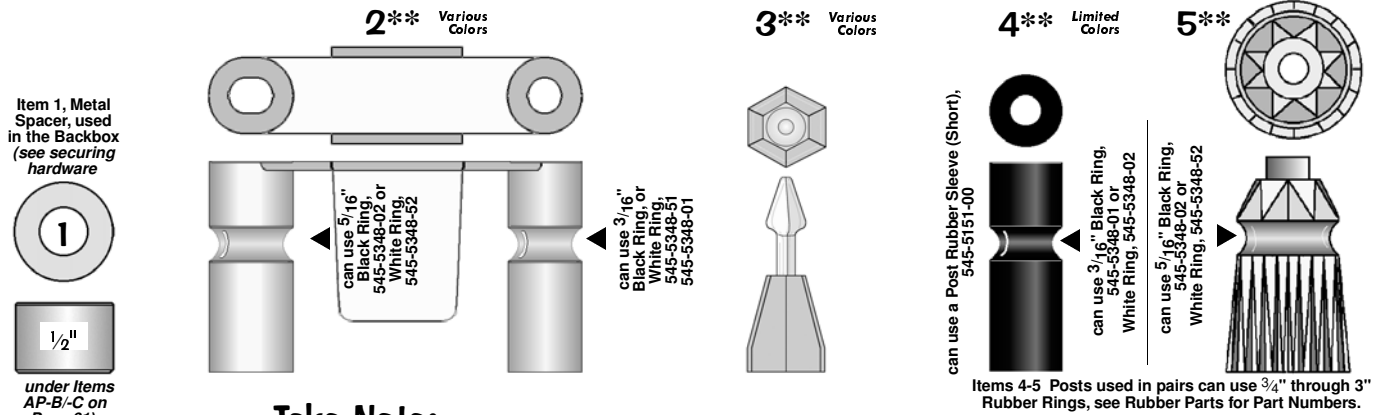
Sec. 4: Parts Id. ...

Nº	HEX SPACER NAME	QTY.	SPI PART Nº	Nº	HEX SPACER NAME	QTY.	SPI PART Nº
1	1/4" X 1/4" : #6-32 Tap (both ends)		254-5008-00	19	2 3/8" X 1/4" : #6-32 Tap (both ends)		254-5008-28
2	3/8" X 1/4" : #6-32 Tap (both ends)		254-5008-12	20	2 1/2" X 1/4" : #6-32 Tap (both ends)		254-5008-16
3A	1/2" X 1/4" : #6-32 Tap (both ends)	9	254-5008-03	21	2 5/8" X 1/4" : #6-32 Tap (both ends)		254-5008-08
3B*	Identical to 3A with #6-32 Thread end		254-5024-03	22	2 3/4" X 1/4" : #6-32 Tap (both ends)		254-5008-15
4A	5/8" X 1/4" : #6-32 Tap (both ends)		254-5008-02	23	2 7/8" X 1/4" : #6-32 Tap (both ends)		254-5008-31
4B*	Identical to 4A with #6-32 Thread end		254-5024-02	24	3" X 1/4" : #6-32 Tap (both ends)		254-5008-14
5	3/4" X 1/4" : #6-32 Tap (both ends)	6	254-5008-04	25	3 1/8" X 1/4" : #6-32 Tap (both ends)	1	254-5008-19
6A	7/8" X 1/4" : #6-32 Tap (both ends)		254-5008-05	26	3 1/4" X 1/4" : #6-32 Tap (both ends)	1	254-5008-26
6B*	Identical to 6A with #6-32 Thread end		254-5024-05	27	3 1/2" X 1/4" : #6-32 Tap (both ends)	1	254-5008-27
7	1" X 1/4" : #6-32 Tap (both ends)		254-5008-06	28	3 5/8" X 1/4" : #6-32 Tap (both ends)		254-5008-25
8A	1 1/8" X 1/4" : #6-32 Tap (both ends)		254-5008-17	29	3 3/4" X 1/4" : #6-32 Tap (both ends)		254-5008-36
8B	Identical to 8A with #6-32 Thread end		254-5024-17	30	4" X 1/4" : #6-32 Tap (both ends)		254-5008-21
9	1 1/4" X 1/4" : #6-32 Tap (both ends)		254-5008-11	31	4 1/4" X 1/4" : #6-32 Tap (both ends)		254-5008-30
10	1 5/16" X 1/4" : #6-32 Tap (both ends)		254-5008-34	32	4 3/8" X 1/4" : #6-32 Tap (both ends)		254-5008-29
11 ‡	1 3/8" X 1/4" : #6-32 Tap (both ends)		254-5008-33	33	5 1/4" X 1/4" : #6-32 Tap (both ends)		254-5008-35
12 ‡	1 1/2" X 1/4" : #6-32 Tap (both ends)		254-5008-09	34	1 1/4" X 5/16" : #6-32 Tap (both ends)		254-5018-09
13 ‡	1 5/8" X 1/4" : #6-32 Tap (both ends)	1	254-5008-13	35	1 3/4" X 5/16" : #6-32 Tap (both ends)		254-5018-06
14 ‡	1 3/4" X 1/4" : #6-32 Tap (both ends)		254-5008-10	36	2" X 5/16" : #6-32 Tap (both ends)		254-5018-07
15 ‡	1 7/8" X 1/4" : #6-32 Tap (both ends)		254-5008-20	37	4" X 5/16" : #6-32 Tap (both ends)		254-5018-03
16 ‡	2" X 1/4" : #6-32 Tap (both ends)		254-5008-07	38	4 5/16" X 5/16" : #6-32 Tap (both ends)		254-5018-00
17 ‡	2 1/8" X 1/4" : #6-32 Tap (both ends)	2	254-5008-32	39	4.92" X 5/16" : #6-32 Tap (both ends)		254-5018-04
18 ‡	2 1/4" X 1/4" : #6-32 Tap (both ends)		254-5008-18	40	1 7/8" X 3/8" : #8-32 Thread (both ends)		530-5285-00

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



Playfield - Posts & Spacers (Actual Size) †

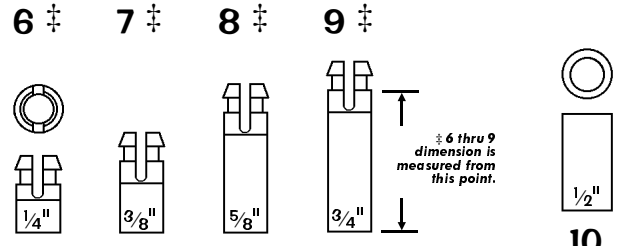


under Items AP-B/-C on Page 61).

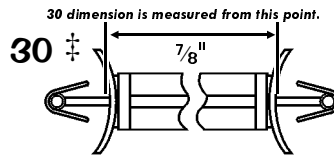
Take Note:

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

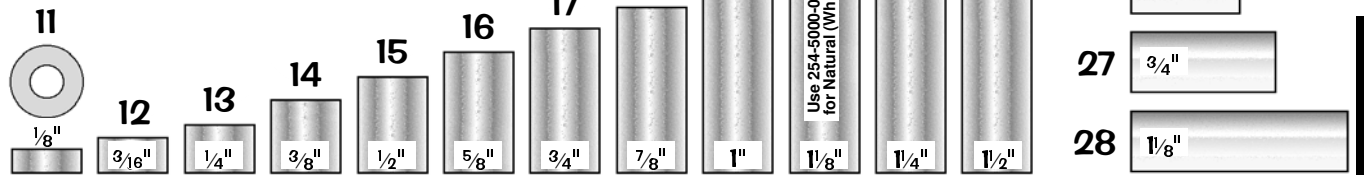


† Items 6 through 9 dimensions are measured from bottom to just under the cut-away. Item 30 dimension is measured from top-to-top of curve. See pictorials with Items 9 & 30.



Take Note:

If any one of Items 11-23 Plastic Spacers is not available in the size required, order the smaller sized spacers required to stack sizes together until appropriate size is achieved (e.g. if 1 1/8" is needed but unavailable, order a 1/2" + 5/8" & stack to = 1 1/8").

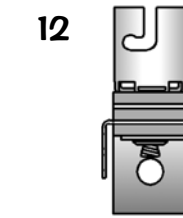
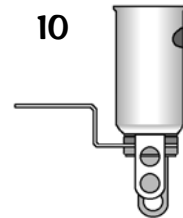
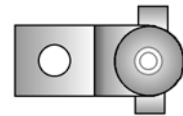
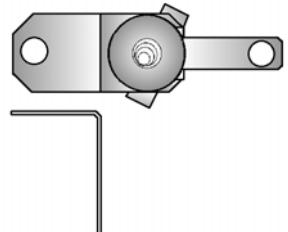
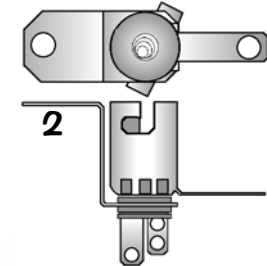
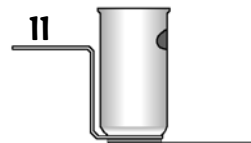
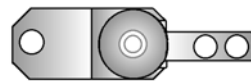
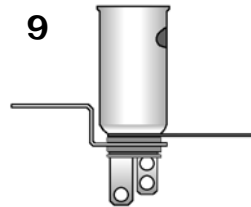
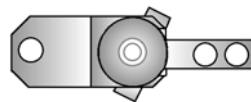
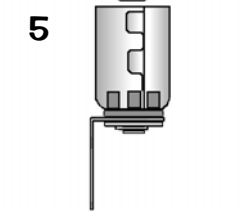
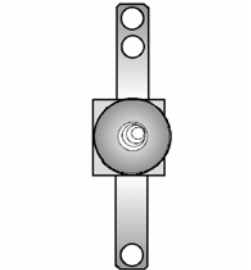
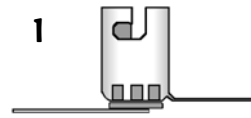
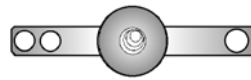
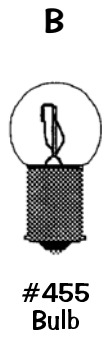
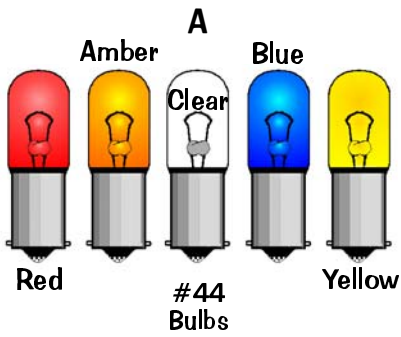


† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

Nº	POST & SPACER NAME	QTY.	SPI PART Nº	Nº	POST & SPACER NAME	QTY.	SPI PART Nº
1	3/8" X 1/2" Metal Spacer (Backbox)	2	530-5099-00	14	3/8" X 3/8" Plastic Spacer Gray	6	254-5000-12
2**	Top Lane Plastic Mini-Lite Hood (Red)	7	550-5061-02	15	1/2" X 3/8" Plastic Spacer Gray	3	254-5000-01
Item 2 typically secured by: #6-32 X 1-3/4" PPH MS (Zinc) (Qty. 2/per) (237-5511-00) and Washer 9/64" X 5/16" OD X 1/32" (Qty. 2/per) (242-5017-00), if used.							
3**	Mini-Jewel Plastic Post (Clear)	13	550-5052-01	16	5/8" X 3/8" Plastic Spacer Gray	6	254-5000-14
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	17	3/4" X 3/8" Plastic Spacer Gray	10	254-5000-07
4**	1 1/16" 1-Groove Plastic Post (Clear)	35	550-5059-01	18	7/8" X 3/8" Plastic Spacer Gray		254-5000-11
5**	1-Groove Jewel Plastic Post (Clear)	4	550-5034-01	19	1" X 3/8" Plastic Spacer Gray or Black	1	254-5000-04
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	20	1 1/8" X 3/8" Plastic Spacer Gray		254-5000-06
7 †	3/8" Slf. Rtn. Plastic Spacer White		254-5007-01	21	1 1/8" X 3/8" Plastic Spacer Natural		254-5000-06N
8 †	5/8" Slf. Rtn. Plastic Spacer White		254-5007-00	22	1 1/2" X 3/8" Plastic Spacer Gray		254-5000-08
9 †	3/4" Slf. Rtn. Plastic Spacer White		254-5007-03	23	1 5/16" X 3/8" Plastic Spacer Gray		254-5000-15
10	1/2" X 1/4" Plastic Spacer White (Narrow)		254-5000-03	24	1/4" X 5/16" X .144" I.D. Metal Spacer	1	254-5014-03
11	1/8" X 3/8" Plastic Spacer Gray		254-5000-19	25	1/2" X 5/16" X .144" I.D. Metal Spacer		254-5014-00
12	3/16" X 3/8" Plastic Spacer Gray		254-5000-18	26	9/16" X 5/16" X .144" I.D. Metal Spacer		254-5014-04
13	1/4" X 3/8" Plastic Spacer Gray	2	254-5000-02	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) †



Sec. 4: Parts Id. ...

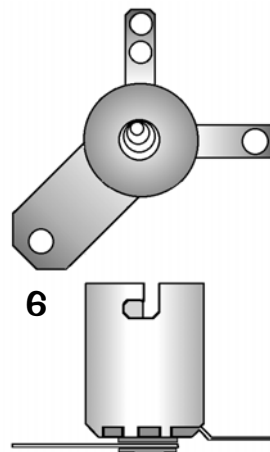
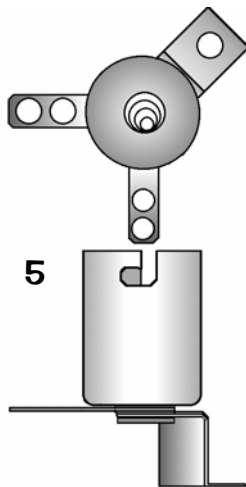
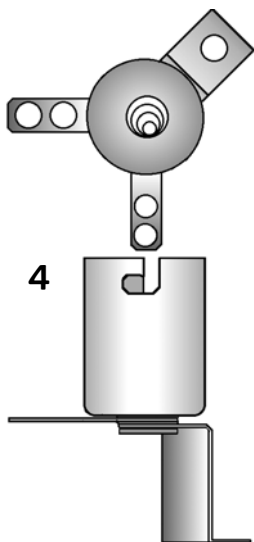
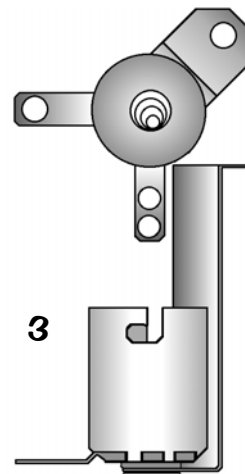
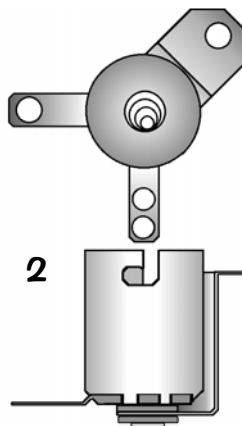
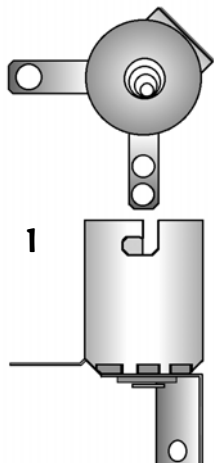
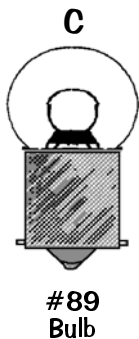
Nº	SMALL BULB or SOCKET NAME	QTY.	SPI PART Nº
A	#44 Bulb (Clear)	42	165-5000-44
A	#44 Bulb (Red)	5	165-5053-02
A	#44 Bulb (Amber)		165-5053-03
A	#44 Bulb (Blue)		165-5053-05
A	#44 Bulb (Yellow)	6	165-5053-06
B	#455 Twinkle Bulb		165-5003-00
1	2-Lug Staple Down Socket	12	077-5000-00
2	3-Lug Stand-Up Short 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

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



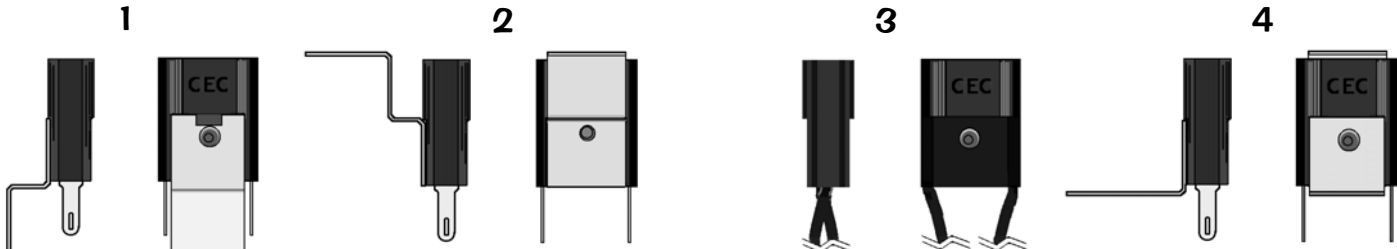
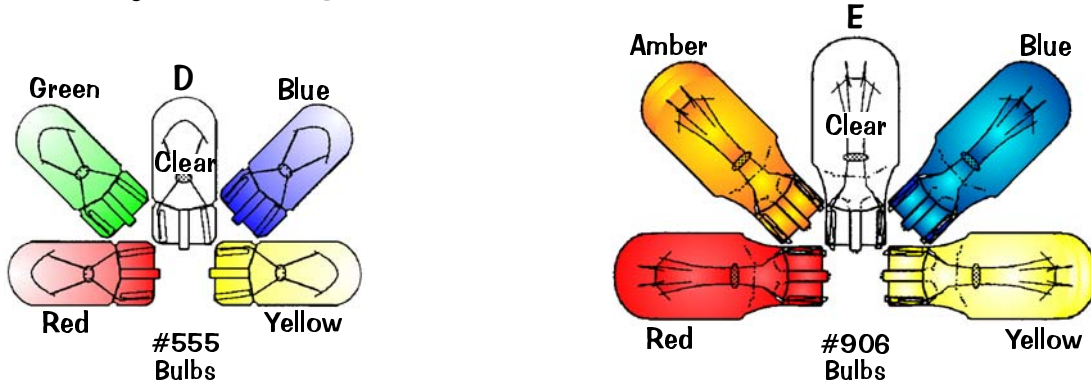
† Items with no Qty. (quantity) are not used in this game. Size and/or quantities may change during production.

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

Sec. 4: Parts Id. ...



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)

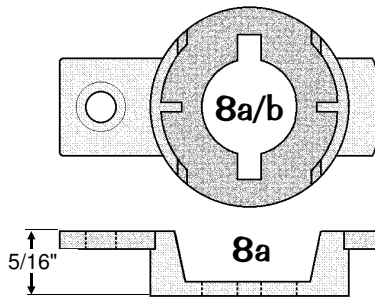
Take Special Note

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.

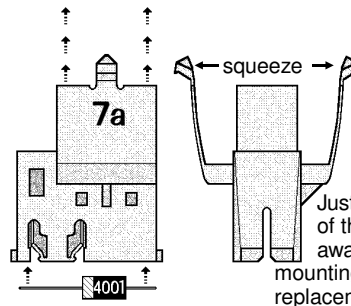
Take Note:

- * 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.
- 4. Item E Bulb (#906) can be used in all sockets, *except* Item 5.
- 5. Item 7a Socket is equipped with a *built-in* Diode, 1N4003 (112-5003-00), however, replacement can be made with a 1N4001 Diode (112-5001-00).
- 6. Item 7b Socket is **NOT** equipped with a diode (Not Required).

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



7a only



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.

Sec. 4: Parts Id. ...

Nº	WEDGE BULB & SOCKET NAME	QTY.	SPI PART Nº	Nº	WEDGE BULB & SOCKET NAME	QTY.	SPI PART Nº
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 Gl)		077-5030-00
D	#555 Wedge Base Bulb (Yellow)		165-5054-06	5	#555 <i>only</i> Wedge Base Socket (Twist)		077-5007-00
E	#906 Wedge Base Bulb (Clear)		165-5004-00	6	#906 <i>only</i> 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 N^o**. **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**.



Sec. 4: Drawings ...

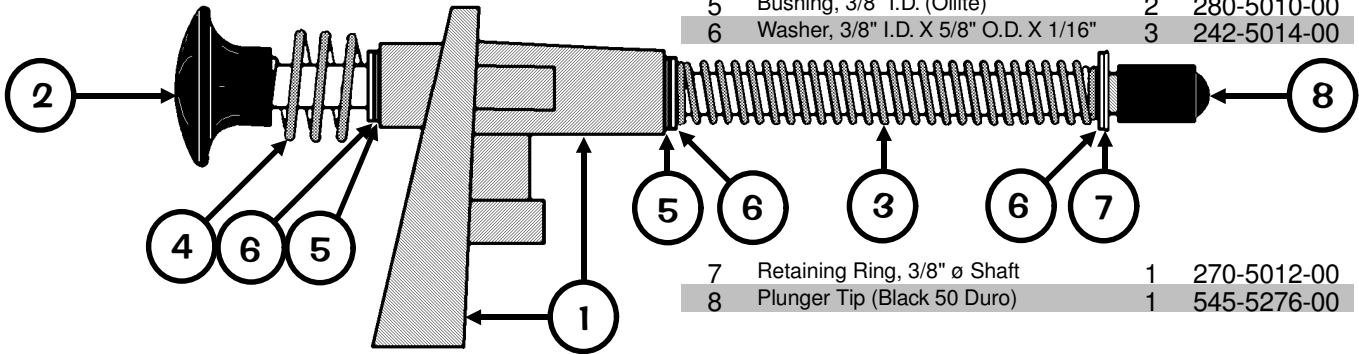
○ **Coil Note:** ○ Either -00B or -00T can be used for coil replacements. -00B or -00T listed is preferable for easier diode access and may differ on game.



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

Manually launch the ball into play.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Housing (Shooter Assembly)	1	535-5067-02	2	Rod Assembly (w/Black Knob)	1	515-6557-00
Item 1 is secured to the Cabinet by: Support Plate (Qty. 1) (535-5027-00), #10-32 X 1/2" PPH (Sems) Zinc TF (Qty. 3) (237-6033-00), #10 Split Lock Washer (Qty. 3) (234-5003-00) and #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5002-00)							
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)

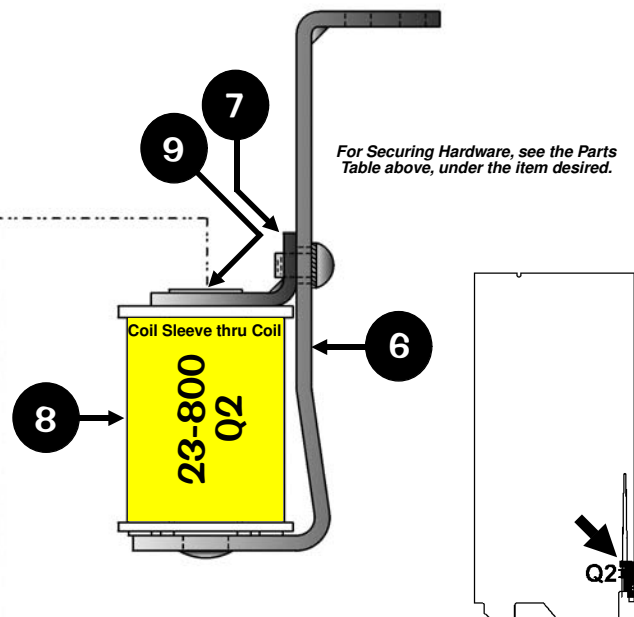
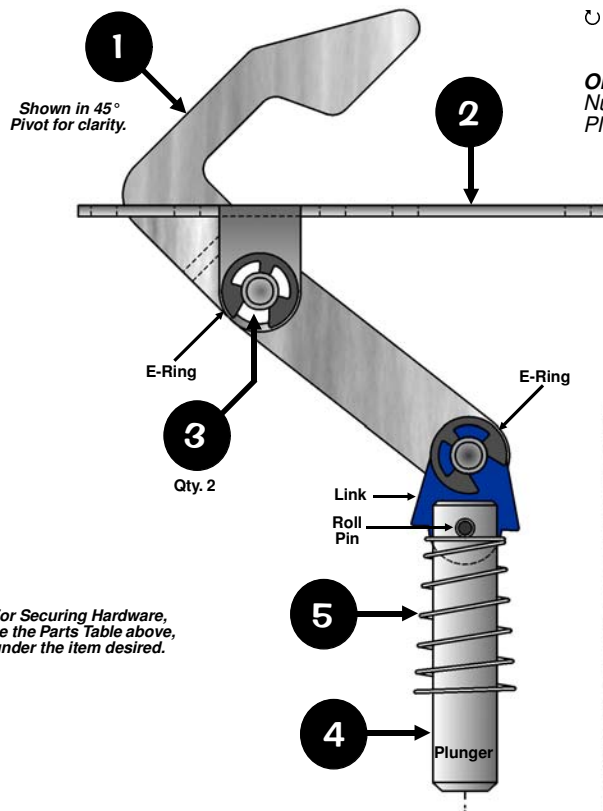
Works in conjunction with the Arm Weld Asm.

Nº	... ARM WELD PART NAME	QTY.	SPI PART Nº	Nº	'PLUNGER COIL PART NAME	QTY.	SPI PART Nº
1	Arm Weld Assembly	1	515-6526-00	6	Autoplunger Coil Bracket Assembly	1	515-6527-00
Item 1 is secured to Item 2 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)							
2	Autoplunger Fulcrum	1	535-7697-00	7	Coil Retainer Bracket	1	535-5203-03
3	Nyliner, 1/4" (Thomson #411-FF)	2	545-5423-00	Item 7 is secured to Item 6 by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)			
4	Plunger & Link Assembly	1	515-5338-00	8	Coil, 23-800	1	090-5001-00B
Item 4 is secured to Item 1 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)							
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	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 -00B or -00T 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.



Sec. 4: Drawings ...



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 exceptions, see note below Item 13 (Parts Table).

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Ball Trough Outhole Mounting Bracket	1	515-6580-01	11	Trough Ball Guide Plate	1	535-7801-00
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	12	Dual OPTO TRANS Board Assembly	1	515-0173-00
Item 2 requires: Heat Shrink Tubing 1/8" ø PUI-24 (Qty. 1"/per) (605-5006-00) Switch has a Diode (1N4004) (112-5003-00). Can be replaced with (1N4001) (112-5001-00).							
3	Sw. Body Protect Plate <i>Not Required</i>	0	535-6539-00	13	Dual OPTO REC Board Assembly	1	515-0174-00
4	Coil Mounting Bracket	1	535-7330-01	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)			
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	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, Switch Body Protect Plates, are not required when using Item 11 (req. for Magnet use).			
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	ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.			
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	Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
8	Plunger Assembly	1	515-5941-01	AP-A	Ball Trough Enter / Exit Scoop	1	535-7329-01
For Individual Items use : Plunger (530-5210-00) & Nylon Plunger (530-5277-01)							
9	Compression (Return) Spring	1	266-5020-00	Item AP-A secured to the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5101-00).			
10	Rubber Bumper (Grommet)	1	545-5105-00	AP-B*	Steel Balls (1-1/16" ø)	4	260-5000-00

Take Note:

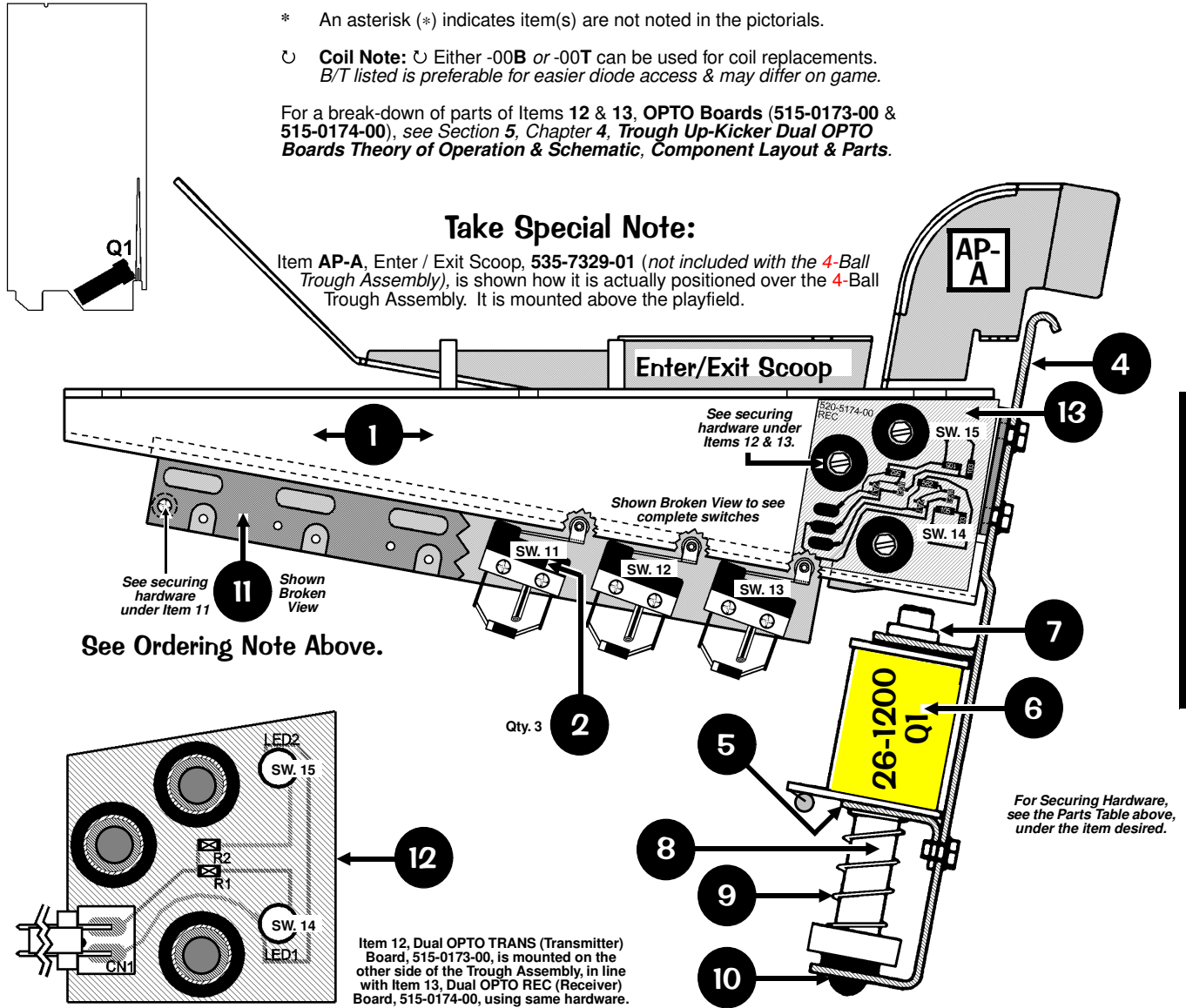
* An asterisk (*) indicates item(s) are not noted in the pictorials.

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

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

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.



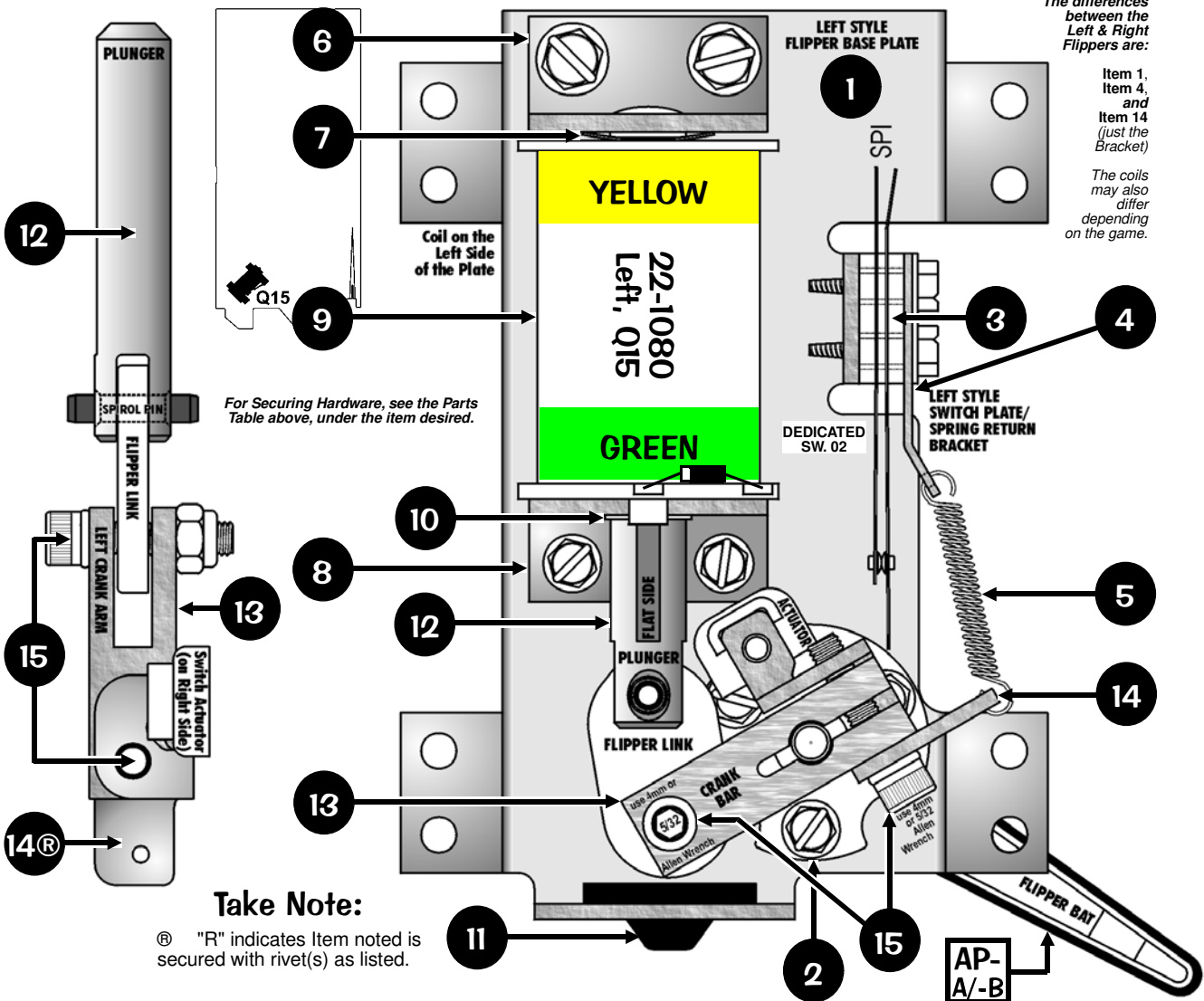
Sec. 4: Drawings ...



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)



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Flipper Base Plate (LEFT)	1	See FRP1	13	Crank Bar	1	530-5070-02
Item 1 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00) Ordering Note: Use Item FRP1, see the end of this Parts Table.				Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)			
2	Flipper Bat Bushing (White Plastic)	1	545-5070-00	14	Ⓜ Switch Actuator (LEFT) Sub-Assy.	1	515-7257-01
Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)				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)			
3	Power (End of Stroke) Switch	1	180-5149-00	15	Set Screw: #10-32 X 3/4" Socket Hd.	2	237-6144-00
Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)				Item 15 requires: #10-32 Nylon Stop Nut (Qty. 1 Flipper Link Side Only) (240-5203-00) Tool Required for Item 15: 5/32" or 4mm Allen Wrench			
4	Sw. Plate/Spring Return Brkt. (LEFT)	1	535-7354-01	Flipper Rebuild Parts for Easier Installation, Save \$:			
5	Flipper Return Spring	1	265-5035-00	FRP1 Flipper Base Plate Kit (LEFT)			
6	Coil Stop Bracket Sub-Assembly	1	515-6308-01	Includes Item 1 pre-threaded, with the Securing Hardware for Items 2, 3, 6 & 8.			
Item 6 is secured to Item 1 by: #10-32 X 3/8" SHWH Swage (Serr) Zinc (Qty. 2) (237-5985-00) and #10 Split Lock Washer (Qty. 2) (244-5003-00)				FRP2 Plunger, Link & Crank (LEFT) Assy.			
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00	Includes above Items 12, 13, 14 and 15 and is pre-assembled.			
8	Coil Support Bracket	1	535-7356-00	FRP3 Flipper (LEFT) Rebuild Kit			
Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)				Same as FRP2, but also includes above Items 6 & 10.			
9	Coil, 22-1080 (YEL-GRN) (Left)	1	090-5032-00T	ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.			
Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).				Nº ASSOCIATED PART NAME QTY. SPI PART Nº			
10	Coil Sleeve	1	545-5388-00	AP-A	YELLOW Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-5133-06-06
11	Deflector Pad (Bumper)	1	545-5428-00	AP-B	Large Flipper RED Rubber Ring	1	545-5277-22
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)							



The differences between the Left & Right Flippers are:

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

The coils may also differ depending on the game.

Sec. 4: Drawings ...

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)

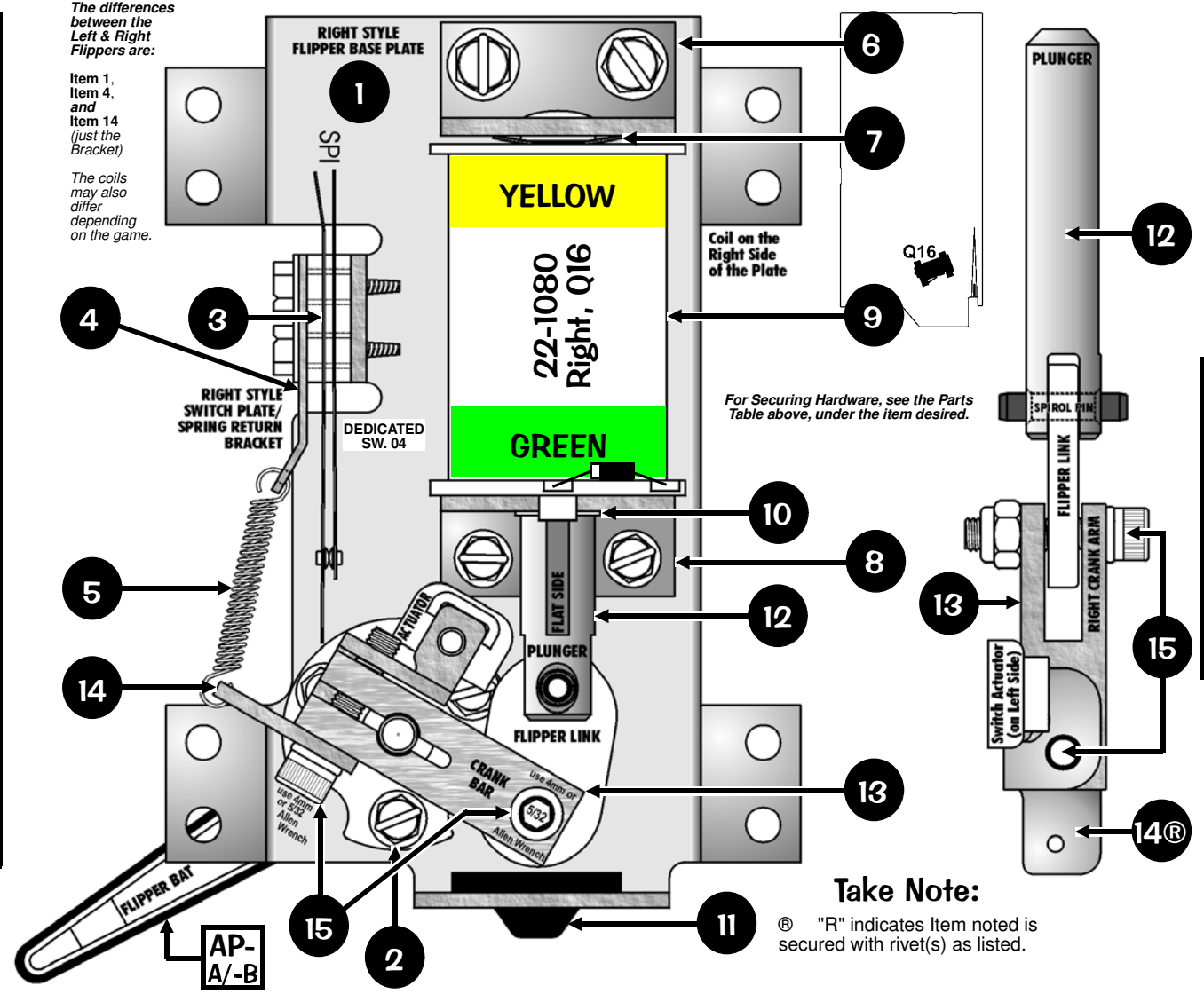


Flipper (Right) Assembly, 500-6543-02 (Items 1-15) and Assoc. Parts: Yellow Flipper Bat & Shaft Assy., 515-5133-06-06 (Item AP-A/-B)



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Flipper Base Plate (RIGHT) <small>Item 1 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00) Ordering Note: Use Item FRP1, see the end of this Parts Table.</small>	1	See FRP1	13	Crank Bar <small>Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)</small>	1	530-5070-02
2	Flipper Bat Bushing (White Plastic) <small>Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)</small>	1	545-5070-00	14	Ⓜ Switch Actuator (RIGHT) Sub-Assy. <small>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)</small>	1	515-7257-00
3	Power (End of Stroke) Switch <small>Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)</small>	1	180-5149-00	15	Set Screw: #10-32 X 3/4" Socket Hd. <small>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</small>	2	237-6144-00
4	Sw. Plate/Spring Return Brkt. (RIGHT)	1	535-7354-00	Flipper Rebuild Parts for Easier Installation, Save \$:			
5	Flipper Return Spring	1	265-5035-00	FRP1	Flipper Base Plate Kit (RIGHT) <small>Includes Item 1 pre-threaded, with the Securing Hardware for Items 2, 3, 6 & 8.</small>		515-6617-00
6*	Coil Stop Bracket Sub-Assembly <small>Item 6 is secured to Item 1 by: #10-32 X 3/8" SHWH Swage (Serr) Zinc (Qty. 2) (237-5985-00) and #10 Split Lock Washer (Qty. 2) (244-5003-00)</small>	1	515-6308-01	FRP2	Plunger, Link & Crank (RIGHT) Assy. <small>Includes above Items 12, 13, 14 and 15 and is pre-assembled.</small>		515-7203-00
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00	FRP3	Flipper (RIGHT) Rebuild Kit <small>Same as FRP2, but also includes above Items 6 & 10.</small>		500-6307-00
8	Coil Support Bracket <small>Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)</small>	1	535-7356-00	ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.			
9	Coil, 22-1080 (Right) <small>Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).</small>	1	090-5032-00T	Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
10	Coil Sleeve	1	545-5388-00	AP-A	YELLOW Flipper Bat & Shaft (Plain) <small>(Non-Knurled End) Assembly</small>	1	515-5133-06-06
11	Deflector Pad (Bumper)	1	545-5428-00	AP-B	Large Flipper RED Rubber Ring	1	545-5277-22
12	Flipper Plunger & Link Sub-Assy. <small>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)</small>	1	515-6304-03				

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



The differences between the Left & Right Flippers are:
Item 1, Item 4, and Item 14 (just the Bracket)
The coils may also differ depending on the game.

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

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

Sec. 4: Drawings ...



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)

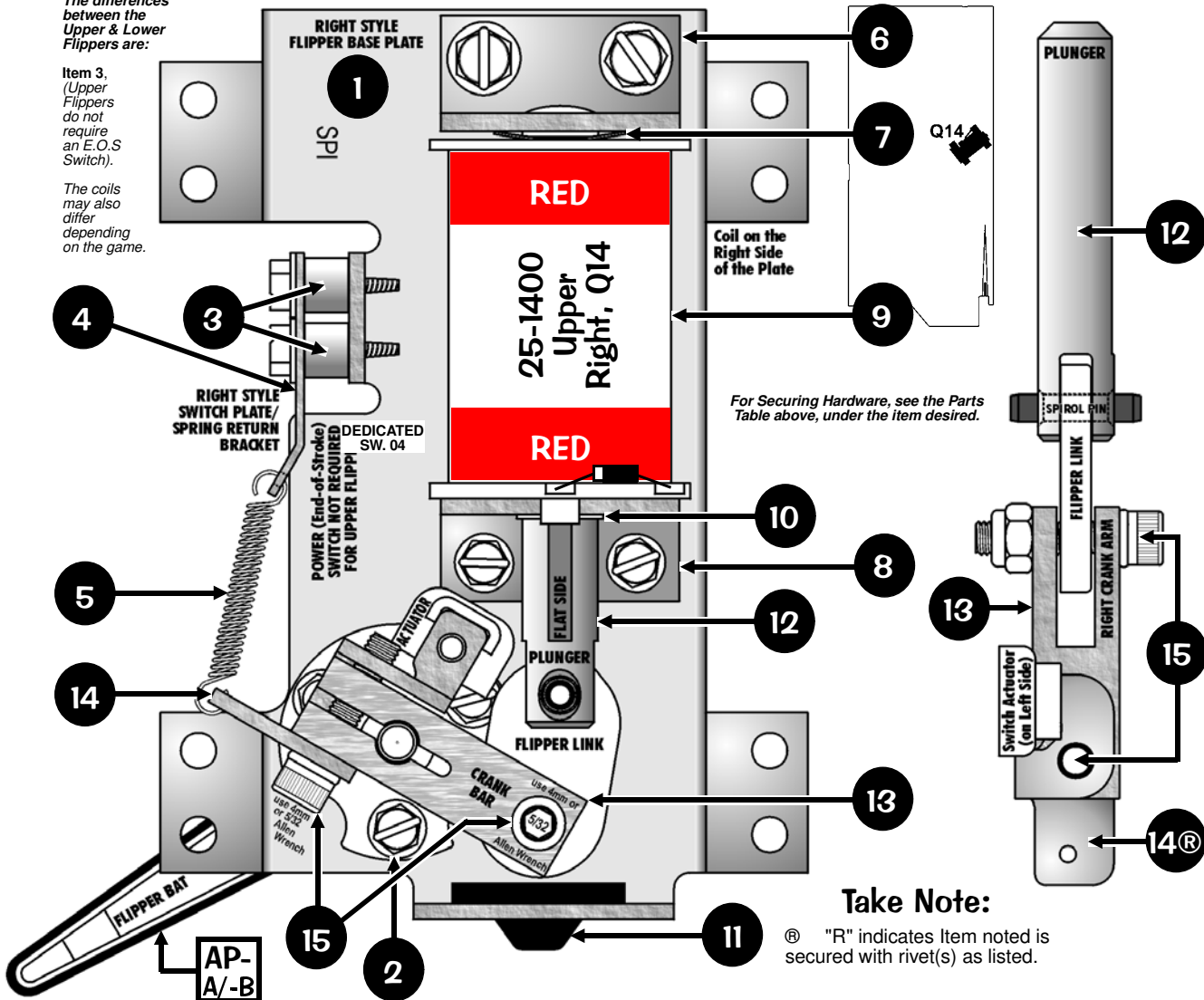


Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Flipper Base Plate (RIGHT)	1	See FRP1	13*	Crank Bar	1	530-5070-02
Item 1 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00) Ordering Note: Use Item FRP1, see the end of this Parts Table.				Item 13 requires: Bushing, .192" ø ID X .312" ø OD X .195" (Qty. 1) (530-5139-00)			
2	Flipper Bat Bushing (White Plastic)	1	545-5070-00	14	® Switch Actuator (RIGHT) Sub-Assy.	1	515-7257-00
Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)				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)			
3	1/4" X 3/8" Spacer Gray	2	254-5000-02	15*	Set Screw: #10-32 X 3/4" Socket Hd.	2	237-6144-00
Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Sw. (Ser.) Zc. (Qty. 1/per) (237-5976-04)				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			
4	Sw. Plate/Spring Return Brkt. (RIGHT)	1	535-7354-00	Flipper Rebuild Parts for Easier Installation, Save \$:			
5	Flipper Return Spring	1	265-5035-00	FRP1	Flipper Base Plate Kit (RIGHT) Includes Item 1 pre-threaded, with the Securing Hardware for Items 2, 3, 6 & 8.		515-6617-00
6*	Coil Stop Bracket Sub-Assembly	1	515-6308-01	FRP2	Plunger, Link & Crank (RIGHT) Assy. Includes above Items 12, 13, 14 and 15 and is pre-assembled.		515-7203-00
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)				FRP3	Flipper (RIGHT) Rebuild Kit Same as FRP2, but also includes above Items 6 & 10.		500-6307-00
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00	ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.			
8	Coil Support Bracket	1	535-7356-00	Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)				AP-A	YELLOW Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-5133-06-06
9	Coil, 25-1400 (RED-RED) (Upr. Rt.)	1	090-5067-00T	AP-B	Large Flipper RED Rubber Ring	1	545-5277-22
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)							

The differences between the Upper & Lower Flippers are:

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

The coils may also differ depending on the game.



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

Take Note:

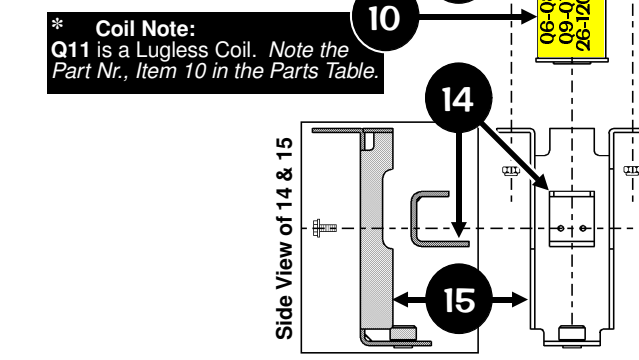
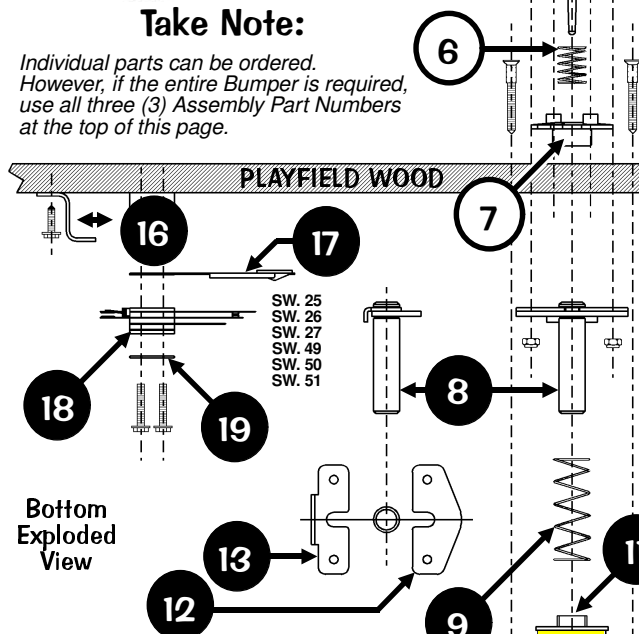
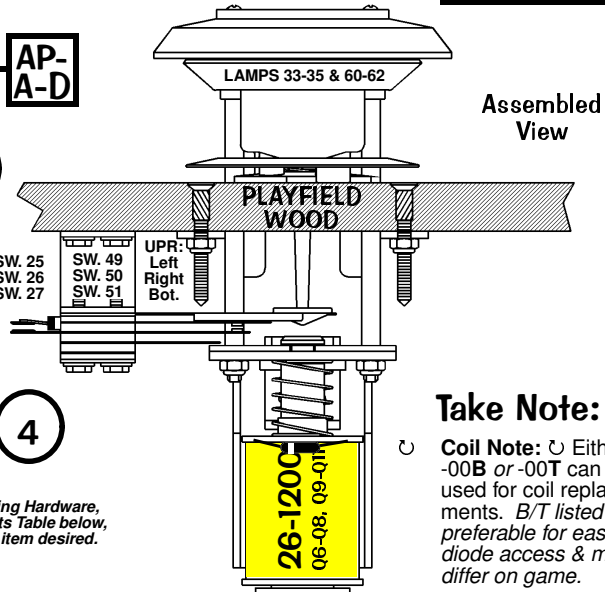
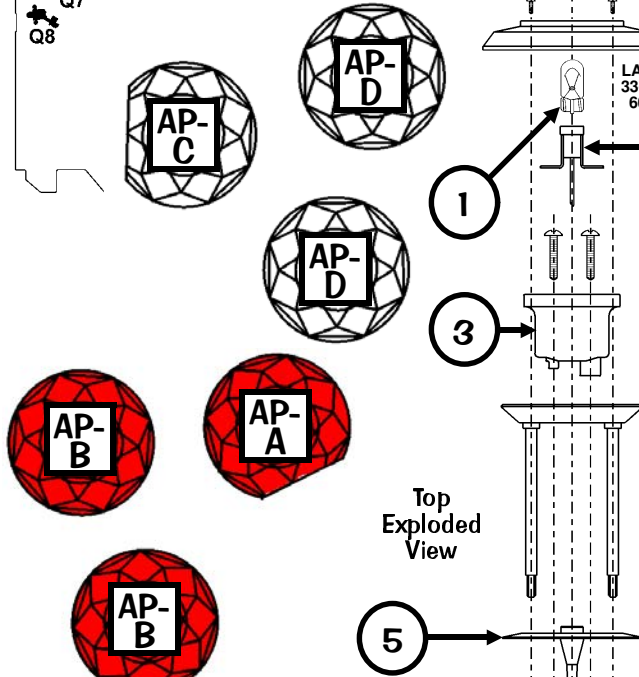
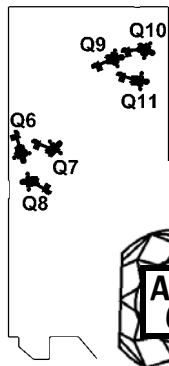
® "R" indicates Item noted is secured with rivet(s) as listed.

Sec. 4: Drawings ...



**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.

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

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

Nº	BUMPER TOP PART NAME	QTY.	SPI PART Nº
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

Nº	BUMPER BOTTOM PART NAME	QTY.	SPI PART Nº
8	Plunger	1	530-5348-00
9	Compression (Return) Spring	1	266-5047-00
10	Coil, 26-1200 (Q6-Q8, Q9-Q10)	1	090-5044-00T
10	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)			

Nº	BUMPER SWITCH PART NAME	QTY.	SPI PART Nº
16	Switch Bracket	1	535-7342-00
Item 16 is secured by: #8 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00)			
17	Spoon Switch Actuator	1	545-5610-01
18	Bumper Stack (Blade) Switch	1	180-5015-03
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.

Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
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)

Sec. 4: Drawings ...



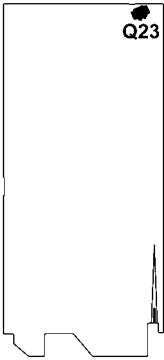
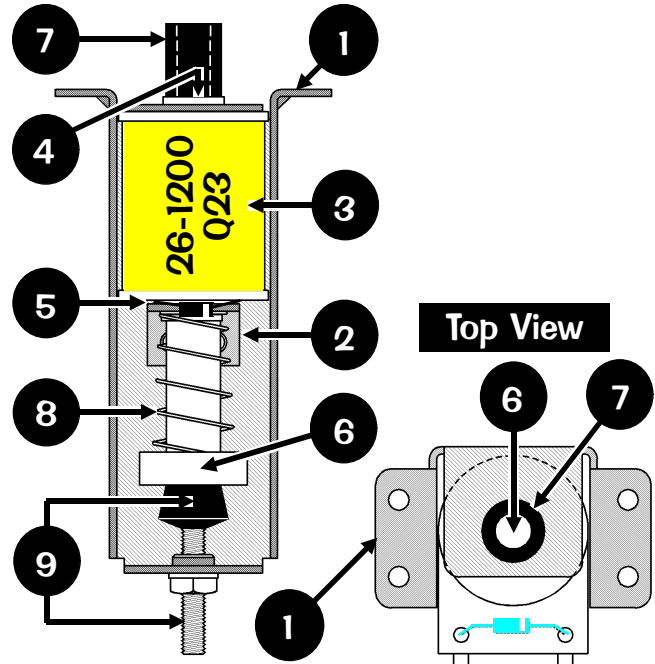
Ball Deflector Assembly (Upper Right Orbit), 500-6433-00 (Items 1-9)

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

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
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 -00B or -00T 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.

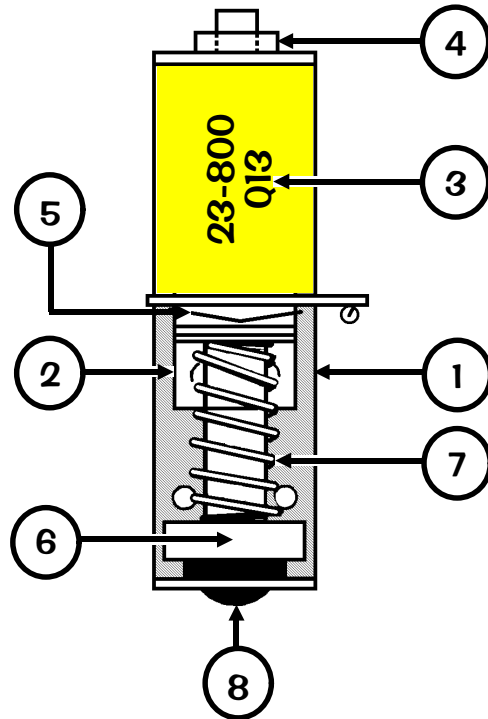


Lock Kicker (Laser Kick) Assembly, 500-5862-00 (Items 1-8)

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

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
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

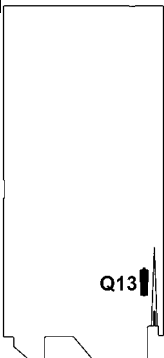
Ordering Note: If 500-5862-00 is unavailable, order the individual part(s) actually required. This assembly is identical to 500-5862-01 (Coil Position: Lugs Face Left) and 500-5862-02 (Coil Position: lugs face right). *Remove coil and put into same position.*



Take Note:

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



Sec. 4: Drawings ...

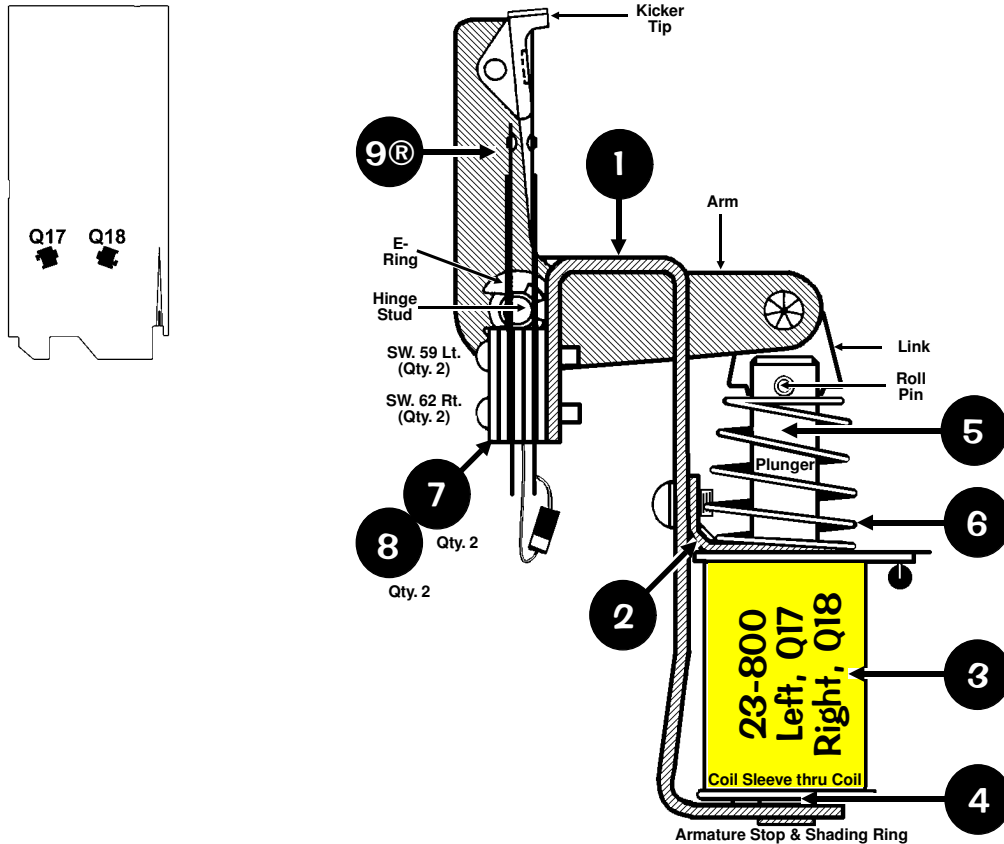


Slingshot Assemblies, 500-5849-00 (Qty. 2) (Items 1-9)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Slingshot Bracket Assembly	1	515-5339-01	6	Compression (Return) Spring	1	266-5020-00
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	7	Slingshot Stack (Blade) Switch	2	180-5054-00
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	8	Switch Body Protect Plate	2	535-5045-00
Coil has a Diode (1N4004) (112-5003-00) positioned @ top (above lugs next to windings).							
4	Coil Sleeve	1	545-5031-00	9®	Riveted Arm & Tip Assembly	1	515-5340-01
5	Plunger & Link Assembly	1	515-5338-00	For Individual Parts use (requires drilling out rivet & re-venting): Arm (515-5341-01), Kicker Tip (545-5216-01) and Rivet, 1/8" ø x 1/4" Lg. (249-5003-00) The Riv. Arm is secured to Item 1 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)			
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.							
Ordering Note: If 500-5849-00 is unavailable, order the individual part(s) actually required.							

Take Note:

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



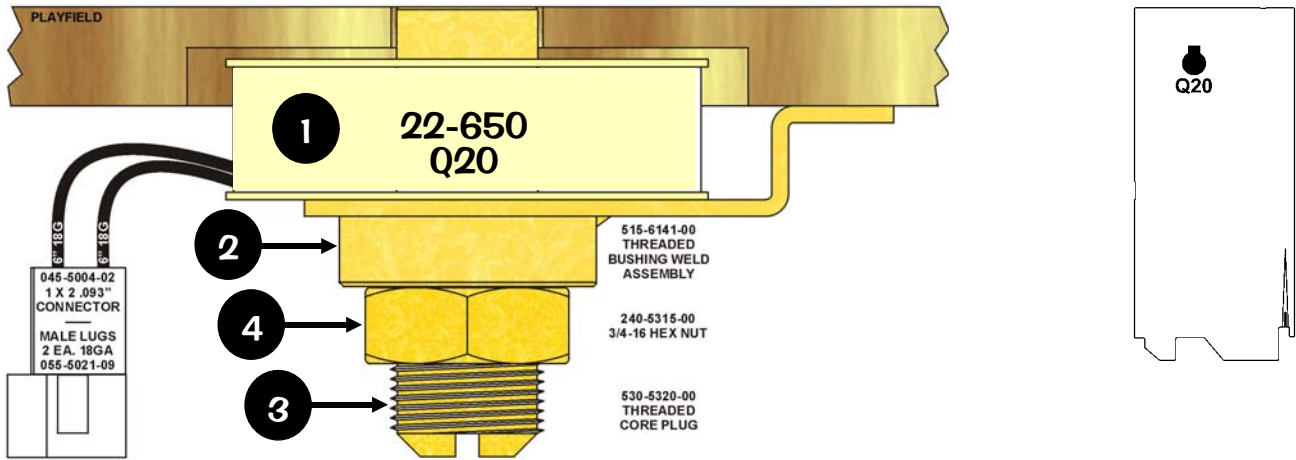
Sec. 4: Drawings ...



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.

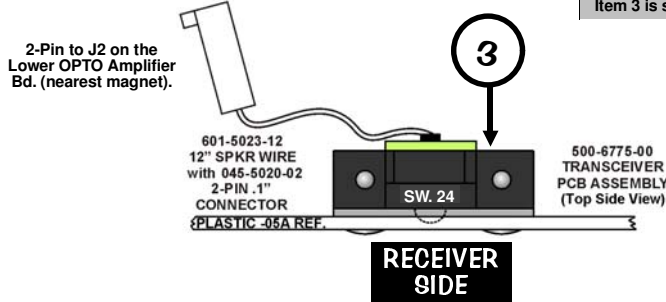
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Magnet Coil, 22-650 (6" Leads + Conn.)	1	500-6791-00	3	Threaded Core Plug	1	530-5320-00
For Individual Items use : Magnet Coil (22-650) (090-5042-00), 1 X 2, .093" Connector Plug 03-09-2022 (045-5004-02) and Male Lugs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



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.

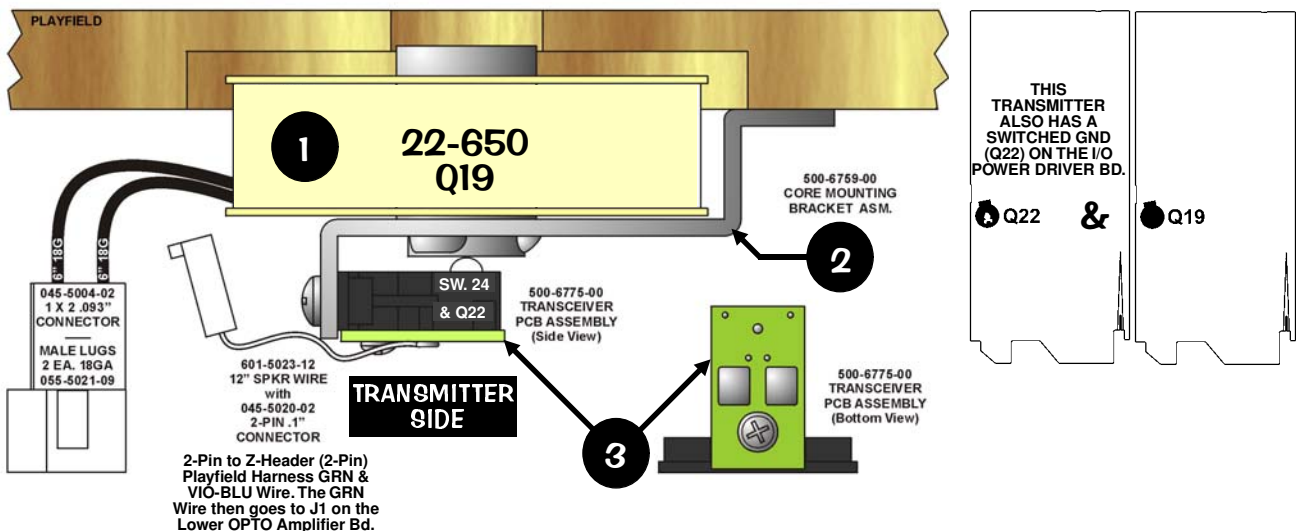
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Magnet Coil, 22-650 (6" Leads + Conn.)	1	500-6791-00	2	Bracket, Magnet Core Mount (w/ OPTO Hole)	1	515-6141-00
For Individual Items use : Magnet Coil (22-650) (090-5042-00), 1 X 2, .093" Connector Plug 03-09-2022 (045-5004-02)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



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.



Sec. 4: Drawings ...



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

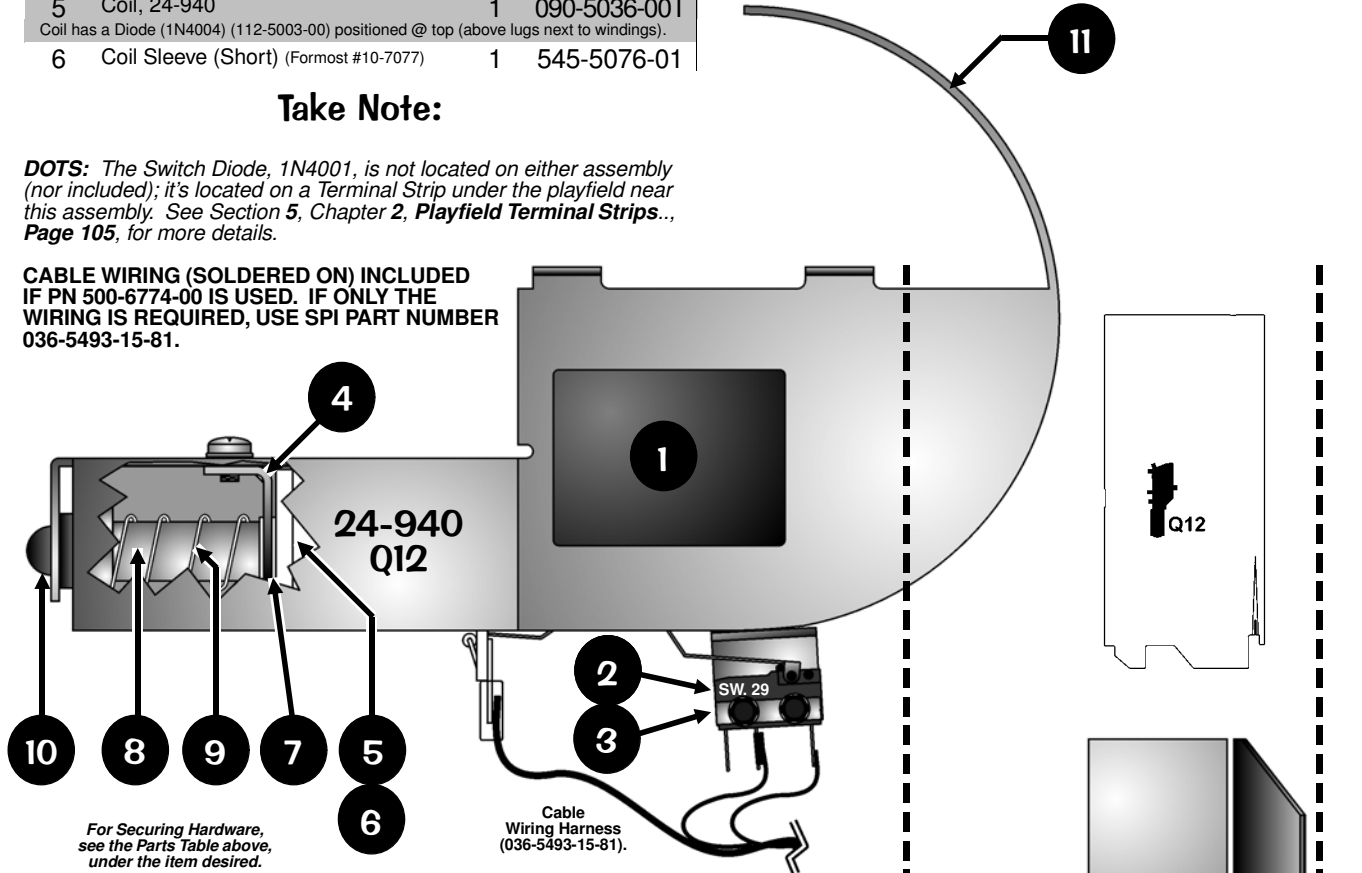
When energized, the ball is kicked back out towards player (ball can enter from the front or side).

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Scoop / Coil Mounting Bracket (Welded)	1	515-7361-00	7	Spring Washer, 17/32" ID X 3/4" X 1"	1	269-5002-00
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	8	Plunger Assembly	1	515-5000-02
3	Switch Body Protect Plate	1	535-6539-00	9	Compression (Relay) Spring	1	266-5020-00
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	10	Rubber Bumper (Grommet)	1	545-5105-00
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	11	Kit: Decals (Screened) -21	1	802-5000-81
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	<p>Note: Individual Decal (-21) is not available individually, ordering of kit is required. For all pieces, see Playfield - Plastics (Screened & Clear) & Decals, Page 67.</p> <p>Ordering Note: If 500-6774-00 is unavailable, order the individual part(s) actually required.</p>			

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.



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

Cable Wiring Harness (036-5493-15-81).

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

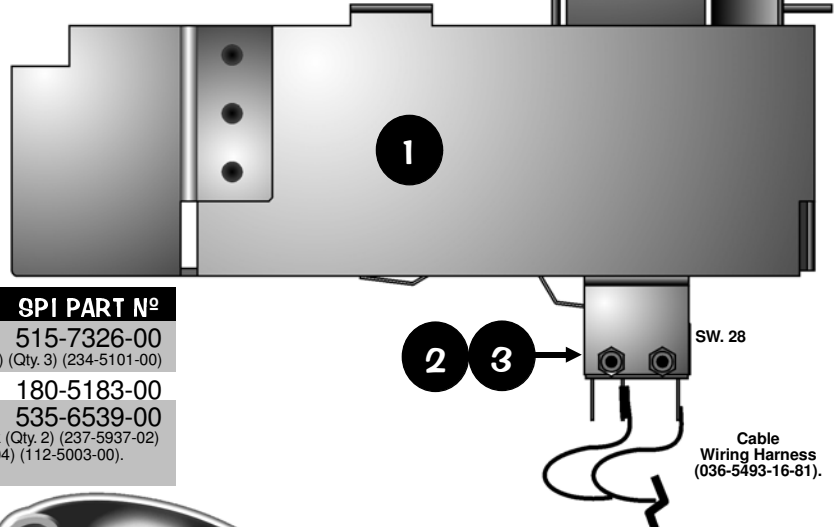
Take Note:

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.

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

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
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).			



Cable Wiring Harness (036-5493-16-81).

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.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Main Frame (Vari-Target Housing) Item 1 is secured below playfield by: #8 X 1/2" SLT HWH AB (Zinc) (Qty. 2) (234-5101-00)	1	535-9308-00	8	3-Switch U-Shaped OPTO PCB Item 8 is secured to Item 5 by: #8-32 X 3/8" SLT Ser HWH (Zinc) (Qty. 2) (237-5975-00)	1	520-5234-00
2	Bracket, Target Stop (Front) 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)	1	535-9312-00	9	Spring, Target Return 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)	1	265-5003-00
3	Bracket, Target Stop (Back) Item 3 is secured to Item 1 by: #8-32 X 3/8" SLT Ser HWH (Zinc) (Qty. 3) (237-5975-00)	1	535-9317-00	10	Kit: Decals (Screened) -97 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.	1	802-5000-81
4®	Vari-Target Arm Riveted Assembly For Individual Items use : Target Arm (No Parts) (535-9309-00), Hub (530-5644-00), OPTO Interrupter Single Blade (535-9310-00), OPTO Interruption 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)	1	515-7323-00				
5	Bracket, OPTO PCB Mount Item 5 is secured to Item 1 by: #8-32 X 3/8" SLT Ser HWH (Zinc) (Qty. 2) (237-5975-00)	1	535-9316-00				
6	Bracket, Mini-Coil Mount Item 6 is secured to Item 1 by: #8-32 X 3/8" SLT Ser HWH (Zinc) (Qty. 2) (237-5975-00)	1	535-9313-00				
7	Mini-Coil & Bracket Assembly 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)	1	515-7329-00				

Take Note:

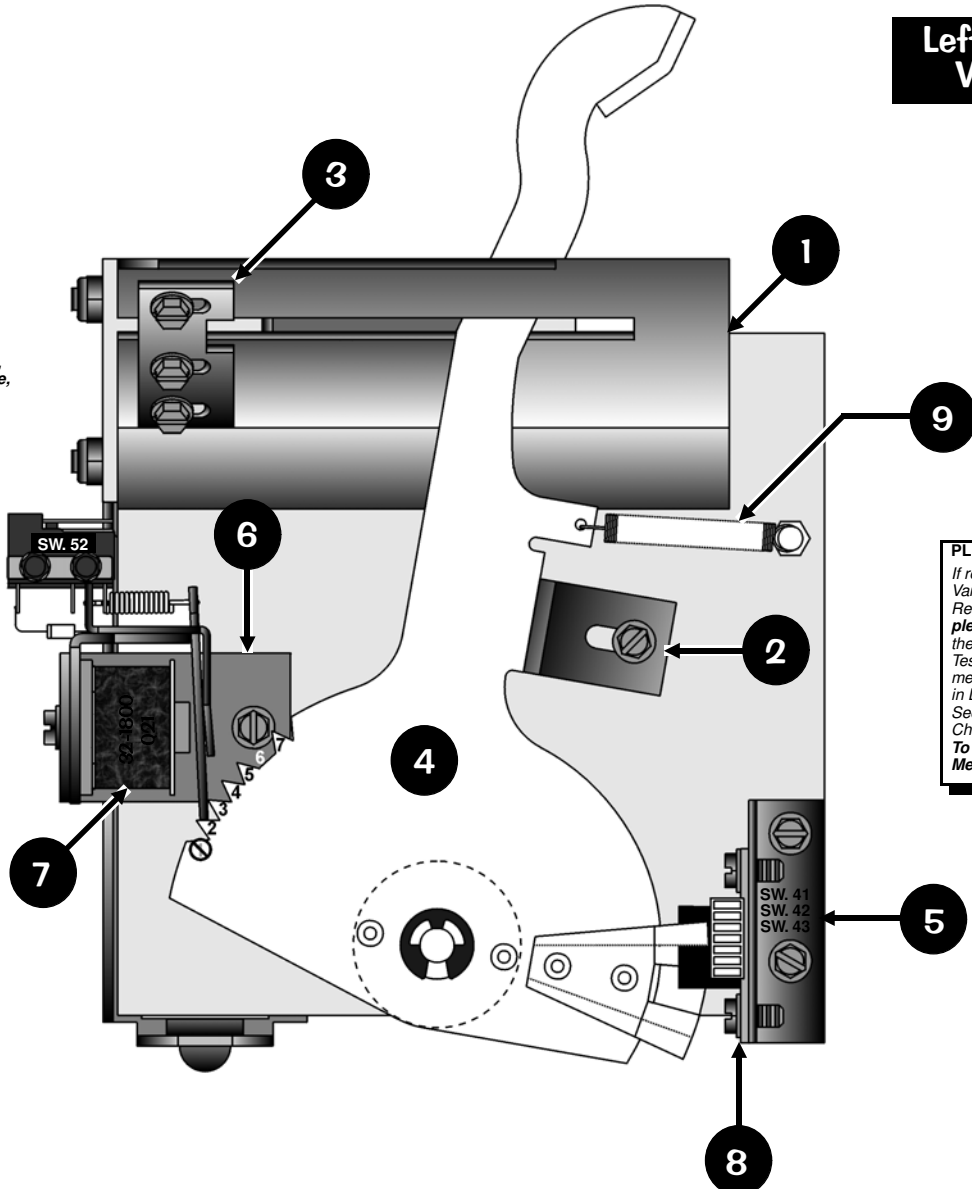
® "R" indicates Item noted is secured with rivet(s) as listed.

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.

Sec. 4: Drawings ...

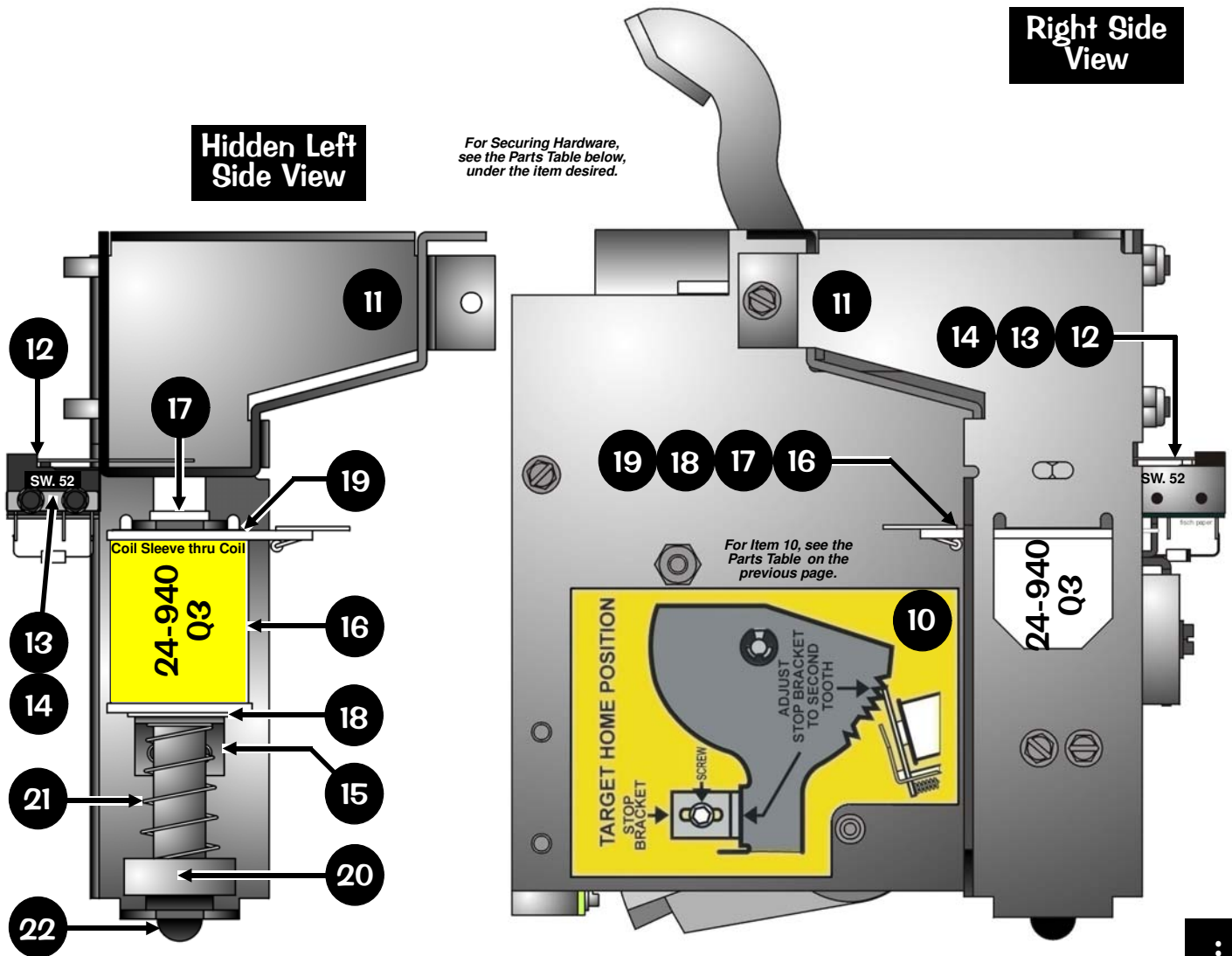


Vari-VUK (Popper) Assembly, 515-7325-00 (Items 11-22)
 Works in conjunction with the Vari-Target (see previous page). Also shown separated for clarity.

Right Side View

Hidden Left Side View

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



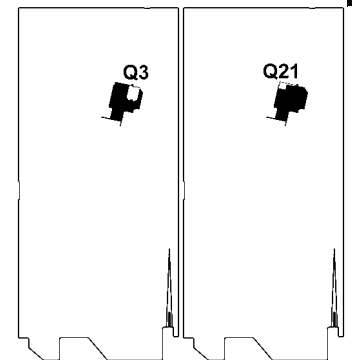
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
11	Bracket, Vari-VUK (Popper)	1	535-9318-00
Item 11 is secured to Item 1 (previous page) by: #8-32 X 3/8" SLT Ser HWH (Zinc) (Qty. 2) (237-5975-00) and #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00)			
Item 11 is secured below playfield by: #8 X 1/2" SLT HWH AB (Zc.) (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 -00B or -00T 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).



Sec. 4: Drawings ...



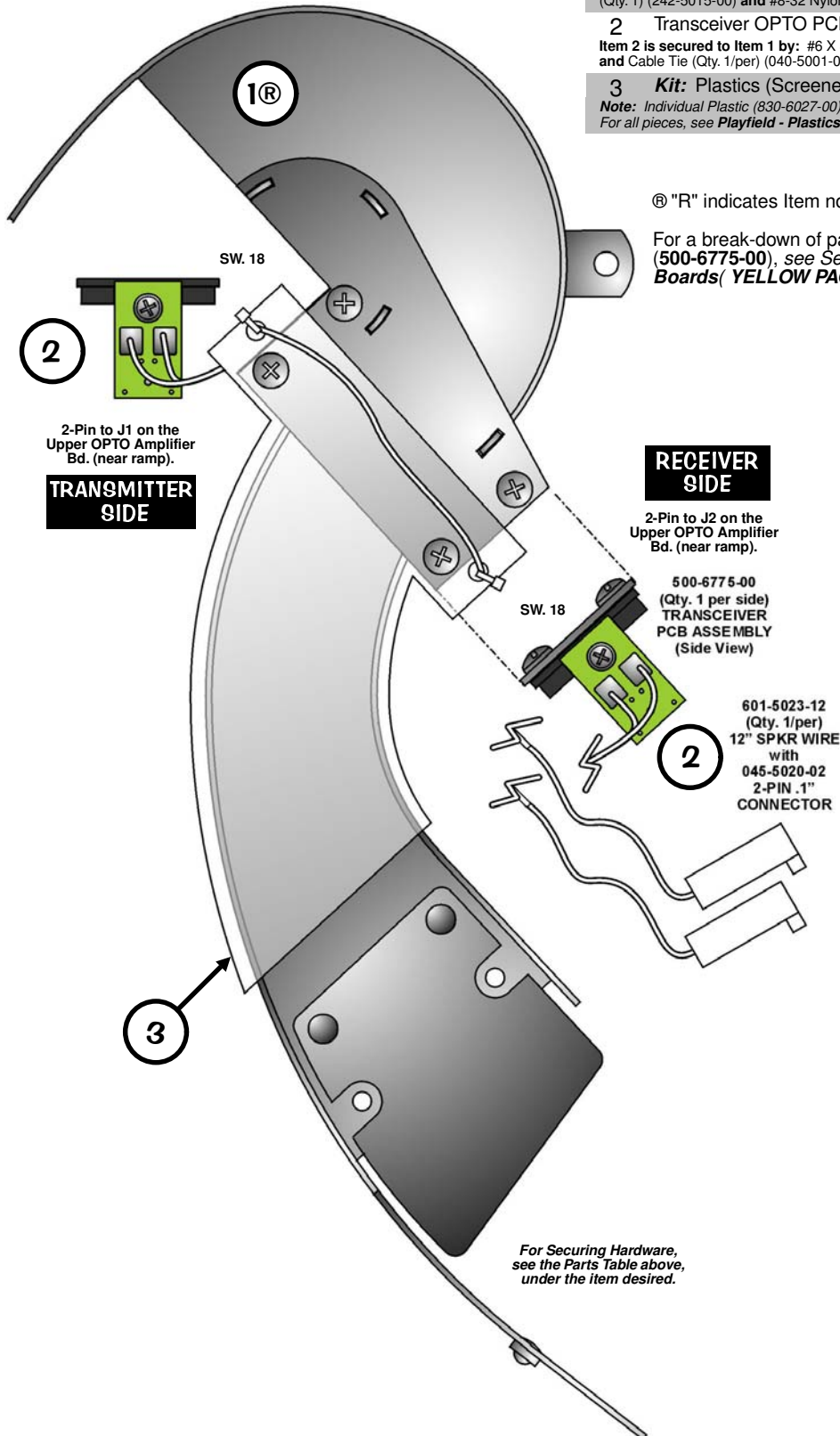
Steel (Metal) Ramp Individual Parts Only (Items 1-3)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1®	Steel (Metal) Ramp Riveted Asm. <i>For Individual Items use :</i> 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)	1	515-7328-00
2	Transceiver OPTO PCB Assembly 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)	2	500-6775-00
3	Kit: Plastics (Screened & Clear) -00 <i>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.</i>	1	803-5000-81

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.



Sec. 4: Drawings ...

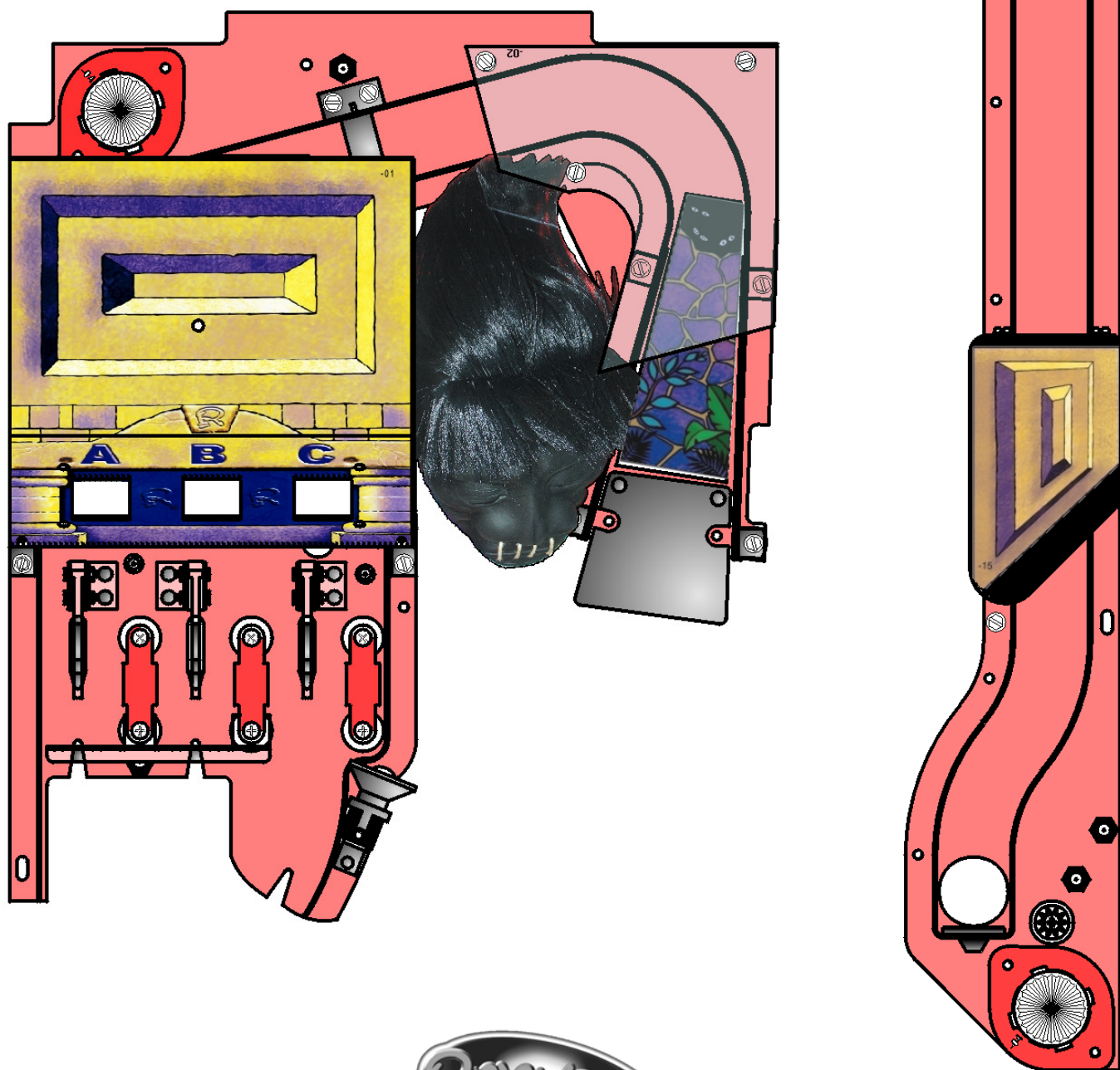


Plastic (Left & Right) Ramps Overview

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**.

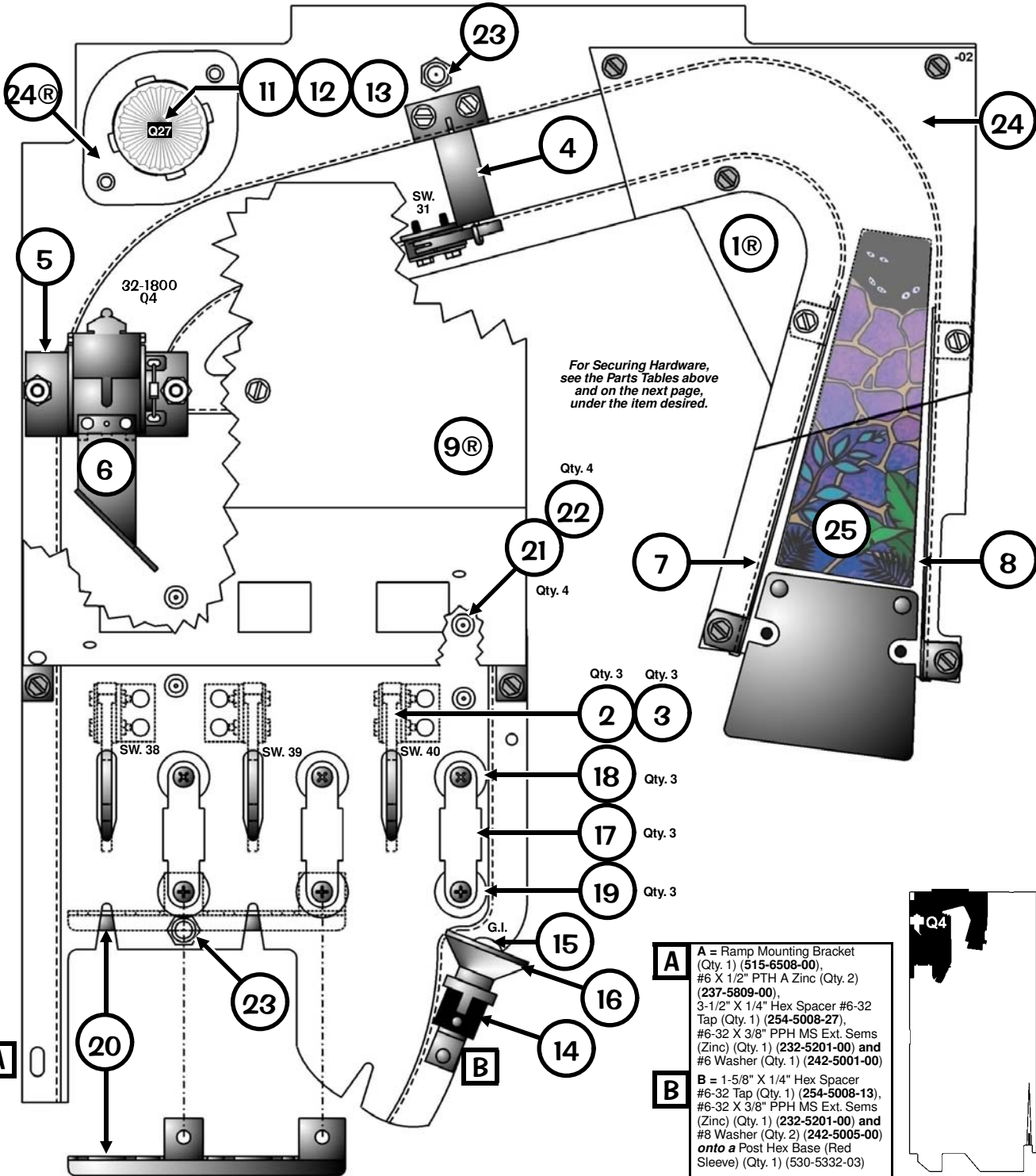
The Plastic Ramps cannot be ordered assembled. Only order the parts required. Drilling out of rivets may be necessary (replace with appropriate sized screw and nut).



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

Parts Table and Views continued on the next page.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1®	Left Plastic Ramp Riveted Assembly	1	515-7320-00R	4	Ramp Gate Switch (Left)	1	500-6593-01
<i>For Individual Items use :</i> 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).				<i>For Individual Items use :</i> Gate Bracket (Left) (535-9171-01), Wire Form (535-9172-00), Micro Switch (Qty. 1) (180-5190-26), #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 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.				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)			
2	Micro Switch (Happ #95-1128-00)	3	180-5183-00	5	Bracket, Mini-Coil Mount (Plate Divtr.)	1	535-9437-00
3	Switch Body Protect Plate	3	535-6539-00	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)			
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).				<i>Parts Table continued on top of next page.</i>			



Sec. 4: Drawings ...

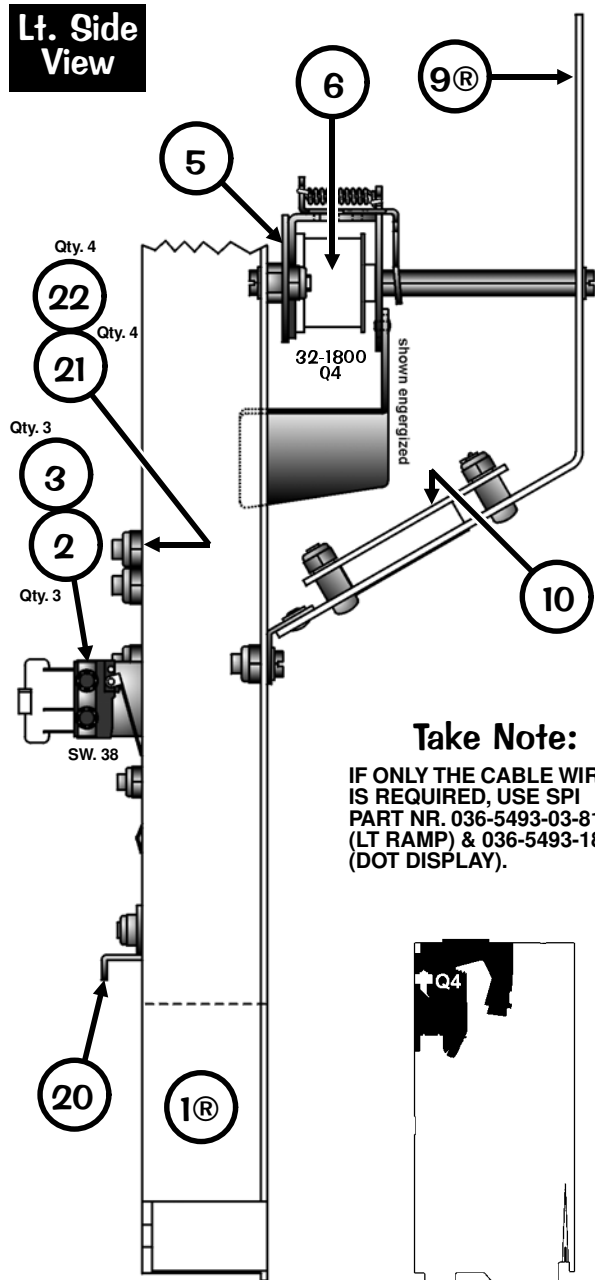


Left Plastic Ramp Individual Parts Only (Items 1-25) Continued

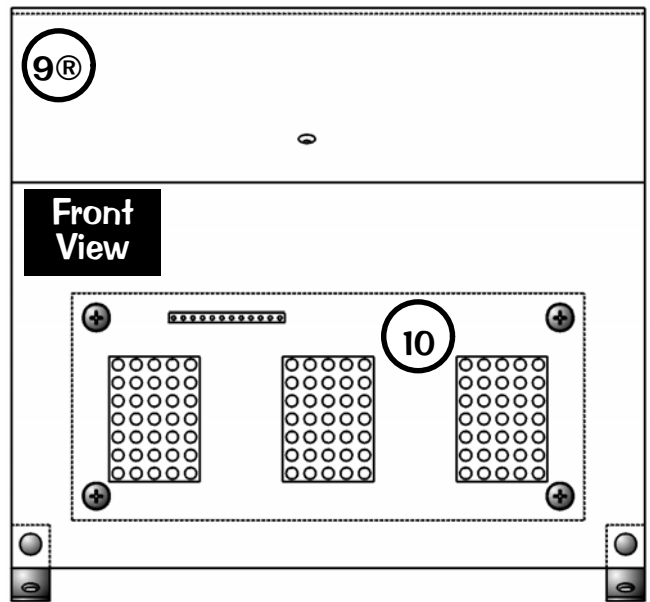
Parts Table and Views continued from the previous page.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
6	Mini-Coil & Bracket Assembly <i>For Individual Items use :</i> 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 82a Undercut (Zinc) (Qty. 1) (237-6030-00)	1	515-7329-00	10	P/F Dot Display (5X7) X3 LED PCB Item 10 is secured to Item 9 by: #6-32 X 5/8" PPH MS (Zinc) (Qty. 4) (237-5503-00), 1/4" Sif. Rtn. Plastic Spacer White (Qty. 4) (254-5007-02) and #6-32 Nylon Stop Nut (Qty. 4) (240-5005-00)	1	520-5236-00
7	Ramp Guard (Left Side)	1	535-9425-00	11	IDC Snap-On Socket No Diode	1	077-5216-01
8	Ramp Guard (Right Side) 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)	1	535-9425-01	12	#906 Wedge Base Bulb (Clear)	1	165-5004-00
9®	Kit: Plastics (Scrnd. Display Cover) Note: Individual Plastic (830-6020-00) is available as an assembly only, ordering of kit is required. For all pieces, see <i>Playfield - Plastics (Screened & Clear) & Decals, Page 67.</i> 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)	1	803-5001-81	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 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)	1	535-9429-00

Parts Table continued at bottom of this page.



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) Items 21 & 22 are secured to Item 1 by: #10-32 Nylon Stop Nut (Qty. 4) (240-5203-00)	4	545-5348-69
23	Mini-Jewel Plastic Post (Clear) Item 23 is secured to Item 1 by: #6 X 3/8" SLT HWH AB (Zinc) (Qty. 1/per) (234-5000-00)	2	550-5052-01
24®	Kit: Plastics (Clear) -02, -04 Note: Individual Plastics (830-6014-XX) are not available individually, ordering of kit is required. For all pieces, see <i>Playfield - Plastics (Screened & Clear) & Decals, Page 67.</i> 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)	1	803-5000-81
25	Kit: Decals (Screened) -22 Note: Individual Decal (820-6341-22) is not available individually, ordering of kit is required. For all pieces, see <i>Playfield - Plastics (Screened & Clear) & Decals, Page 67.</i>	1	802-5000-81

Take Note:

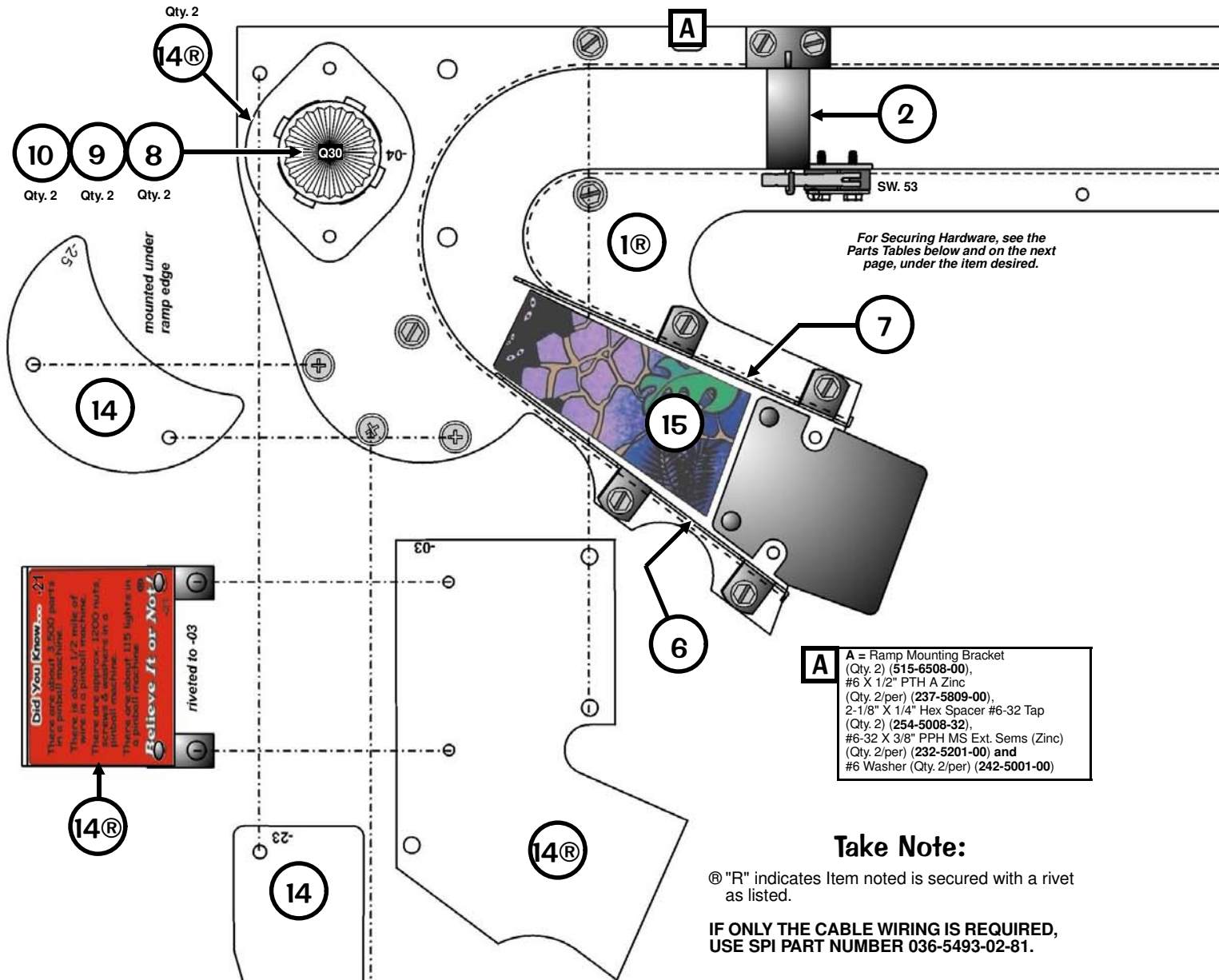
® "R" indicates Item noted is secured with rivet(s) as listed.

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.



For Securing Hardware, see the Parts Tables below and on the next page, under the item desired.



For Securing Hardware, see the Parts Tables below and on the next page, under the item desired.

- A** 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)

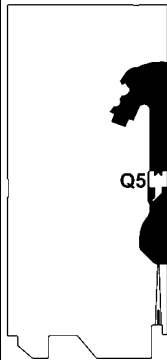
Take Note:

® "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.

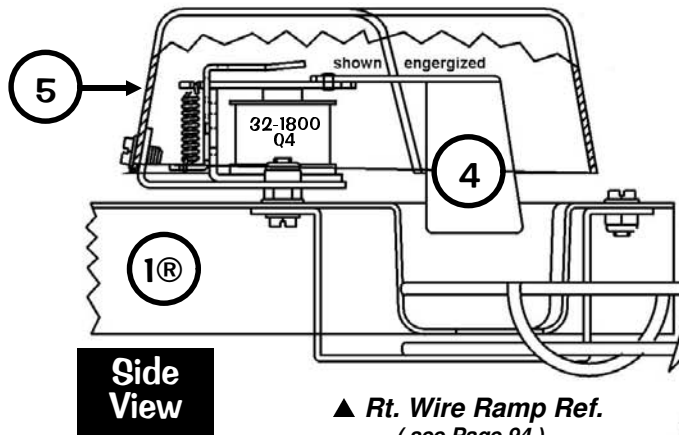
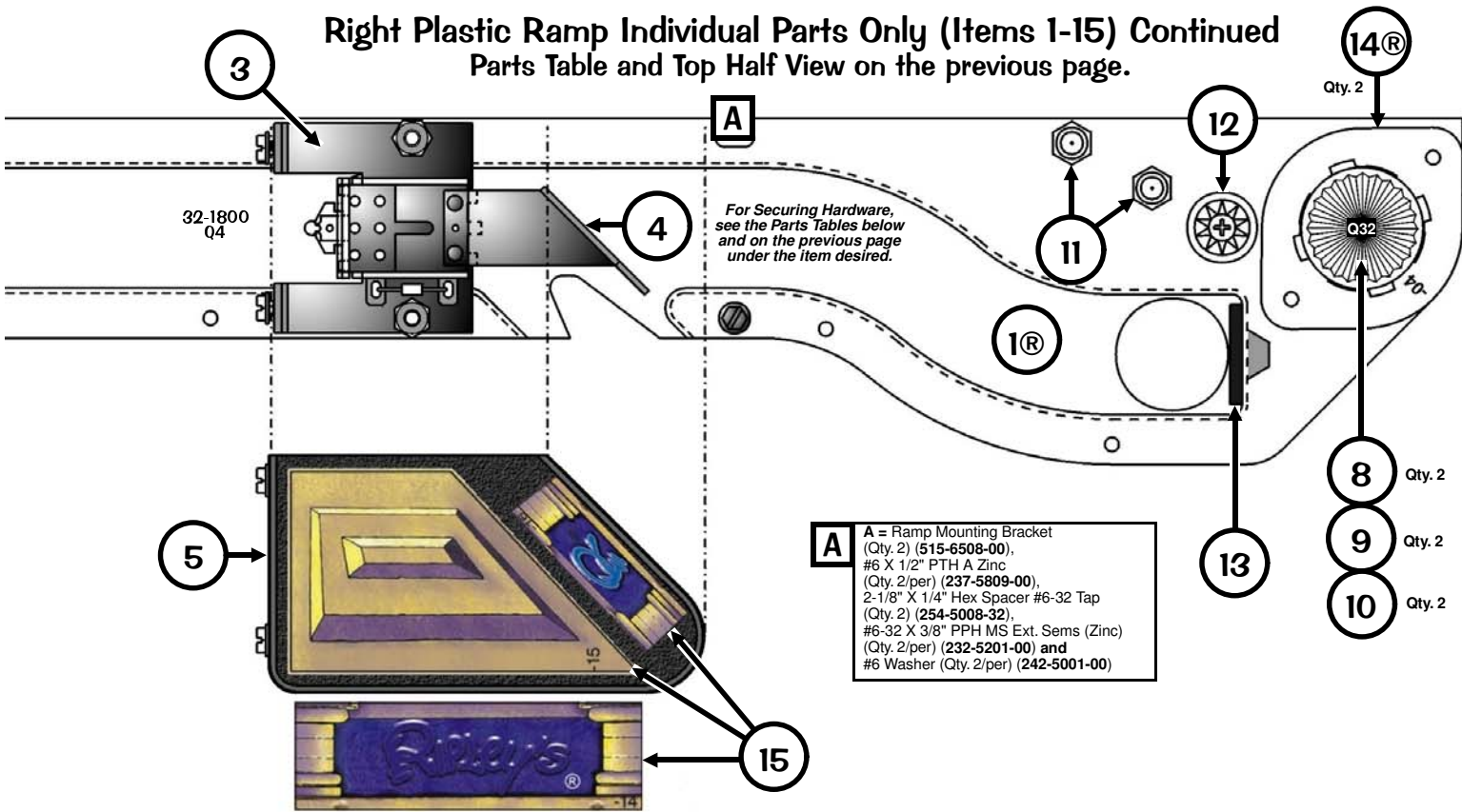
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1®	Right Plastic Ramp Riveted Assembly	1	515-7321-00R
<i>For Individual Items use :</i> Right Plastic Ramp (No Parts) (545-6090-00), Ramp Flap (535-9301-00), #6 Lock Washer (Qty. 2) (246-5000-00) and Rivet, 1/8" o X 3/16" Lg. (Qty. 2) (249-5001-00).			
<i>Item 1 is secured above the playfield @ flap by:</i> #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
<i>For Individual Items use :</i> 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)			
<i>Item 2 is secured to Item 1 by:</i> #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
<i>For Individual Items use :</i> Mini-Coil, 32-1800 (090-5031-00), Coil Armature Assembly (515-7356-01 & -03), Hanger Plate Frame (535-6198-00), Spring (265-5024-00)			
<i>Item 4 is secured to Item 3 by:</i> #8-32 X 3/8" PFH 82a 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
<i>Item 5 is secured to Item 3 by:</i> #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.

Sec. 4: Drawings ...



Right Plastic Ramp Individual Parts Only (Items 1-15) Continued Parts Table and Top Half View on the previous page.

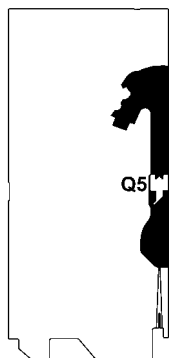


Take Note:

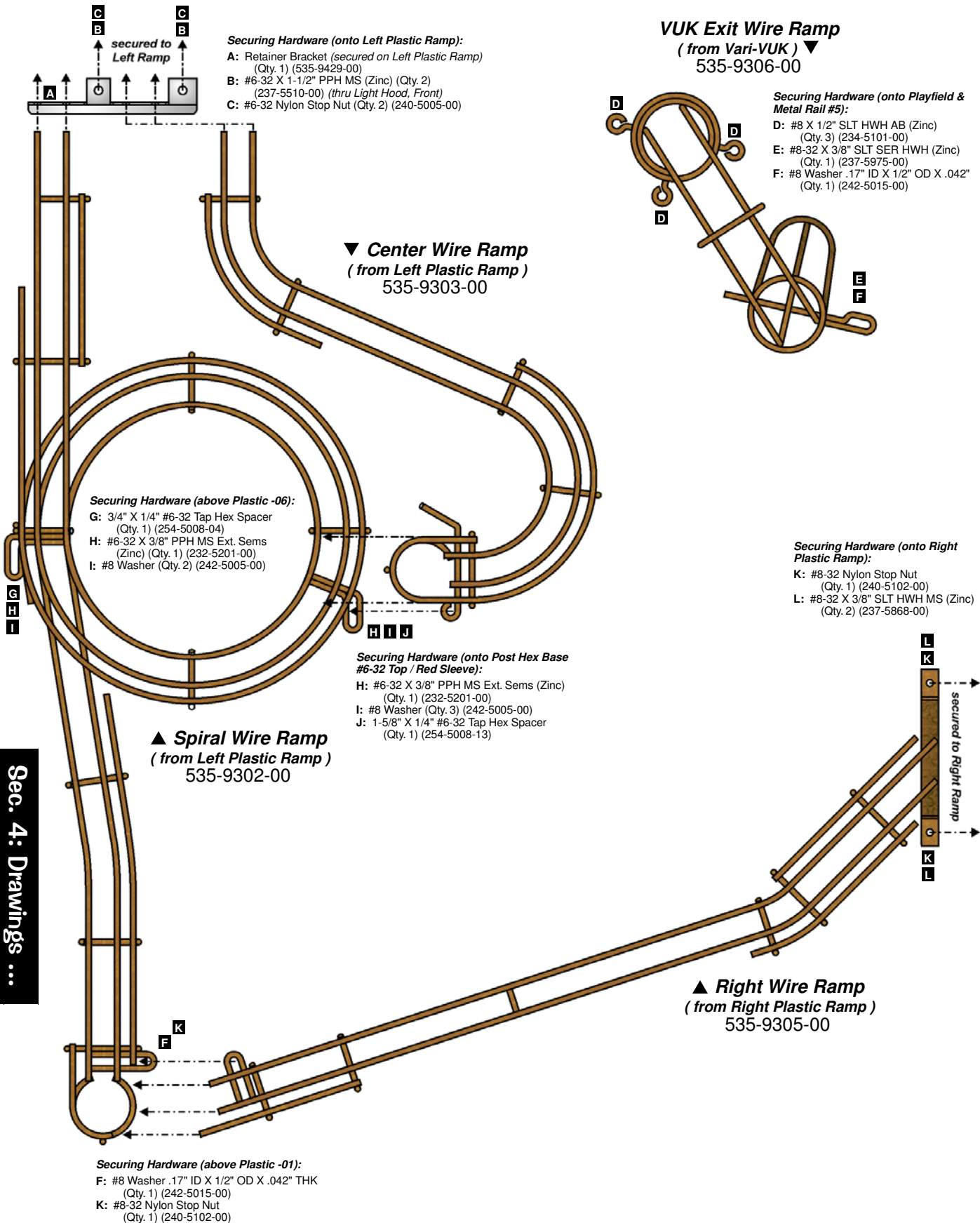
® "R" indicates Item noted is secured with a rivet as listed.

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.			



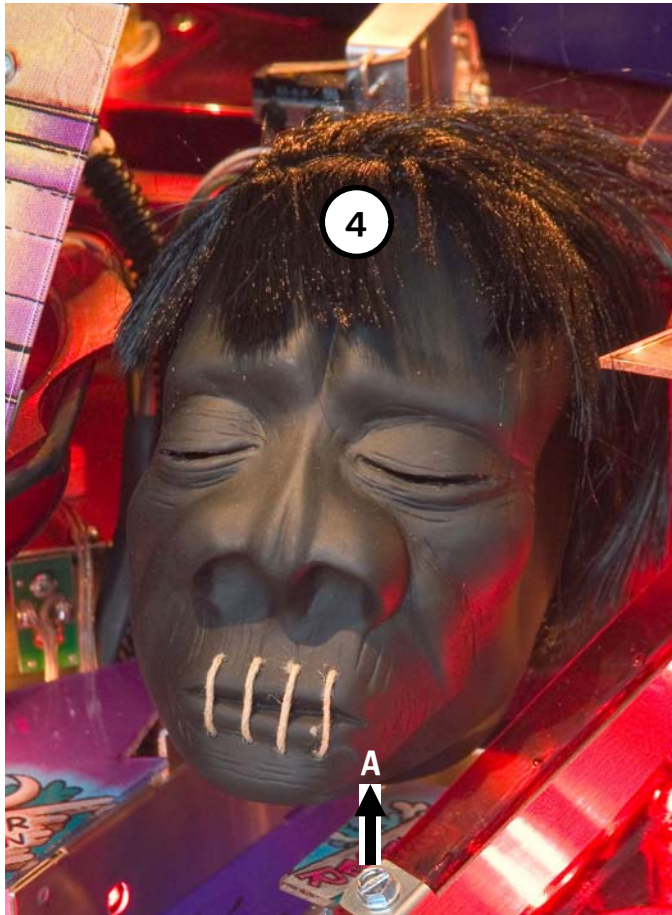
Wire Ramps Overview



Sec. 4: Drawings ...



Shrunkn Head Individual Parts Only (Items 1-4)



Nº	IND. PART NAME	QTY.	SPI PART Nº
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	Shrunkn Head (Altered/Modified)	1	880-5081-01

Take Note:

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

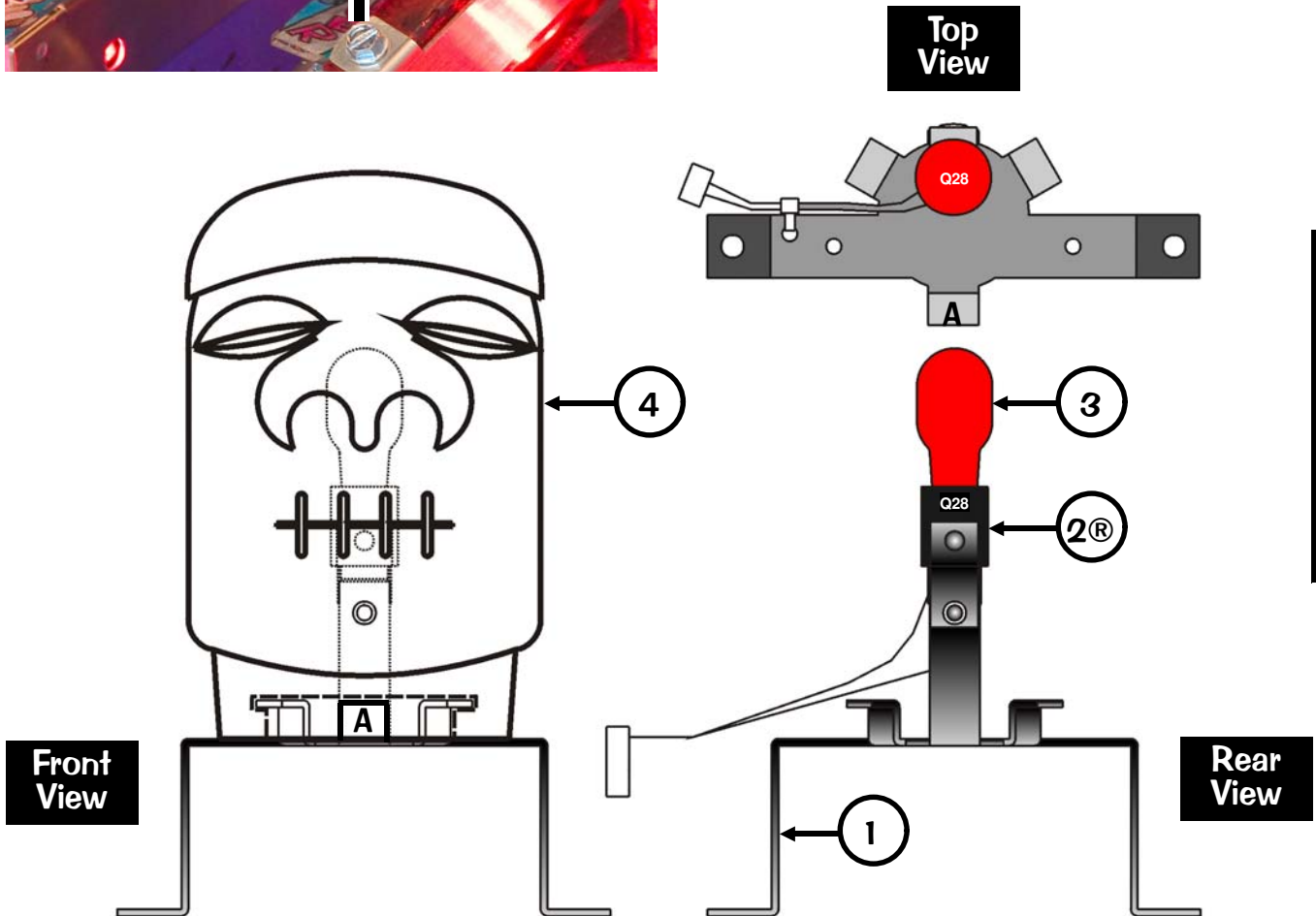
IF ONLY THE CABLE WIRING IS REQUIRED, USE SPI PART NUMBER 036-5493-12-81.

TO CHANGE BULB:

The Shrunkn 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 neck at the rear tabs then pull the front of the neck over the front tab.

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

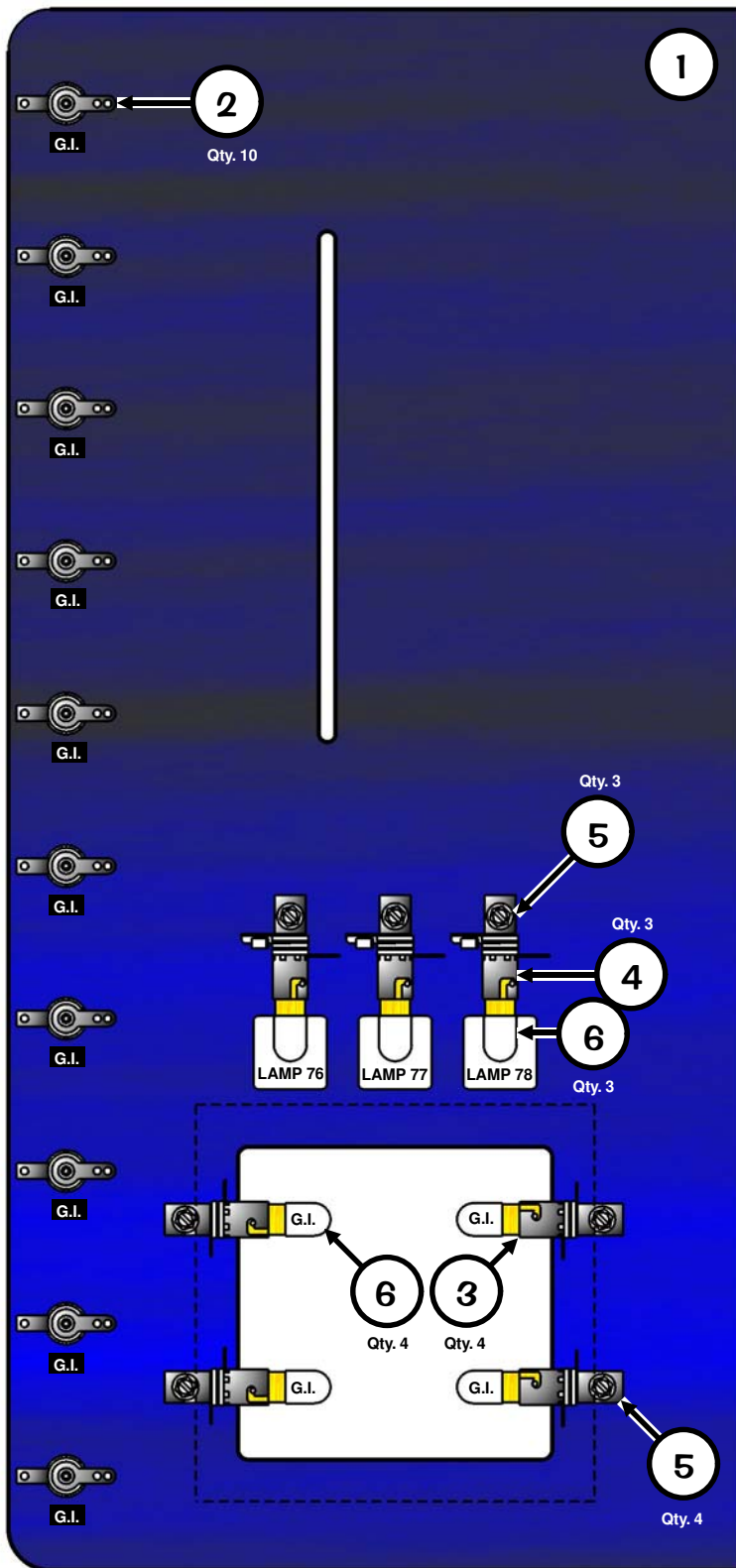


Sec. 4: Drawings ...

Back Panel Individual Parts Only (Items 1-13)

Top & Front Views on the previous page.

Rear View



Nº	IND. PART NAME	QTY.	SPI PART Nº
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.			

Sec. 4: Drawings ...

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)

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

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.

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

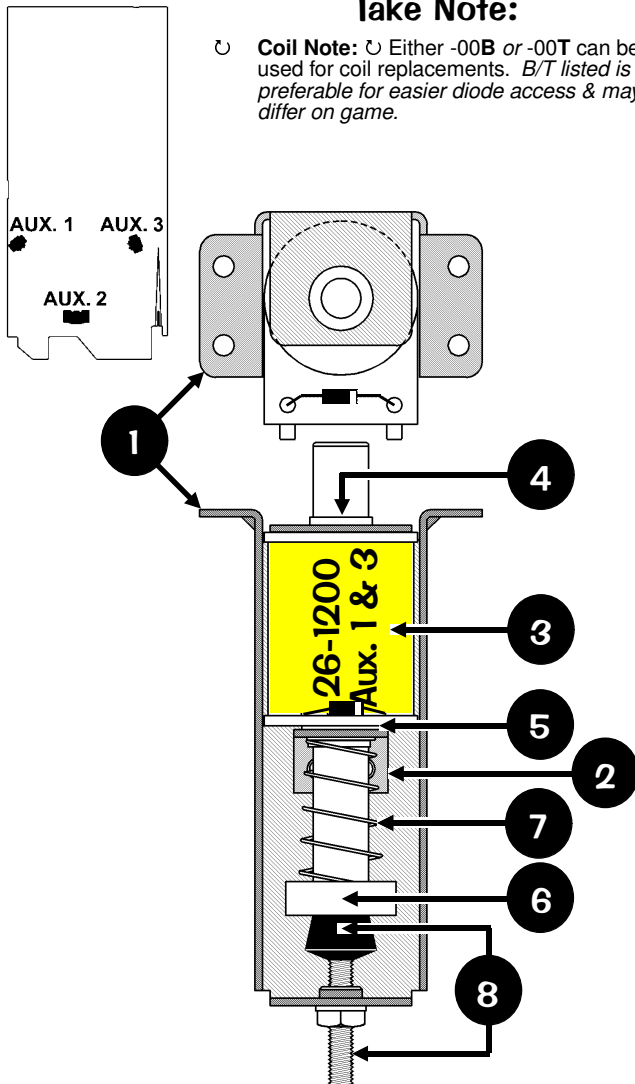
Ordering Note: If 515-6844-00 is unavailable, order the individual part(s) actually required. Item 7D, part of Item 7, Plunger & Shaft Sub-Assembly, is 1 piece and cannot be ordered separated.

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.

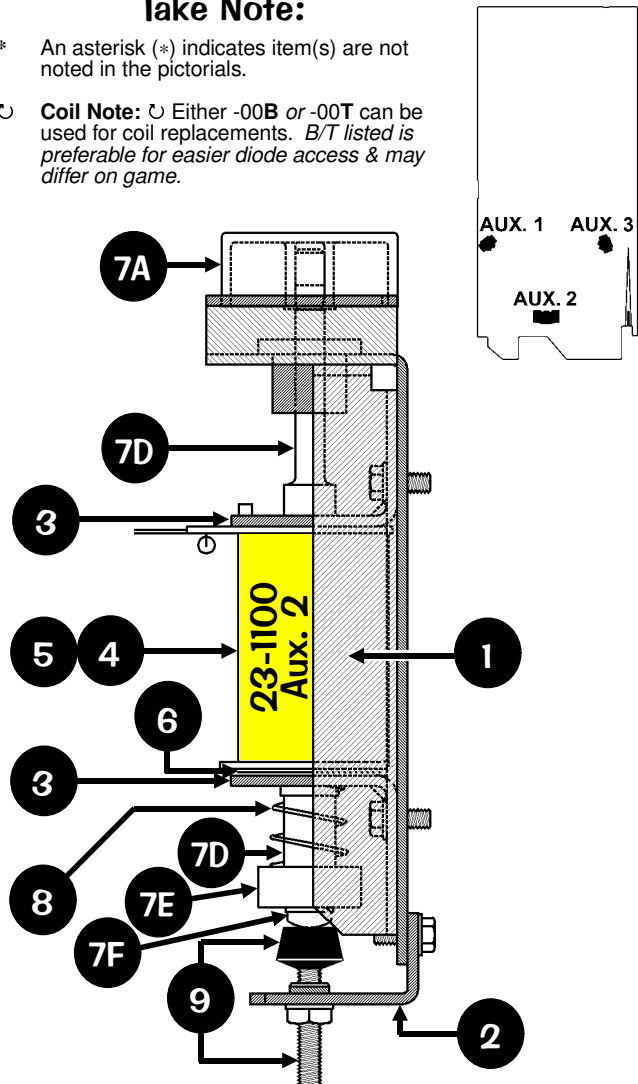
Take Note:

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



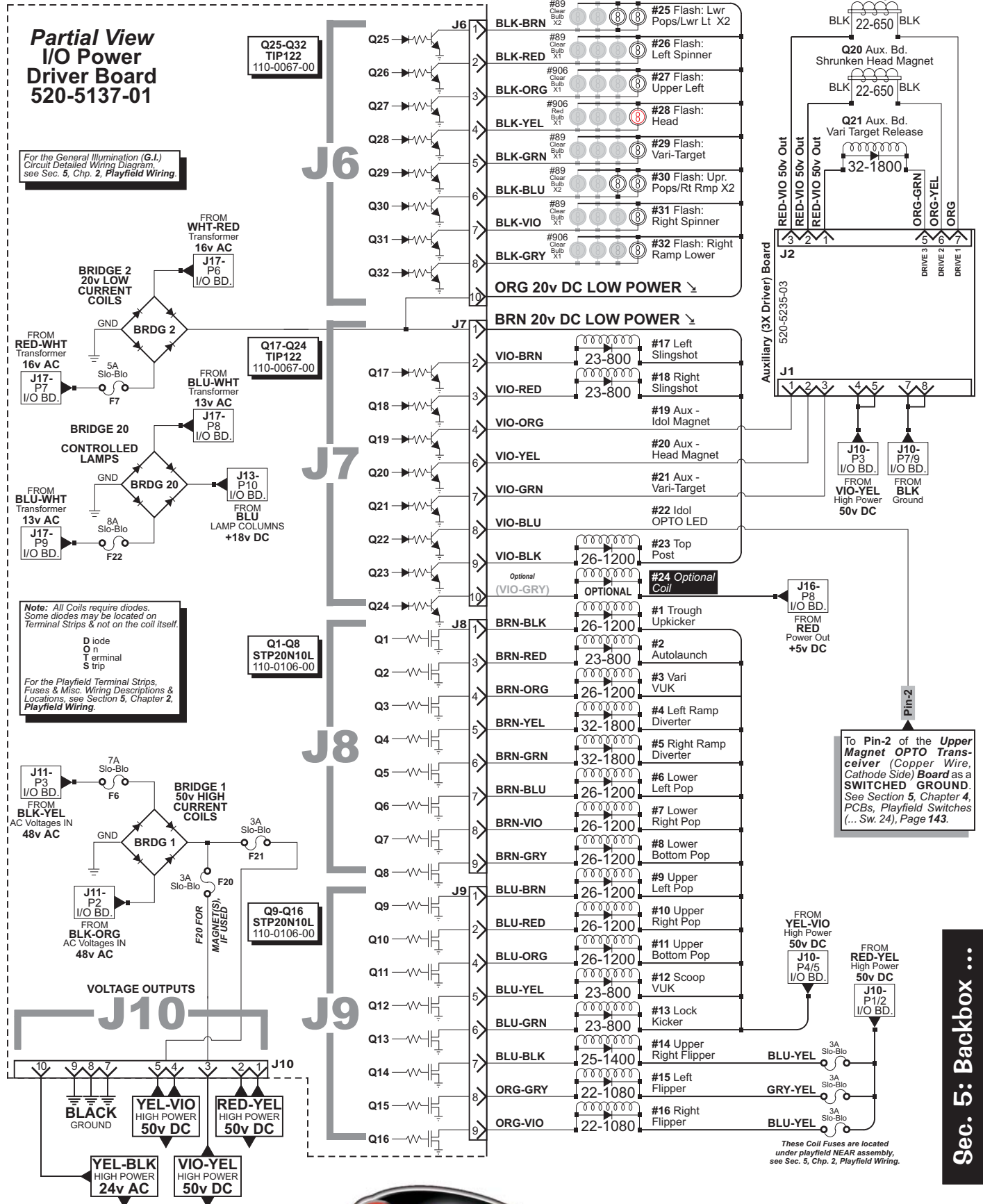
Take Note:

- * An asterisk (*) indicates item(s) are not noted in the pictorials.
- ⊖ **Coil Note:** ⊖ Either -00B or -00T can be used for coil replacements. B/T listed is preferable for easier diode access & may differ on game.



Backbox Wiring

Backbox I/O Power Driver Board Detailed Wiring Diagram



Backbox Board Layout Wiring Diagram

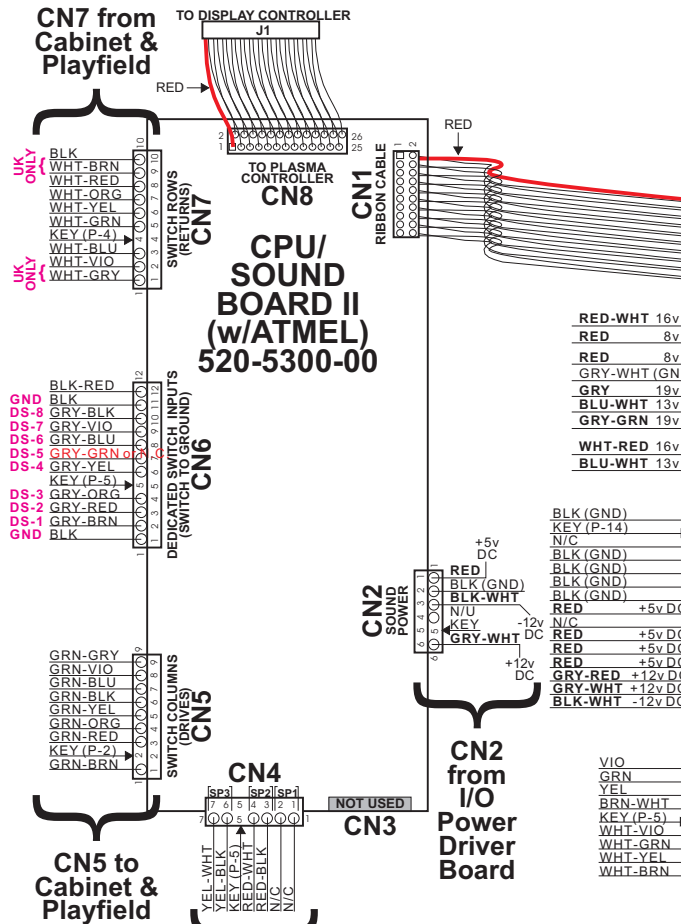
See Section 5, Chapter 4, Printed Circuit Boards (PCBs), Pages 150-154, for UK & Special Application(s) 3X Transistor Driver Board and ToPS™ Overview & Wiring, regarding the use of J2 & J3.

J3 ONLY used if UK GAME (Aux. Driver Bd. Required) or if ToPS™ Kit is installed, Tournament Serial Interface (TSI) Board required. or if Printer Interface Board is used (see Sec. 5, Chp. 3, Cabinet/Coin Door Wiring Diagram, bottom right corner).

J2 I/O to under Playfield Connector for 19-LED Board (Rings)..

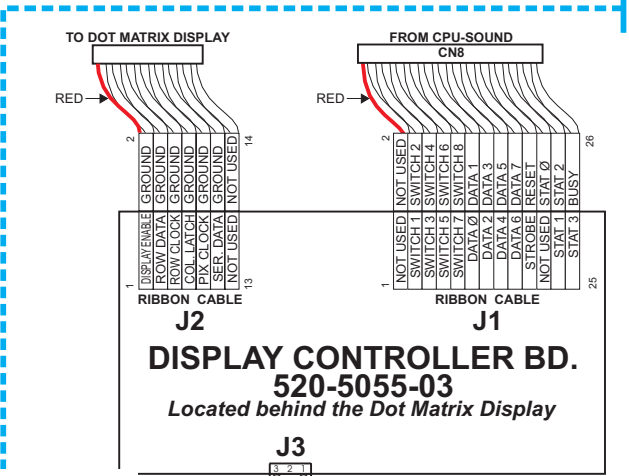
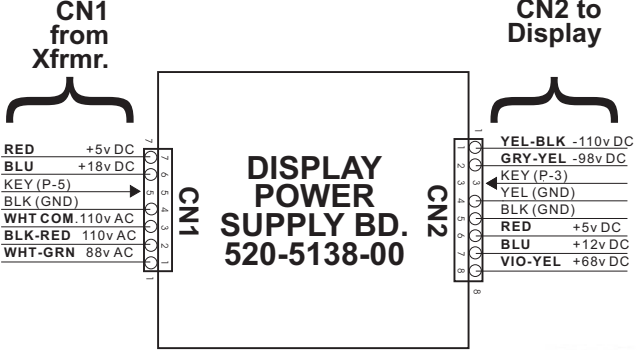
Move Conn. J2 to J4 on TSI Bd. if ToPS™ Kit installed, then connect the Tournament Connector from J1 on TSI Bd. to J2 I/O Board.

Note: If the Printer Interface Board is used, the Dot Display or Tournament Wiring must be disconnected from J2 and/or J3.



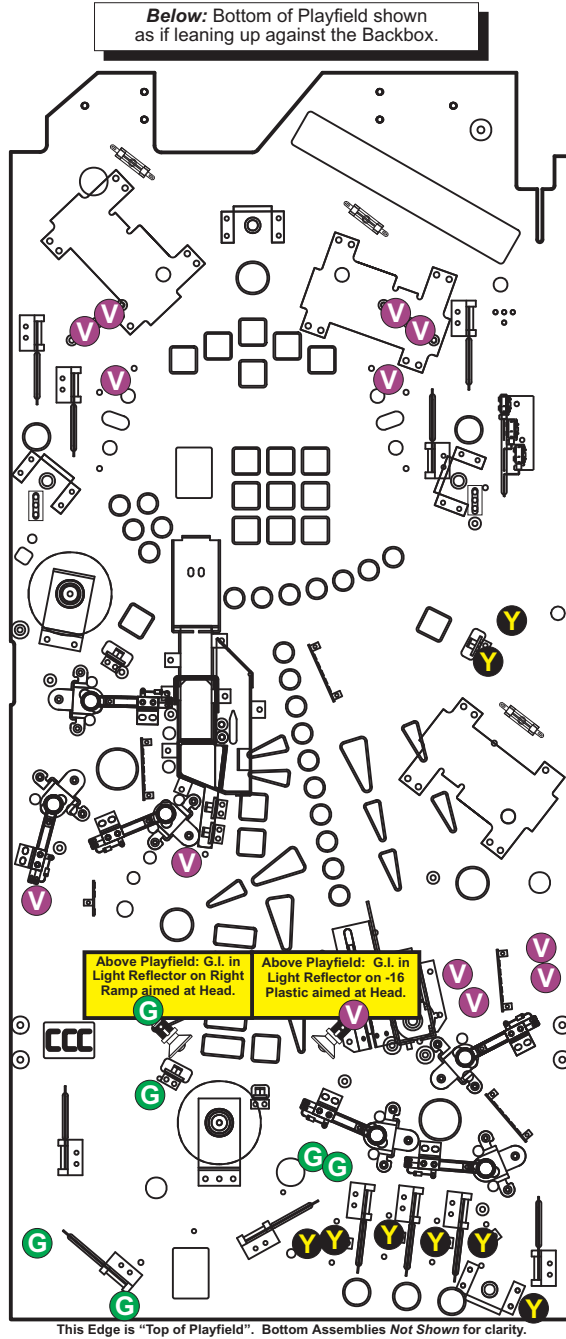
Important: When connecting any Ribbon Cable, always ensure the "Red Line" side of the ribbon cable goes to the Pin-1 side of any Dual 0.1" Header Connector.

Sec. 5: Backbox ...

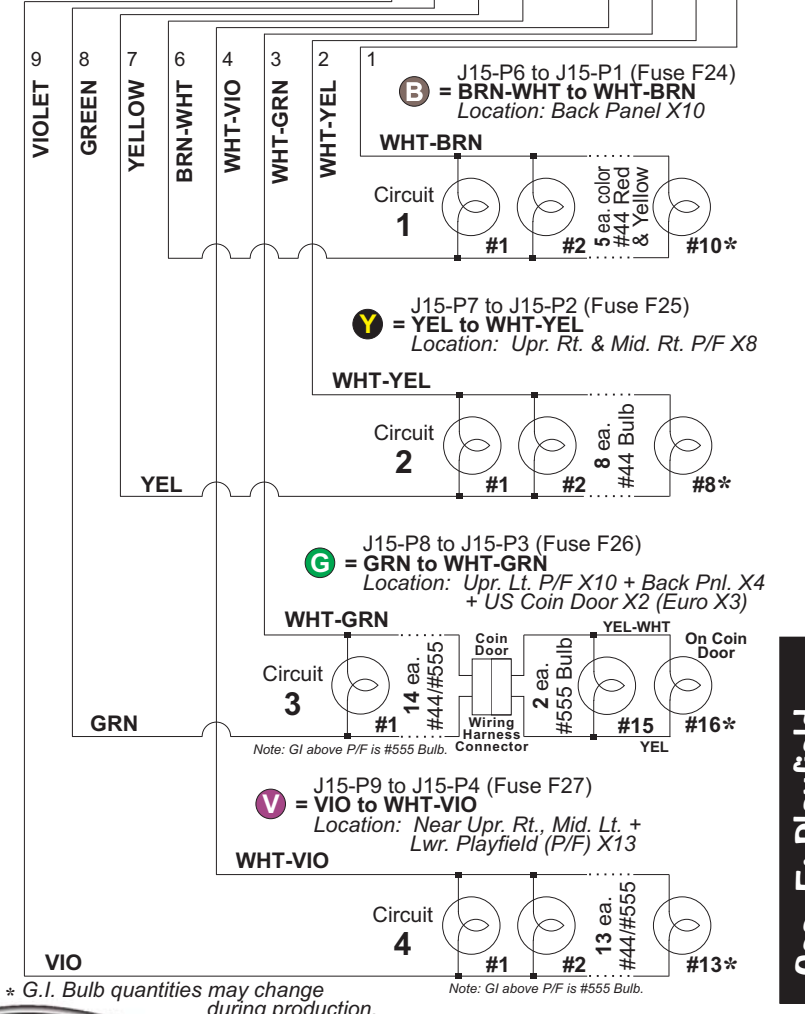
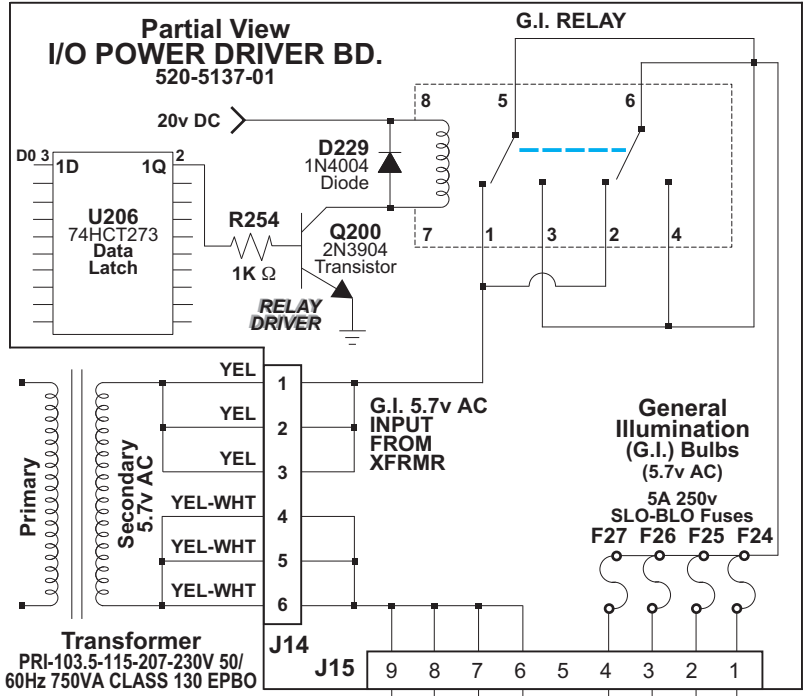
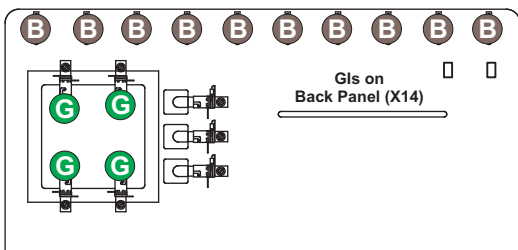


Playfield Wiring

General Illumination Circuit Detailed Wiring Diagram



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



Sec. 5: Playfield ...



Playfield Switch Wiring Diagram

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

For Switch(es): 28 & 29

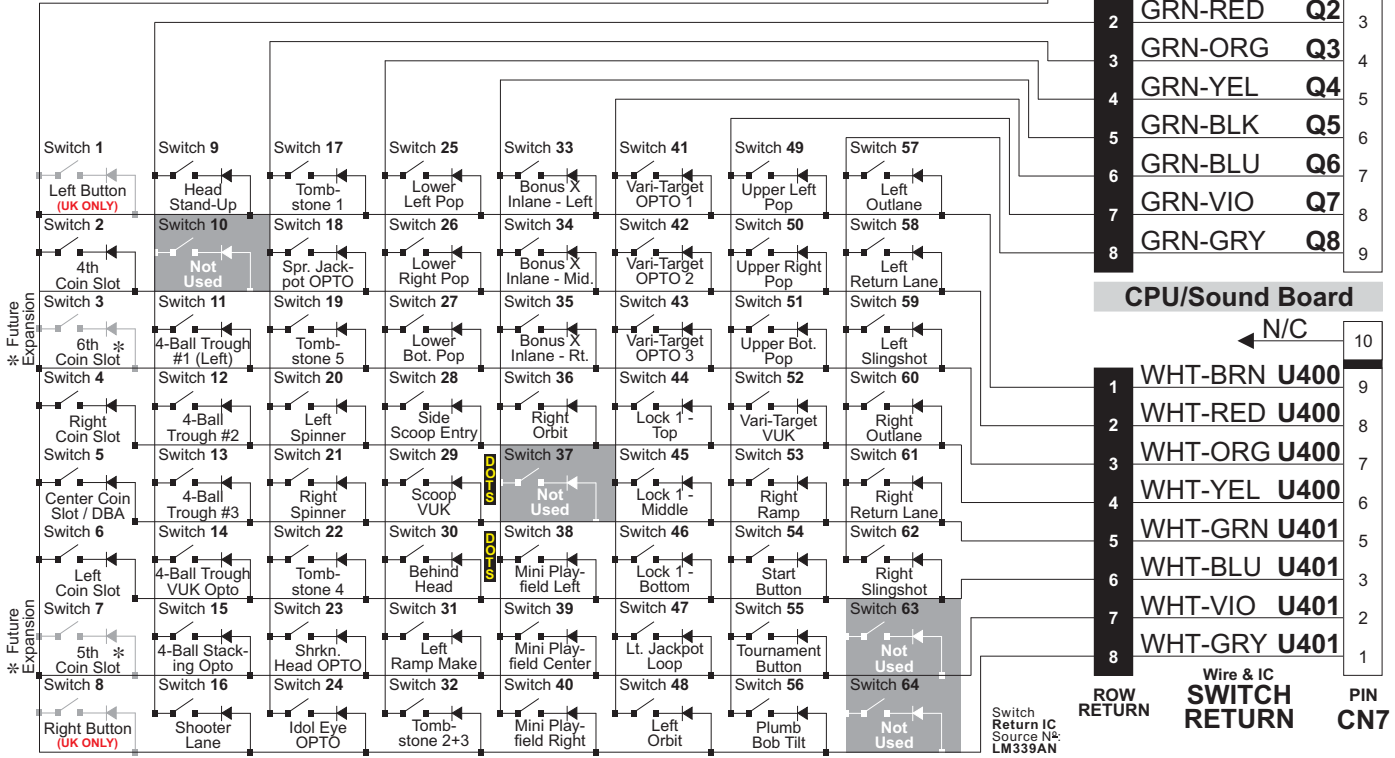
Diode On Terminal Strip

Diode On Diode Board

Switch Drive Transistor Source N#: 2N3904

SWITCH DRIVE Wire & Transistor

CN5 PIN



Playfield Lamp Wiring Diagram

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

For Lamp(s): 33-35 & 60-62

Diode On Terminal Strip

Diode On Diode Board

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

BLUE

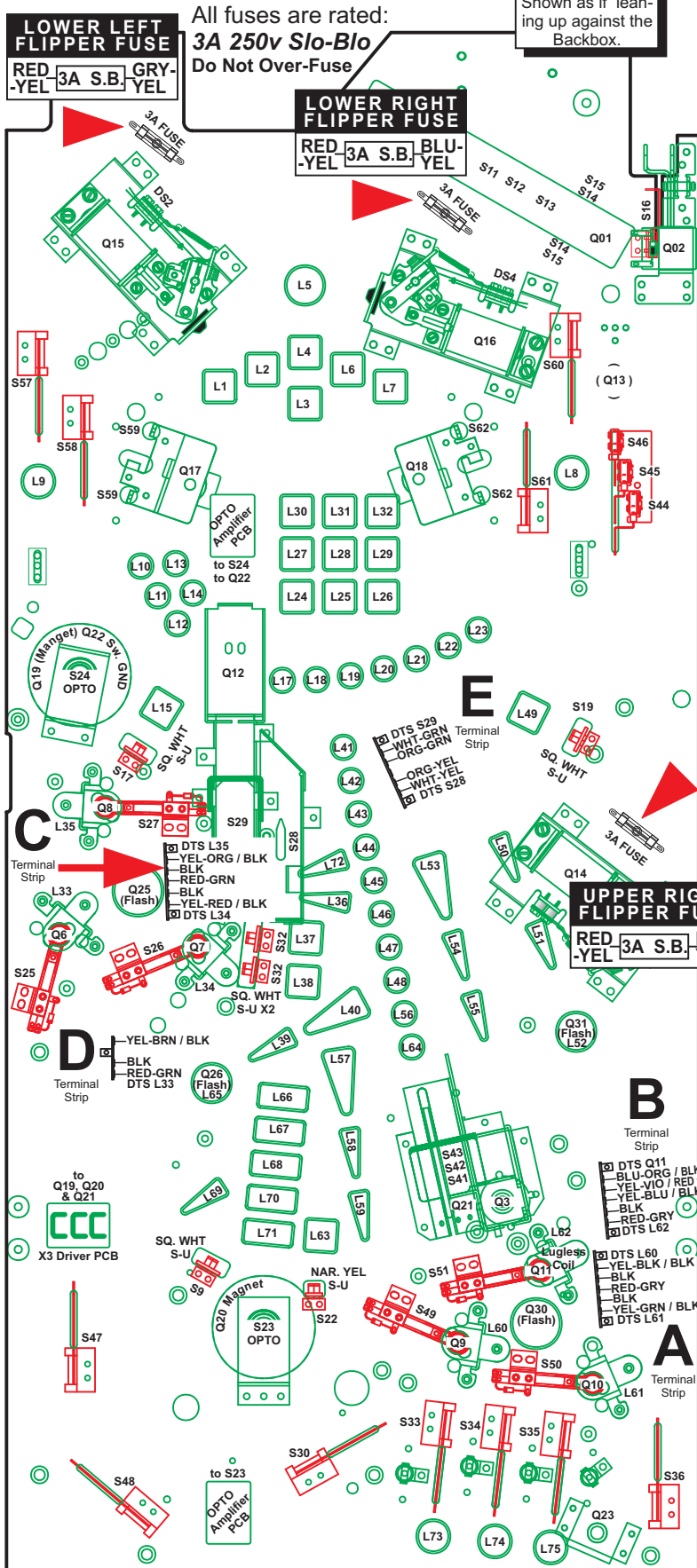


Sec. 5: Playfield ...



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

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

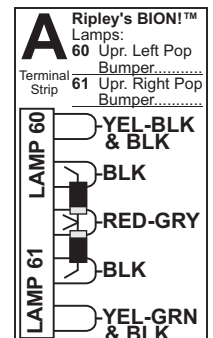
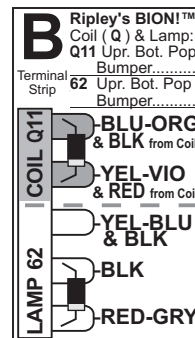
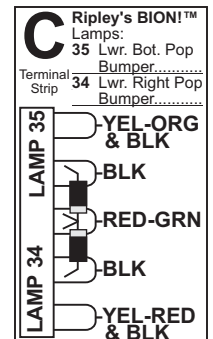
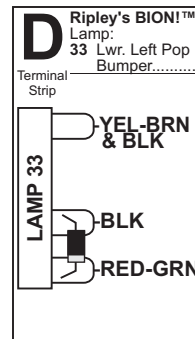
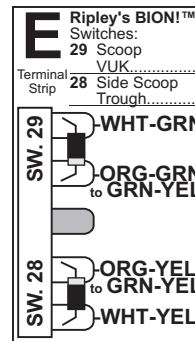


Explanation:

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

Legend:

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

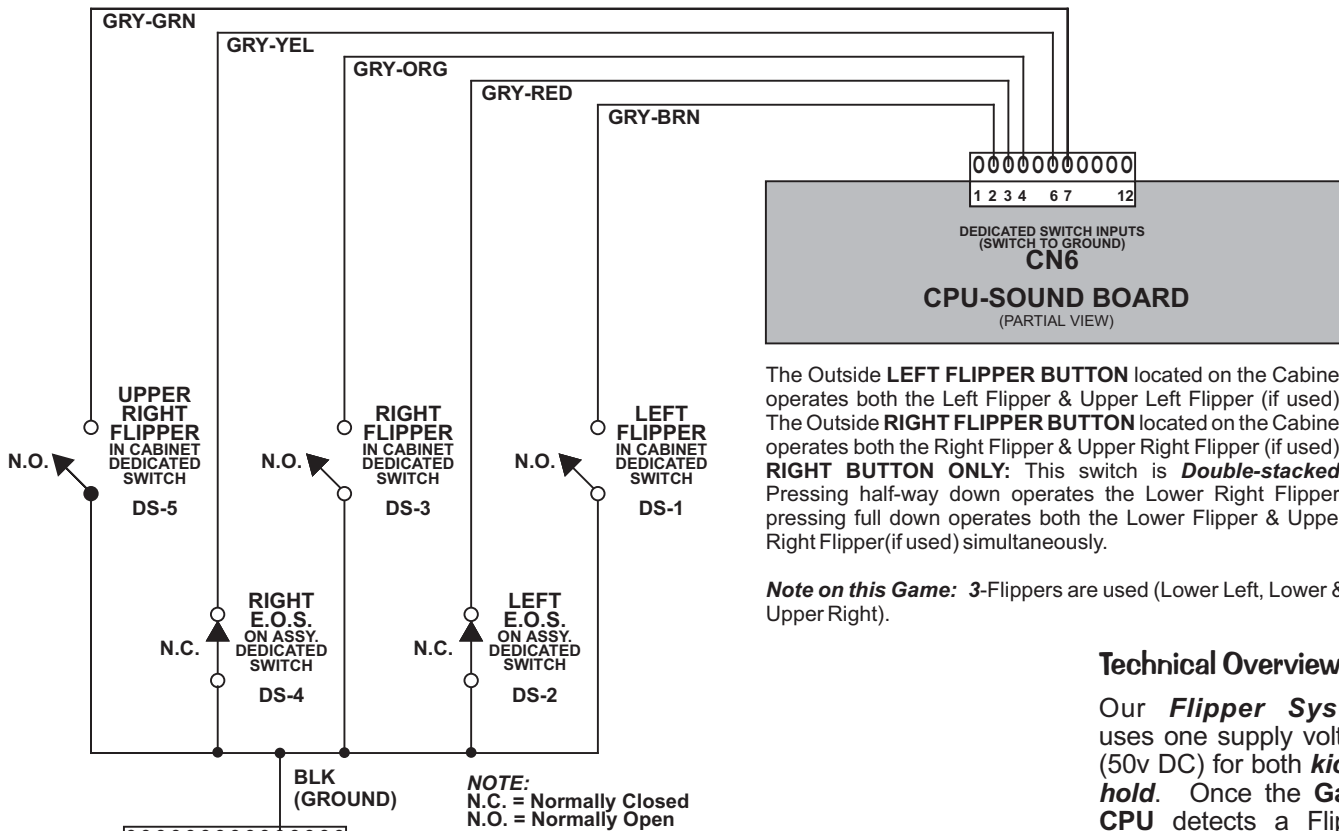


See the Pink Pages, Playfield - General Parts & Switches (Below) (Pg. 66) for Terminal Strips, Diodes, Fuses and Fuse Holders Part Numbers.

Sec. 5: Playfield ...



3- Flipper Circuit Wiring Diagram



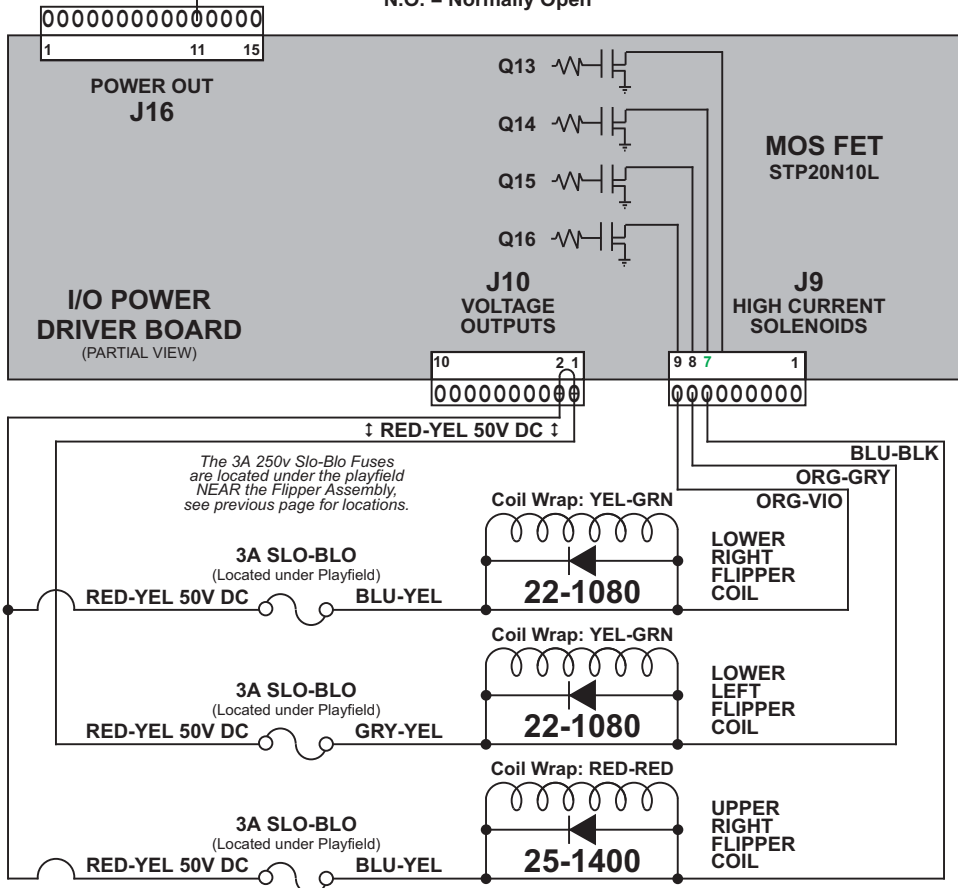
The Outside **LEFT FLIPPER BUTTON** located on the Cabinet operates both the Left Flipper & Upper Left Flipper (if used). The Outside **RIGHT FLIPPER BUTTON** located on the Cabinet operates both the Right Flipper & Upper Right Flipper (if used). **RIGHT BUTTON ONLY:** This switch is **Double-stacked**. 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 40msec pulse to the gate of the Flipper Drive Transistor (STP-20N10L). If it continues to detect a Flipper Cabinet Switch closure (*the player holding the button in*) it will continue to pulse the flipper drive transistor 1msec every 12msecs for the duration of the hold cycle.

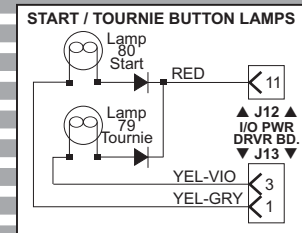
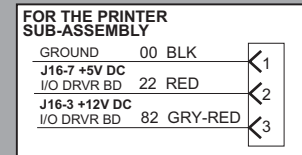
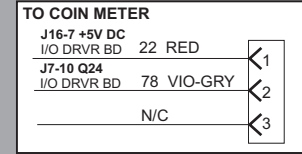
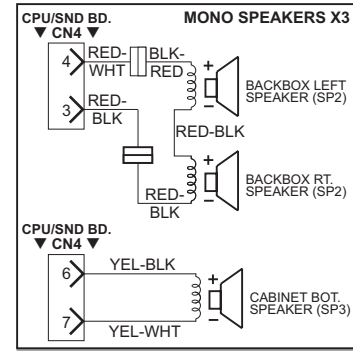
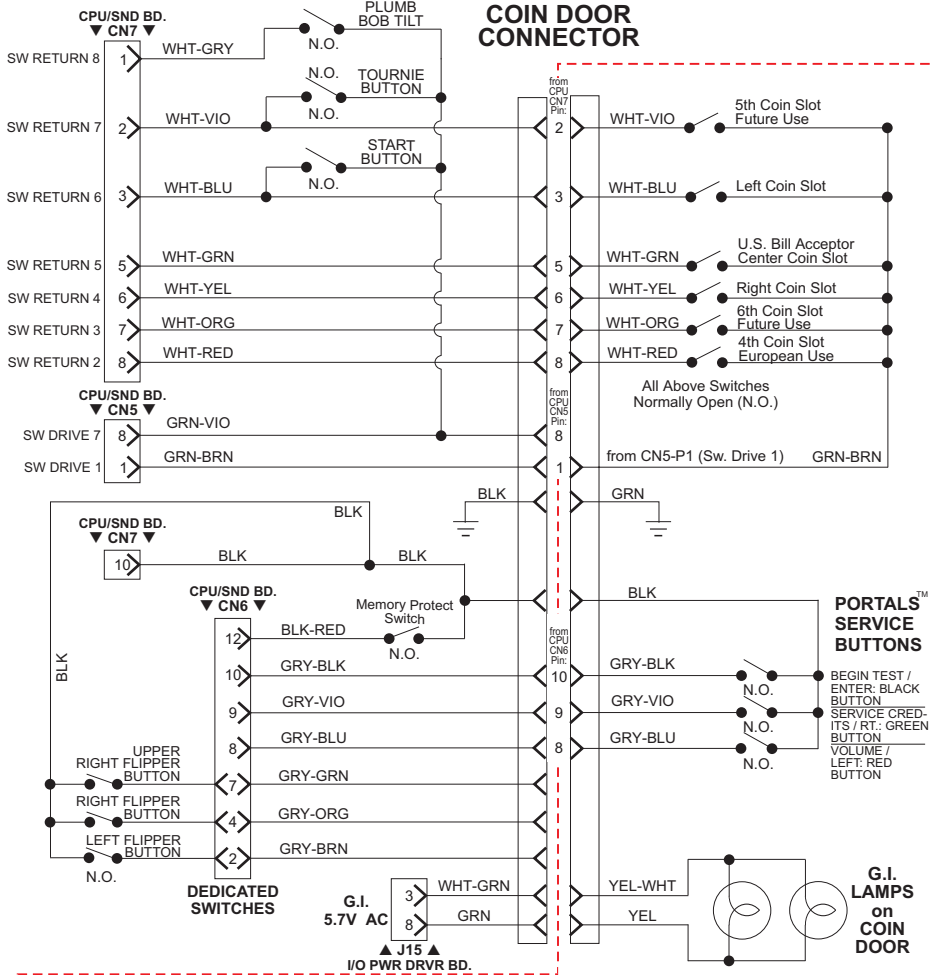
The **E.O.S.** (End-Of-Stroke) **Switch** serves the same function as before as it prevents foldback when the player has the flipper energized to capture balls. The **E.O.S. Switch** is a normally closed switch which opens approximately 1/16" when the flipper is energized. The **Game CPU** will detect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



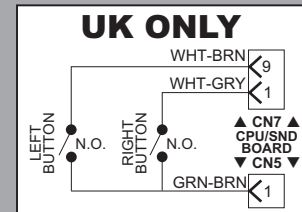
Sec. 5: Playfield ...



Cabinet / Coin Door Wiring Diagram



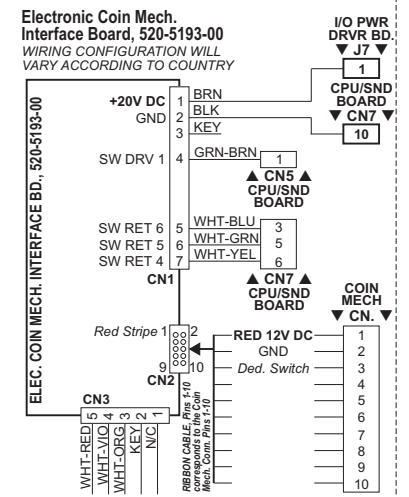
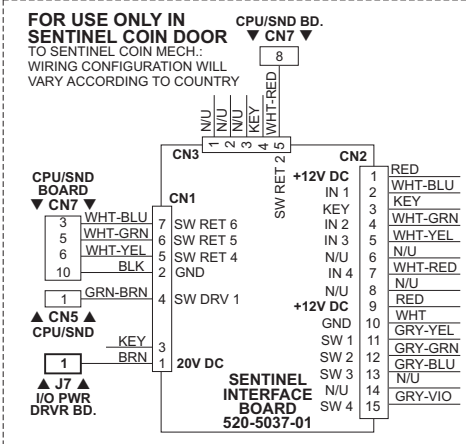
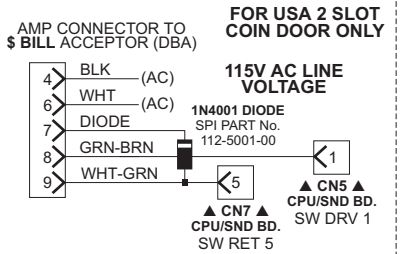
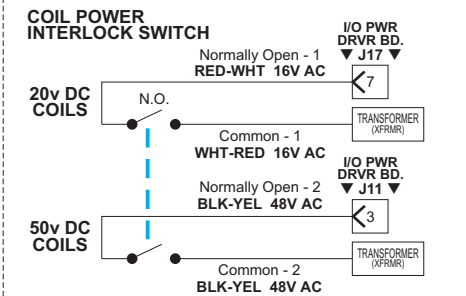
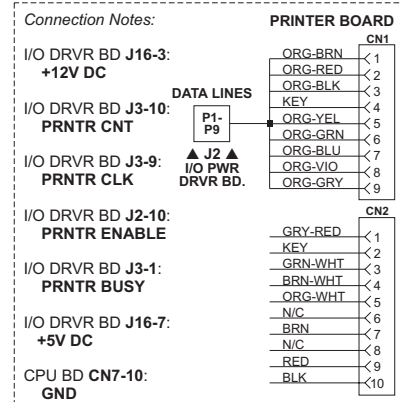
UK ONLY: 2 Extra Cabinet Buttons for the Post Save™ Feature are used. The Left Button operates the Left Outlane Ball Deflector. The Right Button operates the Right Outlane Ball Deflector. Both buttons pushed together operate the Center Up/Down Post. Both buttons are located under the Flipper Buttons.



PRINTER INTERFACE OPTIONAL

Cable Wiring Harness SPI Part N°: 036-5408-00

RS-232 Printer Interface Board SPI Part N°: 520-5069-00



COIN DOOR

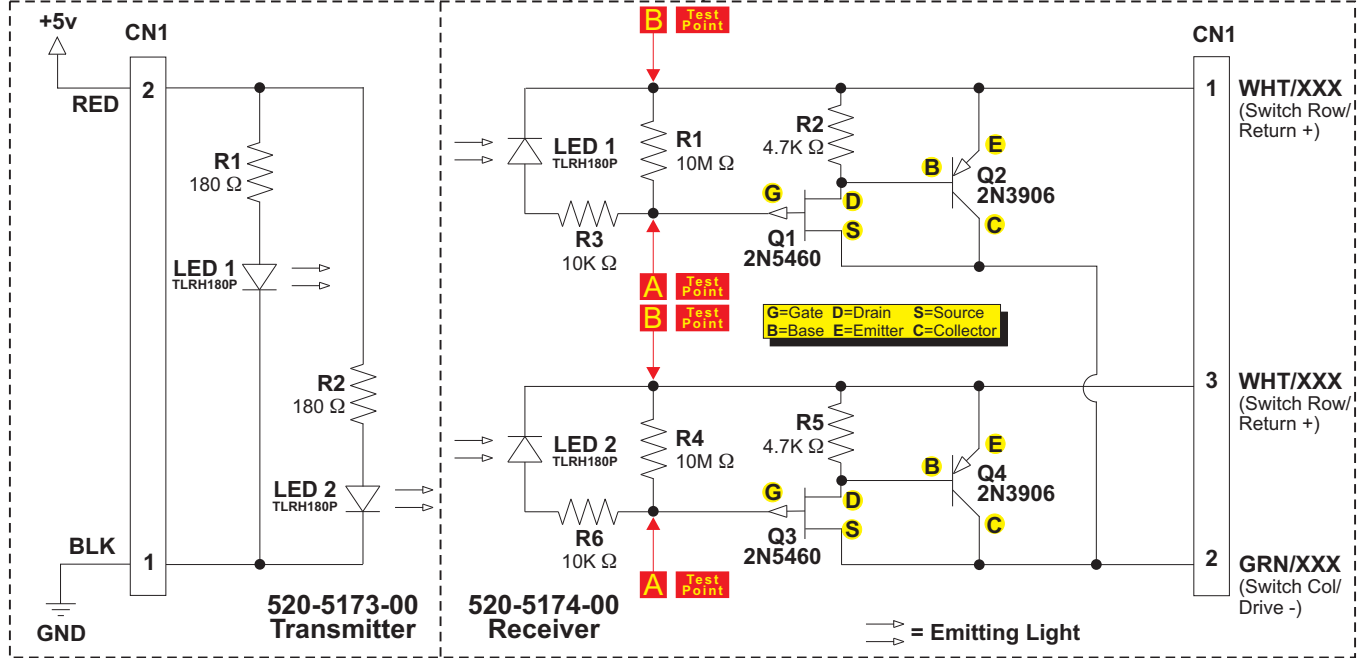
Sec. 5: Cabinet ...



Printed Circuit Boards (PCBs)

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

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

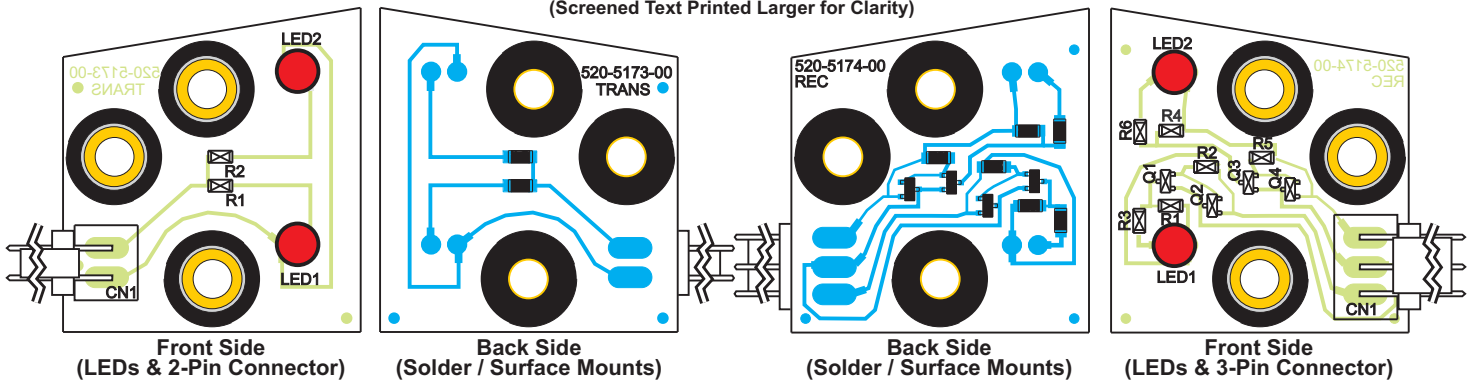


Trough Up-Kicker Dual OPTO Boards Component Layout & Parts

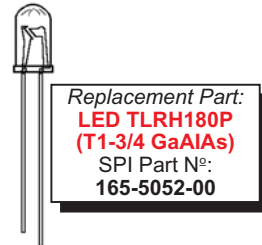
520-5173-00 (TRANS)

Boards Actual Size
(Screened Text Printed Larger for Clarity)

520-5174-00 (REC)



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



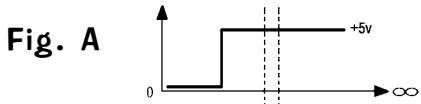
OPTO Troubleshooting

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

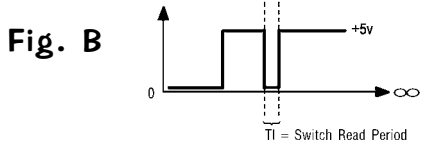
A. **OPEN OPTO** (Light Falling on LED) = **SWITCH OPEN**. Place meter leads across points **A** and **B** on the **LED1 Circuit** (Refer to Schematic Drawing on previous page, 520-5174-00 Receiver Side). It should read approximately 0.8 - 1.2v DC. The **LED2 Circuit** operates the same.

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

2. Oscilloscope Test (indicates normal operating condition):



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



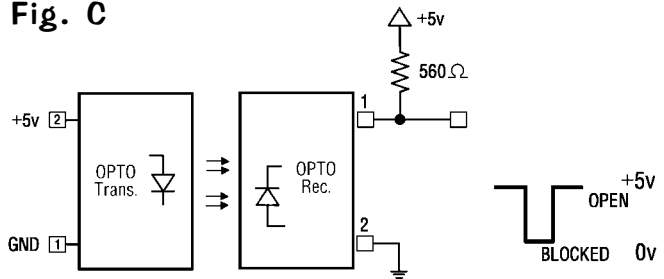
B. **CLOSED OPTO** (Light Blocked) = **SWITCH CLOSED**. Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (see Schematic). The Scope should display a **PULSE STREAM** indicating **Q2** has switched "On" as shown in **Fig. B**, Wave Form Diagram. This is your Switch Drive Pulse.

3. Bench Test (See Fig. C):

Please Note: To perform this test you must use a spare 560Ω Pull-Up Resistor, SPI N^o: 121-5047-00

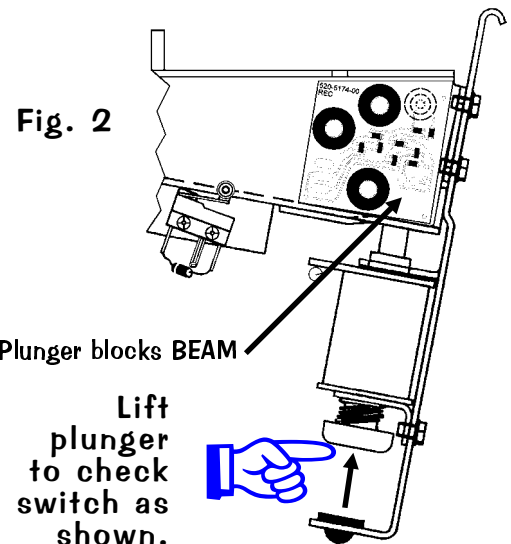
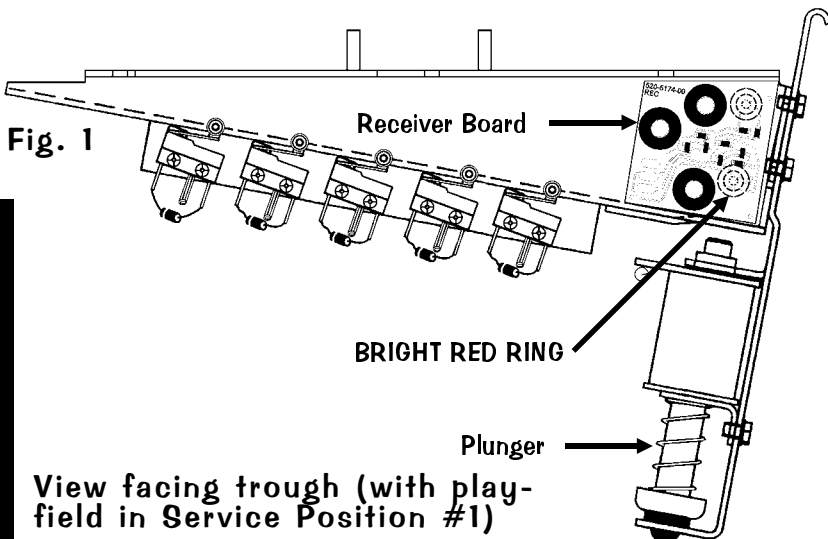
Disconnect the **OPTO Transmitter / Receiver Board** from the circuit. Connect one side of a 560Ω Pull-Up Resistor to **Pin-1** of the OPTO Receiver Bd. and the other side of the resistor to a 5v DC source. Connect **Pin-2** to GND. Connect a +5v DC source to **Pin-1** of the Transmitter & GND to **Pin-2**.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

Fig. C



Trough Dual OPTO Boards Alignment / Test for LED1

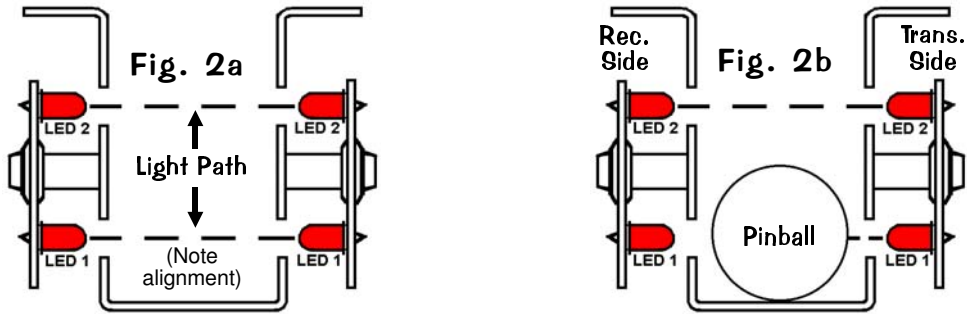
When a working **OPTO** is installed and connected in a game, the transmitter should light (**LED1 lower & LED2 upper**) when the power is switched on. With the playfield in **Service Position #1** (playfield lifted up in the half-way position resting on the Prop Rod or edge slide support brackets) and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



Sec. 5: PCBs

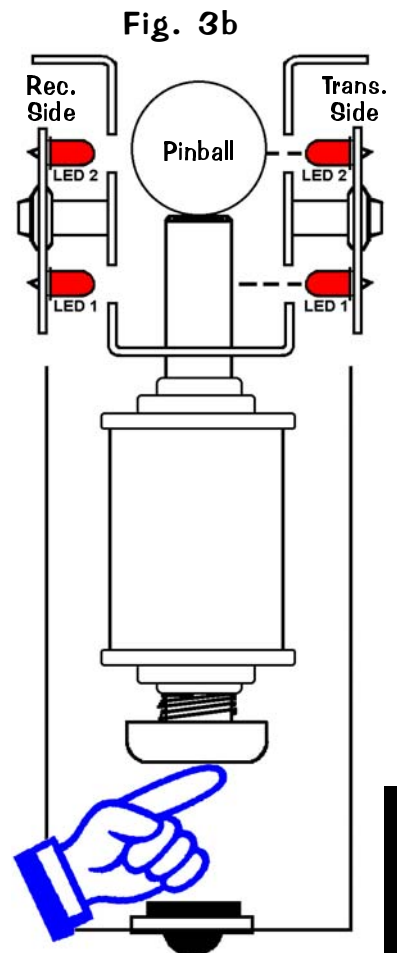
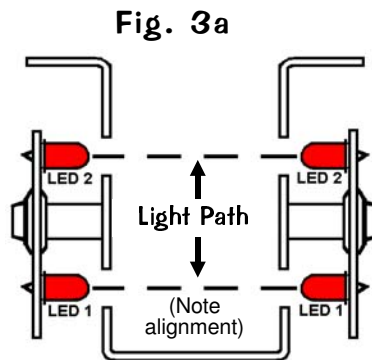
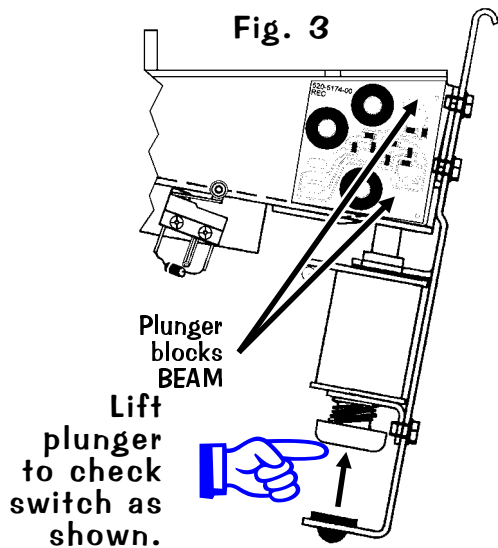


Sectional view from right (Fig. 2a & 2b)



Trough Dual OPTO Boards Alignment / Test for LED2

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



I M P O R T A N T

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

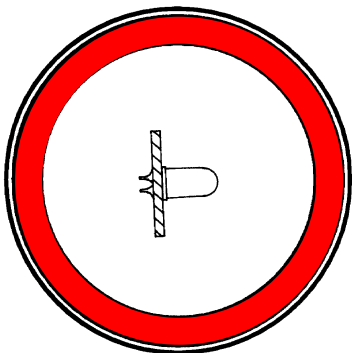


Fig. 4a
Correct Position

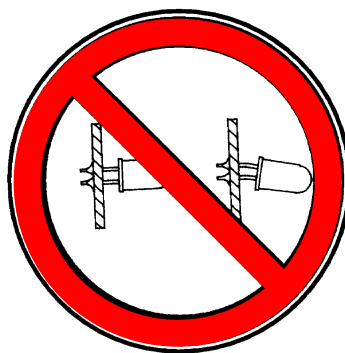
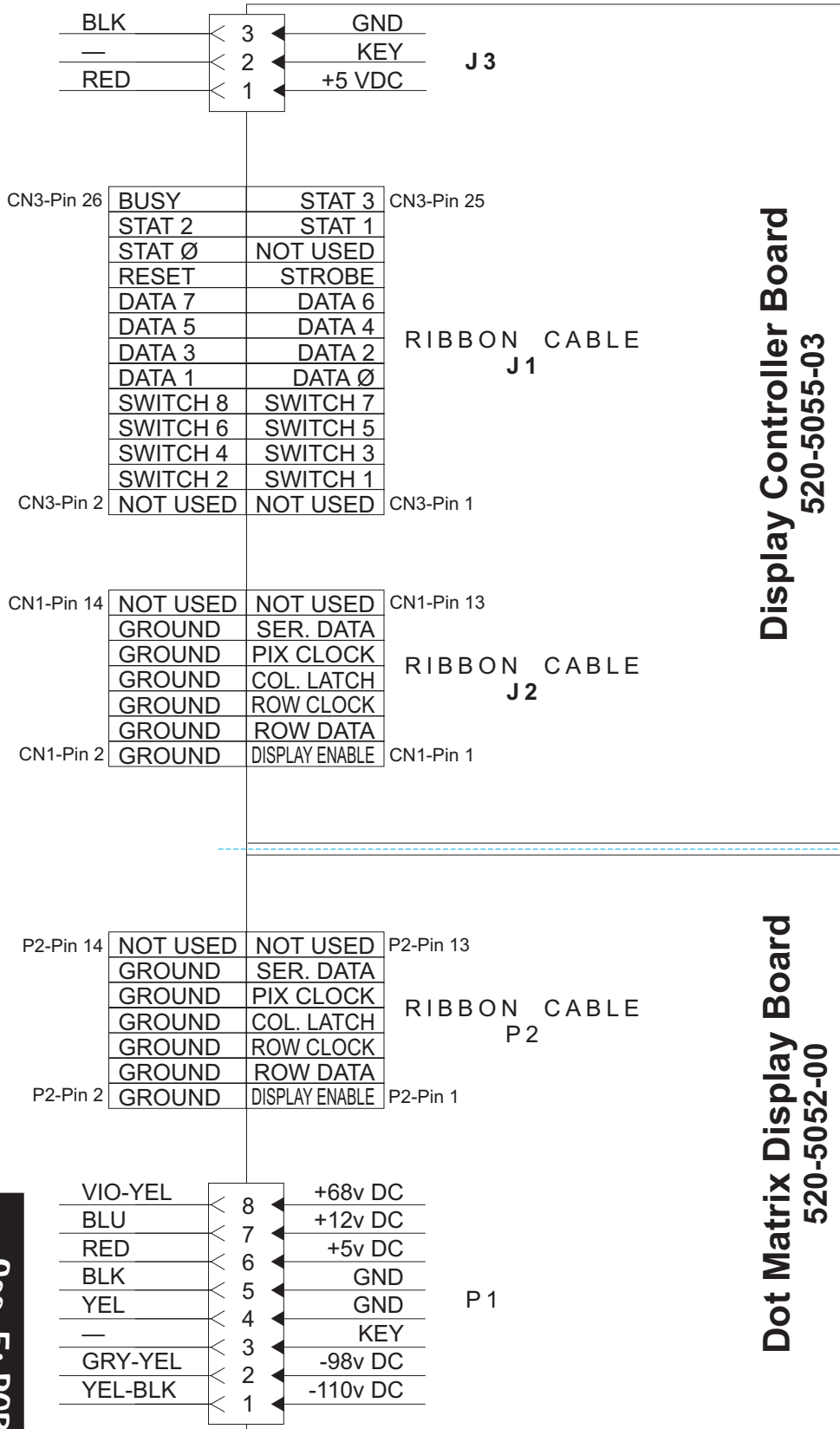


Fig. 4b
Incorrect Position

Dot Matrix Display / Display Controller Bd. Combined Display Connections



Dot Matrix Display Explained

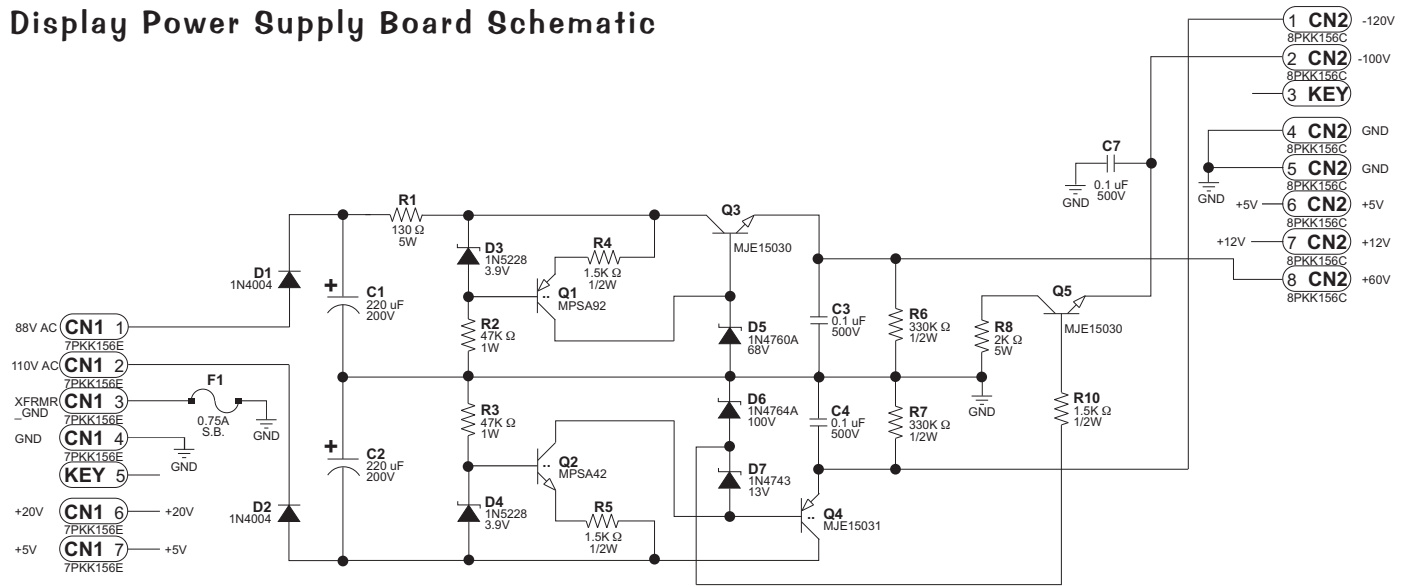
The display utilizes a Micro-Processor Control Board mounted in piggyback fashion to the Dot Matrix Display (128 X 32) Driver Board. The purpose behind this board is to provide more information to the operator as well as displaying graphics to the player.

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.

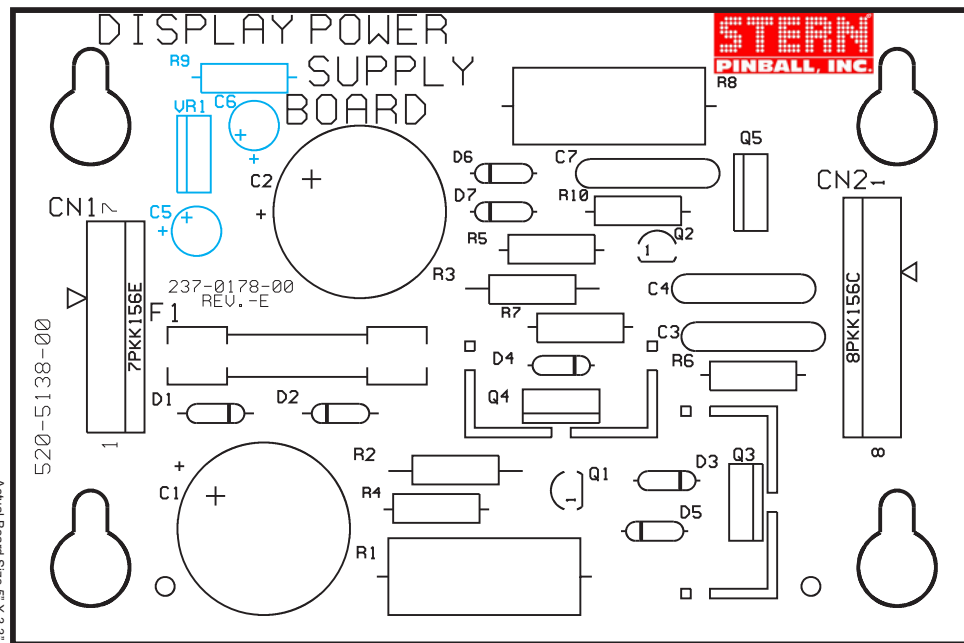
Sec. 5: PCBs



Display Power Supply Board Schematic



Display Power Supply Board Component Layout & Parts

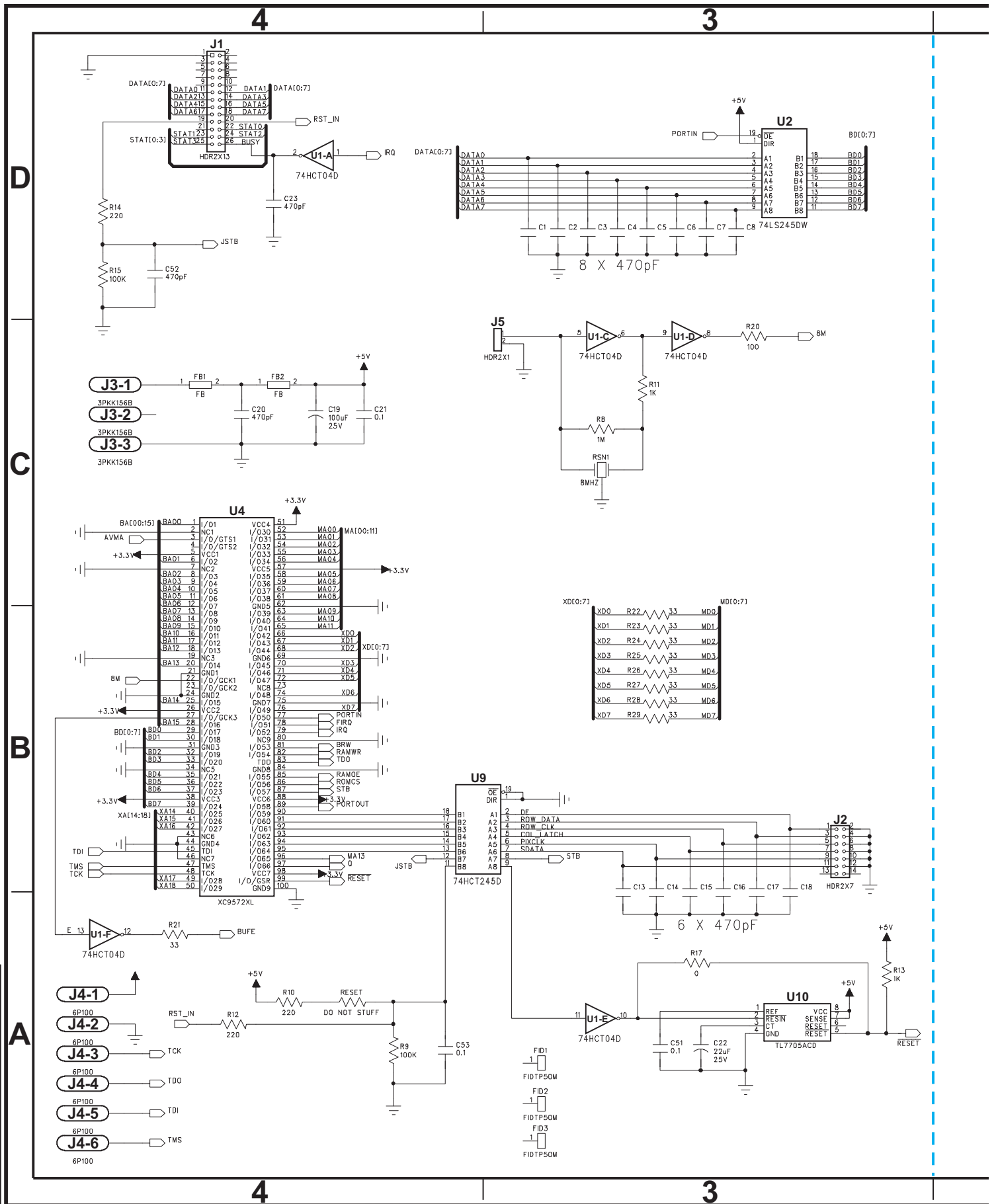


ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	1	520-5138-00	Display Power Supply Board	Complete PCB Assembly
01	2	125-5044-00	C1, C2	220uF, 200v, Radial Lytic Cap.
02	3	125-5035-00	C3, C4, C7	0.1uF, 500v, Ceramic Disk Cap.
03	0	125-5003-00	(C5, C6: NS)	22uF, 35v, Rad Lytic Cap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

Sec. 5: PCBs



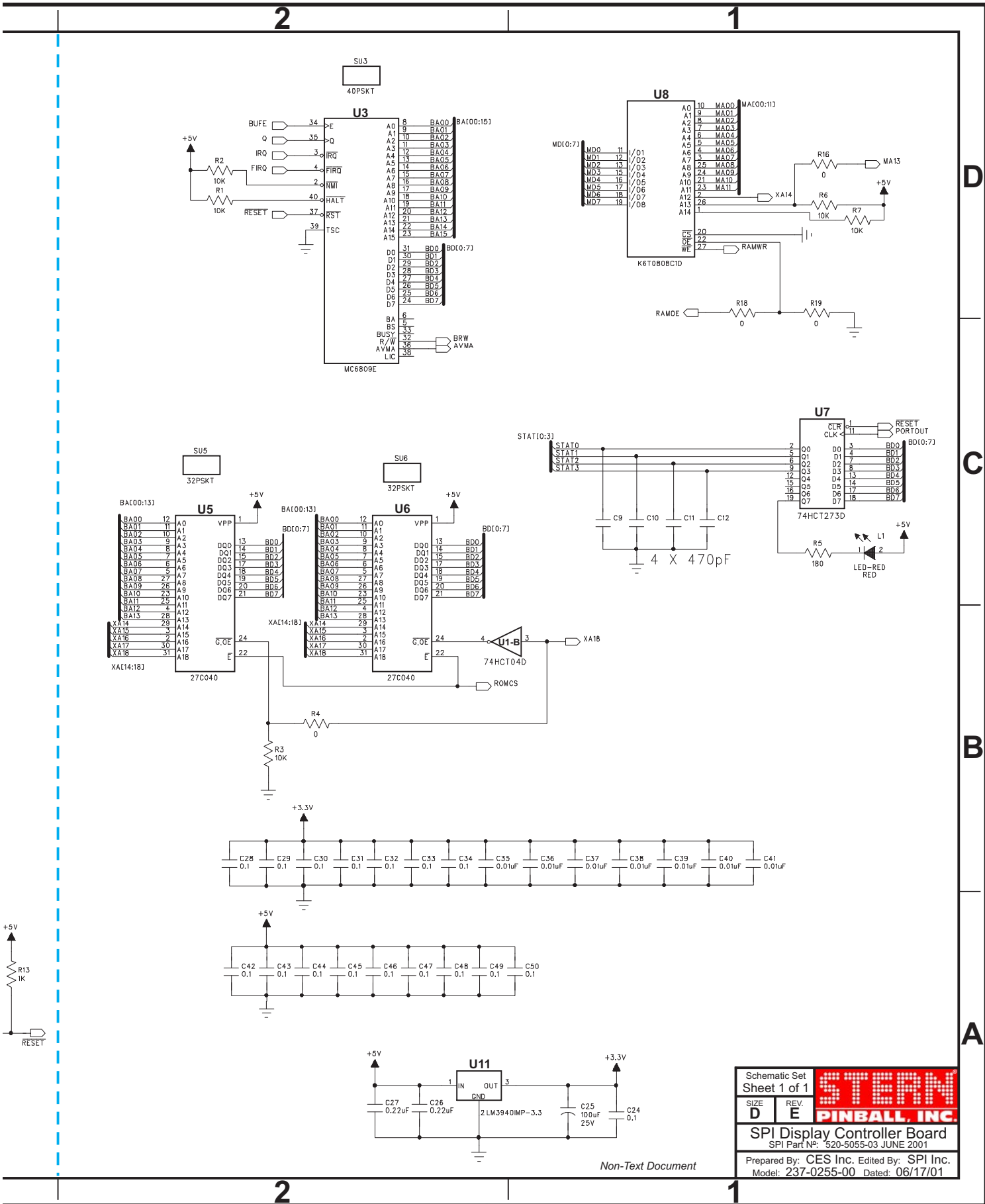
Display Controller Board Schematic



Sec. 5: PCBs



Display Controller Board Schematic



D
C
B
A

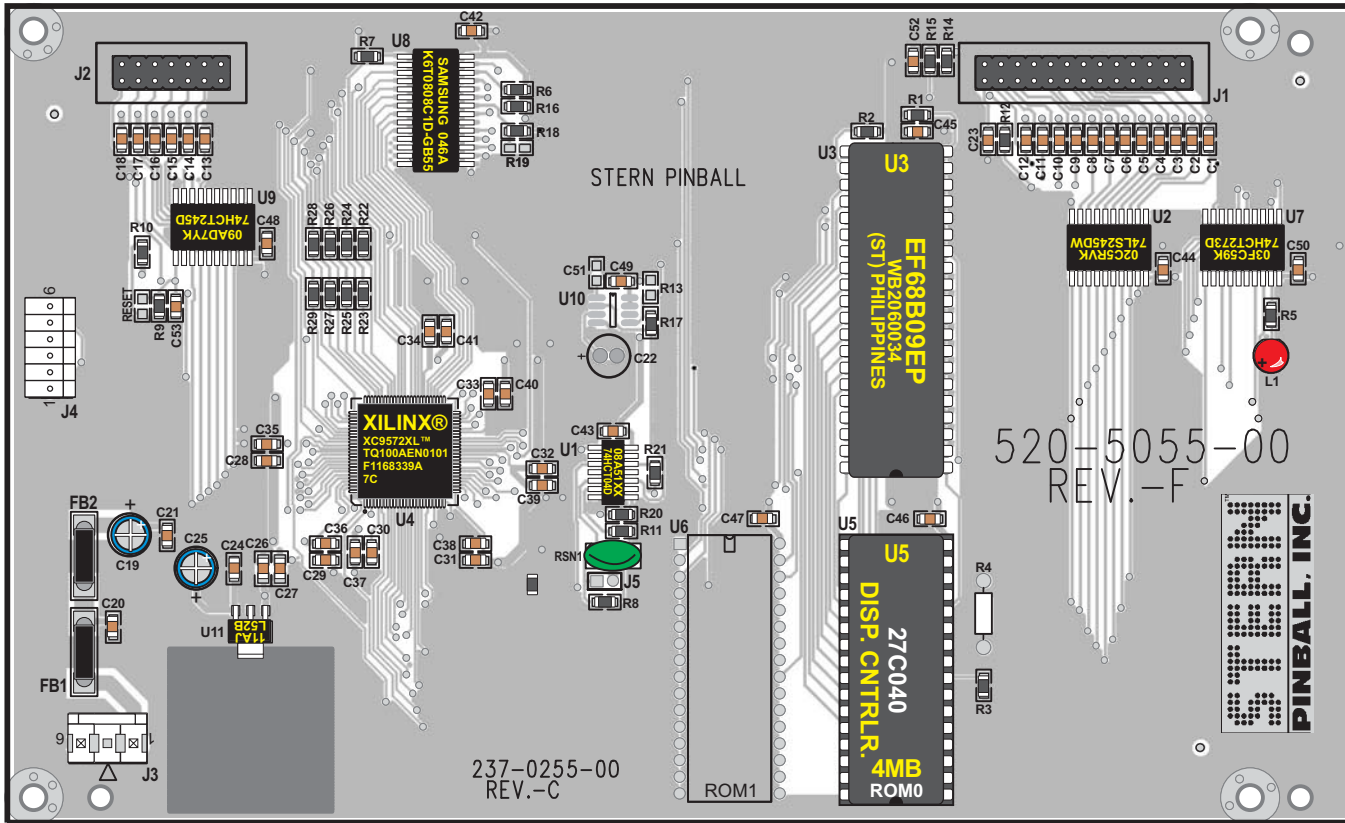
Sec. 5: PCBs

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

Non-Text Document



Display Controller Board Component Layout & Parts



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. 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).

Sec. 5: PCBs



I/O Power Driver Board Theory of Operation

5v Supply:

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

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

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

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

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

Reset Circuitry:

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

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

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

Address Decoding:

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

Solenoid (Coil) Drivers & Flash Lamps:

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

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

Auxiliary In & Out:

J2-8 CMOS Outputs sometimes used for a printer interface.

J3-8 CMOS Inputs general purpose inputs.

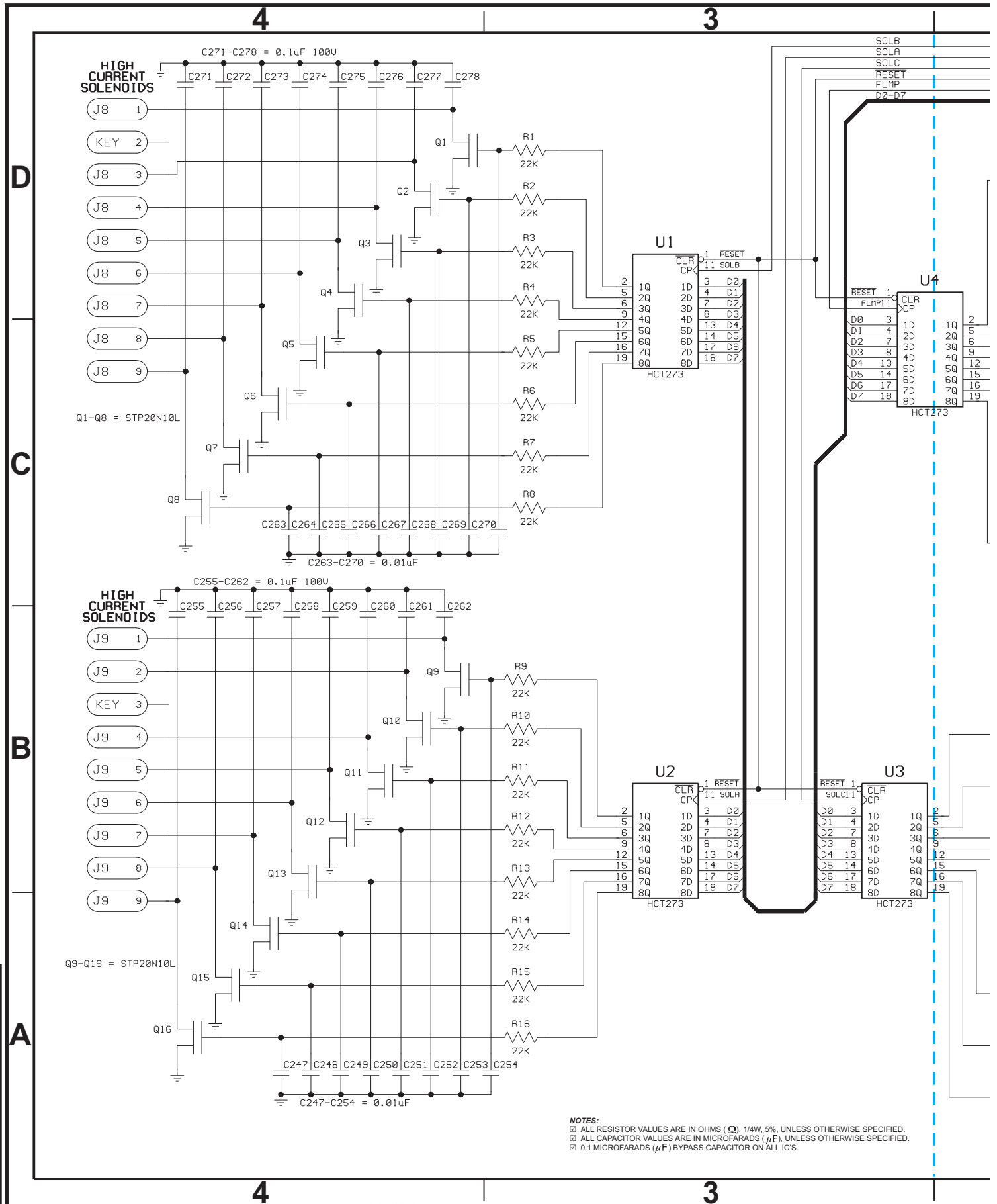
Lamp Matrix:

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

General Illumination (G.I.) Lights:

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

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



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

Sec. 5: PCBs



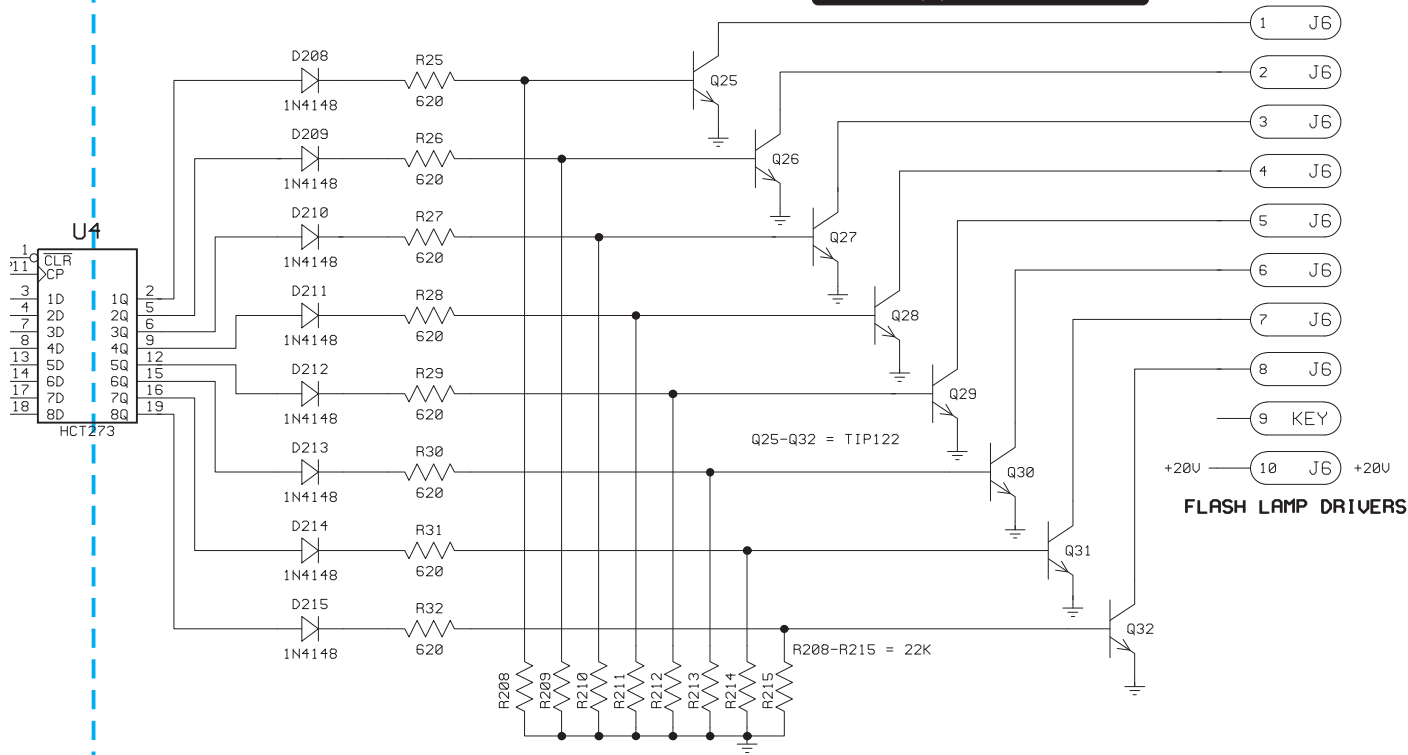
I/O Power Driver Board Schematic (Sheet 1 of 5)

2

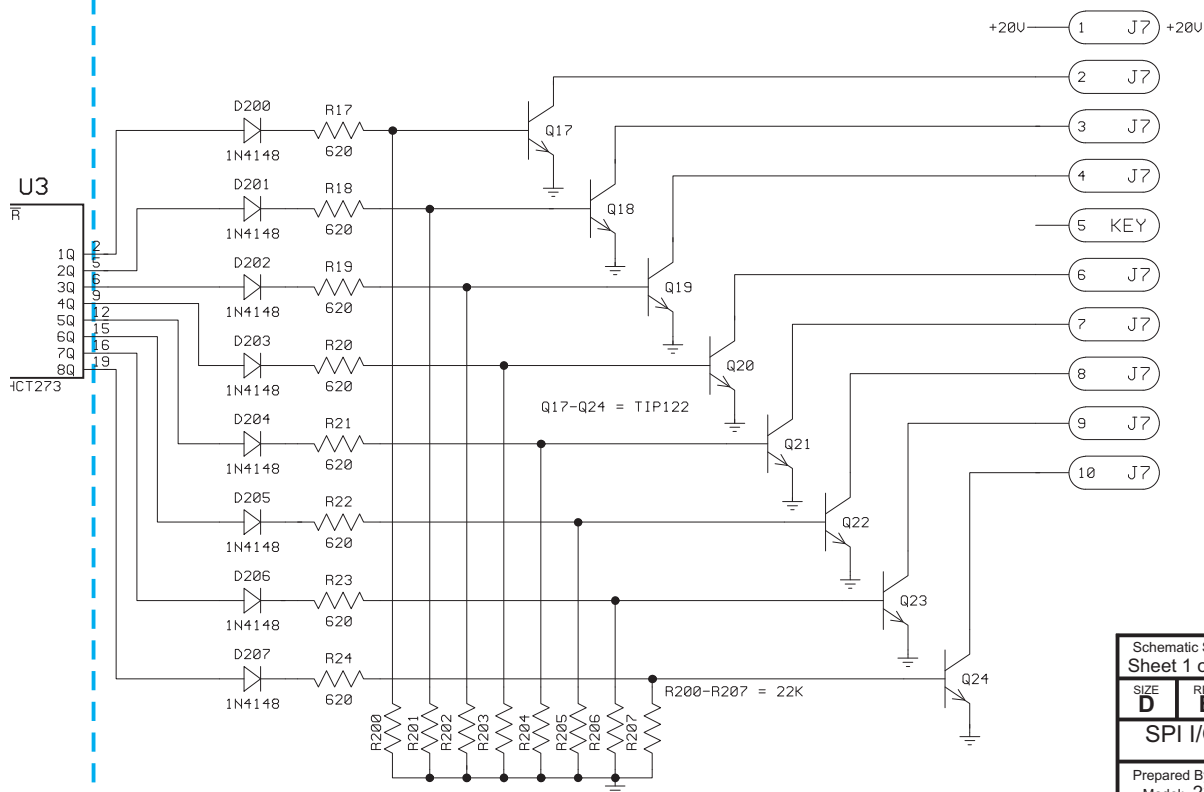
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SOLB	(4-4D)
SOLA	(4-4D)
SOLC	(4-4D)
RESET	(2-4A, 3-4B, 4-1D)
FLMP	(4-4D)
D0-D7	(2-4A, 3-4B, 4-4B)

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



LOW CURRENT SOLENOIDS



Schematic Set		STERN
Sheet 1 of 5		
SIZE	REV.	PINBALL, INC.
D	E	
SPI I/O Power Driver Board		
SPI Part No: 520-5137-01		
Prepared By: CES Inc. Edited By: SPI Inc.		
Model: 237-0161-00 Dated: 09/05/97		

D

C

B

A

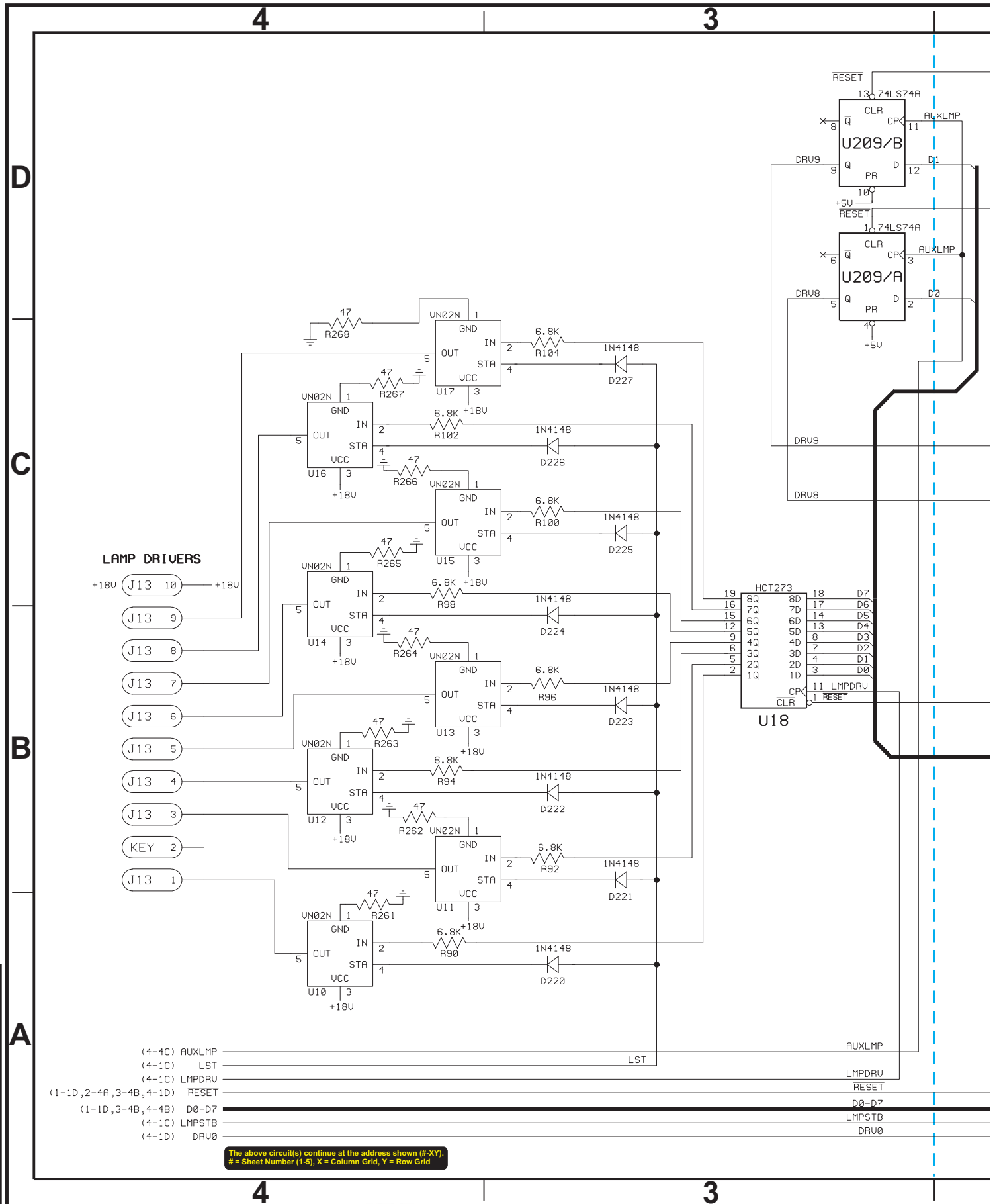
Sec. 5: PCBs

2

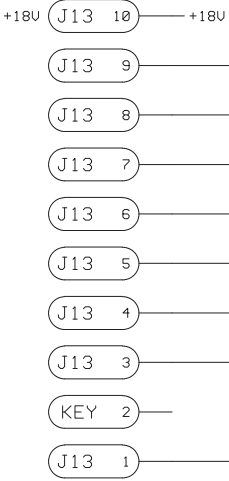
1



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



LAMP DRIVERS

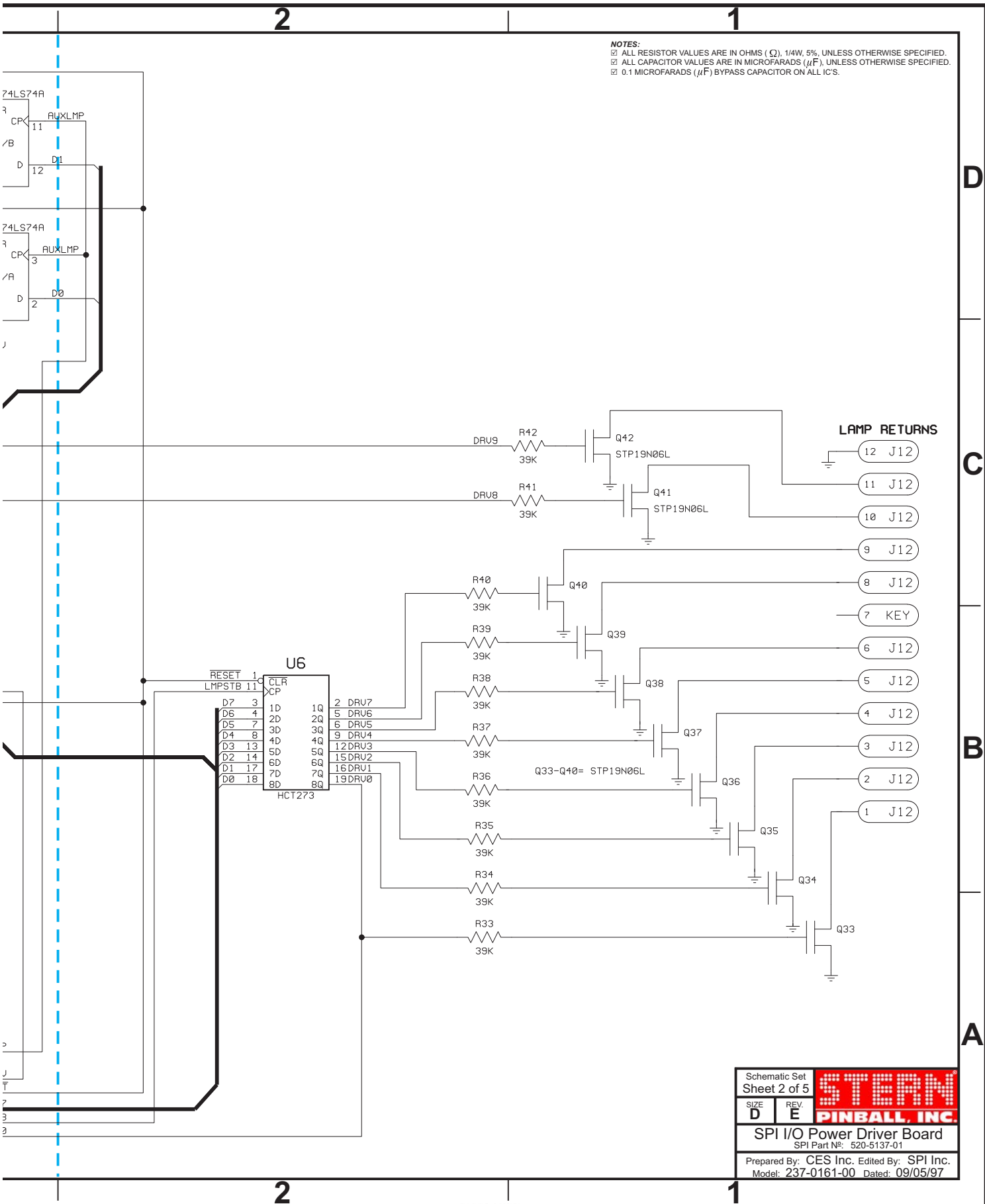


- (4-4C) AUXLMP
- (4-1C) LST
- (4-1C) LMPDRU
- (1-1D, 2-4A, 3-4B, 4-1D) RESET
- (1-1D, 3-4B, 4-4B) D0-D7
- (4-1C) LMPSTB
- (4-1D) DRU0

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

Sec. 5: PCBs



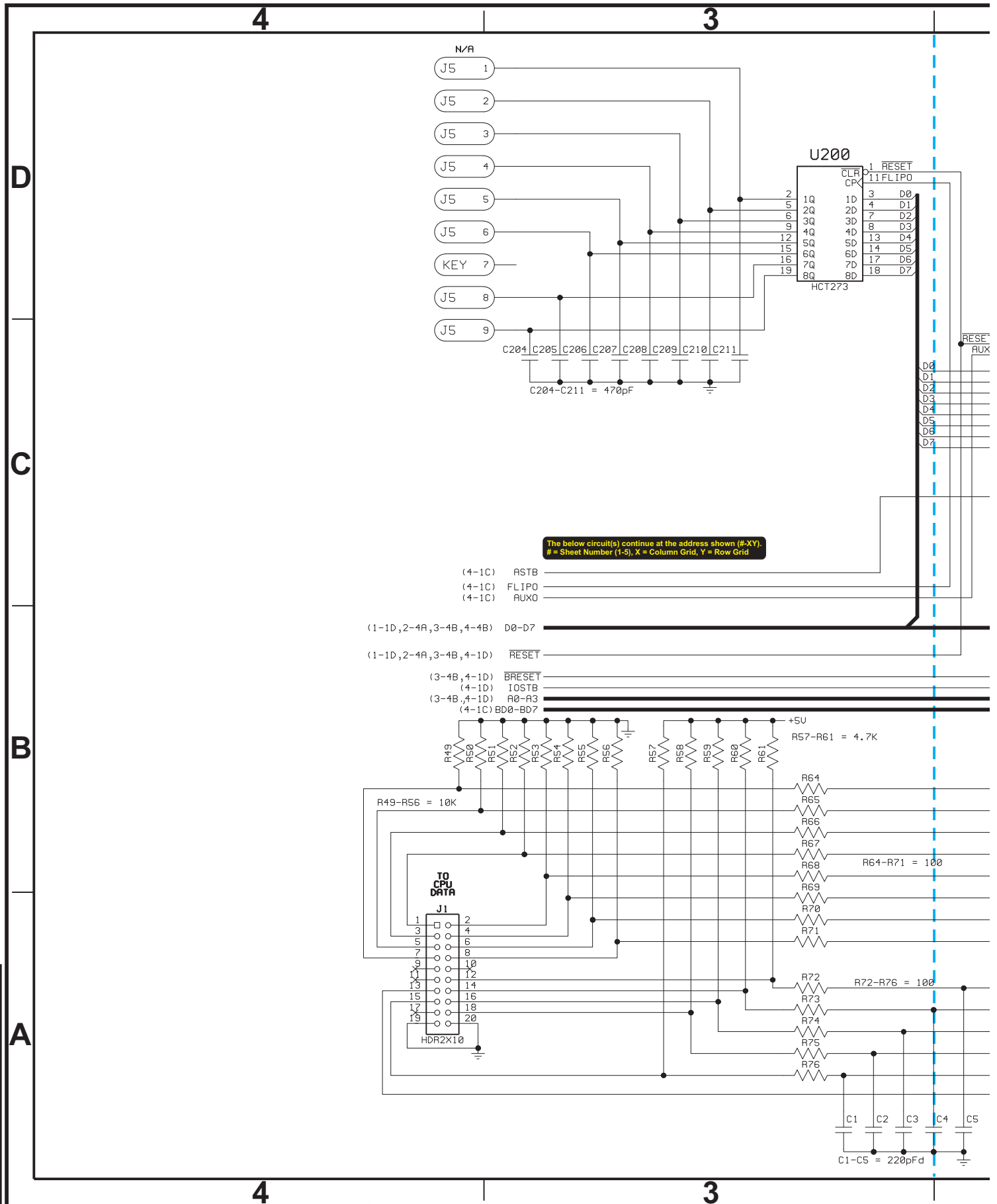


Schematic Set		STERN
Sheet 2 of 5		
SIZE	REV.	PINBALL, INC.
D	E	
SPI I/O Power Driver Board		
SPI Part No: 520-5137-01		
Prepared By: CES Inc. Edited By: SPI Inc.		
Model: 237-0161-00 Dated: 09/05/97		

Sec. 5: PCBs



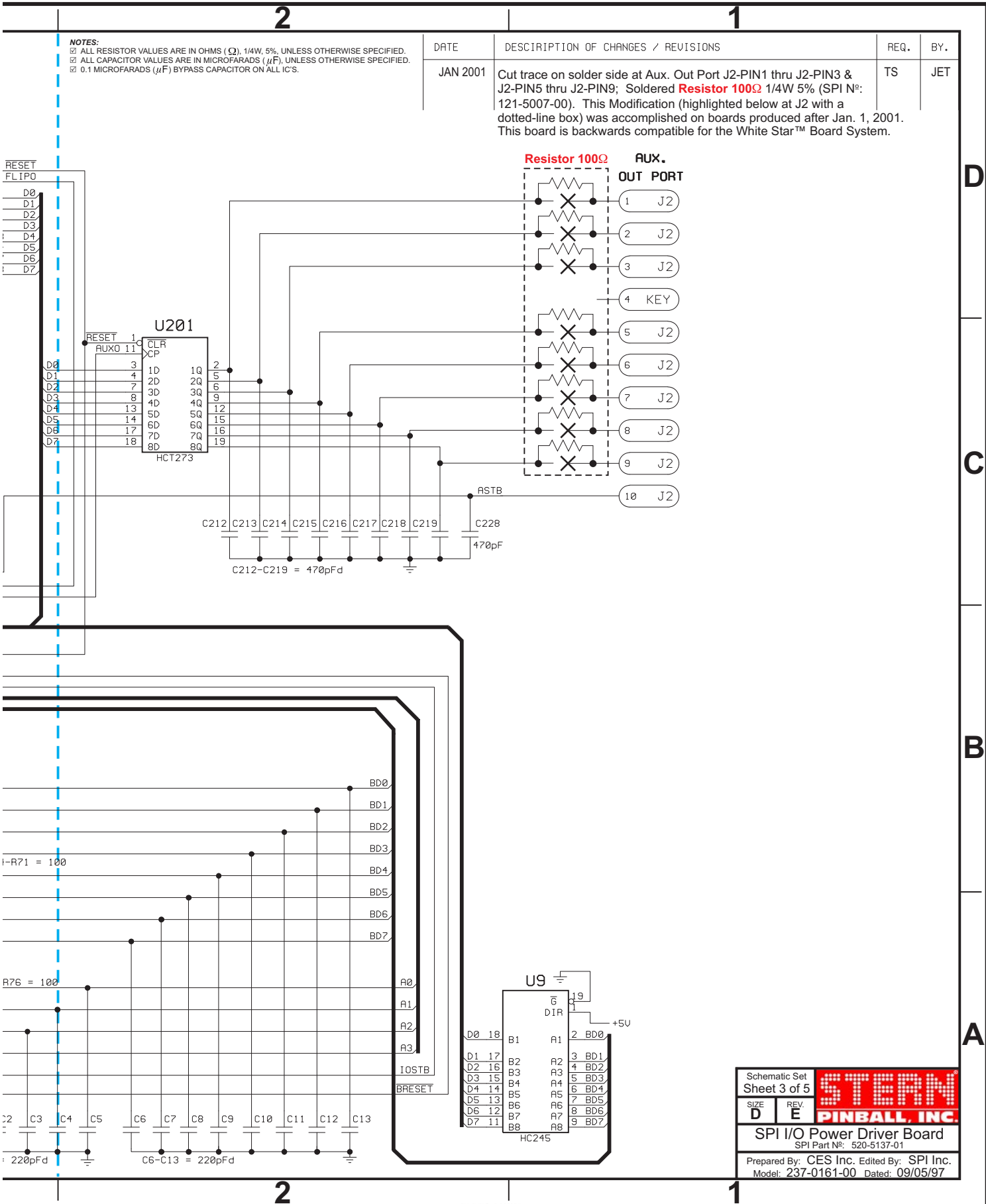
I/O Power Driver Board Schematic (Sheet 3 of 5)



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

Sec. 5: PCBs





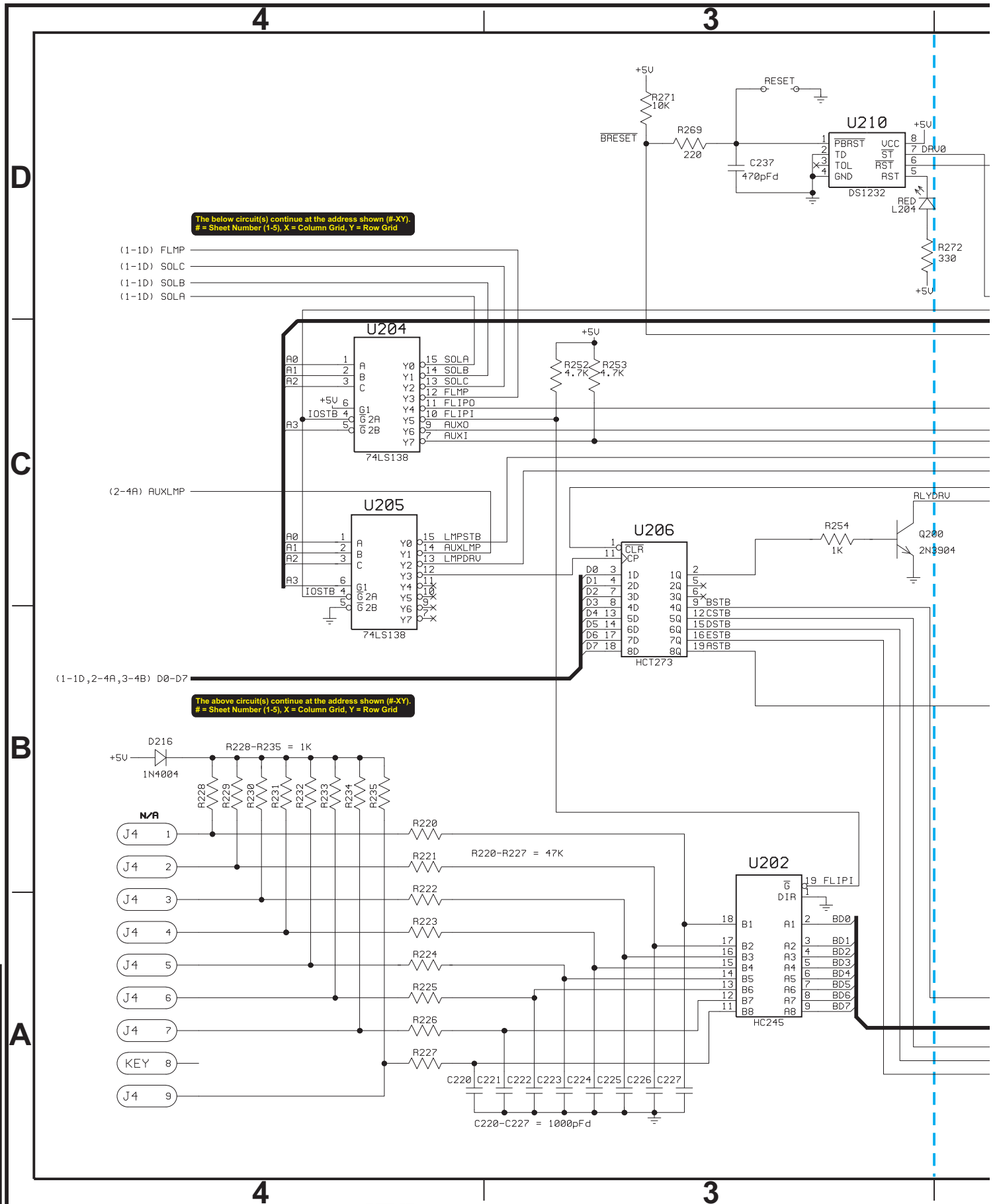
D
C
B
A

Sec. 5: PCBs

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



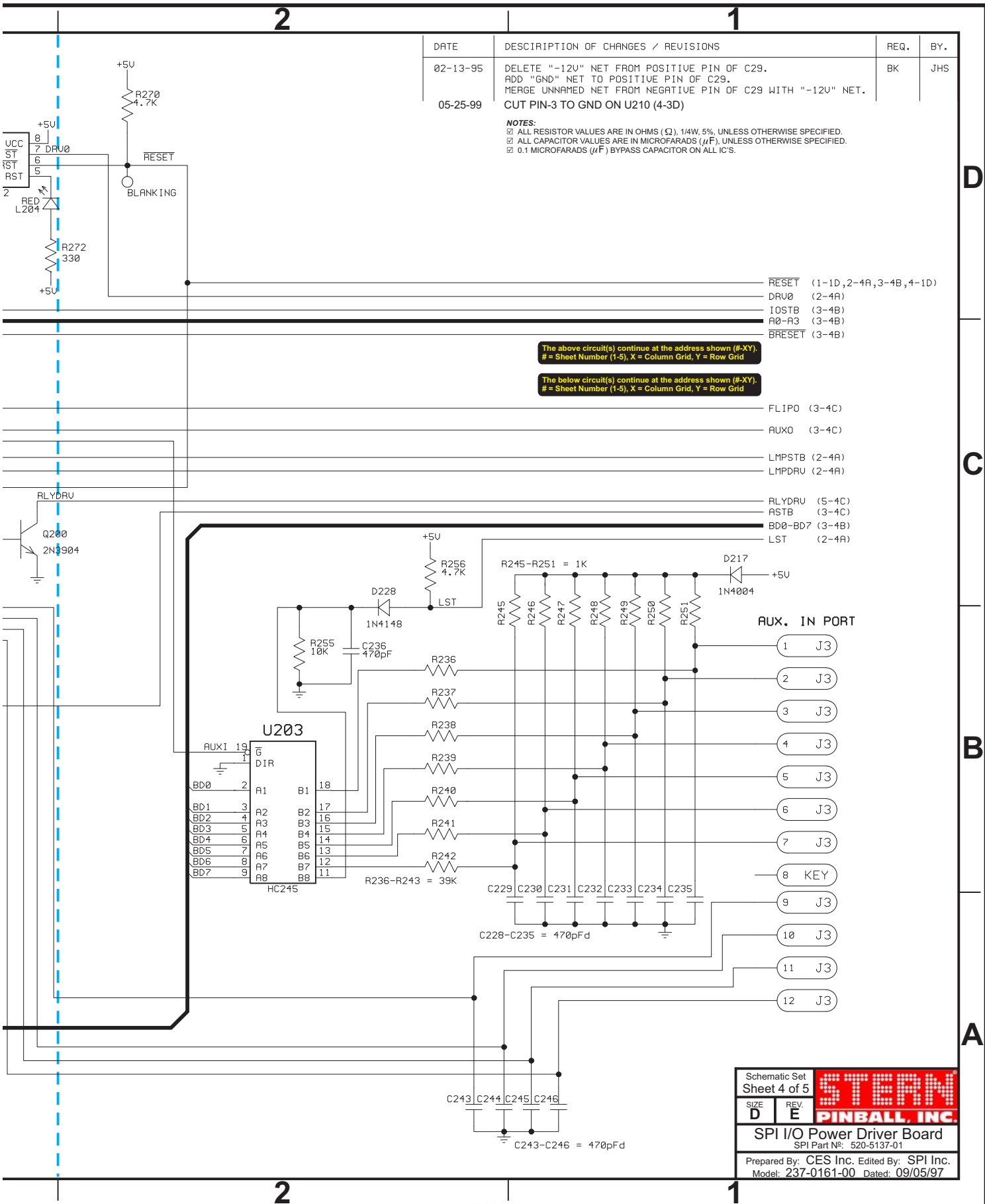
I/O Power Driver Board Schematic (Sheet 4 of 5)



Sec. 5: PCBs



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

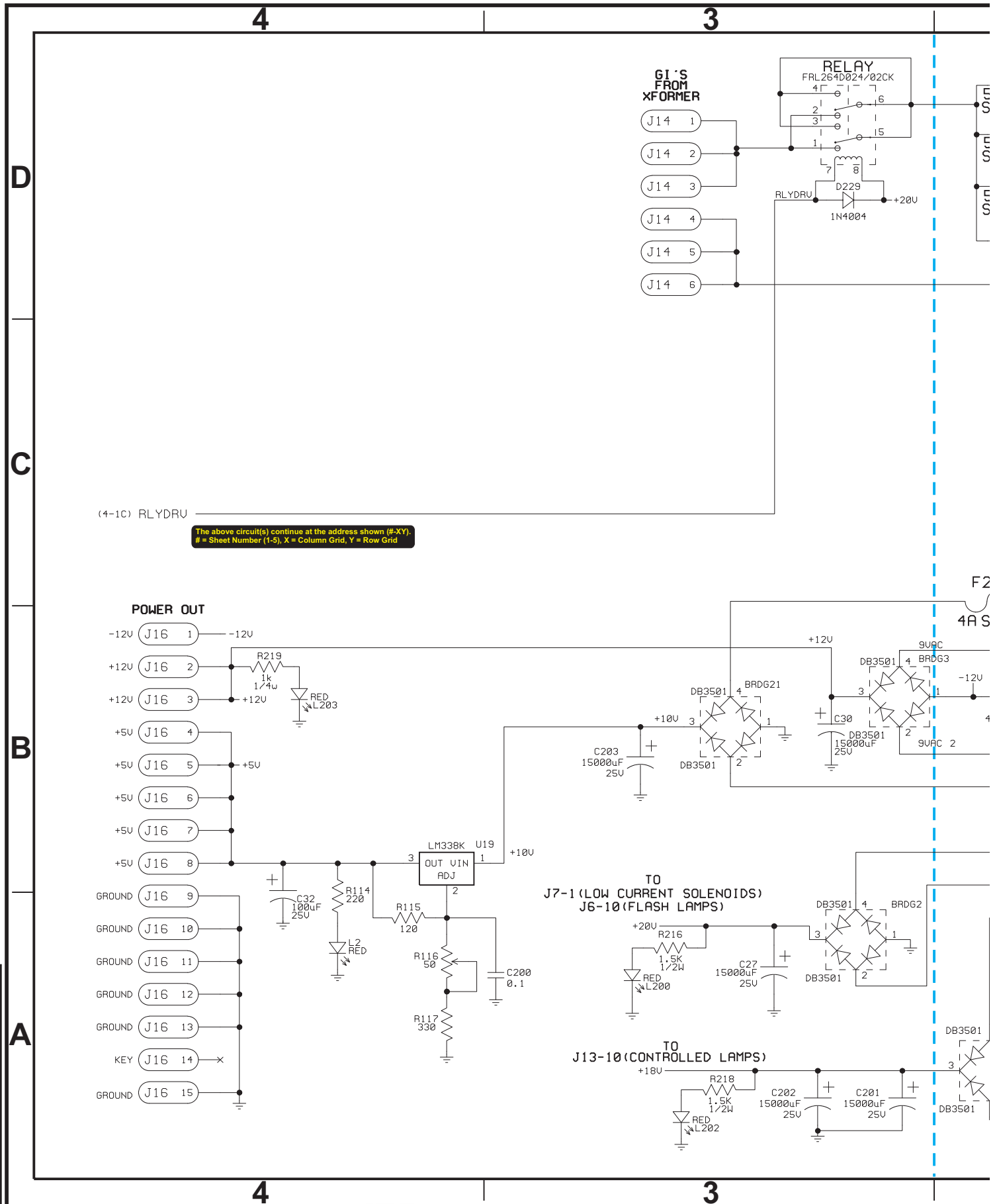


D
C
B
A

Sec. 5: PCBs

Schematic Set Sheet 4 of 5		STERN PINBALL, INC.
SIZE D	REV. E	
SPI I/O Power Driver Board SPI Part No: 520-5137-01		
Prepared By: CES Inc. Edited By: SPI Inc. Model: 237-0161-00 Dated: 09/05/97		

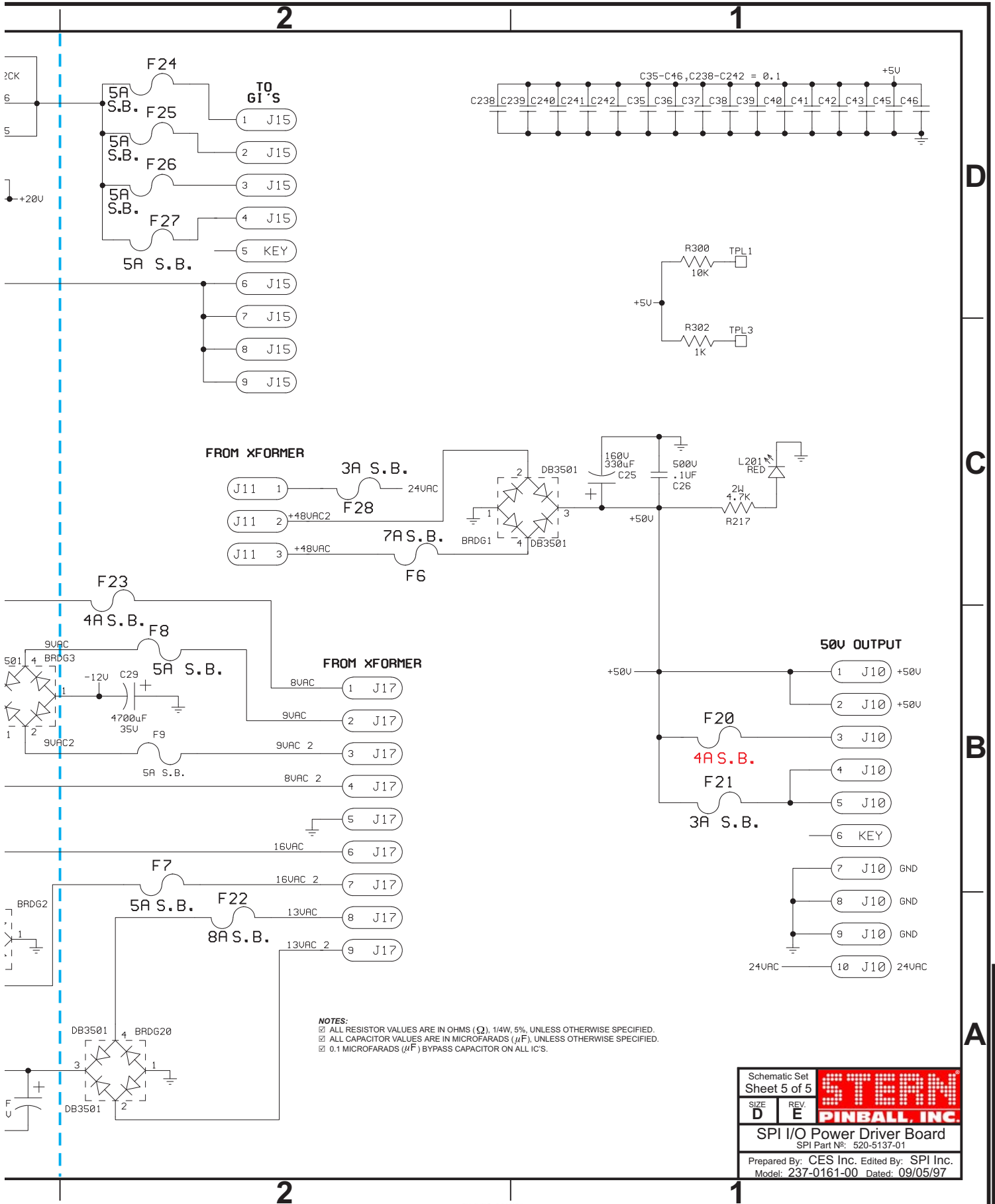




The above circuit(s) continue at the address shown (#-XY).
 # = Sheet Number (1-5), X = Column Grid, Y = Row Grid

Sec. 5: PCBs





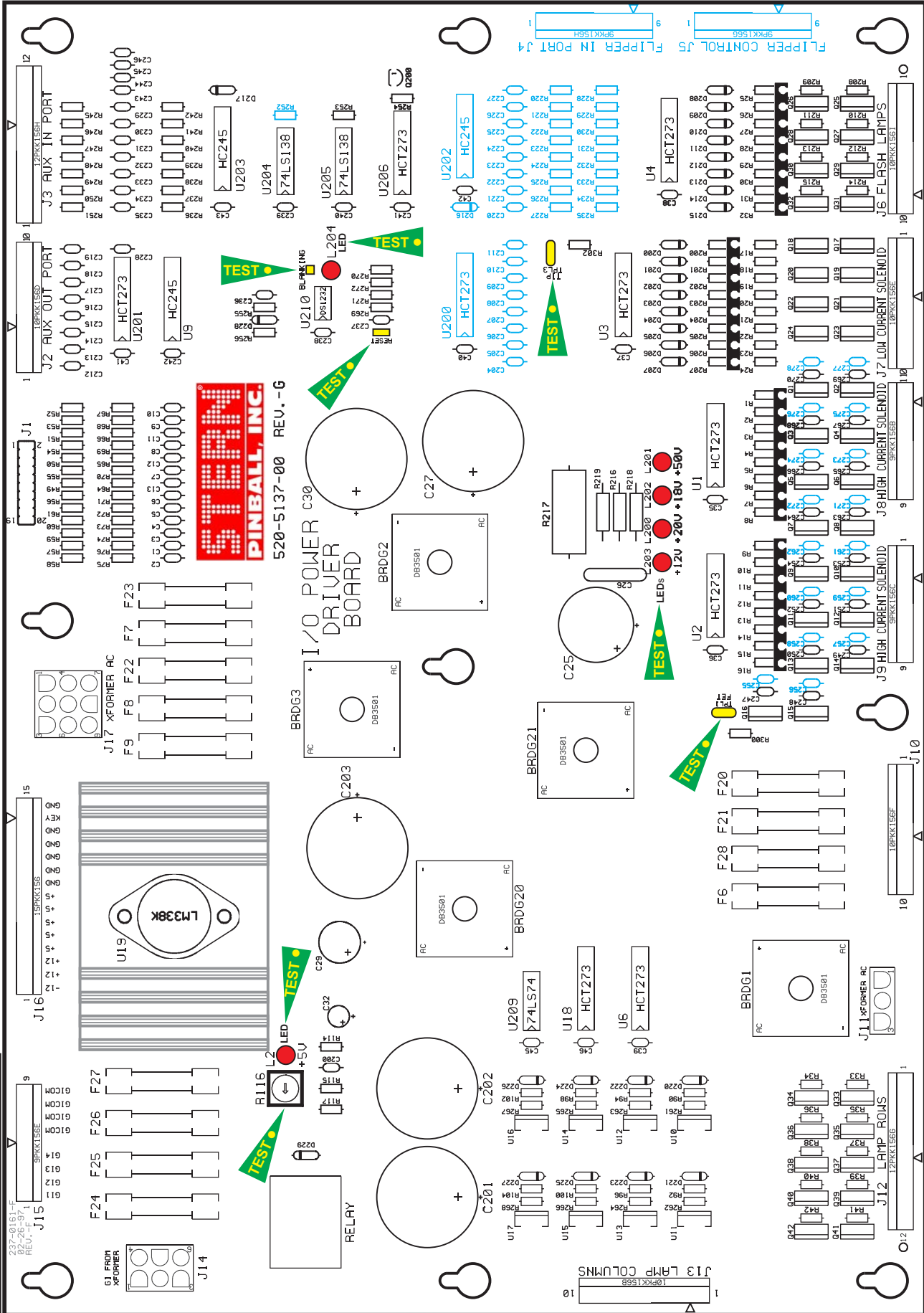
NOTES:
 ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
 ☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μ F), UNLESS OTHERWISE SPECIFIED.
 ☑ 0.1 MICROFARADS (μ F) BYPASS CAPACITOR ON ALL IC'S.

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

Sec. 5: PCBs



I/O Power Driver Board Component Layout



Test Points:



← TIP TPL3
← BLANKING
← L204 LED

← RESET

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

← FET TPL1

LED :
← L2+5V
← R116 POT

Actual Board Size 15.698" X 11"



I/O Power Driver Board Parts

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	1	520-5137-01	I/O Power Driver Board Rev. G	Complete PCB Assembly
01	5	112-5000-00	BRDG1, BRDG2, BRDG3, BRDG20, BRDG21	DB3501
02	13	125-5030-00	C1, C2, C3>C6, C7, C8, C9>C10, C11, C12	220pF, (221), Cap.
03	1	125-5033-00	C25	100uF, 150v, Radial Lytic Cap.
04	1	125-5035-00	C26	.1uF, 500v, Ceramic Disk Cap.
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	100 Ω 1/4W Res.
Resistors on Solder Side @ J2-Pins: 1-3 & 5-9				
41	8	121-5029-00	R90, R92, R94, R96, R98, R100, R102, R104	6.8K Ω 1/4W Res.
42	2	121-5033-00	R114, R269	220 Ω 1/4W Res.
43	1	121-5030-00	R115	120 Ω 1/4W Res.
44	1	121-5039-00	R116	50 Ω Pot
45	2	121-5036-00	R117, R272	330 Ω 1/4W Res.
46	2	121-5038-00	R216, R218	1.5K Ω 1/2W Res.
47	1	121-5050-00	R217	4.7K Ω 2W Res. (SANDBAR)
48	1	121-5009-00	R219, R245>R251, R254, R302 (R228>R235: NS)	1K Ω 1/4W Res.
49	8	121-5016-00	R261, R262, R263, R264, R265, R266, R267, R268	47 Ω 1/4W Res.
50	1	190-5002-00	RELAY	FRL264D024/02CK Relay
51	2	n/a	TPL1, TPL3	Test Point Wire (24ga.) Loops
52	8	100-5012-00	U1, U2, U3, U4, U6, U18, U201, U206 (U200: NS)	74HCT273
53	1	110-0058-00	U9	74LS245
54	1	100-5023-00	U210	DS1232
55	8	110-0089-00	U10, U11, U12, U13, U14, U15, U16, U17	VN02N
56	1	100-0356-00	U19	LM338K
57	1	n/a	U19	Heatsink (5v Reg.)
58	1	100-0338-00	U203 (U202: NS)	74HC245
59	2	100-0148-00	U204, U205	74LS138
60	1	100-0037-00	U209	74LS74
61	1	n/a	BLANKING, RESET	Test Points



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



Sec. 5: PCBs

CPU/Sound Board II (with ATMEL Processor) Theory of Operation

CPU Section:

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

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

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

Switches:

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

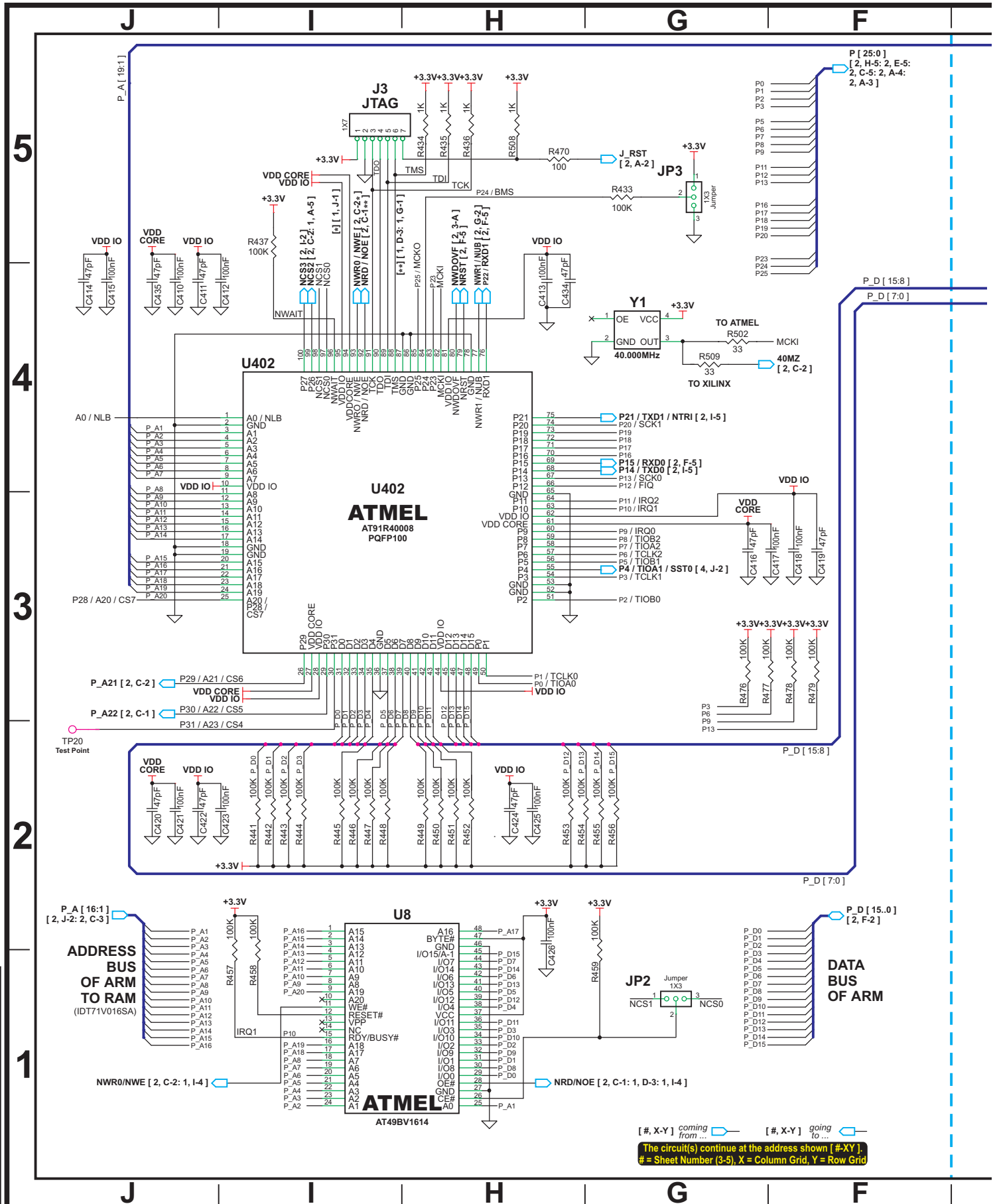
Plasma Interface:

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

Other Test Points (TP):

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

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

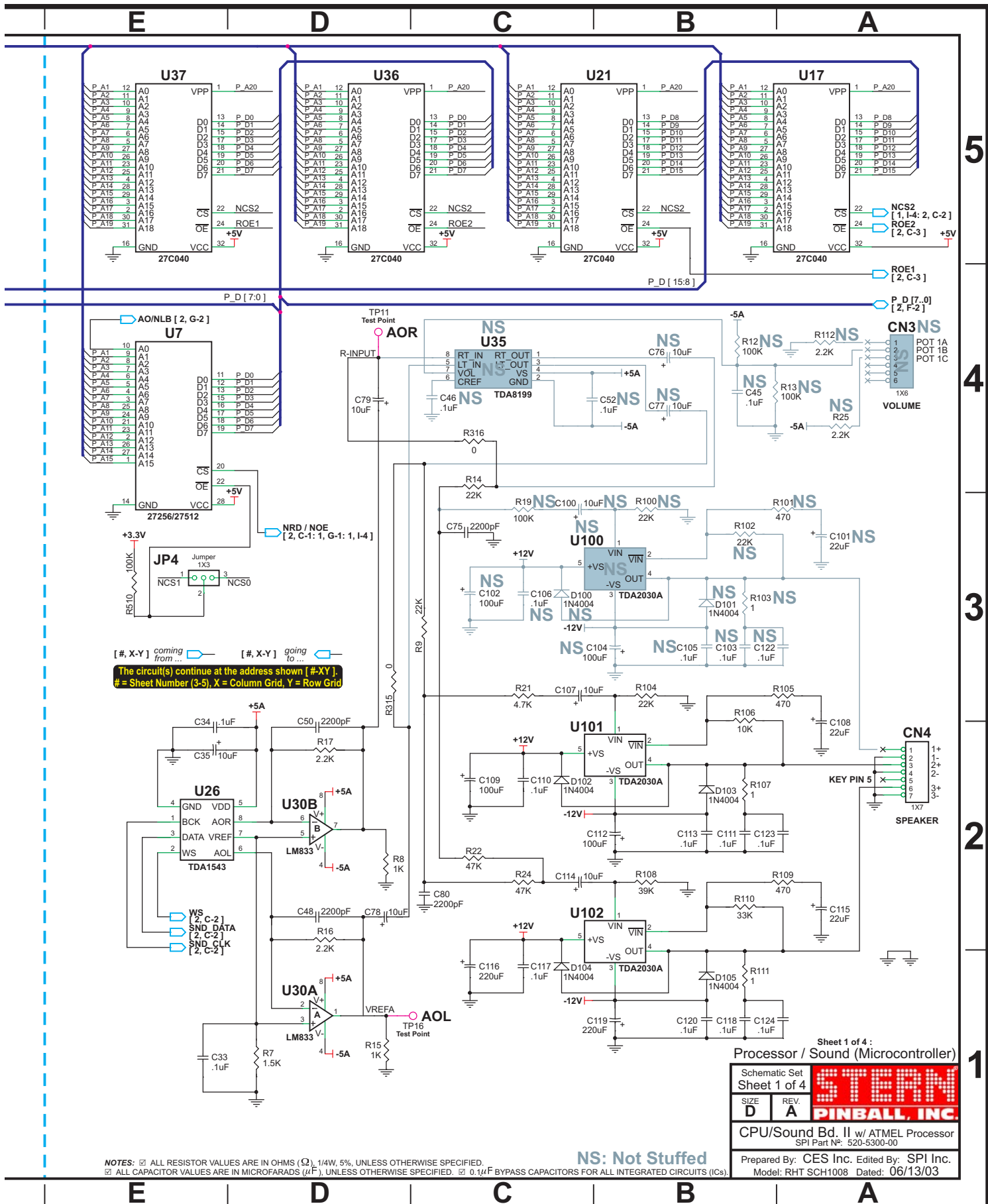


Sec. 5: PCBs

[#, 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

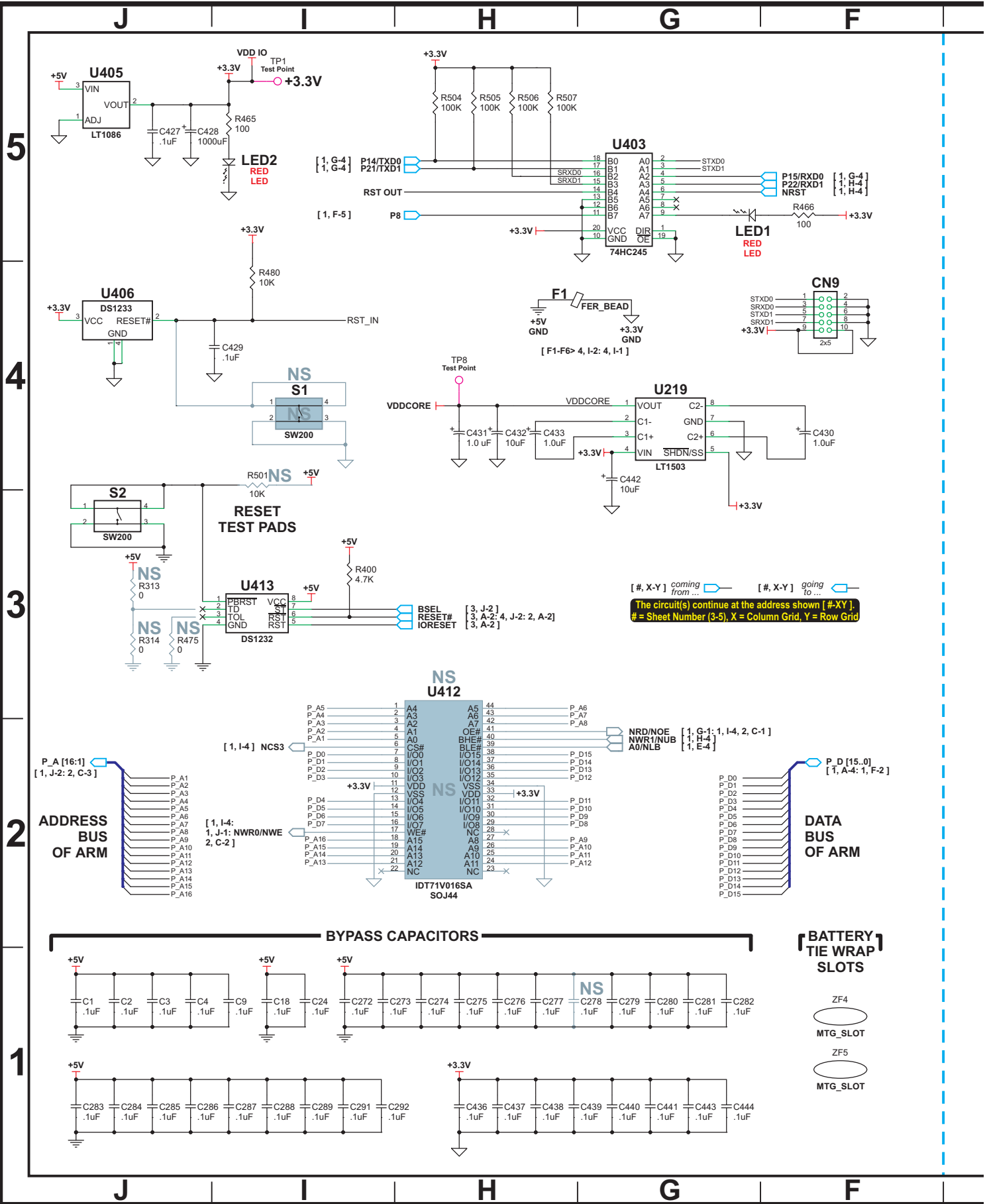


CPU/Sound Board II (with ATMEL Processor) Schematic (Sheet 1 of 4)



Sec. 5: PCBs

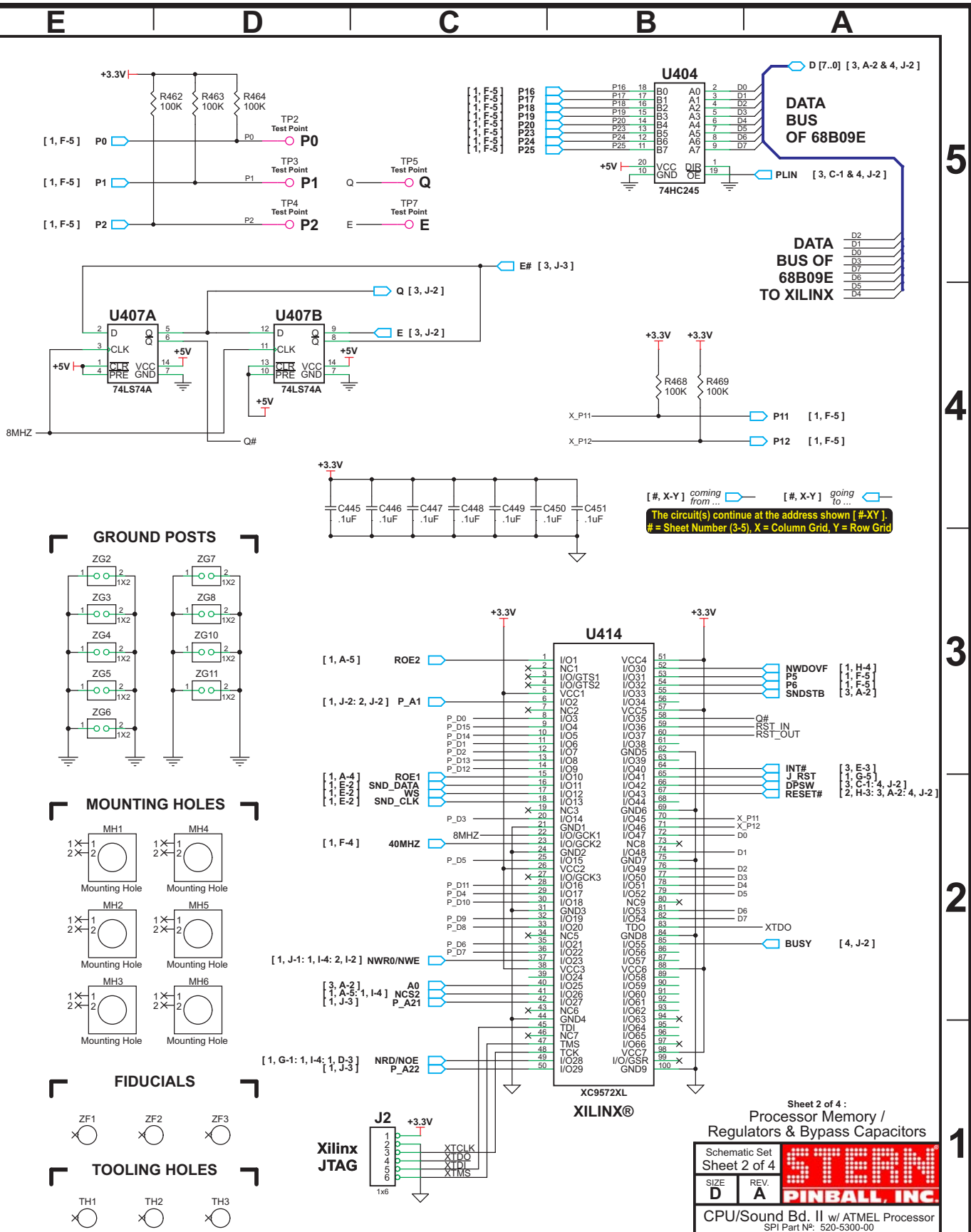




Sec. 5: PCBs



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



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

NS: Not Stuffed

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

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

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

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



Sec. 5: PCBs

[#, 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

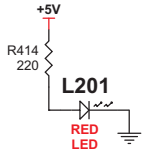
5

4

3

2

1



[2, C-5] E#

[2, C-4] E#

[2, H-3] BSEL

[2, C-4] E#

[2, C-4] E#

[2, H-3] BSEL

[2, C-4] E#

[2, C-4] E#

[2, H-3] BSEL

[2, C-4] E#

[2, C-4] E#

[2, H-3] BSEL

[2, C-4] E#

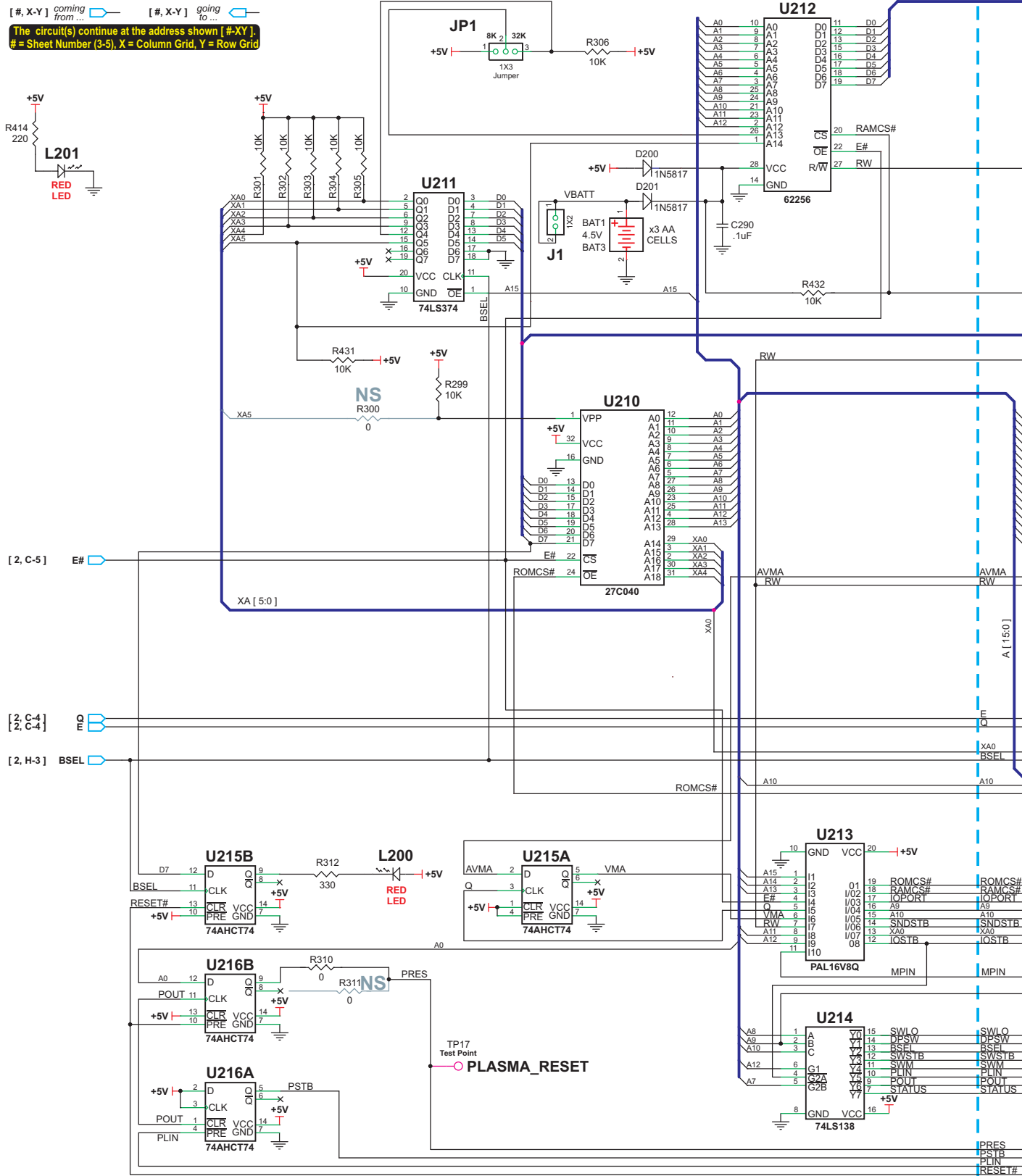
[2, C-4] E#

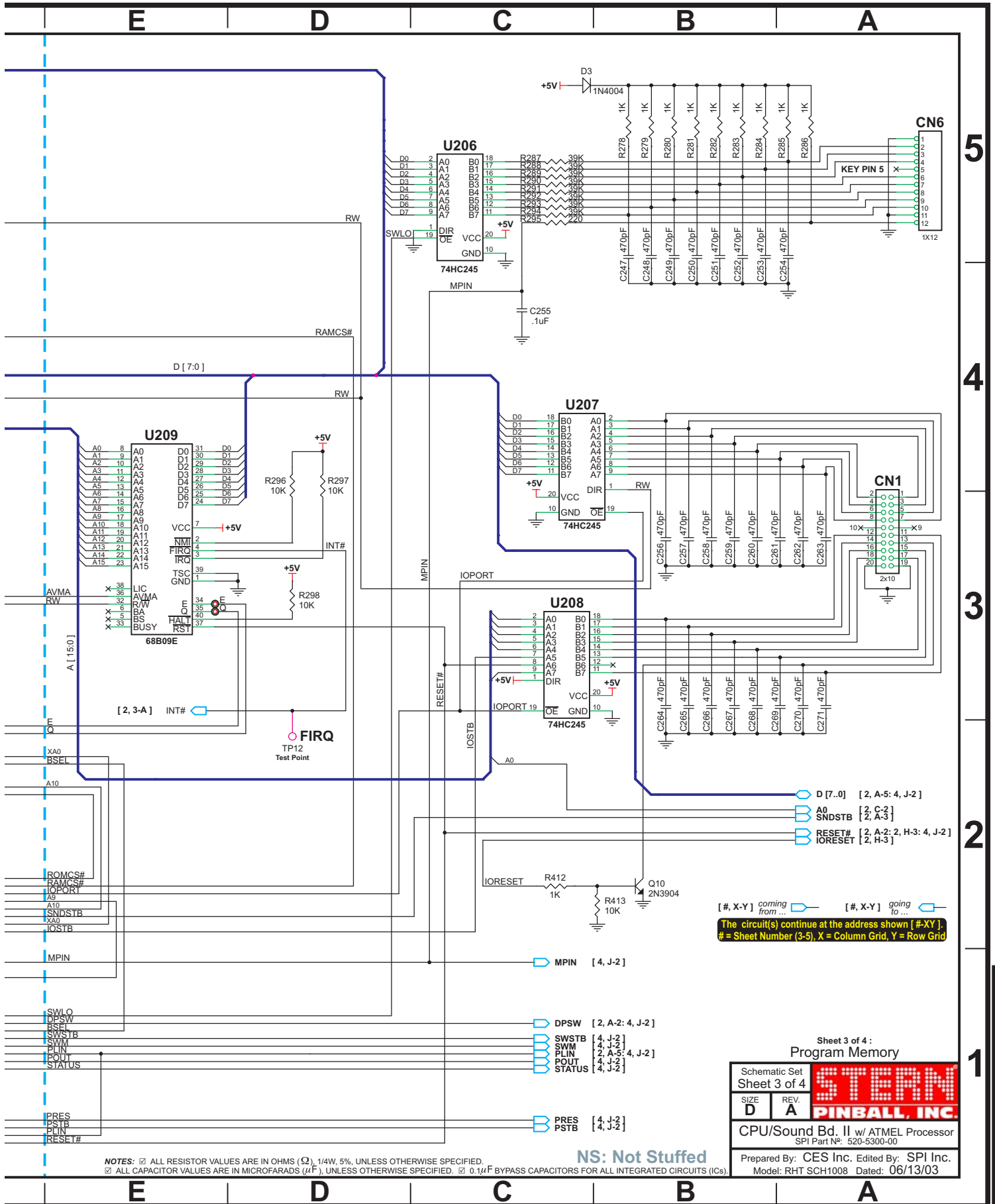
[2, H-3] BSEL

[2, C-4] E#

[2, C-4] E#

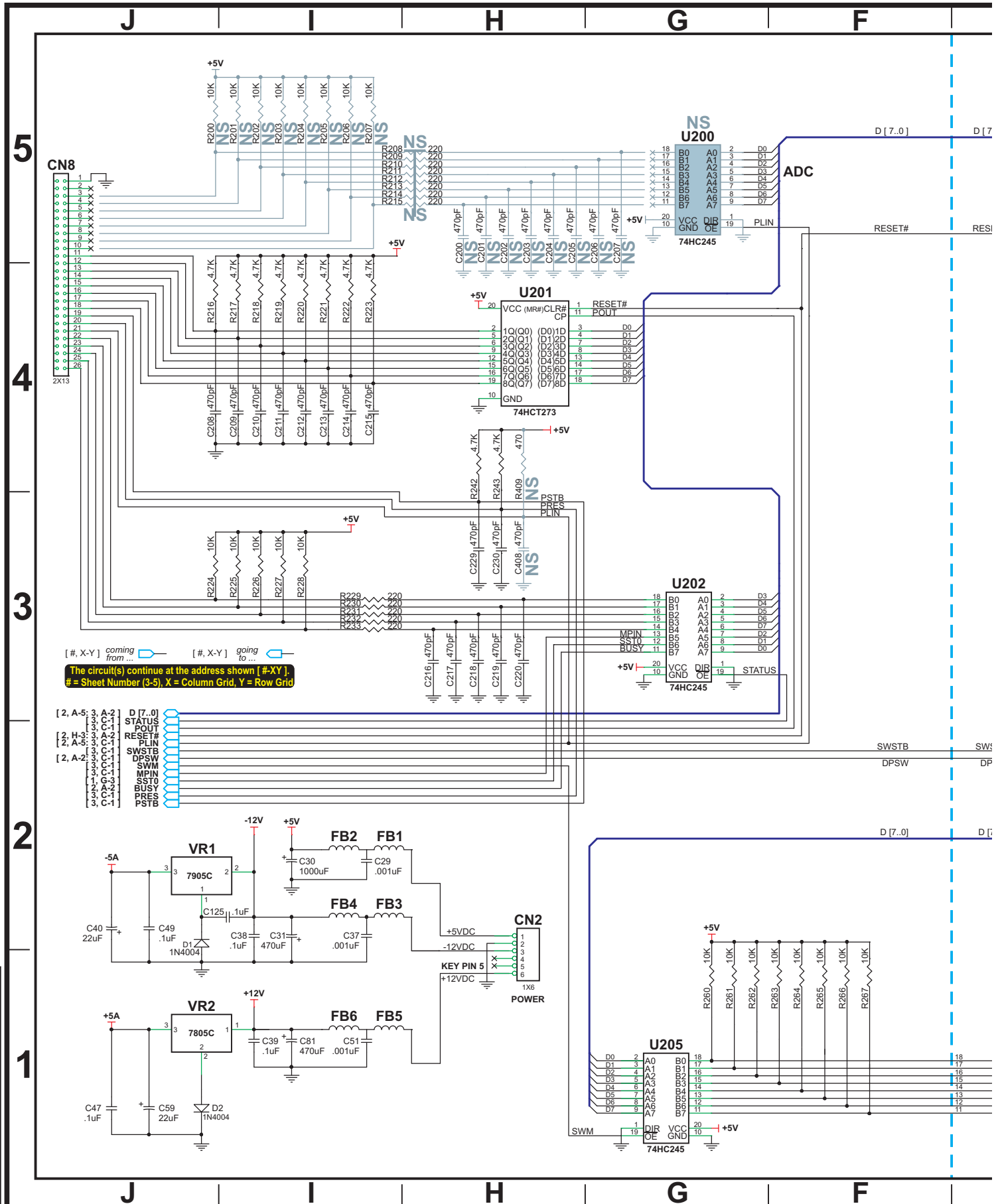
Sec. 5: PCBs





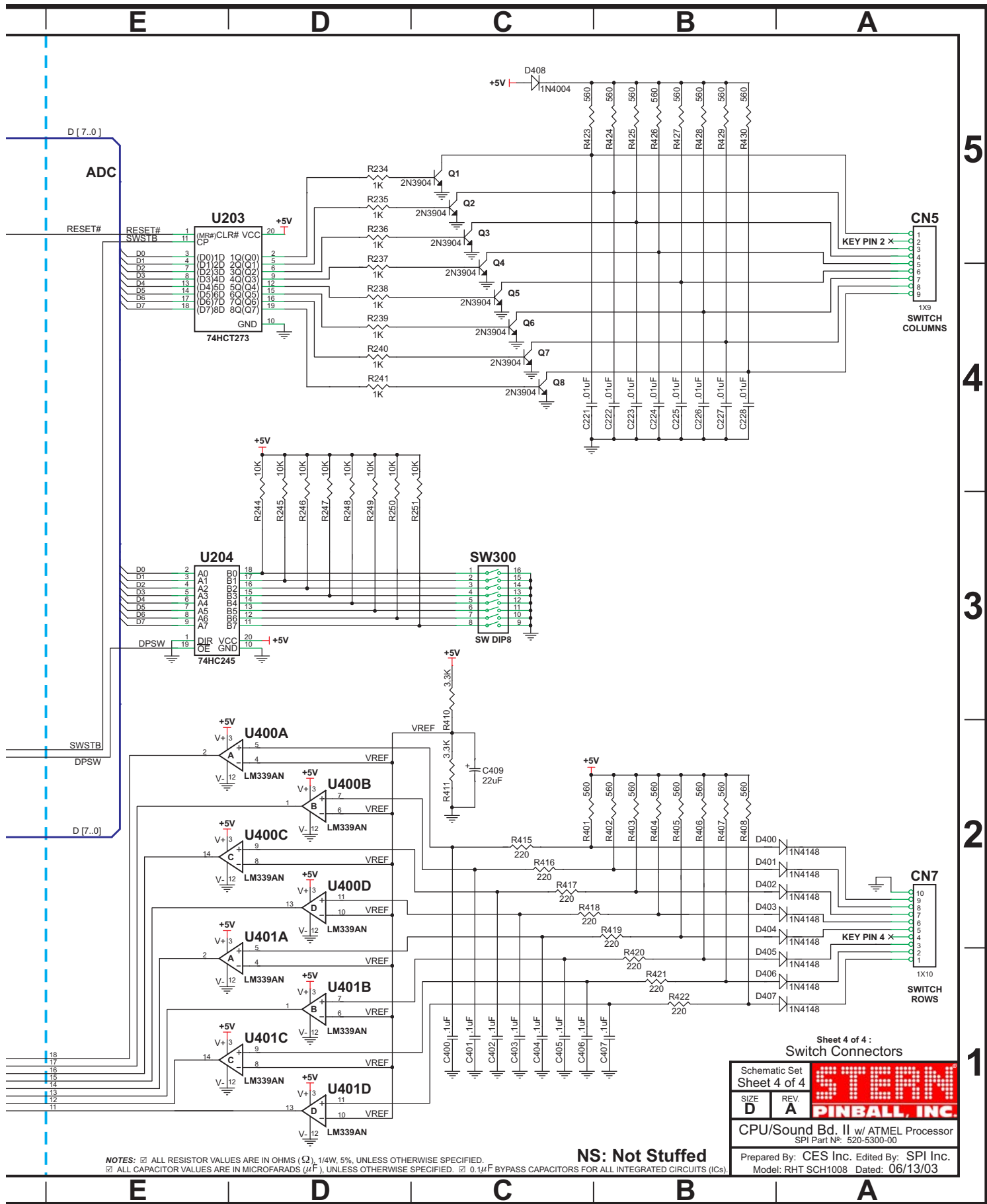
Sec. 5: PCBs





Sec. 5: PCBs





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

NS: Not Stuffed

Sheet 4 of 4 :
Switch Connectors

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

Sec. 5: PCBs



CPU/Sound II Board (with Atmel Processor) Parts

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
			CPU/Sound II Board (with Atmel Processor)	Complete PCB Assembly
01	1	520-5300-00	JP1, JP2, JP3, JP4	3-Pin Jumper & 2-Pin Cover
02	4		CN2 (Key Pin-5)	6-Pin, 6PKK156
03	1	045-5015-06	J2 JTAG Xilinx®	6-Pin, ## Header
04	1	045-5015-07	CN4 (Key Pin-5)	7-Pin, 7PKK156
05	1		J3 JTAG	7-Pin, ## Header
06	1	045-5013-00	CN5 (Key Pin-2)	9-Pin, 9PKK156
07	1		CN9	10-Pin, 0.1 Header
08	1	045-5014-01	CN7 (Key Pin-4)	10-Pin, 10PKK156
09	1	045-5015-00	CN6 (Key Pin-5)	12-Pin, 12PKK156
10	1	045-5015-01	CN1	20-Pin, 0.1 Header
11	1	045-5015-26	CN8	26-Pin, 0.1 Header
12	3	125-5043-00	C29, C37, C51	0.001uF (102), Cap.
13	4	125-5039-00	C48, C50, C75, C80	0.0022uF or 2200pF, (222), Cap.
14	8	125-5029-00	C221>C228	0.01uF (103), 100v Cap.
15	52	125-5031-00	C1>C4, C9, C18, C24, C33, C34, C38, C39, C47, C49, C110, C111, C113, C117, C118, C120, C123, C124, C125, C255, C272>C277, C279>C292, C400>C407, C444 (C45, C46, C52, C103, C105, C106, C122, C278: NS)	0.1uF (104), Axial Cer. Cap.
16	3		C430, C431, C433 (near U403, U404)	1.0uF, ##v, Radial Lytic Cap.
17	1	125-5017-00	C35	10uF, 16v, Radial Tant. Cap.
18	4	125-5017-00	C78, C79, C107, C114 (C76, C77, C100: NS)	10uF, 25v-35v, Radial Lytic Cap.
19	2	125-5015-00	C109, C112 (C102, C104: NS)	100uF, 25v, Radial Lytic Cap.
20	1	125-5014-00	C409	22uF, 16v, Radial Lytic Cap.
21	4	125-5020-00	C40, C59, C108, C115 (C101: NS)	22uF, 25v, Radial Lytic Cap.
22	2	125-5012-00	C116, C119	220uF, 25v, Radial Lytic Cap.
23	2	125-5019-00	C31, C81	470uF, 25v, Radial Lytic Cap.
24	39	125-5028-00	C208>C215, C216>C220, C229, C230, C247>C254, C256>C263, C264>C271 (C200>C207, C408: NS)	470pF (471), Cer. Cap.
25	2	125-5037-00	C30, C428	1000uF, 16v, Radial Lytic Cap.
26	17		C427, C429, C436>C441, C443, C445>C451	SMT .1uF Cap.
27	2		C432, C442 (near U403 & U404)	SMT 10uF Cap.
28	9		C411, C414, C416, C419, C420, C422, C424, C434, C435	SMT 47pF Cap.
29	10		C410, C412, C413, C415, C417, C418, C421, C423, C425, C426	SMT 100nF Cap.
30	7	112-5003-00	D1>D3, D102>D105, D408 (D100, D101: NS)	1N4004, Diode
31	2	112-5008-00	D200, D201	1N5817, Diode
32	8	112-0054-00	D400-D407	1N1418, Diode
33	4	165-5099-00	LED1, LED2, L200, L201	LED T1-3/4 DIFFUSER LED
34	3	124-5064-00	R310, R315, R316 (R300, R311, R313, R314, R475: NS)	0Ω Jumper Res. (1-Stripe)
35	2	121-5041-00	R107, R111 (R103: NS)	1 Ω 1/4W Res.
36	20	121-5009-00	R8, R15, R234>R241, R278>R286, R412	1K Ω 1/4W Res.
37	1	121-5018-00	R7	1.5K Ω 1/4W Res.
38	2	121-5043-00	R16, R17 (R25, R112: NS)	2.2K Ω 1/4W Res.
39	2	121-5048-00	R410, R411	3.3K Ω 1/4W Res.
40	12	121-5021-00	R21, R216>R223, R242, R243, R400	4.7K Ω 1/4W Res.
	36	121-5011-00	R106, R224>R228, R244>R251, R260>R267, R296>R299, R301>R306, R413, R431, R432 (R200>R207, R501: NS)	10K Ω 1/4W Res.
41	3	121-5023-00	R9, R14, R104 (R100, R102: NS)	22K W 1/4W Res.
42	1	121-5022-04	R110	33K Ω 1/4W Res.
43	9	121-5045-00	R108, R287>R294	39K Ω Res.
44	2	121-5032-00	R22, R24	47K Ω 1/4W Res.
45	15	121-5014-00	R229>R233, R295, R414>R422 (R208>R215: NS)	220 Ω 1/4W Res.
46	1	121-5036-00	R312	330 Ω 1/4W Res.
47	2	121-5046-01	R105, R109 (R101, R409: NS)	470 Ω 1/4W Res.
48	16	121-5047-00	R401>R408, R423>R430	560 Ω 1/4W Res.
49	1		F1	SMT xx Res.
50	4		R434, R435, R436, R508	SMT 1K Ω Res.
51	1		R480	SMT 10K Ω Res.
52	2		R502, R509	SMT 33 Ω Res.
53	3		R465, R466, R470	SMT 100 Ω Res.
54	35		R433, R437, R441>R459, R462>R464, R468, R469, R476>R479, R504>R507, R510	SMT 100K Ω Res.
55	9	110-0069-00	Q1-Q8, Q10	2N3904, Transistor
56	1		U402	ATMEL, AT91R40008
57	1		U8	ATMEL, AT49BV1614
58	1		U414	XILINX®, XC9572XL
59	1		U7	512K EPROM Sound (27512)
60	1	(See Pg. DR. Ⓢ Table)	U210 (32-Pin, IC Socket, 077-5217-00)	1MB EPROM CPU Game (27C040)
61	4	(See Pg. DR. Ⓢ Table)	U17, U21, U36, U37 (32-Pin, IC Socket, 077-5217-00)	8MB EPROM Voice 1-4 (M27C04001-12FI)
62	1	(See Pg. DR. Ⓢ Table)	U213 (BLUE DOT)	PAL16V8Q (Programmed) BLUE DOT
63	1	965-6504-00	U212 (28-Pin, IC Dip Socket, 077-5208-00)	6264/MS62256 (MS6264A) (28-Pin)
64	1	105-5046-00	U209 (40-Pin, IC Socket, 077-5209-00)	68B09E (40-Pin)
65	2	100-5015-00	U215, U216	74AHC74 (14-Pin)
66	8	100-0338-00	U202, U204, U205, U206, U207, U208, U403, U404 (U200: NS)	74HC245 (20-Pin)
67	2	100-5012-00	U201, U203	74HCT273 (20-Pin)
68	1	100-0037-00	U407	74LS74 (14-Pin)
69	1	100-0148-00	U214	74LS138 (16-Pin)
70	1	100-0064-00	U211	74LS374 (20-Pin)
71	1		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)
81	1		Y1	40MHz Clock PLE SQ3300S
82	1	181-5002-00	SW300	Dip Switch 8-Pos., (KSD08H Black)
83		n/a	FB1>FB6	Ferrite Bead
84		535-5000-10	HS2, HS3, (HS1: NS) (over U101, U102)	Heat Sink (AAVID 531102)
85	1		S2 (Reset)	Push-Button Switch (B3F4000)
86	1	545-5685-00	BAT1 HOLDER (Always replace all 3, Size AA 1.5v Cells, with new ones, when required)	

* Surface Mounts (SMT) are not listed.

* Surface Mounts (SMT) are not listed.

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

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

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

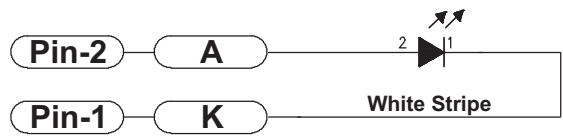
Printed Circuit Boards (PCBs)



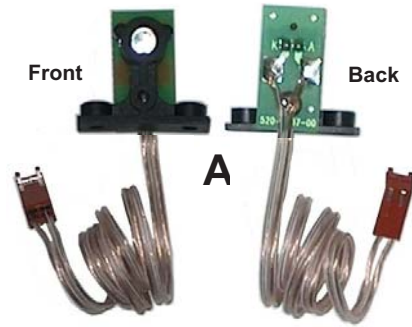
Section 5, Chapter 4
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Sec. 5: PCBs

Playfield Switches OPTO Transceiver Boards Schematic, Component Layout & Parts



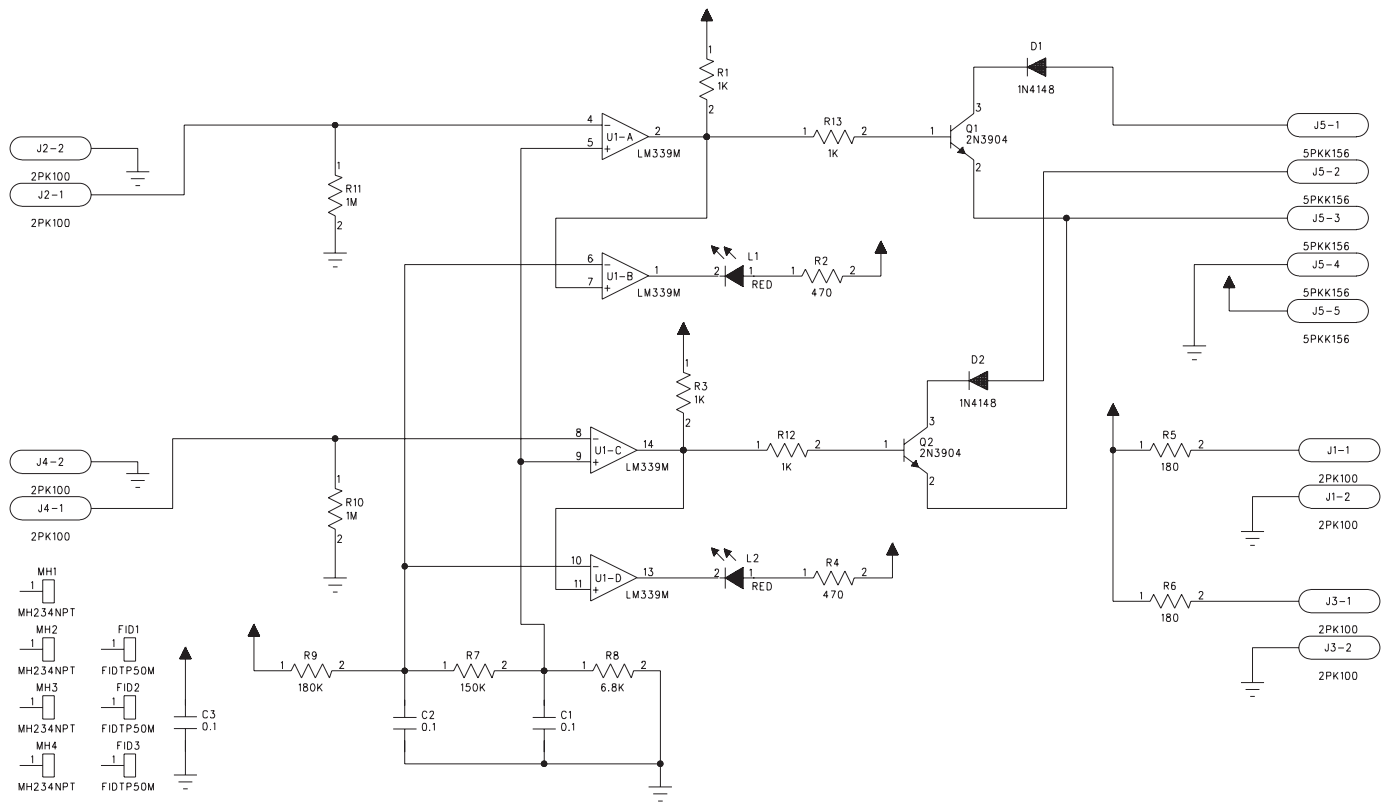
**Mini PCB
OPTO 12" Lead
(Black Bracket)
500-6775-00**



ITEM	QTY	PART NUMBER	REF-DESIGNATOR
A	6	500-6775-00	MINI PCB OPTO ASM WHT / 12" LEAD
01	1	520-5237-00	Mini OPTO Trans. or Rec. Board
02	1	545-6092-00	
03	1	237-5909-00	
04	1	165-5052-00	
05	1	601-5023-12	K, A
		045-5020-02	Note White Strip to Pin-1

DESCRIPTION
PCB Assy. (with all Items 1-5) PCB Only Plain Black Bracket (Plastic) Holder #4-40 X 1/4 PPH Screw LED (Ultra Bright Red) 12" Speaker Wire (1-Side White Stripe) 2-Pin Cn., .100 KK Cmp Trm Molex 08-50-0113

Playfield OPTO Transmitter / Receiver Amplifier Board Schematic



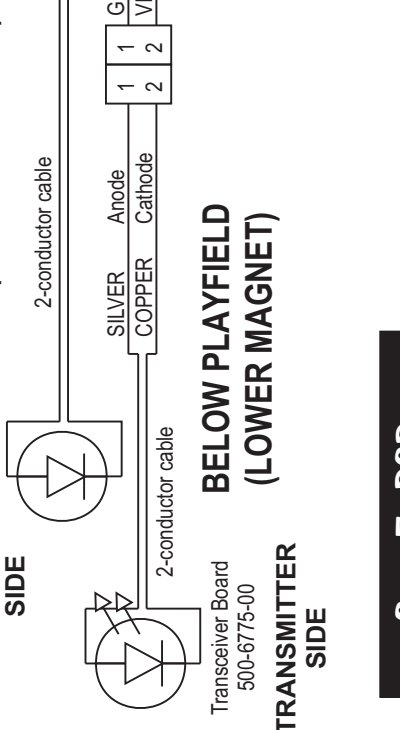
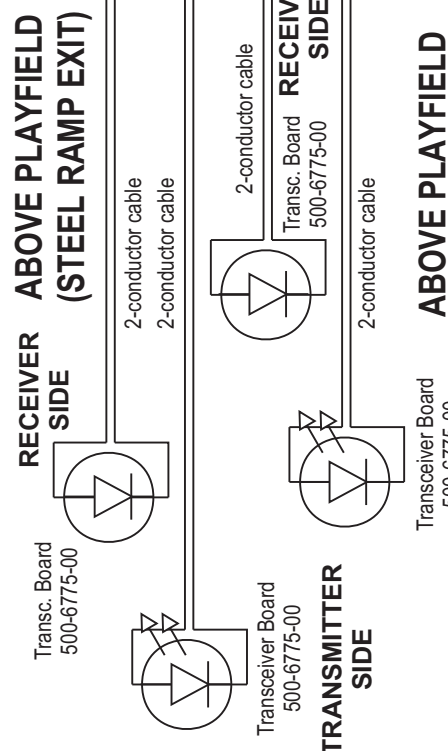
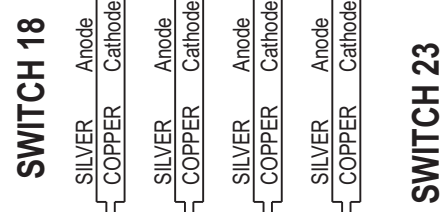
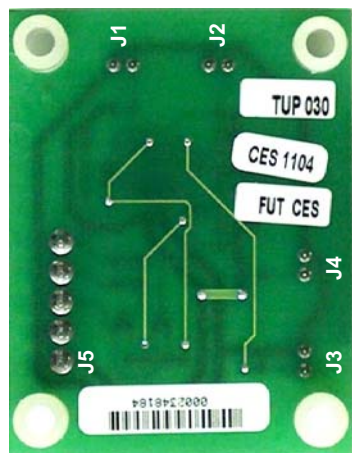
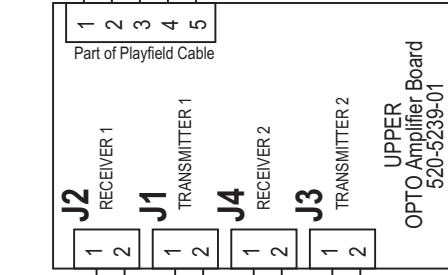
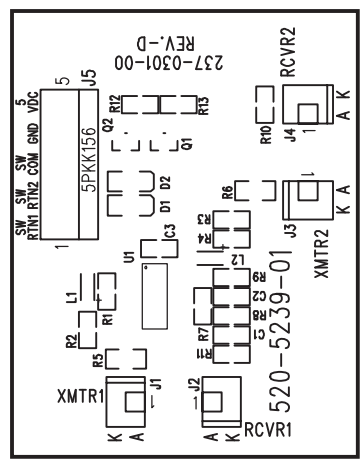
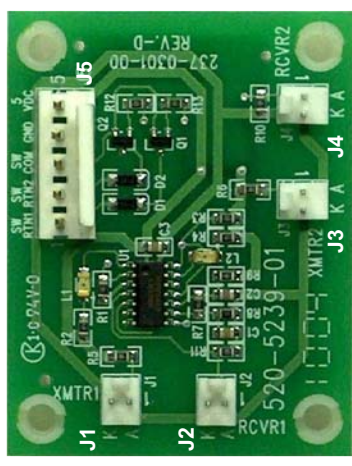
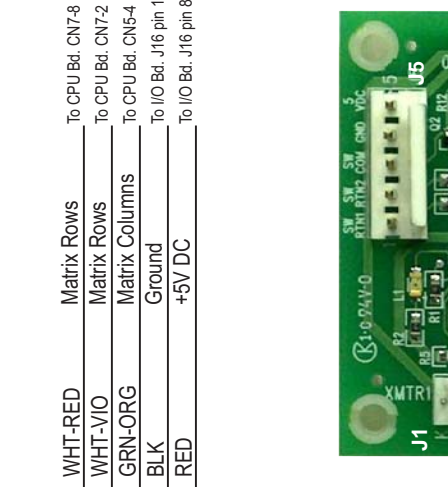
P/F OPTO Transmitter / Receiver Amplifier Bd. Parts (Comp. Layout next Page)

ITEM	QTY	PART NUMBER	REF-DESIGNATOR
—	2	520-5239-01	OPTO Transmitter/Receiver Amplifier Board
01	1		R7
02	2		R5, R6
03	1		R9
04	4		R1, R3, R12, R13
05	2		R10, R11
06	2		R2, R4
07	1		R8
08	3		C1, C2, C3
09	2		D1, D2
10	2		Q1, Q2
11	1		U1
12	4	Mfg. 22-23-2021	J1, J2, J3, J4
13	1	Mfg. 640445-5	J5
14	2	Mfg. APT3216SURC	L1, L2
15	4		n/a

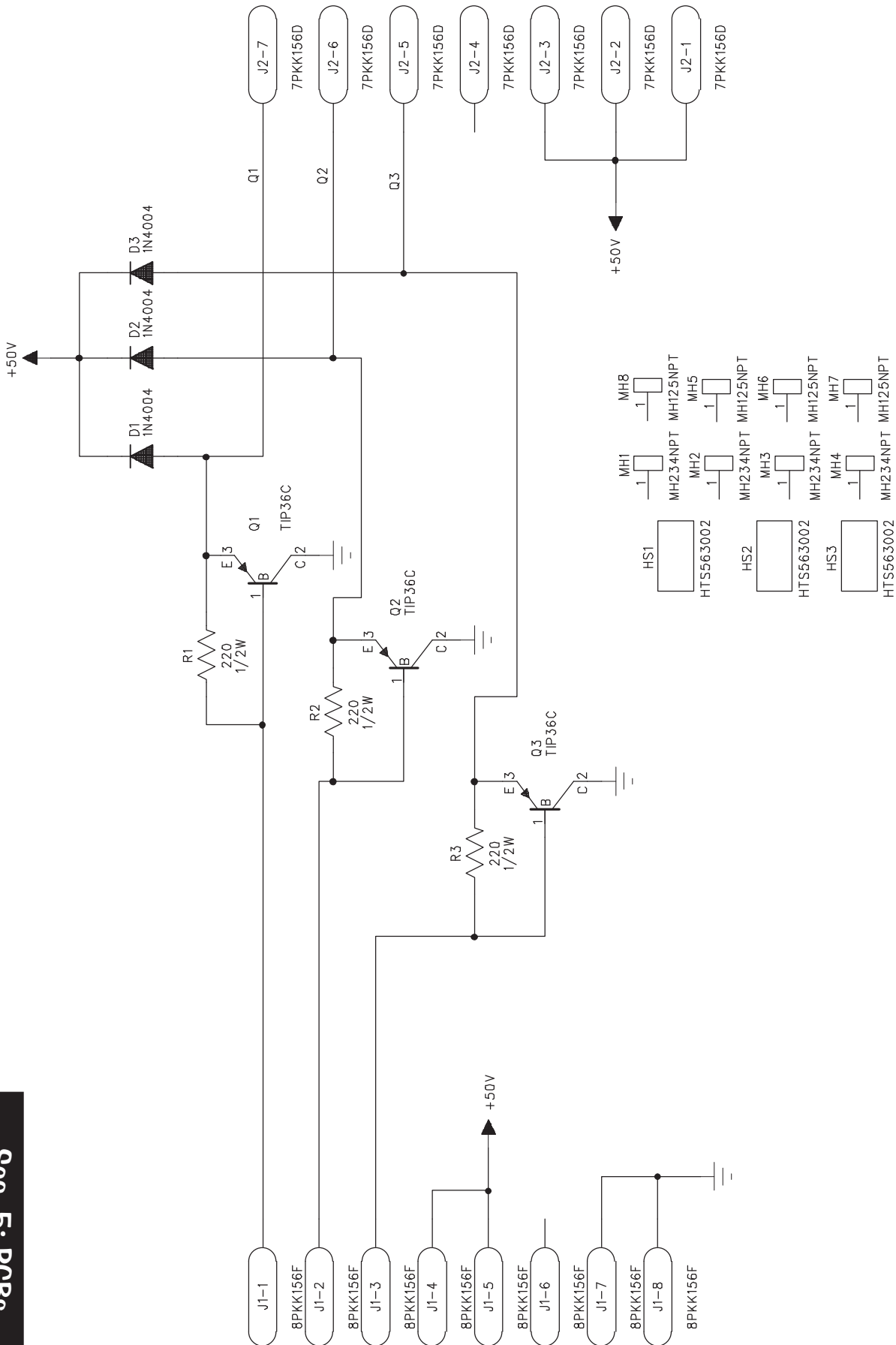
DESCRIPTION
Complete PCB Assembly SMT 150K Ω 1/10W Resistor 805, 5% SMT 180 Ω 1/10W Resistor 805, 5% SMT 180K Ω 1/10W Resistor 805, 5% SMT 1K Ω 1/10W Resistor 805, 5% SMT 1M Ω 1/10W Resistor 805, 5% SMT 470 Ω 1/10W Resistor 805, 5% SMT 6.8K Ω 1/10W Resistor 805, 5% SMT Cer. .1uF 50v Cap., 10% X7R 1N4148W, Diode, 100v, 350MW MMST3904, NPN, 40v, .02A LM339M, Low Power Offset QUA 2-Pin, 0.1 Header (1 Row, VT, Tin) 5-Pin, .156 Header (1 Row, VT, Tin) LEDD-SMT, Red 1206 Spacer (Nylon), .153" ID X 9/32" OD X 3/8"

Sec. 5: PCBs

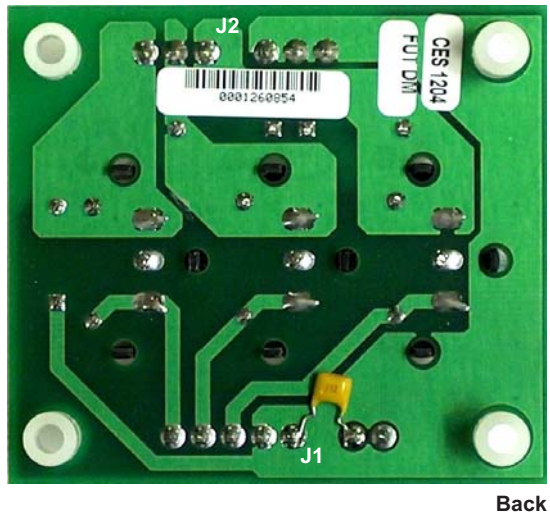
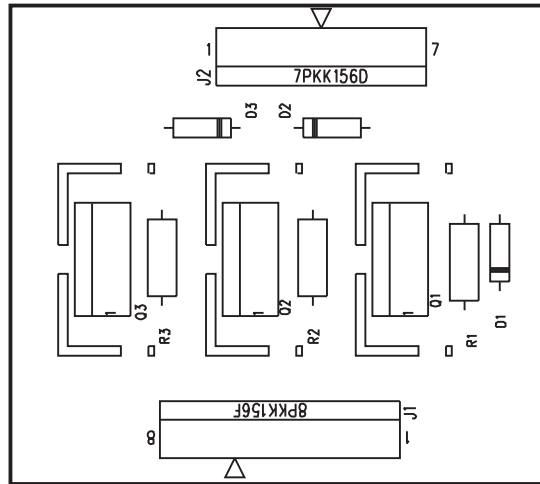
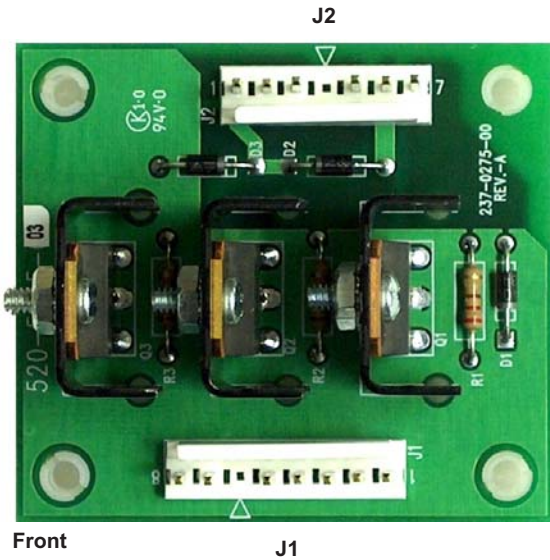
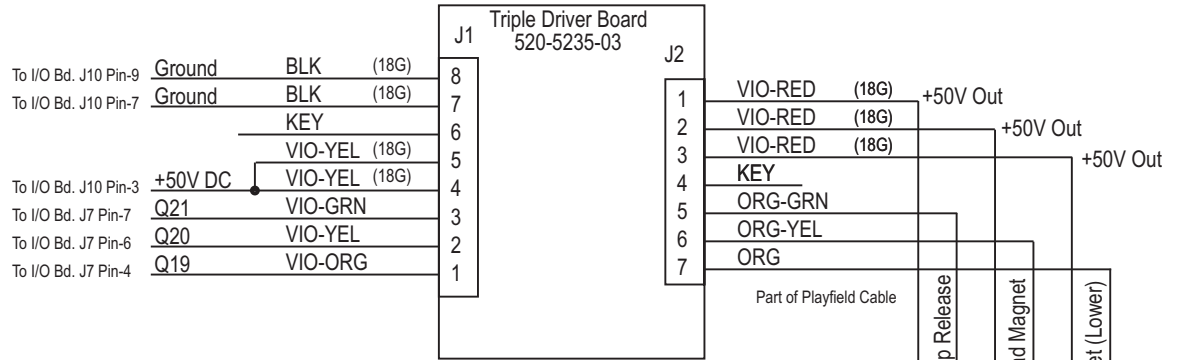




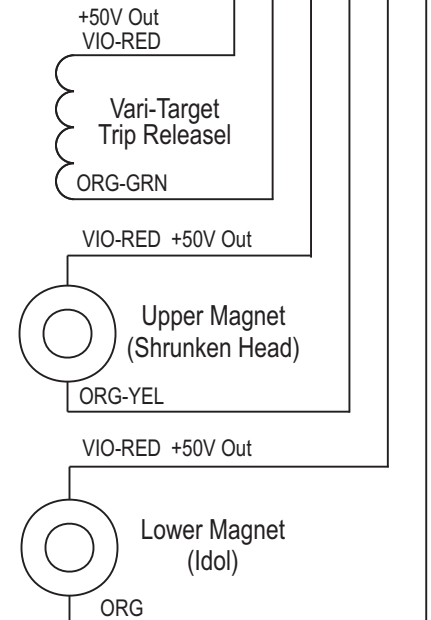
Playfield X3 (Triple) Driver Board Schematic



Playfield X3 (Triple) Driver Board Component Layout, Parts & Wiring



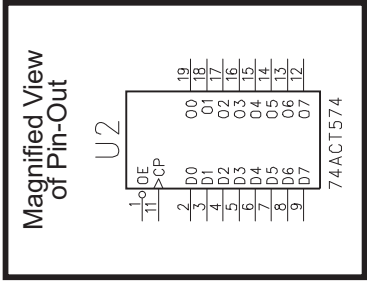
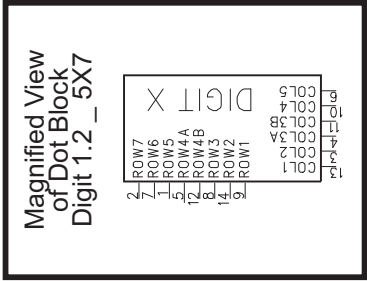
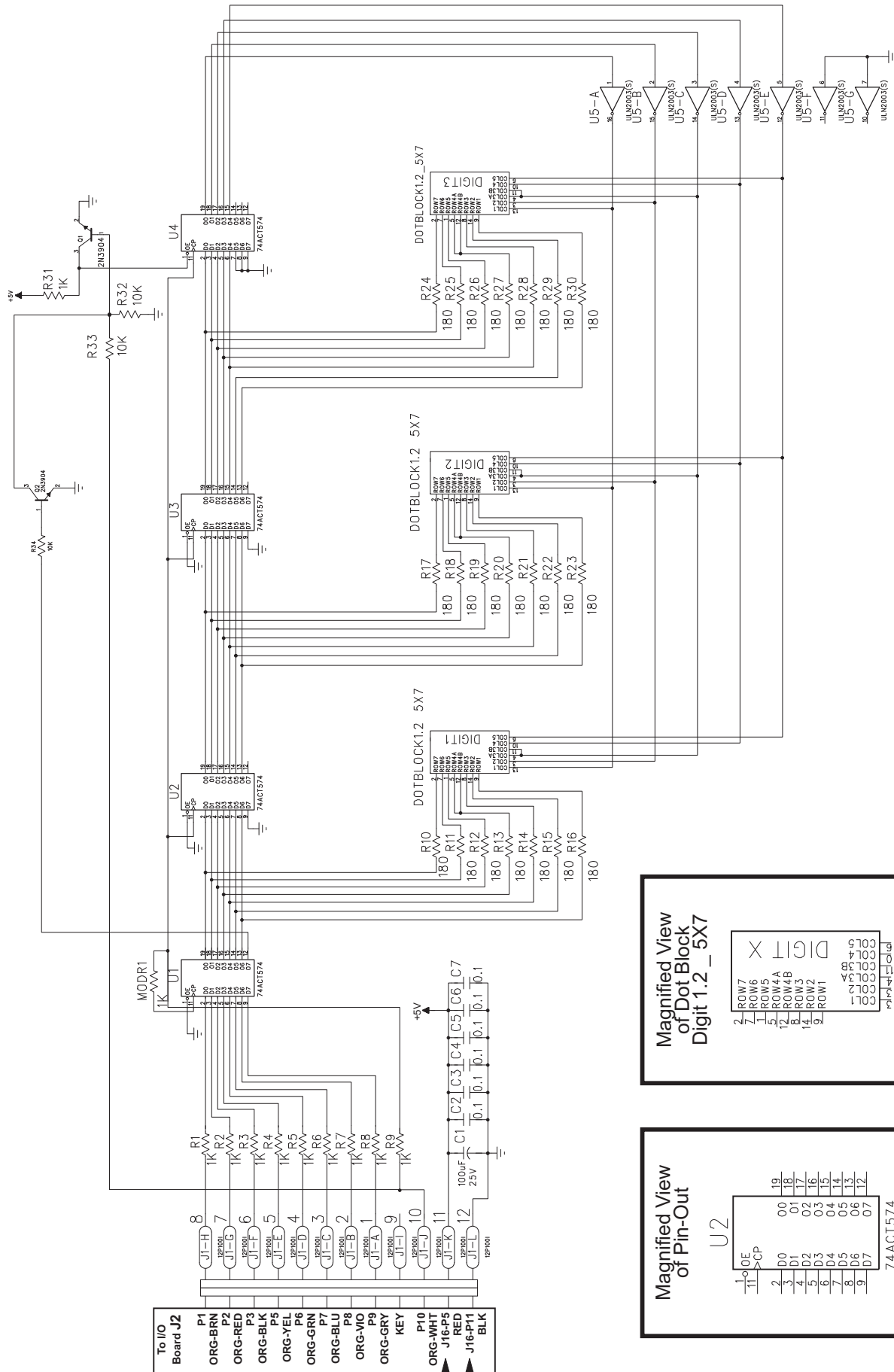
**x3 Driver Board
520-5235-03**



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

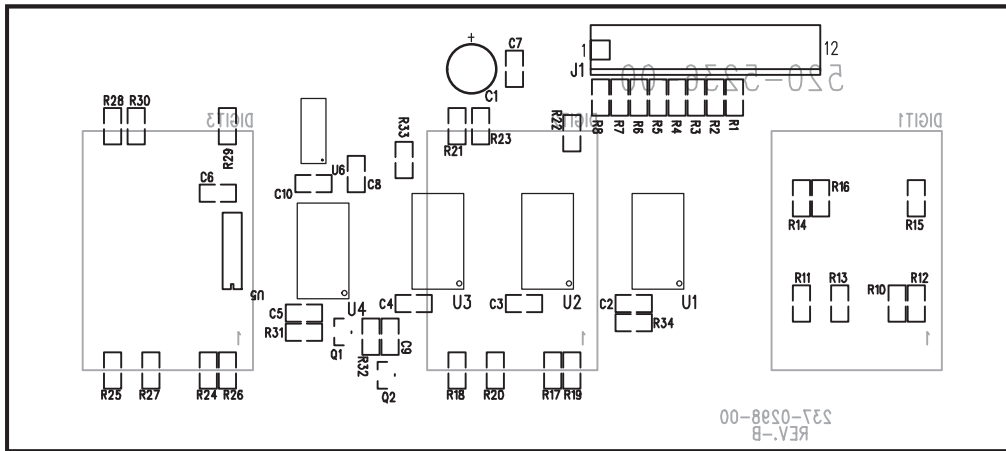
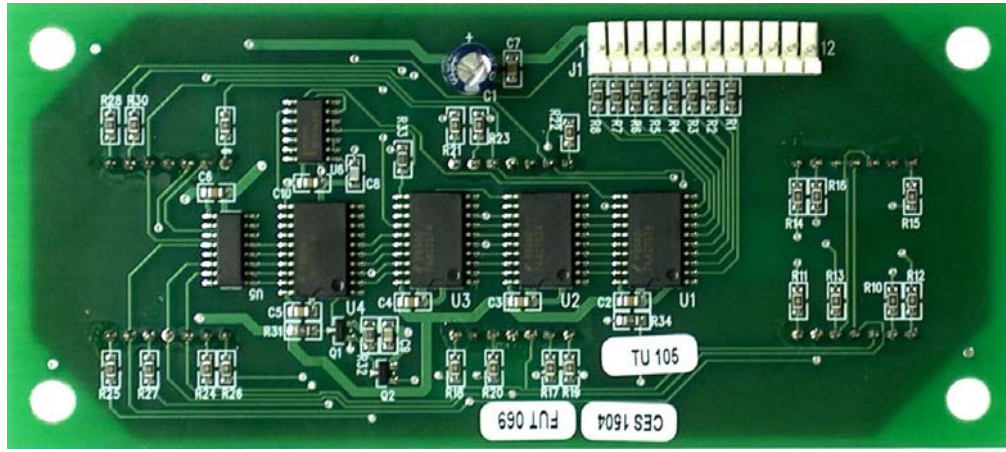
Playfield Dot Display (5X7) x3 LED Board (ABC Left Ramp/Upr. P/F Sign) Schematic

Sec. 5: PCBs

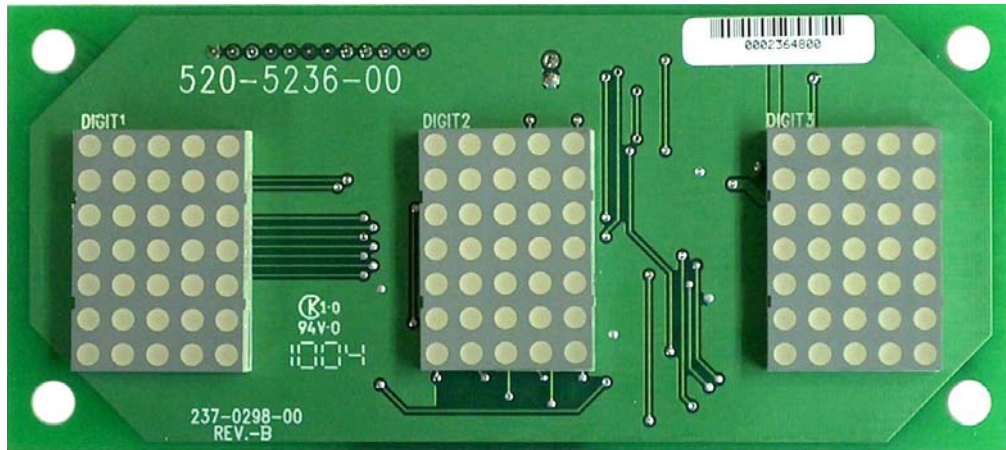


P/F Dot Display (5X7) x3 LED Bd. (ABC ... Sign) Component Layout & Parts

Back Side



Front (Dot Block) Side



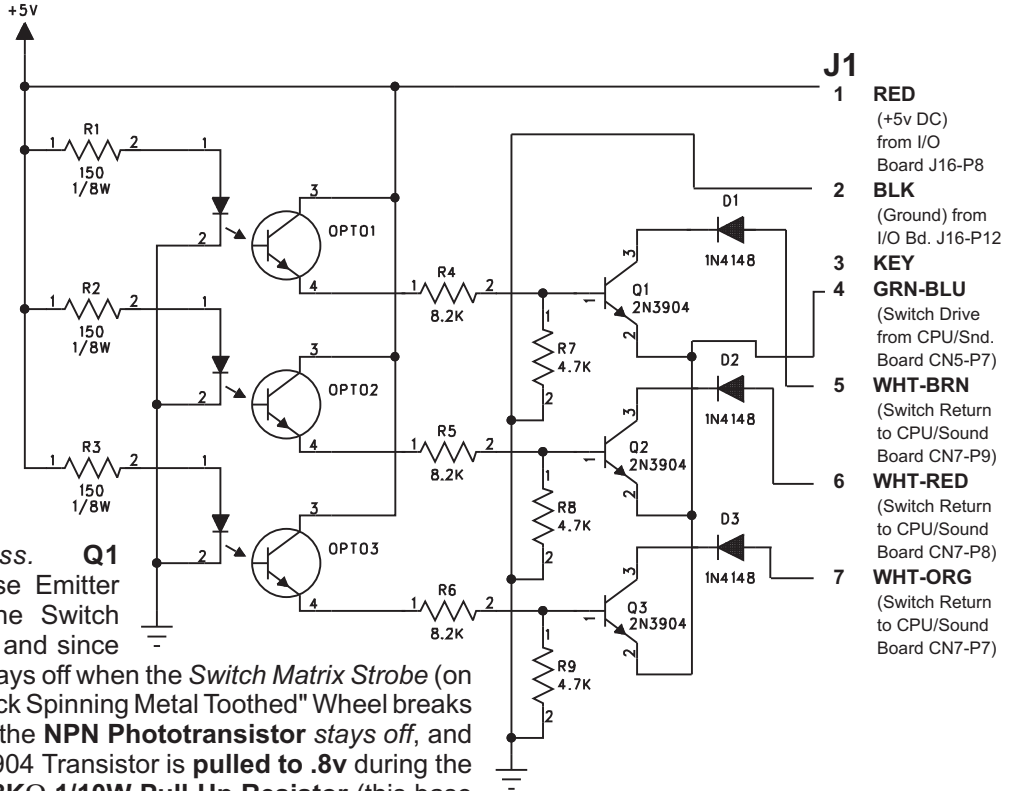
Note: The Housing (cover) is not included with this PC Bd. Assembly. See Section 4, Chapter 2 (Blue Pages), Pages 90-91 for more details.

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	MMST3904 NPN 40V 0.2A
3	4	100-5036-00	U1, U2, U3, U4	74ACT574SC
4	7	100-5039-00	C2-C7, C10	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	Dot Block 1.2: 5X7 LTP-1557AC
8	3	121-5084-00	R32-R34	10KΩ 1/10W 5% SMT Res., 0805
9	9	121-5088-00	R1-R8, R31	(Manex N ^o : 101-0001905)
10	21	121-5086-00	R10-R30	(Manex N ^o : 101-0001897)
11	1	100-5037-00	C1	(Manex N ^o : 131-0003773)
12	1	100-5038-00	U5	(Manex N ^o : 225-0005340)
13	1	100-	U6	74HC04 Hex Inverter 74HC04AD
14	1	121-5089-00	MOD1	1KΩ 1/8W 5CF Res.



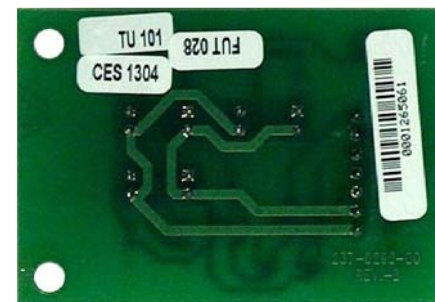
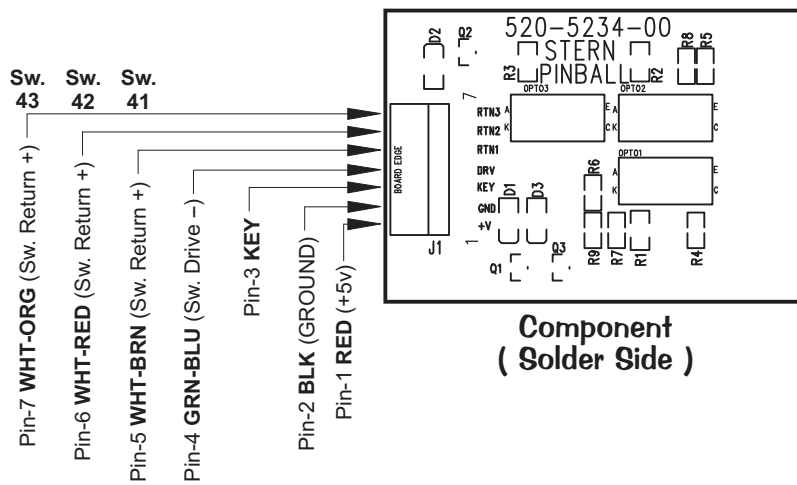
3-Position OPTO PC Board (Vari-Target) Theory of Operation & Schematic

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.



- J1**
- 1 **RED**
(+5v DC)
from I/O
Board J16-P8
 - 2 **BLK**
(Ground) from
I/O Bd. J16-P12
 - 3 **KEY**
 - 4 **GRN-BLU**
(Switch Drive
from CPU/Snd.
Board CN5-P7)
 - 5 **WHT-BRN**
(Switch Return
to CPU/Sound
Board CN7-P9)
 - 6 **WHT-RED**
(Switch Return
to CPU/Sound
Board CN7-P8)
 - 7 **WHT-ORG**
(Switch Return
to CPU/Sound
Board CN7-P7)

3-Position OPTO PC Board (Vari-Target) Component Layout & Parts



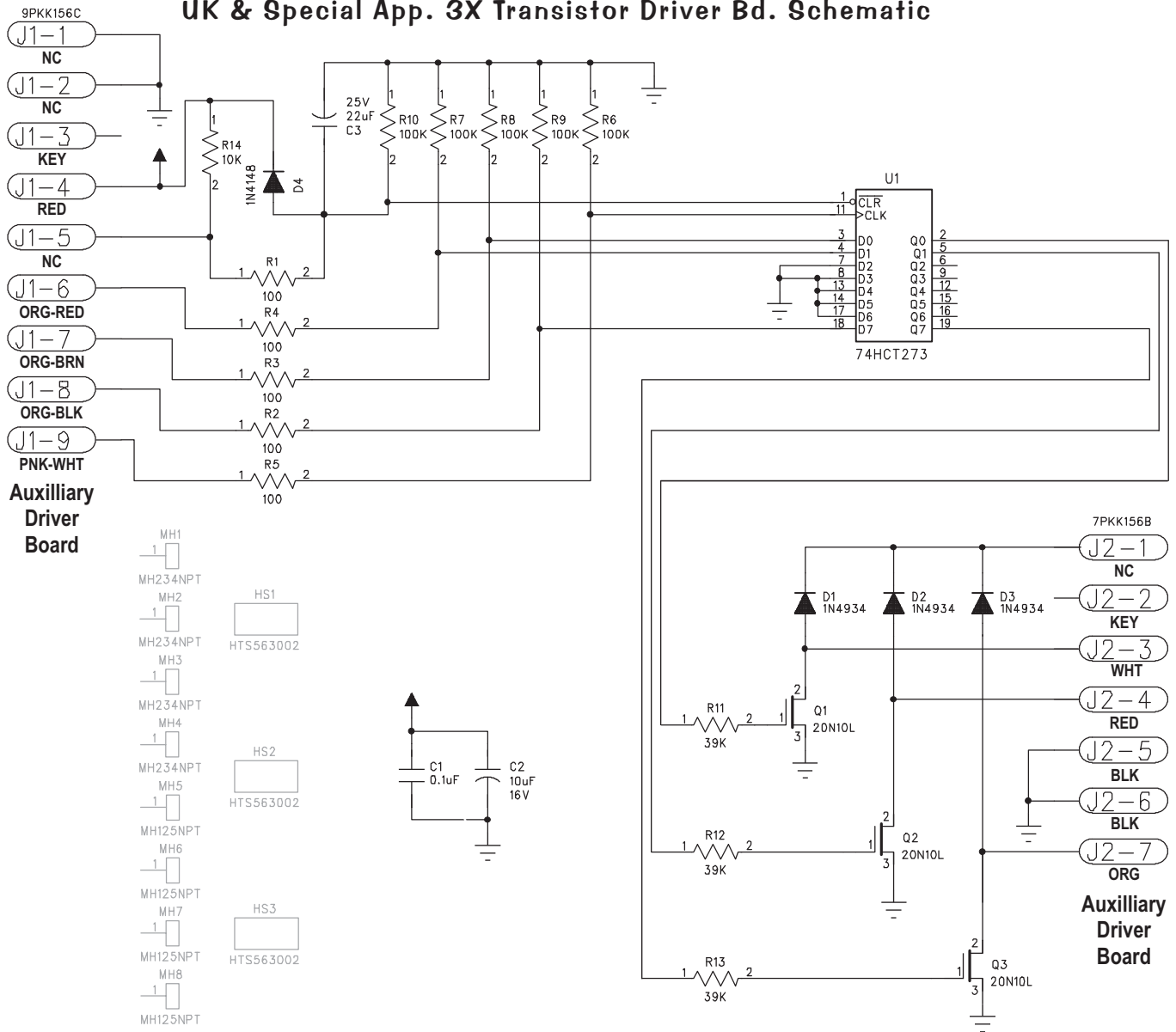
Component
(Solder Side)

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).

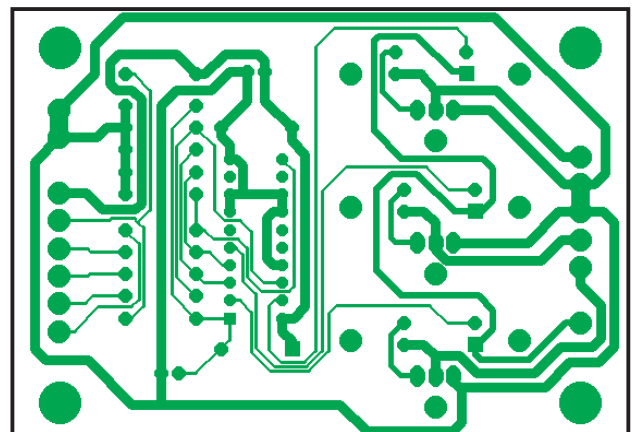
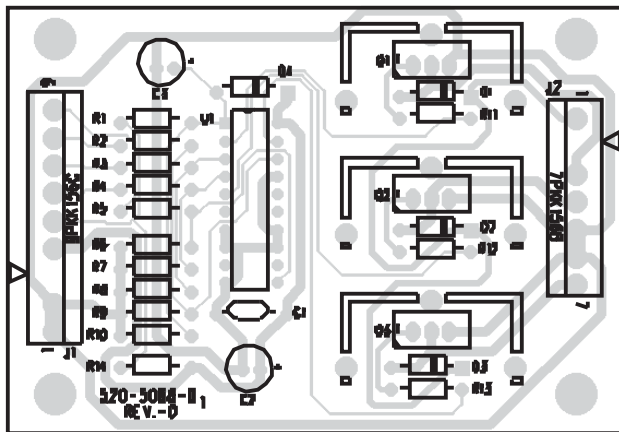
ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
1	1	520-5234-00	3-Position U-Shaped OPTO PC Board	PCB Assembly
2	1	045-5107-07	J1	Connector, 7-Pin, 1" Header.
3	3	121-	R1, R2, R3	150Ω 1/8W 5% SMT Resistor, 1206 case
4	3	121-	R4, R5, R6	8.2K, 1/10W 5% SMT Resistor, 0805 case
5	3	121-	R7, R8, R9	4.7K, 1/10W 5% SMT Resistor, 0805 case
6	3	112-	D1, D2, D3	DL/LL4148 100v 500mW SMT Diode
7	3	110-	Q1, Q2, Q3	MMST3904, NPN, 40V, 0.2A SOT-23 Transistor
		165-	OP1, OP2, OP3	(Slotted) QVE11233 OPTO Sensor Interrupt



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

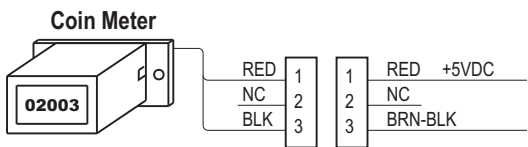
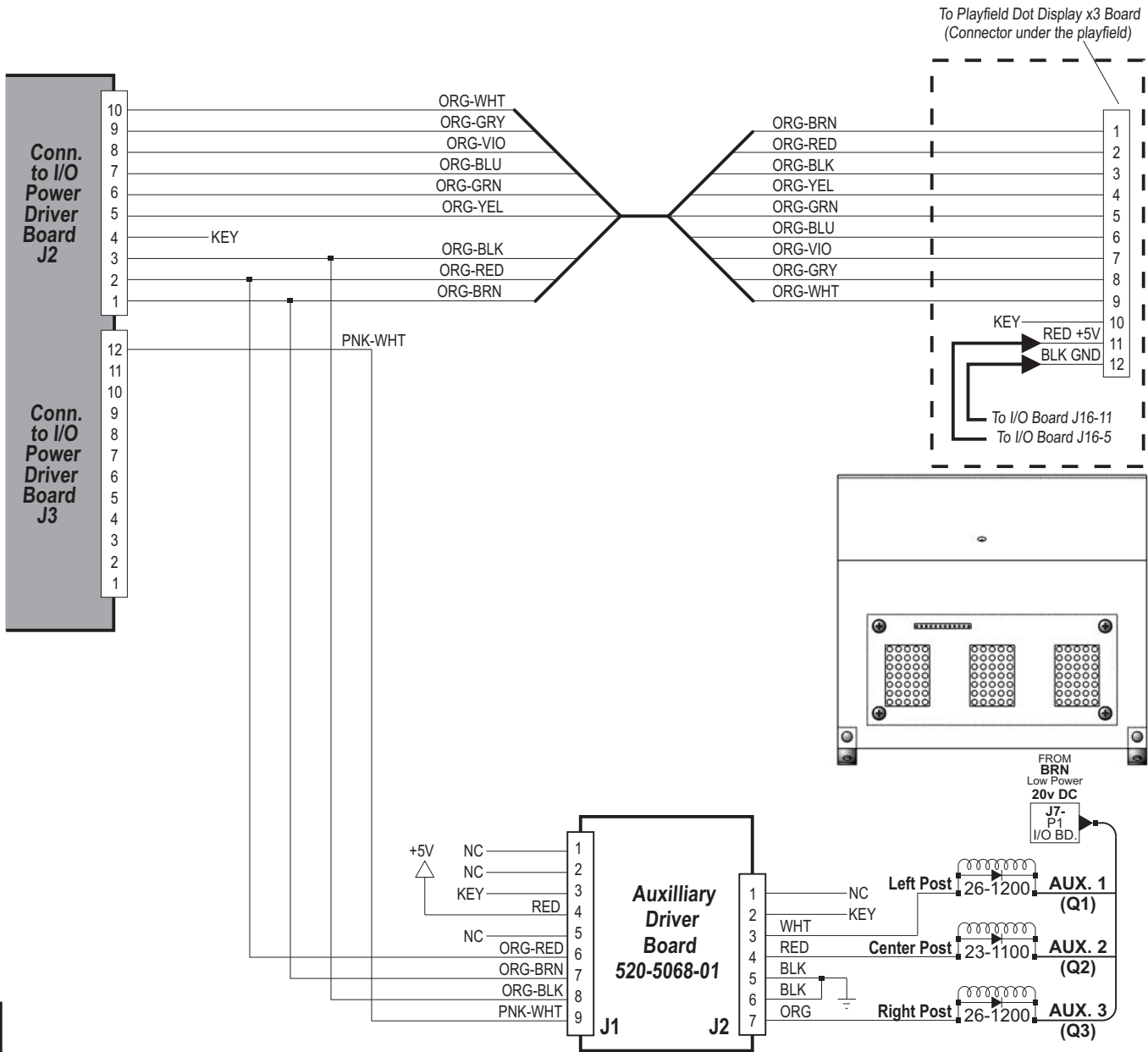


UK & Special App. 3X Transistor Driver Bd. Component Layout (Sol. Exp. Bd.)



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

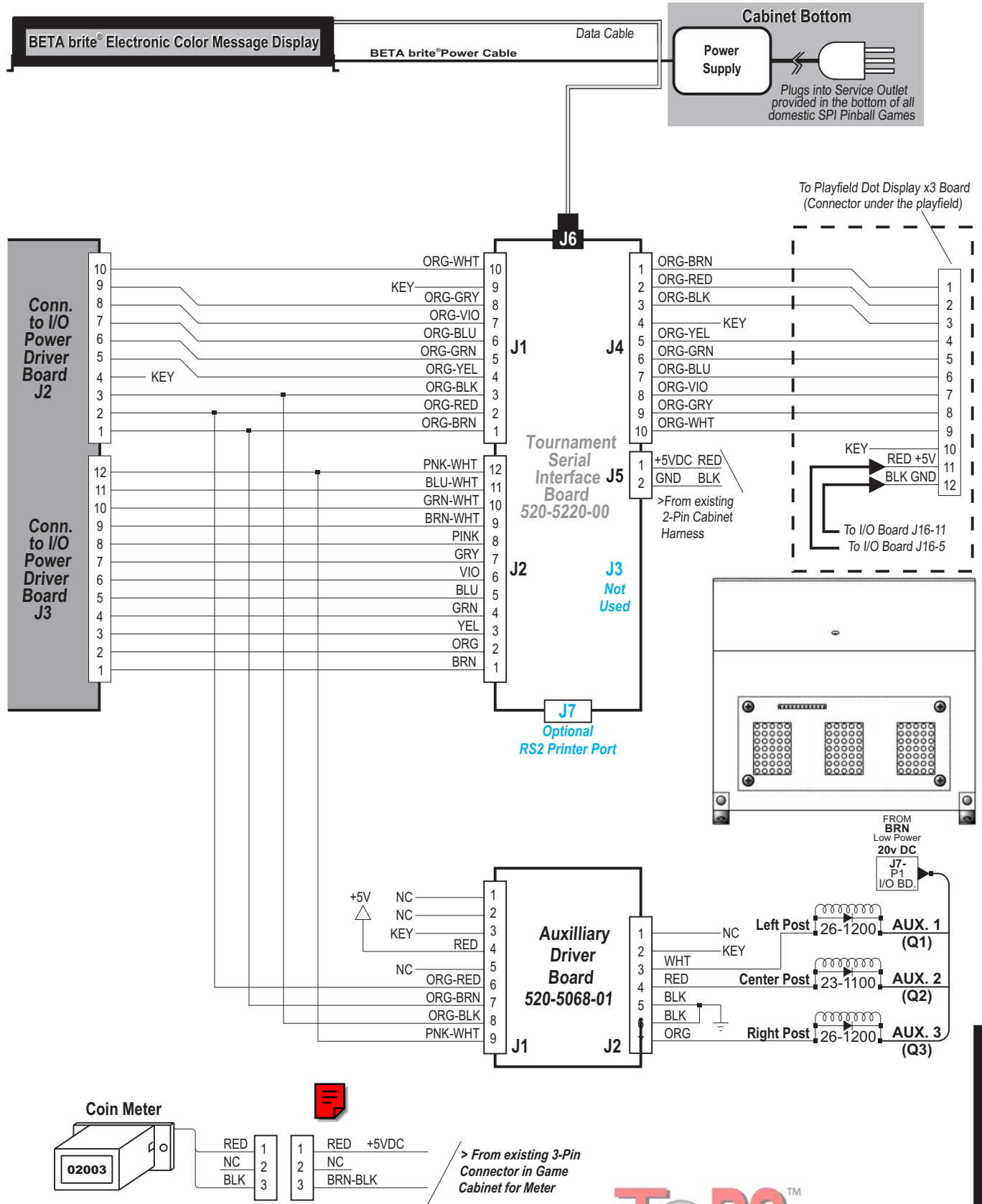
UK 3X Transistor Driver Bd. for Up-Posts & Dot Display X3 LED Overview & Wiring



> 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



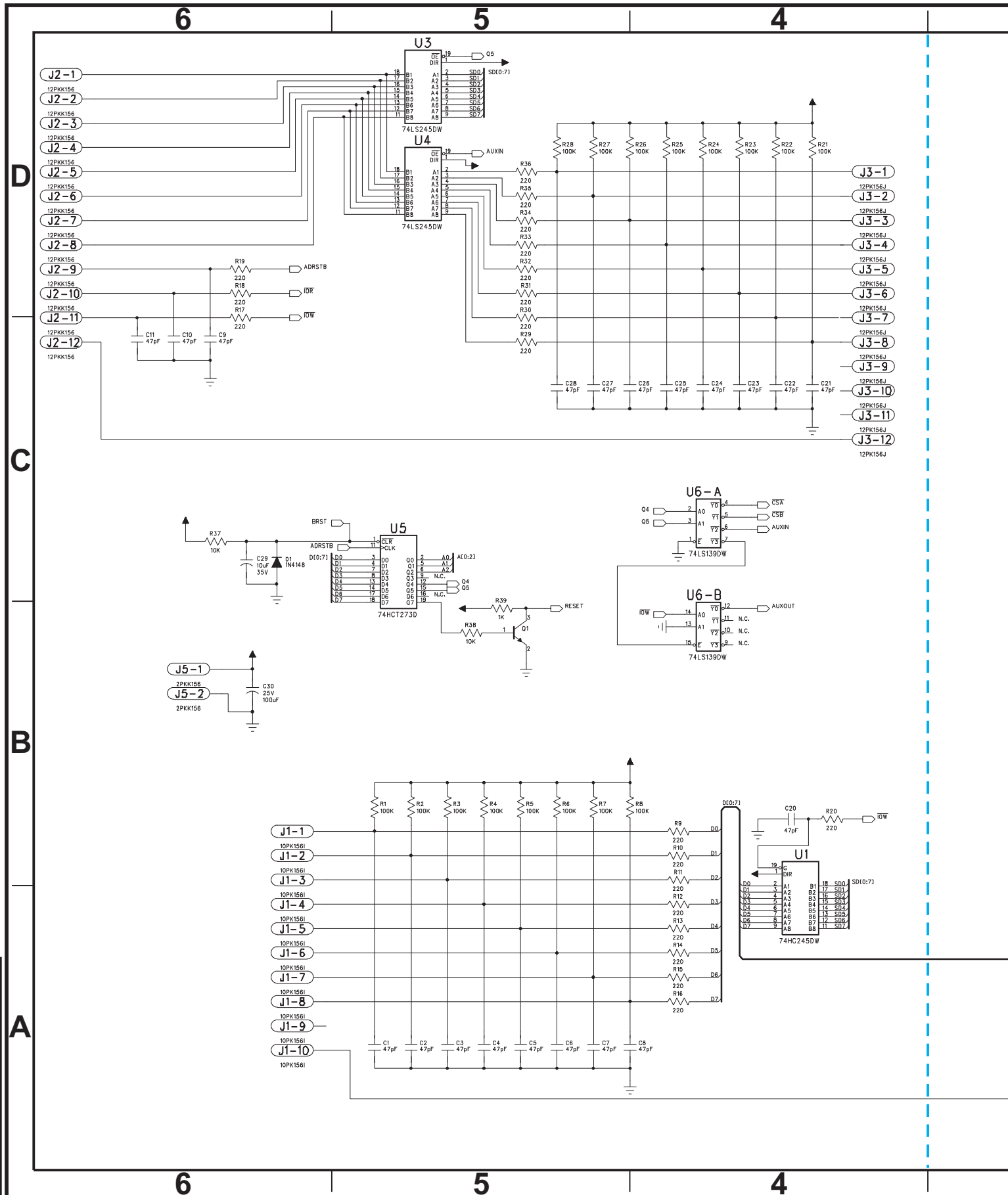
Sec. 5: PCBs

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

TOPS™
TOURNAMENT PINBALL SYSTEM



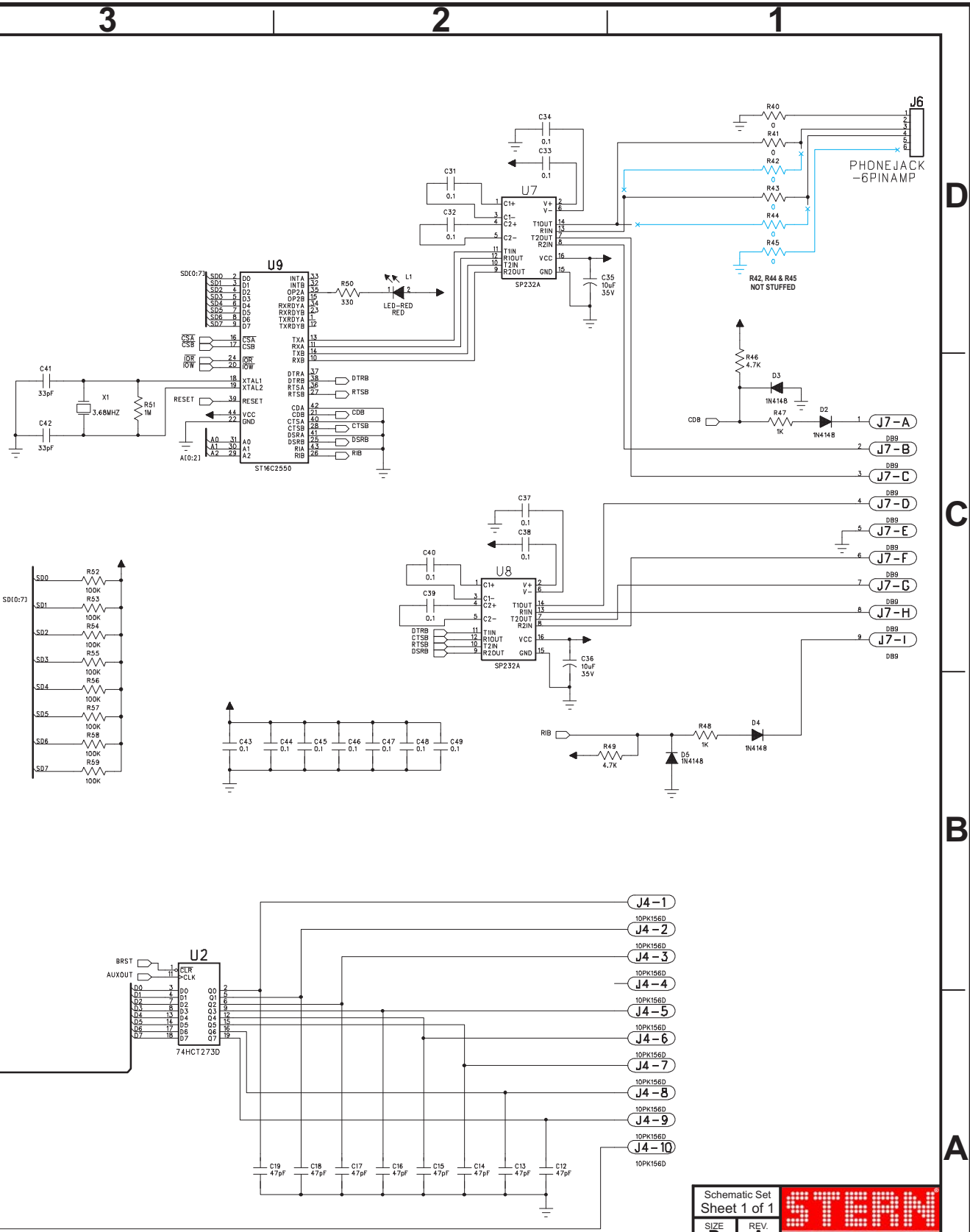
Tournament Serial Interface Board Schematic (Sheet 1 of 1)



Sec. 5: PCBs



Tournament Serial Interface Board Schematic (Sheet 1 of 1)



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

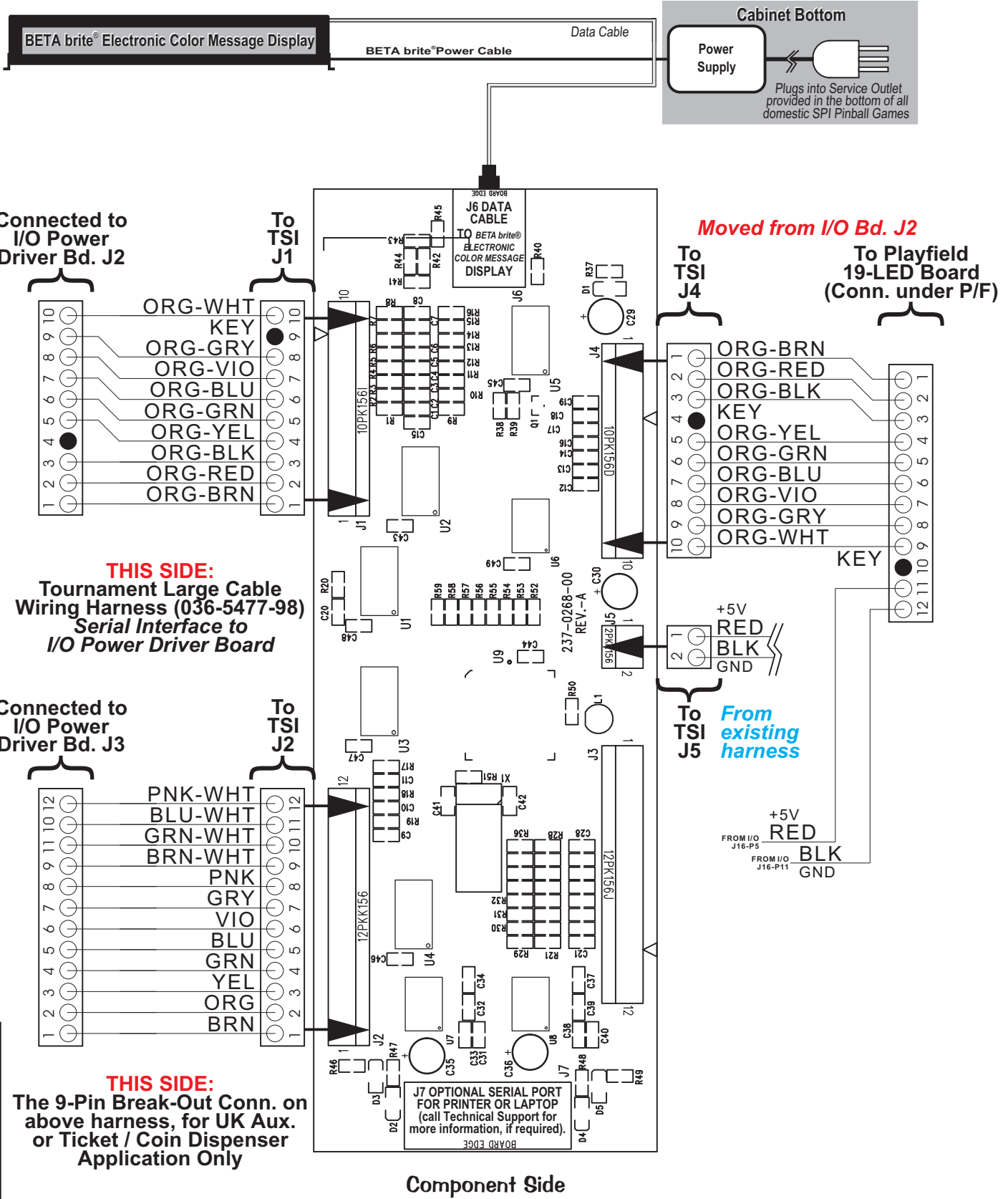
Non-Text Document

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



Sec. 5: PCBs

Tournament Serial Interface Board Component Layout



Sec. 5: PCBs

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



Appendixes A through J

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• Limited Warranty, Cautions, Warnings & Notices	Last Page



APPENDIX A

Pinball Game Firmware Table

EPROM	Chip Size	Program Part N ^o	USA Ver.	Bd. Loc.	Raw Part N ^o
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)	965-0057-00	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	(2M)	965-0069-00		U21	960-5010-00
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

EPROM	Chip Size	Program Part N ^o	USA Ver.	Bd. Loc.	Raw Part N ^o
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)			
Display	(4M)	965-0087-04	-OR- 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)			
Display	(4M)	965-0122-00	-OR- 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	960-5010-00
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	960-5010-00
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	960-5010-00
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	960-5010-00
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	960-5010-00
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	960-5010-00
Sound	(512K)	965-0199-00		U7	960-7001-02
Display*	(4M)	965-0200-00	A4.00	ROM 0	



APPENDIX A

Pinball Game Firmware (for White Star Board System) Table



ROM	Chip Size	Program Part N ^o	USA Ver. & Check Sum	Bd. Loc.	Raw Part N ^o	ROM	Chip Size	Program Part N ^o	USA Ver. & Check Sum	Bd. Loc.	Raw Part N ^o
Apollo 13 (Note 1)						Striker Xtreme (Notes 4, 5)					
Game ROM	(1M)	965-0208-00	A5.01 \$09FF	U210	960-5009-00	Game ROM	(1M)	965-0326-68	A1.02 \$E4FF	U210	960-5009-00
Sound	(512K)	965-0212-00	1.00 \$5244	U7	960-7001-02	Sound	(512K)	965-0327-68	1.00 \$3BCA	U7	960-7001-02
Display	(4M)	965-0213-00	A5.00 \$B92B	ROM 0	960-5015-01	Display	(4M)	965-0328-68	A1.03 \$1957	ROM 0	960-5015-01
Voice 1	(4M)	965-0209-00	1.00 \$7FC7	U17	n/a (masked)	Voice 1	(8M)	965-0329-68	1.00 \$482A	U17	960-5016-00
Voice 2	(4M)	965-0210-00	1.00 \$8E55	U21	n/a (masked)	Voice 2	(8M)	965-0330-68	1.00 \$7312	U21	960-5016-00
Voice 3	(4M)	965-0211-00	1.00 \$08EE	U36	n/a (masked)	Voice 3	(8M)	965-0331-68	1.00 \$DE27	U36	960-5016-00
						Voice 4	(8M)	965-0332-68	1.00 \$C508	U37	960-5016-00
Golden Eye (Note 1)						NFL (Notes 4, 5) <i>Not on CD-R or Website: Code through Distributor Only.</i>					
Game ROM	(1M)	965-0214-42	A4.04 \$3FFF	U210	960-5009-00	Game ROM	(1M)	965-0339-73	A1.00 \$D2FF	U210	960-5009-00
Sound	(512K)	965-0217-42	1.00 \$D615	U7	960-7001-02	Sound	(512K)	965-0340-73	1.00 \$	U7	960-7001-02
Display	(4M)	965-0218-42	A4.00 \$E6ED	ROM 0	960-5015-01	Display	(4M)	965-0341-73	A1.01 \$845A	ROM 0	960-5015-01
Voice 1	(4M)	965-0215-42	1.00 \$3E32	U17	n/a (masked)	Voice 1	(8M)	965-0342-73	1.00 \$	U17	960-5016-00
Voice 2	(4M)	965-0216-42	1.00 \$71F0	U21	n/a (masked)	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
Twister (Note 2)						Sharkey's Shootout (Notes 4, 5)					
Game ROM	(1M)	965-0219-41	A4.05 \$E9FF	U210	960-5009-00	Game ROM	(1M)	965-0333-72	A2.11 \$49FF	U210	960-5009-00
Sound	(512K)	965-0221-41	1.00 \$1FFF	U7	960-7001-02	Sound	(512K)	965-0334-72	1.01 \$9796	U7	960-7001-02
Display	(4M)	965-0222-41	A4.00 \$FD01	ROM 0	960-5015-01	Display	(4M)	965-0335-72	A2.01 \$6C33	ROM 0	960-5015-01
Voice 1	(4M)	965-0220-41	1.00 \$3650	U17	960-5015-01	Voice 1	(8M)	965-0336-72	1.00 \$581E	U17	960-5016-00
Voice 2	(4M)	965-0223-41	1.00 \$9300	U21	960-5015-01	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
ID4: Independence Day (Note 2)						High Roller Casino (Notes 4, 5)					
Game ROM	(1M)	965-0224-45	A2.02 \$9CFF	U210	960-5009-00	Game ROM	(1M)	965-0346-65	A3.00 \$90FF	U210	960-5009-00
Sound	(512K)	965-0227-45	1.00 \$222B	U7	960-7001-02	Sound	(512K)	965-0347-65	1.00 \$581C	U7	960-7001-02
Display	(4M)	965-0229-45	A2.00 \$ABF7	ROM 0	960-5015-01	Display	(4M)	965-0348-65	A3.00 \$74B3	ROM 0	960-5015-01
Voice 1	(4M)	965-0225-45	1.00 \$3AE1	U17	960-5015-01	Voice 1	(8M)	965-0349-65	1.00 \$1E2D	U17	960-5016-00
Voice 2	(4M)	965-0226-45	1.00 \$206E	U21	960-5015-01	Voice 2	(8M)	965-0350-65	1.00 \$38FA	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
Space Jam (Note 2)						Austin Powers™ (Notes 4, 5)					
Game ROM	(1M)	965-0229-43	A3.00 \$E6FF	U210	960-5009-00	Game ROM	(1M)	965-0353-74	A3.02 \$5DFF	U210	960-5009-00
Sound	(512K)	965-0233-43	1.00 \$F1E7	U7	960-7001-02	Sound	(512K)	965-0354-74	1.00 \$DA7B	U7	960-7001-02
Display	(4M)	965-0234-43	A3.00 \$0E57	ROM 0	960-5015-01	Display	(4M)	965-0355-74	A3.00 \$6A34	ROM 0	960-5015-01
Voice 1	(4M)	965-0230-43	1.00 \$DBA8	U17	960-5015-01	Voice 1	(8M)	965-0356-74	1.00 \$D255	U17	960-5016-00
Voice 2	(4M)	965-0231-43	1.00 \$DDF1	U21	960-5015-01	Voice 2	(8M)	965-0357-74	1.00 \$9E75	U21	960-5016-00
Voice 3	(4M)	965-0232-43	1.00 \$F32A	U36	960-5015-01	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
The Star Wars Trilogy - Special Edition (S.E.) (Note 2)						Monopoly® (Notes 4, 5)					
Game ROM	(1M)	965-0235-56	A4.03 \$5EFF	U210	960-5009-00	Game ROM	(1M)	965-0360-75	A3.03 \$5EFF	U210	960-5009-00
Sound	(512K)	965-0238-56	1.00 \$4A7D	U7	960-7001-02	Sound	(512K)	965-0361-75	1.00 \$8C18	U7	960-7001-02
Display	(4M)	965-0239-56	A4.00 \$8817	ROM 0	960-5015-01	Display	(4M)	965-0362-75	A3.01 \$A381	ROM 0	960-5015-01
Voice 1	(4M)	965-0236-56	1.00 \$E66B	U17	960-5015-01	Voice 1	(8M)	965-0363-75	1.00 \$35E6	U17	960-5016-00
Voice 2	(4M)	965-0237-56	1.00 \$8F54	U21	960-5015-01	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	
The Lost World: Jurassic Park (Note 2)						Playboy (Notes 4, 5, 7)					
Game ROM	(1M)	965-0240-53	A2.02 \$C8FF	U210	960-5009-00	Game ROM	(1M)	965-0367-76	A5.00 \$7DFF	U210	960-5009-00
Sound	(512K)	965-0243-53	1.00 \$A35B	U7	960-7001-02	Sound	(512K)	965-0368-76	1.00 \$E719	U17	960-7001-02
Display	(4M)	965-0244-53	A2.01 \$7F46	ROM 0	960-5015-01	Display	(4M)	965-0369-76	A5.00 \$A5FF	ROM 0	960-5015-01
Voice 1	(4M)	965-0241-53	1.00 \$1D27	U17	960-5015-01	Voice 1	(8M)	965-0370-76	1.00 \$9ABE	U17	960-5016-00
Voice 2	(4M)	965-0242-53	1.00 \$8DA4	U21	960-5015-01	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
The X-Files (Note 2)						RollerCoaster Tycoon™ (Notes 4, 5, 7)					
Game ROM	(1M)	965-0245-46	A3.03 \$A2FF	U210	960-5009-00	Sound	(512K)	965-0374-78	1.00 \$F663	U7	960-7001-02
Sound	(512K)	965-0248-46	1.00 \$6648	U7	960-7001-02	Game ROM	(1M)	965-0375-78	A7.01 \$40FF	U210	960-5009-00
Display	(4M)	965-0249-46	A3.00 \$66D0	ROM 0	960-5015-01	Voice 1	(8M)	965-0377-78	1.00 \$3C4A	U17	960-5016-00
Voice 1	(4M)	965-0246-46	1.00 \$349D	U17	960-5015-01	Voice 2	(8M)	965-0378-78	1.00 \$057A	U21	960-5016-00
Voice 2	(4M)	965-0247-46	1.00 \$629C	U21	960-5015-01	Voice 3	(8M)	965-0379-78	1.00 \$04D7	U36	960-5016-00
						Display	(4M)	965-0376-78	A7.00 \$8E23	U5 Disp. Cntr.	960-5015-01
Starship Troopers (Note 3)						The Simpsons™ Pinball Party (Notes 4, 5, 7)					
Game ROM	(1M)	965-0250-59	A2.00 \$85FF	U210	960-5009-00	Sound	(512K)	965-0381-77	1.01 \$A7EE	U7	960-7001-02
Sound	(512K)	965-0253-59	1.00 \$64B2	U7	960-7001-02	Game ROM	(1M)	965-0382-77	A4.00 \$4FFF	U210	960-5009-00
Display	(4M)	965-0254-59	A2.00 \$E77B	ROM 0	960-5015-01	Voice 1	(8M)	965-0383-77	1.00 \$9719	U17	960-5016-00
Voice 1	(4M)	965-0251-59	1.00 \$152A	U17	960-5015-01	Voice 2	(8M)	965-0384-77	1.00 \$18ED	U21	960-5016-00
Voice 2	(4M)	965-0252-59	1.00 \$0291	U21	960-5015-01	Voice 3	(8M)	965-0385-77	1.00 \$ADCE	U36	960-5016-00
Voice 3	(4M)	965-0255-59	1.00 \$95A7	U36	960-5015-01	Voice 4	(8M)	965-0386-77	1.00 \$E7E5	U37	960-5016-00
						Display	(4M)	965-0387-77	A4.00 \$8A03	U5 Disp. Cntr.	960-5015-01
Viper Night Drivin' (Note 4)						Terminator® 3: Rise of the Machines™ (Notes 4, 5, 7)					
Game ROM	(1M)	965-0266-35	A2.01 \$C5FF	U210	960-5009-00	Sound	(512K)	965-0388-79	1.00 \$D2FD	U7	960-7001-02
Sound	(512K)	965-0271-35	1.00 \$4DF8	U7	960-7001-02	Game ROM	(1M)	965-0389-79	A4.00 \$F8FF	U210	960-5009-00
Display	(4M)	965-0272-35	A2.01 \$C17D	ROM 0	960-5015-01	Voice 1	(8M)	965-0390-79	1.00 \$1838	U17	960-5016-00
Voice 1	(4M)	965-0267-35	1.00 \$8018	U17	960-5015-01	Voice 2	(8M)	965-0391-79	1.00 \$F0D5	U21	960-5016-00
Voice 2	(4M)	965-0268-35	1.00 \$2157	U21	960-5015-01	Voice 3	(8M)	965-0392-79	1.00 \$89DA	U36	960-5016-00
Voice 3	(4M)	965-0269-35	1.00 \$59A6	U36	960-5015-01	Voice 4	(8M)	965-0393-79	1.00 \$1200	U37	960-5016-00
Voice 4	(4M)	965-0270-35	1.00 \$D01E	U37	960-5015-01	Display	(4M)	965-0394-79	A4.00 \$6E49	U5 Disp. Cntr.	960-5015-01
Lost In Space (Note 4)						The Lord of the Rings™ (Notes 5, 7, 8)					
Game ROM	(1M)	965-0282-60	A1.01 \$B2FF	U210	960-5009-00	Sound	(512K)	965-0401-80	1.01 \$36BC	U7	960-7001-02
Sound	(512K)	965-0287-60	1.00 \$A6AF	U7	960-7001-02	Game ROM	(1M)	965-0402-80	A8.00 \$94FF	U210	960-5009-00
Display	(4M)	965-0288-60	A1.02 \$32AB	ROM 0	960-5015-01	Voice 1	(8M)	965-0403-80	1.00 \$1792	U17	960-5016-00
Voice 1	(4M)	965-0283-60	1.00 \$4391	U17	960-5015-01	Voice 2	(8M)	965-0404-80	1.00 \$67F1	U21	960-5016-00
Voice 2	(4M)	965-0284-60	1.00 \$8215	U21	960-5015-01	Voice 3	(8M)	965-0405-80	1.00 \$89B6	U36	960-5016-00
Voice 3	(4M)	965-0285-60	1.00 \$5832	U36	960-5015-01	Voice 4	(8M)	965-0406-80	1.00 \$EA49	U37	960-5016-00
Voice 4	(4M)	965-0286-60	1.00 \$8971	U37	960-5015-01	Display	(4M)	965-0407-80	A8.00 \$3C88	U5 Disp. Cntr.	960-5015-01
Godzilla (Note 4)						Ripley's Believe It or Not!® (see website)					
Game ROM	(1M)	965-0289-40	A2.05 \$B1FF	U210	960-5009-00	VIEW ROM LABEL for current version & checksums					
Sound	(512K)	965-0294-40	1.00 \$0CC8	U7	960-7001-02	footnotes:					
Display	(4M)	965-0295-40	A2.00 \$C929	ROM 0	960-5015-01	1 ROMs on CPU/Sound Bd.: 520-5136-00 (Stereo) & Display Cont. Bd.: 520-5055-01					
Voice 1	(4M)	965-0290-40	1.00 \$0D75								

APPENDIX B

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

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



APPENDIX C

Game Name, Production Start Date, Manual Part N^o & CPU Jumper Info†

Game Name	Production Start Date and Manual PN ^o	CPU Ver.	EPROM Position	Jumpers Installed (* see Note)	Jumpers Removed (* see Note)	Game Name White Star Board System™	Production Start Date and Manual PN ^o	CPU/Sound Board Game U7 512K CPU/Sound Board Game U210 1MB CPU/Sound Board Voice ROMS:				Jumpers Installed (* see Note)
								U17	U21	U36	U37	
1 Laser War	MAY 87 780-5001-00	1*	5C	J4 J6a J7a	J5 J6 J7b	29 Apollo 13 (A13)	NOV 95 780-5044-00	4MB	4MB	4MB	Not Used	n / a
2 Secret Service	MAR 88 780-5002-00	2*	5B, 5C	J4 J5a J6a	J5 J5b J6b	30 Golden Eye	FEB 96 780-5042-00	4MB	4MB	Not Used	Not Used	n / a
3 Torpedo Alley	AUG 88 780-5003-00	2*	5B, 5C	J4	J5	31 Twister	APR 96 780-5041-00	4MB	4MB	Not Used	Not Used	n / a
4 Time Machine	DEC 88 780-5004-00	2*	5B, 5C	J4	J5	32 ID4: Independence Day	JUL 96 780-5045-00	4MB	4MB	Not Used	Not Used	n / a
5 Playboy 35th Anniversary	MAY 89 780-5005-00	2*	5B, 5C	J4	J5	33 Space Jam	OCT 96 780-5043-00	4MB	4MB	4MB	Not Used	n / a
6 ABC Monday Night Football	SEP 89 780-5007-00	2*	5B, 5C	J4	J5	34 The Star Wars Trilogy - Special Edition	FEB 97 780-5056-00	4MB	4MB	Not Used	Not Used	n / a
7 Robocop	NOV 89 780-5006-00	2*	5B, 5C	J4	J5	35 The Lost World: Jurassic Park	JUN 97 780-5053-00	4MB	4MB	Not Used	Not Used	n / a
8 Phantom of the Opera	JAN 90 780-5008-00	2*	5B, 5C	J4	J5	36 The X-Files	AUG 97 780-5046-00	4MB	4MB	Not Used	Not Used	n / a
9 Back to the Future	JUN 90 780-5009-00	3*	5B, 5C	J4	J5	37 Starship Troopers	NOV 97 780-5059-00	4MB	4MB	4MB	Not Used	n / a
10 The Simpsons	SEP 90 780-5012-00	3*	5B, 5C	J4	J5	38 Viper Night Drivin'	FEB 98 780-5035-00	4MB	4MB	4MB	4MB	n / a
11 Checkpoint	FEB 91 780-5010-00	3*	5B, 5C	J4	J5	39 Lost In Space	JUN 98 780-5060-00	4MB	4MB	4MB	4MB	n / a
12 Teenage Mutant Ninja Turtles	MAY 91 780-5017-00	3*	5B, 5C	J4	J5	40 Godzilla	SEP 98 780-5040-00	4MB	4MB	4MB	4MB	n / a
13 Batman	JUL 91 780-5011-00	3*	5B, 5C	J4	J5	41 South Park	JAN 99 780-5071-00	8MB	8MB	8MB	8MB	W6
14 Star Trek 25th Anniversary	OCT 91 780-5014-00	3*	5C	J5	J4	42 a Harley-Davidson®	AUG 99 780-5067-01	8MB	8MB	8MB	8MB	W6
15 Hook	JAN 92 780-5019-00	3*	5C	J5	J4	42 b Harley-Davidson® 2nd Edition	SEP 02 780-5067-10	8MB	8MB	8MB	8MB	W6
16 Lethal Weapon 3	JUN 92 780-5026-00	3*	5C	J5	J4	43 a Striker Xtreme	MAR 00 780-5068-01	8MB	8MB	8MB	8MB	W6
17 Star Wars	OCT 92 780-5024-00	3*	5C	J5	J4	43 b NFL	OCT 00 780-5073-00	8MB	8MB	8MB	8MB	W6
18 Rocky & Bullwinkle & Friends	FEB 93 780-5022-00	3*	5C	J5	J4	44 Sharkey's Shootout	JUL/OCT 00 780-5072-01	8MB	8MB	8MB	Not Used	W6
19 Jurassic Park	APR 93 780-5020-00	3*	5C	J5	J4	45 High Roller Casino	JAN 01 780-5065-00	8MB	8MB	8MB	8MB	W6
20 Last Action Hero	AUG 93 780-5027-00	3*	5C	J5	J4	46 Austin Powers™	MAY 01 780-5074-00	8MB	8MB	8MB	8MB	W6
21 Tales from the Crypt	NOV 93 780-5018-00	3*	5C	J5	J4	47 MONOPOLY®	SEP 01 780-5075-00	8MB	8MB	8MB	Not Used	W6
22 The Who's Tommy	FEB 94 780-5028-00	3*	5C	J5	J4	48 Playboy	FEB 02 780-5076-00	8MB	8MB	8MB	8MB	W6
23 WWF Royal Rumble	MAY 94 780-5023-00	3*	5C	J5	J4	49 RollerCoaster Tycoon™	AUG 02 780-5078-00	8MB	8MB	8MB	Not Used	W6
24 Guns-N'-Roses	JUL 94 780-5029-00	3*	5C	J5	J4	50 The Simpsons™ Pinball Party	JAN 03 780-5077-00	8MB	8MB	8MB	8MB	W6
25 Maverick	SEP 94 780-5031-00	3*	5C	J5	J4	51 Terminator® 3: Rise of the Machines™	MAY 03 780-5079-00	8MB	8MB	8MB	8MB	W6
26 Mary Shelley's Frankenstein	DEC 94 780-5036-00	3*	5C	J5	J4	52 The Lord of the Rings™	NOV 03 780-5080-00	8MB	8MB	8MB	8MB	
27 Baywatch	MAR 95 780-5033-00	3*	5C	J5	J4	53 Ripley's Believe It or Not!®	APR 04 780-5081-00	8MB	8MB	8MB	8MB	
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

‡ 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).



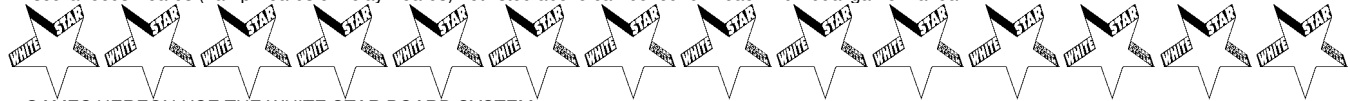
APPENDIX D

Board Type Table

Game Name	Flipper	Sound	Power Supply	Display X-Digit
• Laser War	2-Flipper Board Not Required	<i>initial:</i> 520-5002-00 <i>replaced with:</i> 520-5002-02 <i>520-5002-01 was not used.</i>	520-5000-00	Master: 520-5004-00 plus: 520-5005-00 (Qty. 2): 7 Digit Alpha/Numeric 520-5006-00 (Qty. 2): 7 Digit Numeric 520-5007-00 (Qty. 1): 4 Digit Numeric
• Secret Service • Torpedo Alley	3-Flipper Board Not Required	520-5002-02		520-5014-01 7 Digit Alpha/Numeric Combined
• Time Machine	2-Flipper Board Not Required			520-5030-00 16 Digit Alpha/Numeric Combined
• Playboy 35th Anniversary * • ABC Monday Night Football * • Robocop • Phantom of the Opera • Back to the Future • The Simpsons	520-5033-00 2-Flipper <i>(*only for 100 games of Playboy 35th Anniv. & ABC Mon. Night Football)</i>			

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

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



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

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

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

Game Name	I/O Power Driver	CPU/Sound Mono	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Application	Misc OPTO & App.
Twister	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Light Boards 520-5145-01 through -07		Mag. Drv. Bd. 520-5143-00	Relay Board 520-5010-00				
Independence Day (ID4)	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Light Boards 520-5149-01 through -10		Servo Mtr. Bd. 520-5152-00		520-5082-00 Long Hop opto	520-5083-00 Long Hop opto	Alien Head Enter	
Space Jam	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	2X 7-Segment Display Board 520-5153-00							
The Star Wars Trilogy - Special Ed.	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00							

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 520-5166-00	Display Board			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- Sol- enoid 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
	Miscellaneous PC Boards:	Dot Display (5X7) in Slot Mach. 520-5197-00			for UK ONLY- Sol- enoid Expander Bd. 520-5192-00	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Ball Lock under Roulette	
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- Sol- enoid 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- Sol- enoid 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- Sol- enoid 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- Sol- enoid 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- Sol- enoid 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- Sol- enoid 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	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- Sol- enoid 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- Sol- enoid 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 N ^o	GA-TURNS	Res. (Ω)	SPI PART N ^o	GAUGE-TURNS	Res. (Ω)	Coil Wrap	SPI PART N ^o
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 N^os 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 N ^o	GA-TURNS	Res. (Ω)	SPI PART N ^o	GA-TURNS	Res. (Ω)	SPI PART N ^o	GA-TURNS	Res. (Ω)
22-650	4.3 Ω	090-5042-01	29-1000	15.2 Ω	090-5059-00	33-1590	59.0 Ω	515-6916-00	SPI PART N ^o	
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	N ^o of Flippers	FLIPPERS w/E.O.S. Switch		FLIPPERS no E.O.S. Switch	
		SPI N ^o / GAUGE-TURNS / Color		SPI N ^o / GAUGE-TURNS / Color	
		LOWER LEFT	LOWER RIGHT	UPPER LEFT	UPPER RIGHT
Laser War ‡	2	090-5011-00 22-750 / 30-2600	SAME	Not Used	Not Used
Secret Service ‡	3	090-5006-00 23-620 / 30-2600	SAME	Not Used	090-5006-00 23-620 / 30-2600
Torpedo Alley ‡	3	090-5011-00 22-750 / 30-2600	090-5013-00 23-700 / 30-2600	Not Used	090-5012-00 23-800 / 30-2600
Time Machine ‡	2	090-5011-00 22-750 / 30-2600	SAME	Not Used	Not Used
‡ These coils are dual-wound.					
Playboy 35th Anniversary ††	2	090-5020-02 22-900 -YEL-YEL-	SAME	Not Used	Not Used
ABC Monday Night Football ††	2	090-5020-02 22-900 -YEL-YEL-	SAME	Not Used	Not Used
†† A very small % of these games used a 090-5020-20 coil which used a proto-type Solid State Flipper System. The two types of coils both are 22-900 coils; the only difference is the addition of the 1N5404 Diode on the (-02) coils which was used in the Deger Design.					
Robocop	2	090-5020-20 22-900 -YEL-YEL-	SAME	Not Used	Not Used
Phantom of the Opera	2	090-5020-20 22-900 -YEL-YEL-	SAME	Not Used	Not Used
Back to the Future	2	090-5020-20 22-900 -YEL-YEL-	SAME	Not Used	Not Used
The Simpsons	2	090-5020-20 22-900 -YEL-YEL-	SAME	Not Used	Not Used
Checkpoint	2	090-5020-20 22-900 -YEL-YEL-	SAME	Not Used	Not Used
Teenage Mutant Ninja Turtles	2	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	Not Used
Batman	2	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	Not Used
Star Trek 25th Anniversary	2	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	Not Used
Hook	2	090-5030-00 23-1100 -ORG-ORG-	090-5020-30 23-900 -GRN-GRN-	Not Used	Not Used
Lethal Weapon 3	2	090-5030-00 23-1100 -ORG-ORG-	SAME	Not Used	Not Used
Star Wars	2	090-5032-00 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
Rocky & Bullwinkle & Friends	2	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	Not Used
Jurassic Park	3	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	090-5030-00 23-1100 -ORG-ORG-

Table continued on the next page.



APPENDIX E

Flipper Coil Table †

GAME NAME	N ^o of Flippers	FLIPPERS w/ E.O.S. Switch		FLIPPERS no E.O.S. Switch	
		SPI N ^o / GAUGE-TURNS / Color		SPI N ^o / GAUGE-TURNS / Color	
		LOWER LEFT	LOWER RIGHT	UPPER LEFT	UPPER RIGHT
Last Action Hero	2	090-5020-30 23-900 -GRN-GRN-	SAME	Not Used	Not Used
Tales from the Crypt	3	090-5032-00 22-1080 -YEL-GRN-	SAME	Not Used	090-5041-00 25-1800 -BLU-GRN-
The Who's Tommy	3	090-5020-30 23-900 -GRN-GRN-	SAME	090-5041-00 25-1800 -BLU-GRN-	Not Used
WWF Royal Rumble	4	090-5032-00 22-1080 -YEL-GRN-	SAME	090-5041-00 25-1800 -BLU-GRN-	SAME
Guns N' Roses	3	090-5032-00 22-1080 -YEL-GRN-	SAME	090-5030-00 23-1100 -ORG-ORG-	Not Used
Maverick	3	090-5032-00 22-1080 -YEL-GRN-	SAME	Not Used	090-5032-00 22-1080 -YEL-GRN-
Mary Shelley's Frankenstein	3	090-5030-00 23-1100 -ORG-ORG-	SAME	Not Used	090-5030-00 23-1100 -ORG-ORG-
Baywatch	4	090-5030-00 23-1100 -ORG-ORG-	090-5020-30 23-900 -GRN-GRN-	090-5025-00 24-1570 -See Note-	090-5030-00 23-1100 -ORG-ORG-
Batman Forever	3	090-5032-00 22-1080 -YEL-GRN-	090-5020-20 22-900 -YEL-YEL-	Not Used	090-5020-30 23-900 -GRN-GRN-
Apollo 13	2	090-5032-00 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
Golden Eye	2	090-5032-00 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
Twister	2	090-5020-20 22-900 -YEL-YEL-	090-5032-00 22-1080 -YEL-GRN-	Not Used	Not Used
ID4: Independence Day	3	090-5032-00 22-1080 -YEL-GRN-	SAME	Not Used	090-5020-30 23-900 -GRN-GRN-
Space Jam †	2	090-5032-00T 22-1080 -YEL-GRN-	090-5020-20T 22-900 -YEL-YEL-	Not Used	Not Used
The Star Wars Trilogy - Special Edition †	2	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
The Lost World: Jurassic Park †	2	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
The X-Files †	2	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
Starship Troopers †	3	090-5030-00T 23-1100 -ORG-ORG-	SAME	Not Used	090-5032-00T 22-1080 -YEL-GRN-
Viper Night Drivin' †	2	090-5030-00T 23-1100 -ORG-ORG-	SAME	Not Used	Not Used
Lost In Space †	2	090-5030-00T 23-1100 -ORG-ORG-	090-5032-00T 22-1080 -YEL-GRN-	Not Used	Not Used
Godzilla †	2	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
South Park †	2	090-5030-00T 23-1100 -ORG-ORG-	SAME	Not Used	Not Used
Harley-Davidson® † and Harley-Davidson® 2nd Ed. †	2	090-5032-00T 22-1080 -YEL-GRN-	090-5030-00T 23-1100 -ORG-ORG-	Not Used	Not Used
Striker Xtreme (NFL) †	3	090-5032-00T 22-1080 -YEL-GRN-	090-5030-00T 23-1100 -ORG-ORG-	090-5030-00T 23-1100 -ORG-ORG-	Not Used
Sharkey's Shootout †	3	090-5030-00T 23-1100 -ORG-ORG-	SAME	090-5030-00T 23-1100 -ORG-ORG-	Not Used
High Roller Casino †	2	090-5020-20T 22-900 -YEL-YEL-	090-5032-00T 23-1080 -YEL-GRN-	Not Used	Not Used
Austin Powers™ †	2	090-5020-30 23-900 -GRN-GRN-	090-5030-00T 23-1100 -ORG-ORG-	Not Used	Not Used
MONOPOLY® †	3	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	090-5062-00T 23-1500 -BLU-BLU-
Playboy †	2	090-5030-00T 23-1100 -ORG-ORG-	SAME	Not Used	Not Used
RollerCoaster Tycoon™ †	4	090-5032-00T 22-1080 -YEL-GRN-	SAME	090-5067-00T 25-1400 -RED-RED-	090-5068-00T 25-1600 -WHT-WHT
The Simpsons™ Pinball Party †	6* (5 with Flipper Bats)	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	090-5030-00T 23-1100 -ORG-ORG-
		* The Homer Head Assembly is affixed to an Upr. Rt. Style Flipper (no E.O.S. Switch):		Flippers (Mini-Bats) on 2nd Level Playfield:	
			* 090-5020-20T 22-900 -YEL-YEL-	090-5041-00T 25-1800 -BLU-GRN-	090-5025-00T 24-1570 -See Note-
Terminator® 3: Rise of the Machines™ †	2	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	Not Used
The Lord of the Rings™ †	2	090-5020-20T 22-900 -YEL-YEL-	SAME	Not Used	Not Used
Ripley's Believe It or Not!® †	3	090-5032-00T 22-1080 -YEL-GRN-	SAME	Not Used	090-5067-00T 25-1400 -RED-RED-

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



APPENDIX F

Motor Specification Table

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

Game Name	Function	Specifications	Part N ^o
ABC Monday Night Football	Goal Post Up/Down Movement	Motor 24v A.C. 60 RPM CW	515-5222-00
Phantom of the Opera	Organ Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Checkpoint	Mag Wheel (in Backbox)	Motor D.C. (KEN)	041-5005-00
	Shaker	Johnson Motor (Vibrator)	041-5002-00
Teenage Mutant Ninja Turtles	Spinning Pizza Ball Deflector	Gear Motor 24v A.C. 325 RPM CW	515-5397-00
Batman	Bar Target Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Star Trek 25th Anniversary	Swinging Target	Bowman Motor 24v 22½ RPM	515-5534-00
	Transporter F/X	Gear Motor 24v A.C. 3½ RPM	500-5421-00
	Cooling Fan (for Transporter F/X)	4½" Motor 12v	041-5014-00
Lethal Weapon 3	Spinning Light	Motor 2½ v A.C. 4000 RPM CCW	041-5017-00
Star Wars	Bar Target Up/Down Movement	Bowman Motor 24v 60hz 3W 11 RPM CCW	515-5256-00
	R2D2 Robot Left/Right Movement	Bowman Motor 24v A.C. 22½ RPM CW	515-5571-00
	Death Star Rotation	Bowman "G" Motor 24v A.C. 60Hz 6 RPM CW	515-5570-00
Rocky & Bullwinkle & Friends	Nell Log "Cutting Blade" Forward/Back Movement	Autotrol Model E Motor 24v 60hz 4W 3 RPM CCW	041-5023-00
Jurassic Park	T-Rex Left/Right Movement	Multi Motor 5v D.C.	041-5025-00
	T-Rex Up/Down Movement	Bowman Motor 24v 11 RPM CW	041-5026-00
	Shaker	Johnson Motor (Vibrator)	041-5002-00
Last Action Hero	Crane Left/Right Movement	Multi Products Motor 12v D.C. #3312 OSC	041-5027-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Tales from the Crypt	Tombstone Up/Down Movement	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
The Who's Tommy	Mirror Up/Down Movement	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
	Flipper Blinders	Servo Motor (94102)	041-5032-00
	Spinning Airplane Propellers	Motor D.C.	041-5033-00
WWF Royal Rumble	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Maverick, The Movie	Turning Paddle Wheel	Motor 24v A.C. 10 RPM	041-5036-00
Mary Shelley's Frankenstein	Creature Head Left/Right Movement	Servo Motor (94102)	041-5032-00
Batman Forever	Cannon Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CCW	515-6383-00
Apollo 13	Rocket Up/Down Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CCW	515-6383-00
	Moon Unit Rotational Orbit	Multi Products Motor 24v A.C. 50/60Hz 3W 6 RPM CCW	515-6487-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Golden Eye	Satellite Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CW	515-6528-00

Table continued on the next page.



APPENDIX F

Motor Specification Table

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

Game Name	Function	Specifications	Part N ^o
Twister	Spinning Disc with Magnet	Multi Products Motor 24v A.C. (041-5026-00) 50/60Hz 3W 325 RPM CCW	515-6347-00
	Backbox Fan (Tornado Wind)	Multi Products Motor 24v A.C. (041-5052-00) 50/60Hz 3W 3600 RPM CW	515-6531-00
ID4: Independence Day	Alien Head Open/Close Movement	Servo Motor (94322)	041-5045-00
The Star Wars Trilogy - S.E.	X-Wing Left/Right Movement	Bowman Motor 24v A.C. (041-5058-00) 60Hz 3W 10 RPM CCW	515-6383-01
The Lost World: J.P.	Snagger & Center Link Lift Up/Down Movement	Multi Products Motor 20v D.C. (041-5059-03) 9 RPM Non-Directional	515-6715-03
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
The X-Files	X-File Cabinet Lift Up/Down Movement	Multi Products Motor 20v D.C. 9 RPM CCW	041-5057-00
Starship Troopers	Warrior Bug Forward/Reverse Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12v D.C. 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not incl.) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 Requires 7" Shaft: 530-5503-00
Lost In Space	Spinning Disc with Magnet	Multi Products Motor 24v A.C. (041-5046-00) 50/60Hz 3W 325 RPM CCW	515-6347-00
Godzilla	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW ‡	041-5029-01
Harley-Davidson®	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW ‡	041-5029-01
	Motorcycle Lift Up/Down Movement	Autotrol 24v A.C. (041-5072-02) 20 RPM CCW	515-7025-00
Striker Xtreme (NFL)	Goalie (Linebacker) Left to Right Movement	Multi #3590 12v D.C. (041-5075-00) 60 RPM	515-7071-00
Sharkey's Shootout	Mystery Ball Rotating Movement	Hankscraft Motor Model-E 24v A.C. (041-5076-00) 50/60Hz 3W 20 RPM CW	515-7095-00
High Roller Casino	Roulette Wheel Rotating Movement	Multi Products Motor 20V D.C. (041-5078-00) 17 RPM CCW	515-7153-00
	Up/Dn. Ramp in Slot Mach. Lift Up/Down Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12v D.C. 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not incl.) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 Requires Shaft 4 1/4": 530-5503-01
Austin Powers™	Time Machine Rotating Movement	Multi Products Motor 24v A.C. (041-5079-00) 50/60Hz 20RPM CCW	515-7141-00
	Laser Beam Left to Right Directional	Autotrol Motor 24V A.C. (041-5081-00) 50/60Hz 4W 10RPM Bi-Directional	515-7171-00
	Dr. Evil Target Lift Up/Down Movement	Hankscraft Motor Model-E 24v A.C. (041-5030-00) 50/60Hz 6RPM CCW	515-5900-00
Monopoly®	Mini-Flipper (Waterworks) Rotating Movement	Multi Prod. Motor & Gear Box #7000 EX00159A 20v D.C. 50/60Hz 85RPM CC/CW	041-5083-00
Playboy	Triangular Billboard Rotating Movement	Autotrol Motor (BD511 150-1387) 24v A.C. 50/60Hz 12RPM Bi-Directional	041-5086-02
	Centerfold Mechanism Open/Close Movement	Multi Products (3680) Motor 12v DC 10/12 RPM CC/CW	041-5075-04
	Tease Drop Screen Lift Up/Down Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12v D.C. 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not incl.) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 Requires 7" Shaft: 530-5503-00
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 550-5000-XX	STARBURST CIRCULAR 550-5001-XX	STARBURST CIRCULAR 550-5002-XX	STARBURST CIRCULAR 550-5003-XX	STARBURST CIRCULAR 550-5004-XX
STARBURST CIRCULAR 550-5005-XX	STARBURST CIRCULAR 550-5006-XX	PLAIN CIRCULAR 550-5007-XX	PLAIN CIRCULAR 550-5008-XX	PLAIN CIRCULAR 550-5009-XX	PLAIN CIRCULAR 550-5010-XX
PLAIN CIRCULAR 550-5011-XX	PLAIN CIRCULAR 550-5012-XX	STIPPLE CIRCULAR 550-5048-XX	STIPPLE 1" SQUARE 550-5019-XX	ROLLOVER BUTTON BASE 550-5026-XX	WHITE STAR (only in white) 545-5015-00
STIPPLE RECTANGULAR 550-5018-XX	STIPPLE RECTANGULAR 550-5051-XX	STARBURST RECTANGULAR 550-5044-XX	PLAIN RECTANGULAR 550-5049-XX	PLAIN RECTANGULAR 550-5050-XX	PLAIN RECTANGULAR 550-5063-XX
STARBURST MINI SHIELD 550-5024-XX	STARBURST LARGE SHIELD 550-5025-XX	MINI HOT DOG 550-5020-XX	BEVEL HOT DOG 550-5021-XX	PLAIN HOT DOG 550-5022-XX	BANANA 550-5023-XX
STARBURST ARROW-SMALL 550-5013-XX	STARBURST ARROW-LARGE 550-5070-XX	STARBURST ARROW-HEAD SMALL 550-5014-XX	STARBURST ARROW-HEAD LARGE 550-5015-XX	STARBURST BULLET 550-5016-XX	STARBURST TRIANGLE 550-5017-XX

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

Instructions:

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

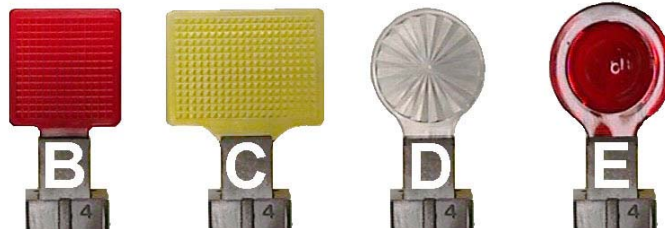
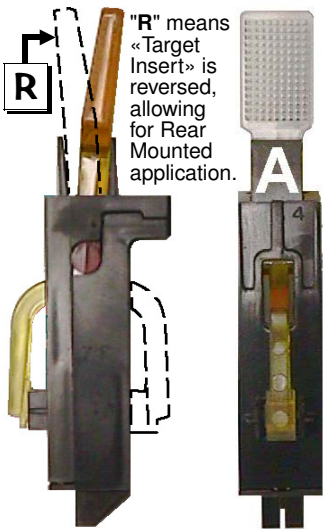
PLASTIC PART COLOR CHART											
N ^o	Color	N ^o	Color	N ^o	Color	N ^o	Color	N ^o	Color	N ^o	Color
-00	Black or Solid Clear	-03	Amber	-06	Yellow	-09	Purple	-12	Fluor. Blue	-15	Luminescent
-01	Clear	-04	Green	-07	Orange	-10	Fluor. Orange	-13	Teal Green	-16	Gold
-02	Red	-05	Blue	-08	White	-11	Fluor.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



APPENDIX I

Stand-Up Targets

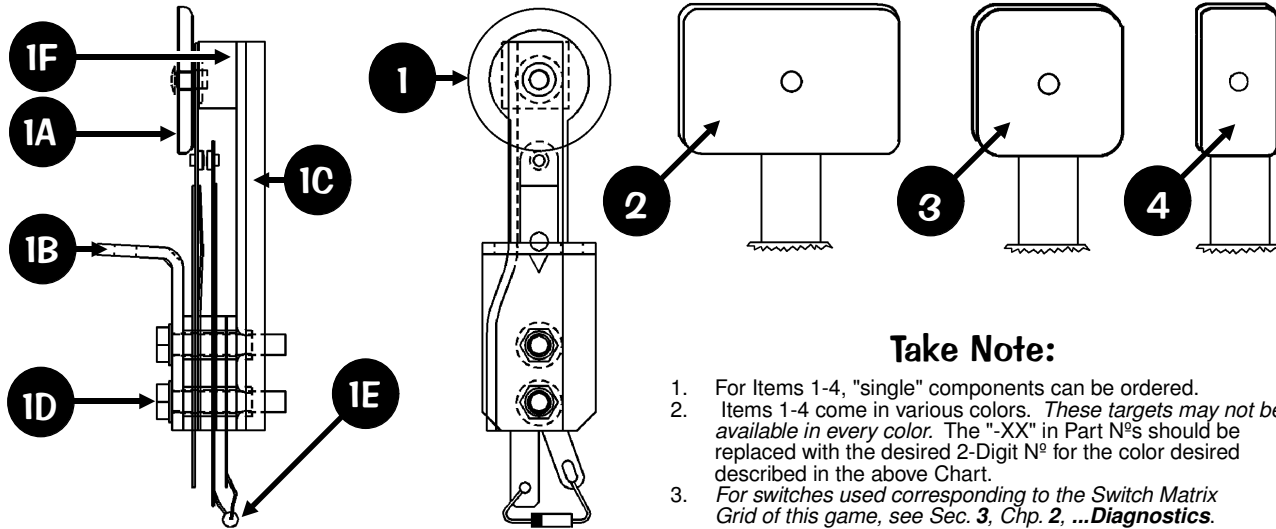
PLASTIC PART COLOR CHART	
Nº	Color
-00	Black
-01	Clear
-02	Red
-03	Amber
-04	Green
-05	Blue
-06	Yellow
-07	Orange
-08	White
-09	Purple
-10	Fluor. Orange
-11	Fluor. Green
-12	Fluor. Blue
-13	Teal Green
-14	Gray
-15	Luminescent
-16	Gold



Take Note:

- For Items A-E, for the Target Assembly use the "500-" SPI Nº; For the Target Assy. with Rear Mount add "R" to "500-" SPI Nº; For just the «Target Insert» use the "545-" SPI Nº.
- Items A-E come in various colors. *These targets may not be available in every color.* The "-XX" in should be replaced with the desired 2-Digit Nº for the color desired described in the Chart **†**.
As of date of print, the following colors were used for Items A-E:
-01 Clear (A, D); -02 Red (A, B, C, D, E); -03 Amber (D, E); -04 Green (A, B); -05 Blue (C); -06 Yellow (A, C); -09 Purple (B, D); -11 Fluorescent Green (A, B, D).
- See Section 3, Chapter 2, **Go To Diagnostics Menu**, for switches used corresponding to the Switch Matrix Grid of this game.

Nº	STAND-UP TARGET NAME	SPI PART Nº	Nº	STAND-UP TARGET NAME	SPI PART Nº
A	Modular Stand-Up Target Narrow Assy.	500-6138-XX	D	Modular Stand-Up Target Round Assy.	500-6075-XX
	Stand-Up Target Narrow (Insert)	545-6138-XX		Stand-Up Target Round (Insert)	545-6075-XX
B	Modular Stand-Up Target Square Assy.	500-6139-XX	E	Mod. Stand-Up Target 1" Spherical Assy.	500-6189-XX
	Stand-Up Target Square (Insert)	545-6139-XX		Stand-Up Target 1" Spherical (Insert)	545-6189-XX
C	Modular Stand-Up Target Rectangle Assy.	500-6228-XX	Note: To receive the Target Assembly with the «Target Insert» «Reversed» simply add a "R" at the end of the Part Nº. See Side View picture above to compare (dashed line shows target reversed).		
	Stand-Up Target Rectangle (Insert)	545-6228-XX			



Take Note:

- For Items 1-4, "single" components can be ordered.
- Items 1-4 come in various colors. *These targets may not be available in every color.* The "-XX" in Part Nºs should be replaced with the desired 2-Digit Nº for the color desired described in the above Chart.
- For switches used corresponding to the Switch Matrix Grid of this game, see Sec. 3, Chp. 2, ...**Diagnostics**.

Nº	STAND-UP (FLAT) TARGET NAME	SPI PART Nº	Nº	STAND-UP (FLAT) TARGET NAME	SPI PART Nº
1	1" Round Stand-Up Target Assy.	500-5835-XX	† Note: Item 2A, is a riveted Sub-Assy, which includes the following items for reference: A1— Stack Switch Radius End (180-5133-00), A2— Washer 5/16" (242-5017-00), A3— Rivet 1/8" ø X 3/16" (249-5001-00) and A4— Rectangular Target (545-5145-XX).		
ORDERING ABOVE (ITEM 1) ASSY. PART Nº WILL INCLUDE:					
1A‡	Switch & Target Assy. 1" Round	515-5966-XX	3	1" Sq. Stand-Up Target Assy.	500-5232-XX
1B	Mounting Bracket	535-6896-00	ORDERING ABOVE (ITEM 3) ASSY. PART Nº WILL INCLUDE:		
1C	Switch Back Plate	535-6452-00	3A‡	Sw. & Target Assy. 1" Square	515-5162-XX
1D	6-32 X 3/4 HWH Swage (Qty. 2)	237-5976-05	Items 3B-F are identical to 1B-F		
1E	Switch Diode, 1N4001	112-5001-00	Same as 1B-F		
1F	Foam Pad	626-5029-00	† Note: Item 3A, is a riveted Sub-Assy, which includes the following items for reference: A1— Stack Switch Radius End (180-5133-00), A2— Washer 5/16" (242-5017-00), A3— Rivet 1/8" ø X 3/16" (249-5001-00) and A4— 1" Square Target (545-5470-XX).		
2	1" X 1 1/2" Stand-Up Rect. Target Assy.	500-5321-XX	4	Narrow Stand-Up Target Assy.	500-5857-XX
ORDERING ABOVE (ITEM 2) ASSY. PART Nº WILL INCLUDE:					
2A‡	Sw. & Target Assy. 1" X 1 1/2" Rect.	515-6027-XX	ORDERING ABOVE (ITEM 4) ASSY. PART Nº WILL INCLUDE:		
Items 2B-F are identical to 1B-F			Same as 1B-F		
† Note: Item 4A, is a riveted Sub-Assy, which includes the following items for reference: A1— Stack Switch Square End (180-5132-00), A2— Washer 5/16" (242-5017-00), A3— Rivet 1/8" ø X 3/16" (249-5001-00) and A4— Narrow Target (545-5210-XX).					

Item 2 Table Note continued in the next column.



APPENDIX J



Coin Cards (USA & International Pricing Defaults) ▶ 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
1-Sided 755-5401-03	1-Sided 755-5401-04	1-Sided 755-5401-05	1-Sided 755-5401-06	1-Sided 755-5401-07	1-Sided 755-5401-08
EURO 9	EURO 10	EURO 11	EURO 12	ToPS™EURO Custom *‡	ToPS™EURO Custom *†‡
1-Sided 755-5401-09	1-Sided 755-5401-10	1-Sided 755-5401-11	1-Sided 755-5401-12	Front 755-5401-20 *‡	Back 755-5401-20 *†‡
JAPAN	JAPAN Custom †	NORWAY 1	NORWAY 2	Republic of S. AFRICA	Republic of S. AFRICA Custom †
Front 755-5408-00	Back 755-5408-00 †	Front 755-5403-00	Back 755-5403-00	Front 755-5409-00	Back 755-5409-00
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 *†‡	<p>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.</p> <p>Note: You can download any Coin Card (in PDF Format, Adobe® Reader v5.0+ required) from our website www.sterpinball.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.</p>	
Front 755-5407-01	Back 755-5407-01 †	Front 755-5407-02 *‡	Back 755-5407-02 *†‡		



GLOSSARY OF TERMS

- A** Followed after a number means "Amp." or Ampage in an expression relating to an electrical object. (e.g. **8A**).
- AC** (Acronym) **Alternating Current**.
- Adj.** (Abbreviation) Adjustment(s).
- Assy.** (Abbreviation) Assembly.
- Au.** (Abbreviation) Audit(s).
- Bd.** (Abbreviation) Board.
- BOT** (Abbreviation) Bottom.
- Brkt.** (Abbreviation) Bracket.
- Bridge Rectifier** A configuration of a diode that allows current to flow in one direction producing both positive and negative pulsating DC Voltages.
- Color Coding** See Appendix H or I, Plastic Part Color Chart or Section 4, Chapter 1, Playfield - Plastic Posts & Spacers.
- Combination (Combo) [Shot]** Any variable pinball shot(s) made successively.
- Conn.** (Abbreviation) Connector.
- CMOS** Short for COSMOS (Complementary Symmetry M.O.S.); Complementary Metal-Oxide Semi-Conductor.
- CN** (Abbreviation) Connector (e.g. **CN5-P3**).
- CT** (Abbreviation) Center.
- DC** (Abbreviation) Direct Current.
- DT** (Abbreviation) Drop Target(s).
- DOTS** (Acronym) **Diode On Terminal Strip**.
- EB** (Abbreviation) Extra Ball.
- Eject** Playfield surface device to kick ball back into play; Saucer.
- EPROM** (Acronym) **Erasable Programmable Read Only Memory**. Can be erased using UV Light and re-programmed.
- e.g.** (Abbreviation) Latin- Exempla gratia. For Example.
- EOS** (Acronym) **End-Of-Stroke** (i.e. Switch for flipper).
- F** (Abbreviation) Fuse (i.e. **F23**).
- GA-Turn** Gauge & Turn describing the windings on a coil (e.g. 23-800, 23 is the gauge of wire and 800 is the amount of windings).
- G.I.** (Abbreviation) General Illumination (Lamps).
- HWH** (Abbreviation) Hex Washer Head.
- IC** (Acronym) **Integrated Circuit** (As in after 24-Pin IC).
- ID or I.D.** (Acronym) **Inside Dimension**.
- i.e.** (Abbreviation) Latin- Id est. That is.
- IO or I/O** (Abbreviation) Input / Output (e.g. I/O Power Driver Bd.)
- LT, Lt. or L.** (Abbreviation) Left.
- Laser Kick** A coil/plunger used above the playfield to kick pinball back into play.
- LED** (Acronym) **Light Emitting Diode**.
- Loop [Shot]** Continuously up a ramp and back to the flipper.
- Lwr.** (Abbreviation) Lower.
- Orbit [Shot]** From the left or right flipper around the back rail of the playfield back to the flipper.
- MB** (Abbreviation) Magnet Board.
- M-BALL or MBALL** (Abbreviation) Multiball™ More than 1 ball in game play.
- MID** (Abbreviation) Middle
- Non-Reflexive** See Reflexive.
- No. or N° or #** (Abbreviation) Number
- NPF** (Acronym) **No Problem Found**.
- N.C. or NC** (Abbreviation) Normally Closed.
- N.O. or NO** (Abbreviation) Normally Open.
- NS** (Abbreviation) Not Stuffed. (Use in Part Listings, Sec. 5)
- OD or O.D.** (Abbreviation) Outside Dimension.
- P** (Abbreviation) Pin (e.g. **CN5-P3**).
- PCB** (Acronym) **Printed Circuit Board**
- P/F** (Abbreviation) Playfield.
- PIA LED** (Acronym) **Peripheral Interface Adapter Light Emitting Diode**. This is a diagnostic LED on the CPU; it should not be lit during normal operation of a pinball game.
- Plumb Bob Tilt** Weight on Tilt Assembly.
- PPH** (Abbreviation) Phillips Pan Head.
- Pop(s)** Another term for Turbo Bumper(s).
- PPB** (Acronym) Playfield Power Board ("Popcorn-Popping Bd.").
- PREV** (Abbreviation) Previous.
- PSB** (Abbreviation) Power Supply Board
- RAM** (Acronym) **Random Access Memory**. **RAM can** store input instructions and supply output information.
- Reflexive/Non-Reflexive Reflexive**—Solenoid Drive Transistor is enabled directly by a switch closure on the (Relating to CPU Boards) solenoid assembly (Ver. 1/2).
- Non-Reflexive**—Solenoid Drive Transistor is enabled by the CPU after reading a switch closure in the Switch Matrix (Ver. 3). Also note: All CPU Boards are backwards compatible (e.g. Jurassic Park/Ver. 3 to Time Machine/ Ver. 2). Swapping a Ver. 2 Board to a Ver. 3 is not possible due to the special solenoids section (i.e. Slingshots, Turbo Bumpers, etc.) changing from **REFLEXIVE** to **NON-REFLEXIVE** on Ver. 3 Boards.
- Relay** An automatic switch operated by current in a coil.
- ROM** (Acronym) **Read Only Memory**. **ROM cannot** store input instructions but can supply output information. **ROM can be programmed only once**.
- RMA** (Abbreviation) Return Merchandise Authorization Number
- RT, Rt. or R.** (Abbreviation) Right; ("**R**" at the end of Target Assy. Part N° signifies Target Insert is Reversed.)
- RO** (Abbreviation) Rollover (switches).
- Saucer** See Eject.
- Scoop** A hole into the playfield. A metal scoop is in place to guide the ball into the kick-back under the playfield.
- Slam Tilt** A switch which closes when the game is slammed into or the Coin Door is slammed shut. Depending on adjustable settings, will cancel game in play when the number of closures required is achieved.
- SMB** (Abbreviation) Shaker Motor Board.
- Solenoid** A coil used for Electro Magnetic devices such as relays, flippers, slingshots, etc.
- SSFB** (Abbreviation) Solid State Flipper Board.
- STEP** Refers to the service switches on the coin door.
- Sub-Assy.** (Abbreviation) Sub-Assembly.
- S-U or S/U** (Abbreviation) Stand-Up (targets).
- TM** (Abbreviation) Trademark
- Transfer [Shot]** Maneuvering the ball in play from one flipper to the other. With flipper in the up position and the ball cradled by that flipper one would activate the flipper button in a quick repetitive manner to bounce the ball to the other side. Skilled players can rebound the ball off the slingshot.
- Tri-Ball** Three balls in play.
- TTL** (Abbreviation) Transistor-Transistor Logic
- Upr.** (Abbreviation) Upper.
- V or v** (Abbreviation) Volt(s).
- Ver.** (Abbreviation) Version.
- VUK** (Acronym) **Vertical Up-Kicker** (Super or Standard).
- X** (Abbreviation) "Times" A multiplier; also used in dimensions.
- X-Ball** An undetermined number of ball(s) during game play.
- Zener Diode** A semi-conductor diode used for voltage regulation. Application depends on reverse break-down voltage.
- "-00B"** "B" at the end of Coil Part Numbers signifies that the diode is attached to the bottom of the lug.
- "-00T"** "T" at the end of Coil Part Numbers signifies that the diode is attached to the top of the lug (the side nearest the coil-winding).



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 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
Mechanics: 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)	1: Q1	2: Q2	3: Q3	4: Q4	5: Q5	6: Q6	7: Q7	8: Q8	GROUND	GROUND
Row (Return)	GRN-BRN CN5-P1	GRN-RED CN5-P3	GRN-ORG CN5-P4	GRN-YEL CN5-P5	GRN-BLK CN5-P6	GRN-BLU CN5-P7	GRN-VIO CN5-P8	GRN-GRY CN5-P9	IC U206 INPUTS	BLK CN6-P1, -P11
1: U400	1 Cabinet Side LT BUTTON (UK ONLY) Sw. Part Number: 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	1: U206 GRY-BRN CN6-P2 Sw. Part Number: 180-5160-00	DS-1 on Cabinet Side #1 LEFT FLIPPER BUTTON 180-5160-00
2: U400	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	2: U206 GRY-Grn. CN6-P3 Sw. Part Number: 180-5149-00 on Flipper	DS-2 Below Playfield #2 LEFT FLIPPER E.O.S (End-of-Stroke) 180-5149-00 on Flipper
3: U400	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)	3: U206 GRY-ORG CN6-P4 Sw. Part Number: 180-5164-00 Doubled	DS-3 on Cabinet Side #3 RIGHT FLIPPER BUTTON 180-5164-00 Doubled
4: U400	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 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	4: U206 GRY-YEL CN6-P6 Sw. Part Number: 180-5149-00 on Flipper	DS-4 Below Playfield #4 RIGHT FLIPPER E.O.S. (End-of-Stroke) 180-5149-00 on Flipper
5: U401	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 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	5: U206 GRY-GRN CN6-P7 Sw. Part Number: 180-5164-00 Doubled	DS-5 on Cabinet Side #5 UPPER RT. FLIPPER BUTTON 180-5164-00 Doubled
6: U401	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)	6: U206 GRY-BLU CN6-P8 Sw. Part Number: 180-5192-02	DS-6 on Coin Door #6 VOLUME (Grn. BUTTON) (In Test: LEFT) 180-5192-02
7: U401	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	7: U206 GRY-VIO CN6-P9 Sw. Part Number: 180-5192-04	DS-7 on Coin Door #7 SERV. Cgrm. (GREEN BUTTON) (In Test: RIGHT) 180-5192-04
8: U401	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	8: U206 GRY-BLK CN6-P10 Sw. Part Number: 180-5192-00	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)	1: U17	2: U16	3: U15	4: U14	5: U13	6: U12	7: U11	8: U10
Row (Ground)	YEL-BRN J13-P9	YEL-RED J13-P8	YEL-ORG J13-P7	YEL-BLK J13-P6	YEL-GRN J13-P5	YEL-BLU J13-P4	YEL-VIO J13-P3	YEL-GRY J13-P1
1: Q33	1 #555 Bulb SUPER JACKPOT 2 MIL RED-BRN J12-P1	2 #555 Bulb SUPER JACKPOT 3 MIL RED-RED J12-P2	3 #555 Bulb SUPER JACKPOT 1 MIL RED-BLK J12-P2	4 #555 Bulb SUPER JACKPOT 4 MIL RED-ORG J12-P3	5 #555 Bulb SHOOT AGAIN RED-BLU J12-P6	6 #555 Bulb SUPER JACKPOT 5 MIL RED-VIO J12-P8	7 #555 Bulb SUPER JACKPOT 6 MIL RED-GRY J12-P9	8 #555 Bulb RIGHT SPECIAL RED-WHT J12-P10
2: Q34	9 #555 Bulb LEFT SPECIAL RED-BLK J12-P2	10 #555 Bulb 1 IDOL COUNTER RED-ORG J12-P3	11 #44 Bulb 2 IDOL COUNTER RED-BLU J12-P6	12 #555 Bulb 3 IDOL COUNTER RED-VIO J12-P8	13 #555 Bulb 4 IDOL COUNTER RED-GRY J12-P9	14 #555 Bulb 5 IDOL COUNTER RED-WHT J12-P10	15 #555 Bulb TOMBSTONE 1 RED J12-P11	16 #44 Bulb SCOOP ARROW RED J12-P11
3: Q35	17 #555 Bulb (R) IPLEYS RED-BRN J12-P1	18 #555 Bulb R (I) PLEYS RED-RED J12-P2	19 #555 Bulb RI (P) LEYS RED-BLK J12-P2	20 #555 Bulb RIP (L) EYS RED-ORG J12-P3	21 #555 Bulb RIPL (E) YS RED-BLU J12-P6	22 #555 Bulb RIPLE (Y) S RED-VIO J12-P8	23 #555 Bulb RIPLEY (S) RED-GRY J12-P9	24 #555 Bulb GRID A1 (UPPER LEFT) RED-WHT J12-P10
4: Q36	25 #555 Bulb GRID B1 RED-BRN J12-P1	26 #555 Bulb GRID C1 RED-RED J12-P2	27 #555 Bulb GRID A2 RED-BLK J12-P2	28 #555 Bulb GRID B2 RED-ORG J12-P3	29 #555 Bulb GRID C2 RED-BLU J12-P6	30 #555 Bulb GRID A3 RED-VIO J12-P8	31 #555 Bulb GRID B3 RED-GRY J12-P9	32 #555 Bulb GRID C3 RED-WHT J12-P10
5: Q37	33 #555 Bulb LOWER LEFT POP RED-BRN J12-P1	34 #555 Bulb LOWER RIGHT POP RED-RED J12-P2	35 #555 Bulb LOWER BOT POP RED-BLK J12-P2	36 #555 Bulb SKILL SHOT RED-ORG J12-P3	37 #555 Bulb TOMBSTONE 2 RED-BLU J12-P6	38 #555 Bulb TOMBSTONE 3 RED-VIO J12-P8	39 #555 Bulb MILLION PLUS RED-GRY J12-P9	40 #555 Bulb LOOP JACKPOT RED-WHT J12-P10
6: Q38	41 #555 Bulb VARI-TARGET SPECIAL RED-BRN J12-P1	42 #555 Bulb VARI-TARGET EB RED-RED J12-P2	43 #555 Bulb VARI-TARGET ? (MYSTERY) RED-BLK J12-P2	44 #555 Bulb VARI-TARGET S.A. RED-ORG J12-P3	45 #555 Bulb VARI-TARGET N.A. RED-BLU J12-P6	46 #555 Bulb VARI-TARGET EUROPE RED-VIO J12-P8	47 #555 Bulb VARI-TARGET AUSTR. RED-GRY J12-P9	48 #555 Bulb VARI-TARGET ASIA RED-WHT J12-P10
7: Q39	49 #555 Bulb TOMBSTONE 5 RED-BRN J12-P1	50 #44 Bulb PENGUIN RED-RED J12-P2	51 #44 Bulb ADVANCE TOMBSTONE RED-BLK J12-P2	52 #44 Bulb RIGHT SPINNER RED-ORG J12-P3	53 #555 Bulb RIGHT JACKPOT RED-BLU J12-P6	54 #555 Bulb LOCK RED-VIO J12-P8	55 #555 Bulb RIPOFF RED-GRY J12-P9	56 #555 Bulb VARI-TARGET ANTAR. RED-WHT J12-P10
8: Q40	57 #555 Bulb CENTER JACKPOT RED-BRN J12-P1	58 #555 Bulb LITE HEAD RED-RED J12-P2	59 #555 Bulb GATE OPEN RED-BLK J12-P2	60 #555 Bulb UPPER LEFT POP RED-ORG J12-P3	61 #555 Bulb UPPER RIGHT POP RED-BLU J12-P6	62 #555 Bulb UPPER BOT POP RED-VIO J12-P8	63 #44 Bulb TOMBSTONE 4 RED-GRY J12-P9	64 #555 Bulb VARI-TARGET AFRICA RED-WHT J12-P10
9: Q41	65 #44 Bulb LEFT SPINNER RED-BRN J12-P1	66 #555 Bulb MULTIBALL RED-RED J12-P2	67 #555 Bulb LIGHT LOCKS RED-BLK J12-P2	68 #555 Bulb COLLECT BIG-FOOT BONUS RED-ORG J12-P3	69 #555 Bulb SUPER JACKPOT RED-BLU J12-P6	70 #555 Bulb ODDITORIUM RED-VIO J12-P8	71 #555 Bulb THE HEAD KNOWS RED-GRY J12-P9	72 #555 Bulb BOZO RED-WHT J12-P10
10: Q42	73 #555 Bulb BONUS X INLANE LEFT RED J12-P11	74 #555 Bulb BONUS X INLANE CTR RED J12-P11	75 #555 Bulb BONUS X INLANE RT RED J12-P11	76 #44 Bulb BACK PANEL A RED J12-P11	77 #44 Bulb BACK PANEL B RED J12-P11	78 #44 Bulb BACK PANEL C RED J12-P11	79 #555 Bulb TOURNAMENT BUTTON RED J12-P11	80 #555 Bulb START BUTTON RED J12-P11

▼ U.S. ▼
Customary
Inch Ruler



Metric Conversion

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

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

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