Find-It-In-Front:
Dr. Pinball Section
The inside cover & the front pages
DR. ❶ thru DR. ⑩ covers the basics
Alot of questions get answered here...

DR. DR. DR. DR.
NO YES END PREV QUIT
The Portals™ Service Menu,
Section 3, is your Technical Friend...

STERN™
PINBALL, INC.
2020 Janice Ave., Melrose Park, IL 60160

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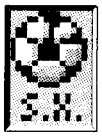
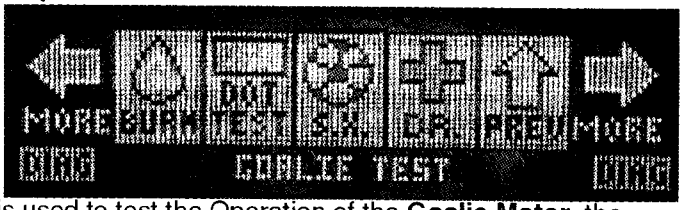
March 2000 - Print Copy: ①
SPI PN#: 780-5068-01

First you must enter the **Portals™ Service Menu** by pressing the **BLACK "ENTER" Button** inside the *Coin Door*.



Striker Xtreme (Goalie Test)

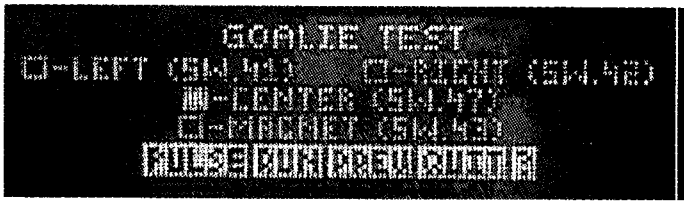
To initiate, from the **DIAGNOSTICS MENU**, select the "S.X." *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Button** (the **LEFT** and **RIGHT FLIPPER Buttons** operates in the same manner) and press the **Black "ENTER" Button** (the **START Button** operates in the same manner).

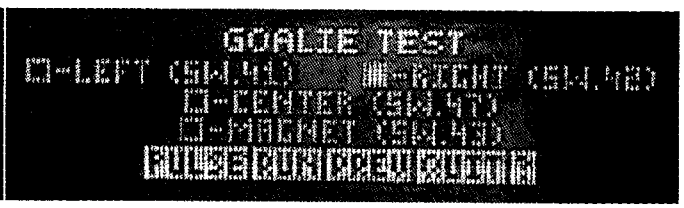


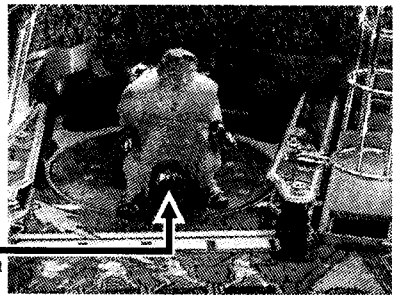
This will bring up the **GOALIE TEST MENU**. This menu is used to test the Operation of the **Goalie Motor**, the **Goalie Motor OPTO PC Board Switches** and the **Goalie Magnet Switch**.

Important: The **Power Interlock Switch** must be pulled out for this *test to function* while the **Coin Door** is **OPEN**.

This test is provided to allow the technician a simple method of testing ***Motor Operation*** (**Q25** / **Q26**) & the ***OPTO Switches***, ❒ - **LEFT (Sw. 41)**, ❒ - **RIGHT (SW. 42)**, ❒ - **CENTER (SW. 47)** and ❒ - **MAGNET (SW. 43)**. Upon entering this test menu, the display will indicate the switch status of the ***Goalie Motor***. The ❒ - **CENTER (SW. 47)** indicator will be active (❒ will turn solid ■). If the *Goalie is off-center*, **none** of the Switch Indicator boxes will be "filled".

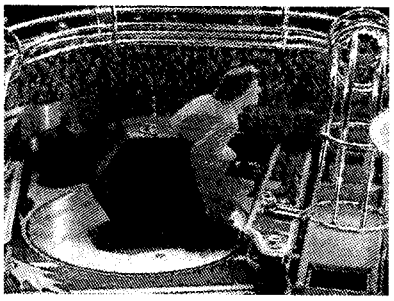




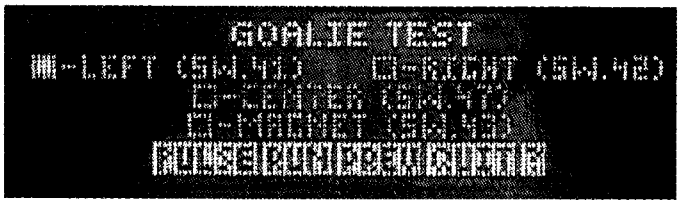


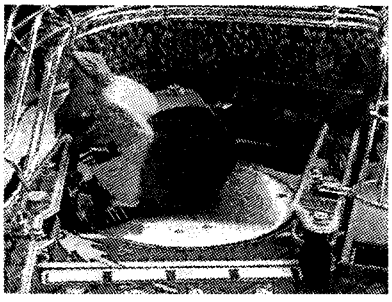
Magnet Switch 43, is inbetween the Goalie Legs. See Magnet Switch Test Procedure below.

Goalie in the Center Position (OP2), ❒ - CENTER (SW. 47) is indicated as closed.



Goalie in the Right Position (OP3), ❒ - RIGHT (SW. 42) is indicated as closed.



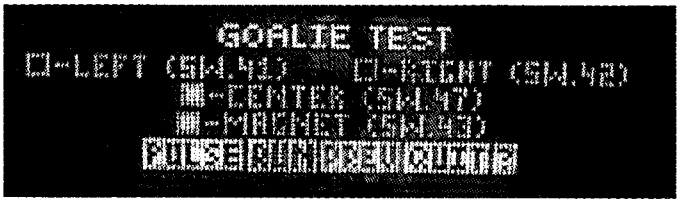


Goalie in the Left Position (OP1), ❒ - LEFT (SW. 41) is indicated as closed.

Motor & OPTO Switch Test Procedure:

Select the "PULSE" *Icon* to pulse the motor (in steps). If the Goalie is at **Center (HOME)** the motor will turn to the ❒ - **RIGHT (SW. 42)** position ***(OP3** on the OPTO Bd.)*. Continuously activating the "PULSE" *Icon* will bring the Goalie back into the ❒ - **CENTER (SW. 47)** position ***(OP2** on the OPTO Bd.)* then onto the ❒ - **LEFT (SW. 41)** position ***(OP1** on the OPTO Bd.)*. Selecting the "RUN" *Icon* will automatically cycle the motor to the next open switch (OPTO) and then will stop. Select the "RUN" *Icon* again to return (cycle) to the other positions. Watch the *Dot Matrix Display* to ensure the **Switches 41 (OP1)**, **42 (OP3)** & **47 (OP2)** are being indicated as closed as the motor stops (❒ will turn solid ■).

Note: *These OPTO Switches close when the Motor Cam Flag Bracket passes between the OPTOs.*



Magnet & Switch Test Procedure:

With the Goalie in the Center Position (facing forward), depress the ***Magnet Switch Actuator*** *(inbetween the Goalie's Legs)* with a *pinball*. The display will indicate ❒ - **MAGNET (SW. 43)** as activated (❒ will turn solid ■). At the *moment of this Switch 43 closure*, the **Magnet** will *grab*, *hold* and *release* the pinball. This ***Magnet Switch 43*** can also be tested in the "SWITCH TEST MENU" (see **Go To Switch Menu** on Page 14).

Note: *The Goalie will automatically return to the **HOME** Pos. (Center) upon exiting the **Portals™ Service Menu**. To exit this Menu, select & activate the "PREV" Icon to go back to the **DIAGNOSTICS MENU** or activate the "QUIT" Icon to exit the **Portals™ Service Menu**. See Sec. 5, Chp. 4, Printed Circuit Boards, for the Goalie Motor OPTO PC Board Theory of Operation & Schematic and the Component Layout & Parts, on Page 123.*

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.

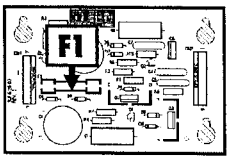
▼ BACKBOX LAYOUT LOCATIONS: Fuses, Bridges, Relays & ROMs ▼

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

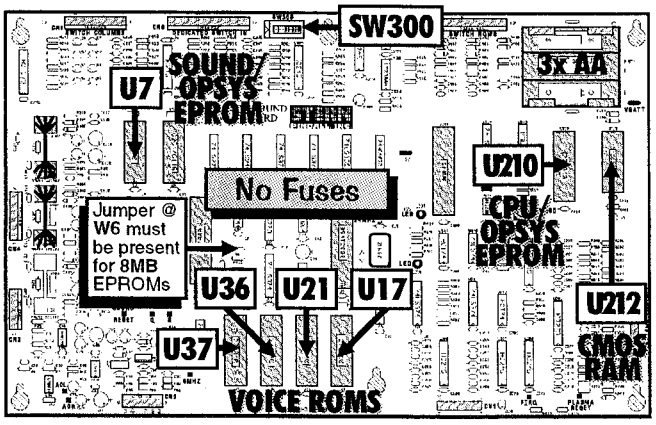
QUICK REFERENCE FUSE CHART			
Backbox Fuses			
LOC: DISPLAY POWER SUPPLY (P.S.) BOARD			
F1	¾A 250v S.B.	90v DC	High Voltage Display
LOC: I / O POWER DRIVER BOARD			
F6	7A 250v S.B.	50v DC	Primary High Power Coils/Flippers
F7	5A 250v S.B.	20v DC	Low Power Coils
F8	5A 250v S.B.	12v DC	Logic Power
F9	5A 250v S.B.	12v DC	Logic Power
F20	3A 250v S.B.	50v DC	Magnet(s)
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)
This Game's Playfield Fuses			
LOC: UNDER PLAYFIELD (By Assemblies Listed)			
n/a	3A 250v S.B.	50v DC	Rt. Flipper (BLU-YEL↔RED-YEL)
n/a	3A 250v S.B.	50v DC	Lt. Flipper (GRY-YEL↔RED-YEL)
n/a	3A 250v S.B.	50v DC	Upper Flipper (GRY-YEL↔RED-YEL)
n/a	3A 250v S.B.	50v DC	Ramp Magnet (VIO-YEL↔WHT)
n/a	3A 250v S.B.	50v DC	Goalie Magnet (VIO-YEL↔WHT)

For Backbox & Cabinet General Parts, review Section 4, Chapter 1, Parts Identification & Location (The Pink Pages).
For Schematics and/or Component Parts on above Boards, review Section 5, Chapter 4, Printed Circuit Boards (The Yellow Pages).

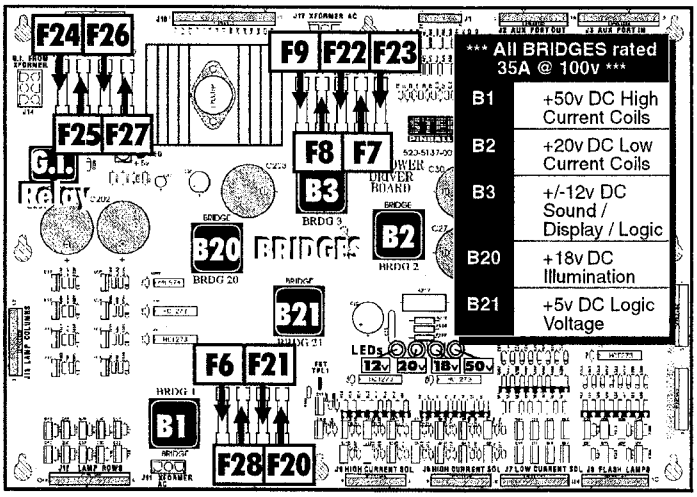
Display Power Supply Board

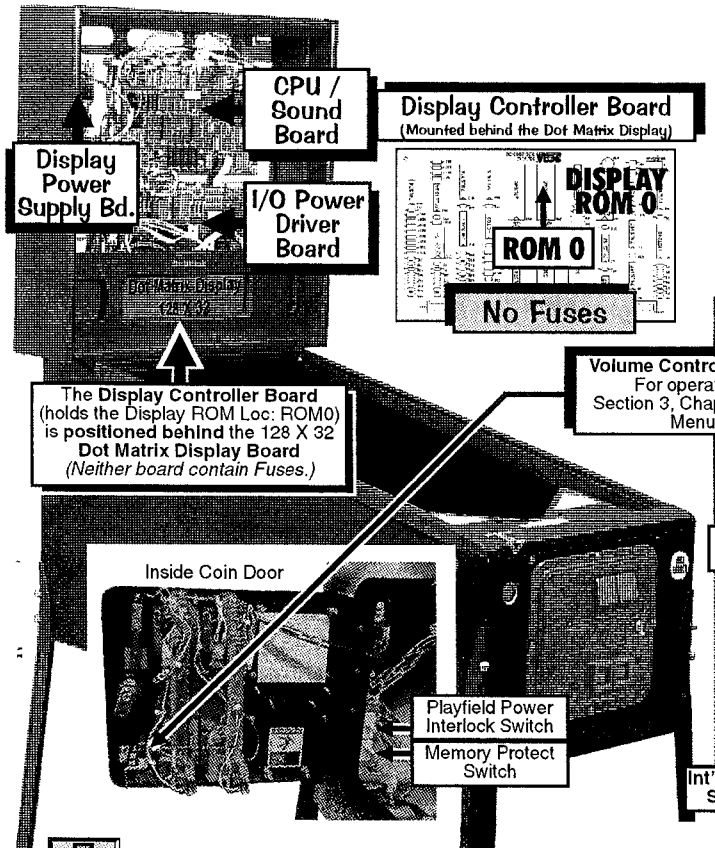


CPU / Sound Board



I/O Power Driver Board

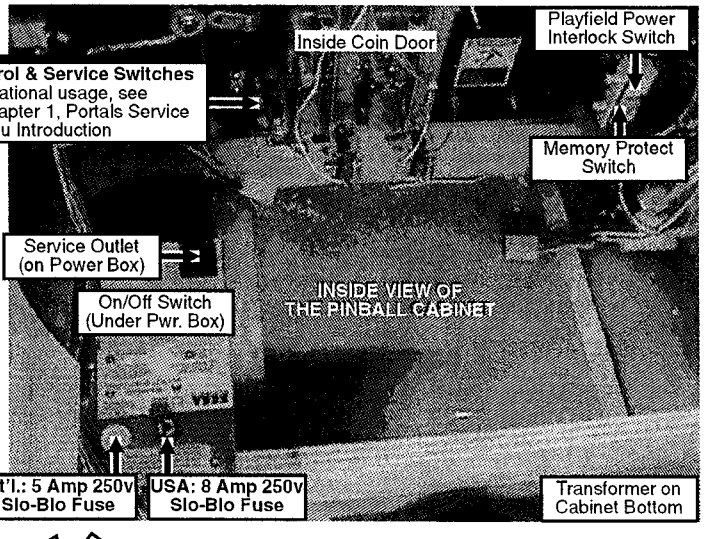




Display Controller Board
(Mounted behind the Dot Matrix Display)

The **Display Controller Board** (holds the Display ROM Loc: ROM0) is **positioned behind** the 128 X 32 **Dot Matrix Display Board** *(Neither board contain Fuses.)*

Volume Control & Service Switches
For operational usage, see Section 3, Chapter 1, Portals Service Menu Introduction



DR.

Find-It-In-Front:
Dr. Pinball

STRIKER XTREME

▼ FIND-IT-IN-FRONT: DR. PINBALL SECTION EXPLAINED ▼

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

▼ HOW IT WORKS ▼

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

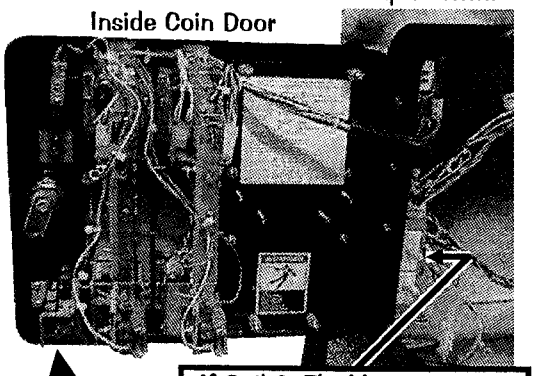
Step 1: Push down the **Black "BEGIN TEST" Button**. Looking at the Video Display you will momentarily see the introductory screen followed by the **MAIN MENU**.

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

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

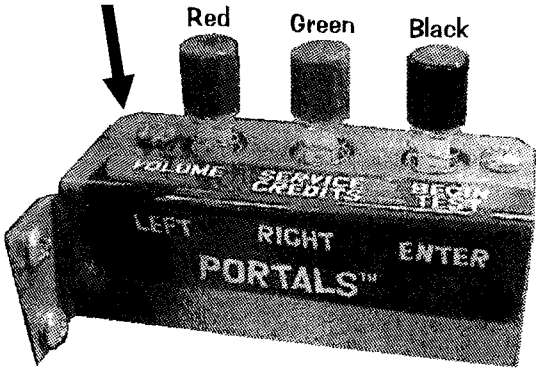
While in the **Portals™ Service Menu**, the **Start Button** can be used in lieu of the **Black Button**; the **Left** & **Right Flipper Buttons** can be used in lieu of the **Red** & **Green Buttons**. However, in *Switch* or *Active Switch Tests* ***only*** the **Red** & **Green Buttons** can be used.

Inside Coin Door

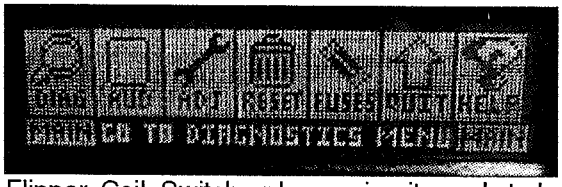


If Coil & Flashlamp Testing, the Playfield Power Interlock Switch must be pulled out.

Portals™ Service Switch Set



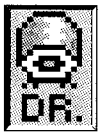
In our **Portals™ Service Menu**, selecting the "DR." *Icon* will bring the operator/technician into Dr. Pinball (Flow Chart Menus), the "on-screen" diagnostic aide. This is a feature that will allow you to utilize the power of the micro-processor assisting in troubleshooting a problem with the machine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



While in the **MAIN MENU**, select the "DIAG" *Icon*, then select the Cross "DR." *Icon* (the last *Icon* before the "PREV" *Icon*). This will bring you (the operator / technician) into **DR. PINBALL** (Flow Chart Menus) which offers you a choice of three (3) Sub-Menus: Coil "DR.," Switch "DR." & Lamp "DR." *Icons*. Selecting a particular sub-menu will give you a choice of which specific Flipper, Coil, Switch or Lamp circuit needs to be diagnosed. The display will now ask 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* asks a question or requests a procedure, respond by selecting the appropriate *Mini-Icon*, and continue.

From the Main Menu in Portals™ GO TO DIAGNOSTICS MENU →

From the Diagnostics Menu GO TO DR. PINBALL →



From the Dr. Pinball Menu

GO TO COIL, SWITCH OR LAMP FLOW CHARTS

The following are the *Mini-Icons* with explanations for the **Dr. Pinball Sub-Menus**:

Select a Coil, Lamp, Switch or Flipper to diagnose with the "-" or "+" *Icon*; select the "RUN" *Icon* to activate the choice. The "PREV" *Icon* goes back to previous question. The "QUIT" *Icon* exits Portals completely.

Seen when a question is being asked on the Display. Select the "YES" *Icon* or "NO" *Icon* to answer the question given. The "END" *Icon* lets you select a new item to test.

Seen when diagnosis is given. Select any *Icon* for your next step. The "?" *Icon* gives Help.

In Coil Flow Chart Menu, select the "PULSE" *Icon* to pulse the coil selected.

ENSURE 4 PINBALLS ARE INSTALLED FOR PROPER OPERATION OF:




STRIKER XTREME

▼ DIAGNOSTIC AIDS ▼

The *display reads* "OPERATOR ALERT..."

— A message displayed during Game Mode or Power-Up to alert the operator of a problem.

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.). If this assembly has a closed switch indicating a ball is stuck or the switch is *stuck closed*, the **CPU/Sound Board** will activate the coil ten times. If the switch remains closed, the game will display a message indicating there is a problem (e.g. "**OPERATOR ALERT AUTO LAUNCH NOT WORKING**"). This not only warns the operator of a problem immediately, but indicates exactly where the operator should look to resolve it.

The *display flashes* "OPEN THE COIN DOOR"

— This indicates that CMOS RAM memory (CPU Loc. U212) has been corrupted.

This is caused by either failure in memory (e.g. batteries are dead or faulty **RAM**) or upon installation of updated version of code. Opening the Coin Door will initiate a Factory Restore, by opening the Memory Protect Switch. Check battery voltage at **VBATT Test Point** on the **CPU/Sound Board**.

▼ CPU DIP SWITCH SETTINGS ▼

(Loc. SW300 CPU/Sound Board)

CUSTOM FACTORY ADJUSTMENTS BY COUNTRY*

*All countries not noted use the "USA Setting"

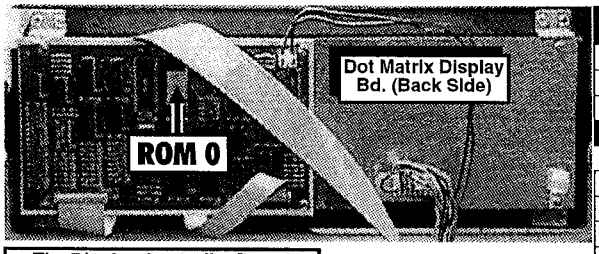
CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
USA *	ON								
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
EUROLAND	ON	▲	▲	▲	▲				
	OFF					▼	▼	▼	▼
AUSTRIA	ON	▲							
	OFF		▼	▼	▼	▼	▼	▼	▼
(BELGIUM)	ON		▲						
	OFF	▼		▼	▼	▼	▼	▼	▼
(BRAZIL)	ON	▲		▲	▲				
	OFF		▼			▼	▼	▼	▼
CANADA	ON	▲	▲						
	OFF			▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
FRANCE	ON		▲	▲					
	OFF	▼			▼	▼	▼	▼	▼
GERMANY	ON	▲	▲	▲					
	OFF				▼	▼	▼	▼	▼
ITALY	ON				▲				
	OFF	▼	▼	▼		▼	▼	▼	▼
JAPAN	ON	▲			▲				
	OFF		▼	▼		▼	▼	▼	▼
NETHERLANDS (HOLLAND / DUTCH)	ON			▲					
	OFF	▼	▼		▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
NORWAY	ON		▲		▲				
	OFF	▼		▼		▼	▼	▼	▼
SWEDEN	ON	▲	▲		▲				
	OFF			▼		▼	▼	▼	▼
SWITZERLAND	ON			▲	▲				
	OFF	▼	▼			▼	▼	▼	▼
UK	ON	▲		▲					
	OFF		▼		▼	▼	▼	▼	▼
UK FOR NEW 50p, 2£ COIN MECH	ON		▲	▲	▲				
	OFF	▼				▼	▼	▼	▼

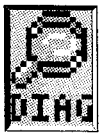
▼ ROM SUMMARY TABLE ▼



The Display Controller Board (holds the Display ROM Loc: ROM0) is positioned behind the 128 X 32 Dot Matrix Display Board.

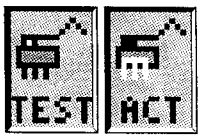
I.C. NAME	TYPE	BD. NAME	LOC.	PART Nº
Game ROM	1MB	CPU / Sound Bd.	U210	965-0326-68
Sound EPROM	512K	CPU / Sound Bd.	U7	965-0327-68
Display EPROM	4MB	Display Cntlr. Bd.	ROM 0	965-0328-68
Display EPROM	N/C	Display Cntlr. Bd.	ROM 1	N/A
Voice ROM 1	8MB	CPU / Sound Bd.	U17	965-0329-68
Voice ROM 2	8MB	CPU / Sound Bd.	U21	965-0330-68
Voice ROM 3	8MB	CPU / Sound Bd.	U36	965-0331-68
Voice ROM 4	8MB	CPU / Sound Bd.	U37	965-0332-68

For Game, Sound & Voice ROM Locations see DR. ❶.

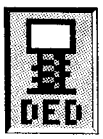


From the Main Menu in Portals™ GO TO DIAGNOSTICS MENU

From the Diagnostics Menu GO TO SWITCH MENU



From the Switch Menu GO TO SWITCH OR ACTIVE SWITCH TEST



From the Switch Menu GO TO DEDICATED SWITCH TEST

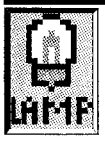
SWITCH MATRIX GRID & DEDICATED SWITCHES

Diode On Terminal Strip:

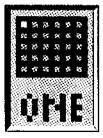
Column (Drive) / Row (Return)	1: Q1 GRN-BRN CN5-P1	2: Q2 GRN-RED CN5-P3	3: Q3 GRN-ORG CN5-P4	4: Q4 GRN-YEL CN5-P5	5: Q5 GRN-BLK CN5-P6	6: Q6 GRN-BLU CN5-P7	7: Q7 GRN-VIO CN5-P8	8: Q8 GRN-GRY CN5-P9
1: U400 WHT-BRN CN7-P9	LEFT BUTTON (UK ONLY) on Cabinet side 1	SPINNER (LT ORBIT) On Assembly 9	4-BANK D/T #1 (LT) On Assembly DOTS 17	GOALIE OPTO On Assembly 25	LEFT TOP LANE Under P/F 33	GOALIE MOTOR (LT) On Assembly 41	LEFT TURBO BUMPER On Assembly 49	LEFT OUTLANE Under P/F 57
2: U400 WHT-RED CN7-P8	4TH COIN SLOT On Coin Door 2	NOT USED 10	4-BANK D/T #2 On Assembly DOTS 18	BALL S-U (POPS) On Assembly 28	MID TOP LANE Under P/F 34	GOALIE MOTOR (RT) On Assembly 42	RIGHT TURBO BUMPER On Assembly 50	LEFT RETURN LANE Under P/F 58
3: U400 WHT-ORG CN7-P7	6TH COIN SLOT On Coin Door 3	4-BALL TROUGH #1 (LEFT) On Assembly 11	4-BANK D/T #3 On Assembly DOTS 19	BALL 2-BANK S-U TOP On Assembly 27	RIGHT TOP LANE Under P/F 35	GOALIE MAGNET On Assembly 43	BOTTOM TURBO BUMPER On Assembly 51	LEFT SLINGSHOT On Assembly 59
4: U400 WHT-YEL CN7-P6	RIGHT COIN SLOT On Coin Door 4	4-BALL TROUGH #2 On Assembly 12	4-BANK D/T #4 (RT) On Assembly DOTS 20	BALL 2-BANK S-U BOT On Assembly 28	NOT USED 36	GOALIE UNDER-TROUGH On Assembly 44	KICKER TARGET On Assembly DOTS 52	RIGHT OUTLANE Under P/F 60
5: U401 WHT-GRN CN7-P5	CENTER COIN SLOT / DBA On Coin Door 5	4-BALL TROUGH #3 On Assembly 13	4-BALL LOCK #1 (TOP) On Assembly DOUBLE 21	BALL S-U (RT RAMP) On Assembly 29	NOT USED 37	LEFT VUK On Assembly DOTS 45	NOT USED 53	RIGHT OUTER RETURN Under P/F 61
6: U401 WHT-BLU CN7-P3	LEFT COIN SLOT On Coin Door 6	4-BALL TROUGH VUK OPTO On Assembly 14	4-BALL LOCK #2 On Assembly DOUBLE 22	NOT USED 30	RIGHT RAMP ENTER On Assembly 38	TOP SUPER VUK On Assembly DOTS 46	START BUTTON Cabinet Front 54	RIGHT SLINGSHOT On Assembly 62
7: U401 WHT-VIO CN7-P2	5TH COIN SLOT On Coin Door 7	4-BALL STACKING OPTO On Assembly 15	4-BALL LOCK #3 On Assembly DOUBLE 23	SKILL SHOT Under P/F 31	RIGHT RAMP EXIT On Assembly 39	GOALIE MOTOR (CTR) On Assembly 47	SLAM TILT On Coin Door 55	NOT USED 63
8: U401 WHT-GRY CN7-P1	RIGHT BUTTON (UK ONLY) on Cabinet side 8	SHOOT-ER LANE Under P/F DOTS 16	4-BALL LOCK #4 (BOT) On Assembly DOUBLE 24	RIGHT ORBIT Under P/F 32	NOT USED 40	RIGHT INNER RETURN Under P/F 48	PLUMB BOB TILT Inside Cabinet 56	NOT USED 64

IC U206 INPUTS / GND	Ground BLK CN6-P1, -P11
1: U206 GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON in Cabinet side D8-1
2: U206 GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke) in Cabinet side D8-2
3: U206 GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON in Cabinet side D8-3
4: U206 GRY-YEL CN6-P6	#4 RIGHT FLIPPER E.O.S. (End-of-Stroke) in Cabinet side D8-4
5: U206 GRY-GRN CN6-P7	#5 UPPER FLIPPER BUTTON in Cabinet side D8-5
6: U206 GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (In Test: LEFT) on Coin Door D8-6
7: U206 GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) on Coin Door D8-7
8: U206 GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) on Coin Door D8-8

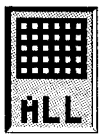
Diode On Diode Board:



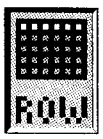
From the Diagnostics Menu GO TO LAMP MENU



From the Lamp Menu GO TO SINGLE LAMP TEST



From the Lamp Menu GO TO TEST ALL LAMPS



From the Lamp Menu GO TO ROW OR COLUMN TEST

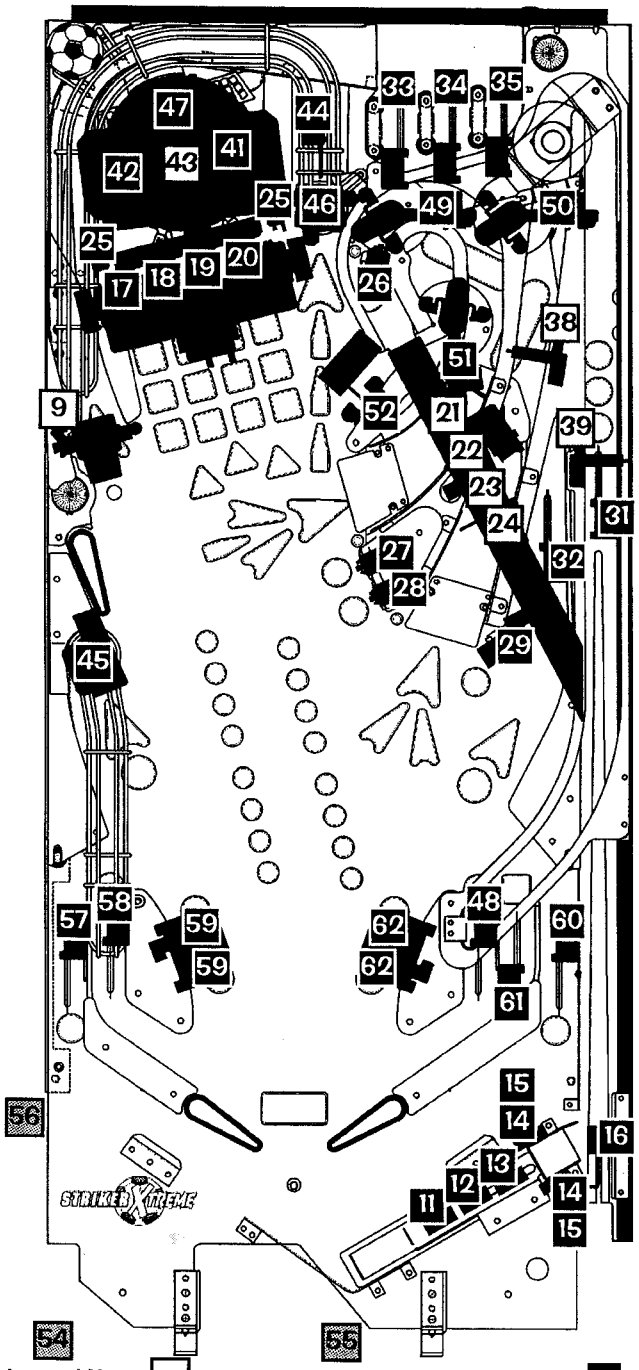
LAMP MATRIX GRID

Diode On Terminal Strip:

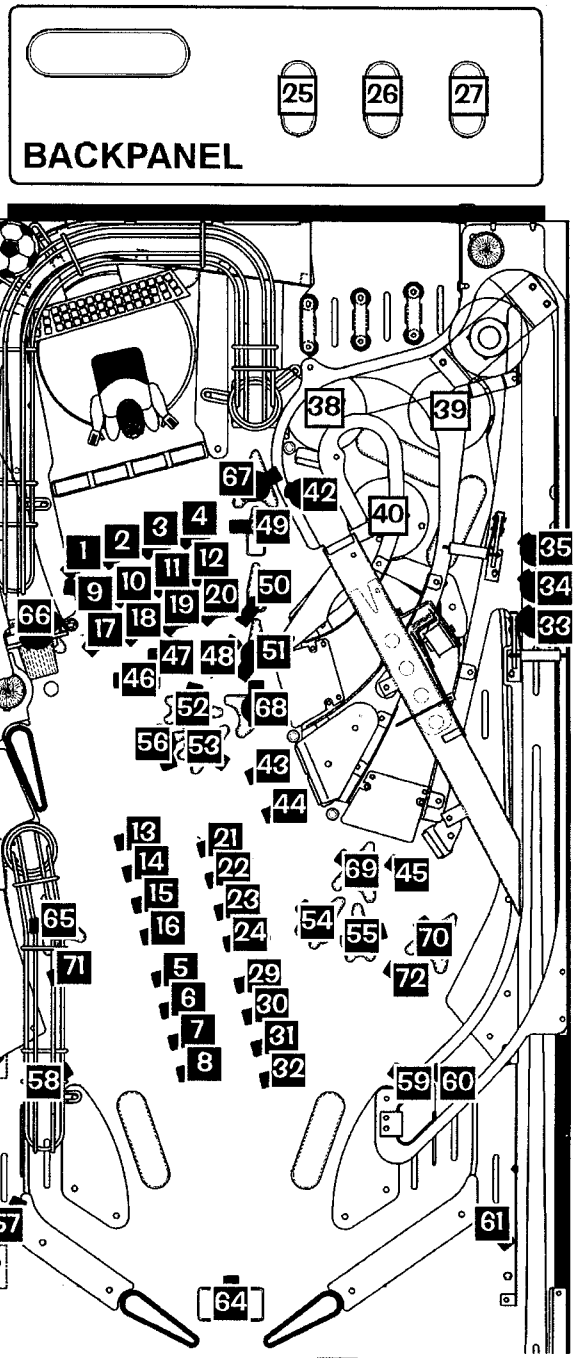
Column (18v) / Row (GND)	1: U17 YEL-BRN J13-P9	2: U16 YEL-RED J13-P8	3: U15 YEL-ORG J13-P7	4: U14 YEL-BLK J13-P6	5: U13 YEL-GRN J13-P5	6: U12 YEL-BLU J13-P4	7: U11 YEL-VIO J13-P3	8: U10 YEL-GRY J13-P1
1: Q33 RED-BRN J12-P1	GOALIE TOP #1 (LT) #555 Bulb 1	GOALIE TOP #2 #555 Bulb 2	GOALIE TOP #3 #555 Bulb 3	GOALIE TOP #4 (RT) #555 Bulb 4	ENGLAND #555 Bulb 5	BRAZIL #555 Bulb 6	SWITZER-LAND #555 Bulb 7	FINLAND #555 Bulb 8
2: Q34 RED-BLK J12-P2	GOALIE MID #1 (LT) #555 Bulb 9	GOALIE MID #2 #555 Bulb 10	GOALIE MID #3 #555 Bulb 11	GOALIE MID #4 (RT) #555 Bulb 12	FRANCE #555 Bulb 13	USA #555 Bulb 14	SPAIN #555 Bulb 15	AUSTRALIA #555 Bulb 16
3: Q35 RED-ORG J12-P3	GOALIE BOT #1 (LT) #555 Bulb 17	GOALIE BOT #2 #555 Bulb 18	GOALIE BOT #3 #555 Bulb 19	GOALIE BOT #4 (RT) #555 Bulb 20	GERMANY #555 Bulb 21	BELGIUM #555 Bulb 22	SWEDEN #555 Bulb 23	HOLLAND #555 Bulb 24
4: Q36 RED-YEL J12-P4	(C)UP (BACK PANEL) #44 Bulb 25	C(U)P (BACK PANEL) #44 Bulb 26	CU(P) (BACK PANEL) #44 Bulb 27	NOT USED 28	ITALY #555 Bulb 29	CANADA #555 Bulb 30	AUSTRIA #555 Bulb 31	JAPAN #555 Bulb 32
5: Q37 RED-ORN J12-P5	SKILL SHOT (1) #555 Bulb 33	SKILL SHOT (2) #555 Bulb 34	SKILL SHOT (3) #555 Bulb 35	NOT USED 36	NOT USED 37	LEFT TUR-BO BUMPER DOTS #555 Bulb 38	RIGHT TUR-BO BUMPER DOTS #555 Bulb 39	BOT TUR-BO BUMPER DOTS #555 Bulb 40
6: Q38 RED-BLU J12-P6	NOT USED 41	BALL S-U (POPS) #555 Bulb 42	BALL 2-BANK S-U TOP #555 Bulb 43	BALL 2-BANK S-U BOT #555 Bulb 44	BALL S-U (RT RAMP) #555 Bulb 45	BIG POINTS #555 Bulb 46	BEAT COUNTRY #555 Bulb 47	XTREME #555 Bulb 48
7: Q39 RED-VIO J12-P8	EXTRA BALL #44 Bulb 49	VENDOR #44 Bulb 50	HALFTIME #555 Bulb 51	LOCK (SIDE RAMP) #555 Bulb 52	HURRY-UP (SIDE RAMP) #555 Bulb 53	LOCK (RT RAMP) #555 Bulb 54	HURRY-UP (RT RAMP) #555 Bulb 55	PENALTY KICK #555 Bulb 56
8: Q40 RED-GRY J12-P9	LEFT OUTLANE #555 Bulb 57	LEFT RE-TURN LANE #555 Bulb 58	RIGHT INNER RETURN #555 Bulb 59	RIGHT OUTER RETURN #555 Bulb 60	RIGHT OUTLANE #555 Bulb 61	NOT USED 62	NOT USED 63	SHOOT AGAIN #555 Bulb 64
9: Q41 RED-WHT J12-P10	LEFT VUK ARROW #555 Bulb 65	LEFT ORBIT ARROW #555 Bulb 66	TOP VUK ARROW #555 Bulb 67	RAMP LEFT ENTER ARROW #555 Bulb 68	RAMP RIGHT ENTER ARROW #555 Bulb 69	RIGHT OR-BIT ARROW #555 Bulb 70	SPOT SHOOT OUT #555 Bulb 71	ADVANCE POPS #555 Bulb 72
10: Q42 NOT USED RED J12-P11	NOT USED 73	NOT USED 74	NOT USED 75	NOT USED 76	NOT USED 77	NOT USED 78	NOT USED 79	NOT USED 80

Find-It-In-Front: Dr. Pinball

SWITCH MATRIX GRID LOCATIONS

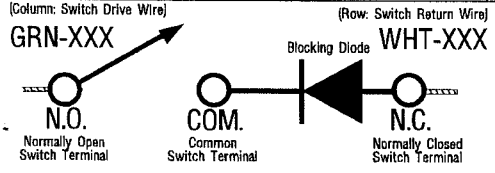


LAMP MATRIX GRID LOCATIONS

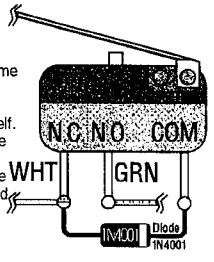


Legend Note: ☐ = Switches/Lamps mounted above P/F. ■ = Switches/Lamps mounted below the P/F. ▩ = ...mounted on Cabinet.

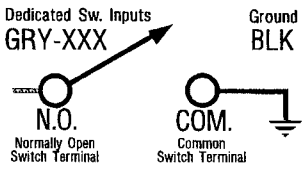
TYPICAL SWITCH SCHEMATIC



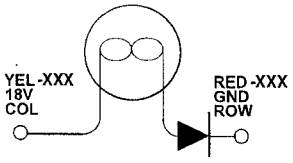
Note:
All Switches require diodes. Some diodes are located on Terminal Strips OR Diode Boards (under playfield) & not on the switch itself.
Diode **O**n **T**erminal **S**trip
Diode **O**n **D**iode **B**oard



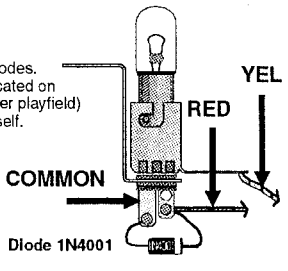
DEDICATED SWITCH SCHEMATIC



TYPICAL LAMP SCHEMATIC



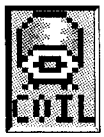
Note:
All Lamps require diodes. Some diodes are located on Terminal Strips (under playfield) & not on the lamp itself.
Diode **O**n **T**erminal **S**trip



Find-It-In-Front:
Dr. Pinball

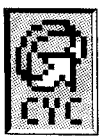
STRIKER XTREME

From the Main Menu in Portals™ GO TO DIAGNOSTICS MENU →



From the Diagnostics Menu GO TO COIL MENU →

From the Coil Menu GO TO COIL TEST →



From the Coil Menu GO TO CYCLING COILS

COILS DETAILED CHART TABLE

	High Current Coils Group 1	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	I/O Pwr. Drvr.	BRN-BLK	J8-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#2	AUTO LAUNCH	Q2	I/O Pwr. Drvr.	BRN-RED	J8-P3	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00T
#3	LEFT VUK	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#4	TOP SUPER VUK	Q4	I/O Pwr. Drvr.	BRN-YEL	J8-P5	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#5	KICKER TARGET	Q5	I/O Pwr. Drvr.	BRN-GRN	J8-P6	YEL-VIO	J10-P4/5	50v DC	23-700 090-5022-00T
#6	4-BANK DROP TARGET RESET	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	YEL-VIO	J10-P4/5	50v DC	23-1100 090-5030-00T
#7	4-BANK #1 (TOP) DOWN	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	YEL-VIO	J10-P4/5	50v DC	33-1590 515-6916-00
#8	BALL LOCK	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	YEL-VIO	J10-P4/5	50v DC	32-1800 090-5031-00

	High Current Coils Group 2	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn
#9	LEFT TURBO BUMPER	Q9	I/O Pwr. Drvr.	BLU-BRN	J9-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#10	RIGHT TURBO BUMPER	Q10	I/O Pwr. Drvr.	BLU-RED	J9-P2	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#11	BOTTOM TURBO BUMPER	Q11	I/O Pwr. Drvr.	BLU-ORG	J9-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#12	GOALIE MAGNET	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#13	RAMP MAGNET	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#14	UPPER FLIPPER (50v RED/YEL)	Q14	I/O Pwr. Drvr.	BLU-BLK	J9-P7	RED-YEL GRY-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T
#15	LEFT FLIPPER (50v RED/YEL)	Q15	I/O Pwr. Drvr.	ORG-GRY	J9-P8	RED-YEL GRY-YEL	J10-P1/2	50v DC	22-1080 090-5032-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16	I/O Pwr. Drvr.	ORG-VIO	J9-P9	RED-YEL BLU-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T

	Low Current Coils Group 1	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn or Meter #
#17	LEFT SLINGSHOT	Q17	I/O Pwr. Drvr.	VIO-BRN	J7-P2	BRN	J7-P1	20v DC	23-800 090-5001-00T
#18	RIGHT SLINGSHOT	Q18	I/O Pwr. Drvr.	VIO-RED	J7-P3	BRN	J7-P1	20v DC	23-800 090-5001-00T
#19	BALL DEFLECTOR	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	BRN	J7-P1	20v DC	26-1200 090-5044-00T
#20	FLASH: STADIUM X4	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#21	4-BANK #2 DOWN	Q21	I/O Pwr. Drvr.	VIO-GRN	J7-P7	BRN	J7-P1	20v DC	33-1590 515-6916-00
#22	4-BANK #3 DOWN	Q22	I/O Pwr. Drvr.	VIO-BLU	J7-P8	BRN	J7-P1	20v DC	33-1590 515-6916-00
#23	4-BANK #4 (BOT) DOWN	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	BRN	J7-P1	20v DC	33-1590 515-6916-00
#24	OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v DC	Meter 5v 091-5000-00

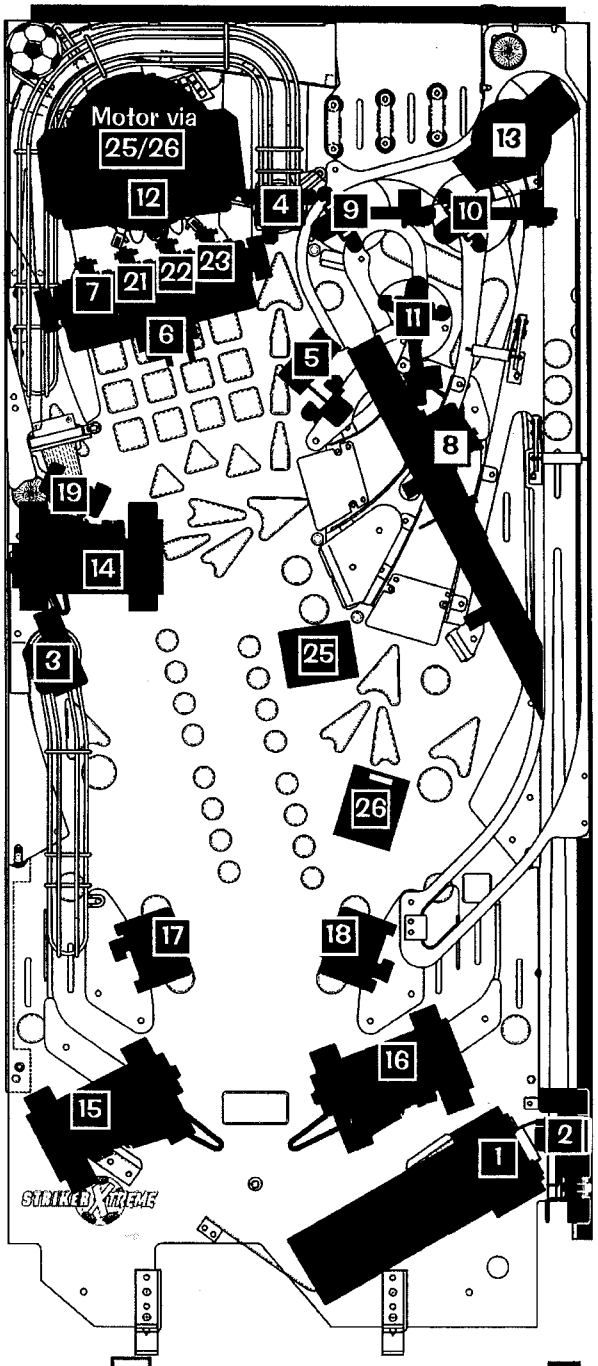
D iode O n T erminal S trip (if noted)

	Low Current Coils Group 2	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Bulb Type
#25	GOALIE MTR DRV RELAY BD	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	YEL-VIO YEL-BLK	J10-P4/5	50v DC	Relay Bd. 520-5010-00
#26	GOALIE BI-DIRECTIONAL MTR RELAY BD	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	YEL-VIO YEL-BLK	J10-P4/5	50v DC	B-D Relay 520-5066-00
#27	FLASH: UPPER FLIPPER X1	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#28	FLASH: SPINNER X1	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#29	FLASH: RAMP X1	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#30	FLASH: BACK PANEL X4	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#31	FLASH: POPS X4	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#32	FLASH: SLINGSHOTS X4	Q32	I/O Pwr. Drvr.	BLK-GRY	J6-P8	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89

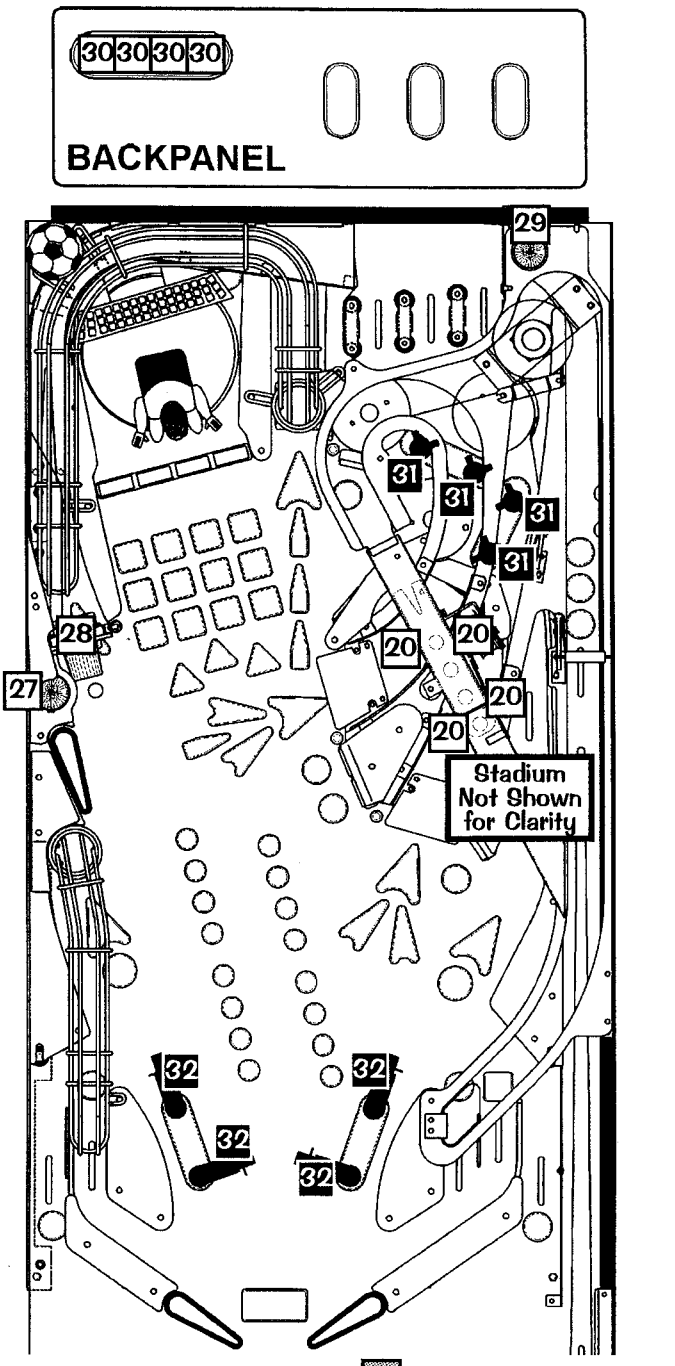
Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: #20 & #27-#32)

	Auxilliary (OPTIONAL UK ONLY)	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn
	AUX 1: LEFT UP/DOWN POST	Q1	Sol. Expander (Aux. Board)	WHT	CN2-P5	BRN	J7-P1	20v DC	28-1050 090-5046-00T
	AUX 2: CENTER UP/DOWN POST	Q2	Sol. Expander (Aux. Board)	RED	CN2-P4	BRN	J7-P1	20v DC	23-1100 090-5030-00T
	AUX 3: RIGHT UP/DOWN POST	Q3	Sol. Expander (Aux. Board)	ORG	CN2-P3	BRN	J7-P1	20v DC	28-1050 090-5046-00T

COIL LOCATIONS

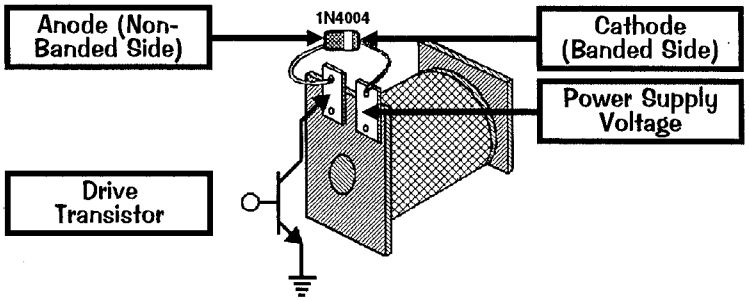


FLASH LAMP LOCATIONS



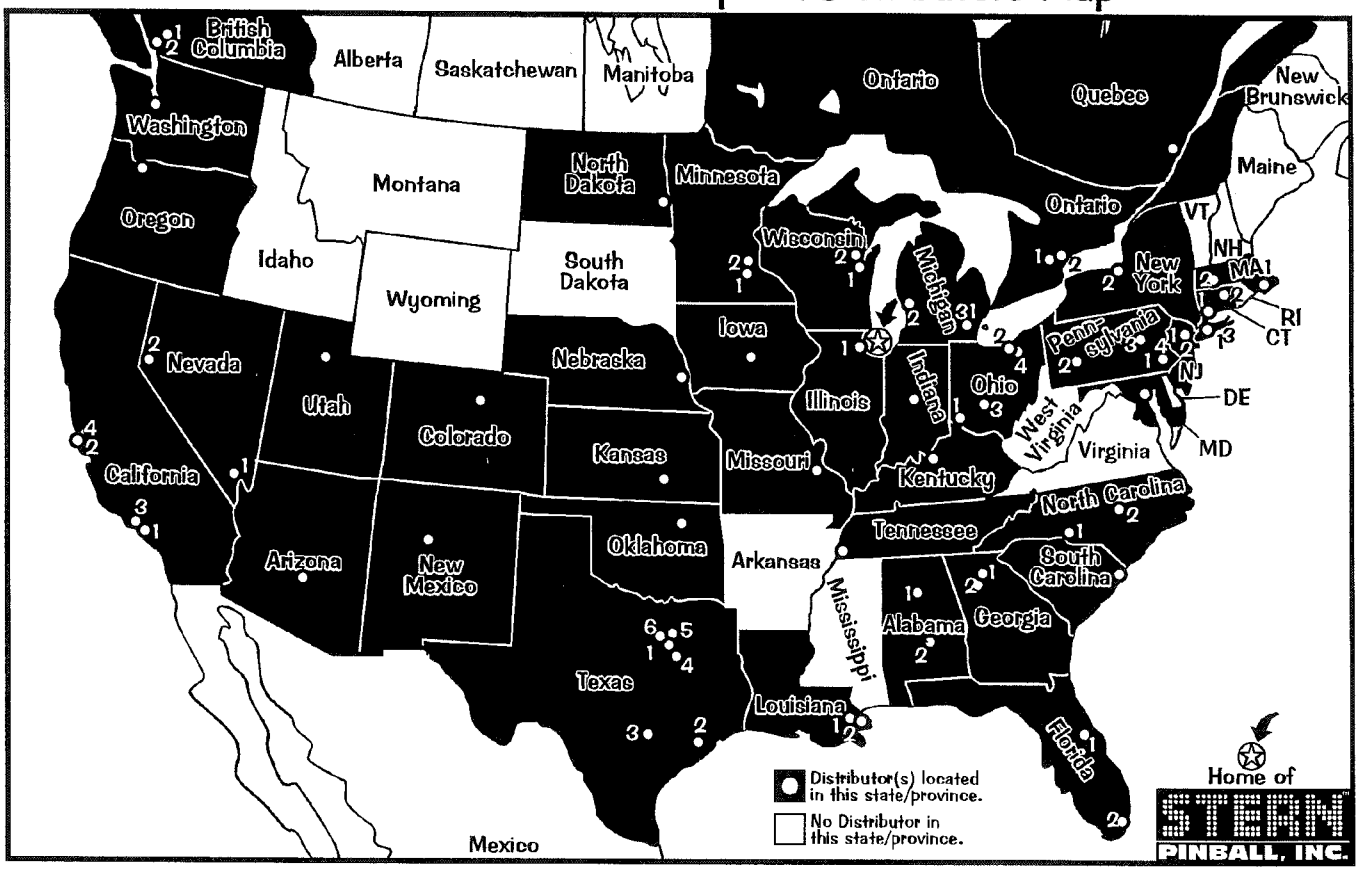
Legend Note: = Coils/Flashers mounted above P/F. = Coils/Flashers mounted below the P/F. = ...mounted in/on Cabinet.

TYPICAL COIL WIRING

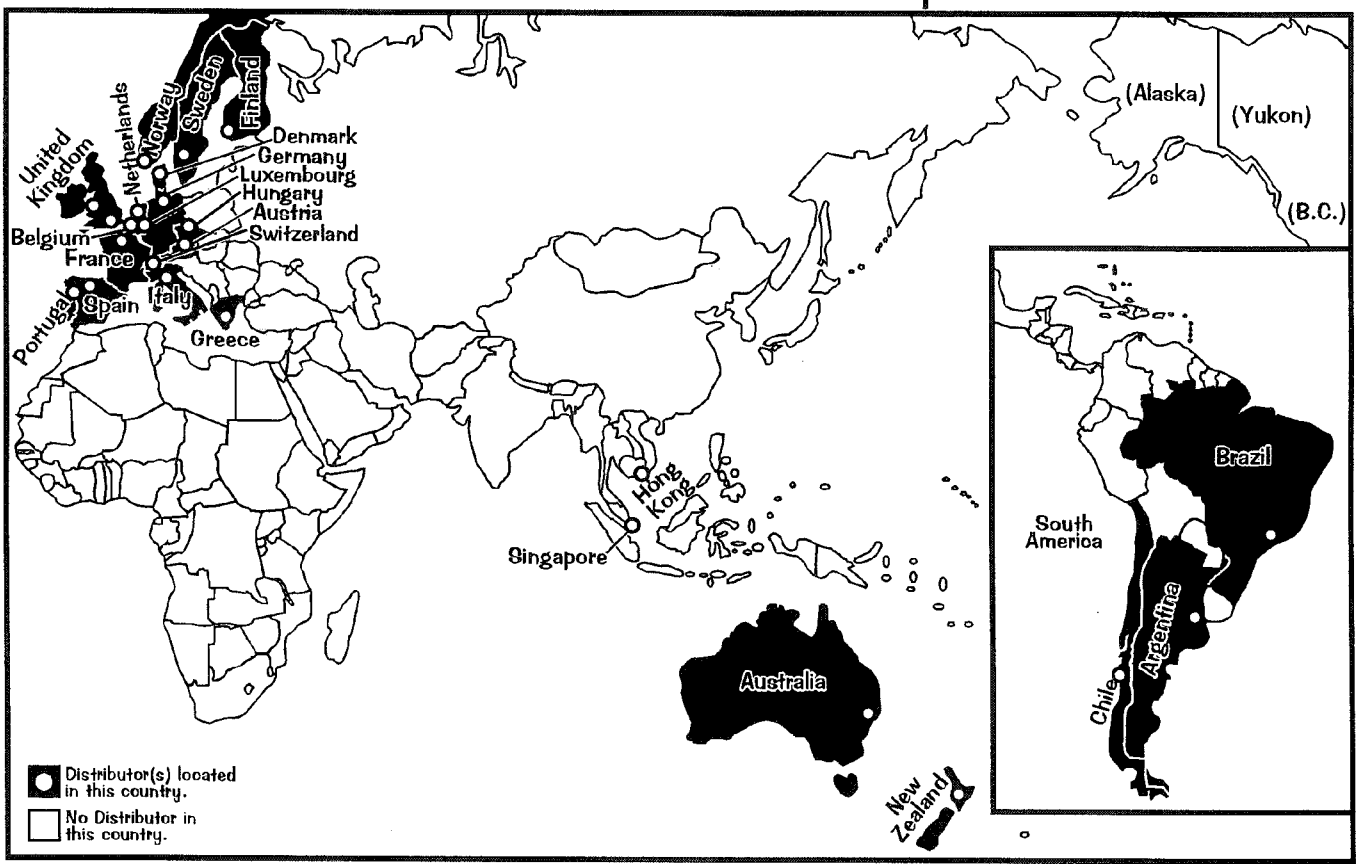


Note:
All Coils require diodes. Some diodes are located on Terminal Strips (under playfield) & not on the coil itself.
D iode
O n
T erminal
S trip

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 **1-708-345-7700**.

STERN PINBALL, INC. PARTS SALES & TECHNICAL SUPPORT

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

Domestic Pinball & Redemption Distributors Directory

ALABAMA

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

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

ARIZONA

Betson West
Phoenix
1-602-233-0190

Mountain Coin
Phoenix
1-602-269-7596

BRITISH COLUMBIA

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

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

CALIFORNIA

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

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

COLORADO

Mountain Coin
Denver
1-303-427-2133

Warehouse of Games
Denver
1-303-893-4300

CONNECTICUT

Betson Enterprises
Milford (1)
1-203-878-6966

T & M Distributing
Willimantic (2)
1-860-456-4231

FLORIDA

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

Florida (cont.)

Brady Distributing
Miami (2)
1-305-621-1415
Orlando (1)
1-407-872-1666

GEORGIA

Game Exchange, S.E.
Roswell (1)
1-770-594-7215

Greater Southern Dist.
Atlanta (2)
1-404-352-3040

ILLINOIS

Atlas Distributing
Elk Grove Village
1-847-952-7500

IOWA

Greater America Dist.
Des Moines
1-515-244-2828

Moss Distributing
Des Moines
1-515-266-6422

INDIANA

Atlas Distributing
Indianapolis
1-317-786-6892

Cleveland Coin
Indianapolis
1-317-895-4270

Shaffer Distributing
Indianapolis
1-317-899-2530

KANSAS

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

KENTUCKY

Atlas Distributing
Louisville
1-502-966-5266

LOUISIANA

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

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

MARYLAND

State Sales & Service
Baltimore
1-410-646-4100

Weiner Distributing
Baltimore
1-410-525-2600

MASSACHUSETTS

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

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

MICHIGAN

Atlas Distributing
Redford (1)
1-313-794-4880
Wyoming (2)
1-616-241-1472

Cleveland Coin
Livonia (3)
1-734-432-1040

MINNESOTA

Hanson Distributing
Bloomington (1)
1-612-884-6604

Lieberman Music
Minneapolis (2)
1-612-887-5299

MISSOURI

Shaffer Distributing
St. Louis
1-314-645-3393

NEBRASKA

Central Dist.
Omaha
1-402-493-5600

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

Mid-City Distributing
Omaha
1-402-341-5300

NEVADA

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

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

NEW JERSEY

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

State Sales & Service
Carteret (2)
1-732-750-2700

NEW MEXICO

Mountain Coin
Albuquerque
1-505-345-7706

NEW YORK

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

Deith Distributing
Roslyn Heights (3)
1-516-621-1234

T & M Distributing
Syracuse (2)
1-315-432-1932

NORTH CAROLINA

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

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

NORTH DAKOTA

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

OHIO

Atlas Distributing
Cincinnati (1)
1-513-851-4100

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

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

OKLAHOMA

Galaxy Distributing
Tulsa
1-918-835-1166

ONTARIO

New Way Sales
Rexdale (1)
1-416-674-8000

Starburst Coin Mach.
Toronto (2)
1-416-251-2122

OREGON

Dunis Distributing
Portland
1-503-234-5491

PENNSYLVANIA

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

Cleveland Coin
Pittsburgh (2)
1-412-323-8400

Green Coin
Pittsburgh (2)
1-412-881-8804

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

State Sales & Service
Bensalem (4)
1-215-638-1122

QUEBEC

Laniel Automatic Mach.
Montreal
1-514-731-8571

SOUTH CAROLINA

Green Coin
Mrytle Beach
1-843-626-1900

TENNESSEE

Brady Distributing
Memphis
1-901-345-7811

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

TEXAS

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

H.A. Franz, & Co.
Houston (2)
1-713-523-7366

Texas (cont.)

H.A. Franz, & Co.
San Antonio (3)
1-210-226-6322

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

Nickels & Dimes
Carrollton (5)
1-972-492-3262

Southgate Amusement
Houston (2)
1-713-691-7335
San Antonio (3)
1-210-225-3844

Southgate/Moss Dist.
Irving (6)
1-972-721-4600

UTAH

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

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

WASHINGTON

Music Vend
Seattle
1-206-682-5700

WISCONSIN

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

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.

International Distributors Directory

ARGENTINA

Universe Electronics
Buenos Aires
011-54-1-865-4730

Electroport (Florencia)
Mar Del Plata
011-54-223-495-5532

AUSTRALIA

A. Hankin & Co.
New Castle
011-61-249-298-4857

Amusement Mach. Dist.
Matraville
011-61-29-316-6000

AUSTRIA

Nova Games
See Germany

Parts & Service Only
R. Rupp
011-43-34-528-6105
Tab
011-43-72-297-8040

BELGIUM

Nova Games
See Germany

Parts & Service Only
National Music Co.
011-32-2-414-4596

Belgium (continued)

Parts & Service Only
Splin S.A.
011-32-4-362-7677

BRAZIL

Unimax Trading
São Paulo
011-55-11-533-5615

CHILE

Cuinsa
Santiago
011-56-2-641-8520

DENMARK

Nova Games
See Germany

FINLAND

Nova Games
See Germany

Parts & Service Only
Pelika Ray-Oy
011-358-94-370-2925

FRANCE

Avranches Automatic
Ducey
011-33-23-389-6162

Kunick Paris
Aubervilliers Cedex
011-33-14-811-3131

France (continued)

Kunick Group
Devecey
011-33-38-156-8620

SFA
Paris
011-33-15-326-8080

GERMANY

Nova Games
Hamburg
011-49-4-053-8060

Parts & Service Only
Bally Wulff (Berlin)
011-49-3-062-0020
Bally Wulff (Hannover)
011-49-511-358-5368

GREECE

Nova Games
See Germany

Parts & Service Only
Elcoin
011-30-1-492-9357
Greece Coin
011-30-1-577-7012

HONG KONG

Bondeal Limited
Kowloon
011-85-22-487-9089

HUNGARY

Nova Games
See Germany

Parts & Service Only
Flipper Flex
011-36-1-132-6512

ITALY (RSM)

TechnoPlay S.A.
San Marino
011-37-0-890-0361

LUXEMBOURG

Nova Games
See Germany

NETHERLANDS

Nova Games
See Germany

Parts & Service Only
AWA
011-31-2-069-4260
Errél Industries
011-31-73-645-6111

NEW ZEALAND

Amco Machine Supplies
Auckland
011-64-9-846-7606

NORWAY

Nova Games
See Germany

Norway (continued)

Parts & Service Only
Vendcomatic
011-47-2-291-8383

PORTUGAL

Nova Games
See Germany

Parts & Service Only
Jacinto & Martins, Lda.
011-35-121-496-3744

SINGAPORE

Parts & Service Only
Valibel Technologies
011-65-748-8404

SPAIN

Nova Games
See Germany

Parts & Service Only
AmuseTEC, S.L.
011-34-93-739-6827
Sente, S.A.
011-34-91-541-7112

SWEDEN

Nova Games
See Germany

Parts & Service Only
Truemax AB
011-46-4-015-3635

SWITZERLAND

Nova Games
See Germany

Parts & Service Only
Novomat, A.G.
011-41-62-388-8961

UNITED KINGDOM

Deith Leisure
Surrey, England
011-44-181-336-1222

Electrocoin
London, England
011-44-208-965-2055

Electrocoin Aftersales
Cardiff, S. Wales
011-44-122-234-3888

Note: Prefix of "011" is USA's Dialing Code.

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

BEFORE TRANSPORTING

TRANSPORTATION

To reduce the possibility of damage, observe **ALL** precautions whenever transporting the game. ***Read & follow*** *Section 1, Chapter 1,* **Game Assembly Procedures**, & **How to Secure the Backbox for Transporting**.

Remove the legs & secure the game within the transporting vehicle.

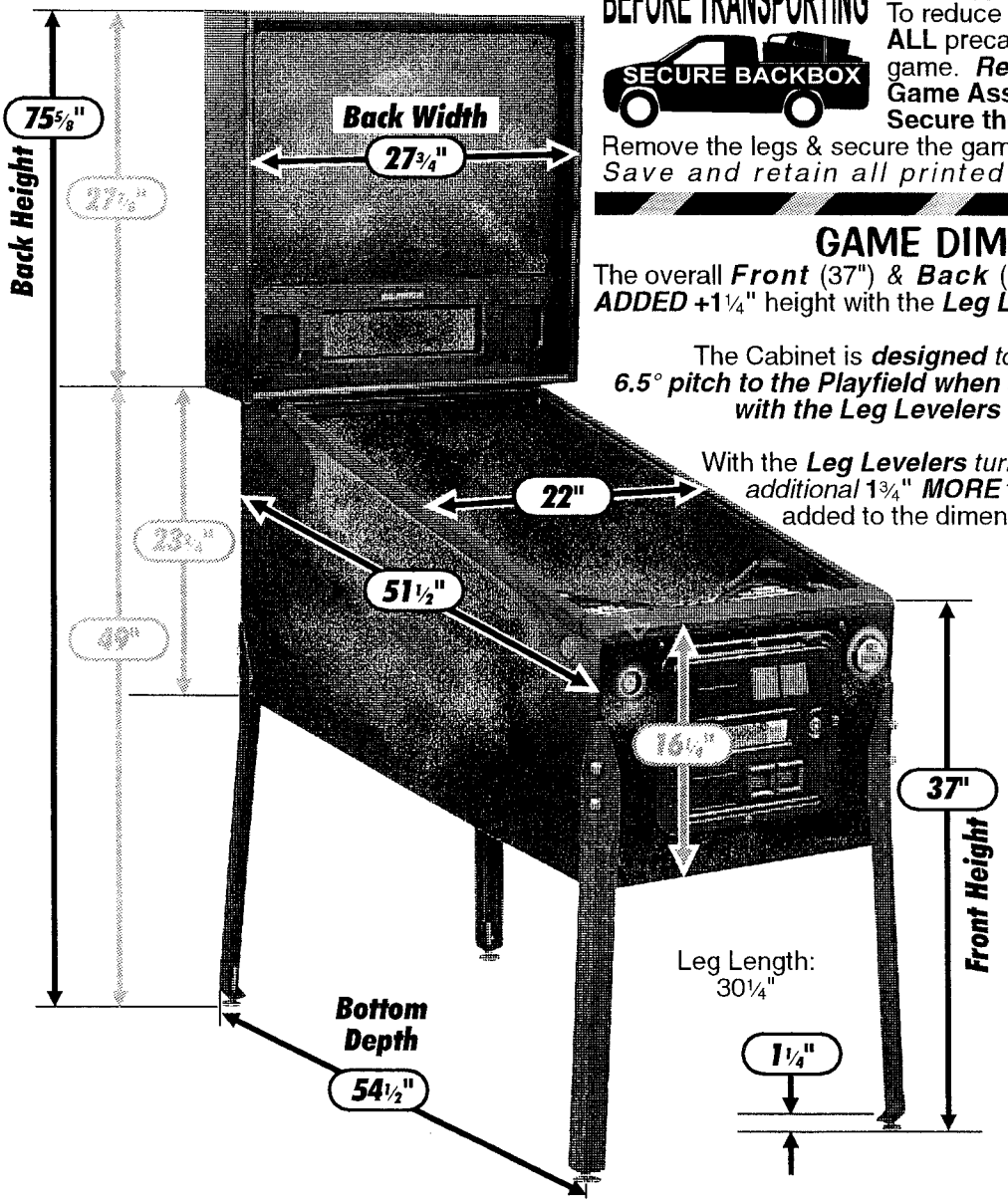
Save and retain all printed information on the game.

GAME DIMENSIONS

The overall ***Front*** (37") & ***Back*** (75⅝") dimensions reflect the ***ADDED*** **+1¼"** height with the ***Leg Levelers*** *turned all the way* ***in***;

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

With the ***Leg Levelers*** *turned all the way* ***out***, *an additional* 1¾" ***MORE*** to the overall height should be added to the dimensions.



Shipping Box Dimensions

Height: 55½"
Width: 30½"
Depth: 31"
Weight: 250lbs. (+/- 3)

C A U T I O N

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

General Table of Contents

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

Section 4, Chapter 1, Parts Identification & Location (The Pink Pages) Continued on the Next Page

Game Set-Up

Game Assembly Procedures

(Reference Find-It-In-Front: Dr. Pinball)

1. After the game is removed from the shipping carton, the following steps should be followed before initial game play. ***CAUTION:*** *At least 2 people are required to move and maneuver game. Use proper moving equipment & extreme care while handling.* **Pinball game is 250+ lbs.**
   Refer to **DR.** ⑩ for Power Requirements, Transportation and Game Dimensions.

2. The four (4) Cabinet Legs (Leg Levelers are attached) are in the corner packing material of the crate, install as outlined in Item 3. A large Allen Wrench (use for securing the backbox in the up an down position) is inserted & taped to the rear of the cabinet. Leg Bolts, Steel Balls and any miscellaneous parts are in the cash box.

3. Support rear of cabinet and attach rear legs using two leg bolts for each leg. Support front of cabinet and attach front legs using two leg bolts for each leg.

4. While assuring that no cables are being pinched, carefully raise the backbox and secure it in its upright position with the Allen Wrench in the hole in the back of the cabinet and rotating the wrench 270° (¾ turn).

5. Remove the Coin Door & Backbox Keys from the playfield glass or Ball Shooter Plunger; unlock the Backbox and open.

6. 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.

7. Remove the Front Molding & carefully remove the playfield glass and set it aside.

8. Remove all shipping tie downs, shipping blocks, packing foam, shipping instruction pages, etc. (if any) inside the cabinet. ***READ ALL PRINTED INFORMATION!*** Shipping instructions, labels and/or decals describe warnings, cautions, and/or important information specific to the game.

9. Raise the playfield and support it, by lifting the Prop Rod (located on the left, inside the cabinet). The end of the Prop Rod should be placed into the hole under playfield. See the illustration "Easy Access Service System" opposite this page.

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

11. Remove the Plumb Bob tilt from the parts package and install on the pendulum wire on the inside left of the cabinet. Check the plumb tilt and adjust as required. See Section 4, Chapter 1, Parts Identification & Location.

12. Lower the playfield and ensure game is level side-to-side by adjusting Leg Levelers, if required. See the illustration "Leg Leveler Adjustment" opposite this page.

13. With the Leg Levelers turned all the way in (1.25" from floor to bottom of leg), the game pitch is 6.5°; depending on the condition of the floor, adjust the Leg Levelers as required.

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

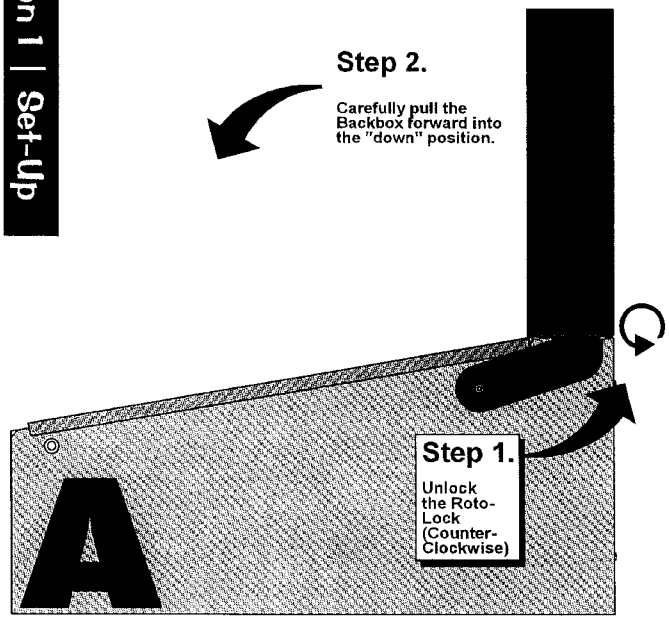
14. If desired, perform any self tests at this time. See Section 3, Chapter 1, Portals™ Service Menu Introduction, and Chapter 2, Go To Diagnostics Menu, for instructions on how to enter "Begin Play Test" and "Game Specific" to test components on the game.

15. **INSTALL 4 BALLS** on the playfield near the outhole and carefully reinstall the playfield glass. (Amount of balls are always specified on decal attached to the lock down assembly.)

16. If desired, make Game Pricing (Standard and/or Custom) and Add-A-Ball, Novelty, or X-Ball Play adjustments at this time. See Section 3, Chapter 4, Go To Adjustments Menu, for instructions on how to enter adjustments. Follow instructions in the tables provided in the manual for suggestions of customizing changes.

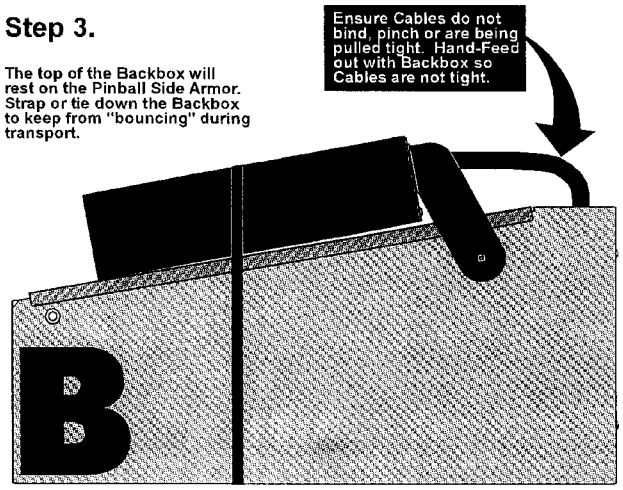
➡Per CE "The appliance has to be placed in a horizontal position."
"This appliance is not to be cleaned by a Water Jet."

How to Secure the Backbox for Transporting



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.



See Section 4, Chapter 1, Backbox (Back Side/ Front Side) Assemblies, for part numbers.

Leg Leveler Adjustment

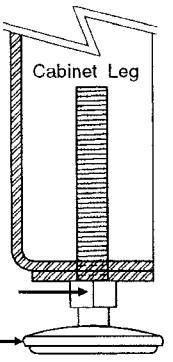
This cabinet is designed to automatically have a 6.5° pitch without any Leg Leveler adjustment!

Attach the four (4) Leg Assemblies to cabinet corners with the eight (8) leg bolts provided. See Section 4, Chapter 1, Cabinet - General Parts, for part numbers.

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

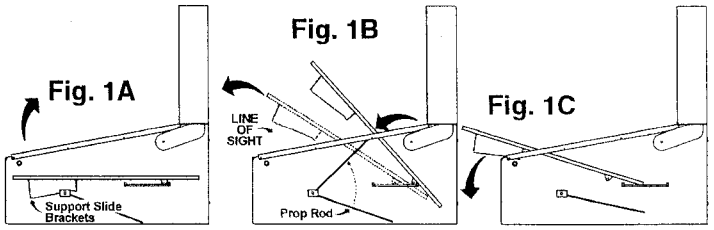
Verify 6.5° pitch. Minor adjustment(s) may be necessary depending on the location floor being level.

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



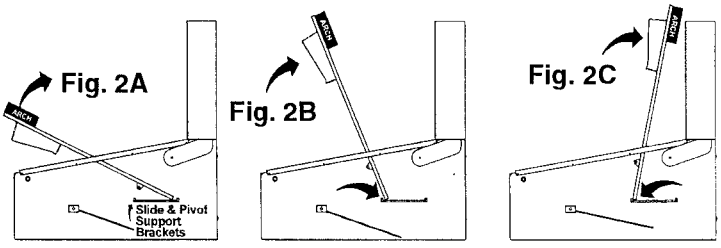
Easy Access Service System - 3 Positions

Carefully lift the playfield ***using the Left and Right Ball Guides*** upward.



Positions 1 & 2

When lifted high enough, the ***Playfield Support Slide Brackets*** (Fig. 1A) can be seen & can clear the cabinet front. At this time, pull the playfield toward the front of the cabinet, checking that the mechanical components clear the cabinet front, then rest the playfield on the ***Playfield Support Slide Brackets*** at the front channel of cabinet (Fig. 1C); Or, the ***Prop Rod*** (located on the right inside of cabinet) can be used by positioning the ***Prop Rod*** end into the receiving playfield hole (Fig. 1B).



Position 3

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

Game Operation & Features

Start of Game Features

Starting a Normal Game

Insert coin(s). The game generates a sound for the first coin & for each subsequent coin with the display indicating the number of credits posted. Press the **Start Button** and a start-up sound is produced, and the posted credits are reduced by one. Subsequent players can be added (**up to 6 can play!**) by pressing the **Start Button** before the end of ball 1 (with sufficient credit in the game).

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

Starting Team Play (Doubles!)

Team Play is a four player game. The totals for players 1 & 3 (Team 1) and players 2 & 4 (Team 2) are displayed individually as well as the combined score for both teams. Team Play only works in a 4-Player game. In all other cases, the individual scores are shown.

Starting League/Tournament Play

After credit is posted, while holding in the **Left Flipper Button**, press the **Start Button**. League Play has now begun. The differences between Normal Game Play and League/Tournament Play are: There is no "auto-percentaging" (awarding extra balls, specials, etc. to players with very low scores on the second or third ball). Mystery Features are awarded in a set order rather than random in Normal Game Play. Percentage Game Features are not automatically advanced as they are for the Regular Play Features.

Starting Pinball Wizard Play

After credit is posted, while holding in the **Right Flipper Button**, press the **Start Button**. Pinball Wizard Play has now begun. The same as League/Tournament Play, but ooooooh! so much gosh darn harder!

During Game Features

Feature Mode & Combination Shots

Features are lit on the playfield and started by completing *certain play shots* (e.g. completion of Target Banks, Orbit(s), Ramp(s) and/or any combination of the shots). Combination shots (combos) are a series of shots completed in many different variations. For example, a shot to the Ramp with the ball being returned to the Left Inlane then immediately shot to the Orbit of the playfield returning to a Flipper and then shot to another Ramp would be a hard combo shot worthy of many points. These combinations vary per game. For feature modes & combos certain points or awards are given after completion.

Multiball

Multiball is started after completion of certain Feature Modes or may be a mode itself depending on game rules/play. Multiball may vary with the amount of balls used in Multiball depending on game style. Typically, if Multiball play was short, a "restart" option is given. Watch the Display for instructions on the restart.

Replay Feature

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

Video Mode

The video modes ***may*** require the player to "*play on-screen*". The interactive video play ***may*** require the player to use the **Flipper Buttons** to play the mode.

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 (Default = 2, adjustable) or its prolonged closure will end the current Ball-In-Play. Closure of the Slam Tilt Switch on the coin door ends the current game(s).

Match Feature

At the end of each ball, earned bonuses are collected. At the end of the last ball of a game (including any extra balls, if applicable), earned bonuses are collected, then the system produces a random 2-digit number (a multiple of 10; 00 to 90). Matching the last 2 digits of the player's score with this number awards a credit. In Adj. 11, Match Percentage (Default=**9%**, adjustable) 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 (to award a credit). Changing this adjustment to **OFF** will not display the "Match Animation" nor award a credit.

Continued Next Page.

End of Game Features Continued

Entering Initials/Name (Adjustable, see Sec. 3, Chp. 4, Adj. 32, High Score Initials)

If player achieved a new high score in any of the 3 categories (Regular, Wizard or Special Game Feature), the player may enter their 3 initials or 10-Letter Name. Use the **Left** & **Right Flipper Buttons** to choose 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: A **Custom Message** (Adjustable, see Sec. 3, Chp. 4, Adj. 34) can be displayed during the Attract Mode; enter letters in the same fashion.*

Auto Percentaging

This game is equipped with an Auto Percentaging Adjustment. The replay percent is automatically adjusted or you can set a fixed replay score. The factory default percentage is **10%**. Four levels may be selected. Adjustments allow awarding of a "credit" or an "extra ball" as each level is exceeded. With the ***Auto Percentage 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). See Section 3, Chapter 4, Go To Adjustments Menu, Adj. 1 & Adj. 2. You may choose to make a different "score-to-beat" adjustment; this is done by utilizing Adj. 2, Replay Levels.

Instruction Card

Below is a **COPY** of the Game Instruction Card (SPI Nº: 755-5168-01, American/Spanish Double-Sided) 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.* (***Suggestion:*** **COPY & CUT** along the dotted line and fold in the center to keep the "COPY" sturdy.)

COPY & CUT

Manufactured by Stern™Pinball, Inc. © 2000 Striker Xtreme Pinball — SPI Part Nº: 755-5168-01 SPANISH

Nota para Participates: Para hacer más puntos dispare a los destellos luminosos ((FLASHING SHOTS)) !!
Asegúrese de mirar al *Display* para seguir las instrucciones cuando sea posible.

TIRO de HABIL (Skill Shot) Calcula tu tiempo para dispararr la bola para colectar unos de los premios.
BONUS MULTIPLICADO Deletiar ***C-U-P*** para abanzar al *Bonus X.*
GOALS Pasa la *defensa* y el *portero* para colectar premios (**Big Points**, **Beat Country** o **Xtreme Round**).
TIRO DE PENALTY Complete ***4*** ***Soccer Objetivos*** para iluminar la ***Rampa del lado*** y encuentra la ***avenida del retorno del defensa*** para un **Penalty Kick**.
SHOOTOUT Dispara el agujero izquierdo para deletiar ***S-H-O-O-T-O-U-T***. Entonces dispara cualquiera *Ramp para colectar* el premio del *Shootout Hurry-Up* y toma un tiro al *goal gratis*.
PAISES Ganale a pais iluminado cuando *Beat Country* esta iluminado en el goal. Completa los grupos para *ganar premios Extra.*
MULTIBOLA ESTADIO Dispara el ***Spinner*** para iluminar *Locks (bolas detenedas).* Dispara a las ***Rampas*** iluminadas para *encerrar las bolas en el estadio.* Durante *Multibola*, las ***Flechas rojas*** estan iluminadas para *Jackpots.* Dispara a la ***Rampa del lado*** para *Super Jackpot.* Dispara un *goal* siempre le gana a un pais y ilumina todos los *Jackpots*
TIRO GRATIS Ganandole a un pais ilumina *tiro gratis* en las ***avenidas de fuera*** (*¡ te regresa la bola !*).
MEDIO TIEMPO Ganandole al segundo pais en *un grupo* ilumina *Medio Tiempo (Half-Time).*
BOLAS de SOCCER Asiendo *tiros, Soccer* ⚽⚽⚽⚽ *objetivos y Soccer Combinaciones* ganas ***bolas de Soccer.*** Colectando ***las bolas*** ilumina *vendedor* para un *premio misterioso.*
EXTRA BOLAS Ilumina *Extra Bolas* ganandole á los paises, *colectando bolas, el premio del vendedor, y ...?*
CELEBRACION de MULTIBOLA Ganandole a todos los paises para empezar *Celebracion Multibola.* Todos los tiros siempre estan iluminados para los *Jackpots.* Encierra todas las bolas para una oportunidad a *Super Shootout* para points grandes.

Translation by Mike Salas (S.P.I.)

FOLD HERE

SKILL SHOT Time your plunge to collect one of the *displayed Awards.*
BONUS MULTIPLIER Spell ***C-U-P*** to advance *Bonus X.*
GOALS Get past *defenders* and the *goalie* to collect current *goal award* (**Big Points**, **Beat Country** or **Xtreme Round**).
PENALTY KICK Complete ***4*** ⚽ ***Soccer Targets*** to light the ***Side Ramp*** and spot the ***Defender Return Lane*** for a **Penalty Kick**.
SHOOTOUT Shoot the ***Left Hole*** to spell ***S-H-O-O-T-O-U-T***. Then shoot either ***Ramp shot*** to collect *Shootout Hurry-Up Award* and take a free shot on *goal.*
COUNTRIES Defeat flashing country when *Beat Country* is lit at *goal.* Complete groups to earn extra *Awards.*
STADIUM MULTIBALL Shoot the ***Spinner*** to light *Locks.* Shoot lit ***Ramps*** to *lock balls in Stadium.* During *Multiball*, all ***Red Arrows*** are lit for *Jackpots.* Shoot the ***Side Ramp*** for *Super Jackpot.* Shooting a *goal* always *defeats a country* and *relights* all *Jackpots.*
FREE KICK Defeating a country lights *Free Kick* on the ***Outlanes*** *(you get the ball back!).*
HALF-TIME Defeating the 2nd country in a group lights *Half-Time.*
SOCCER BALLS Making *shots*, ***Soccer Ball*** ⚽⚽⚽⚽***Targets*** and *Soccer Ball Combos* awards ***Soccer Balls***. Collecting ***Soccer Balls*** lights *Vendor* for a *Mystery Award.*
EXTRA BALL Light *Extra Ball* by defeating countries, collecting *Soccer Balls*, *Vendor Award*, *and...?*
CELEBRATION MULTIBALL Defeat all countries to start *Celebration Multiball.* All shots are always lit for *Jackpots.* Lock all balls for a chance at *Super Shootout* for huge points.

Note to Beginners: To score better, shoot at the **((FLASHING SHOTS)) !!**
Be sure to LOOK UP at the Dot Display for instructions when possible.

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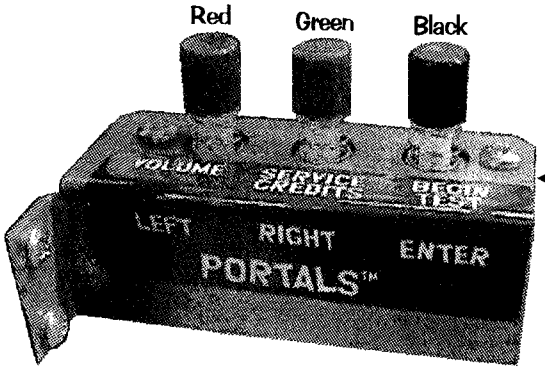
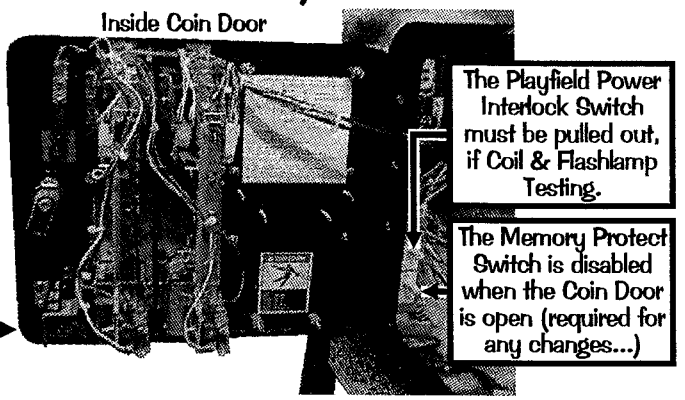
Portals™ Service Menu Introduction

Section 3
Table of Contents

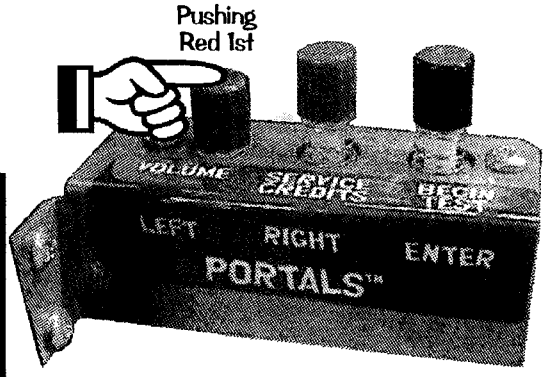
Service Switch Set (Red, Green & Black Buttons) Access & Use

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





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

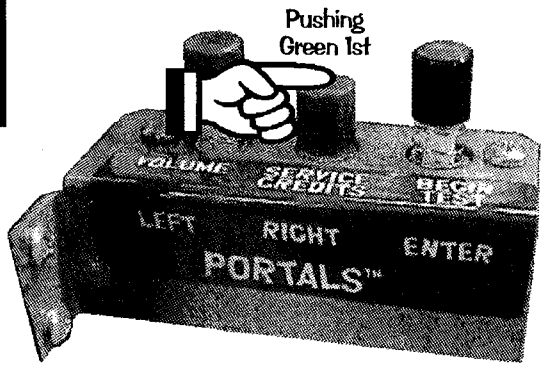


Function 1, Volume Menu

Pushing the ***Red 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.*

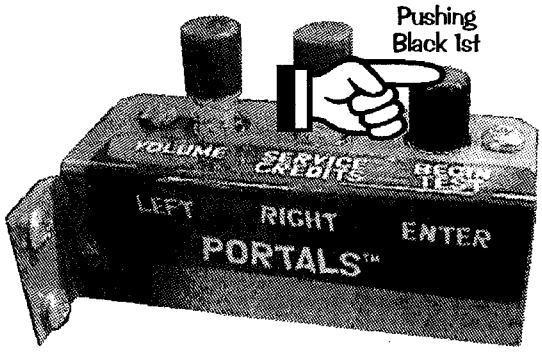
Set between **0** and **31**; **15** is the *Factory Default*. Once your adjustments are made, this menu will ***automatically exit*** a few seconds after the last button depression.



Function 2, Service Credits Menu

Pushing the ***Green Button*** first, adds ***Service Credits*** *(will not affect your audits as "paid" credits).* This is useful for the technician to test the game in regular play without affecting the game audits. Each depression adds **1 credit**; up to **50 credits** can be applied. **Adjustment 15**, **Credit Limit**, determines this *(the Factory Default is 30, however, it can be changed from 04-50; see Chapter 4 of this Section for details).* Once your credits are added, this menu will ***automatically exit*** a few seconds after the last button depression.

Note: *This function is disabled if **Adjustment 33, Free Play**, is set to **YES**. The Service Credits are limited to the Credit Limit in addition to any paid credits present in the game (e.g. If the Credit Limit is 30, and there are 8 paid credits present, only 22 Service Credits can be applied.).*



Function 3, Portals™ Service Menu

Pushing the ***Black Button*** first, enters the ***Portals™ Service Menu***. Once in, move through the menus and sub-menus by pushing down or 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.*

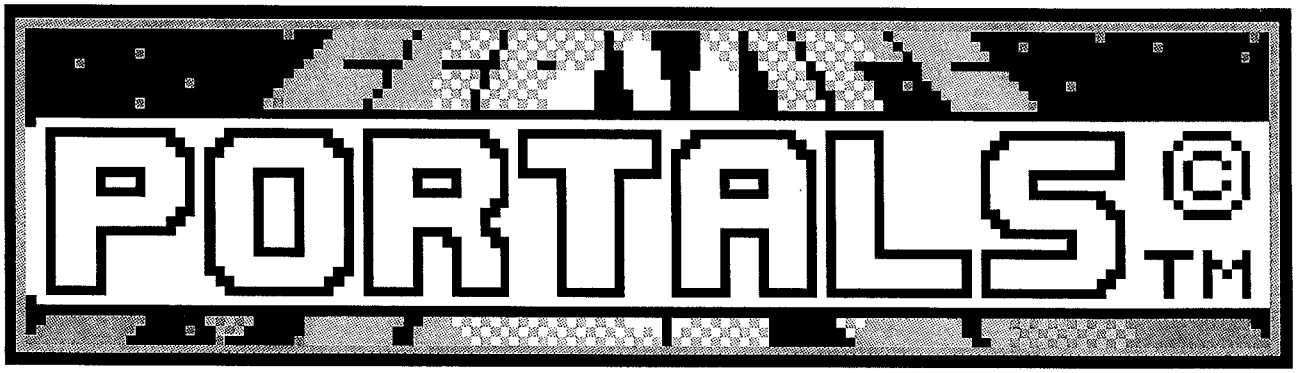
Please read the remainder of this Chapter for more information on the **Portals™ Service Menu**. The remaining six (6) Chapters of this Section explains all *Icons* & ***Menus*** in detail. ***Read! Read! Read!***

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 diasabled 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

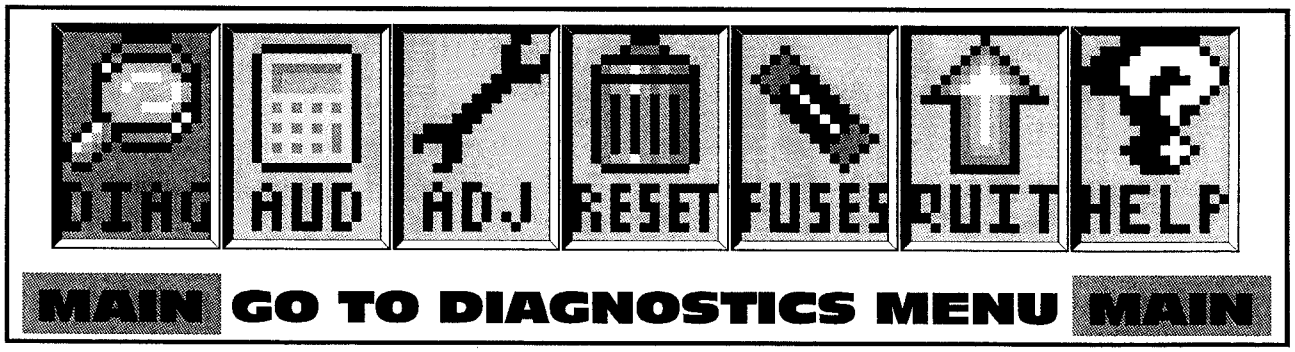
This section will cover all functions available in the **Portals™ Service Menu** in a *Step-By-Step* process. This section is divided into chapters which coincide with the **MAIN MENU**. The following pages in this chapter will instruct the operator on how to move through the menus. It's simple, easy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

To get into the **Service Menu Mode** review **"Function 3, Portals™ Service Menu"** on the previous page. Push down the **Black "BEGIN TEST" Button** to begin. Looking at the Video Display you will momentarily see the introductory screen "**Service Menu**" with a *satellite flying from right to left pulling a banner* "**Portals©TM**" 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* (**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. View the last chapter (HELP) if more information is required. Selecting the "QUIT" *Icon* with the **Red "LEFT"** or **Green "RIGHT" Buttons** (or either **Flipper Button**), then pressing the **Black "ENTER" Button** (or **Start Button**) will exit the Service Mode. This applies to the large and small "QUIT" *Icons*.

The **chapters** in this **section**, which coincide with the **MAIN MENU**, will also provide more detailed information which could not fit in the display. Use both the manual and the display to help customize, troubleshoot and/or diagnose faults, if any.

Portals™ Service Menu Icon Tree for Striker Xtreme Pinball Game

MAIN MENU

- DIAG → GO TO DIAGNOSTICS MENU
- AUD → GO TO AUDITS MENU
- ADJ → GO TO ADJUSTMENTS MENU
- RESET → GO TO RESET MENU
- FUSES → GO TO FUSES LIST
  - GAME FUSES LISTING
  - Reference current Game Manual, Sec. 3, Chapter 6.
- QUIT → QUIT THIS SESSION
  - Exits back to Attract Mode
- HELP → GO TO HELP SCREEN

Go To Help Screen → **HELP SCREEN**

See the next page for "**Summary of Common Icons**" or reference Sec. 3, Chapter 7.

Go To Adjustments Menu → **ADJUSTMENTS MENU**

Reference current Game Manual, Sec. 3, Chapter 4.

- S.P.I. → S.P.I. ADJUSTMENTS
  - 1st Adjustment of Game Generic Group
- S.S. → STRIKER XTREME ADJUSTMENTS
  - 1st Adjustment of Game Specific Group
- ABCD CUST MSG → CUSTOM MESSAGE
  - Direct Access to Adjustment 34, Custom Message
- STAR → FILM STAR RESET
  - REQUEST INSTALLED (Back to Attract Mode)

Go To Reset Menu → **RESET MENU**

Reference current Game Manual, Sec. 3, Chapter 5.

- COIN → RESET COIN AUDITS
  - REQUEST INSTALLED
- AUD → RESET GAME AUDITS
  - REQUEST INSTALLED
- FACT → FACTORY RESET
  - REQUEST INSTALLED (Back to Attract Mode)

Go To Audits Menu → **AUDITS MENU**

Reference current Game Manual, Sec. 3, Chapter 3.

- EARN → EARNINGS AUDITS
  - 1st Audit of Game Earnings Group
- S.P.I. → S.P.I. AUDITS
  - 1st Audit of Game Generic Group
- S.S. → STRIKER XTREME AUDITS
  - 1st Audit of Game Specific Group
- PRNT → GO TO PRINTER MENU

Go To Audits Menu → **PRINTER SUB-MENU**

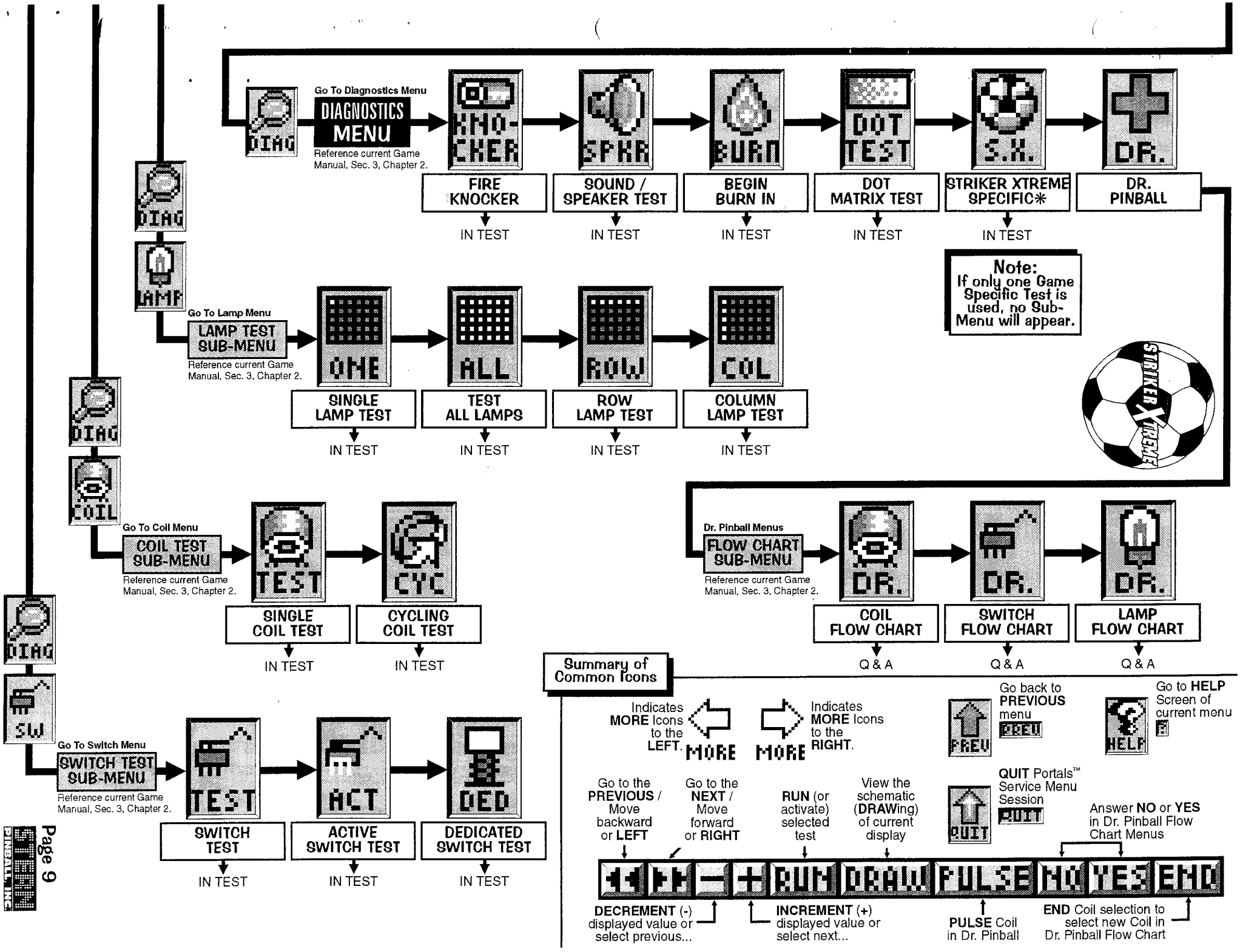
Reference current Game Manual, Sec. 3, Chapter 3.

- QUIK → QUICK PRINTOUT
  - Special Equipment is required.
- ALL SUM → FULL PRINTOUT
  - Special Equipment is required.
- RESET → RESET PRINTER
  - Nº of Copies Printed is reset.

Go To Diagnostics Menu → **DIAGNOSTICS MENU**

Reference current Game Manual, Sec. 3, Chapter 2.

- SW → GO TO SWITCH MENU
- COIL → GO TO COIL MENU
- LAMP → GO TO LAMP MENU
- FLASH → TEST FLASH LAMPS
  - IN TEST
- CLR → CLEAR BALL TROUGH
  - IN TEST
- TECH → TECHNICIAN ALERT
  - PLAYFIELD STATUS
- SERV → SERVICE PHONE #
  - 1-800-KICKERS (USA Setting)
- PLAY → BEGIN PLAY TEST
  - IN TEST


DIAG
Go To Diagnostics Menu
DIAGNOSTICS MENU
Reference current Game Manual, Sec. 3, Chapter 2.
KNO-CKER
SPKR
BURN
DOT TEST
S.X.
DR.
FIRE KNOCKER
SOUND / SPEAKER TEST
BEGIN BURN IN
DOT MATRIX TEST
STRIKER XTREME SPECIFIC*
DR. PINBALL
IN TEST
Note:
If only one Game Specific Test is used, no Sub-Menu will appear.
LAMP
Go To Lamp Menu
LAMP TEST SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 2.
ONE
ALL
ROW
COL
SINGLE LAMP TEST
TEST ALL LAMPS
ROW LAMP TEST
COLUMN LAMP TEST
COIL
Go To Coil Menu
COIL TEST SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 2.
TEST
CYC
SINGLE COIL TEST
CYCLING COIL TEST
Dr. Pinball Menus
FLOW CHART SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 2.
COIL FLOW CHART
SWITCH FLOW CHART
LAMP FLOW CHART
Q & A
SW
Go To Switch Menu
SWITCH TEST SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 2.
TEST
ACT
DED
SWITCH TEST
ACTIVE SWITCH TEST
DEDICATED SWITCH TEST
Summary of Common Icons
Indicates MORE Icons to the LEFT.
MORE
Indicates MORE Icons to the RIGHT.
MORE
PREV
Go back to PREVIOUS menu
HELP
Go to HELP Screen of current menu
Go to the PREVIOUS / Move backward or LEFT
Go to the NEXT / Move forward or RIGHT
RUN (or activate) selected test
View the schematic (DRAWing) of current display
QUIT
QUIT Portals™ Service Menu Session
Answer NO or YES in Dr. Pinball Flow Chart Menus
RUN
DRAW
PULSE
NO
YES
END
DECREMENT (-) displayed value or select previous...
INCREMENT (+) displayed value or select next...
PULSE Coil in Dr. Pinball
END Coil selection to select new Coil in Dr. Pinball Flow Chart

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, the sub-menu's 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, see Chapter 7.

The "MORE" *symbols* are indicating that *"more icons"* are available which don't appear in the display and which way to move the selection to view the *Icons*.

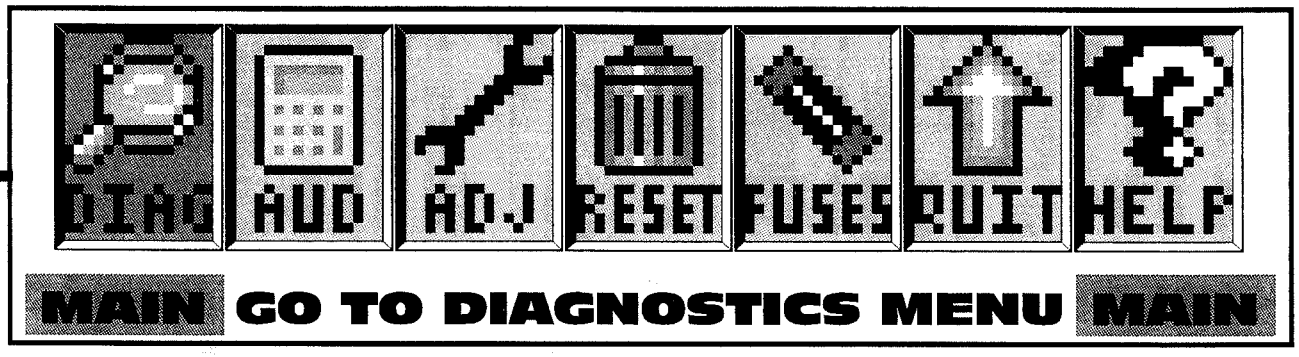
Important Note:

Exit any sub-menu and return to the **MAIN MENU** by selecting & activating the "PREV" *Icons*. ***If no Icons appear in the display because of a testing function or special display (e.g. Help, Schematic Display, etc.), press any service button to exit to the previous menu or sub-menu.***

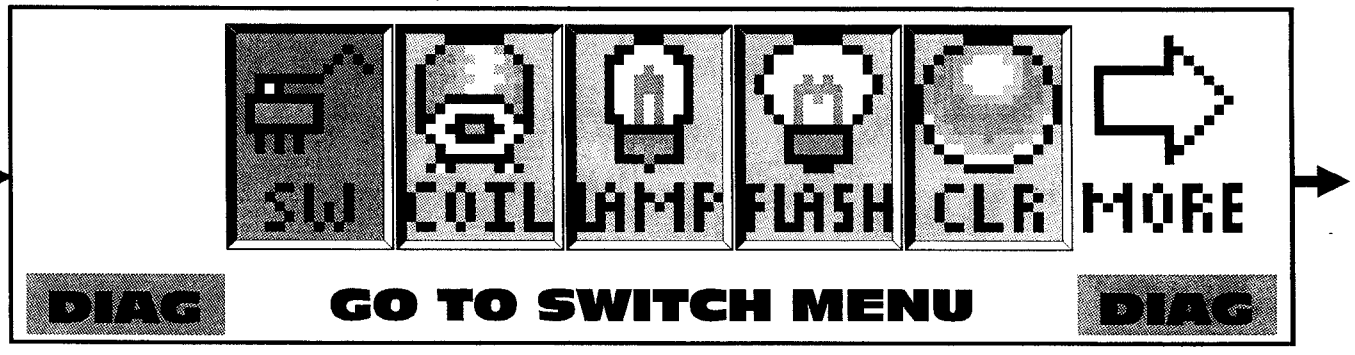
Selecting & activating the "QUIT" *Icon* from any display will exit the *Service Session.*

Selecting & activating the "HELP" *Icon* will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)

Example: From the **MAIN MENU**, use the **Red "LEFT"** or **Green "RIGHT" Buttons** to select the "DIAG" *Icon* (**GO TO DIAGNOSTICS MENU**).

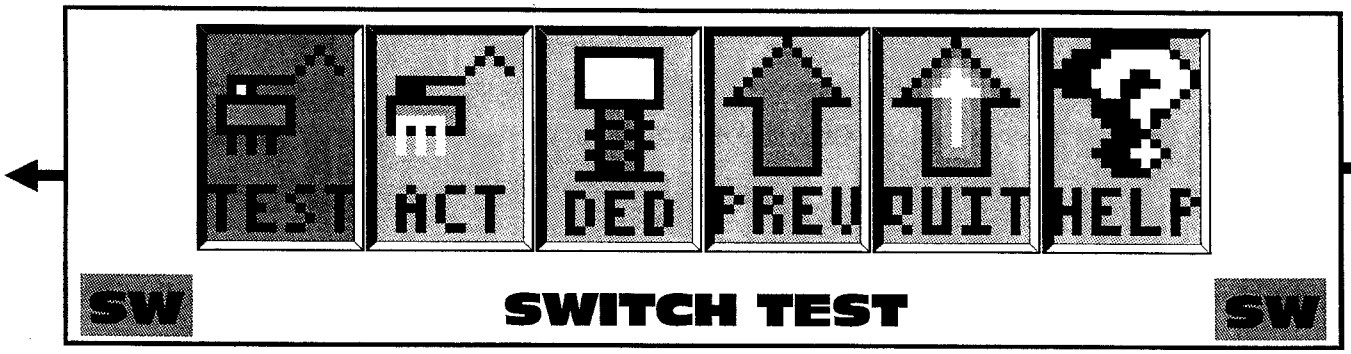


Press the **Black "ENTER" Button** to activate this **ICON**. This will bring up the **DIAGNOSTICS MENU**.

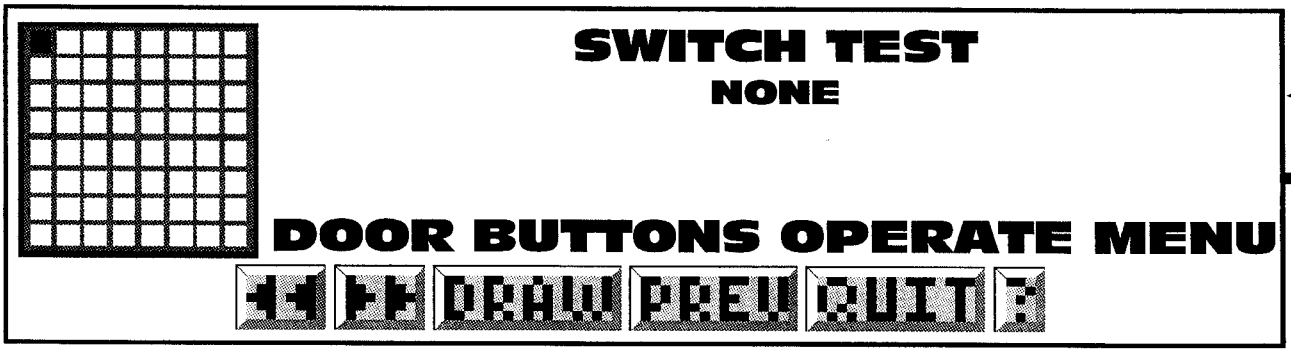


The **DIAGNOSTICS MENU** now appears with the "SW" *Icon* (**GO TO SWITCH MENU**) flashing. Press the **Black Button** to *activate* this icon. This will bring up the **SWITCH TEST MENU**.

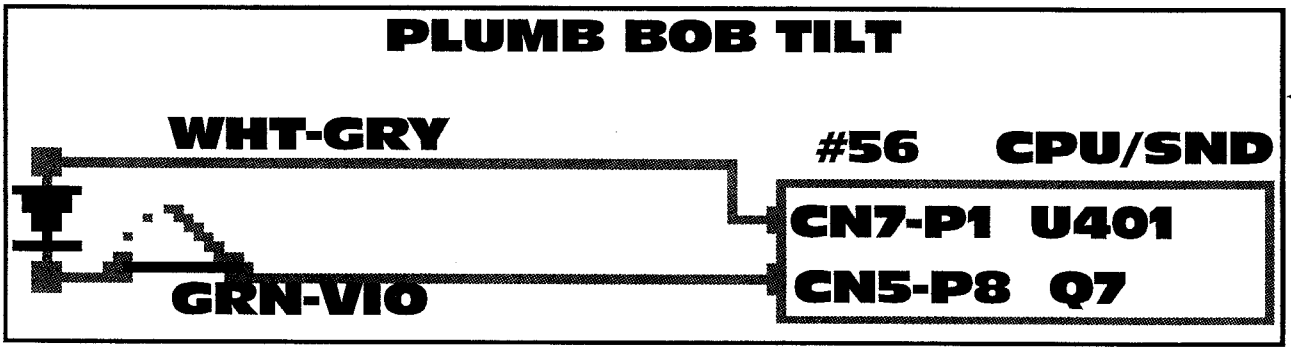
The **SWITCH TEST MENU** now appears with the "TEST" *Icon* (**SWITCH TEST**) flashing:
Press the **Black "ENTER" Button** to *activate* this icon. This will bring up the **Switch Test Display**.



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 the **Red** or **Green Buttons** to select the "DRAW" *Icon.* Press the **Black Button** to *activate* this icon. This will bring up the **Switch Schematic Display** for the switch being closed.



An example is shown with Switch #56, Plumb Bob Tilt, selected. 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, the part number (not shown in the above example) and the "Pin-Outs" from the CPU/Sound Board.

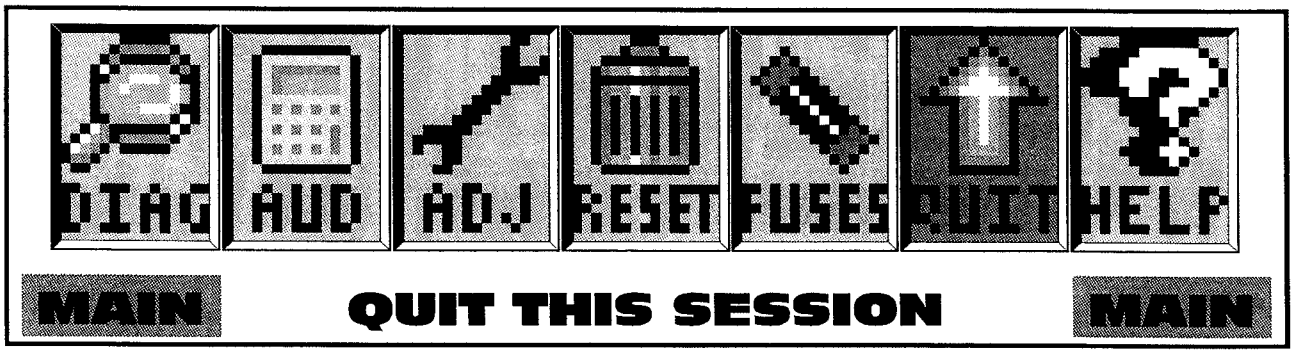
While in Switch or Active Switch Tests, the **Flipper & Start Buttons** are deactivated. Use the **Red "LEFT," Green "RIGHT"** and/or **Black "ENTER" Buttons** to select and activate the **"MINI-ICONS"** at the bottom of the display. In Switch Test, if the "Left Arrow" or "Right Arrow" *Icon* is activated, the display will go to the previous tests (Active and Dedicated Switch Tests). Use the **Red** or **Green Buttons** to change the selected **ICON** to "PREV"*Icon.* Press the **Black "ENTER" Button** to go to the previous menu.

Note:
In **Dedicated Switch Test**, the **Flipper & Start Buttons** are to be used instead of the **Red**, **Green** & **Black Service Buttons**, as these buttons are deactivated for this test.

Exit out of the sub-menu by activating the big "PREV" *Icon* in the menu. This will bring up the **DIAGNOSTICS MENU**. The Switch Test Session is now complete. See the next page about exiting the **Portals™ Service Menu**.

Exiting the Portals™ Service Menu

All *Icons* will be covered in the chapters of this section with the exception of the "QUIT" *Icon*, in the **MAIN MENU**. Both the large and small *Icons* if selected and activated, will exit the user from the **Portals™ Service Menu**. The display will return back to the **ATTRACT MODE**! To re-enter the **Portals™ Service Menu** follow the instructions at the beginning of this chapter.



If more help is required, see Chapter 7 of this section, and view the various help displays in the game.

Your Notes

Go To Diagnostics Menu

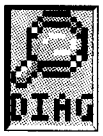
Special Note: If the ***display flashes*** **"OPEN THE DOOR"** the game is indicating that memory has been corrupted. This is caused be either failure in memory (e.g. batteries are dead and/or faulty **RAM**) or upon installation of updated version of game code. Opening the **Coin Door** will initiate a *Factory Restore (Reset)*, by opening the ***Memory Protect Switch***. Check battery voltage at **VBATT Test Point** on the **CPU/Sound Board**.

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). Select the "DIAG" *Icon* from the **MAIN MENU** to go to the **DIAGNOSTICS MENU**. 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 Specific Test***.) may be used for troubleshooting. All *Icons* and there usages are explained throughout this chapter.

During game play, activation of switches and operation of coils with associated switches are monitored. If the **CPU/Sound Board** does not detect a switch transition ("Stuck Open" / "Stuck Closed") for 50 games, it is considered faulty. When operation of a coil should close or open a switch and does not, the coil is considered faulty. In the Attract Mode, faulty switches and coils (if any) are reported (Select the "TECH" *Icon*, ***Technician Alert***, from the **DIAGNOSTICS MENU**). *Note that reporting of an unused switch does not constitute a problem and that a bad coil could mean that the associated switch requires adjustment.*

⚠ **CAUTION:** Remove pinballs from the Ball Trough prior to lifting the playfield for servicing. This can easily be done in the **Portals™ Service Menu System**. Select the "DIAG" *Icon* from the **MAIN MENU** to go to the **DIAGNOSTICS MENU**. Select the "CLR" *Icon* to enter the **CLEAR BALL TROUGH MENU**. Select the "RUN" *Icon* & press the **Start Button** to remove one ball at a time. This is also useful to retrieve one ball for game testing in ***Begin Play Test*** & ***Game Specific Test***. ***Important:*** The **Power Interlock Switch** must be pulled out.



GO TO DIAGNOSTICS MENU

With the game in the Attract Mode, open the Coin Door and press the **Black "BEGIN TEST" Button**. Select the "DIAG" *Icon* in the **MAIN MENU** with either **Flipper** or **Red "LEFT"** & **Green "Right" Buttons** (upon entry of the **Portals™ Service Menu**, the system defaults with the selection of the "DIAG" *Icon* flashing) and press the **Start** or **Black "ENTER" Buttons**. The **DIAGNOSTICS MENU** appears.

The "MORE" *symbols* are indicating that *"more icons"* are available which don't appear in the display and which way to move the selection to view the *Icons*.

Important Notes:

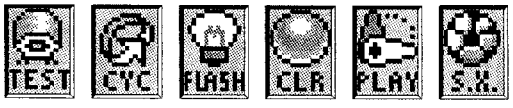
Exit any sub-menu and return to the **MAIN** MENU by selecting & activating the "PREV" *Icons*. If no *Icons* appear in the display because of a testing function or special display (e.g. "Help"), press any button to exit.

Selecting & activating the "HELP" *Icon* from any display will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)

Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.

In Diagnostics, selecting & activating the "-" or "+" *Icons* moves test forwards/backwards. Selecting & activating the "RUN" *Icon* repeats the test on the coil or flash lamp left off at. Selecting & activating the "ARROW" *Icons* moves between tests in the sub-menu. Selecting & activating the "DRAW" *Icon* will show the schematic for that switch or coil.

Some tests require navigation through the menu(s) and selection of the *Icons* with **ONLY** the **Red "LEFT," Green "RIGHT"** and **Black "ENTER" Buttons**. This is required in ***Switch*** & ***Active Switch Tests***, as the **Flipper** & **Start Buttons** are a part of the test.



In ***Single Coil Test***, ***Cycling Coil Test***, ***Test Flash Lamps***, ***Clear Ball Trough, Begin Play Test*** & ***Striker Xtreme Specific*** Menu's, ***the*** **Power Interlock Switch** (inside Coin Door) must be pulled out. (See ***Access & Use*** in Chapter 1 of this section for the location.)

If the Power Interlock Switch is not pulled out, all electro-mechanical devices (such as Coils) cannot be tested (20v & 50v DC power is disabled). Closing the Coin Door will automatically reset this switch.

Go To Switch Menu

From the **DIAGNOSTICS MENU**, select the "SW" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** 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 switches possible. The Switch Test Menu consists of three (3) parts: Switch Test, Active Switches, and Dedicated Switch Test.

Note: The Flipper & Start Buttons are deactivated during Switch Tests.

Switch Test

To initiate, from the **SWITCH MENU**, select the "TEST" *Icon* with the **Red** or **Green Button** & press the **Black Button**. In Switch Test, close each switch and observe the display. The display will describe the switch in the Switch Matrix, which includes the switch name, Return (Row) Wire, Drive (Column) Wire, Part Nº, and the "Pin-Outs" from the CPU/SOUND Board. When the switch is released, the information of the last switch closed will remain in the display until another switch is closed or the test is exited. To view the switch schematic, select the "DRAW" *Mini-Icon* with the **Red** or **Green Button** & press the **Black Button**.

Active Switch Test

To initiate, from the **SWITCH MENU**, select the "ACT" *Icon* with either **Red** or **Green Button** & press the **Black Button**. If still in a previous test, select the "PREV" *Icon* to return to Switch Menu or selecting either of the "ARROW" *Icons* will move through the tests. 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 Nº, 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.). The display will describe the switch which includes the Switch Name, Return (Row) Wire, Drive (Column) Wire, Part Nº, and the "Pin-Outs" from the CPU/SOUND Board.

SWITCH MATRIX GRID & DEDICATED SWITCHES

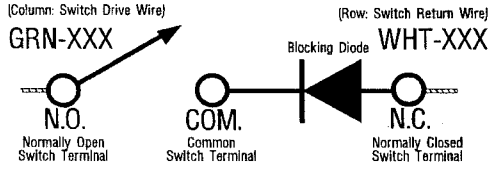
Diode On Terminal Strip :

Row (Return) \ Column (Drive)	1: Q1 GRN-BRN CN5-P1	2: Q2 GRN-RED CN5-P3	3: Q3 GRN-ORG CN5-P4	4: Q4 GRN-YEL CN5-P5	5: Q5 GRN-BLK CN5-P6	6: Q6 GRN-BLU CN5-P7	7: Q7 GRN-VIO CN5-P8	8: Q8 GRN-GRY CN5-P9
1: U400 WHT-BRN CN7-P9	LEFT BUTTON (UK ONLY) On Cabinet side 1	SPINNER (LT ORBIT) On Assembly 9	4-BANK D/T #1 (LT) On Assembly DOTS 17	GOALIE OPTO On Assembly 25	LEFT TOP LANE Under P/F 33	GOALIE MOTOR (LT) On Assembly 41	LEFT TURBO BUMPER On Assembly 49	LEFT OUTLANE Under P/F 57
2: U400 WHT-RED CN7-P8	4TH COIN SLOT On Coin Door 2	NOT USED 10	4-BANK D/T #2 On Assembly DOTS 18	BALL S-U (POPS) On Assembly 26	MID TOP LANE Under P/F 34	GOALIE MOTOR (RT) On Assembly 42	RIGHT TURBO BUMPER On Assembly 50	LEFT RETURN LANE Under P/F 58
3: U400 WHT-ORG CN7-P7	6TH COIN SLOT On Coin Door 3	4-BALL TROUGH #1 (LEFT) On Assembly 11	4-BANK D/T #3 On Assembly DOTS 19	BALL 2-BANK S-U TOP On Assembly 27	RIGHT TOP LANE Under P/F 35	GOALIE MAGNET On Assembly 43	BOTTOM TURBO BUMPER On Assembly 51	LEFT SLINGSHOT On Assembly 59
4: U400 WHT-YEL CN7-P6	RIGHT COIN SLOT On Coin Door 4	4-BALL TROUGH #2 On Assembly 12	4-BANK D/T #4 (RT) On Assembly DOTS 20	BALL 2-BANK S-U BOT On Assembly 28	NOT USED 36	GOALIE UNDER-TROUGH On Assembly 44	KICKER TARGET On Assembly DOTS 52	RIGHT OUTLANE Under P/F 60
5: U401 WHT-GRN CN7-P5	CENTER COIN SLOT / DBA On Coin Door 5	4-BALL TROUGH #3 On Assembly 13	4-BALL LOCK #1 (TOP) On Assembly DIODE 21	BALL S-U (RT RAMP) On Assembly 29	NOT USED 37	LEFT VUK On Assembly DOTS 45	NOT USED 53	RIGHT OUTER RETURN Under P/F 61
6: U401 WHT-BLU CN7-P3	LEFT COIN SLOT On Coin Door 6	4-BALL TROUGH VUK OPTO On Assembly 14	4-BALL LOCK #2 On Assembly DIODE 22	NOT USED 30	RIGHT RAMP ENTER On Assembly 38	TOP SUPER VUK On Assembly DOTS 46	START BUTTON Cabinet Front 54	RIGHT SLINGSHOT On Assembly 62
7: U401 WHT-VIO CN7-P2	5TH COIN SLOT On Coin Door 7	4-BALL STACKING OPTO On Assembly 15	4-BALL LOCK #3 On Assembly DIODE 23	SKILL SHOT Under P/F 31	RIGHT RAMP EXIT On Assembly 39	GOALIE MOTOR (CTR) On Assembly 47	SLAM TILT On Coin Door 55	NOT USED 63
8: U401 WHT-GRY CN7-P1	RIGHT BUTTON (UK ONLY) On Cabinet side 8	SHOOT-ER LANE Under P/F DOTS 16	4-BALL LOCK #4 (BOT) On Assembly DIODE 24	RIGHT ORBIT Under P/F 32	NOT USED 40	RIGHT INNER RETURN Under P/F 48	PLUMB BOB TILT Inside Cabinet 56	NOT USED 64

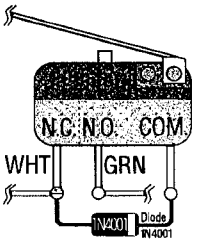
Diode On Diode Board :

GND / IC U206 INPUTS	Ground BLK CN6-P1, -P11
1: U206 GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON In Cabinet side DS-1
2: U206 GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke) In Cabinet side DS-2
3: U206 GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON In Cabinet side DS-3
4: U206 GRY-YEL CN6-P5	#4 RIGHT FLIPPER E.O.S. (End-of-Stroke) In Cabinet side DS-4
5: U206 NOT USED GRY-GRN CN6-P7	NOT USED DS-5
6: U206 GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (In Test: LEFT) on Coin Door DS-6
7: U206 GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) on Coin Door DS-7
8: U206 GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) on Coin Door DS-8

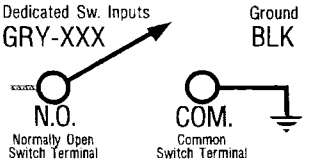
Typical Switch Schematic & Wiring



Note:
All Switches require diodes. Some diodes are located on Terminal Strips OR Diode Boards (under playfield) & not on the switch itself.
Diode On Terminal Strip Diode On Diode Board

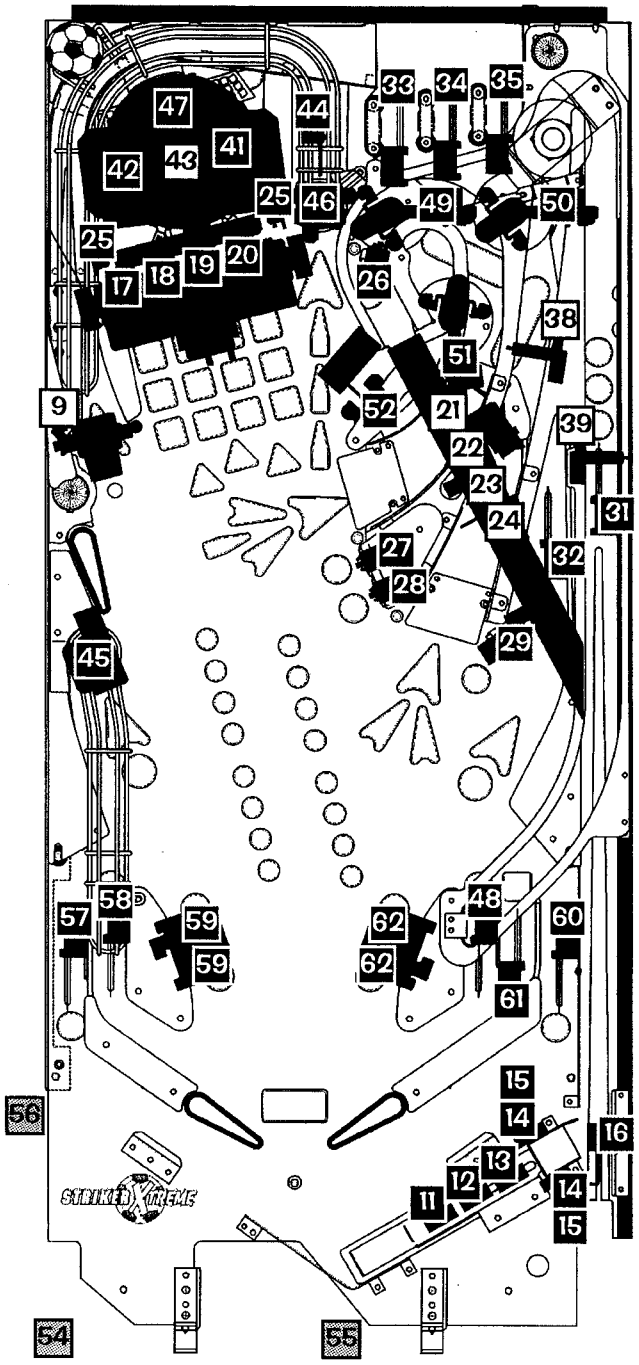


Dedicated Switch Schem.



Switch Matrix Grid Descriptions with Part Numbers and Locations

The Switch locations correspond with the Switch Nº in the Part Number Table shown & the Switch Matrix Grid (previous page).



Sw. Nº	Col. Nº	Row Nº	See Notes	Switch Matrix Description		Part Nº
				Note: The ¥ Coin Switch (for Japan) is 180-5091-00		
1	1	1		LEFT BUTTON (UK ONLY)		180-5160-00
2*	1	2		4TH COIN SLOT		180-5024-00
3*	1	3		*6TH COIN SLOT*		*(Future Use)*
4*	1	4		RIGHT COIN SLOT		180-5024-00
5*	1	5		CENTER COIN SLOT / DBA		
6*	1	6		LEFT COIN SLOT		
7*	1	7		*5TH COIN SLOT*		*(Future Use)*
8	1	8		RIGHT BUTTON (UK ONLY)		180-5160-00
9	2	1		SPINNER (LT ORBIT)		180-5010-04
10	2	2		NOT USED		
11	2	3		4-BALL TROUGH #1 (LEFT)		180-5119-02
12	2	4		4-BALL TROUGH #2		
13	2	5		4-BALL TROUGH #3		
14‡	2	6		4-BALL TROUGH VUK OPTO	BOT TRANS: 520-5173-00 BOT REC: 520-5174-00	
15‡	2	7		4-BALL STACKING OPTO	TOP TRANS: 520-5173-00 TOP REC: 520-5174-00	
16	2	8	DOTS	SHOOTER LANE		180-5157-00
17	3	1	DOTS	4-BANK D/T #1 (LT)		180-5158-00
18	3	2	DOTS	4-BANK D/T #2		
19	3	3	DOTS	4-BANK D/T #3		
20	3	4	DOTS	4-BANK D/T #4 (RT)		
21	3	5	DODB	4-BALL LOCK #1 (TOP)		*4-Position Membrane Switch Pad* 181-5001-00
22	3	6	DODB	4-BALL LOCK #2		
23	3	7	DODB	4-BALL LOCK #3		
24	3	8	DODB	4-BALL LOCK #4 (BOTTOM)		
25	4	1		GOALIE OPTO	TRANS: 520-5082-00 REC: 520-5083-01	
26	4	2		BALL S-U (POPS)		500-6075-01
27	4	3		BALL 2-BANK S-U TOP		500-6075-01R
28	4	4		BALL 2-BANK S-U BOT		
29	4	5		BALL S-U (RT RAMP)		500-6075-01
30	4	6		NOT USED		
31	4	7		SKILL SHOT	on Lt. Mount R/O	500-6227-01
32	4	8		RIGHT ORBIT	on Lt. Mount R/O	
33	5	1		LEFT TOP LANE	on Rt. Mount R/O	500-6227-02
34	5	2		MID TOP LANE	on Rt. Mount R/O	
35	5	3		RIGHT TOP LANE	on Rt. Mount R/O	
36	5	4		NOT USED		
37	5	5		NOT USED		
38	5	6		RIGHT RAMP ENTER	on Gate	180-5087-00
39	5	7		RIGHT RAMP EXIT	on Gate	
40	5	8		NOT USED		
41	6	1		GOALIE MOTOR (LT)	on OPTO Bd.	520-5155-00
42	6	2		GOALIE MOTOR (RT)	on OPTO Bd.	
43	6	3		GOALIE MAGNET		180-5165-00
44	6	4		GOALIE UNDERTROUGH		180-5057-00
45	6	5	DOTS	LEFT VUK		180-5116-01
46	6	6	DOTS	TOP SUPER VUK		180-5052-00
47	6	7		GOALIE MOTOR (CTR)	on OPTO Bd.	520-5155-00
48	6	8		RT INNER RETURN	on Rt. Mount R/O	500-6227-02
49	7	4		LEFT TURBO BUMPER		180-5015-03
50	7	2		RIGHT TURBO BUMPER		
51	7	3		BOTTOM TURBO BUMPER		
52	7	4	DOTS	KICKER TARGET	Leaf Switch	180-5054-00
53	7	5		NOT USED		
54	7	6		START BUTTON	Switch Only	180-5174-00
55*	7	7		SLAM TILT	On Coin Door	180-5022-00
56*	7	8		PLUMB BOB TILT	HANGER 535-5319-00 CONTACT 535-7563-01	
57	8	1		LEFT OUTLANE	on Rt. Mount R/O	500-6227-02
58	8	2		LEFT RETURN LANE	on Rt. Mount R/O	
59	8	3		LEFT SLINGSHOT	Leaf Switch X2	180-5054-00
60	8	4		RIGHT OUTLANE	on Rt. Mount R/O	500-6227-02
61	8	5		RT OUTER RETURN	on Rt. Mount R/O	
62	8	6		RIGHT SLINGSHOT	Leaf Switch X2	180-5054-00
63	8	7		NOT USED		
64	8	8		NOT USED		

‡ Sw. 14 / Sw. 15 have both REC/TRANS on 1 board respectively.

DOTS: Diode On Terminal Strip, or **DODB:** Diode On Diode Board

Legend Note:

☐ = Switches mounted above playfield.

■ = Switches mounted below playfield.

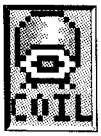
* The following switches are located in the cabinet and are not noted in the diagram above:

2 4 5 6

The following switches are not used:

10 30 36 37 40 53 55 63 64

Switches for *Future Use:* 3 & 7



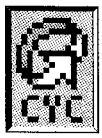
Go To Coil Menu

From the **DIAGNOSTICS MENU**, select the "COIL" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button.** The coils are listed in groups. Coils 01-16 are typically High Current Coils (although Low Current Coils may be used in these positions & will be noted). Coils 17-32 are typically Low Current Coils. Flash Lamps are typically used in positions 26-32 (although may be used in any position & will be noted), read **Single Coil Test** below.

Single Coil Test

To initiate, from the **COIL MENU**, select the "TEST" *Icon* with either **Red** or **Green Button** and press the **Black Button.** Ensure the **Power Interlock Switch** is pulled out. Select either the "-" or "+" *Icons.* Start with the "+" *Icon* to start the manual Coil Test from #1 (The test runs through all Coils and Flash Lamps #1-#32 & AUX 1-3 *(Auxilliary Positions are Optional UK Only).* Press the **Black Button** on the "+" *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 & 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" *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.

Important: The **Power Interlock Switch** must be pulled out for this *test to function* while the **Coin Door** is **OPEN.**



Cycling Coil Test

To initiate, from the **COIL MENU**, select the "CYC" *Icon* with either **Red** or **Green Button** and press the **Black Button.** If still in a previous test, select the "PREV" *Icon* to return to Coil Menu or selecting either of the "ARROW" *Icons* will 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 Backbox. The display indicates "CYCLING COILS."

Important: The **Power Interlock Switch** must be pulled out for this *test to function* while the **Coin Door** is **OPEN.**

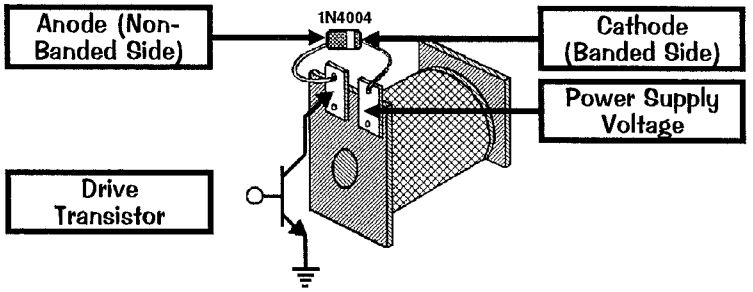
Coil & Flash Lamp Descriptions

#	Type	Coil / Flash Lamp Descriptions
1	Coil	TROUGH UP-KICKER (VUK) (26-1200)
2	Coil	AUTO LAUNCH (24-940)
3	Coil	LEFT VUK (26-1200)
4	Coil	TOP SUPER VUK (23-800)
5	Coil	KICKER TARGET (23-700)
6	Coil	4-BANK DROP TARGET RESET (23-1100)
7	Coil	4-BANK #1 (TOP) DOWN (33-1590)
8	Coil	BALL LOCK (32-1800)
9	Coil	LEFT TURBO BUMPER (26-1200)
10	Coil	RIGHT TURBO BUMPER (26-1200)
11	Coil	BOTTOM TURBO BUMPER (26-1200)
12	Coil	GOALIE MAGNET (22-650)
13	Coil	RAMP MAGNET (22-650)
14	Coil	UPPER FLIPPER [50V RED/YEL] (23-1100)
15	Coil	LEFT FLIPPER [50V RED/YEL] (22-1080)
16	Coil	RIGHT FLIPPER [50V RED/YEL] (23-1100)

#	Type	Coil / Flash Lamp Descriptions
17	Coil	LEFT SLINGSHOT (23-800)
18	Coil	RIGHT SLINGSHOT (23-800)
19	Coil	BALL DEFLECTOR (26-1200)
20	Flash	FLASH: STADIUM X4 (#906 Bulb)
21	Coil	4-BANK #2 DOWN (33-1590)
22	Coil	4-BANK #3 DOWN (33-1590)
23	Coil	4-BANK #4 (BOT) DOWN (33-1590)
24	Coil	(OPTIONAL COIN METER)
25	Flash	GOALIE MTR DRV RELAY BD (520-5010-00)
26	Flash	GOALIE BI-DIRECTIONAL MTR RELAY BD (520-5066-00)
27	Flash	FLASH: UPPER FLIPPER X1 (#906 Bulb)
28	Flash	FLASH: SPINNER X1 (#906 Bulb)
29	Flash	FLASH: RAMP X1 (#906 Bulb)
30	Flash	FLASH: BACK PANEL X4 (#906 Bulb)
31	Flash	FLASH: POPS X4 (#89 Bulb)
32	Flash	FLASH: SLINGSHOTS X4 (#89 Bulb)

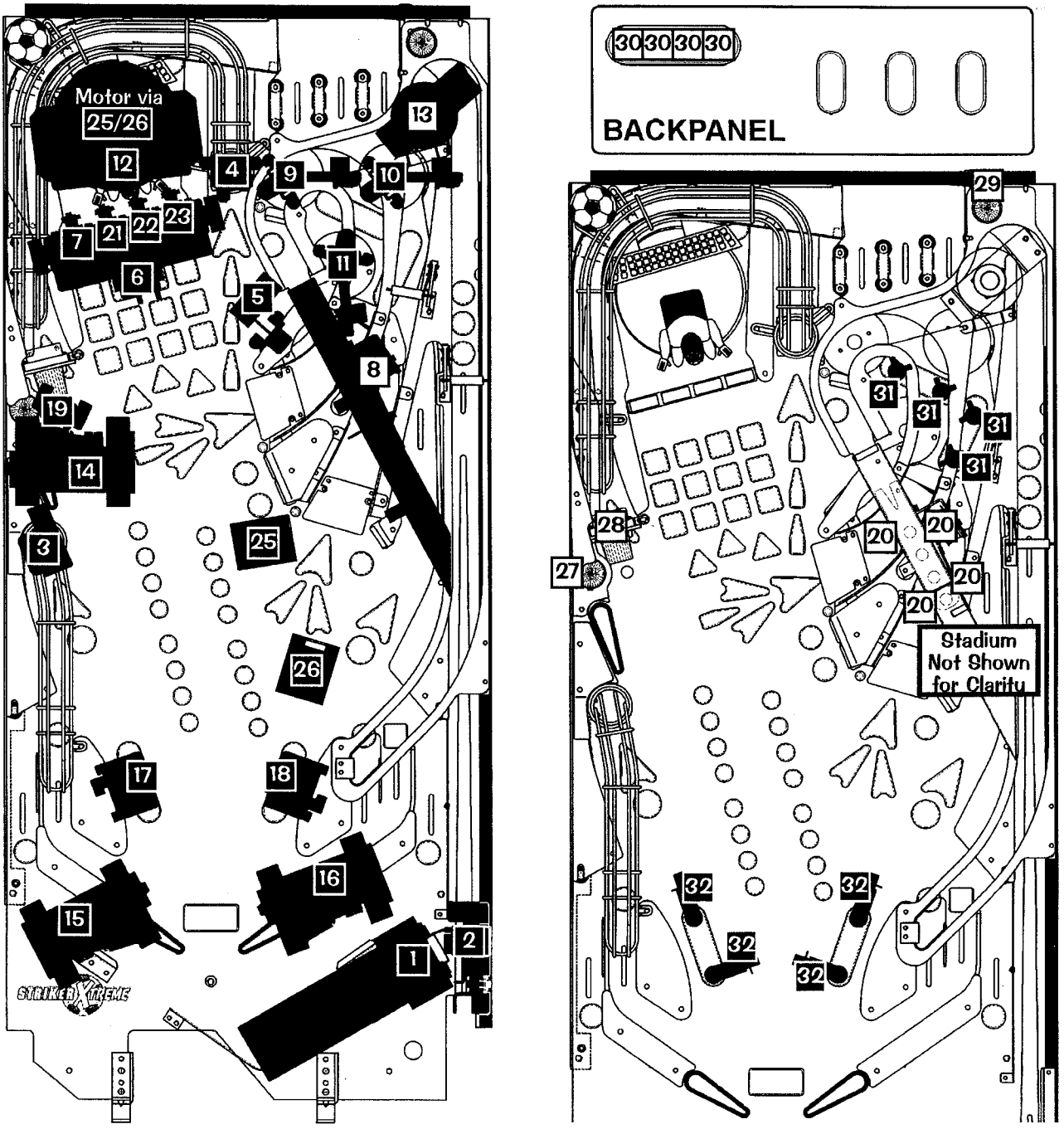
See the next three (3) pages for the **Coil & Flash Lamp Location Maps** (corresponds to above tables), **Coils Detailed Chart Table** & the **Backbox I/O Power Driver Board Detailed Wiring Diagram.**

Typical Coil Wiring



Note:
All Coils require diodes. Some diodes are located on Terminal Strips (under playfield) & not on the coil itself.
D iode
O n
T erminal
S trip

Coil & Flash Lamp Locations



Use the previous page and the following two (2) pages in conjunction with above Coil and Flash Lamp Maps.

Legend Note:

☐ = Coils and Flash Lamps mounted above playfield.

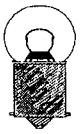
■ = Coils and Flash Lamps mounted below playfield.

The following Coil is optional:

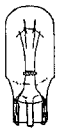
24

The following Coil(s) are Not Used:

The following Bulb Types are used for Flash Lamps:

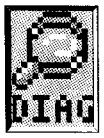


#89 Bulb
(Bayonet)
165-5000-89

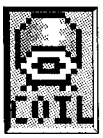


#906 Bulb
(Wedge Base)
165-5004-00

The following Flash Lamp(s) are Not Used:

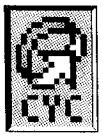


From the Main Menu in Portals™ GO TO DIAGNOSTICS MENU →



From the Diagnostics Menu GO TO COIL MENU →

From the Coil Menu GO TO COIL TEST →



From the Coil Menu GO TO CYCLING COILS

COILS DETAILED CHART TABLE

High Current Coils Group 1		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	I/O Pwr. Drvr.	BRN-BLK	J8-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#2	AUTO LAUNCH	Q2	I/O Pwr. Drvr.	BRN-RED	J8-P3	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00T
#3	LEFT VUK	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#4	TOP SUPER VUK	Q4	I/O Pwr. Drvr.	BRN-YEL	J8-P5	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#5	KICKER TARGET	Q5	I/O Pwr. Drvr.	BRN-GRN	J8-P6	YEL-VIO	J10-P4/5	50v DC	23-700 090-5022-00T
#6	4-BANK DROP TARGET RESET	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	YEL-VIO	J10-P4/5	50v DC	23-1100 090-5030-00T
#7	4-BANK #1 (TOP) DOWN	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	YEL-VIO	J10-P4/5	50v DC	33-1590 515-6916-00
#8	BALL LOCK	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	YEL-VIO	J10-P4/5	50v DC	32-1800 090-5031-00

High Current Coils Group 2		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn
#9	LEFT TURBO BUMPER	Q9	I/O Pwr. Drvr.	BLU-BRN	J9-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#10	RIGHT TURBO BUMPER	Q10	I/O Pwr. Drvr.	BLU-RED	J9-P2	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#11	BOTTOM TURBO BUMPER	Q11	I/O Pwr. Drvr.	BLU-ORG	J9-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#12	GOALIE MAGNET	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#13	RAMP MAGNET	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#14	UPPER FLIPPER (50v RED/YEL)	Q14	I/O Pwr. Drvr.	BLU-BLK	J9-P7	RED-YEL GRY-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T
#15	LEFT FLIPPER (50v RED/YEL)	Q15	I/O Pwr. Drvr.	ORG-GRY	J9-P8	RED-YEL GRY-YEL	J10-P1/2	50v DC	22-1080 090-5032-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16	I/O Pwr. Drvr.	ORG-VIO	J9-P9	RED-YEL BLU-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T

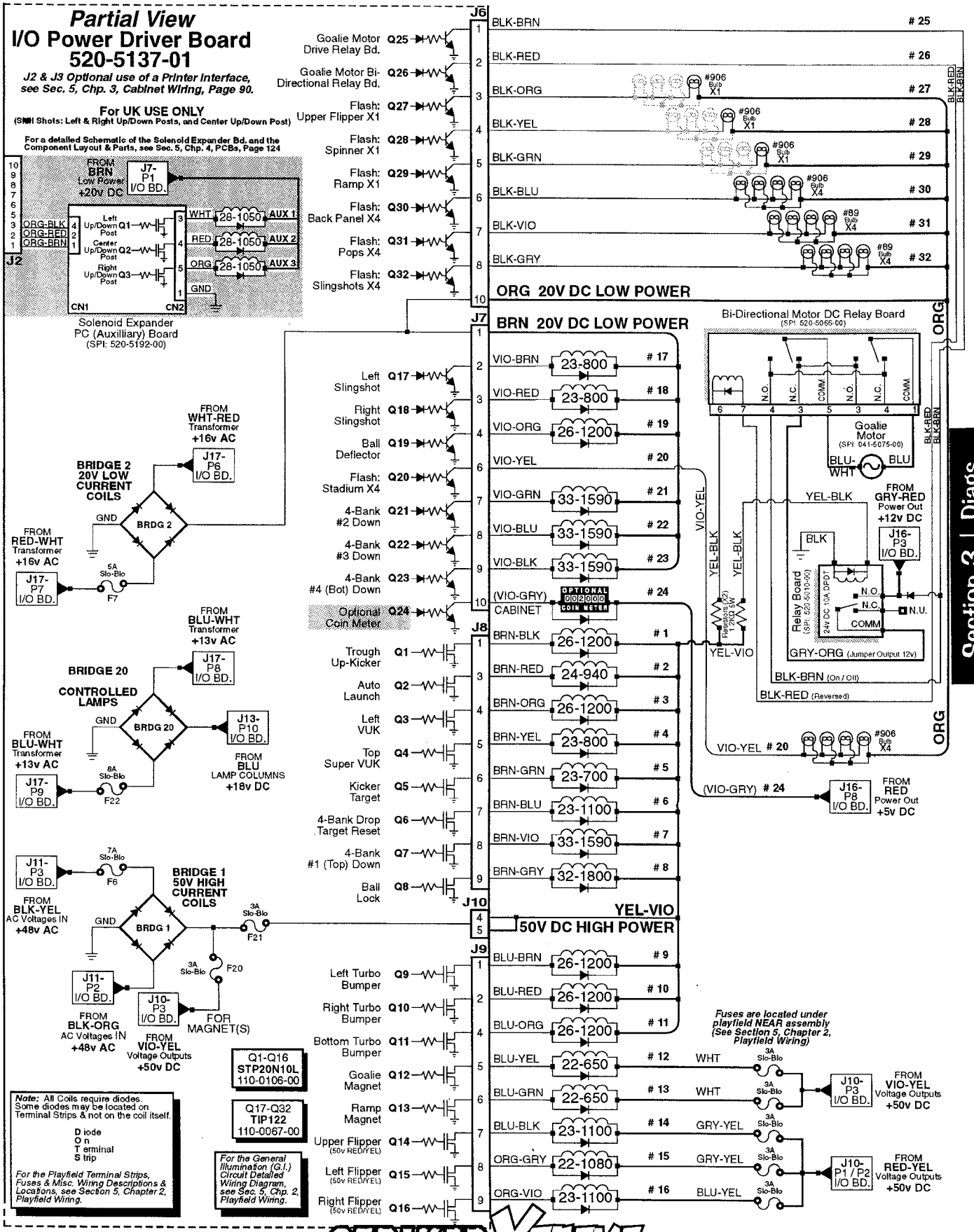
Low Current Coils Group 1		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn or Meter #
#17	LEFT SLINGSHOT	Q17	I/O Pwr. Drvr.	VIO-BRN	J7-P2	BRN	J7-P1	20v DC	23-800 090-5001-00T
#18	RIGHT SLINGSHOT	Q18	I/O Pwr. Drvr.	VIO-RED	J7-P3	BRN	J7-P1	20v DC	23-800 090-5001-00T
#19	BALL DEFLECTOR	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	BRN	J7-P1	20v DC	26-1200 090-5044-00T
#20	FLASH: STADIUM X4	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#21	4-BANK #2 DOWN	Q21	I/O Pwr. Drvr.	VIO-GRN	J7-P7	BRN	J7-P1	20v DC	33-1590 515-6916-00
#22	4-BANK #3 DOWN	Q22	I/O Pwr. Drvr.	VIO-BLU	J7-P8	BRN	J7-P1	20v DC	33-1590 515-6916-00
#23	4-BANK #4 (BOT) DOWN	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	BRN	J7-P1	20v DC	33-1590 515-6916-00
#24	OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v DC	Meter 5v 091-5000-00

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

Low Current Coils Group 2		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Bulb Type
#25	GOALIE MTR DRV RELAY BD	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	YEL-VIO YEL-BLK	J10-P4/5	50v DC	Relay Bd. 520-5010-00
#26	GOALIE BI-DIRECTIONAL MTR RELAY BD	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	YEL-VIO YEL-BLK	J10-P4/5	50v DC	B-D Relay 520-5066-00
#27	FLASH: UPPER FLIPPER X1	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#28	FLASH: SPINNER X1	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#29	FLASH: RAMP X1	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#30	FLASH: BACK PANEL X4	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#31	FLASH: POPS X4	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#32	FLASH: SLINGSHOTS X4	Q32	I/O Pwr. Drvr.	BLK-GRY	J6-P8	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89

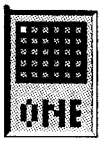
Note: In Test Flash Lamps Menu ("Flash" loop), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: #20 & #27-#32)

Auxilliary (OPTIONAL UK ONLY)	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn
AUX 1: LEFT UP/DOWN POST	Q1	Sol. Expander (Aux. Board)	WHT	CN2-P5	BRN	J7-P1	20v DC	28-1050 090-5046-00T
AUX 2: CENTER UP/DOWN POST	Q2	Sol. Expander (Aux. Board)	RED	CN2-P4	BRN	J7-P1	20v DC	23-1100 090-5030-00T
AUX 3: RIGHT UP/DOWN POST	Q3	Sol. Expander (Aux. Board)	ORG	CN2-P3	BRN	J7-P1	20v DC	28-1050 090-5046-00T


Partial View
I/O Power Driver Board
520-5137-01
J2 & J3 Optional use of a Printer Interface, see Sec. 5, Chp. 3, Cabinet Wiring, Page 90.
For UK USE ONLY
(Small Shots: Left & Right Up/Down Posts, and Center Up/Down Post)
For a detailed Schematic of the Solenoid Expander Bd. and the Component Layout & Parts, see Sec. 5, Chp. 4, PCBs, Page 124
FROM BRN Low Power +20v DC
J7-P1 I/O BD.
ORG-BLK
ORG-RED
ORG-BRN
J2
Left Up/Down Post Q1
Center Up/Down Post Q2
Right Up/Down Post Q3
WHT 28-1050 AUX 1
RED 28-1050 AUX 2
ORG 28-1050 AUX 3
GND
CN1
CN2
Solenoid Expander PC (Auxilliary) Board (SPI: 520-5192-00)
J6
Goalie Motor Drive Relay Bd. Q25
Goalie Motor Bi-Directional Relay Bd. Q26
Flash: Upper Flipper X1 Q27
Flash: Spinner X1 Q28
Flash: Ramp X1 Q29
Flash: Back Panel X4 Q30
Flash: Pops X4 Q31
Flash: Slingshots X4 Q32
BLK-BRN # 25
BLK-RED # 26
BLK-ORG # 27
BLK-YEL # 28
BLK-GRN # 29
BLK-BLU # 30
BLK-VIO # 31
BLK-GRY # 32
#906 Bulb X1
#906 Bulb X4
#89 Bulb X4
ORG 20V DC LOW POWER
J7
BRN 20V DC LOW POWER
Left Slingshot Q17
Right Slingshot Q18
Ball Deflector Q19
Flash: Stadium X4 Q20
4-Bank #2 Down Q21
4-Bank #3 Down Q22
4-Bank #4 (Bot) Down Q23
Optional Coin Meter Q24
VIO-BRN 23-800 # 17
VIO-RED 23-800 # 18
VIO-ORG 26-1200 # 19
VIO-YEL # 20
VIO-GRN 33-1590 # 21
VIO-BLU 33-1590 # 22
VIO-BLK 33-1590 # 23
(VIO-GRY) OPTIONAL COIN METER CABINET # 24
Bi-Directional Motor DC Relay Board (SPI: 520-5066-00)
N.O. N.C. COMM
Goalie Motor (SPI: 041-5075-00)
BLU-WHT
BLU
YEL-BLK
FROM GRY-RED Power Out +12v DC
J16-P3 I/O BD.
BLK
Relay Board (SPI: 520-5010-00) 24v DC 10A DPDT
N.O. N.C. N.U. COMM
GRY-ORG (Jumper Output 12v)
BLK-BRN (On / Off)
BLK-RED (Reversed)
VIO-YEL # 20
(VIO-GRY) # 24
J16-P8 I/O BD.
FROM RED Power Out +5v DC
ORG
BLK-RED
BLK-BRN
J8
Trough Up-Kicker Q1
Auto Launch Q2
Left VUK Q3
Top Super VUK Q4
Kicker Target Q5
4-Bank Drop Target Reset Q6
4-Bank #1 (Top) Down Q7
Ball Lock Q8
BRN-BLK 26-1200 # 1
BRN-RED 24-940 # 2
BRN-ORG 26-1200 # 3
BRN-YEL 23-800 # 4
BRN-GRN 23-700 # 5
BRN-BLU 23-1100 # 6
BRN-VIO 33-1590 # 7
BRN-GRY 32-1800 # 8
YEL-VIO
J10
50V DC HIGH POWER
J9
Left Turbo Bumper Q9
Right Turbo Bumper Q10
Bottom Turbo Bumper Q11
Goalie Magnet Q12
Ramp Magnet Q13
Upper Flipper (50v RED/YEL) Q14
Left Flipper (50v RED/YEL) Q15
Right Flipper (50v RED/YEL) Q16
BLU-BRN 26-1200 # 9
BLU-RED 26-1200 # 10
BLU-ORG 26-1200 # 11
BLU-YEL 22-650 # 12 WHT
BLU-GRN 22-650 # 13 WHT
BLU-BLK 23-1100 # 14 GRY-YEL
ORG-GRY 22-1080 # 15 GRY-YEL
ORG-VIO 23-1100 # 16 BLU-YEL
3A Slo-Blo
J10-P3 I/O BD.
FROM VIO-YEL Voltage Outputs +50v DC
J10-P1 / P2 I/O BD.
FROM RED-YEL Voltage Outputs +50v DC
Fuses are located under playfield NEAR assembly (See Section 5, Chapter 2, Playfield Wiring)
FROM WHT-RED Transformer +16v AC
J17-P6 I/O BD.
BRIDGE 2 20V LOW CURRENT COILS
GND
BRDG 2
FROM RED-WHT Transformer +16v AC
J17-P7 I/O BD.
5A Slo-Blo
F7
FROM BLU-WHT Transformer +13v AC
J17-P8 I/O BD.
BRIDGE 20 CONTROLLED LAMPS
BRDG 20
J13-P10 I/O BD.
FROM BLU LAMP COLUMNS +18v DC
FROM BLU-WHT Transformer +13v AC
J17-P9 I/O BD.
8A Slo-Blo
F22
J11-P3 I/O BD.
7A Slo-Blo
F6
FROM BLK-YEL AC Voltages IN +48v AC
BRIDGE 1 50V HIGH CURRENT COILS
BRDG 1
3A Slo-Blo
F21
F20
J11-P2 I/O BD.
J10-P3 I/O BD.
FROM BLK-ORG AC Voltages IN +48v AC
FROM VIO-YEL Voltage Outputs +50v DC
FOR MAGNET(S)
Q1-Q16 STP20N10L 110-0106-00
Q17-Q32 TIP122 110-0067-00
Note: All Coils require diodes. Some diodes may be located on Terminal Strips & not on the coil itself.
Diode On Terminal Strip
For the Playfield Terminal Strips, Fuses & Misc. Wiring Descriptions & Locations, see Section 5, Chapter 2, Playfield Wiring.
For the General Illumination (G.I.) Circuit Detailed Wiring Diagram, see Sec. 5, Chp. 2, Playfield Wiring.

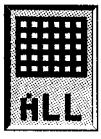
Go To Lamp Menu

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



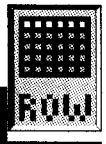
Single Lamp Test

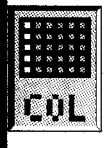
To initiate, from the **LAMP MENU**, select the "ONE" *Icon* with either **Red** or **Green Button** and press the **Black Button**. Select either the "-" or "+" *Icons*. Start with the "+" *Icon* to start the manual Lamp Test from Column 1, Row 1, Switch 1. Press the **Black Button** on the "+" *Icon*, as each lamp is selected, the lamp will light at it's location on the playfield as well as the display, indicating the Lamp Matrix Grid Position, 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" *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 **Red** or **Green Button** and press the **Black Button**. If still in Single Lamp Test (or any 1 of the 4 tests), select the "PREV" *Icon* to return to Lamp Menu or selecting either of the "ARROW" *Icons* will 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 **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black Button**. If still in a previous test, select the "PREV" *Icon* to return to Lamp Menu or selecting either of the "ARROW" *Icons* will move through the tests, keep activating until Row or Column Lamp Test (whichever desired) is displayed. In this test, each set of lamps in each Row or Column of the Lamp Matrix Grid (respective to each test) will light-up on the playfield and is indicated in the display.

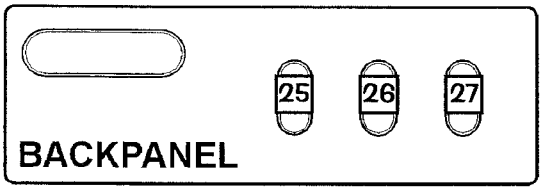
LAMP MATRIX GRID

D iode O n T erminal S trip :

Row (GND) \ Column (18V)	1: U17 YEL-BRN J13-P9	2: U16 YEL-RED J13-P8	3: U15 YEL-ORG J13-P7	4: U14 YEL-BLK J13-P6	5: U13 YEL-GRN J13-P5	6: U12 YEL-BLU J13-P4	7: U11 YEL-VIO J13-P3	8: U10 YEL-GRY J13-P1
1: Q33 RED-BRN J12-P1	GOALIE TOP #1 (LT) #555 Bulb 1	GOALIE TOP #2 #555 Bulb 2	GOALIE TOP #3 #555 Bulb 3	GOALIE TOP #4 (RT) #555 Bulb 4	ENGLAND #555 Bulb 5	BRAZIL #555 Bulb 6	SWITZER-LAND #555 Bulb 7	FINLAND #555 Bulb 8
2: Q34 RED-BLK J12-P2	GOALIE MID #1 (LT) #555 Bulb 9	GOALIE MID #2 #555 Bulb 10	GOALIE MID #3 #555 Bulb 11	GOALIE MID #4 (RT) #555 Bulb 12	FRANCE #555 Bulb 13	USA #555 Bulb 14	SPAIN #555 Bulb 15	AUSTRALIA #555 Bulb 16
3: Q35 RED-ORG J12-P3	GOALIE BOT #1 (LT) #555 Bulb 17	GOALIE BOT #2 #555 Bulb 18	GOALIE BOT #3 #555 Bulb 19	GOALIE BOT #4 (RT) #555 Bulb 20	GERMANY #555 Bulb 21	BELGIUM #555 Bulb 22	SWEDEN #555 Bulb 23	HOLLAND #555 Bulb 24
4: Q36 RED-YEL J12-P4	(C)UP (BACK PANEL) #44 Bulb 25	C(U)P (BACK PANEL) #44 Bulb 26	CU(P) (BACK PANEL) #44 Bulb 27	NOT USED 28	ITALY #555 Bulb 29	CANADA #555 Bulb 30	AUSTRIA #555 Bulb 31	JAPAN #555 Bulb 32
5: Q37 RED-ORN J12-P5	SKILL SHOT (1) #555 Bulb 33	SKILL SHOT (2) #555 Bulb 34	SKILL SHOT (3) #555 Bulb 35	NOT USED 36	NOT USED 37	LEFT TUR-BO BUMPER #555 Bulb 38	RIGHT TUR-BO BUMPER #555 Bulb 39	BOT TUR-BO BUMPER #555 Bulb 40
6: Q38 RED-BLU J12-P6	NOT USED 41	BALL S-U (POPS) #555 Bulb 42	BALL 2-BANK S-U TOP #555 Bulb 43	BALL 2-BANK S-U BOT #555 Bulb 44	BALL S-U (RT RAMP) #555 Bulb 45	BIG POINTS #555 Bulb 46	BEAT COUNTRY #555 Bulb 47	XTREME #555 Bulb 48
7: Q39 RED-VIO J12-P8	EXTRA BALL #44 Bulb 49	VENDOR #44 Bulb 50	HALFTIME #555 Bulb 51	LOCK (SIDE RAMP) #555 Bulb 52	HURRY-UP (SIDE RAMP) #555 Bulb 53	LOCK (RT RAMP) #555 Bulb 54	HURRY-UP (RT RAMP) #555 Bulb 55	PENALTY KICK #555 Bulb 56
8: Q40 RED-GRY J12-P9	LEFT OUTLANE #555 Bulb 57	LEFT RE-TURN LANE #555 Bulb 58	RIGHT INNER RETURN #555 Bulb 59	RIGHT OUTER RETURN #555 Bulb 60	RIGHT OUTLANE #555 Bulb 61	NOT USED 62	NOT USED 63	SHOOT AGAIN #555 Bulb 64
9: Q41 RED-WHT J12-P10	LEFT VUK ARROW #555 Bulb 65	LEFT ORBIT ARROW #555 Bulb 66	TOP VUK ARROW #555 Bulb 67	RAMP LEFT ENTER ARROW #555 Bulb 68	RAMP RIGHT ENTER ARROW #555 Bulb 69	RIGHT OR-BIT ARROW #555 Bulb 70	SPOT SHOOT OUT #555 Bulb 71	ADVANCE POPS #555 Bulb 72
10: Q42 NOT USED RED J12-P11	NOT USED 73	NOT USED 74	NOT USED 75	NOT USED 76	NOT USED 77	NOT USED 78	NOT USED 79	NOT USED 80

Lamp Matrix Grid Locations

The lamp locations correspond with the Lamp Nº in the Lamp Matrix Grid on the previous page.



Legend Note:

□ = Lamps mounted above playfield.

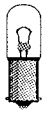
■ = Lamps mounted below playfield.

The following Lamps are not used:

28 | 36 - 37 | 41 | 62 - 63 | 73 - 80

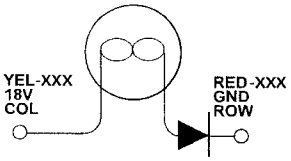
The following Bulbs are used in the Lamp Matrix Grid (See Table Grid on previous page for details):

#555 Bulb (Wedge)
165-5002-00

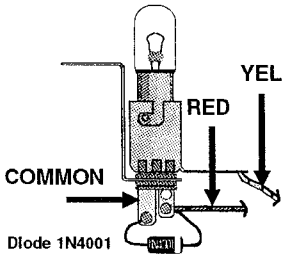


#44 Bulb (Bayonet)
165-5000-44

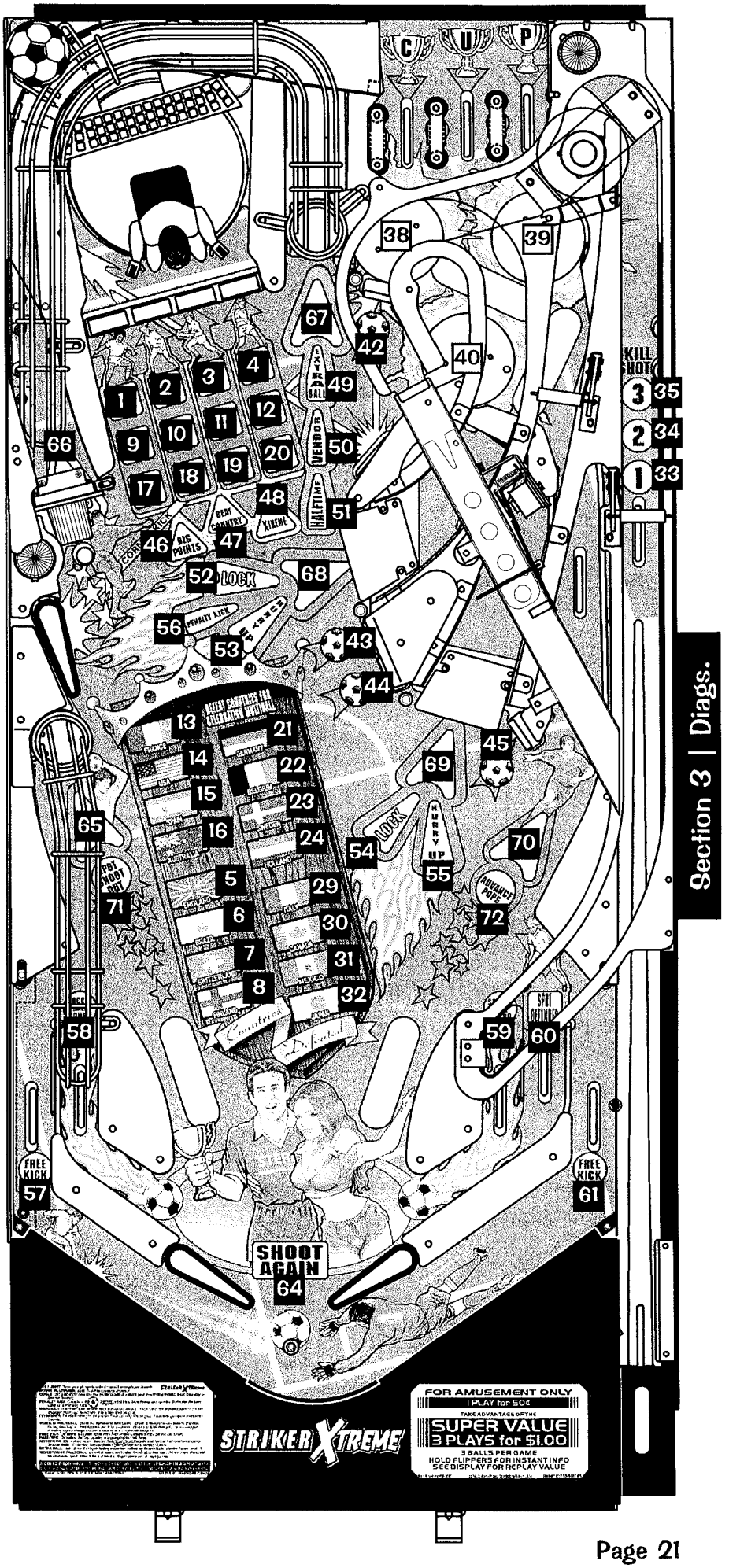
Typical Lamp Schematic

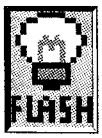


Typical Lamp Wiring



Note:
All Lamps require diodes.
Some diodes are located on Terminal Strips (under playfield) & not on the lamp itself.
D iode
O n
T erminal
S trip





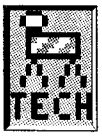
Test Flash Lamps

From the **DIAGNOSTICS MENU**, select the "FLASH" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. After selecting this *Icon* the display will indicate "CYCLING FLASHERS" and all the Flash Lamps will cycle continuously until the test is exited. This test is allows the technician to easily spot any burned-out bulbs and replace them. Flashers tested are Flash Lamps in Positions: **Q1-Q32** and in this game Flash Lamp(s) are in Position(s): **Q20, Q27-Q32**.

Important: The **Power Interlock Switch** must be pulled out for this *test to function* while the **Coin Door** is **OPEN**.

Clear Ball Trough

From the **DIAGNOSTICS MENU**, select the "CLR" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. This 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" *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. ***Important:*** The **Power Interlock Switch** must be pulled out. ⚠ **Caution:** *Continuous use of above test may overheat the Trough Up-Kicker Coil.* ⚠



Technician Alert

From the **DIAGNOSTICS MENU**, select the "TECH" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. After selecting this *Icon* the display will indicate if there are any faulty switches (i.e., switches that are normally closed but remain open or open switches that have not been closed (activated) in 50 games.)

Service Phone

From the **DIAGNOSTICS MENU**, select the "SERV" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. After selecting this *Icon* the display will indicate a phone number to call if technical assistance is required (the phone number is different for each *Country Dip Switch Setting*).

Begin Play Test

From the **DIAGNOSTICS MENU**, select the "PLAY" *Icon* with either **Red "LEFT"** or **Green "RIGHT"** Button 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 function, similar tests may be performed on the "Ejects", Slingshots, Vertical Up-Kickers, Pop Bumpers, etc. in the game. For unique Play Test functions, select the "GAME SPECIFIC" *Icon* in the **DIAGNOSTICS MENU**. ***Important:*** The **Power Interlock Switch** must be pulled out.

Fire Knocker

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

Sound / Speaker Test

From the **DIAGNOSTICS MENU**, select the "SPKR" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** 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 "+" *Icons* and press the **Black "ENTER" Button** to activate the first test. Repeat to visually see & hear all tests. Select the "RUN" *Icon* to activate the test chosen without moving to the next test.

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

Sound / Speaker Test Continued Next Page

Speaker Phase Testing

Continued

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

1. Check each speaker for polarity markings. If the speakers have polarity markings, verify that the Backbox Speaker RED/WHT Wire and the Cabinet Speaker YEL/WHT Wire is connected to the negative (-) terminal.

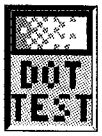
2. Disconnect the speaker output connector from the CPU / Sound Board and connect a 1.5-volt battery across each speaker pair one at a time while observing the speakers. Make sure the positive battery terminal is connected to the positive lead (CN4, Pin-3 (RED/BLK) or Pin-6 (YEL/BLK)) each time. As the connection is made, check speaker cone movement; proper connections are indicated by outward movement.

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

Note: For ROM Locations, see Page* DR. ❶. *For ROM Usage (Summary Table) see Page* DR. ❸ *in the "Find-It-In-Front: Dr. Pinball Section". Voice ROMs (U17, U21, U36 & U37) which are 8MB must have a Jumper at W6 on the CPU/Sound Board to function properly.

Begin Burn In

From the **DIAGNOSTICS MENU**, select the "BURN" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** 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. To reset Burn-In minutes to 00, select the "RESET" *Icon* in the **MAIN MENU** and select the "FACT" *Icon* (Factory Reset). See Chapter 5, Go To Reset Menu, of this section.



Dot Matrix Test

From the **DIAGNOSTICS MENU**, select the "DOT TEST" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. After selecting this *Icon* the Dot Matrix Test immediately begins. The display will immediately illuminate & cycle for 1 pass of each test continuously for each of the following tests:

1. Illuminates 1 vertical column of dots, turning it off & illuminating the next column, until each column has been individually lit, while the other columns are off.
2. Illuminates 1 horizontal row of dots, turning it off & illuminating the next row, until each row has been individually lit, while the other rows are off.
3. Illuminates all the dots, except for one column from left to right.
4. Illuminates all the dots, except for one row from top to bottom.
5. Illuminates every other dot lit, in both the rows and columns.
6. Illuminates all dots at 30%, 70% & 100% brightness.

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

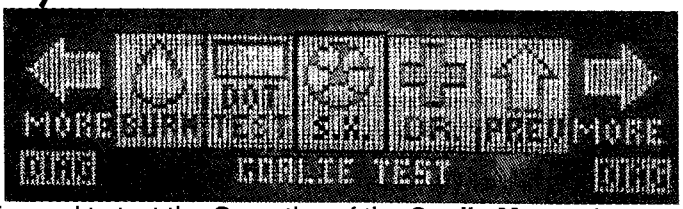
Dot Matrix Display Explained

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

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

Striker Xtreme (Goalie Test)

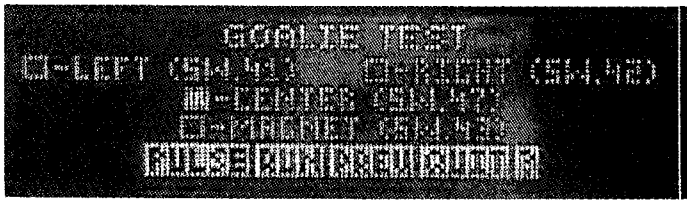
To initiate, from the **DIAGNOSTICS MENU**, select the "S.X." *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Button** (the **LEFT** and **RIGHT FLIPPER Buttons** operates in the same manner) and press the **Black "ENTER" Button** (the **START Button** operates in the same manner).

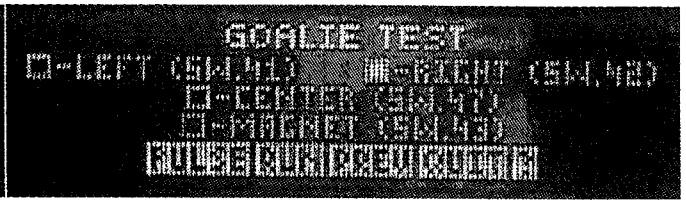


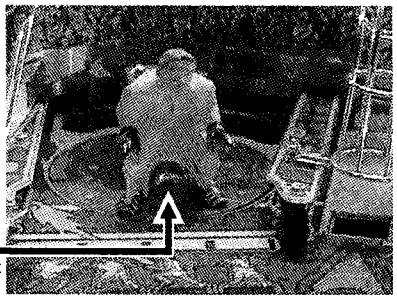
This will bring up the **GOALIE TEST MENU**. This menu is used to test the Operation of the **Goalie Motor**, the **Goalie Motor OPTO PC Board Switches** and the **Goalie Magnet Switch**.

Important: The **Power Interlock Switch** must be pulled out for this *test to function* while the **Coin Door** is **OPEN**.

This test is provided to allow the technician a simple method of testing ***Motor Operation*** (**Q25 / Q26**) & the ***OPTO Switches***, ❒ **- LEFT (Sw. 41)**, ❒ **- RIGHT (SW. 42)**, ❒ **- CENTER (SW. 47)** and ❒ **- MAGNET (SW. 43)**. Upon entering this test menu, the display will indicate the switch status of the ***Goalie Motor***. The ❒ **- CENTER (SW. 47)** indicator will be active (❒ will turn solid ■). If the *Goalie is off-center*, **none** of the Switch Indicator boxes will be "filled".

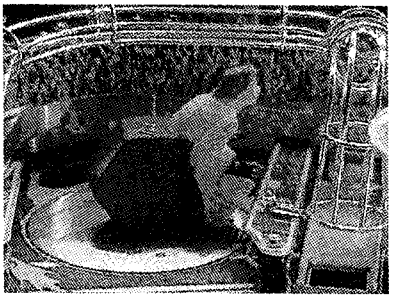




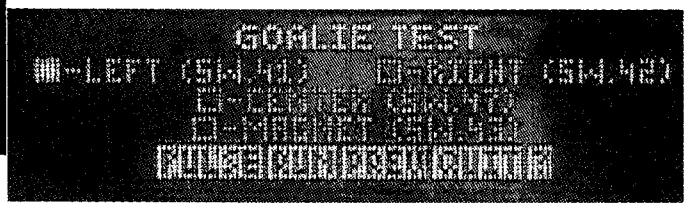


Magnet Switch 43, is inbetween the Goalie Legs. See Magnet Switch Test Procedure below.

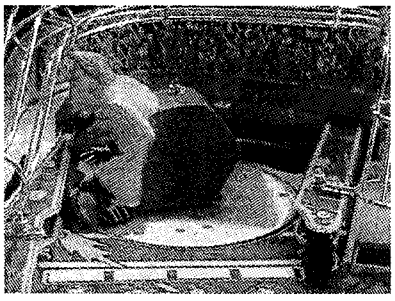
Goalie in the Center Position (OP2), ❒ - CENTER (SW. 47) is indicated as closed.



Goalie in the Right Position (OP3), ❒ - RIGHT (SW. 42) is indicated as closed.



Goalie in the Left Position (OP1), ❒ - LEFT (SW. 41) is indicated as closed.



Motor & OPTO Switch Test Procedure:

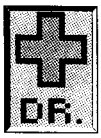
Select the "PULSE" *Icon* to pulse the motor (in steps). If the Goalie is at **Center (HOME)** the motor will turn to the ❒ **- RIGHT (SW. 42)** position ***(OP3** on the OPTO Bd.)*. Continuously activating the "PULSE" *Icon* will bring the Goalie back into the ❒ **- CENTER (SW. 47)** position ***(OP2** on the OPTO Bd.)* then onto the ❒ **- LEFT (SW. 41)** position ***(OP1** on the OPTO Bd.)*. Selecting the "RUN" *Icon* will automatically cycle the motor to the next open switch (OPTO) and then will stop. Select the "RUN" *Icon* again to return (cycle) to the other positions. Watch the *Dot Matrix Display* to ensure the **Switches 41 (OP1), 42 (OP3)** & **47 (OP2)** are being indicated as closed as the motor stops (❒ will turn solid ■).

Note: *These OPTO Switches close when the Motor Cam Flag Bracket passes between the OPTOs.*

Magnet & Switch Test Procedure:

With the Goalie in the Center Position (facing forward), depress the ***Magnet Switch Actuator*** *(inbetween the Goalie's Legs)* with a *pinball.* The display will indicate ❒ **- MAGNET (SW. 43)** as activated (❒ will turn solid ■). At the *moment of this Switch 43 closure*, the **Magnet** will *grab*, *hold* and *release* the pinball. This ***Magnet Switch 43*** can also be tested in the "SWITCH TEST MENU" (see **Go To Switch Menu** on Page 14).

Note: *The Goalie will automatically return to the **HOME** Pos. (Center) upon exiting the **Portals™ Service Menu**. To exit this Menu, select & activate the "PREV" Icon to go back to the **DIAGNOSTICS MENU** or activate the "QUIT" Icon to exit the **Portals™ Service Menu**. See Sec. 5, Chp. 4, Printed Circuit Boards, for the Goalie Motor OPTO PC Board Theory of Operation & Schematic and the Component Layout & Parts, on Page 123.*



Dr. Pinball (Flow Chart Menus)

To initiate, from the **DIAGNOSTICS MENU**, select the Cross "DR." *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Button** 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 sub-menus: Coil "DR.," Switch "DR." and Lamp "DR." *Icons*. Selecting a particular sub-menu 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. The display will now ask 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 asks a question or request a procedure the Dr. 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 your **Flipper Buttons** to "SELECT" a *Mini-Icon* and the **Start Button** to "ENTER" your selection.

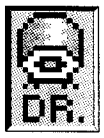
The following are the *Mini-Icons* with explanations for the Dr. Pinball Sub-Menus to follow:

→ Select a Coil, Lamp or Switch to diagnose with "-" or "+" *Icon*; Then select the "RUN" *Icon* to activate the choice.
"PREV" goes back to previous question.
"QUIT" exits Portals completely.
Help "?" gives direction on button usage.

→ Seen when a question is being asked on the Display. Select "YES" or "NO" to answer the question given.
"END" lets you select a new item to test.
"PREV", "QUIT" and "?" (see first example above).

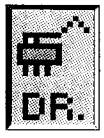
→ Seen when diagnosis is given. Select any *Icon* for your next step.
"END" lets you select a new item to test.
"PREV", "QUIT" and "?" (see first example above).

→ In Coil Flow Chart Menu, select "PULSE" to pulse the coil selected.
"END" lets you select a new item to test.
"PREV", "QUIT" and "?" (see first example above).



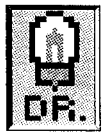
Coil Flow Chart

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

Game Audit Table for STRIKER XTREME

STERN PINBALL, INC.

Copy for Field Audit Tracking Performance (Use blank columns to fill-in Audit Info.).

Earnings Audits 1-12

	Audit Name	Fill-In		Audit Name	Fill-In		Audit Name	Fill-In
1	TOTAL PAID CREDITS		5	COINS THRU LEFT SLOT		9	TOTAL COINS	
2	FREE GAME PERCENTAGE		6	COINS THRU RIGHT SLOT		10	TOTAL EARNINGS	
3	AVERAGE BALL TIME		7	COINS THRU CENTER SLOT		11	METER CLICKS	
4	AVERAGE GAME TIME		8	COINS THRU 4TH SLOT		12	SOFTWARE METER	

S.P.I. Audits 13-55

	Audit Name	Fill-In		Audit Name	Fill-In		Audit Name	Fill-In
13	TOTAL BALLS PLAYED		28	20M—49.9M SCORES		43		
14	TOTAL EXTRA BALLS		29	50M—69.9M SCORES		44		
15	EXTRA BALL PERCENT		30	70M—99.9M SCORES		45		
16	REPLAY 1 AWARDS		31	100M—129.9M SCORES		46		
17	REPLAY 2+ AWARDS		32	130M+ SCORES		47		
18	TOTAL REPLAYS		33	AVERAGE SCORES		48		
19	REPLAY PERCENT		34	SERVICE CREDITS		49		
20	TOTAL SPECIALS		35	BALL SEARCH STARTED		50		
21	SPECIAL PERCENT		36	LOST BALL FEEDS		51		
22	TOTAL MATCHES		37	LOST BALL GAME STARTS		52	LEFT FLIPPER USED	
23	HIGH SCORE AWARDS		38	LEFT DRAINS		53	RIGHT FLIPPER USED	
24	HIGH SCORE PERCENT		39	CENTER DRAINS		54		
25	TOTAL FREE PLAYS		40	RIGHT DRAINS		55		
26	TOTAL PLAYS		41	SLAM TILTS				
27	0—19.9M SCORES		42	TOTAL BALLS SAVED				

Striker Xtreme Audits 56-99 (All Audits Subject to Change)

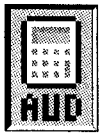
	Audit Name	Fill-In		Audit Name	Fill-In		Audit Name	Fill-In
56	LEFT ORBITS		72	2+ MBALL STARTS		88	PENALTY KICK COMP.	
57	RIGHT ORBITS		73	MBALL RESTART LIT		89	SHOOTOUT STARTED	
58	SIDE RAMP SHOTS		74	MBALL RESTARTED		90	SHOOTOUT HURRY-UP	
59	RIGHT RAMP SHOTS		75	MBALL JACKPOTS		91	SHOOTOUT JACKPOTS	
60	DROP TARGETS HIT		76	SUPER JACKPOTS		92	ALT. SOCCER BALLS	
61	DROP TARGETS COMP.		77	DOUBLE JACKPOTS		93	VENDOR LIT	
62	GOALIE OPTO SHOTS		78	DOUBLE SUPER JPOTS		94	VENDOR COLLECTED	
63	GOALIE MAGNET		79	SKILL AWARD 1		95	HALF-TIME LIT	
64	LEFT VUK SHOTS		80	SKILL AWARD 2		96	HALF-TIME AWARDED	
65	TOP VUK SHOTS		81	SKILL AWARD 3		97	FREE KICKS AWARDED	
66	POP BUMPER HITS		82	BIG POINTS GOALS		98	BONUS X AWARDED	
67	SPINNER		83	FAILSAFE GOALS		99	CELEBRATION MBALL	
68	SOCCER BALL TARG. HIT		84	COUNTRIES DEFEATED			CPU Version:	
69	BALLS LOCKED		85	XTREME ROUNDS			Display Version:	
70	STADIUM MBALL READY		86	PENALTY KICK LIT			Date Audited:	
71	STADIUM MULTIBALL		87	PENALTY KICK STARTED			Audited By:	

Location:

Go To Audits Menu

Overview

The **Portals™ Service Menu System** provides 99 Audit Functions for accounting purposes and for evaluation of *Game Difficulty Adjustments*. The Audit Functions are divided into 3 groups: • **Earnings (Coin) Audits**, are the first 12 most-used Audits • **S.P.I. Audits**, are the Game Play Generic Audits 13-55 • **Striker Xtreme Audits**, are the Game Play Specific Audits 56-99; Audits left open (blank space in gray, e.g. Audits 43-51, 54 & 55) are currently ***Not Used,*** allowing for ***Future Expansion,*** if any, or are ***Proprietary***. If the code version is upgraded, view Audits in the display & write the audit(s) in the blank(s) if any audit(s) were added. Each group may be viewed in the **Portals™ Service Menu** (see Chapter 1, **Portals™ Service Menu Introduction**, of this Section). View all audits with the **Game Audit Table** provided on the previous page.

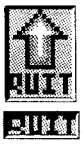


GO TO AUDITS MENU

With the game in the Attract Mode, open the Coin Door and press the **Black "BEGIN TEST" Button**. Select the "AUD" *Icon* in the **MAIN MENU** with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The **AUDITS MENU** appears.

Important Notes:

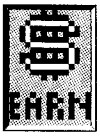
Exit any sub-menu and return to the **MAIN MENU** by selecting & activating the "PREV" *Icons*. If no *Icons* appear in the display because of a testing function or special display (e.g. "Help"), press any button to exit.



Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.

Selecting & activating the "HELP" *Icon* from any display will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)

Selecting & activating the "ARROW" *Icons* selects the next or previous audit in the group.



Earnings Audits (1-12)

From the **AUDITS MENU**, select the "EARN" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Select and activate the "RIGHT ARROW" *Icon* to view the 1st audit in this group. Continue to select either of the "ARROW" *Icons* to view each audit one at a time. The display will describe the audit number, the audit name, and the audit total or value. The current audit will remain in the display until the next audit is chosen or when the sub-menu is exited.

Au. Nº	Audit Name	Audit Definition
Au. 1	Total Paid Credits	Provides the total number of paid credits.
Au. 2	Free Game Percentage	This percentage is derived from dividing Audit 25, Total Free Plays, by Audit 26, Total Plays.
Au. 3	Average Ball Time	In seconds, the average ball time is derived from the total play time divided by Audit 13, Total Balls Played.
Au. 4	Average Game Time	The average game time is expressed in minutes and seconds.
Au. 5	Coins Thru Left Slot	Provides the total number of times Coin Switch (Sw. 6) was closed.
Au. 6	Coins Thru Right Slot	Provides the total number of times Coin Switch (Sw. 4) was closed.
Au. 7	Coins Thru Center Slot	Provides the total number of times Coin Switch (Sw. 5) was closed.
Au. 8	Coins Thru 4th Slot	Provides the total number of times Coin Switch (Sw. 2) was closed.
Au. 9	Total Coins	Provides the total amount of coins registered through all the slots.
Au. 10	Total Earnings	The total cash value accumulated since the last *Factory Restore* occurred (see Chapter 5, Go to Reset Menu, of this section).
Au. 11	Meter Clicks	Provides the total number of money clicks accumulated. (Based on the country's lowest coin denomination used for the game credit.)
Au. 12	Software Meter	Provides the continuing total of Meter Clicks. This audit cannot be reset; the display shows the constant addition of Meter Clicks.

S.P.I. Audits (13-55)

From the **AUDITS MENU**, select the "S.P.I." *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Select and activate the "RIGHT ARROW" *Icon* to view the 1st audit in this group. Continue to select either of the "ARROW" *Icons* to view each audit one at a time. The display will describe the audit number, the audit name, and the audit total or value. The current audit will remain in the display until the next audit is chosen or when the sub-menu is exited.

Au. Nº	Audit Name	Audit Definition
Au. 13	Total Balls Played	Provides the total number of regular and extra balls.
Au. 14	Total Extra Balls	Provides the total number of extra balls awarded.
Au. 15	Extra Balls Percent	Provides the percentage total from dividing Audit 14, Total Extra Balls, by Audit 26, Total Plays.
Au. 16	Replay 1 Awards	Provides the total awards (Credit, Extra Ball, Or Audit) for level 1.
Au. 17	Replay 2+ Awards	Provides the total awards (Credit, Extra Ball, Or Audit) for level(s) 2 or higher.
Au. 18	Total Replays	Provides the total awards (Credits, Extra Balls, Or Audit Only) for exceeding replay score levels.
Au. 19	Replay Percent	Provides the percentage total from dividing Audit 18, Total Replays, by Audit 26, Total Plays. The percentage reflects replay total awards for exceeding replay score levels.
Au. 20	Total Specials	Provides the total awards (Credits, Extra Balls, Or Scores) for making specials.
Au. 21	Special Percent	This percentage is derived from dividing Audit 20, Total Specials, by Audit 26, Total Plays.
Au. 22	Total Matches	Provides the total credits awarded for matching the last two digits of the score with the system-generated Match Number at the end of the game. Percentage of match credits is adjustable from 0% to 10% by Adjustment 11, Match Percentage, if enabled. (See Chapter 4, Go to Adjustments Menu, of this section.)
Au. 23	High Score Awards	Provides the total credits awarded for exceeding the High-Score-To-Date scores.
Au. 24	High Score Percent	This percentage is derived from dividing Audit 23, High Score Awards, by Audit 26, Total Plays.
Au. 25	Total Free Plays	Provides the total free credits for replays, High-Score-To-Date, Specials, and Match.
Au. 26	Total Plays	This total is derived by adding the sum of Audit 1, Total Paid Credits, and Audit 25, Total Free Plays. Note that free credits are not recorded in the Audit until they are actually used.
Au. 27	0—19.9M Scores	Provides the total number of games the Player's final score was between 0 and 19,900,000 points.
Au. 28	20M—49.9M Scores	Provides the total number of games the Player's final score was between 20,000,000 and 49,900,000 points.
Au. 29	50M—69.9M Scores	Provides the total number of games the Player's final score was between 50,000,000 and 69,900,000 points.
Au. 30	70M—99.9M Scores	Provides the total number of games the Player's final score was between 70,000,000 and 99,900,000 points.
Au. 31	100M—129.9M Scores	Provides the total number of games the Player's final score was between 100,000,000 and 129,900,000 points.
Au. 32	130M+ Scores	Provides the total number of games the Player's final score was over 130,000,000 points.
Au. 33	Average Scores	This total is derived from adding the Final Score of each game to a table and dividing this sum by Audit 26, Total Plays.
Au. 34	Service Credits	Provides the total number of times Dedicated Switch (DS-7) was closed, not in the Portals™ Service Menu. (See Chapter 1, Introduction [*Access & Use*] for instructions on how to receive Service Credits.)
Au. 35	Ball Search Started	Provides the total number of times the game performed a ball search.
Au. 36	Lost Ball Feeds	Provides the total number of times the game added a ball to play when it could not find a ball after ball search.

S.P.I. Audits Continued.

Audit Name		Audit Definition
Au. 37	Lost Ball Game Starts	Provides the total number of times the game started with a ball missing from the ball trough at the start of a game.
Au. 38	Left Drains	Provides the total number of times Rollover Switch 57 was closed.
Au. 39	Center Drains	Provides the total number of times the game ball had drained with the last switch closed was not Sw. 57 or Sw. 60.
Au. 40	Right Drains	Provides the total number of times Rollover Switch 60 was closed.
Au. 41	Slam Tilts	Provides the total number of times Contact Switch 55 was closed.
Au. 42	Total Balls Saved	Provides the total number of times this feature was used. This feature is enabled at the start of each ball and is disabled as soon as the ball makes contact with 5 game switches or allocated time expired.
Au. 43-Au. 51		These audits are ***Not Used***, allowing for ***Future Expansion***, if any, and/or ***Proprietary*** (used for programming).
Au. 52	Left Flipper Used	Provides the total number of times Dedicated Sw. (DS-1) was closed.
Au. 53	Right Flipper Used	Provides the total number of times Dedicated Sw. (DS-3) was closed.
Au. 54-Au. 55		These audits are ***Not Used***, allowing for ***Future Expansion***, if any, and/or ***Proprietary*** (used for programming).

Striker Xtreme Audits (56-99) (All Audits Subject to Change)

From the **AUDITS MENU**, select the "S.X." *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Select and activate the "RIGHT ARROW" *Icon* to view the 1st audit in this group. Continue to select either of the "ARROW" *Icons* to view each audit one at a time. The display will describe the audit number, the audit name, and the audit total or value. The current audit will remain in the display until the next audit is chosen or when the sub-menu is exited.

Au. Nº	Audit Name	Audit Definition
Au. 56	Left Orbits	Provides the total number of times this feature was completed. †
Au. 57	Right Orbits	Provides the total number of times this feature was completed. †
Au. 58	Side Ramp Shots	Provides the total number of times this feature was completed. †
Au. 59	Right Ramp Shots	Provides the total number of times this feature was completed. †
Au. 60	Drop Targets Hit	Provides the total number of times the 4-Bank Switches 17-20 were closed.
Au. 61	Drop Targets Completed	Provides the total number of times this feature was completed. †
Au. 62	Goalie OPTO Shots	Provides the total number of times the OPTO Switch 25 was closed.
Au. 63	Goalie Magnet	Provides the total number of times the Goalie Magnet Switch 43 was closed.
Au. 64	Left VUK Shots	Provides the total number of times the VUK (Left Style) Switch 45 was closed.
Au. 65	Top VUK Shots	Provides the total number of times the Super VUK Switch 46 was closed.
Au. 66	Pop Bumper Hits	Provides the total number of times this feature was completed. †
Au. 67	Spinner	Provides the total number of times the Spinner (Left Orbit) Switch 9 was closed.
Au. 68	Soccer Ball Targ. Hit	Provides the total number of times the Soccer Ball Stand-Up Targets Switches 26-29 were closed.
Au. 69	Balls Locked	Provides the total number of times this feature was completed. †
Au. 70	Stadium MBall Ready	Provides the total number of times this feature was ready (lit) awaiting this specific Multiball Feature. † ‡
Au. 71	Stadium Multiball	Provides the total number of times Stadium Multiball was played. †

† Multiple variations of switch closures (see Diagnostics) are used to determine completion of the feature stated.
‡ Multiple variations of switch closures (see Diagnostics) are used to determine the lighting of the feature stated.

Audit Name		Audit Definition
Au. 72	2+ MBall Starts	Provides the total number of times Multiball was played more than once by a single player in one game. †
Au. 73	MBall Restart Lit	Provides the total number of times Multiball was played and no Jackpots were collected. ‡
Au. 74	MBall Restarted	Provides the total number of times Multiball was restarted after Multiball Restart was lit. ‡
Au. 75	MBall Jackpots	Provides the total number of times this feature was awarded. †
Au. 76	Super Jackpots	Provides the total number of times this feature was awarded. †
Au. 77	Double Jackpots	Provides the total number of times this feature was awarded. †
Au. 78	Double Super Jpots	Provides the total number of times this feature was awarded. †
Au. 79	Skill Award 1	Provides the total number of times this feature was awarded. †
Au. 80	Skill Award 2	Provides the total number of times this feature was awarded. †
Au. 81	Skill Award 3	Provides the total number of times this feature was awarded. †
Au. 82	Big Points Goals	Provides the total number of times this feature was awarded. †
Au. 83	Failsafe Goals	Provides the total number of times this feature was awarded with the Goalie OPTO Switch 25 closed, followed by the Super VUK Switch 46 Closed WITHOUT the Goalie Under-Trough Switch 44 getting closed.
Au. 84	Countries Defeated	Provides the total number of times this feature was awarded. †
Au. 85	Xtreme Rounds	Provides the total number of times this feature was awarded. †
Au. 86	Penalty Kick Lit	Provides the total number of times this feature was lit. ‡
Au. 87	Penalty Kick Started	Provides the total number of times this feature was started. †
Au. 88	Penalty Kick Completed	Provides the total number of times this feature was completed. †
Au. 89	Shootout Started	Provides the total number of times this feature was started. †
Au. 90	Shootout Hurry-Up	Provides the total number of times this feature was awarded. †
Au. 91	Shootout Jackpots	Provides the total number of times this feature was awarded. †
Au. 92	Alt. Soccer Balls	Provides the total number of times this feature was awarded. †
Au. 93	Vendor Lit	Provides the total number of times this feature was lit. ‡
Au. 94	Vendor Collected	Provides the total number of times this feature was completed. †
Au. 95	Half-Time Lit	Provides the total number of times this feature was lit. ‡
Au. 96	Half-Time Awarded	Provides the total number of times this feature was awarded. †
Au. 97	Free Kicks Awarded	Provides the total number of times this feature was awarded. †
Au. 98	Bonus X Awarded	Provides the total number of times this feature was awarded. †
Au. 99	Celebration Multiball	Provides the total number of times Stadium Multiball was played. †

† Multiple variations of switch closures (see Diagnostics) are used to determine completion of the feature stated.
‡ Multiple variations of switch closures (see Diagnostics) are used to determine the lighting of the feature stated.

Use the below space for any additions and/or changes, if any (see the Dot Matrix Display):

Au.

Au.

Au.

Au.

Au.

Au.

Au.

Go To Printer Menu

From the **AUDITS MENU**, select the "PRNT" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The **PRINTER MENU** appears.

☞ Special equipment is required for this Sub-Menu

The **Portals™ Service Menu System** provides 3 Audit Printing Adjustment Functions to print information on a "Hand-Held" printer, download game information to a Laptop PC or clear the printout count. A printer interface board, hand-held printer and/or a special software program is required to run this menu. Entering this menu and selection/activation of the *Icons* without this equipment/software will not affect the game.

Quick Printout (Printer Interface)

From the **PRINTER MENU**, select the "QUIK" *Icon* with either **Red** or **Green Button** and press the **Black Button**. Select the "+" *Icon* and press the **Black Button** to start the printout. Only the Earnings Audits can be printed out to a "Hand-Held" Printer.

Full Printout (Alison Interface Program)

From the **PRINTER MENU**, select the "ALISON" *Icon* with either **Red** or **Green Button** and press the **Black Button**. Select the "+" *Icon* and press the **Black Button** to start the download. A special software program and a Lap Top PC is required. All game audits (Earnings, S.P.I. & Game Specific) can be retrieved.

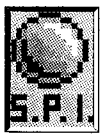
Reset Printer (Nº of Copies Printed Reset)

From the **PRINTER MENU**, select the "RESET" *Icon* with either **Red** or **Green Button** and press the **Black Button**. Select the "+" *Icon* and press the **Black Button** to start the clear the "Nº of copies printed" count total.

RESETTING AUDIT NOTES:

Audit Note: 1st Way to Reset Audits

To reset audits, from the **MAIN MENU**, select the "ADJ" *Icon*. See Chapter 4, Go to Adjustments Menu, of this section.



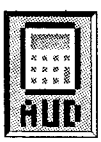
Select the "S.P.I." *Icon*, from the **ADJUSTMENT MENU**, and advance to Adj. 8, Reset Coin Audits, with the "RIGHT ARROW" *Icon*. Select the "+" *Icon* to change setting to **YES**. When enabled, the *Coin Audits* (5-11) will be reset to zero.

Advance to Adj. 9, Reset Game Audits, with the "RIGHT ARROW" *Icon*. Select the "+" *Icon* to change setting to **YES**. When enabled, *all the audits* will be reset to zero, **except** for the *Coin Audits* (5-11) ***and*** Audit 12, Software Meter (the only audit which cannot be reset to zero).

Audit Note: 2nd Way to Reset Audits

To reset audits, from the **MAIN MENU**, select the "RESET" *Icon*. See Chapter 5, Go to Reset Menu, of this section.

Selection of the "COIN" *Icon*, from the **RESET MENU**, will reset the *Coin Audits* (5-11) to zero.



Selection of the "AUD" *Icon*, from the **RESET MENU**, will reset all audits to zero, **except** for the *Coin Audits* (5-11) ***and*** Audit 12, Software Meter (the only audit which cannot be reset to zero).

Game Adjustment Table for STRIKER XTREME

STERN PINBALL, INC.

Some adjustments have a "Drop-Down" Table for further customization.

S.P.I. Adjustments 1-48

	Adjustment Name	USA Default	Your Setting		Adjustment Name	USA Default	Your Setting
1	REPLAYS: FIXED/AUTO ‡	...10%...		25	DEFAULT HIGH SCORE #5	300,000,000	
2	REPLAY LEVELS ‡	1 ...		26	DEFAULT HIGH SCORE #6	275,000,000	
3	REPLAY AWARD	CREDIT		27	DEFAULT HIGH SCORE #7	250,000,000	
4	FREE GAME LIMIT	05		28	DEFAULT HIGH SCORE #8	225,000,000	
5	EXTRA BALL LIMIT	03		29	DEFAULT HIGH SCORE #9	200,000,000	
6	GAME DIFFICULTY ‡	MODERATE		30	DEFAULT HIGH SCORE #10	175,000,000	
7	GAME PRICING ‡	USA3		31	HSTD RESET COUNT	2,000	
8	RESET COIN AUDITS	NO		32	HIGH SCORE INITIALS	3 Initials	
9	RESET GAME AUDITS	NO		33	FREE PLAY	NO	
10	RESET HIGH SCORES	NO		34	CUSTOM MESSAGE	ON	
11	MATCH PERCENTAGE	9%		35	ATTRACT MODE MUSIC	ON	
12	BALLS PER GAME	03		36	FLASH LAMP POWER	NORMAL	
13	TILT WARNINGS	01		37	COIL PULSE POWER	NORMAL	
14	REPLAY BOOST	YES		38	KNOCKER VOLUME	NORMAL	
15	CREDIT LIMIT	30		39	MINIMUM GAME TIME	OFF	
16	ALLOW HIGH SCORES	YES		40	BKGRND MUSIC VOLUME	01	
17	HIGH SCORE #1 AWARDS	01		41	GAME RESTART	YES	
18	HIGH SCORE #2 AWARDS	00		42	EXTRA BALL PERCENTAGE	25%	
19	HIGH SCORE #3 AWARDS	00		43	BILL VALIDATOR	NO	
20	HIGH SCORE #4 AWARDS	00		44	TOURNAMENT MODE	NONE	
21	DEFAULT HIGH SCORE #1	400,000,000		45	EURO. TOKEN DISP.	OFF	
22	DEFAULT HIGH SCORE #2	375,000,000		46	SPECIAL MEMORY	YES	
23	DEFAULT HIGH SCORE #3	350,000,000		47	LOCATION ID	00	
24	DEFAULT HIGH SCORE #4	325,000,000		48	GAME ID	00	

PLEASE NOTE: *All Factory Settings (Defaults) described in the tables above/below and within the Adjustment Definitions are for USA Settings only (CPU/Snd Bd. Dip Sw. 300 Settings 1-8 are all "OFF"). Different countries may have different Factory Settings (Defaults). ‡ Adj. 1, 2, 6 & 7 have "Drop-Down" Tables, see definitions.*

Striker Xtreme Adjustments 49-57

	Adjustment Name	USA Default	Your Setting		Adjustment Name	USA Default	Your Setting
49	EXTRA BALL MEMORY	ON		54	HOST COUNTRY	USA	
50	STADIUM MBALL RESTART	MODERATE		55	NEXT BALL FREE KICK	UNCHANGED	
51	STAD. MBALL CRITERION	MODERATE		56	UK POST SAVE ENABLED	NO	
52	GOALIE ENABLED	YES		57	UK COIN MECH. TYPE	CURRENT:	
53	OPPONENT CRITERION	MODERATE		ADJ. (56) CAN ONLY BE ADJUSTED IF THE GAME HAS THE UK EPROM INSTALLED (UK ONLY). ADJ. (57) CAN ONLY BE ADJUSTED IF USING UK DIP SWITCH OPTION SETTING 2.			

Go To Adjustments Menu

Overview

The **Portals™ Service Menu System** provides 57 Adjustment Functions to vary game difficulty or to customize (e.g. Adjusting: High Score Levels; Balls per game; Game Pricing; Default High Scores; etc.). The Adjustment Functions are divided into 2 groups: • **S.P.I. Adjustments**, are the Game Play Generic Adjustments (1-48) • **Striker Xtreme Adjustments**, are the Game Play Specific Adjustments (49-57); Any Adjustment(s) left open or are currently *Not Used*, are allowing for Future Expansion, if any, or are Proprietary. If the code version is upgraded, view Adjustments in the display & write the adjustment(s) in the blank(s) if any adjustment(s) were added. Each group may be viewed manually after entering the **Portals™ Service Menu** (see Chapter 1, **Portals™ Service Menu Introduction**, of this Section). All adjustments can be viewed at a glance with the **Game Adjustment Table** provided on the previous page. If a value is changed, the display will indicate **REQUEST INSTALLED**. ***Important:*** *The **Coin Door** must be **OPEN** allowing the **Memory Protect Switch** to be disabled so changes can be made.*

GO TO ADJUSTMENTS MENU

With the game in the Attract Mode, open the Coin Door and press the **Black "BEGIN TEST" Button**. Select the "ADJ" *Icon* in the **MAIN MENU** with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The **ADJUSTMENTS MENU** appears.

Important Notes:

Exit any sub-menu and return to the **MAIN MENU** by selecting & activating the "PREV" *Icons*. If no *Icons* appear in the display because of a testing function or special display (e.g. "Help"), press any button to exit.

Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.

Selecting & activating the "HELP" *Icon* from any display will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)

In Adjustments, selecting & activating the "-" *Icon* decrements the value setting. Selecting & activating the "+" *Icon* increments the value setting.

Selecting & activating the "ARROW" *Icons* selects the next or previous adj. in the group.

S.P.I. Adjustments (1-48)

From the **ADJUSTMENTS MENU**, select the "S.P.I." *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Select and activate the "RIGHT ARROW" *Icon* to view the 1st adjustment in this group. Continue to select either of the "ARROW" *Icons* to view each adjustment one at a time. Select either the "-" or "+" *Icons* to change the value, if desired. The display will describe the adjustment number, the adjustment name, and the adjustment total or value. The current adjustment will remain in the display until the next adjustment is chosen or when the sub-menu is exited.

Adj. Nº	Adjustment Name	Adjustment Definition
Adj. 1	**Replays: Fixed / Auto**	Set between **01% - 50%** and **Fixed** (0%) for Replay Levels. Default is **10%**. Four levels may be selected. Adjustments allow awarding of a credit or an extra ball as each level is exceeded. With the ***Autopercentage Feature***, if the actual replay percentage is higher or lower than that desired, the game will automatically adjust for the new recommended percentage score(s).
Adj. 2	**Replay Levels**	Set between **1 - 4** or **NONE** for the number of replay levels to be active. A "Drop-Down" Table appears (after selection of number of replay levels) showing Replay Level 1. Adjust Replay Level 1 between 10M - 9.99B. Adjust Replay Level 2, 3 and/or 4 respectively.
Adj. 3	**Replay Award**	Set for replays to award: **CREDIT, EXTRA BALL, NONE** or **SPECIAL** (When score threshold is achieved, a Playfield Special is lit.) Default is **CREDIT**.
Adj. 4	**Free Game Limit**	Set between **01 - 09** or **NO FREE GAMES**. Default is **05**. Adjust the maximum number of *Free Games* that may be accumulated per game.
Adj. 5	**Extra Ball Limit**	Set between **01 - 09** or **NO EXTRA BALLS**. Default is **03**. Adjust the maximum number of *Extra Balls* that may be accumulated per game.

Adjustment Name	Adjustment Definition

Adj. 6 Game Difficulty

Set to **EXTRA EASY**, **EASY**, **MODERATE**, **HARD** or **EXTRA HARD.** *(Note: Additional game features which are not adjusted may also change when adjusting this adjustment; see below table.)* Default is **MODERATE**. Any one of the ***INSTALL*** settings (in a "Drop-Down" Table) for this adjustment may be activated to automatically select settings for multiple adjustments affecting game difficulty. Select and activate the "-" or "+" *Icons* to choose the difficulty level required. After activation, the individual adjustments may be readjusted, if desired. Refer to the **Install Adjustment Table** below for details.

Adjustments which change when set to:	Extra Easy	Easy	Moderate	Hard	Extra Hard
(49) Extra Ball Memory	ON	ON	ON	ON	OFF
(50) Stadium MBall Restart	EXTRA EASY	EASY	MODERATE	HARD	EXTRA HARD
(51) Stad. MBall Criterion	EXTRA EASY	EASY	MODERATE	HARD	EXTRA HARD
(53) Opponent Criterion	EXTRA EASY	EASY	MODERATE	HARD	EXTRA HARD

Play Rules: Novelty & 4-Ball, plus Add-A-Ball Settings

The following three combinations are recommended for situations where local laws restrict certain game features regarding the use of replays or the number of balls per game:

Novelty Play Rules - Set to establish recommended settings for no Free Play or Extra Balls:

Adj.	Adjustment Name	Setting	Adj.	Adjustment Name	Setting
1	Replays: Fixed/Auto	Fixed	5	Extra Ball Limit	00
2	Replay Levels	None	11	Match Percentage	Off
3	Replay Award	None	17	High Score #1 Awards	1
4	Free Game Limit	0	18	High Score #2 Awards	0

4-Ball Play Rules - Set to establish recommended settings for 4-Ball Play:

Adj.	Adjustment Name	Setting	Adj.	Adjustment Name	Setting
1	Replays: Fixed/Auto	07%	5	Extra Ball Limit	3
2	Replay Levels	1	11	Match Percentage	4
3	Replay Award	Credit	12	Balls Per Game	5
4	Free Game Limit	5	17	High Score #1 Awards	1
			18	High Score #2 Awards	0

Add-A-Ball Settings -To disable awarding of credits and provide awards with an Extra Ball:

Adj.	Adjustment Name	Setting	Adj.	Adjustment Name	Setting
3	Replay Award	Extra Ball	16	Allow High Scores	No
4	Free Game Limit	00	17-20	High Score #1 - #4 Awards	0
11	Match Percentage	Off			

Adj. 7 Game Pricing

Set between **USA1** thru **UK6** or **CUSTOM**. Default is **USA3** *(foreign Game Pricing Options are in the Standard Pricing Select Table on the following pages)*. There are two methods available for coin switch programming: Standard & Custom. Standard pricing uses a single adjustment as seen in the first display. See the Standard Pricing Table. If "Custom" is selected, a "Drop-Down" Table appears. Select a pricing scheme shown in the Custom Pricing Table as seen below.

With Adjustment 7 set to **CUSTOM** operating the **Black "Enter" Button** again initiates a drop down menu representing coin switch pulses for the LEFT, CENTER, RIGHT and 4TH Coin Slots. The prescribed the number of pulses are required for 1 Credit. For example, if *Left Coin Pulses,* was set to 02 and *Coin Switch Pulses Required for 1 Credit*, to 01 a coin in the Left Slot would produce 2 Credits. Further, if *Left Coin Pulses,* was set to 01 and *Coin Switch Pulses Required for 1 Credit*, to 02, 2 Coins in the Left Slot would be required for 1 Credit.

Coin Switch Pulses Required for Bonus Credit may be set to post bonus credits when a minimum amount of coins are inserted at one time. For example, if *Left Coin Pulses* was set to 01, *Coin Switch Pulses Required for 1 Credit* to 01 and *Coin Switch Pulses Required for Bonus Credit* to 04, 1 Credit would be posted for each of the first 3 Coins in the Left Slot and 2 Credits for the 4th Coin.

S.P.I. Adjustment 7 Continues on the next page.

S.P.I. Adjustment 7 Continued.

Standard/Custom Pricing - Set for the desired pricing scheme from the Standard Pricing Table as indicated on the Dot Matrix Display. For Custom Pricing, set to **CUSTOM**. When set to **CUSTOM**, the following adjustments are utilized to tailor each individual coin chute:

Left Coin Switch Pulses	Set the number of pulses registered for closure of the Left Coin Switch; **00** to **99**.
Right Coin Switch Pulses	Set the number of pulses registered for closure of the Right Coin Switch; **00** to **99**.
Center Coin Switch Pulses	Set the number of pulses registered for closure of the Center Coin Switch; **00** to **99**.
4th Coin Switch Pulses	Set the number of pulses registered for closure of the Fourth Coin Switch; **00** to **99**.
Coin Switch Pulses Required for 1 Credit	Set the number of pulses required to post one credit; **00** to **99**.
Coin Switch Pulses Required for Bonus Credit	Set the number of pulses required to award the 1st Bonus credit(s); **00** to **99**.
Coin Sw. Pulses Req. for 2nd Bonus Credit	Set the number of pulses required to award the 2nd Bonus credit; **00** to **99**.
Credits awarded for 1st Bonus	Set the number of credits awarded for achieving the first Bonus level; **00** to **99**.

Custom Pricing Table

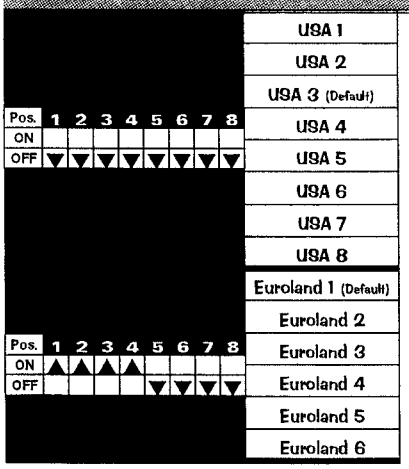
Coin Mechanisms					<<< Adjustments >>>							
LEFT	CENTER	RIGHT	4TH	*Plays/Coins*	LEFT Pulses	CENTER Pulses	RIGHT Pulses	4TH Pulses	Pulses /Credit	Pulses /Bonus	Pulses /2nd Bonus	Credit /1st Bonus
25¢	$1.00	25¢	N/U	1/25¢ 3/50¢	01	04	01	00	01	02	00	01
				1/25¢ 5/$1.00	01	04	01	00	01	04	00	01
				1/25¢ 6/$1.00	05	20	05	00	04	20	00	01
5SCH	10SCH	10SCH	N/U	1/10 S	01	02	02	00	02	00	00	00
				1/10 S 4/30 S	04	08	08	00	06	00	00	00
10*p*	50*p*	£1	20*p*	1/30*p* 2/50*p* 5/£1	01	06	15	02	03	00	00	00
				1/50*p* 3/£1	01	05	15	02	05	00	00	00
				1/30*p* 4/£1	01	05	12	02	03	00	00	00
20¢	N/U	$1.00	N/U	1/60¢ 2/$1.00	01	00	05	00	03	05	00	01

Below and the following page is the **Standard Pricing Select Table** for the individual countries listed. The *Pricing Scheme* is determined in two ways - **1:** The CPU/Sound Board Dip Switch (Sw. 300) Setting; and, **2:** The Country Setting Option. For each country listed, the Dip Switch Setting is shown (Column 1). At this time, not all countries have a *unique* Dip Switch Setting. For the countries without a unique setting, the USA Setting (or all positions in the "OFF" position) is used. In lieu of determining the best *Pricing Scheme* for your location, "pre-sets" were made available which would best suit any given situation. If the Factory Default setting is not the selection you feel is best for your location, choose any of the other pre-set settings. If any of these settings do not suit your needs, then **CUSTOM PRICING** will need to be accomplished (however, any "custom" changes made here will be lost after a **FACTORY RESET** so it is suggested to write down your unique set-up).

The Standard Pricing Select Table Explained:

Column 1: CPU/Sound Board Dip Switch 300 Settings: (self-explanatory). **Column 2:** Country Setting Option: The different available pre-sets are listed. **Columns 3-6:** Coin Mechanisms - These show the coinage through the available slots on the Coin Doors. Different countries use different Coin Doors. For example, USA style Coin Doors, which have only 2 coin acceptors (left & right) may utilize the "Center" slot cable for an optional Bill Validator. Different Coin Doors may have up to 4 coin acceptors. **Columns 7-10:** Pricing Scheme Explained - Shows the number of plays received for the monies required determined by the setting selected.

Standard Pricing Select Table



CPU/SOUND BOARD DIP SWITCH 300 SETTINGS	COUNTRY SETTING OPTION	Coin Mechanisms COINS THRU ... SLOT: LEFT	CENTER	RIGHT	4TH	Pricing Scheme Explained *Number of "Plays" for Price Amount Shown*			
	USA 1	25¢	$1.00	25¢		1 /25¢			
	USA 2					1 /50¢	2 /75¢	3 /$1.00	
	USA 3 (Default)					1 /50¢			
	USA 4					1 /50¢			
	USA 5					1 /50¢	5 /$2.00		
	USA 6					1 /50¢	2 /'4 X 25¢'	3 /$1.00 Bill	← Used to promote the Bill Validator
	USA 7					1 /50¢	4 /$1.50	6 /$2.00	
	USA 8					1 /50¢	3 /$1.00		
	Euroland 1 (Default)	0.20 €	0.50 €	1.00 €	2.00 €	1 /0.50€			
	Euroland 2					2 /0.50€			
	Euroland 3					1 /0.50€	5 /2.00€		
	Euroland 4					1 /0.50€	3 /1.00€		
	Euroland 5					1 /1.00€	2 /1.50€	3 /2.00€	
	Euroland 6					1 /1.00€	5 /2.00€		

Standard Pricing Select Table - (Continued)

CPU DIP SWITCH SETTINGS Location SW300 CPU/SOUND BOARD	COUNTRY SETTING OPTION † ‡	Coin Mechanisms — COINS THRU ... SLOT: LEFT	CENTER	RIGHT	4TH	Pricing Scheme Explained — *Number of "Plays" for Price Amount Shown*			
		Please Note: for all USA Settings, see previous page (bottom).							
Pos. 1 2 3 4 5 6 7 8 ON ▲ OFF ▼▼▼▼▼▼▼▼	Austria †	5S	10S	10S		1 /10S	2 /15S	3 /20S	
Pos. 1 2 3 4 5 6 7 8 ON OFF ▼▼▼▼▼▼▼▼	Australia 1 ‡	20¢	$A 1	$A 2		1 /$A 1	3 /$A 2		
Pos. 1 2 3 4 5 6 7 8 ON OFF ▼▼▼▼▼▼▼▼	Australia 2 ‡					1 /$A 1			
Pos. 1 2 3 4 5 6 7 8 ON ▲ OFF ▼▼▼▼▼▼▼▼	(Belgium †)	5 BF	20 BF	50 BF		1 /20 BF	3 /50 BF		
Pos. 1 2 3 4 5 6 7 8 ON ▲ ▲ ▲ OFF ▼ ▼ ▼ ▼	(Brazil †)	This country uses unique Tokens and/or Debit Cards *only* (pricing varies).							
		1 'coin'	4 'coins'	1 'coin'		1 /"2 coins'			
Pos. 1 2 3 4 5 6 7 8 ON ▲ ▲ OFF ▼▼▼▼▼▼▼▼	Canada †	25¢	25¢	Can$ 1		1 /50¢	2 /75¢	3/ Can$ 1	
Pos. 1 2 3 4 5 6 7 8 ON OFF ▼▼▼▼▼▼▼▼	Denmark 1 ‡	1 DKr	5 DKr	10 DKr	20 DKr	1 /3 DKr	2 /5 DKr		
	Denmark 2 ‡					1 /2 DKr	3 /5 DKr	7 /10DKr	
Pos. 1 2 3 4 5 6 7 8 ON OFF ▼▼▼▼▼▼▼▼	Finland ‡	1 Fmk	5 Fmk			1 /5 Fmk	4 /10 Fmk		
Pos. 1 2 3 4 5 6 7 8 ON ▲ ▲ OFF ▼▼▼▼▼▼▼▼	France 1 †	1 Fr	5 Fr	10 Fr	20 Fr	1 /3 Fr	2 /5 Fr	5 /10 Fr	11 /20 Fr
	France 2					1 /5 Fr	3 /10 Fr	7 /20 Fr	
	France 3					1 /3 Fr	2 /5 Fr	4 /10 Fr	9 /20 Fr
Pos. 1 2 3 4 5 6 7 8 ON ▲ ▲ ▲ OFF ▼▼▼▼▼	Germany 1	1 DM	2 DM	5 DM		1 /1 DM	6/'1 X 5 DM'		
	Germany 2					1 /2 DM	2 /3 DM	3 /4 DM	4 /5 DM
	Germany 3 †					1 /2 DM	2 /3 DM	3 /4 DM	5 /5 DM
	Germany 4					1 /1 DM	6 /5 DM		
Pos. 1 2 3 4 5 6 7 8 ON OFF ▼▼▼▼▼▼▼▼	Greece ‡	50 Dr		100 Dr		1 /50 Dr	3 /100 Dr		
Pos. 1 2 3 4 5 6 7 8 ON OFF ▼▼▼▼▼▼▼▼	Hong Kong ‡	1 HK$	2 HK$	5 HK$		1 /5 HK$			
Pos. 1 2 3 4 5 6 7 8 ON OFF ▼▼▼▼▼▼▼▼	Hungary ‡	10 Ft	10 Ft	20 Ft		1 /20 Ft	3 /40 Ft		
Pos. 1 2 3 4 5 6 7 8 ON ▲ OFF ▼▼▼▼▼▼▼▼	Italy 1 †	500 Lit		500 Lit		1 /500 Lit			
	Italy 2					1 /1000 Lit	3 /2000 Lit		
Pos. 1 2 3 4 5 6 7 8 ON ▲ ▲ OFF ▼▼▼▼▼▼▼▼	Japan 1 †			100¥		1 /100¥			
	Japan 2					1 /100¥	3 /200¥		
Pos. 1 2 3 4 5 6 7 8 ON OFF ▼▼▼▼▼▼▼▼	Korea ‡	100 Won		100 Won		1 /100 Won			
Pos. 1 2 3 4 5 6 7 8 ON ▲ OFF ▼▼▼▼▼▼▼▼	Netherlands 1	1 Fls.	1 Fls.	2.5 Fls.		1 /1 Fls.	3 /2.5 Fls.		
	Netherlands 2 †		2.5 Fls.	5 Fls.		1 /1 Fls.	3 /2.5 Fls.	6 /5 Fls.	
Pos. 1 2 3 4 5 6 7 8 ON OFF ▼▼▼▼▼▼▼▼	New Zealand 1 ‡	$NZ 1		$NZ 2		1 /$NZ 1			
	New Zealand 2 ‡					1 /$NZ 1	3 /$NZ 2		
Pos. 1 2 3 4 5 6 7 8 ON ▲ ▲ OFF ▼ ▼ ▼▼▼▼▼	Norway 1 †	10 NKr	5 NKr	20 NKr		2 /10 NKr	1 /5 NKr	4 /20 NKr	
	Norway 2					1 /10 NKr	3 /20 NKr		
Pos. 1 2 3 4 5 6 7 8 ON OFF ▼▼▼▼▼▼▼▼	Spain ‡	100 Pts		500 Pts		1 /100 Pts	6 /500 Pts		
Pos. 1 2 3 4 5 6 7 8 ON ▲ ▲ ▲ OFF ▼▼▼▼▼	Sweden 1 †	1 SKr	5 SKr	10 SKr		1 /10 SKr	2 /15 SKr	3 /20 SKr	
	Sweden 2					1 /5 SKr	2 /10 SKr		
Pos. 1 2 3 4 5 6 7 8 ON ▲ ▲ OFF ▼▼▼▼▼▼▼▼	Switzerland 1 †	1 SwF	2 SwF	5 SwF		1 /1 SwF	6 /5 SwF		
	Switzerland 2					1 /1 SwF	3 /2 SwF	9 /5 SwF	
Pos. 1 2 3 4 5 6 7 8 ON ▲ ▲ OFF ▼▼▼▼▼▼▼▼	UK 1 †	10p	50p	£1	20p	3 /£1	7 /£2	The Pricing Scheme using the New UK Dip Sw. Setting (with 2, 3 & 4 = ON), is the same (UK1 - UK6). Use only with the *New Style Coin Mech. The New 50p & £2* Coins can be accomodated in 5th & 6th Coin Slots.	
	UK 2					4 /£1	8 /£2		
Dip Switch Setting for New 50p / £2: Pos. 1 2 3 4 5 6 7 8 ON ▲ ▲ ▲ OFF ▼ ▼▼▼▼▼	UK 3					1 /50p	2 /£1	5 /£2	
	UK 4					1 /30p	2 /60p	3 /90p	4 /£1
	UK 5					1 /£1	3 /£2	This is "software controlled" by noting the presence/non-presense of pulses via Normal Coin Slots 1-4 (Left, Center, Right & 4th). If an old style Coin Mech is used, see new adjustment to accomodate.	
SEE NOTES IN PRICING SCHEME	UK 6					3 /£2			

Notes: † Indicates Factory Default for that setting.
‡ Indicates a USA Dip Switch Setting (all positions in the "OFF" position).

	Adjustment Name	Adjustment Definition
Adj. 8	**Reset Coin Audits**	Set to **YES** or **NO**. Default is **NO**. ⚠ When set to **YES** *(select the "+" Icon to change)* all *Coin Audits* (Audits 5-11), will be reset to zero.
Adj. 9	**Reset Game Audits**	Set to **YES** or **NO**. Default is **NO**. ⚠ When set to **YES** *(select the "+" Icon to change)* all audits will be reset to zero, except for the *Coin Audits* (Audits 5-11) and Audit 12, Software Meter (the only audit which cannot be reset to zero).
Adj. 10	**Reset High Scores**	Set to **YES** or **NO**. Default is **NO**. When set to **YES** *(select the "+" Icon to change)* all the High Score Levels and associated initials will be restored to the backup settings.
Adj. 11	**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.
Adj. 12	**Balls Per Game**	Set between **02 - 05**. Default is **03**. Adjusts the number of balls per game.
Adj. 13	**Tilt Warnings**	Set to **00**, **01** or **03**. Default is **01**. Adjusts the number of plumb bob tilt switch closures before the ball in play is tilted.
Adj. 14	**Replay Boost**	Set to **YES** or **NO**. Default is **YES**. When set to **YES**, exceeding a replay will set a temporary replay level for each time a replay level is surpassed. This new level will equal the previous replay level (when the replay was awarded) plus 50M for each following game, until the replays have all been played (then the previous level is resumed).
Adj. 15	**Credit Limit**	Set between **04 - 50**. Default is **30**. Adjusts the maximum number of credits that may be posted.
Adj. 16	**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 Adj. 3, Replay Award). Set to **NO** to disable this feature. There are 10 High Scores that will allow the player to enter their initials (or name) (See Adj. 32, Initials), however, only the top 4 can receive an award if this adjustment is enabled.
Adj. 17	**High Score #1 Awards**	Set between **00 - 05**. Default is **01**. Adjusts the number of awards awarded for exceeding Level 1 *(the highest of the four (4) Levels).*
Adj. 18	**High Score #2 Awards**	Set between **00 - 03**. Default is **00**. Adjusts the number of awards awarded for exceeding Level 2.
Adj. 19	**High Score #3 Awards**	Set between **00 - 02**. Default is **00**. Adjusts the number of awards awarded for exceeding Level 3.
Adj. 20	**High Score #4 Awards**	Set between **00 - 01**. Default is **00**. Adjusts the number of awards awarded for exceeding Level 4.
Adj. 21	**Default High Score #1**	Set between **1,000,000 - 9,999,000,000** or **00** *(increments of 1M).* Default is **400,000,000**. Adjusts the desired ***High Score Level*** to which Level 1 may be achieved (not affected by **Adj. 31**).
Adj. 22	**Default High Score #2**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **375,000,000**. Adjusts the desired ***High Score Level*** to which Level 2 may be achieved (not affected by **Adj. 31**).
Adj. 23	**Default High Score #3**	Set between **1,000,000 - 9,999,000,000***0* or **00** *(increments of 1M).* Default is **350,000,000**. Adjusts the desired ***High Score Level*** to which Level 3 may be achieved (not affected by **Adj. 31**).
Adj. 24	**Default High Score #4**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **325,000,000**. Adjusts the desired ***High Score Level*** to which Level 4 may be achieved (not affected by **Adj. 31**).
Adj. 25	**Default High Score #5**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **300,000,000**. Adjusts the desired ***High Score Level*** to which Level 5 may be achieved (not affected by **Adj. 31**).
Adj. 26	**Default High Score #6**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **275,000,000**. Adjusts the desired ***High Score Level*** to which Level 6 may be achieved (not affected by **Adj. 31**).
Adj. 27	**Default High Score #7**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **250,000,000**. Adjusts the desired ***High Score Level*** to which Level 7 may be achieved (not affected by **Adj. 31**).

Adjustment Name	Adjustment Definition
Adj. 28 **Default High Score #8**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **225,000,000**. Adjusts the desired ***High Score Level*** to which Level 8 may be achieved (not affected by **Adj. 31**).
Adj. 29 **Default High Score #9**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **200,000,000**. Adjusts the desired ***High Score Level*** to which Level 9 may be achieved (not affected by **Adj. 31**).
Adj. 30 **Default High Score #10**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **175,000,000**. Adjusts the desired ***High Score Level*** to which Level 10 may be achieved (not affected by **Adj. 31**).
Adj. 31 **HSTD Reset Count**	Set between **100 - 9,900** or **OFF** *(increments of 100).* Default is **2,000**. **HSTD** (**H**igh **S**core **T**o **D**ate). Adjusts the number of games between automatic resets of high score levels to backup settings and ball time averager adjustments. Set to **OFF** for "no reset or adjustment".
Adj. 32 **High Score Initials**	Set to **3 INITIALS** or **10 LETTER**. Default is **3 INITIALS**. When set to **3 INITIALS**, player is allowed only 3 initials to input. When set to **10 LETTER NAME**, player is allowed to enter 10 initials to input.
Adj. 33 **Free Play**	Set to **YES** or **NO**. Default is **NO**. When set to **YES**, no coins are required for *Game Play.*
Adj. 34 **Custom Message**	Set to **ON, CHANGE** or **OFF**. Default is **ON**. When set to **CHANGE** *(select the "+" Icon to change settings until "CHANGE" appears in the display, then select the ">>" Icon to access.) This adjustment can be accessed in two (2) ways by either selecting the "SEGA" Icon* and advancing to this **Adjustment 34**, or can be directly accessed by selecting the "ABCD CUST MSG" *Icon* in the **ADJUSTMENTS MENU**. View the definition at the end of this chapter under the **Custom Message** entry for the operation explanation.
Adj. 35 **Attract Mode Music**	Set to **ON** or **OFF**. Default is **ON**. When set to **ON**, attraction music / sounds are played between games.
Adj. 36 **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.
Adj. 37 **Coil Pulse Power**	Set to **NORMAL, HARD** or **SOFT**. Default is **NORMAL**. When **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. These adjustments are provided to compensate for Low Line or High Line voltage conditions where the solenoids appear to kicking too weak or too hard. Adjust as required.
Adj. 38 **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.
Adj. 39 **Minimum Game Time**	Set between **0:01 - 14:59** or **OFF** for minimum game time. Default is **OFF**. If the last ball in play drains prior to what the game time is set for, another ball will be served into the Shooter Lane and Normal Play will continue. Subsequent balls will continue to do be served into the shooter lane if the last ball still drains prior to and up until minimum game time is satisfied.
Adj. 40 **Bkgrnd (Background) Music Volume**	Set between **01 - 15**. Default is **01**. After volume is set via Portals Service Buttons (See Sec. 3, Chp. 1, ...Intro) 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.
Adj. 41 **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 Section 2, Chapter 1, Game Operations & Features for details.
Adj. 42 **Extra Ball Percentage**	Set between **0% - 50%**. This adjustment allows the operator to adjust how frequently the ***Extra Ball Feature*** is made available to the player.

S.P.I. Adjustments Continued.

Adjustment Name		Adjustment Definition
Adj. 43	**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.*"
Adj. 44	**Tournament Mode**	Set to **NONE, IFPA, EXPO, PAPA** or **HOME**. Default is **NONE**. Tournament Mode determines the default conditions to quickly prepare a game for tournament play. When this setting is changed ***all audits will be reset*** and ***all adjustments will be initiated*** to the particular style selected. The game will then return to *Game Over Attract Mode*, as if a *Factory Reset* had been performed. **NONE** - Same as a Factory Reset conditions. **IFPA** - Straight 50¢ play, No Replay, No Extra Ball, No High Scores, 2 Tilt Warnings and No Match. **EXPO or PAPA** - Same as **IFPA** settings except ***Free Play*** is enabled. **HOME** - Sets game for ***Free Play***, ***Extra Ball Play***, ***No Replay***, ***10% Match*** & ***30% Extra Ball***.
Adj. 45	**Euro. Token Disp.**	Set to **ON** or **OFF**. Default is **OFF**. When set to **ON**, the operator can enable the **BRN/BRN-GRY Wires** *(out of the Main Cabinet Cable Harness, by bottom speaker)* to drive an external device (e.g. European Token Dispenser) without the game giving a replay. (Ref. **Coil #8** or **Q8**.)
Adj. 46	**Special Memory**	Set to **YES** or **NO**. Default is **YES**. When set to **YES**, the lit 'Special' light will be retained in memory from ball to ball for the same player. When set to **NO**, the lit 'Special' light will go out at the end of each ball.
Adj. 47	**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.)*
Adj. 48	**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.)*

Please Note: *For more details on Audit Printing, review Section 3, Chapter 3, Go To Audits Menu (Go To Printer Menu, Page 31). For more details on Factory Reset, review Section 3, Chapter 5, Go To Reset Menu.*

Striker Xtreme Adjustments (49-57)

From the **ADJUSTMENTS MENU**, select the "S.X." *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Select and activate the "RIGHT ARROW" *Icon* to view the 1st adjustment in this group. Continue to select either of the "ARROW" *Icons* to view each adjustment one at a time. Select either the "-" or "+" *Icons* to change the value, if desired. The display will describe the adjustment number, the adjustment name, and the adjustment total or value. The current adjustment will remain in the display until the next adjustment is chosen or when the sub-menu is exited.

Adj. Nº	Adjustment Name	Adjustment Definition
Adj. 49	**Extra Ball Memory**	Set to **ON** or **OFF**. Default is **ON**. When set to **ON**, the lit 'Extra Ball' light will be retained in memory from ball-to-ball for the same player. When set to **OFF**, the lit 'Extra Ball' light will go out at the end of each ball.
Adj. 50	**Stadium MBall Restart**	Set to **EXEASY, EASY, MODERATE, HARD** or **EXHARD**. Default is **MODERATE**. Determines how Stadium Multiball can restart.
Adj. 51	**Stad. MBall Criterion**	Set to **EXEASY, EASY, MODERATE, HARD** or **EXHARD**. Default is **MODERATE**. Determines how the Stadium Multiball Feature is started and played.
Adjustment Note: Settings for above Adjustments 49, 50 & 51 will change automatically if Adjustment 6 is changed, see Page 34.		
Adj. 52	**Goalie Enabled**	Set to **YES** or **NO**. Default is **YES**. When set to **YES**, the Goalie Motor Assembly (**Motor Driver Relay Bd. Q25 & Motor Bi-Directional Relay Bd. Q26**) is operational. When set to **NO**, the **Motor Q25 & Motor Relay Bd. Q26** is disabled. Use the **NO** setting if any of the following is/are malfunctioning or is awaiting service and/or repair: Motor Assembly or Relay Bd. (Q25), Relay Board (Q26) and/or OPTO Switches (41, 42 & 47)

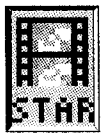
Adjustment Name	Adjustment Definition
Adj. 53 **Opponent Criterion**	Set to **EXEASY, EASY, MODERATE, HARD** or **EXHARD**. Default is **MODERATE**. Determines how the Opponent Criterion Feature is started and played.

Adjustment Note: Settings for above Adjustment 53 will change automatically if Adjustment 6 is changed, see Page 34.

	Host Country	Set to **FRANCE, USA, SPAIN, AUSTRALIA, ENGLAND** (UK), **BRAZIL, SWITZERLAND, FINLAND, GERMANY, BELGIUM, SWEDEN, HOLLAND** (The Netherlands), **ITALY, CANADA, MEXICO** or **JAPAN**. Default is **USA** (Default Country is determined by the CPU Dip Switch Setting, Loc. SW300, on the CPU/Sound Board).
Adj. 54	View DR. ❸ in the front of this manual for current Dip Switch Settings & the Default Country: USA = USA; Austria=USA; Belgium=Belgium; Brazil=Brazil; Canada=Canada; France=France; Germany=Germany; Italy=Italy; Japan=Japan; Netherlands=Holland; Norway=USA; Sweden=Sweden; Switzerland=Switzerland; UK=England; Use this adjustment to change the Host Country to another, if desired. ***Please Note:*** *In game play, on the initial ball (prior to the skill shot), the Default Host Country appears in the upper left corner of the Dot Display. The Host Country can still be changed (only for that game) by cycling through the countries using the flipper buttons. The current Host Country will be displayed.*	
	Next Ball Free Kick	Set to **TURN ON (EASY), UNCHANGED (MODERATE)** or **TURN OFF (HARD)**. Default is **UNCHANGED (MODERATE)**. Determines how the ***Virtual Laser Kick*** is ***lit***.
Adj. 55	After *"defeating a country"* (game feature), the **Left** & **Right Outlanes** are ***lit*** for ***Virtual Laser Kick*** *(Ball Save).* When the ball drains via the *Outlane Lit*, the ball will be automatically returned to play via the **Shooter Lane**. **TURN ON (EASY)** leaves the lanes lit between balls; **UNCHANGED (MODERATE)** leaves in the state of the previous ball loss; **TURN OFF (HARD)** turns of between balls.	
Adj. 56	**UK Post Save Enabled**	**/////// THIS ADJUSTMENT CAN ONLY BE ADJUSTED IF THE GAME HAS THE UK EPROM INSTALLED FOR UK SETTINGS ///////** 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 a different way; Non-UK Games cannot adjust this setting.)
Adj. 57	**UK Coin Mech. Type**	**/////// THIS ADJUSTMENT CAN ONLY BE ADJUSTED IF THE GAME HAS THE UK EPROM INSTALLED FOR UK SETTINGS and HAS THE DIP SWITCH SETTING OPTION 2 SET (2, 3 & 4 ON) ///////** Set to **CURRENT: 2 POUND AT #5** if using a Coin Control Mech 74-1129-104**U** (latest version). Set to **OLD: 2 POUND AT #6** if using older version Coin Control Mech 74-1129-104. Default is **CURRENT: 2 POUND AT #5**.

Custom Message

To go directly to ***Adjustment 34, Custom Message,*** from the **ADJUSTMENT MENU**, select the "CUST MSG" *Icon* either **Red "LEFT"** or **Green "RIGHT" Button** 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.

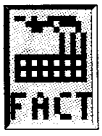


Film Star Reset

To reset the game with *Special Home Settings* (*not the normal Factory Setting*), from the **ADJUSTMENT MENU**, select the "STAR" *Icon* either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. This *Special Setting* automatically changes ***Adjustment 6, Game Difficulty,*** to **EASY** and ***Adjustment 33, Free Play,*** to **YES**. This setting is determined to be ideal for the home environment.

Take Note:

To **Restore** or **Reset** any of the adjustments to the *Factory Settings (Default)*, review Sec. 3, Chp. 5, **Go To Reset Menu**. Follow the "RESET" *Icon* or "FACT" *Icon* and their explanations.



Go To Reset Menu

Overview

The **Portals™ Service Menu System** provides three (3) functions to reset adjustments and/or audits back to the *Factory Setting*. See Chapter 3, Go to Audits Menu, and Chapter 4, Go to Adjustments Menu, for the Game Audits & Adjustments Information. If a reset of ***Coin*** or ***Game Audits*** is performed, the display will indicate **REQUEST INSTALLED** and return to the **RESET MENU**. If a **Factory Reset** is performed, the display will indicate **REQUEST INSTALLED**, the ***Service Session*** is *exited* & returns to the ***Attract Mode***. Please note that once reset, all customized settings are lost! Certain *Audits & Adjustments* cannot be reset (refer to the details below).

GO TO RESET MENU

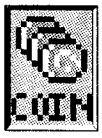
With the game in the Attract Mode, open the Coin Door and press the **Black "BEGIN TEST" Button**. Select the "RESET" *Icon* in the **MAIN MENU** with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The **RESET MENU** appears.

Important Notes:

Exit any sub-menu and return to the **MAIN MENU** by selecting & activating the "PREV" *Icon*.

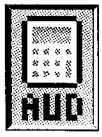
Selecting & activating the "QUIT" *Icon* from the display will exit the Service Session.

Selecting & activating the "HELP" *Icon* from the display will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)



Reset Coin Audits

From the **RESET MENU**, select the "COIN" *Icon* with either **Red** or **Green Button** and press the **Black Button**. ⚠ All Coin Audits (See **Fig. 1**) will be reset to Factory Settings. The display will indicate **REQUEST INSTALLED** and return to the **RESET MENU**. Coin Audits can also be reset from the **ADJUSTMENTS MENU**, **SEGA ADJUSTMENT 8**. See Chapter 4, Go to Adjustments Menu, of this section. After selecting this *Icon*, all of the ***Coin Audits (5-11)*** are reset to zero.



Reset Game Audits

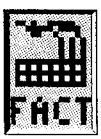
From the **RESET MENU**, select the "AUD" *Icon* with either **Red** or **Green Button** and press the **Black Button**. ⚠ All Game Audits (See **Fig. 2**) will be reset to Factory Settings. The display will indicate **REQUEST INSTALLED** and return to the **RESET MENU**. Game Audits can also be reset from the **ADJUSTMENTS MENU**, **SEGA ADJUSTMENT 9**. See Chapter 4, Go to Adjustments Menu, of this section. After selecting this *Icon*, all of the ***Audits*** are reset to zero, except for the Coin Audits (Audits 5-11) and Audit 12, Software Meter. Audit 12 is the only audit which cannot be reset.

Fig. 1

• Reset Coin Audits	
Earnings Audits (Coin Audits Only 5-11)	
Au. №	Description
1-4	The first 4 Audits in the game.
5	Coins Thru Left Slot
6	Coins Thru Right Slot
7	Coins Thru Center Slot
8	Coins Thru 4th Slot
9	Total Coins
10	Total Earnings
11	Meter Clicks
12	Software Meter
13 +	The remainder of the Audits.

Fig. 2

• Reset Game Audits	
Earnings (1-4), Generic/Specific Audits (13+)	
Au. №	Description
1-4	The first 4 Audits in the game.
5	Coins Thru Left Slot
6	Coins Thru Right Slot
7	Coins Thru Center Slot
8	Coins Thru 4th Slot
9	Total Coins
10	Total Earnings
11	Meter Clicks
12	Software Meter
13 +	The remainder of the Audits.

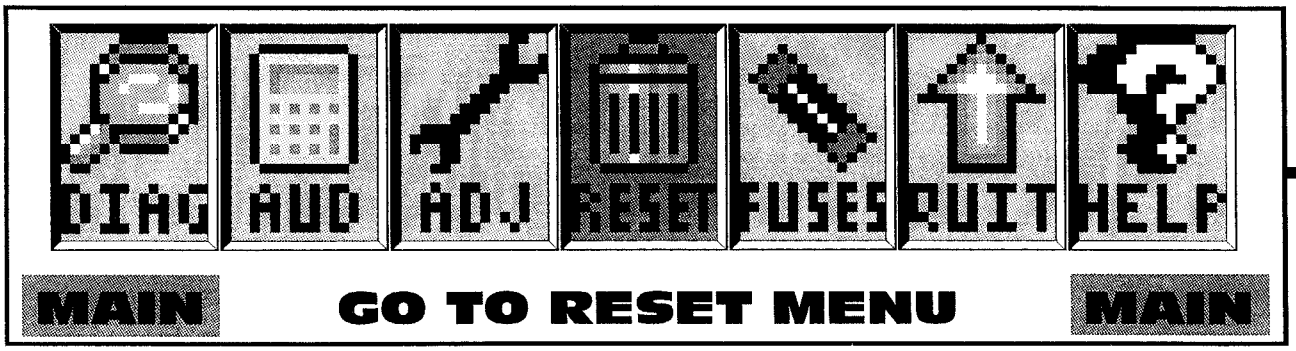


Factory Reset

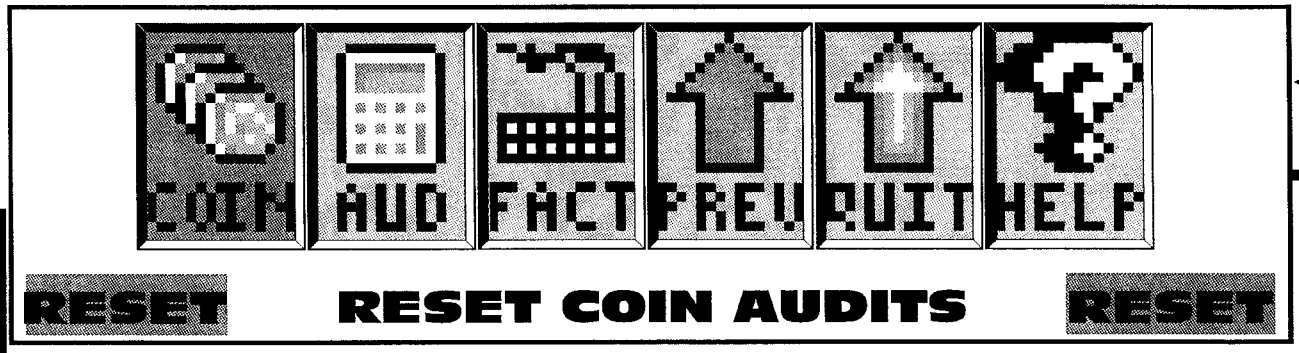
From the **RESET MENU**, select the "FACT" *Icon* with either **Red** or **Green Button** and press the **Black Button**. ⚠ All adjustments will be reset to *Factory Settings* (except for Proprietary Adjustments). The display will indicate **REQUEST INSTALLED** and exit the Service Session. See Chapter 4, Go to Adjustments Menu, of this section, for the *Factory Settings* in the **Game Adjustment Table**.

Example:

From the **MAIN MENU**, use the **Red** or **Green Buttons** to select the "RESET" *Icon* (**GO TO RESET MENU**).



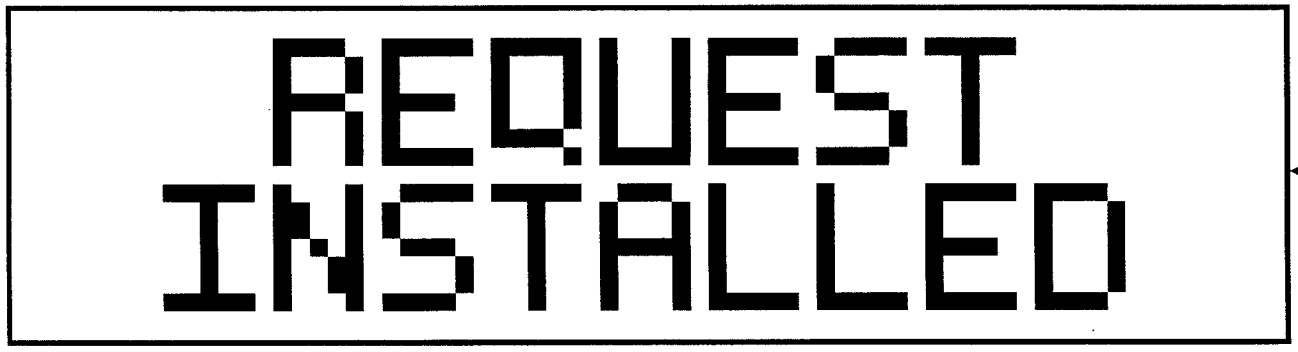
Press the **Black Button** to activate this **ICON**. This will bring up the **RESET MENU**.



The **RESET MENU** now appears with the "COIN" *Icon* (**RESET COIN AUDITS**) flashing:

DO NOT PRESS THE START BUTTON **AFTER SELECTING ANY THREE OF THESE ICONS UNLESS THIS IS WHAT IS DESIRED (SETTINGS WILL BE LOST)! PLEASE READ THE PREVIOUS PAGE FOR EXACTLY WHAT WILL HAPPEN IF ANY OF THESE THREE ICONS ARE ACTIVATED.**

From the **RESET MENU**, select any of the *Icons* ("COIN", "AUD" or "FACT") with either **Red** or **Green Button** and press the **Black Button** to activate the **ICON** chosen.



If the "COIN" or "AUD" *Icons* are chosen and activated, the affected audits (see previous page) will be reset, the display will indicate **REQUEST INSTALLED** and the display will return to the **RESET MENU**.

If the "FACT" *Icon* is chosen and activated, all adjustments will be reset back to the *Factory Settings*. The display will indicate **REQUEST INSTALLED** (momentarily), the ***Service Session*** is automatically *exited* and returns to the ***Attract Mode***.

Go To Fuses List

Overview

The **Portals™ Service Menu System** provides a current Fuse List for this game. 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, such as magnets). See the front of this manual (page **DR. ❶**) for the complete Fuse List in the *Quick Reference Fuse Chart* and note the drawings.

GO TO FUSES LIST

With the game in the Attract Mode, open the Coin Door and press the **Black "BEGIN TEST" Button**. Select the "FUSES" *Icon* in the **MAIN MENU** with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Select and activate the "RIGHT ARROW" *Icon* to view the 1st fuse in this group. Continue to select either of the "ARROW" *Icons* to view each fuse one at a time. The display will describe the fuse identification number (e.g. F1, F6, F7, etc.), location of fuse (i.e. Backbox: Board name located on; or Cabinet: Under the playfield or in Service Outlet), rating of fuse (e.g. 5A 250v S.B. - i.e. 5 Amp, 250 volt, Slo-Blo), 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.

Important Notes:

Exit any sub-menu and return to the **MAIN MENU** by selecting & activating the "PREV" *Icons*. If no *Icons* appear in the display because of a testing function or special display (e.g. "Help"), press any button to exit.

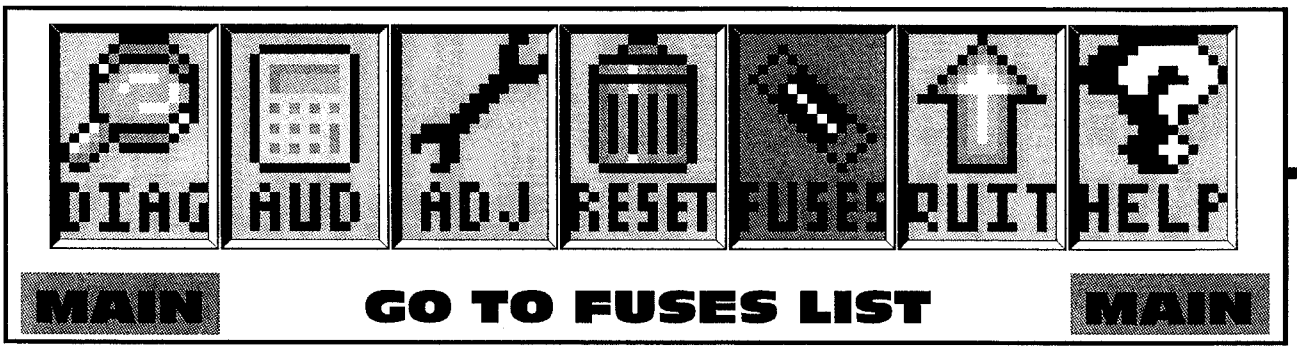
Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.

Selecting & activating the "HELP" *Icon* from any display will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)

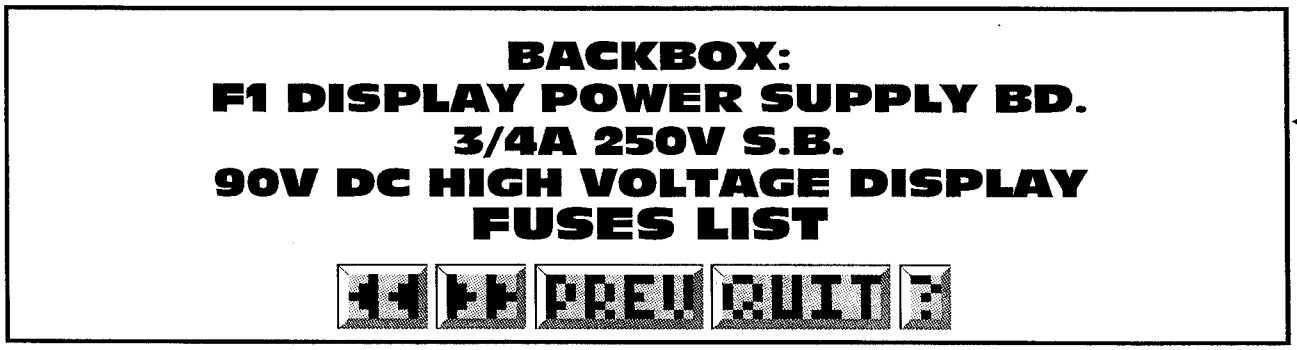
Selecting & activating the "ARROW" *Icons* selects the next or previous fuse in this group.

Example:

From the **MAIN MENU**, use the **Red** or **Green Buttons** to select the "FUSES" *Icon* (**GO TO FUSES LIST**).



Press the **Black Button** to activate this **ICON**. This will bring up the **FUSES LIST**.



▼ BACKBOX LAYOUT LOCATIONS: Fuses, Bridges, Relays & ROMs ▼

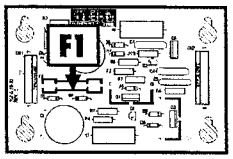
CAUTION: *For continued protection against risk of fire, replace only with same type of fuse having the same electrical rating!*

QUICK REFERENCE FUSE CHART

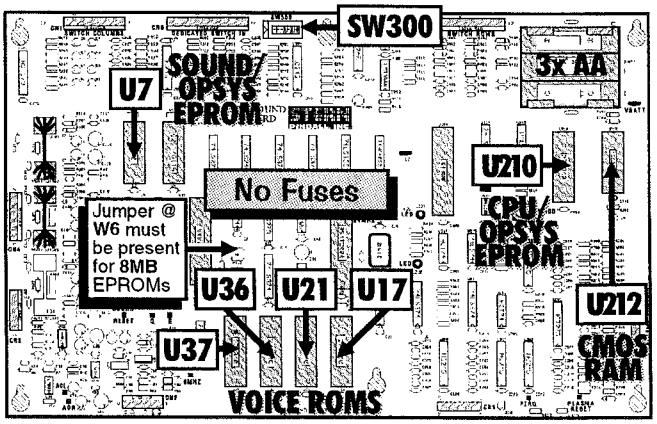
Backbox Fuses			
LOC:	DISPLAY POWER SUPPLY (P.S.) BOARD		
F1	¾A 250v S.B.	90v DC	High Voltage Display
LOC:	I / O POWER DRIVER BOARD		
F6	7A 250v S.B.	50v DC	Primary High Power Coils/Flippers
F7	5A 250v S.B.	20v DC	Low Power Coils
F8	5A 250v S.B.	12v DC	Logic Power
F9	5A 250v S.B.	12v DC	Logic Power
F20	3A 250v S.B.	50v DC	Magnet(s)
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)
This Game's Playfield Fuses			
LOC:	UNDER PLAYFIELD (By Assemblies Listed)		
n/a	3A 250v S.B.	50v DC	Rt. Flipper (BLU-YEL↔RED-YEL)
n/a	3A 250v S.B.	50v DC	Lt. Flipper (GRY-YEL↔RED-YEL)
n/a	3A 250v S.B.	50v DC	Upper Flipper (GRY-YEL↔RED-YEL)
n/a	3A 250v S.B.	50v DC	Ramp Magnet (VIO-YEL↔WHT)
n/a	3A 250v S.B.	50v DC	Goalie Magnet (VIO-YEL↔WHT)

For Backbox & Cabinet General Parts, review Section 4, Chapter 1, Parts Identification & Location (The Pink Pages).
For Schematics and/or Component Parts on above Boards, review Section 5, Chapter 4, Printed Circuit Boards (The Yellow Pages).

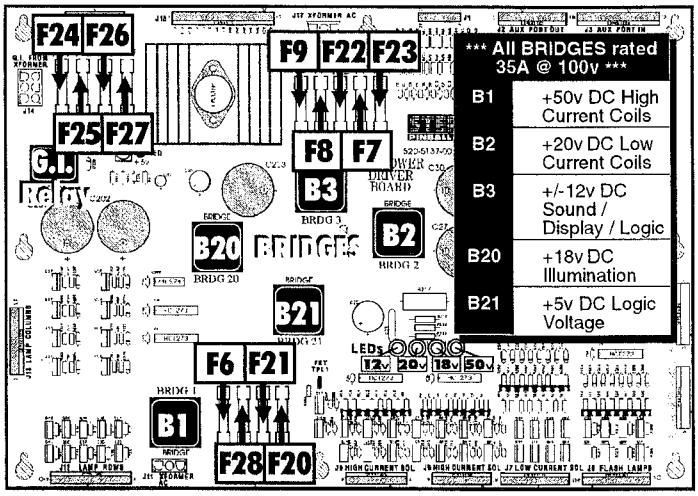
Display Power Supply Board



CPU / Sound Board

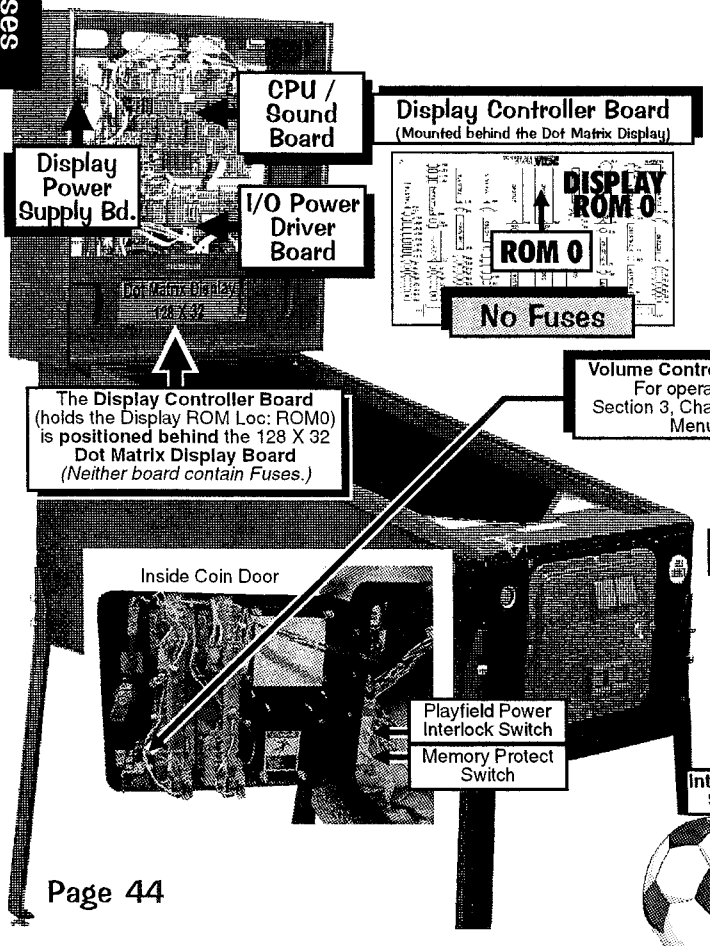


I/O Power Driver Board



*** 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



Go To Help Screen

Overview

The **Portals™ Service Menu System** provides help screens in each display (except if the display is in a testing mode). Each screen is basic and some terms may vary. At the beginning of each chapter in this section, *Icons* are shown and described to give detail of the particular function of the individual *Icons*. The table on the previous page was designed to help answer some questions of situations which may arise.

GO TO HELP SCREEN

With the game in the Attract Mode, open the Coin Door and press the **Black "BEGIN TEST" Button**. Select the "HELP" *Icon* in the **MAIN MENU** with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The **HELP SCREEN** appears cycling through the different icon usages pertinent to that menu level.

MENU HELP SCREEN
USE THE RED OR GREEN BUTTONS TO CHANGE THE SELECTED ICON. PRESS THE BLACK BUTTON TO ACTIVATE THE SELECTED ICON. THE FLIPPER & START BUTTONS FUNCTION IN THE SAME WAY.

Important Notes:

Exit any sub-menu and return to the **MAIN MENU** by selecting & activating the "PREV" *Icons*. If no *Icons* appear in the display because of a testing function or special display (e.g. "Help"), press any button to exit.

Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.

Selecting & activating the "HELP" *Icon* from any display will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)

These "Mini-Icons" vary in functionality depending in what sub-menu they are used. Refer to the beginning of each chapter in this section for the function they serve in that menu or select the "HELP" *Icons* in the display where the *Icon* in question is being used.

Review Chapter 1, Introduction: How to enter the **Portals™ Service Menu**. The chapter outlines the entire **Portals™ Service Menu**. View the **Icon Tree** in this manual which describes the names and menu descriptions of each *Icon*. View the display, after selecting and activating either of the "HELP" or "?" *Icons*.

Review Chapter 2, Go to Diagnostics Menu: Find all the tests needed to troubleshooting the game.

Review Chapter 3, Go to Audits Menu: Gather play information and printing functions (downloading).

Review Chapter 4, Go to Adjustments Menu: Customize the game to vary difficulty of play or to change functions of the game.

Review Chapter 5, Go to Reset Menu: Reset audits and adjustments to Factory Settings.

Review Chapter 6, Go to Fuses Menu: View the location & descriptions of the game fuses (the same information is referenced in the Fuse Chart Table on **DR. ❶**).

This concludes the **Portals™ Service Menu**. Review the Table of Contents at the beginning of this manual, and the detailed Table of Contents for Section 3 to quickly find the information required. The remainder of the sections in this manual will cover all the parts in this game and provide helpful information to aide in troubleshooting. If questions still arise after reading this Section completely, call our Technical Support Department.

PORTALS™ SERVICE MENU
PROBLEM/SOLUTION TABLE

Use this table for a quick simple solution(s) guide. For more technical assistance view Section 5.

PROBLEM	SOLUTION
Will not enter the Service Mode after depressing the **Black "BEGIN TEST" Button**.	• Check the Service Switch(es) (**Red, Green & Black Buttons**) for loose connections or bad Ground. • Check the associated wiring harness to/from the CPU Board Connector CN6. • Check CPU Board, possibly failed.
All Service Buttons (**Red, Green** and **Black**) appear nonfunctional.	• Check the Service Switches for poor connections or broken wires.
The **Green Service Button** in the Attract Mode will not enter the Service Credits Menu to add Service Credits.	• Check to make sure the Game is not in "Free Play." *If the game is set to Free Play, adding Service Credits is not required.* • Check the Service Switche(s) for poor connections or broken wires.
The display blanks out.	• Check the Dot Matrix Display for loose wiring harness connections. • Check F1 (3/4A Fuse) on the Display Pwr. Supply Bd. Refer to Section 5, Chapter 4, Schematics & Troubleshooting.
Icons *"scroll"* along continuously in the **MAIN MENU**.	• If the Service Switch Set and/or the Coin Door was replaced, ensure the Locking Mechanism on the **Green Button** is removed. If the Green Button "clicks" and locks into an up/down position, the Green Button has this lock switch. Remove it. (Ref. to Svc. Bulletin #74.)
The **Start** and **Flipper Buttons** do not select or activate *Icons* in the **SWITCH TEST MENU**.	• This is normal. These switches are deactivated, as they are a part of the Switch Test. Use the **Red "LEFT" or Green "RIGHT" & Black "ENTER" Buttons** in this Sub-Menu (See Chapter 1).
Can't move selection of *Icon* with the **Left** and/or **Right Flipper Buttons**.	• Check the **Flipper Buttons** for loose connections or bad Ground and refer to Section 5, Chapter 2, Playfield Wiring, #-Flipper Circuit Wiring Diagram. • This is normal ***only*** in Diagnostic's Switch & Active Switch Tests (see previous Problem).
Some *Icons* appear non-functional in the **PRINTER MENU(S)**.	• If no printing equipment is connected, the "-" *Icon*, "+" *Icon* and "RUN" *Icon* will appear not to function (see Chapter 5).
Some *Icons* appear non-functional in the **GAME SPECIFIC MENU** under the **DIAGNOSTICS MENU**.	• If there is no other test under this Menu, the "Left Arrow" & "Right Arrow" *Icons* will appear not to function. The remaining *Icons* should function as normal. *Note: If there is no Game Specific Special Test, the **"GAME SPECIFIC"** Icon will not invoke another display.*
The display returns to the **ATTRACT MODE** exiting the Service Session from the **FACTORY RESET MENU**.	• This is normal. After a **FACTORY RESET**, the Service Session is automatically exited (see Chapter 4 (end) or Chapter 6).
In **COIL TEST MENU**, the coils and flashlamps ***do not*** fire after activating the "RUN" *Icon*.	• Ensure the **POWER INTERLOCK SWITCH** (See figure on front inside cover) ***is pulled out***.
In **ADJUSTMENTS MENU**, with the Coin Door **CLOSED**, adjustments are not getting changed as desired while using the **Flipper** & **Start Buttons** to select *Icons* and change values.	• This is normal. The ***Memory Protect Switch*** is enabled when the Coin Door is **CLOSED**. Changes can be made with the Coin Door **OPEN** only.
In **Portals™ Service Menu**, the volume cannot be adjusted with the **Red** or **Green Buttons**.	• The Volume adjustment can only be made when in the **Attract Mode**. The **Volume Mode** is entered by pressing the **Red "VOLUME" Button**. Then use the **Red** or **Green Button** to increase/decrease volume. (Red "LEFT" decrements; Green "RIGHT" increments.)
In **Portals™ Service Menu**, the display seems to lock up, or the Help Display appears to be non-functional.	• If you cannot clear the situation by exiting back one Menu, exit completely out of the **Portals™ Service Menu**, and re-enter. If the problem persists, call Technical Support for additional help.

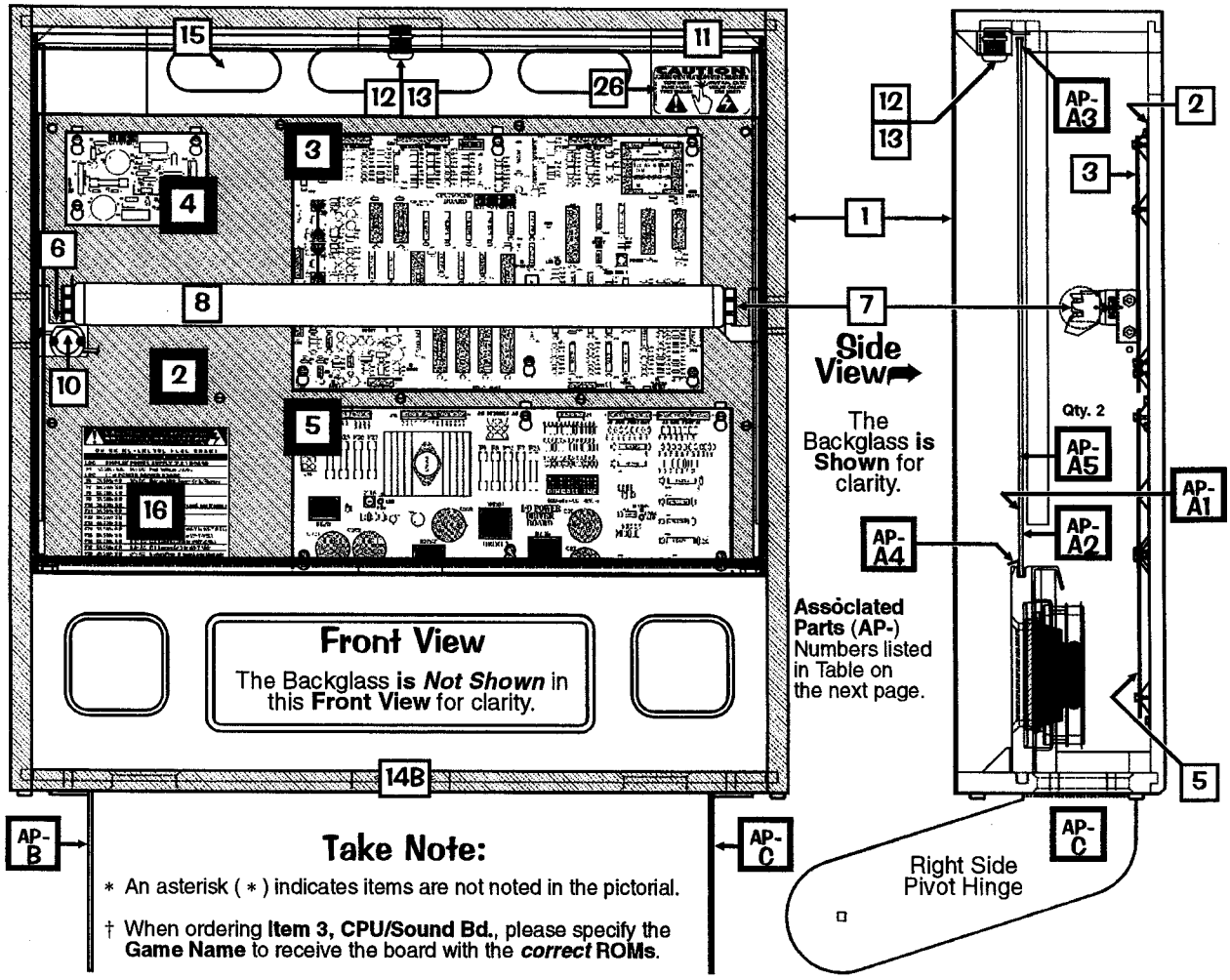
Parts Identification & Location (The Pink Pages)

Overview

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

Section 4
Table of Contents

Backbox (Showcase III: Striker Xtreme) Assembly, 505-6002-68-68 (Items 1-25)



Take Note:

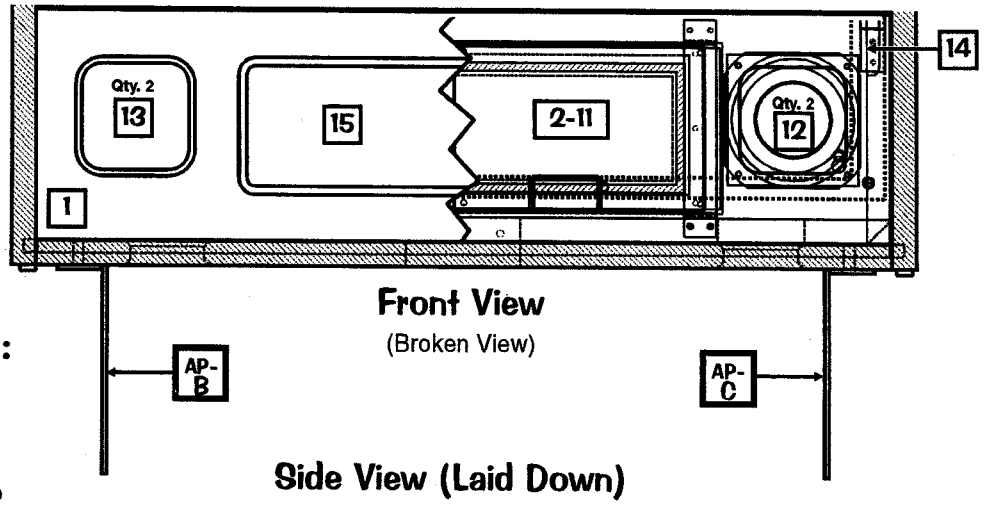
* An asterisk (*) indicates items are not noted in the pictorial.

† When ordering **Item 3, CPU/Sound Bd.**, please specify the **Game Name** to receive the board with the ***correct*** **ROMs**.

№	BACKBOX PART NAME	QTY.	SPI PART №
1	Backbox (Showcase III: **Striker Xtreme**)	1	525-5558-68
Item 1 is Screened with Striker Xtreme Art; **Item 1** comes with Black T-Molding installed.			
2	PCB Metal Mounting Plate	1	535-5809-04
Item 2 is secured to Item 1 by: #8 X 1/2" SHWH AB (Zinc) (Qty. 8) (234-5101-00) **and** #10 Washer 7/32" ID X .5" OD X 1/16" (Qty. 4) (242-5003-00)			
3 †	CPU/Sound Board (Mono) FCC-FEB98	1	520-5136-16
4	Display Power Supply Board	1	520-5138-00
5	I/O Power Driver Board	1	520-5137-01
Items 3, 4 & 5 are secured to Item 2 by: #8-32 X 3/8" HWH MS (Qty. 19) (237-5903-00)			
6	Fluorescent Light Bracket Assy. Left	1	515-6545-00
ORDERING ABOVE ITEM 6) SUB-ASSY. PART № WILL INCLUDE:			
6A	Fluorescent Light Bracket Left	1	535-7739-00
6B	Lamp Holder (Self-Locking)	1	077-5214-00
6C	#8-32 X 5/8" PPH MS (Sems) Zinc	1	232-5203-00
6D	Starter Base (with Leads)	1	077-5213-00
6E	#4-40 X 1/2" PPH MS (Sems) Zinc	2	237-5913-00
7	Fluorescent Light Bracket Assy. Right	1	515-6545-01
ORDERING ABOVE ITEM 7) SUB-ASSY. PART № WILL INCLUDE:			
7A	Fluorescent Light Bracket Right	1	535-7739-01
7B-7C	Identical to Items 6B-6C above.		See 6B-6C
Items 6 & 7 are secured by: #10-24 X 1-1/4" Carriage Bolt Sq. Neck (Qty. 2/per) (231-5012-00) **and** #10-24 Keps Nut (Qty. 2/per) (240-5207-00)			
8	Fluorescent Tube (F20T12CW)	1	165-5031-02
9*	3/4" X 3" Reinforced Strapping Tape	1	626-5040-00
Above Item 9 is self-adhesive. It is located on Items 6 & 7. Sold in 12" Lengths only.			
10	Starter - Fluorescent (FS2 Light)	1	165-5011-01
11	Ballast SP2/K 5/8" Core 120v 50/60 Hz 13W	1	010-5015-00
	Ballast Mounting Plate		530-8657-00
Item 11 is secured to Item 1 by: #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5102-04)			

№	BACKBOX PART NAME	QTY.	SPI PART №
12	Lock Mounting Plate for 2000	1	535-8128-01
13	Camlock (Cam 440X) & Key	1	355-5018-02
Items 12-13 are secured by: #8 X 5/8" TP Torx T20 (Qty. 4) (237-5947-00)			
14A	*#1 Roto Lock Male (on Cabinet)*	*1*	*355-5006-01*
14B	#1 Roto Lock Female (R2-0002-02)	1	355-5006-02
Item 14B 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)			
15	Back Vent Grill 2-1/2" X 18"	1	545-5072-02
Item 15 is secured by: Staple 5/16" (Qty. 24) (631-5000-00)			
16	Fuse Description Decal (Generic)	1	820-6152-00
17*	Fuse Description Decal Game № 68	1	820-6152-68
18*	Fuse Label (UL)	1	820-6143-00
19*	Backbox Date Label	1	820-5091-00
20*	Ribbon Cable, 20-Pin (4")	1	036-5000-04
21*	Ribbon Cable, 26-Pin (68")	1	036-5001-68
Item 20 (20-Pin) connects the CPU/Sound Board to the I/O Power Driver Board. **Item 21 (26-Pin) connects** the CPU/Sound Board to the Display Controller Board.			
22*	1/4" Clamp (Double)	3	040-5000-23
23*	1/2" Clamp (Single)	1	040-5000-06
24*	3/4" Clamp (Single)	3	040-5000-08
25*	1" Clamp (Single)	6	040-5000-09
Items 22-25 secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 13) (234-5101-00)			
26	"CAUTION - VERY HOT" Decal	1	820-6266-00

Speaker Panel Assy. for the Backbox (Showcase III), 515-6888-03 (Items 1-15) and Assoc. Parts: Backglass Assembly & Pivot Hinges (Left & Right) (See Below Table)



Front View
(Broken View)

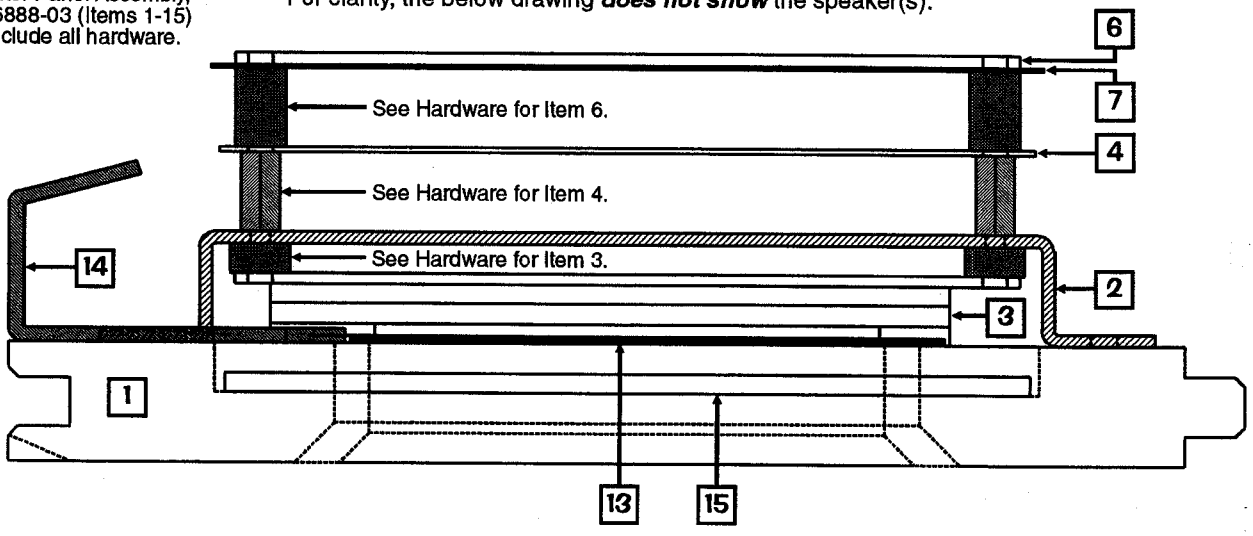
Take Note:

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

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

Side View (Laid Down)

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



Nº	SPEAKER PANEL PART NAME	QTY.	SPI PART Nº
1	Speaker Panel (Black Wood)	1	525-5515-00
2	Dot Matrix Disp. Bd. Mounting Bracket	2	535-8368-01
	Item 2 is secured to Item 1 by: #8 X 3/4" HWH AB (Zinc) (Qty. 4/per) (234-5103-00)		
3	Dot Matrix Display Board 128 X 32	1	520-5052-00
	Item 3 is secured to Item 2 by (at corners): 3/16" X 3/8" Spacer Gray (Qty. 4) (254-5000-18) **and** #6-32 X 1/2" HWH Swage (Serr) Zinc (Qty. 4) (237-5976-03) **Item 3 is secured to Item 4 (at the top center) by:** 3/4" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-04) **and** #6-32 X 1/4" PPH MS (Sems) Zinc (Qty. 1) (232-5200-00)		
4	Static Shield (Steel Plate)	1	535-6437-00
	Item 4 is secured to Item 2 by: 1/2" X 1/4" Hex Spacer #6-32 Tap (Qty. 4) (254-5008-03) **and** #6-32 X 1/2" PPH MS (Sems) Zinc (Qty. 2, on Left Side only) (232-5202-00)		
5*	Edge Protector (on Item 4)	2	545-5592-01
6	Display Controller Board FCC-FEB98	1	520-5055-03
	Item 6 is secured to Item 4 by: 1/2" X 5/16" X .144 ID Spacer Tap (Qty. 3) (254-5014-00), #6-32 X 3/4" PPH MS (Sems) Zinc (Qty. 3) (237-5504-00), 1/2" X 1/4" Hex Spacer #6-32 Tap. (Qty. 1) (254-5008-03) **and** #6-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5200-00)		
7	RF Shield	1	820-5092-00
	Item 7 is secured inbetween: "Item 6" and its' mounting hardware described.		
8*	Ground Strap (25") (on Items 4, 6, 12)	4	600-5006-25
9*	1/2" Clamp (Single) (on Item 4)	1	040-5000-06
10*	Ribbon Cable, 14-Pin	1	036-5260-00
	Item 10 (14-Pin) connects the Dot Matrix Disp. Board to the Disp. Controller Board.		
11*	Foam 3/16" Thk. X 1/4" X 36"	6	626-5026-00
	Above Item 11 is self-adhesive. Located between Items 3 & 17. Sold in 12" Lengths only.		
12	Speaker (Shld.) 4" 8Ω MG Elec #4060SH	2	031-5004-01
13	Speaker Grill (Black w/no Artwork)	2	535-8081-01
14	Speaker Panel Hook Bracket	2	535-7009-02
	Items 12, 13 & 14 are secured by: #8 X 3/4" HWH AB (Zinc) (**Items 12/13:** Qty. 4/per; **Item 14:** Qty. 2/per) (234-5103-00)		
15	Plastic Shield (Display Cover)	1	545-5884-00
	Item 15 is secured to Item 2 by: #6 X 3/8" HWH AB (Zinc) (Qty. 8) (234-5000-00)		

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

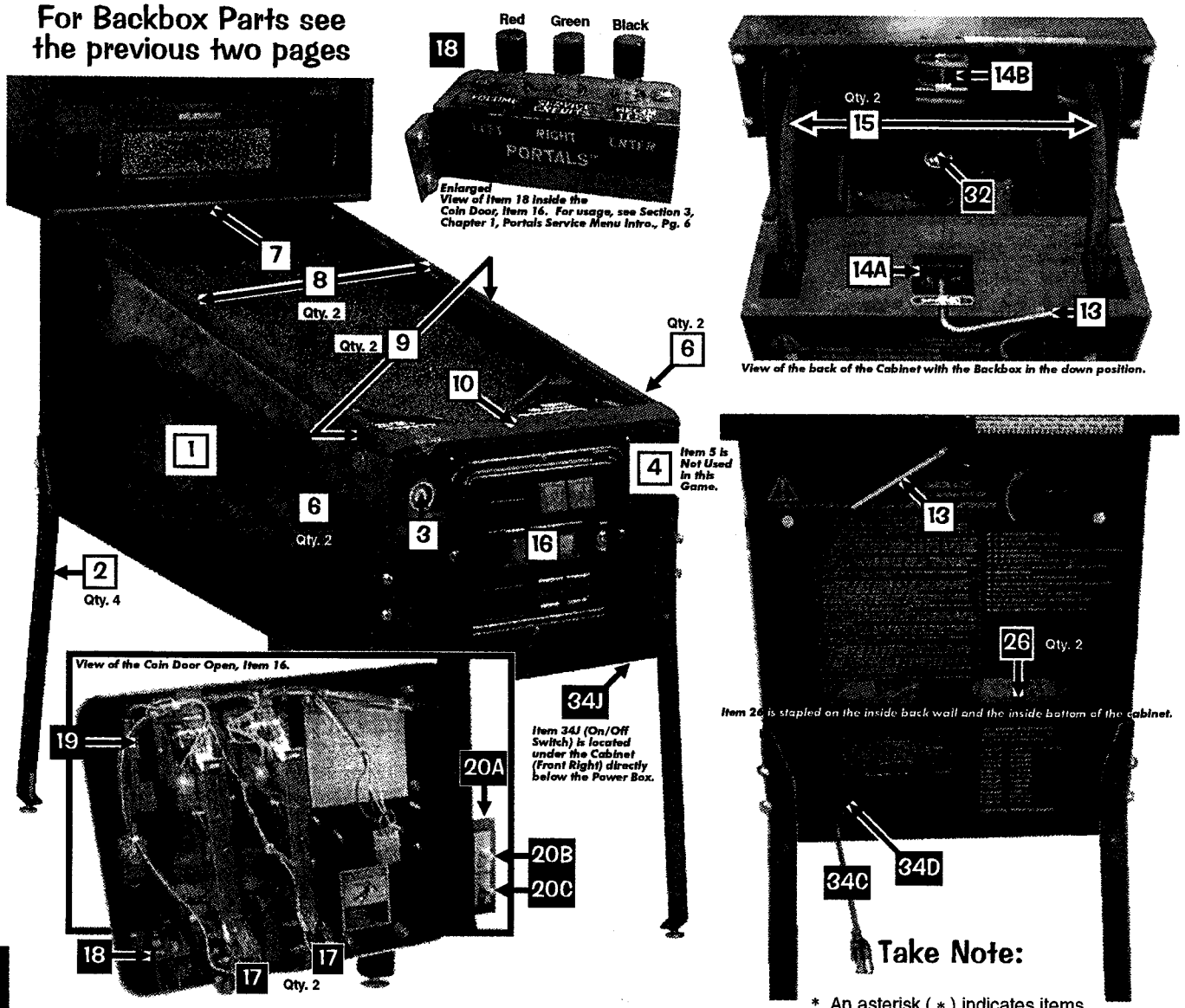
ASSOC. PARTS **ARE NOT INCLUDED** WITH BACKBOX/SPKR. PANEL ASSY'S.

Nº	ASSOC. BACKBOX PART NAME	QTY.	SPI PART Nº
AP-A	Backglass Assembly (Game Nº 68)	1	515-5450-00-68
	GROUPING ABOVE (ITEM AP-A) SUB-ASSY PART Nº WILL INCLUDE:		
AP-A1	Clear Backglass 25.906" X 19.187"	1	660-5038-02
AP-A2	Screened Film (Game Nº 68)	1	830-5268-00
AP-A3	Top Plastic Channel - 26"	1	545-5018-15
AP-A4	Bottom Plastic Lift Channel - 26-1/16"	1	545-5021-01
AP-A5	Plastic Edging (Left/Right) - 18-1/8"	2	545-5018-14
AP-A6*	Tape (double-sided) (12" Length) *Note: AP-A6 secures AP-A5 to AP-A1*	1/2	626-5005-00
AP-B	Pivot Hinge Left	1	535-7999-00
AP-C	Pivot Hinge Right	1	535-7999-01

Items AP-B & AP-C are secured to Backbox by: 1/4"-20 X 1-1/4" C.B. Sq. Neck (Qty. 4) (231-5003-00), 1/4"-20 Flange Nut (Qty. 4) (240-5300-00) **and** Fend Washer 1/4" I.D. X 1" O.D. (Qty. 1) (242-5009-00)
Items AP-B & AP-C are secured to Cabinet by: 1/4"-20 X 7/8" Carriage Bolt Sq. Neck (Qty. 2) (231-5014-00), Hinge Spacer (Qty. 2) (530-5099-00), Washer 1/4" I.D. X 7/8" O.D. X 1/8" Yellow (Qty. 1/per) (242-5016-01), Fend Washer 1/4" I.D. X 1" O.D. (Qty. 1/per) (242-5009-00) **and** 1/4"-20 Flange Nut (Qty. 1/per) (240-5300-00)

Cabinet - General Parts & Switches

For Backbox Parts see the previous two pages



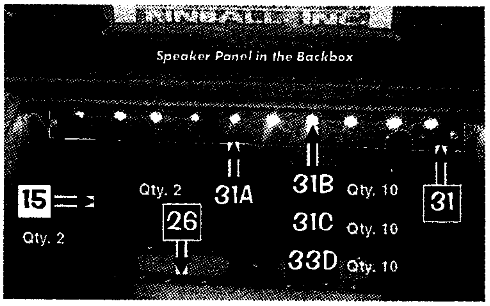
Take Note:

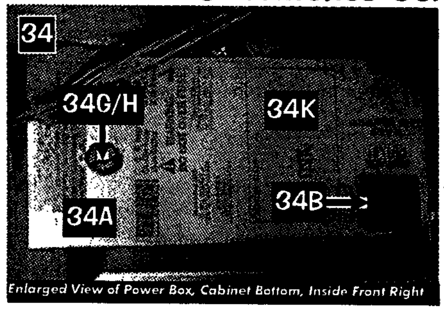
* An asterisk (*) indicates items are not noted in the pictorials.

Nº	CABINET PART NAME	QTY.	SPI PART Nº
1	Game Nº 68 Screened Cabinet (Plain)	1	525-6000-68
2	Black Leg & Leveler Assembly	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) *To order just a Leg Leveler (3/8" - 16 X 3") use SPI Nº: 500-5017-00. A Leg "without" a Leg Leveler is not available.*		
3	Start Button Assy. (Red "Flipper" Style)	1	500-6090-02
	Item 3 includes the Switch. FOR SWITCH ONLY SEE: Next Page, Item 25.		
4	Ball Shooter (Plunger) Assembly	1	500-6146-51-04
	Item 4 is secured by: Support Plate (Qty. 1) (535-5027-00), #10-32 X 3/8" SHWH (Serr) Swage (Qty. 3) (237-5985-00) **and** #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5002-00). **FOR A BREAKDOWN OF PARTS SEE: Sec. 4, Chp. 2, Drawings..., Page 64.**		
5	Large Rd. Auto Launch Assy. ()	0	500-6121-XX
	Item 5 includes the Switch. FOR SWITCH ONLY SEE: Next Page, Item 25. ***NOT USED***		
6	Flipper Button Assembly Red	2	500-5026-32
	Item 6 is secured by: Pal Nut for Flipper Button (Metal) (Qty. 2) (240-5003-01) **and is fitted with:** O-Ring 11/32" X 7/32" X 1/16" (Qty. 1/per) (545-5850-00) **Item 6 *DOES NOT* include the Switch. FOR SWITCHES SEE:** Next Page, Items 23A/B.		
7	Rear Glass Channel 20-3/8" Length	1	545-5038-00
8	Plastic Channel 42-5/8" Lg. (Lt. & Rt.)	2	545-5017-00
9	Side Armor "with holes" (Lt. & Rt.)	2	535-7297-02
	Item 9 is secured by: #10-24 X 1" Carriage Bolt Sq. Neck (2/per) (231-5021-00), #10-24 Hex Nut (2/per) (240-5202-00) **and** #8 X 5/8" T20 Tmp. Prf. (2/per) (237-5947-00)		
10	Front Molding - Black	1	500-5757-01-00
11*	Foam Rubber 3/8" X 3/16" X 20-3/8"	1	626-5001-00
	Above Item 11 is self-adhesive. It is located on Item 10. Sold in 12" Lengths only.		

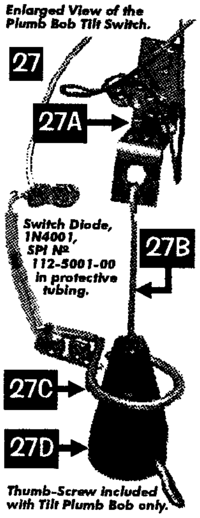
Nº	CABINET PART NAME	QTY.	SPI PART Nº
12*	P/F Glass (Tmprd.) 21" X 43" X 3/16"	1	660-5001-00
13	Hex Key Allen Wrench 5/16"	1	777-0001-00
14A	#1 Roto Lock Male	1	355-5006-01
14B	*#1 Roto Lock Female (on Backbox)*	*1*	*355-5006-02*
	Item 14A is secured by: #10-24 X 1-3/4" Carr. Bolt Sq. Neck (Qty. 2) (231-5022-00), #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)		
15	Corrugated Tubing Black 1¼"ø X 2.6' Lg.	2	605-5008-00
	Above Item 15 covers the Cables Wiring Harnesses going into the Backbox from the Cab.		
16	Coin Door (with Validator) USA only	1	500-5018-172
	Item 16 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.*		
17	Coin Door Switch (USA)	2	180-5024-00
	Coin Door Switch (¥ Japan)	n/a	180-5091-00
18	Diagnostics Service Switches (X3)	1	180-5012-03
	Item 18 is secured to Coin Door by: Diagnostics Sw. Bracket (Qty. 1) (535-6860-01)		
19	Slam Tilt Switch (On Coin Door)	1	180-5022-00
20	Dual Switch Assembly	1	500-5808-00
	ORDERING ABOVE (ITEM 20) ASSEMBLY PART Nº WILL INCLUDE:		
20A	Mounting Bracket	1	535-6958-00
20B	Playfield Power Interlock Sw. (Top)	1	180-5136-00
20C	Memory Protect Switch (Bottom)	1	180-5000-00
	Item 20 is secured to Cabinet by: #8 X 1/2" SHWH AB (Zinc) (Qty. 2) (234-5101-00)		

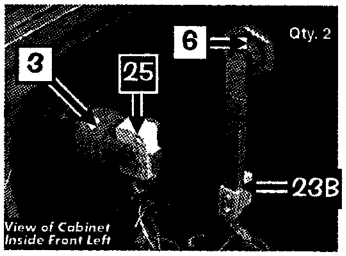
Parts Table & Views continue on the Next Page.

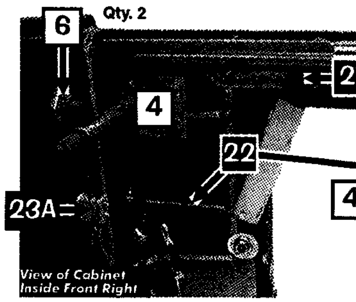


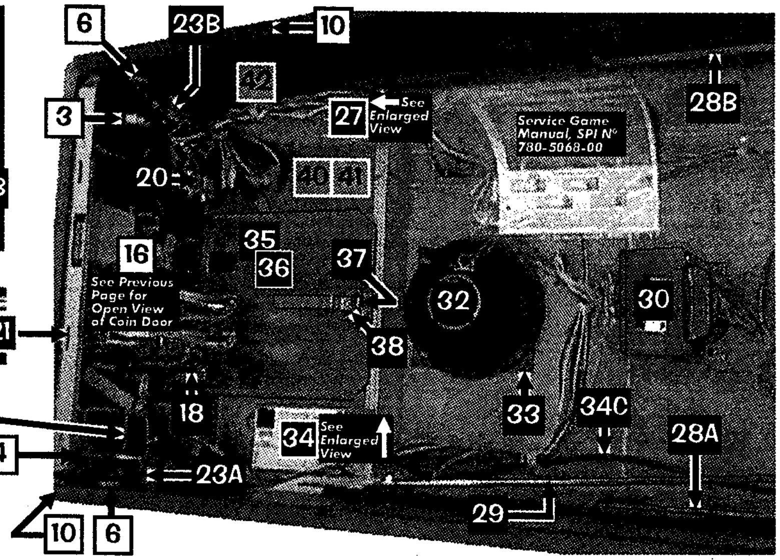


Items 39, 40 & 41 (Shaker Motor and related items) are NOT REQUIRED in this game.









№	CABINET PART NAME	QTY.	SPI PART №
21	Front Molding Lockdown Assembly	1	500-5020-01
Item 21 is secured by: #10-24 X 1-1/4" Carr. Bolt (Qty. 2) (231-5012-00), #10-24 Keps Nut (Qty. 2) (240-5207-00), #8 X 5/8" HWH AB Zinc (Qty. 4) (234-5102-04) and #10 Washer 7/32" ID X 1/2" OD X 1/16" (Qty. 2) (242-5003-00)			
22	Lockdown Spring (connected to handle)	1	265-5008-00
23A	Flipper Switch - Self-Cleaning	1	180-5160-00
23B	Flipper Sw. - X2 Stack for Lwr & Upr Flippers	1	180-5164-00
24*	Foam Strip (2 on 23A; 1 on 23B)	3	626-5042-00
25	Start Button (SWITCH ONLY) / Auto Launch 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	n/a
ORDER ONLY INDIVIDUAL PARTS NEEDED (NO ASSY. NUMBER):			
27A	Bracket for Hanger Wire	1	535-5221-00
27B	Hanger Wire	1	535-5319-00
27C	Contact Wire Form	1	535-7563-01
27D	Plumb Bob Weight (includes Thumb-Screw)	1	535-5029-00
Items 27A & 27C are secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00)			
28A	Slide & Pivot Support Bracket - Right	1	535-5989-00
28B	Slide & Pivot Support Bracket - Left	1	535-5990-00
Items 28A & 28B are secured by: #10-24 X 1-1/4" Carriage Bolt Sq. Neck (3/per) (231-5012-00) and #10-24 KEPS Nut (3/per) (240-5207-00)			
29	Prop Rod	1	535-7553-00
Item 29 is secured by: #10-24 X 1-3/4" Carriage Bolt Sq. Neck (Qty. 1) (231-5022-00), Washer #10 7/32" ID X .5" OD X 1/16" Thk (Qty. 1) (242-5003-00) and #10-24 Nylon Stop Nut (Qty. 1) (240-5206-00)			
30	Transformer with Ballast Winding	1	010-5012-00
Item 30 is secured by: 1/4"-20 X 5/8" PPH MS (Zinc) (Qty. 4) (237-5854-00) and 1/4" Split Lock Washer (Qty. 4) (244-5000-00) *Item 17 Specifications: PRI 103.5 / 115 / 207 / 230V 50/60Hz 750VA Class 130 EPBO*			
31	Cabinet Light Board Assembly	1	500-6413-68
ORDERING ABOVE (ITEM 31) ASSEMBLY PART № WILL INCLUDE:			
31A	Cab. Light Bd. Plain (Black Wood)	1	525-5563-00
31B	2-Lug Stand-Up Lg. Shell Socket (Gls)	10	077-5031-00
31C	#44 Bulb (Small Bayonet Type)	10	165-5000-44
31D	Rubber Lite Cover Yellow	10	545-5014-06
31E*	Decal Cover	1	820-6258-24
31F*	#6 X 3/8" PPH Zinc	1/per	232-5000-00
Item 31 is secured by: #8-32 X 1-1/2" HWH MS (Ser) Zinc (Qty. 2) (237-5946-00) and #8 Washer (Qty. 2) (242-5005-00)			

№	CABINET PART NAME	QTY.	SPI PART №
32	Speaker 8" ø Rd. 8010 4Ω	1	031-5007-00
33	Speaker Grill 7" X 7"	1	545-5072-03
Items 32 & 33 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)			
34	Power Input Box Sub-Assy. for 2000	1	515-5360-07
ORDERING ABOVE (ITEM 34) SUB-ASSY. PART № WILL INCLUDE:			
34A	Power Box (Plain)	1	535-5932-00
34B	Service Outlet (for USA)	1	180-5008-01
34C	Line Cord 10' ROJ 3" Max	1	034-5000-10
34D	Recessed Cup for Line Cord	1	545-5122-00
34E*	Line Filter	1	150-5000-00
34F*	Varistor TNR15921 1KM	1	150-5001-00
34G	Fuse 8 Amp 250v Slo-Blo (Domestic)	1	200-5000-05
34H	Fuse Holder	1	205-5001-00
34I*	On/Off Switch Bracket	1	535-8318-00
34J	On/Off Rocker Sw. (Arcolectric C1350AB)	1	180-5001-01
34K	Power Box Decal	1	820-6123-03
35	Cash Box Plastic Bottom	1	545-5090-00
36	Cash Box Cover (Validator)	1	535-5013-03
37	Cash Box Lock Bracket (wire)	1	535-7562-00
38	Large Hair-Pin Clip	1	535-7772-00
[redacted]			
Item 39 secured by: #8-32 T-Nut (Qty. 4) (240-5101-00) and #8 X 5/8" HWH SWAGE (Ser) Zinc (Qty. 4) (237-5975-03)			
[redacted]			
Item 40 secured to Item 39B by: #8-32 X 3/8" HWH MS (Taptite) (Qty. 2) (237-5967-00)			
[redacted]			
Item 41 secured by: 3/8" Slf. Rtn. Spacer White (Qty. 4) (254-5007-01) and #6 X 3/4" HWH AB (Zinc) (Qty. 4) (234-5003-00)			

Playfield - General Parts & Switches (Below)

Nº	BELOW PLAYFIELD PART NAME	QTY.	SPI PART Nº
1	Playfield Support Slide Bracket	2	535-6862-02

Item 1 is secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 2/per) (234-5101-00) **and** #8-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 1/per) (237-5975-03)

2	Edge Slide Bracket	2	535-5988-00

Item 2 is secured by: #4 X 1/2" PFH (Zinc) (Qty. 3/per) (237-5840-00)

3	Pivot Pin Bracket Welded Assy. 2000	2	500-5329-03

Item 3 is secured by: #8-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 1/per) (237-5975-03) #8-32 X 1" PFH (Zinc) (Qty. 1/per) (237-6029-00) **&** #8-32 NS Nut (Qty. 1/per) (240-5102-00)

4	Diode Terminal Strip 2-Lug (810) Isolated	6	055-5203-00
5	Diode Terminal Strip 3-Lug (813) Isolated	4	055-5204-03
6	Diode Terminal Strip 7-Lug Isolated	1	055-5204-07

Items 4, 5 & 6 are secured by: #6 X 3/8 HWH AB Zinc (Qty. 1-2/per) (234-5000-00).
NOTE: *1N4001 Diodes (112-5001-00) are for Switches and/or Lamps. * 2 -Lug (Item 4 note with *) 1N4004 Diode (112-5004-00) for Coil. ** 3-Lug (Item 5 noted with **) has 2 Resistors (1.2KΩ, 5W) (121-5080-00). See Sec. 5, Chp. 2, Playfield Diode Terminal Strip...*

7	3A 250v Slo-Blo Fuse	5	200-5000-08
	Fuse Clip Holder (Socket)		205-5000-01

Item 7, 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).
Item 7 is secured by: #6 X 1/2" PPH AB (Qty. 1/per) (237-5805-00)

8*	#8 Solder Lug	7	055-5140-08

Item 8 is secured by: #6 X 3/8" HWH AB (Zinc) Red (Qty. 1/per) (234-5000-00)

9	VUK Spacer (Wood) **between VUK & P/F**	1	525-5548-00

† **Item 9 is required for to lower the VUK (Lt. Style). Item 9 is secured by:** *Same Hardware securing the VUK, See Section 4, Chapter 2 (The Blue Pages).*

Nº	BELOW SWITCHES PART NAME	QTY.	SPI PART Nº
A	Micro **(Shooter Lane)** Sw. Assembly	1	500-6096-00
ORDERING ABOVE ITEM A ASSEMBLY PART Nº WILL INCLUDE:			
AA*	**Micro Switch**	1	**180-5157-00**
	Diode, 1N4001 (On Terminal Strip)	0	112-5001-00
AB*	Switch Mounting Bracket	1	535-6173-00
AC*	Switch Body Protect Plate	1	535-6539-00
AD*	#2-56 X 1/2" **HWH SER UNS #4ND TR3 BO**	2	237-5937-02
AE*	#2-56 Hex Nut	2	240-5301-00

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

B	Micro Sw. Assy. R/O Lt. Mount Reg.	2	500-6227-01
C	Micro Sw. Assy. R/O Rt. Mount Reg.	8	500-6227-02

Items B & C are secured by: #6 X 1/2" HWH AB (Zinc) Red (Qty. 2/per) (234-5001-02)

D	Modular S-U Target **Rnd. (Clr.) Rvrs. Mnt.**	2	500-6075-01R
E	Modular S-U Target Round (Clear)	2	500-6075-01

Items D & E are secured by: #8 X 3/4" HWH AB (Zinc) (Qty. 2/per) (234-5103-00)

F	Micro Switch (on Turbo (Pop) Bumper)	3	180-5015-03
G	Micro Switch (on Super VUK)	1	180-5052-00
H	Stack **(Blade)** SW. (on Slings & Kicker Trgt.)	5	180-5054-00
I	Micro **(HI-Form)** SW. (on Under-Trough)	1	180-5057-00
J	Micro **(Heavy Duty "Y")** Switch (on VUK)	1	180-5116-01
K	Micro **(Lite Force, Roller)** SW. (on Ball Trough)	3	180-5119-02
L	Micro Switch (on Drop Targets)	4	180-5158-00
M	EOS Switch (on Flippers)	2	180-5149-00
N	Dual OPTO TRANS Bd. (on Ball Trough)	1	520-5173-00
	Dual OPTO REC Board (on Ball Trough)		520-5174-00
O	Long Hop OPTO TRANS Bd. (on Brkt.)	1	520-5082-00
	Long Hop OPTO REC Board (on Brkt.)		520-5083-01
P	OPTO Bd. 3-Position Motor Sensor	1	520-5155-00

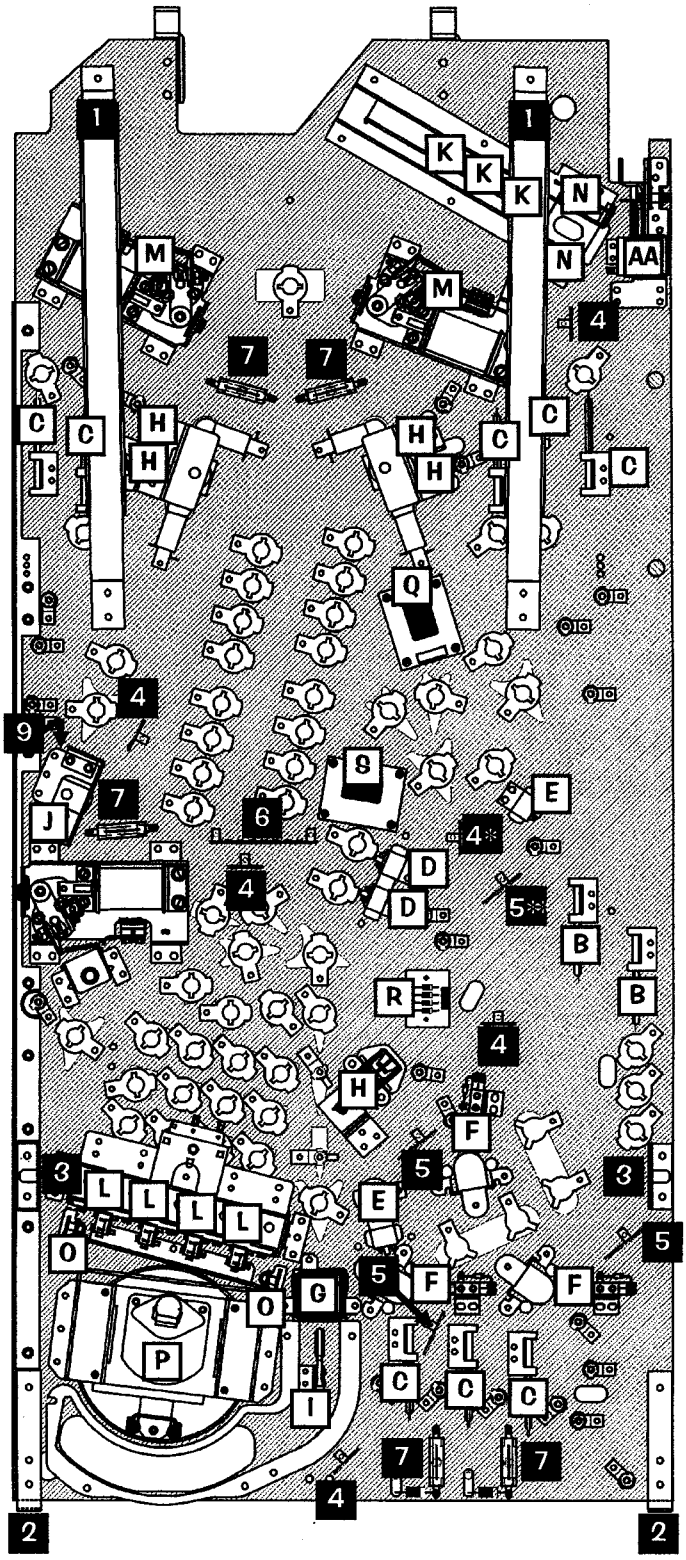
Items F thru P are on Major Assemblies: For securing hardware of Switches F-P, see the assemblies the switch is located on in the **Blue Pages, Section 2, Chapter 2.**

Nº	MISC. PCB PART NAME	QTY.	SPI PART Nº
Q	DC Relay Bd. Bi-Directional	1	520-5066-00
R	Diode PC Board	1	520-5146-00
S	Aux. Relay Board	1	520-5010-00

Items Q, R & S require: 3/8" Slf. Rtn. Spacer White (Q: Qty. 4, R, S: Qty. 2) (254-5007-01) **and** #6 X 3/4" HWH AB (Zinc) (Q: Qty. 4, R, S: Qty. 2) (234-5003-00)

UK†	Solenoid Expander Bd. **>> UK ONLY <<**	1	520-5192-00

† **Item UK is required for UK Games** *to support the Left & Right Outlane Ball Deflectors & Center Up/Down Post Assemblies not supported in the Normal Coil Matrix of Q1-Q32.*

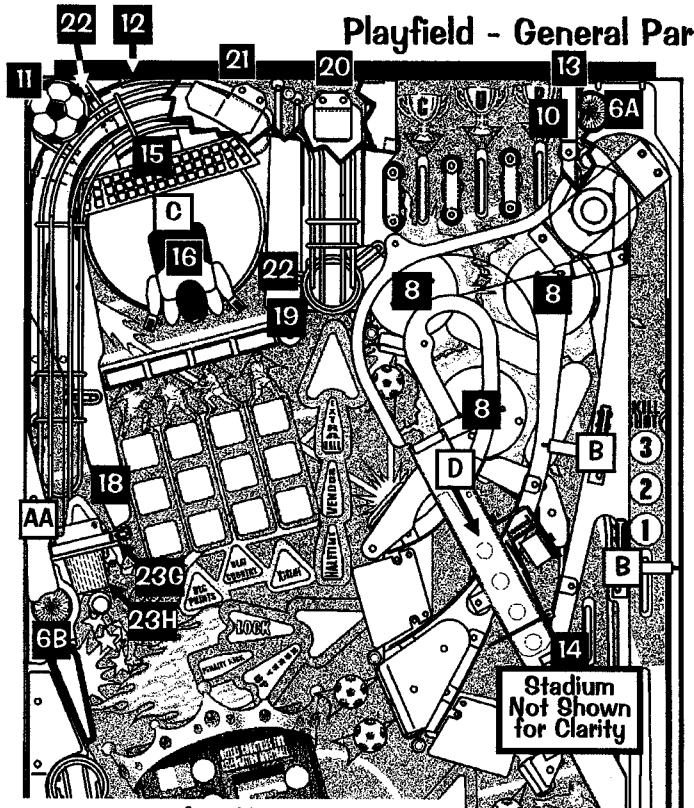


Take Note:

* An asterisk (*) indicates items are not shown on this page.

1. For Sockets & Bulbs (drawings & part numbers) see Pgs. 60-62.
2. For Major Assemblies, Ramps and/or Under Troughs, **see the Blue Pages, Sec. 2, Chp. 2.**
3. **Legend Note:** Items noted with a black square ■ are General Parts. Items noted with a white square ❒ are Switches or OPTO Boards, or Misc. PC Boards.

Playfield - General Parts & Switches (Above)



Take Note:

* An asterisk (*) indicates items are not noted in the pictorial.

® "R" indicates item has a riveted-on part, if removing/adding rivets is not an option, order teh entire ® Sub-Assembly.

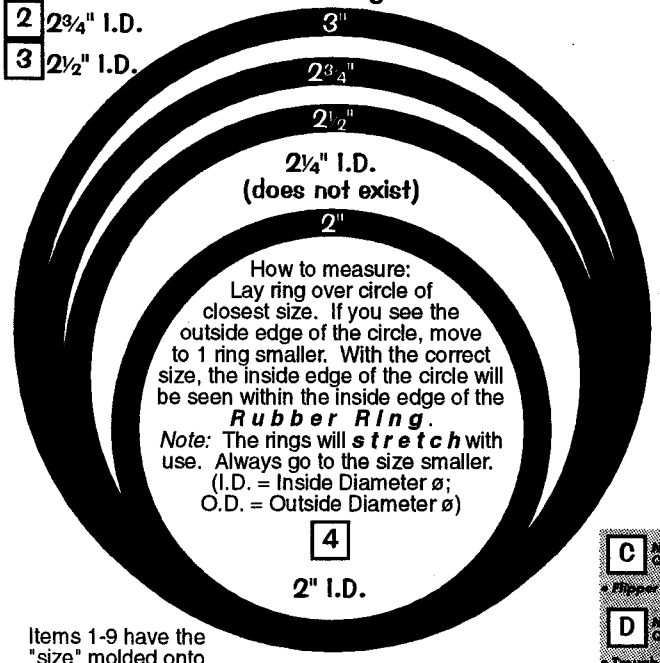
1. Some unique parts *may be included with* **or** *associated with* a Major Assembly or Ramp Assembly; **see the Blue Pages, Sec. 2, Chp. 2.** for parts required not appearing on this page.
   If you still cannot find the part required, Call Stern™ Pinball Technical Support, 1-800-542-5377 or 1-708-345-7700.
2. **Legend Note:** Items noted with a black square ■ are General Parts. Items noted with a white square ❒ are Switches.

Nº	ABOVE PLAYFIELD PART NAME	QTY.	SPI PART Nº
n/a *	P/F Screened **w/** Inserts & **NO** Parts	1	830-5100-68
	P/F Complete **w/** Inserts & **ALL** Parts		505-6004-68-68
1	Playfield Hanger Bracket	2	535-8385-00
	Item 1 is secured to the P/F by: #8-32 X 7/8" HWH MS Zinc (Qty. 2/per) (237-5890-00)		
2	Arch Retaining (Hold-Down) Brackets	2	535-8394-00
	Item 2 is secured to the playfield by: #8 X 1/2" SHWH AB (Zc.) (Qty. 3/per) (234-5101-00)		
3	Arch Assembly (Metal)	1	500-6005-01
	ORDERING ABOVE (ITEM 3) ASSEMBLY PART Nº WILL INCLUDE:		
3A*	Arch (Plain Black Metal) w/o Fork	1	535-8392-01
3B*	Nelson Protect Strip 8-9/16"	2	545-5212-02
	Item 3 is secured to the playfield by: #10-32 X 5/16" PH FL U/C MS STL Zinc (Qty. 2) (237-6013-00). ***Usage Note:*** 500-6005-**01** or 535-8392-**01** use with Game with a ***Shooter Plunger***; 500-6005-**00** or 535-8392-**00** use with Game with an ***Auto Launch Button.*** *(Note: Decals are not included with the above. See Playfield - Plastic, Decals & Mylar.)*		
4A	Instruction Card (USA/Spanish) Nº: 68	1	755-5168-01
4B	Coin Card (Double-Sided)	1	755-5087-01
4C	*OPTIONAL* Coin Card ("Blank")	0	755-5087-02
	Note: *Use Item 4B* ***(Side 1: 1 Play 50¢ 3 Plays $1)*** *for Adj. 7, Game Pricing, USA 8 Setting; Use Item 4B* ***(Side 2: 1 Play 50¢)*** *for USA 3 Setting. Use Item 4C OPTIONAL* ***(Blank)*** *for Custom Settings* ***(not included*** *in USA Games or Foreign Games w/own Country Coin Card; Item 4C can be purchased, call your Distributor).*		
5	1-1/16" Steel Balls	4	260-5000-00
6A	Mini-Mars Light Cover Clear	1	550-5031-01
6B	Mini-Mars Light Cover Yellow	1	550-5031-06
7	Plug-Cap (3/16") Black Plastic	1	545-5232-01
	Note: *Use Item 7 (in the Spare Parts Bag) if the Center Post (@ Drain) is not desired.*		
8	Rubber Lite Cover Yellow (on Pops)	3	545-5014-06
9	Ramp Mounting Welded Bracket	2	515-6508-00
	Item 9 is secured on Wood Rail: #6 X 1/2" PTH A (Zinc) (Qty. 2/per) (237-5809-00)		
10	1-Way Gate Mounting Bracket	1	535-5269-02
	Wire Gate (for above)		535-5307-02
11	Soccer Ball Foam Rbr. (stops Ball Trap)	1	880-5044-00
	Item 11 is secured to the CABINET by: #8 X 3" PFH Dry Wall Scr. (Qty. 1) (237-6032-00)		
12	Back Panel Striker Xtreme (No Parts)	1	525-5560-00
	Item 12 is secured by: #6 X 3/8" HWH AB (Zinc) (Qty. 7) (234-5000-00)		
13	Gate Retainer Bracket (on Back Panel)	1	535-8596-00
	Item 13 is secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 1) (234-5101-00)		
14*	Stadium Molded Plastic (Lock Ball Cover)	1	545-5945-00
	Item 14 is secured by: For Trough & Hardware see Sec. 4, Chp. 2, Drawings..., Pg. 80.		
15	Soccer Net Molded Metal	1	535-8668-00
	Item 15 is secured by: #6-32 X 1/4" HWH Swage (Qty. 2) (237-5976-01)		
16	Goalie Molded Plastic	1	880-5043-00
17	Rail Protector Plate	1	535-6707-01
	Item 17 is secured on Rt. Wood Rail by: #6 X 1/2" PTH A (Zinc) (Qty. 2) (237-5809-00)		
18	Protect Plate (for Plastic Buty. -15)	1	535-8658-00
19	Protect Plate (for Plastic Buty. -18)	1	535-8659-00
20	Snubber Bracket (by Top Hole SVUK)	1	535-8250-01
	Item 20 is secured by: #8-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 2) (237-5975-03)		
21	Snubber Bracket (behind Goalie)	1	535-8250-02
	Item 21 is secured by: #8 X 1/2" SHWH AB Zinc (Qty. 2) (234-5101-00)		
22	Wire (Ball Trap Stops)	2	265-5059-00

Nº	ABOVE SWITCHES PART NAME	QTY.	SPI PART Nº
23®	Spinner & Light Assembly	1	500-6415-00-68
	ORDERING ABOVE RIVETED ASSEMBLY PART Nº WILL INCLUDE:		
AA	**Micro Switch (1-1/4")**	**1**	**180-5010-04**
23B*	Switch Body Protect Plate	1	535-6539-00
23C*	Diode, 1N4001	1	112-5001-00
23D*	#2-56 X 1/2" HWH Ser Uns #4HD TR3	1	237-5937-02
23E*	Spinner Bracket (Light & Sign Mount)	1	535-8654-00
23F*	Spinner Sub-Assembly	1	515-5553-00
23G®	**Plastic Piece (Buty. -12) Sign Assy.**	**1**	**515-7063-12R-68**
	Incl.: Plastic Piece (Buty. -12) Plain (830-5972-12), Wedge Base Offset Socket (077-5029-00) & Rivet, 1/8" ø X 3/16" Lg. (249-5001-00)		
23H	**Mini-Mars Light Cover Snap-In Red**	**1**	**550-5030-02**
23I*	#555 Wedge Base Bulb	1	165-5002-00
23J*	Decals (Front Bottom & Top)	1	820-6258-12, -15
	Item 23 is secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 1) (234-5101-00) **and** #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1) (232-5201-00)		
B	Micro Switch (on Ramp 1-Way Gates)	2	180-5087-00
C	Micro Switch (on Goalie Magnet Core)	1	180-5173-00
D	Membrane Sw. Pad 4-Pos. (on Trough)	1	181-5001-00

Playfield - Rubber Parts (Rings Actual Size) †

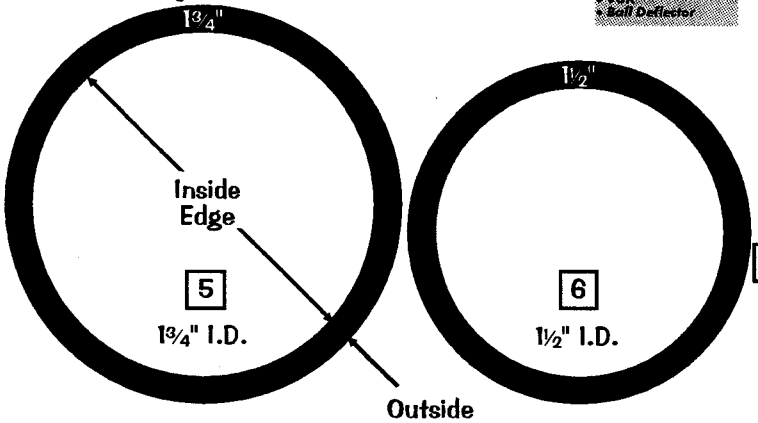
1 3" I.D.
2 2¾" I.D.
3 2½" I.D.

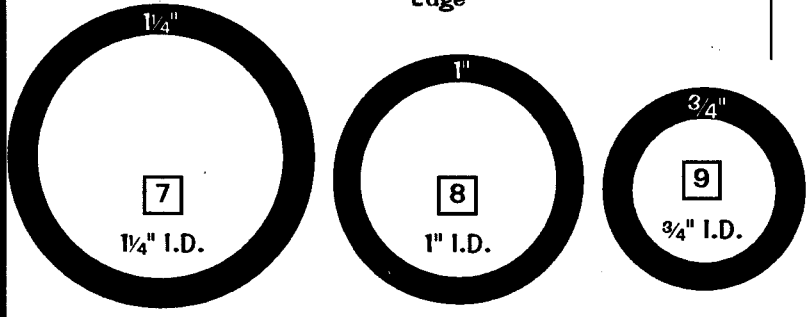


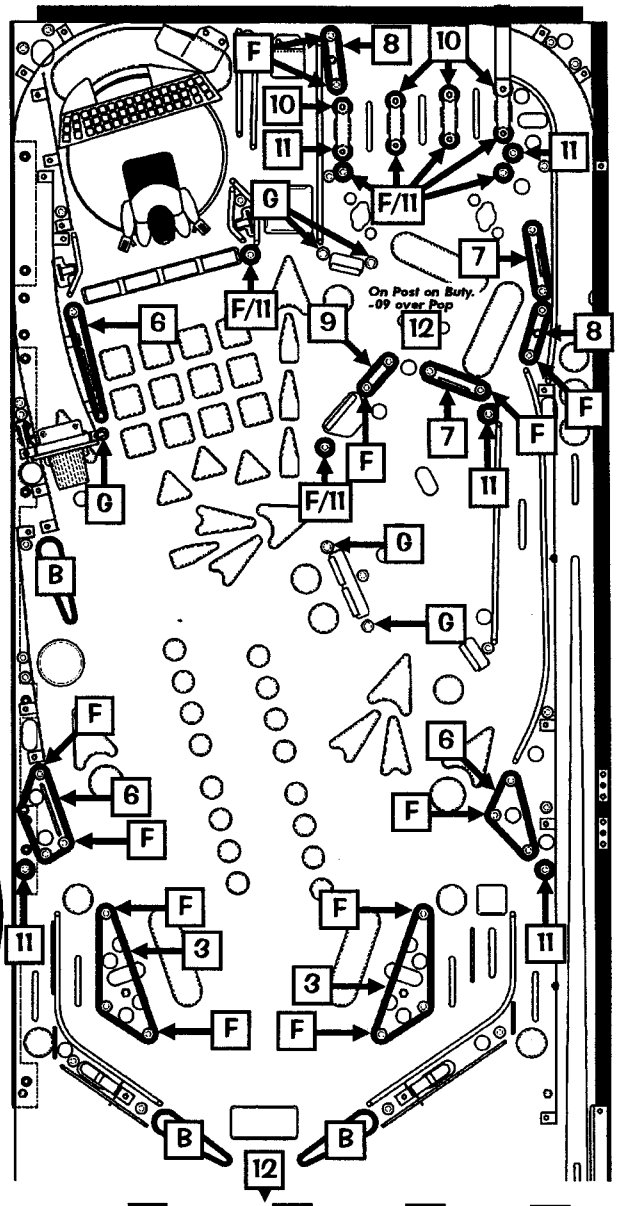
Items 1-9 have the "size" molded onto the Rubber Ring.

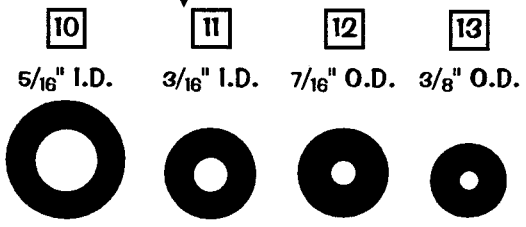
C Not Shown Qty. 3
• Flipper Assemblies

D Not Shown Qty. 4
• Trough Up-Kicker
• SVUK
• VUK
• Ball Deflector



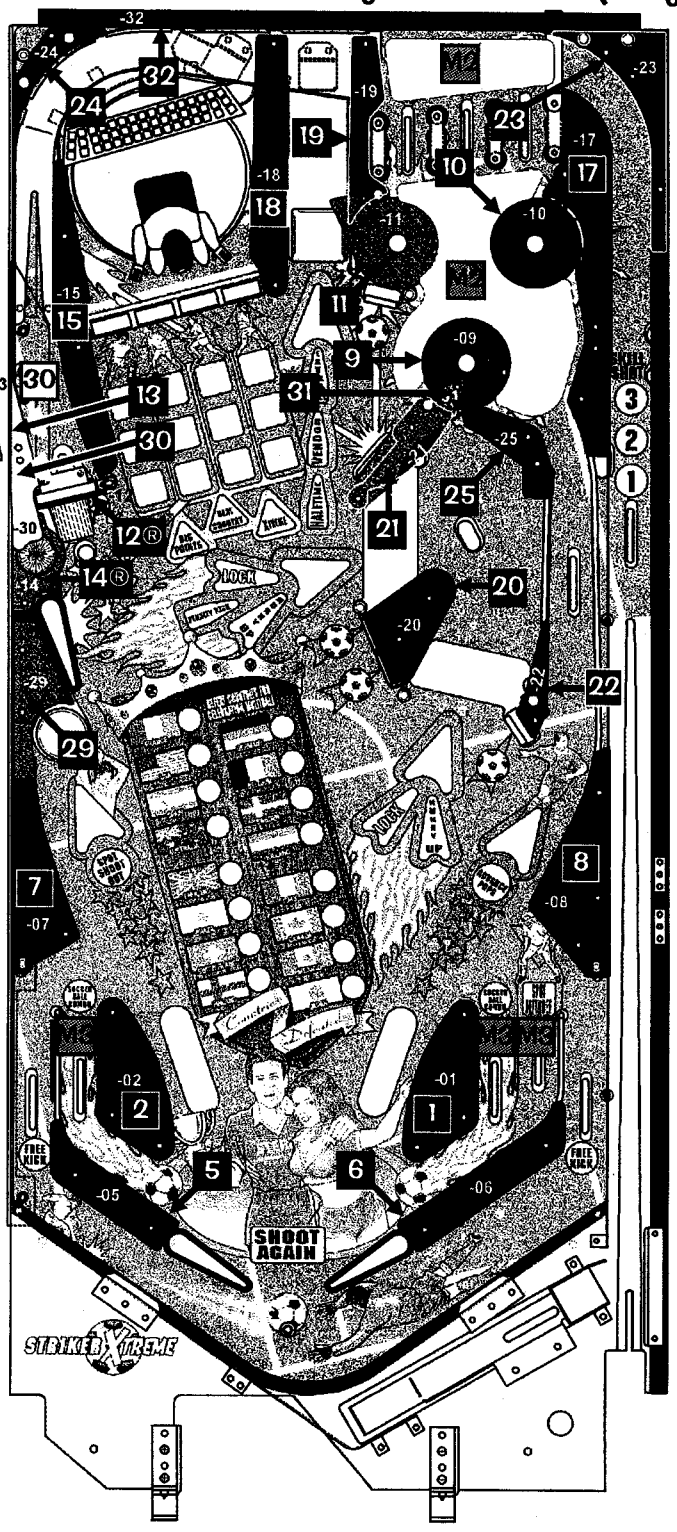






N°	ABOVE PLAYFIELD PART NAME	QTY.	BPI PART N°
A	Small Flipper Rubber Ring	0	545-5207-00
B	Large Flipper Black Rubber Ring	3	545-5277-00
C*	Rubber Deflector Pad (Bumper)	3	545-5428-00
D*	Rubber Bumper (Grommet)	4	545-5105-00
E	Bumper Post Rubber	0	545-5009-00
F	Post Rubber (Sleeve Short)	19	545-5151-00
G	Post Black Rubber (Sleeve Tall)	5	545-5308-00
1	3" I.D. BLK Rubber Ring	0	545-5348-10
2	2¾" I.D. Black Rubber Ring	0	545-5348-20
3	2½" I.D. Black Rubber Ring	2	545-5348-09
4	2" I.D. Black Rubber Ring	0	545-5348-08
5	1¾" I.D. Black Rubber Ring	0	545-5348-21
6	1½" I.D. Black Rubber Ring	3	545-5348-07
7	1¼" I.D. Black Rubber Ring	2	545-5348-06
8	1" I.D. Black Rubber Ring	2	545-5348-05
9	¾" I.D. Black Rubber Ring	1	545-5348-04
10	5/16" I.D. Black Rubber Ring	4	545-5348-02
11	3/16" I.D. Black Rubber Ring	12	545-5348-01
12	7/16" O.D. Black Rubber Ring	2	545-5348-17
13	3/8" O.D. Black Rubber Ring	0	545-5348-19
14*	O-Ring 11/32" X 7/32" X 1/16"	2	545-5850-00

Playfield - Plastic (Butyrate), Decals and Mylar



Nº	PLASTIC (BUTY.) PART NAME	QTY.	SPI PART Nº
Note: 2 pieces (12 & 14) have ® Riveted Part Incl.			830-5972-XX
1	Right Slingshot (Screened)	1	830-5972-01
2	Left Slingshot (Screened)	1	830-5972-02
5	Left Return Lane (Screened)	1	830-5972-05
6	Right Return Lane (Screened)	1	830-5972-06
7	Left Side Lower Playfield (Screened)	1	830-5972-07
8	Right Side Playfield (Screened)	1	830-5972-08
9	Bottom Pop Cover (Screened)	1	830-5972-09
10	Right Pop Cover (Screened)	1	830-5972-10
11	Left Pop Cover (Screened)	1	830-5972-11
12®	Spinner Sign (Screened)	1	515-7063-12R-68
Item 12 Includes: Plastic (830-5972-12), Wedge Base Offset Socket (077-5029-00) and Rivet, 1/8" ø X 3/16" (249-5001-00). Use **830-5972-12** if socket attached is not desired.			
13	Left Side Upper Playfield (Screened)	1	830-5972-13
14®	Above Items 7 & 13 (Screened)	1	515-7063-14R-68
Item 14 Includes: Plastic (830-5972-14), Wedge Base Offset Socket (077-5029-00) and Rivet, 1/8" ø X 3/16" (249-5001-00). Use **830-5972-14** if socket attached is not desired.			
15	Left Side of Goalie (Screened)	1	830-5972-15
***Note:** If Item 15 Butyrate Plastic Piece is replaced, ensure the Protect Plate (535-8658-00) is transfered to replacement piece using the same hardware.*			
16*	Key Chain FOB	1	830-5972-16
17	Top Right Playfield (Screened)	1	830-5972-17
18	Rt. Side of Goalie (Screened)	1	830-5972-18
***Note:** If Item 18 Butyrate Plastic Piece is replaced, ensure the Protect Plate (535-8659-00) is transfered to replacement piece using the same hardware.*			
19	Rt. Side of VUK (Screened)	1	830-5972-19
20	Center Ramp (Screened)	1	830-5972-20
21	Left Side of Ramp (Screened)	1	830-5972-21
22	Right Side of Ramp (Screened)	1	830-5972-22
23	Top Rt. Corner Playfield (Screened)	1	830-5972-23
24	Top Lt. Corner Playfield (Screened)	1	830-5972-24
25	Inside of Ramp (Screened)	1	830-5972-25
29	Above Item 7 (Screened)	1	830-5972-29
30	Above Item 14 (Partial Clear)	1	830-5972-30
31	Above Item 21 (Screened)	1	830-5972-31
32	Back Panel (Screened)	1	830-5972-32

***Note:** Items 3, 4, 26, 27, 28 are **Not Used**. No Clear Pieces.*

Nº	MYLAR PART NAME	QTY.	SPI PART Nº
M1*	Clear - Full P/F 1 Piece Main **Striker X.**	1	820-5879-00
M2	Clear - P/F Top Pieces **Striker Xtreme**	1	820-5877-00
M3	Clear - Square Ball Drop	3	820-5815-00
M4*	Black Mylar - Cover Discs **(In Cabinet)**	2	820-5041-00

Nº	GAME DECAL PART NAME	QTY.	SPI PART Nº
D1*	Game Nº 68 Screened Decal Sheet Set		820-6258-XX

***Note: Individual pieces may not available,** in which case the entire sheet set must be ordered.* **-01:** Bottom Arch Left; **-02:** Bottom Arch Right; **-03:** Bottom Arch Center; **-04:** Bottom Arch Shooter; **-05:** Coin Door Front; **-06:** Install 4 Balls; **-07:** Portals Coin Door; **-08:** Flipper Right; **-09:** Flipper Left; **-10:** Steel Ramp Wall Upper Left; **-11:** Target; **-12:** Spinner Front; **-13:** Spinner Back; **-14:** 4-Bank (1); **-15:** 4-Bank (2); **-16:** 4-Bank (3); **-17:** 4-Bank (4); **-18:** Flipper Upper; **-19:** Stadium Bottom Front; **-20:** Stadium Top Front; **-21:** Lock Mech Rear Side; **-22:** Lock Mech Front Side; **-23:** 1-800-KICKERS; **-24:** Cabinet Light Strip; **-25** Up Post Cover (UK Use Only)

D2*	Diode Terminal Strip Desc. Decals	820-6221-68
See Sec. 5, Chapter 2, Playfield Wiring, Page 87 for more details.		
D3*	Game Specific Backbox Fuse Locations	820-6152-68

Nº	GENERIC DECAL PART NAME	QTY.	SPI PART Nº

Power Box (820-6223-00)
Generic Backbox Fuse Loc. (820-6152-00)
UL Listing Label (820-6141-00)
Power Box Decal - USA/Int'l (820-6123-01)
High Voltage Label (UL) (820-6082-01)
Warning-Fingers... Shaker Motor (820-6062-00)
Protective Earth (820-6224-00)
Fuse Label (UL) (820-6143-00)
Danger Coin Door (UL) (820-6140-00)
Shock Hazard (UL) 820-6263-00
Suitable ...Use... (UL) (820-6001-01)

■ Plastic Screened

n/a Plastic Partial Clear

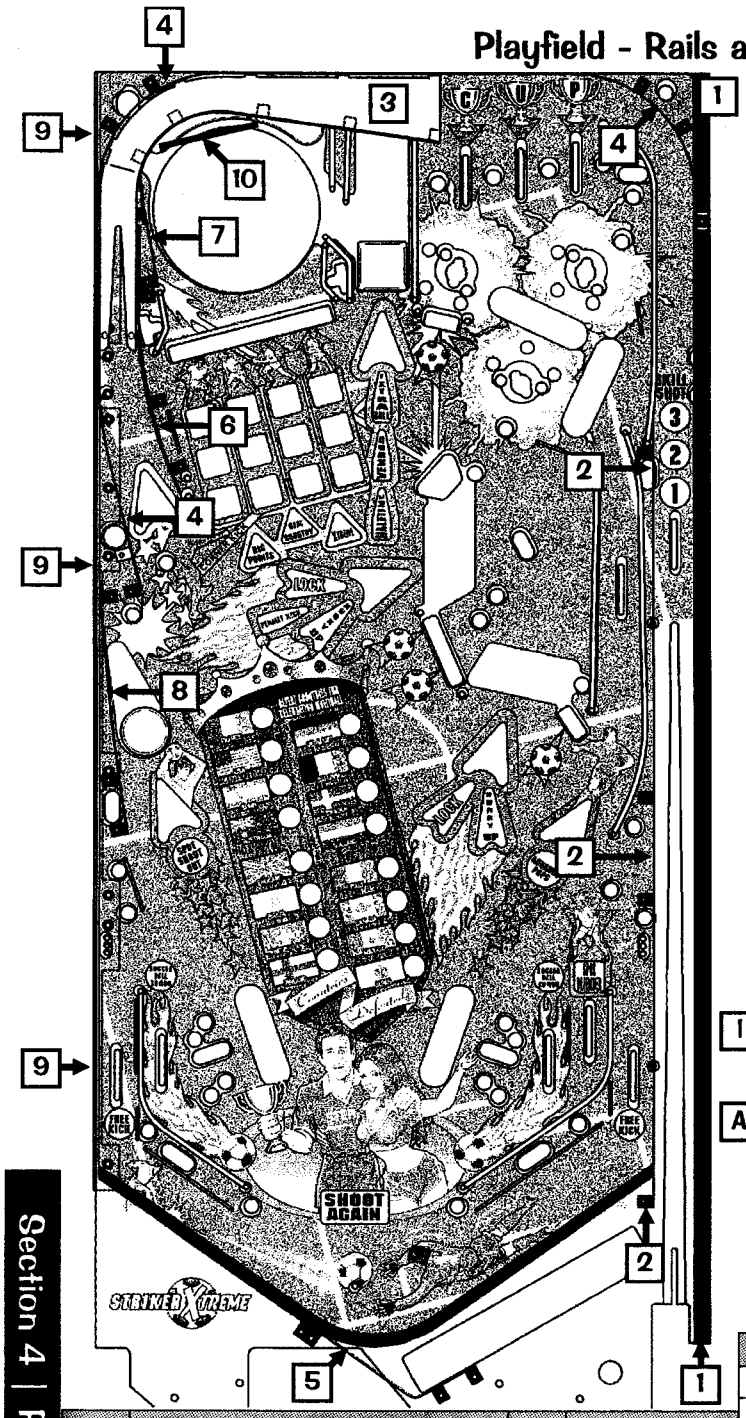
▩ Mylar

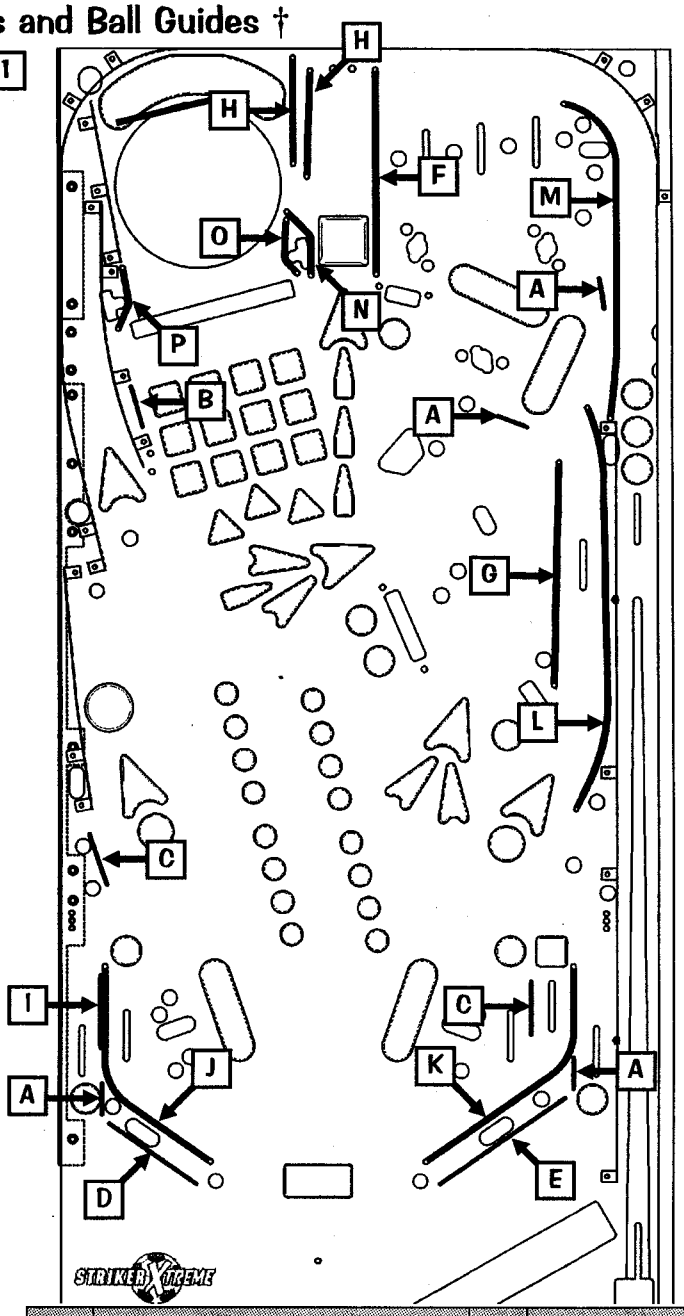
Take Note:

* An asterisk (*) indicates items are not noted in the pictorial.

1. To order the entire Plastic Sheet Set (Screened & Clear), use the Part Nº with the "-XX" ending. For individual pieces replace the "-XX" with appropriate last 2-Digit Nº. *Attention: Individual pieces may not be available.*
2. **Legend Note:** Items noted with a black square ■ are Screened; ...a white square ❒ are © Clear; ...a gray square ▩ are Mylar.

Playfield - Rails and Ball Guides †





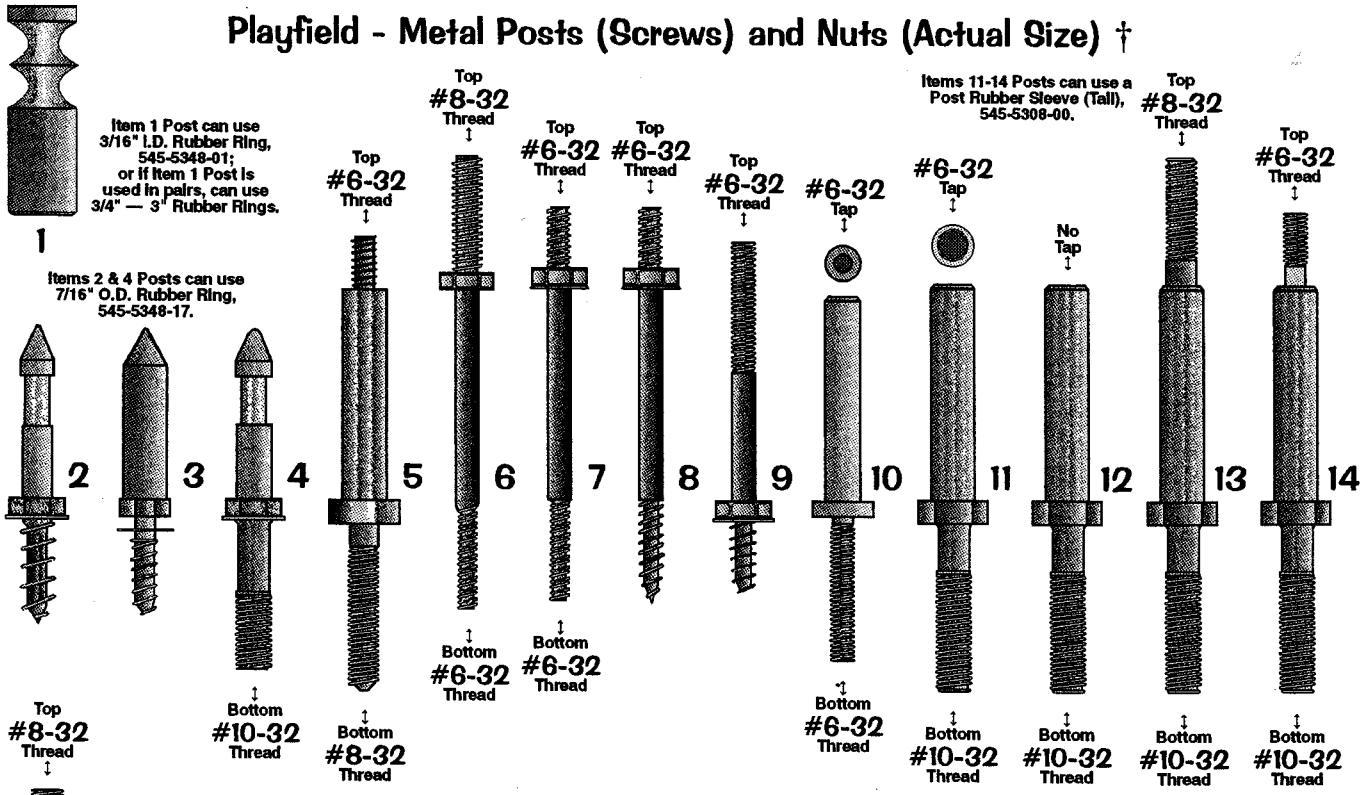
Nº	WOOD/METAL RAIL PART NAME	QTY.	9PI PART Nº
1	Wood Rail (Right Side)	1	525-5559-00
	Item 1 is secured by: #6 X 1-1/4" PFH A (Zinc) (Qty. 5) (237-5804-00)		
2	Metal Rail (Shooter Lane)	1	535-8590-00
	Item 2 is secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00), #8 Washer .17 " ID X 1/2" OD X 1/32" (Qty. 2) (242-5015-00) **and** #8-32 Stop Nut (Qty. 2) (240-5102-00),		
3	Metal Rail (Left Orbit Metal Ramp)	1	515-7048-00
	Item 3 is secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 1) (234-5101-00), #6 X 1/2" PTH A (Zinc) (Qty. 1) (237-5809-00), #4 X 5/8" PFH (Black) (Qty. 2) (237-5833-00) **and** #8-32 X 3/8" HWH MS Type C (Qty. 2) (237-5903-00)		
4	Metal Rail (Top)	1	535-8591-01
5	Metal Rail (Center Drain under Arch)	1	535-8393-00
6	Metal Rail (Goalie, Lower)	1	535-8648-00
7	Metal Rail (Goalie, Upper)	1	535-8652-00
8	Metal Rail (Left VUK)	1	535-8653-00
	Items 4-8 are secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 18) (234-5101-00)		
9	Metal Rail (Playfield Left)	1	535-8594-00
	Item 9 is secured under the playfield **by:** #8 X 1/2" PFH Under-Cut Type AB (Qty. 9) (237-6028-00)		
10	Metal Rail (Under Goalie Net)	1	535-8682-00

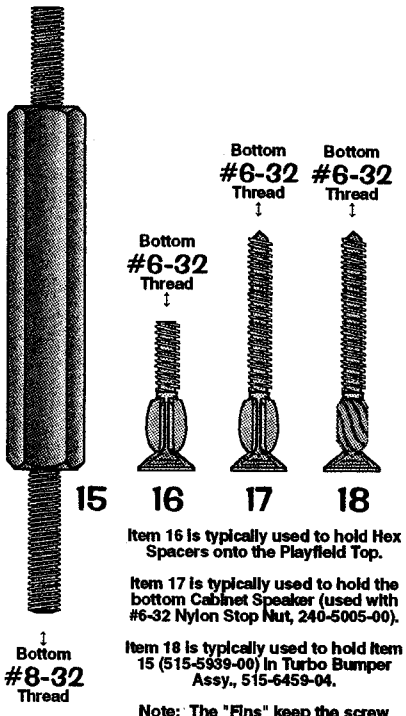
Nº	WIRE FORM PART NAME	QTY.	9PI PART Nº
A	Wire Form - 1"	4	535-5300-05
B	Wire Form - 1-3/8"	1	535-5300-16
C	Wire Form - 1-3/4"	2	535-5300-09
D	Wire Form - 3-1/2"	1	535-5300-03
E	Wire Form - 5"	1	535-5300-22

Nº	BALL GUIDE RAIL PART NAME	QTY.	9PI PART Nº
F	Ball Guide Rail (6-3/4")	1	535-6492-05
G	Ball Guide Rail (7-3/8")	1	535-6492-07
H	Ball Guide Rail (3-1/2")	2	535-6492-08
I	Ball Guide Rail (Outlane Fence)	1	535-7595-00
J	Ball Guide Rail (Left Return)	1	535-8582-00
K	Ball Guide Rail (Right Return)	1	535-8583-00
L	Ball Guide Rail (Right Orbit)	1	535-8585-00
M	Ball Guide Rail (Top Shooter Lane)	1	535-8587-00
N	Ball Guide Rail (Top Center, Right)	1	535-8649-00
O	Ball Guide Rail (Top Center, Left)	1	535-8650-00
P	Ball Guide Rail (Top Left)	1	535-8651-00

† Items with Ø Qty. are not used in this game.
Size and/or quantities may change during production.

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





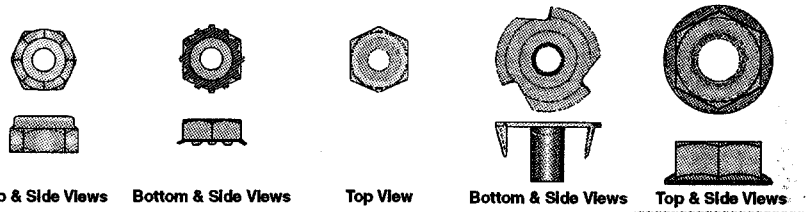
Item 16 is typically used to hold Hex Spacers onto the Playfield Top.

Item 17 is typically used to hold the bottom Cabinet Speaker (used with #6-32 Nylon Stop Nut, 240-5005-00).

Item 18 is typically used to hold Item 15 (515-5939-00) in Turbo Bumper Assy., 515-6459-04.

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

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



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

Top & Side Views

Nylon Stop Nuts *Not Shown:*

- #6-32 (w/ ¼" Hex Body): 240-5010-00
- #8-32: 240-5102-00 ✓
- #10-32: 240-5203-00 ✓
- #10-24: 240-5206-00 ✓
- #4-40: 240-5303-00 ✓
- #4-40 (18/8 Stainless): 240-5303-01
- 5/16"-18: 240-5316-00

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

Bottom & Side Views

KEPS Nuts *Not Shown:*

- #6-32 (w/ ¼" Hex Body): 240-5011-00
- #8-32: 240-5104-00 ✓
- #10-32: 240-5208-00 ✓
- #10-24: 240-5207-00 ✓
- #4-40: 240-5318-00

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

Top View

Hex Nuts *Not Shown:*

- #8-32: 240-5103-00
- #10-32: 240-5201-00
- #10-24: 240-5202-00 ✓
- #10-32 X 3/8": 240-5209-00
- ¾-16: 240-5315-00 ✓
- #2-56: 240-5301-00 ✓
- 7/8"-14: 240-5317-00

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

Bottom & Side Views

T-Nuts *Not Shown:*

- #6-32 (w/Side Cut Off): 240-5002-01
- #8-32: 240-5101-00 ✓
- #10-32 (Black Oxide): 240-5007-00
- #10-32 (w/Side Cut Off): 240-5205-00
- #10-24: 240-5200-00

Shown Below~ • ¼" X 20 Flange Nut: 240-5300-00 ✓

Top & Side Views

Miscellaneous Nuts *Not Shown:*

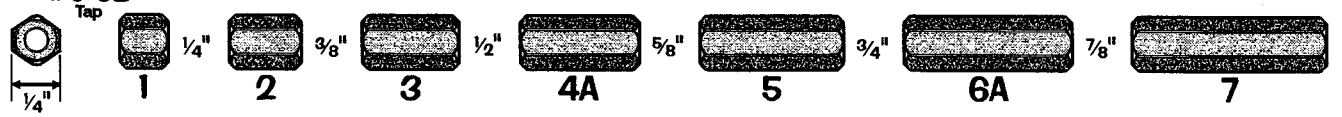
- Plastic Pal Nut (on Flipper Buttons): 240-5003-00
- Metal Pal Nut (on Flipper Buttons): 240-5003-01 ✓
- #6-32 Wing Nut: 240-5001-00
- #8-32 Wing Nut: 240-5100-00
- ¼"-20 Wing Nut: 240-5302-00
- ¼"-20 Toggle Wing: 240-5324-00

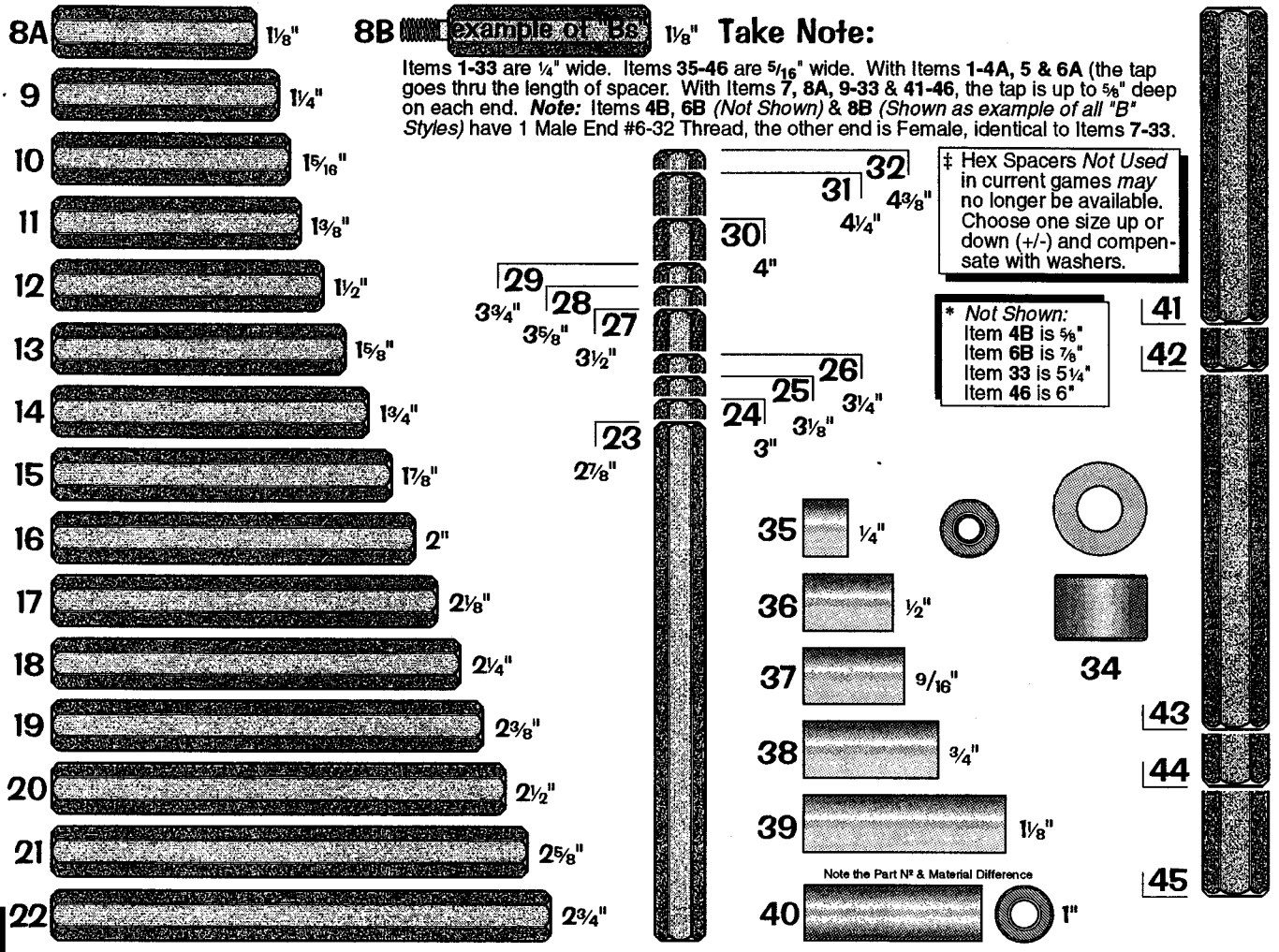
Nº	METAL POST NAME	QTY.	SPI PART Nº	Nº	METAL POST NAME	QTY.	SPI PART Nº
1	Stand-Off Double Groove Post 1-7/16"	0	530-5102-01	10	Post #6-32 Tap / #6-32 Bottom	0	530-5127-00
2	Mini-Post Wood Screw	4	530-5004-00	11	Post Hex Base #6-32 Tap/#10-32 Bot.	1	530-5332-01
3	Mini-Post Wood Screw (no cut-away)	2	530-5004-01	12	Post Hex Base (No Tap)/#10-32 Bot.	3	530-5332-00
4	Mini-Post Mach. Screw / #10-32 Bot.	2	530-5005-00	13	Post Hex Base #6-32 Top/#10-32 Bot.	0	530-5332-02
5	Post Fasten #6-32 Top / #8-32 Bot.	0	530-5007-00	14	Post Hex Base #6-32 Top/#10-32 Bot.	1	530-5332-03
6	Post Fasten #8-32 Top / #6-32 Bot.	6	530-5008-00	15	Playfield Support #8-32 Top/Bottom	0	530-5286-00
7	Post Fasten #6-32 Top / #6-32 Bot.	18	530-5012-02	16	#6-32 X 3/4" Fin Shank Screw	6	237-5921-02
8	Post Fstn. #6-32 Top / Wood Scr. Bot.	17	530-5010-02	17	#6-32 X 1-1/4" Fin Shank Screw	4	237-5883-00
9	Post #6-32 Top / Wood Screw Bottom	0	530-5263-01	18	#6-32 X 1-3/16" Spirol Fin Shank Scr.	9	237-5957-00

† Items with Ø Qty. are not used in this game. Size and/or quantities may change during production.

Playfield - Metal Spacers (Actual Size) †

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





Take Note:

Items **1-33** are ¼" wide. Items **35-46** are 5/16" wide. With Items **1-4A, 5 & 6A** (the tap goes thru the length of spacer. With Items **7, 8A, 9-33** & **41-46**, the tap is up to ⅝" deep on each end. ***Note:*** Items **4B, 6B** *(Not Shown)* & **8B** *(Shown as example of all "B" Styles)* have 1 Male End #6-32 Thread, the other end is Female, identical to Items **7-33.**

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

* *Not Shown:*
Item **4B** is ⅝"
Item **6B** is ⅞"
Item **33** is 5¼"
Item **46** is 6"

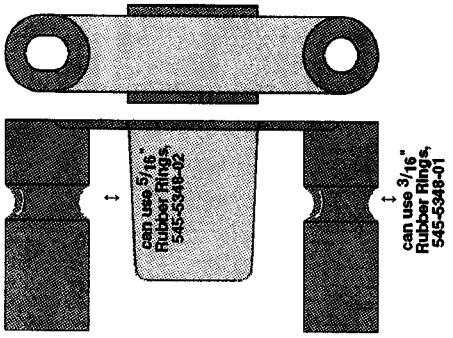
Note the Part Nº & Material Difference

Nº	METAL SPACER NAME	QTY.	SPI PART Nº	Nº	METAL SPACER NAME	QTY.	SPI PART Nº
1	¼" X ¼" Hex Spacer #6-32 Tap	0	254-5008-00	23	2⅞" X ¼" Hex Spacer #6-32 Tap	0	254-5008-31
2	⅜" X ¼" Hex Spacer #6-32 Tap	2	254-5008-12	24	3" X ¼" Hex Spacer #6-32 Tap	2	254-5008-14
3	½" X ¼" Hex Spacer #6-32 Tap	8	254-5008-03	25	3⅛" X ¼" Hex Spacer #6-32 Tap	0	254-5008-19
4A	⅝" X ¼" Hex Spacer #6-32 Tap	1	254-5008-02	26	3¼" X ¼" Hex Spacer #6-32 Tap	0	254-5008-26
4B*	Same as 4A but with Male End #6-32	2	254-5024-02	27	3½" X ¼" Hex Spacer #6-32 Tap	3	254-5008-27
5	¾" X ¼" Hex Spacer #6-32 Tap	4	254-5008-04	28	3⅝" X ¼" Hex Spacer #6-32 Tap	0	254-5008-25
6A	⅞" X ¼" Hex Spacer #6-32 Tap	1	254-5008-05	29	3¾" X ¼" Hex Spacer #6-32 Tap	3	254-5008-36
6B*	Same as 6A but with Male End #6-32	2	254-5024-05	30	4" X ¼" Hex Spacer #6-32 Tap	0	254-5008-21
7	1" X ¼" Hex Spacer #6-32 Tap	0	254-5008-06	31	4¼" X ¼" Hex Spacer #6-32 Tap	0	254-5008-30
8A	1⅛" X ¼" Hex Spacer #6-32 Tap	0	254-5008-17	32	4⅜" X ¼" Hex Spacer #6-32 Tap	0	254-5008-29
8B	Same as 8A but with Male End #6-32	0	254-5024-17	33*	5¼" X ¼" Hex Spacer #6-32 Tap	0	254-5008-35
9	1¼" X ¼" Hex Spacer #6-32 Tap	1	254-5008-11	34	⅜" X ½" Spacer (Used with Backbox)	2	530-5099-00
10	1 5/16" X ¼" Hex Spacer #6-32 Tap	0	254-5008-34	35	¼" X 5/16" X .144" I.D. Spacer Tap	1	254-5014-03
11 ‡	1⅜" X ¼" Hex Spacer #6-32 Tap	0	254-5008-33	36	½" X 5/16" X .144" I.D. Spacer Tap	3	254-5014-00
12 ‡	1½" X ¼" Hex Spacer #6-32 Tap	0	254-5008-09	37	9/16" X 5/16" X .144" I.D. Spacer Tap	0	254-5014-04
13 ‡	1⅝" X ¼" Hex Spacer #6-32 Tap	0	254-5008-13	38	¾" X 5/16" X .144" I.D. Spacer Tap	0	254-5014-01
14	1¾" X ¼" Hex Spacer #6-32 Tap	3	254-5008-10	39	1⅛" X 5/16" X .144" I.D. Spacer Tap	0	254-5014-02
15 ‡	1⅞" X ¼" Hex Spacer #6-32 Tap	0	254-5008-20	40	1" X 5/16" X .144" I.D. Spacer Tap	0	254-5014-00
16	2" X ¼" Hex Spacer #6-32 Tap	0	254-5008-07	41	1¾" X 5/16" Hex Spacer #6-32 Tap	0	254-5018-06
17	2⅛" X ¼" Hex Spacer #6-32 Tap	1	254-5008-32	42	2" X 5/16" Hex Spacer #6-32 Tap	0	254-5018-07
18	2¼" X ¼" Hex Spacer #6-32 Tap	0	254-5008-18	43	4" X 5/16" Hex Spacer #6-32 Tap	0	254-5018-03
19	2⅜" X ¼" Hex Spacer #6-32 Tap	0	254-5008-28	44	4 5/16" X 5/16" Hex Spacer #6-32 Tap	0	254-5018-00
20	2½" X ¼" Hex Spacer #6-32 Tap	0	254-5008-16	45	4.92" X 5/16" Hex Spacer #6-32 Tap	2	254-5018-04
21	2⅝" X ¼" Hex Spacer #6-32 Tap	0	254-5008-08	46*	6" X 5/16" Hex Spacer #6-32 Tap	0	254-5018-02
22	2¾" X ¼" Hex Spacer #6-32 Tap	0	254-5008-15				

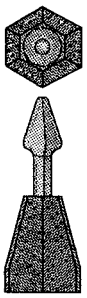
† Items with Ø Qty. are not used in this game. Size and/or quantities may change during production.

Playfield - Plastic Posts and Spacers (Actual Size) †

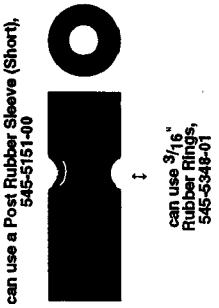
1** Various Colors



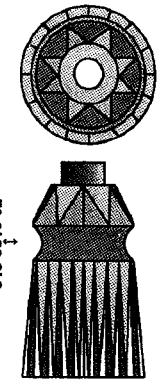
2** Various Colors



3** Limited Colors



4** Various Colors



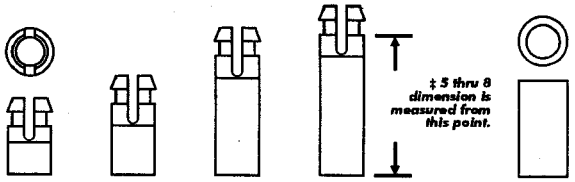
Items 3-4 Posts used in pairs can use 3/4" through 3" Rubber Rings, (See Rubber Parts for Part Nºs).

Take Note:

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

** Items **1, 2 & 4** come in various colors (may not be available in every color). Item **3** is currently only available in the color stated in this game manual (other colors used in prior games may no longer be available). The "-XX" in Part Nºs which may come in various colors should be replaced with the desired 2-Digit Nº. corresponding to the color desired. *Some colors may no longer be available for desired item.*

5 ‡ 6 ‡ 7 ‡ 8 ‡ 9



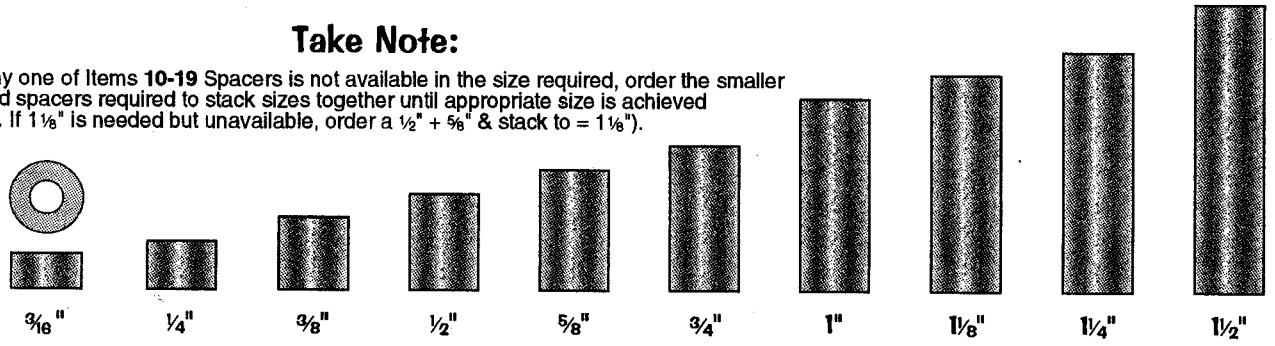
1/4" 3/8" 5/8" 3/4" 1/2"

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

10 11 12 13 14 15 16 17 18 19

Take Note:

If any one of Items **10-19** Spacers is not available in the size required, order the smaller sized spacers required to stack sizes together until appropriate size is achieved (e.g. If 1⅛" is needed but unavailable, order a ½" + ⅝" & stack to = 1⅛").



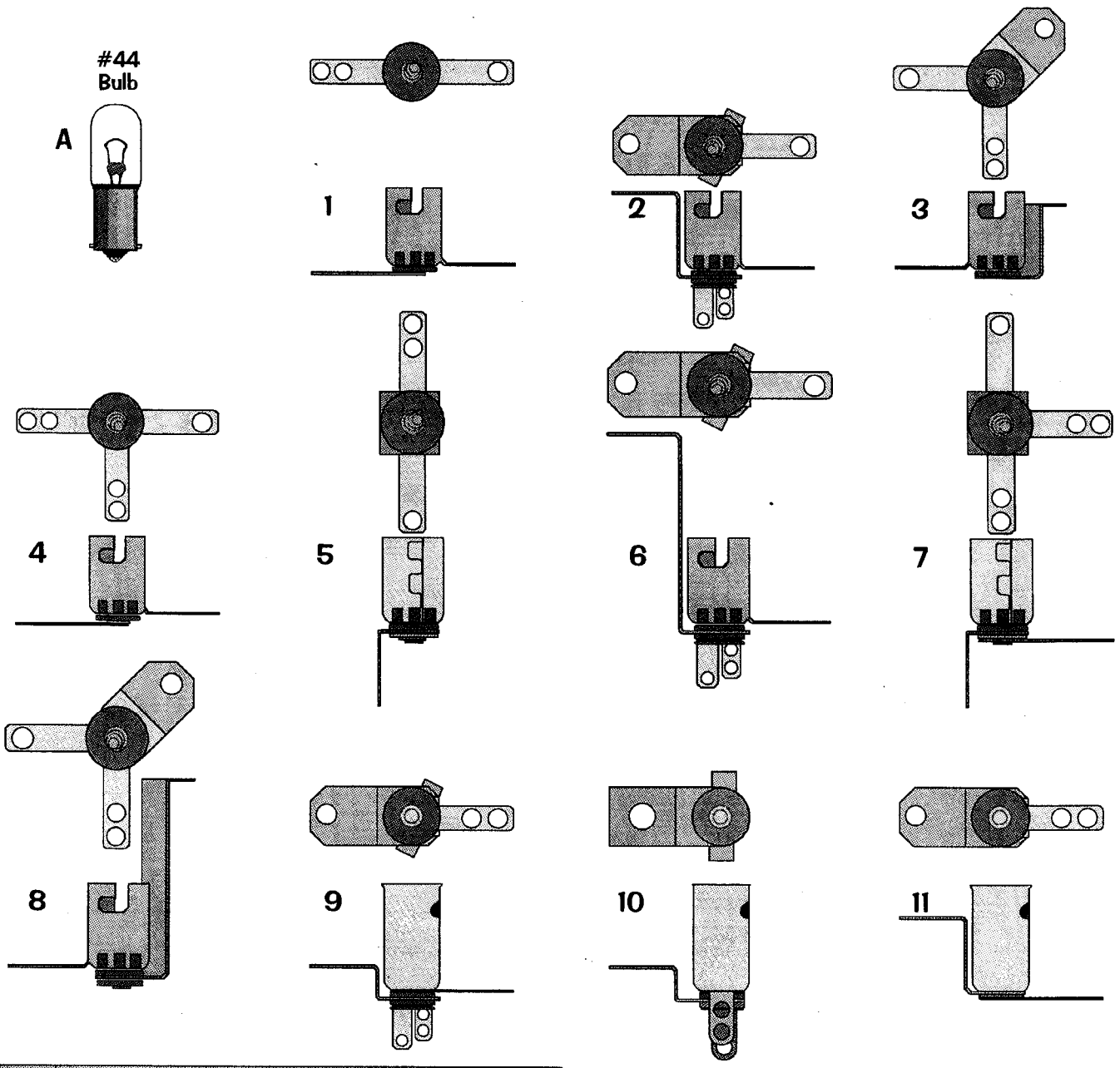
3/16" 1/4" 3/8" 1/2" 5/8" 3/4" 1" 1 1/8" 1 1/4" 1 1/2"

† Items with Ø Qty. are not used in this game. Size and/or quantities may change during production.

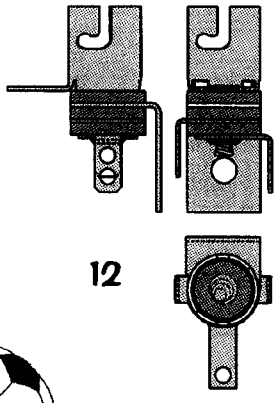
Nº	PLASTIC POST/SPACER NAME	QTY.	GPI PART Nº
1**	Top Lane Mini-Light Hood Blue	4	550-5061-05
	Item 1 typically secured by: #6-32 X 1-3/4" PPH MS (Zinc) (Qty. 2/per) (237-5511-00) **and** Washer 9/64" X 5/16" OD X 1/32" (Qty. 2/per) (242-5017-00)		
2**	Mini-Jewel Post Clear	1	550-5052-01
	Item 2 typically secured by: #6 X 3/8" HWH AB (Zinc) (Qty. 1/per) (234-5000-00)		
3**	1 1/16" Single Groove Post Black	53	550-5059-00
4**	Single Groove Jewel Post (-)	0	550-5034-XX
	Items 3 & 4 typically secured by: Post Fastening Screw #6-32 Top / #6-32 Bottom (Qty. 1/per) (530-5012-02, Item 7 Page 57) ***and may use*** Washer 9/64" X 5/16" OD X 1/32" (Qty. 1/per) (242-5017-00) **with a** #6-32 Nylon Stop Nut (Qty. 1/per) (240-5005-00).		
5 ‡	½" Slf. Rtn. Spacer White	0	254-5007-02
6 ‡	⅜" Slf. Rtn. Spacer White	8	254-5007-01
7 ‡	⅝" Slf. Rtn. Spacer White	0	254-5007-00
8 ‡	¾" Slf. Rtn. Spacer White	0	254-5007-03

Nº	PLASTIC POST/SPACER NAME	QTY.	GPI PART Nº
9	½" X ⅜" Spacer White (Narrow)	0	254-5000-09
10	3/16" X ⅜" Spacer Gray (4 for Dot Display)	4	254-5000-18
11	¼" X ⅜" Spacer Gray	2	254-5000-02
12	⅜" X ⅜" Spacer Gray	0	254-5000-12
13	½" X ⅜" Spacer Gray	0	254-5000-01
14	⅝" X ⅜" Spacer Gray	0	254-5000-14
15	¾" X ⅜" Spacer Gray	0	254-5000-07
16	1" X ⅜" Spacer Gray/Black	1	254-5000-04
17	1⅛" X ⅜" Spacer Gray	0	254-5000-16
18	1¼" X ⅜" Spacer Gray	0	254-5000-05
19	1½" X ⅜" Spacer Gray	1	254-5000-08
	Items 3, 4 & 16 typically secured by: Items 6, 7 & 8 Post Fasten Screws, see Page 57. **Items 10-19 typically secured by:** #6 PPH Screw 1/2" Longer than spacer size.		

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



Nº	#44 BULB & SOCKET NAME	QTY.	9PI PART Nº
A	#44 Bulb	42	165-5000-44
1	2-Lug Staple Down Socket	0	077-5000-00
2	3-Lug Stand-Up Short Socket	0	077-5008-00
3	2-Lug Stand-Up Short Socket	0	077-5002-00
4	3-Lug Staple Down Socket	0	077-5001-00
5	2-Lug Laydown Socket	0	077-5003-00
6	3-Lug Stand-Up Long Socket	2	077-5009-00
7	3-Lug Laydown Socket (3 Lugs Flat)	3	077-5006-00
8	2-Lug Stand-Up Long Socket	0	077-5005-00
9	3-Lug Stand-Up Long Shell Socket	0	077-5013-00
10	2-Lug Stand-Up Lg. Shell Socket (GIs)	37	077-5031-00
11	1-Lug Stand-Up Long Shell Socket	0	077-5012-00
12	3-Lug Laydown Socket (2 Lugs Bent)	0	077-5032-00

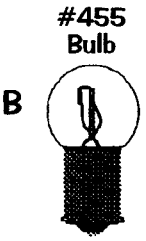


Nº	#455 BULB	QTY.	9PI PART Nº
B	#455 Twinkle Bulb	0	165-5003-00

Take Note:

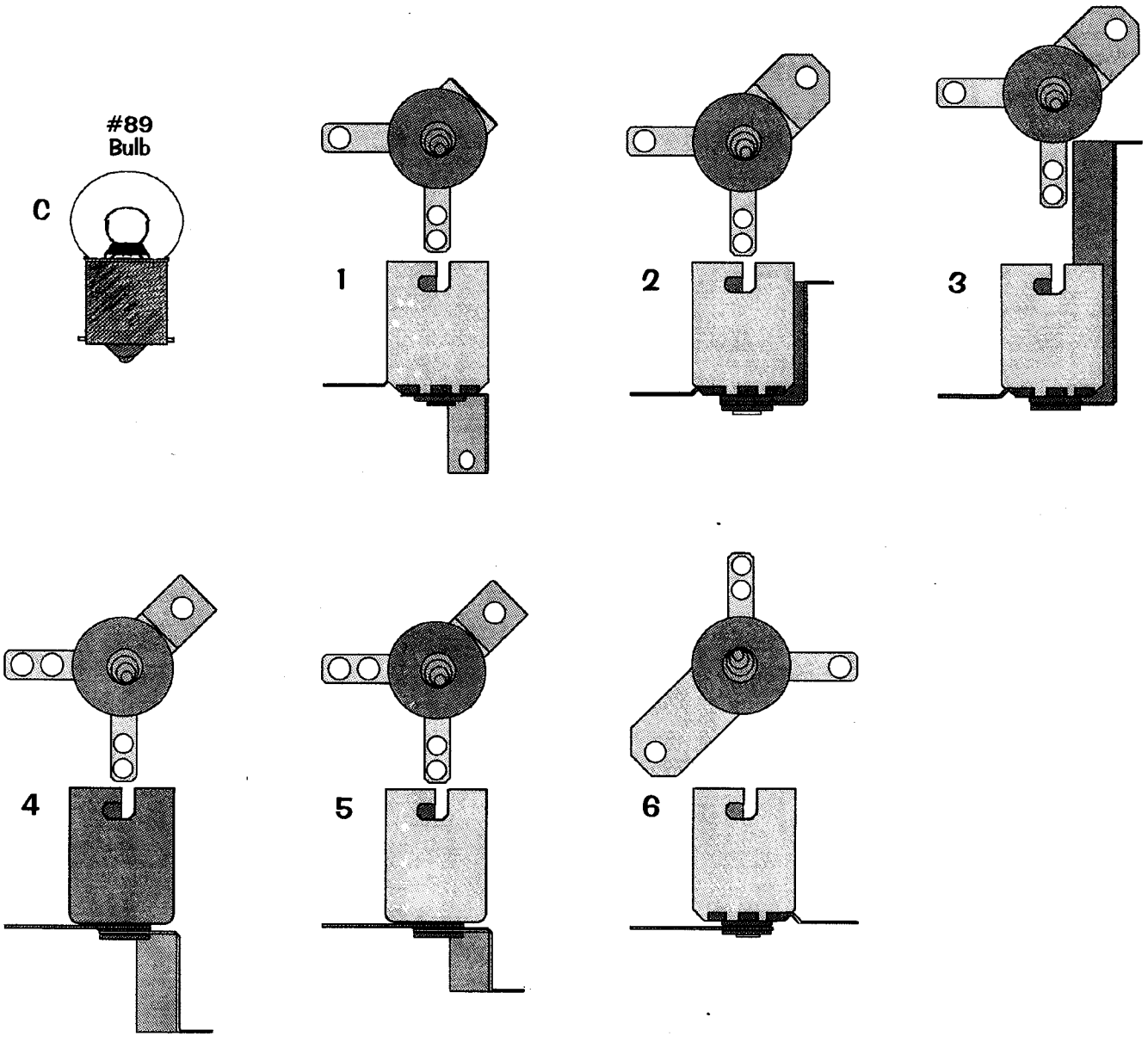
Item B Bulb (#455) is normally used in conjunction with Item **11** Socket, but ***can*** be used with Items **1-12** Sockets on this page.

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



† Items with Ø Qty. are not used in this game. Size and/or quantities may change during production.

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



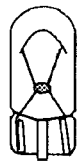
† Items with Ø Qty. are not used in this game. Size and/or quantities may change during production.

Nº	#89 BULB & SOCKET NAME	QTY.	SPI PART Nº
C	#89 Bulb	8	165-5000-89
1	Laydown Standard Socket	4	077-5100-00
2	2-Lug Stand-Up Short Socket	0	077-5101-00
3	2-Lug Stand-Up Long Socket	4	077-5102-00
4	Stand-Up Socket Rev. Short	0	077-5103-00
5	2-Lug Stand-Up Small Socket	0	077-5106-00
6	Straight Leg Socket	0	077-5107-00

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

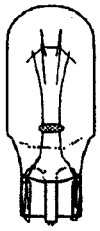
#555 Bulb

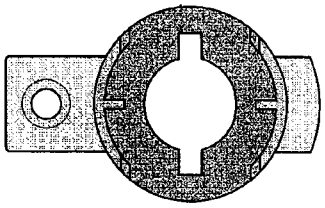
D



#906 Bulb

E

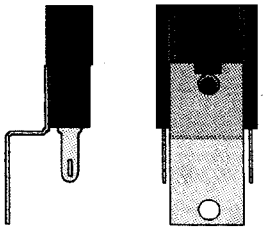




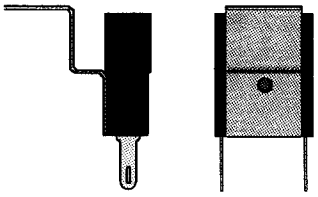
3a / 3b Top View

3b Side View is Not Shown

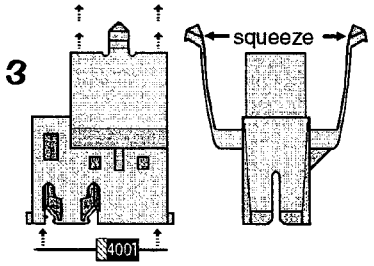
1



2

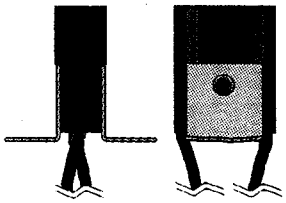


3

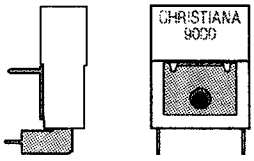


This Socket is equipped with a *built-in* Diode, 1N4003, (112-5013-00). However, replacement can be made with Diode, 1N4001, (112-5003-00).

4



5

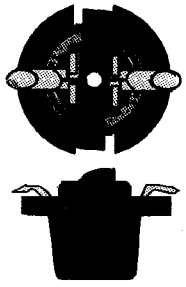


↕ Take Special Note ↕

Item 3 is an **IDC** (Insulation Displacement Connection) Style Socket. This style is solderless, and has a built-in diode. This socket is secured to the playfield or component by Items **3a** and **3b** Snap-On Socket Brackets, or *may* also be snapped into **Item 3c** Socket Mounting Board. Just squeeze the "side arms" of the socket together and pull away from the bracket or mounting board for easy Bulb replacement. *Note: Item 3c Socket Mounting Board is used only when sockets are positioned too close together (typically is a clear plastic piece; if used in this game, Item 3c will show the Qty. and Part Nº.).*

6

7



Take Note:

* An asterisk (*) indicates items are not shown on this page.

1. Item **4** Socket has 2 Wires attached are approximately 12" ea.
2. Item **5** Socket **was** used on PC Light Boards to position bulbs horizontally; Item **5** Socket is secured by soldering into place.
3. Item **6** Socket **was** used on PC Light Boards to position bulbs vertically; Item **6** Socket is secured by "twisting" into place.
4. Item **E** Bulb (#906) is normally used in conjunction with Item **7** Socket, but ***can*** be used with Items **1, 2, 3** or **5**.

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

5. See the start of this chapter for Fluor. Bulb & Associated Parts.

Nº	#555 BULB & SOCKET NAME	QTY.	SPI PART Nº
D	#555 Wedge Base Bulb (Clear)	65	165-5002-00
1	Laydown #555 Wedge Base Socket	10	077-5026-01
2	#555 Wedge Base Offset Socket	3	077-5029-00
3	#555 IDC Snap-On Socket	58	077-5216-00
3a	5/16" Ht. Snap-On Socket Bracket	58	545-5760-18
3b *	13/32" Ht. Snap-On Socket Bracket	0	545-5760-19
3c *	Clear Plastic (Butyl) Socket Mtg. Bd.	0	Not Used
4	#555 W.B. Socket (for Pop Bumper)	3	077-5206-00
5	#555 W.B. Socket (Solder Type)	0	077-5207-00
6	#555 Wedge Base Socket (Twist)	0	077-5007-00

Nº	#906 BULB & SOCKET NAME	QTY.	SPI PART Nº
E	#906 Wedge Base Bulb (Clear)	9	165-5004-00
	#906 Wedge Base Bulb (Red)	0	165-5004-02
	#906 Wedge Base Bulb (Amber)	0	165-5004-03
	#906 Wedge Base Bulb (Blue)	0	165-5004-05
	#906 Wedge Base Bulb (Yellow)	0	165-5004-06
7	#906 Wedge Base Socket (Twist)	0	077-5016-00

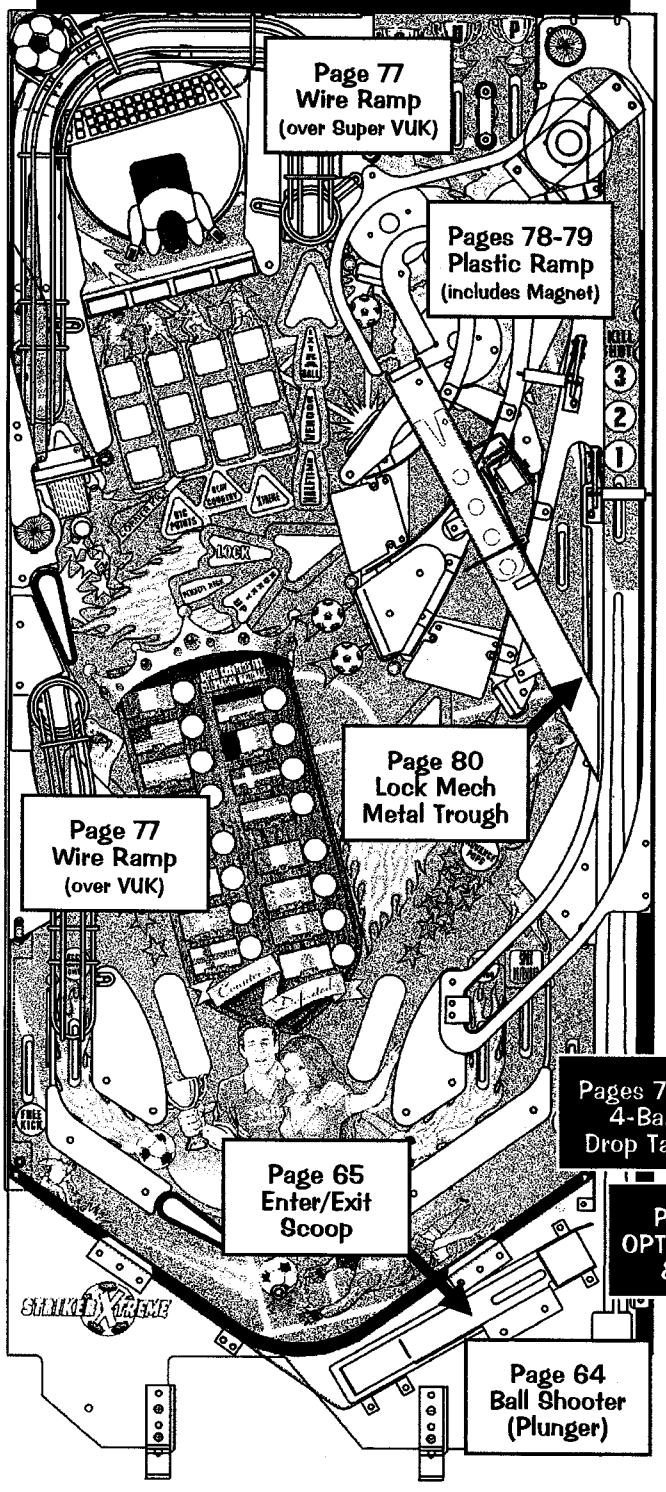
† Items with Ø Qty. are not used in this game. Size and/or quantities may change during production.

Drawings for Major Assemblies & Ramps (The Blue Pages)

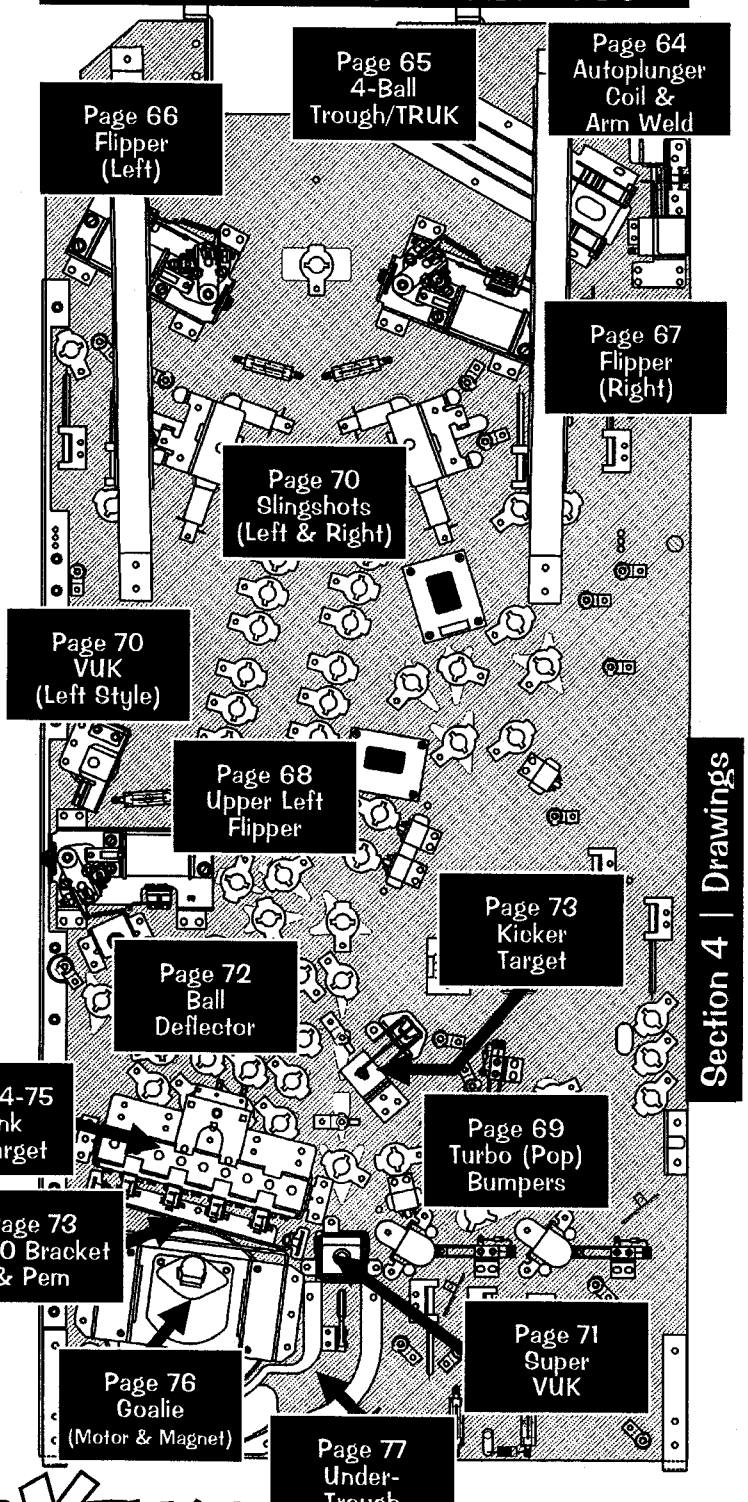
Overview

Drawings are provided for the Major Assemblies in this game with individual parts of each assembly numbered. Items noted with a white circle ○ are mounted above the playfield; items noted with a black circle ● are mounted below. All numbered parts describe the **NAME**, **QUANTITY** & **PART Nº**. **ASSOCIATED PARTS** (**AP-**) are noted and/or viewed with the associated Major Assembly. Parts not listed in this chapter are detailed in the Pink Pages, Chapter 1, Parts Identification & Location. Below are drawings of the Playfield (*Above & Below*) with the **PART Nº & PAGE Nº HIGHLIGHTED**. ***Important:*** Read all "**Take Note:**" items.

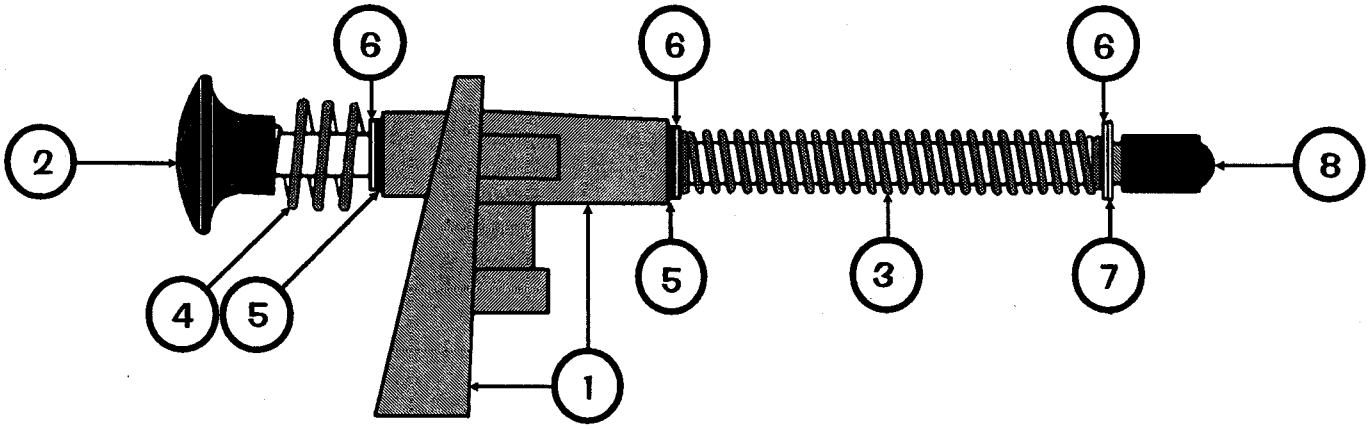
ASSEMBLIES MOUNTED ABOVE THE PLAYFIELD



ASSEMBLIES MOUNTED BELOW THE PLAYFIELD



Ball Shooter (Plunger) Assembly, 500-6146-51-04 (Items 1-8)



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Housing (Shooter Assembly)	1	535-5067-02	6	Washer, 3/8" I.D. X 5/8" O.D. X 1/16"	3	242-5014-00
2	Rod Assembly (w/ Soccer Ball Knob)	1	515-6557-51	7	Retaining Ring, 3/8" ø Shaft	1	270-5012-00
3	Comp. Spring (Green, .035" ø)	1	266-5001-04	8	Plunger Tip (Black 50 Duro)	1	545-5276-00
4	Compression Spring (Short Plunger)	1	266-5010-00				
5	Bushing, 3/8" I.D. (Oilite)	2	280-5010-00				

Ball Shooter (Plunger) Assembly (500-6146-51-04) is secured to the Cabinet by:
Support Plate (Qty. 1) (535-5027-00), #10-32 X 3/8 SHWH (Serr) Swage (Qty. 3) (237-5985-00) **and** #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5002-00)

Autoplunger Coil Assembly, 500-6092-02 (Items 1-6) with Autoplunger Arm Weld Assembly, 500-6091-00 (Items 7-9)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº

Autoplunger Coil Assembly, 500-6092-02 (Items 1-6)

1	Autoplunger Coil Bracket Assembly	1	515-6527-00
2	Coil Retainer Bracket	1	535-5203-03

Item 2 is secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)

3	Coil, 24-940	1	090-5036-00T
ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
4	Coil Sleeve	1	545-5031-00
5	Plunger & Link Assembly	1	515-5338-00
ORDERING ABOVE (ITEM 5) SUB-ASSY. PART Nº WILL INCLUDE:			
5A	Plunger 2"	1	530-5025-01
5B	Plunger Link	1	545-5293-00
5C	Roll Pin, 1/8" ø X 5/8" Lg.	1	251-5008-00

Item 5B is secured to Item 7 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)

6	Compression Return Spring	1	266-5020-00

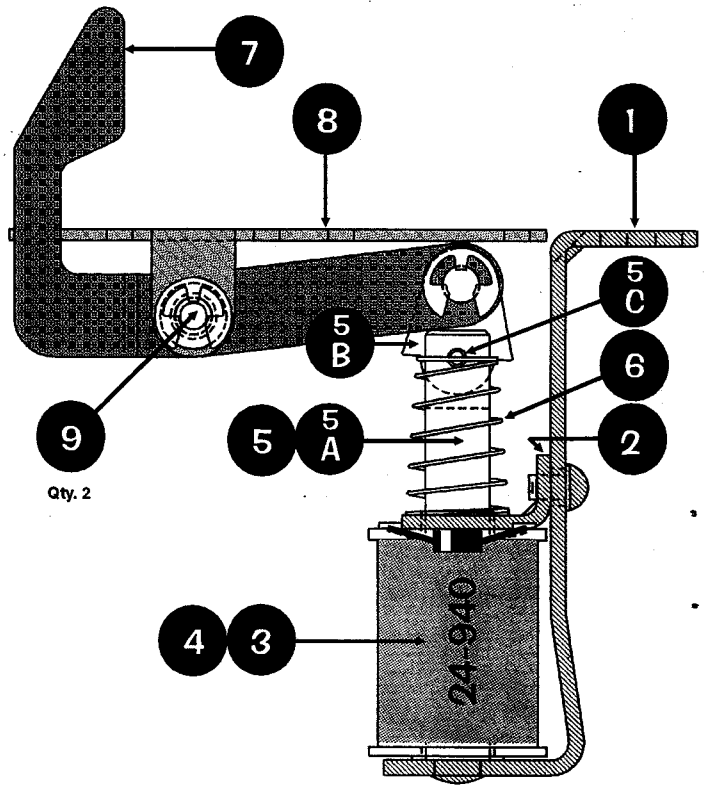
Autoplunger Arm Weld Assy., 500-6091-00 (Items 7-9)

7	Arm Weld Assembly	1	515-6526-00

Item 7 is secured to Item 8 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)

8	Autoplunger Fulcrum	1	535-7697-00
9	Nyliner, 1/4" (Thomson #4l1-FF)	2	545-5423-00

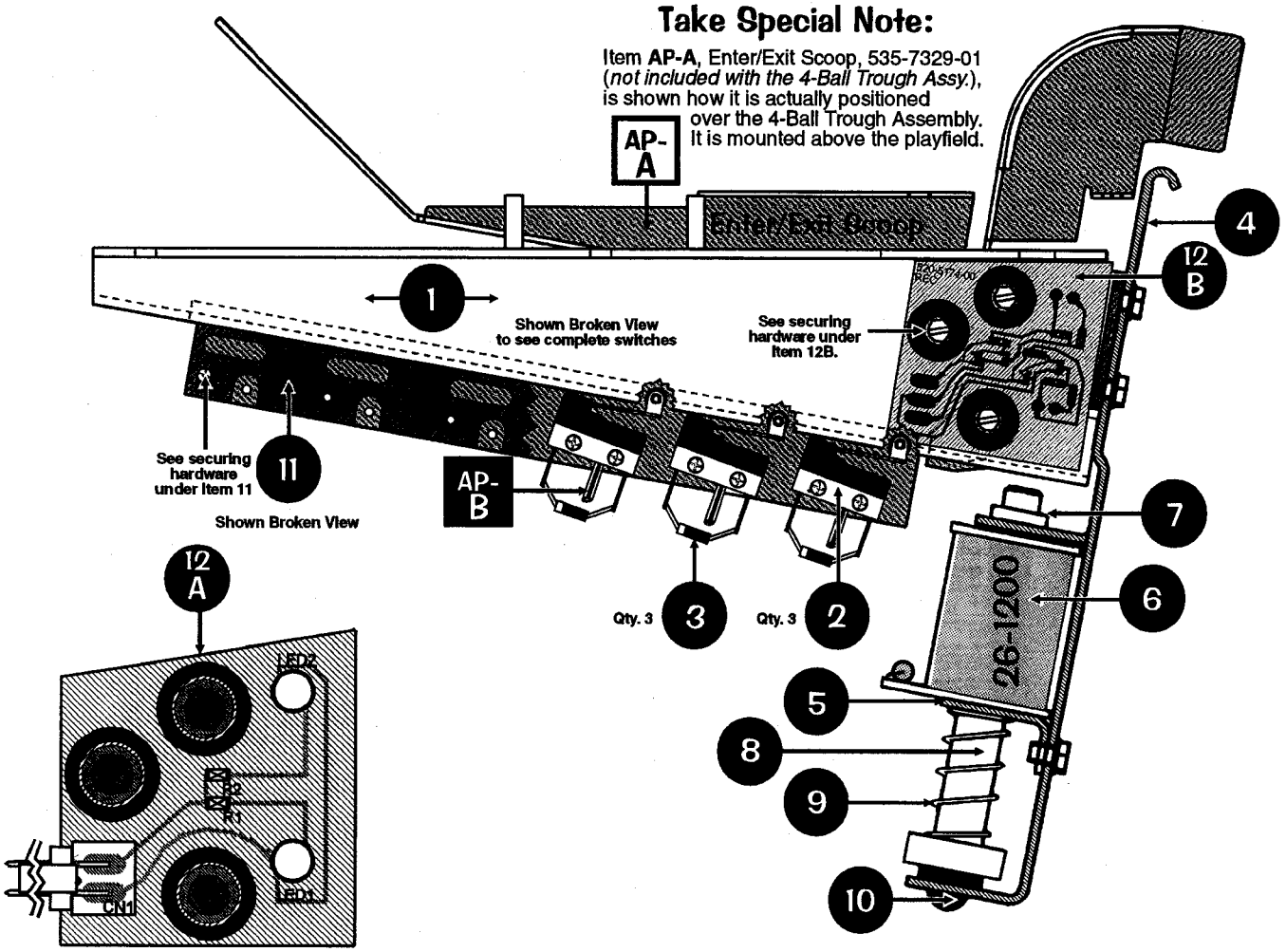
Autoplunger Arm Weld Assembly (500-6091-00) and Autoplunger Coil Assembly (500-6092-01) are secured under the playfield by:
#8 X 1/2" SHWH AB (Zinc) (Qty. 9) (234-5101-00)



4-Ball Trough Assembly, 500-6318-24 (Items 1-12B)
and Associated Part: Ball Trough Enter/Exit Scoop, 535-7329-01 (Item AP-A)

Take Special Note:

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



Item 12A, Dual OPTO TRANS (Transmitter) Board, 520-5173-00, is mounted on the other side of the Trough Assembly, in line with Item 12B, Dual OPTO REC (Receiver) Board, 520-5174-00, using same hardware.

Take Note:

* An asterisk (*) indicates item is *Not Shown* in pictorial.

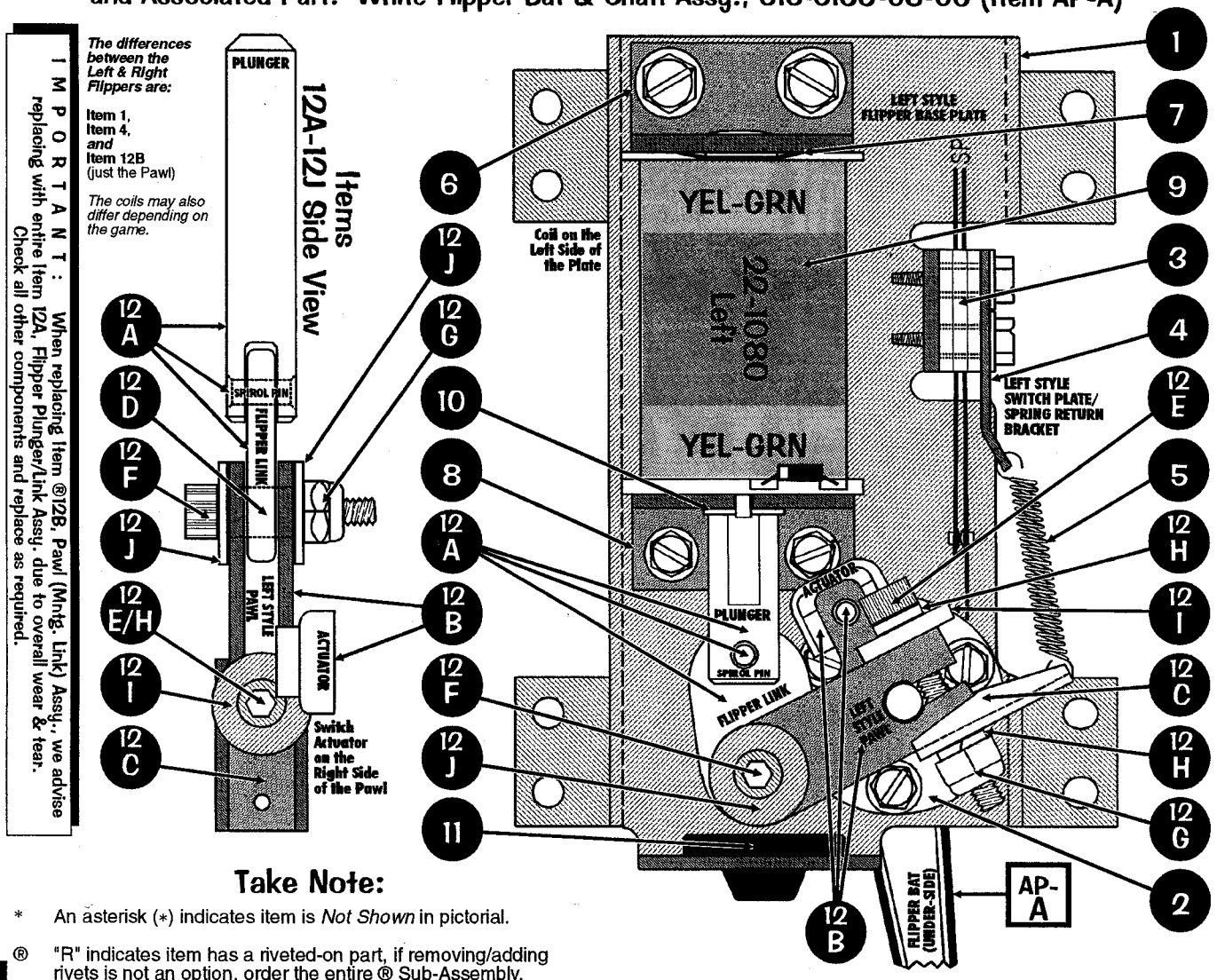
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Ball Trough Outhole Mounting Bracket	1	515-6580-01
2	Micro-Switch (Roller Actuator, Lite-Force)	3	180-5119-02
	Item 2 is secured to Item 1 by: #2-56 X 1/2" HWH (Ser) UNS #4HD TR3 BO (Qty. 1/per) (237-5937-02)		
3	Switch Diode, 1N4001	3	112-5001-00
4	Coil Mounting Bracket	1	535-7330-01
	Item 4 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Serr) Zinc (Qty. 4) (237-5975-00)		
5	Coil Retaining Bracket	1	535-5203-03
	Item 5 is secured to Item 4 by: #8-32 X 1/4" HWH MS (Serr) Zinc (Qty. 2) (237-5964-01)		
6	Coil, 26-1200	1	090-5044-00T
	ORDERING ABOVE (ITEM 6) COIL PART № WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
7	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
8	Plunger Assembly	1	515-5941-01
9	Compression Spring	1	266-5020-00
10	Rubber Bumper (Grommet)	1	545-5105-00

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
11	Trough Ball Guide Plate	1	535-7801-00
	Item 11 is secured to Item 1 by: 1/4" X 5/16" X .144" I.D. Spacer Tap. (Qty. 1) (254-5014-03) **and** #2-56 X 1/2" HWH (Ser) UNS #4HD TR3 BO (Qty. 4) (237-5937-02)		
12A	Dual OPTO Transmitter (TRANS) Bd.	1	520-5173-00
12B	Dual OPTO Receiver (REC) Board	1	520-5174-00
	Items 12A & 12B are secured to Item 1 by: OPTO PCB Tube Spacer (Brass) (Qty. 3/per) (530-5308-02), OPTO PCB Rubber Grommet (Qty. 3/per) (545-5518-00) **and** #6-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 3/per) (237-5976-04)		
	4-Ball Trough Assembly (500-6318-24) is secured below the playfield by: #8 X 1/2" SHWH AB (Zinc) (Qty. 6) (234-5101-00)		

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

№	ASSOCIATED PART NAME	QTY.	SPI PART №
AP-A	Ball Trough Enter / Exit Scoop	1	535-7329-01
	Item AP-A secured to the playfield by: #8 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00).		
AP-B	Heat Shrink Tubing 1/8" ø PUI-24	3"	605-5006-00
n/a*	Steel Balls (1-1/16" ø)	4	260-5000-00

Flipper (Left) Assembly, 500-5944-12 (Items 1-12)
and Associated Part: White Flipper Bat & Shaft Assy., 515-5133-08-06 (Item AP-A)



Take Note:

* An asterisk (*) indicates item is *Not Shown* in pictorial.

® "R" indicates item has a riveted-on part, if removing/adding rivets is not an option, order the entire ® Sub-Assembly.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Flipper Base Plate Kit (Left)	1	515-6617-01
ORDERING ABOVE (ITEM 1) KIT (LEFT) PART Nº WILL INCLUDE:			
	Note: Flipper Base Plate (Left) comes threaded with all securing hardware (Thread Forming Screws) as listed under each of the Items which will get secured to it (Items **2**, **3**, **6** & **8**).		
2	Flipper Bat Bushing	1	545-5594-00
Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)			
3	Power (End of Stroke) Switch	1	180-5149-00
Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)			
4	Switch Plate/Spring Return Lt. Brkt.	1	535-7354-01
5	Flipper Return Spring	1	265-5035-00
6	Coil Stop Bracket Sub-Assembly	1	515-6308-01
Item 6 is secured to Item 1 by: #10-32 X 3/8" SHWH Swage (Serr) Zinc (Qty. 2) (237-5985-00) **and** #10 Split Lock Washer (Qty. 2) (244-5003-00)			
7	Spring Washer	1	269-5002-00
8	Coil Support Bracket	1	535-7356-00
Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)			
9	Coil, 22-1080 (YEL-GRN) (Left)	1	090-5032-00T
ORDERING ABOVE (ITEM 9) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
10	Coil Sleeve	1	545-5388-00
11	Deflector Pad (Bumper)	1	545-5428-00

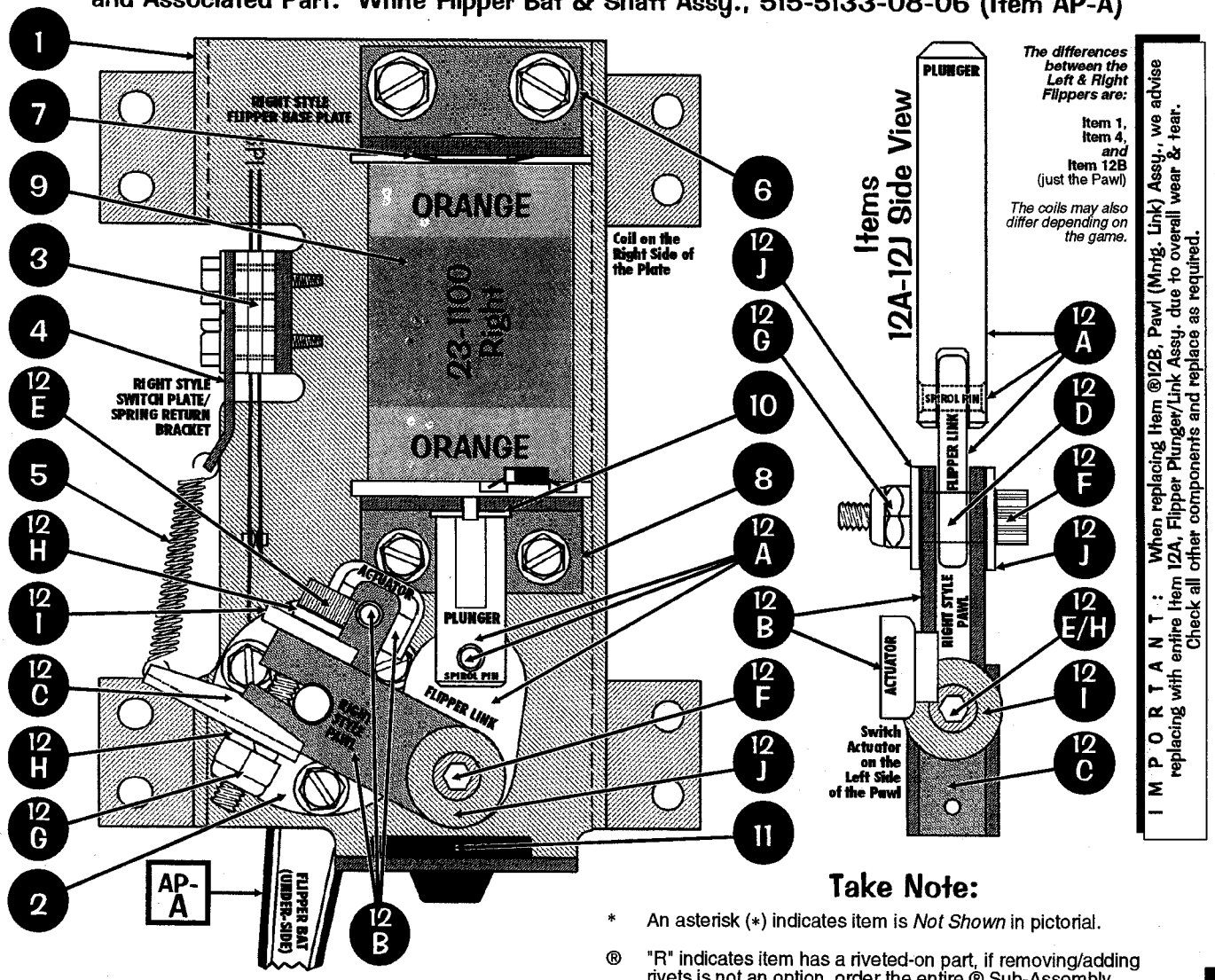
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
12	Plunger, Link & Pawl (Left) Sub-Assy.	1	515-6518-01
ORDERING ABOVE (ITEM 12) SUB-ASSY. PART Nº WILL INCLUDE:			
12A	**Flipper Plunger/Link Sub-Assy.**	1	**515-6304-01**
includes :	*Plunger "Flipper" Link*	*1*	*545-5611-00*
includes :	*Spirol Pin ø 5/32" X 3/4" Lg.*	*1*	*251-5015-02*
includes :	*Flipper Plunger with "Flat"*	*1*	*530-5349-01*
®12B	**Pawl (Mntg. Link) (Left) Sub-Assy.**	1	**515-6305-01**
Includes :	*Pawl (Mounting Link) (Left) Plain*	*1*	*535-7271-01*
Includes :	*Switch Actuator*	*1*	*545-5612-00*
Includes :	*Rivet, 1/8" ø X 1/4" Lg.*	*1*	*249-5003-00*
12C	**Return Bracket**	1	**535-7353-00**
12D	Flipper Link Bushing (Metal, Ext.) (.385" Lg. X .192" ID X .312" OD)	1	530-5139-01
12E	#10-32 X 1-1/4" Lg. Socket Head	1	237-5950-01
12F	#10-32 X 7/8" Lg. Socket Head	1	237-5966-00
12G	#10-32 Nylon Stop Nut	2	240-5203-00
12H	#10 Split Lock Washer	2	244-5003-00
12I	Washer .203" ID X .63" OD X .105" Thk W/cut	1	242-5039-01
12J	Washer .203" ID X .63" OD X .062" Thk	2	242-5038-00

Flipper (Left) Assembly (500-5944-12) Is secured below the playfield by:
#10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00)

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

Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
AP-A	White Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-5133-08-06
	Large Flipper **BLACK** Rubber Ring	1	545-5277-00

Flipper (Right) Assembly, 500-5944-04 (Items 1-12)
and Associated Part: White Flipper Bat & Shaft Assy., 515-5133-08-06 (Item AP-A)



Take Note:

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Nº	INDIVIDUAL PART NAME	QTY.	9PI PART Nº
1	Flipper Base Plate Kit (Right)	1	515-6617-00
ORDERING ABOVE (ITEM 1) KIT (RIGHT) PART Nº WILL INCLUDE:			
	Note: Flipper Base Plate (Right) comes threaded with all securing hardware (Thread Forming Screws) as listed under each of the Items which will get secured to it (Items **2**, **3**, **6** & **8**).		
2	Flipper Bat Bushing	1	545-5594-00
Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)			
3	Power (End of Stroke) Switch	1	180-5149-00
Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)			
4	Switch Plate/Spring Return Rt. Brkt.	1	535-7354-00
5	Flipper Return Spring	1	265-5035-00
6	Coil Stop Bracket Sub-Assembly	1	515-6308-01
Item 6 is secured to Item 1 by: #10-32 X 3/8" SHWH Swage (Serr) Zinc (Qty. 2) (237-5985-00) **and** #10 Split Lock Washer (Qty. 2) (244-5003-00)			
7	Spring Washer	1	269-5002-00
8	Coil Support Bracket	1	535-7356-00
Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)			
9	Coil, 23-1100 (ORG) (Right)	1	090-5030-00T
ORDERING ABOVE (ITEM 9) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
10	Coil Sleeve	1	545-5388-00
11	Deflector Pad (Bumper)	1	545-5428-00

Nº	INDIVIDUAL PART NAME	QTY.	9PI PART Nº
12	Plunger, Link & Pawl (Rt.) Sub-Assy.	1	515-6518-00
ORDERING ABOVE (ITEM 12) SUB-ASSY. PART Nº WILL INCLUDE:			
12A	**Flipper Plunger/Link Sub-Assy.**	1	515-6304-01
Includes :	*Plunger "Flipper" Link*	*1*	*545-5611-00*
Includes :	*Spirol Pin ø 5/32" X 3/4" Lg.*	*1*	*251-5015-02*
Includes :	*Flipper Plunger with "Flat"*	*1*	*530-5349-01*
®12B	**Pawl (Mntg. Link) (Rt.) Sub-Assy.**	1	515-6305-00
Includes :	*Pawl (Mounting Link) (Rt.) Plain*	*1*	*535-7271-00*
Includes :	*Switch Actuator*	*1*	*545-5612-00*
Includes :	*Rivet, 1/8" ø X 1/4" Lg.*	*1*	*249-5003-00*
12C	**Return Bracket**	1	535-7353-00
12D	Flipper Link Bushing (Metal, Ext.) (.385" Lg. X .192" ID X .312" OD)	1	530-5139-01
12E	#10-32 X 1-1/4" Lg. Socket Head	1	237-5960-01
12F	#10-32 X 7/8" Lg. Socket Head	1	237-5966-00
12G	#10-32 Nylon Stop Nut	2	240-5203-00
12H	#10 Split Lock Washer	2	244-5003-00
12I	Washer .203" ID X .63" OD X .105" Thk w/cut	1	242-5039-01
12J	Washer .203" ID X .63" OD X .062" Thk	2	242-5038-00

Flipper (Right) Assembly (500-5944-04) Is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00)

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

Nº	ASSOCIATED PART NAME	QTY.	9PI PART Nº
AP-A	White Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-5133-08-06
	Large Flipper **BLACK** Rubber Ring	1	545-5277-00

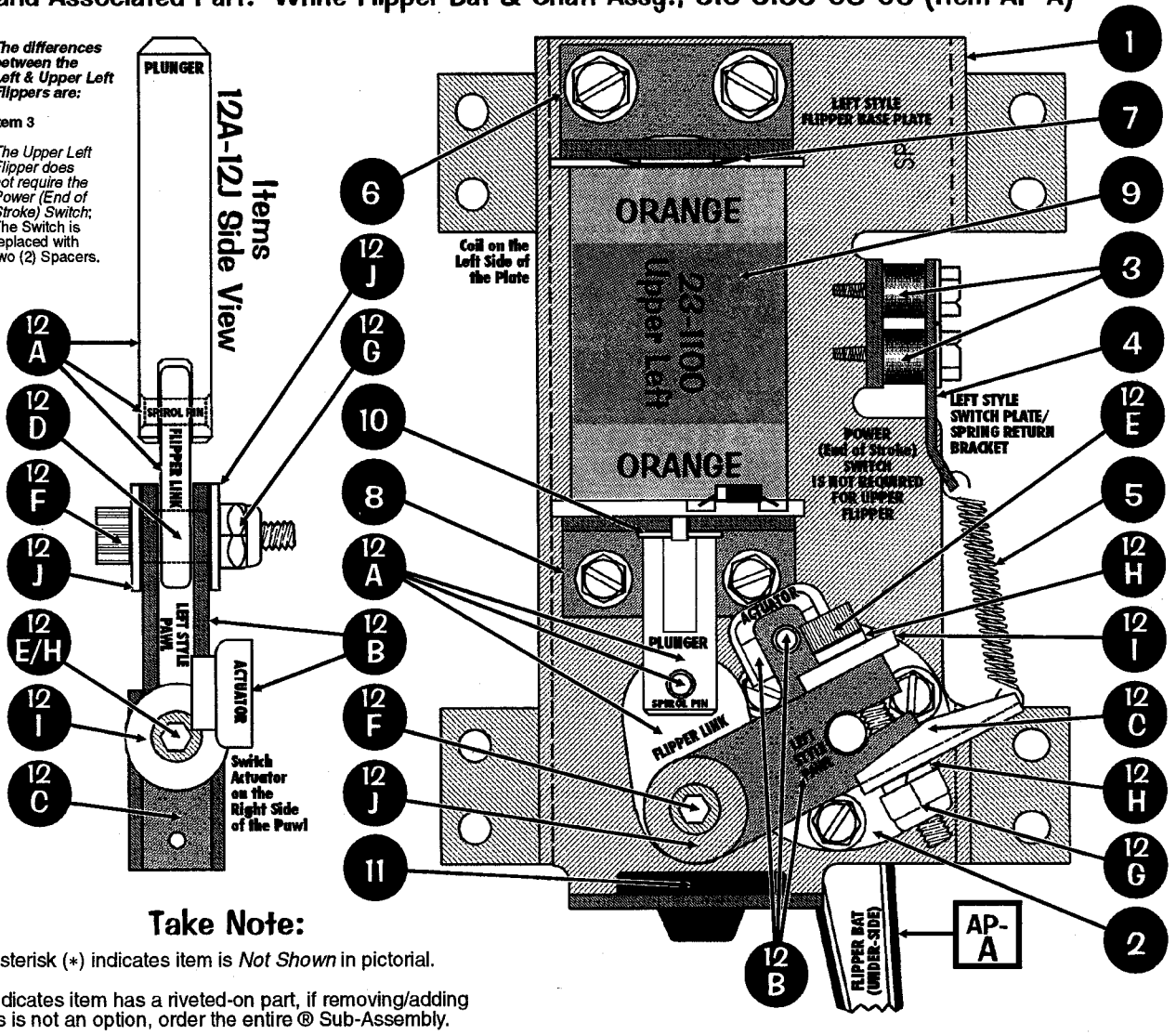
Flipper (Upper Left) Assembly, 500-5944-34 (Items 1-12)
and Associated Part: White Flipper Bat & Shaft Assy., 515-5133-08-06 (Item AP-A)

IMPORTANT: When replacing Item ®12B, Pawl (Mntg. Link) Assy., we advise replacing with entire Item 12A, Flipper Plunger/Link Assy. due to overall wear & tear. Check all other components and replace as required.

The differences between the Left & Upper Left Flippers are:

Item 3

The Upper Left Flipper does not require the Power (End of Stroke) Switch; The Switch is replaced with two (2) Spacers.



Take Note:

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®" R" indicates item has a riveted-on part, if removing/adding rivets is not an option, order the entire ® Sub-Assembly.

Nº	INDIVIDUAL PART NAME	QTY.	9PI PART Nº
1	Flipper Base Plate Kit (Left)	1	515-6617-01
ORDERING ABOVE (ITEM 1) KIT (LEFT) PART Nº WILL INCLUDE:			
	Note: Flipper Base Plate (Left) comes threaded with all securing hardware (Thread Forming Screws) as listed under each of the Items which will get secured to it (Items **2**, **3**, **6** & **8**).		
2	Flipper Bat Bushing	1	545-5594-00
Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)			
3	1/4" X 3/8" Spacer Gray	2	254-5000-02
Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)			
4	Switch Plate/Spring Return Lt. Brkt.	1	535-7354-01
5	Flipper Return Spring	1	265-5035-00
6	Coil Stop Bracket Sub-Assembly	1	515-6308-01
Item 6 is secured to Item 1 by: #10-32 X 3/8" SHWH Swage (Serr) Zinc (Qty. 2) (237-5985-00) **and** #10 Split Lock Washer (Qty. 2) (244-5003-00)			
7	Spring Washer	1	269-5002-00
8	Coil Support Bracket	1	535-7356-00
Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)			
9	Coil, 23-1100	1	090-5030-00T
ORDERING ABOVE (ITEM 9) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
10	Coil Sleeve	1	545-5388-00
11	Deflector Pad (Bumper)	1	545-5428-00

Nº	INDIVIDUAL PART NAME	QTY.	9PI PART Nº
12	Plunger, Link & Pawl (Left) Sub-Assy.	1	515-6518-01
ORDERING ABOVE (ITEM 12) SUB-ASSY. PART Nº WILL INCLUDE:			
12A	**Flipper Plunger/Link Sub-Assy.**	1	515-6304-01
Includes :	*Plunger "Flipper" Link*	*1*	*545-5611-00*
Includes :	*Spirol Pin ø 5/32" X 3/4" Lg.*	*1*	*251-5015-02*
Includes :	*Flipper Plunger with "Flat"*	*1*	*530-5349-01*
®12B	**Pawl (Mntg. Link) (Left) Sub-Assy.**	1	515-6305-01
Includes :	*Pawl (Mounting Link) (Left) Plain*	*1*	*535-7271-01*
Includes :	*Switch Actuator*	*1*	*545-5612-00*
Includes :	*Rivet, 1/8" ø X 1/4" Lg.*	*1*	*249-5003-00*
12C	**Return Bracket**	1	535-7353-00
12D	Flipper Link Bushing (Metal, Ext) (.385" Lg. X .192" ID X .312" OD)	1	530-5139-01
12E	#10-32 X 1-1/4" Lg. Socket Head	1	237-5950-01
12F	#10-32 X 7/8" Lg. Socket Head	1	237-5966-00
12G	#10-32 Nylon Stop Nut	2	240-5203-00
12H	#10 Split Lock Washer	2	244-5003-00
12I	Washer .203" ID X .63" OD X .105" Thk W/cut	1	242-5039-01
12J	Washer .203" ID X .63" OD X .062" Thk	2	242-5038-00

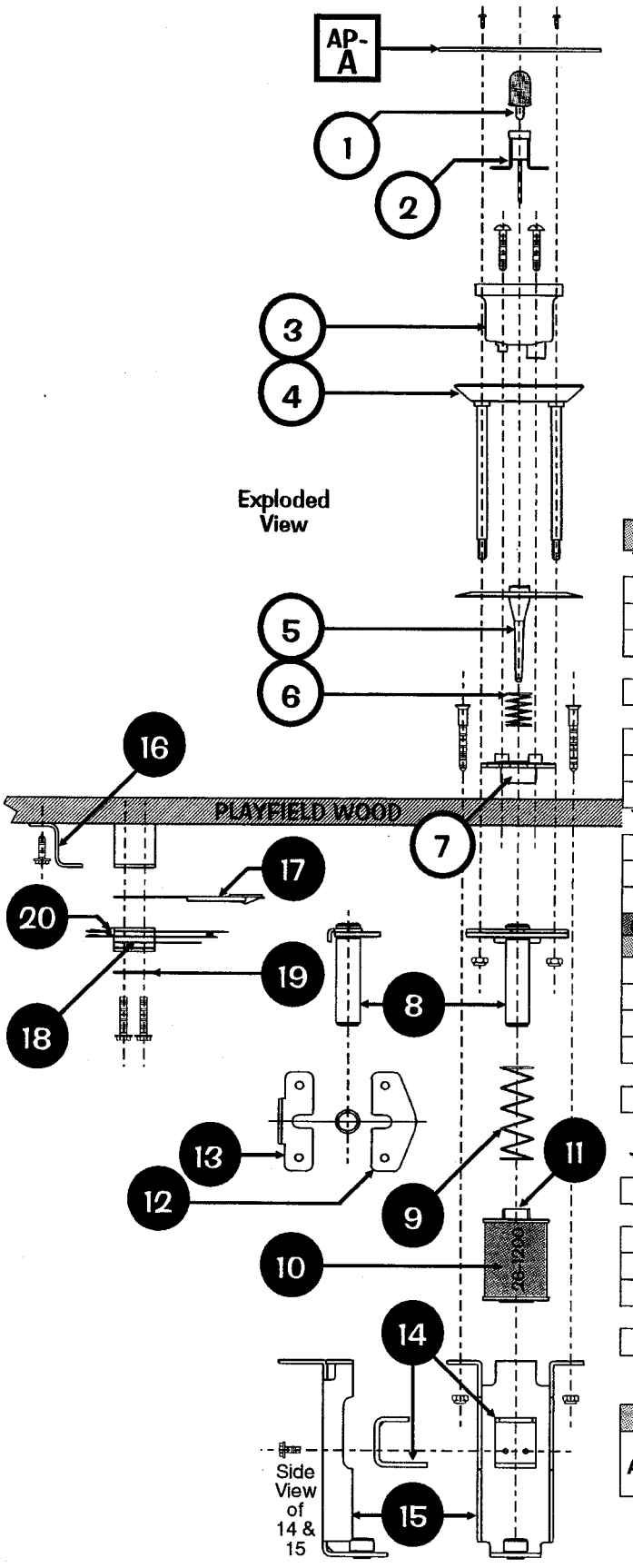
Flipper (Upper Left) Assembly (500-5944-34) Is secured below the playfield by:
#10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 6) (237-5949-00) **and**
#8-3/8" HWH AB (Zinc) Yellow) (Qty. 2) (234-5100-00)

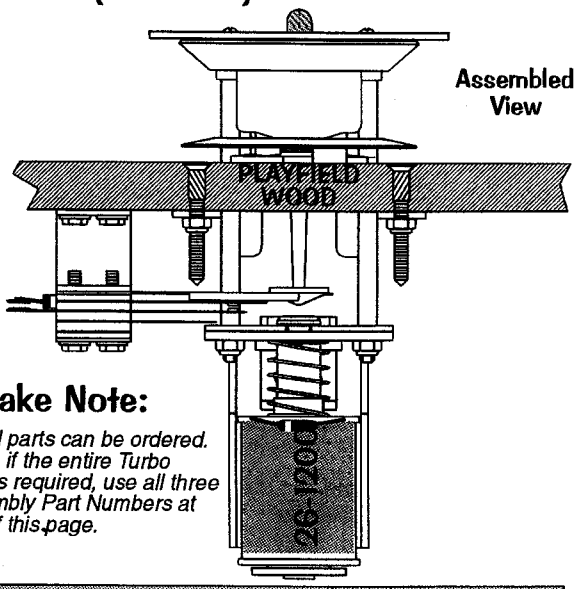
ASSOCIATED PARTS **ARE NOT INCLUDED** WITH THE ABOVE ASSEMBLY.

Nº	ASSOCIATED PART NAME	QTY.	9PI PART Nº
AP-A	White Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-5133-08-06
	Large Flipper **BLACK** Rubber Ring	1	545-5277-00

Turbo (Pop) Bumper Top Assy., 515-6459-01 (Qty. 3) (Items 1-7),
Turbo (Pop) Bumper Bottom Assy., 515-6459-04 (Qty. 3) (Items 8-15),
Turbo (Pop) Bumper Switch Assy., 515-6459-03 (Qty. 3) (Items 16-20)

and Associated Part(s): See Table Below (Item AP-A)





Assembled View

Take Note:

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

Nº	INDIVIDUAL PART NAME	QTY.	GPI PART Nº
Turbo Bumper Top Assy., 515-6459-01 (Items 1-7)			
1	#555 Wedge Base Bulb	1	165-5002-00
2	#555 Wedge Base Socket	1	077-5206-00
3	Bumper Body	1	545-5197-00
Item 3 is secured by: #5 X 7/8" PRH AB (Zinc) (Qty. 2) (237-5826-00)			
4	Ring Assembly	1	515-5085-00
Item 4 is secured by: #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00)			
5	Bumper Skirt	1	545-5607-00
6	Bumper Skirt Compression Spring	1	266-5048-00
7	Bumper Base	1	545-5195-00
Turbo Bumper Bottom Assy., 515-6459-04 (Items 8-15)			
8	Plunger	1	530-5348-00
9	Coil Compression Spring	1	266-5047-00
10	Coil, 26-1200	1	090-5044-00T
ORDERING ABOVE (ITEM 10) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
11	Coil Sleeve	1	545-5031-00
12	Fiber Yoke	1	545-5609-00
13	Metal Yoke	1	535-7346-00
14	Metal Yoke Stop	1	535-7347-00
Item 14 is secured by: #6-32 X 1/4" HWH Swage (Serr.) Zinc (Qty. 2) (237-5976-01)			
15	Coil Bracket Welded Assembly	1	515-5939-00
Item 15 is secured by: #6-32 X 1-3/16" Spiral Fin Shank (Qty. 3) (237-5957-00) **and** #6-32 Nylon Stop Nut (Qty. 3) (240-5005-00)			
Turbo Bumper Switch Assy., 515-6459-03 (Items 16-20)			
16	Switch Bracket	1	535-7342-00
Item 16 is secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 2) (234-5101-00)			
17	Spoon Switch Actuator	1	545-5610-01
18	Turbo Bumper Stack (Blade) Switch	1	180-5015-03
19	Switch Body Protect Plate	1	535-7344-00
Items 18 & 19 are secured by: #6-32 X 3/4" HWH Swage (Serr) Zc. (Qty. 2) (237-5976-05)			
20	Switch Diode, 1N4001	1	112-5001-00

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

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

Nº	ASSOCIATED PART NAME	QTY.	GPI PART Nº
AP-A	Plastic (Buty.) Bottom Pop Cover -09 Plastic (Buty.) Right Pop Cover -10 Plastic (Buty.) Right Pop Cover -11	1	830-5972-XX

Items AP-A are secured to Item 4 by: #4 X 3/8" PPH AB (Zinc) (Qty. 2/per) (237-5815-00). Replace the **"-XX"** with the last **2-Digits** required. **Plastic -09** also has a Mini-Jewel Post Clear (Qty. 1) (550-5052-01), 7/16" O.D. Rubber Ring (Qty. 1) (545-5348-17); **The Mini-Jewel Post is secured to Plastic -09 by:** #6 X 3/8" HWH AB (Zinc) (Qty. 1) (234-5000-00)

Slingshot (Left & Right) Assemblies, 500-5849-00 (Qty. 2) (Items 1-10)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Slingshot Bracket Assembly	1	515-5339-01
ORDERING ABOVE (ITEM 1) SUB-ASSY. PART Nº WILL INCLUDE:			
1A	Slingshot Bracket	1	535-5919-01
1B	Hinge Stud	1	530-5034-01
1C	Armature Stop	1	530-5017-01
1D	Shading Ring	1	530-5307-00
2	Coil Retaining Bracket	1	535-5203-03

Item 2 is secured to Item 1A by: #8-32 X 3/8" PPH MS (Sems) (Qty. 2) (232-5301-00)

3	Coil, 23-800	1	090-5001-00T
ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
4	Coil Sleeve	1	545-5031-00
5	Plunger & Link Assembly	1	515-5338-00
ORDERING ABOVE (ITEM 5) SUB-ASSY. PART Nº WILL INCLUDE:			
5A	Plunger 2" Lg.	1	530-5025-01
5B	Plunger Link	1	545-5293-00
5C	Roll Pin 1/8" ø x 5/8" Lg.	1	251-5008-00

Item 5B is secured to Item 10A by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)

6	Compression Spring	1	266-5020-00
7	Slingshot Stack (Blade) Switch	2	180-5054-00
8	Switch Body Protect Plate	2	535-5045-00

Items 7 & 8 are secured to Item 1A by: #6-32 X 5/8" HWH Swage (Qty. 4) (237-5976-04)

9	Switch Diode, 1N4001	2	112-5001-00
10®	Riveted Arm & Tip Assembly	1	515-5340-01
ORDERING ABOVE ® RIVETED ASSY. PART Nº WILL INCLUDE:			
10A	Arm	1	515-5341-01
10B	Kicker Tip	1	545-5216-01
10C	Rivet, 1/8" ø x 1/4" Lg.	1	249-5003-00

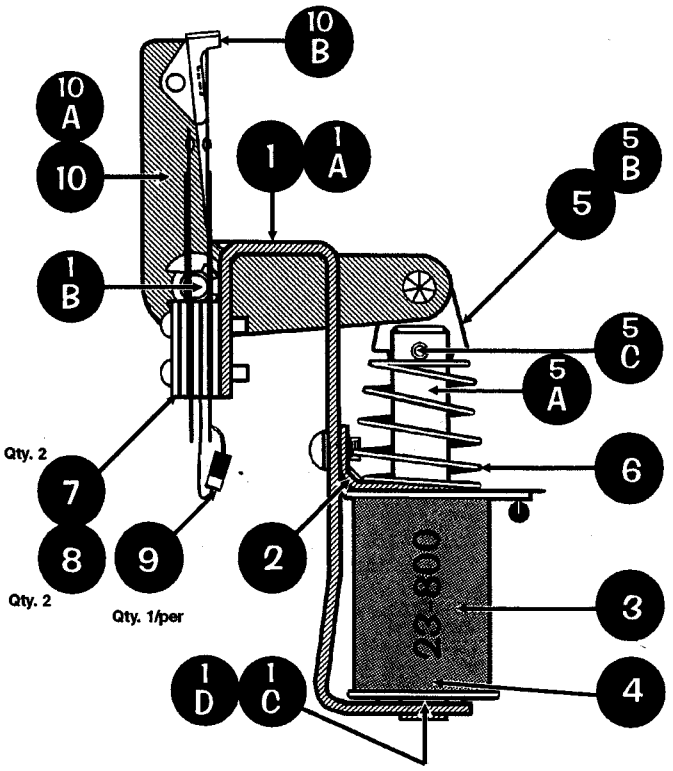
Item 10A is secured to Item 1A by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)

Slingshot Assemblies (500-5849-01) are secured below the playfield by:
#8 X 1/2" SHWH AB (Zinc) (Qty. 3/per) (234-5101-00)

Take Note:

* An asterisk (*) indicates item is *Not Shown* in pictorial.

® "R" indicates item has a riveted-on part, if removing/adding rivets is not an option, order the entire ® Sub-Assembly.



VUK (Left Style) Assembly, 500-6290-00 (Items 1-12)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	VUK Coil Mounting Bracket (Left Style)	1	535-8296-00
2	Micro (Heavy Duty "Y" Actuator) SW.	1	180-5116-01
3	Switch Lug Insulator (Fiche Paper)	1	545-5759-00
4	Switch Body Protect Plate	1	535-6539-00

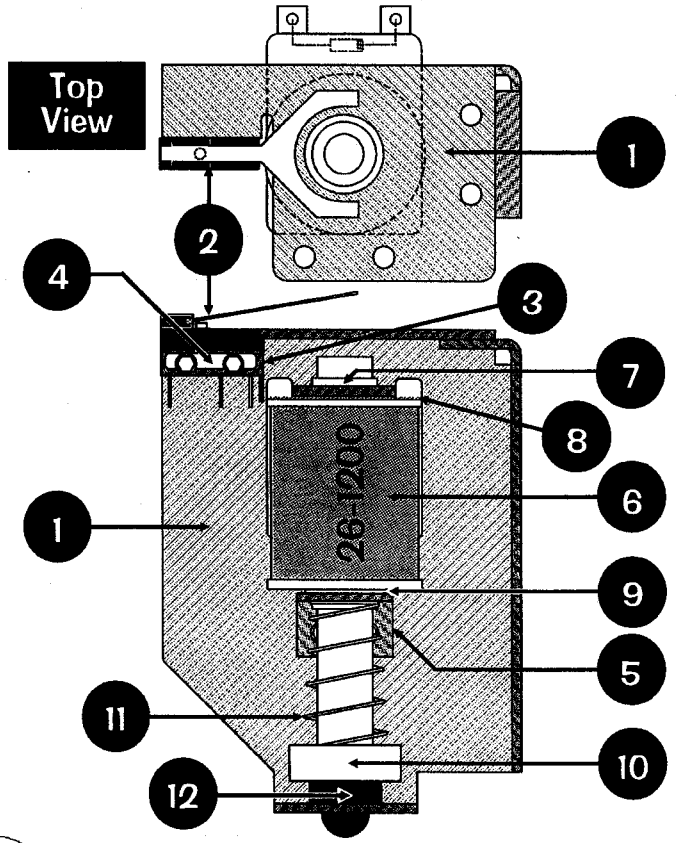
Items 2, 3 & 4 are secured by: #2-56 X 1/2" HWH MS (Serr) Zinc Thread-Forming 3/16" (Qty. 2) (237-5937-02)

5	Coil Retaining Bracket	1	535-5203-03

Item 5 is secured by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)

6	Coil, 26-1200	1	090-5044-00T
ORDERING ABOVE (ITEM 6) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
7	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
8	Coil Lug Insulator (Fiche Paper)	1	545-5431-00
9	Spring Washer, 17/32" ID X 3/4" X 1"	1	269-5002-00
10	Plunger Assembly	1	515-5941-01
11	Compression (Relay) Spring	1	266-5020-00
12	Rubber Bumper (Grommet)	1	545-5105-00

VUK (Left Style) Assembly (500-6290-00) is secured under the playfield by:
Wood VUK Spacer (Qty. 1) (525-5548-00) **and** #8 X 3/4" HWH AB (Zinc) (Qty. 3) (234-5103-00)



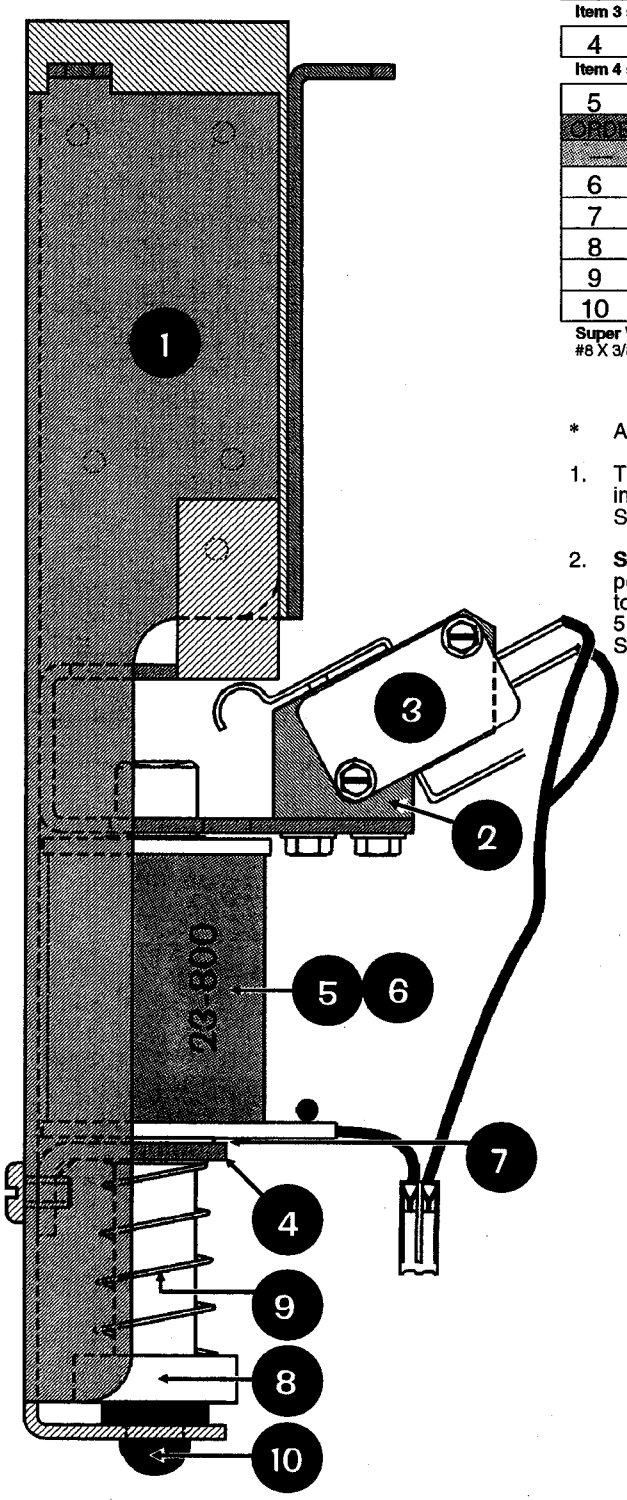
Take Note:

* An asterisk (*) indicates item is *Not Shown* in pictorial.

The Switch Diode, 1N4001, is not located on this assembly (nor included); it's located on a *Terminal Strip* under the playfield.
See Section 5, Chapter 2, Playfield Terminal Strips..., Page 87.

Super VUK Assembly, 500-6184-06-68 (Items 1-10)

CAUTION: #8-32 x 3/8" YELLOW SCREWS (SECURING ASSEMBLIES TO THE UNDER-SIDE OF PLAYFIELD) SHOULD NOT BE REPLACED WITH LONGER ONES.



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	SVUK Mounting Weldment Bracket	1	515-6744-05
2	Super VUK Switch Bracket	1	535-8144-01
	Item 2 secured to Item 1 by: #6-32 X 3/8" HWH Swage (Serr) Zinc (Qty. 2) (237-5976-02)		
3	Micro-Switch	1	180-5052-00
	Item 3 secured to Item 2 by: #4-40 X 5/8" MS (Serr) Zinc (Qty. 2) (237-5945-00)		
4	Coil Retaining Bracket	1	535-5203-03
	Item 4 secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) (Qty. 2) (232-5300-00)		
5	Coil, 23-800	1	090-5001-00T
	ORDERING ABOVE (ITEM 5) COIL PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
6	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
8	Plunger Assembly	1	515-5941-01
9	Compression (Relay) Spring	1	266-5020-00
10	Rubber Bumper (Grommet)	1	545-5105-00

Super VUK Assembly (500-6184-06-68) Is secured under the playfield by:
#8 X 3/8" HWH AB (Zinc) Yellow (Qty. 3) (234-5100-00)

Take Note:

* An asterisk (*) indicates item is *Not Shown* in pictorial.

1. The Switch Diode, 1N4001, is not located on this assembly (nor included); it's located on a *Terminal Strip* under the playfield. See Section 5, Chapter 2, Playfield Terminal Strips..., Page 87.

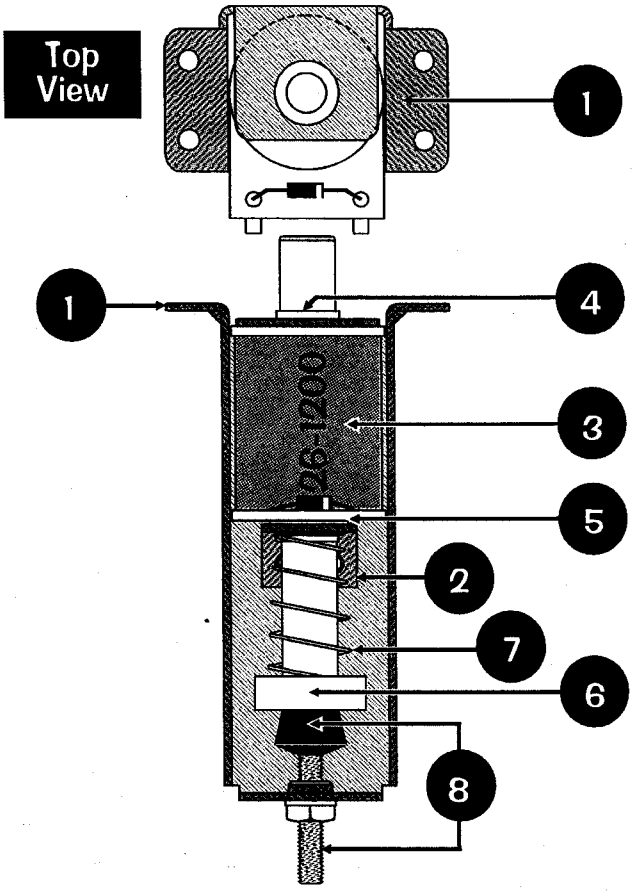
2. **SPI Nº 500-6184-06**, uses a new SVUK Mtg. Bracket 515-6744-**05**, positioning the Switch towards the front. All the Parts are identical to **500-6184-05** except for Item 1, SVUK Mntg. Bracket use 515-6744-04. The difference is the Weldment positioning the Switch Bracket.

Ball Deflector (behind Upper Left Flipper) Assy., 500-5788-02 (Items 1-8)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Ball Deflector Coil Mounting Bracket	1	535-6857-02
2	Coil Retaining Bracket	1	535-5203-03
Item 2 is secured by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)			
3	Coil, 26-1200	1	090-5044-00T
ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
4	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
5	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
6	Solid Plunger Assembly	1	515-6858-00
7	Compression (Relay) Spring	1	266-5022-01
8	#10-32 Adj. Spindle Stop w/Rubber Tip	1	280-5014-00

Item 8 is secured by: #10-32 Keps Nut (Qty. 1) (240-5208-00)

Ball Deflector Assembly (500-5788-02) is secured under the playfield by:
#8-32 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00)



Take Note:

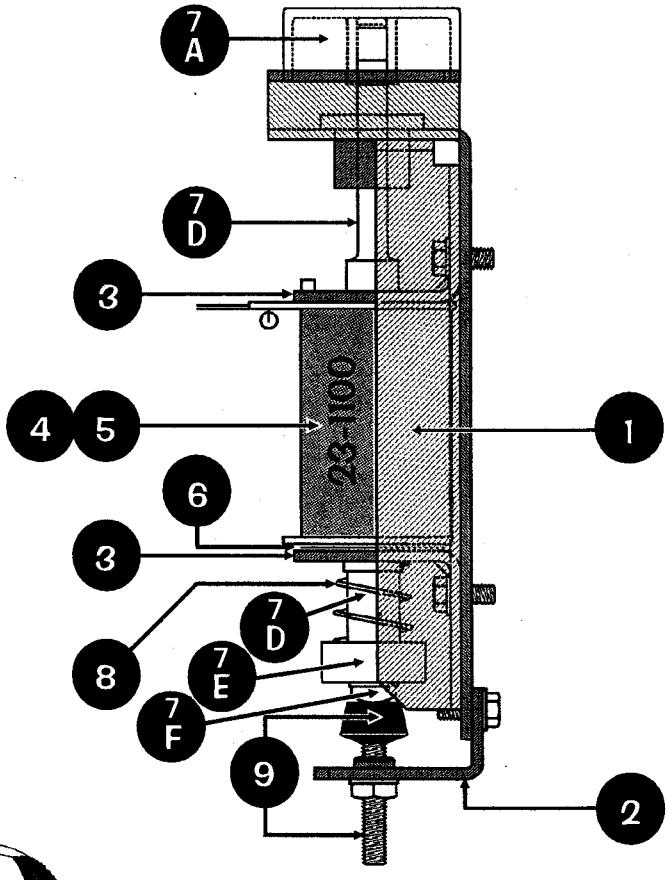
UK Only Optional: An additional two (2) Ball Deflector Assemblies are used in the Left & Right Outlanes; identical to 500-5788-02 except for the Coil. Use SPI Part Nº 500-5788-**03**, to receive part with a Coil 28-1050.

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

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Up/Down Post Coil Mounting Bracket	1	515-6840-00
2	Adjustment Spindle Stop Bracket	1	535-8303-00
3	Coil Retaining Bracket	2	535-7356-00
Items 2 & 3 are secured by: #8-32 X 3/8" Swage (Serr) Zinc (Qty. 2/per) (237-5975-00)			
4	Coil, 23-1100 (ORG)	1	090-5030-00T
ORDERING ABOVE (ITEM 4) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
5	Coil Sleeve (with extension)	1	545-5847-00
6	Spring Washer, 17/32" ID X 3/4" X 1"	1	269-5002-00
7	Plunger & Shaft Assembly	1	515-6844-00
ORDERING ABOVE (ITEM 7) SUB-ASSY PART Nº WILL INCLUDE:			
7A	Ball Bumper Plastic (Top) Red	1	550-5029-02
7B*	Roll Pin, 3/32" ø X 1/2" Long	1	251-5002-00
7C*	Retaining Ring, 1/4" ø Shaft	1	270-5002-00
7D	Plunger & Shaft Sub-Assembly	1	515-6841-00
7E	Plunger Head	1	530-5511-00
7F	#10-32 X 3/8" PPH MS (Sems) Zinc	1	232-5401-00
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)

Up/Down Post Assembly (500-6293-00) is secured under the playfield by:
#8-32 X 1/2" SHWH AB (Zinc) (Qty. 6) (234-5101-00)

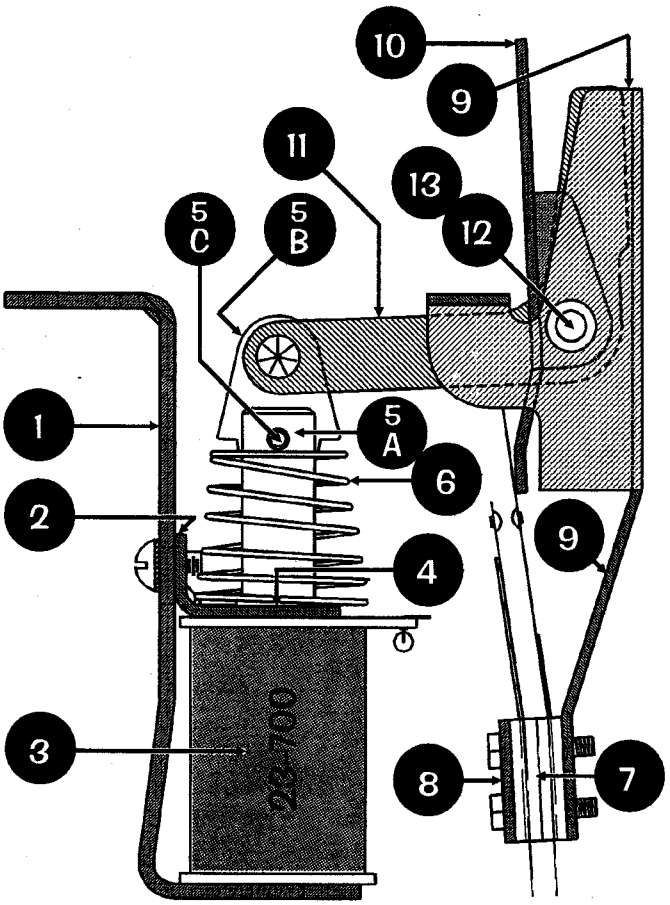


» UK ONLY « OPTIONAL

Take Note:

Item **7D**, part of Item **7**, Plunger & Shaft Sub-Assembly, is 1 piece and cannot be ordered separated.

Kicker Target Assembly, 500-6414-00-68 (Items 1-13)



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Bracket & Armature Stop Assembly	1	515-6435-00
2	Coil Retaining Bracket	1	535-5203-03

Item 2 is secured to Item 1A by: #8-32 X 1/4" PPH MS (Sems) (Qty. 2) (232-5300-00)

3	Coil, 23-700	1	090-5022-00T
ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
4	Coil Sleeve	1	545-5031-00
5	Plunger & Link Assembly	1	515-5338-03-68
ORDERING ABOVE (ITEM 5) SUB-ASSY PART Nº WILL INCLUDE:			
5A	Plunger 2-1/4" Lg.	1	530-5025-03
5B	Plunger Link	1	545-5293-00
5C	Roll Pin 1/8" ø x 5/8" Lg.	1	551-5008-00

Item 5B is secured to Item 10A by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)

6	Compression Spring	1	266-5020-00
7	Stack (Blade) Switch	1	180-5054-00
8	Switch Body Protect Plate	1	535-5045-00

Items 7 & 8 are secured to Item 1A by: #6-32 X 5/8" HWH Swage (Qty. 2) (237-5976-04)

9	Kicking Target Housing	1	535-8642-00
10	Kicking Target Arm	1	535-8641-00
11	Kicking Target Kicker Cam	1	515-7062-00
12	Nyliner (Heyco, #SB-312-3)	1	545-5948-00
13	Kicking Target Shaft	1	530-5557-00

Items 11 & 13 are secured by: Retaining Ring, 3/16" ø Shaft (Qty. 2) (270-5001-00)

Kicker Target Assembly (500-6414-00-68) secured below the playfield by:
#8 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00) **and**
#6 X 1/2" HWH AB (Zinc) Red (Qty. 3) (234-5001-02)

Take Note:

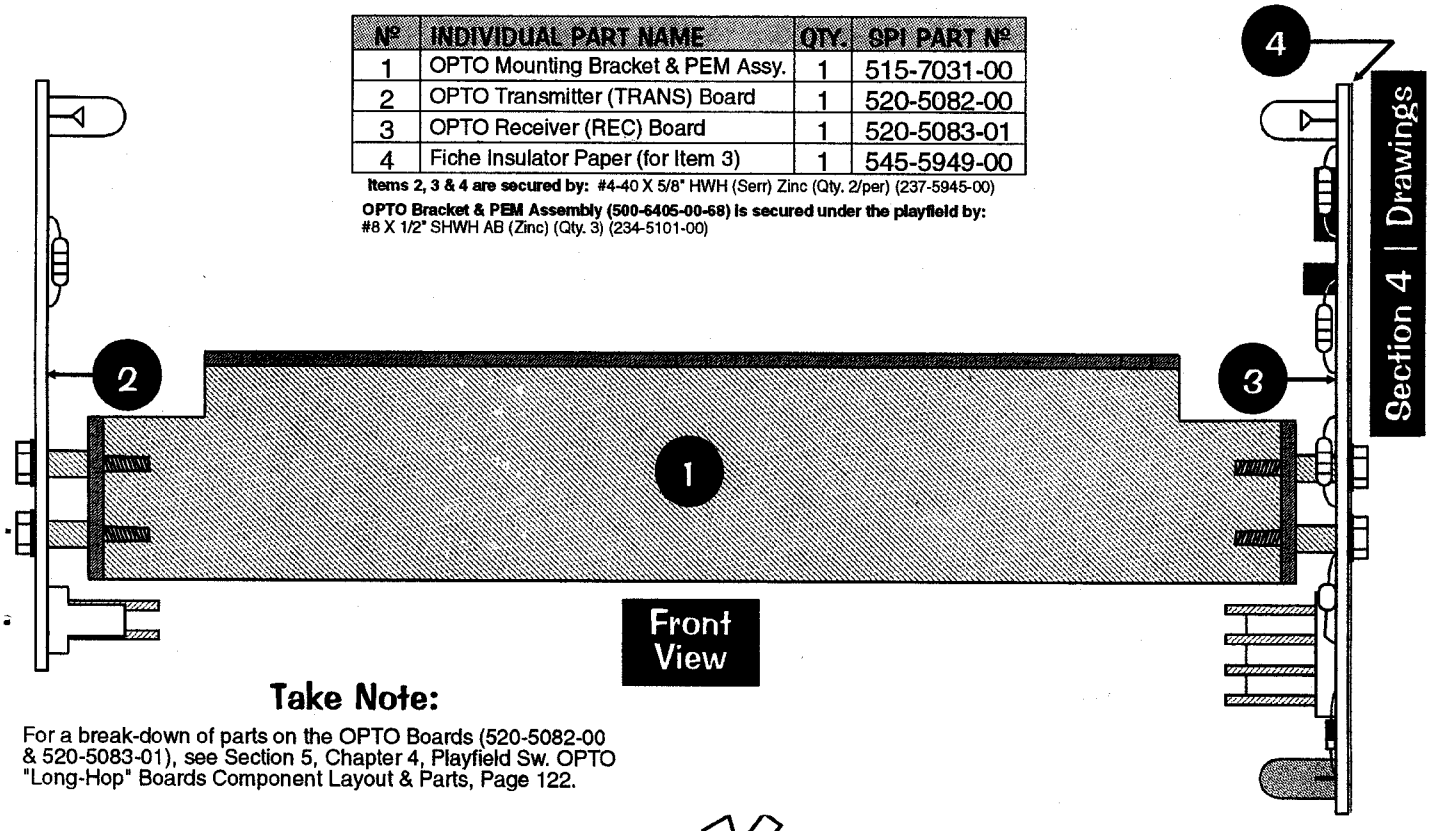
The Switch Diode, 1N4001, is not located on this assembly (nor included); it's located on a *Terminal Strip* under the playfield. See Section 5, Chapter 2, Playfield Terminal Strips..., Page 87.

OPTO Bracket & PEM Asembly, 500-6405-00-68 (Items 1-4)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	OPTO Mounting Bracket & PEM Assy.	1	515-7031-00
2	OPTO Transmitter (TRANS) Board	1	520-5082-00
3	OPTO Receiver (REC) Board	1	520-5083-01
4	Fiche Insulator Paper (for Item 3)	1	545-5949-00

Items 2, 3 & 4 are secured by: #4-40 X 5/8" HWH (Serr) Zinc (Qty. 2/per) (237-5945-00)

OPTO Bracket & PEM Assembly (500-6405-00-68) is secured under the playfield by:
#8 X 1/2" SHWH AB (Zinc) (Qty. 3) (234-5101-00)

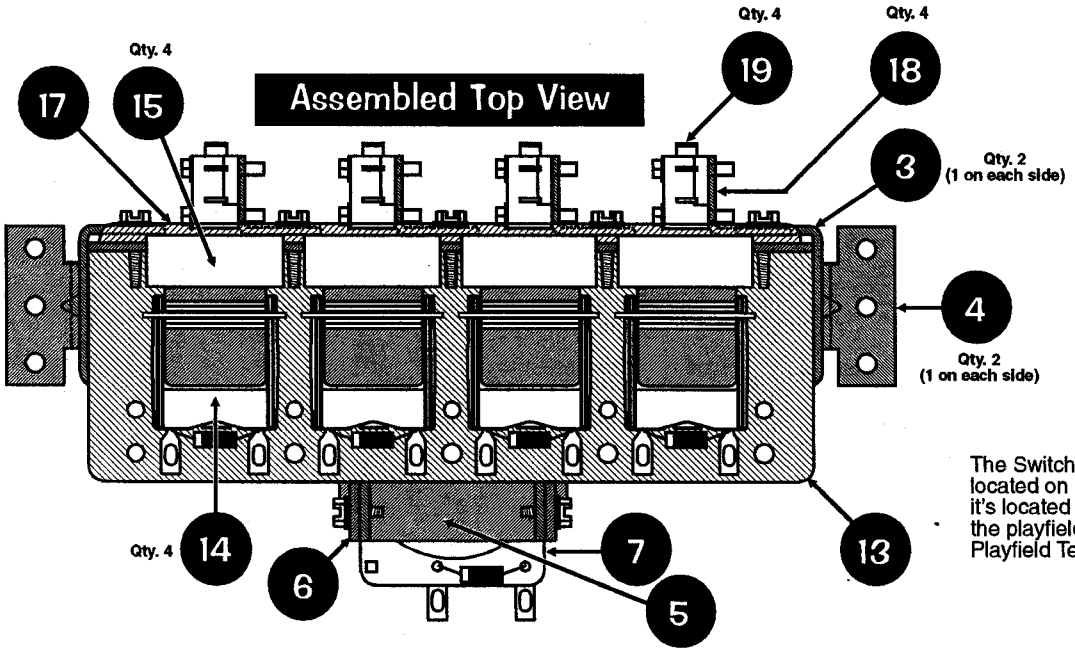


Take Note:

For a break-down of parts on the OPTO Boards (520-5082-00 & 520-5083-01), see Section 5, Chapter 4, Playfield Sw. OPTO "Long-Hop" Boards Component Layout & Parts, Page 122.

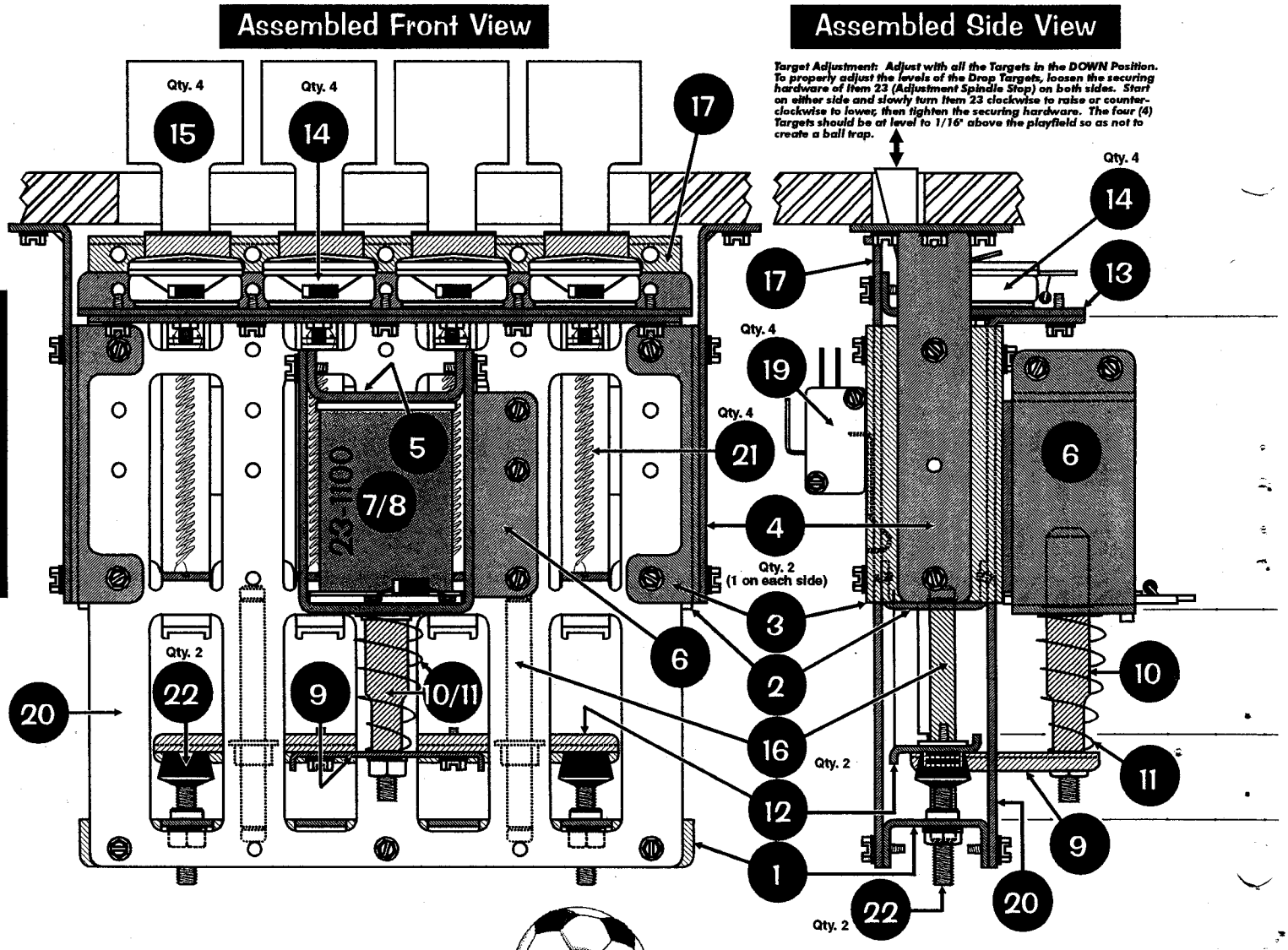
4-Bank Drop Target Assembly, 500-6345-14-68 (Items 1-22)

The Parts Table for this assembly is on the next page.



Take Note:

The Switch Diodo, 1N4001, is not located on this assembly (nor included); it's located on a *Terminal Strip* under the playfield. See Section 5, Chapter 2, Playfield Terminal Strips..., Page 87.



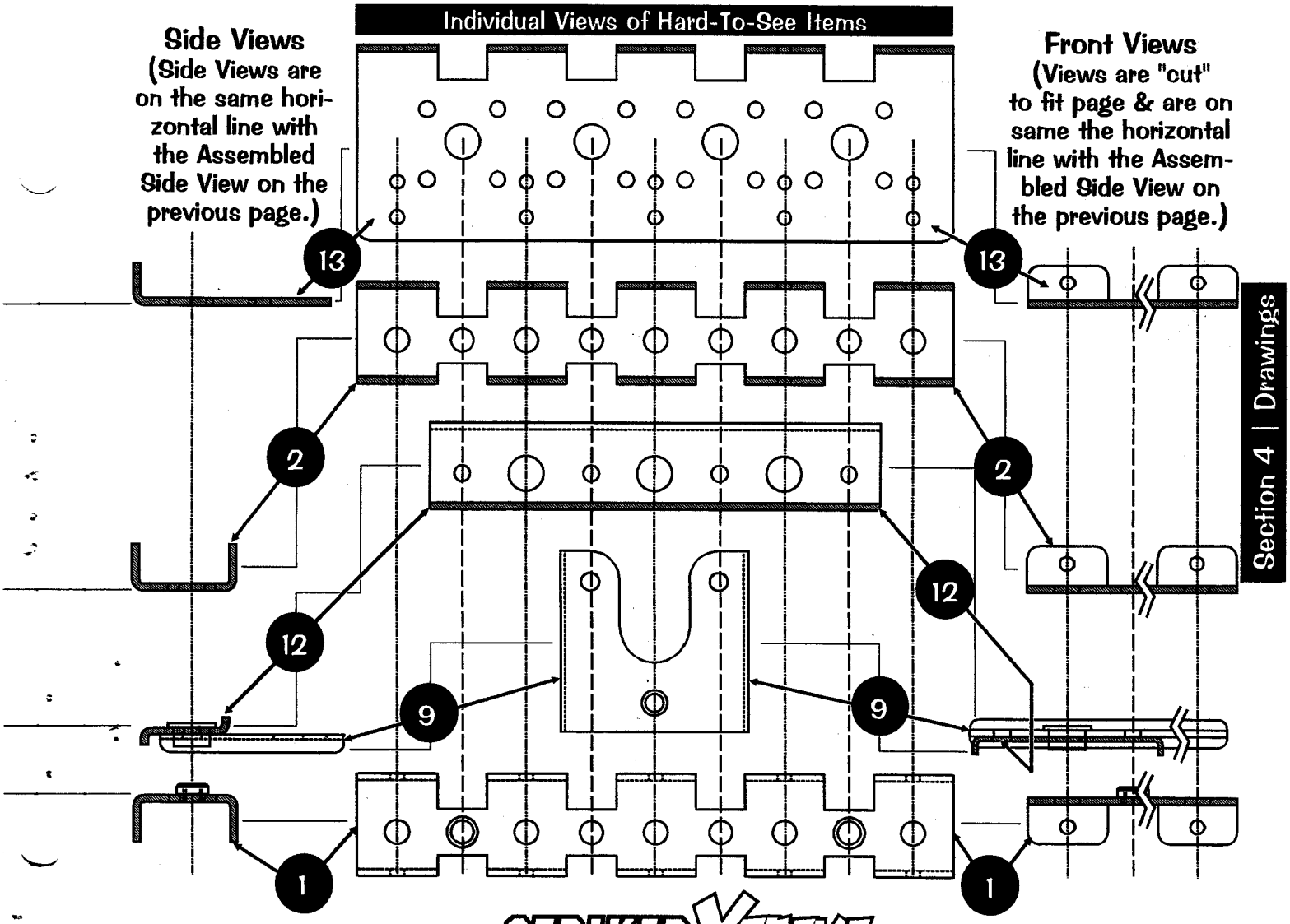
4-Bank Drop Target Assembly, 500-6345-14-68 (Items 1-22)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Guide Brkt. (4-Bank) *with Pem Nuts*	1	515-6904-**04**
	Item 1 is secured at the bottom and inbetween Items 17 & 21 by: See below Item 21.		
2	Guide Brkt. (4-Bank) *without Pem Nuts*	1	535-8408-**04**
	Item 2 is secured at the middle and inbetween Items 17 & 21 by: See below Item 21.		
3	Mounting Plate Housing Side	2	535-8415-00
	Item 3 is secured at the both sides over Items 17 & 21 by: See below Item 21.		
4	Mounting Bracket Side (Short Feet)	2	535-8416-01
	Item 4 is secured over Item 3 (on each side) by: See below Item 21.		
5	Coil Housing Stop Bracket Sub-Assy.	1	515-6905-00
	Item 5 is secured over Item 7 inbetween Item 6 by: See below Item 21.		
6	Coil Housing Bracket	1	535-8411-00
	Item 6 is secured on Item 21: See below Item 21.		
7	Coil, 23-1100	1	090-5030-00T
	ORDERING ABOVE (ITEM 7) COIL PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
8	Coil Sleeve	1	545-5709-00
9	Plunger Lift Bracket	1	535-8413-00
	Item 9 is secured under Item 12: #10-32 X 3/8" SHWH (Ser) Swage (Qty. 2) (237-5985-00)		
10	Drive Coil Plunger	1	530-5522-00
	Item 10 is secured under Item 9: #10-32 Nylon Stop Nut (Qty. 1) (240-5203-00) **and over Item 9:** #10 Lock Washer (Qty. 1) (246-5002-00)		
11	Compression Spring	1	266-5020-00
12	Reset/Stop Bracket Assy. (4-Bank)	1	515-6903-**04**
13	Trip Coil Mounting Bracket (4-Bank)	1	535-8410-**04**
	Item 13 is secured at the top of Items 17 & 21 by: See below Item 21.		
14	Coil, 33-1590 (Miniature) Assembly	4	515-6916-00
	ORDERING ABOVE (ITEM 14) COIL ASSY PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top) Coil riveted onto Weldment Bracket	1	112-5003-00
	Item 14 is secured onto Item 13 by: #8-32 Keps Nut (Qty. 1/per) (240-5104-00) **and** #8 Washer (Qty. 1/per) (242-5005-00)		
15	Drop Target White (Rollover)	4	545-5533-01
16	Drop Target Guide Shaft	2	530-5521-00
	Item 16 is secured to Items 1 & 2 by: Retaining Ring, 1/4" ø (Qty. 2/per) (270-5002-00)		
17	Switch Support Bracket (4-Bank)	1	535-8407-**04**
	Item 17 is secured to Items 1, 2 & 13 by: See below Item 21.		
18	Switch Bracket	4	535-8414-00
	Item 18 is secured to Item 17 by: See below Item 21.		
19	Switch (D/T)	4	180-5158-00
	Item 19 is secured to Item 18 by: #4-40 X 5/8" HWH MS (Ser) Zc. (Qty. 2/per) (237-5945-00)		
20	Spring Support Bracket (4-Bank)	1	535-8420-**04**
	Items 1-6, 13, 17, 18 & 20 are secured by: #8-32 X 3/8" HWH MS Type C (237-5903-00) *Item 3 = 8 Item 4 = 4 Item 5 = 4 Item 6 = 3 Item 13 = 6 Item 17 = 4 Item 18 = 8 Item 20 = 3*		
21	Spring (D/T Reset)	4	265-5003-00
22	#10-32 Adj. Spindle Stop w/Rubber Tip	2	280-5014-00
	Item 22 is secured by: #10-32 Keps Nut (Qty. 1/per) (240-5208-00)		
	4-Bank Drop Target Assembly (500-6345-14-68) is secured under the playfield by: #8-32 X 1/2" SHWH AB (Zinc) (Qty. 6) (234-5101-00)		

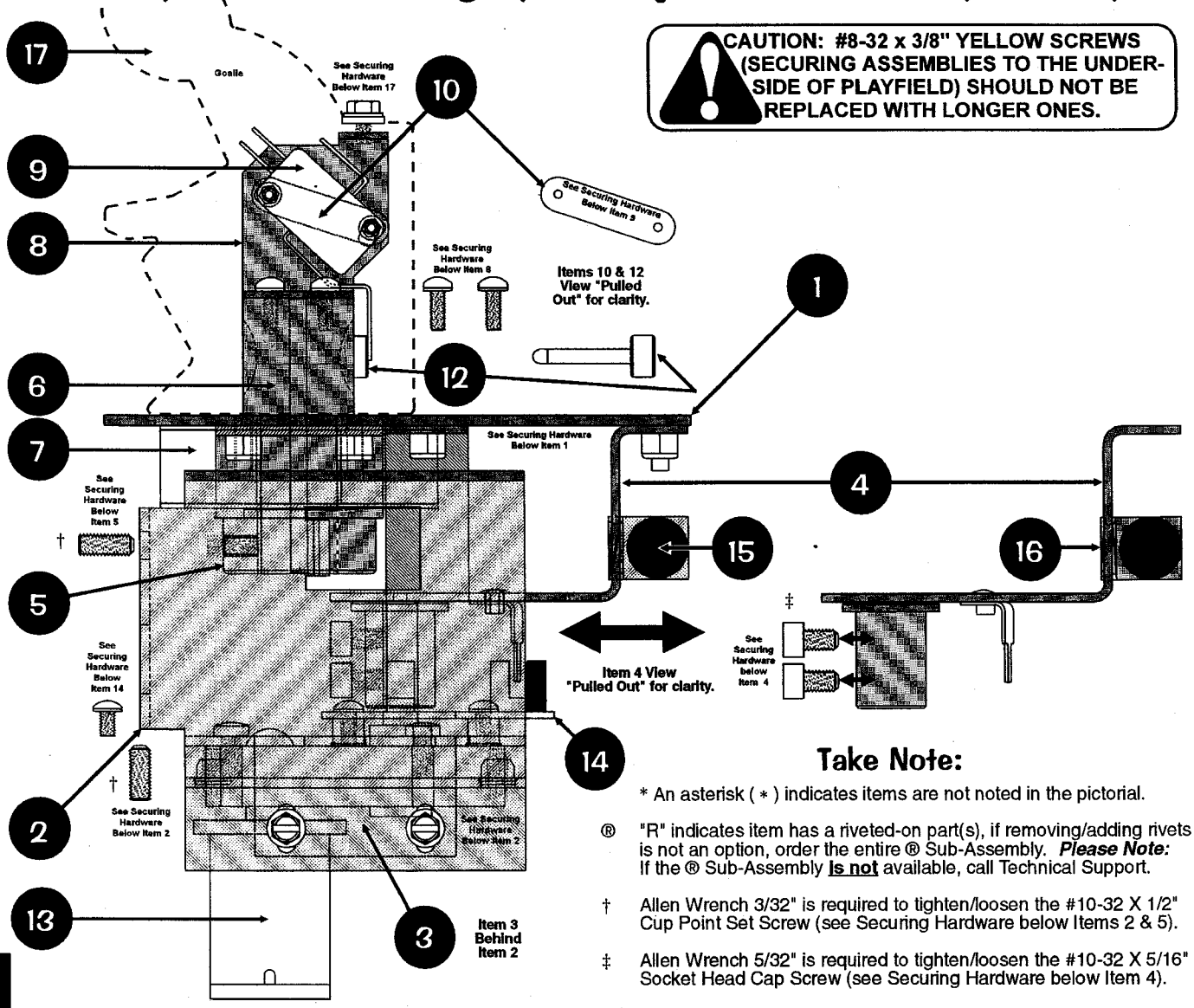
Individual Views of Hard-To-See Items

Side Views (Side Views are on the same horizontal line with the Assembled Side View on the previous page.)

Front Views (Views are "cut" to fit page & are on same the horizontal line with the Assembled Side View on the previous page.)



Goalie (includes Motor & Magnet) Assembly, 500-6406-00-68 (Items 1-16)



CAUTION: #8-32 x 3/8" YELLOW SCREWS (SECURING ASSEMBLIES TO THE UNDER-SIDE OF PLAYFIELD) SHOULD NOT BE REPLACED WITH LONGER ONES.

Take Note:

* An asterisk (*) indicates items are not noted in the pictorial.

® "R" indicates item has a riveted-on part(s), if removing/adding rivets is not an option, order the entire ® Sub-Assembly. ***Please Note:*** If the ® Sub-Assembly **Is not** available, call Technical Support.

† Allen Wrench 3/32" is required to tighten/loosen the #10-32 X 1/2" Cup Point Set Screw (see Securing Hardware below Items 2 & 5).

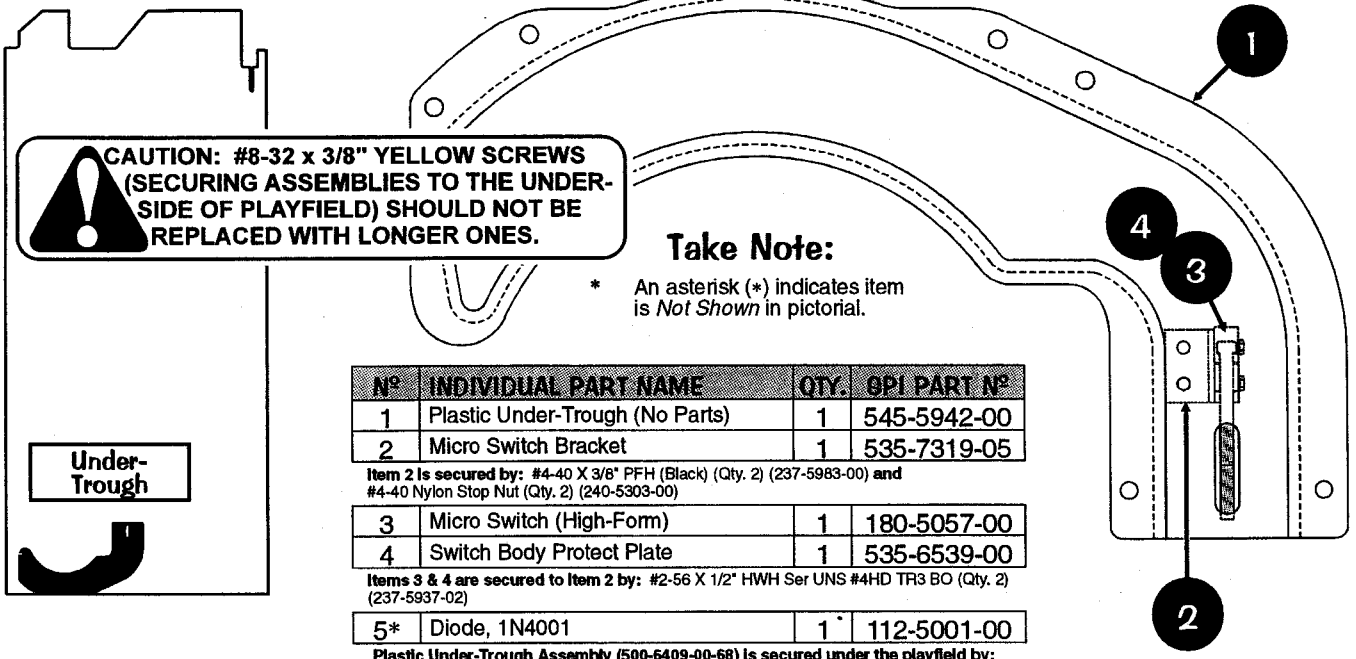
‡ Allen Wrench 5/32" is required to tighten/loosen the #10-32 X 5/16" Socket Head Cap Screw (see Securing Hardware below Item 4).

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Goalie Mech Platform	1	535-8609-01
	Item 1 is secured to Items 4 & 5 by: #8-32 Nylon Stop Nut (Qty. 7) (240-5102-00)		
2	Goalie Mech Main Bracket	1	535-8607-01
	Item 2 is secured to Item 3 by: #8-32 X 3/8" HWH MS (Type C) (Qty. 4) (237-5903-00). **Item 2 requires 4 (four) adjustment Set Screws into Item 3 by:** #10-32 X 1/2" Cup Point Set Screw (Qty. 4) (237-5980-00)		
3	Goalie Mech Motor Bracket	1	535-8608-01
4®	Riveted OPTO Flag Brkt. Assy.	1	515-7070-00-68
	ORDERING ABOVE ® RIVETED ASSY. PART Nº WILL INCLUDE:		
4A	Goalie Mech Drive Bracket Sub-Assy.	1	515-7044-01
	Note: Item 4A includes:		
	Goalie Mech Drive Bracket	*1*	*535-8613-01*
	Goalie Mech Coupling	*1*	*530-5495-02*
4B	OPTO "Flag" Bracket	1	535-8655-00
4C*	Rivet 1/8" ø X 3/16" Lg.	2	249-5001-00
	Item 4 requires 2 (two) Adj. Set Screws: #10-32 X 5/16" SHCS (Qty. 2) (237-5845-01)		
5	Core Mounting Bracket Sub-Assy.	1	515-6587-01
	Item 5 requires 1 (one) Adj. Set Screw into Item 6 by: #10-32 X 1/2" Cup Point Set Screw (Qty. 1) (237-5980-00)		
6	Goalie Mech Magnet Core	1	530-5558-00
7	Magnet Assembly	1	515-7065-00-68
	ORDERING ABOVE (ITEM 7) SUB-ASSY. PART Nº WILL INCLUDE:		
7A	Magnet, 22-650 (with conn. & lugs)	1	090-5042-01

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
8	Core Switch Bracket	1	535-8624-02
	Item 8 is secured at the top of Item 6 by: #6-32 X 3/8" PPH MS (Sems) (Qty. 2) (232-5201-00)		
9	Magnet Core Switch	1	180-5173-00
	Item 9 is secured to Items 8 & 10 by: #4-40 X 5/8" HWH MS (Serr) Zinc St. (Qty. 2) (237-5945-00)		
10	#4-40 Nut Plate (helps secure Item 9)	1	535-8212-00
11*	Diode, 1N4001	1	112-5001-00
12	Core Switch Actuator	1	545-5941-01
13	Motor Assembly	1	515-7071-00-68
	ORDERING ABOVE (ITEM 10) SUB-ASSY. PART Nº WILL INCLUDE:		
13A	Motor 60 RPM12v DC Multi #3590	1	041-5075-00
13B	Resitor, 100Ω 5% LUO 431 5W	1	121-5075-00
13C	Axial Cer. Cap, 0.1uF	1	125-5031-00
	& includes necessary wiring & conn.		
	Item 13 is secured under Item 3 by: #8-32 X 1/2" PPH MS (Sems) (Qty. 4) (237-5602-00)		
14	OPTO Board (3-Pos. Motor Sensor)	1	520-5155-00
	Item 14 is secured over Item 3 by: #6-32 X 1/4" PPH MS (Sems) (Qty. 4) (232-5200-00)		
15	Rubber Bumper (Grommet) 1138 (A60)	1	545-5105-00
16	Nyliner 3/8" I.D. (Thomson #6L1-FF)	1	545-5423-01
17	Goalie (Molded Plastic)	1	880-5043-00
	Item 17 is secured over Item 8 by: #6-32 X 3/8" HWH Swage (Serr) (Qty. 2) (237-5976-02) **and** #6 Washer (Qty. 2) (242-5001-00)		

Goalie Assembly (500-6406-00-68) is secured under the playfield by: #8-32 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00) and #8 X 3/8" HWH AB (Zinc) Yellow (Qty. 2) (234-5100-00)

Plastic Under-Trough Assembly, 500-6409-00-68 (Items 1-5)



CAUTION: #8-32 x 3/8" YELLOW SCREWS (SECURING ASSEMBLIES TO THE UNDER-SIDE OF PLAYFIELD) SHOULD NOT BE REPLACED WITH LONGER ONES.

Take Note:

* An asterisk (*) indicates item is *Not Shown* in pictorial.

№	INDIVIDUAL PART NAME	QTY.	GPI PART №
1	Plastic Under-Trough (No Parts)	1	545-5942-00
2	Micro Switch Bracket	1	535-7319-05

Item 2 is secured by: #4-40 X 3/8" PFH (Black) (Qty. 2) (237-5983-00) **and** #4-40 Nylon Stop Nut (Qty. 2) (240-5303-00)

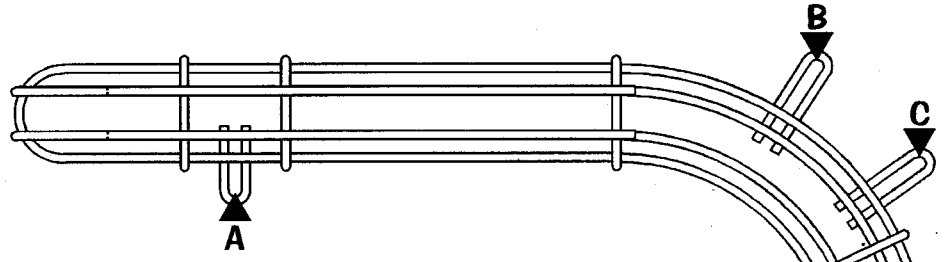
3	Micro Switch (High-Form)	1	180-5057-00
4	Switch Body Protect Plate	1	535-6539-00

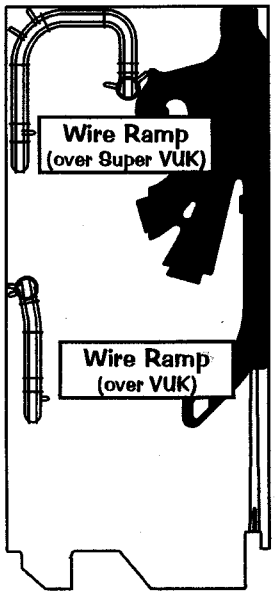
Items 3 & 4 are secured to Item 2 by: #2-56 X 1/2" HWH Ser UNS #4HD TR3 BO (Qty. 2) (237-5937-02)

5*	Diode, 1N4001	1	112-5001-00

Plastic Under-Trough Assembly (500-6409-00-68) is secured under the playfield by: #8-32 X 3/8" HWH AB (Zinc) Yellow (Qty. 6) (234-5100-00)

Wire Ramp (over Super VUK) Assy. (No Individual Parts), 515-7034-00



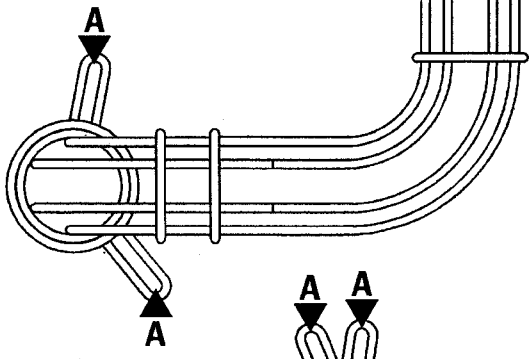


Wire Ramps (515-7034-00 & 515-7061-00) are secured above the Playfield by:

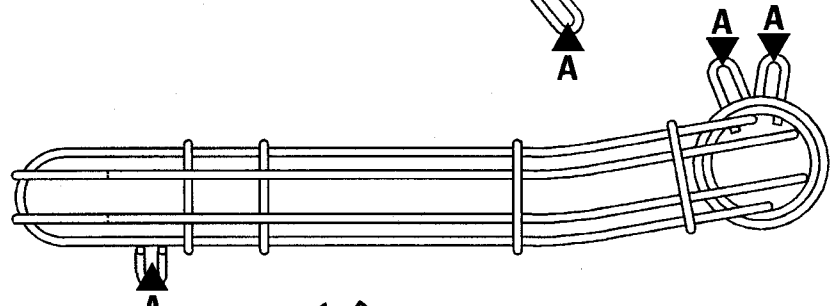
A▲▼ #8 Washer (Qty. 2/per) (242-5005-00) **and**
#8-32 Nylon Stop Nut (Qty. 1/per) (240-5102-00)
onto Post Fasten #8-32 Top #6-32 Bot Screw (Qty. 1/per) (530-5008-00)

B▼ Washer 13/64" ID X 5/8" OD X .062 (Qty. 1) (242-5038-00) **and**
#6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1) (232-5201-00)
onto 3-1/2" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-27)

C▼ Washer 13/64" ID X 5/8" OD X .062 (Qty. 1) (242-5038-00),
#6 Washer (Qty. 1) (242-5001-00)
and #6-32 X 2" PPH MS (Zinc) (Qty. 1) (237-5513-00)
into 1-1/2" X 3/8" Spacer Gray (Qty. 1) (254-5000-08)



Wire Ramp (over VUK) Assembly (No Individual Parts), 515-7061-00



515-7054-00

Plastic Ramp (includes Magnet) Assembly, 500-6402-00-68 (Items 1-13)

Drawing continues on the next page.

Nº	INDIVIDUAL PART NAME	QTY.	9PI PART Nº
1®	Riveted Plastic Ramp Sub-Assembly	1	515-7054-00R-68
ORDERING ABOVE (1®) RIVETED ASSY PART Nº WILL INCLUDE:			
1A	Plastic Ramp (Dual) (No Parts)	1	545-5935-00
1B	Ramp Flap	2	535-8605-00
1C	Wedge Base Offset Socket	1	077-5029-00
1D*	Rivet, 1/8" ø X 3/16" Lg. (for 1B)	2	249-5001-00
1E*	#6 Riveting Lock Washer (for 1B)	2	246-5000-00
1F*	Rivet, 1/8" ø X 1/4" Lg. (for 1C)	1	249-5003-00
2	Ramp Protect Bracket (Lower Right)	1	535-8644-00

Item 2 is secured by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2) (232-5201-00) **and** #6-32 Nylon Stop Nut (Qty. 1 @ bottom) (240-5005-00)

3	Ramp Protect Bracket (Lower Left)	1	535-8645-00
4	Ramp Protect Bracket (Upper Left)	1	535-8646-00
5	Ramp Protect Bracket (Upper Right)	1	535-8647-00

Items 3-5 are secured by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2/per) (232-5201-00) **and** #6-32 Nylon Stop Nut (Qty. 2/per) (240-5005-00)

6	Gate (Roll-Under) Assembly	1	515-6556-04
ORDERING ABOVE (ITEM 6) SUB-ASSY PART Nº WILL INCLUDE:			
6A	Gate Bracket	1	535-7756-01
6B	Wire Form (on above item)	1	535-7755-02
6C	Micro Switch (for Roll-Under Gate)	1	180-5087-00
6D*	Switch Body Protect Plate	1	535-6539-00
6E*	Diode, 1N4001	1	112-5001-00
6F*	#2-56 X 1/2" HWH Ser UNS #4HD TRS BO	2	237-5937-02
7	Gate (Roll-Under) Assembly	1	515-6556-02
ORDERING ABOVE (ITEM 7) SUB-ASSY PART Nº WILL INCLUDE:			
7A	Gate Bracket	1	535-7756-02
7B	Wire Form (on above item)	1	535-7755-02
7C	Micro Switch (for Roll-Under Gate)	1	180-5087-00
7D*	Switch Body Protect Plate	1	535-6539-00
7D*	Diode, 1N4001	1	112-5001-00
7E*	#2-56 X 1/2" HWH Ser UNS #4HD TRS BO	2	237-5937-02

Items 6-7 are secured by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2/per) (232-5201-00) **and** #6-32 Nylon Stop Nut (Qty. 2/per) (240-5005-00)

8	1-Way Gate Mounting Bracket	1	535-5269-03
	Wire Gate (for above) *Non-Magnetic*		535-8661-00

Item 8 is secured by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2/per) (232-5201-00) **and** #6-32 Nylon Stop Nut (Qty. 2/per) (240-5005-00)

9	Ramp Exit Protector	1	535-8167-01

Item 9 is secured by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2) (232-5201-00) **and** #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00)

10	Magnet Core Assembly (on Ramp)	1	500-6407-00-68
ORDERING ABOVE (ITEM 10) SUB-ASSY PART Nº WILL INCLUDE:			
10A	Threaded Core Weld Sub-Assembly	1	515-7047-00
10B	Threaded Core Plug	1	530-5320-00
10C	3/4"-16 Hex Nut	1	240-5315-00
11	Magnet Assembly	1	515-7066-00-68
ORDERING ABOVE (ITEM 11) SUB-ASSY PART Nº WILL INCLUDE:			
11A	Magnet, 22-650 (with conn. & lugs)	1	090-5042-01

Item 11 is secured by: #8-32 X 3/8" PFH (82) Under-Cut (Qty. 3) (237-6030-00)

12	#906 Wedge Base Bulb (Clear)	1	165-5004-00
13	Mini-Mars Light Cover Snap-In Clear	1	550-5030-01

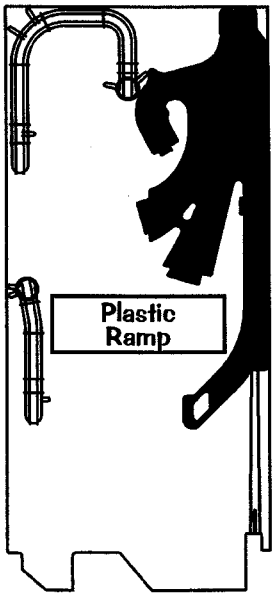
Plastic Ramp Assembly (500-6402-00-68) is secured above the Playfield by:
- **A▲** 4.92" X 5/16" Hex Spacer #6-32 Top (Qty. 2) (254-5018-04)
- **B▲▼** 3" X 1/4" Hex Spacer #6-32 Top (Qty. 2) (254-5008-14)
- **C▲** 1-3/4" X 1/4" Hex Spacer #6-32 Top (Qty. 2) (254-5008-10)
- **D▼** 1-1/4" X 1/4" Hex Spacer #6-32 Top (Qty. 1) (254-5008-11)
- **E▲** 3-3/4" X 1/4" Hex Spacer #6-32 Top (Qty. 1) (254-5008-36)

On Plastic Ramp to support Stadium (See Page 80):
F▲ 3-1/2" X 1/4" Hex Spacer #6-32 Tap (Qty. 1 @ top) (254-5008-27)

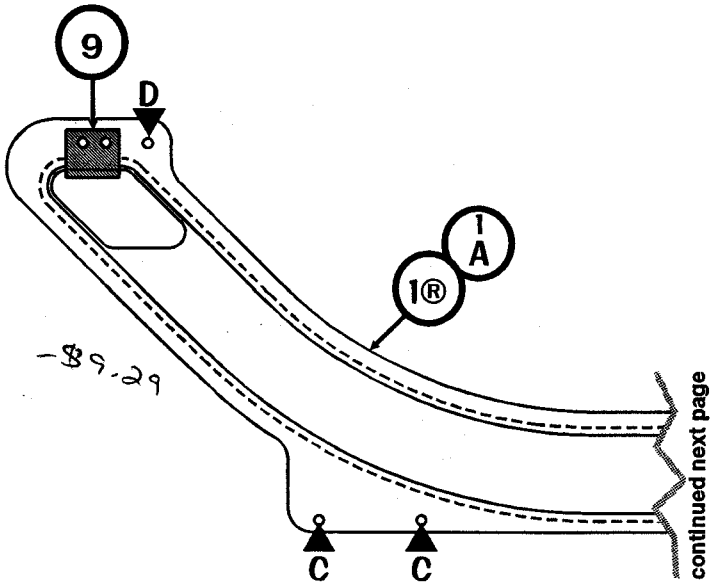
at C on the Wood Rail sides with Ramp Mounting Bracket (Qty. 1/per) (515-6508-00)

at A-F on the Ramp with #6-32 X 3/8" PPH MS Sems (Zinc) (Qty. 1/per) (232-5201-00) **and at A-E on the Ramp with** #6 Washer (Qty. 1/per) (242-5001-00)

G▲▼ at the Ramp Flap (Item 1B) with #4 X 5/8" PFH (Black) (Qty. 2/per) (237-5833-00)



▲▼ For how this Ramp is Secured to the Playfield see the Securing Hardware under Item 14 below.



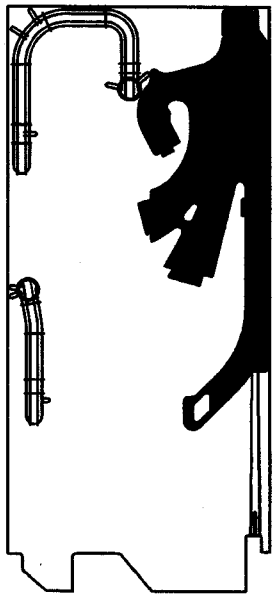
continued next page

Take Note:

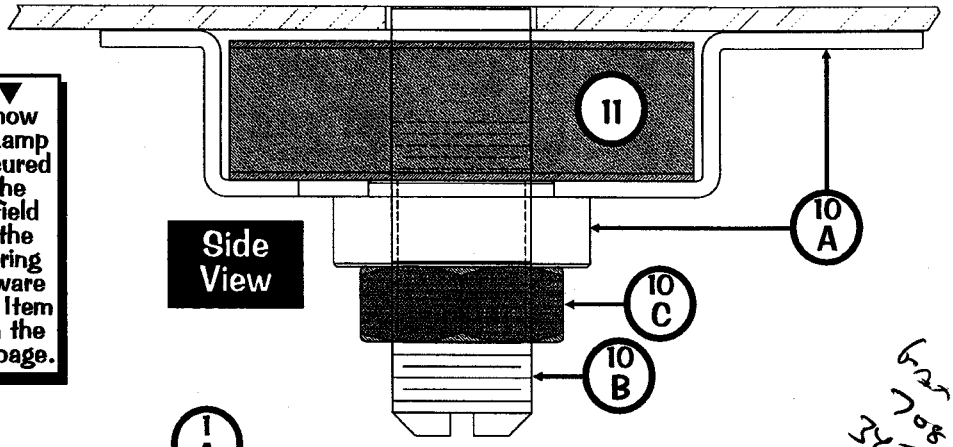
* An asterisk (*) indicates items are not noted in the pictorial.

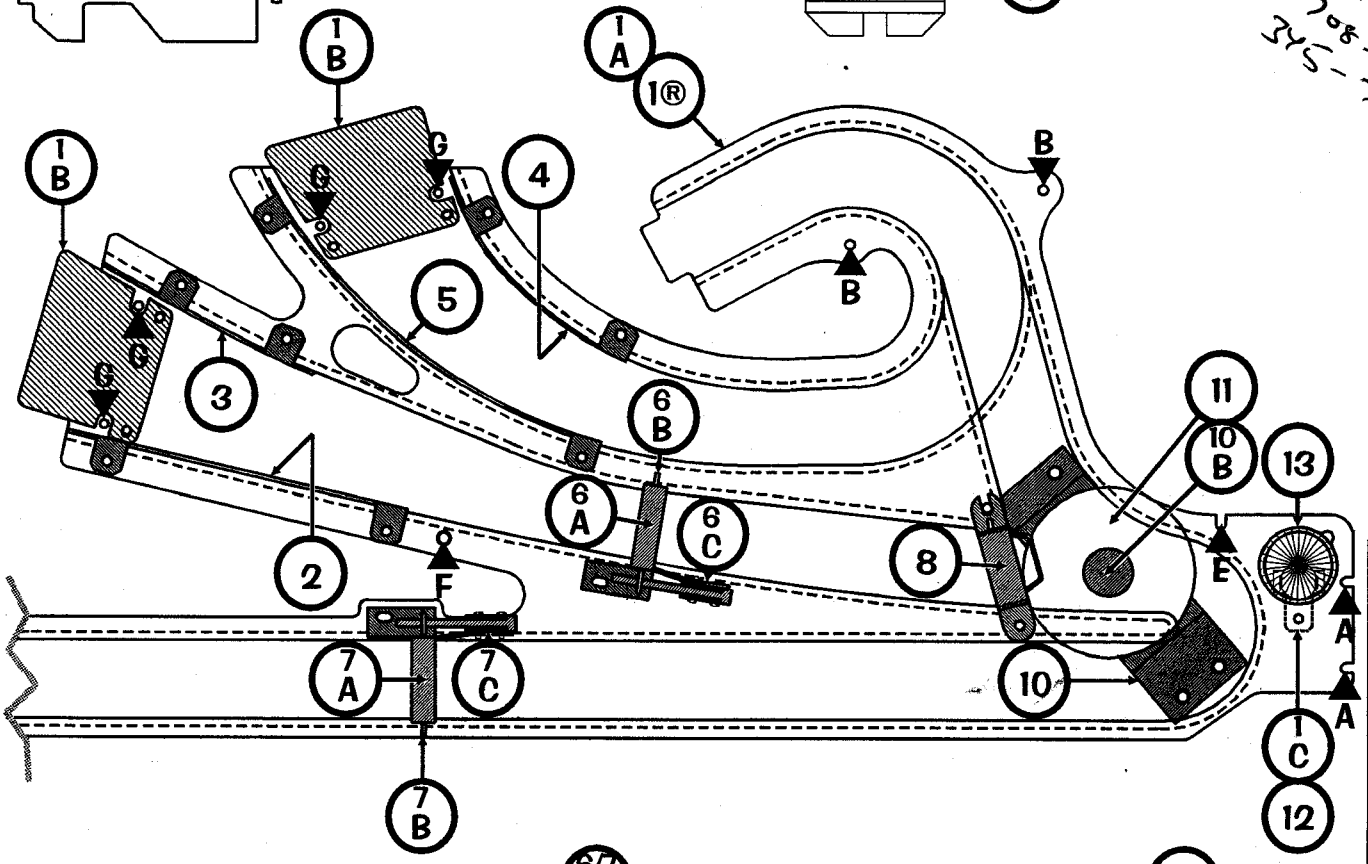
® "R" indicates item has a riveted-on part(s), if removing/adding rivets is not an option, order the entire ® Sub-Assembly. ***Please Note:*** If the ® Sub-Assembly **Is not** available, call Technical Support.

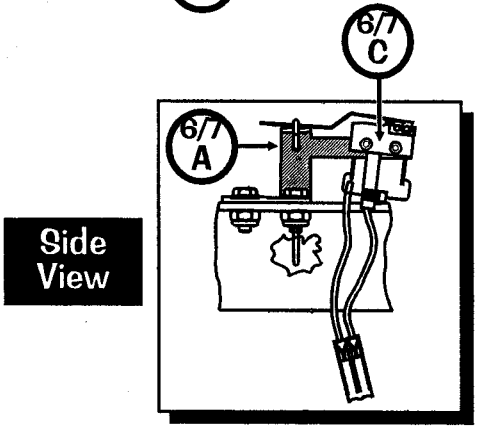
Parts Table on the previous page.

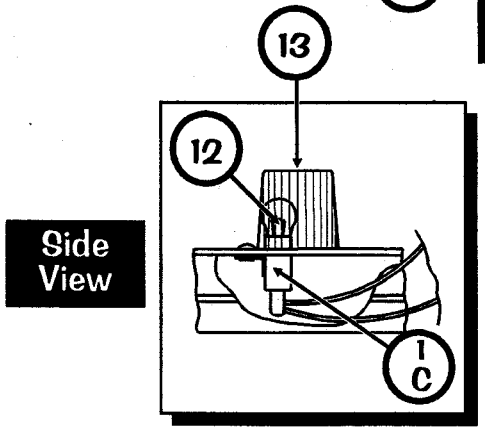


For how this Ramp is Secured to the Playfield see the Securing Hardware under Item 14 on the prev. page.









Lock Mech Metal Trough Assembly, 500-6404-00-68 (Items 1-8)
and Associated Part: (See Table Below)

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

№	ASSOCIATED PART NAME	QTY.	SPI PART №
®	Stadium Assy. *(Not Shown for Clarity)*	1	515-7067-01R
ORDERING ABOVE ® SUB-ASSY PART № WILL INCLUDE:			
	Stadium Molded Plastic (Cover)	1	545-5945-00
	Laydown Wedge Base Socket	4	077-5026-01
	Rivet, 1/8" ø X 3/16" Lg.	4	249-5001-00
	#6 Lock Washer Riveting (2 @ top)	2	246-5000-00
	Decal Stadium Bottom Front	1	820-6258-19
	Decal Stadium Top Front	1	820-6258-20

Stadium Assembly (515-7067-01R) is secured at above referenced B▼ by:
#6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 3) (232-5201-00), #6-32 X 1/4"PPH MS Sems Zinc (Qty. 2) (232-5200-00) **and** #6 Washer (Qty. 3) (242-5001-00)

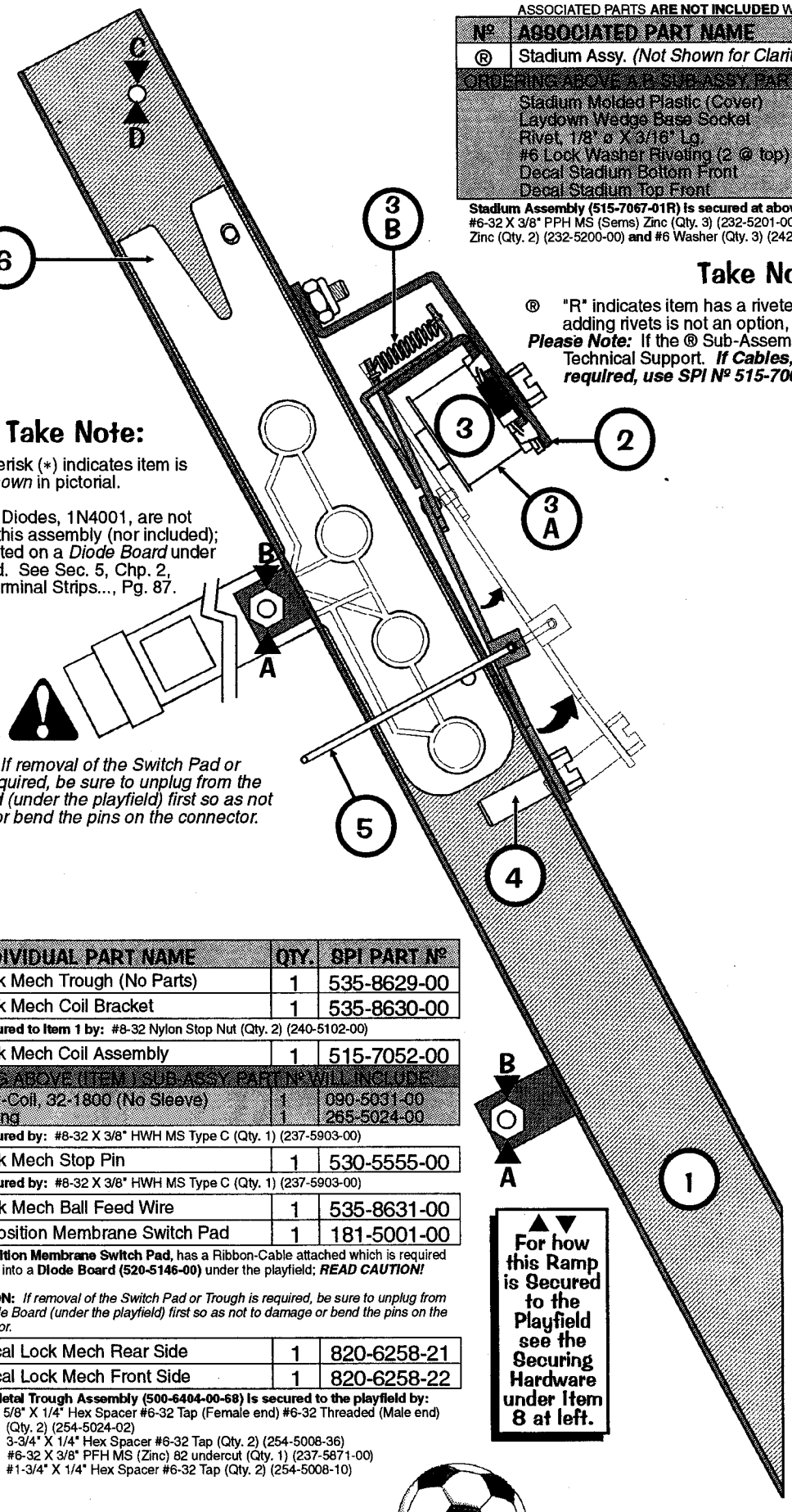
Take Note:

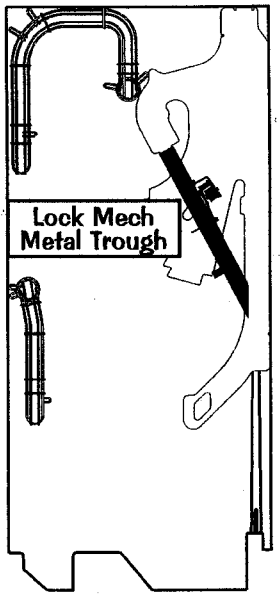
® "R" indicates item has a riveted-on part(s), if removing/ adding rivets is not an option, order the entire ® Sub-Assy.
Please Note: If the ® Sub-Assembly **Is not** available, call Technical Support. ***If Cables, Connector & Bulb are required, use SPI № 515-7067-00-68***

Take Note:

* An asterisk (*) indicates item is *Not Shown* in pictorial.

The Switch Diodes, 1N4001, are not located on this assembly (nor included); they're located on a *Diode Board* under the playfield. See Sec. 5, Chp. 2, Playfield Terminal Strips..., Pg. 87.





CAUTION: *If removal of the Switch Pad or Trough is required, be sure to unplug from the Diode Board (under the playfield) first so as not to damage or bend the pins on the connector.*

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Lock Mech Trough (No Parts)	1	535-8629-00
2	Lock Mech Coil Bracket	1	535-8630-00
Item 2 is secured to Item 1 by: #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00)			
3	Lock Mech Coil Assembly	1	515-7052-00
ORDERING ABOVE ITEM 3 SUB-ASSY PART № WILL INCLUDE:			
3A	Mini-Coil, 32-1800 (No Sleeve)	1	090-5031-00
3B	Spring	1	265-5024-00
Item 3 is secured by: #8-32 X 3/8" HWH MS Type C (Qty. 1) (237-5903-00)			
4	Lock Mech Stop Pin	1	530-5555-00
Item 3 is secured by: #8-32 X 3/8" HWH MS Type C (Qty. 1) (237-5903-00)			
5	Lock Mech Ball Feed Wire	1	535-8631-00
6	4-Position Membrane Switch Pad	1	181-5001-00

Item 6, 4-Position Membrane Switch Pad, has a Ribbon-Cable attached which is required to be plugged into a **Diode Board (520-5146-00)** under the playfield; ***READ CAUTION!***

CAUTION: *If removal of the Switch Pad or Trough is required, be sure to unplug from the Diode Board (under the playfield) first so as not to damage or bend the pins on the connector.*

7*	Decal Lock Mech Rear Side	1	820-6258-21
8*	Decal Lock Mech Front Side	1	820-6258-22

Lock Mech Metal Trough Assembly (500-6404-00-68) Is secured to the playfield by:
A (above) ▲ 5/8" X 1/4" Hex Spacer #6-32 Tap (Female end) #6-32 Threaded (Male end) (Qty. 2) (254-5024-02)
B (below) ▼ 3-3/4" X 1/4" Hex Spacer #6-32 Tap (Qty. 2) (254-5008-36)
C (above) ▼ #6-32 X 3/8" PFH MS (Zinc) 82 undercut (Qty. 1) (237-5871-00)
D (below) ▲ #1-3/4" X 1/4" Hex Spacer #6-32 Tap (Qty. 2) (254-5008-10)

▲▼ For how this Ramp is Secured to the Playfield see the Securing Hardware under Item 8 at left.

Table of Contents

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 (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	I/O Pwr. Drvr.	BRN-BLK	J8-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#2	AUTO LAUNCH	Q2	I/O Pwr. Drvr.	BRN-RED	J8-P3	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00T
#3	LEFT VUK	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#4	TOP SUPER VUK	Q4	I/O Pwr. Drvr.	BRN-YEL	J8-P5	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#5	KICKER TARGET	Q5	I/O Pwr. Drvr.	BRN-GRN	J8-P6	YEL-VIO	J10-P4/5	50v DC	23-700 090-5022-00T
#6	4-BANK DROP TARGET RESET	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	YEL-VIO	J10-P4/5	50v DC	23-1100 090-5030-00T
#7	4-BANK #1 (TOP) DOWN	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	YEL-VIO	J10-P4/5	50v DC	33-1590 515-6916-00
#8	BALL LOCK	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	YEL-VIO	J10-P4/5	50v DC	32-1800 090-5031-00

	High Current Coils Group 2	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn
#9	LEFT TURBO BUMPER	Q9	I/O Pwr. Drvr.	BLU-BRN	J9-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#10	RIGHT TURBO BUMPER	Q10	I/O Pwr. Drvr.	BLU-RED	J9-P2	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#11	BOTTOM TURBO BUMPER	Q11	I/O Pwr. Drvr.	BLU-ORG	J9-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#12	GOALIE MAGNET	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#13	RAMP MAGNET	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#14	UPPER FLIPPER (50v RED/YEL)	Q14	I/O Pwr. Drvr.	BLU-BLK	J9-P7	RED-YEL GRY-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T
#15	LEFT FLIPPER (50v RED/YEL)	Q15	I/O Pwr. Drvr.	ORG-GRY	J9-P8	RED-YEL GRY-YEL	J10-P1/2	50v DC	22-1080 090-5032-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16	I/O Pwr. Drvr.	ORG-VIO	J9-P9	RED-YEL BLU-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T

	Low Current Coils Group 1	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn or Meter #
#17	LEFT SLINGSHOT	Q17	I/O Pwr. Drvr.	VIO-BRN	J7-P2	BRN	J7-P1	20v DC	23-800 090-5001-00T
#18	RIGHT SLINGSHOT	Q18	I/O Pwr. Drvr.	VIO-RED	J7-P3	BRN	J7-P1	20v DC	23-800 090-5001-00T
#19	BALL DEFLECTOR	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	BRN	J7-P1	20v DC	26-1200 090-5044-00T
#20	FLASH: STADIUM X4	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#21	4-BANK #2 DOWN	Q21	I/O Pwr. Drvr.	VIO-GRN	J7-P7	BRN	J7-P1	20v DC	33-1590 515-6916-00
#22	4-BANK #3 DOWN	Q22	I/O Pwr. Drvr.	VIO-BLU	J7-P8	BRN	J7-P1	20v DC	33-1590 515-6916-00
#23	4-BANK #4 (BOT) DOWN	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	BRN	J7-P1	20v DC	33-1590 515-6916-00
#24	OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v DC	Meter 5v 091-5000-00

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

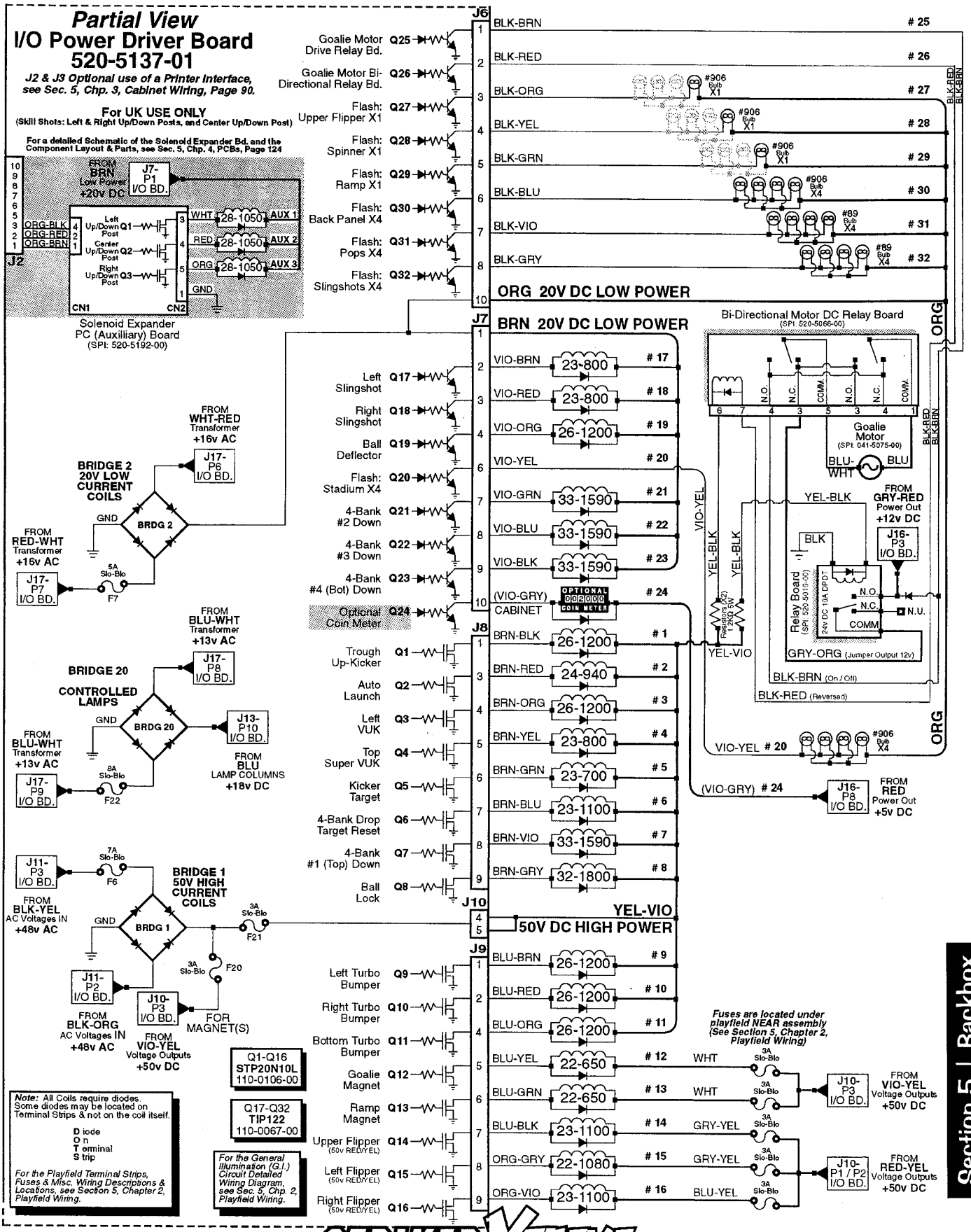
	Low Current Coils Group 2	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Bulb Type
#25	GOALIE MTR DRV RELAY BD	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	YEL-VIO YEL-BLK	J10-P4/5	50v DC	Relay Bd. 520-5010-00
#26	GOALIE BI-DIRECTIONAL MTR RELAY BD	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	YEL-VIO YEL-BLK	J10-P4/5	50v DC	B-D Relay 520-5066-00
#27	FLASH: UPPER FLIPPER X1	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#28	FLASH: SPINNER X1	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#29	FLASH: RAMP X1	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#30	FLASH: BACK PANEL X4	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#31	FLASH: POPS X4	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#32	FLASH: SLINGSHOTS X4	Q32	I/O Pwr. Drvr.	BLK-GRY	J6-P8	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89

Note: In Test Flash Lamps Menu ("Flash" loop), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: #20 & #27-#32)

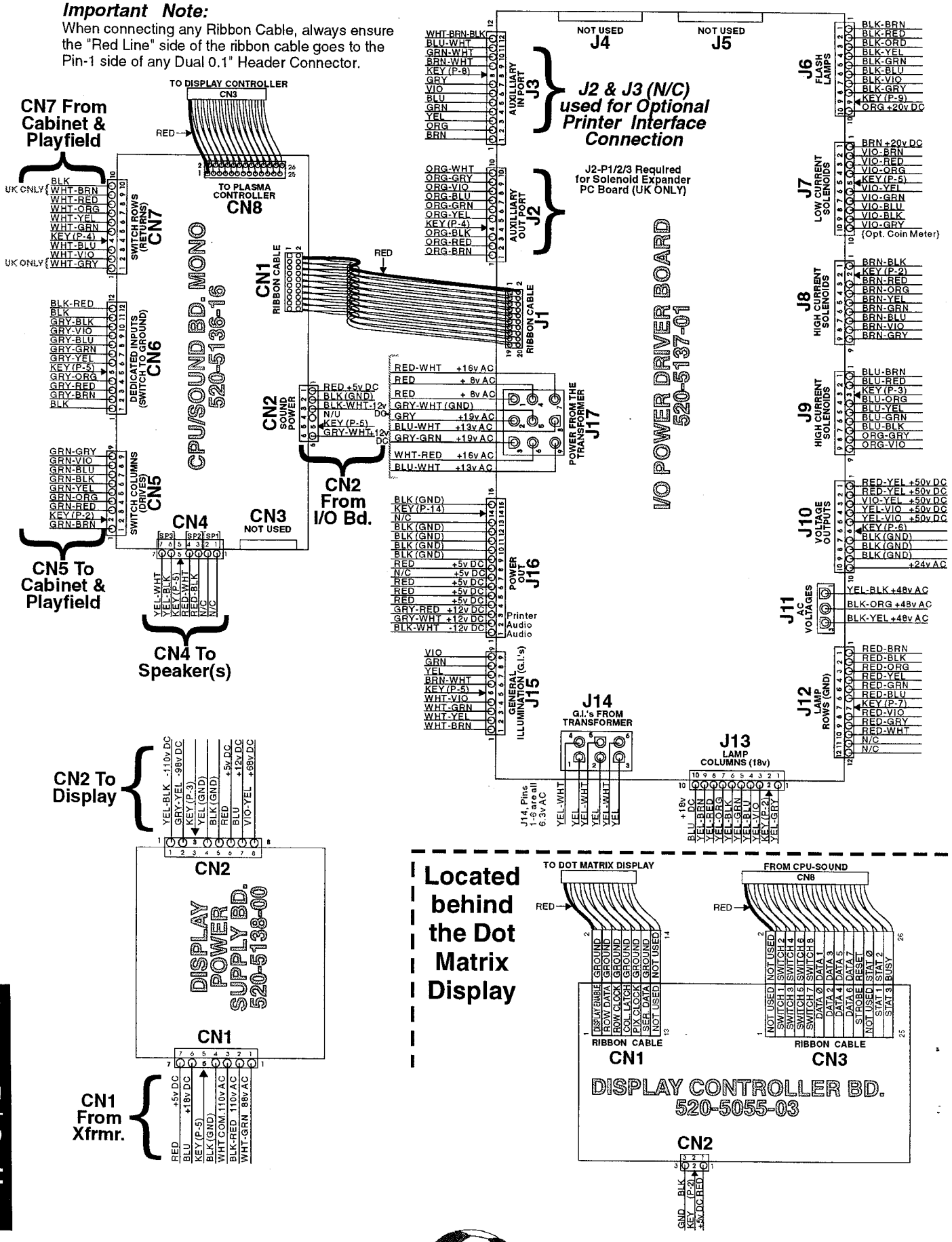
	Auxilliary (OPTIONAL UK ONLY)	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn
	AUX 1: LEFT UP/DOWN POST	Q1	Sol. Expander (Aux. Board)	WHT	CN2-P5	BRN	J7-P1	20v DC	28-1050 090-5046-00T
	AUX 2: CENTER UP/DOWN POST	Q2	Sol. Expander (Aux. Board)	RED	CN2-P4	BRN	J7-P1	20v DC	23-1100 090-5030-00T
	AUX 3: RIGHT UP/DOWN POST	Q3	Sol. Expander (Aux. Board)	ORG	CN2-P3	BRN	J7-P1	20v DC	28-1050 090-5046-00T

Backbox Wiring

Backbox I/O Power Driver Board Detailed Wiring Diagram

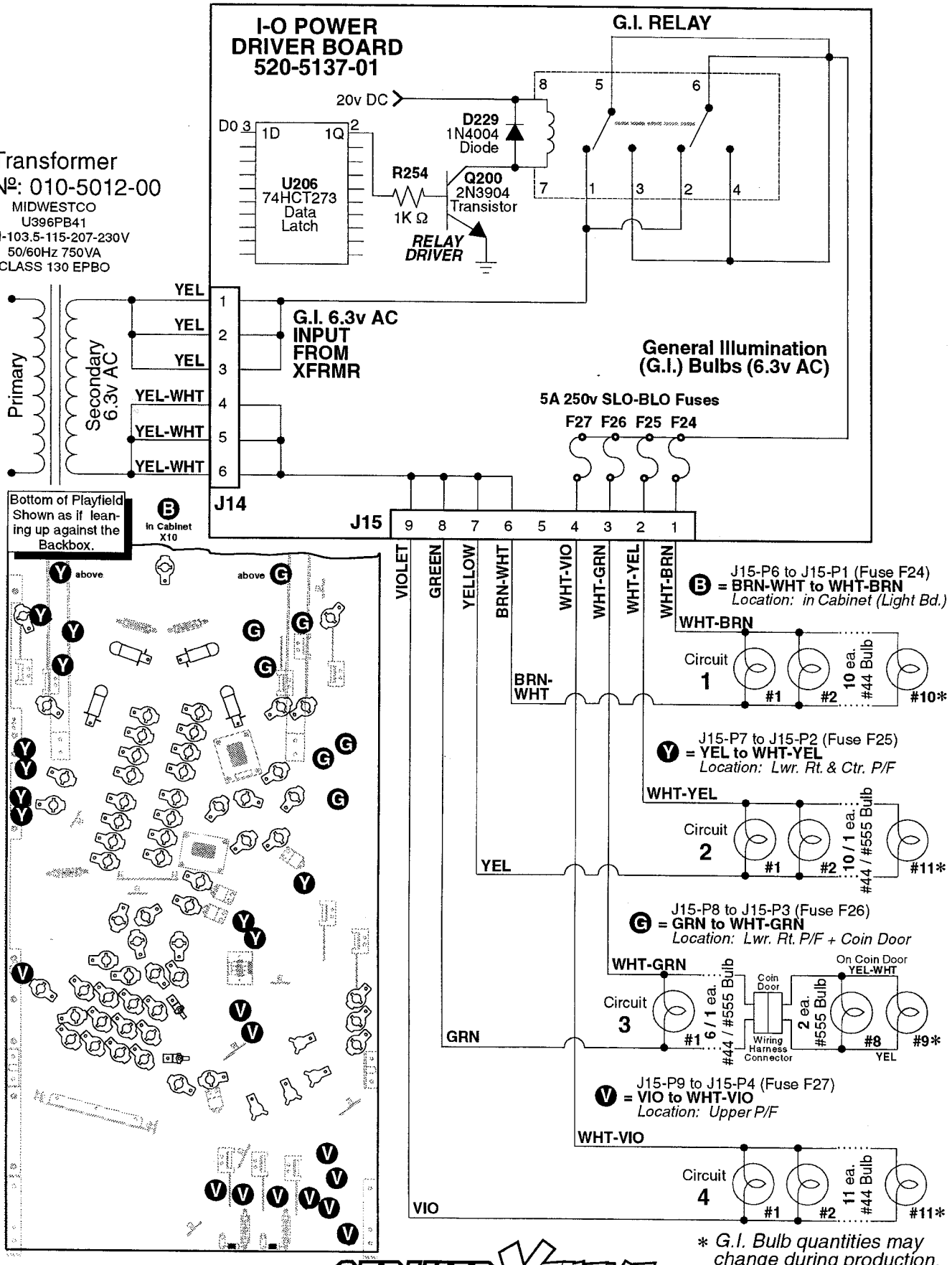


Important Note:
When connecting any Ribbon Cable, always ensure the "Red Line" side of the ribbon cable goes to the Pin-1 side of any Dual 0.1" Header Connector.



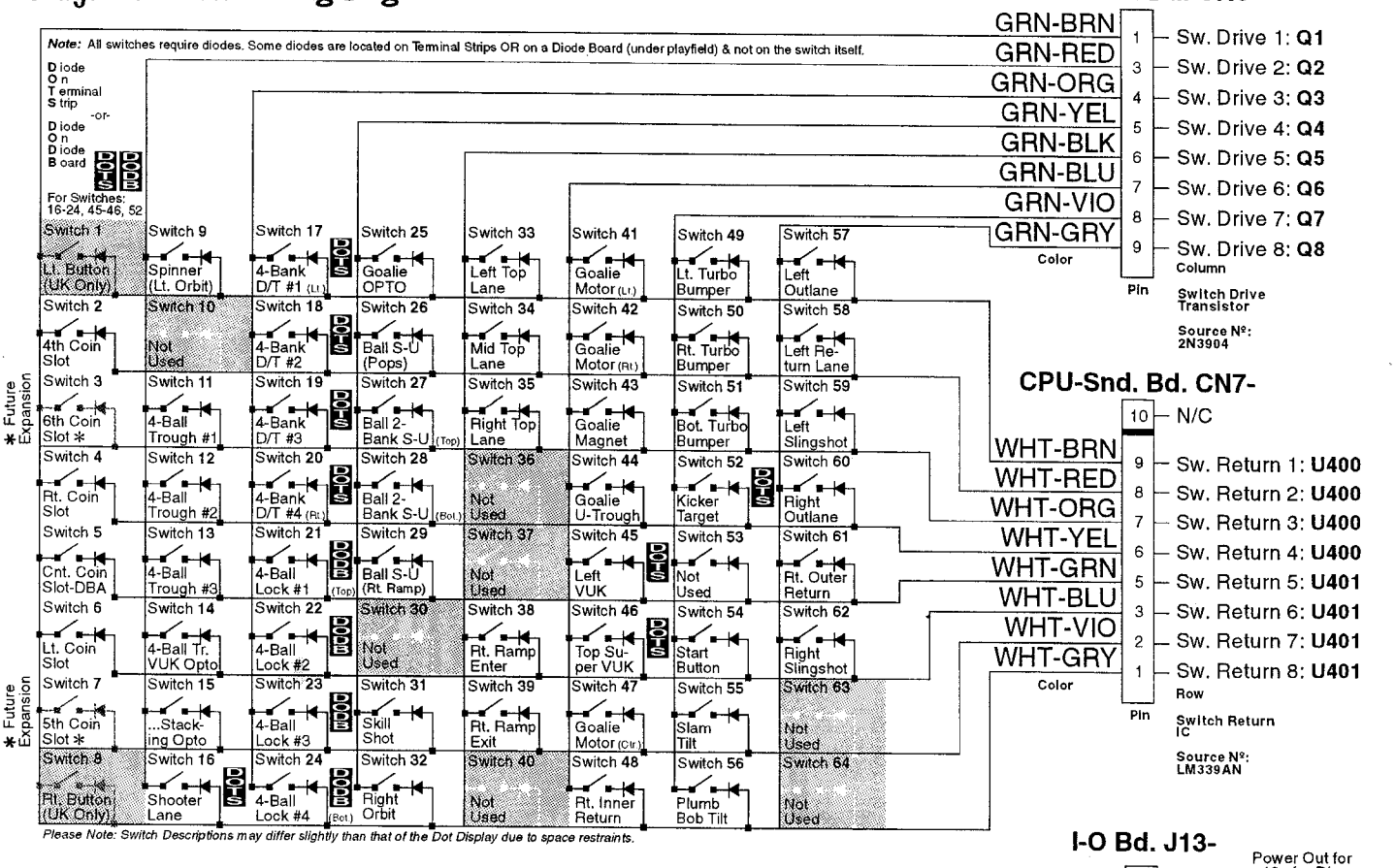
Playfield Wiring

General Illumination Circuit Detailed Wiring Diagram



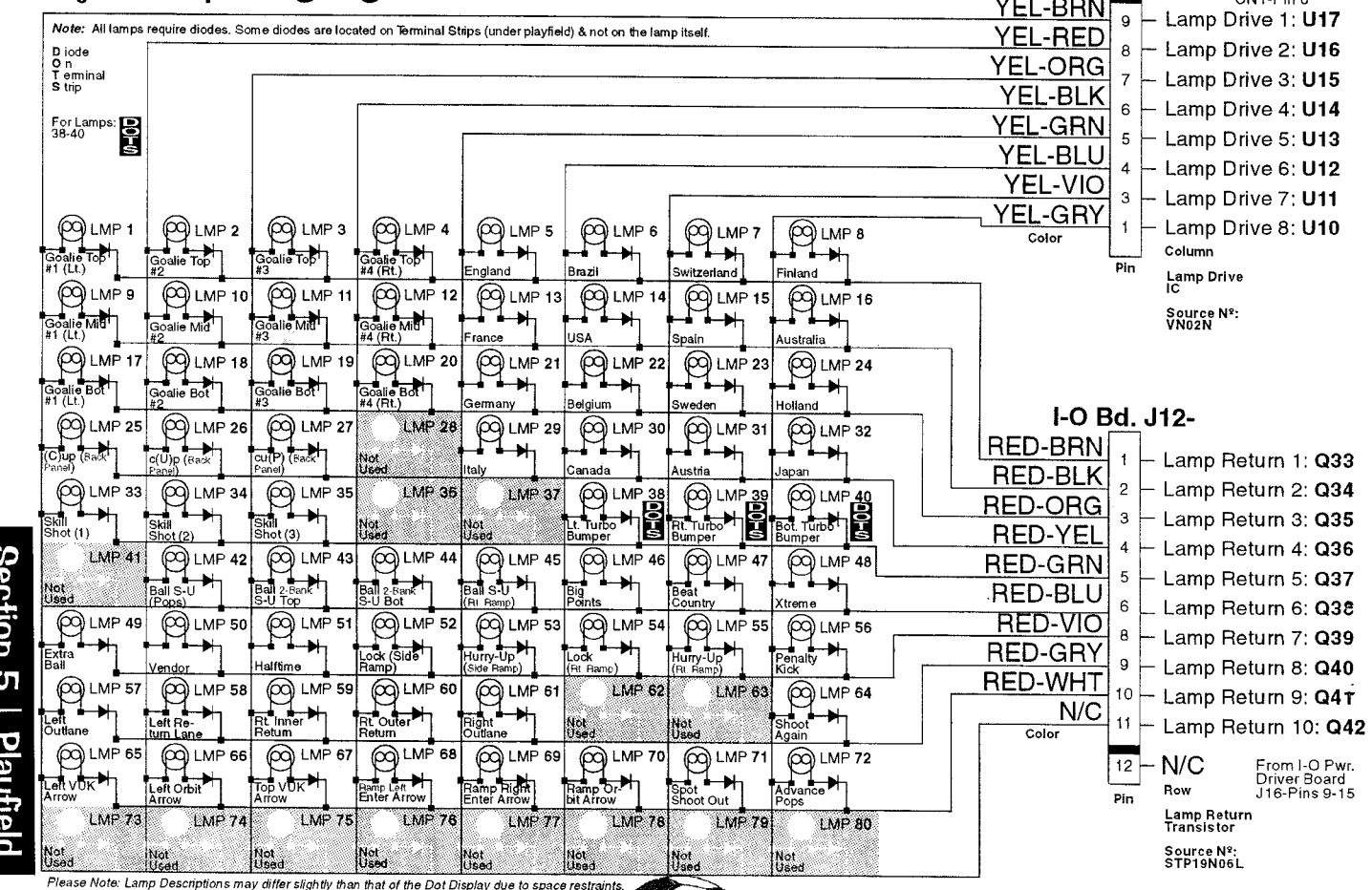
* G.I. Bulb quantities may change during production.

Playfield Switch Wiring Diagram

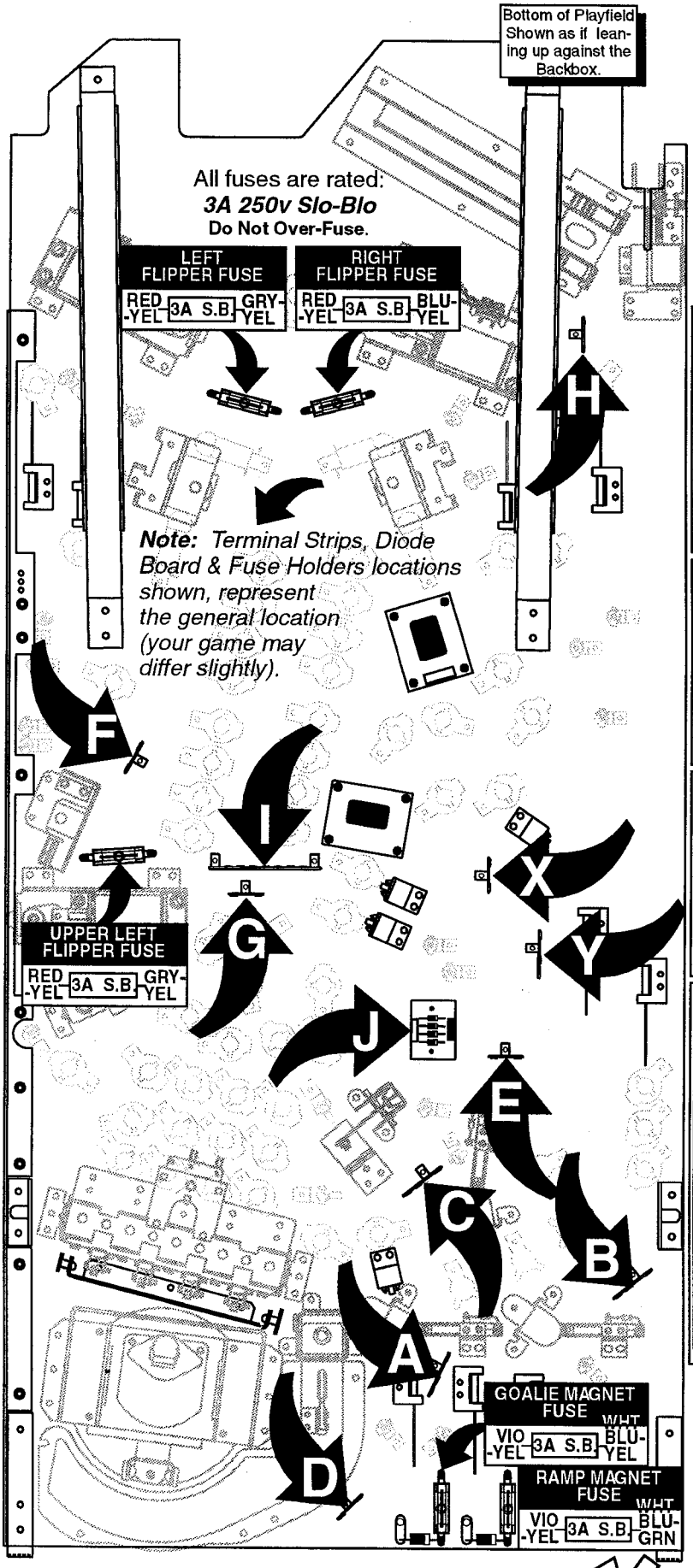


Please Note: Switch Descriptions may differ slightly than that of the Dot Display due to space restraints.

Playfield Lamp Wiring Diagram



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



Explanation:
All switches, lamps, coils require diodes. The diodes not physically located on the switch, lamp or coil are located on Terminal Strips or Diode Bd. under the playfield. The Switch & 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 Diode Board (noted by "**DODB**" meaning: "Diode on Diode Board"). There is one diode located per solder lug for the Magnet Fuse(s).

A Striker Xtreme Terminal Strip: Lamp 38: Left Turbo (Pop) Bumper

Lamp 38: YEL-BLU, BLK, RED-GRN

B Striker Xtreme Terminal Strip: Lamp 39: Right Turbo (Pop) Bumper

Lamp 39: YEL-VIO, BLK, RED-GRN

C Striker Xtreme Terminal Strip: Lamp 40: Bottom Turbo (Pop) Bumper

Lamp 40: YEL-GRY, BLK, RED-GRN

D Striker Xtreme Terminal Strip: Switch 46 Top Super VUK

Switch 46: WHT-BLU, ORG-BLU to GRN-BLU

E Striker Xtreme Terminal Strip: Switch 52 Kicker Target

Switch 52: WHT-YEL, ORG-YEL to GRN-VIO

F Striker Xtreme Terminal Strip: Switch 45 Left VUK

Switch 45: WHT-GRN, ORG-GRN to GRN-BLU

G Striker Xtreme Terminal Strip: Switch 20 4-Bank Drop Target #4 (Rt.)

Switch 20: WHT-YEL, ORG-YEL to GRN-ORG

H Striker Xtreme Terminal Strip: Switch 16 Shooter Lane

Switch 16: WHT-GRY, ORG-GRY to GRN-RED

X Striker Xtreme Terminal Strip: Coil 25 (Q25) Goalie Motor Driver Relay Bd.

Coil 25 (Q25): BLK-BRN, GRY-RED

I Striker Xtreme Terminal Strip: Sws. 17, 18 & 19: 4-Bank Drop Target (Lt.) #1, #2 & #3

Sw. 17: ORG-BRN to GRN-ORG, WHT-BRN
Sw. 18: ORG-RED to GRN-ORG, WHT-RED
Sw. 19: ORG to GRN-ORG, WHT-ORG

J Striker Xtreme Diode Board Pin-Out Wiring:

PIN-1, WHT-GRN
Sw. 21: Ball Lock #1 Top
PIN-2, WHT-BLU
Sw. 22: ...Ball Lock #2
PIN-3, WHT-VIO
Sw. 23: ...Ball Lock #3
PIN-4, WHT-GRY
Sw. 24: ...Ball Lock #4
PIN-5, KEY
PIN-6, GRN-ORG

This Side: 6-Pin Ribbon Connector to Switch Membrane
1 2 3 4 6
Diode Board 520-5146-00

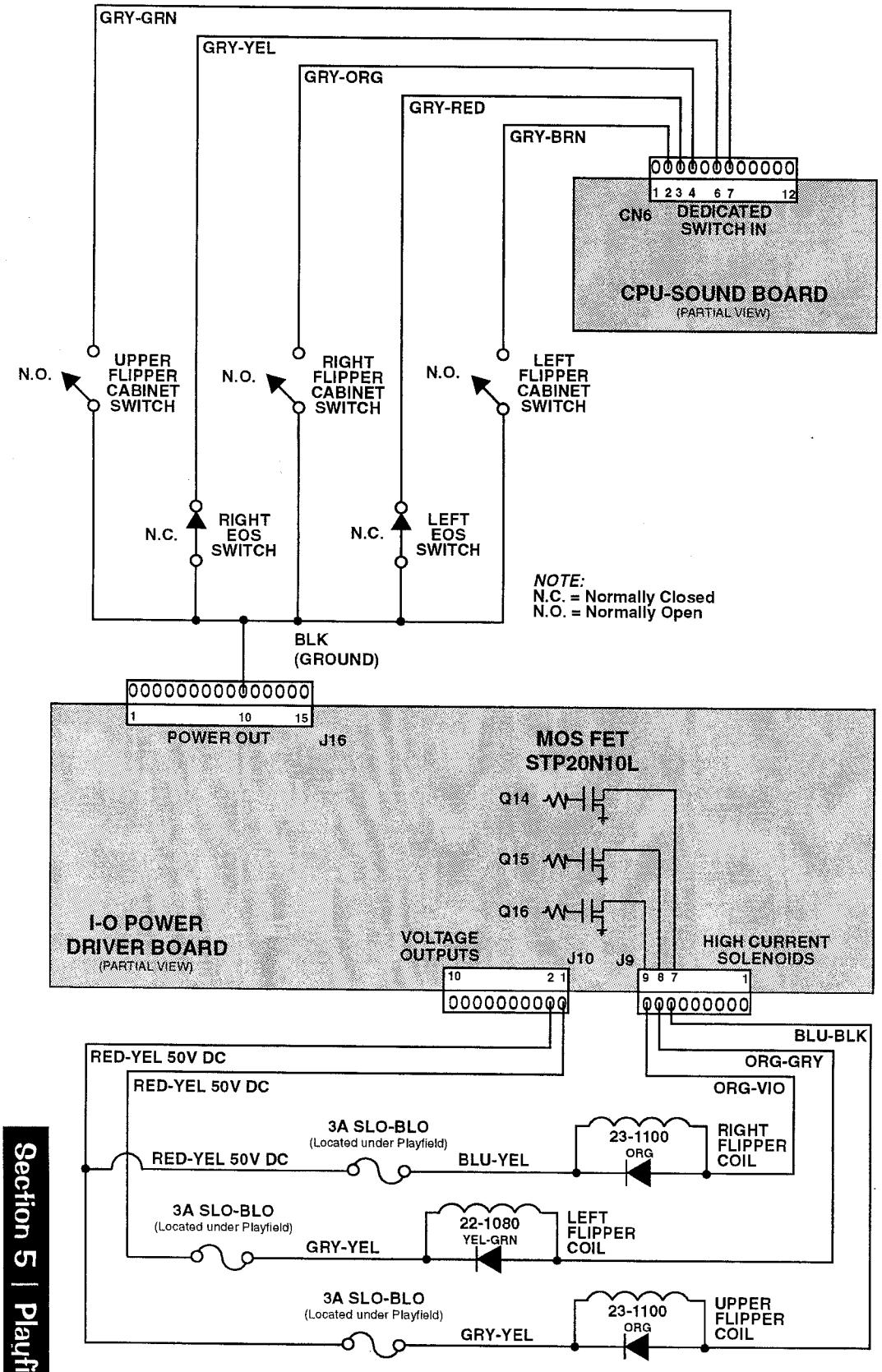
Y Striker Xtreme Terminal Strip Current Limiting Resistor for Relay Boards (1.2KΩ 5W)

YEL-BLK 18 gauge
18 gauge YEL-VIO
18 gauge YEL-BLK

See the Pink Pages, Playfield - General Parts (Below) (Page 52) for Terminal Strips, Diodes, Fuses and Fuse Holders Part Nºs.

3-Flipper Circuit Wiring Diagram

The **White Star Board System**™ has allowed us to *simplify* the *Flipper Circuit* to the point where we have *eliminated the Flipper Board* all together. The *Flipper Circuit* is now configured the same as any other Solenoid Drive Circuit.



Technical Overview

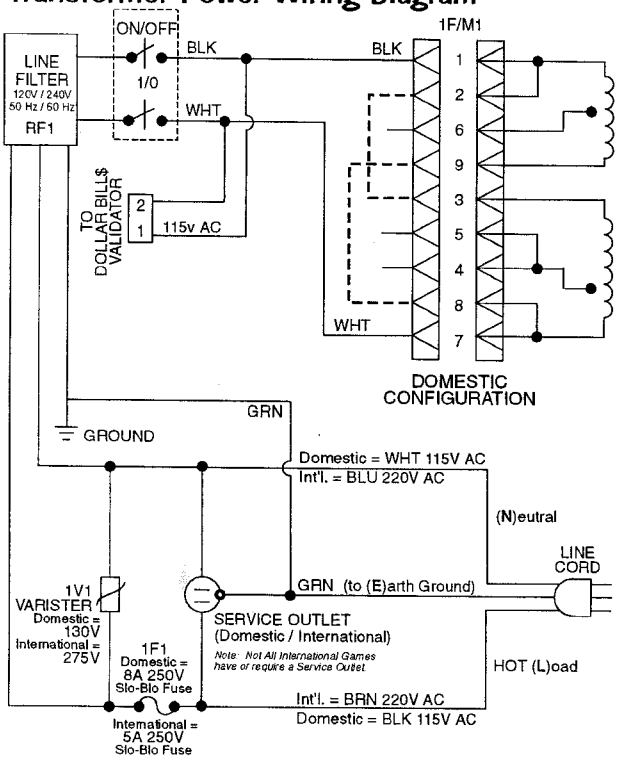
Our ***Flipper System*** uses one supply voltage (50v DC) for both ***kick*** & ***hold***. Once the **Game CPU** detects a Flipper Cabinet Switch closure (during game play) it applies a 40*msec* pulse to the gate of the Flipper Drive Transistor (STP-20N10L). If it continues to detect a Flipper Cabinet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

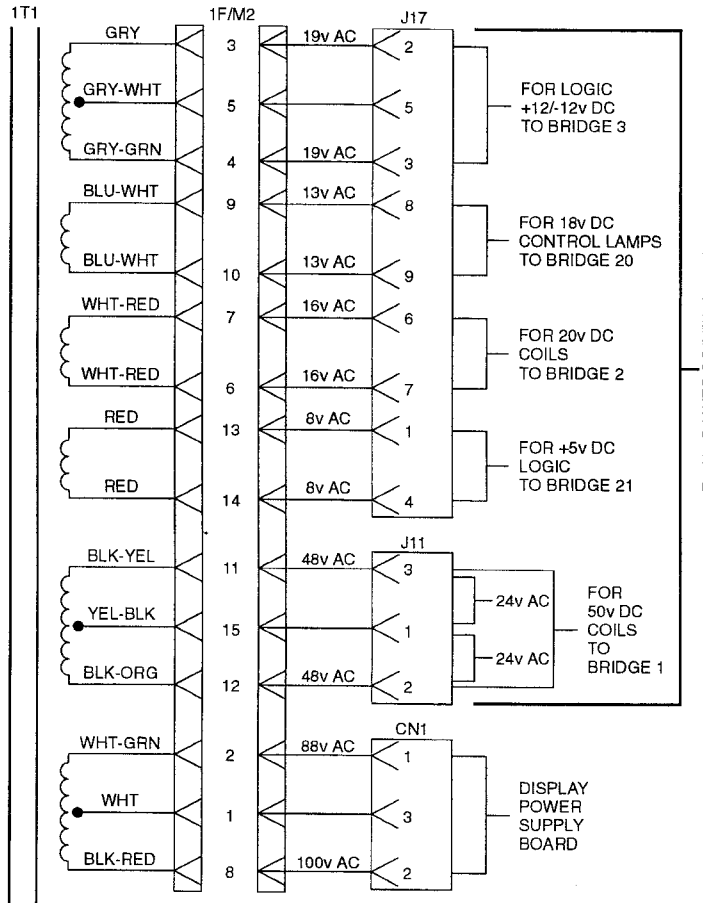
The **E.O.S.** (End-Of-Stroke) **Switch** serves the same function as before as it prevents foldback when the player has the flipper energized to capture balls. The **E.O.S. Switch** is a normally closed switch which opens approximately 1/16" when the flipper is energized. The **Game CPU** will detect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

Note: *If an Upper Flipper is used, the Flipper Button on the side of the Upper Flipper will have a* ***"Double-Stacked" E.O.S. Switch****. This allows the player to push the Flipper Button half-way down to energize only the Lower Flipper; pushing the Flipper Button all the way down will energize both the Lower & Upper Flippers.*

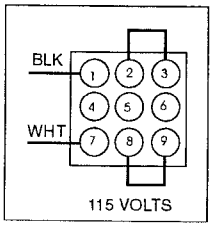
Cabinet Wiring

Transformer Power Wiring Diagram





JUMPERS FOR VOLTAGE VARIATION

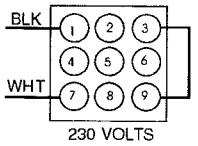


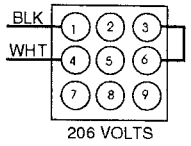
<<< CONFIGURATON FOR DOMESTIC 115V <<<

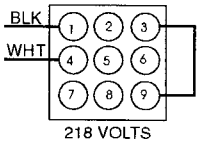
V V CONFIGURATION OF 220V V V
V V OR LOWER LINE VOLTAGES V V
V V FOR INTERNATIONAL USE V V

EXPORT/ HIGH LINE VOLTAGE
230/218/206 VOLTS

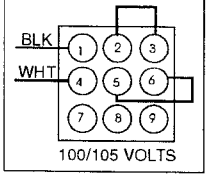
1F1= 5A 250V SLO BLO
1V1= 275V VARISTOR





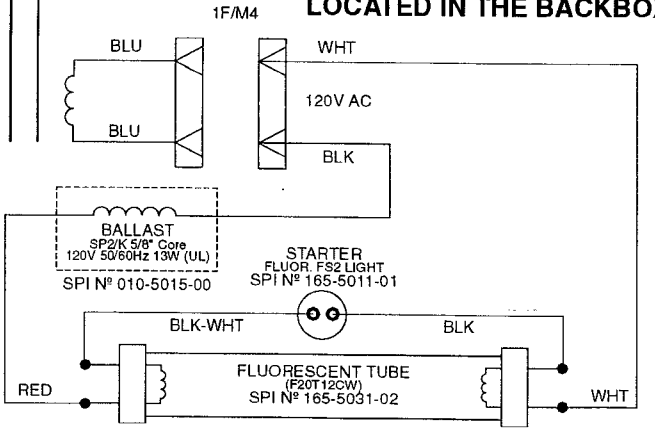


1F1= 8A SLO BLO
1V1= 130V VARISTOR



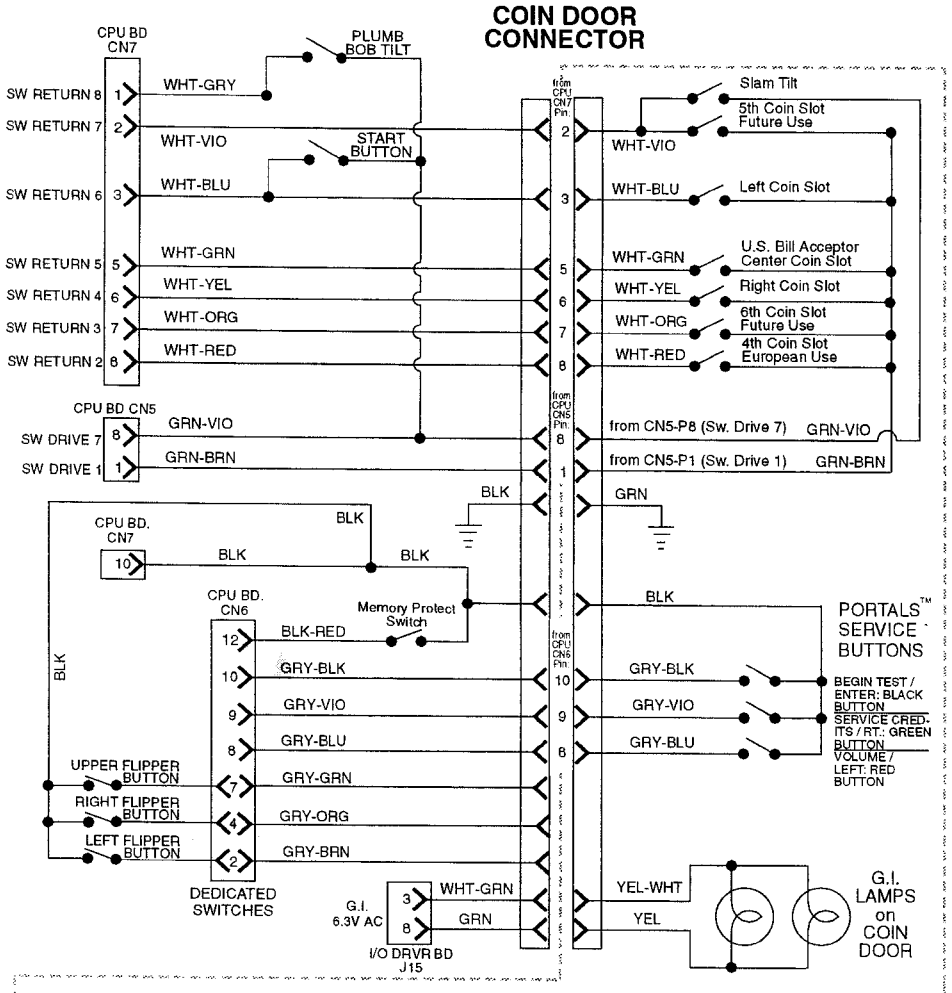
<<< CONFIGURATON FOR JAPAN or LOW LINE VOLTAGE <<<

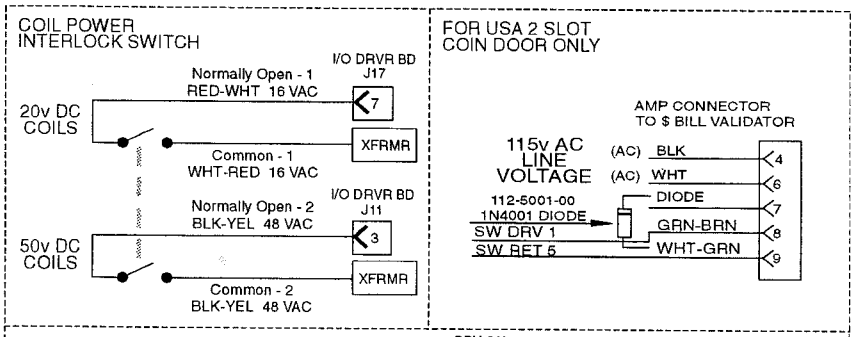
LOCATED IN THE BACKBOX

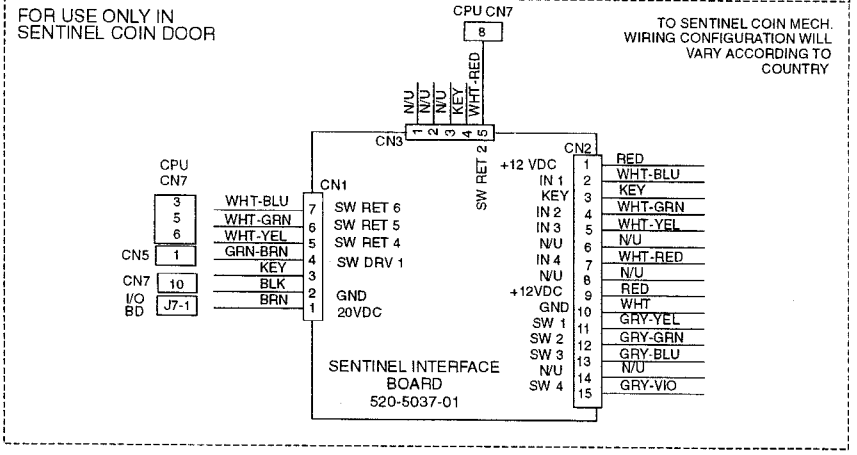


FLUORESCENT TUBE, STARTER & BALLAST IN THE BACKBOX

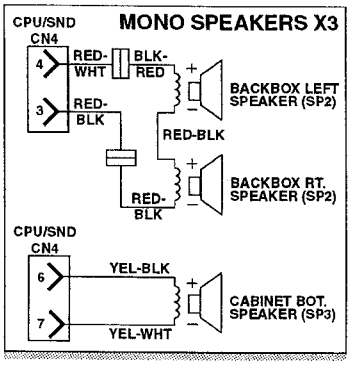
Cabinet / Coin Door Wiring Diagram

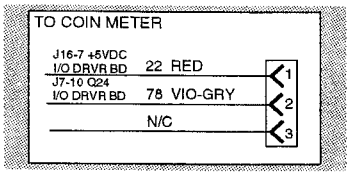


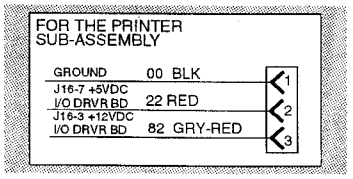


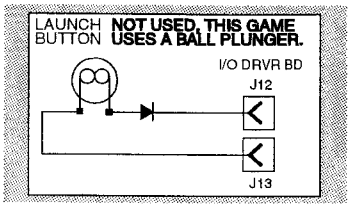


COIN DOOR

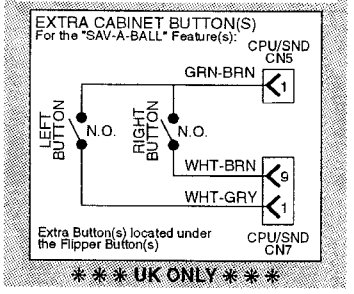






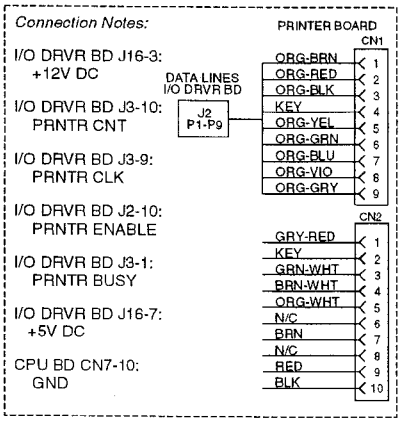


UK uses the Extra **Left** Button to operate the Left Outlane Ball Deflector.
UK uses the Extra **Right** Button to operate the Right Outlane Ball Deflector.
UK uses both Extra **Lt. & Rt.** Buttons to operate the Up/Down Center Post.



PRINTER INTERFACE OPTIONAL

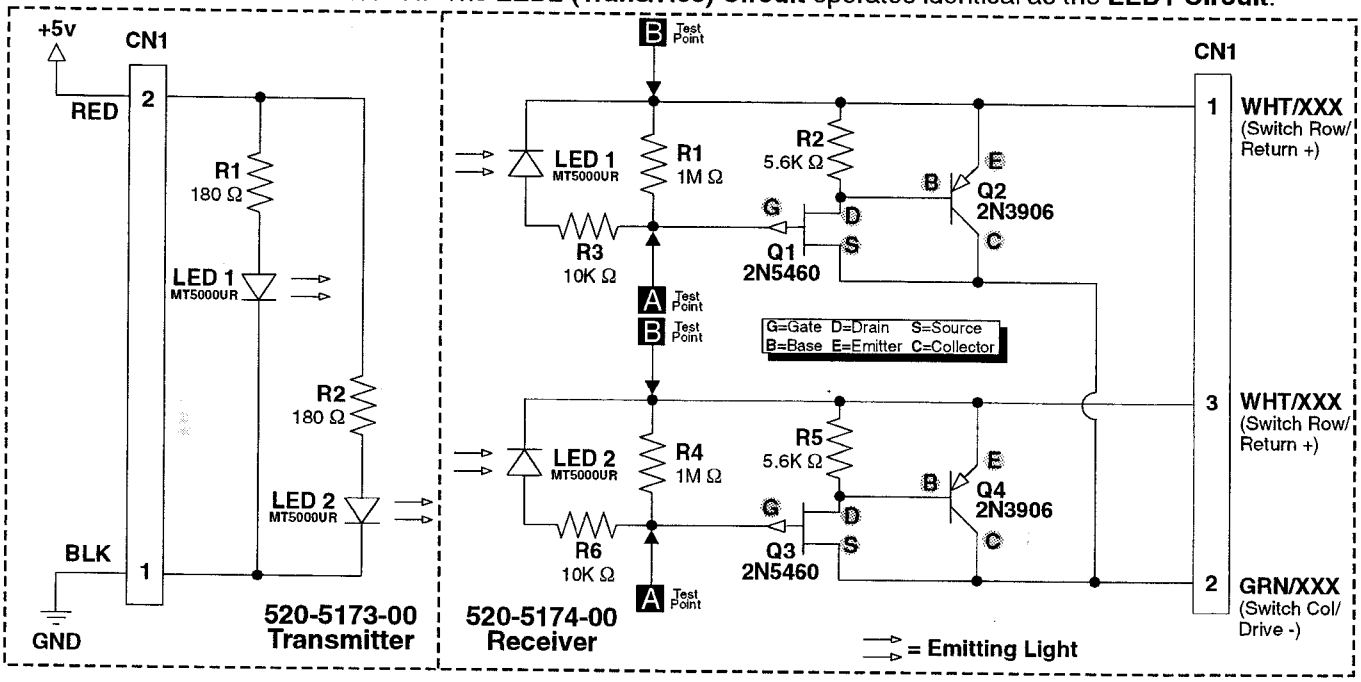
Cable Wiring Harness SPI Part Nº:
036-5408-00
RS-232 Printer Interface Board SPI Part Nº:
520-5069-00



Printed Circuit Boards (PCBs)

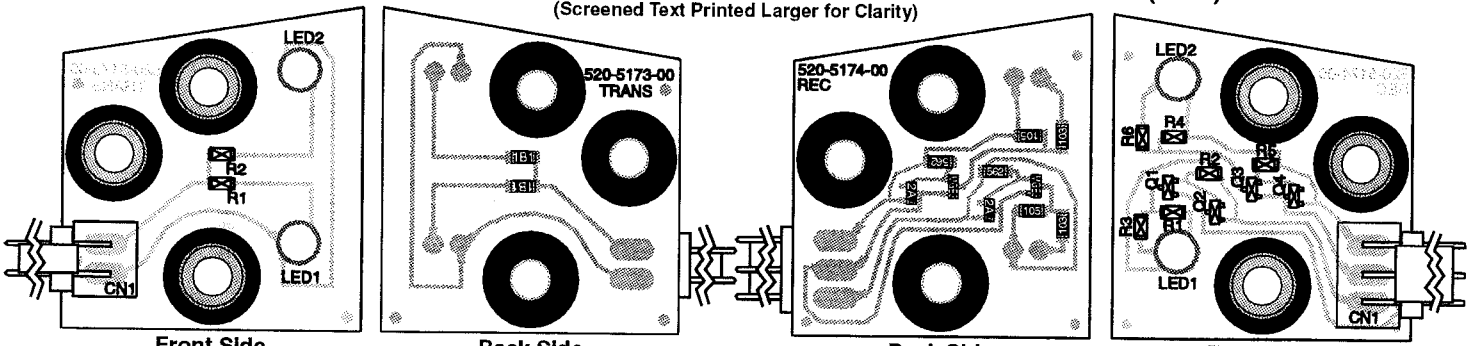
Trough Up-Kicker Dual OPTO Boards Theory of Operation & Schematic

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



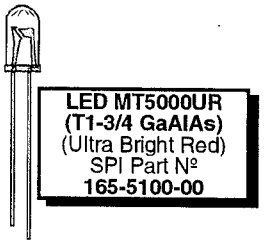
Trough Up-Kicker Dual OPTO Boards Component Layout & Parts

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



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

ITEM	QTY	PART NUMBER	REF-DESIGNATOR
A	**1**	**515-0173-00**	**Dual-OPTO Trans. Bd. Assy.**
—	**1**	**520-5173-00**	**Dual-OPTO Trans. Bd.**
1	2	165-5100-00	LED1, LED2
2	2	121-5067-00	R1, R2
3	1	045-5111-02	CN1
4	3	545-5518-00	n/a
5	3	530-5308-02	n/a
B	**1**	**515-0174-00**	**Dual-OPTO Rec. Bd. Assy.**
—	**1**	**520-5174-00**	**Dual-OPTO Rec. Bd.**
1	2	165-5100-00	LED 1, LED 2
2	2	121-5068-00	R1, R4
3	2	121-5069-00	R2, R5
4	2	121-5011-00	R3, R6
5	2	110-5006-00	Q1, Q3
6	2	110-0086-00	Q2, Q4
7	1	045-5111-03	CN1
8	3	545-5518-00	n/a
9	3	530-5308-02	n/a



LED MT5000UR
(T1-3/4 GaAlAs)
(Ultra Bright Red)
SPI Part Nº
165-5100-00

DESCRIPTION

PCB Assy. (with all **Items 1-5**)
PCB Assy. (with **Items 1-3** only)
LED MT5000UR (Ultra Bright Red)
180 Ω 1/8W Chip Res. (CRCW)
2X, .156" Rt. Angle (26-60-5020) Conn.
OPTO PCB Rubber Grommet
OPTO PCB Brass Tube Spacer
PCB Assy. (with all **Items 1-9**)
PCB Assy. (with **Items 1-7** only)
LED MT5000UR (Ultra Bright Red)
1M Ω 1/8W Chip Res. (CRCW)
5.6K Ω 1/8W Chip Res. (CRCW)
10K Ω 1/8W Chip Res. (CRCW)
2N5460, Transistor (P-FET SOT-23)
2N3906, Transistor
3X, .156" Rt. Angle (26-60-5030) Conn.
OPTO PCB Rubber Grommet
OPTO PCB Brass Tube Spacer

OPTO Troubleshooting

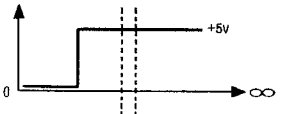
1. Volt Meter Test (indicates normal operating condition):

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 previos page, 520-5174-00 Receiver Side). It should read approximately 0.8 - 1.2v DC. The **LED2 Circuit** operates the same.

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

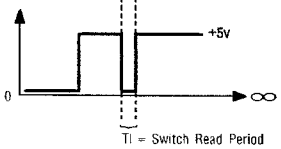
2. Oscilloscope Test (indicates normal operating condition):

Fig. A



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.

Fig. B



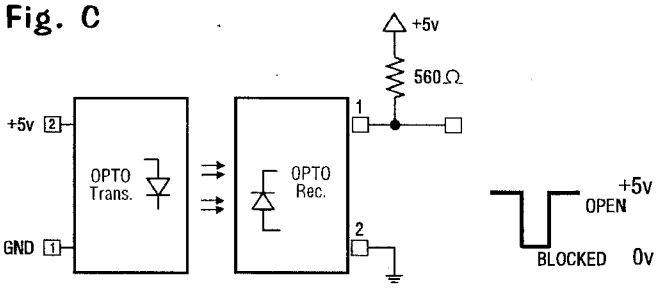
B. **CLOSED OPTO** (Light Blocked) = *SWITCH CLOSED.* Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (see Schematic). The Scope should display a **PULSE STREAM** indicating **Q2** has switched "On" as shown in **Fig. B**, Wave Form Diagram. This is your Switch Drive Pulse.

3. Bench Test (See Fig. C):

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

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

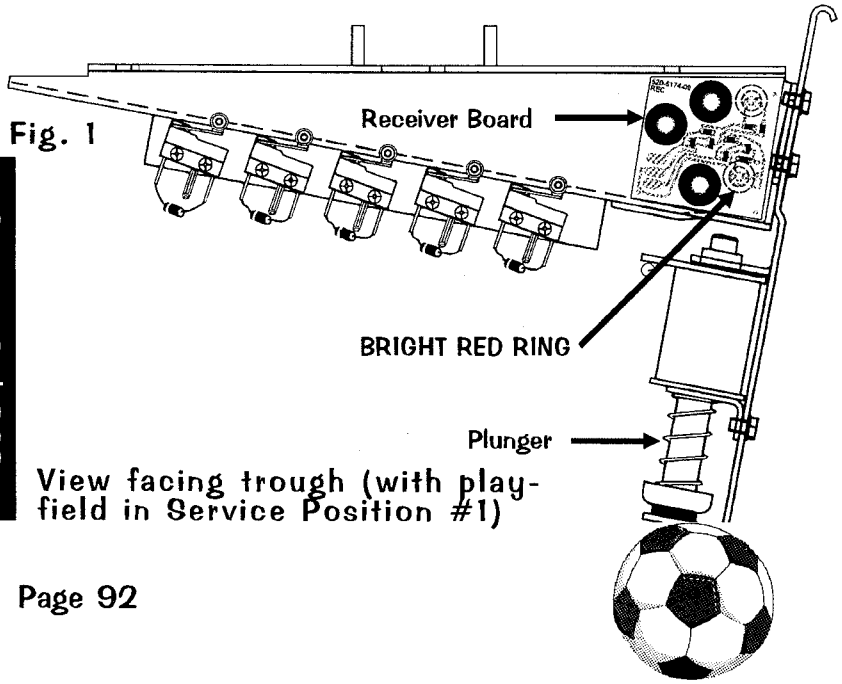
Fig. C



Trough Dual OPTO Boards Alignment / Test for LED1

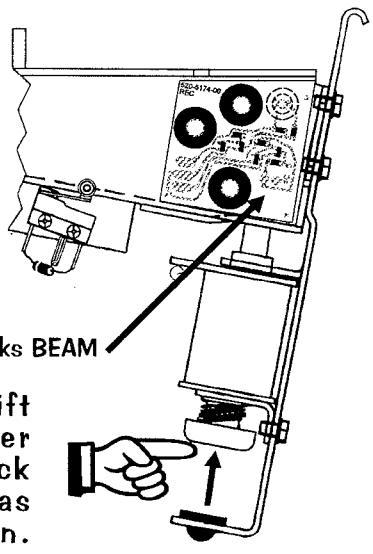
When a working **OPTO** is installed and connected in a game, the transmitter should light (LED1 lower & LED2 upper) when the power is switched on. With the playfield in Service Position #1 (playfield lifted up in the half-way position resting on the Prop Rod or edge slide support brackets) and the game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

Fig. 1

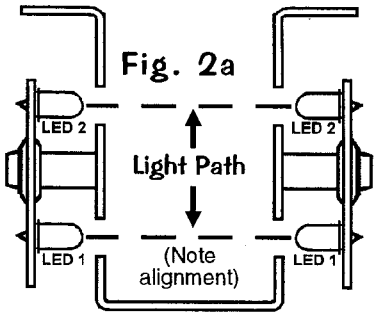


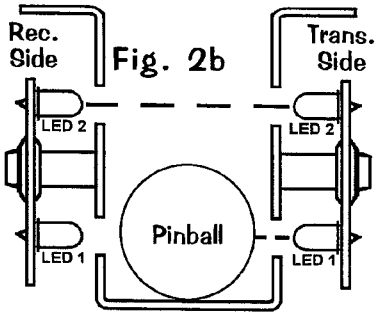
View facing trough (with playfield in Service Position #1)

Fig. 2



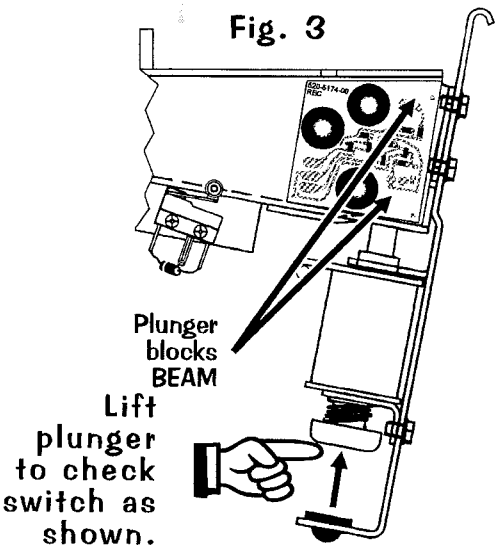
Sectional view from right (Fig. 2a & 2b)

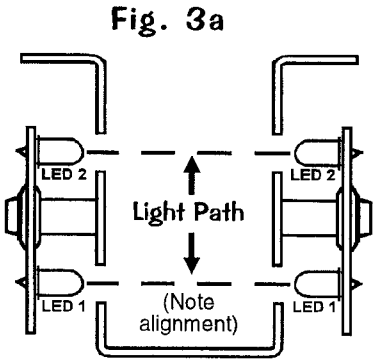


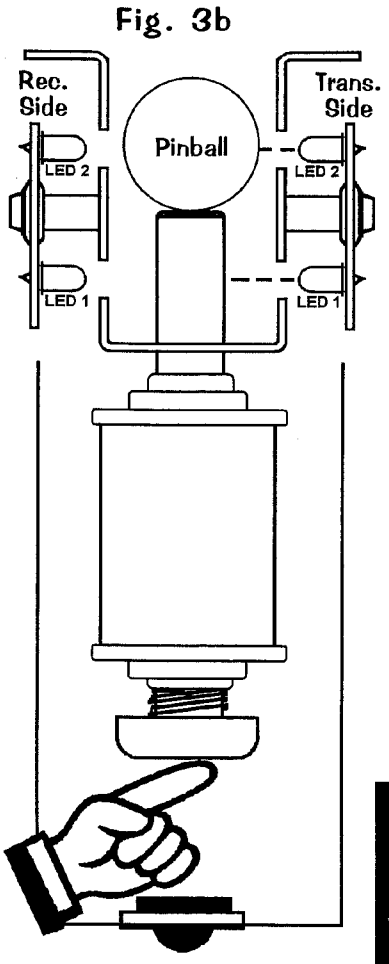


Trough Dual OPTO Boards Alignment / Test for LED2

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







I M P O R T A N T

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

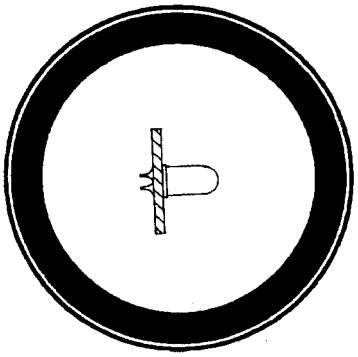


Fig. 4a
Correct Position

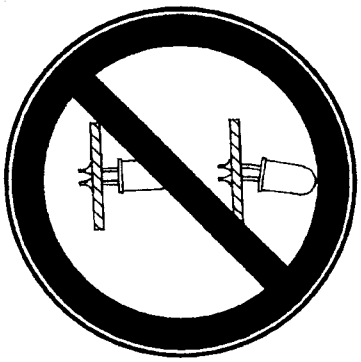
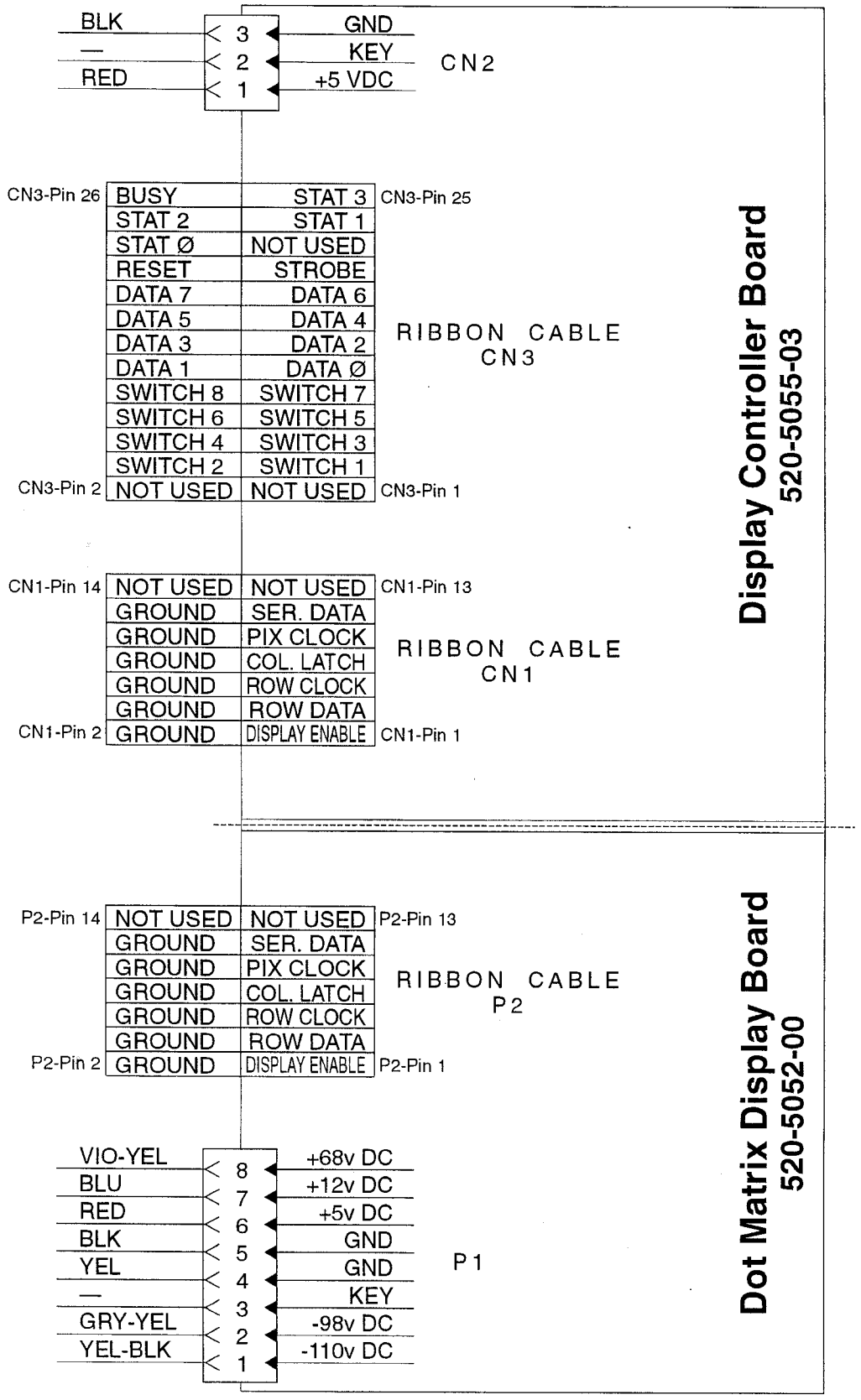
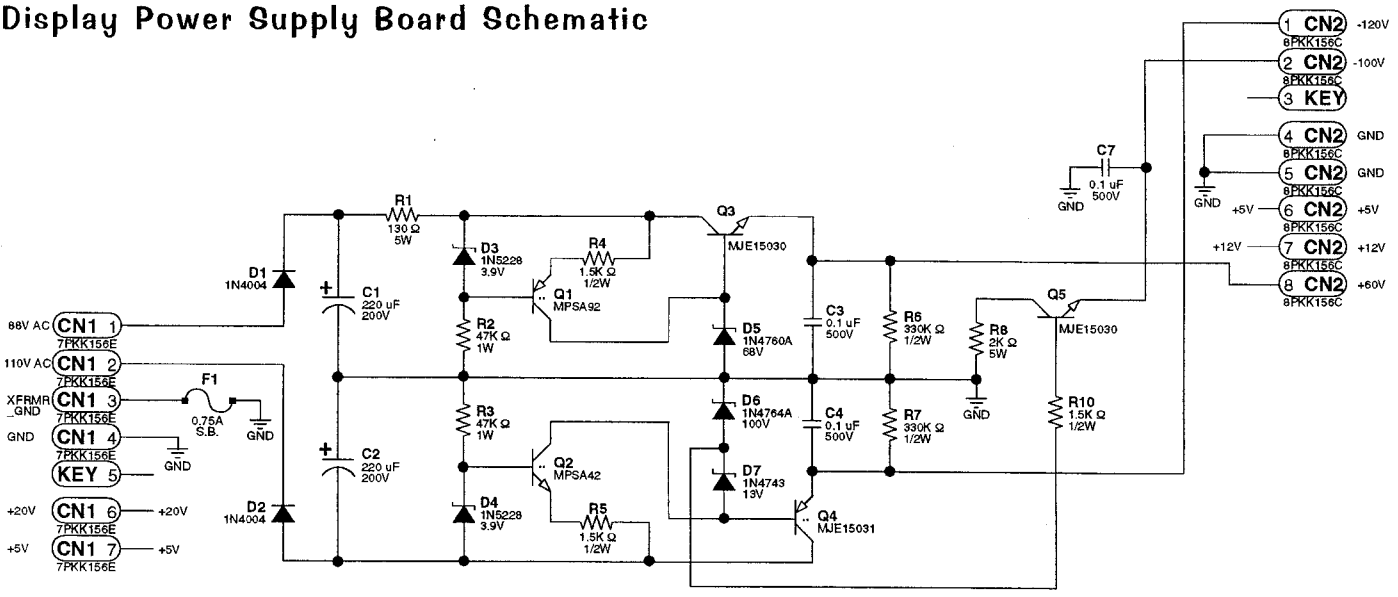


Fig. 4b
Incorrect Position

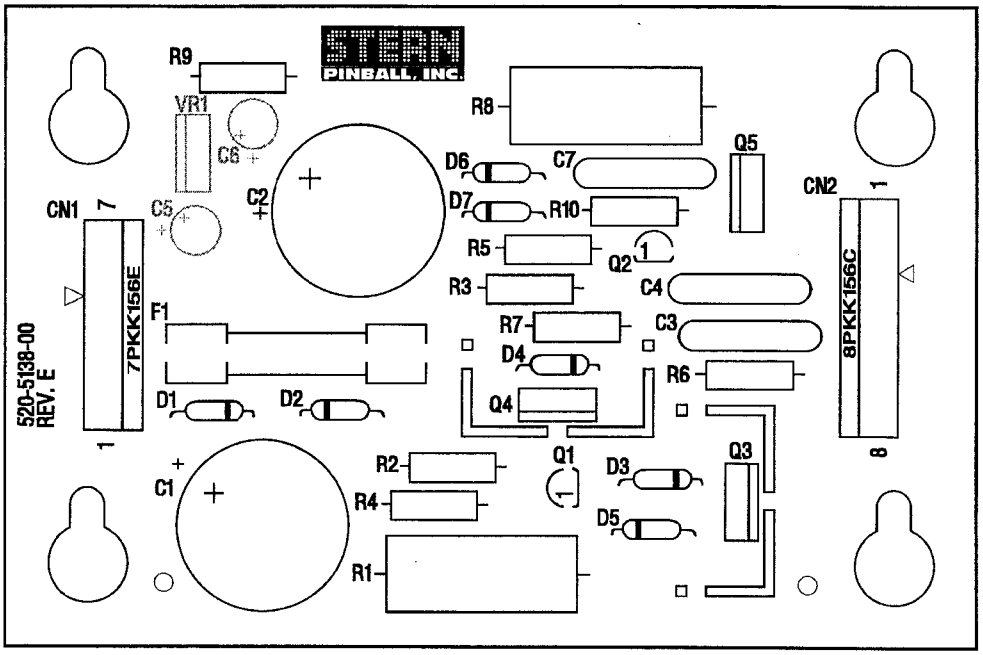
Dot Matrix Display/Display Controller Bd. Combined Display Connections



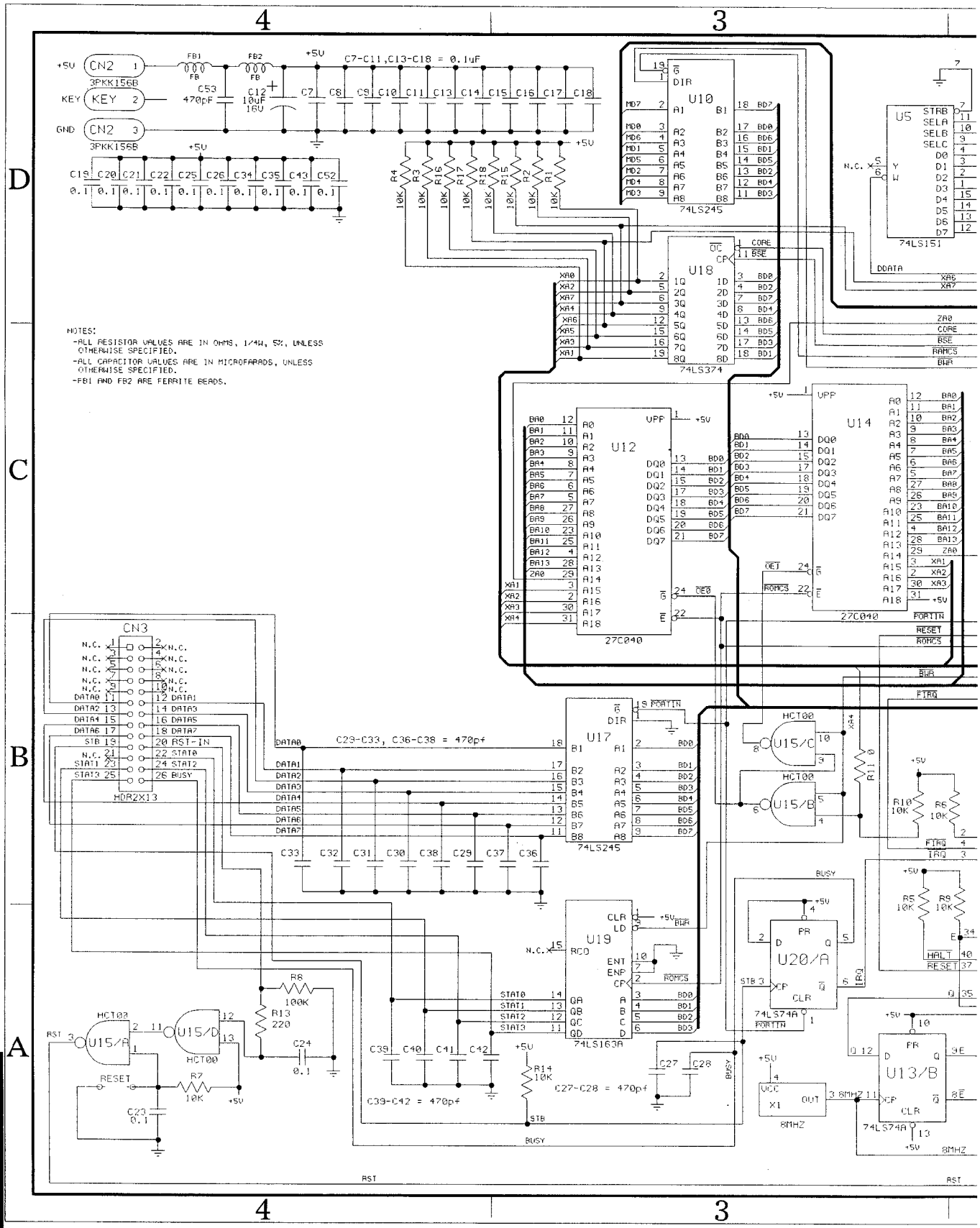
Display Power Supply Board Schematic

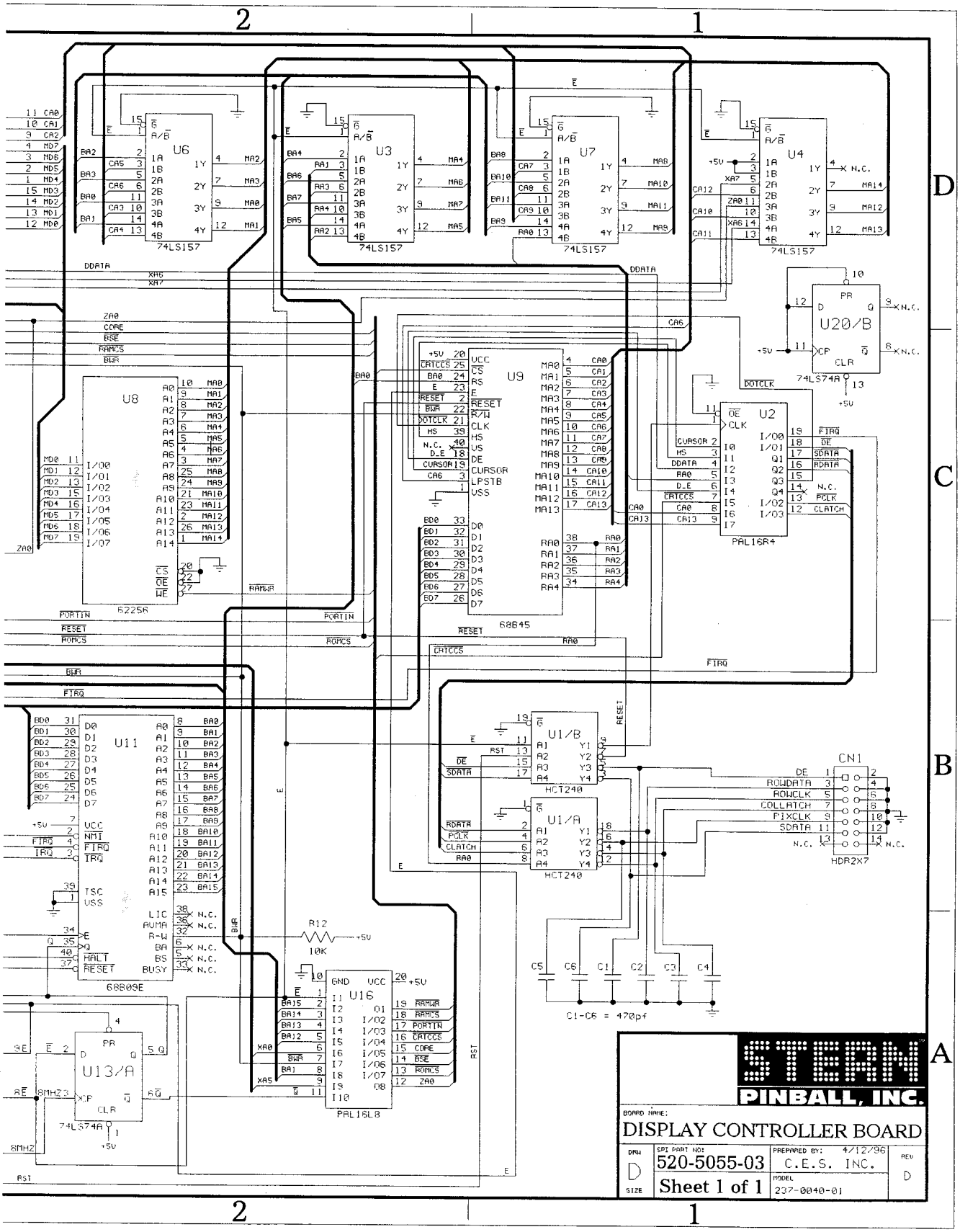


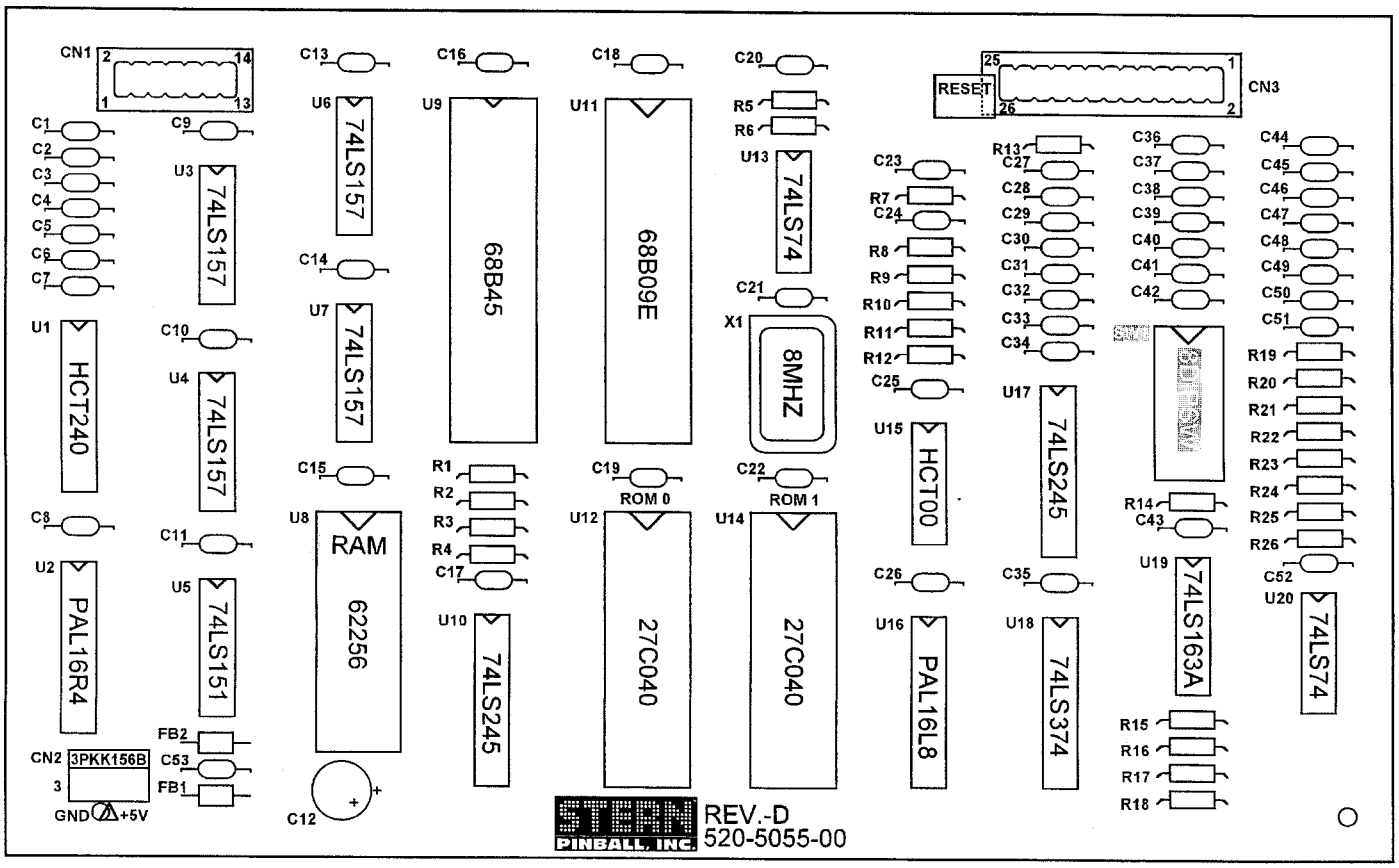
Display Power Supply Board Component Layout & Parts



ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	1	**520-5138-00**	**Display Power Supply Board**	**Complete PCB Assembly**
1	1	200-5000-17	F1	3/4A (0.75A) S.B. Fuse
2	2	535-5000-11	Q3, Q4	Heatsinks - AAVID #563002
3	2	125-5044-00	C1, C2	220uF, 200v, Radial Lytic Cap.
4	4	121-5038-00	R4, R5, R9, R10	1.5K Ω 1/2W Res. (R9: NS)
5	2	121-5059-00	R6, R7	330K Ω 1/2W Res.
6	2	121-5060-00	R2, R3	47K Ω 1W Res.
7	1	121-5061-00	R1	130 Ω 5W Res.
8	1	121-5062-00	R8	2K Ω 5W Res.
9	2	112-0053-00	D3, D4	1N5228, 3.9v, Diode
10	1	112-0062-00	D5	1N4760A, 68v, Diode
11	1	112-0049-00A	D6	1N4764A, 100v, Diode
12	1	112-0061-00	D7	1N4743, 13v, Diode
13	1	110-0100-00	Q1	MPSA92, Transistor
14	1	110-0082-00	Q2	MPSA42, Transistor
15	3	125-5035-00	C3, C4, C7	0.1uF, 500v, Ceramic Disk Cap.
16	1	110-0103-00	Q4	MJE15031, Transistor
17	2	110-0101-00	Q3, Q5	MJE15030, Transistor
18	0	125-5003-00	C5, C6	22uF, 25v, Rad Lytic Cap (C5, C6: NS)
19	0	124-5003-00	VR1	78L12CT (VR1: NS)
20	1	045-5015-08	CN2	8PKK156 (PIN3=KEY)
21	2	112-5003-00	D1, D2	1N4004, Diode
22	1	045-5015-07	CN1	7PKK156E (PIN5=KEY)
23	2	240-5008-00	Q3, Q4	6/32 KEPS Nut
24	2	237-5501-00	Q3, Q4	6/32 X 3/8" PPH Screw
25	2	205-0004-00	F1	Fuse Clips


NOTES:
-ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
-ALL CAPACITOR VALUES ARE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.
-FB1 AND FB2 ARE FERRITE BEADS.
C7-C11,C13-C18 = 0.1uF
C29-C33, C36-C38 = 470pF
C39-C42 = 470pF
C27-C28 = 470pF
U10
74LS245
U18
74LS374
U12
27C040
U14
27C040
U17
74LS245
U19
74LS163A
U20/A
74LS74A
U13/B
74LS74A
U15/A
U15/B
U15/C
U15/D
HCT00
U5
74LS151
CN2
CN3
HDR2X13
X1
8MHZ


U6
U3
U7
U4
74LS157
U8
6225R
U9
68B45
U20/B
74LS74A
U2
PAL16R4
U11
68B09E
U1/B
U1/A
HCT240
CN1
HDR2X7
R12
10K
U16
PAL16L8
U13/A
8MHZ
C1-C6 = 470pf
STERN
PINBALL, INC.
BOARD NAME:
DISPLAY CONTROLLER BOARD
SPI PART NO:
520-5055-03
PREPARED BY:
C.E.S. INC.
4/12/96
Sheet 1 of 1
MODEL
237-0040-01
SIZE
D
REV
D



ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	1	**520-5055-03**	**Display Controller Board (FCC FEB98)**	**Complete PCB Assembly**
1	2	077-5217-00	U12, U14	32-Pin, IC Dip Socket
2	1	100-0397-00	U8	32K X 8 Static RAM (62256L-10PC)
3	1	100-0189-01	U11	68B09E
4	1	100-0233-00	U9	68B45
5	1	100-0351-00	U15	74HCT00
6	1	100-5001-00	U1	74HCT240
7	1	100-5000-00	U5	74LS151
8	4	100-0046-00	U3, U4, U6, U7	74LS157
9	1	100-0049-00	U19	74LS163A
10	2	100-0058-00	U7, U10	74LS245
11	1	100-0064-00	U18	74LS374
12	2	100-0037-00	U13, U20	74LS74
13	1	965-0107-00	**U16 - ORANGE DOT** (Note the type of PAL)	PAL16L8 (15CN), (Programmed) **- ORANGE DOT**
14	1	965-0108-00	**U2 - ORANGE DOT** (Note the type of PAL)	PAL16R4 (25CN), (Programmed) **- ORANGE DOT**
15	23	125-5031-00	C7>C11, C13>C26, C34, C35, C43, C52	.1 uF, (104), Axial Cer. Cap
16	1	121-5051-00	R8	100K Ω 1/4W C.F. Res. 5%
17	15	121-5011-00	R1>R7, R9, R10, R12, R14>R18	10K Ω 1/4W Res. 5%
18	1	121-5014-00	R13	220 Ω 1/4W C.F. Res. 5%
19	0	n/a	R19>R26	(R19>R26: NS)
20	21	125-5028-00	C1>C6, C27>C33, C36>C42, C44>C51, C53	470pF, (471), Axl. Cap (C44>C51: NS)
21	2	n/a	FB1, FB2	Ferrite Bead (2743001182)
22	1	125-5015-00	C12	100uF, 25v, Cap. (Radial Elec.)
23	1	045-5015-26	CN3	13-Pin, Dual Row .1" HDR Conn.
24	1	045-5015-03	CN2	3-Pin, KK-156 Conn. (540445-3)
25	1	045-5015-02	CN1	7-Pin, Dual Row .1" Hdr. Conn.
26	1	140-0013-00	X1	8Mhz Clock Oscillator
27	0	Not Used	SW1	(SW1: NS)
28	1	(See Pg. **DR. ❸** Table)	U12 U14 (ROM 0)	4MB ROM (U14: NS)
29	1	n/a	U1 (@ Pins 9 & 10)	100pF, Cap.

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

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

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

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

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

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

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

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

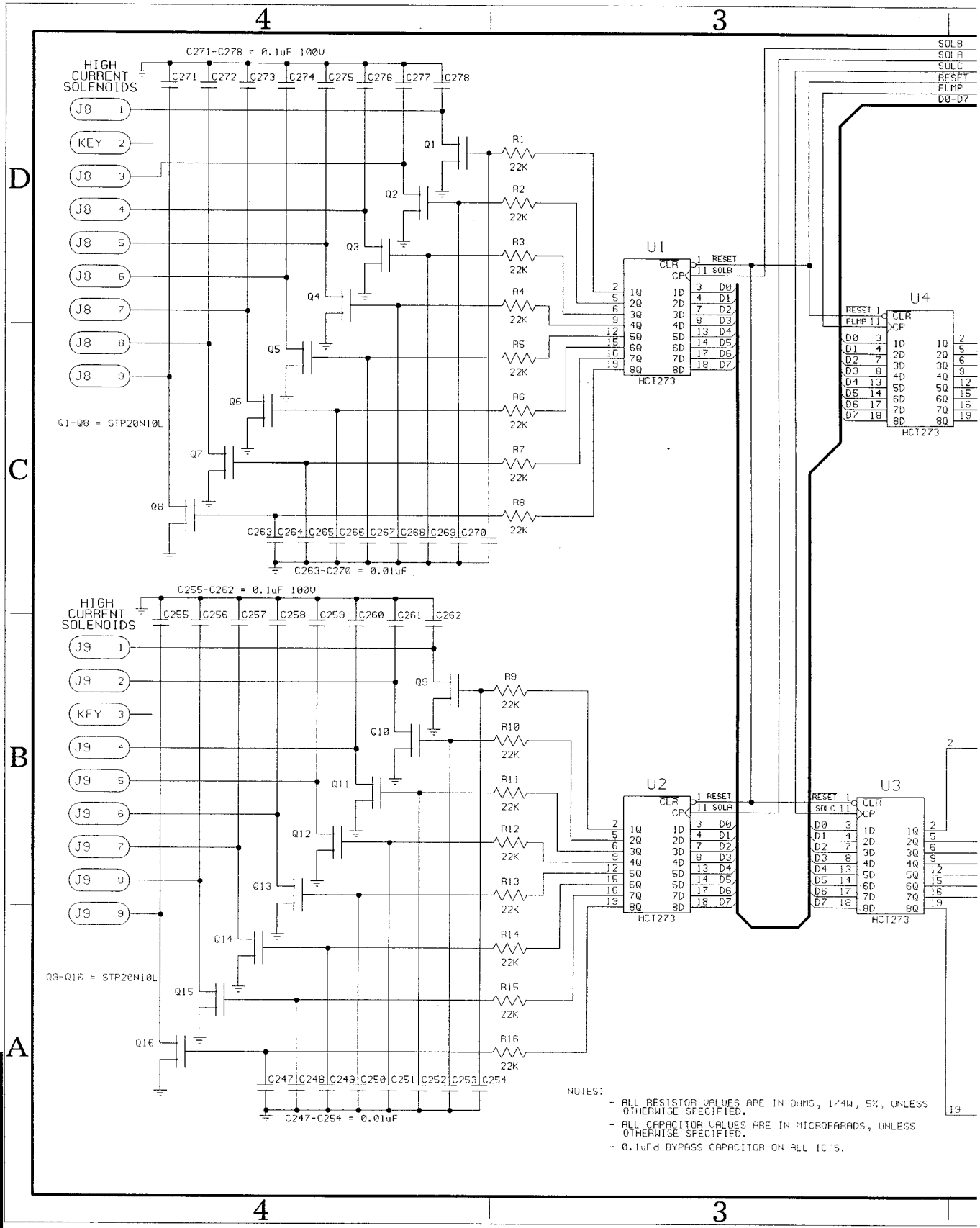
Solenoid (Coil) Drivers & Flash Lamps:
J8 & **J9** are high side drivers for driving solenoids and other heavy loads. Each connector has its own buffer driving 8 drivers. **J8** & **J9** consist of **MOSFET Drivers 20N10L** which can easily & safely be tested by clipping one end of a clip-lead to test 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).*

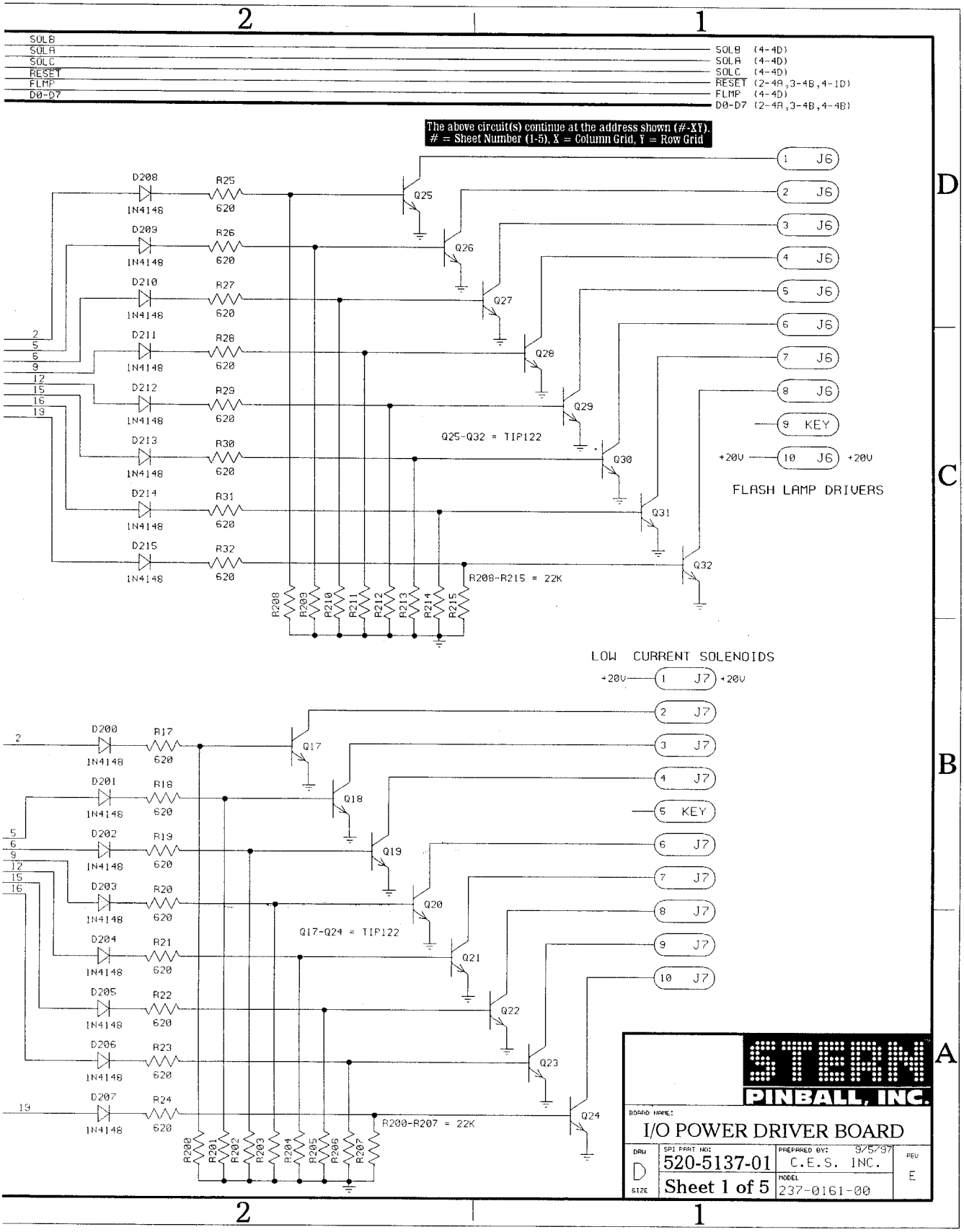
Note 1 ** Clip on the resistor side with the white stripe. ** R1 controls Q1 and R2 controls Q etc...*

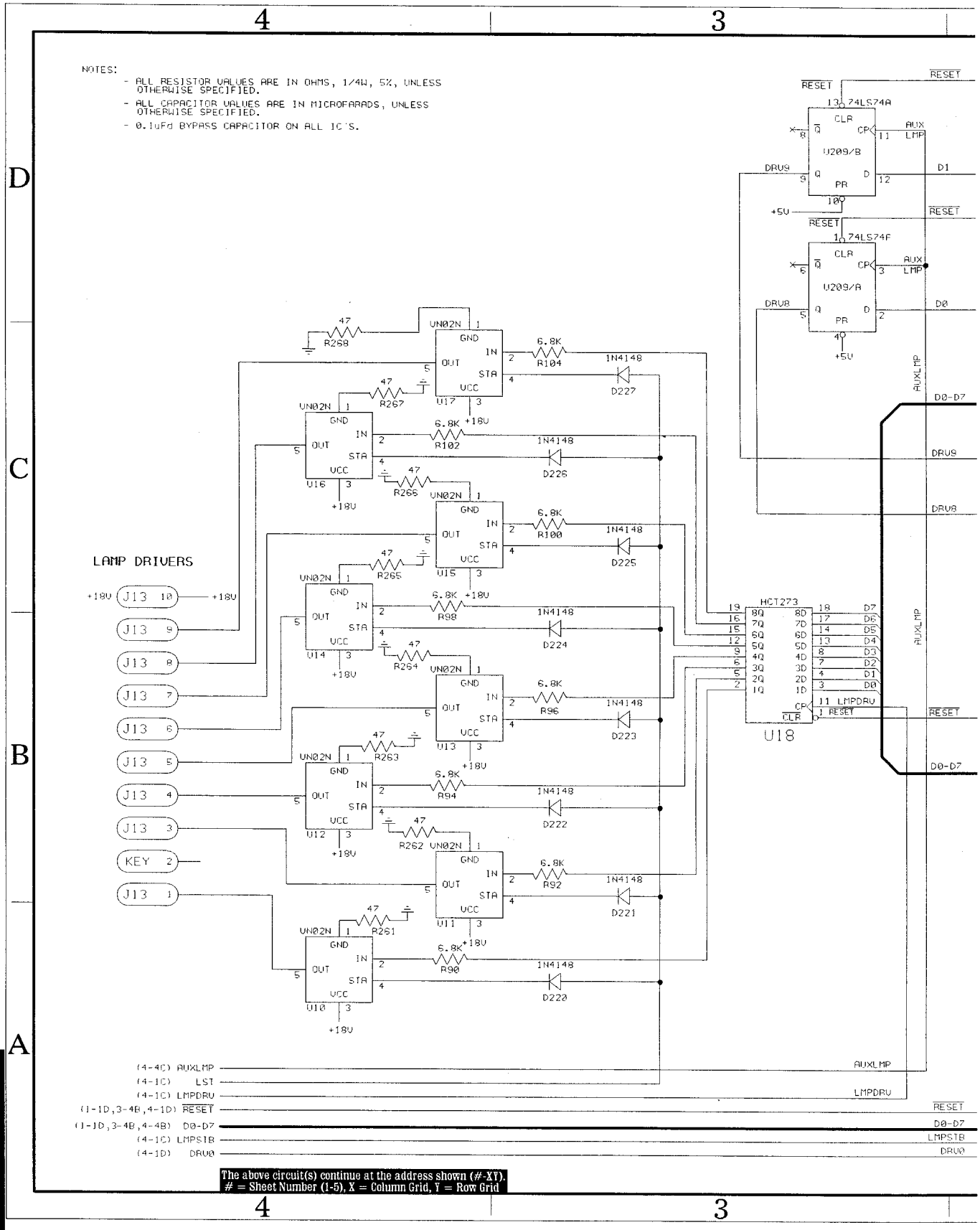
Auxiliary In & Out:
J2-8 CMOS Outputs sometimes used for a printer interface.
J3-8 CMOS Inputs general purpose inputs.

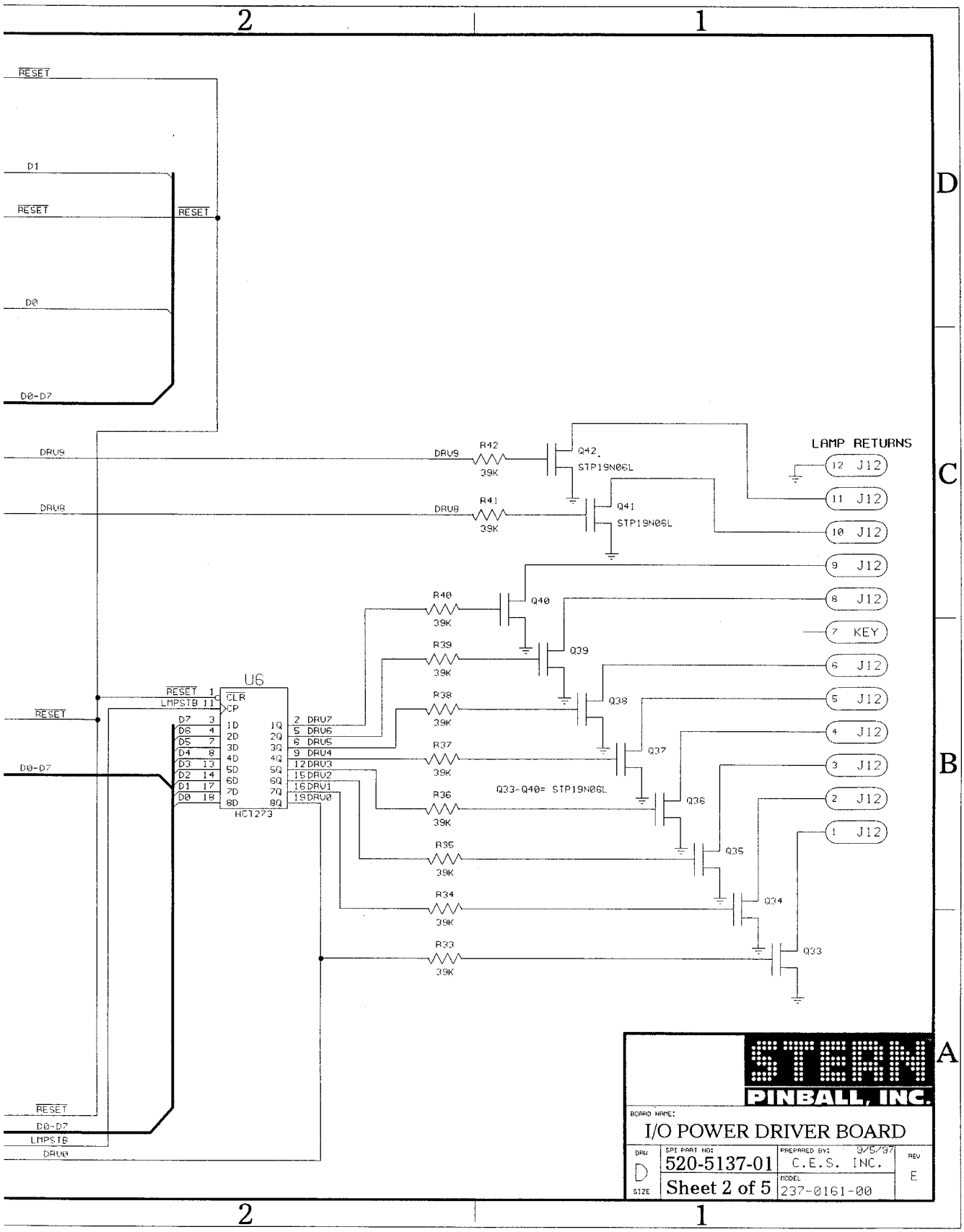
Lamp Matrix:
J12 has 10 low side drivers for the lamp strobes which consist of **19N06L MOSFETS**. Only one lamp strobe should be low at any time. Again the scanning of the lamp strobes keeps the I/O from resetting. **J13** has 8 high side drivers with each having a status indicator. All the status indicators 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.

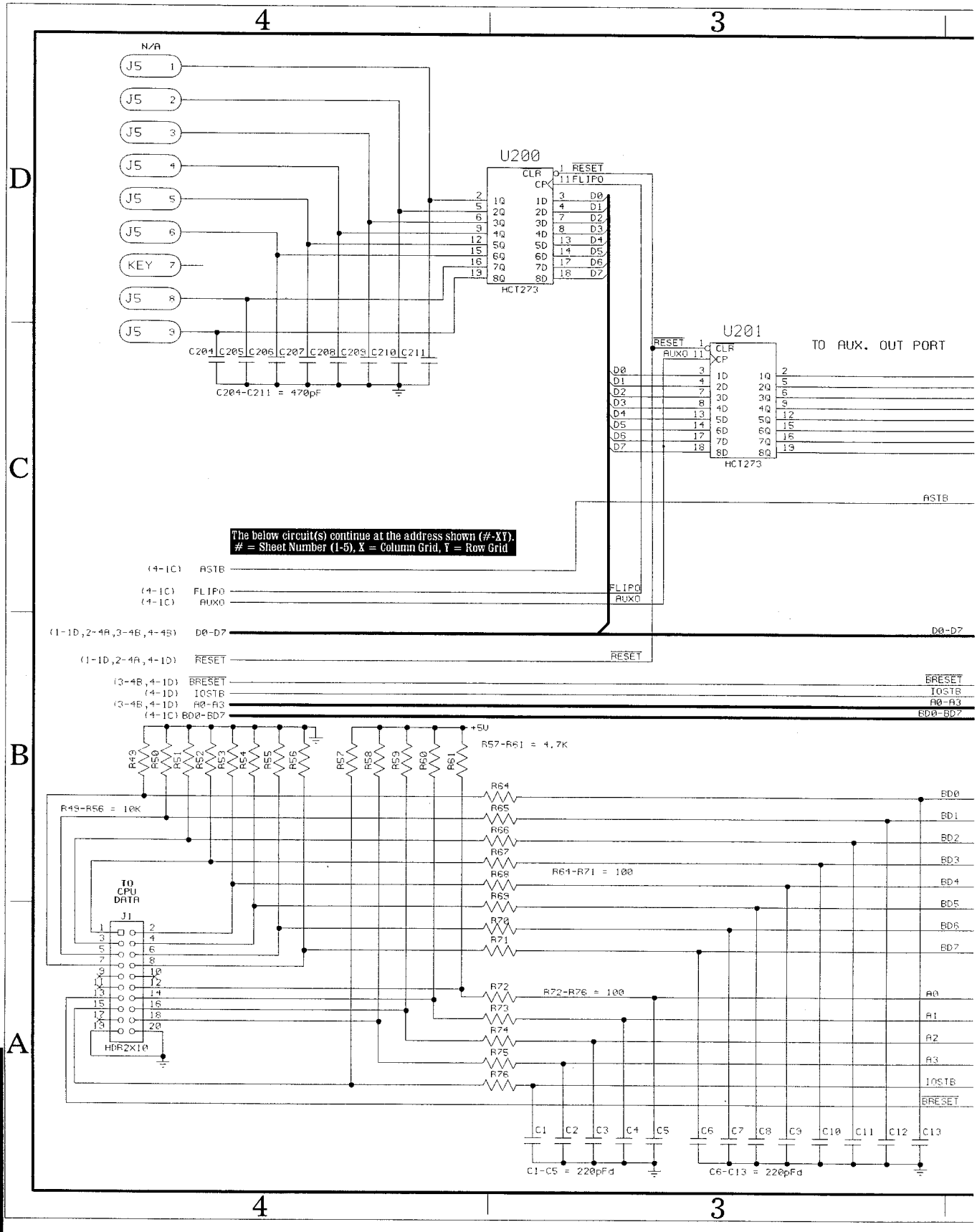
General Illumination (G.I.) Lights:
J15 has 6v AC switched on & off by a relay on the I/O Board. The relay is controlled by **Q200** which supplies power to the 24v coil winding to activate the relay. There are 4 taps on **J15** each fused at 5A for this 6v AC source.

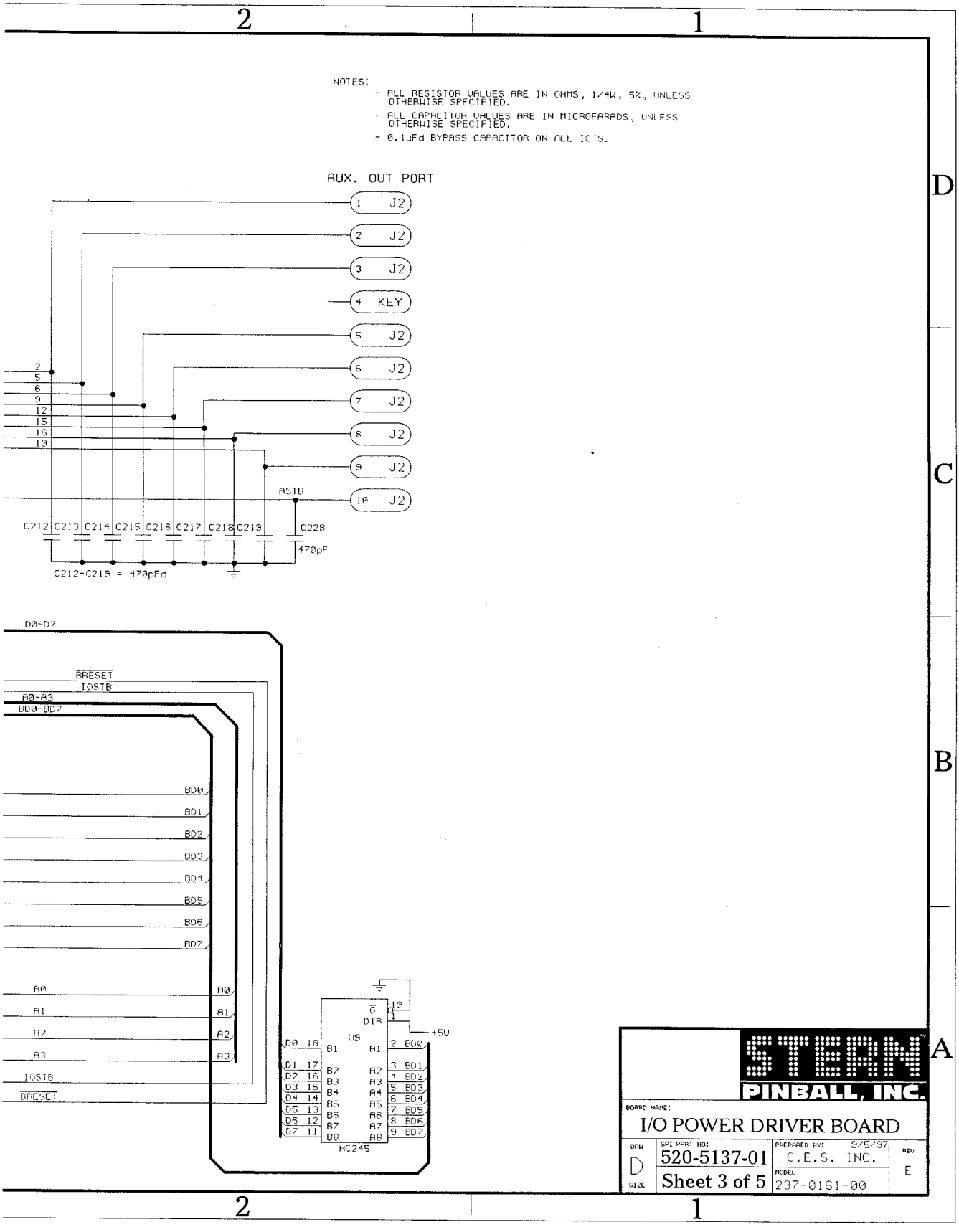

4
3
D
C
B
A
C271-C278 = 0.1uF 100V
HIGH CURRENT SOLENOIDS
C271 C272 C273 C274 C275 C276 C277 C278
J8 1
KEY 2
J8 3
J8 4
J8 5
J8 6
J8 7
J8 8
J8 9
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8
Q1-Q8 = STP20N10L
R1 R2 R3 R4 R5 R6 R7 R8
22K
C263 C264 C265 C266 C267 C268 C269 C270
C263-C270 = 0.01uF
C255-C262 = 0.1uF 100V
HIGH CURRENT SOLENOIDS
C255 C256 C257 C258 C259 C260 C261 C262
J9 1
J9 2
KEY 3
J9 4
J9 5
J9 6
J9 7
J9 8
J9 9
Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16
Q9-Q16 = STP20N10L
R9 R10 R11 R12 R13 R14 R15 R16
22K
C247 C248 C249 C250 C251 C252 C253 C254
C247-C254 = 0.01uF
U1
U2
U3
U4
HCT273
CLR
CP
RESET
SOLB
SOLA
SOLC
FLMP
D0-D7
SOLB
SOLA
SOLC
RESET
FLMP
D0-D7
NOTES:
- ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
- ALL CAPACITOR VALUES ARE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.
- 0.1uFd BYPASS CAPACITOR ON ALL IC'S.

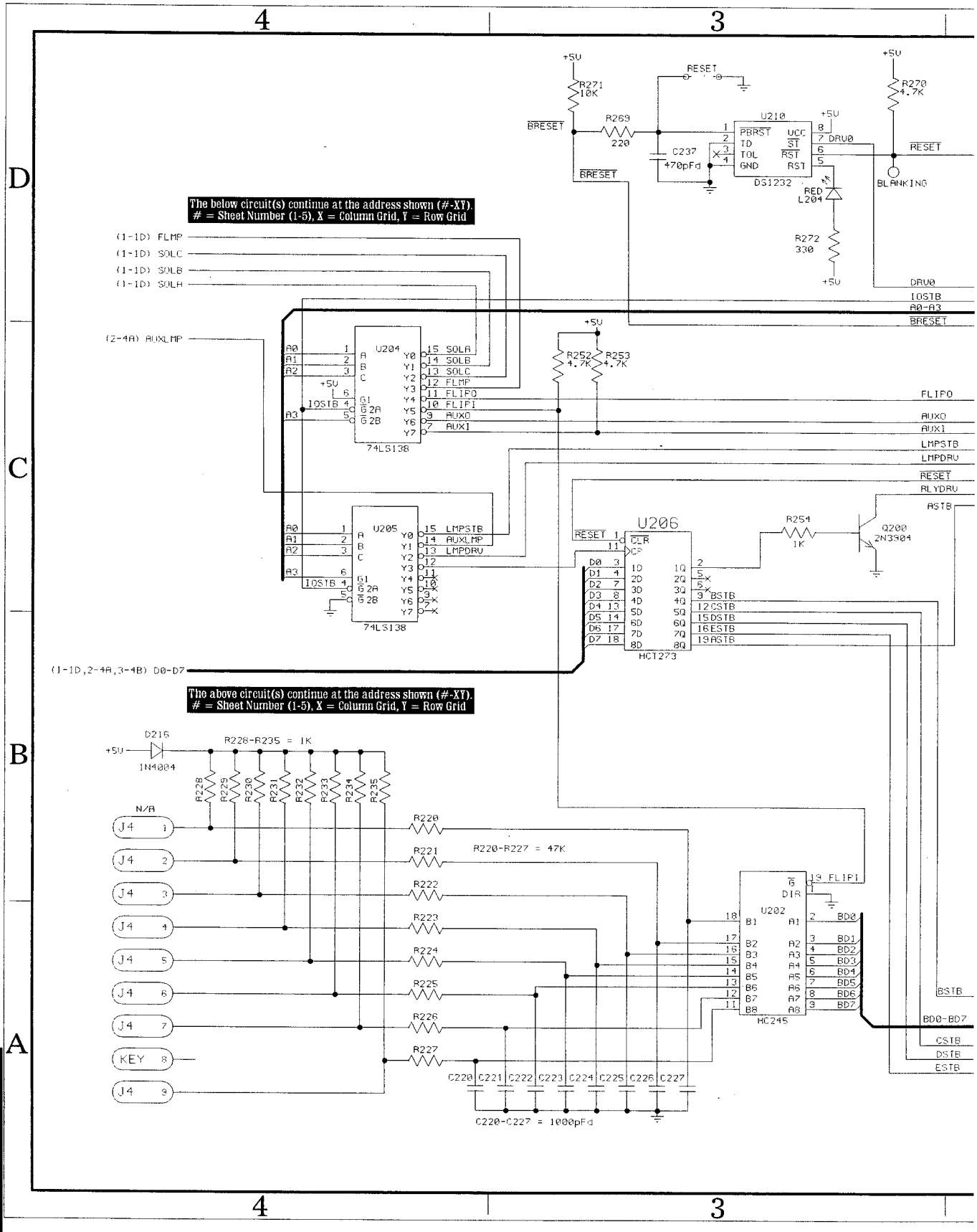

SOLB
SOLA
SOLC
RESET
FLMP
D0-D7
SOLB (4-4D)
SOLA (4-4D)
SOLC (4-4D)
RESET (2-4A,3-4B,4-1D)
FLMP (4-4D)
D0-D7 (2-4A,3-4B,4-4B)
The above circuit(s) continue at the address shown (#-XY). # = Sheet Number (1-5), X = Column Grid, Y = Row Grid
D208 IN4148 R25 620 Q25
D209 IN4148 R26 620 Q26
D210 IN4148 R27 620 Q27
D211 IN4148 R28 620 Q28
D212 IN4148 R29 620 Q29
D213 IN4148 R30 620 Q30
D214 IN4148 R31 620 Q31
D215 IN4148 R32 620 Q32
Q25-Q32 = TIP122
R208-R215 = 22K
R208 R209 R210 R211 R212 R213 R214 R215
1 J6
2 J6
3 J6
4 J6
5 J6
6 J6
7 J6
8 J6
9 KEY
+20V 10 J6 +20V
FLASH LAMP DRIVERS
LOW CURRENT SOLENOIDS
+20V 1 J7 +20V
2 J7
3 J7
4 J7
5 KEY
6 J7
7 J7
8 J7
9 J7
10 J7
D200 IN4148 R17 620 Q17
D201 IN4148 R18 620 Q18
D202 IN4148 R19 620 Q19
D203 IN4148 R20 620 Q20
D204 IN4148 R21 620 Q21
D205 IN4148 R22 620 Q22
D206 IN4148 R23 620 Q23
D207 IN4148 R24 620 Q24
Q17-Q24 = TIP122
R200-R207 = 22K
R200 R201 R202 R203 R204 R205 R206 R207
STERN PINBALL, INC.
BOARD NAME:
I/O POWER DRIVER BOARD
DRW D SIZE
SPI PART NO: 520-5137-01
Sheet 1 of 5
PREPARED BY: C.E.S. INC. 9/5/97
MODEL 237-0161-00
REV E

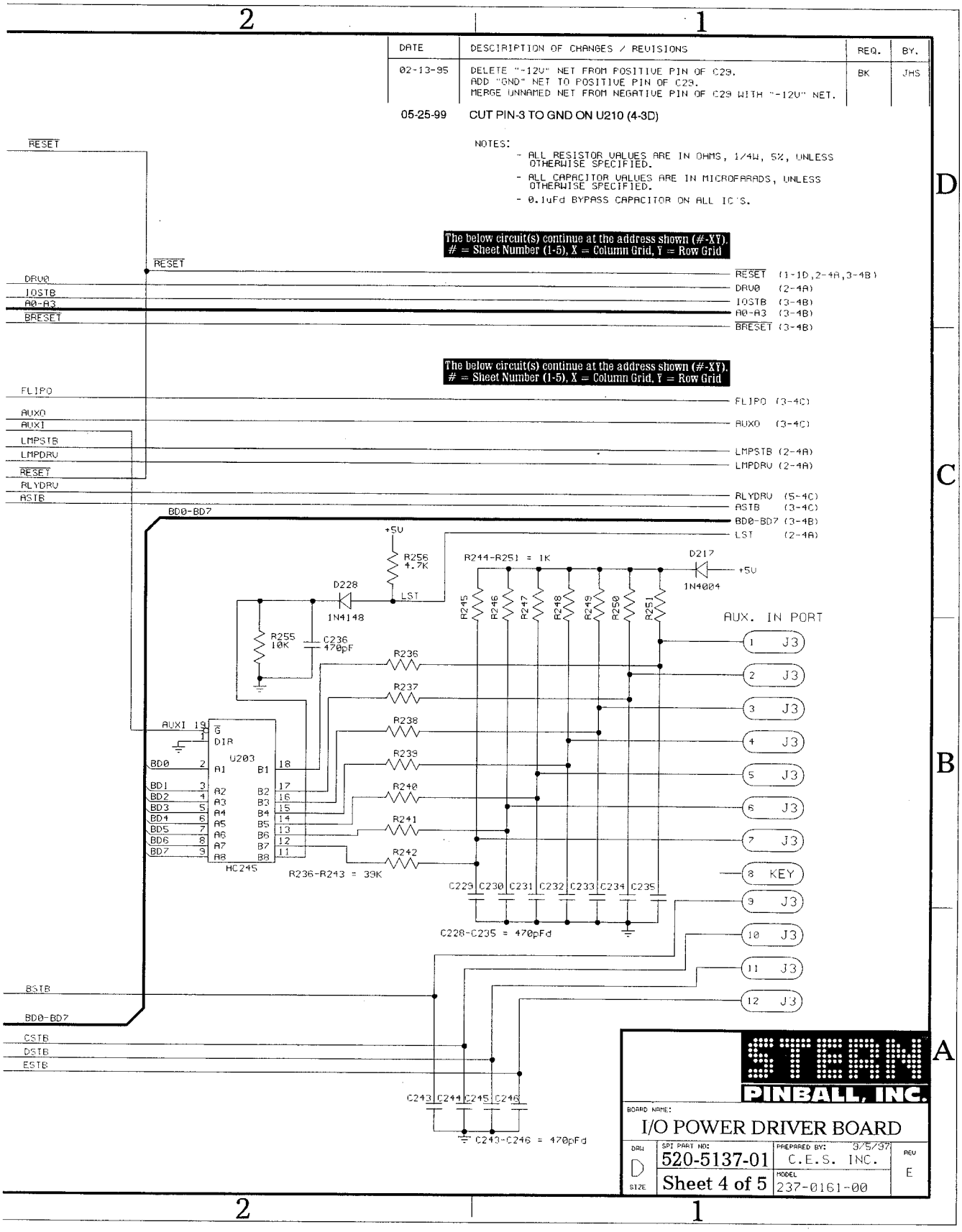

NOTES:
- ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
- ALL CAPACITOR VALUES ARE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.
- 0.1uFd BYPASS CAPACITOR ON ALL IC'S.
LAMP DRIVERS
J13 10
J13 9
J13 8
J13 7
J13 6
J13 5
J13 4
J13 3
KEY 2
J13 1
+18V
UN02N
GND
IN
OUT
STA
VCC
U17
U16
U15
U14
U13
U12
U11
U10
R258
R267
R266
R265
R264
R263
R262
R261
R104
R102
R100
R98
R96
R94
R92
R90
6.8K
47
1N4148
D227
D226
D225
D224
D223
D222
D221
D220
74LS74A
U209/B
74LS74F
U209/A
CLR
PR
AUX LMP
DRV9
DRV8
D1
D0
+5V
RESET
HCT273
U18
LMPDRV
AUXLMP
D0-D7
(4-4C) AUXLMP
(4-1C) LSI
(4-1C) LMPDRV
(1-1D,3-4B,4-1D) RESET
(1-1D,3-4B,4-4B) D0-D7
(4-1C) LMPSIB
(4-1D) DRV0
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid


2
1
D
C
B
A
RESET
D1
D0
D0-D7
DRV9
DRV8
R42
39K
Q42
STP19N06L
R41
Q41
LAMP RETURNS
12 J12
11 J12
10 J12
9 J12
8 J12
7 KEY
6 J12
5 J12
4 J12
3 J12
2 J12
1 J12
R40
Q40
R39
Q39
R38
Q38
R37
Q37
R36
Q36
R35
Q35
R34
Q34
R33
Q33
U6
CLR
CP
1D 2D 3D 4D 5D 6D 7D 8D
1Q 2Q 3Q 4Q 5Q 6Q 7Q 8Q
HCT273
LMPSTB
DRV7
DRV6
DRV5
DRV4
DRV3
DRV2
DRV1
DRV0
Q33-Q40= STP19N06L
STERN
PINBALL, INC.
BOARD NAME:
I/O POWER DRIVER BOARD
DRW
D
SIZE
SPI PART NO:
520-5137-01
Sheet 2 of 5
PREPARED BY:
C.E.S. INC.
9/5/97
MODEL
237-0161-00
REV
E


4
3
D
C
B
A
N/A
J5 1
J5 2
J5 3
J5 4
J5 5
J5 6
KEY 7
J5 8
J5 9
U200
HCT273
U201
HCT273
TO AUX. OUT PORT
C204 C205 C206 C207 C208 C209 C210 C211
C204-C211 = 470pF
The below circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
(4-1C) ASTB
(4-1C) FLIPO
(4-1C) AUXO
(1-1D,2-4A,3-4B,4-4B) D0-D7
(1-1D,2-4A,4-1D) RESET
(3-4B,4-1D) BRESET
(4-1D) IOSTB
(3-4B,4-1D) A0-A3
(4-1C) BD0-BD7
R49 R50 R51 R52 R53 R54 R55 R56
R57 R58 R59 R60 R61
+5V
R57-R61 = 4.7K
R49-R56 = 10K
R64 R65 R66 R67 R68 R69 R70 R71
R64-R71 = 100
R72 R73 R74 R75 R76
R72-R76 = 100
TO CPU DATA
J1
HDR2X10
C1 C2 C3 C4 C5
C1-C5 = 220pFd
C6 C7 C8 C9 C10 C11 C12 C13
C6-C13 = 220pFd


2
1
NOTES:
- ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
- ALL CAPACITOR VALUES ARE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.
- 0.1uFd BYPASS CAPACITOR ON ALL IC'S.
AUX. OUT PORT
1 J2
2 J2
3 J2
4 KEY
5 J2
6 J2
7 J2
8 J2
9 J2
10 J2
ASTB
2
5
6
9
12
15
16
19
C212 C213 C214 C215 C216 C217 C218 C219
C228
470pF
C212-C219 = 470pFd
D0-D7
BRESET
IOSTB
A0-A3
BD0-BD7
BD0
BD1
BD2
BD3
BD4
BD5
BD6
BD7
A0
A1
A2
A3
IOSTB
BRESET
U9
HC245
DIR
+5V
D
C
B
A
STERN
PINBALL, INC.
BOARD NAME:
I/O POWER DRIVER BOARD
DRW
D
SIZE
SPI PART NO:
520-5137-01
Sheet 3 of 5
PREPARED BY:
C.E.S. INC.
9/5/97
MODEL
237-0161-00
REV
E


4
3
D
C
B
A
+5V
R271 10K
BRESET
R269 220
RESET
C237 470pFd
U210
DS1232
PBRST
TD
TOL
GND
VCC
ST
RST
DRV0
R270 4.7K
BLANKING
RED L204
R272 330
The below circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
(1-1D) FLMP
(1-1D) SOLC
(1-1D) SOLB
(1-1D) SOLA
(2-4A) AUXLMP
IOSTB
A0-A3
U204
74LS138
SOLA
SOLB
SOLC
FLMP
FLIPO
FLIPI
AUXO
AUXI
R252 4.7K
R253 4.7K
LMPSTB
LMPDRV
RLYDRV
ASTB
U205
LMPSTB
AUXLMP
LMPDRV
U206
HCT273
R254 1K
Q200 2N3904
BSTB
CSTB
DSTB
ESTB
(1-1D,2-4A,3-4B) D0-D7
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
D216
1N4004
R228-R235 = 1K
R220-R227 = 47K
N/A
J4
KEY
R220
R221
R222
R223
R224
R225
R226
R227
C220 C221 C222 C223 C224 C225 C226 C227
C220-C227 = 1000pFd
U202
HC245
DIR
BD0
BD1
BD2
BD3
BD4
BD5
BD6
BD7
BD0-BD7


2
1
D
C
B
A
DATE
DESCRIPTION OF CHANGES / REVISIONS
REQ.
BY.
02-13-95
DELETE "-12V" NET FROM POSITIVE PIN OF C29.
ADD "GND" NET TO POSITIVE PIN OF C29.
MERGE UNNAMED NET FROM NEGATIVE PIN OF C29 WITH "-12V" NET.
BK
JHS
05-25-99
CUT PIN-3 TO GND ON U210 (4-3D)
NOTES:
- ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
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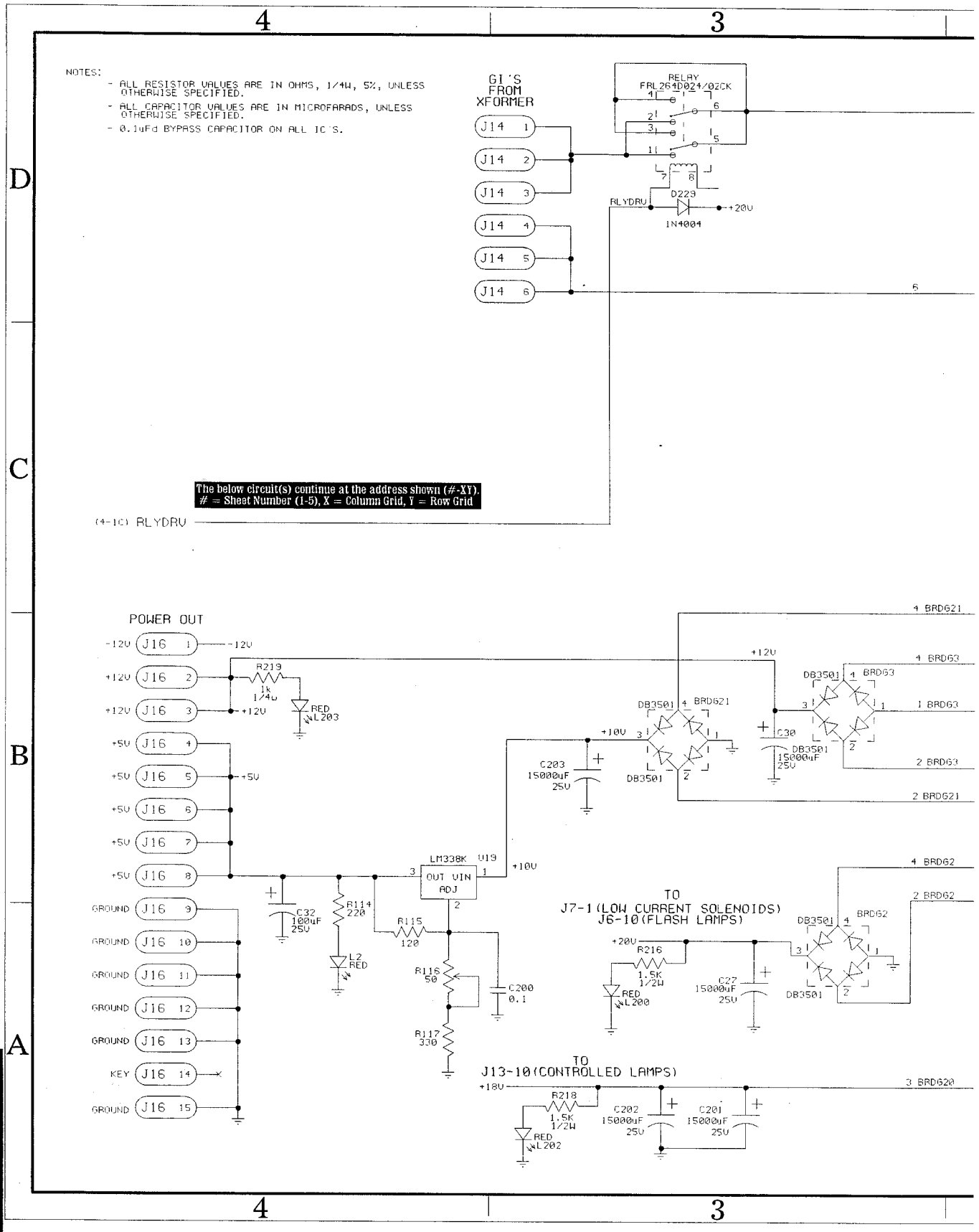
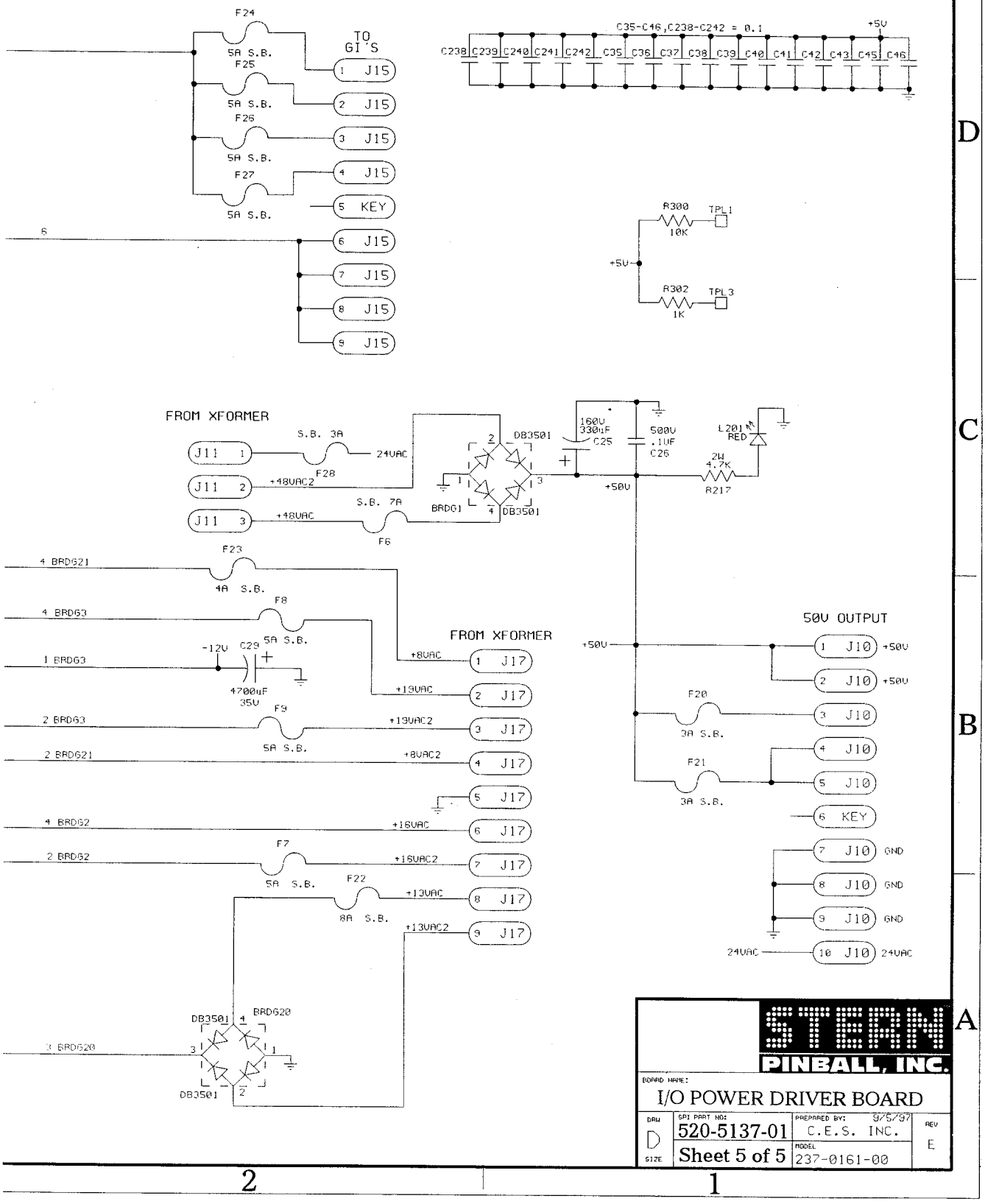
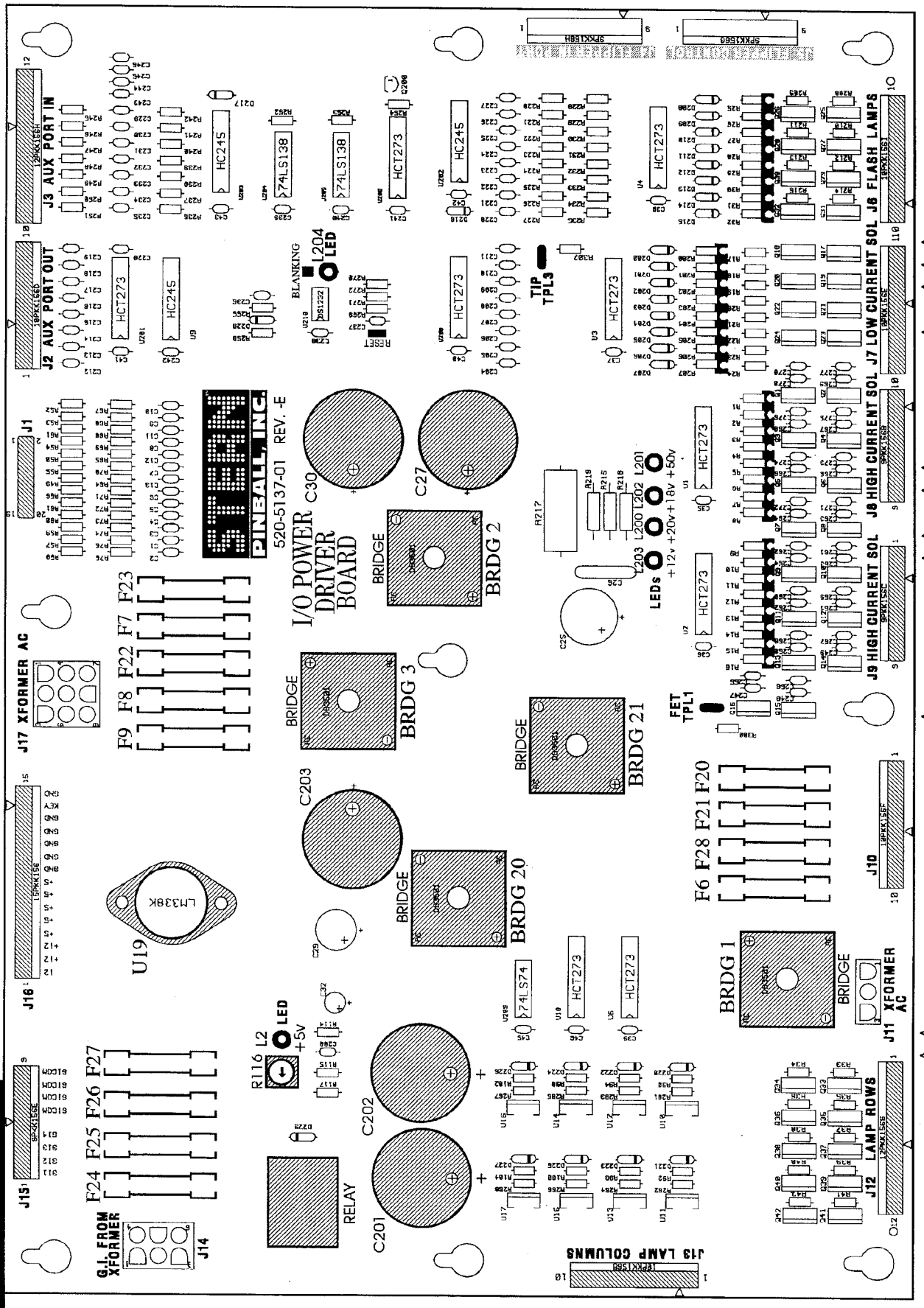
- 0.1uFd BYPASS CAPACITOR ON ALL IC'S.
The below circuit(s) continue at the address shown (#-XY). # = Sheet Number (1-5), X = Column Grid, Y = Row Grid
RESET
DRV0
IOSTB
A0-A3
BRESET
RESET (1-1D,2-4A,3-4B)
DRV0 (2-4A)
IOSTB (3-4B)
A0-A3 (3-4B)
BRESET (3-4B)
The below circuit(s) continue at the address shown (#-XY). # = Sheet Number (1-5), X = Column Grid, Y = Row Grid
FLIPO
AUXO
AUXI
LMPSTB
LMPDRV
RESET
RLYDRV
ASTB
FLIPO (3-4C)
AUXO (3-4C)
LMPSTB (2-4A)
LMPDRV (2-4A)
RLYDRV (5-4C)
ASTB (3-4C)
BD0-BD7
BD0-BD7 (3-4B)
LST (2-4A)
+5V
R256 4.7K
LST
D228
1N4148
R255 10K
C236 470pF
R244-R251 = 1K
D217
1N4004
+5V
R245
R246
R247
R248
R249
R250
R251
AUX. IN PORT
J3
J3
J3
J3
J3
J3
J3
KEY
J3
J3
J3
J3
R236
R237
R238
R239
R240
R241
R242
R236-R243 = 39K
AUXI 19
G
DIR
U203
HC245
BD0
BD1
BD2
BD3
BD4
BD5
BD6
BD7
A1
A2
A3
A4
A5
A6
A7
A8
B1
B2
B3
B4
B5
B6
B7
B8
C229 C230 C231 C232 C233 C234 C235
C228-C235 = 470pFd
BSTB
BD0-BD7
CSTB
DSTB
ESTB
C243 C244 C245 C246
C243-C246 = 470pFd
STERN
PINBALL, INC.
BOARD NAME:
I/O POWER DRIVER BOARD
DRW
D
SIZE
SPI PART NO:
520-5137-01
Sheet 4 of 5
PREPARED BY:
3/5/97
C.E.S. INC.
MODEL
237-0161-00
REV
E


4
3
D
C
B
A
NOTES:
- ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
- ALL CAPACITOR VALUES ARE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.
- 0.1uFd BYPASS CAPACITOR ON ALL IC'S.
GI'S FROM XFORMER
J14 1
J14 2
J14 3
J14 4
J14 5
J14 6
RELAY FRL26AD024/02CK
RLYDRV
D229
1N4004
+20V
6
The below circuit(s) continue at the address shown (#-XY). # = Sheet Number (1-5), X = Column Grid, Y = Row Grid
(4-1C) RLYDRV
POWER OUT
-12V J16 1
+12V J16 2
+12V J16 3
+5V J16 4
+5V J16 5
+5V J16 6
+5V J16 7
+5V J16 8
GROUND J16 9
GROUND J16 10
GROUND J16 11
GROUND J16 12
GROUND J16 13
KEY J16 14
GROUND J16 15
R219 1k 1/4w
RED L203
C32 100uF 25V
R114 220
L2 RED
R115 120
R116 50
C200 0.1
R117 330
LM338K U19
OUT VIN ADJ
+10V
C203 15000uF 25V
DB3501
C30 15000uF 25V
4 BRDG21
4 BRDG3
1 BRDG3
2 BRDG3
2 BRDG21
4 BRDG2
2 BRDG2
BRDG2
TO J7-1(LOW CURRENT SOLENOIDS) J6-10(FLASH LAMPS)
R216 1.5K 1/2W
RED L200
C27 15000uF 25V
TO J13-10(CONTROLLED LAMPS)
3 BRDG20
R218 1.5K 1/2W
RED L202
C202 15000uF 25V
C201 15000uF 25V


2
1
D
C
B
A
F24
5A S.B.
F25
5A S.B.
F26
5A S.B.
F27
5A S.B.
TO GI'S
1 J15
2 J15
3 J15
4 J15
5 KEY
6 J15
7 J15
8 J15
9 J15
C35-C46,C238-C242 = 0.1
+5V
C238 C239 C240 C241 C242 C35 C36 C37 C38 C39 C40 C41 C42 C43 C45 C46
R300
10K
TPL1
+5V
R302
1K
TPL3
FROM XFORMER
J11 1
J11 2
J11 3
S.B. 3A
24VAC
F28
+48VAC2
S.B. 7A
+48VAC
F6
DB3501
BRDG1
160V 330uF C25
500V .1UF C26
+50V
L201 RED
2W 4.7K
R217
4 BRDG21
F23
4A S.B.
4 BRDG3
F8
5A S.B.
1 BRDG3
-12V
C29
4700uF 35V
FROM XFORMER
+8VAC
+13VAC
2 BRDG3
F9
5A S.B.
+13VAC2
2 BRDG21
+8VAC2
1 J17
2 J17
3 J17
4 J17
5 J17
6 J17
7 J17
8 J17
9 J17
4 BRDG2
+18VAC
2 BRDG2
F7
5A S.B.
+16VAC2
F22
8A S.B.
+13VAC
+13VAC2
3 BRDG20
DB3501
BRDG20
DB3501
50V OUTPUT
+50V
F20
3A S.B.
F21
3A S.B.
1 J10 +50V
2 J10 +50V
3 J10
4 J10
5 J10
6 KEY
7 J10 GND
8 J10 GND
9 J10 GND
24VAC
10 J10 24VAC
STERN PINBALL, INC.
BOARD NAME:
I/O POWER DRIVER BOARD
DRW D SIZE
SPI PART NO: 520-5137-01
Sheet 5 of 5
PREPARED BY: C.E.S. INC. 9/5/97
MODEL 237-0161-00
REV E


TEST POINTS:
<< TIP TPL3
<< BLANKING
<< L204 LED
<< RESET
<< L201 LED+50v
<< L202 LED+18v
<< L200 LED+20v
<< L203 LED+12v
<< FET TPL1
<< L2 LED +5v
<< R116 POT
J3 AUX PORT IN
J2 AUX PORT OUT
J7 LOW CURRENT SOL
J6 FLASH LAMPS
J8 HIGH CURRENT SOL
J9 HIGH CURRENT SOL
J1
J17 XFORMER AC
J16
J15
J14
G.I. FROM XFORMER
J10
J11 XFORMER AC
J12 LAMP ROWS
J13 LAMP COLUMNS
PINBALL, INC.
520-5137-01 REV. -E
I/O POWER DRIVER BOARD
BRIDGE
BRDG 1
BRDG 2
BRDG 3
BRDG 20
BRDG 21
C27
C30
C201
C202
C203
F6 F7 F8 F9 F20 F21 F22 F23 F24 F25 F26 F27 F28
L200 L201 L202 L203
LEDs
+12v +20v +18v +50v
L204 LED
BLANKING
RESET
TIP TPL3
FET TPL1
L2 LED +5v
R116
RELAY
U19
LM338K
HCT273
HC245
74LS138
74LS74

I/O Power Driver Board Parts

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	1	**520-5137-01**	**I/O Power Driver Board**	**Complete PCB Assembly**
1	16	125-5027-00	C255>C262, C271>C278	0.1uF, (104), 100v, Cap.
2	22	125-5028-00	C204>C219, C228>C237, C243>C246	470pF, (471), Axial Cap. (C204>C211: NS)
3	16	125-5029-00	C247>C254, C263>C270	0.01uF, (103), 100v Cap.
4	13	125-5030-00	C7 C8 C9 C10 C11 C12 C13 C1 C2 C3 C4 C5 C6	220pF, (221), Cap.
5	0	n/a	C220>C227	(C220>C227: NS)
6	17	125-5031-00	C35>C43, C45, C46, C200, C238>C242	0.1uF, (104), Cap.
7	16	110-0106-00	Q1>Q16	20N10L STP, Transistor
8	32	121-5042-00	R1>R16, R200>R215	22K Ω 1/4W Res.
9	16	121-5003-00	R17>R32	620 Ω 1/4W Res.
10	17	121-5045-00	R33>R42, R236>R242	39K Ω 1/4W Res.
11	13	121-5007-00	R64>R76	100 Ω 1/4W Res.
12	8	121-5029-00	R90, R92, R94, R96, R98, R100, R102, R104	6.8K Ω 1/4W Res.
13	1	121-5030-00	R115	120 Ω 1/4W Res.
14	0	n/a	R220>R227	(R220>R227: NS)
15	9	121-5009-00	R228>R235, R245>R251, R254, R302	1K Ω 1/4W Res. (R228>R235: NS)
16	8	121-5032-00	R261>R268	47K Ω 1/4W Res.
17	2	121-5033-00	R114, R269	220 Ω 1/4W Res.
18	8	121-5021-00	R49, R57>R61, R252, R253, R256, R270	4.7K Ω 1/4W Res. (R252: NS)
19	11	121-5011-00	R50>R56, R255, R271, R300	10K Ω 1/4W Res.
20	2	121-5036-00	R117, R272	330 Ω 1/4W Res.
21	8	100-5012-00	U1>U4, U6, U18, U200, U201, U206	74HCT273 (U200: NS)
22	1	n/a	RESET	(RESET: NS)
23	1	121-5009-00	R219	1K Ω 1/4W Res.
24	2	121-5038-00	R216, R218	1.5K Ω 1/2W Res.
25	7	200-5000-01	F7>F9, F24>F27	5A 250v S.B. Fuse
26	1	200-5000-03	F6	7A 250v S.B. Fuse
27	1	200-5000-06	F23	4A 250v S.B. Fuse
28	1	200-5000-05	F22	8A 250v S.B. Fuse
29	3	200-5000-08	F20, F21, F28	3A 250v S.B. Fuse
30	1	045-5013-00	J15	9PKK156 (PIN 5=KEY)
31	1	045-5016-00	J16	15PKK156
32	1	100-5023-00	U210	DS1232
33	1	110-0069-00	Q200	2N3904, Transistor.
34	1	125-5032-00	C32	100uF, 25v, Radial Lytic Cap.
35	1	045-5015-01	J1	20-Pin, 0.1 Dual Row Header
36	1	100-0338-00	U202, U203	74HC245 (U202: NS)
37	10	110-0088-00	Q33>Q42	19N06L STP, Transistor
38	6	165-5099-00	**L2, L200>L204**	**LED T1-3/4 DIFFUSER LED**
39	1	045-5014-01	J2	10PKK156 (PIN 4=KEY)
40	1	121-5039-00	R116	50 Ω Pot
41	16	110-0067-00	Q17>Q32	TIP122
42	1	125-5033-00	C25	100uF, 150v, Radial Lytic Cap.
43	1	110-0058-00	U9	74LS245
44	1	125-5034-00	C29	4700uF, 35v, Radial Lytic Cap.
45	1	190-5002-00	RELAY	FRL264D024/02CK Relay
46	0	n/a	J5	(J5: NS)
47	1	100-0037-00	U209	74LS74
48	0	n/a	J4	(J4: NS)
49	2	100-0148-00	U204, U205	74LS138
50	1	125-5035-00	C26	.1UF, 500v, Ceramic Disk Cap.
51	1	100-0356-00	U19	LM338K
52	5	112-5000-00	BRDG1, BRDG2, BRDG3, BRDG20, BRDG21	DB3501
53	5	125-5036-00	C27, C30, C201>C203	15000uF, 25v, Radial Lytic Cap.
54	25	112-0054-00	D200>D215, D220>D227	1N4148, Diode
55	2	112-5003-00	D216, D217, D229	1N4004, Diode (D216: NS)
56	2	n/a	TPL1, TPL3	*Test Point Wire (24ga.) Loops*
57	1	045-5014-01	J7	10PKK156 (PIN 5=KEY)
58	1	045-5014-01	J6	10PKK156 (PIN 9=KEY)
59	8	110-0089-00	U10>U17	VN02N
60	1	045-0014-03	J11	10-84-4030 (3 PIN MOLEX)
61	1	045-5015-00	J12	12PKK156 (PIN 7=KEY)
62	1	045-0014-09	J17	10-84-4090 (9 PIN MOLEX)
63	1	n/a	BLANKING	*Test Point - Do Not Stuff*
64	1	121-5050-00	R217	4.7K Ω 2W Res. (SANDBAR)
65	1	045-5014-01	J13	10PKK156 (PIN 2=KEY)
66	1	045-0014-06	J14	10-84-4060 (6 PIN MOLEX)
67	1	045-5014-01	J10	10PKK156 (PIN 6=KEY)
68	1	045-5015-00	J3	12PKK156 (PIN 8=KEY)
69	1	045-5013-00	J9	9PKK156 (PIN 3=KEY)
70	1	045-5013-00	J8	9PKK156 (PIN 2=KEY)
71	26	205-0004-00	F6>F9, F20>F28	Fuse Clips
72	1	n/a	U19	Heatsink (5v Reg.)

Your Notes

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

A watchdog is used to monitor the CPU and the 5v supply. If the 5v supply is below 4.75 the watchdog will hold the CPU/Sound Board & I/O Board in reset. The watchdog must be fed at a rate of ***250ms*** or faster. The signal used to feed the watchdog comes from the EPROM Bank select signal used to load **U211**. The CPU has a timer interrupt used as a heartbeat for the system this signal comes from counter **U2**. The clock for this counter is the **CPU Q CLOCK**. Clearing the timer interrupt is done by reading the ***DIP Switch***. The timer interrupt can be observed at **TEST POINT FIRQ**. In normal operation "**FIRQ**" should be toggling at a rate of *976Hz*.

The I/O Interface **CN1** is buffered by two (2) **HC245** Chips. The CPU's reset line is buffered by **Q10** and fed over to the I/O through **CN1**. An I/O strobe signal is feed 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 which pull one of 8 strobes 'low' to *activate* a Single Column of switches. The *Switch Return Signals* are fed into **CN7** [SWITCH ROWS] and are highly filtered and compared to a 2.5v *reference voltage*. The *Switch Return Voltage* must be below 2.5v to make a *Valid Switch Closure*. If *false switches* are appearing, check that none of the **2N3904** Transistors are permanently pulling the *strobe line low*. Only one strobe from **CN5** [SWITCH COLUMNS] should be *low at any time*. **CN6** [DEDICATED SWITCH IN] is a *Dedicated Bank of Input Switches*. Switches connected to **CN6** are connected to ground instead of a strobe and may be read at any time.

Plasma Interface:

The data path for communication to and from the Plasma Controller Board is 8 bits wide. There are separate *Input* and *Output Busses*. The *Input Bus* from the Plasma Controller to the CPU/Sound Board comes in on **CN8** [PLASMA CONTROL]-**Pins 3-10** and is fed into **U200** for input to the CPU's *Data Bus*. Data going out to the controller comes from the CPU's *Data Bus* through **U201** and onto **CN8-Pins 11-18**. Status back from the Plasma Controller comes in on **CN8-Pins 22-26** and is fed into **U202** for input to the CPU's *Data Bus*. Two control signals that go out to the Plasma Controller are **PRES** [PLASMA RESET] and **CN8-Pin 19** [**PSTB** - *Plasma Strobe*]. The Plasma Reset is software controllable through **U216/B** and also has a test point "Plasma Reset". The *Plasma Strobe Signal* to the controller is generated from **U216/A** and is *used to latch data* into the Plasma Controller.

Sound Section:

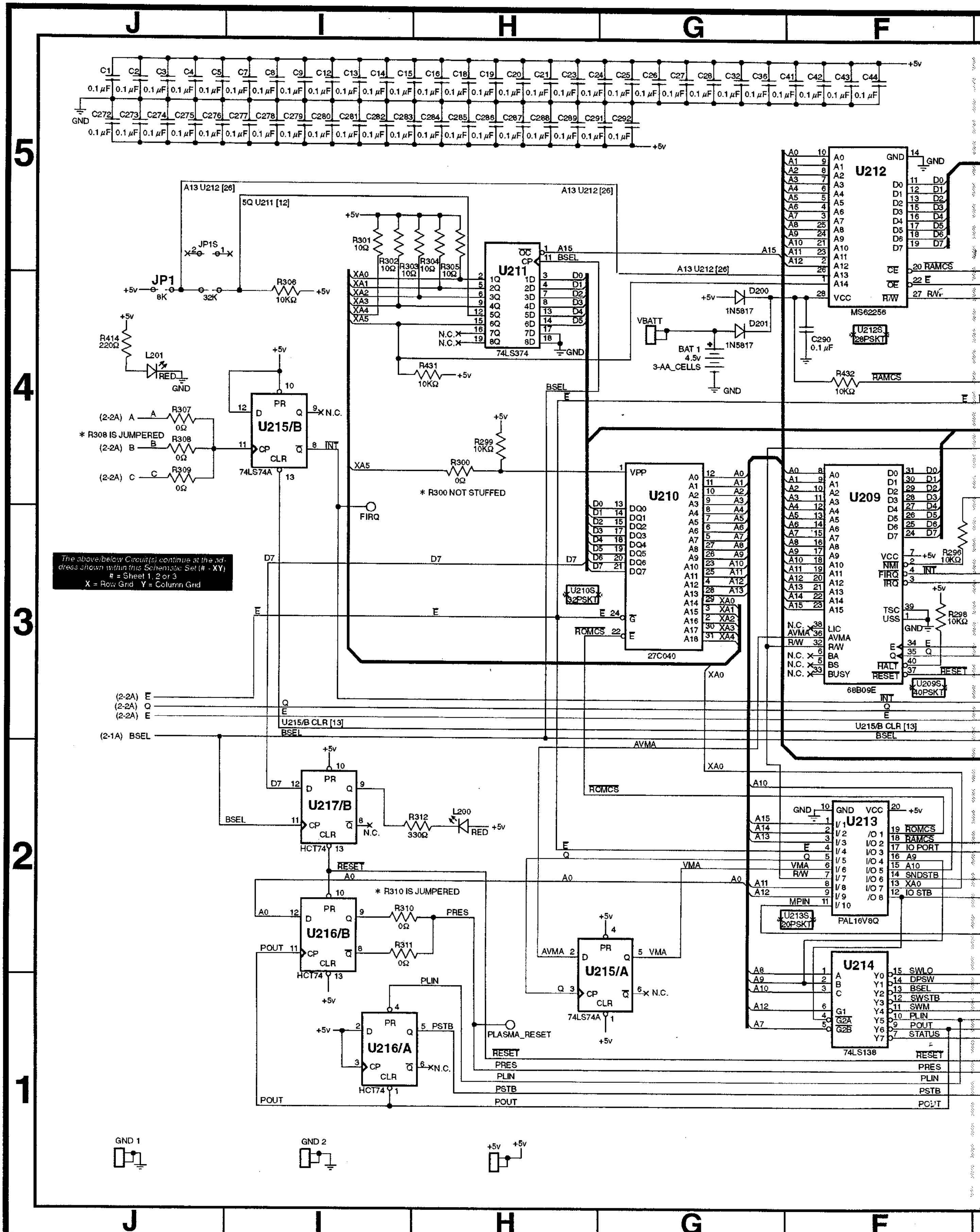
The audio section consists of a **BSMT SOUND CHIP U9** Sound (Voice) EPROMs (**U17 U21 U36 U37**) **68B09E U6** and Sound Code **EPROM U7**. The **BSMT** latches sound EPROM addresses in **U13** & **U12** for output to the Sound EPROMs. Sound Data from the EPROMs is read through **U19** to the **BSMT**. The EPROMs are bank selected by **U22**. When the **BSMT** has sound data to be played out to the speakers it loads 16 bits into a 16 bit shift register made up of **U24** & **U23**. The data stream from the shift register is serially shifted into a stereo 16 bit *Digital to Analog Converter* (**DAC**). When the system is operating properly the ws (word select) input of the **DAC** will be toggling. The ws input is used to latch the right and left channel sound data into the **DAC**. If the ws line is not oscillating no analog signal will come out of the **DAC**. The **DAC** outputs are a controlled current source. These outputs are converted to a voltage by an operational amplifier **U30** to form the analog signal. **TEST POINTS AOR** and **AOL** are the outputs of the operational amplifier. These outputs are then fed directly into three power amplifiers (**TDA2030A**) or optionally into an analog volume control chip **U35** for a potentiometer volume control. The analog section has its own +5v & -5v derived from **VR1** & **VR2**. These separate supply voltages are for the **DAC U26** Operational Amplifier **U30** and analog volume control **U35**.

Sound calls are made from the **CPU's 68B09E U200** to the sound section by latching data into **U5**. The sound section's **CPU 68BO9E (U6)** reads in this data and handles the interfacing to the **BSMT**.

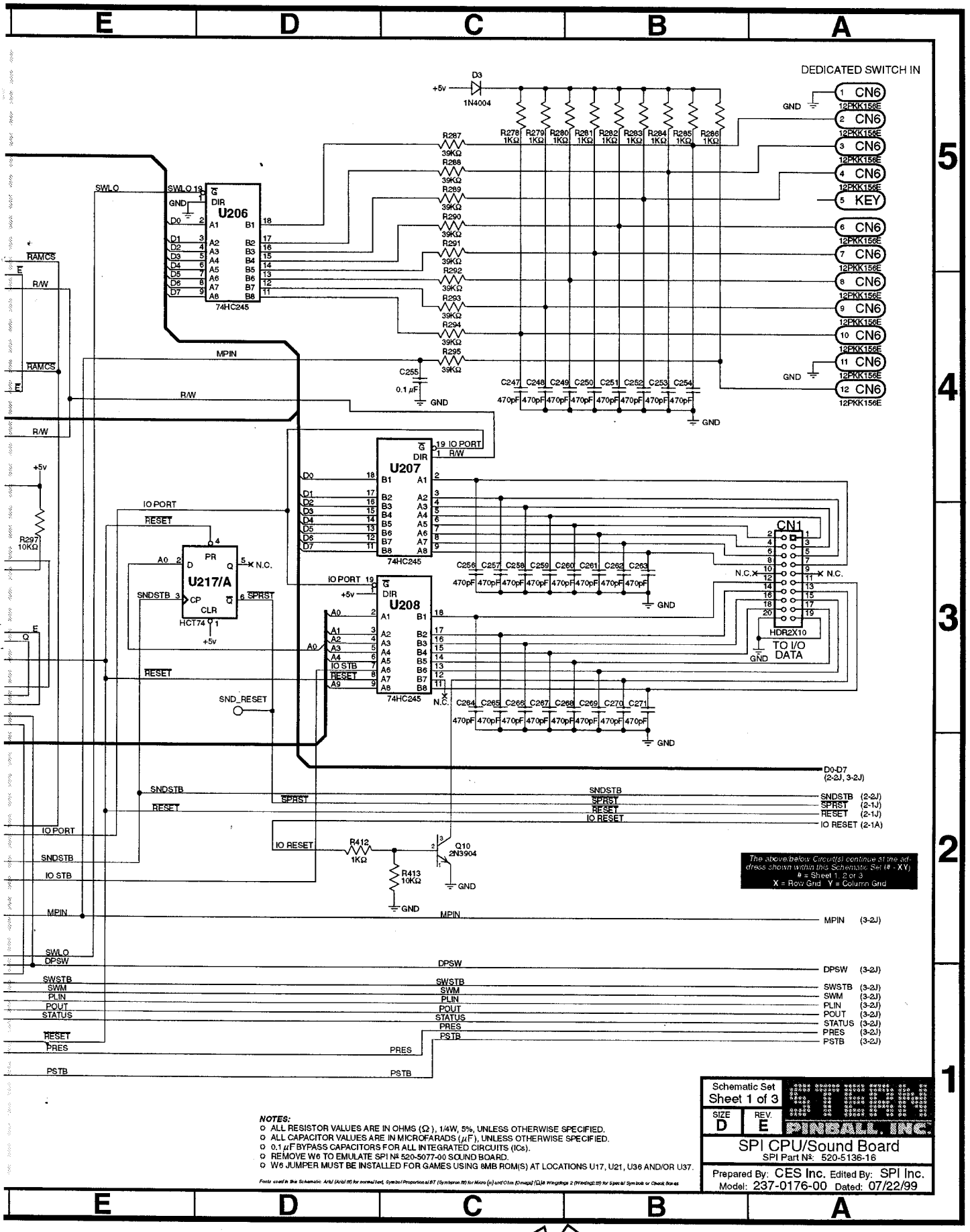
Other Test Points:

E & **Q** - The CPU signals for both **68B09E** processors. Should be at 2Mhz with **Q** leading **E** by ***500 nsec***.
24Mhz - The oscillator used for the **BSMT** & derivation of **E** & **Q**.
SND-FIRQ - The sound sections CPU interupt.
6Mhz - This clock is generated internally on the **BSMT** and is used for shifting the data samples into th **DAC**.

W6 Jumper - This jumper must be installed for games that use **8MB** Sound EPROMs (**U17 U21 U36 U37**). For games which use **4MB** Sound EPROMs this jumper is not installed but will operate on boards with W6 installed.



J
I
H
G
F
5
4
3
2
1
U212
MS62256
U211
74LS374
U215/B
74LS74A
U210
27C040
U209
68B09E
U213
PAL16V8Q
U214
74LS138
U217/B
HCT74
U216/B
HCT74
U216/A
HCT74
U215/A
74LS74A
JP1
JP1S
R306 10KΩ
R414 220Ω
L201 RED
R307 0Ω
R308 0Ω
R309 0Ω
* R308 IS JUMPERED
R431 10KΩ
R299 10KΩ
R300 0Ω
* R300 NOT STUFFED
VBATT
BAT 1 4.5v 3-AA_CELLS
D200 1N5817
D201 1N5817
C290 0.1 µF
R432 10KΩ
R296 10KΩ
R298 10KΩ
FIRQ
The above/below Circuit(s) continue at the address shown within this Schematic Set (# - XY)
# = Sheet 1, 2 or 3
X = Row Grid Y = Column Grid
R312 330Ω
L200 RED
* R310 IS JUMPERED
R310 0Ω
R311 0Ω
PLASMA_RESET
GND 1
GND 2
+5v



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 μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).
- REMOVE W6 TO EMULATE SPI № 520-5077-00 SOUND BOARD.
- W6 JUMPER MUST BE INSTALLED FOR GAMES USING 8MB ROM(S) AT LOCATIONS U17, U21, U36 AND/OR U37.

Fonts used in the Schematic: Arial (Arial ttf) for normal text, Symbol (Proportional BT (Symbprop.ttf) for Micro (μ) and Ohm (Omega) (Ω), & Wingdings 2 (Wingdng2.ttf) for Special Symbols or Check Boxes

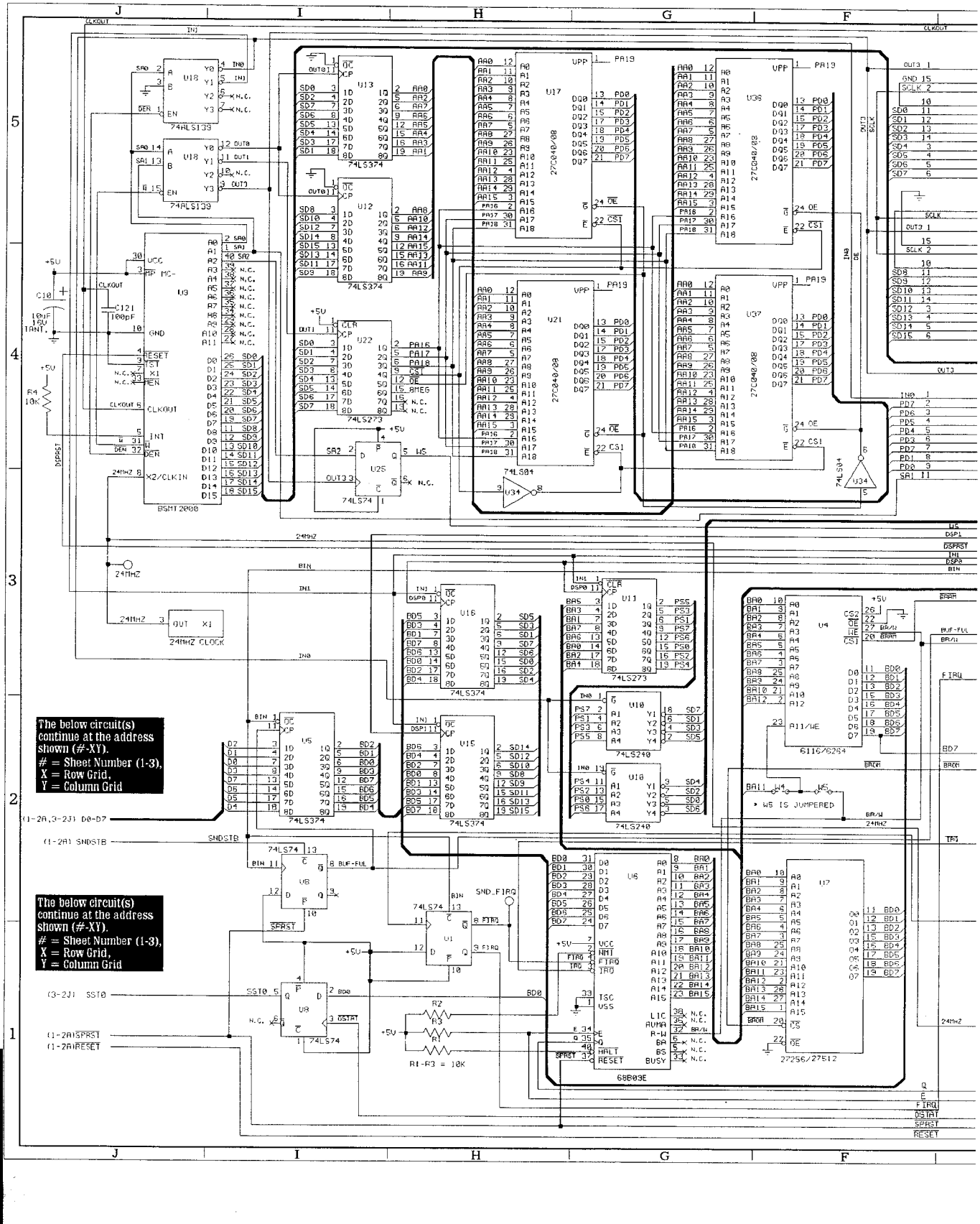
Schematic Set	Sheet 1 of 3
SIZE	D
REV.	E

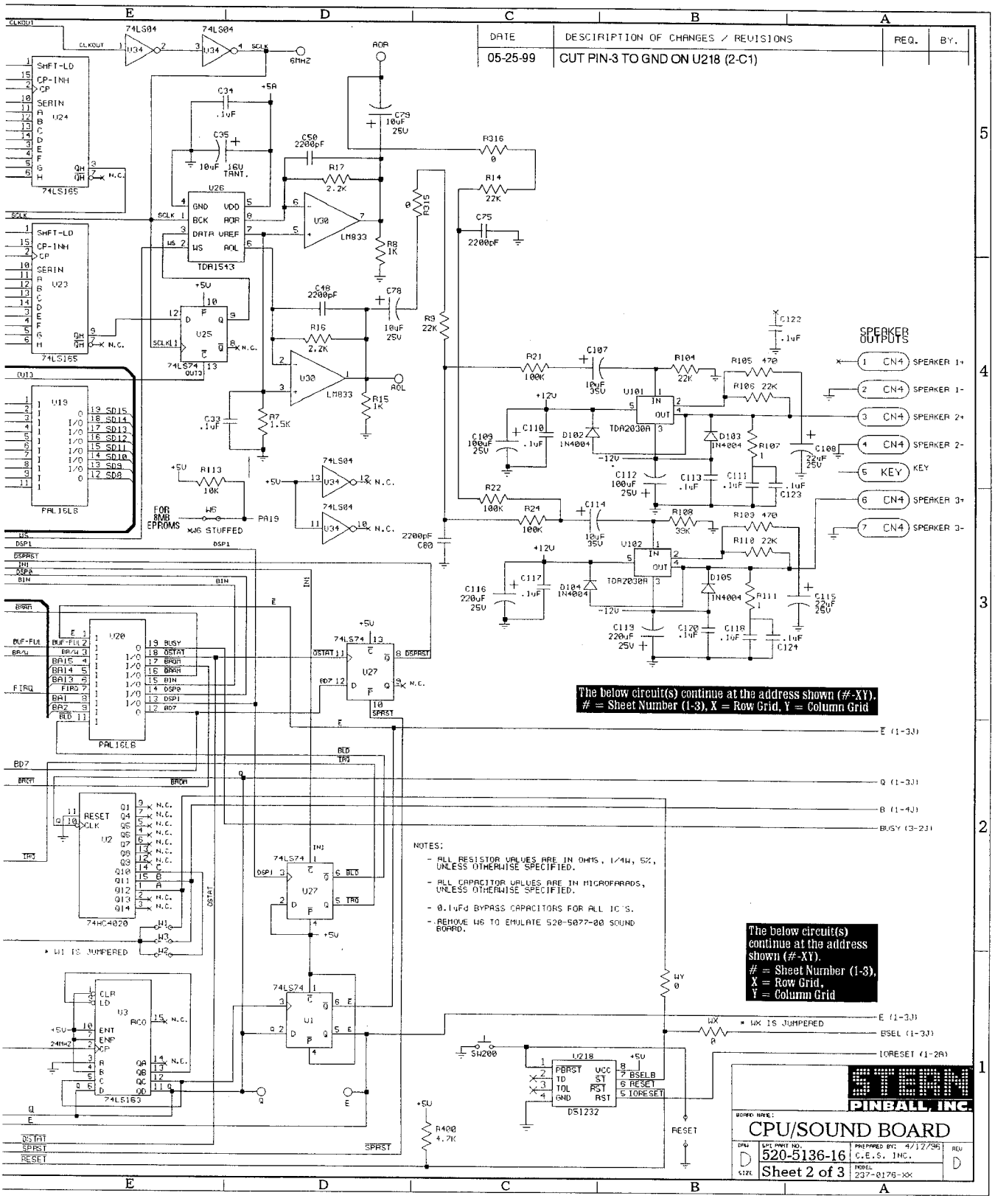
SPI PINBALL, INC.

SPI CPU/Sound Board
SPI Part №: 520-5136-16

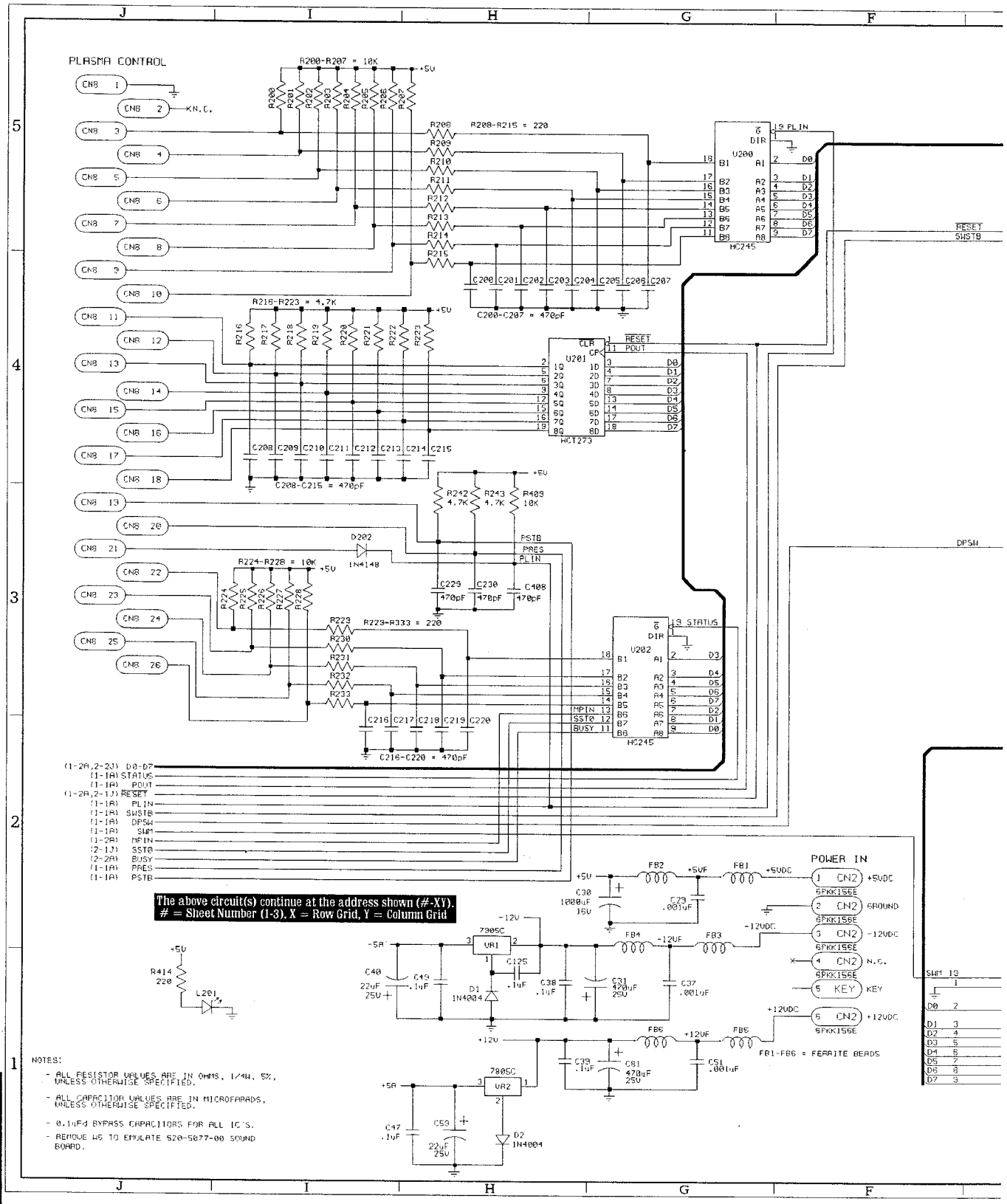
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0176-00 Dated: 07/22/99

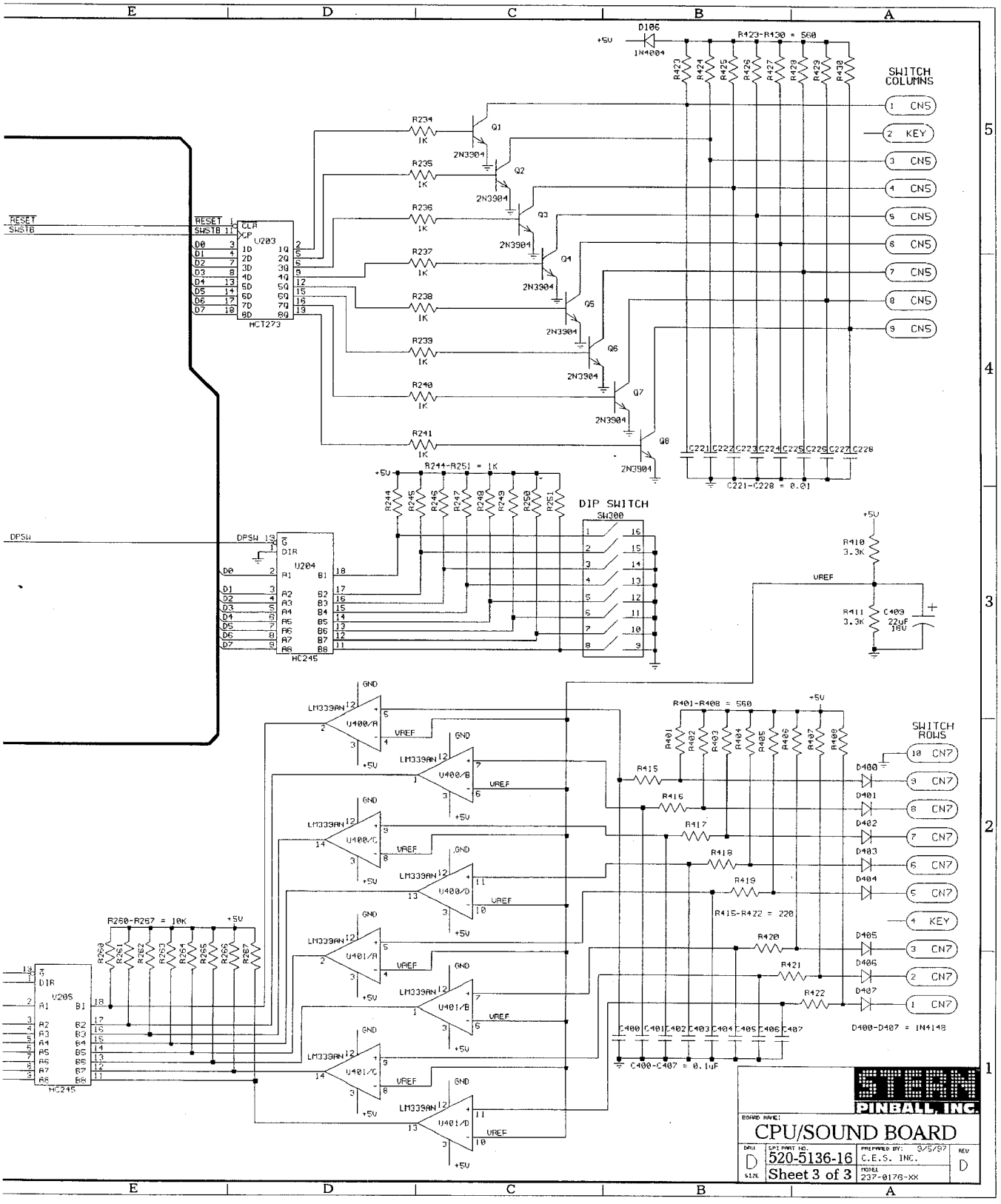
CPU/Sound Board Schematic (Sheet 2 of 3)



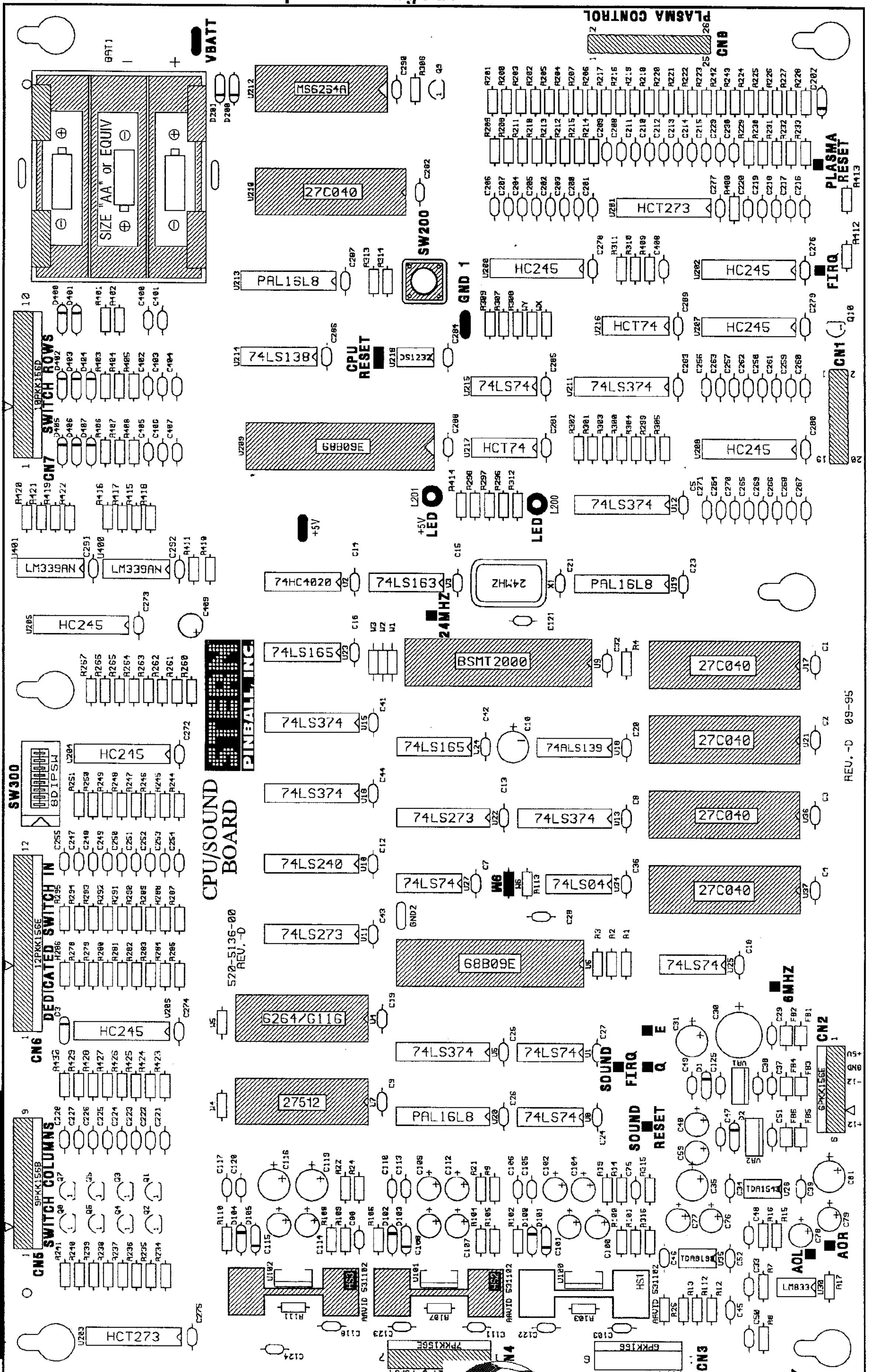

DATE
DESCRIPTION OF CHANGES / REVISIONS
REQ.
BY.
05-25-99
CUT PIN-3 TO GND ON U218 (2-C1)
SPEAKER OUTPUTS
CN4 SPEAKER 1+
CN4 SPEAKER 1-
CN4 SPEAKER 2+
CN4 SPEAKER 2-
KEY KEY
CN4 SPEAKER 3+
CN4 SPEAKER 3-
The below circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-3), X = Row Grid, Y = Column Grid
NOTES:
- ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
- ALL CAPACITOR VALUES ARE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.
- 0.1uFd BYPASS CAPACITORS FOR ALL IC'S.
- REMOVE W6 TO EMULATE 520-5077-00 SOUND BOARD.
* W1 IS JUMPERED
* WX IS JUMPERED
FOR 8MB EPROMS
*W6 STUFFED
STERN PINBALL, INC.
BOARD NAME:
CPU/SOUND BOARD
DRN D
SIZE
SYS PART NO. 520-5136-16
PREPARED BY: C.E.S. INC. 4/12/96
Sheet 2 of 3
MODEL 237-0176-XX
REV D

CPU/Sound Board Schematic (Sheet 3 of 3)




D106
1N4004
R423-R430 = 560
SWITCH COLUMNS
1 CN5
2 KEY
3 CN5
4 CN5
5 CN5
6 CN5
7 CN5
8 CN5
9 CN5
Q1 2N3904
Q2 2N3904
Q3 2N3904
Q4 2N3904
Q5 2N3904
Q6 2N3904
Q7 2N3904
Q8 2N3904
R234 1K
R235 1K
R236 1K
R237 1K
R238 1K
R239 1K
R240 1K
R241 1K
RESET
SWST8
U203 HCT273
C221-C228 = 0.01
R244-R251 = 1K
DIP SWITCH SW300
DPSW
U204 HC245
R410 3.3K
R411 3.3K
VREF
C409 22uF 16V
R401-R408 = 560
SWITCH ROWS
10 CN7
9 CN7
8 CN7
7 CN7
6 CN7
5 CN7
4 KEY
3 CN7
2 CN7
1 CN7
D400 D401 D402 D403 D404 D405 D406 D407
D400-D407 = IN4148
R415 R416 R417 R418 R419 R420 R421 R422
R415-R422 = 220
C400-C407 = 0.1uF
R250-R257 = 10K
U205 HC245
LM339AN
U400/A U400/B U400/C U400/D
U401/A U401/B U401/C U401/D
GND
+5V
STERN PINBALL, INC.
BOARD NAME: CPU/SOUND BOARD
DRW D
S/T PART NO. 520-5136-16
Sheet 3 of 3
PREPARED BY: C.E.S. INC. 3/5/97
MODEL 237-0176-XX
REV D

CPU/Sound Board Component Layout



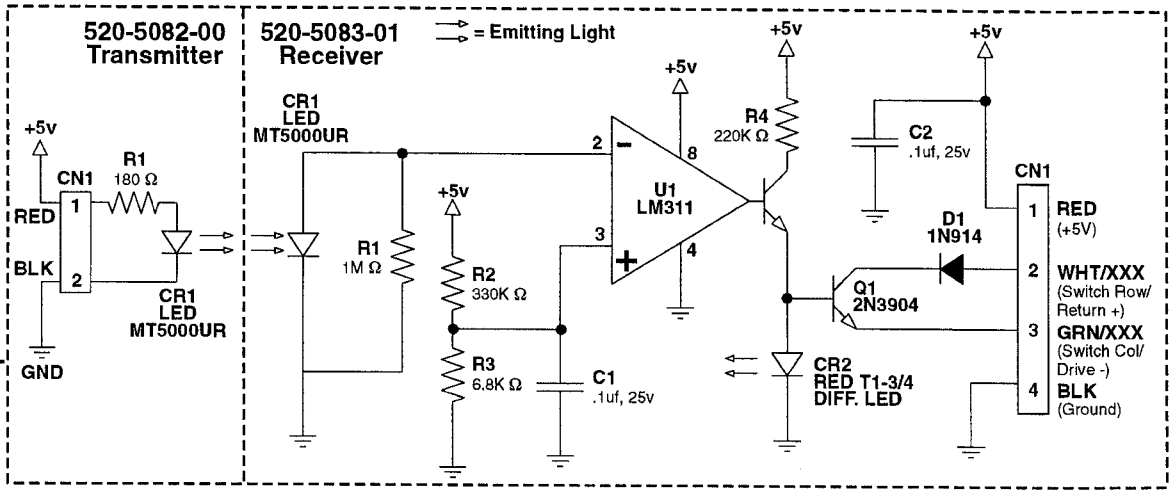
TEST POINTS:

- << VBATT
- << PLASMA RESET
- << FIRQ
- << SW200
- << GROUND 1
- << CPU RESET
- << L201 LED+5v
- << L200 LED
- << +5v
- << 24 Mhz
- << W6 requires a Jumper if using 8MB EPROMs in U17, U21, U36 and/or U37
- << 6 Mhz
- << E
- << SOUND FIRQ
- << Q
- << SOUND RESET
- << AOR
- << AOL

CPU/Sound Board Parts

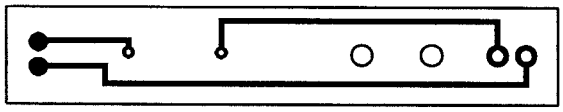
ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	1	520-5136-16	CPU/Sound Board Mono (FCC FEB98)	**Complete PCB Assembly**
1	1	124-5001-00	VR2	LM7805CT +5v Regulator
2	5	121-5051-00	R12, R13, R19, R21, R22, R24	100K Ω 1/4W Res. (R19: NS)
3	2	121-5009-00	R103, R107, R111	1K Ω 1/4W Res. (R103: NS)
4	38	121-5011-00	R1>R4, R113, R200>R207, R224>R228, R244>R251, R260>R267, R296>R299, R301>R306, R409, R413	10K Ω 1/4W Res. (R200>R207, R409, R413: NS)
5	5	121-5023-00	R9, R14, R100, R102, R104, R106, R110	22K Ω 1/4W Res. (R100, R102: NS)
6	20	121-5009-00	R15, R8, R234>R241, R278>R286, R412	1K Ω 1/4W Res.
7	4	121-5043-00	R16, R17, R25, R112	2.2K Ω 1/4W Res.
8	1	121-5018-00	R7	1.5K Ω 1/4W Res.
9	2	121-5046-00	R101, R105, R109	470K Ω 1/4W Res. (R101: NS)
10	9	121-5045-00	R108, R287>R294	39K Ω Res.
11	1	121-5036-00	R312	330 Ω 1/4W Res.
12	12	n/a	R300, R308>R311, R313>R316, WX, WY	0Ω *Jumper Wire (24ga.)*
13	15	121-5033-00	R208>R215, R229>R233, R414>R422	220 Ω 1/4W Res. (R208>R215: NS)
14	11	121-5021-00	R216>R223, R242, R243, R400	4.7K Ω 1/4W Res.
15	16	121-5047-00	R401>R408, R423>R430	560 Ω 1/4W Res.
16	2	121-5048-00	R410, R411	3.3K Ω 1/4W Res.
17	1	100-0049-00	U3	74LS163
18	1	(See Pg. **DR. ❸** Table)	U7	27512 EPROM
19	1	045-5015-07	CN4	7PKK156 (PIN5=KEY)
20	1	Not Used	RESET	*Do Not Stuff*
21	5	(See Pg. **DR. ❸** Table)	U17, U21, U36, U37, U210	27C040 EPROM
22	2	100-5008-00	U23, U24	74LS165
23	4	125-5017-00	C76>C79	10uF, 25v, Radial Lytic Cap.
24	4	125-5020-00	C40, C59, C101, C108, C115	22uF, 25v, Radial Lytic Cap. (C101: NS)
25	2	125-5017-00	C100, C10,7 C114	10uF, 35v, Radial Lytic Cap. (C100: NS)
26	2	125-5015-00	C102, C104, C109, C112	100uF, 25v, Rad. Ltc. Cap. (C102, C104: NS)
27	1	125-5014-00	C409	22uF, 16v, Radial Lytic Cap.
28	1	100-5016-00	U35	TDA1899
29	1	125-5037-00	C30	1000uF, 16v, Radial Lytic Cap.
30	1	100-0027-00	U34	74LS04
31	1	100-0043-00	U18	74ALS139
32	6	100-0064-00	U5, U12, U13, U15, U16, U211	74LS374
33	1	100-0249-00	U2	74HC4020
34	1	100-0149-00	U10	74LS240
35	6	n/a	W1>**W6** (Jumper required @ W6 if using 8MB EPROMs)	0Ω *Jumper Wire (24ga.)*
36	2	125-5019-00	C31, C81	470uF, 25v, Radial Lytic Cap.
37	2	125-5017-00	C10, C35	10uF, 16v, Radial Tant. Cap.
38	2	125-5012-00	C116, C119	220uF, 25v, Radial Lytic Cap.
39	1	045-5015-06	CN2	6PKK156 (PIN 5=KEY)
40	1	140-0011-00	X1	24Mhz
41	1	105-0116-00	U9	BSMT2000
42a	1	965-0136-00	**U19 - YELLOW DOT**	PAL16L8 (Programmed) - **YELLOW DOT**
42b	1	965-0137-00	**U20 - WHITE DOT**	PAL16L8 (Programmed) - **WHITE DOT**
42c	1	965-6504-00	**U213- BLUE DOT**	PAL16L8 (Programmed) - **BLUE DOT**
43	5	100-0037-00	U1, U8, U25, U27, U215	74LS74
44	3	125-5043-00	C29, C37, C51	0.001uF, (102), Cap.
45	79	125-5031-00	C1>C5, C7>C9, C12>C16, C18>C21, C23>C26, C28, C32>C34, C36, C38, C39, C41>C47, C49, C52, C102 C103, C105, C106, C110, C111, C113, C117, C118, C120, C122>C125, C255, C272>C292, C400>C407	0.1uF, (104), Axial Cer. Cap. (C102, C103, C105, C106: NS)
46	1	125-5038-00	C121	100pF, (101), Cap.
47	4	125-5039-00	C48, C50, C75, C80	0.0022uF, (222), Cap.
48	39	125-5028-00	C200>C220, C229, C230, C247>C254, C256>C271	470pF, (471), Cer. Cap. (C200>C207: NS)
49	8	125-5029-00	C221>C228, C408	0.01uF, (103), 100v Cap. (C408: NS)
50	1	045-5015-06	CN3	6PKK156
51	1	100-0375-00	U30	LM833
52	2	100-0022-00	U22 U11	74LS273
53	7	112-5003-00	D1>D3, D100>D105	1N4004, Diode (D100, D101: NS)
54	2	112-5008-00	D200, D201	1N5817, Diode
55	8	112-0054-00	D202, D400>D407	1N4148, Diode (D202: NS)
56	1	124-5002-00	VR1	LM7905CT -5v Regulator
57	2	100-5016-20	U100>U102	TDA2030V (U100: NS)
58	1	100-5018-00	U26	TDA1543
59	1	n/a	SW200	B3F4000
60	1	165-5099-00	**L200**	**LED T1-3/4 DIFFUSER LED**
61	1	165-5099-00	**L201**	**LED T1-3/4 DIFFUSER LED**
62	2	100-5015-00	U216, U217	HCT74
63	1	100-0148-00	U214	74LS138
64	1	105-0046-00	U212	MS6264A
65	1	100-0189-01	U6, U209	68B09E
66	1	545-5685-00	BAT1 BATTERY HOLDER	3-AA CELLS 4.5v
67	1	045-5015-01	CN1	20-Pin, 0.1 HEADER
68	10	n/a	6MHZ AOR Q AOL 24MHZ	*Test Points* - NS
69	10	110-0069-00	Q1>Q10	2N3904, Transistor
70	1	045-5013-00	CN5	9PKK156 (PIN 2=KEY)
71	2	100-5012-00	U201, U203	74HCT273
72	6	100-0338-00	U200, U202, U204>U208	74HC245 (U200: NS)
73	1	100-5023-00	U218	DS1232
74	1	045-5015-26	CN8	26-Pin, 0.1 HEADER
75	1	045-5014-01	CN7	10PKK156 (PIN 4=KEY)
76	4	n/a	VBATT +5v GND1, GND2	*Test Point Wire (24ga.) Loops*
77	1	045-5015-00	CN6	12PKK156 (PIN 5=KEY)
78	1	181-5002-00	SW300	8-Pin, Dip Switch
79	2	100-0377-00	U400, U401	LM339AN
80	1	105-0052-05	U4	6116 RAM
81	3	535-5000-10	U100>U102	AAVID 531102
82	3	077-5209-00	U6, U9, U209	40-Pin, IC Socket
83	5	077-5217-00	U17, U21, U36, U37, U210	32-Pin, IC Socket
84	3	077-5208-00	U4, U7, U212	28-Pin, IC Dip Socket
85	1	n/a	U1 (@ Pins 5 & 6)	100pF, Cap.

Playfield Sw. OPTO "Long-Hop" Boards Theory of Operation & Schematic



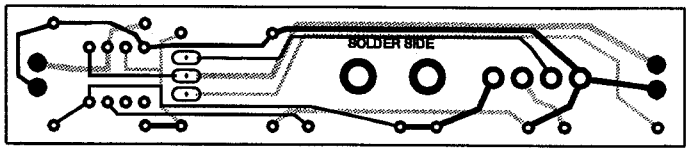
The light falling on **LED (CR1)** generates a voltage which is applied to the input (Pin-2) of the **LM311 Comparator (U1)**. **R1** bleeds off excess charge. At about a volt input from **LED (CR1)** the **Comparator (U1)** trips & drives either **Q1** (during switch line strobes) or the indicator **LED (CR2)** (in between strobes). If a switch line is being strobed, the emitter of **Q1** drops to the saturation voltage of the Switch Line Driver, about .3 volts. This plus the .7 volt drop on the base give a 1v forward bias voltage to **Q1**, which is lower than the 1.7v drop on **LED (CR2)** so the current flows through the **Transistor** during strobes. This drives **Q1** on and makes the switch. If the strobe line is high, then the 1.7v path through **LED (CR2)** is lower than **Q1**'s bias voltage so current flows through **LED (CR2)** and the indicator lights. **D1** prevents reverse bleed, **R2** and **R3** form the voltage divider for the trip point, **R4** is a current limiter for both **Q1** and **CR2**, **C1** and **C2** are general noise-filter caps.

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



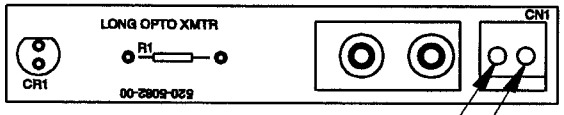
Solder Side (Green)

520-5082-00 (TRANS)



Solder Side (Green)

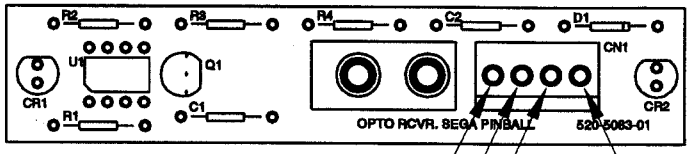
520-5083-01 (REC)



Component Side (Beige)

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

CN1



Component Side (Beige)

Pin-3 **GRN/XXX** (Sw. Drive « - »)
Pin-2 **WHT/XXX** (Sw. Return « + »)
Pin-1 **RED** (+5v)

CN1

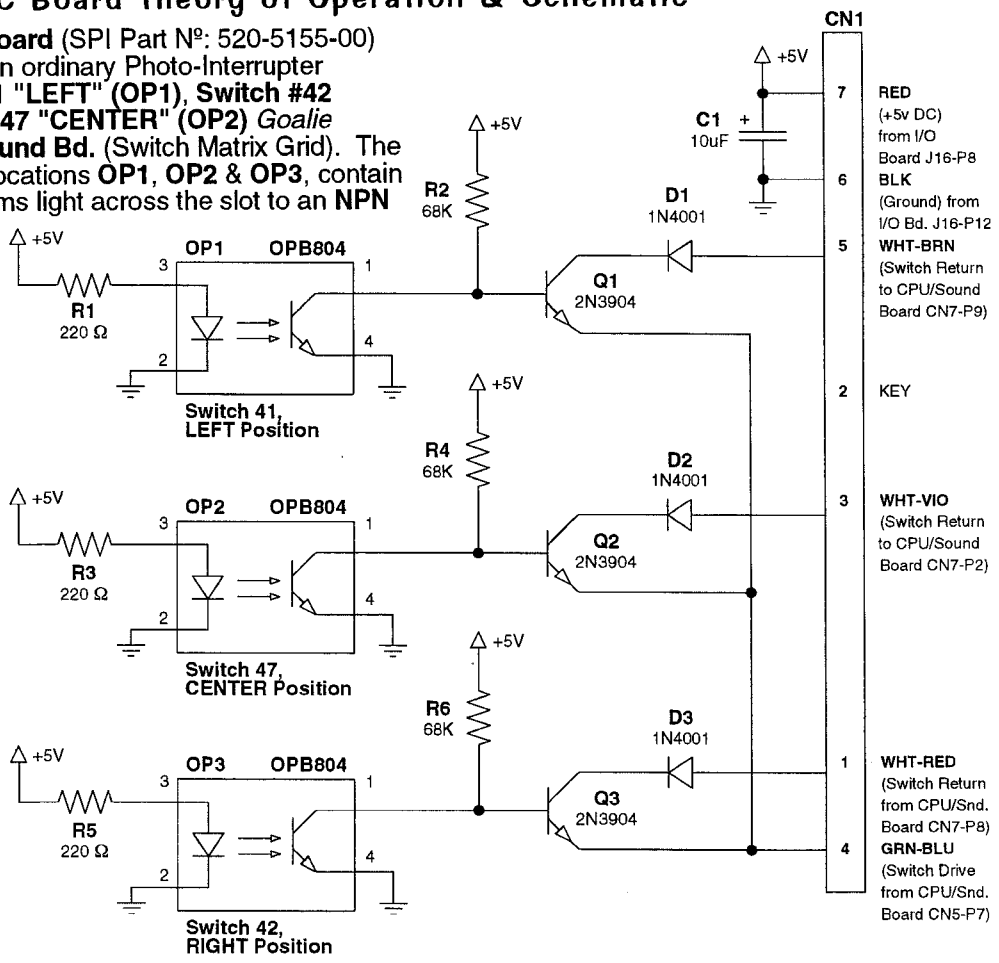
Pin-4 **BLK** (GROUND)

Note: *In this game, this Combo OPTO Board is used as a Playfield Detection Switch for the Motorcycle & the below trough. See the Switch Matrix Grid (Pg. 86). 1 Pair is used for Switch 37, OPTO (GRN-BLK, WHT-GRN).*

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
A	1	**520-5083-01**	**OPTO Receiver Board**	**Complete PCB Assembly**
1	1	165-5100-00	**CR1**	**LED MT5000UR** (Ultra Bright Red)
2	1	165-5099-00	**CR2**	**LED T1-3/4 RED DIFFUSER**
3	1	112-5014-00	D1	1N914, Diode
4	1	121-5013-00	R1	1M Ω 1/4W Res., 5%
5	1	121-5037-00	R2	330K Ω 1/4W Res., 5%
6	1	121-5077-00	R3	6.8K Ω 1/4W Res., 5%
7	1	121-5014-00	R4	220 Ω 1/4W Res., 5%
8	2	125-5023-00	C1, C2	.1uF, 25v, Axial Ceramic Cap.
6	1	100-5025-00	U1	LM311
7	1	110-0069-00	Q1	2N3904, Transistor
8	1	045-5200-04	CN1	4X1, .156" Locking Straight Hdr. Conn. (Molex 50-84-1040)
B	1	**520-5082-00**	**OPTO Transmitter Board**	**Complete PCB Assembly**
1	1	165-5100-00	**CR1**	**LED MT5000UR** (Ultra Bright Red)
2	1	121-5066-00	R1	180 Ω 1/4W Res.
3	1	045-5206-02	CN1	2X1, .156" Locking Straight Hdr. Conn. (Molex 50-84-1020)

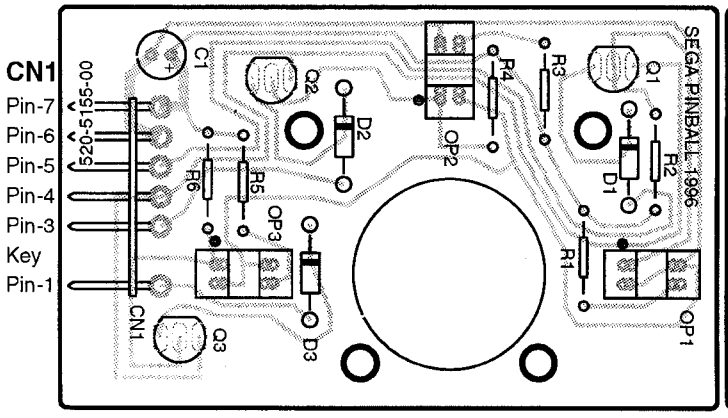
Goalie Motor OPTO PC Board Theory of Operation & Schematic

This **OPTO Printed Circuit Board** (SPI Part №: 520-5155-00) used on the Goalie Motor, is an ordinary Photo-Interrupter designed to signal **Switch #41 "LEFT" (OP1), Switch #42 "RIGHT" (OP3)** and **Switch #47 "CENTER" (OP2)** *Goalie Positions* back to the **CPU/Sound Bd.** (Switch Matrix Grid). The slotted OPTO's (U-Shaped), locations **OP1**, **OP2** & **OP3**, contain a small infrared **LED** that beams light across the slot to an **NPN Phototransistor**. This causes the **Phototransistor** to *conduct* and *pulls down the voltage* at the base of **Q1**, **Q2** and **Q3** (Transistors 2N3904) to **.3v** *or less.* **Q1**, **Q2** and **Q3** require the Base-Emitter Drop Voltage (**.7v**) **plus** the Switch Drive Drop (**.1v**) to *conduct,* and since **.3v** *is less* than this **.8v**, **Q1**, **Q2** and **Q3** stays off when the *Switch Matrix Strobe* (on Pin-4 of CN1) polls them. If the Metal Flag Bracket (riveted on the CAM) of the Motor Shaft breaks the beam in the **OPTO Slot**, the **NPN Phototransistors** *stay off,* and the *base voltages* on associated 2N2904 Transistor is **pulled to .8v** during the *Switch Strobe* by the 68KΩ 1/4W Resistors (this base voltage will actually be higher when the switch is not being polled). With the **.8v** applied to the bases, **Q1**, **Q2** and **Q3** conduct through **D1**, **D2** and **D3**, respectively. These Diodes (1N4001) prevent certain kinds of *Matrix-Related leakages* which show up as a "Phantom Switch" that completes the corners of a square in the Matrix with three (3) Real Activated Switches comprising the other three (3) corners.

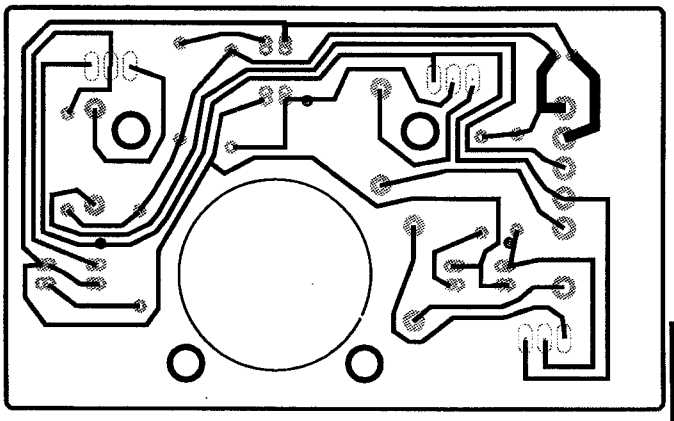


Goalie Motor OPTO PC Board Component Layout & Parts

Component Side (Beige)

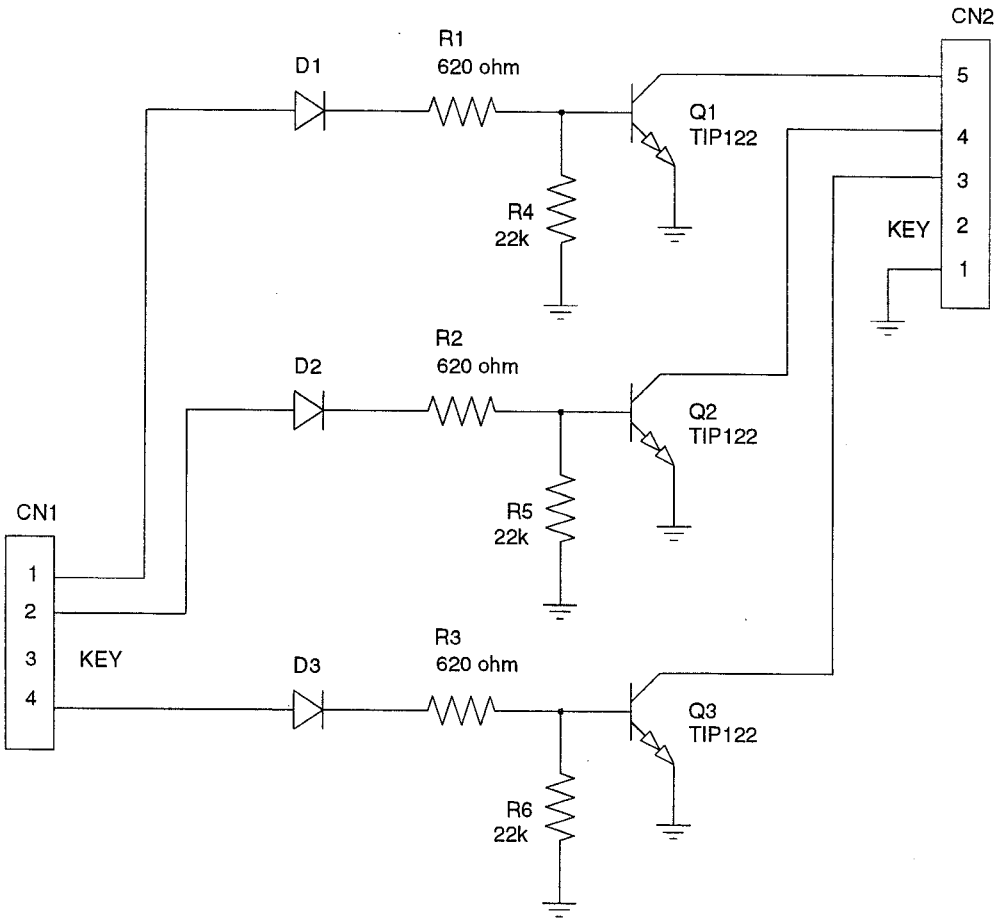


Solder Side (Green)



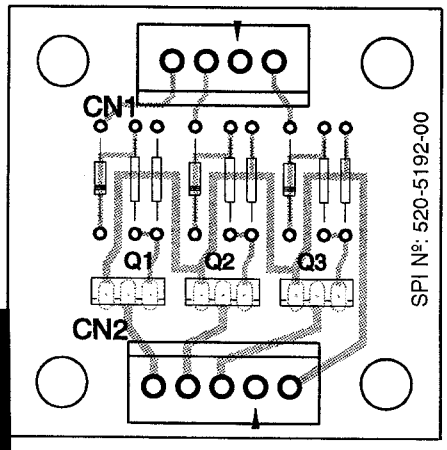
ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
—	1	**520-5155-00**	—	**Complete PCB Assembly**
1	2	165-5036-00	OP1, OP2, OP3	Slotted OPTO OPB804 Rec/Trans
2	2	112-5001-00	D1, D2, D3	1N4001, Diode
3	2	121-5014-00	R1, R3, R5	220Ω 1/4W Resistor 5%
4	2	121-5035-00	R2, R4, R6	68KΩ 1/4W Resistor 5%
5	1	125-5017-00	C1	10uf, 16v Radial Electrolytic Cap. (Panasonic ECE-A1VU100 (35v) or eqv.)
6	2	110-0069-00	Q1, Q2, Q3	2N3904, Transistor
7	1	045-5009-07	CN1	7x1 .156" Header Connector

Solenoid Expander PC Board (UK ONLY) Schematic



Solenoid Expander PC Board (UK ONLY) Component Layout & Parts

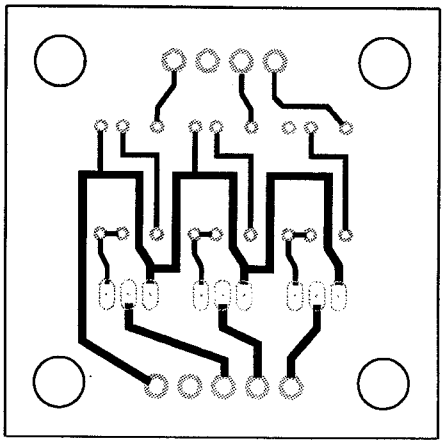
Component Side (Beige)



CN1 to I/O J2
Pin-1 ORG-BRN to J2-P1
Pin-2 ORG-RED to J2-P2
Pin-3 Key
Pin-4 ORG-BLK to J2-P3

CN2 to Coils to I/O J7-P1 20v BRN
Pin-1 GND
Pin-2 Key
Pin-3 WHT Left Up/Down Post (Aux. 1)
Pin-4 RED Center Up/Down Post (Aux. 2)
Pin-5 ORG Right Up/Down Post (Aux. 3)

Solder Side (Green)



ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
—	1	520-5192-00	—	**Complete PCB Assembly**
1	1		CN1	Connector, 4X .156"
2	1		CN2	Connector, 5X .156"
3	3	112-5014-00	D1, D2, D3	1N914, Signal Diode
4	3	121-5003-00	R1, R2, R3	620Ω, 1/4W CF Resistor
5	3	121-5042-00	R4, R5, R6	22KΩ, 1/4W CF Resistor
6	3	110-0067-00	Q1, Q2, Q3	Tip122 (NPN Darl. Transistor)

Appendixes A through I

Appendix
Table of Contents

APPENDIX A

Pinball Game Firmware Table

EPROM	Chip Size	Program Part №	USA Ver.	Bd. Loc.	Raw Part №
Laser War					
CPU	(256K)	965-0004-00		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 9	60-5007-00
			- 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 9	60-7001-02
Secret Service					
CPU	(256K)	965-0011-00	A-6	B5	960-5007-00
CPU	(256K)	965-0012-00	A-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	A02-1	B5	960-5007-00
CPU	(256K)	965-0017-00	A02-1	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	A02-3	B5	960-5007-00
CPU	(256K)	965-0022-00	A02-3	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	A02-3	B5	960-5007-00
CPU	(256K)	965-0047-00	A02-3	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	(256K)	965-0031-00	A02-7	B5	960-5007-00
CPU	(256K)	965-0032-00	A02-7	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	A03-4	B5	960-5007-00
CPU	(256K)	965-0037-00	A03-4	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	(256K)	965-0026-00	A03-2	B5	960-5007-00
CPU	(256K)	965-0027-00	A03-2	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	A02-0	B5	960-5007-00
CPU	(256K)	965-0042-00	A02-0	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	(256K)	965-0051-00	A02-7	B5	960-5007-00
CPU	(256K)	965-0052-00	A02-7	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	(256K)	965-0056-00	A1-7	B5	960-5007-00
CPU	(256K)	965-0134-00	A1-7	C5	960-5007-00
Voice 1	(1M)	965-0057-00		F7	960-5009-00
Voice 2	(1M)	965-0058-00		F5	960-5009-00
Sound	(256K)	965-0059-00		F4	960-5007-00
Display	(512K)	965-0060-00	CP80	U8	960-7001-02
Teenage Mutant Ninja Turtles					
CPU	(256K)	965-0061-00	A1.04	B5	960-5007-00
CPU	(256K)	965-0062-00	A1.04	C5	960-5007-00
Voice 1	(1M)	965-0063-00		F5/6	960-5009-00
Voice 2	(1M)	965-0064-00		F4/5	960-5009-00
Sound	(256K)	965-0065-00		F7	960-5007-00
Display	(512K)	965-0066-00	A1.04	U8	960-7001-02
Batman					
CPU	(128K)	965-0067-00	A1.06	B5	960-5006-00
CPU	(256K)	965-0135-00	A1.06	C5	960-5007-00
Voice 1	(2M)	965-0068-00		U17	960-5010-00
Voice 2	(1M)	965-0069-00		U21	960-5009-00
Sound	(256K)	965-0070-00		U7	960-5007-00
Display	(1M)	965-0071-00	A1.06	U8	960-5009-00
Star Trek 25th Anniversary					
CPU	(512K)	965-0072-00	A2.01	C5	960-7001-02
Voice 1	(2M)	965-0073-00		U17	960-5010-00
Voice 2	(2M)	965-0074-00		U21	960-5010-00
Sound	(256K)	965-0075-00		U7	960-5007-00
Display	(1M)	965-0076-00	A1.09	U8	960-5009-00
Hook					
CPU	(512K)	965-0077-00	A4.08	C5	960-7001-02
Voice 1	(2M)	965-0078-00		U17	960-5010-00
Voice 2	(2M)	965-0079-00		U21	960-5010-00
Sound	(256K)	965-0080-00		U7	960-5007-00
Display	(1M)	965-0081-00	A4.01	U8	960-5009-00

EPROM	Chip Size	Program Part №	USA Ver.	Bd. Loc.	Raw Part №
Lethal Weapon 3					
CPU	(512K)	965-0082-00	A2.07	C5	960-7001-02
Voice 1	(2M)	965-0083-00		U17	960-5010-00
Voice 2	(2M)	965-0084-00		U21	960-5010-00
Sound	(256K)	965-0085-00		U7	960-5007-00
Display	(2M)	965-0086-00	A2.06	ROM 0	960-5010-00
Display	(2M)	965-0087-00	A2.06	ROM 1	960-5010-00
	(Used on Display PCB 520-5055-00)				
			-OR-		
Display	(4M)	965-0087-04	A2.06	ROM 0	960-5015-00
	(Used on Display PCB 520-5055-01)				
Star Wars					
CPU	(512K)	965-0119-00	A1.03	C5	960-7001-02
Voice 0	(4M)	965-0132-00		U17	960-5015-00
Voice 1	(2M)	965-0133-00		U21	960-5010-00
Sound	(256K)	965-0131-00		U7	960-5007-00
Display	(2M)	965-0120-00	A1.04	ROM 0	960-5010-00
Display	(2M)	965-0121-00	A1.04	ROM 1	960-5010-00
	(Used on Display PCB 520-5055-00)				
			-OR-		
Display	(4M)	965-0122-00	A1.05	ROM 0	960-5015-00
	(Used on Display PCB 520-5055-01)				
Rocky & Bullwinkle & Friends					
CPU	(512K)	965-0138-00	A1.30	C5	960-7001-02
Voice 0	(4M)	965-0139-00		U17	960-5015-00
Voice 1	(2M)	965-0140-00		U21	960-5010-00
Sound	(256K)	965-0141-00		U7	960-5007-00
Display	(4M)	965-0142-00	A1.30	ROM 0	960-5015-00
Jurassic Park					
CPU	(512K)	965-0143-00	A5.13	C5	960-7001-02
Voice 0	(4M)	965-0144-00		U17	960-5015-00
Voice 1	(2M)	965-0145-00		U21	960-5010-00
Sound	(256K)	965-0146-00		U7	960-5007-00
Display	(4M)	965-0147-00	A5.10	ROM 0	960-5015-00
Last Action Hero					
CPU	(512K)	965-0148-00	A1.12	C5	960-7001-02
Voice 0	(4M)	965-0149-00		U17	960-5015-00
Voice 1	(2M)	965-0150-00		U21	960-5010-00
Sound	(256K)	965-0151-00		U7	960-5007-00
Display	(4M)	965-0152-00	A1.06	ROM 0	960-5015-00
Tales from the Crypt					
CPU	(512K)	965-0157-00	A3.03	C5	960-7001-02
Voice 0	(4M)	965-0158-00		U17	960-5015-00
Voice 1	(2M)	965-0159-00		U21	960-5010-00
Sound	(256K)	965-0160-00		U7	960-5007-00
Display	(4M)	965-0161-00	A3.01	ROM 0	960-5015-00
The Who's Tommy					
CPU	(512K)	965-0162-00	A4.00	C5	960-7001-02
Voice 1	(4M)	965-0165-00		U17	960-5015-00
Voice 2	(4M)	965-0166-00		U21	960-5015-00
Voice 3	(4M)	965-0167-00		U36	960-5015-00
Voice 4	(4M)	965-0168-00		U37	960-5015-00
Sound	(512K)	965-0164-00		U7	960-7001-02
Display	(4M)	965-0163-00	A4.00	ROM 0	960-5015-00
WWF Royal Rumble					
CPU	(512K)	965-0169-00	A1.06	C5	960-7001-02
Voice 1	(4M)	965-0172-00		U17	960-5015-00
Voice 2	(4M)	965-0173-00		U21	960-5015-00
Voice 3	(4M)	965-0174-00		U36	960-5015-00
Sound	(512K)	965-0171-00		U7	960-7001-02
Display	(4M)	965-0170-00	A1.02	ROM 0	960-5015-00
Guns N' Roses					
CPU	(512K)	965-0175-00	A3.00	C5	960-7001-02
Voice 1	(4M)	965-0178-00		U17	960-5015-00
Voice 2	(4M)	965-0179-00		U21	960-5015-00
Voice 3	(4M)	965-0180-00		U36	960-5015-00
Voice 4	(4M)	965-0181-00		U37	960-5015-00
Sound	(512K)	965-0177-00		U7	960-7001-02
Display	(4M)	965-0176-00	A3.00	ROM 0	960-5015-00
Maverick *					
CPU	(512K)	965-0182-00	A4.04	C5	960-7001-02
Voice 1	(4M)	965-0186-00		U17	960-5015-00
Voice 2	(4M)	965-0187-00		U21	960-5015-00
Voice 3	(4M)	965-0187-01		U36	960-5015-00
Sound	(512K)	965-0185-00		U7	960-7001-02
Display*	(4M)	965-0183-00	A4.01	ROM 0	960-5015-00
Display*	(4M)	965-0184-00	A4.01	ROM 3	960-5015-00
Mary Shelley's Frankenstein *					
CPU	(512K)	965-0188-00	A1.03	C5	960-7001-02
Voice 1	(4M)	965-0192-00		U17	960-5015-00
Voice 2	(4M)	965-0193-00		U21	960-5015-00
Voice 3	(4M)	965-0194-00		U36	960-5015-00
Sound	(512K)	965-0191-00		U7	960-7001-02
Display*	(4M)	965-0189-00	A1.03	ROM 0	960-5015-00
Display*	(4M)	965-0190-00	A1.03	ROM 3	960-5015-00
Baywatch *	(CPU Board 520-5003-04)				
CPU	(512K)	965-0195-00	A4.00	C5	960-7001-02
Voice 1	(4M)	965-0196-00		U17	960-5015-00
Voice 2	(4M)	965-0197-00		U21	960-5015-00
Sound	(512K)	965-0199-00		U7	960-7001-02
Display*	(4M)	965-0200-00	A4.00	ROM 0	960-5015-00
Display*	(4M)	965-0201-00	A4.00	ROM 3	960-5015-00
Batman Forever *	(CPU Board 520-5003-04)				
CPU	(512K)	965-0202-00	A3.02	C5	960-7001-02
Voice 1	(4M)	965-0203-00		U17	960-5015-00
Voice 2	(4M)	965-0204-00		U21	960-5015-00
Sound	(512K)	965-0205-00		U7	960-7001-02
Display*	(4M)	965-0206-00	A3.00	ROM 0	960-5015-00
Display*	(4M)	965-0207-00	A3.00	ROM 3	960-5015-00

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

APPENDIX A

Pinball Game Firmware (for White Star Board System) Table

ROM	Chip Size	Program Part №	USA Ver. & Check Sum	Bd. Loc.	Raw Part №
Apollo 13					
CPU / Sound Board:			**520-5136-00 (Stereo)**		
Game ROM	(1M)	965-0208-00	A5.01 I $09FF	U210	960-5009-00
Voice 1	(4M)	965-0209-00	U17	n/a (masked)	
Voice 2	(4M)	965-0210-00	U21	n/a (masked)	
Voice 3	(4M)	965-0211-00	U36	n/a (masked)	
Sound	(512K)	965-0212-00	U7		960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0213-00	A5.00 I $B92B	ROM 0	960-5015-01
Golden Eye					
CPU / Sound Board:			**520-5136-00 (Stereo)**		
Game ROM	(1M)	965-0214-42	A4.04 I $3FFF	U210	960-5009-00
Voice 1	(4M)	965-0215-42		U17	n/a (masked)
Voice 2	(4M)	965-0216-42		U21	n/a (masked)
Sound	(512K)	965-0217-42		U7	960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0218-42	A4.00 I $E6ED	ROM 0	960-5015-01
Twister					
CPU / Sound Board:			**520-5136-10 (Mono)**		
Game ROM	(1M)	965-0219-41	A4.05 I $E9FF	U210	960-5009-00
Voice 1	(4M)	965-0220-41		U17	960-5015-01
Voice 2	(4M)	965-0223-41		U21	960-5015-01
Sound	(512K)	965-0221-41		U7	960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0222-41	A4.01 I $FD01	ROM 0	960-5015-01
ID4: Independence Day					
CPU / Sound Board:			**520-5136-10 (Mono)**		
Game ROM	(1M)	965-0224-45	A2.02 I $9CFF	U210	960-5009-00
Voice 1	(4M)	965-0225-45		U17	960-5015-01
Voice 2	(4M)	965-0226-45		U21	960-5015-01
Sound	(512K)	965-0227-45		U7	960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0228-45	A2.00 I $ABF7	ROM 0	960-5015-01
Space Jam					
CPU / Sound Board:			**520-5136-10 (Mono)**		
Game ROM	(1M)	965-0229-43	A3.00 I $E6FF	U210	960-5009-00
Voice 1	(4M)	965-0230-43		U17	960-5015-01
Voice 2	(4M)	965-0231-43		U21	960-5015-01
Voice 3	(4M)	965-0232-43		U36	960-5015-01
Sound	(512K)	965-0233-43		U7	960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0234-43	A3.00 I $0057	ROM 0	960-5015-01
The Star Wars Trilogy - Special Edition (S.E.)					
CPU / Sound Board:			**520-5136-10 (Mono)**		
Game ROM	(1M)	965-0235-56	A4.03 I $5EFF	U210	960-5009-00
Voice 1	(4M)	965-0236-56		U17	960-5015-01
Voice 2	(4M)	965-0237-56		U21	960-5015-01
Sound	(512K)	965-0238-56		U7	960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0239-56	A4.00 I $8817	ROM 0	960-5015-01
The Lost World: Jurassic Park					
CPU / Sound Board:			**520-5136-10 (Mono)**		
Game ROM	(1M)	965-0240-53	A2.01 I $C2FF	U210	960-5009-00
Voice 1	(4M)	965-0241-53		U17	960-5015-01
Voice 2	(4M)	965-0242-53		U21	960-5015-01
Sound	(512K)	965-0243-53		U7	960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0244-53	A2.01 I $7F46	ROM 0	960-5015-01
The X-Files					
CPU / Sound Board:			**520-5136-10 (Mono)**		
Game ROM	(1M)	965-0245-46	A3.03 I $A2FF	U210	960-5009-00
Voice 1	(4M)	965-0246-46		U17	960-5015-01
Voice 2	(4M)	965-0247-46		U21	960-5015-01
Sound	(512K)	965-0248-46		U7	960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0249-46	A3.00 I $66D0	ROM 0	960-5015-01
Starship Troopers					
CPU / Sound Board:			**520-5136-15 (Mono FCC NOV97)**		
Game ROM	(1M)	965-0250-59	A2.00 I $85FF	U210	960-5009-00
Voice 1	(4M)	965-0251-59		U17	960-5015-01
Voice 2	(4M)	965-0252-59		U21	960-5015-01
Voice 3	(4M)	965-0255-59		U36	960-5015-01
Sound	(512K)	965-0253-59		U7	960-7001-02
Display Controller Bd.:			**520-5055-02 (FCC NOV97)**		
Display	(4M)	965-0254-59	A2.00 I $E77B	ROM 0	960-5015-01
Viper Night Drivin'					
CPU / Sound Board:			**520-5136-16 (Mono FCC FEB98)**		
Game ROM	(1M)	965-0266-35	A2.01 I $C5FF	U210	960-5009-00
Voice 1	(4M)	965-0267-35		U17	960-5015-01
Voice 2	(4M)	965-0268-35		U21	960-5015-01
Voice 3	(4M)	965-0269-35		U36	960-5015-01
Voice 4	(4M)	965-0270-35		U37	960-5015-01
Sound	(512K)	965-0271-35		U7	960-7001-02
Display Controller Bd.:			**520-5055-03 (FCC FEB98)**		
Display	(4M)	965-0272-35	A2.01 I $C17D	ROM 0	960-5015-01
Lost In Space					
CPU / Sound Board:			**520-5136-16 (Mono FCC FEB98)**		
Game ROM	(1M)	965-0282-60	A1.01 I $B2FF	U210	960-5009-00
Voice 1	(4M)	965-0283-60		U17	960-5015-01
Voice 2	(4M)	965-0284-60		U21	960-5015-01
Voice 3	(4M)	965-0285-60		U36	960-5015-01
Voice 4	(4M)	965-0286-60		U37	960-5015-01
Sound	(512K)	965-0287-60		U7	960-7001-02
Display Controller Bd.:			**520-5055-03 (FCC FEB98)**		
Display	(4M)	965-0288-60	A1.02 I $32AB	ROM 0	960-5015-01
Godzilla					
CPU / Sound Board:			**520-5136-16 (Mono FCC FEB98)**		
Game ROM	(1M)	965-0289-40	A2.05I $B1FF	U210	960-5009-00
Voice 1	(4M)	965-0290-40		U17	960-5015-01
Voice 2	(4M)	965-0291-40		U21	960-5015-01
Voice 3	(4M)	965-0292-40		U36	960-5015-01
Voice 4	(4M)	965-0293-40		U37	960-5015-01
Sound	(512K)	965-0294-40		U7	960-7001-02
Display Controller Bd.:			**520-5055-03 (FCC FEB98)**		
Display	(4M)	965-0295-40	A2.00 I $C929	ROM 0	960-5015-01
South Park					
CPU / Sound Board:			**520-5136-16 (Mono FCC FEB98)**		
Note: This game uses four (4) 8MB VOICE ROMS at U17, U21, U36 & U37 requiring a Jumper at Loc. W6. Refer to CPU/Snd. Bd. Schematic (2 of 3).					
Game ROM	(1M)	965-0301-71	A1.03 I $58FF	U210	960-5009-00
Voice 1	(8M)	965-0302-71		U17	960-5016-00
Voice 2	(8M)	965-0303-71		U21	960-5016-00
Voice 3	(8M)	965-0304-71		U36	960-5016-00
Voice 4	(8M)	965-0305-71		U37	960-5016-00
Sound	(512K)	965-0306-71		U7	960-7001-02
Display Controller Bd.:			**520-5055-03 (FCC FEB98)**		
Display	(4M)	965-0307-71	A1.01 I $166F	ROM 0	960-5015-01
Harley-Davidson®					
CPU / Sound Board:			**520-5136-16 (Mono FCC FEB98)**		
Note: This game uses four (4) 8MB VOICE ROMS at U17, U21, U36 & U37 requiring a Jumper at Loc. W6. Refer to CPU/Snd. Bd. Schematic (2 of 3).					
Game ROM	(1M)	965-0319-67	A1.03 I $3EFF	U210	960-5009-00
Voice 1	(8M)	965-0322-67		U17	960-5016-00
Voice 2	(8M)	965-0323-67		U21	960-5016-00
Voice 3	(8M)	965-0324-67		U36	960-5016-00
Voice 4	(4M)	965-0325-67		U37	960-5015-01
Sound	(512K)	965-0320-67		U7	960-7001-02
Display Controller Bd.:			**520-5055-03 (FCC FEB98)**		
Display	(4M)	965-0321-67	A1.04 I $FC7C	ROM 0	960-5015-01
Striker Xtreme					
CPU / Sound Board:			**520-5136-16 (Mono FCC FEB98)**		
Note: This game uses four (4) 8MB VOICE ROMS at U17, U21, U36 & U37 requiring a Jumper at Loc. W6. Refer to CPU/Snd. Bd. Schematic (2 of 3).					
Game ROM	(1M)	965-0326-68	A I $	U210	960-5009-00
Voice 1	(8M)	965-0329-68		U17	960-5016-00
Voice 2	(8M)	965-0330-68	**GAME CODE**	U21	960-5016-00
Voice 3	(8M)	965-0331-68	**IN**	U36	960-5016-00
Voice 4	(8M)	965-0332-68	**PRODUCTION**	U37	960-5016-00
Sound	(512K)	965-0327-68		U7	960-7001-02
Display Controller Bd.:			**520-5055-03 (FCC FEB98)**		
Display	(4M)	965-0328-68	A I $	ROM 0	960-5015-01

Game Revisions can be updated after the Production Run. This Table is accurate as of the printing of this manual. If any changes occurred, the next game manual will include the updated information. The version stated is USA. If there is a question of as to the latest Code Revision & Check Sum call our Technical Support Department, 1-800-542-5377 or 1-708-786-5466.

APPENDIX B

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

Table №	Type	Source Number	STERN™ PINBALL	N T E®	E C G®	Radio Shack®	R C A®
	RECTIFICATION, BLOCKING, DAMPENING DIODES AND/OR LIGHT EMITTING DIODES (LEDs)						
1	Diode	1N4001	112-5001-00	NTE552	ECG552	- — - — -	SK9000
	Diode	1N4004	112-5003-00	NTE116	ECG116	276-1103	SK3312
	Diode	1N5401	112-0056-00	NTE5801	ECG5801	276-1143	SK9004
	Diode	1N5404	112-5004-00	NTE5804	ECG5804	276-1144	SK9007
	Diode	T6A10L	112-5006-01	- — - — -	- — - — -	- — - — -	- — - — -
	Diode	FR302	112-5009-00	- — - — -	ECG588	- — - — -	SK5014
	Diode, Signal	1N914	112-5014-00	- — - — -	- — - — -	- — - — -	- — - — -
	LED	MT5000UR or (T1-3/4 GaAlAs)	165-5100-00	- — - — -	- — - — -	276-066B	- — - — -
	ZENER DIODES						
2	Diode	1N4742A 12v	112-0061-00	NTE142A	ECG142A	276-563	SK12V
	Diode	1N4760B 68v	112-0062-00B	NTE5092A	ECG5092A	- — - — -	SK68V
	Diode	1N4764A 100v	112-0049-00A	NTE5096A	ECG5096A	- — - — -	SK100V
	Diode	1N5228 3.9v	112-0053-00	NTE5007A	ECG5007A	- — - — -	SK3A9
	Diode	1N5234B 6.2v	112-0047-00B	NTE5013A	ECG5013A	276-561	SK6A2
	Diode	1N5379 110v	112-0072-00	NTE5157	ECG5157	- — - — -	SK110X
	Diode	1N6267A 6.8v	112-5011-00	- — - — -	ECG4902	- — - — -	- — - — -
	Diode	1N4752A 33v	112-5010-00A	- — - — -	- — - — -	- — - — -	SK33V
	Diode	1N4736 6.8v 1w	112-5007-00	- — - — -	- — - — -	- — - — -	- — - — -
	TRANSISTORS - TYPE FET, NPN, PNP AND/OR SCR						
3	FET Trans.	STP20N10L	110-0106-00	- — - — -	ECG2943	- — - — -	- — - — -
	FET Trans.	STP19N06L	110-0088-00	- — - — -	- — - — -	- — - — -	- — - — -
	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	- — - — -	ECG5463 / 65 / 66 / 68		- — - — -
	BRIDGE RECTIFIERS (BR)			**Comments:**			
4	BR (Present)	DB3501 or CM3501	112-5000-00	For White Star I/O Bds., BR = 35 Amp @ 100v P.I.V.			
	RELAYS			**Comments:**			
5	Relay	FRL-264 D024/02CK	190-5002-00	For PPB, Power Supply, & White Star I/O Boards, Relay = 24v DC 10 Amp DPDT			
	Relay	FRL-264 D006/04CV	190-5001-00	For CPU Boards, Relay = 6v DC 5 Amp 4 Pole DT			

APPENDIX C

Game Mfg. Date, Manual Part Nº and CPU Jumper Table†

Game Name	Game Mfg. Date and Manual PNº	CPU Ver.	EPROM Position	Jumpers Installed (see Note)	Jumpers Removed (see Note)
1. Laser War	MAY 87 780-5001-00	1 2	5C 5B, 5C	J4 J6a J7a J4 J5a J6a	J5 J6 J7b J5 J5b J6b
2. Secret Service	MAR 88 780-5002-00	2	5B, 5C	J4	J5
3. Torpedo Alley	AUG 88 780-5003-00	2	5B, 5C	J4	J5
4. Time Machine	DEC 88 780-5004-00	2	5B, 5C	J4	J5
5. Playboy 35th Anniversary	MAY 89 780-5005-00	2	5B, 5C	J4	J5
6. ABC Monday Night Football	SEP 89 780-5007-00	2	5B, 5C	J4	J5
7. Robocop	NOV 89 780-5006-00	2	5B, 5C	J4	J5
8. Phantom of the Opera	JAN 90 780-5008-00	2	5B, 5C	J4	J5
9. Back to the Future	JUN 90 780-5009-00	3	5B, 5C	J4	J5
10. The Simpsons	SEP 90 780-5012-00	3	5B, 5C	J4	J5
11. Checkpoint	FEB 91 780-5010-00	3	5B, 5C	J4	J5
12. Teenage Mutant Ninja Turtles	MAY 91 780-5017-00	3	5B, 5C	J4	J5
13. Batman	JUL 91 780-5011-00	3	5B, 5C	J4	J5
14. Star Trek 25th Anniversary	OCT 91 780-5014-00	3	5C	J5	J4
15. Hook	JAN 92 780-5019-00	3	5C	J5	J4
16. Lethal Weapon 3	JUN 92 780-5026-00	3	5C	J5	J4
17. Star Wars	OCT 92 780-5024-00	3	5C	J5	J4
18. Rocky & Bull-winkle & Friends	FEB 93 780-5022-00	3	5C	J5	J4
19. Jurassic Park	APR 93 780-5020-00	3	5C	J5	J4
20. Last Action Hero	AUG 93 780-5027-00	3	5C	J5	J4
21. Tales from the Crypt	NOV 93 780-5018-00	3	5C	J5	J4
22. The Who's Tommy	FEB 94 780-5028-00	3	5C	J5	J4
23. WWF Royal Rumble	MAY 94 780-5023-00	3	5C	J5	J4
24. Guns-N'-Roses	JUL 94 780-5029-00	3	5C	J5	J4
25. Maverick	SEP 94 780-5031-00	3	5C	J5	J4
26. Mary Shelley's Frankenstein	DEC 94 780-5036-00	3	5C	J5	J4
27. Baywatch	MAR 95 780-5033-00	3	5C	J5	J4
28. Batman Forever	JUL 95 780-5038-00	3	5C	J5	J4

Game Name	Game Mfg. Date and Manual PNº	CPU Ver.	EPROM Position	Jumpers Installed	Jumpers Removed
29. Apollo 13 (A13)	NOV 95 780-5044-00	—	U210	n / a	n / a
30. Golden Eye	FEB 96 780-5042-00	—	U210	n / a	n / a
31. Twister	APR 96 780-5041-00	—	U210	n / a	n / a
32. ID4: Inde-pendence Day	JUL 96 780-5045-00	—	U210	n / a	n / a
33. Space Jam	OCT 96 780-5043-00	—	U210	n / a	n / a
34. The Star Wars Trilogy - S.E.	FEB 97 780-5056-00	—	U210	n / a	n / a
35. The Lost World: J.P.	JUN 97 780-5053-00	—	U210	n / a	n / a
36. The X-Files	AUG 97 780-5046-00	—	U210	n / a	n / a
37. Starship Troopers	NOV 97 780-5059-00	—	U210	n / a	n / a
38. Viper Night Drivin'	FEB 98 780-5035-00	—	U210	n / a	n / a
39. Lost In Space	JUN 98 780-5060-00	—	U210	n / a	n / a
40. Godzilla	SEP 98 780-5040-00	—	U210	n / a	n / a
41. South Park	JAN 99 780-5071-00	—	U17 U21 U36 U37	W6 CPU/Snd.	n / a
42. Harley-Davidson®	AUG 99 780-5067-01	—	U17 U21 U36 U37	W6 CPU/Snd.	n / a
43. Striker Xtreme	MAR 00 780-5068-01	—	U17 U21 U36 U37	W6 CPU/Snd.	n/a

† Additional Information for Installed / Removed Jumpers (List 1-28 only):

Board Combinations with **ROM** at Location **5C** (Game 1, Ver1) **Installed** J1b, J3, J4, J6a, **J7a** & J8 **Removed** J1a, J2, J5, **J6** & **J7b**

Board Combinations w/ **ROM** at Locations **5B, 5C** (Game 1, Ver2) **Installed J1b**, J3, J4, **J5a, J6a, J7b** & J8 **Removed** J1a, J2, J5, **J5b, J6b,** & **J7a**

Board Combinations w/ **ROM** at Locations **5B, 5C** (Games 2-12, Ver2/3) **Installed** J1b, J3, **J4, J5b, J6b,** J7b & J8 **Removed J1a**, J2, **J5, J5a, J6a** & J7a

Board Combinations with **ROM** at Locations **5C** (Games 14-28, Ver3) **Installed** J1b, J3, **J5**, J5b, J6b, J7b & J8 **Removed** J1a, J2, **J4,** J5a, J6a & J7a

* Version 1 has a 2K RAM which is a 24-pin IC in Position 5D; Versions 2 & 3 have a 8K RAM which is a 28-PIN IC in Position 5D.

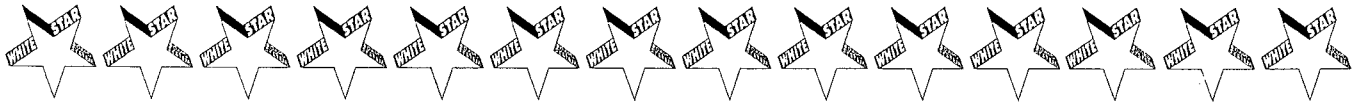
APPENDIX D

Board Type Table

Game Name	Flipper	Sound	Power Supply	Display X-Digit
Laser War	2-Flipper Board Not Required	***Initial:*** 520-5002-00 ***replaced with:*** 520-5002-02 *520-5002-01 was not used.*	520-5000-00	Master: 520-5004-00 plus: 520-5005-00 (Qty. 2): 7 Digit Alpha/Numeric 520-5006-00 (Qty. 2): 7 Digit Numeric 520-5007-00 (Qty. 1): 4 Digit Numeric
Secret Service	3-Flipper Board Not Required	520-5002-02	520-5000-00	520-5014-01 7 Digit Alpha/Numeric Combined
Torpedo Alley	3-Flipper Board Not Required	520-5002-02	520-5000-00	520-5014-01 7 Digit Alpha/Numeric Combined
Time Machine	2-Flipper Board Not Required	520-5002-02	520-5000-00	520-5014-01 7 Digit Alpha/Numeric Combined
Playboy 35th Anniversary	520-5033-00 2-Flipper (for 100 games)	520-5002-02	520-5000-00	520-5014-01 7 Digit Alpha/Numeric Combined
ABC Monday Night Football	520-5033-00 2-Flipper (for 100 games)	520-5002-02	520-5000-00	520-5030-00 16 Digit Alpha/Numeric Combined
Robocop	520-5033-00 2-Flipper	520-5002-02	520-5000-00	520-5030-00 16 Digit Alpha/Numeric Combined
Phantom of the Opera	520-5033-00 2-Flipper	520-5002-02	520-5000-00	520-5030-00 16 Digit Alpha/Numeric Combined
Back to the Future	520-5033-00 2-Flipper	520-5002-02	520-5000-00	520-5030-00 16 Digit Alpha/Numeric Combined
The Simpsons	520-5033-00 2-Flipper	520-5002-03	520-5000-00	520-5030-00 16 Digit Alpha/Numeric Combined

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

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



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

Game Name	Flipper	I/O Power Driver	CPU/Sound Stereo	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO 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			

Table continued on the next page.

APPENDIX D

Board Type Table

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

Game Name	I/O Power Driver	CPU/Sound Mono	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Apllication	Misc OPTO & App.
Twister	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Light Boards 520-5145-01 through -07		Mag. Drv. Bd. 520-5143-00	Relay Board 520-5010-00				
Independence Day (ID4)	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Light Boards 520-5149-01 through -10		Servo Mtr. Bd. 520-5152-00		520-5082-00 Long Hop OPTO	520-5083-00 Long Hop OPTO	Alien Head Enter	
Space Jam	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	2X 7-Segment Display Board 520-5153-00							
The Star Wars Trilolgy - Special Ed.	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00							
The Lost World: J.P.	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	520-5162-00 2-Pos. Motor Sensor on Snagger Motor
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Shaker Mtr. Bd. 520-5065-00						
The X-Files	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	520-5155-00 3-Pos. Motor Sensor on File Cab. Motor
	Miscellaneous PC Boards:					520-5082-00 Long Hop OPTO	520-5083-00 Long Hop OPTO	File Cabinet Enter	
Starship Troopers	520-5137-01	520-5136-15	520-5138-00	520-5052-00 128 X 32	520-5055-02	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	4X 7-Segment Display Board 520-5166-00				520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	L/R Orbit Lane Enter	
Viper Night Drivin'	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00				520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Jump Ramp	
Lost In Space	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00							
Godzilla	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Shaker Mtr. Bd. 520-5065-00							
South Park	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:					520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Kenny Under Trough Enter	
Harley-Davidson®	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00	Shaker Mtr. Bd. 520-5065-00	Diode Board 520-5146-00		520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Motorcycle Enter	
Striker Xtreme	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5155-00 3-Pos. Motor Sensor on Goalie Motor
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Relay Board 520-5010-00	Diode Board 520-5146-00	for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Goalie Under-Trough Enter	

† ***Note:*** To order Game Specific CPU/Sound Board please specify Game Name.

APPENDIX E

Generic Coil Cross-Reference Guide † ‡

STANDARD COILS						FLIPPER COILS			
GA-TURNS	Res. (Ω)	SPI PART Nº	GA-TURNS	Res. (Ω)	SPI PART Nº	GAUGE-TURNS	Res. (Ω)	COLOR	SPI PART Nº
20-400	1.0 Ω	090-5021-00	**24-940** †	5.5 Ω	090-5036-00T	**21-900** †	*not available*	RED	090-5020-10T
22-500	1.7 Ω	090-5017-00			090-5036-00B	**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	090-5020-20T
23-700	3.1 Ω	090-5022-00	**26-1200** †	10.3 Ω	090-5044-00T	**22-1080** †	4.3 Ω	YEL/GRN	090-5032-00T
23-750	3.4 Ω	090-5019-00			090-5044-00B				090-5032-00B
23-800 †	3.6 Ω	090-5001-00T	**27-1300**	14.2 Ω	090-5003-00	**23-620**/30-2600 ‡	2.4 / 75.0 Ω	N/A	090-5006-00
		090-5001-00B	**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	090-5004-00T	**23-800**/30-2600 ‡	2.8 / 90.5 Ω	N/A	090-5012-00
23-1200	7.1 Ω	090-5008-00			090-5004-00B	**23-900**	3.8 Ω	GRN	090-5020-30
23½-765	3.6 Ω	090-5037-03	**28-1050**	11.5 Ω	090-5046-00	**23-1100**	5.1 Ω	ORG	090-5030-00
24-900	5.0 Ω	090-5002-00	**29-2000**	33.6 Ω	090-5016-00	**24-1570**	9.5 Ω	N/A	090-5025-00
NOTE: Ohm values may vary +/- .03 Ω depending on meter calibration.						**25-1800**	13.8 Ω	BLU/GRN	090-5041-00

† Coil Part Nºs ending with a "T" signifies the Diode is on the top of the lug; ...ending with a "B" signifies the Diode is on the bottom of the lug.
‡ These coils are dual-wound.

MAGNET COILS		
GA-TURNS	Res. (Ω)	SPI PART Nº
22-650	4.3 Ω	090-5042-01

The above coil has 12" leads.

LUGLESS COILS		
GA-TURNS	Res. (Ω)	SPI PART Nº
23-800	3.6 Ω	090-5053-00

MINI-COILS		
GA-TURNS	Res. (Ω)	SPI PART Nº
29-1000	15.2 Ω	090-5059-00
31-1500	52.0 Ω	090-5054-00
32-1800	50.2 Ω	090-5031-00

NOTE: All Coil Part Nºs listed ***Do Not Include*** Coil Sleeves (must be ordered separately)

Flipper Coil Table ‡ ††

GAME NAME	Nº of Flippers	LOWER FLIPPERS SPI Nº / GAUGE-TURNS / Color		UPPER FLIPPERS SPI Nº / GAUGE-TURNS / Color	
		LEFT	RIGHT	LEFT	RIGHT
Laser War ‡	**2**	090-5011-00 **22-750 / 30-2600**	SAME	Not Used	Not Used
Secret Service ‡	**3**	090-5006-00 **23-620 / 30-2600**	SAME	Not Used	090-5006-00 **23-620 / 30-2600**
Torpedo Alley ‡	**3**	090-5011-00 **22-750 / 30-2600**	090-5013-00 **23-700 / 30-2600**	Not Used	090-5012-00 **23-800 / 30-2600**
Time Machine ‡	**2**	090-5011-00 **22-750 / 30-2600**	SAME	Not Used	Not Used

‡ These coils are dual-wound.

Playboy 35th Anniversary ††	**2**	090-5020-02 **22-900 -YEL-**	SAME	Not Used	Not Used
ABC Monday Night Football ††	**2**	090-5020-02 **22-900 -YEL-**	SAME	Not Used	Not Used

†† A very small % of these games used a 090-5020-20 coil which used a proto-type Solid State Flipper System. The two types of coils both are 22-900 coils; the only difference being the addition of the 1N5404 Diode on the (-02) coils which was used in the Deger Design.

Robocop	**2**	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
Phantom of the Opera	**2**	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
Back to the Future	**2**	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
The Simpsons	**2**	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
Checkpoint	**2**	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
Teenage Mutant Ninja Turtles	**2**	090-5020-30 **23-900 -GRN-**	SAME	Not Used	Not Used
Batman	**2**	090-5020-30 **23-900 -GRN-**	SAME	Not Used	Not Used
Star Trek 25th Anniversary	**2**	090-5020-30 **23-900 -GRN-**	SAME	Not Used	Not Used
Hook	**2**	090-5030-00 **23-1100 -ORG-**	090-5020-30 **23-900 -GRN-**	Not Used	Not Used
Lethal Weapon 3	**2**	090-5030-00 **23-1100 -ORG-**	SAME	Not Used	Not Used

Table continued on the next page.

APPENDIX E

Flipper Coil Table †

GAME NAME	Nº of Flippers	LOWER FLIPPERS		UPPER FLIPPERS	
		SPI Nº / GAUGE-TURNS / Color		SPI Nº / GAUGE-TURNS / Color	
		LEFT	RIGHT	LEFT	RIGHT
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-**	SAME	Not Used	Not Used
Jurassic Park	3	090-5020-30 **23-900 -GRN-**	SAME	Not Used	090-5030-00 **23-1100 -ORG-**
Last Action Hero	2	090-5020-30 **23-900 -GRN-**	SAME	Not Used	Not Used
Tales from the Crypt	3	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	090-5041-00 **25-1800 -BLU-GRN-**
The Who's Tommy	3	090-5020-30 **23-900 -GRN-**	SAME	090-5041-00 **25-1800 -BLU-GRN-**	Not Used
WWF Royal Rumble	4	090-5032-00 **22-1080 -YEL-GRN-**	SAME	090-5041-00 **25-1800 -BLU-GRN-**	SAME
Guns N' Roses	3	090-5032-00 **22-1080 -YEL-GRN-**	SAME	090-5030-00 **23-1100 -ORG-**	Not Used
Maverick	3	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	090-5032-00 **22-1080 -YEL-GRN-**
Mary Shelley's Frankenstein	3	090-5030-00 **23-1100 -ORG-**	SAME	Not Used	090-5030-00 **23-1100 -ORG-**
Baywatch	4	090-5030-00 **23-1100 -ORG-**	090-5020-30 **23-900 -GRN-**	090-5025-00 **24-1570 -N/A-**	090-5030-00 **23-1100 -ORG-**
Batman Forever	3	090-5032-00 **22-1080 -YEL-GRN-**	090-5020-20 **22-900 -YEL-**	Not Used	090-5020-30 **23-900 -GRN-**
Apollo 13	2	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
Golden Eye	2	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
Twister	2	090-5020-20 **22-900 -YEL-**	090-5032-00 **22-1080 -YEL-GRN-**	Not Used	Not Used
ID4: Independence Day	3	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	090-5020-30 **23-900 -GRN-**
Space Jam †	2	090-5032-00T **22-1080 -YEL-GRN-**	090-5020-20T **22-900 -YEL-**	Not Used	Not Used
The Star Wars Trilogy - Special Edition †	2	090-5032-00T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
The Lost World: Jurassic Park †	2	090-5032-00T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
The X-Files †	2	090-5032-00T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
Starship Troopers †	3	090-5030-00T **23-1100 -ORG-**	SAME	Not Used	090-5032-00T **22-1080 -YEL-GRN-**
Viper Night Drivin' †	2	090-5030-00T **23-1100 -ORG-**	SAME	Not Used	Not Used
Lost In Space †	2	090-5030-00T **23-1100 -ORG-**	090-5032-00T **22-1080 -YEL-GRN-**	Not Used	Not Used
Godzilla †	2	090-5032-00T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
South Park †	2	090-5030-00T **23-1100 -ORG-**	SAME	Not Used	Not Used
Harley-Davidson †	2	090-5032-00T **22-1080 -YEL-GRN-**	090-5030-00T **23-1100 -ORG-**	Not Used	Not Used
Striker Xtreme †	3	090-5032-00T **22-1080 -YEL-GRN-**	090-5030-00T **23-1100 -ORG-**	090-5030-00T **23-1100 -ORG-**	Not Used

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

APPENDIX F

Motor Specification Table

The following table only list games that used motors.

Game Name	Function	Specifications	Part №
ABC Monday Night Football	Goal Post Up/Down Movement	Motor 24v A.C. 60 RPM CW	515-5222-00
Phantom of the Opera	Organ Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Checkpoint	Mag Wheel (in Backbox)	Motor D.C. (KEN)	041-5005-00
	Shaker	Johnson Motor (Vibrator)	041-5002-00
Teenage Mutant Ninja Turtles	Spinning Pizza Ball Deflector	Gear Motor 24v A.C. 325 RPM CW	515-5397-00
Batman	Bar Target Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Star Trek 25th Anniversary	Swinging Target	Bowman Motor 24v 22½ RPM	515-5534-00
	Transporter F/X	Gear Motor 24v A.C. 3½ RPM	500-5421-00
	Cooling Fan (for Transporter F/X)	4½" Motor 12v	041-5014-00
Lethal Weapon 3	Spinning Light	Motor 2½ v A.C. 4000 RPM CCW	041-5017-00
Star Wars	Bar Target Up/Down Movement	Bowman Motor 24v 60hz 3W 11 RPM CCW	515-5256-00
	R2D2 Robot Left/Right Movement	Bowman Motor 24v A.C. 22½ RPM CW	515-5571-00
	Death Star Rotation	Bowman "G" Motor 24v A.C. 60Hz 6 RPM CW	515-5570-00
Rocky & Bullwinkle & Friends	Nell Log "Cutting Blade" Forward/Back Movement	Autotrol Model E Motor 24v 60hz 4W 3 RPM CCW	041-5023-00
Jurassic Park	T-Rex Left/Right Movement	Multi Motor 5v D.C.	041-5025-00
	T-Rex Up/Down Movement	Bowman Motor 24v 11 RPM CW	041-5026-00
	Shaker	Johnson Motor (Vibrator)	041-5002-00
Last Action Hero	Crane Left/Right Movement	Multi Products Motor 12v D.C. #3312 OSC	041-5027-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Tales from the Crypt	Tombstone Up/Down Movement	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
The Who's Tommy	Mirror Up/Down Movement	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
	Flipper Blinders	Servo Motor (94102)	041-5032-00
	Spinning Airplane Propellers	Motor D.C.	041-5033-00
WWF Royal Rumble	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Maverick, The Movie	Turning Paddle Wheel	Motor 24v A.C. 10 RPM	041-5036-00
Mary Shelley's Frankenstein	Creature Head Left/Right Movement	Servo Motor (94102)	041-5032-00
Batman Forever	Cannon Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CCW	515-6383-00
Apollo 13	Rocket Up/Down Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CCW	515-6383-00
	Moon Unit Rotational Orbit	Multi Products Motor 24v A.C. 50/60Hz 3W 6 RPM CCW	515-6487-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Golden Eye	Satellite Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CW	515-6528-00

Table continued on the next page.

APPENDIX F

Motor Specification Table

The following table only list games that used motors.

Game Name	Function	Specifications	Part №
Twister	Spinning Disc with Magnet	Multi Products Motor 24v A.C. 50/60Hz 3W 325 RPM CCW	515-6347-00
	Backbox Fan (Tornado Wind)	Multi Products Motor 24v A.C. 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. 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. 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, Series 36000: 1.4"ø (Non-Captive Shaft) HSI #36864-12 (Unipolar) / Travel per Step = .004 Step Angle = 15° / 12v D.C. / 4.6W	515-6794-00-59
Lost In Space	Spinning Disc with Magnet	Multi Products Motor 24v A.C. 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 AC 6 RPM CW	041-5072-01
Striker Xtreme	Goalie Left to Right Movement	Multi #3590 12v D.C. 60 RPM	041-5075-00

No motors were used on the following games: Laser War, Secret Service, Torpedo Alley, Time Machine, Playboy 35th Anniversary, Robocop, Back to the Future, The Simpsons, Hook, Guns N' Roses, Baywatch, Space Jam, Viper Night Drivin', South Park.

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

APPENDIX G

Part Number Prefix Classification Codes

I. Electrical Source, Energy & Signal Converters
- 010- Transformers
- 031- Speakers
- 090- Solenoids (Coils)

II. Conductors, Connectors & Insulators
- 034- Line Cords
- 036- Cable and Harness Assemblies
- 041- Motors
- 045- Connectors (All Types)
- 077- Lamp Sockets

III. Circuits & Circuit Elements
- 100- ICs
- 110- Transistors
- 112- Diodes
- 121- Resistors
- 123- Resistors (Variable & Adjustable)
- 124- Regulators & Bridge Rectifiers
- 125- CAPS
- 140- Crystals
- 165- Light Bulbs
- 180- Switches
- 190- Relays

IV. Bolts, Screws, Nuts & Washers
- 231- Bolts
- 232- Screws (Pan Head)
- 234- Screws (HWH)
- 237- Screws (Misc.)
- 240- Nuts (Misc.)
- 242- Washers (Flat, Round)
- 244- Washers (Split Lock)
- 246- Washers (Lockers, External Tooth)

V. Mechanical Components
- 249- Rivets
- 251- Pins (Dowel)
- 254- Stand-Offs, Spacers and Shims
- 260- Steel Ball
- 265- Springs (Extension)
- 266- Springs (Compression)
- 269- Springs (Washers - Belleville, Wave)
- 280- Grommets and Bushing

VI. Handles, Locks, Catches & Latches, Keys & Hinges
- 355- Handles, Locks, Catches & Latches and Keys
- 390- Hinges

VII. Fabricated Parts (In-House Assemblies)
- 500- End Product (Systems and Models)
- 515- Sub-Assemblies
- 520- Printed Circuit Boards (PCBs)
- 522- Display Glass
- 525- Wood Parts
- 530- Screw Machined Parts
- 535- Fabricated Parts
- 545- Molded (Extruded) Plastic/Rubber Parts
- 550- Molded (Inserts)

VIII. Bulk Materials
- 600- Braided Ground Wire
- 601- Stranded Wire
- 602- Ribbon Cable
- 605- Sleeving (Shrink Tubing)
- 626- Foam Rubber

IX. Miscellaneous
- 705- Packing & Shipping Items
- 820- Decals and Labels (Sets & Misc.)
- 830- Butyrate (Plastic Pieces)
- 900- Game Posters
- 960- EPROM (Raw Part)
- 965- EPROM (Programmed Part)

APPENDIX H

Playfield Inserts (Plastic Light Covers)

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

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

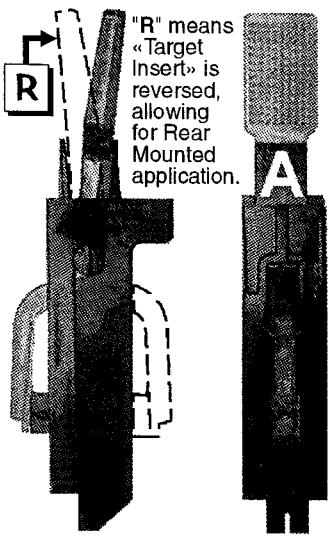
Instructions: Parts which may come in various colors (i.e. targets, some posts, playfield inserts, etc.) end in a 2-digit Nº which correspond to the color of that part. The "-XX" in Part Nºs which may come in various colors should be replaced with the desired 2-Digit Nº. corresponding to the color desired. *Not all colors may be available.*

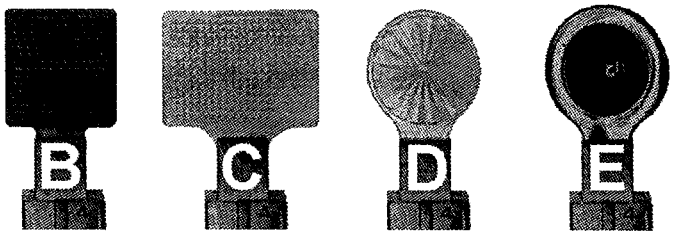
PLASTIC PART COLOR CHART

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

APPENDIX I

Stand-Up Targets





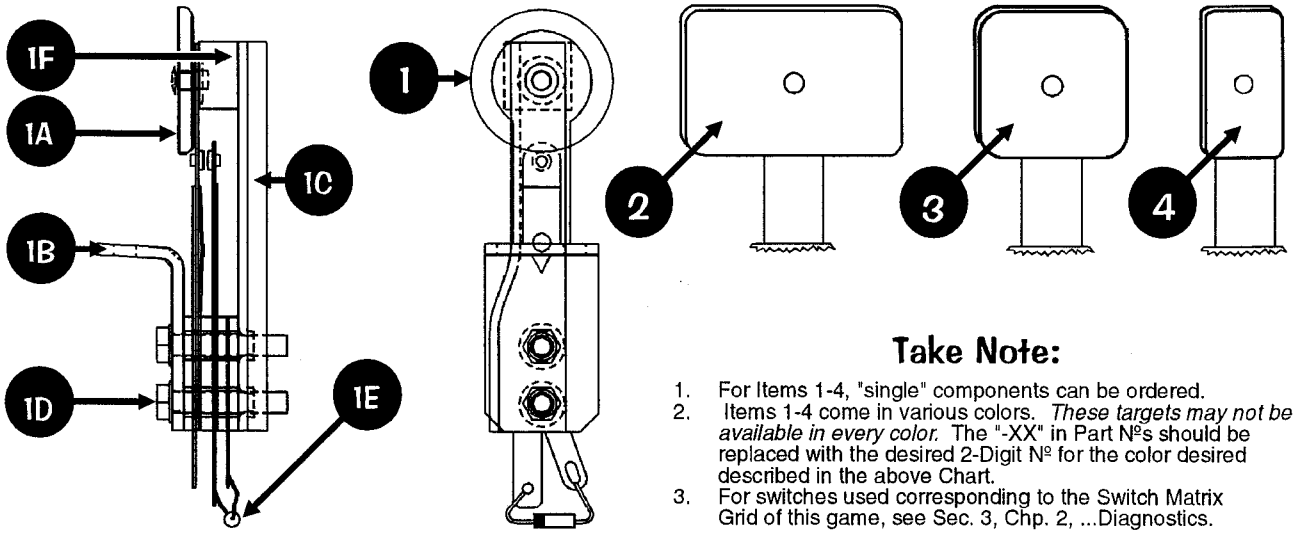
PLASTIC PART COLOR CHART	
Nº	Color
-00	Black
-01	Clear
-02	Red
-03	Amber
-04	Green
-05	Blue
-06	Yellow
-07	Orange
-08	White
-09	Purple
-10	Fluor. Orange
-11	Fluor. Green
-12	Fluor. Blue
-13	Teal Green
-14	Gray
-15	Luminescent
-16	Gold

Take Note:

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

Nº	STAND-UP TARGET NAME	SPI PART Nº
A	Modular Stand-Up Target Narrow Assy.	500-6138-XX
	Stand-Up Target Narrow (Insert)	545-6138-XX
B	Modular Stand-Up Target Square Assy.	500-6139-XX
	Stand-Up Target Square (Insert)	545-6139-XX
C	Modular Stand-Up Target Rectangle Assy.	500-6228-XX
	Stand-Up Target Rectangle (Insert)	545-6228-XX
D	Modular Stand-Up Target Round Assy.	500-6075-XX
	Stand-Up Target Round (Insert)	545-6075-XX
E	Mod. Stand-Up Target 1" Spherical Assy.	500-6189-XX
	Stand-Up Target 1" Spherical (Insert)	545-6189-XX

NOTE: To receive the Target Assy. 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).



Take Note:

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

Nº	STAND-UP (FLAT) TARGET NAME	SPI PART Nº
1	1" Round Stand-Up Target Assy.	500-5835-XX
ORDERING ABOVE (ITEM 1) ASSY. PART Nº WILL INCLUDE:		
1A‡	Switch & Target Assy. 1" Round	515-5966-XX
1B	Mounting Bracket	535-6896-00
1C	Switch Back Plate	535-6452-00
1D	6-32 X ¾ HWH Swage (Qty. 2)	237-5976-05
1E	Switch Diode, 1N4001	112-5001-00
1F	Foam Pad	626-5029-00

‡ Note: Item 1A, is a riveted Sub-Assy. which includes the following items for reference: A1— Stack Switch Radius End (180-5133-00), A2— Washer 5/16" (242-5017-00), A3— Rivet 1/8" ø X 3/16" (249-5001-00) and A4— 1" Round Target (545-5456-XX).

2	1" X 1½" Stand-Up Rect. Target Assy.	500-5321-XX
ORDERING ABOVE (ITEM 2) ASSY. PART Nº WILL INCLUDE:		
2A‡	Sw. & Target Assy. 1" X 1½" Rect. Items 2B-F are identical to 1B-F	515-6027-XX Same as 1B-F

‡ Note: Item 2A, is a riveted Sub-Assy. which includes the following items for reference: A1— Stack Switch Radius End (180-5133-00), A2— Washer 5/16" (242-5017-00), A3— Rivet 1/8" ø X 3/16" (249-5001-00) and A4— Rectangular Target (545-5145-XX).

3	1" Sq. Stand-Up Target Assy.	500-5232-XX
ORDERING ABOVE (ITEM 3) ASSY. PART Nº WILL INCLUDE:		
3A‡	Sw. & Target Assy. 1" Square Items 3B-F are identical to 1B-F	515-5162-XX Same as 1B-F

‡ Note: Item 3A, is a riveted Sub-Assy. which includes the following items for reference: A1— Stack Switch Radius End (180-5133-00), A2— Washer 5/16" (242-5017-00), A3— Rivet 1/8" ø X 3/16" (249-5001-00) and A4— 1" Square Target (545-5470-XX).

4	Narrow Stand-Up Target Assy.	500-5857-XX
ORDERING ABOVE (ITEM 4) ASSY. PART Nº WILL INCLUDE:		
4A‡	Sw. & Target Assy. Narrow Items 4B-F are identical to 1B-F	515-5967-XX 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.

GLOSSARY OF TERMS

A Followed after a number means "Amp." or Ampage in an expression relating to an electrical object. (e.g. 8**A**).

AC (Acronym) **A**lternating **C**urrent.

Adj. (Abbreviation) Adjustment(s).

Assy. (Abbreviation) Assembly.

Au. (Abbreviation) Audit(s).

Bd. (Abbreviation) Board.

BOT (Abbreviation) Bottom.

Brkt. (Abbreviation) Bracket.

Bridge Rectifier A configuration of a diode that allows current to flow in one direction producing both positive and negative pulsating DC Voltages.

Color Coding See Appendix H or I, Plastic Part Color Chart or Section 4, Chapter 1, Playfield - Plastic Posts & Spacers.

Combination (Combo) [Shot] Any variable pinball shot(s) made successively.

Conn. (Abbreviation) Connector.

CMOS Short for COSMOS (Complementary Symmetry M.O.S.); Complementary Metal-Oxide Semi-Conductor.

CN (Abbreviation) Connector (e.g. **CN**5-P3).

CT (Abbreviation) Center.

DC (Abbreviation) Direct Current.

DT (Abbreviation) Drop Target(s).

DOTS (Acronym) **D**iode **O**n **T**erminal **S**trip.

EB (Abbreviation) Extra Ball.

Eject Playfield surface device to kick ball back into play; Saucer.

EPROM (Acronym) **E**rasable **P**rogrammable **R**ead **O**nly **M**emory. Can be erased using UV Light and re-programmed.

e.g. (Abbreviation) Latin- Exempli gratia. For Example.

EOS (Acronym) **E**nd-**O**f-**S**troke (i.e. Switch for flipper).

F (Abbreviation) Fuse (i.e. F23).

GA-Turn Gauge & Turn describing the windings on a coil (e.g. 23-800, 23 is the gauge of wire and 800 is the amount of windings.

G.I. (Abbreviation) General Illumination (Lamps).

HWH (Abbreviation) Hex Washer Head.

IC (Acronym) **I**ntegrated **C**ircuit (As in after 24-Pin IC).

ID or I.D. (Acronym) **I**nside **D**imension.

i.e. (Abbreviation) Latin- Id est. That is.

IO or I/O (Abbreviation) Input / Output (e.g. I/O Power Driver Bd.)

LT, Lt. or L. (Abbreviation) Left.

Laser Kick A coil/plunger used above the playfield to kick pinball back into play.

LED (Acronym) **L**ight **E**mitting **D**iode.

Loop [Shot] Continuously up a ramp and back to the flipper.

Lwr. (Abbreviation) Lower.

Orbit [Shot] From the left or right flipper around the back rail of the playfield back to the flipper.

MB (Abbreviation) Magnet Board.

M-BALL or MBALL (Abbreviation) Multiball™ More than 1 ball in game play.

MID (Abbreviation) Middle

Non-Reflexive See Reflexive.

No. or Nº or # (Abbreviation) Number

NPF (Acronym) **N**o **P**roblem **F**ound.

N.C. or NC (Abbreviation) Normally Closed.

N.O. or NO (Abbreviation) Normally Open.

NS (Abbreviation) Not Stuffed. (Use in Part Listings, Sec. 5)

OD or O.D. (Abbreviation) Outside Dimension.

P (Abbreviation) Pin (e.g. CN5-**P**3).

PCB (Acronym) **P**rinted **C**ircuit **B**oard

P/F (Abbreviation) Playfield.

PIA LED (Acronym) **P**eripheral **I**nterface **A**dapter **L**ight **E**mitting **D**iode.. This is a diagnostic LED on the CPU; it should not be lit during normal operation of a pinball game.

Plumb Bob Tilt Weight on Tilt Assembly.

PPH (Abbreviation) Phillips Pan Head.

Pop(s) Another term for Turbo Bumper(s).

PPB (Acronym) Playfield Power Board ("Popcorn-Popping Bd.").

PREV (Abbreviation) Previous.

PSB (Abbreviation) Power Supply Board

RAM (Acronym) **R**andom **A**ccess **M**emory. RAM **can** store input instructions and supply output information.

Reflexive/Non-Reflexive Reflexive—Solenoid Drive Transistor is enabled directly by a switch closure on the (Relating to CPU Boards) solenoid assembly (Ver. 1/2).
Non-Reflexive—Solenoid Drive Transistor is enabled by the CPU after reading a switch closure in the Switch Matrix (Ver. 3). Also note: All CPU Boards are backwards compatible (e.g. Jurassic Park/Ver. 3 to Time Machine/ Ver. 2). Swapping a Ver. 2 Board to a Ver. 3 is not possible due to the special solenoids section (i.e. Slingshots, Turbo Bumpers, etc.) changing from ***REFLEXIVE*** to ***NON-REFLEXIVE*** on Ver. 3 Boards.

Relay An automatic switch operated by current in a coil.

ROM (Acronym) **R**ead **O**nly **M**emory. ROM **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 Nº signifies Target Insert is **R**eversed.)

RO (Abbreviation) Rollover (switches).

Saucer See Eject.

Scoop A hole into the playfield. A metal scoop is in place to guide the ball into the kick-back under the playfield.

Slam Tilt A switch which closes when the game is slammed into or the Coin Door is slammed shut. Depending on adjustable settings, will cancel game in play when the number of closures required is achieved.

SMB (Abbreviation) Shaker Motor Board.

Solenoid A coil used for Electro Magnetic devices such as relays, flippers, slingshots, etc.

SSFB (Abbreviation) Solid State Flipper Board.

STEP Refers to the service switches on the coin door.

Sub-Assy. (Abbreviation) Sub-Assembly.

S-U or S/U (Abbreviation) Stand-Up (targets).

TM (Abbreviation) Trademark

Transfer [Shot] Maneuvering the ball in play from one flipper to the other. With flipper in the up position and the ball cradled by that flipper one would activate the flipper button in a quick repetitive manner to bounce the ball to the other side. Skilled players can rebound the ball off the slingshot.

Tri-Ball Three balls in play.

TTL (Abbreviation) Transistor-Transistor Logic

Upr. (Abbreviation) Upper.

V or v (Abbreviation) Volt(s).

Ver. (Abbreviation) Version.

VUK (Acronym) **V**ertical **U**p-**K**icker (Super or Standard).

X (Abbreviation) "Times" A multiplier; also used in dimensions.

X-Ball An undetermined number of ball(s) during game play.

Zener Diode A semi-conductor diode used for voltage regulation. Application depends on reverse break-down voltage.

"-00B" "B" at the end of Coil Part Numbers signifies that the diode is attached to the bottom of the lug.

"-00T" "T" at the end of Coil Part Numbers signifies that the diode is attached to the top of the lug (the side nearest the coil-winding).

Parts Order Checklist Notes

Date Ordered	Part №	Qty.	Description	Date Received