featuring our Portals Service Menu and our unique

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

DR. DR. DR. DR.

HOW YES HOW PREVIOUS TER

SEGA™ PINBALL, INC.

11th ANNIVERSARY

Service





Joe Blackwell
DIRECTOR,
Parts Sales &
Technical Support



Susan Molitor
Parts
Sales
MANAGER



Patty Schraps
Parts
Stockroom
MANAGER



Eric Winston
Technical
Support
ENGINEER



Doug Lemons
Technical
Support
ENGINEER



Linda Garza
Customer
Service
REPRESENTATIVE



Jay Alfer
Technical Support
Documentation
ADMINISTRATOR

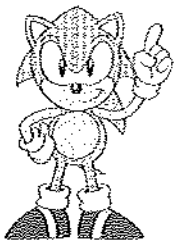
Sega Pinball, Inc. TM & © 1998.
All Rights Reserved. Printed in the U.S.A.

September 1998 - Print Copy

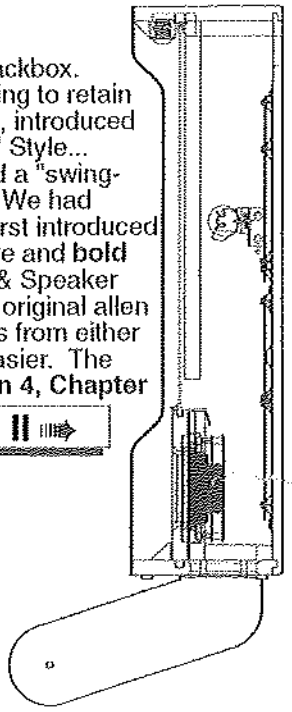
Please call us at 1-800-542-5377 or 1-708-345-7700 for Technical Support.

SPI PN#: 780-5040-00

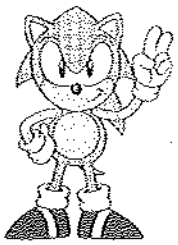
WOW! Look what's new at Sega Pinball!



THE BACK BOX: Well, we've done it again! We went and changed our Backbox. Why? Well, first, we want to change the look of our games periodically also trying to retain the original Pinball "look and characteristics". The **Sega Showcase I** Backbox, introduced in **SpaceJam**™ and used through **Viper**™ was a bold change from the "Classic" Style... however, with changes came adjustments; the **Sega Showcase I** Backbox had a "swing-open" door which limited servicing of the PCBs to the Right Side of the game. We had quite a few requests to return to the "Old" Style from a servicing standpoint. First introduced in **Lost In Space**™ is the ***NEW* Sega Showcase II** Backbox! Another innovative and **bold** new look! A Backbox using a single lock and an ***easy-to-remove*** Back Glass & Speaker Panel / Dot Matrix Display. The operating principles are the same: it still folds down (using the original allen wrench key) and lays upon the cabinet side armor molding. And, you can now service the PCBs from either side of the game! Back Glass & Speaker Panel / Dot Matrix Display cleaning and removal is easier. The reviews have been great, just look at your own game! For more on Backbox Parts, see **Section 4, Chapter 1, Parts Identificaiton (The Pink Pages).**

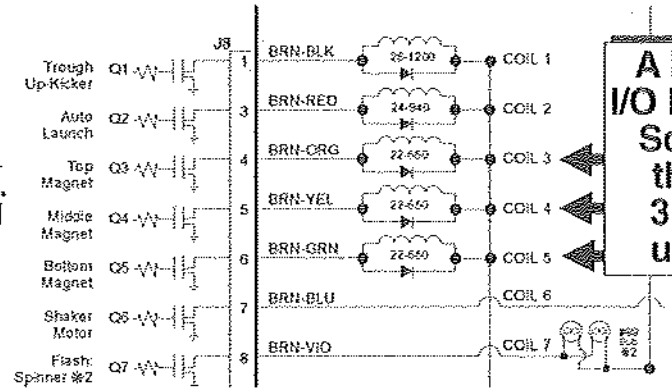


Side View of the New Showcase II ➠



MAGNETS: Imagine an electro-magnet in a Pinball Machine being used on the playfield that requires ***No Extra Interface Board!*** Well, we've done it! Through long-term field testing and design we have produced the use of electro-magnetic features on our games just like we use a coil in a Pop Bumper, Slingshot or VUK. Through game software programming we can control the magnetic properties in all four (4) Magnet Assemblies used in this game (one of which acts as a Top Orbit Diverter)...and ***No Interface Board!*** The magnets still get the same results as if we're using an Interface Board. This change was to keep things simple. *Troubleshooting?* **Easier!** Now, no more extra schematics to scheme over...just troubleshoot like any other coil. For more on troubleshooting, see **Section 3, Chapter 2, Go To Diagnostics Menu** (then Go To Coil Menu) or **Section 5, Chapter 1, Backbox Wiring.**

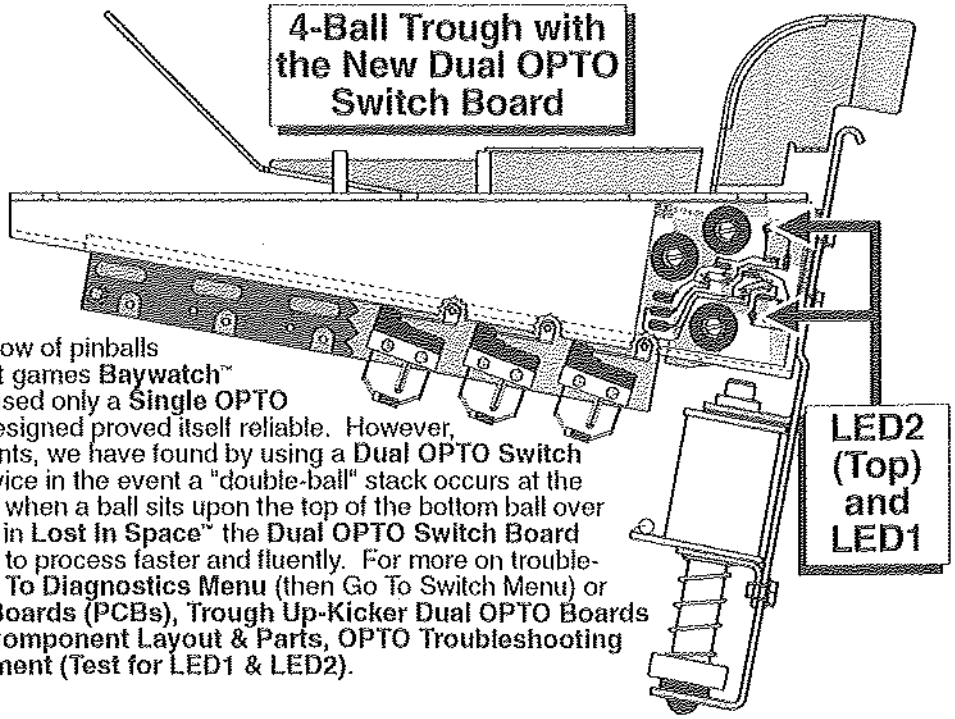
I/O POWER DRIVER BD. 520-5137-01



A Partial View of the I/O Power Driver Board Schematic showing the location of the 3 of the 4 Magnets used in this game.

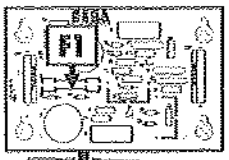


TROUGH DUAL OPTO BOARDS: We have been using **Single OPTO Switch Boards** in our Ball Troughs (as the switch for the Trough Up-Kicker) for a long while now and with great success! Through long-term field testing and design we have produced the **Dual OPTO Switch Board.** Why? Increased reliabilty and handling of the flow of pinballs in and out of the Ball Trough. In our past games **Baywatch**™ through **Viper**™ the Ball Trough Design used only a **Single OPTO Switch** at the Trough Up-Kicker. This designed proved itself reliable. However, as we strive continuously for improvements, we have found by using a **Dual OPTO Switch Board** it will now act as a monitoring device in the event a "double-ball" stack occurs at the Trough Up-Kicker (A double-ball stack is when a ball sits upon the top of the bottom ball over the Trough Up-Kicker.). First introduced in **Lost In Space**™ the **Dual OPTO Switch Board** will identify this and allow ball transistion to process faster and fluently. For more on trouble-shooting, see **Section 3, Chapter 2, Go To Diagnostics Menu** (then Go To Switch Menu) or **Section 5, Chapter 4, Printed Circuit Boards (PCBs), Trough Up-Kicker Dual OPTO Boards Theory of Operation & Schematic, ...Component Layout & Parts, OPTO Troubleshooting and Trough Dual OPTO Boards Alignment (Test for LED1 & LED2).**

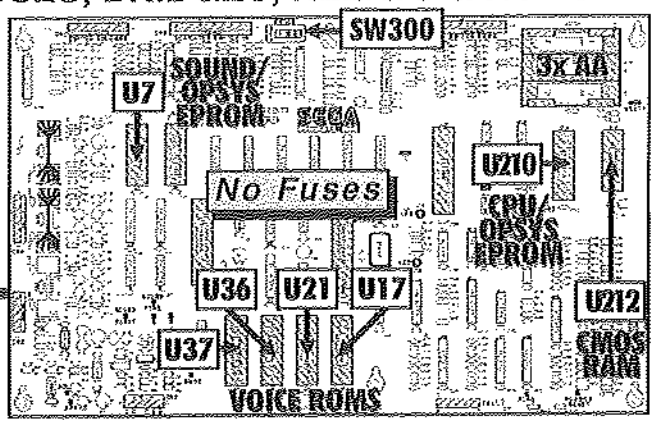


New to our Pinball Games?
Don't forget to go over **Section 3, Chapter 1, Portals**™ **Service Menu Introduction.** *If using Diagnostics...very useful!*
And, as always, if you get stuck? Comments? Questions? Call Technical Support at 800-542-5377 or 708-345-7700.

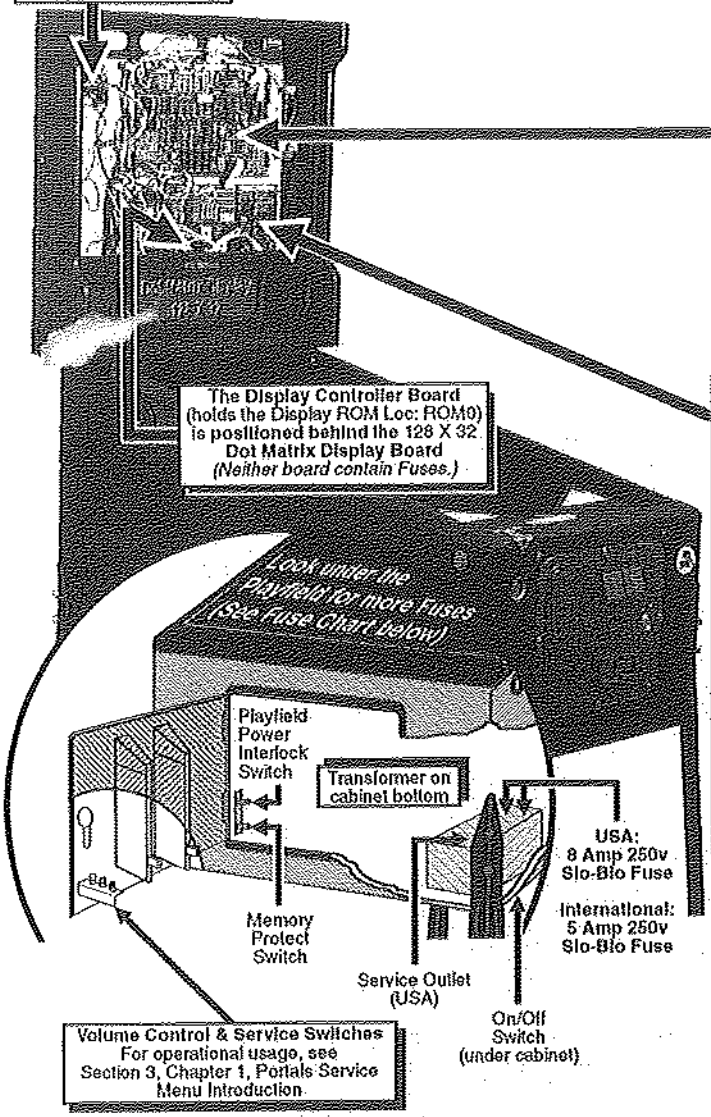
BACKBOX LAYOUT LOCATIONS: FUSES, BRIDGES, RELAYS & ROMs

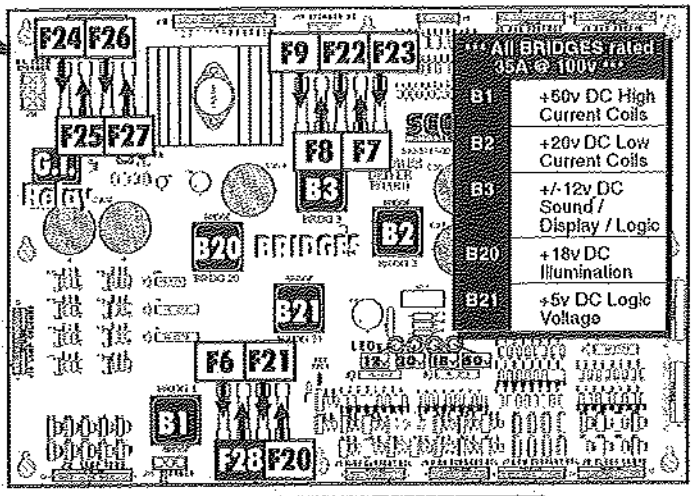


Display Power Supply Bd.



CPU / Sound Board





I/O Power Driver Board

For Backbox & Cabinet General Parts, see Section 4, Chapter 1, Parts Identification & Location (The Pink Pages)

For Schematics and/or Component Parts on above Boards, see Sec. 5, Chp. 4, Printed Circuit Boards (PCBs) (The Yellow Pages)

GODZILLA

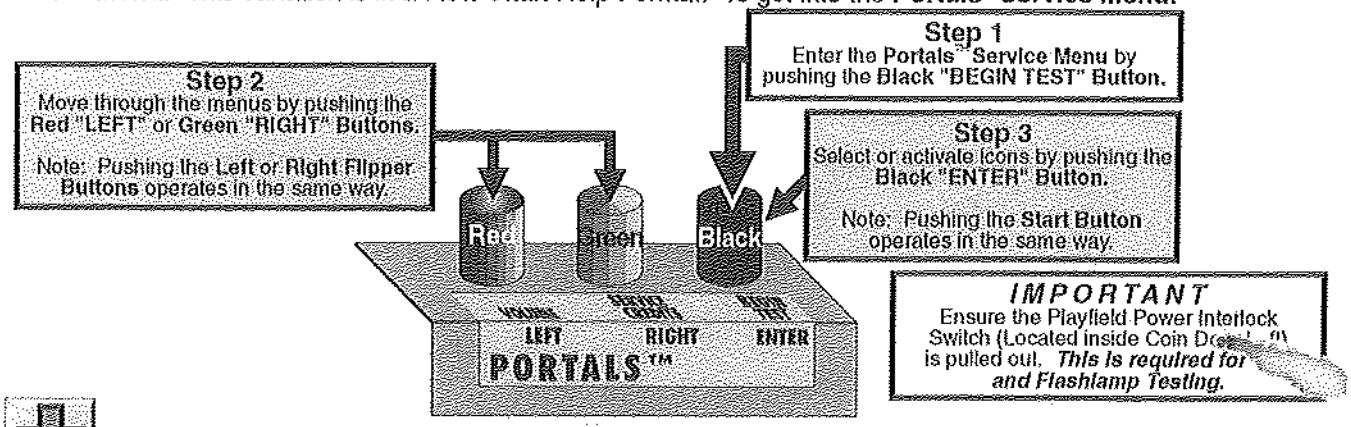
QUICK REFERENCE FUSE CHART			
This Game's Playfield Fuses			
LOC: UNDER PLAYFIELD (By Assemblies Listed)			
n/a	3A 250v S.B.	50v DC	Rt. Flipper (BLU-YEL↔RED-YEL)
n/a	3A 250v S.B.	50v DC	Lt. Flipper (GRY-YEL↔RED-YEL)
n/a	3A 250v S.B.	50v DC	Left Magnet (VIO-YEL↔BLK)
n/a	3A 250v S.B.	50v DC	Top Magnet (VIO-YEL↔BLK)
n/a	3A 250v S.B.	50v DC	Mid. Magnet (VIO-YEL↔BLK)
n/a	3A 250v S.B.	50v DC	Bot. Magnet (VIO-YEL↔BLK)
LOC: SHAKER MOTOR BD. (Inside Cabinet Rt. Side)			
F2	2½A 250v s.b.	12v DC	Shaker Motor
F3	2½A 250v s.b.	12v DC	Shaker Motor

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	Magnets
F21	3A 250v S.B.	50v DC	Coils
F22	8A 250v S.B.	18v DC	Controlled Lamps
F23	4A 250v S.B.	5v DC	Logic
F24	5A 250v S.B.	6.3v AC	G.I. Lamps (BRN-WHT 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)

✻ 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 - ⓫) will assist the technician in locating important technical information needed to troubleshoot the Pinball Machine. Dr. Pinball is also available on the game in the **Portals™ Service Menu**. This variation is in a Flow Chart Help Format. To get into the **Portals™ Service Menu:**





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.)*.

☆ ☆ ☆ ☆ HOW IT WORKS ☆ ☆ ☆ ☆

First, the operator/technician must enter the Service Mode (for a complete description of the **Portals™ Service Menu** and **ICONS** see Section 3, Chapter 1). To get into the Service Menu Mode: • Power-up game (if not already) & open the Coin Door. • On the Coin Door is the Portals™ Service Switch Set (**Red, Green & Black Buttons**). Push down the **Black "BEGIN TEST" Button**. 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™ © SEGA PINBALL, INC.," followed by the **MAIN MENU**.

While in the **MAIN MENU**, select the "DIAG" *Icon*, then select the Cross "DR." *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." and 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 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.

Note: The "Portals" service switches located on the coin door can also be used to select and enter Mini-Icons. In switch test this is required since flipper and start switches are part of the test.



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



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



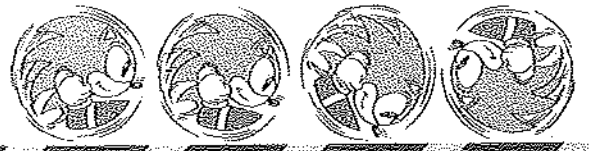
Seen when question is being asked on the Display. Select 'YES' or 'NO' to answer question given.
'END' lets you select a new item to test.

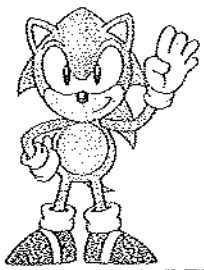


Seen when diagnosis is given.
Select any Icon for your next step.
'?' gives Help.



In Coil Flow Chart Menu, select 'PULSE' to pulse the coil selected.







❊ 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 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 **CMOS RAM** with power off.

CPU DIP SWITCH SETTINGS, LOC. SW300 CPU/SOUND BOARD

CUSTOM FACTORY ADJUSTMENTS BY COUNTRY*

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

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

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

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

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

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

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

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

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

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
NETHERLANDS (Holland / Dutch)	ON			●					
	OFF	●	●		●	●	●	●	●

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

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

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

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

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
UK (New 50p, 2£ Coin Mech)	ON		●	●	●				
	OFF	●				●	●	●	●

*All countries not noted use the "USA Setting"

ROM SUMMARY TABLE

I.C. NAME	TYPE	BOARD NAME	LOC.	PART N°
Game ROM	1MB	CPU / Sound Board	U210	965-0289-40
Voice ROM 1	4MB	CPU / Sound Board	U17	965-0290-40
Voice ROM 2	4MB	CPU / Sound Board	U21	965-0291-40
Voice ROM 3	4MB	CPU / Sound Board	U36	965-0292-40
Voice ROM 4	4MB	CPU / Sound Board	U37	965-0293-40
Sound EPROM	512K	CPU / Sound Board	U7	965-0294-40

Display EPROM	4MB	Display Controller Bd.	ROM Ø	965-0295-40
Display EPROM	Not Used	Display Controller Bd.	ROM 1	Not Used

FOR:



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	NOT USED	6: Q6 GRN-BLU CN5-P7	7: Q7 GRN-VIO CN5-P8	8: Q8 GRN-GRY CN5-P9
1: U400 WHT-BRN CN7-P9	LT LOCK SAVE/4 BALL (UK ONLY) Above P/F 1	NOT USED 9	LEFT 4-BANK BOTTOM Under P/F 17	NOT USED 25	NOT USED 33	LT CAPTIVE BALL BOT Under P/F 41	LEFT TURBO BUMPER Under P/F 49	LEFT OUTLANE Under P/F 57
2: U400 WHT-RED CN7-P8	4TH COIN SLOT on Coin Door 2	NOT USED 10	LEFT 4-BANK #2 Under P/F 18	GODZILLA RAMP (LT) Above P/F 26	NOT USED 34	LT CAPTIVE BALL TOP Under P/F 42	RIGHT TURBO BUMPER Under P/F 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) Under P/F 11	LEFT 4-BANK #3 Under P/F 19	NOT USED 27	NOT USED 35	RT CAPTIVE BALL BOT Under P/F 43	BOTTOM TURBO BUMPER Under P/F 51	LEFT SLINGSHOT Under P/F 59
4: U400 WHT-YEL CN7-P6	RIGHT COIN SLOT on Coin Door 4	4-BALL TROUGH #2 Under P/F 12	LEFT 4-BANK TOP Under P/F 20	ORBIT RAMP (RT) Above P/F 28	NOT USED 36	RT CAPTIVE BALL TOP Under P/F 44	NOT USED 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 Under P/F 13	RIGHT 4-BANK BOTTOM Under P/F 21	(T) AXI S-U Under P/F 29	NOT USED 37	INNER LEFT ORBIT Above P/F 45	LAUNCH BUTTON Cabinet Front 53	RIGHT RETURN LANE Under P/F 61
6: U401 WHT-BLU CN7-P3	LEFT COIN SLOT on Coin Door 6	4-BALL TROUGH VUK OPTO Under P/F 14	RIGHT 4-BANK #2 Under P/F 22	T (A) XI S-U Under P/F 30	NOT USED 38	SPINNER Above P/F 46	START BUTTON Cabinet Front 54	RIGHT SLINGSHOT Under P/F 62
7: U401 WHT-VIO CN7-P2	5TH COIN SLOT on Coin Door 7	4-BALL STACKING OPTO Under P/F 15	RIGHT 4-BANK #3 Under P/F 23	TA (X) I S-U Under P/F 31	NOT USED 39	LEFT ORBIT Under P/F 47	SLAM TILT on Coin Door 55	NOT USED 63
8: U401 WHT-GRY CN7-P1	RT LOCK SAVE/4 BALL (UK ONLY) Above P/F 8	SHOOTER LANE Under P/F 16	RIGHT 4-BANK TOP Under P/F 24	TAX (I) S-U Under P/F 32	NOT USED 40	RIGHT ORBIT Under P/F 48	PLUMB BOB TILT Inside Cabinet 56	NOT USED 64

GND to 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
NOT USED	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



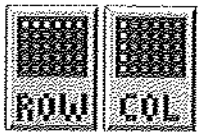
From the Diagnostics Menu GO TO LAMP MENU



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

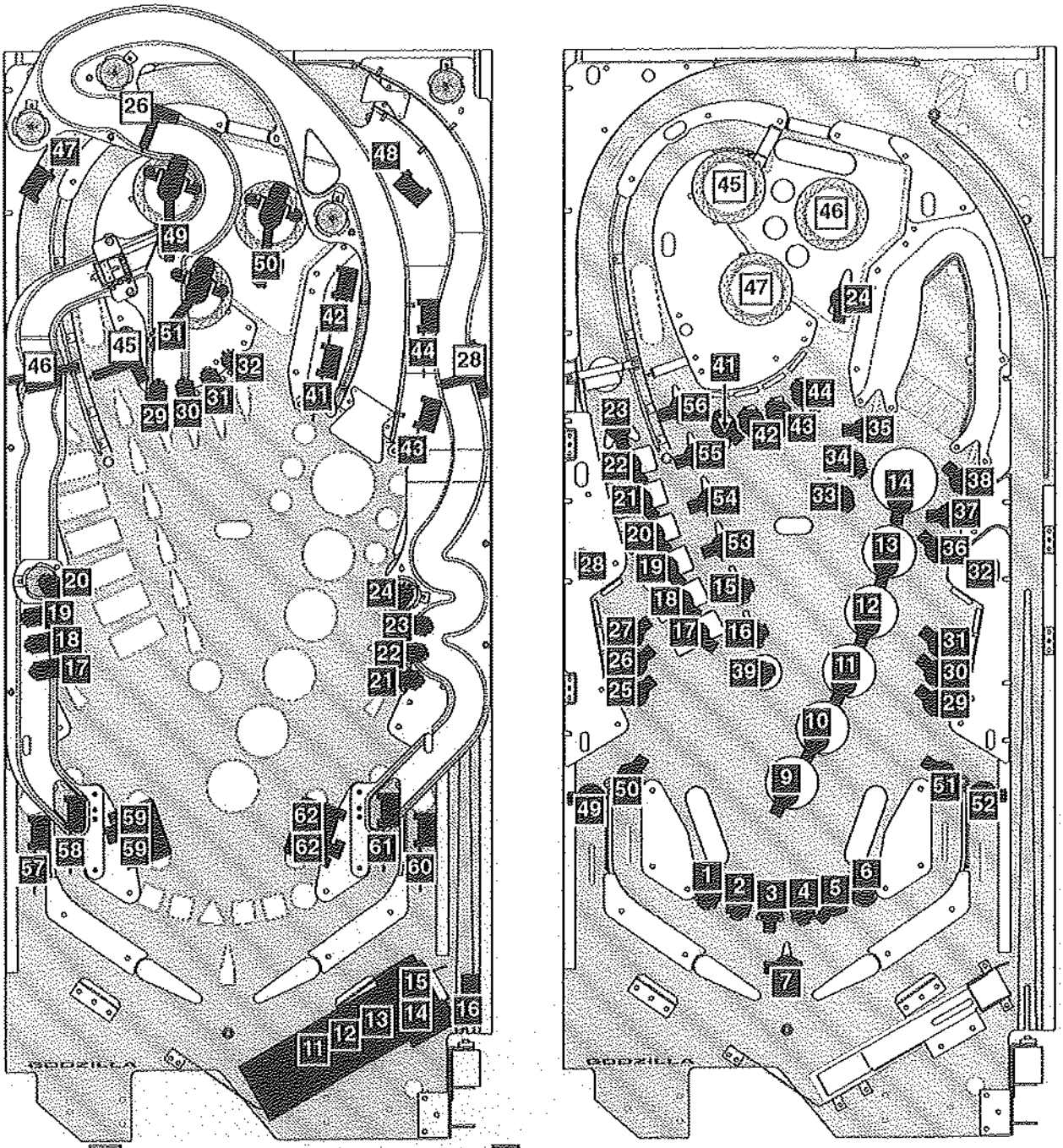
LAMP MATRIX GRID

Diode On Terminal Strip

Column (18v) / Row (GND)	1: U17 YEL-BRN J13-P9	2: U16 YEL-RED J13-P8	3: U16 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	2X BONUS #555 Bulb 1	3X BONUS #555 Bulb 2	LITE SUPER SPINNER #555 Bulb 3	4X BONUS #555 Bulb 4	5X BONUS #555 Bulb 5	LITE HELI-COPTER... #555 Bulb 6	SHOOT AGAIN #555 Bulb 7	LAUNCH BUTTON #555 Bulb 8
2: Q34 RED-BLK J12-P2	RAMP #1 (BOT) #555 Bulb 9	RAMP #2 #555 Bulb 10	RAMP #3 #555 Bulb 11	RAMP #4 #555 Bulb 12	LITE GODZILLA... #555 Bulb 13	SCORE DOES MATTER #555 Bulb 14	SONAR (MULTIBALL) #555 Bulb 15	BABY (MULTIBALL) #555 Bulb 16
3: Q35 RED-ORG J12-P3	SPOT SONAR #555 Bulb 17	MYSTERY #555 Bulb 18	SUPER POPS (ORBIT) #555 Bulb 19	LITE BABY GODZILLA... #555 Bulb 20	LITE EXTRA BALL #555 Bulb 21	MEAN GREEN #555 Bulb 22	SPINNER ARROW #555 Bulb 23	SUPER POPS (BUMPER) #555 Bulb 24
4: Q36 RED-YEL J12-P4	LEFT 4-BANK BOTTOM #555 Bulb 25	LEFT 4-BANK #2 #555 Bulb 26	LEFT 4-BANK #3 #555 Bulb 27	LEFT 4-BANK TOP #44 Bulb 28	RT 4-BANK BOTTOM #555 Bulb 29	RIGHT 4-BANK #2 #555 Bulb 30	RIGHT 4-BANK #3 #555 Bulb 31	RIGHT 4-BANK TOP #44 Bulb 32
5: Q37 RED-GRN J12-P5	LT CAPTIVE BALL #1 (BOT) #555 Bulb 33	LT CAPTIVE BALL #2 #555 Bulb 34	LT CAPTIVE BALL #3 (TOP) #555 Bulb 35	RT CAPTIVE BALL #1 (BOT) #555 Bulb 36	RT CAPTIVE BALL #2 #555 Bulb 37	RT CAPTIVE BALL #3 (TOP) #555 Bulb 38	SAVE NEW YORK #555 Bulb 39	UP / DOWN POST (UK ONLY) #555 Bulb 40
6: Q38 RED-BLU J12-P6	(T) AXI #555 Bulb 41	T (A) XI #555 Bulb 42	TA (X) I #555 Bulb 43	TAX (I) #555 Bulb 44	LEFT TURBO BUMPER 8 15 #555 Bulb 45	RIGHT TURBO BUMPER 8 15 #555 Bulb 46	BOT. TURBO BUMPER 8 15 #555 Bulb 47	NOT USED 48
7: Q39 RED-VIO J12-P8	LEFT OUTLANE #555 Bulb 49	LEFT RETURN LANE #555 Bulb 50	RIGHT RETURN LANE #555 Bulb 51	RIGHT OUTLANE #555 Bulb 52	GODZILLA (MULTIBALL) #555 Bulb 53	HELICOPTER (MULTIBALL) #555 Bulb 54	TAXI (MULTIBALL) #555 Bulb 55	EXTRA BALL #555 Bulb 56
NOT USED	NOT USED 57	NOT USED 58	NOT USED 59	NOT USED 60	NOT USED 61	NOT USED 62	NOT USED 63	NOT USED 64
NOT USED	NOT USED 65	NOT USED 66	NOT USED 67	NOT USED 68	NOT USED 69	NOT USED 70	NOT USED 71	NOT USED 72
NOT USED	NOT USED 73	NOT USED 74	NOT USED 75	NOT USED 76	NOT USED 77	NOT USED 78	NOT USED 79	NOT USED 80

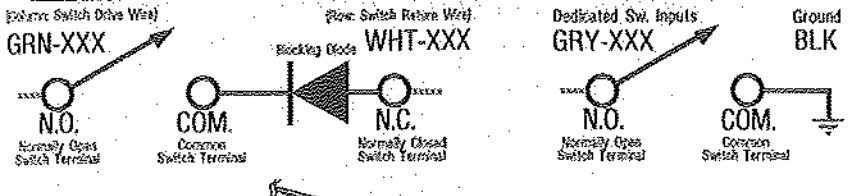


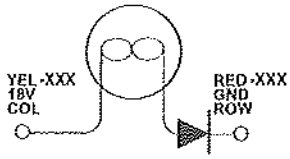
SWITCH MATRIX GRID LOCATIONS	LAMP MATRIX GRID LOCATIONS



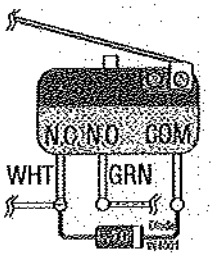
Legend Note: ☐ = Switches/Lamps mounted above playfield. ■ = Switches/Lamps mounted below the playfield.

TYPICAL SWITCH SCHEMATIC	DEDICATED SWITCH SCHEMATIC	TYPICAL LAMP SCHEMATIC

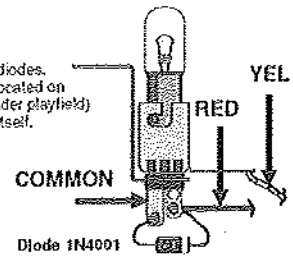




Note:
All Switches require diodes.
Some diodes are located on Terminal Strips (under playfield) & not on the switch itself.
Diode
On
Terminal
Strip



Note:
All Lamps require diodes.
Some diodes are located on Terminal Strips (under playfield) & not on the lamp itself.
Diode
On
Terminal
Strip



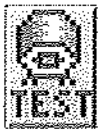
DR. Find-It-In-Front:
Dr. Pinball



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 Output Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connection	Power Voltage	Coil (GA/Turn) Motor / Bulb
#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	24-940 090-5036-00B
#3 TOP MAGNET (ORBIT)	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#4 MIDDLE MAGNET (PFLD)	Q4	I/O Pwr. Drvr.	BRN-YEL	J8-P5	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#5 BOTTOM MAGNET (PFLD)	Q5	I/O Pwr. Drvr.	BRN-GRN	J8-P6	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#6 SHAKER MOTOR	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	RED-WHT	J17-P7	16v AC 12v DC	Motor Only 041-5029-01
#7 FLASH SPINNER*2	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#8 EUROPEAN TOKEN DISPENSER	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	YEL-VIO	J10-P4/5	50v DC	Various (Coil)

High Current Coils Group 2	Drive Transistor (D.T.)	Driver Output Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connection	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 LEFT SLINGSHOT	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#13 RIGHT SLINGSHOT	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#14 LEFT MAGNET (LANE)	Q14	I/O Pwr. Drvr.	BLU-BLK	J9-P7	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#15 LEFT FLIPPER (50V RED/YEL)	Q15	I/O Pwr. Drvr.	ORG-GRY	J9-P8	RED-YEL GRY-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T
#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

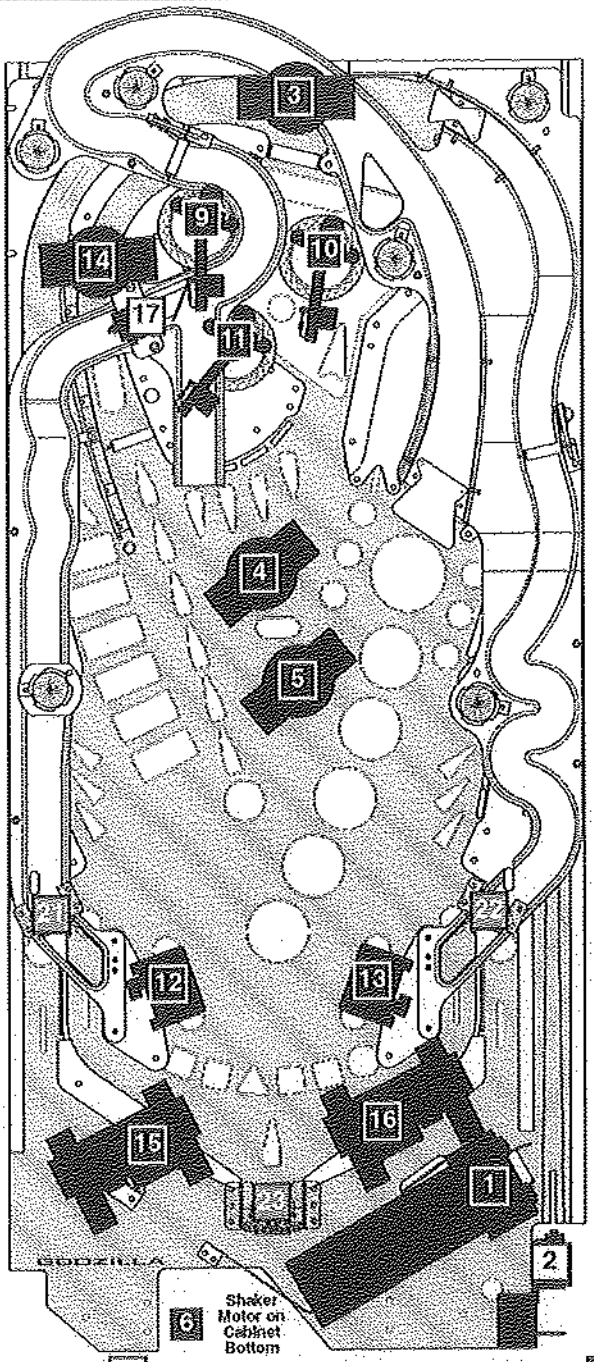
Low Current Coils Group 1	Drive Transistor (D.T.)	Driver Output Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connection	Power Voltage	Coil (GA/Turn) Motor / Bulb
#17 RAMP DIVERTER	Q17	I/O Pwr. Drvr.	VIO-BRN	J7-P2	BRN	J7-P1	20v DC	32-1800 090-5031-00T
#18 FLASH LT*1	Q18	I/O Pwr. Drvr.	VIO-RED	J7-P3	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#19 FLASH RT*1	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#20 FLASH INNER LT ORBIT*2	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#21 LT OUTLANE (UK ONLY)	Q21	I/O Pwr. Drvr.	VIO-GRN	J7-P7	BRN	J7-P1	20v DC	28-1050 090-5016-00
#22 RT OUTLANE (UK ONLY)	Q22	I/O Pwr. Drvr.	VIO-BLU	J7-P8	BRN	J7-P1	20v DC	28-1050 090-5016-00
#23 UP/DOWN POST (UK ONLY)	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	BRN	J7-P1	20v DC	23-1100 090-5030-00T
#24 OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v DC	Meter 5v 031-5000-00

Diode-On-Terminal Strip (Loose)

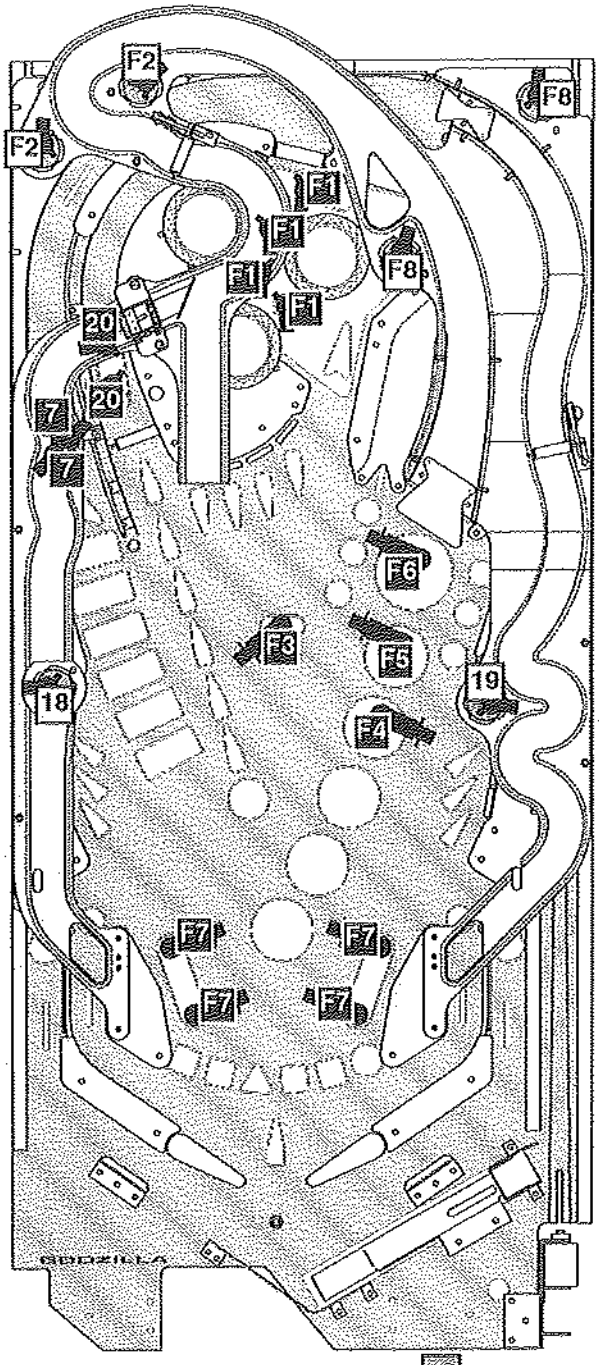
Flash Lamps (FLASH)	Drive Transistor (D.T.)	Driver Output Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connection	Power Voltage	Bulb
#F1 FLASH POPS*4	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F2 FLASH TOP LT*2	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F3 FLASH CTR PFLD*1	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F4 FLASH RAMP #4*1	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F5 FLASH LITE GODZ*1	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F6 FLASH SCORE DOES...*1	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F7 FLASH SLINGS*4	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F8 FLASH TOP RT*2	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 Flash Lamps F1-F8 ONLY. Test all others in SINGLE or CYCLING COIL TESTS.

COIL LOCATIONS

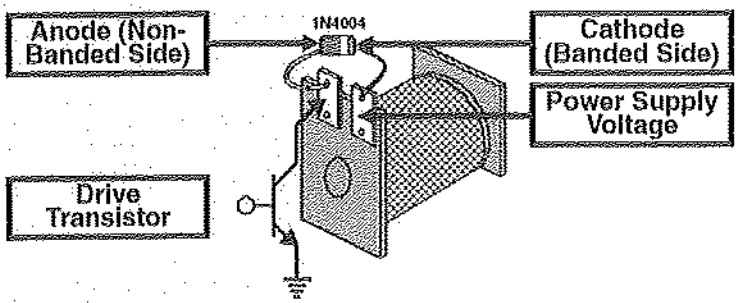


FLASH LAMP LOCATIONS



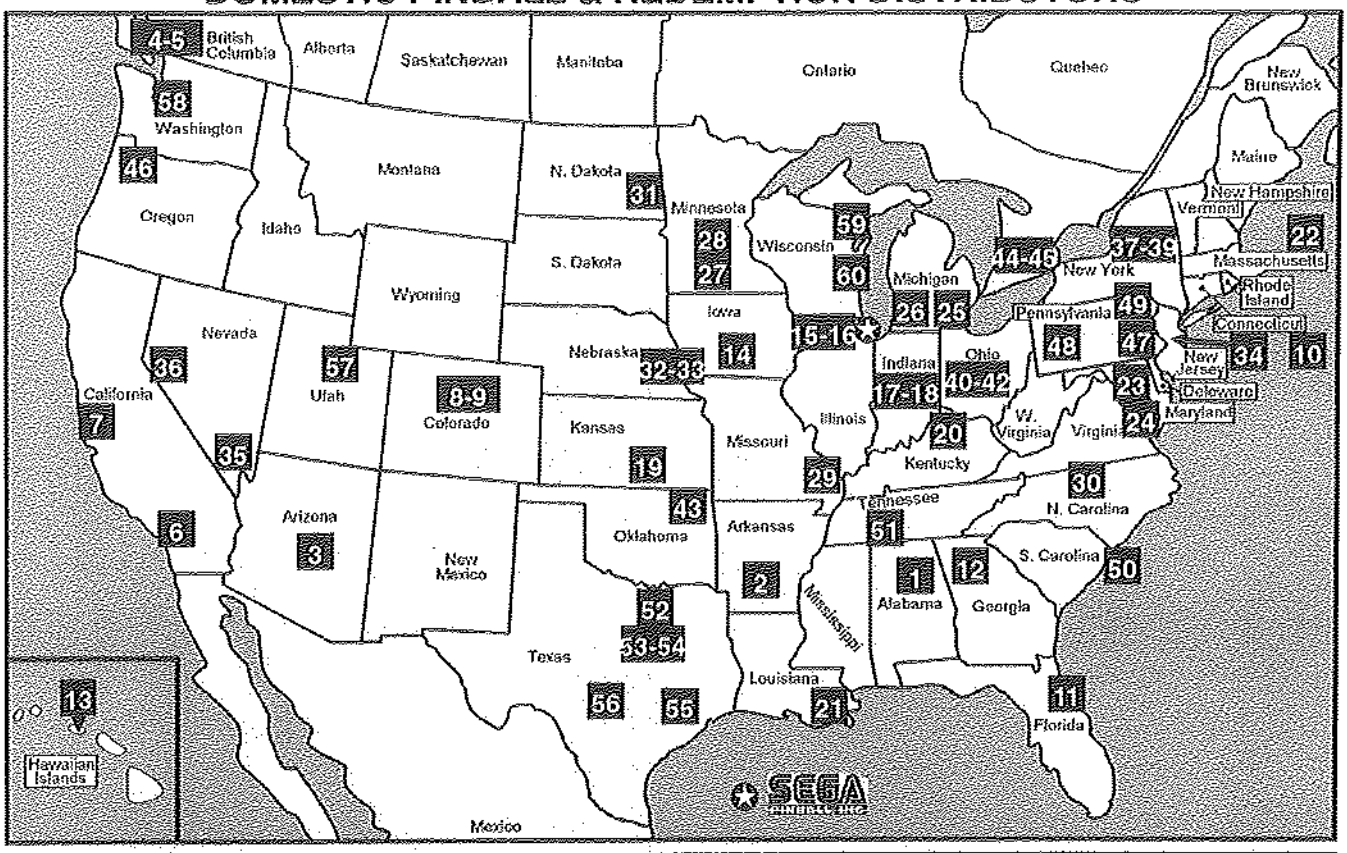
Legend Note: = Coils/Flashes mounted above playfield. = Coils/Flashes mounted below the playfield. = UK Optional

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



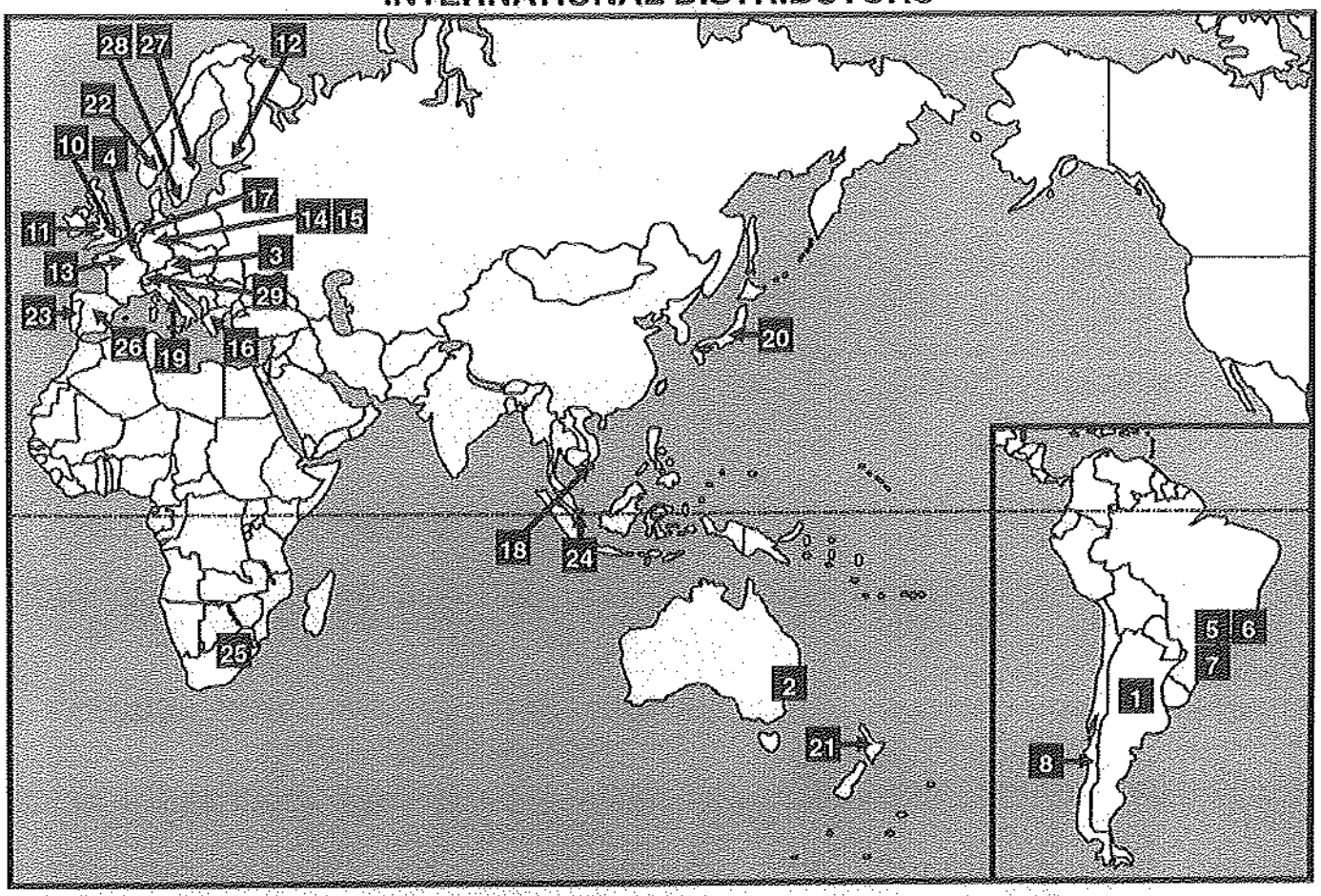
#	STATE/PROVINCE AND CITY		NAME	PHONE
1	AL	Birmingham	Birmingham Vending	205-324-7526
2	AR	N. Little Rock	Godwin Distributing	501-753-1138
3	AZ	Phoenix	Betson West	602-233-0190
4	BC	Bumaby (Can.)	Can. Coin Machine	604-420-4008
5		Vancouver (Can.)	Pacific Vending	604-324-2164
6	CA	Buena Park	Betson West	714-228-7500
7		S. San Francisco		415-952-4220
8	CO	Denver	Col. Game Exchange	303-893-4300
9			Mountain Coin	303-427-2133
10	CT	Williamantic	T & M Distributing	860-456-4231
11	FL	Orlando	Birmingham Vending	407-425-1505
12	GA	Roswell	Game Exchange/SE, Inc.	770-594-0000
13	HI	Ewa Beach	50th State Coin Op.	808-682-4561
14	IA	Des Moines	Greater American Dist.	515-244-2828
15	IL	Elk Grove Village	Atlas Distributing	847-952-7500
16		Bensenville	Namco Cybertainment	630-238-2200
17	IN	Indianapolis	Atlas Distributing	317-786-6892
18		Indianapolis	Shaffer Distributing, Co.	317-899-2530
19	KS	Wichita	United Distributors, Inc.	316-263-6181
20	KY	Louisville	Atlas Distributing	502-966-5266
21	LA	Metairie	AMA Distributors, Inc.	504-835-3232
22	MA	E. Long Meadow	Gekay Sales	413-525-2700
23	MD	Baltimore	Automated Services	410-646-4100
24			Weiner Distributing	410-525-2600
25	MI	Redford	Atlas Distributing	313-794-4880
26		Wyoming	Atlas Distributing	616-241-1472
27	MN	Bloomington	Hanson Distributing	612-884-6604
28		Minneapolis	Sandler Vending	612-998-0010
29	MO	St. Louis	Shaffer Distributing, Co.	314-645-3393
30	NC	Archdal	Operators Distributing	910-884-5714

#	STATE/PROVINCE AND CITY		NAME	PHONE
31	ND	Fargo	M.H. Associates, Inc.	701-282-7877
32	NE	Omaha	Greater American Dist.	402-553-2812
33			Mid-City Dist.	402-341-5300
34	NJ	Springfield	State Sales & Service	973-467-9700
35	NV	Las Vegas	Betson West	702-740-8484
36		Reno	Reno Game Sales	702-829-2080
37	NY	Garden City Park	T & M Distributing	516-747-0034
38		Roslyn Heights	Deith Distributing	516-621-1234
39		Syracuse	T & M Distributing	315-432-1932
40	OH	Cincinnati	Atlas Distributing	513-771-1909
41		Columbus	Shaffer Distributing, Co.	614-421-6800
42		Macedonia		330-467-4850
43	OK	Tulsa	Galaxy Distributing, Co.	918-835-1166
44	ON	Rexdale (Can.)	New Way Sales	416-674-8000
45		Toronto (Can.)	Starburst Coin Machines	416-251-2122
46	OR	Portland	American Coin	503-233-7000
47	PA	Bensalem	State Sales & Service	215-638-1122
48		Pittsburgh	Green Coin	412-881-8804
49		Wilkes-Barre	Roth Novelty	717-824-9994
50	SC	Myrtle Beach	Green Coin	803-629-1900
51	TN	Memphis	Green G.A.M.E.S.	901-353-1000
52	TX	Carrollton	Nickels & Dimes	972-492-3262
53		Corsicana	Master Sales	903-874-4740
54		Dallas	Commercial Music	214-741-6381
55		Houston	H.A. Franz, & Co.	713-523-7366
56		San Antonio		210-226-6322
57	UT	Salt Lake City	Struve Distributing	801-328-1636
58	WA	Seattle	American Coin	206-764-9020
59	WI	Green Bay	Pioneer Sales & Svc.	920-468-5200
60		Menomonee Falls	Pioneer Sales & Svc.	414-781-1420

TECHNICAL SUPPORT SEGA PINBALL, INC.

For Parts and Service, call your local distributor. The numbered locations are general areas. View table and map for corresponding numbered distributor. If your state/province does not have a distributor, call the nearest state/province. Distributors and phone numbers are subject to change. Call Sega Pinball, Inc. Technical Support with any questions or if your distributor cannot help you, at 1-800-542-5377 (USA or Canada or elsewhere at 1-708-345-7700).

INTERNATIONAL DISTRIBUTORS



#	COUNTRY AND CITY	NAME	PHONE (-011)
1	Argentia, Urquiza	Florencia	54-232-5532
2	Australia, Matraville	Amusement Mach. Dist.	61-29-316-6000
3	Austria, Grazerstrasse	Rupp Austria	43-34-528-6105
4	Belgium, Brussels	Splin S.A.	32-43-62-7677
5	Brazil, Sao Paulo	Parkland	55-11-792-42864
6		Unimax	55-11-533-5615
7		Universe	55-11-575-0731
8	Chile, Santiago	Cuinsa	56-2-696-0167
9		Universe Electronics	56-2-235-7822
10	England, London	Electrocoin	44-181-965-2055
11	So. Wales, Cardiff	Electrocoin	44-22-261-5100
12	Finland, Espoo	Pelika Ray Oy	35-8-943-7091
13	France, Aubervilliers	PLF Sa	33-14-811-3131
14	Germany, Berlin	Bally Wulff	49-3-062-0020
15	Germany, Hannover	Bally Wulff	49-511-358-5343

#	COUNTRY AND CITY	NAME	PHONE (-011)
16	Greece, Athens	Greece Coin	30-1-554-1608
17	Holland, 's-Hertogenbosch	Érrel Industries	31-73-645-6111
18	Hong Kong, Kwai Fong	Bondeal Limited	85-2-487-9089
19	Italy (RSM), Serravalle	Technoplay Sa	39-54-990-0361
20	Japan, Tokyo	Data East, Corp.	81-35-370-0708
21	New Zealand, Auckland	Amco Machine Supp.	64-9-846-7606
22	Norway, Oslo	Vendcomatic	47-2-216-0830
23	Portugal, Amadora	Jacinto & Martins	35-11-495-1868
24	Singapore, Singapore	Valibel Technologies	65-748-8404
25	South Africa, Lalucia	Unimac	27-3-152-5544
26	Spain, Madrid	Sente S.A.	34-1-541-7112
27	Sweden, Bromma	Axlon	46-8-704-6580
28	Sweden, Malmo	Truemax AB	46-40-153-635
29	Switzerland, Harkingen	Novomat Ag	41-62-398-4061

TECHNICAL SUPPORT SEGA PINBALL INC

For Parts and Service, call your local distributor. The numbered locations are general areas. View table and map for corresponding numbered distributor. If your country does not have a distributor, call the nearest country. Distributors and phone numbers are subject to change. Call Sega Pinball, Inc. Technical Support with any questions or if your distributor cannot help you, at 1-708-345-7700.

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**

TRANSPORTATION



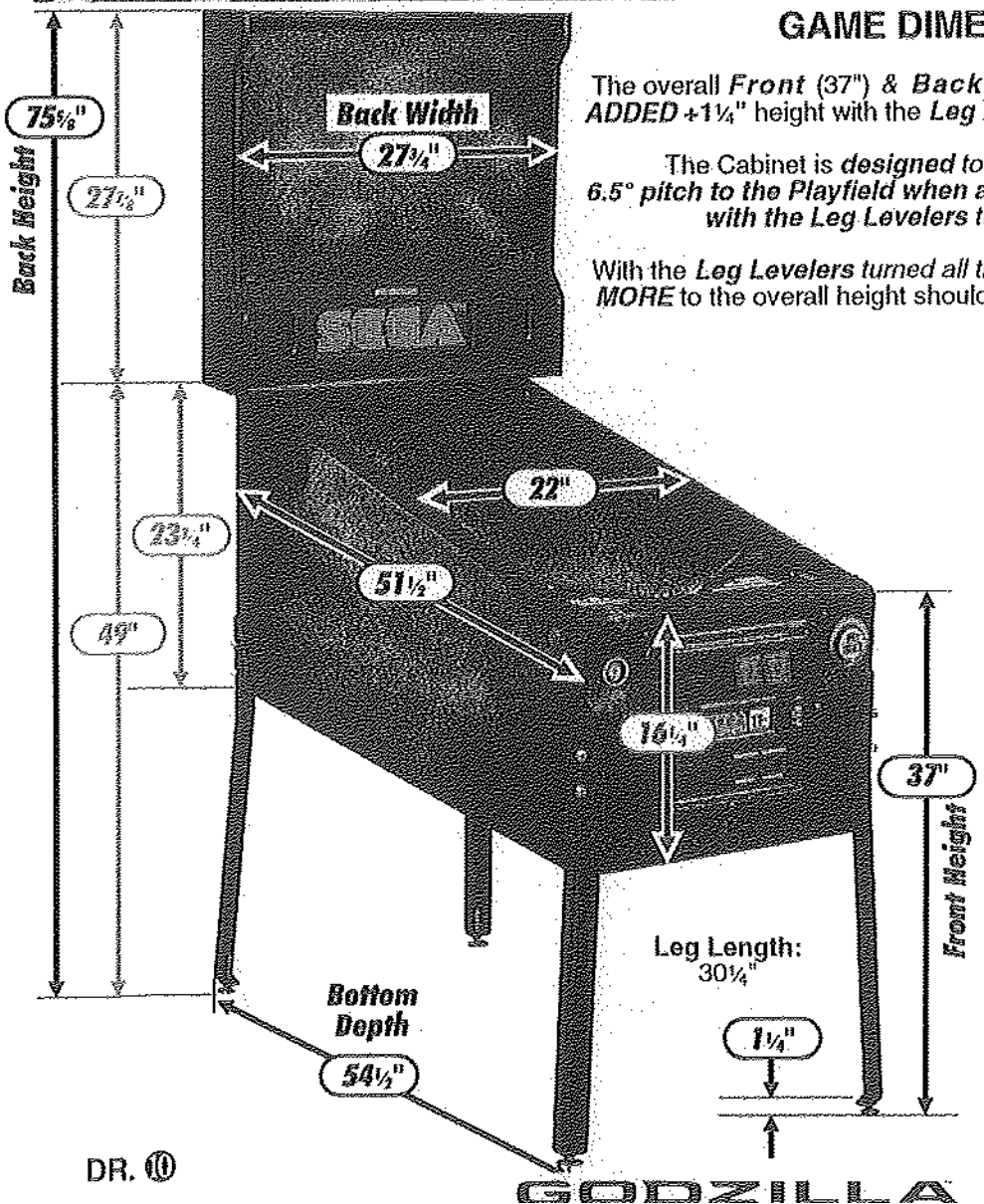
To reduce the possibility of damage, observe **ALL** precautions whenever transporting the game. ***Read & follow*** *Section 1, Chapter 1,* **Game Assembly Procedures**, & **How to Secure the Backbox for Transporting.** Remove the legs & secure the game within the transporting vehicle. *Save and retain 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)

CAUTION

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

GODZILLA

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

GODZILLA™

General Table of Contents

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

WOW! Look what's new at Sega Pinball! ..... Inside Front

- ✻ Backbox Layout Locations: Fuses, Bridges, Relays & ROMs ..... DR. ❶
- ✻ Find-It-In-Front: Dr. Pinball Section Explained ..... DR. ❷
- ✻ Install 4-Balls ✻ Diagnostic Aides ✻ CPU DIP Switch Settings ✻ ROM Summary Table ..... DR. ❸
- ✻ Switch Matrix Grid & Dedicated Switches ✻ Lamp Matrix Grid ..... DR. ❹
- ✻ Switch & Lamp Matrix Grid Locations ✻ Typical Switch, Dedicated Switch & Lamp Schematics ..... DR. ❺
- ✻ Coils Detailed Chart Table ..... DR. ❻
- ✻ Coil & Flash Lamp Locations ✻ Typical Coil Wiring ..... DR. ❼
- ✻ Domestic Pinball & Redemption Distributors ..... DR. ❽
- ✻ International Distributors ..... DR. ❾
- ✻ Power Requirements ✻ Transportation ✻ Game Dimensions ..... DR. ❿

Game Manual General Table of Contents ..... i-ii

SECTION 1 1

Chapter 1, Game Set-Up 1

Game Assembly Procedures 1

➢ ✻ *How to Secure the Backbox for Transporting* ✻ *Leg Leveler Adjustment* ✻ *Easy Access Service System - 3 Positions* *2*

SECTION 2 3

Chapter 1, Game Operation & Features 3

✻ Start of Game Features ✻ During Game Features ✻ End of Game Features 3-4

✻ Instruction Card 4

Chapter 2, Playfield Overview 5

Overview 5

Playfield Top Ball Shots: Layers 1-3 7-9

Playfield Bottom (No Ball Shots): Layer 1 10

SECTION 3 11

Chapter 1, Portals™ Service Menu Introduction 11

Portals™ Service Menu Table of Contents (View for an outline of this section) 11

➢ ✻ *Portals™ Service Menu Access & Use* ✻ *How to Use This Section* *12-13*

➢ *Portals™ Service Menu Icon Tree* *14-15*

➢ *Portals™ Service Menu Example* *16-18*

Chapter 2, Go To Diagnostics Menu 19

Chapter 3, Go To Audits Menu 32-33

Chapter 4, Go To Adjustments Menu 38-39

Chapter 5, Go To Reset Menu 47

Chapter 6, Go To Fuses List 49

Chapter 7, Go To Help Screen 51

General Table of Contents Continued on the Next Page

SECTION 4 53

Chapter 1, Parts Identification & Location (The Pink Pages) 53
Overview 53
Backbox (Showcase II) Assembly 54
Speaker Panel Assy. for the Backbox (Showcase II) & Associated Parts 55
Cabinet - General Parts 56
Cabinet & Playfield - Switches 57
Playfield - General Parts (Below) & Playfield - General Parts (Above) 58-59
Playfield - Rubber Parts (Rings Actual Size) 60
Playfield - Plastic (Butyrate), Decals and Mylar 61
Playfield - Rails and Ball Guides 62
Playfield - Metal Posts and Nuts (Actual Size) 63
Playfield - Metal Spacers (Actual Size) 64
Playfield - Plastic Posts and Spacers (Actual Size) 65
Playfield - Small Bayonet Type Bulbs and Sockets (Actual Size) 66
Playfield - Large Bayonet Type Bulb and Sockets (Actual Size) 67
Playfield - Wedge Base Bulbs and Sockets (Actual Size) 68

Chapter 2, Drawings for Major Assemblies & Ramps (The Blue Pages) 69
Overview 69
Ball (Auto) Launch, 500-5477-01 & A.P.: Shooter Lane Sw. Assy. ..... Top 70
Lt. & Rt. Slingshot Assemblies, 500-5849-00 (Qty. 2) & A.P.: 2-3/4" I.D. Black Rubber Ring ..... Bot 70
4-Ball Trough Assembly, 500-6318-24 & A.P.: Ball Trough Enter/Exit Scoop 71
Flipper (Left) Assembly, 500-5944-14 & A.P.: Flipper Bat & Shaft Assy. 72
Flipper (Right) Assembly, 500-5944-04 & A.P.: Flipper Bat & Shaft Assy. 73
Turbo (Pop) Bumper Top Assy., 515-6459-05 (Qty. 3) ..... Top 74
Turbo (Pop) Bumper Switch Assy., 515-6459-03 (Qty. 3) ..... Mid 74
Turbo (Pop) Bumper Bottom Assy.,, 515-6459-04 (Qty. 3) ..... Bot 74
Threaded Bushing Core Assy., 515-6142-01 (Qty. 4)2 & A.P.: Magnet Coil (22-650) (Qty. 4) 75
Plastic Ramp Assembly, 500-6308-00-40 & A.P.: Godzilla Head & Arm & Misc. 76-77
UK ONLY OPTIONAL: Left & Right Outlane Ball Deflector Assemblies, 500-5788-03 (Qty. 2) ..... Top 78
UK ONLY OPTIONAL: Up/Down Post Assembly, 500-6293-00 ..... Bot 78

SECTION 5 79

➢ *Schematics & Troubleshooting Table of Contents (outline of this section) 79*
Chapter 1, Backbox Wiring (The Yellow Pages) 81
Chapter 2, Playfield Wiring (The Yellow Pages) 83
Chapter 3, Cabinet Wiring (The Yellow Pages) 87
Chapter 4, Printed Circuit Boards (PCBs) (The Yellow Pages) 89

APPENDIXES A-I 111

➢ *Appendixes A-I Table of Contents (outline of this section) 111*
Appendixes A-I 112-124
➢ *Plastic Part Color Chart ..... (Bottom) 123 + (Top) 124*
Glossary of Terms 125
Parts Order Checklist Notes 126

Limited Warranty, Cautions, Warnings & Notices ..... Inside Back

Game Set-Up

Game Assembly Procedures

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

1. Open the top of the carton and lay it on its side with the bottom of the cabinet down. Using the plastic banding strip as a handle, slide the game out of the carton. ***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. ⓓ for Power Requirements, Transportation and Game Dimensions.

2. Remove all packing material. The four (4) Cabinet Leg Assemblies (Leg Levelers are attached) are in the corner packing material of the crate. A large Allen Wrench (use for securing the backbox) is inserted and 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. ➽Per CE: "The appliance has to be placed in a horizontal position."

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 Keys from the playfield glass, and open the Coin Door. Remove the Backbox Keys hanging inside the Coin Door, 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 either on the left or right side, inside the cabinet) and placing the notched end into the hole on the 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.

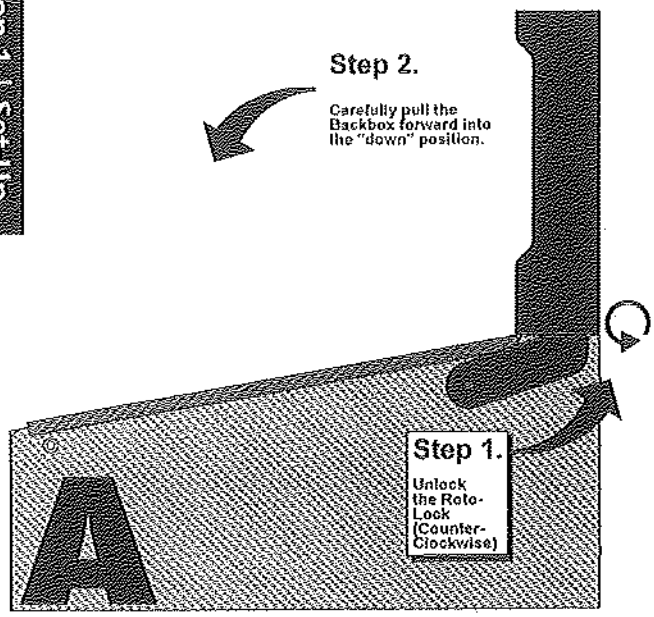
The playfield incline affects difficulty of play. Use the recommended incline; Game difficulty is best varied using game adjustments.

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.)

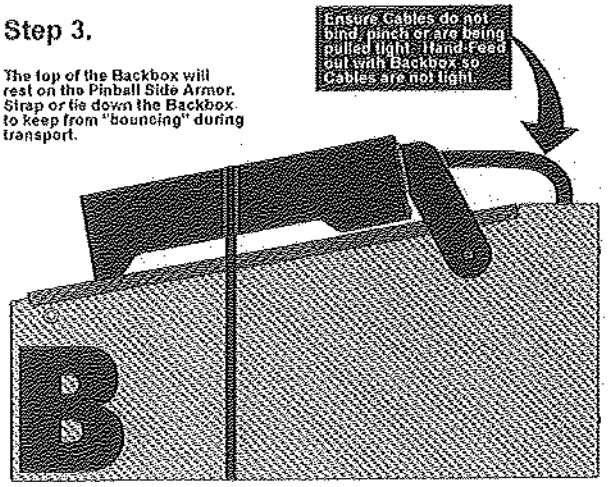
16. If desired, make Game Pricing (Standard and/or Custom) and Add-A-Ball, Novelty, or X-Ball Play adjustments at this time. See Section 3, Chapter 4, Go To Adjustments Menu, for instructions on how to enter adjustments. Follow instructions in the tables provided in the manual for suggestions of customizing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

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

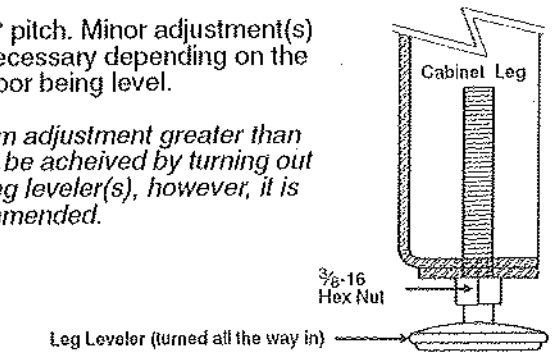
This cabinet is designed to automatically have a 6.5° pitch without any Leg Leveler adjustment!

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!

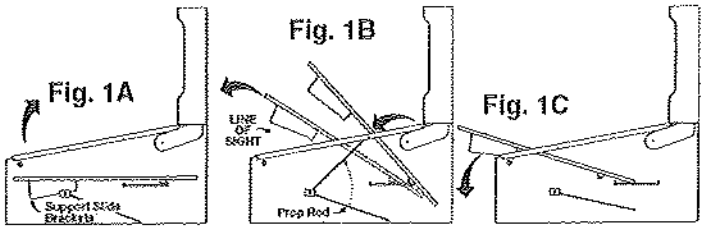
Verify 6.5° pitch. Minor adjustment(s) may be necessary depending on the location floor being level.

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



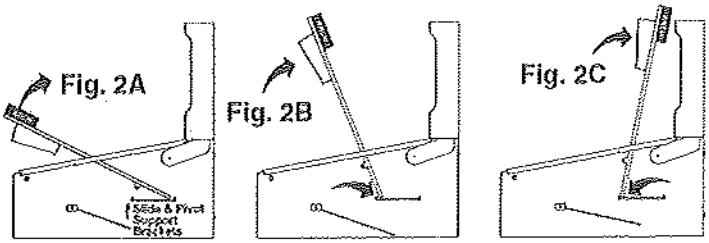
Easy Access Service System - 3 Positions

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 ½ 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=7%, 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

If player achieved a new high score in any of the 3 categories (Regular, Novice or Wizard), the player may enter his/her initials. To enter your initials, 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) can be displayed during the *Attract Mode*; enter letters in the same fashion.)

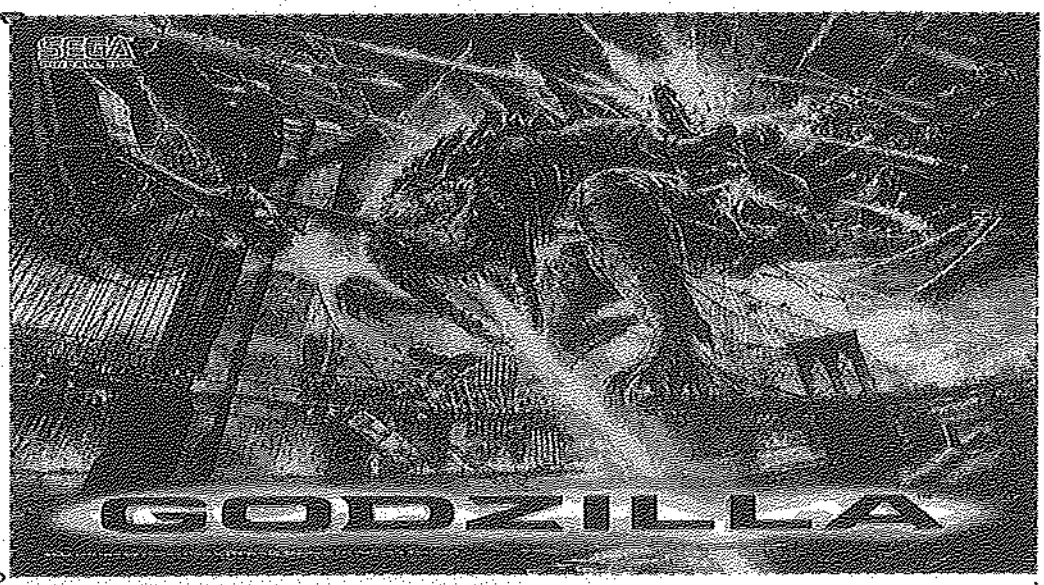
Manual Percentaging

This game is equipped with a Manual Percentage Adjustment. As with our previous games, you can either set operator adjustments for a replay percent or you can set a fixed replay score. See Section 3, Chapter 4, Go To Adjustments Menu, Adjustments 1 & 2. If you set operator adjustments for a particular replay percent, the game will compute a recommended score to keep the game at that replay percentage. If a change is recommended and the game coin door is opened, the display will indicate if the replay is too high or low and make a sound to alert the operator. By pressing the Start Button, the score to beat will be changed to a more appropriate level. If you close the Coin Door or enter the **Portals™ Service Menu**, no score change will be made. You may choose to ignore the recommended change; for example, you may not think last week's players were the usual crowd. Just close the door and the message will disappear without altering the existing level. Or 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 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



FOLD HERE

TAXI Multiball Completing the word **T A X I** (see *Dot Display*) qualifies the *Start Multiball Shot*. During ***Multiball***, spell **T - A - X - I** for ***Jackpots***.

Helicopter Multiball Completing a *Combo Shot* (*Return Lane to Green Target*) advances ***X*** (*Bonus Multiplier*). Completing all *Combo Shots* qualifies the *Start Multiball Shot*. During ***Multiball***, complete the **3 Yellow Targets** (*Right or Left*) for ***Jackpots***.

Baby Zilla Multiball The *Spinner Shot* qualifies the *Start Multiball Shot*. During ***Multiball***, shoot the *Left Orbit Shot* for ***Jackpots***.

Sonar Multiball Completing all **6 "Sonar" Lights (Captive Balls)** qualifies the *Start Multiball Shot*. During ***Multiball***, shoot the **Lit Captive Ball** for ***Jackpots***.

Godzilla Multiball Completing the *Right Ramp Feature* qualifies the *Start Multiball Shot*. During ***Multiball***, shoot the *Ramp Shot* for ***Jackpots***.

Save New York Playing all ***5 Multiballs*** qualifies the *Start Multiball Shot* for ***"Save New York"***.

Multi-Multiball Players can start up to ***5 Multiballs*** at once! The amount of current ***Multiballs*** affects the ***Jackpot Value***. *Jackpot Levels* are highest when starting ***Multi-Multiballs***. Additional ***Multiballs*** can be added during *Multiball Play*. Adding a ***Multiball*** does increase the ***Jackpot Value***, but to a lessor degree than starting with the same amount of ***Multiballs***. Starting ***5 Multiballs*** (simultaneously) awards ***"Enter Initials"*** for up to 5 Players.

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

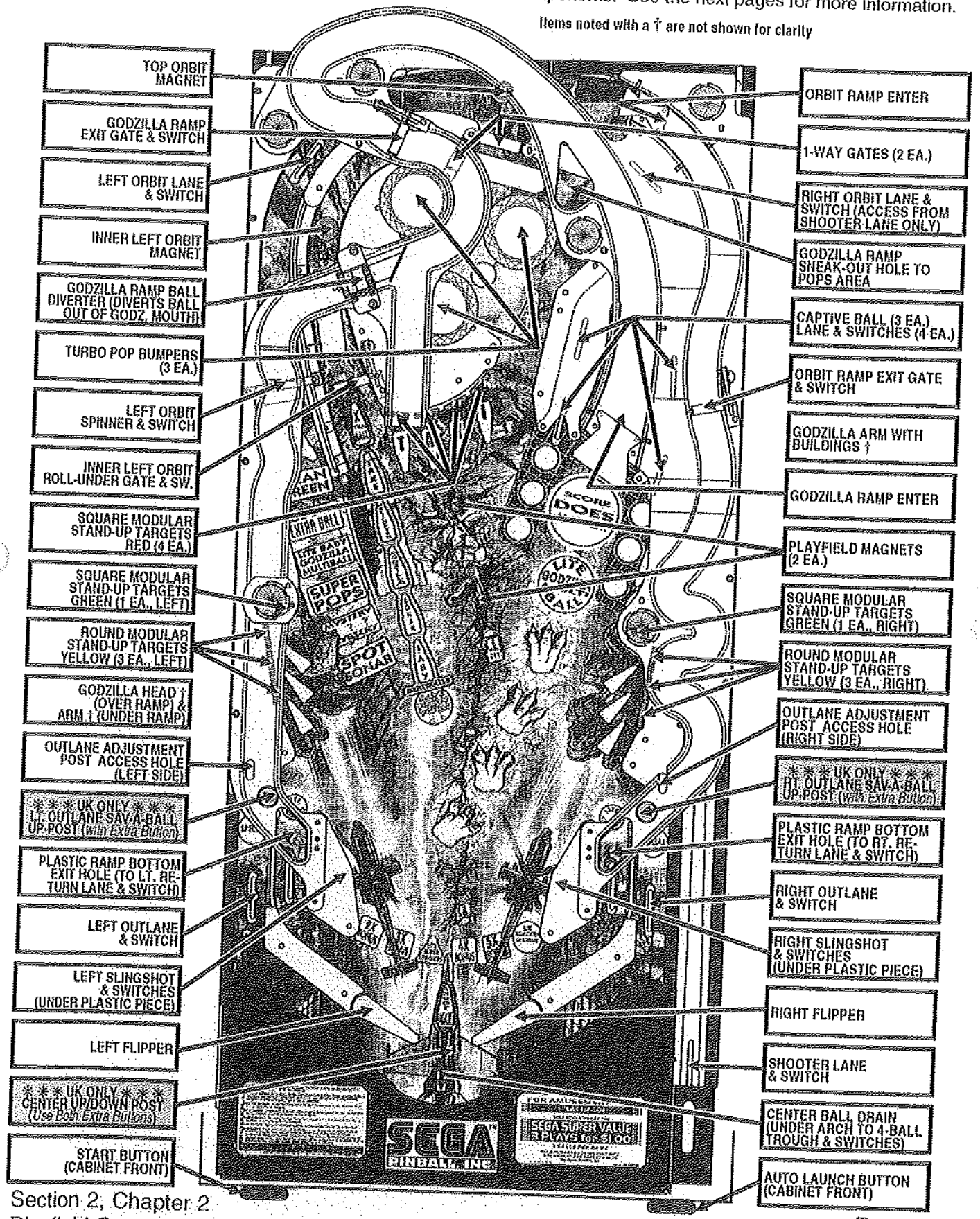
Sega Pinball, Inc. TM & © 1998. Godzilla, TM & © 1998 Toho Co, Ltd. & TriStar Pictures. All Rights Reserved. Sega Part № 755-5140-00 USA

Playfield Overview

Overview

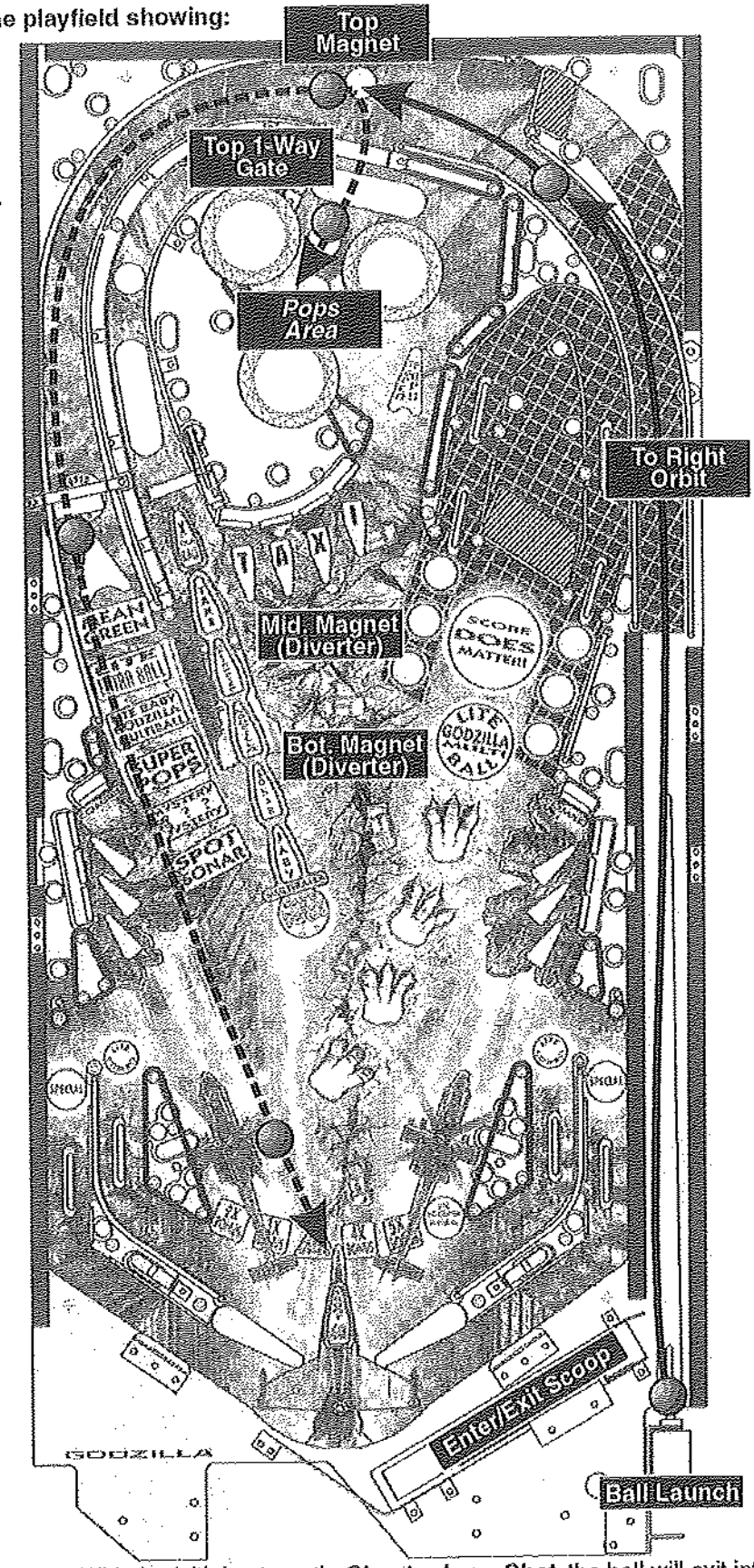
Below is the *Godzilla Playfield Map* showing all visible components. See the next pages for more information.

Items noted with a † are not shown for clarity

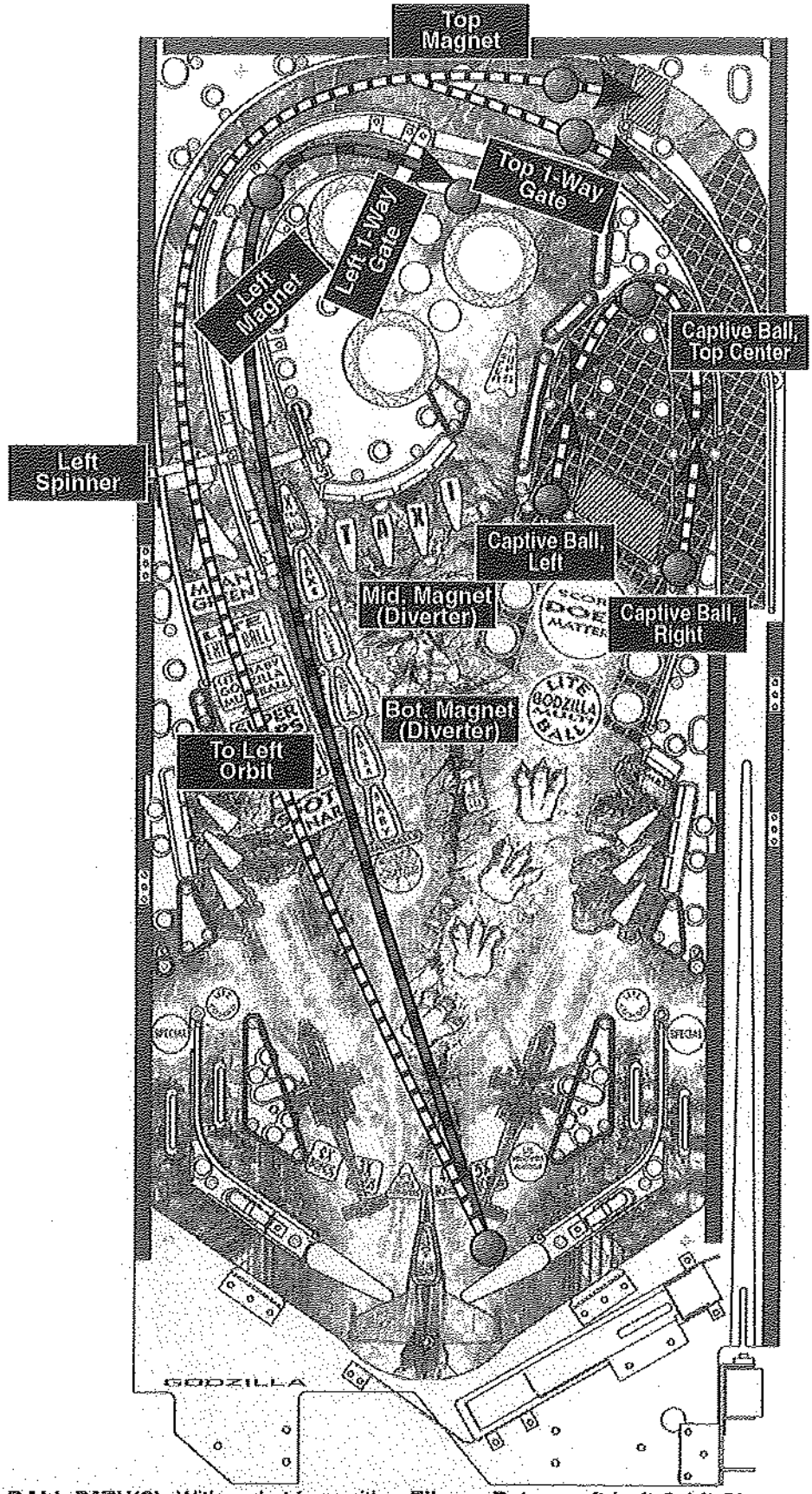


Playfield Top Ball Shots: Layer 1

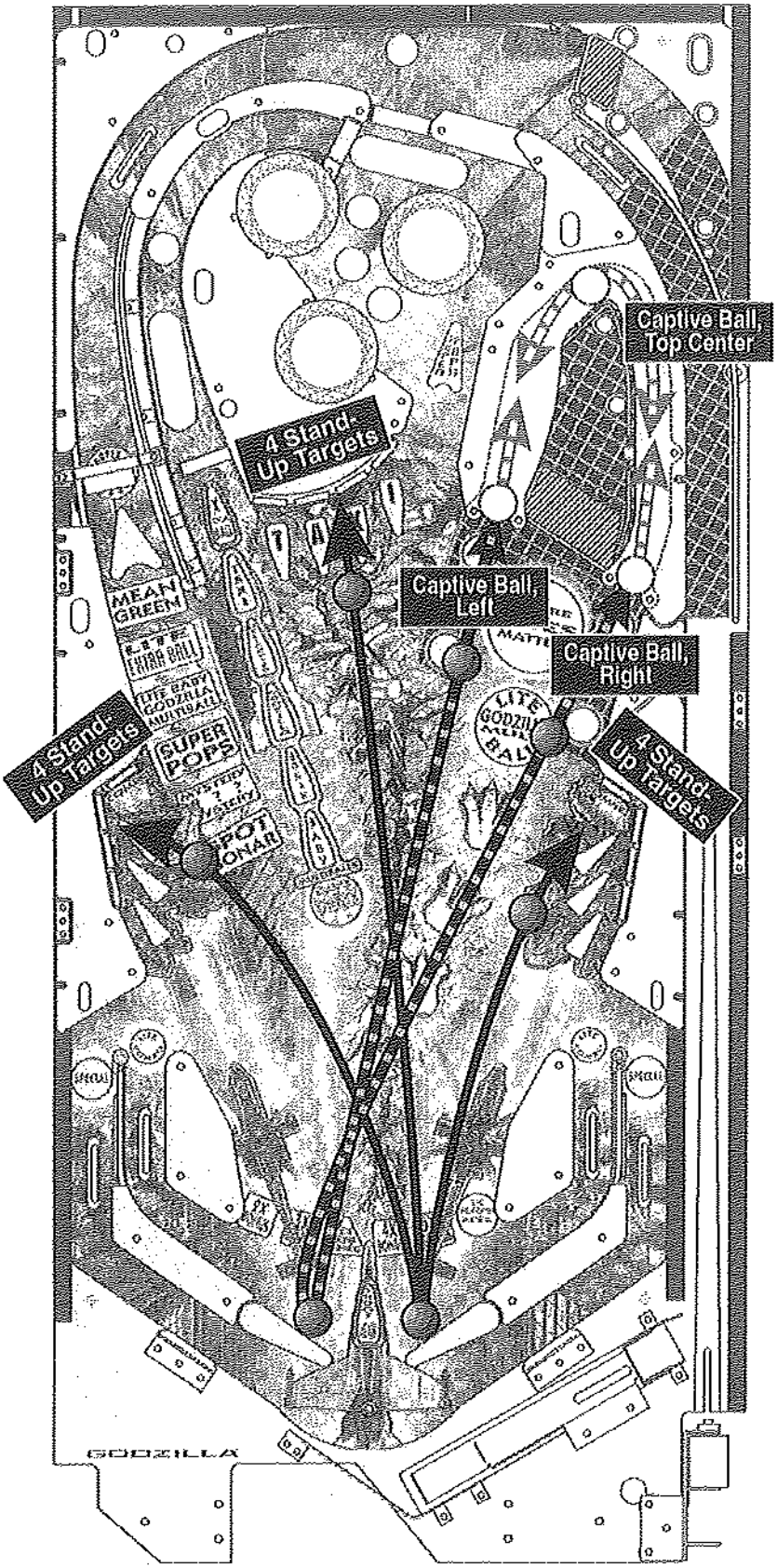
Below is the top of the playfield showing: Playfield Wood Rails, Ball Guides, Flat Metal Rails, Posts, Rubber Rings, Target Tops, Flipper Bats, Ball Launch and the Enter/Exit Scoop (over the Ball Trough).



POSSIBLE BALL PATH(S): With the initial automatic ***Shooter Lane Shot***, the ball will exit into the **Right Orbit**. With the **Top Magnet Diverter ON**, the ball(s) will drop through the **Top 1-Way Gate** into the *Pop Bumper Area*. With the **Top Magnet Diverter OFF**, the ball(s) will continue around the **Orbit** returning to either **Flipper Bat**. With the **Middle & Bottom Magnet Diverters ON** your ball can eventually be anywhere!



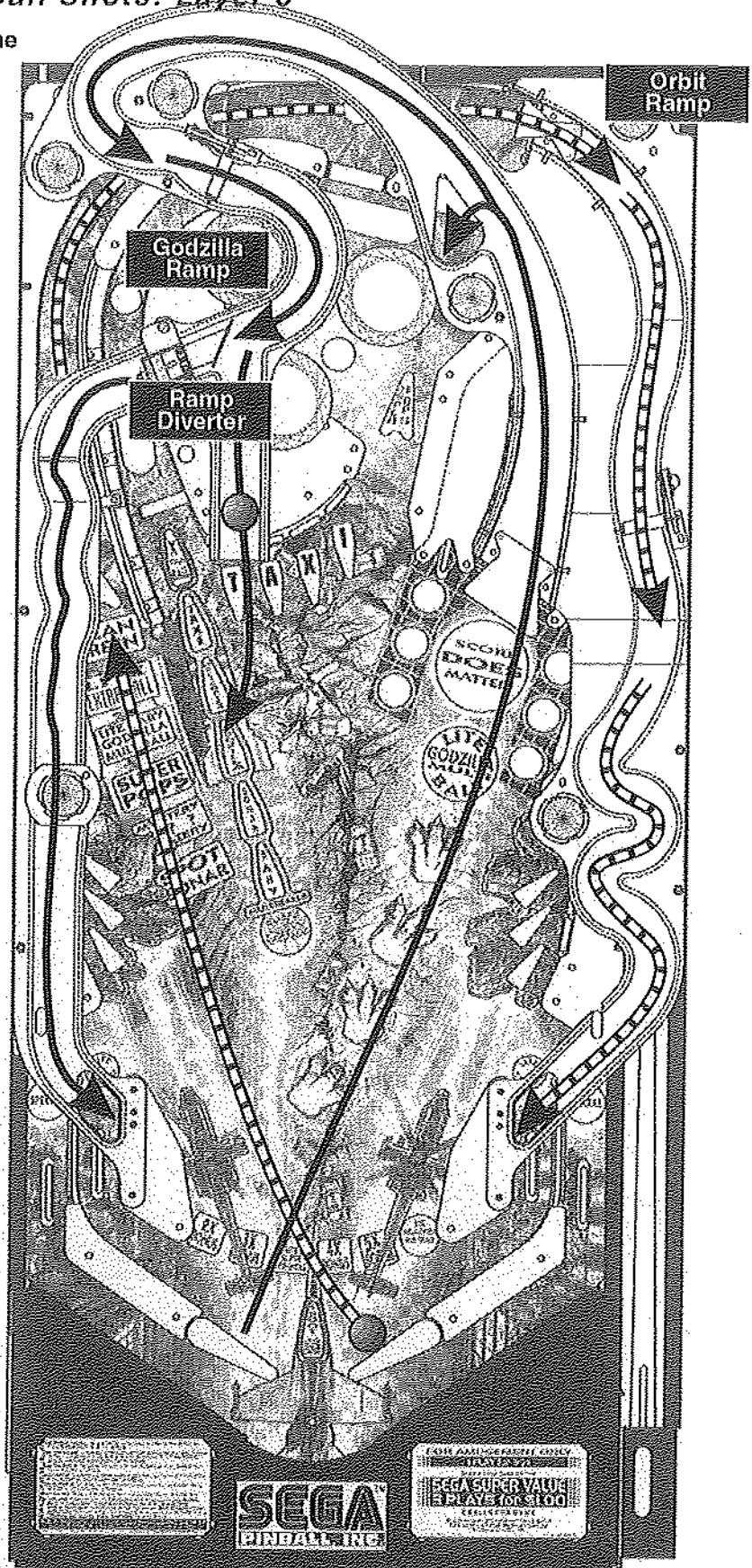
POSSIBLE BALL PATH(S): With a shot from either **Flipper Bat**, a ***soft Left Orbit Shot*** can send the ball back into the **Shooter Lane**, and a ***hard Left Orbit Shot*** will send the ball into the **Orbit Ramp** (See Page 9). If the **Top Magnet Diverter** is **ON,** into the *Pops Area* you go. A shot into the ***Left Inner Orbit*** will send the Ball through the **Left 1-Way Gate** into the *Pops Area*. With The **Lt. Magnet ON**, the ball will be held (*watch the Display*) & then thrown!



POSSIBLE BALL PATH(S): ***Shots*** to the 3 sets of **Stand-Up Targets.** ***Shots*** to either the **Left** or the **Right Captive Ball** will knock the **Top Center Captive Ball** back & forth between the posts. **Watch the Dot Display for Helpful Hints!** *Please Note: Each Captive Ball is in its' own "lane"; If balls were removed for cleaning ensure the balls are put back correctly (1 Captive Ball between each set of posts).*

Playfield Top Ball Shots: Layer 3

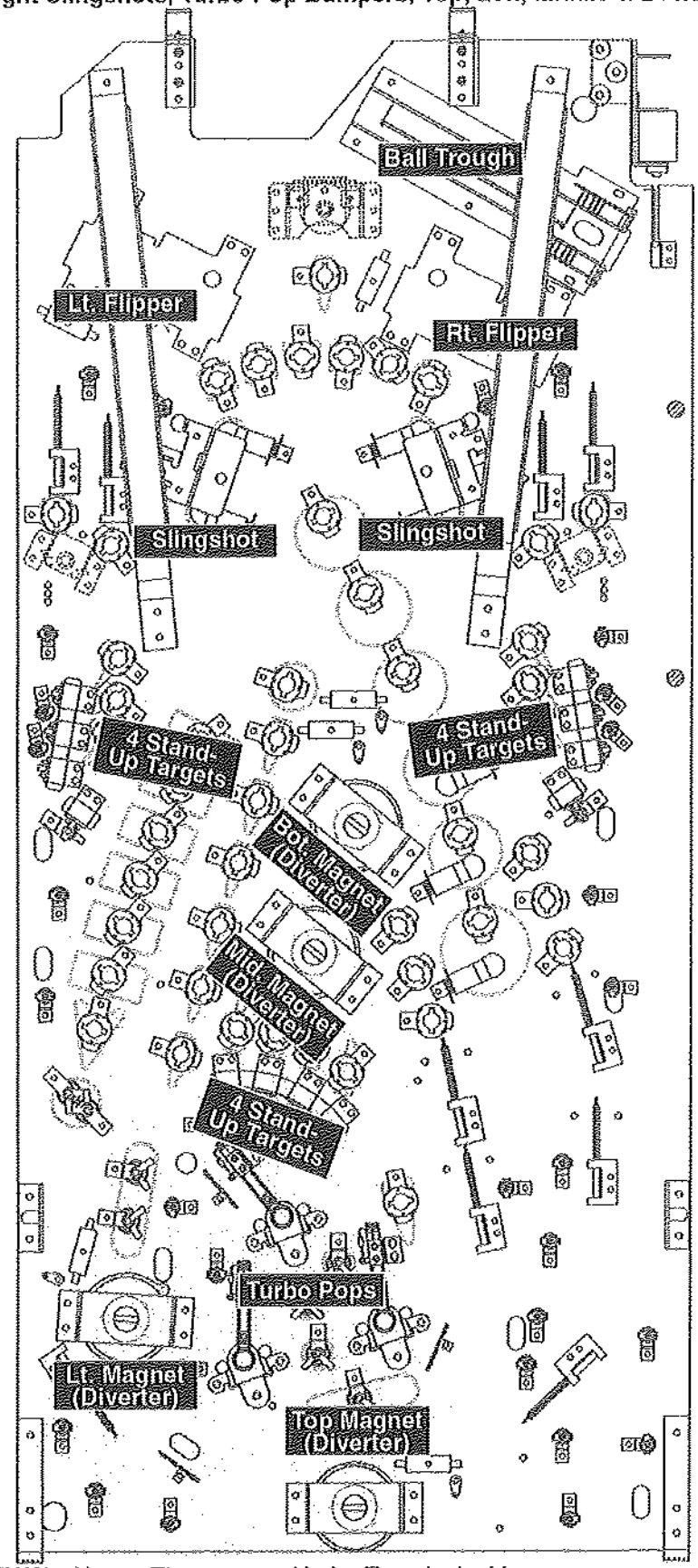
Below is the top of the playfield showing: Addition of the Plastic Ramp and the Bottom Arch.



POSSIBLE BALL PATH(S): A ***hard shot*** to the ***Left Orbit*** will send the ball up the **Orbit Ramp** exiting out the *Right Bottom Exit Hole* into the **Right Return Lane**. A ***soft shot*** to the **Godzilla Ramp** will send the ball through the *Top Exit Hole* into the *Pops Area*. A ***hard shot*** with the **Ball Diverter UP** will send the ball through the *Left Bottom Exit Hole* into the **Left Return Lane**; with the **Ball Diverter DOWN** the ball will exit out of **Godzilla's Mouth**.

Playfield Bottom (No Ball Shots): Layer 1

Below is the bottom of the playfield *(as shown as if the playfield is up leaning against the Backbox)* showing:
bulbs & sockets, switches, brackets and bottom mounted assemblies: **4-Ball Trough, Left & Right Flippers, Left & Right Slingshots, Turbo Pop Bumpers, Top, Left, Middle & Bottom Magnets**



POSSIBLE BALL PATH(S): None. There are no Under-Troughs in this game.

Portals™ Service Menu Introduction

Section 3
Table of Contents

Chapter 1, • INTRODUCTION 11

PORTALS™ *Service Switch Set Access & Use / How to Use This Section 12-13*
Portals™ Service Menu Icon Tree 14-15
Portals™ Service Menu Example and Exiting the Portals™ Service Menu 16-18

Chapter 2, • GO TO DIAGNOSTICS MENU 19

DIAG
- •• *Go To Switch Menu 20*
- ••• *Switch Test / Active Switch Test / Dedicated Switch Test 20*
- ¤ Switch Matrix Grid & Dedicated Switches 20
- ¤ Switch Matrix Grid Descriptions with Part Numbers and Locations 21
- •• *Go To Coil Menu 22*
- ••• *Single Coil Test / Cycling Coil Test 22*
- ¤ Coil & Flash Lamp Descriptions 22
- ¤ Coil & Flash Lamp Locations 23
- ¤ Coils Detailed Chart Table 24
- ¤ Backbox I/O Power Driver Board Detailed Wiring Diagram 25
- •• *Go To Lamp Menu 26*
- ••• *Single Lamp Test / Test All Lamps / Row & Column Lamp Tests 26*
- ¤ Lamp Matrix Grid 26
- ¤ Lamp Matrix Grid Locations 27
- •• *Test Flash Lamps 28*
- •• *Clear Ball Trough 28*
- •• *Technician Alert 28*
- •• *Service Phone # 28*
- •• *Begin Play Test 28*
- •• *Fire Knocker 28*
- •• *Sound / Speaker Test 28*
- ¤ Speaker Phase Testing 29
- •• *Begin Burn In 29*
- •• *Dot Matrix Test & Dot Matrix Display Explained 29*
- •• *Godzilla Specific (Not Used) 30*
- •• *Dr. Pinball (Flow Chart Menus: Coil, Switch & Lamp) 31*

Chapter 3, • GO TO AUDITS MENU 33

AUD
- ¤ Game Audit Table 32
- •• *Earnings Audits (Audits 1-12) 33*
- •• *Sega Audits (Audits 13-55) 34-35*
- •• *Godzilla Audits (Audits 56-99) 35-37*
- •• *Go To Printer Menu 37*
- ••• *...Printer Interface, ...Alison Interface, ...Nº of Copies Printed (Adjustments) 37*

Chapter 4, • GO TO ADJUSTMENTS MENU 39

ADJ
- ¤ Game Adjustment Table 38
- •• *Sega Adjustments (Adjustments 1-48) 39-43*
- •• *Godzilla Adjustments (Adjustments 49+) 44*
- •• *Custom Message (Direct Access to Adjustment 34) 46*
- •• *Film Star Reset (Special Factory Reset Settings for the Home Environment) 46*

Chapter 5, • GO TO RESET MENU 47

RESET
- •• *Reset Coin Audits / Reset Game Audits / Factory Reset 47*
- ¤ Example 48

Chapter 6, • GO TO FUSES LIST 49

FUSES
- •• *Go To Fuses List 49*
- ¤ Example and Backbox Layout Locations: Fuses, Bridges, Relays & ROMs 49-50

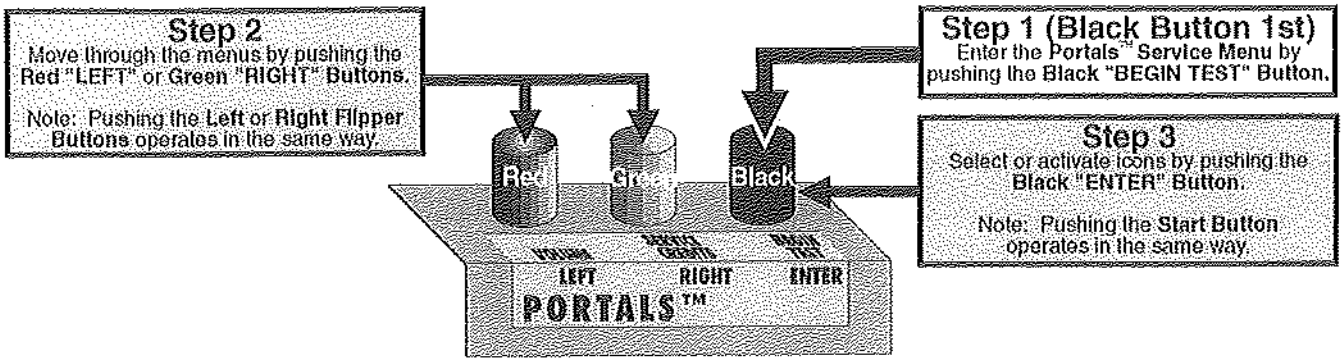
Chapter 7, • Go To Help Screen 51

HELP
- •• *Go To Help Screens (Multi-Level) 51*
- ¤ Problem / Solution Table 52

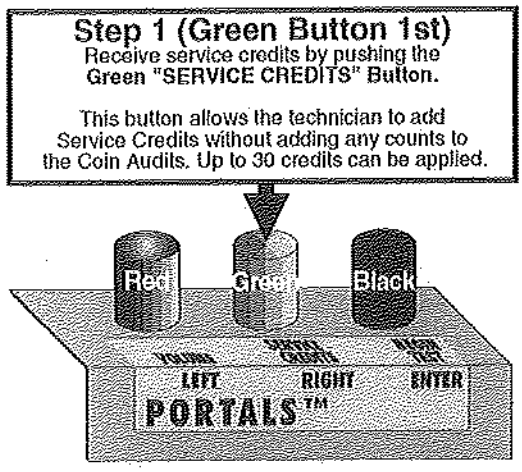
Service Switch Set (Red, Green & Black Buttons) Access & Use

Open Coin Door and view Service Switch Set (see figures below). The Memory Protect Switch is now disabled; when changing adjustments, leave the coin door open, so changes can be made. ***Important:*** The **Playfield Power Interlock Switch** must be pulled out for electro-mechanical device testing (this is required).

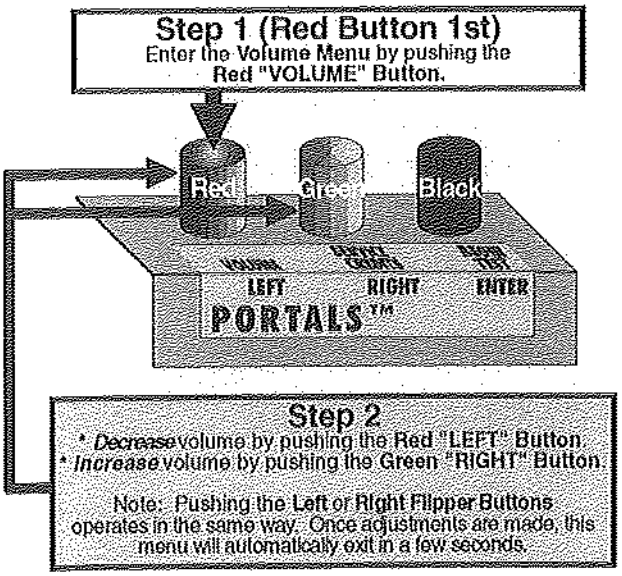
❶ *Entering* Portals™ Service Menu *(will not operate in Volume Mode):*

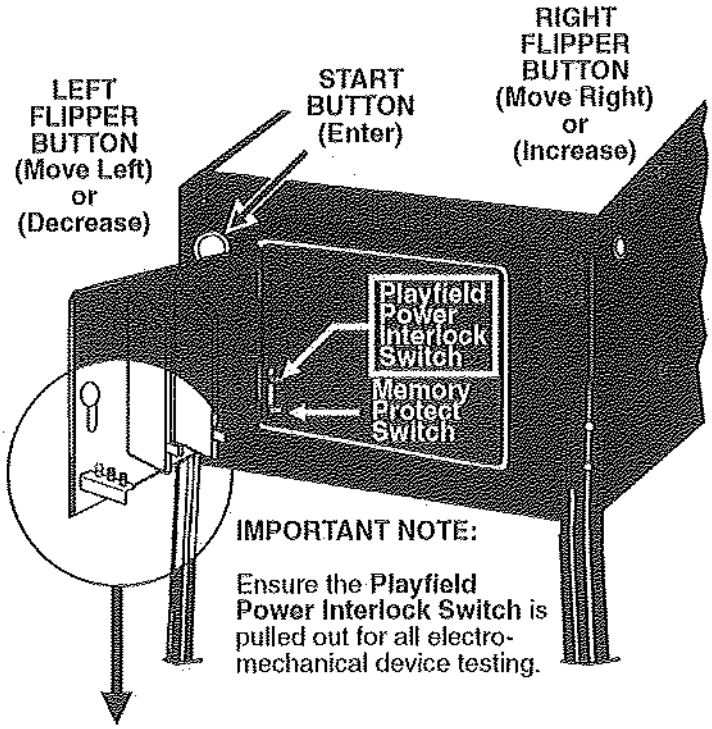


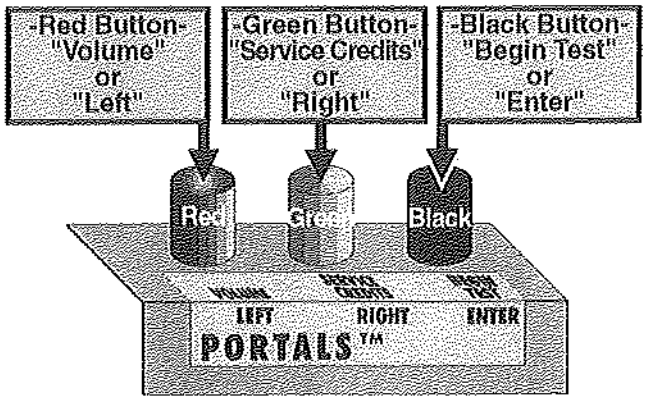
❷ *Adding* Service Credits *(will not operate in Service or Volume Modes):*



❸ *Entering the* Volume Menu *(will not operate in Service Mode):*





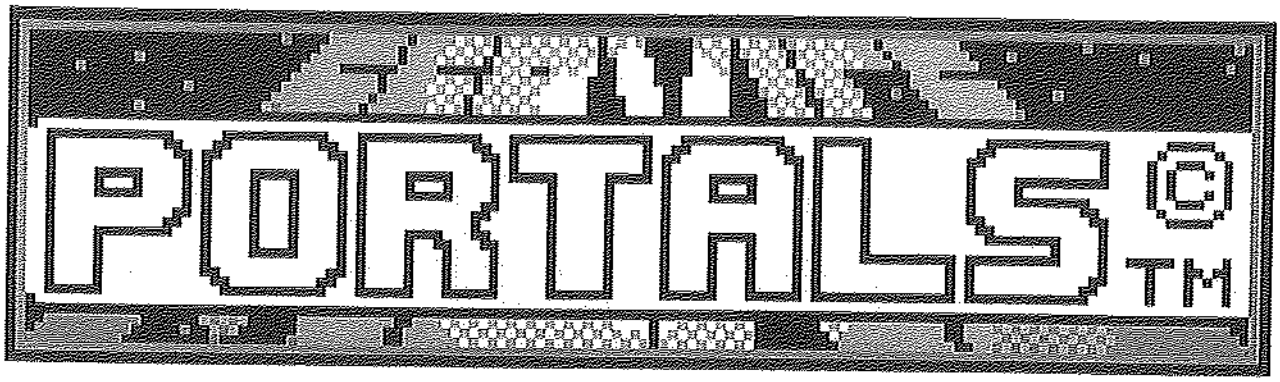


How to Use This Section

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: • Power-up game (if not already) & open the Coin Door. • On the Coin Door is the Service Switch Set (**Red, Green & Black Buttons**). Push down the **Black "BEGIN TEST" Button.**

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™ ©**" followed by the **MAIN MENU:**

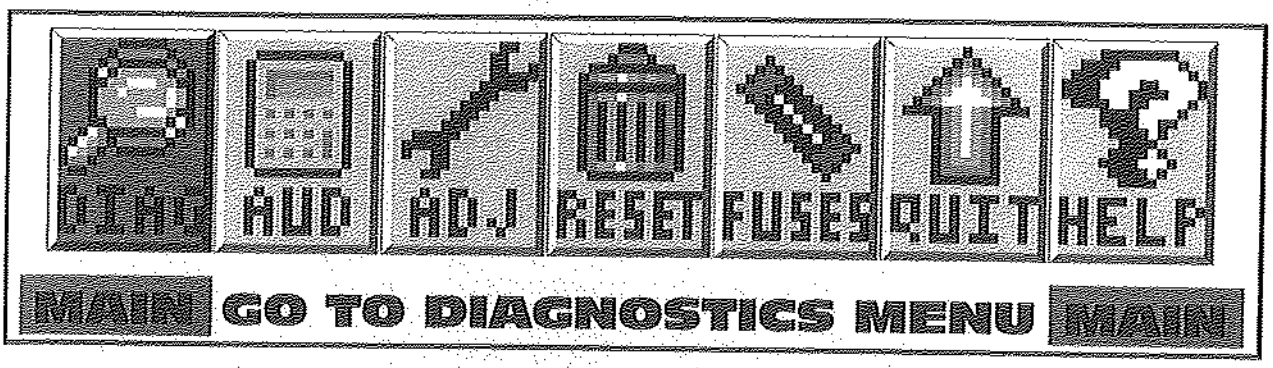


The Coin Door may be closed for security, however, please note with the Coin Door closed, the game's ***MEMORY PROTECT*** is enabled; ***meaning any changes that are made will be not be written to memory.*** If changing adjustments is required, ensure the Coin Door is open.

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.

For diagnostic purposes, be sure the ***Playfield Power Interlock Switch*** is pulled out so ***Playfield Power*** is not disabled.

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



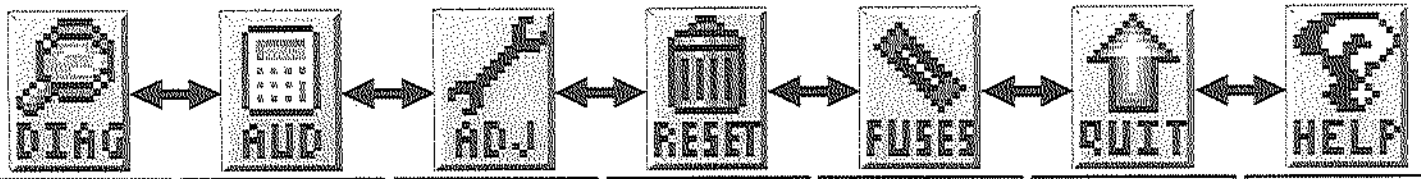
As the operator views the Menu Screen(s), the ⇦ MORE ⇨ MORE symbols indicates that there are more *Icons* to select in each direction. The *Icon* selected will blink. Pushing the **Black "ENTER" Button** (or **Start Button**) will select the *Icon* and the Menu Screen will change to the menu selected.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

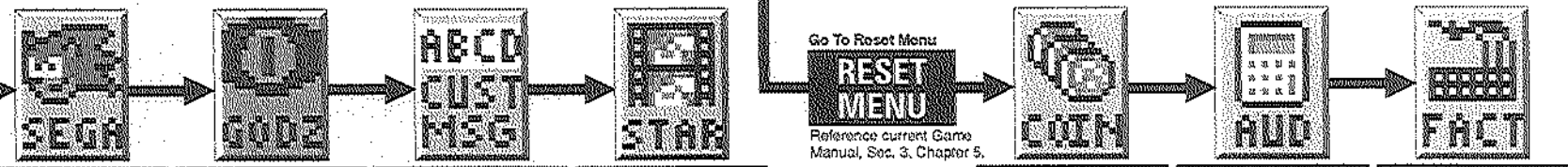
Portals™ Service Menu Icon Tree for *Godzilla*





MAIN MENU

- GO TO DIAGNOSTICS MENU
- GO TO AUDITS MENU
- GO TO ADJUSTMENTS MENU
- GO TO RESET MENU
- GO TO FUSES LIST → GAME FUSES LISTING. *Reference current Game Manual, Sec. 3, Chapter 6.*
- QUIT THIS SESSION → Exits Back to Attract Mode
- 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.*

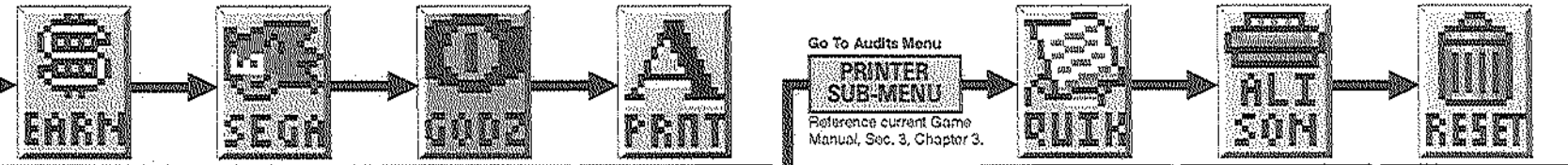


Go To Adjustments Menu: ADJUSTMENTS MENU
Reference current Game Manual, Sec. 3, Chapter 4.

- SEGA ADJUSTMENTS → 1st Adjustment of Game Generic Group
- GODZILLA ADJUSTMENTS → 1st Adjustment of Game Specific Group
- CUSTOM MESSAGE → Direct Access to Adjustment 34, Custom Message
- FILM STAR RESET → REQUEST INSTALLED (Back to Attract Mode)

Go To Reset Menu: RESET MENU
Reference current Game Manual, Sec. 3, Chapter 5.

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

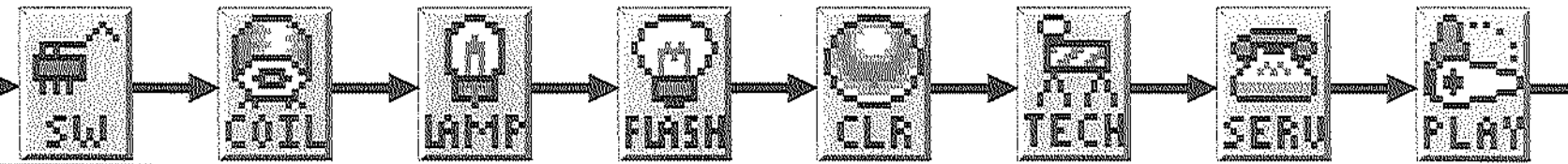


Go To Audits Menu: AUDITS MENU
Reference current Game Manual, Sec. 3, Chapter 3.

- EARNINGS AUDITS → 1st Audit of Game Earnings Group
- SEGA AUDITS → 1st Audit of Game Generic Group
- GODZILLA AUDITS → 1st Audit of Game Specific Group
- GO TO PRINTER MENU

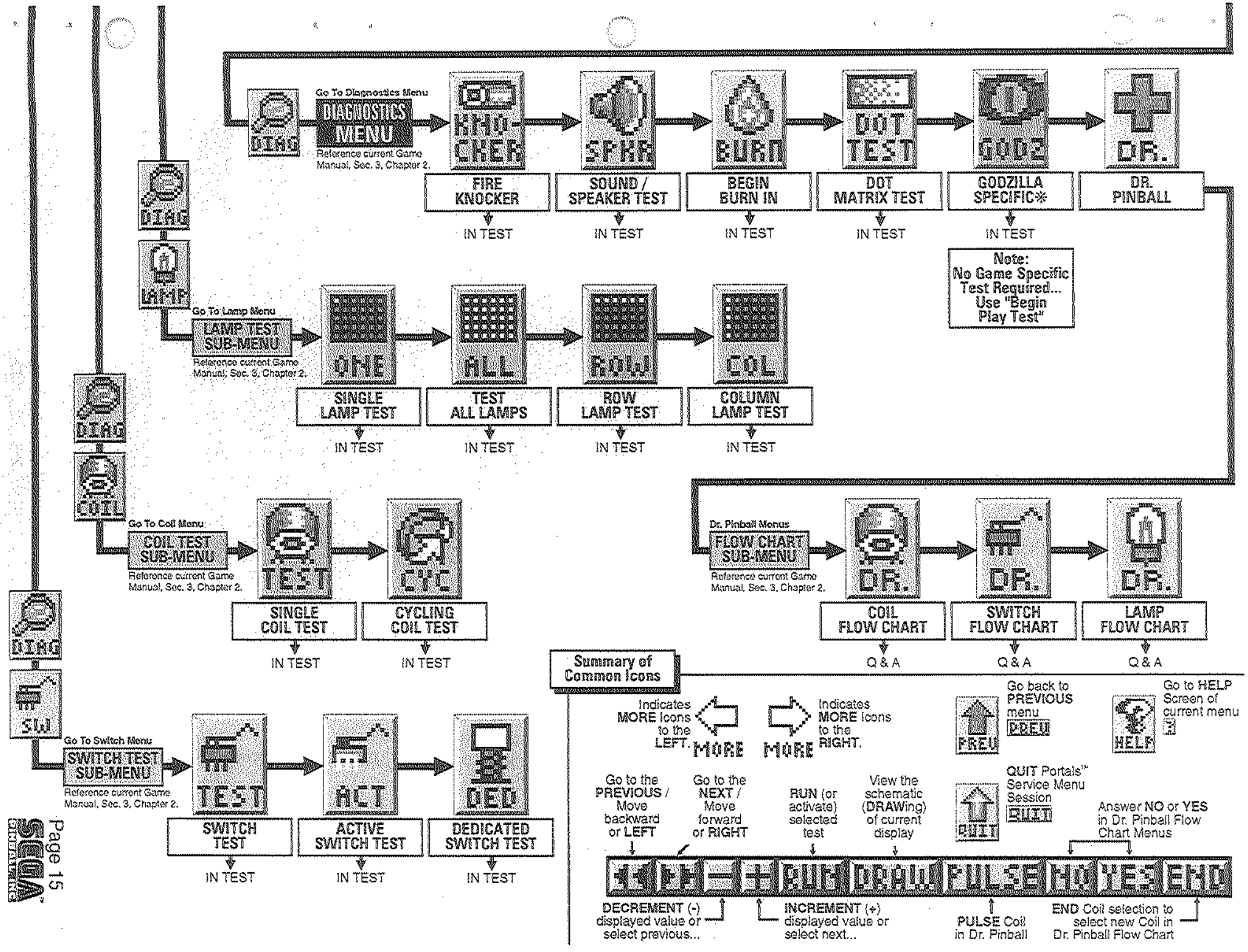
Go To Audits Menu: PRINTER SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 3.

- QUICK PRINTOUT → Special Equipment is required.
- FULL PRINTOUT → Special Equipment is required.
- RESET PRINTER → N° of Copies Printed is reset.



Go To Diagnostics Menu: DIAGNOSTICS MENU
Reference current Game Manual, Sec. 3, Chapter 2.

- GO TO SWITCH MENU
- GO TO COIL MENU
- GO TO LAMP MENU
- TEST FLASH LAMPS → IN TEST
- CLEAR BALL TROUGH → IN TEST
- TECHNICIAN ALERT → PLAYFIELD STATUS
- SERVICE PHONE # → 1-800-KICKERS (USA Setting)
- 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
GOD2
DR.
FIRE KNOCKER
SOUND / SPEAKER TEST
BEGIN BURN IN
DOT MATRIX TEST
GODZILLA SPECIFIC*
DR. PINBALL
IN TEST
Note: No Game Specific Test Required... Use "Begin Play Test"
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.
DR.
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
MORE
Indicates MORE icons to the RIGHT.
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
PREV
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.***

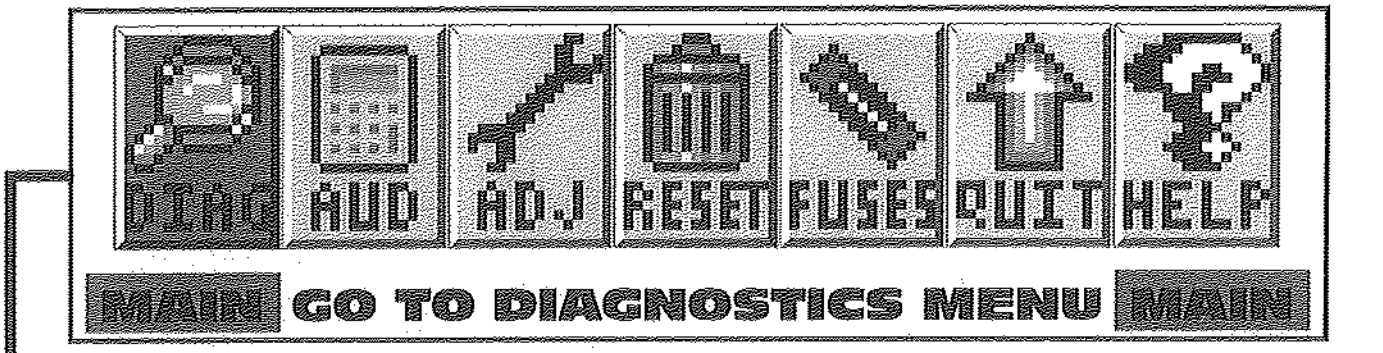


Selecting & activating the "QUIT" *Icon* from any display will exit the *Service Session*.

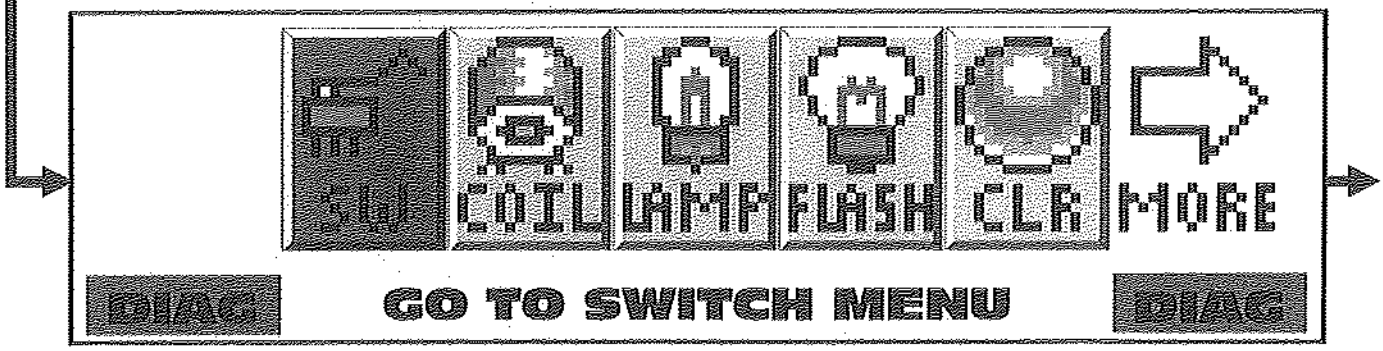


Selecting & activating the "HELP" *Icon* will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)

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

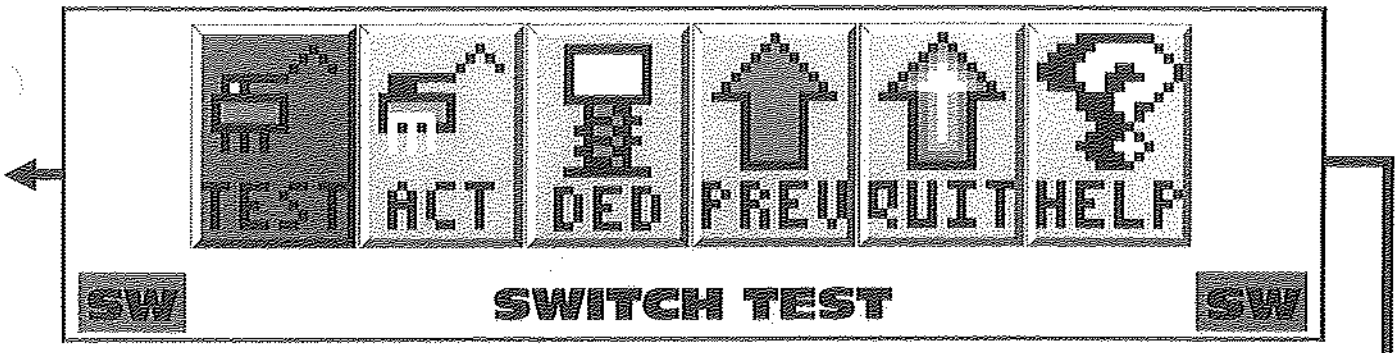


Press the **Black "ENTER" Button** to activate this **ICON**. This will bring up the **DIAGNOSTICS MENU**.

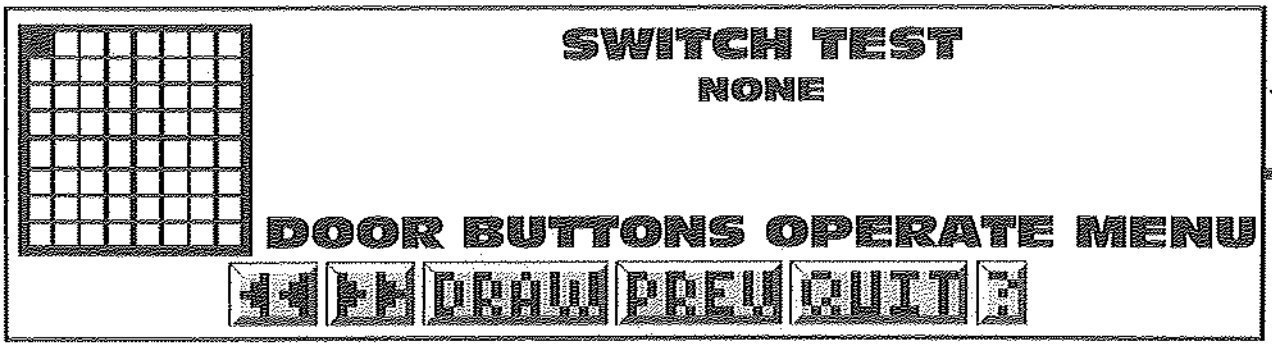


The **DIAGNOSTICS MENU** now appears with the "SW" *Icon* (GO TO SWITCH MENU) flashing. Press the **Black Button** to *activate* this icon. This will bring up the **SWITCH TEST MENU**.

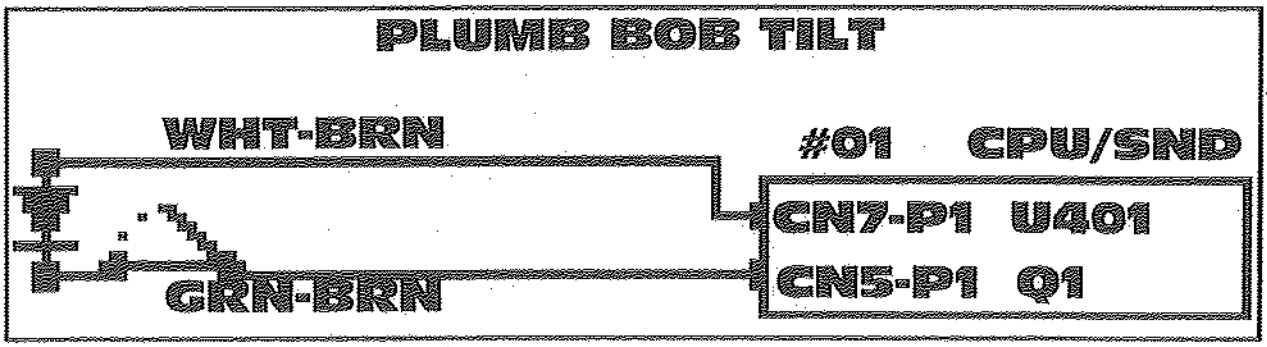
The **SWITCH TEST MENU** now appears with the "TEST" *Icon* (SWITCH TEST) flashing:
Press the **Black "ENTER" Button** to *activate* this icon. This will bring up the **Switch Test Display**.



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 #01, 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.

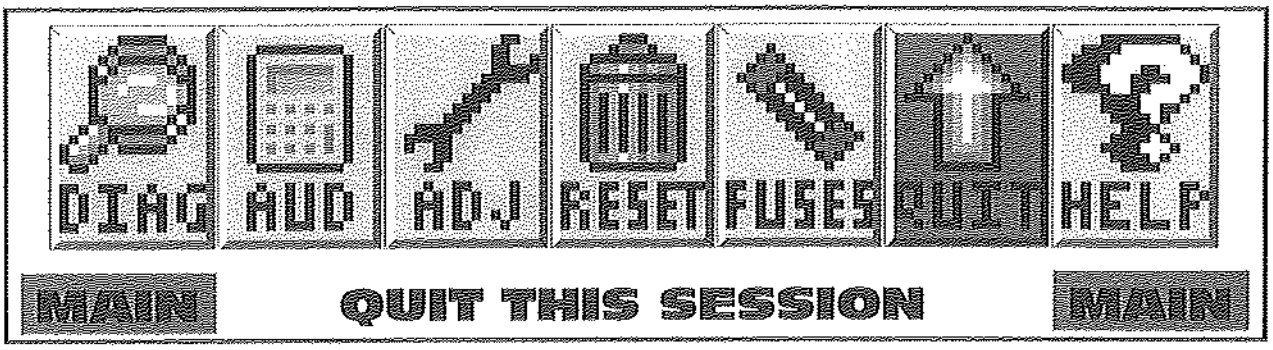
While in Switch or Active Switch Tests, the **Flipper & Start Buttons** are deactivated. Use the **Red "LEFT," Green "RIGHT"** and/or **Black "ENTER" Buttons** to select and activate the "**MINI-ICONS**" at the bottom of the display. In Switch Test, if the "Left Arrow" or "Right Arrow" *Icon* is activated, 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*, by opening the ***Memory Protect Switch***. Check battery voltage at **CMOS RAM** with the power off.

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*** & ***Game Specific (Not Used)*** 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 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 positions 01-07). Coils 17-24 are typically Low Current Coils. The remaining positions (F1-F8) are typically for Flash Lamps (although Flash Lamps may be used in positions 01-24). ***Important:*** The **Power Interlock Switch** must be pulled out.

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 Coils 1-24 and Flash Lamps F1-F8; *Note: Some Flash Lamps are used in Coil Positions; this game: #7, #18, #19 & #20.*). 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.

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.

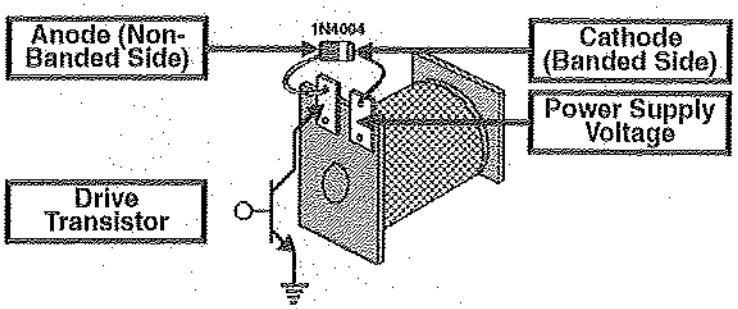
Coil & Flash Lamp Descriptions

Type	Coil / Flash Lamp Descriptions
COIL 1	TROUGH UP-KICKER (VUK) (26-1200)
COIL 2	AUTO LAUNCH (50V) (24-940)
COIL 3	TOP MAGNET (ORBIT) (22-650)
COIL 4	MIDDLE MAGNET (PFLD) (22-650)
COIL 5	BOTTOM MAGNET (PFLD) (22-650)
COIL 6	SHAKER MOTOR (041-5029-01)
COIL 7	FLASH SPINNER*2 (#89 Bulb)
COIL 8	(EUROPEAN TOKEN DISPENSER)
COIL 9	LEFT TURBO BUMPER (26-1200)
COIL 10	RIGHT TURBO BUMPER (26-1200)
COIL 11	BOTTOM TURBO BUMPER (26-1200)
COIL 12	LEFT SLINGSHOT (23-800)
COIL 13	RIGHT SLINGSHOT (23-800)
COIL 14	LEFT MAGNET (LANE) (22-650)
COIL 15	LEFT FLIPPER [50V RED/YEL] (23-1100)
COIL 16	RIGHT FLIPPER [50V RED/YEL] (23-1100)

Type	Coil / Flash Lamp Descriptions
COIL 17	RAMP DIVERTER (32-1800)
COIL 18	FLASH LT*1 (#89 Bulb)
COIL 19	FLASH RT*1 (#89 Bulb)
COIL 20	FLASH INNER LT. ORBIT*2 (#89 Bulb)
COIL 21	LT OUTLANE (UK ONLY) (28-1050)
COIL 22	RT OUTLANE (UK ONLY) (28-1050)
COIL 23	UP/DOWN POST (UK ONLY) (23-1100)
COIL 24	(OPTIONAL COIN METER)
#F1	FLASH POPS*4 (#89 Bulb)
#F2	FLASH TOP LT*2 (#89 Bulb)
#F3	FLASH CTR PFLD*1 (#89 Bulb)
#F4	FLASH RAMP #4*1 (#89 Bulb)
#F5	FLASH LITE GODZ*1 (#89 Bulb)
#F6	FLASH SCORE DOES...*1 (#89 Bulb)
#F7	FLASH SLINGS*4 (#89 Bulb)
#F8	FLASH TOP RT*2 (#89 Bulb)

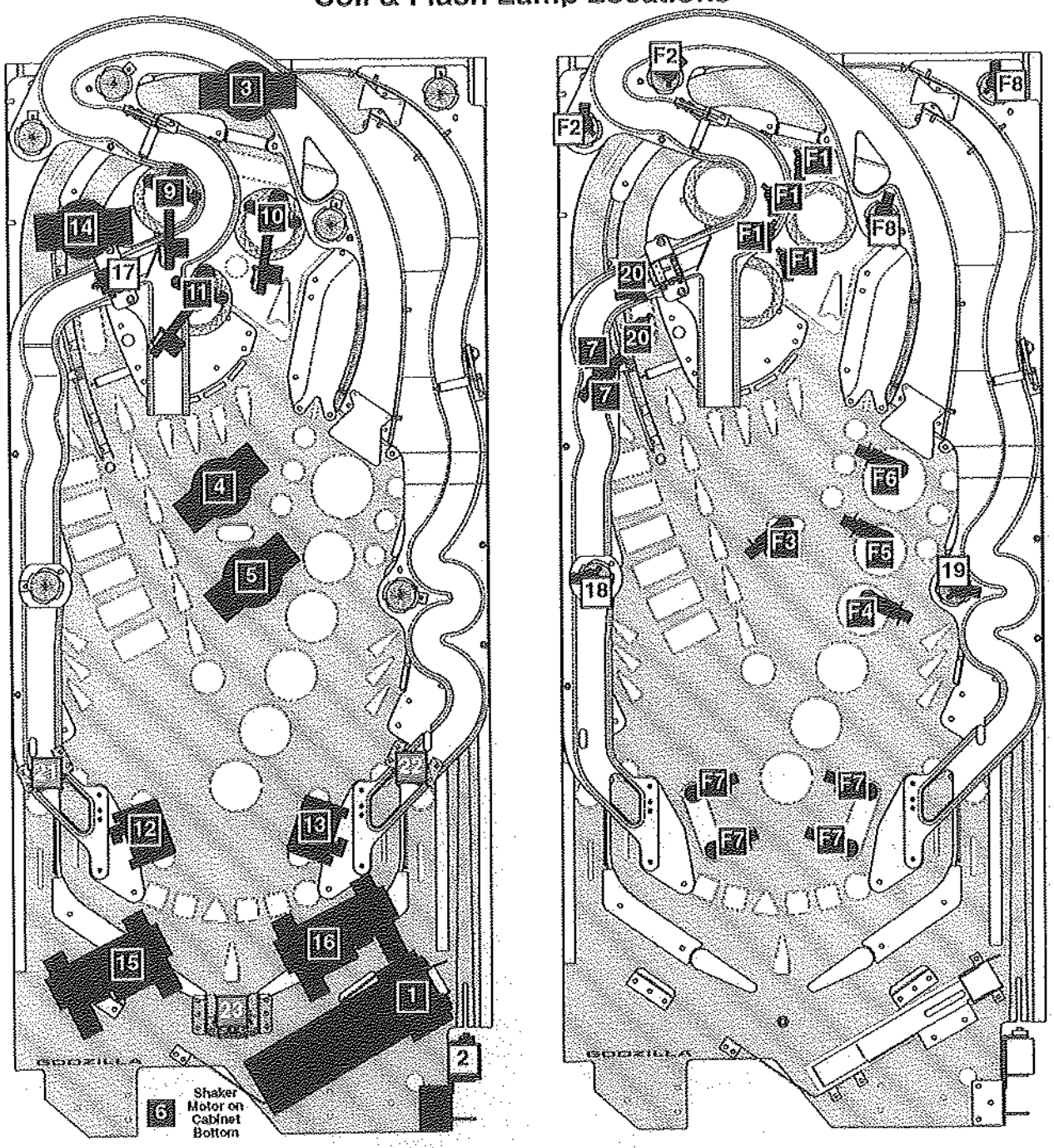
See the next three (3) pages for the **Coil & Flash Lamp Location Maps** (corresponds to above tables), **Coils Detailed Chart Table** & the **Backbox I/O Power Driver Board Detailed Wiring Diagram**.

Typical Coil Wiring



Note:
All Coils require diodes. Some diodes are located on Terminal Strips (under playfield) & not on the coil itself.
Diode
On
Terminal
Strip

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 Coils are optional for **UK Only:***

21 22 23

The following Coils are Optional:

08 24

The following Bulb Type is used for Flash Lamps:



#89 Bulb
(Bayonet)
165-5000-89

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 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

Diode On Terminal Strip

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	2X BONUS #555 Bulb 1	3X BONUS #555 Bulb 2	LITE SUPER SPINNER #555 Bulb 3	4X BONUS #555 Bulb 4	5X BONUS #555 Bulb 5	LITE HELI-COPTER... #555 Bulb 6	SHOOT AGAIN #555 Bulb 7	LAUNCH BUTTON #555 Bulb 8
2: Q34 RED-BLK J12-P2	RAMP #1 (BOT) #555 Bulb 9	RAMP #2 #555 Bulb 10	RAMP #3 #555 Bulb 11	RAMP #4 #555 Bulb 12	LITE GODZILLA... #555 Bulb 13	SCORE DOES MATTER #555 Bulb 14	SONAR (MULTIBALL) #555 Bulb 15	BABY (MULTIBALL) #555 Bulb 16
3: Q35 RED-ORG J12-P3	SPOT SONAR #555 Bulb 17	MYSTERY #555 Bulb 18	SUPER POPS (ORBIT) #555 Bulb 19	LITE BABY GODZILLA... #555 Bulb 20	LITE EXTRA BALL #555 Bulb 21	MEAN GREEN #555 Bulb 22	SPINNER ARROW #555 Bulb 23	SUPER POPS (BUMPER) #555 Bulb 24
4: Q36 RED-YEL J12-P4	LEFT 4-BANK BOTTOM #555 Bulb 25	LEFT 4-BANK #2 #555 Bulb 26	LEFT 4-BANK #3 #555 Bulb 27	LEFT 4-BANK TOP #44 Bulb 28	RT 4-BANK BOTTOM #555 Bulb 29	RIGHT 4-BANK #2 #555 Bulb 30	RIGHT 4-BANK #3 #555 Bulb 31	RIGHT 4-BANK TOP #44 Bulb 32
5: Q37 RED-GRN J12-P5	LT CAPTIVE BALL #1 (BOT) #555 Bulb 33	LT CAPTIVE BALL #2 #555 Bulb 34	LT CAPTIVE BALL #3 (TOP) #555 Bulb 35	RT CAPTIVE BALL #1 (BOT) #555 Bulb 36	RT CAPTIVE BALL #2 #555 Bulb 37	RT CAPTIVE BALL #3 (TOP) #555 Bulb 38	SAVE NEW YORK #555 Bulb 39	UP / DOWN POST (UK ONLY) #555 Bulb 40
6: Q38 RED-BLU J12-P6	(T) AXI #555 Bulb 41	T (A) XI #555 Bulb 42	TA (X) I #555 Bulb 43	TAX (I) #555 Bulb 44	LEFT TUR-BO BUMPER 8 15 #555 Bulb 45	RIGHT TUR-BO BUMPER 8 15 #555 Bulb 46	BOT. TUR-BO BUMPER 8 15 #555 Bulb 47	NOT USED 48
7: Q39 RED-VIO J12-P8	LEFT OUTLANE #555 Bulb 49	LEFT RE-TURN LANE #555 Bulb 50	RIGHT RE-TURN LANE #555 Bulb 51	RIGHT OUTLANE #555 Bulb 52	GODZILLA (MULTIBALL) #555 Bulb 53	HELICOPTER (MULTIBALL) #555 Bulb 54	TAXI (MULTIBALL) #555 Bulb 55	EXTRA BALL #555 Bulb 56
NOT USED	NOT USED 57	NOT USED 58	NOT USED 59	NOT USED 60	NOT USED 61	NOT USED 62	NOT USED 63	NOT USED 64
NOT USED	NOT USED 65	NOT USED 66	NOT USED 67	NOT USED 68	NOT USED 69	NOT USED 70	NOT USED 71	NOT USED 72
NOT USED	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 Number 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:

48 57 - 80

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

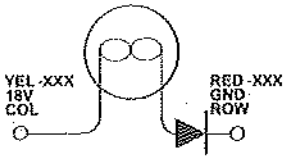


#555 Bulb (Wedge)
165-5002-00

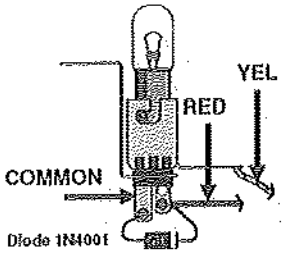


#44 Bulb (Bayonet)
165-5000-44

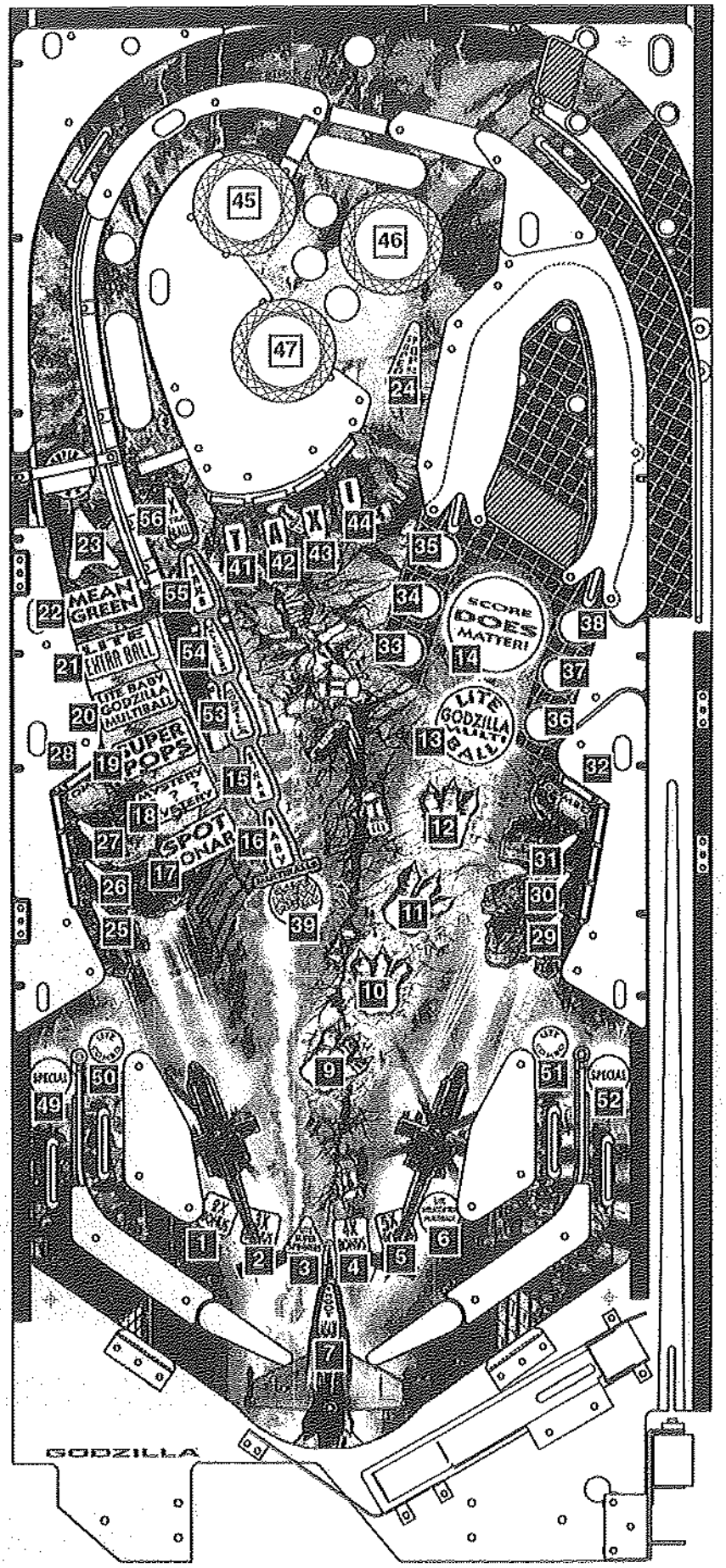
Typical Lamp Schematic



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





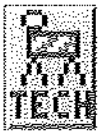
Test Flash Lamps

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. ***Important:*** The **Power Interlock Switch** must be pulled out.



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 left outlane switch, the Laser Kick 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.

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

Speaker Phase Testing

Connections to each of speakers are polarized and each must be connected appropriately for the best quality sound. If one speaker has the positive and negative connections reversed with respect to the other one, bass frequencies will not be produced properly and the overall sound quality will be poor.



Speaker Phase Testing Continued

Continued

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 ROM 1 (Loc. U17)	Speech Pattern 1
Voice ROM 2 (Loc. U21)	Speech Pattern 2
Voice ROM 3 (Loc. U36)	Speech Pattern 3
Voice ROM 4 (Loc. U37)	Speech Pattern 4



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.



Not Used (Game Specific Test)

If special Game Specific Test(s) were required, the Game Specific Icon would activate. When this test is **Not Used**, generic Help Screens will appear explaining the general use of the Control Functions with Portals, if this *Icon* is activated. To test all coil mechanisms select the "PLAY" *Icon* between "SERV" *Icon* & "KNO-CKER" *Icon*, for **BEGIN PLAY TEST MENU**, (see page 28).

THIS PAGE IS INTENTIONALLY BLANK.

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 question is being asked on the Display. Select "YES" or "NO" to answer 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.

GODZILLA

GAME AUDIT TABLE

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

SEGA PINBALL INC

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	

Sega 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				

Godzilla Audits 56-99 (All Audits Subject to Change)

	Audit Name	Fill-In		Audit Name	Fill-In		Audit Name	Fill-In
56	LEFT ORBIT		72	MULTIBALL/1 LIT		88	SAVE NEW YORK COMPLETED	
57	INNER LT. ORBIT		73	MULTIBALL/2 LIT		89	POP BUMPER HITS	
58	GODZILLA RAMP (LT.)		74	MULTIBALL/3 LIT		90	POP BUMPER BONUS X	
59	RIGHT 4-BANK TOP		75	MULTIBALL/4 LIT		91	MEAN GREEN	
60	LEFT 4-BANK TOP		76	MULTIBALL/5 LIT		92		
61	TAXI COMPLETED		77	TAXI MBALL ADDED		93		
62	LT CAPTIVE BALL BOT		78	HELICOPTER MBALL ADDED		94		
63	RT CAPTIVE BALL BOT		79	GODZILLA MBALL ADDED		95		
64	LEFT ORBIT AWARD		80	SONAR MBALL ADDED		96		
65	TAXI MBALL READY		81	BABY MBALL ADDED		97		
66	HELICOPTER MBALL READY		82	TAXI MBALL JACKPOTS		98		
67	GODZILLA MBALL READY		83	HELICOPTER MBALL JACKPOTS		99		
68	SONAR MBALL READY		84	GODZILLA MBALL JACPOTS			*CPU Version:*	
69	BABY MBALL READY		85	SONAR MBALL JACPOTS			*Display Version:*	
70	MULTIBALL START		86	BABY MBALL JACKPOTS			*Date Audited:*	
71	2+ MBALL START		87	SAVE NEW YORK			*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: 1st— **Earnings (Coin) Audits**, are the first 12 most-used Audits; 2nd— **Sega Audits**, are the Game Play Generic Audits 13-55; 3rd— **Godzilla Audits**, are the Game Play Specific Audits 56-99; Audits left open (blank space in gray, e.g. Audits 43-51, 54 & 55, 92-99) 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. Copy page to fill-in important audit information as required.



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:



PREV

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.



QUIT

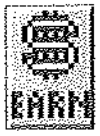
Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.



?

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. №	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.

Sega Audits (13-55)

From the **AUDITS MENU**, select the "SEGA" *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.



Sega 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 Switch (DS-1) was closed.
Au. 53	Right Flipper Used	Provides the total number of times Dedicated Switch (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).



Godzilla Audits (56-99) (All Audits Subject to Change)

From the **AUDITS MENU**, select the "GODZ" *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 Orbit	Provides the total number of times this feature was completed. †
Au. 57	Inner Lt. Orbit	Provides the total number of times this feature was completed. †
Au. 58	Godzilla Ramp (Lt.)	Provides the total number of times this feature was completed. †
Au. 59	Right 4-Bank Top	Provides the total number of times this feature was completed. †
Au. 60	Left 4-Bank Top	Provides the total number of times this feature was completed. †
Au. 61	Taxi Completed	Provides the total number of times this feature was completed. †
Au. 62	Lt. Captive Ball Bot.	Provides the total number of times this feature was completed. †
Au. 63	Rt. Captive Ball Bot.	Provides the total number of times this feature was completed. †
Au. 64	Left Orbit Award	Provides the total number of times this feature was completed. †
Au. 65	Taxi MBall Ready	Provides the total number of times this feature was ready (lit) awaiting Multiball. † ‡
Au. 66	Helicopter MBall Ready	Provides the total number of times this feature was ready (lit) awaiting Multiball. † ‡
Au. 67	Godzilla MBall Ready	Provides the total number of times this feature was ready (lit) awaiting Multiball. † ‡
Au. 68	Sonar MBall Ready	Provides the total number of times this feature was ready (lit) awaiting Multiball. † ‡
Au. 69	Baby MBall Ready	Provides the total number of times this feature was ready (lit) awaiting Multiball. † ‡
Au. 70	Multiball Start	Provides the total number of times Multiball was played. †
Au. 71	2+ MBall Start	Provides the total number of times Multiball was played more than once by a single player in one game. †

† 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.

Godzilla Audits Continued (All Audits Subject to Change)

	Audit Name	Audit Definition
Au. 72	Multiball / 1 Lit	Provides the total number of times this feature was lit. ‡
Au. 73	Multiball / 2 Lit	Provides the total number of times this feature was lit. ‡
Au. 74	Multiball / 3 Lit	Provides the total number of times this feature was lit. ‡
Au. 75	Multiball / 4 Lit	Provides the total number of times this feature was lit. ‡
Au. 76	Multiball / 5 Lit	Provides the total number of times this feature was lit. ‡
Au. 77	Taxi MBall Added	Provides the total number of times this feature was awarded. †
Au. 78	Helicopter MBall Added	Provides the total number of times this feature was awarded. †
Au. 79	Godzilla MBall Added	Provides the total number of times this feature was awarded. †
Au. 80	Sonar MBall Added	Provides the total number of times this feature was awarded. †
Au. 81	Baby MBall Added	Provides the total number of times this feature was awarded. †
Au. 82	Taxi MBall Jackpots	Provides the total number of times this feature was awarded. †
Au. 83	Helicopter MBall Jackpots	Provides the total number of times this feature was awarded. †
Au. 84	Godzilla MBall Jackpots	Provides the total number of times this feature was awarded. †
Au. 85	Sonar MBall Jackpots	Provides the total number of times this feature was awarded. †
Au. 86	Baby MBall Jackpots	Provides the total number of times this feature was awarded. †
Au. 87	Save New York	Provides the total number of times this feature was lit. ‡
Au. 88	Save New York Completed	Provides the total number of times this feature was completed. †
Au. 89	Pop Bumper Hits	Provides the total number of times this feature was started, counting the number of switch closures up until another feature switch (other than Pop Bumpers) is activated.
Au. 90	Pop Bumper Bonus X	Provides the total number of times this feature was awarded after the predesignated number of switch closures. †
Au. 91	Mean Green	Provides the total number of times this feature was played. †
Au. 92-Au. 99		At time of printing, these audits are ***Not Used***, allowing for ***Future Expansion***, if any.

† 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. _____

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.



Adjustment 53, Printer Interface (Quick Printout)

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.



Adjustment 54, Alison Interface (Full Printout)

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, Sega & Game Specific) can be retrieved.



Adjustment 55, Nº of Copies Printed (Reset Printer)

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 "SEGA" *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

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

Sega Adjustments 1-48

	Adjustment Name	USA Default	Your Setting		Adjustment Name	USA Default	Your Setting
1	REPLAYS: FIXED/MANUAL ‡	...10%...		25	DEFAULT HIGH SCORE #5	150,000,000	
2	REPLAY LEVELS ‡	1 ...		26	DEFAULT HIGH SCORE #6	125,000,000	
3	REPLAY AWARD	CREDIT		27	DEFAULT HIGH SCORE #7	120,000,000	
4	FREE GAME LIMIT	05		28	DEFAULT HIGH SCORE #8	115,000,000	
5	EXTRA BALL LIMIT	03		29	DEFAULT HIGH SCORE #9	110,000,000	
6	GAME DIFFICULTY ‡	MODERATE		30	DEFAULT HIGH SCORE #10	105,000,000	
7	GAME PRICING ‡	USA8		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	1	
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	250,000,000		45	EURO. TOKEN DISP.	OFF	
22	DEFAULT HIGH SCORE #2	225,000,000		46	SPECIAL MEMORY	YES	
23	DEFAULT HIGH SCORE #3	200,000,000		47	LOCATION ID	00	00
24	DEFAULT HIGH SCORE #4	175,000,000		48	GAME ID	00	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.

Godzilla Adjustments 49-52

	Adjustment Name	USA Default	Your Setting		Adjustment Name	USA Default	Your Setting
49	EXTRA BALL MEMORY	ON		51	UK POST SAVE	OFF	
50	ALWAYS DIVERT TO POPS	NO		52	UK COIN MECH. TYPE	NO	
					ADJ. 51/52 CAN ONLY BE ADJUSTED IF THE GAME HAS THE UK EPROM INSTALLED (UK ONLY)		

Go To Adjustments Menu

Overview

The **Portals™ Service Menu System** provides 52 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: 1st— **Sega Adjustments**, are the Game Play Generic Adjustments (1-48); 2nd— **Godzilla Adjustments**, are the Game Play Specific Adjustments (49-52); There are no Adjustment(s) left open or are currently Not Used, 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**.



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.



Sega Adjustments (1-48)

From the **ADJUSTMENTS MENU**, select the "SEGA" *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 / Manual**	Adjust for percentage of awards for Replay Levels (1% through 50%). Lower the automatic value to 0% and the display will indicated Fixed. Replays may be adjusted either for fixed levels or for a system-adjusted manual percentage of replay awards. Four levels may be selected. Adjustments allow awarding of a credit or an extra ball as each level is exceeded. With the manual percentage feature, if the actual replay percentage is higher or lower than that desired, the game computes new recommended manual percentage score(s). When the coin door is subsequently opened the player displays indicate the recommended level and a sound is made to alert the operator of a potential change. This new level is entered into adjustments simply by pressing the **Black "ENTER" Button**. (If the Coin Door is closed or the operator enters the Portals™ Service Menu, the replay level is not changed.)
Adj. 2	**Replay Levels**	Adjust the number of replay levels to be active (1 to 4). Once the number of Replay Levels has been selected, a "Drop-Down" Table appears 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.)

Adjustment Name		Adjustment Definition
Adj. 4	Free Game Limit	Adjust the max. # of *Free Games* that may be accumulated per game; 0 - 9.
Adj. 5	Extra Ball Limit	Adjust the max. # of *Extra Balls* that may be accumulated per game; 1 - 9 or OFF.
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

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/Manual	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/Manual	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	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.

Sega 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 Switch Pulses Required 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
5*SCH*	10*SCH*	10*SCH*	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:				Pricing Scheme Explained *Number of 'Plays' for Price Amount Shown*			
		LEFT	CENTER	RIGHT	4TH				
Pos. 1 2 3 4 5 6 7 8	USA1	25¢	$1.00	25¢		1 /25¢			
ON	USA2	25¢	$1.00	25¢		1 /50¢	2 /75¢	3 /$1.00	
OFF ▮ ▮ ▮ ▮ ▮ ▮ ▮ ▮	USA3	25¢	$1.00	25¢		1 /50¢			
	USA4	25¢		25¢		1 /50¢			
	USA5	25¢	$1.00	25¢		1 /50¢	5 /$2.00		
	USA6	25¢	$1.00	25¢		1 /50¢	2 /'4 X 25¢'	3 /$1.00 Bill	⇐ Used to promote the Bill Validator
	USA7	25¢	$1.00	25¢		1 /50¢	4 /$1.50	6 /$2.00	
	USA8 †	25¢	$1.00	25¢		1 /50¢	3 /$1.00		

Standard Pricing Select Table - *(Continued)*

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*			
		Please Note: for all USA Settings, see previous page (bottom).							
Pos. 1 2 3 4 5 6 7 8 ON 1 OFF	Austria †	5S	10S	10S		1 /10S	2 /15S	3 /20S	
Pos. 1 2 3 4 5 6 7 8 ON OFF 1 2 3 4 5 6 7 8	Australia 1 ‡	20¢	$A 1	$A 2		1 /$A 1	2 /$A 2		
	Australia 2 ‡	20¢	$A 1	$A 2		1 /$A 1	2 /$A 2		
Pos. 1 2 3 4 5 6 7 8 ON 2 OFF 1 3 4 5 6 7 8	Belgium †	5 BF	20 BF	50 BF		1 /20 BF	3 /50 BF		
Pos. 1 2 3 4 5 6 7 8 ON 1 3 4 OFF 2 5 6 7 8	Brazil †	This country uses unique Tokens and/or Debit Cards *only* (pricing varies). 1 'coin'	4 'coins'	1 'coin'		1 /'2 coins'			
Pos. 1 2 3 4 5 6 7 8 ON 1 2 OFF 3 4 5 6 7 8	Canada †	25¢	25¢	Can$ 1		1 /50¢	2 /75¢	3/ Can$ 1	
Pos. 1 2 3 4 5 6 7 8 ON OFF 1 2 3 4 5 6 7 8	Denmark 1 ‡	1 DKr	5 DKr	10 DKr	20 DKr	1 /3 DKr	2 /5 DKr		
	Denmark 2 ‡	1 DKr	5 DKr	10 DKr	20 DKr	1 /2 DKr	3 /5 DKr	7 /10DKr	
Pos. 1 2 3 4 5 6 7 8 ON OFF 1 2 3 4 5 6 7 8	Finland ‡	1 Fmk	5 Fmk			1 /5 Fmk	4 /10 Fmk		
	France 1 †	1 Fr	5Fr	10 Fr	20 Fr	1 /3 Fr	2 /5 Fr	5 /10 Fr	11 /20 Fr
Pos. 1 2 3 4 5 6 7 8 ON 2 OFF 1 3 4 5 6 7 8	France 2	1 Fr	5 Fr	10 Fr	20 Fr	1 /5 Fr	3 /10 Fr	7 /20 Fr	
	France 3	1 Fr	5 Fr	10 Fr	20 Fr	1 /3 Fr	2 /5 Fr	4 /10 Fr	9 /20 Fr
	Germany 1	1 DM	2 DM	5 DM		1 /1 DM	6/'1 X 5 DM'		
Pos. 1 2 3 4 5 6 7 8 ON 1 2 OFF 3 4 5 6 7 8	Germany 2	1 DM	2 DM	5 DM		1 /2 DM	2 /3 DM	3 /4 DM	4 /5 DM
	Germany 3 †	1 DM	2 DM	5 DM		1 /2 DM	2 /3 DM	3 /4 DM	5 /5 DM
	Germany 4	1 DM	2 DM	5 DM		1 /1 DM	6 /5 DM		
Pos. 1 2 3 4 5 6 7 8 ON OFF 1 2 3 4 5 6 7 8	Greece ‡	50 Dr		100 Dr		1 /50 Dr	3 /100 Dr		
Pos. 1 2 3 4 5 6 7 8 ON OFF 1 2 3 4 5 6 7 8	Hong Kong ‡	1 HK$	2 HK$	5 HK$		1 /5 HK$			
Pos. 1 2 3 4 5 6 7 8 ON OFF 1 2 3 4 5 6 7 8	Hungary ‡	10 Ft	10 Ft	20 Ft		1 /20 Ft	3 /40 Ft		
Pos. 1 2 3 4 5 6 7 8 ON 1 2 3 OFF 4 5 6 7 8	Italy 1 †	500 Lit		500 Lit		1 /500 Lit			
	Italy 2	500 Lit		500 Lit		1 /1000 Lit	3 /2000 Lit		
Pos. 1 2 3 4 5 6 7 8 ON 1 3 OFF 2 4 5 6 7 8	Japan 1 †			100¥		1 /100¥			
	Japan 2			100¥		1 /100¥	3 /200¥		
Pos. 1 2 3 4 5 6 7 8 ON OFF 1 2 3 4 5 6 7 8	Korea ‡	100 Won		100 Won		1 /100 Won			
Pos. 1 2 3 4 5 6 7 8 ON 3 OFF 1 2 4 5 6 7 8	Netherlands 1	1 Fls.	1 Fls.	2.5 Fls.		1 /1 Fls.	3 /2.5 Fls.		
	Netherlands 2 †	1 Fls.	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 1 2 3 4 5 6 7 8	New Zealand 1 ‡	$NZ 1		$NZ 2		1 /$NZ 1	2 /$NZ 2		
	New Zealand 2 ‡	$NZ 1		$NZ 2		1 /$NZ 1	3 /$NZ 2		
Pos. 1 2 3 4 5 6 7 8 ON 2 3 OFF 1 4 5 6 7 8	Norway 1 †	10 NKr	5 NKr	20 NKr		2 /10 NKr	1 /5 NKr	4 /20 NKr	
	Norway 2	10 NKr	5 NKr	20 NKr		1 /10 NKr	3 /20 NKr		
Pos. 1 2 3 4 5 6 7 8 ON OFF 1 2 3 4 5 6 7 8	Spain ‡	100 Pts		500 Pts		1 /100 Pts	6 /500 Pts		
Pos. 1 2 3 4 5 6 7 8 ON 1 2 OFF 3 4 5 6 7 8	Sweden 1 †	1 SKr	5 SKr	10 SKr		1 /10 SKr	2 /15 SKr	3 /20 SKr	
	Sweden 2	1 SKr	5 SKr	10 SKr		1 /5 SKr			
Pos. 1 2 3 4 5 6 7 8 ON 3 OFF 1 2 4 5 6 7 8	Switzerland 1 †	1 SwF	2 SwF	5 SwF		1 /1 SwF	6 /5 SwF		
	Switzerland 2	1 SwF	2 SwF	5 SwF		1 /1 SwF	3 /2 SwF	9 /5 SwF	
Pos. 1 2 3 4 5 6 7 8 ON 1 3 OFF 2 4 5 6 7 8	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	10p	50p	£1	20p	4 /£1	8 /£2		
New Dip Switch Setting for New 50p & New £2	UK 3	10p	50p	£1	20p	1 /50p	2 /£1	5 /£2	
	UK 4	10p	50p	£1	20p	1 /30p	2 /60p	3 /90p	4 /£1
Pos. 1 2 3 4 5 6 7 8 ON 1 2 3 4 OFF 5 6 7 8	UK 5	10p	50p	£1	20p	1 /£1	3 /£2	This is "software controlled" by noting the presence/non-presence 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 POTS IN PARTS SECTION	UK 6	10p	50p	£1	20p	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**	Default is **NO**. Select the "+" *Icon* to change to **YES**. ⚠ When enabled, all *Coin Audits* (Audits 5-11), will be reset to zero.
Adj. 9	**Reset Game Audits**	Default is **NO**. Select the "+" *Icon* to change to **YES**. ⚠ When enabled, 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**	When enabled (set to **YES**) the High Score Levels and associated initials will be restored to the backup settings when the "+" *Icon* is selected and activated.
Adj. 11	**Match Percentage**	Set Match percent from **00%** to **10%** or **OFF**. At **00%** the match display occurs at the end of the game but never awards a credit.
Adj. 12	**Balls Per Game**	Default is **3**. Adjust the number of balls per game: **2** to **5**.
Adj. 13	**Tilt Warnings**	Adjust the number of plumb bob tilt switch closures before the ball in play is tilted; **1**, **2**, **3** or **OFF**.
Adj. 14	**Replay Boost**	Set to **YES** or **NO**. 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 50 Million for each following game, until the replays have all been played. At this time the previous level is resumed.
Adj. 15	**Credit Limit**	Default is **30**. Adjust the maximum number of credits that may be posted: **4** to **50**.
Adj. 16	**Allow High Scores**	Set to **YES** or **NO**. 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**	Adjust the number of awards (**0** to **4**) awarded for exceeding level 1 (the highest of the four levels).
Adj. 18	**High Score #2 Awards**	Adjust the number of awards (**0** to **3**) awarded for exceeding level 2.
Adj. 19	**High Score #3 Awards**	Adjust the number of awards (**0** to **2**) awarded for exceeding level 3.
Adj. 20	**High Score #4 Awards**	Adjust the number of awards (**0** to **1**) awarded for exceeding level 4.
Adj. 21-30	**Default High Score #1 - #10**	Adjust the score level to which the world record, (level 1) (the highest of the four levels) may be altered. This adjustment is not affected by Adj. 31, HSTD Reset Count. Adjust the backup score to which levels **2 - 10** may be reset, respectively.
Adj. 31	**HSTD Reset Count**	Default is **2,000**. HSTD (High Score To Date). Adjust the number of games between automatic resets of high score levels to backup settings and ball time averager adjustments: **100** to **9,900** or **OFF** (no reset or adjustment).
Adj. 32	**High Score Initials**	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**	When set to **YES**, no coins are required for game play.
Adj. 34	**Custom Message**	Set to **ON** or **OFF**. When set to **ON**, this function is used to establish a custom message periodically displayed during the attract mode. Set the feature to **CHANGE** selecting the "+" *Icon*. Using either of the Flipper Buttons or the **"RED"** and/or **"GREEN" Buttons**, select either of the **"ARROW"** *Icons*. Press the **"BLACK" Button** (*Request Installed* blinks at the top of the display and the letter **A** is indicated in the first position in the display. 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**.

	Adjustment Name	Adjustment Definition
Adj. 35	Attract Mode Music	Set to **ON** or **OFF**. When set to **ON**, attraction music / sounds are played between games.
Adj. 36	Flash Lamp Power	Set to **NORMAL, DIM** or **OFF**. When set to **NORMAL** the flash lamps are active, when **DIM** the flash lamps impulse power is reduced by **25%** and when **OFF** the flash lamps will not flash.
Adj. 37	Coil Pulse Power	Set to **NORMAL, HARD** or **SOFT**. 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 - 8:59** 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 **1 - 15**. Default is **1**. 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**. When set to **YES**, a new game may be started during any ball after the first ball is completed (if credits are available). (Note-Pressing start 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 from **0** to **50**. Allows the operator to adjust how frequently the Extra Ball feature is made available to the player.
Adj. 43	Bill Validator	Set to **YES** or **NO**. When set to **YES** , the display, in game attract mode, will show an "*Insert Bill Animation.*" When set to **NO**, the display, in game attract mode will show "*Insert Coin Animation.*"
Adj. 44	Tournament Mode	Set to **NONE, PINBALL EXPO, IFPA-PAPA** or **HOME**. 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. **PINBALL EXPO-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**. When set to **ON**, the operator can enable the "knocker" cable in the cabinet to drive an external device (e.g. European Token Dispenser) without the game giving a replay.
Adj. 46	Special Memory	Set to **YES** or **NO**. 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	**00** to **9999**. Allows the operator to assign a location identification number to the audit print-out sheet. *(Will not be affected by Factory Reset.)*
		See the end of this Sec. 3, Chp. 3, Go To Audits Menu, & Chp. 5, Go to Reset Menu, for more details on Factory Reset & Printing.
Adj. 48	Game ID	**00** to **9999**. Allows the operator to assign a game identification number to the audit print-out sheet. *(Will not be affected by Factory Reset.)*
		See the end of this Sec. 3, Chp. 3, Go To Audits Menu, & Chp. 5, Go to Reset Menu, for more details on Factory Reset & Printing.



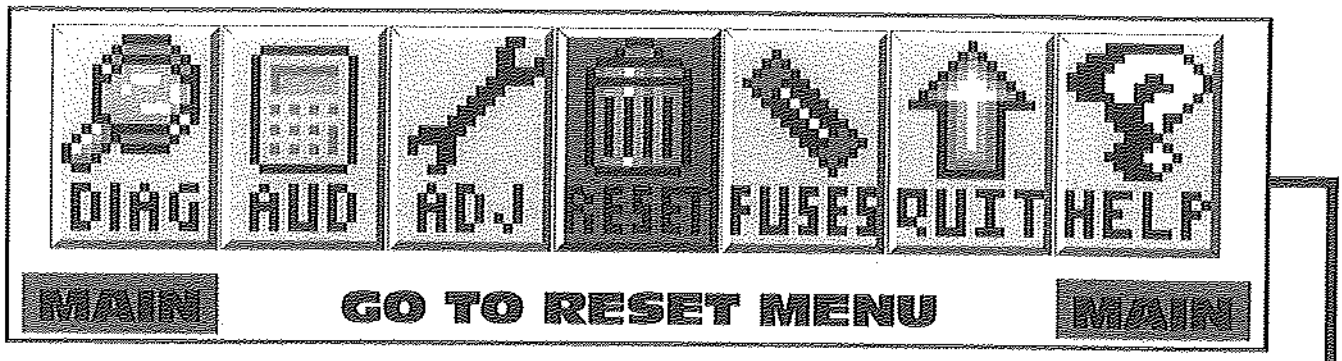
Godzilla Adjustments (49-52)

From the **ADJUSTMENTS MENU**, select the "GODZ" *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.

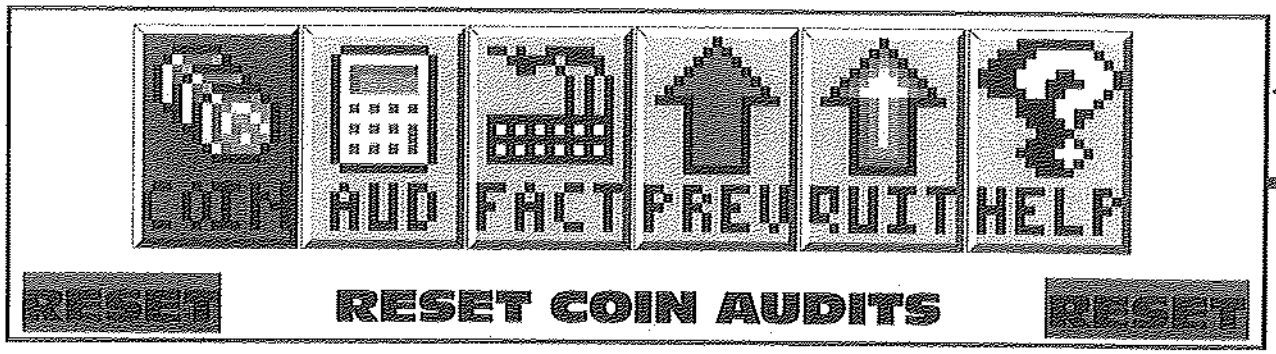
Adj. Nº	Adjustment Name	Adjustment Definition
Adj. 49	Extra Ball Memory	Set to **ON** or **OFF**. Default is **ON**. When set to **ON**, the lit 'Extra Ball' light will be retained in memory from ball-to-ball for the same player. When set to **OFF**, the lit 'Extra Ball' light will go out at the end of each ball.
Adj. 50	Always Divert to Pops	Set to **YES** or **NO**. Default is **NO**, (UK Default is **YES**). When set to **NO**, balls ***will NOT*** always get diverted into the Pop Bumpers via the use of the Top Orbit Magnets. When set to **YES**, the pinball(s) will always get diverted into the Pop Bumpers.
Adj. 51	UK Post Save	**/////// THIS ADJUSTMENT CAN ONLY BE ADJUSTED IF THE GAME HAS THE UK EPROM INSTALLED FOR UK SETTINGS ///////** Set to **OFF** or **ON**. Default is **OFF**, (UK Default is **ON**). When set to **ON** this feature is available when lit. Set to **OFF** to disable this feature. (UK Games have Outlane & Center Post Save Devices which are accessed in a different way. Domestic games should cannot adjust this setting.)
Adj. 52	UK Coin Mech. Type	**/////// THIS ADJUSTMENT CAN ONLY BE ADJUSTED IF THE GAME HAS THE UK EPROM INSTALLED FOR UK SETTINGS ///////** Set to **OLD**, **NEW** or **NO**. Default is **NO**, (UK Default is **NEW**). Set to **NEW** if using a Coin Control Mech 74-1129-104**U**. Set to **OLD** if using older version Coin Control Mech 74-1129-104.

Example:

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



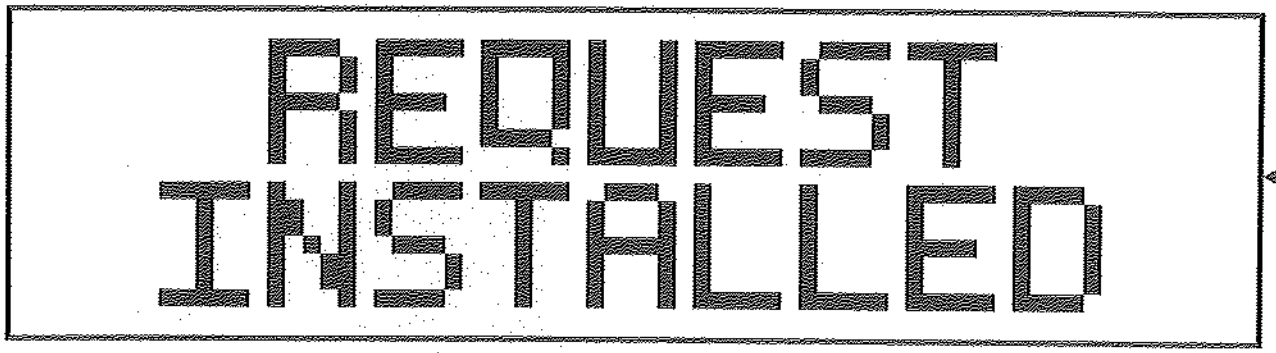
Press the **Black Button** to activate this **ICON**. This will bring up the **RESET MENU**.



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.



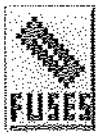
If the "COIN" or "AUD" *Icons* are chosen and activated, the affected audits (see previous page) will be reset, the display will indicate **REQUEST INSTALLED** and the display will return to the **RESET MENU**.

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. ⓭) 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.



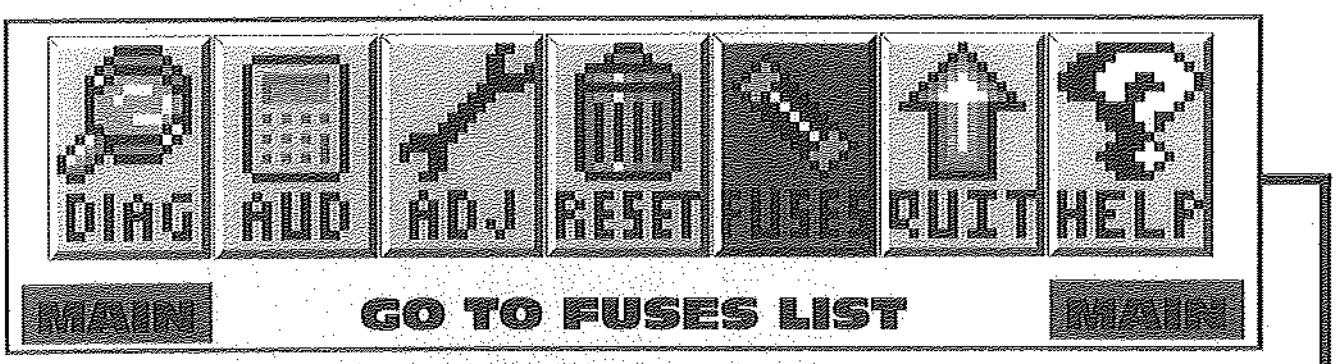
Selecting & activating the "HELP" *Icon* from any display will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)



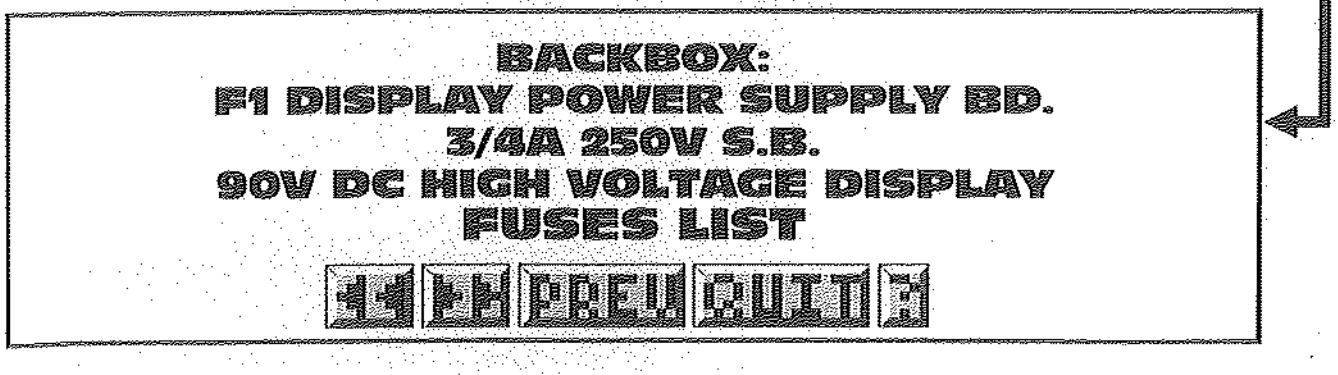
Selecting & activating the "ARROW" *Icons* selects the next or previous fuse in this group.

Example:

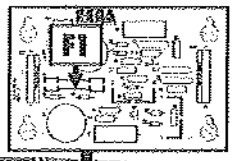
From the **MAIN MENU**, use the **Red** or **Green Buttons** to select the "FUSES" *Icon* (GO TO FUSES LIST).



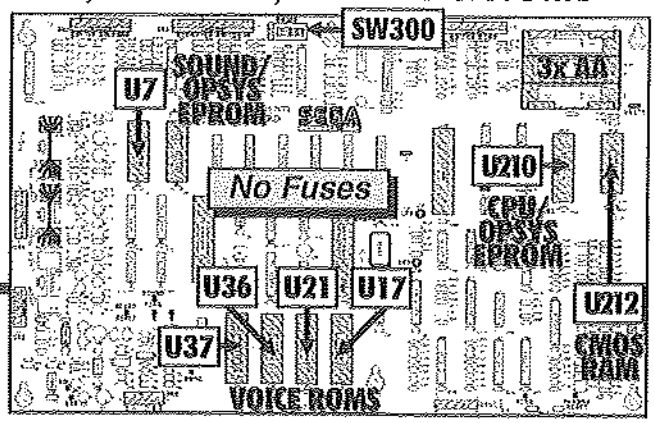
Press the **Black Button** to activate this **ICON**. This will bring up the **FUSES LIST**.



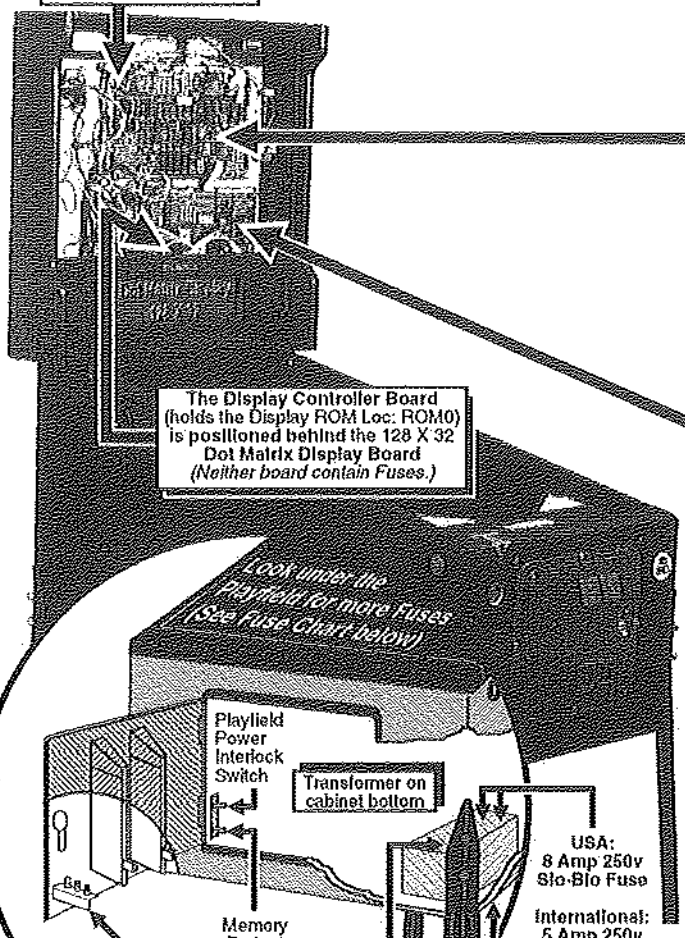
BACKBOX LAYOUT LOCATIONS: FUSES, BRIDGES, RELAYS & ROMs

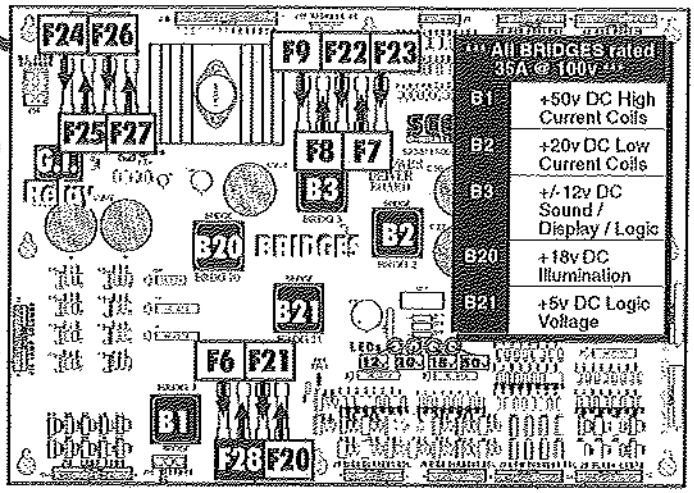


Display Power Supply Bd.



CPU / Sound Board





I/O Power Driver Board

Section 3 | Fuses

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	Magnets
F21	3A 250v S.B.	50v DC	Coils
F22	8A 250v S.B.	18v DC	Controlled Lamps
F23	4A 250v S.B.	5v DC	Logic
F24	5A 250v S.B.	6.3v AC	G.I. Lamps (BRN-WHT 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)

For Backbox & Cabinet General Parts, see Section 4, Chapter 1, Parts Identification & Location (The Pink Pages)

For Schematics and/or Component Parts on above Boards, see Sec. 5, Chp. 4, Printed Circuit Boards (PCBs) (The Yellow Pages)

GODZILLA

QUICK REFERENCE FUSE CHART			
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	Left Magnet (VIO-YEL↔BLK)
n/a	3A 250v S.B.	50v DC	Top Magnet (VIO-YEL↔BLK)
n/a	3A 250v S.B.	50v DC	Mid. Magnet (VIO-YEL↔BLK)
n/a	3A 250v S.B.	50v DC	Bot. Magnet (VIO-YEL↔BLK)
LOC:	SHAKER MOTOR BD. (Inside Cabinet Rt. Side)		
F2	2½A 250v S.B.	12v DC	Shaker Motor
F3	2½A 250v S.B.	12v DC	Shaker Motor

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 "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.



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.

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 CN14. • Check CPU Board, possibly failed.
Service Buttons (**Red, Green** and **Black**) are nonfunctional.	• Check the Service Switches for poor connections or broken wires.
The display blanks out.	• Check the Dot Matrix Display for loose wiring harness connections. • Check Bridge Rectifier 3 & 8 Amp Slo Blo Fuse. 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 Service 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 the Game Manual Flipper Troubleshooting Flowchart. • 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 **Portals™ Service Menu**, the volume cannot be adjusted with the **Red** or **Green Buttons.**	• The Volume adjustment can only be made when the Service Menu is exited. 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 Tech. Support for additional help.

Parts Identification & Location (The Pink Pages)

Overview

This section provides the part numbers and locations of all the components in the pinball machine. The parts are arranged in basically 3 groups: Backbox, Cabinet, and 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 and 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

Chapter 1 (The Pink Pages)
Overview 53

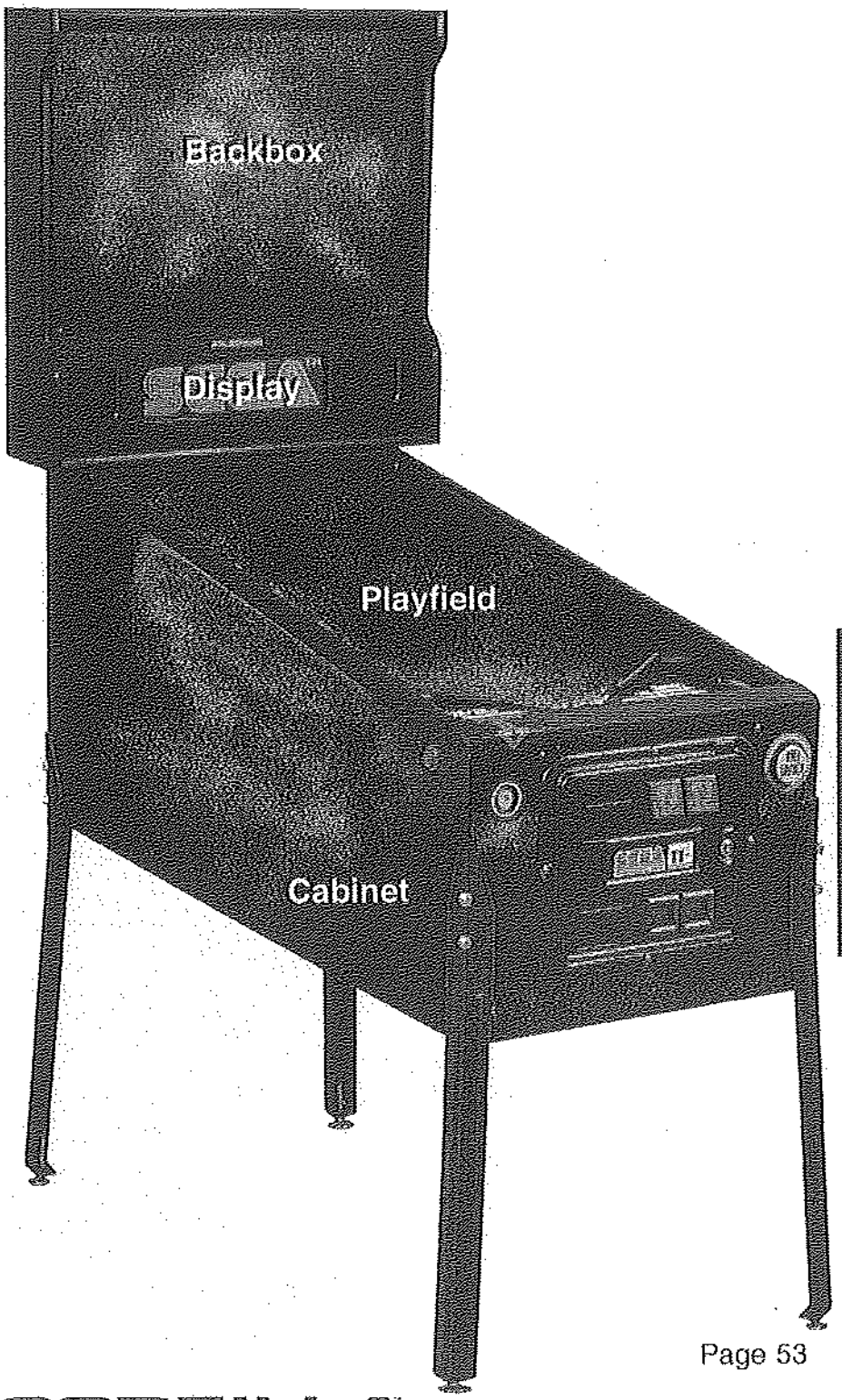
Backbox -
Backbox (Showcase II) Assy. 54
Speaker Panel Assy. and Assoc. Parts for the Backbox 55

Cabinet -
General Parts 56

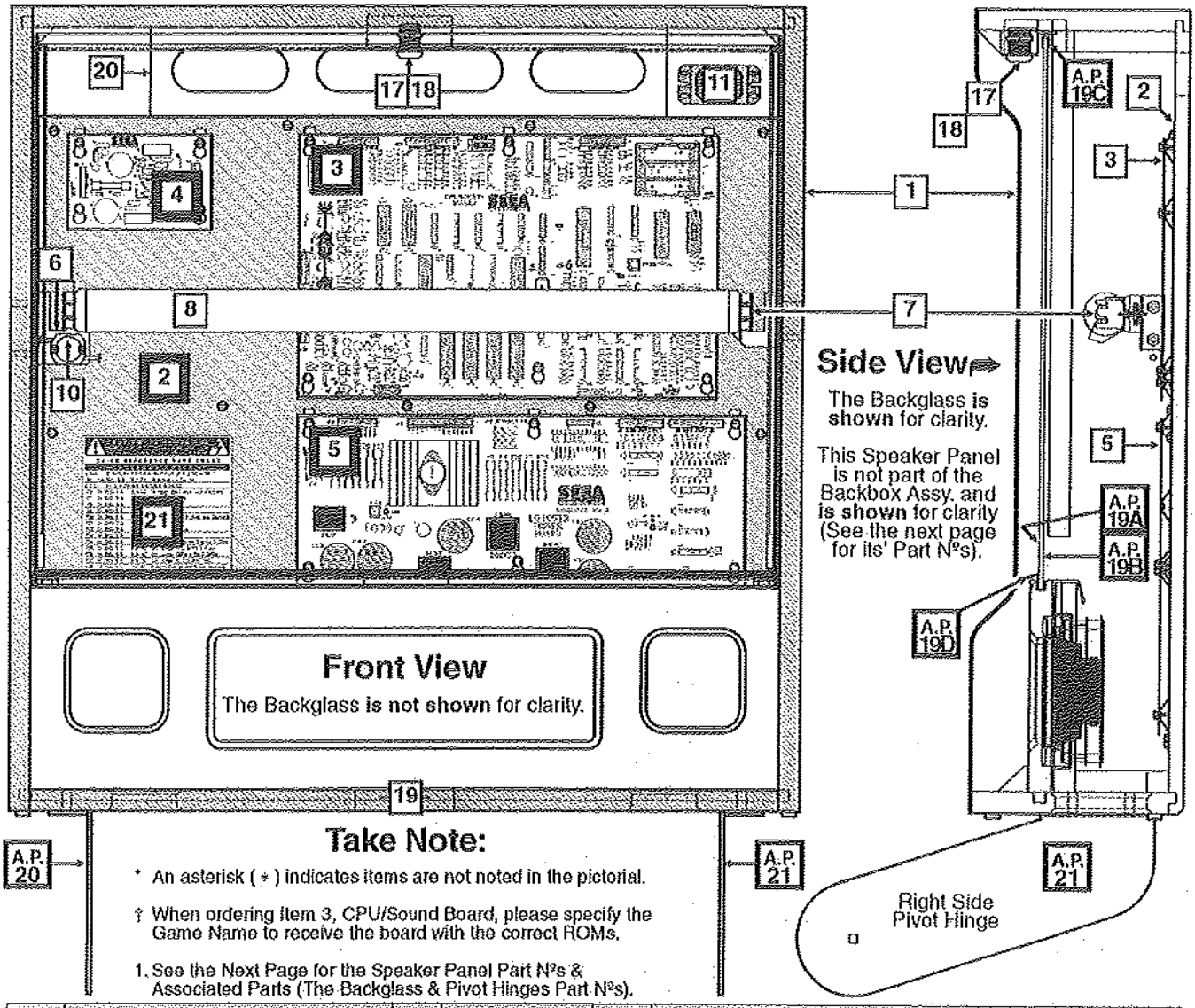
Cabinet & Playfield -
Switches 57

Playfield -
General Parts (Below) 58
General Parts (Above) 59
Rubber Parts 60
Plastic, Decals and Mylar 61
Rails and Ball Guides 62
Metal Posts and Nuts 63
Metal Spacers 64
Plastic Posts and Spacers 65
Small Bayonet Type Bulbs and Sockets 66
Large Bayonet Type Bulb and Sockets 67
Wedge Base Bulbs and Sockets 68

Chapter 2 (The Blue Pages)
Overview 69
Major Assembly Drawings 70-78



Backbox (Showcase II) Assembly, 505-6002-40-40 (Items 1-27)



Take Note:

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

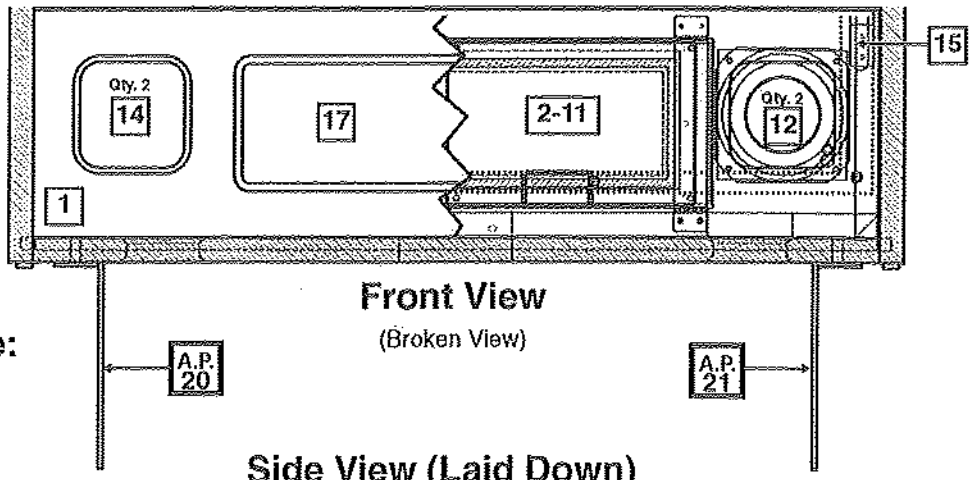
† When ordering item 3, CPU/Sound Board, please specify the Game Name to receive the board with the correct ROMs.

1. See the Next Page for the Speaker Panel Part Nºs & Associated Parts (The Backglass & Pivot Hinges Part Nºs).

Nº	Individual Part Name (Back)	QTY.	SPI Part Nº
1	Backbox Showcase II (Plain, Black Wood with Green T-Molding)	1	525-5505-04
2	PCB Metal Mounting Plate	1	535-5809-04
	Item 2 secured to Item 1 by: #8 X 1/2" HWH AB (Zinc) Blue (Qty. 8) (234-5101-05)		
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 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 Nº WILL INCLUDE:		
6A	Fluorescent Light Bracket Left	1	535-7739-01
6B	Lamp Holder (Self-Locking)	1	077-5214-00
6C	#6-32 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	237-5813-00
7	Fluorescent Light Bracket Assy. Right	1	515-6545-01
	ORDERING ABOVE (ITEM 7) SUB-ASSY. PART Nº WILL INCLUDE:		
7A	Fluorescent Light Bracket Right	1	535-7739-00
7B-7C	Identical to Items 6B-6C above.		See 6B-6C
	Items 6 & 7 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/A 120v 60Hz 13W UL	1	010-5007-00
	Item 11 secured to Item 1 by: #6 X 3/8" HWH AB (Zinc) (Qty. 2) (234-5050-00)		

Nº	Individual Part Name (Back)	QTY.	SPI Part Nº
12*	Fluor. Power Cable Wiring Harness	1	036-5402-15
13*	1/4" Clamp (Double)	3	040-5000-23
14*	1/2" Clamp (Single)	1	040-5000-06
15*	3/4" Clamp (Single)	3	040-5000-08
16*	1" Clamp (Single)	5	040-5000-09
	Items 13-16 secured by: #6 X 1/2" HWH AB (Zinc) Blue (Qty. 12) (234-5101-05)		
17	Lock Mounting Plate	1	535-5860-00
18	Backbox Lock & Key	2	355-5008-00
	Items 17-18 secured by: #6 X 5/8" TP Torx T20 (Qty. 2) (237-5947-00)		
19	#1 Roto Lock Female (R2-0002-02)	1	355-5006-02
	Item 19 secured by: #10-24 X 1-3/4" CBSN (Qty. 2) (231-5022-00), #10-32 Nylon Stop Nut (Qty. 2) (240-5203-00) and #10 Washer 7/32" ID X .5" OD X 1/16" (Qty. 2) (242-5003-00)		
	Note: #1 Roto Lock Male (on Cabinet)	1	355-5006-01
20	Back Vent Grill 2-1/2" X 18"	1	545-5072-02
	Item 20 secured by: Staple 5/16" (Qty. 24) (631-5000-00)		
21	Fuse Description Decal (Generic)	1	820-6152-00
22*	Fuse Description Decal Game Nº 40	1	820-6152-40
23*	Ribbon Cable, 20-Pin	1	036-5000-04
24*	Ribbon Cable, 26-Pin	1	036-5001-80
	Item 23 (20-Pin) connects the CPU/Sound Board to the I/O Power Driver Board. Item 24 (26-Pin) connects the CPU/Sound Board to the Display Controller Board.		
25*	Display Cable Wiring Harness	1	036-5409-00
26*	Fuse Label (UL)	1	820-6143-00
27*	Backbox Date Label	1	820-5091-00

Speaker Panel Assy. for the Backbox (Showcase II), 515-6888-00 (Items 1-18) and Assoc. Parts: Backglass Assembly & Pivot Hinges (Left & Right) (Items 19-21)



Front View
(Broken View)

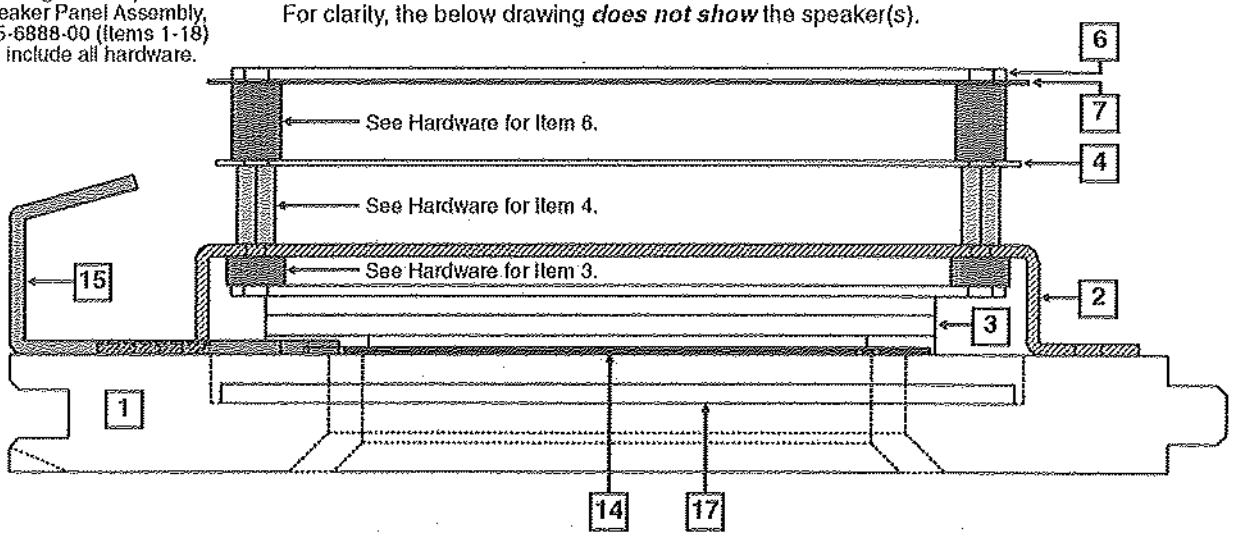
Take Note:

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

1. Ordering the complete Speaker Panel Assembly, 515-6888-00 (Items 1-18) will include all hardware.

Side View (Laid Down)

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



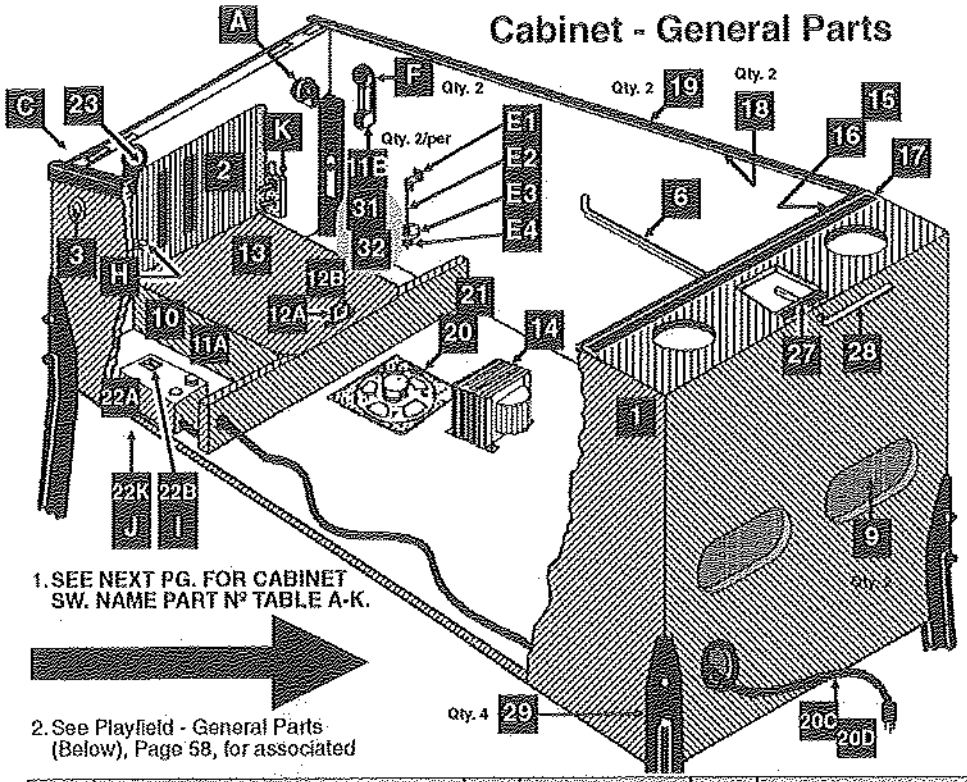
Nº	Individual Part Name (Front)	QTY.	SPI Part Nº
1	Speaker Panel (for Showcase II)	1	525-5515-00
2	Dot Matrix Disp. Bd. Mounting Bracket	2	535-8368-01
	Item 2 secured to Item 1 by: #8 X 3/4" HWH AB (Zinc) (Qty. 4/per) (234-5103-00)		
3	Dot Matrix Display Board 128 X 32	1	520-5052-00
	Item 3 secured to 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 (Sem) Zinc (Qty. 4) (237-5978-03) **Item 3 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 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-FE89s	1	520-5055-03
	Item 6 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)	2	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"	3	626-5026-00
	Above Item 11 is self-adhesive. Located between Items 3 & 17. Sold in 12" Lengths only.		
12	Speaker 4 X 4 Quam (#89-9572)	2	031-5004-00
13*	Speaker Cable Wiring Harness	1	036-5442-00

Nº	Individual Part Name (Front)	QTY.	SPI Part Nº
14	Speaker Grill (Black w/no Artwork)	2	535-8081-00
15	Speaker Panel Hook Bracket	2	535-7009-02
	Items 12, 14 & 15 secured by: #8 X 3/4" HWH AB (Zinc) (Items 12/14: Qty. 4/per; Item 15: Qty. 2/per) (234-5103-00)		
16*	Sega Logo (self-adhesive)	1	535-7877-00
17	Plastic Shield (Display Cover)	1	545-5884-00
	Item 17 secured to Item 2 by: #6 X 3/8" HWH AB (Zinc) (Qty. 8) (234-5099-00)		
18*	Ground Strap (41")	2	600-5006-41

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

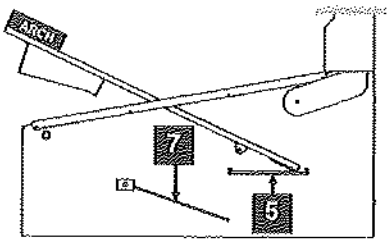
Nº	Assoc. Backbox Part Name	QTY.	SPI Part Nº
19	Backglass Assembly (Game Nº 40)	1	515-5450-00-40
	ORDERING ABOVE (ITEM 19) SUB ASSY. PART Nº WILL INCLUDE:		
19A	Clear Backglass 25.906" X 19.187"	1	660-5038-02
19B	Screened Film (Game Nº 40)	1	830-5240-00
19C	Top Plastic Channel - 26"	1	545-5018-15
19D	Bottom Plastic Lift Channel - 26-1/16"	1	545-5021-01
19E*	Plastic Edging (Left/Right) - 18-1/8"	2	545-5018-14
19F*	Tape (double-sided) (12" Length) *Note: 19F secures 19E to 19A*	1/2	626-5005-00
20	Pivot Hinge Left	1	535-7999-00
21	Pivot Hinge Right	1	535-7999-01
	Items 20 & 21 secured to Backbox by: 1/4"-20 X 1-1/4" C.B. Sq. Neck (Qty. 4) (231-5003-00) and 1/4"-20 Flange Nut (Qty. 4) (240-5300-00) **Items 20 & 21 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. 2) (242-5016-01), Washer 1/4" I.D. X 1" O.D. (Qty. 2) (242-5009-00) and 1/4"-20 Flange Nut (Qty. 2) (240-5300-00)		

Cabinet - General Parts



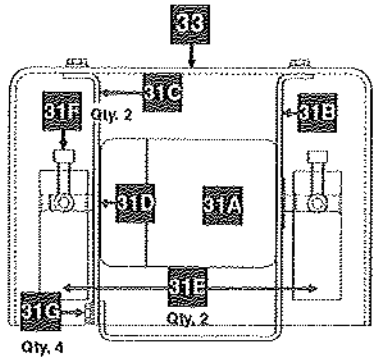
1. SEE NEXT PG. FOR CABINET SW. NAME PART Nº TABLE A-K.

2. See Playfield - General Parts (Below), Page 58, for associated



Take Note:

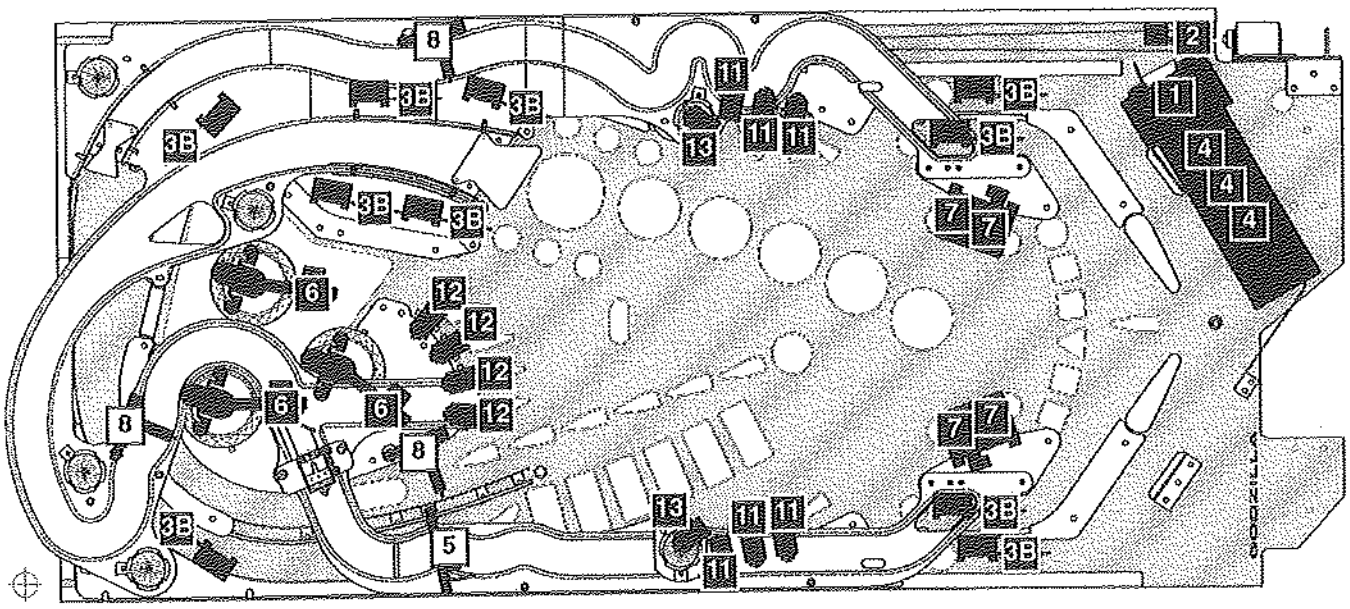
* An asterisk (*) indicates items are not noted in the pictorial.

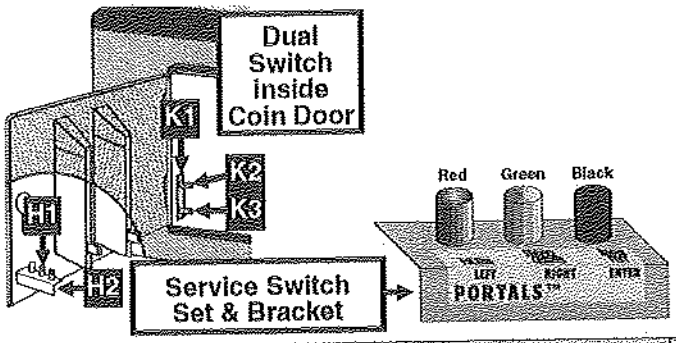


Nº	Cabinet Part Name	QTY.	SPI Part Nº
1	Game 60 Screened Cabinet (Plain)	1	525-6000-60
2	Coin Door (with Validator) USA only	1	500-5018-172
	Item 2 secured by: 1/4"-20 X 1-1/4" Carriage Bolt Sq. Neck (Qty. 4) (231-5003-00) and 1/4"-20 Flange Nut (Qty. 4) (240-5300-00). *NOTE: For Coin Door other than USA call Technical Support for SPI Part Nº.*		
3	Flipper Button Assembly Red	2	500-5026-32
4*	Pal Nut for Flipper Button	2	240-5003-01
	Item 4 is fitted with: O-Ring 11/32" X 7/32" X 1/16" (Qty. 1/per) (545-5850-00)		
5	Slide & Pivot Support Bracket - Right	1	535-5989-00
6	Slide & Pivot Support Bracket - Left	1	535-5990-00
	Items 5 & 6 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)		
7	Prop Rod	1	535-7553-00
	Item 7 secured by: #10-24 X 1-3/4" Carriage Bolt Sq. Neck (231-5022-00), Washer #10 7/32" ID X .5" OD X 1/16" Thk and #10-24 Nylon Stop Nut (240-5206-00)		
8*	Mylar Carriage Bolt Cover Disc	2	820-5041-00
9	Grills 2-1/2" X 18" (on Back & Bottom)	2	545-5072-02
10	Cash Box Plastic Bottom	1	545-5090-00
11A	1/2" X 3/4" X 1-1/2" Black Foam Rubber Tape	1	626-5004-00
	Above Item 11A is self-adhesive. It is located behind Item 10. Sold in 12" Lengths only.		
11B	Foam Strip (2/per Flipper Switch Front/Back)	4	626-5042-00
12A	Cash Box Lock Bracket (wire)	1	535-7562-00
12B	Large Hair-Pin Clip	1	535-7772-00
13	Cash Box Cover (Validator)	1	535-5013-03
14	Transformer with Ballast Winding	1	010-5012-00
	Item 14 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 14 Specifications: PRI 103.5 / 115 / 207 / 230V 50/60Hz 750VA Class 130 EPBO*		
15	Rear Glass Channel 20-3/8" Length	1	545-5038-00
16	Foam Rubber 3/8" X 3/16" X 20-3/8"	2	626-5001-00
	Above Item 16 is self-adhesive. It is located in Item 15. Sold in 12" Lengths only.		
17	Cabinet Pedestal Bracket	1	535-8035-00
	Item 17 secured by: #8 X 3/4" PFH (Zinc) (Qty. 3) (237-5822-00)		
18	Plastic Channel 42-5/8" Lg. (Lt. & Rt.)	2	545-5017-00
19	Side Armor "with holes" (Lt. & Rt.)	2	535-7297-02
	Item 19 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 Tamper Proof (237-5947-00)		
20	Speaker 8" ø Rd. Quam 4Ω #99-9808	1	031-5005-00
21	Speaker Grill 7" X 7"	1	545-5072-03
	Items 20 & 21 secured by: #8-32 X 1-1/4" Fin Shank Screw (Qty. 4) (237-5854-00) and #8-32 Keps Nut (Qty. 4) (240-5008-00)		
22	Power Input Box Sub-Assy. (no Vol. pot)	1	515-5360-02-60
	ORDERING ABOVE (ITEM 22) SUB-ASSY PART Nº WILL INCLUDE:		
	Items 22A - 22M continues in the next column.		

Nº	Cabinet Part Name	QTY.	SPI Part Nº
22A	Power Box (Plain)	1	535-5932-00
22B	Service Outlet (for USA)	1	180-5008-01
22C	Line Cord 10' ROJ 3" Max.	1	034-5000-10
22D	Recessed Cup for Line Cord	1	545-5122-00
22E*	Line Filter	1	150-5000-00
22F*	Varistor TNR159211KM	1	150-5001-00
22G*	Fuse 8 Amp 250v Slo-Blo (Domestic)	1	200-5000-05
22H*	Fuse 2 Amp 250v Slo-Blo (Blk. Lites)	1	200-5000-14
22I*	Fuse Holder	2	205-5001-00
22J*	On/Off Switch Bracket	1	535-8318-00
22K	On/Off Rocker SW. (Arcolectric C1350AB)	1	180-5001-01
22L*	Power Box Decal	1	820-6123-01
22M*	Fuse Label UL Decal	1	820-6143-00
23	Front Molding Lockdown Assembly	1	500-5020-01
	Item 23 secured by: #10-24 X 1-1/4" Carriage Bolt (Qty. 2) (231-5012-00), #10-24 Keps Nut (Qty. 2) (240-5207-00) and #10 Washer 7/32" ID X 1/2" OD X 1/16" (Qty. 2) (242-5003-00)		
24*	Front Molding Lockdown Spring	1	265-5008-00
25*	Front Molding - Black	1	500-5757-01-00
26*	P/F Glass (Tmprd.) 21" X 43" X 3/16"	1	660-5001-00
27	#1 Roto Lock Male	1	355-5006-01
Note:	*#1 Roto Lock Female (on Backbox)*	1	*355-5006-02*
	Item 27 secured by: #10-24 X 1-3/4" Carriage Bolt Sq. Neck (Qty. 2) (231-5022-00) and #10-24 Nylon Stop Nut (Qty. 2) (240-5206-00)		
28	Hex Key Allen Wrench 5/16"	1	777-0001-00
29	Black Leg & Leveler Assembly	4	500-5921-50
	Item 29 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 500-5917-00. A Leg "without" a Leg Leveler is not available.*		
30*	Corrugated Tubing 1¼" ø (Black), (12')	2	605-5008-00
	Above Item covers the Cables Wiring Harnesses going into the Backbox from the Cabinet. Sold in 12" Lengths only.		
31	Shaker Motor (Vibrator) Assy. *(NEW)*	1	515-5893-01
	ORDERING ABOVE (ITEM 31) SUB-ASSY PART Nº WILL INCLUDE:		
31A	Shaker Motor (0.5v DC 2950 RPM CW	1	041-5029-01
31B	Shaker Motor Mounting Bracket	1	535-6711-01
31C	Shaker Motor Leg Bracket	1	535-6711-02
31D	Insulator	1	545-5425-00
31E	Shaker Motor Weight	2	535-6727-01
31F	#10-32 X 5/8" Lg. Soc. Set Screw	2	237-5911-00
31G	#8-32 X 1/4" HWH MS (Taplite)	4	237-5964-01
31H*	Capacitor - Tecate 1 MFD 500v	1	130-5000-00
31I*	Shaker Motor Cable Wiring Harness	1	036-5123-00
	Item 31 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)		
32	Shaker Motor P.C. Board	1	520-5065-00
	Item 32 secured by: 3/8" Sil. Rtn. Spacer White (Qty. 4) (254-5007-01) and #6 X 3/4" HWH AB (Zinc) (Qty. 4) (234-5003-00)		
33	Shaker Motor Plastic Cover Housing	1	545-5241-00
	Item 33 secured to Item 32B by: #8-32 X 3/8" HWH MS (Taplite) (Qty. 2) (237-5957-00)		

Cabinet & Playfield - Switches





Take Note:

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

1. For switches used corresponding to the Switch Matrix Grid of this game, see Section 3, Chapter 2, ...Diagnostics.
2. For location of the Cabinet Switches, see the previous page.
3. ‡ Items 9-13, Stand-Up Targets, see the Plastic Part Color Chart on Plastic Posts and Spacers, further in this chapter, for other color alternatives, if color desired is not available.
4. **Legend Note:** Items noted with a white square ☐ are mounted above the playfield; items noted with a black square ■ are mounted below the playfield or on/in the cabinet.

№	Cabinet Switch Name	QTY.	Part №
A	Start Button Sw. Assy. (Yellow Flsp. Style)	1	500-6090-06
B*	Coin Door Switch (USA)	4	180-5024-00
	Coin Door Switch (¥ Japan)	n/a	180-5091-00
C	Large Round Auto Launch Assy. (Yel)	1	500-6121-06
D*	Slam Tilt Switch (On Coin Door)	1	180-5022-00
E	Cabinet Plumb Bob Tilt Switch	1	n/a
ORDER ONLY INDIVIDUAL PARTS NEEDED (NO ASSY. NUMBER):			
E1	Tilt Hanger Bracket	1	535-5221-00
E2	Tilt Hanger Wire (Attached to bracket)	1	535-5319-00
E3	Tilt Contact Wire	1	535-7563-01
E4	Tilt Plumb Bob (Atch'd to hanger wire)	1	535-5029-00
F	Flipper Cabinet Sw. - Self-Cleaning	2	180-5160-00
G*	EOS Switch (on Lwr. Flippers)	2	180-5149-00
H	Diagnostics Service Switches (X3)	1	180-5012-03
Item H secured to Diagnostics Switch Bracket (535-6850-01) on Coin Door.			
I	Service Outlet - US	1	180-5008-01
J	On/Off Rocker Sw. (Arcotectric C1350AB)	1	180-5001-01
Item J secured to On/Off Sw. Mounting Bracket (535-6318-00) on Cabinet Bottom.			
K	Dual Switch Assembly	1	500-5808-00
ORDERING ABOVE (ITEM K) ASSEMBLY PART № WILL INCLUDE:			
K1*	Mounting Bracket	1	535-6958-00
K2	Playfield Power Interlock Switch (Top)	1	180-5136-00
K3	Memory Protect Switch (Bottom)	1	180-5000-00
Item K secured to Cabinet by: #8 X 1/2" HWH AB (Zinc) Blue (Qty. 2) (234-5101-05)			

№	Playfield Switch Name	QTY.	Part №
1	Dual OPTO TRANS Board	1	520-5173-00
	Dual OPTO REC Board	1	520-5174-00
2	Shooter Lane Switch Assembly	1	500-5498-01
ORDERING ABOVE (ITEM 2) ASSEMBLY PART № WILL INCLUDE:			
2A*	Micro Switch	1	180-5100-01
2B*	Switch Mounting Bracket	1	535-6173-00
2C*	#2-56 X 3/8" HWH MS (Ser) (F 3/16" Hd.	2	237-5938-01
2D*	Diode, 1N4001	1	112-5001-00
3A	P/F R/O Micro Sw. Assy. (Lt. Mount)	0	500-6227-01
3B	P/F R/O Micro Sw. Assy. (Rt. Mount)	10	500-6227-02
Items 2, 3A & 3B typically secured by: #6 X 1/2" HWH AB (Zinc) Red (234-5001-02)			
4	Micro Switch (Roller Actuator)	3	180-5119-00
5	Micro Switch (1-1/4") (on: Spinners)	1	180-5010-04
6	Turbo Bumper Switch	3	180-5015-03
7	Slingshot Stack (Blade) Switch	4	180-5054-00
8	Micro Switch (Roll-Under Gate)	3	180-5087-00
9 ‡	Modular S-U Target Narrow	0	500-6138-XX
10 ‡	Modular S-U Target Rectangle	0	500-6228-XX
11 ‡	Modular S-U Target Round Yellow	6	500-6075-06
12 ‡	Modular S-U Target Square Red	4	500-6139-02
13 ‡	Modular S-U Target Square Green	2	500-6139-04
Items 9-13 typically secured by: #8 X 3/4" HWH AB (Zinc) (Qty. 2/per) (234-5103-00)			

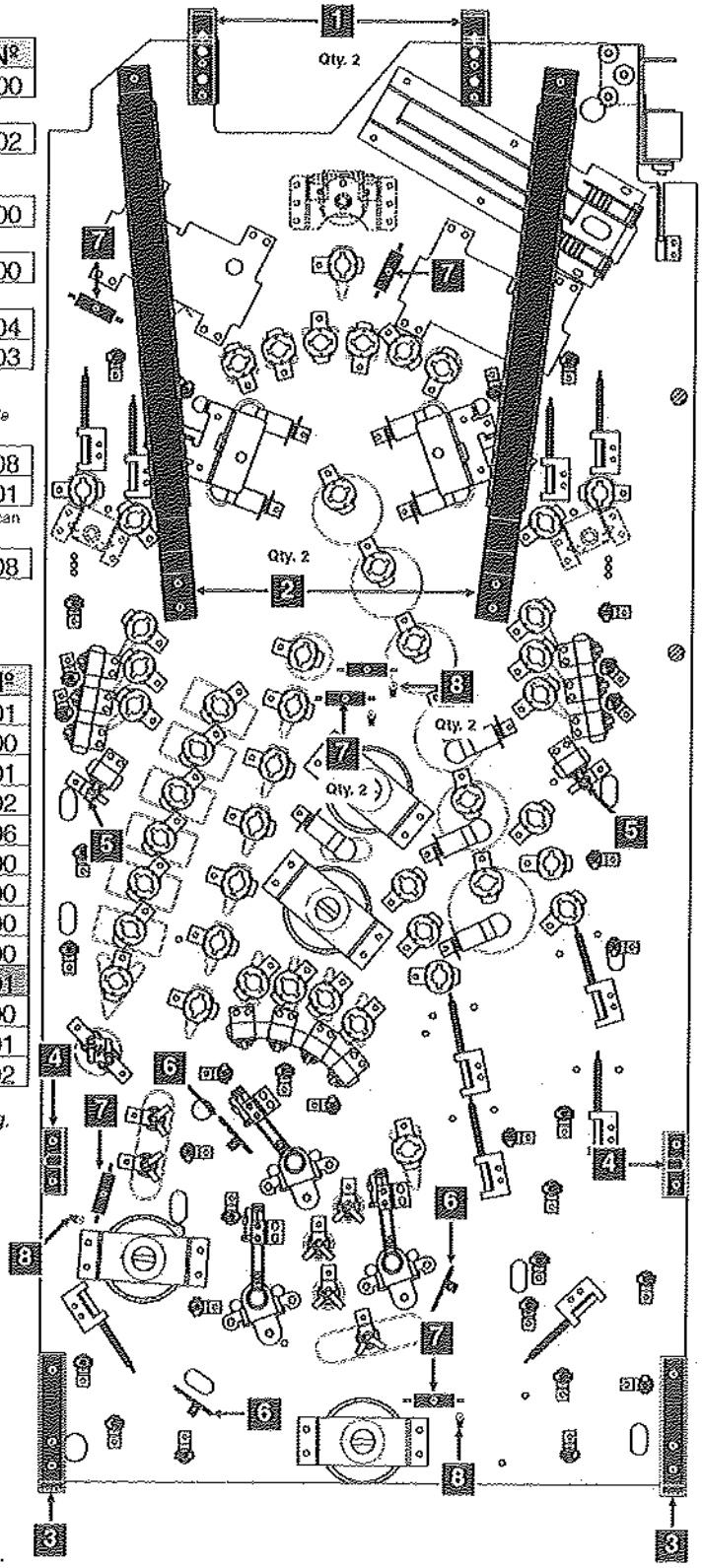
SEE ABOVE PARTIAL CABINET DRAWING (H & K) AND PREVIOUS PAGE FOR CABINET SWITCH A-K LOCATIONS.

Playfield - General Parts (Below)

Nº	Below Playfield Part Name	QTY.	SPI Part Nº
1	Playfield Hanger Bracket *(NEW Style)*	2	535-8385-00
	Item 1 secured by: #8-32 X 7/8" HWH MS Zinc (Qty. 2/per) (237-5890-00)		
2	Playfield Support Slide Bracket	2	535-6862-02
	Item 2 secured by: #8 X 1/2" HWH AB (Zinc) Blue (Qty. 2/per) (234-5101-05) and #8-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 1/per) (237-5975-03)		
3	Edge Slide Bracket	2	535-5988-00
	Item 3 secured by: #4 X 1/2" PFH (Zinc) (Qty. 3/per) (237-5840-00)		
4	Pivot Pin Bracket Welded Assembly	2	500-5329-00
	Item 4 secured by: #8-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 2/per) (237-5975-03)		
5	Rubber Lite Cover GREEN	2	545-5014-04
6	3-Pos. Diode Terminal Strip (821) Isolated	3	055-5204-03
	Item 6 secured by: #6 X 3/8 HWH AB Zinc (Qty. 1/per) (234-5000-03). *NOTE: Items 6 & 9 use 1N4001 Diodes (Qty. 3, Item 6; Qty. 4, Item 9;) (112-5001-00). 1N4001 Diodes are for Switches and/or Lamps. See Section 5, Chapter 2, Playfield Diode Terminal Strip Locations for Diode Usage & Wire Colors.*		
7	3A 250v Slo-Blo Fuse	6	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).		
8	Solder Lug #8	4	055-5140-08
	Items 7 & 8, Fuse Clip Holder(s) and/or Solder Lugs are secured by: #8 X 1/2" PPH AB (Qty. 1/per) (237-5805-00)		

Nº	Miscellaneous Part Name	QTY.	SPI Part Nº
n/a *	3½" Plastic Post (holds cables)	10	545-5253-01
n/a *	Screw Down Cable Tie	4	040-5005-00
n/a *	4" Cable Tie PLT1MXMR	159	040-5001-01
n/a *	5½" Cable Tie PLT1.5I	16	040-5001-02
n/a *	5½" Cable Tie PLT1.5M-XMR	190	040-5001-06
n/a *	Insulating Tubing #18 (Teflon) (12" Long)	1	605-5003-00
n/a *	Heat Shrink Tubing ⅛" ø (BLK) (12" Lg.)	11	605-5002-00
n/a *	Heat Shrink Tubing ⅛" ø PUI-24 (12" Lg.)	1	605-5006-00
n/a *	Heat Shrink Tubing ¼" ø (CLR) (12" Lg.)	2	605-5004-00
n/a *	Heat Shrink Tubing ¼" ø (BLK) (12" Lg.)	0	605-5004-01
n/a *	Split Flex Tubing 1¼" ø (12" Long)	2	605-5008-00
n/a *	Split Flex Tubing ¼" ø (12" Long)	5	605-5008-01
n/a *	Split Flex Tubing ½" ø (12" Long)	1	605-5008-02

Tubular Note: *Tubing is sold by the foot. The quantity shown is a mulliple of that amount to cover lengths under 12" in this game. (e.g. a qty. of 6 means there is 5 feet plus up to 11" of tubing.).*

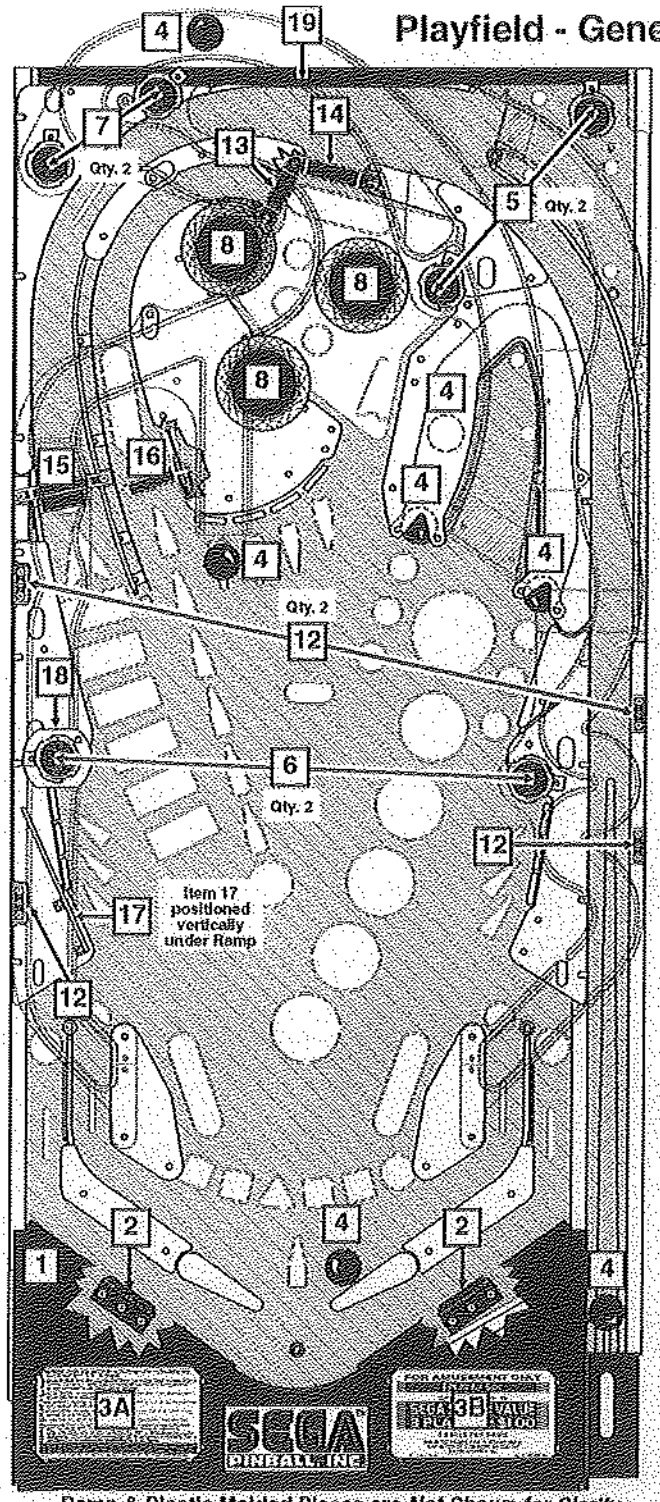


Take Note:

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

1. For Sockets & Bulbs (drawings & part numbers) see Pgs. 66-68.
2. For Major Assemblies, Ramps and/or Under Troughs, see the Blue Pages, Sec. 2, Chp. 2
3. For Switches see the previous page.
4. *Tubing is used to insulate various cables/lugs. Tubing can only be ordered in 12" increments. Cut the amount required for each application. Cut sizes are variable in length. The quantities reflect total lengths required for entire game (averaged up to nearest foot). Quantities may change during production.*
3. **Legend Note:** Items noted with a black square ■ are mounted below the playfield.

Playfield - General Parts (Above)



Ramp & Plastic Molded Pieces are *Not Shown for Clarity*
(See the Blue Pages for Items associated with the Ramp)

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.

1. Some unique parts *may be included with* or *associated with* a Major Assembly or Ramp Assembly; **see the Blue Pages** for parts required not appearing on this page.
   If you still cannot find the part required, call Sega Pinball Technical Support, 1-800-542-5377.
2. **Legend Note:** Items noted with a white square ☐ are mounted above the playfield.

Nº	Above Playfield (P/F) Name	QTY.	SPI Part Nº
n/a *	P/F Screened w/ Inserts & NO Parts	1	830-5100-40
	P/F Complete w/ Inserts & ALL Parts		505-6004-40-40
1	Arch Assembly (Metal)	1	500-6005-00-40
ORDERING ABOVE (ITEM 1) ASSEMBLY PART Nº WILL INCLUDE:			
1A*	Arch (Plain Black Metal) w/Fork	1	535-8392-00
1B*	Nelson Protect Strip 8-9/16"	2	545-5212-02

Item 1 secured to the playfield by: #10-32 X 5/16" PH FL U/C MS STL Zinc (Qty. 2) (237-6013-00)
(Note: Decals are not included with the above. See Playfield - Plastic, Decals & Mylar.)

2	Arch Retaining (Hold-Down) Brackets	2	535-8394-00

Item 2 secured to the playfield by: #8 X 1/2" HWH AB (Zinc) Blue (Qty. 3/pair) (234-5101-05)

3A	Instruction Card - Godzilla	1	755-5140-00
3B	Coin Card (50¢-1 75¢-1/2 $1-3)	1	755-5087-00
4	1-1/16" Steel Balls (4-play, 3-captive)	7	260-5000-00
5	Mini-Mars Light Cover Snap-In (Red)	2	550-5030-02
6	Mini-Mars Light Cover Snap-In (Green)	2	550-5030-04
7	Mini-Mars Light Cover Snap-In (Yellow)	2	550-5030-06
8	Pop Bumper Cap (Blue)	3	550-5057-05
9 *	Plastic Molded Godzilla Head	1	545-5889-00
10 *	Plastic Molded Left Arm & Buildings	1	545-5890-00

Item 10 secured by: Arm Mounting Bracket (Qty. 1) (515-6920-00), #8 Washer (Qty. 4) (242-5005-00) and #8-32 Nylon Stop Nut (Qty. 4) (240-5102-00)

11 *	Plastic Molded Right Arm	1	545-5891-00
12	Ramp Mounting Welded Bracket	4	515-6508-00
13	1-Way Gate Mounting Bracket (Sm.)	1	535-5269-03
	Wire Gate (for above)		535-5307-03
14	1-Way Gate Mounting Bracket (Lg.)	1	535-5269-06
	Wire Gate (for above)		535-5307-09
15	Spinner Assembly	1	500-6324-01
ORDERING ABOVE (ITEM 15) ASSEMBLY PART Nº WILL INCLUDE:			
15A	Spinner Mounting Bracket	1	535-5269-06
15B	Spinner Assembly	1	515-5553-00
15C	Micro-Switch (1-1/4")	1	180-5010-04
15D	#2-56 X 1/2" HWH (Zinc)	2	237-5937-01
15E	Diode, 1N4001	1	112-5001-00
15F	Switch Body Protect Plate	1	535-6539-00

Items 15 secured by: #6 X 1-1/4" PPH (Zinc) (Qty. 1) (237-5975-00) and #8-32 X 3/8" HWH Swage (Serr) Zinc (Qty. 1) (237-5975-00)
Item 15 has decals, see Playfield - Plastic (Butyrate), Decals and Mylar (Page 51).

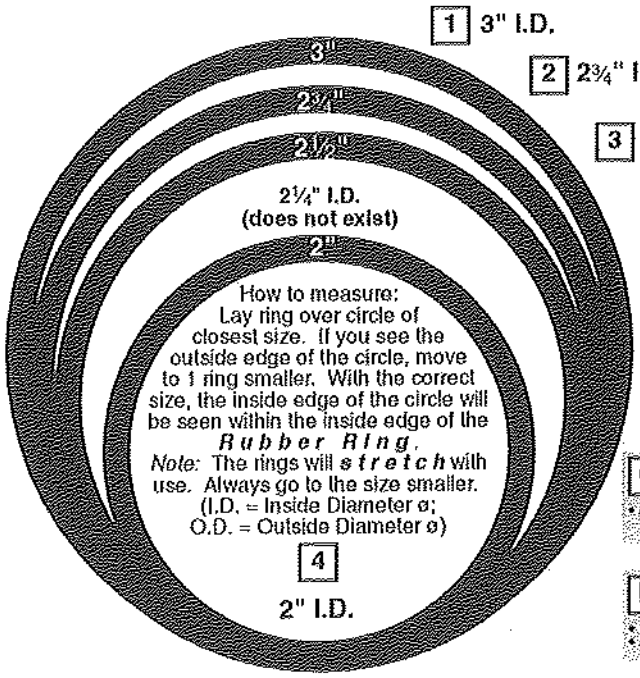
16	Gate (Roll-Under) Assembly		515-6556-01
ORDERING ABOVE (ITEM 16) ASSEMBLY PART Nº WILL INCLUDE:			
16A	Gate Bracket	1	535-7756-01
16B	Wire Form	1	535-7755-01
16C	Micro-Switch	1	180-5087-00
16D	Diode, 1N4001	1	112-5001-00
16E	#2-56 X 3/8" HWH MS (Serr TF 3/16" HD	2	237-5938-01

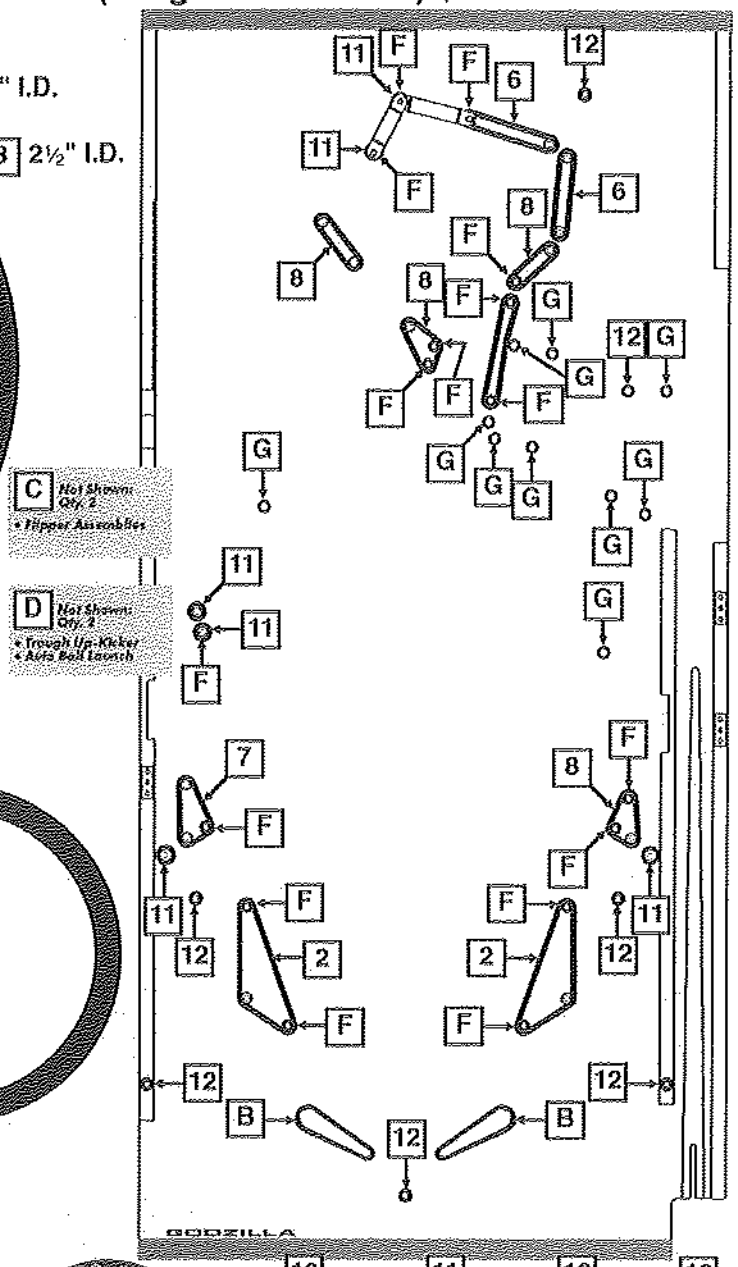
Items 16 secured by: #6 X 1/2" HWH (A8) Zinc Red (Qty. 2) (234-5001-02)

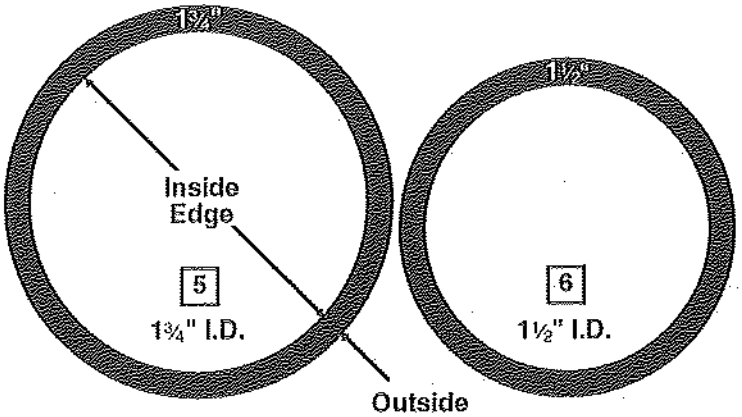
17®	Riveted Screened Plastic Assy. -12	1	515-6915-12R
ORDERING ABOVE RIVETED ASSEMBLY PART Nº WILL INCLUDE:			
17A	Screened Plastic Piece (Butyrate) -12	1	830-5949-12
17B	Mounting Bracket 90° Angle	2	535-5911-01
17C	Rivet, 1/8" ø X 3/16" Long	1	249-5001-00
18®	Riveted Screened Plastic Assy. -14	1	515-6915-14R
ORDERING ABOVE RIVETED ASSEMBLY PART Nº WILL INCLUDE:			
18A	Screened Plastic Piece (Butyrate) -14	1	830-5949-14
18B	2-Lug Stand-Up Short Socket	1	077-5101-00
18C	Rivet, 1/8" ø X 3/16" Long	1	249-5001-00
19	Wood Back Panel (Black, Plain)	1	525-5506-00
	Plastic Back Panel Shield	1	545-5838-02

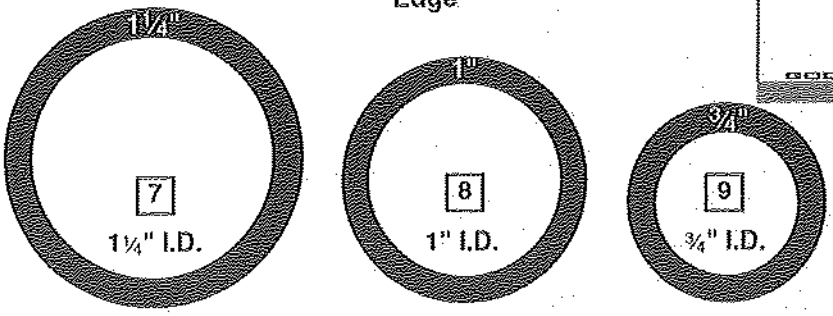
Items 19 secured by: #6 X 1-1/4" PFH A (Zinc) (Qty. 4) (237-5804-00)
If Item 19 has decal(s), see Playfield - Plastic (Butyrate), Decals and Mylar (Page 61).

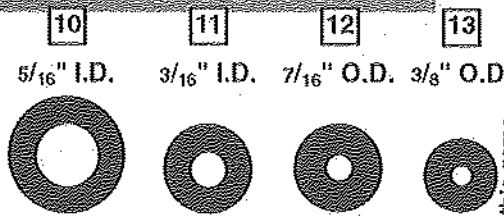
Playfield - Rubber Parts (Rings Actual Size) †







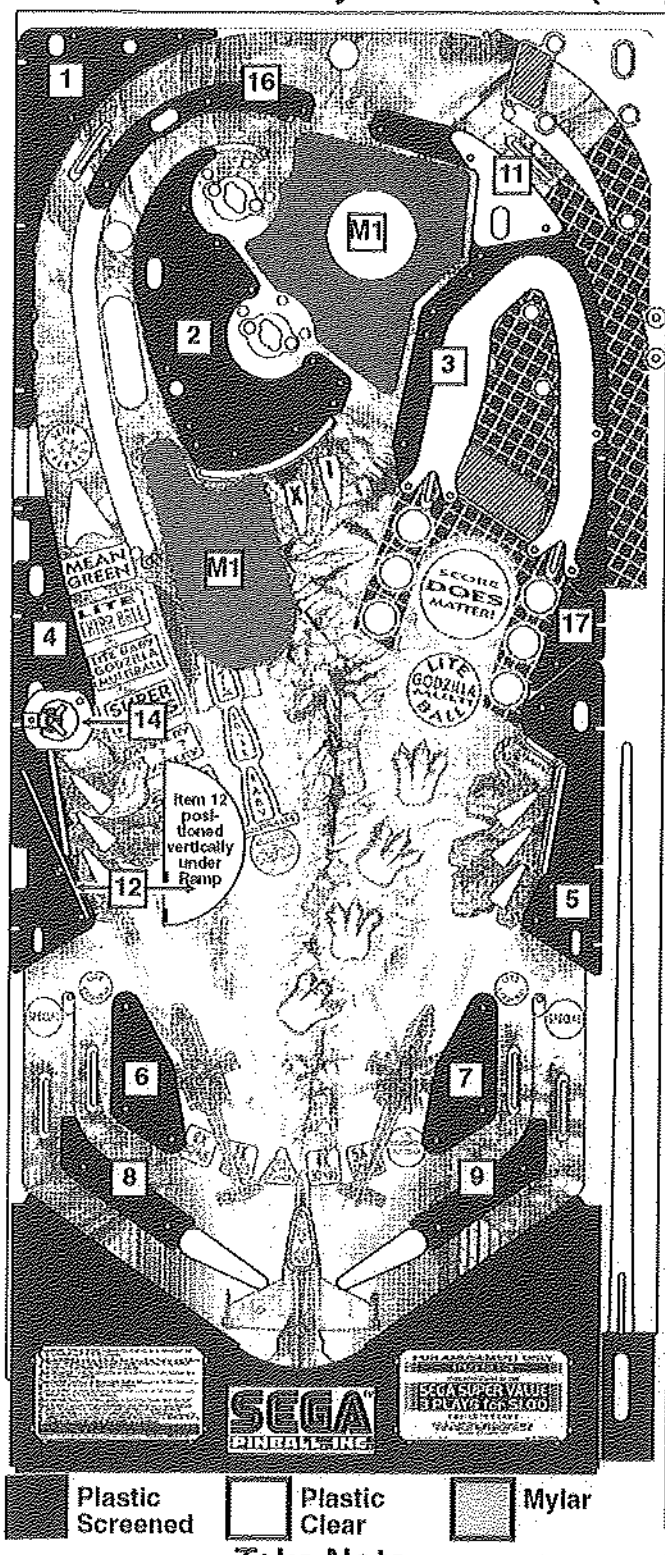




Nº	Rubber Part Name	QTY.	Part Nº	Nº	Rubber Part Name	QTY.	Part Nº
A	Small Flipper Rubber Ring	0	545-5207-00	4	2" I.D. Black Rubber Ring	1	545-5348-08
B	Large Flipper Black Rubber Ring	2	545-5277-00	5	1¾" I.D. Black Rubber Ring	0	545-5348-21
C*	Rubber Deflector Pad (Bumper)	2	545-5428-00	6	1½" I.D. Black Rubber Ring	2	545-5348-07
D*	Rubber Bumper (Grommet)	2	545-5105-00	7	1¼" I.D. Black Rubber Ring	1	545-5348-06
E	Bumper Post Rubber	0	545-5009-00	8	1" I.D. Black Rubber Ring	4	545-5348-05
F	Post Rubber (Sleeve Short)	16	545-5151-00	9	¾" I.D. Black Rubber Ring	0	545-5348-04
G	Post Black Rubber (Sleeve Tall)	10	545-5308-00	10	5/16" I.D. Black Rubber Ring	0	545-5348-02
1	3" I.D. BLK Rubber Ring	0	545-5348-10	11	3/16" I.D. Black Rubber Ring	6	545-5348-01
2	2¾" I.D. Black Rubber Ring	2	545-5348-20	12	7/16" O.D. Black Rubber Ring	7	545-5348-17
3	2½" I.D. Black Rubber Ring	0	545-5348-09	13	3/8" O.D. Black Rubber Ring	0	545-5348-19

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

Playfield - Plastic (Butyrate), Decals and Mylar



Plastic Screened | Plastic Clear | Mylar

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.

1. To order the entire Decal or Plastic (Screened or Clear) sheets, 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.

Nº	Plastic (Butyrate) Name	QTY.	SPI Part Nº
Note: Some pieces are © clear OR ® rivited.			830-5949-XX
1	Top Left Corner Playfield (Screened)	1	830-5949-01
2	Around Pop Bumpers (Screened)	1	830-5949-02
3	Top Right Playfield (Semi-Screened)	1	830-5949-03
4	Left Side Playfield (Screened)	1	830-5949-04
5	Right Side Playfield (Screened)	1	830-5949-05
6	Left Slingshot (Screened)	1	830-5949-06
7	Right Slingshot (Screened)	1	830-5949-07
8	Left Return Lane (Screened)	1	830-5949-08
9	Right Return Lane (Screened)	1	830-5949-09
10*	Not Used	0	n/a
11©	Top Right (Clear) (over -03)	1	830-5949-11
12®©	Ball Trap Prevent (Riv.) (Clr.) (vert. -04)	1	830-5949-12

Item 12 has brackets ® *riveted* to it. If you need this item 12 with the brackets already riveted, see Playfield - General Parts (Above) Page 59 (Item 17).

13	Not Used	0	n/a
14®©	Lt. Side Light (Riv.) (Clear) (over Ramp)	1	830-5949-14

Item 14 has a socket ® *riveted* to it. If you need this item 14 with the socket already riveted, see Playfield - General Parts (Above) Page 59 (Item 18).

15*	Key Chain Fob (Screened)	1	830-5949-15
16	Top Left Inner Loop (Screened)	1	830-5949-16
17	Top Right Center (Screened)	1	830-5949-17

Nº	Mylar Name	QTY.	SPI Part Nº
M1	Clear Mylar - Pop Bumper Area Clear Mylar - Ball Drop under Godzilla Head	1	820-5872-00
M2*	Clear Mylar Square - Return Lane Ball Drop	2	820-5815-00
M3*	Clear Mylar - In front of Slingshots	2	820-5821-00
M4*	Black Mylar - Cover Discs (in Cab. hiding bolts)	2	820-5041-00

Nº	Game #60 Decal Name	SPI Part Nº
D1*	#40 Screened Decal Sheet	820-6235-XX

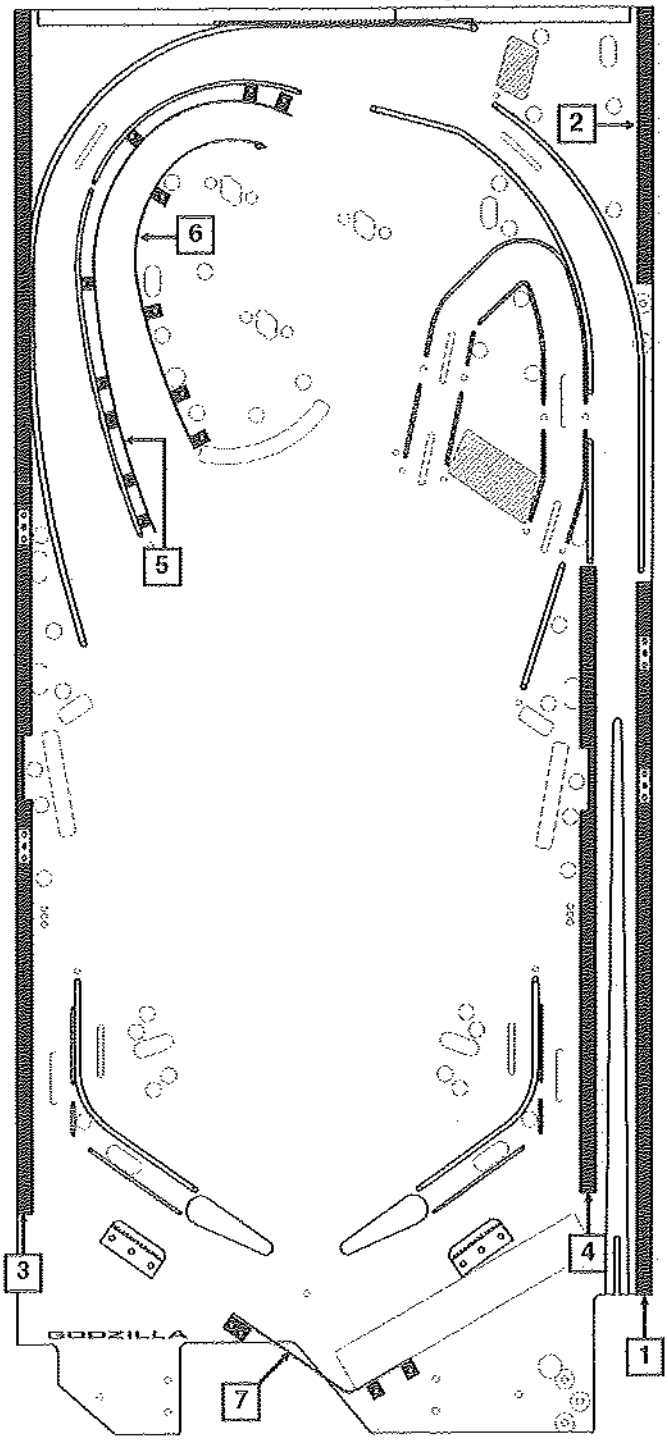
Note: View the last 2-Digit Nº on decal (if applicable) for the desired individual replacement.
(Individual pieces may not be available, in which case the entire sheet must be ordered.)

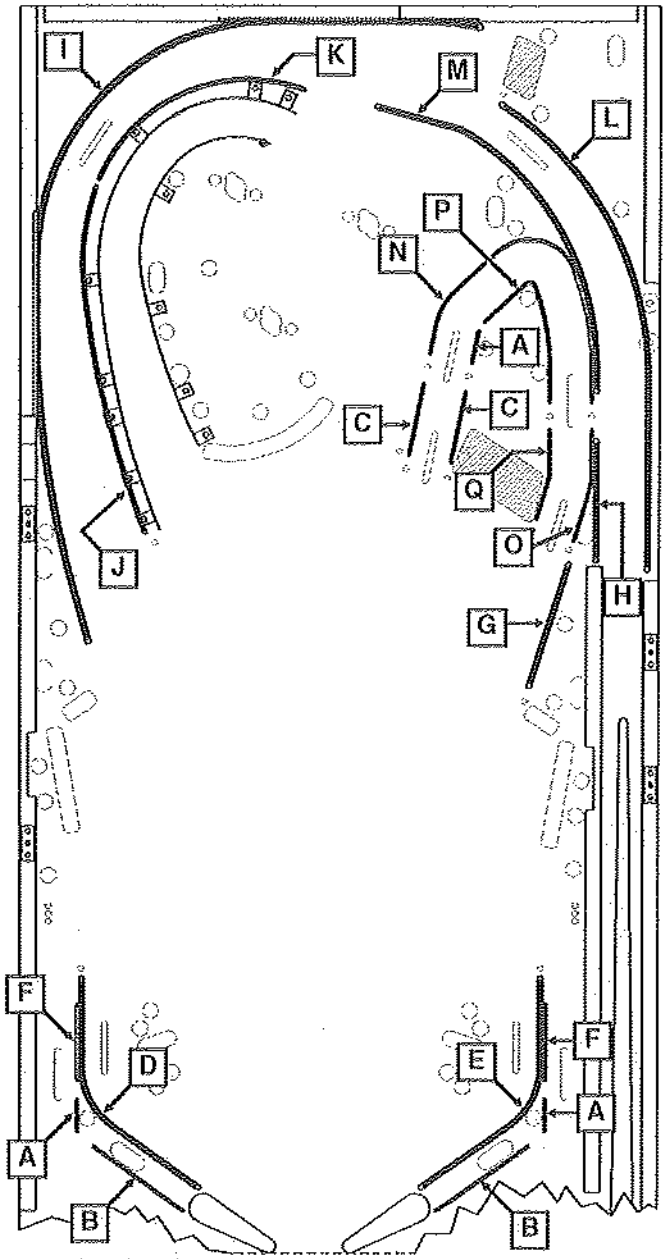
- -01 Portals Service Switch Bracket (Coin Door)
- -02 "Install 4 Balls"
- -03 Coin Door (Outside Front)
- -04 "Size Does Matter Logo" (Backpanel)
- -05 Godzilla Ramp Mouth Exit
- -06 Bottom Arch Left
- -07 Bottom Arch Center
- -08 Bottom Arch Right
- -09 Bottom Arch Shooter Lane Cover
- -10 Spinner (Front)
- -11 Spinner (Back)
- -12 Flipper Bat Right
- -13 Flipper Bat Left
- -14 "I" (on Red Stand-Up Target)
- -15 "A" (on Red Stand-Up Target)
- -16 "X" (on Red Stand-Up Target)
- -17 "I" (on Red Stand-Up Target)
- -18 "Combo" (on Green Stand-Up Target)
- -19 "Combo" (on Green Stand-Up Target)

D2*	Decal - 'Power'	820-6223-00
D3*	Decal - 'Protective Earth'	820-6224-00
D4*	Godzilla Diode Terminal Strip Desc. Decal	820-6221-40
D5*	Game Specific Backbox Fuse Loc.	820-6152-40
D6*	Warning ('fingers...') Motor Decal	820-6062-00

Nº	Generic Decal Names	SPI Part Nº
A*	Game Generic Backbox Fuse Loc.	820-6152-00
B*	*Fuse Lable (UL)*	820-6143-00
C*	*UL Listing Label*	820-6141-00
D*	*Danger Coin Door Label (UL)*	820-6140-00
E*	*Power Box Decal - USA*	820-6123-01
F*	*Power Box Decal* Supplement	820-6123-04
G*	*High Voltage Label (UL)*	820-6082-01
H*	*Suitable for Indoor Use Only (UL)*	820-6001-01

Playfield - Rails and Ball Guides †





Take Note:

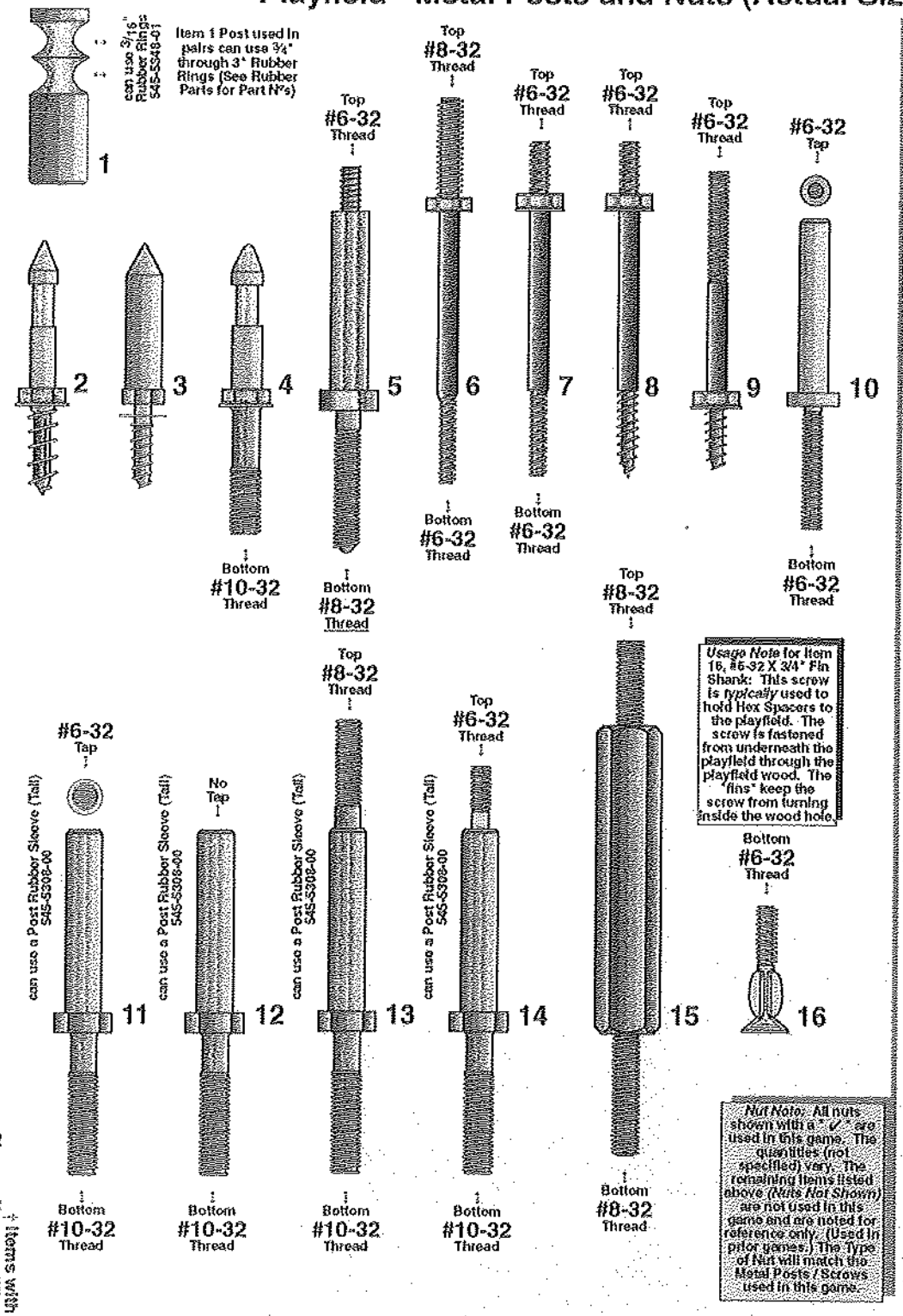
Legend Note: Items noted with a white square ☐ are mounted above the playfield.

№	Wood & Metal Rail (MR) Name	QTY.	SPI Part №
1	Wood Rail 22-1/2"	1	525-5007-41
2	Wood Rail 8-3/4"	1	525-5007-48
3	Wood Rail (Left Side Playfield)	1	525-5507-00
4	Wood Rail (Shooter Lane Left)	1	525-5509-00
	Items 1-4 secured by: #6 X 1-1/4" PFH A (Zinc) (Qty. 16) (237-5804-00)		
5	Metal Rail (Inner Lt. Orbit Left Side)	1	535-8436-00
6	Metal Rail (Inner Lt. Orbit Right Side)	1	535-8437-00
7	Metal Rail (Center Drain under Arch)	1	535-8393-00

№	Ball Guide Rail (BGR) Name	QTY.	SPI Part №
A	Wire Form 1"	3	535-5300-05
B	Wire Form 3-1/2"	2	535-5300-03
C	Wire Form 2-1/4"	2	535-5300-12
D	Ball Guide Rail - Left Return Lane	1	535-7560-00
E	Ball Guide Rail - Right Return Lane	1	535-7560-01
F	Ball Guide Rail - Outlane Fence	2	535-7595-00
G	Ball Guide Rail - 4"	1	535-6492-11
H	Ball Guide Rail - 3-3/4"	1	535-6492-14
I	Ball Guide Rail - Left Orbit Left	1	535-8354-00
J	Ball Guide Rail - Inner Lt. Orbit Bot.	1	535-8355-00
K	Ball Guide Rail - Inner Lt. Orbit Top	1	535-8356-00
L	Ball Guide Rail - Right Orbit Right	1	535-8359-00
M	Ball Guide Rail - Right Orbit Top Left	1	535-8360-00
N	Ball Guide Rail - Cap. Ball Top Outside	1	535-8362-00
O	Ball Guide Rail - Rt. Captive Ball Rt.	1	535-8363-00
P	Ball Guide Rail - Cap. Ball Top Inside	1	535-8364-00
Q	Ball Guide Rail - Rt. Captive Ball Left	1	535-8365-00

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

Playfield - Metal Posts and Nuts (Actual Size) †



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 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 ✓
• ⅜-16: 240-5315-00 ✓
• #2-56: 240-5301-00
• ⅞"-14: 240-5317-00

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

Top & Side Views

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: 240-5316-00

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

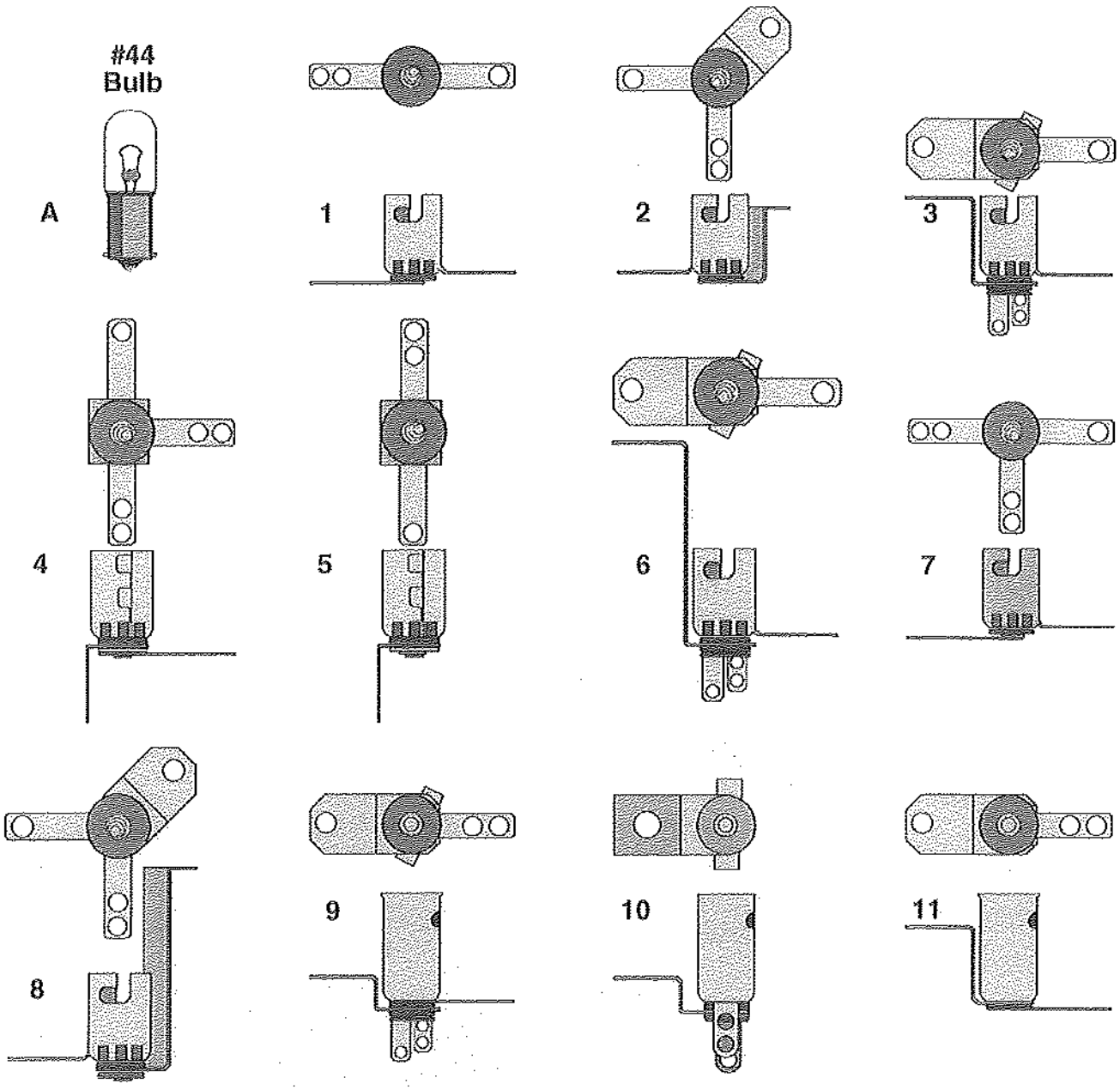
Miscellaneous Nuts *Not Shown:*

• Plastic Pal Nut (on Flipper Buttons): 240-5003-00
• Metal Pal Nut (on Flipper Buttons): 240-5003-01 ✓
• #6-32 Acorn Cap (White): 240-5000-00
• #6-32 Acorn Cap (Black): 240-5006-00
• #6-32 Wing Nut: 240-5001-00
• #8-32 Wing Nut: 240-5100-00
• ¼"-20 Wing Nut:

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

№	Metal Post Name	QTY.	SPI Part №	№	Metal Post Name	QTY.	SPI Part №
1	Stand-Off Double Groove Post 1 11/16"	0	530-5102-00	9	Post #6-32 Top / Wood Screw Bottom	0	530-5263-01
2	Mini-Post Wood Screw	4	530-5004-00	10	Post #6-32 Tap / #6-32 Bottom	0	530-5127-00
3	Mini-Post Wood Screw (no slot away)	0	530-5004-01	11	Post Hex Base #6-32 Tap/#10-32 Bot.	5	530-5332-01
4	Mini-Post Mach. Screw / #10-32 Bot.	5	530-5005-00	12	Post Hex Base (No Tap)/#10-32 Bot.	5	530-5332-00
5	Post Fasten #6-32 Top / #8-32 Bot.	0	530-5007-00	13	Post Hex Base #8-32 Top/#10-32 Bot.	0	530-5332-02
6	Post Fasten #8-32 Top / #6-32 Bot.	0	530-5008-00	14	Post Hex Base #6-32 Top/#10-32 Bot.	0	530-5332-03
7	Post Fasten #6-32 Top / #6-32 Bot.	30	530-5012-02	15	Playfield Support #6-32 Top/Bottom	0	530-5285-00
8	Post Fstn. #6-32 Top / Wood Scr. Bot.	10	530-5010-02	16	#6-32 X 3/4" Fin Shank Screw	4	237-5921-02

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



№	#44 Bulb & Socket Name	QTY.	SPI Part №
A	#44 Bulb	38	165-5000-44
1	2-Lug Staple Down Socket	0	077-5000-00
2	2-Lug Stand-Up Short Socket	0	077-5002-00
3	3-Lug Stand-Up Short Socket	0	077-5008-00
4	3-Lug Laydown Socket	0	077-5006-00
5	2-Lug Laydown Socket	2	077-5003-00
6	3-Lug Stand-Up Long Socket	0	077-5009-00
7	3-Lug Staple Down Socket	0	077-5001-00
8	2-Lug Stand-Up Long Socket	0	077-5005-00
9	3-Lug Stand-Up Long Shell Socket	2	077-5013-00
10	2-Lug Stand-Up Lg. Shell Socket (GI's)	34	077-5031-00
11	1-Lug Stand-Up Long Shell Socket	0	077-5012-00

№	#455 Bulb	QTY.	SPI Part №
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 1-10 Sockets on this page.

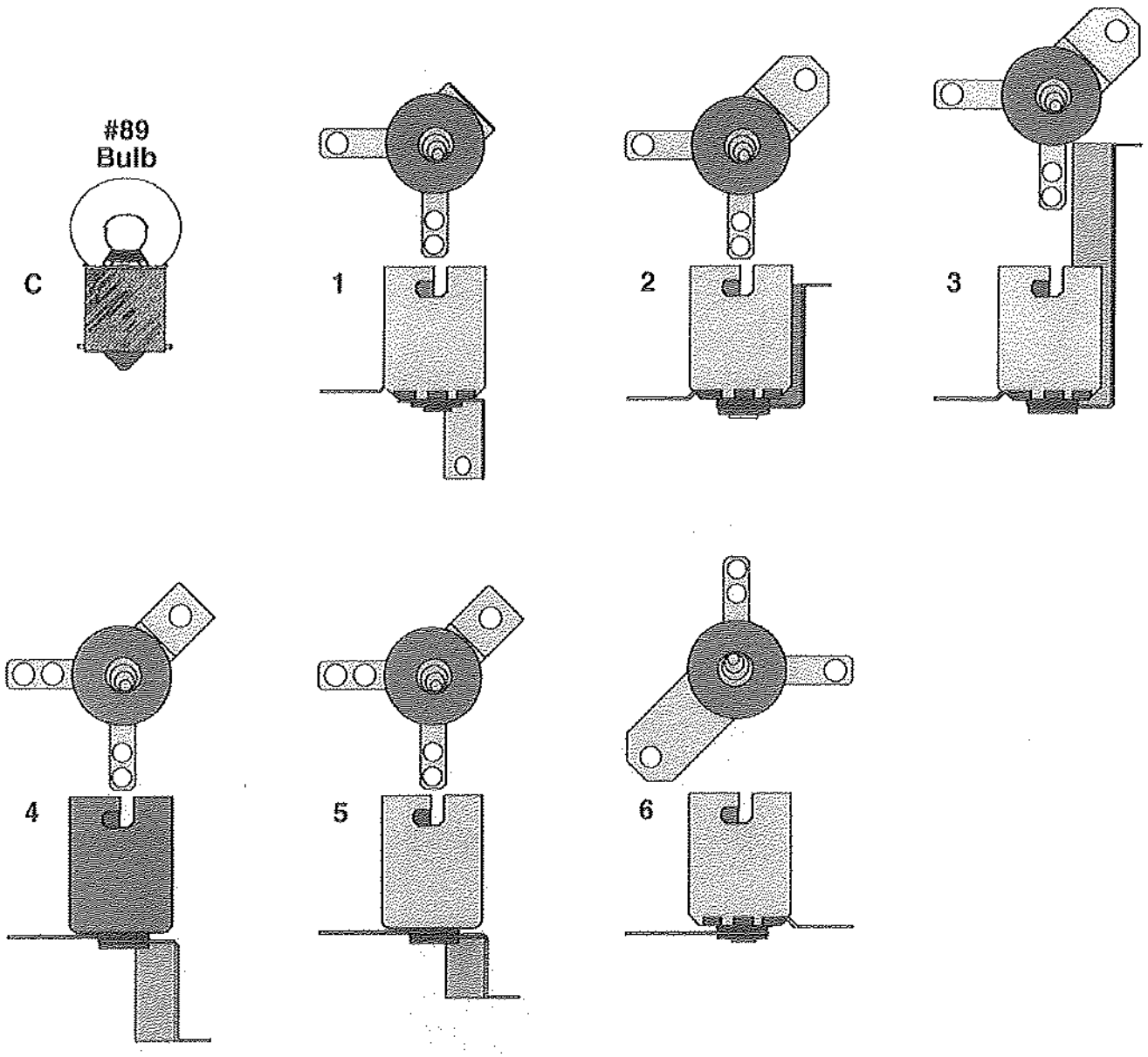
Note: Always replace with same type bulb in original application.

#455
Bulb

B

† 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) †

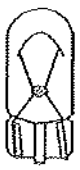


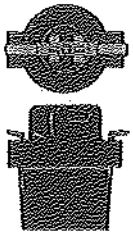
Nº	#89 Bulb & Socket Name	QTY.	SPI Part Nº
C	#89 Bulb	22	165-5000-89
1	Laydown Standard Socket	8	077-5100-00
2	2-Lug Stand-Up Short Socket	6	077-5101-00
3	2-Lug Stand-Up Long Socket	8	077-5102-00
4	Stand-Up Socket Rev. Short	0	077-5103-00
5	2-Lug Stand-Up Small Socket	0	077-5106-00
6	Straight Leg Socket	0	077-5107-00

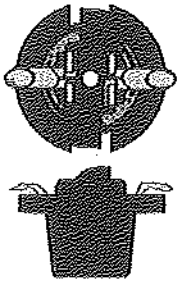
† Items with Ø Qty. are not used in this game. Size and/or quantities may change during production.

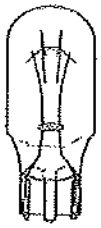
Playfield - Wedge Base Bulbs and Sockets (Actual Size) †

#555 Bulb

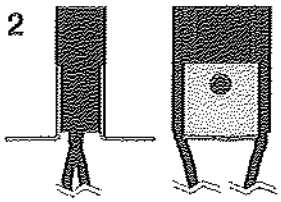
A 

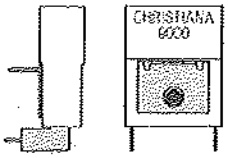
1 

8 

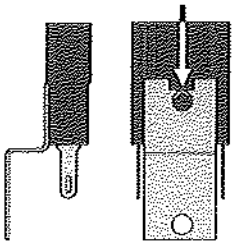
B 

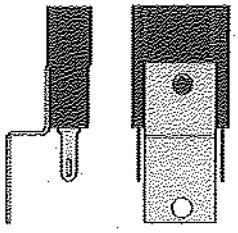
#906 Bulb

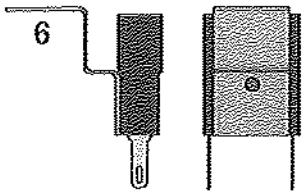
2 

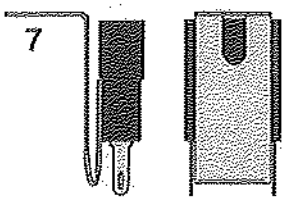
3 

Note the notch.

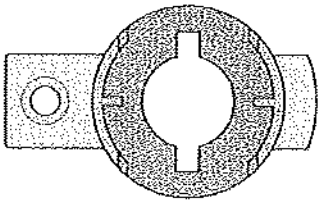
4 

5 

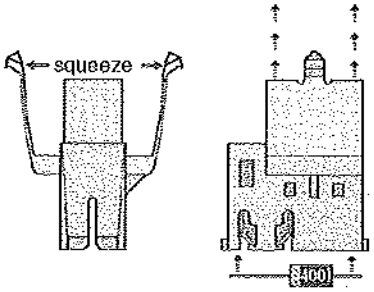
6 

7 

The below Snap-On Socket Bracket currently is available in two height sizes (item 9a is 5/16" High and item 9b is 19/32" High.)

9a 

5/16" 

9 

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

Take Special Note:

Item 9 Socket is the new Insulation Displacement Connection (IDC) Style. This new design is used in the same application as PC Light Boards, allowing for easier bulb replacement. This style is solderless, and has a built-in diode. This socket is secured to the playfield or component by Items 9a & 9b Snap-On Socket Brackets, or *may* also be snapped into Item 9c Socket Mounting Board (specially designed Clear Plastic piece) where sockets are positioned too close together. Just squeeze the "side arms" of the socket together and pull away from the bracket or mounting board for easy #555 Bulb replacement.

Nº	#555 Bulb & Socket Name	QTY.	SPI Part Nº
A	#555 Wedge Base Bulb	51	165-5002-00
1	#555 Wedge Base (WB) Socket	0	077-5007-00
2	Turbo Pop Bumper Socket	3	077-5206-00
3	PC Light Board Laydown WB Socket	0	077-5207-00
4	Laydown WB Socket (with notch)	0	077-5026-01
5	Laydown WB Socket (without notch)	0	077-5026-00
6	WB Offset Socket (Step Bracket)	0	077-5029-00
7	WB Offset Socket (use Item 6)	0	077-5029-01

Nº	#906 Bulb & Socket Name	QTY.	SPI Part Nº
B	#906 Wedge Base Bulb	0	165-5004-00
8	#906 Wedge Base Socket	0	077-5016-00

Nº	#555 IDC Socket Name	QTY.	SPI Part Nº
9	#555 IDC Snap-On Socket	48	077-5216-00
9a	5/16" Ht. Snap-On Socket Bracket	48	545-5760-18
9b *	19/32" Ht. Snap-On Socket Bracket	0	545-5760-19
9c *	Clear Plastic (Butyr.) Socket Mtg. Bd.	0	Not Used

Take Note:

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

1. Item 1 Socket was used on PC Light Boards to position bulbs vertically.
2. Item 2 Socket has 2 Wires attached are approximately 12" ea.
3. Item 3 Socket was used on PC Light Boards to position bulbs horizontally.
4. Item 4 Socket is normally used with Reflectors.
5. If Item 7 Socket is desired, order Item 6 for replacement. >>>Item 7 Socket is no longer available.<<<
6. Item 8 Bulb (#906) is normally used in conjunction with Item 8 Socket, but *can* be used with Items 1-7 Sockets on this page. *Note: Always replace with same type bulb in original application.*
7. Item 8 Socket is sometimes used in conjunction with Mini-Mars or special Plastic (Butyrate) assemblies.
8. See the start of this chapter for Fluor. Bulb & Associated Parts.

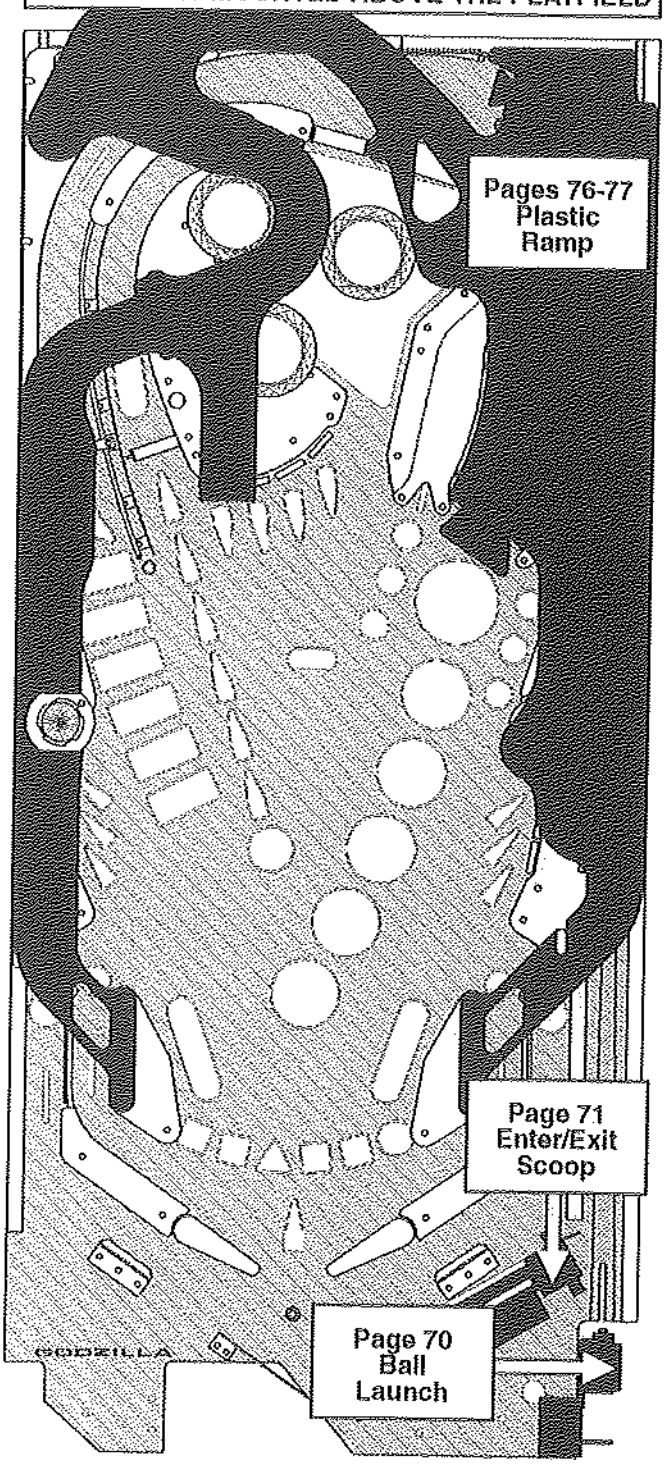
† Items with Ø Qty. are not used in this game. Size and/or quantities may change during production.

Drawings for Major Assemblies & Ramps (The Blue Pages)

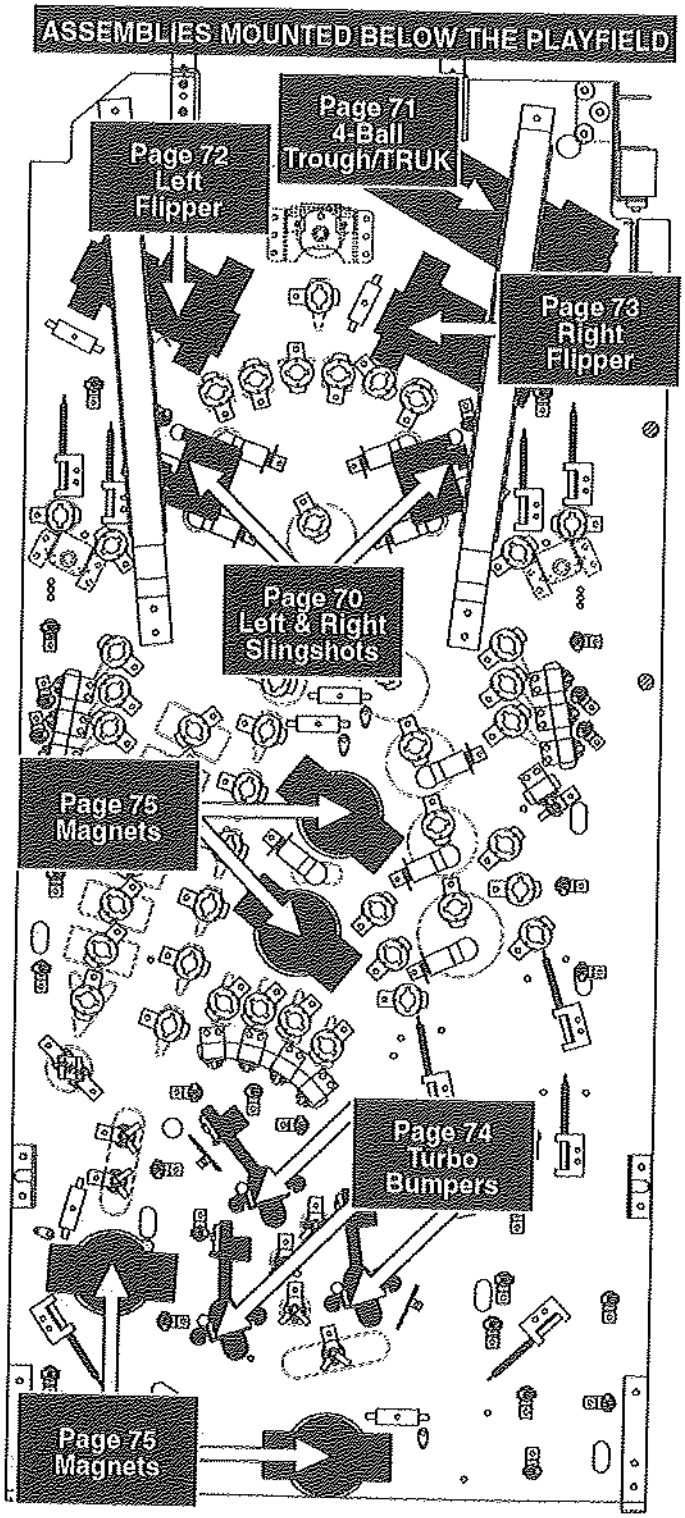
Overview

Drawings are provided for the Major Assemblies in this game with individual parts of each assembly numbered. Items noted with a white circle (①) are mounted above the playfield; items noted with a black circle (❶) are mounted below. All numbered parts describe the name, quantity & Part Nº. Associated Parts 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 (Auto) Launch Assembly, 500-5477-01 (Items 1-10)
and Associated Part: Shooter Lane Switch Assy., 500-5498-01 (Item 11*)

Take Note:

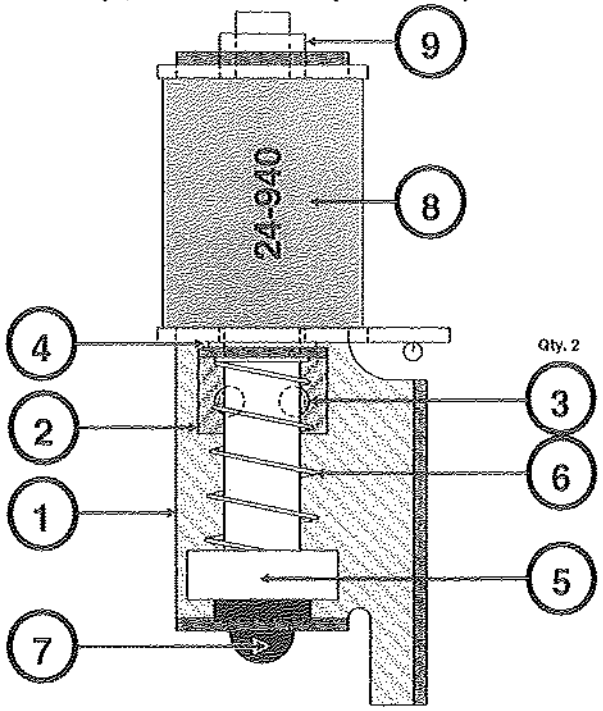
* An asterisk (*) indicates item is *Not Shown* in pictorial.

Nº	Individual Part Name	QTY.	SPI Part Nº
1	Coil Mounting Bracket	1	535-6385-00
2	Coil Retaining Bracket	1	535-5203-03
3	#8-32 X 1/4" PPH MS (SEMS)	2	232-5300-00
4	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
5	Plunger Assembly	1	515-5000-02
6	Compression (Relay) Spring	1	266-5020-00
7	Rubber Bumper (Grommet)	1	545-5105-00
8	Coil, 24-940	1	090-5036-00B
ORDERING ABOVE (ITEM 8) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at bottom)	1	112-5003-00
9	Coil Sleeve	1	545-5076-00
10*	Cable Wiring Harness	1	036-5390-16

Ball (Auto) Launch Assembly, 500-5477-01 is secured above the playfield by:
#8-32 X 7/8" HWH MS (Zinc) (Qty. 2) (237-5890-00), #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00) and #8-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 1) (237-5975-03)

ASSOCIATED PART IS NOT INCLUDED WITH THE ABOVE ASSEMBLY.

Nº	Associated Part Name	QTY.	SPI Part Nº
11*	Shooter Lane Switch Assembly	1	500-5498-01



Left & Right Slingshot Assemblies, 500-5849-00 (Qty. 2) (Items 1-13)
and Assoc. Part: 2-3/4" I.D. Black Rubber Ring (Qty. 1/per), 545-5348-20 (Item 14*)

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®	Riveted Arm & Tip Assembly	1	515-5340-01
ORDERING ABOVE ® RIVETED ASSY. PART Nº WILL INCLUDE:			
2A	Arm	1	515-5341-01
2B	Kicker Tip	1	545-5216-01
2C	Rivet, 1/8" ø x 1/4" Lg.	1	249-5003-00
3	Plunger & Link Assembly	1	515-5338-00
ORDERING ABOVE (ITEM 3) SUB-ASSY. PART Nº WILL INCLUDE:			
3A	Plunger 2" Lg.	1	530-5025-01
3B	Plunger Link	1	545-5293-00
3C	Roll Pin 1/8" ø x 5/8" Lg.	1	251-5008-00
4	Compression Spring	1	266-5020-00
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	1	545-5031-00
7	Coil Retaining Bracket	1	535-5203-03
8	#8-32 X 1/4" PPH MS (SEMS)	2	232-5300-00
9	Slingshot Stack (Blade) Switch	2	180-5054-00
10	Switch Body Protect Plate	2	535-5045-00
11	Switch Diode, 1N4001	2	112-5001-00
12	#6-32 X 5/8" HWH SWAGE	4	237-5976-04
13	Retaining Ring, 1/4" ø Shaft	2	270-5002-00

Slingshot Assemblies (Qty. 2), 500-5849-01 are secured below the playfield by:
#8 X 1/2" HWH AB (Zinc) Blue (Qty. 3/per) (234-5101-05)

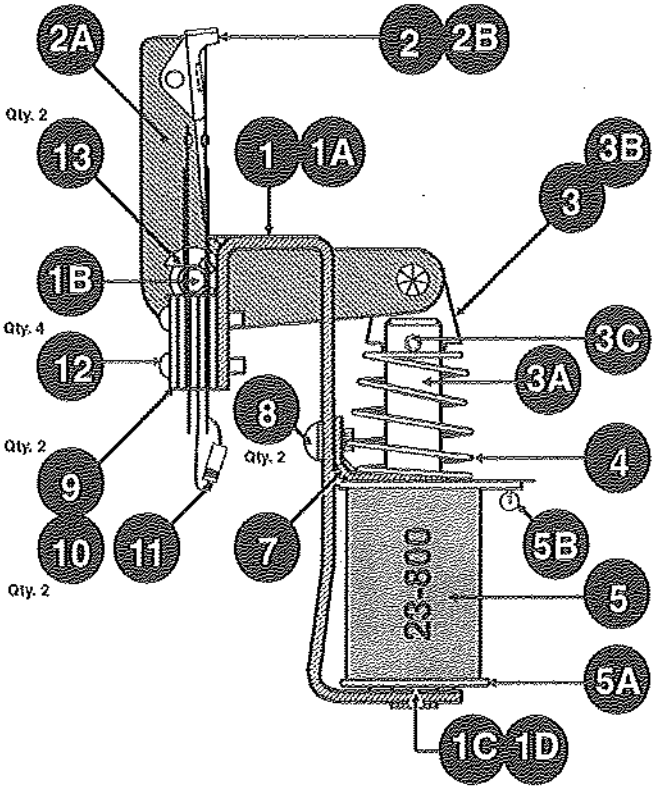
ASSOCIATED PART IS NOT INCLUDED WITH THE ABOVE ASSEMBLY.

Nº	Associated Part Name	QTY.	SPI Part Nº
14*	2-3/4" I.D. Black Rubber Ring (1 per)	2	545-5348-20

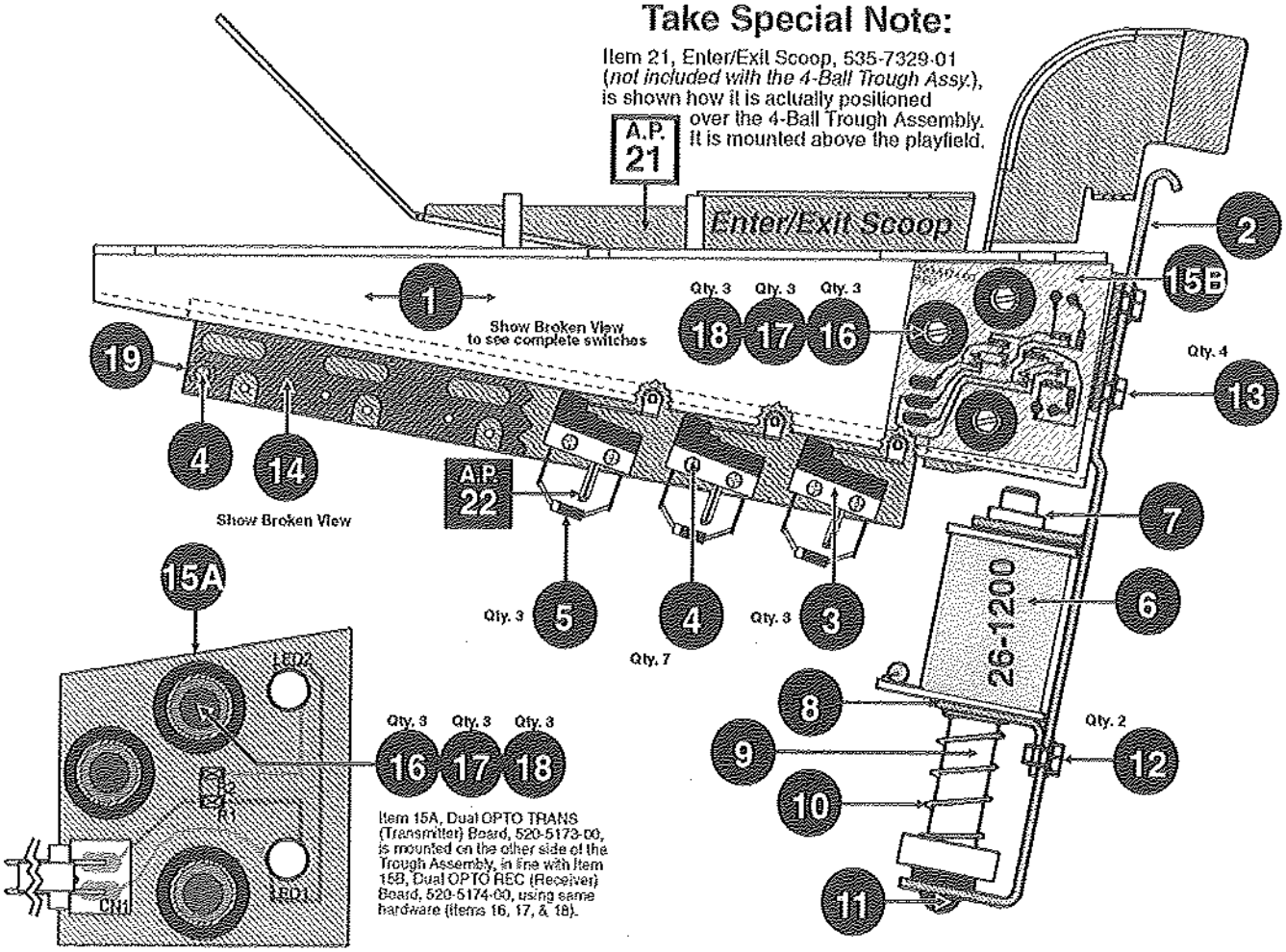
Take Note:

* 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.



4-Ball Trough Assembly, 500-6318-24 (Items 1-20)
and Associated Part: Ball Trough Enter/Exit Scoop, 535-7329-01 (Item 21)



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	Coil Mounting Bracket	1	535-7330-01
3	Micro-Switch (Roller Actuator)	3	180-5119-00
4	#2-56 X 1/2" HWH (Ser) TF 3/16" Hd.	7	237-5937-01
5	Switch Diode, IN4001	3	112-5001-00
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	1	545-5076-00
8	Coil Retaining Bracket	1	535-5203-03
9	Plunger Assembly	1	515-5941-01
10	Compression Spring	1	266-5020-00
11	Rubber Bumper (Grommet)	1	545-5105-00
12	#8-32 X 1/4" HWH (Serr) Zinc TF	2	237-5964-00
13	#8-32 X 3/8" HWH Swage (Serr) Zinc	4	237-5975-00
14	Trough Ball Guide Plate	1	535-7801-00

№	Individual Part Name	QTY.	SPI Part №
15A	Dual OPTO Transmitter (TRANS) Bd.	1	520-5173-00
15B	Dual OPTO Receiver (REC) Board	1	520-5174-00
16	OPTO PCB Tube Spacer (Brass)	6	530-5308-02
17	OPTO PCB Rubber Grommet	6	545-5518-00
18	#6-32 X 5/8" HWH Swage (Serr) Zinc	6	237-5976-04
19	1/4" X 5/16" X .144" I.D. Spacer Tap.	1	254-5014-03
20*	Cable Wiring Harness	1	036-5399-04

4-Ball Trough Assy., 500-6318-24 is secured below the playfield by:
#8 X 1/2" HWH AB (Zinc) Blue (Qty. 5) (234-5101-05)

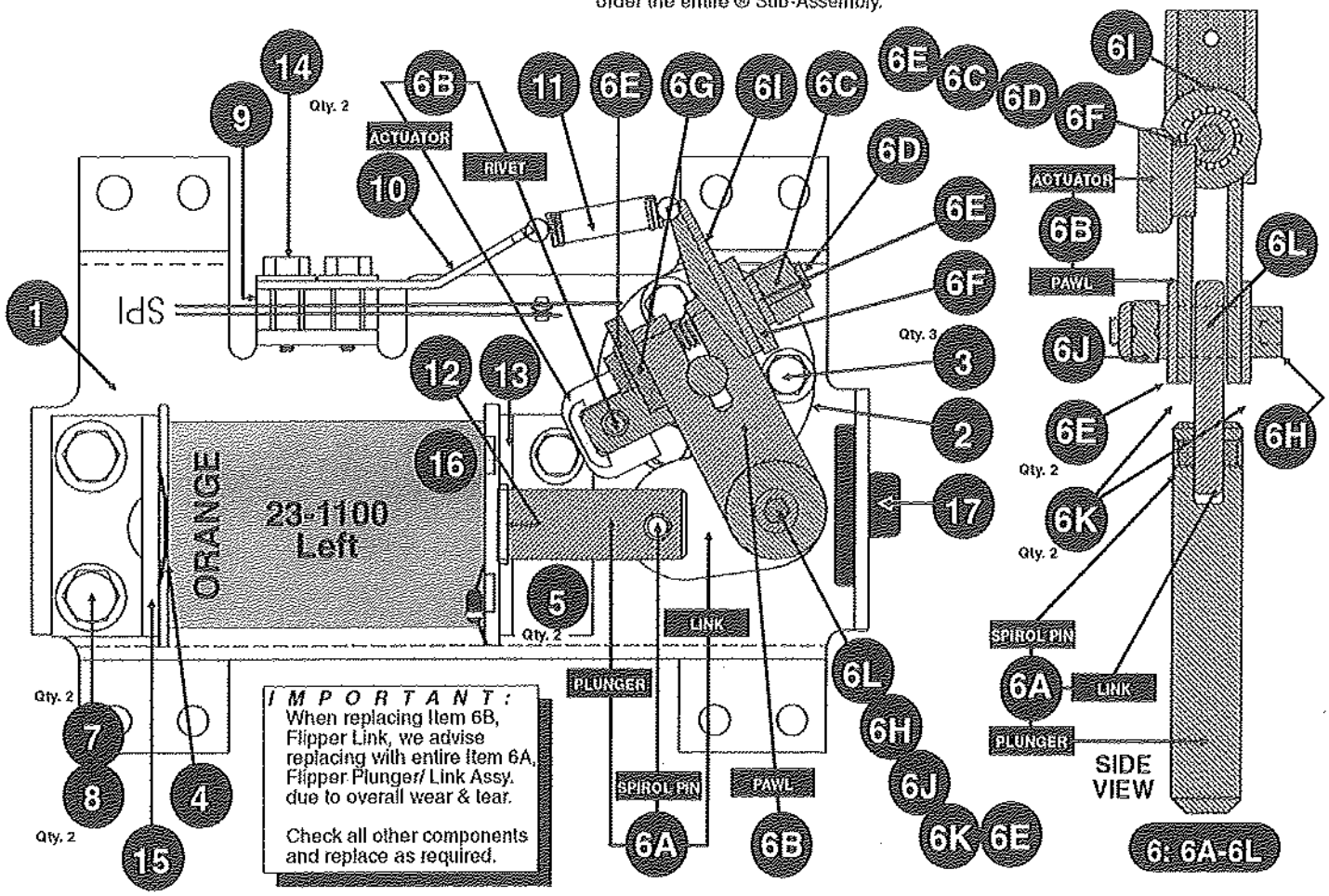
ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.

№	Associated Part Name	QTY.	SPI Part №
21	Ball Trough Enter / Exit Scoop	1	535-7329-01
Item 21 secured to the playfield by: #8 X 1/2" HWH AB (Zinc) Blue (Qty. 4) (234-5101-05).			
22	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, 500-5944-14 (Items 1-17)
and Associated Part: Flipper Bat & Shaft Assy., 515-6532-08-05 (Item 18*)

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.



IMPORTANT:
When replacing Item 6B, Flipper Link, we advise replacing with entire Item 6A, Flipper Plunger/ Link Assy. due to overall wear & tear.

Check all other components and replace as required.

Nº	Individual Part Name	QTY.	SPI Part Nº
1	Flipper Base Plate Kit (Left)	1	515-6617-01
ORDERING ABOVE (ITEM 1) SUB-ASSY. PART Nº WILL INCLUDE:			
—	Flipper Base Plate (Left) already threaded with all necessary Thread Forming Screws (Items 3, 5, 7 & 15)		
2	Flipper Bushing	1	545-5594-00
3	#6-32 X 3/8" HWH Swage (Serr) Zinc	3	237-5976-02
4	Spring Washer	1	269-5002-00
5	#8-32 X 3/8" HWH Swage (Serr) Zinc	2	237-5975-00
6	Plunger, Link & Pawl (Left) Sub-Assy.	1	515-6518-01
ORDERING ABOVE (ITEM 6) SUB-ASSY. PART Nº WILL INCLUDE:			
6A	**Flipper Plunger/Link Sub-Assy.**	1	**515-6304-01**
Includes :	*Flipper Link*	*1*	*545-5611-00*
Includes :	*Spirol Pin ø 5/32" X 7/16" Lg.*	*1*	*251-5015-01*
Includes :	*Flipper Plunger with "Flat"*	*1*	*530-5349-01*
® 6B	**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*
6C	#10-32 X 9/32" Long 3/8" Hex Nut	1	240-5209-00
6D	#10-32 SOC HD X 1.25" Lg.	1	237-5950-01
6E	#10 Star Washer	3	246-5002-00
6F	Wshr. .203"ID X .63"OD X .105" THK	1	242-5039-00
6G	Washer (same as 6F but w/angle cut)	1	242-5039-01
6H	#10-32 X 7/8" Lg. SOC HD	1	237-5966-00
6I	Return Bracket	1	535-7353-00
6J	#10-32 Nylon Stop Nut	1	240-5203-00
6K	Wshr. .203"ID X .63"OD X .062" THK	2	242-5038-00
6L	Flipper Bushing (Extended)	1	530-5139-01

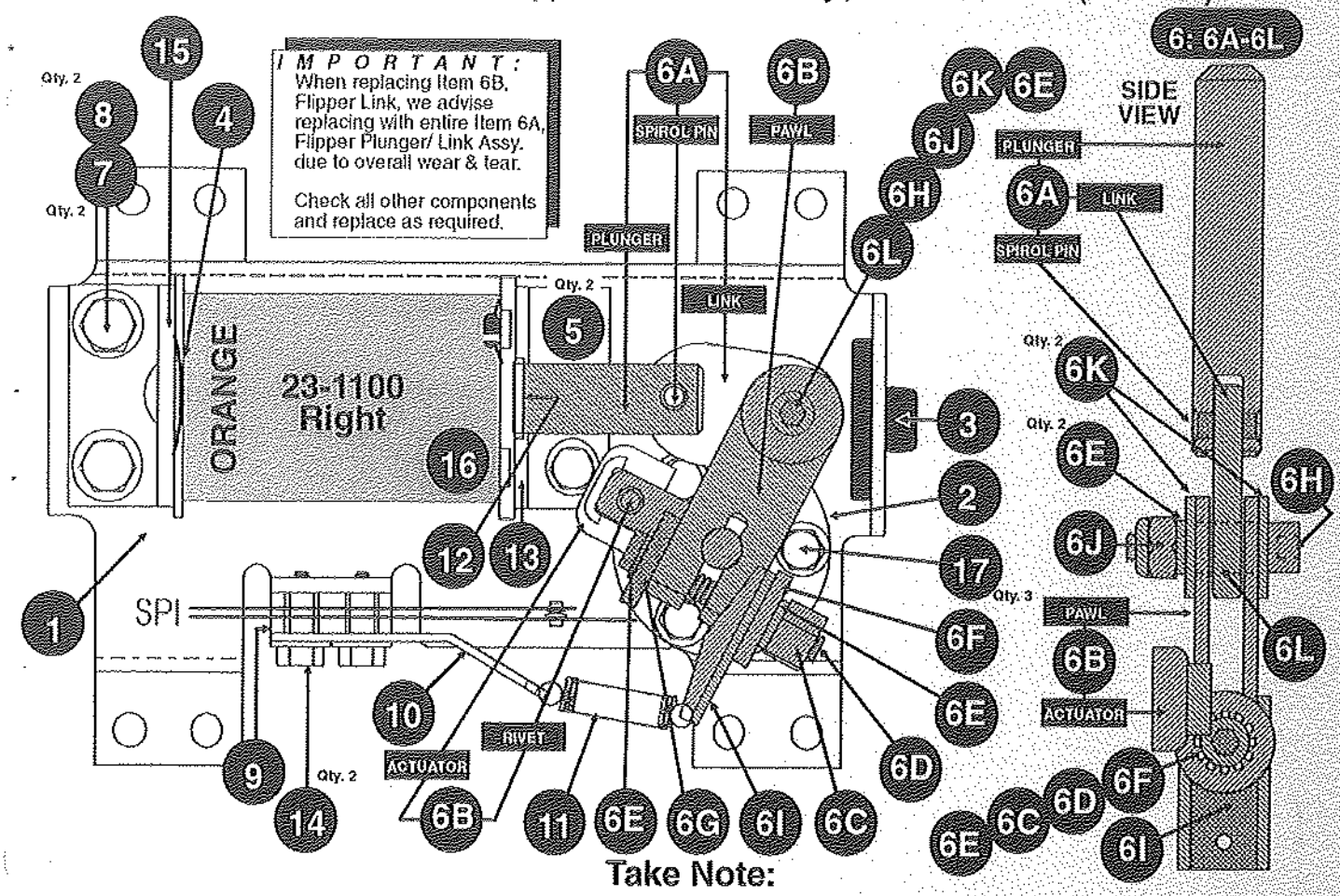
Nº	Individual Part Name	QTY.	SPI Part Nº
7	#10-32 X 3/8" SHWH Swage (Sr) Zn.	2	237-5985-00
8	#10 Split Lock Washer	2	244-5003-00
9	Power (End of Stroke) Switch	1	180-5149-00
10	Switch Plate/Spring Return Lt. Brkt.	1	535-7354-01
11	Flipper Return Spring	1	265-5035-00
12	Coil Sleeve	1	545-5388-00
13	Coil Support Bracket	1	535-7356-00
14	#6-32 X 5/8" HWH Swage (Serr) Zinc	2	237-5976-04
15	Coil Stop Sub-Assembly	1	515-6308-01
ORDERING ABOVE (ITEM 15) SUB-ASSY. PART Nº WILL INCLUDE:			
15A	Coil Stop with with .093" ø Hole	1	530-5350-01
15B	Shading Ring	1	530-5123-00
15C	Coil Stop Bracket	1	535-7355-00
16	Coil, 23-1100 (ORG) (Left)	1	090-5030-00T
ORDERING ABOVE (ITEM 16) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
17	Deflector Pad (Bumper)	1	545-5428-00

Flipper (Left) Assembly, 500-5944-14 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
18*	Flip. Bat & Shaft Assy. (WHT, Knurled-End) with SEGA SATURN® LOGO	1	515-6532-08-05
n/a*	Large Flipper **BLACK** Rubber Ring	1	545-5277-00

Flipper (Right) Assembly, 500-5944-04 (Items 1-17)
and Associated Part: Flipper Bat & Shaft Assy., 515-6532-08-05 (Item 18*)



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 (Right)	1	515-6617-00
ORDERING ABOVE (ITEM 1) SUB-ASSY. PART Nº WILL INCLUDE:			
—	Flipper Base Plate (Right) already threaded with all necessary Thread Forming Screws (Items 3, 5, 7 & 15)		
2	Flipper Bushing	1	545-5594-00
3	#6-32 X 3/8" HWH Swage (Serr) Zinc	3	237-5976-02
4	Spring Washer	1	269-5002-00
5	#8-32 X 3/8" HWH Swage (Serr) Zinc	2	237-5975-00
6	Plunger, Link & Pawl (Rt.) Sub-Assy.	1	515-6518-00
ORDERING ABOVE (ITEM 6) SUB-ASSY. PART Nº WILL INCLUDE:			
6A	Flipper Plunger/Link Sub-Assy.	1	515-6304-01
includes:	*Flipper Link*	*1*	*545-5611-00*
includes:	*Spirol Pin ø 5/32" X 7/16" Lg.*	*1*	*251-5015-01*
includes:	*Flipper Plunger with "Flat"*	*1*	*530-5349-01*
® 6B	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*
6C	#10-32 X 9/32" Long 3/8" Hex Nut	1	240-5209-00
6D	#10-32 SOC HD X 1.25" Lg.	1	237-5950-01
6E	#10 Star Washer	3	246-5002-00
6F	Wshr. .203"ID X .63"OD X .105" THK	1	242-5039-00
6G	Washer (same as 6F but w/angle cut)	1	242-5039-01
6H	#10-32 X 7/8" Lg. SOC HD	1	237-5966-00
6I	Return Bracket	1	535-7353-00
6J	#10-32 Nylon Stop Nut	1	240-5203-00
6K	Wshr. .203"ID X .63"OD X .062" THK	2	242-5038-00
6L	Flipper Bushing (Extended)	1	530-5139-01

Nº	Individual Part Name	QTY.	SPI Part Nº
7	#10-32 X 3/8" SHWH Swage (Sr) Zn.	2	237-5985-00
8	#10 Split Lock Washer	2	244-5003-00
9	Power (End of Stroke) Switch	1	180-5149-00
10	Switch Plate/Spring Return Rt. Brkt.	1	535-7354-00
11	Flipper Return Spring	1	265-5035-00
12	Coil Sleeve	1	545-5388-00
13	Coil Support Bracket	1	535-7356-00
14	#6-32 X 5/8" HWH Swage (Serr) Zinc	2	237-5976-04
15	Coil Stop Sub-Assembly	1	515-6308-01
ORDERING ABOVE (ITEM 15) SUB-ASSY. PART Nº WILL INCLUDE:			
15A	Coil Stop with with .093" ø Hole	1	530-5350-01
15B	Shading Ring	1	530-5123-00
15C	Coil Stop Bracket	1	535-7355-00
16	Coil, 23-1100 (ORG) (Right)	1	090-5030-00T
ORDERING ABOVE (ITEM 16) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
17	Deflector Pad (Bumper)	1	545-5428-00

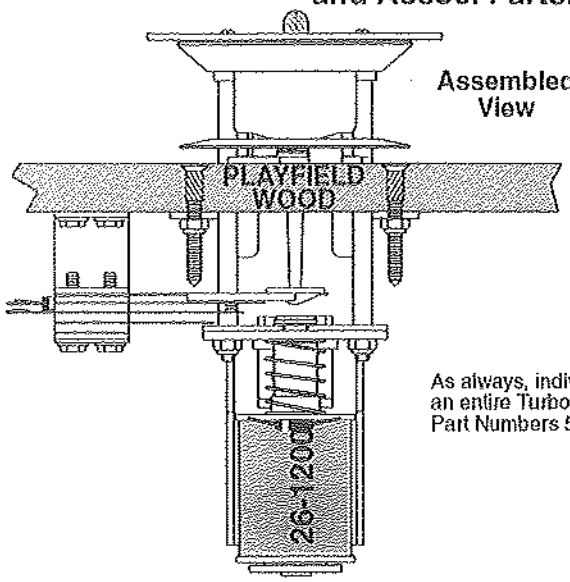
Flipper (Right) Assembly, 500-5944-02 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00)

ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY

Nº	Associated Part Name	QTY.	SPI Part Nº
18*	Flip. Bat & Shaft Assy. (WHT, Knurled-End) with SEGA SATURN® LOGO	1	515-6532-08-05
n/a*	Large Flipper **BLACK** Rubber Ring	1	545-5277-00

Turbo Bumper Top Assy., 515-6459-05 (Qty. 3) (Items 1-10A), Turbo Bumper Bottom Assy., 515-6459-04 (Qty. 3) (Items 10B-19), Turbo Bumper Switch Assy., 515-6459-03 (Qty. 3) (Items 20-25)

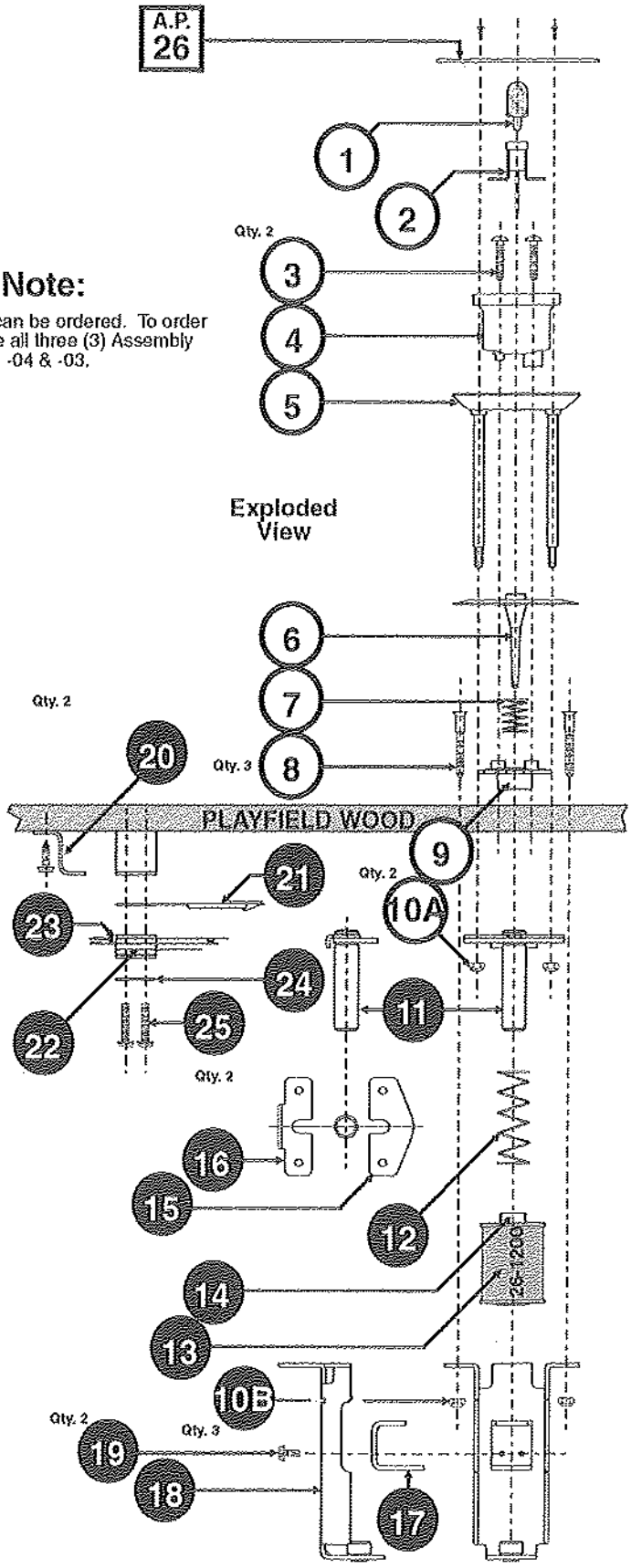
and Assoc. Parts: See Table Below (Items 26-27)



Assembled View

Take Note:

As always, individual parts can be ordered. To order an entire Turbo Bumper, use all three (3) Assembly Part Numbers 515-6459-05, -04 & -03.



Exploded View

Nº	Individual Part Name	QTY.	SPI Part Nº
Turbo Bumper Top Assy., 515-6459-05 (Items 1-10A)			
1	#555 Wedge Base Bulb	1	165-5002-00
2	#555 Wedge Base Socket	1	077-5206-00
3	#5 X 7/8" PRH AB (Zinc)	2	237-5826-00
4	Bumper Body	1	545-5197-00
5	Ring Assembly	1	515-5085-00
6	Bumper Skirt	1	545-5607-00
7	Bumper Skirt Spring (Zinc Yellow)	1	266-5048-01
8	#6-32 X 1-3/16" Spiral Fin Shank	3	237-5957-00
9	Bumper Base	1	545-5195-00
10A	#6-32 Nylon Stop Nut	2	240-5005-00
Turbo Bumper Bottom Assy., 515-6459-04 (Items 10B-19)			
10B	#6-32 Nylon Stop Nut	3	240-5005-00
11	Plunger	1	530-5348-00
12	Coil Spring	1	266-5047-00
13	Coil, 26-1200	1	090-5044-00T
ORDERING ABOVE (ITEM 13) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
14	Coil Sleeve	1	545-5031-00
15	Fiber Yoke	1	545-5609-00
16	Metal Yoke	1	535-7346-00
17	Metal Yoke Stop	1	535-7347-00
18	Coil Bracket Welded Assembly	1	515-5939-00
19	#6-32 X 1/4" HWH Swage (Serr) Zinc	2	237-5976-01
Turbo Bumper Switch Assy., 515-6459-03 (Items 20-25)			
20	Switch Bracket	1	535-7342-00
21	Spoon Switch Actuator	1	545-5610-01
22	Turbo Bumper Stack (Blade) Switch	1	180-5015-03
23	Switch Diode, 1N4001	1	112-5001-00
24	Switch Body Protect Plate	1	535-7344-00
25	#6-32 X 3/4" HWH Swage (Serr) Zinc	2	237-5976-05

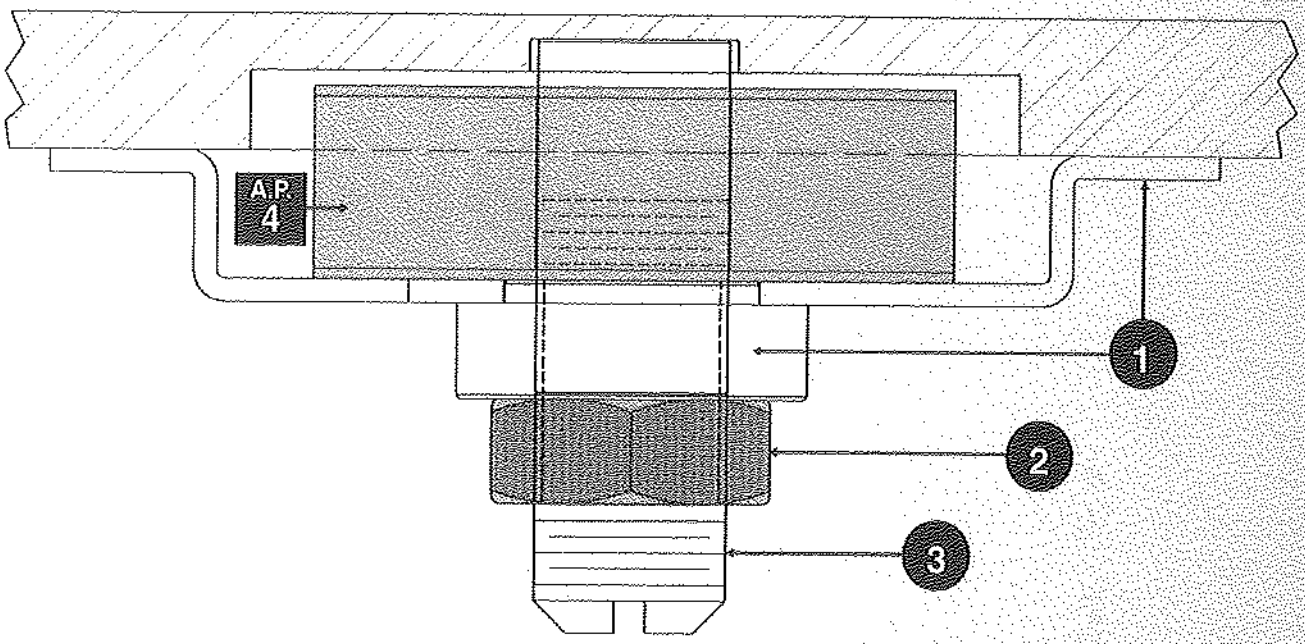
The Top & Bottom Assemblies are secured together by hardware included in assemblies.
Item 20 is secured by: #8 X 1/2" HWH AB (Zinc) Blue (Qty. 2/per) (234-5101-05)

ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLY.

Nº	Associated Part Name	QTY.	SPI Part Nº
26	Plastic Pop Cap (Blue)	3	550-5057-05

Item 26 is secured to Item 5 by: #4 X 3/4" PRH (Zinc) (Qty. 2/per) (237-5873-00)

Threaded Bushing Core Assembly (New), 515-6142-01 (Qty. 4) (Items 1-3)
and Associated Part: Magnet Coil (22-650), 090-5042-01 (Qty. 4) (Item 4)



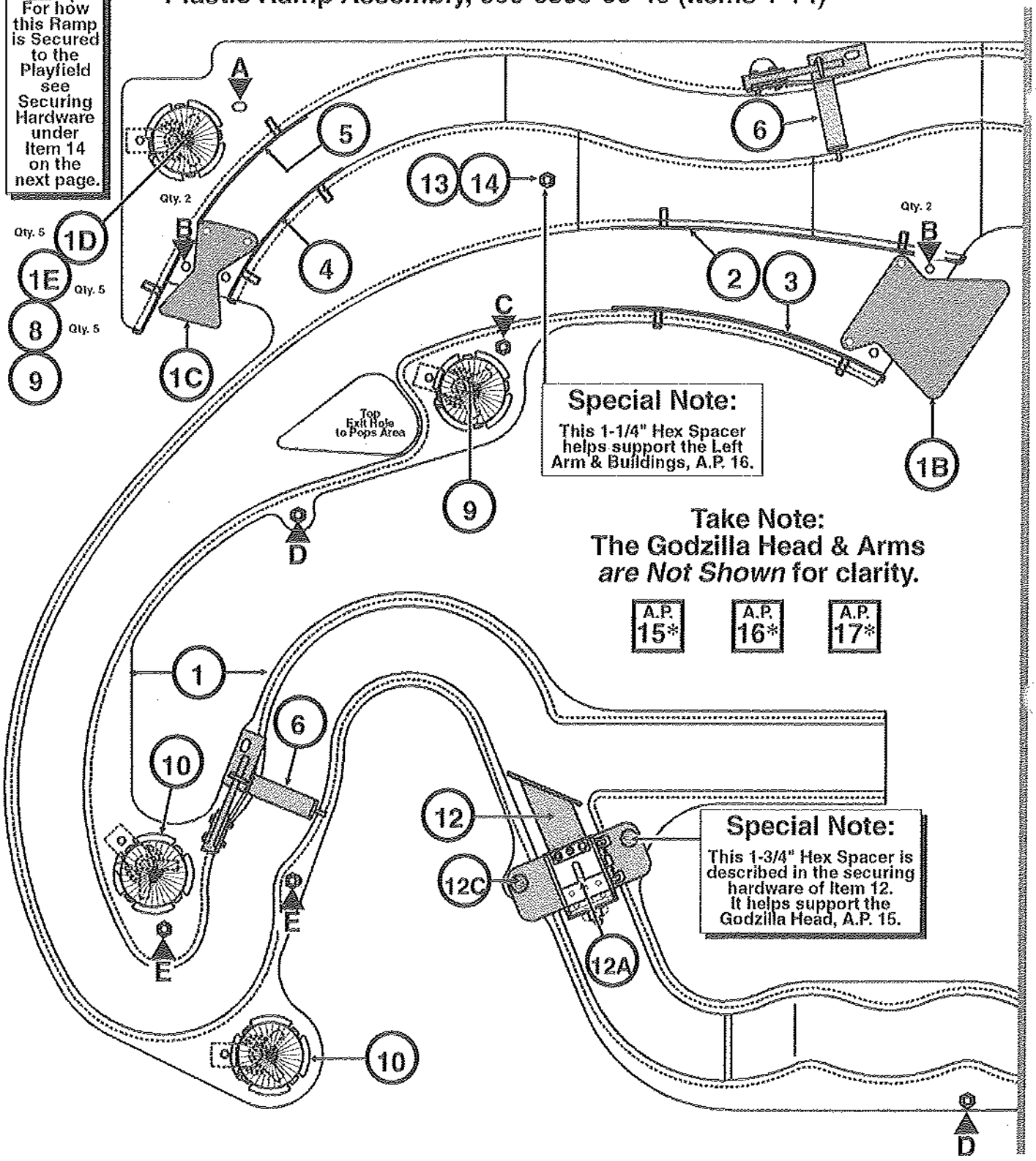
ASSOCIATED PART IS NOT INCLUDED WITH THE ABOVE ASSEMBLY.

Nº	Individual Part Name	QTY.	SPI Part Nº
1	Threaded Bushing Weld Assy. New	1	515-6141-01
2	Threaded Core Plug	1	530-5320-00
3	3/4"-16 Hex Nut	1	240-5315-00

Nº	Associated Part Name	QTY.	SPI Part Nº
4	Magnet Coil, 22-650 (12' Leads) (1/per)	4	090-5042-01

Both Thr. Bushing Weld Assemblies, 515-6141-00 are secured under the playfield by: #8 X 1/2 HWH AB (Zinc) Blue (Qty. 4/per) (234-5101-05)

Plastic Ramp Assembly, 500-6308-00-40 (Items 1-14)



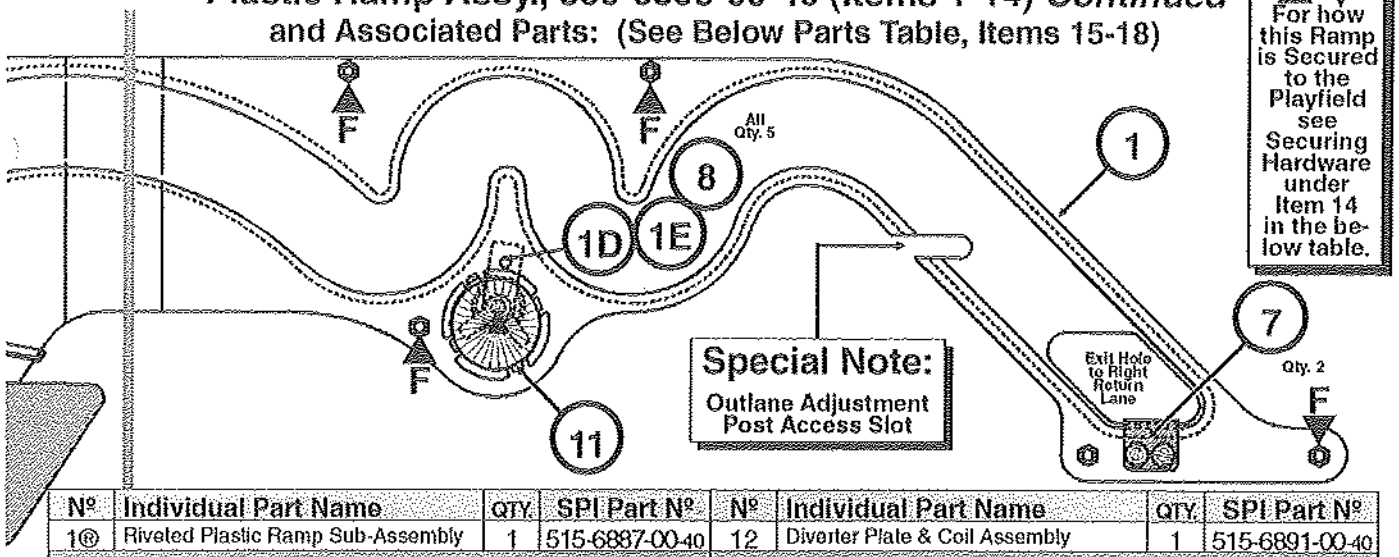
Take Note:

* 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.

Plastic Ramp Assy., 500-6308-00-40 (Items 1-14) *Continued*
and Associated Parts: (See Below Parts Table, Items 15-18)

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



Nº	Individual Part Name	QTY.	SPI Part Nº
1®	Riveted Plastic Ramp Sub-Assembly	1	515-6887-00-40
ORDERING ABOVE RIVETED ASSEMBLY PART Nº WILL INCLUDE:			
1A	Green Plastic Ramp (Plain, no parts)	1	545-5880-00
1B	Ramp Flap (Large) (Godzilla Entry)	1	535-8373-00
1C	Ramp Flap (Small) (Left Orbit Entry)	1	535-8372-01
1D	2-Lug Stand-Up Short Socket	5	077-5101-00
1E	Rivet, 1/8" ø X 3/16" Lg.	9	249-5001-00
1F	#6 Lock Washer (Riveting)	9	246-5000-00

Items 1E & 1F secure Items 1B, 1C & 1D to 1A (1B & 1C use Qty. 2/per).

2	Large Ramp Entry Protect (Rt. Side)	1	535-8378-02
3	Large Ramp Entry Protect (Lt. Side)	1	535-8379-01
4	Small Ramp Entry Protect (Rt. Side)	1	535-8376-01
5	Small Ramp Entry Protect (Lt. Side)	1	535-8377-01

Items 2-5 secured by: #6-32 Nylon Stop Nut (Qty. 2/per) (240-5005-00)

6	Roll-Under Gate Assembly	2	515-6490-04
ORDERING ABOVE (ITEM 6) SUB-ASSY. PART Nº WILL INCLUDE:			
6A	Gate Mounting Bracket	1	535-7613-02
6B	Wire Form	1	535-7755-02
6C	Micro-Switch for the Gate	1	180-5087-00
6D	Diode, 1N4001	1	112-5001-00
6E	#2-56 X 3/8" HWH MS (Sem) TF ø3/16" Hd.	2	237-5938-01

Item 6 secured by: #6-32 X 1/2 PPH MS Sems (Zinc) (Qty. 2/per) (232-5202-00) and #6-32 Nylon Stop Nut (Qty. 2/per) (240-5005-00)

7	Ramp Exit Hole Protect Bracket	2	535-8167-01

Item 7 secured by: #6-32 X 1/2 PPH MS Sems (Zinc) (Qty. 2/per) (232-5202-00) and #6-32 Nylon Stop Nut (Qty. 2/per) (240-5005-00)

8	#89 Bulb	5	165-5000-89
9	Mini-Mars Light Cover Snap-In Red	2	550-5030-02
10	Mini-Mars Light Cover Snap-In Yellow	2	550-5030-06
11	Mini-Mars Light Cover Snap-In Green	1	550-5030-04

Nº	Individual Part Name	QTY.	SPI Part Nº
12	Diverter Plate & Coil Assembly	1	515-6891-00-40
ORDERING ABOVE (ITEM 12) SUB-ASSY. PART Nº WILL INCLUDE:			
12A	Coil & Bracket Sub-Assembly	1	515-6595-00
	Item 12A Includes:		
	32-1800 Coil	*1*	*090-5031-00*
	Return Spring	*1*	*265-5024-00*
12B	Diverter Coil Mounting Plate	1	535-8390-00
12C	#8-32 X 3/8" PPH MS (Sems) Zinc	1	232-5301-00

Item 12 secured by: #6-32 X 1/2 PPH MS Sems (Zinc) (Qty. 2/per) (232-5202-00), #6-32 Nylon Stop Nut (Qty. 2/per) (240-5005-00) and 1-3/4" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-10).
Note: The Godzilla Head (A.P. 15) is secured onto this 1-3/4" Hex Spacer and secured with #6-32 X 3/8" PPH MS Sems (Zinc) (Qty. 1) (232-5201-00), #6 Washer (Qty. 1) (242-5001-00)

13	1-1/4" X 1/4" Hex Spacer #6-32 Tap	1	254-5008-11
14	#6-32 X 3/8" PPH MS Sems (Zinc)	1	232-5201-00

Plastic Ramp Assembly, 500-6308-00-40 is secured onto the playfield by:

A▼ 3-1/2" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-27) at playfield with #6-32 X 3/4" Fin Shank Screw (Qty. 1) (237-5921-02) and at the Ramp with #6-32 X 3/8" PPH MS Sems (Zinc) (Qty. 1) (232-5201-00), #6 Washer (Qty. 1) (242-5001-00)

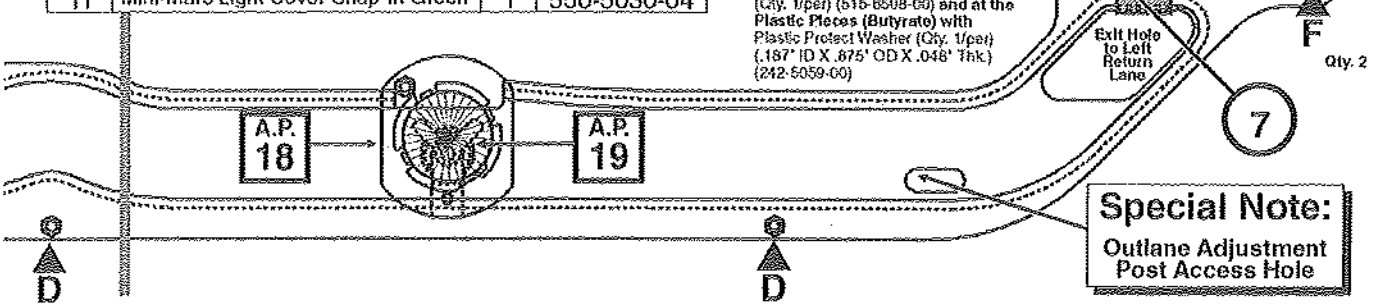
B▼ 4 X 5/8" PFH (Black) Screw (Qty. 2/per) (237-5833-00) at the Ramp Flaps.

C▼ 2-1/4" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-18), #6-32 X 3/8" PPH MS Sems (Zinc) (Qty. 1) (232-5201-00) and #6 Washer (Qty. 1) (242-5001-00)

D▲ 3-1/4" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-26), #6-32 X 3/8" PPH MS Sems (Zinc) (Qty. 1) (232-5201-00) and #6 Washer (Qty. 1) (242-5001-00) and at the Wood Rails with Ramp Mounting Bracket (Qty. 1/per) (515-6508-00)

E▲ 5-1/4" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-35) at playfield with #6-32 X 3/4" Fin Shank Screw (Qty. 1) (237-5921-02) and at the Ramp with #6-32 X 3/8" PPH MS Sems (Zinc) (Qty. 1) (232-5201-00), #6 Washer (Qty. 1) (242-5001-00)

F▲ 1-1/2" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-09), #6-32 X 3/8" PPH MS Sems (Zinc) (Qty. 1) (232-5201-00) and #6 Washer (Qty. 1) (242-5001-00), at the Wood Rails with Ramp Mounting Bracket (Qty. 1/per) (515-6508-00) and at the Plastic Pieces (Butyrate) with Plastic Protect Washer (Qty. 1/per) (.187" ID X .875" OD X .048" Thk.) (242-5059-00)



ASSOCIATED PART IS NOT INCLUDED WITH THE ABOVE ASSEMBLY.

Nº	Associated Part Name	QTY.	SPI Part Nº
15 *	Plastic Molded Godzilla Head	1	545-5889-00

Item 15 supported by: Existing Hardware for Item 12 (Hex Spacer side).

16 *	Plastic Molded Left Arm & Buildings	1	545-5890-00

Item 16 secured onto the Backpanel by: Arm Mounting Bracket (Qty. 1) (515-6920-00), #8 Washer (Qty. 4) (242-5005-00) and #8-32 Nylon Stop Nut (Qty. 4) (240-5102-00)
Item 16 supported on the Ramp by: Items 13 & 14 above.

17 *	Plastic Molded Right Arm	1	545-5891-00

ASSOCIATED PART IS NOT INCLUDED WITH THE ABOVE ASSEMBLY.

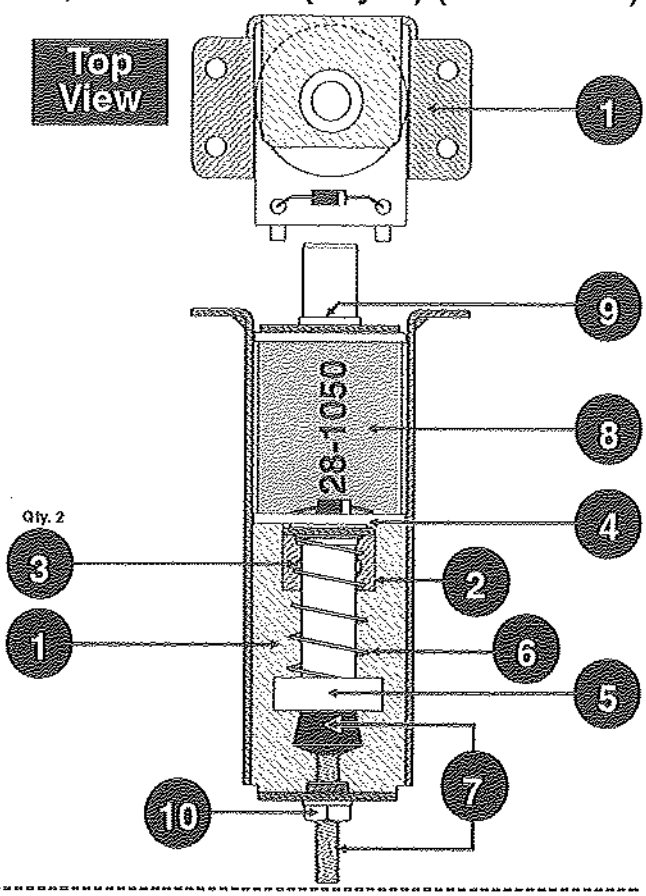
Nº	Associated Part Name	QTY.	SPI Part Nº
18®	Riveted Screened Plastic Assy. -14	1	515-6915-14R
ORDERING ABOVE RIVETED ASSEMBLY PART Nº WILL INCLUDE:			
18A	Screened Plastic Piece (Butyrate) -14	1	830-5949-14
18B	2-Lug Stand-Up Short Socket	1	077-5101-00
18C	Rivet 1/8" ø X 9/16" Long	1	249-5001-00

Item 18 supported by: 2-1/4" X 1/4" Hex Spacer #6-32 Tap, (Qty. 1) (254-5008-18), #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1) (232-5201-00) and #6 Washer (Qty. 1) (242-5001-00)

19	Mini-Mars Light Cover Snap-In Green	1	550-5030-04

Lt. & Rt. Outlane Ball Deflector Assemblies, 500-5788-03 (Qty. 2) (Items 1-10)

UK ONLY OPTIONAL



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
3	#8-32 X 1/4" PPH MS (SEMS)	2	232-5300-00
4	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
5	Solid Plunger Assembly	1	515-6858-00
6	Compression (Relay) Spring	1	266-5022-01
7	Adj. Spindle Stop (incl. rubber piece)	1	280-5014-00
8	Coil, 28-1050	1	090-5046-00
ORDERING ABOVE (ITEM 8) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
9	Coil Sleeve	1	545-5076-00
10	#10-32 Keps Nut	1	240-5208-00

Left & Right Ball Deflector Assemblies, 500-5788-03 is secured under the playfield by:
#8-32 X 1/2" HWH AB (Zinc) Blue (Qty. 4/per) (234-5101-05)

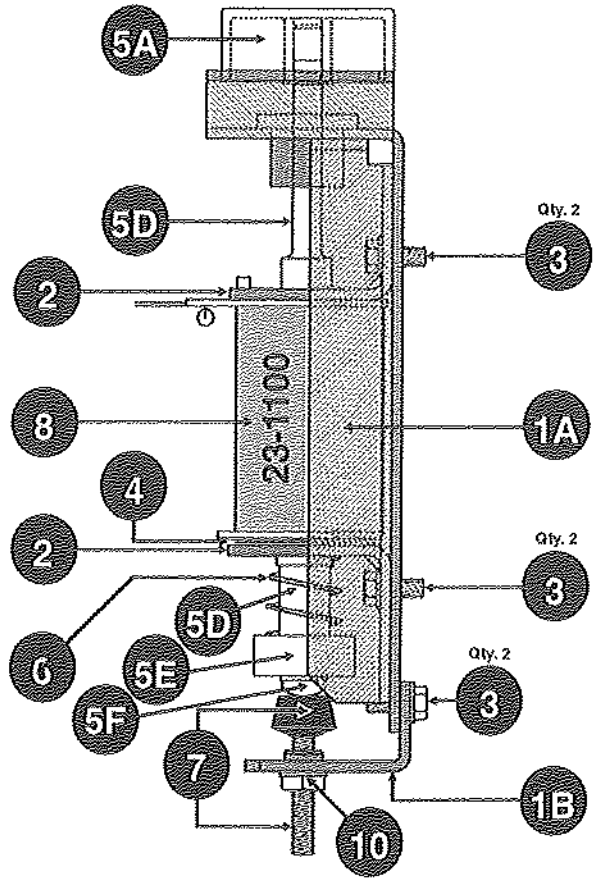
Up / Down Post Assembly, 500-6293-00 (Items 1-10)

UK ONLY OPTIONAL

Take Note:

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

1. Item 5D, part of Item 5, Plunger & Shaft Sub-Assembly, is 1 piece and cannot be ordered separated.



Nº	Individual Part Name	QTY.	SPI Part Nº
1A	Up/Down Post Coil Mounting Bracket	1	515-6840-00
1B	Bottom Mounting Bracket	1	535-8303-00
2	Coil Retaining Bracket	2	535-7356-00
3	#8-32 X 3/8" Swage (Serr) Zinc	6	237-5975-00
4	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
5	Plunger & Shaft Assembly	1	515-6844-00-35
ORDERING ABOVE (ITEM 5) SUB-ASSY. PART Nº WILL INCLUDE:			
5A	Ball Bumper Plastic (Top) Red	1	550-5029-02
5B*	Roll Pin, 3/32" ø X 1/2" Long	1	251-5002-00
5C*	Retaining Ring, 1/4" ø Shaft	1	270-5002-00
5D	Plunger & Shaft Sub-Assembly	1	515-6841-00
5E	Plunger Head	1	530-5511-00
5F	#10-32 X 3/8" PPH MS (Sems) Zinc	1	232-5401-00
6	Compression (Relay) Spring	1	266-5022-01
7	Adj. Spindle Stop (incl. rubber piece)	1	280-5014-00
8	Coil, 23-1100 (ORG)	1	090-5030-00T
ORDERING ABOVE (ITEM 8) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
9	Coil Sleeve (with extension)	1	545-5847-00
10	#10-32 Keps Nut	1	240-5208-00

Up/Down Post Assembly, 500-6293-00 is secured under the playfield by:
#8-32 X 1/2" HWH AB (Zinc) Blue (Qty. 6) (234-5101-05)

Table of Contents

- ☐ Coils Detailed Chart Table 80

- Chapter 1, Backbox Wiring 81
  - ■ Backbox Board Layout Wiring Diagram 81
  - ☐ Backbox I/O Power Driver Board Detailed Wiring Diagram 82

- Chapter 2, Playfield Wiring 83
  - ■ General Illumination Circuit Detailed Wiring Diagram 83
  - ☐ Playfield Switch Wiring Diagram & Playfield Lamp Wiring Diagram 84
  - ■ Playfield Terminal Strips, Fuses & Misc. Wiring Descriptions & Locations 85
  - ☐ 2-Flipper Circuit Wiring Diagram 86

- Chapter 3, Cabinet Wiring 87
  - ■ Transformer Power Wiring Diagram 87
  - ☐ Cabinet / Coin Door Wiring Diagram 88

- Chapter 4, Printed Circuit Boards (PCBs) 89
  - ■ Trough Up-Kicker Dual OPTO Boards Theory of Operation & Schematic 89
  - ■ Trough Up-Kicker Dual OPTO Boards Component Layout & Parts 89
  - ☐ OPTO Troubleshooting 89-90
  - ☐ Single Trough & Double-Stack OPTO Boards Alignment / Test 90
  - ■ Theory of Operation & Schematic (Not Available at time of Printing) 91
  - ■ Boards Component Layout & Parts (Not Available at time of Printing) 91
  - ☐ Dot Matrix Display/Display Controller Bd. Combined Display Connections 92
  - ■ Display Power Supply Board Schematic 93
  - ■ Display Power Supply Board Component Layout & Parts 93
  - ☐ Display Controller Board Schematic 94
  - ☐ Display Controller Board Component Layout & Parts 95
  - ■ I/O Power Driver Board Theory of Operation 96
  - ■ I/O Power Driver Board Schematic (Sheet 1 of 5) 97
  - ■ I/O Power Driver Board Schematic (Sheet 2 of 5) 98
  - ■ I/O Power Driver Board Schematic (Sheet 3 of 5) 99
  - ■ I/O Power Driver Board Schematic (Sheet 4 of 5) 100
  - ■ I/O Power Driver Board Schematic (Sheet 5 of 5) 101
  - ■ I/O Power Driver Board Component Layout 102
  - ■ I/O Power Driver Board Parts 103
  - ☐ CPU/Sound Board Theory of Operation 104
  - ☐ CPU/Sound Board Schematic (Sheet 1 of 3) 105
  - ☐ CPU/Sound Board Schematic (Sheet 2 of 3) 106
  - ☐ CPU/Sound Board Schematic (Sheet 3 of 3) 107
  - ☐ CPU/Sound Board Component Layout 108
  - ☐ CPU/Sound Board Parts 109

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

COILS DETAILED CHART TABLE

High Current Coils Group 1	Drive Transistor (D.T.)	Driver Output Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connection	Power Voltage	Coil (GA/Turn) Meter / Bulb
#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	24-940 090-5036-00D
#3 TOP MAGNET (ORBIT)	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#4 MIDDLE MAGNET (PFLD)	Q4	I/O Pwr. Drvr.	BRN-YEL	J8-P5	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#5 BOTTOM MAGNET (PFLD)	Q5	I/O Pwr. Drvr.	BRN-GRN	J8-P6	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#6 SHAKER MOTOR	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	RED-WHT	J17-P7	16v AC 12v DC	Motor Only 041-5029-01
#7 FLASH SPINNER*2	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#8 EUROPEAN TOKEN DISPENSER	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	YEL-VIO	J10-P4/5	50v DC	Various (Ca)

High Current Coils Group 2	Drive Transistor (D.T.)	Driver Output Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connection	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 LEFT SLINGSHOT	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#13 RIGHT SLINGSHOT	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#14 LEFT MAGNET (LANE)	Q14	I/O Pwr. Drvr.	BLU-BLK	J9-P7	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#15 LEFT FLIPPER (50V RED/YEL)	Q15	I/O Pwr. Drvr.	ORG-GRY	J9-P8	RED-YEL GRY-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T
#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 Output Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connection	Power Voltage	Coil (GA/Turn) Meter / Bulb
#17 RAMP DIVERTER	Q17	I/O Pwr. Drvr.	VIO-BRN	J7-P2	BRN	J7-P1	20v DC	32-1800 090-5031-00T
#18 FLASH LT*1	Q18	I/O Pwr. Drvr.	VIO-RED	J7-P3	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#19 FLASH RT*1	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#20 FLASH INNER LT. ORBIT*2	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#21 LT OUTLANE (UK ONLY)	Q21	I/O Pwr. Drvr.	VIO-GRN	J7-P7	BRN	J7-P1	20v DC	28-1050
#22 RT OUTLANE (UK ONLY)	Q22	I/O Pwr. Drvr.	VIO-BLU	J7-P8	BRN	J7-P1	20v DC	28-1050
#23 UP/DOWN POST (UK ONLY)	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	BRN	J7-P1	20v DC	23-1100
#24 OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v DC	Meter 5v 091-5000-00

D Cols On Terminal Strip (Note 3)

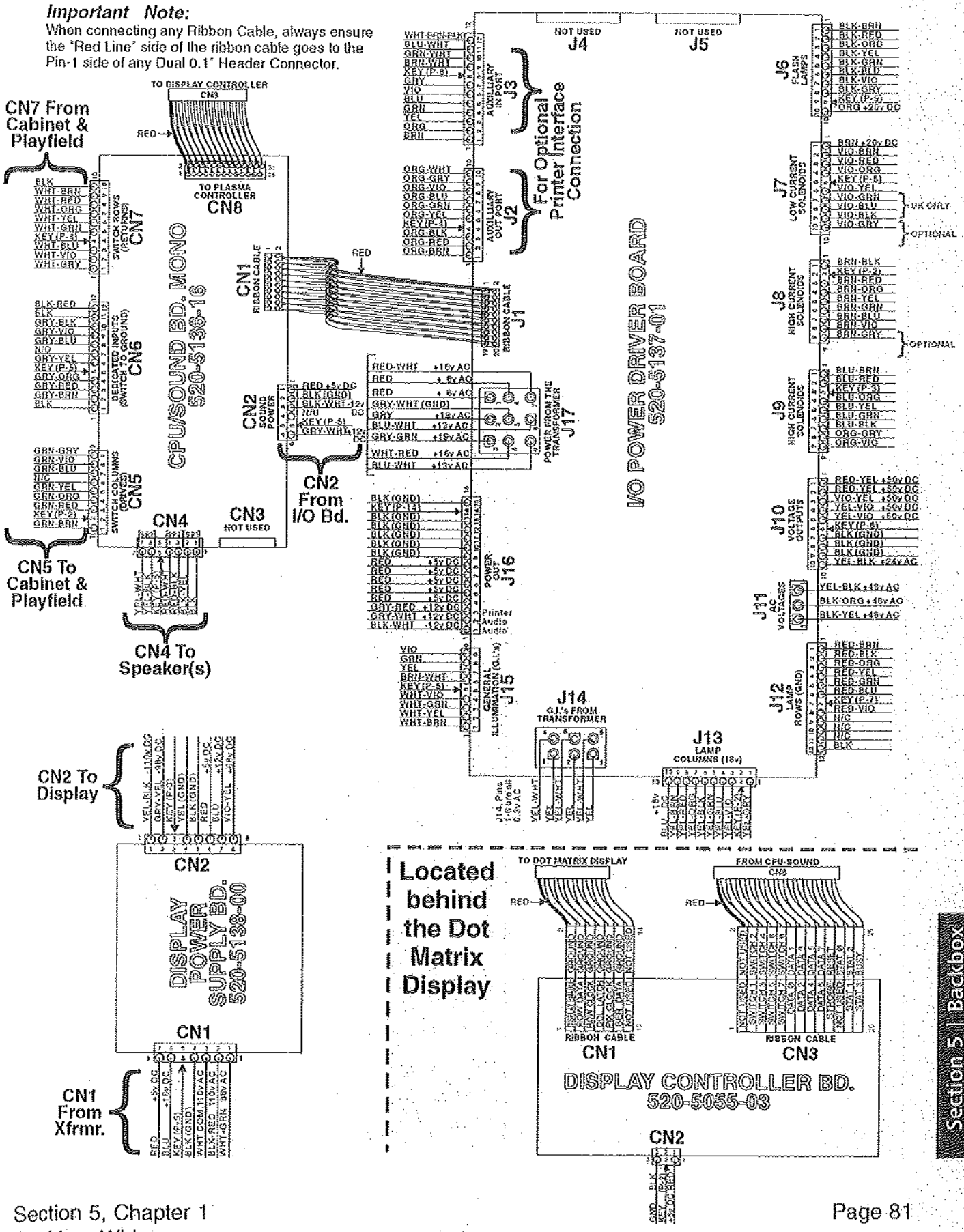
Flash Lamps (FLASH)	Drive Transistor (D.T.)	Driver Output Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connection	Power Voltage	Bulb
#F1 FLASH POPS*4	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F2 FLASH TOP LT*2	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F3 FLASH CTR PFLD*1	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F4 FLASH RAMP #4*1	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F5 FLASH LITE GODZ*1	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F6 FLASH SCORE DOES...*1	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F7 FLASH SLINGS*4	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#F8 FLASH TOP RT*2	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 Flash Lamps F1-F8 ONLY. Test all others in SINGLE or CYCLING COIL TESTS.

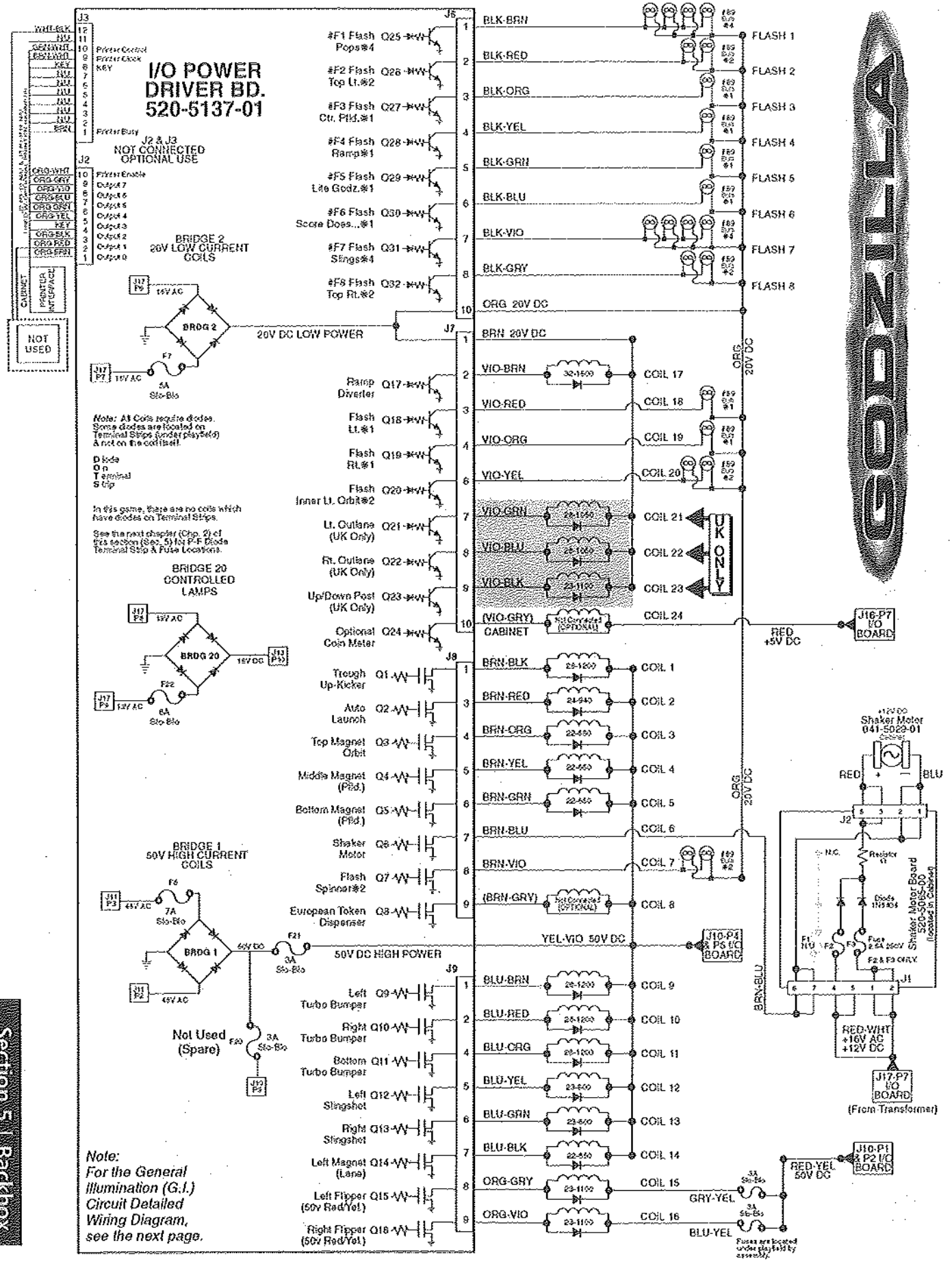
Backbox Wiring

Backbox Board Layout 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.

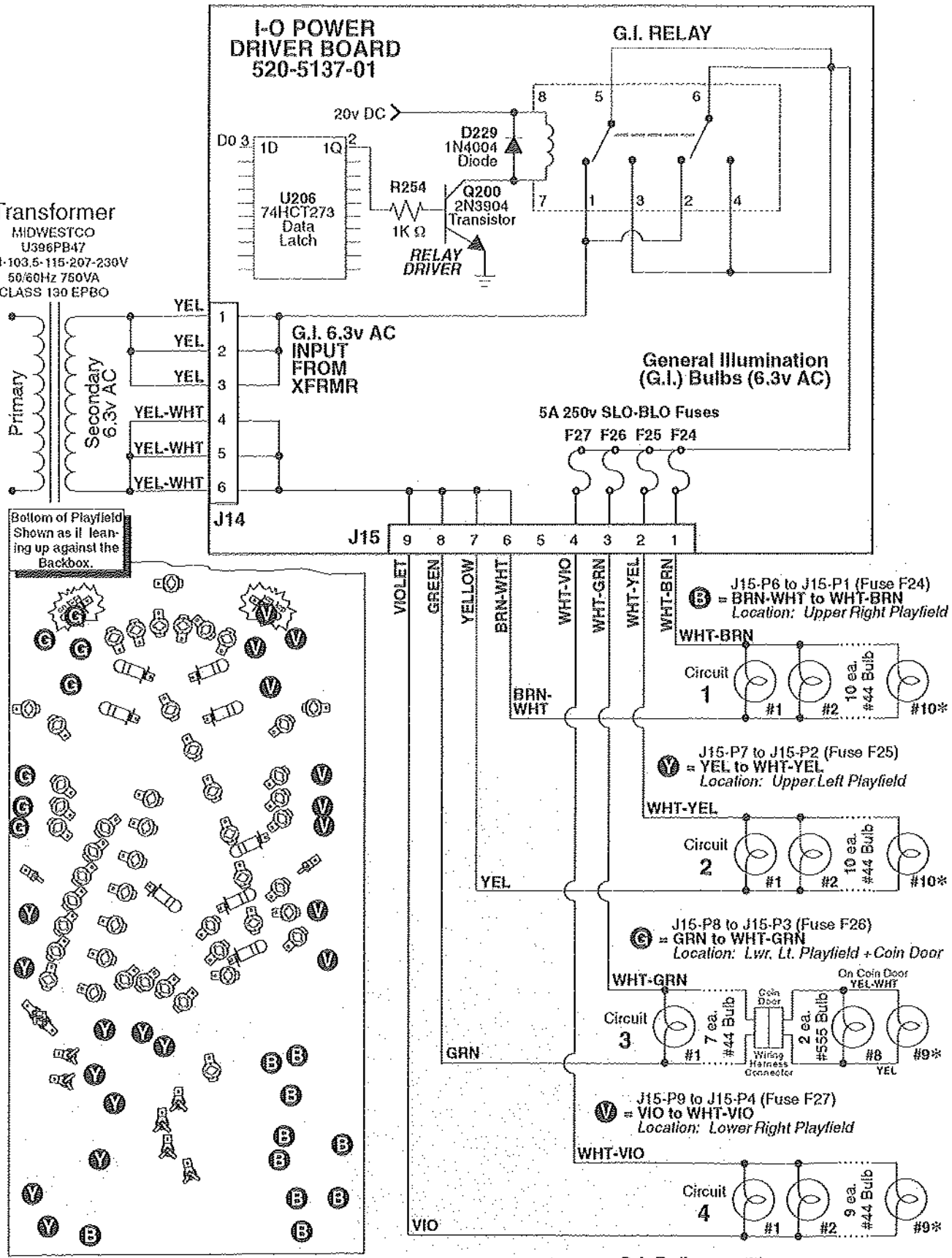


Backbox I/O Power Driver Board Detailed Wiring Diagram



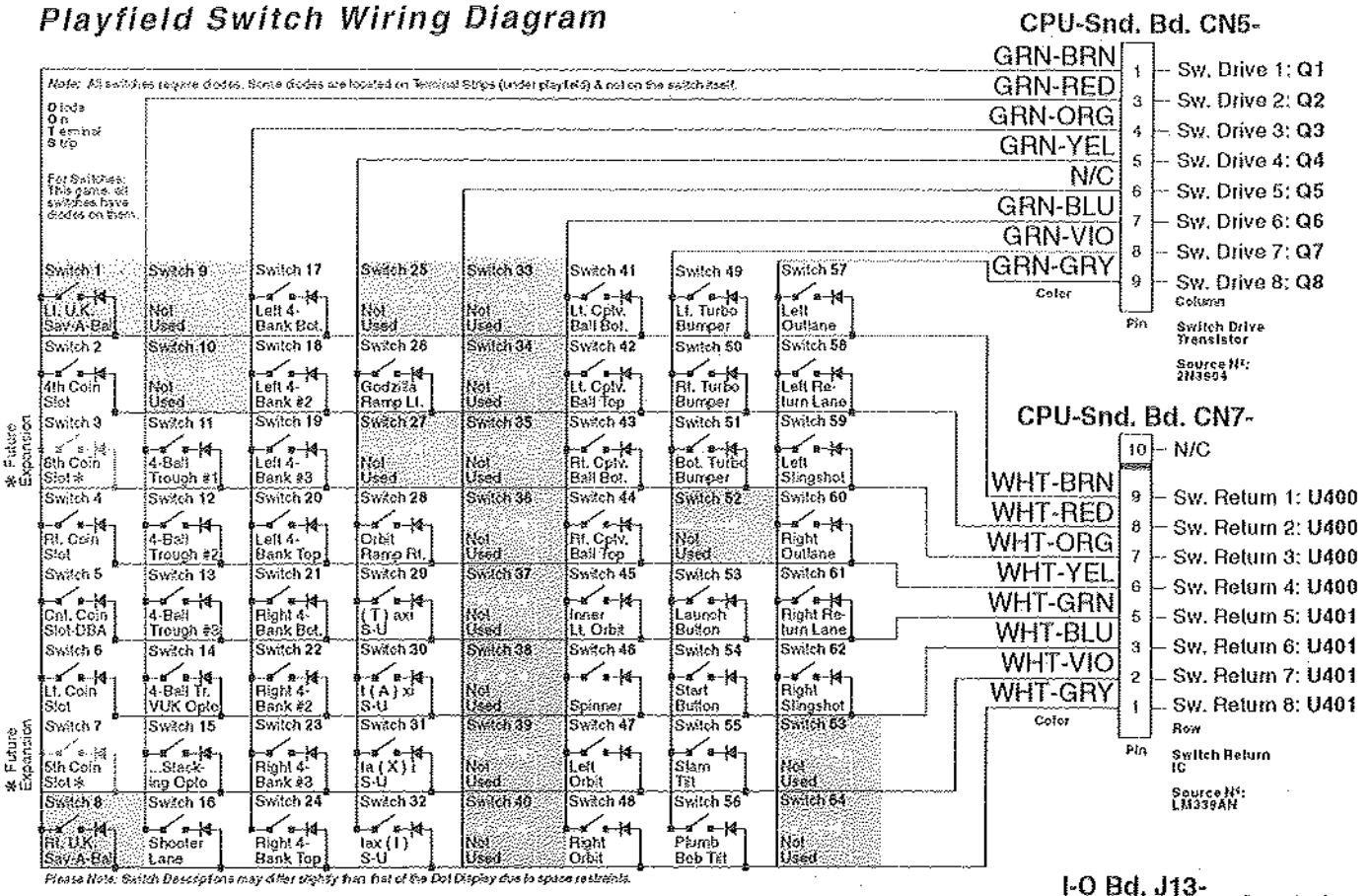
Playfield Wiring

General Illumination Circuit Detailed Wiring Diagram



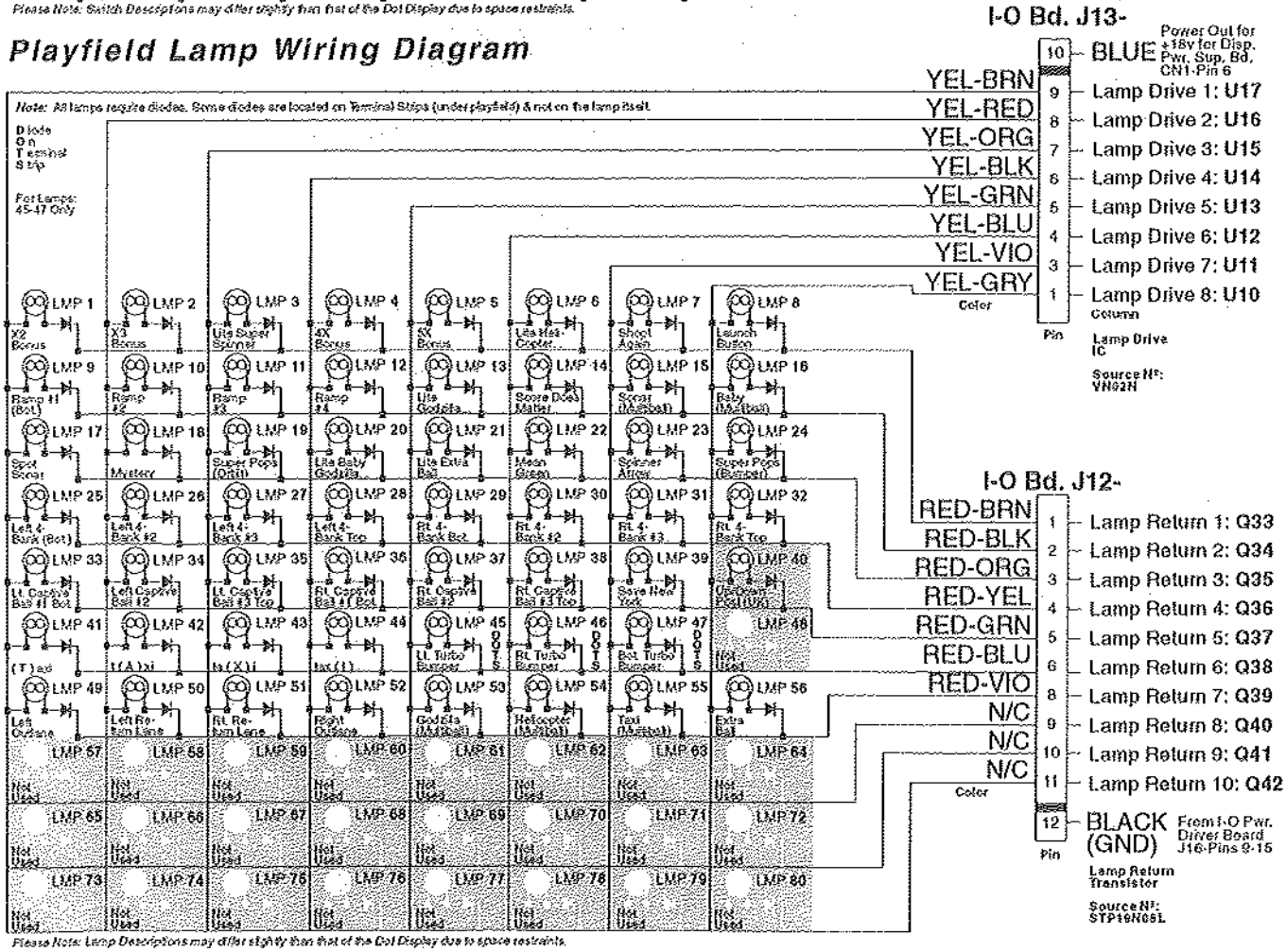
* *G.I. Bulb quantities may change during production.*

Playfield Switch Wiring Diagram

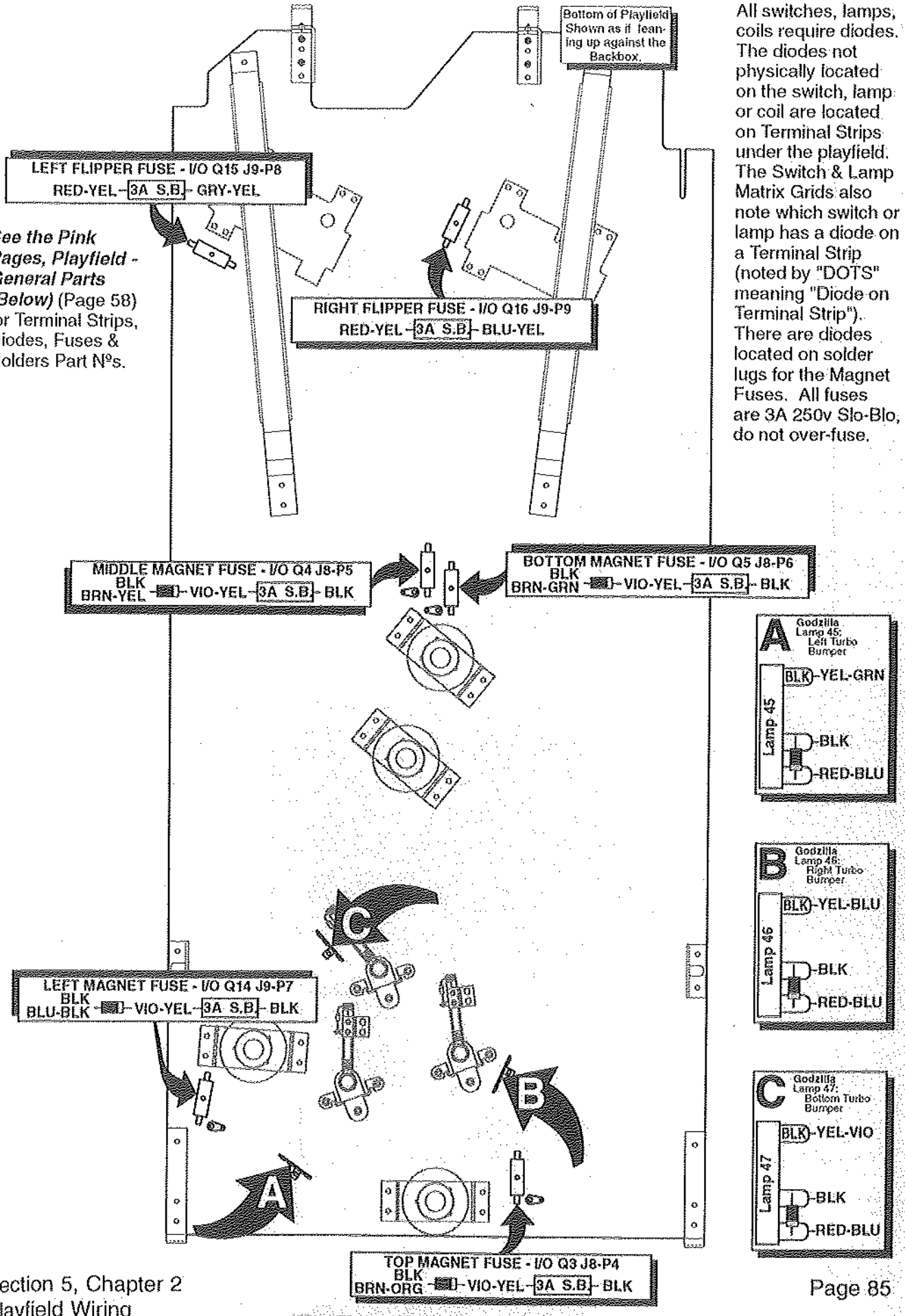


Please Note: Switch Descriptions may differ slightly from that of the Dot Display due to space restraints.

Playfield Lamp Wiring Diagram



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

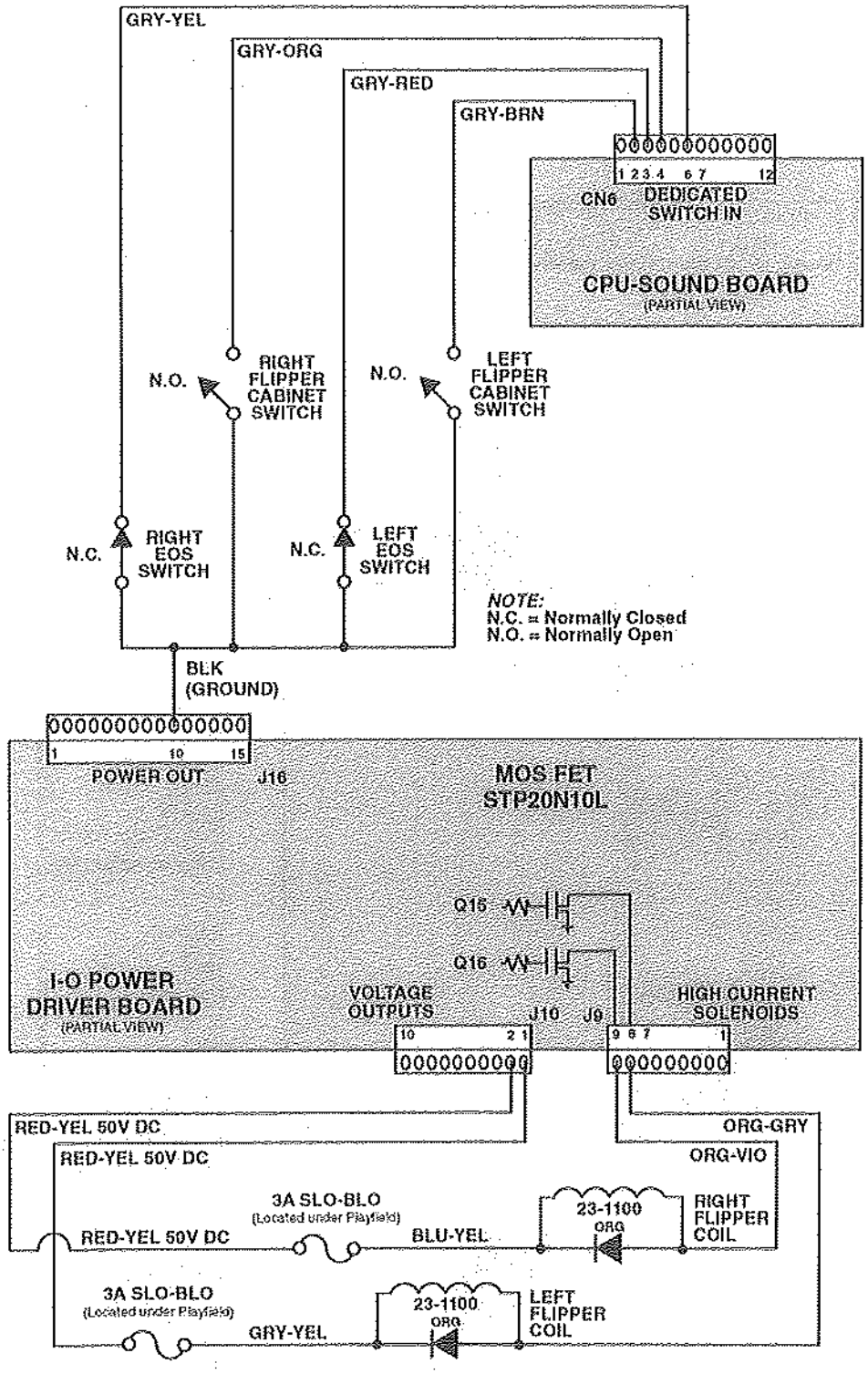


See the Pink Pages, Playfield - General Parts (Below) (Page 58) for Terminal Strips, Diodes, Fuses & Holders Part Nºs.

All switches, lamps, coils require diodes. The diodes not physically located on the switch, lamp or coil are located on Terminal Strips 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"). There are diodes located on solder lugs for the Magnet Fuses. All fuses are 3A 250v Slo-Blo, do not over-fuse.

2-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.



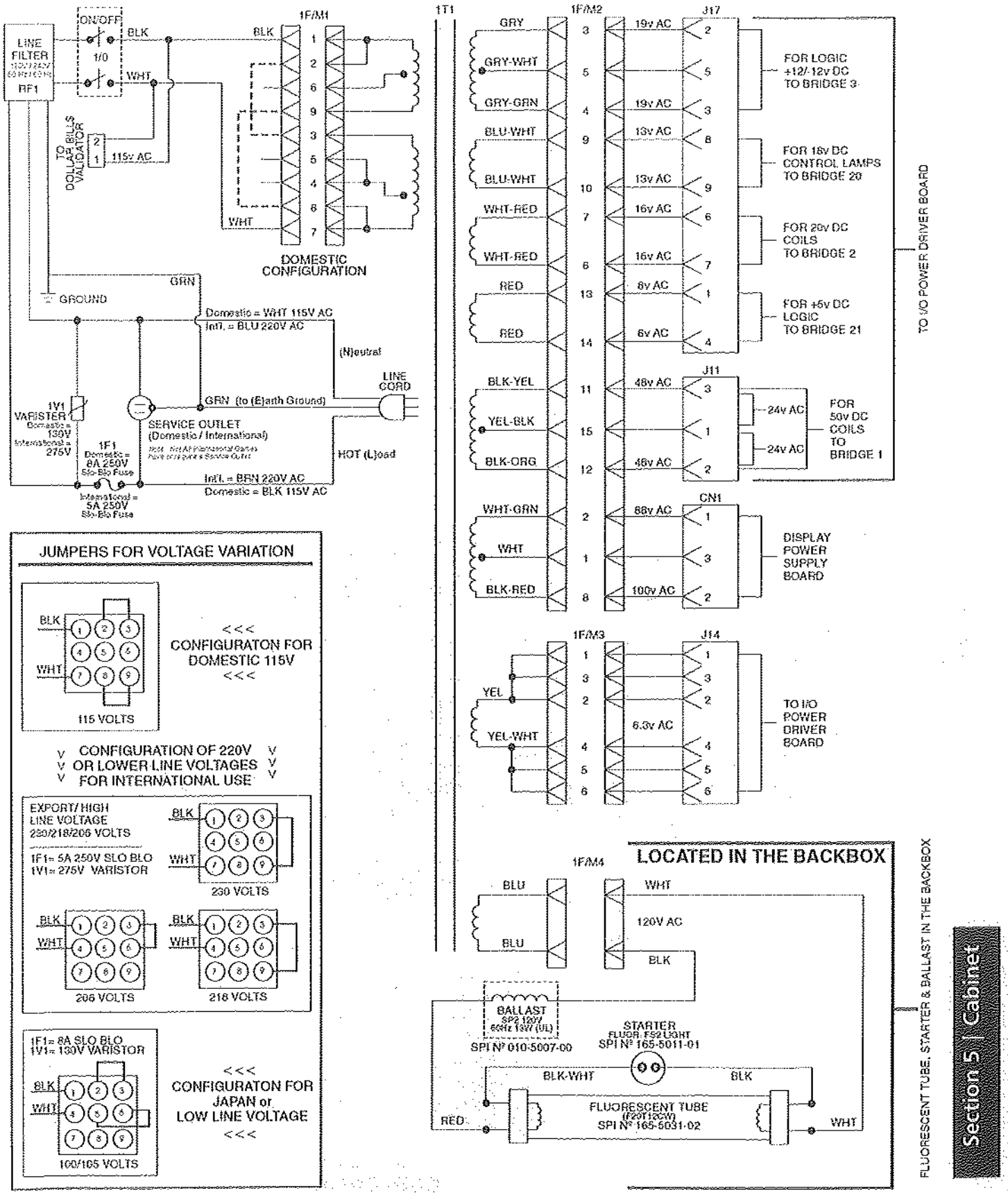
Technical Overview

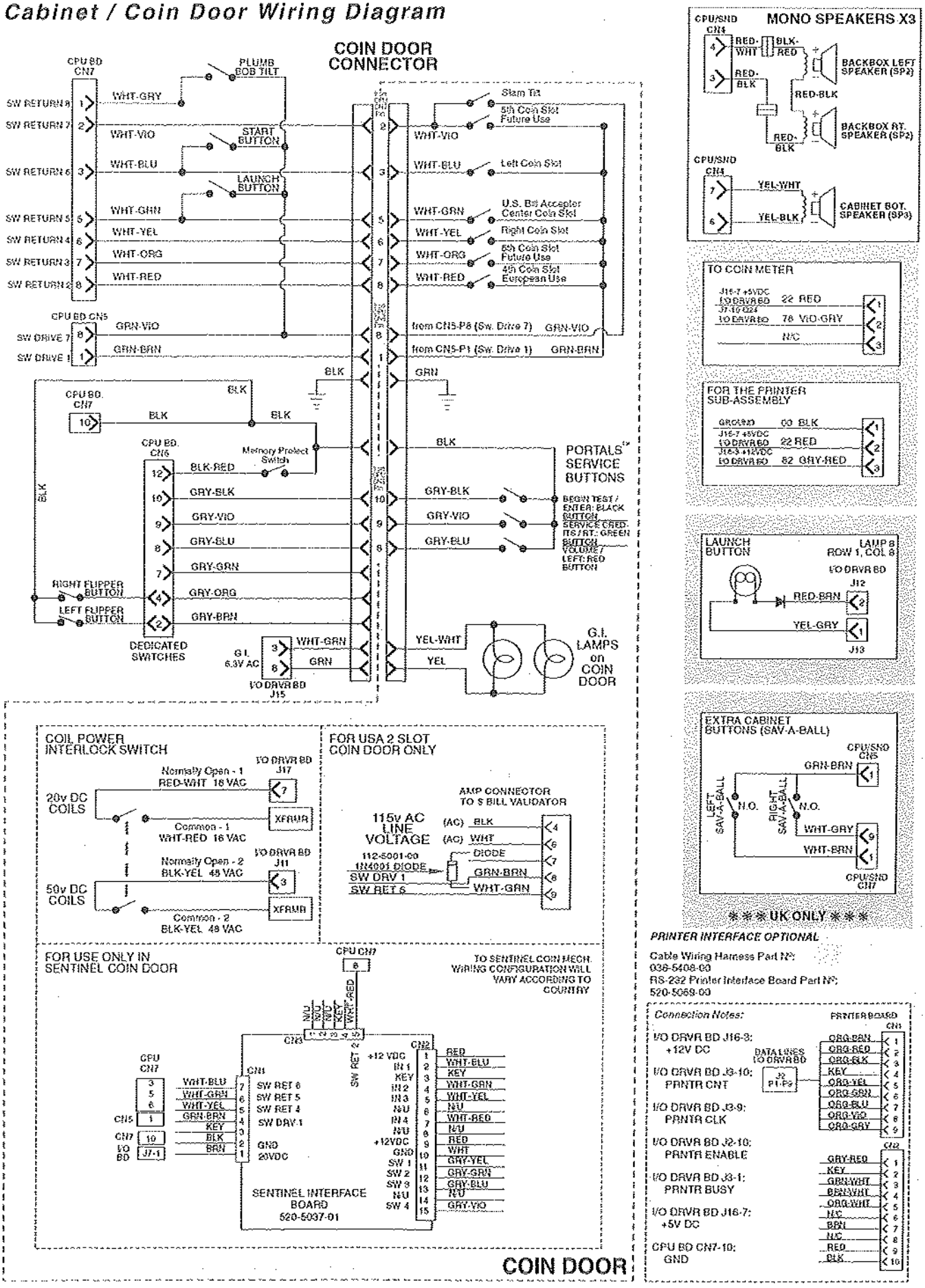
Our ***New Flipper System*** uses one supply voltage (50v DC) for both kick and hold. Once the **Game CPU** detects a flipper cabinet switch closure (during game play) it applies a 40 msec pulse to the gate of the flipper drive transistor (STP20N10L). If it continues to detect a flipper cabinet switch 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 a 1/16" when the flipper is energized. The **Game CPU** will detect a switch closure if the flipper bat is forced back by a high velocity shot or rebound on the playfield and will apply another 40 msec pulse of 50v DC to the coil.

Cabinet Wiring

Transformer Power Wiring Diagram

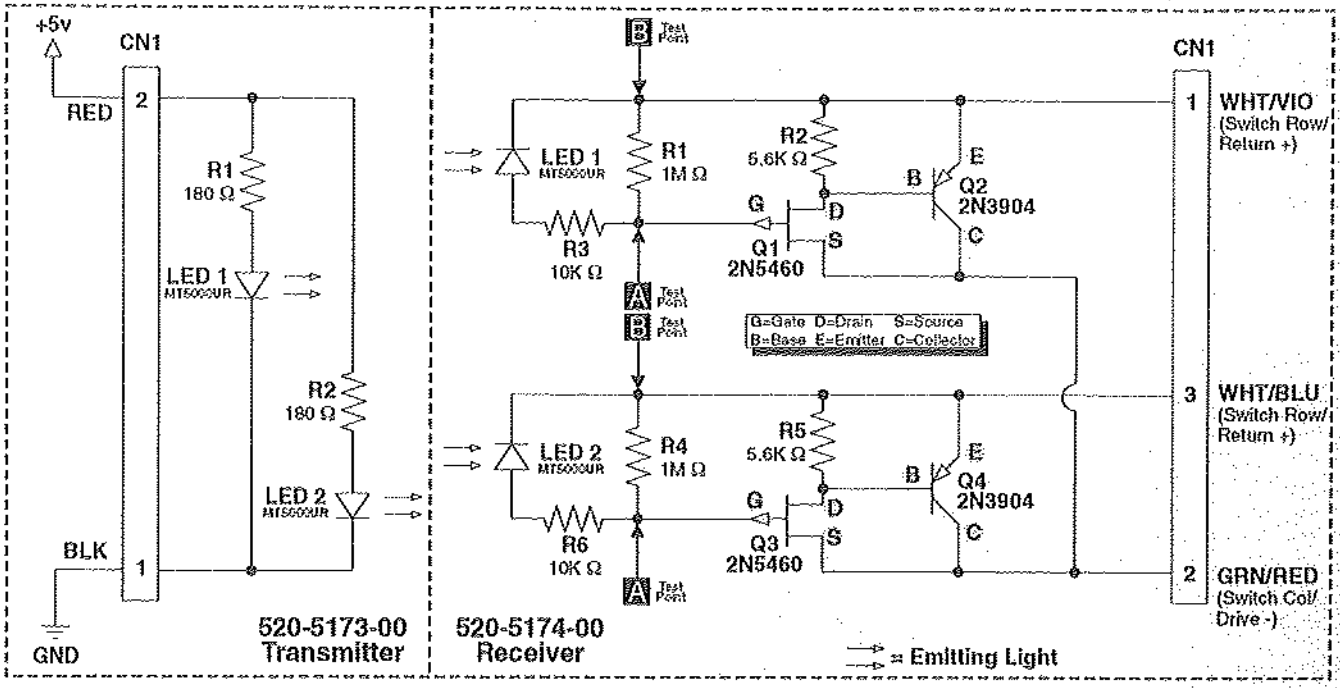



COIN DOOR CONNECTOR
CPU BD CN7
PLUMB BOB TILT
SW RETURN 8
SW RETURN 7
SW RETURN 6
SW RETURN 5
SW RETURN 4
SW RETURN 3
SW RETURN 2
WHT-GRY
WHT-VIO
WHT-BLU
WHT-GRN
WHT-YEL
WHT-ORG
WHT-RED
START BUTTON
LAUNCH BUTTON
Slam Tilt
5th Coin Slot Future Use
Left Coin Slot
U.S. $ Acceptor Center Coin Slot
Right Coin Slot
5th Coin Slot Future Use
4th Coin Slot European Use
CPU BD CN5
SW DRIVE 7
SW DRIVE 1
GRN-VIO
GRN-BRN
from CN5-P8 (Sw. Drive 7)
from CN5-P1 (Sw. Drive 1)
BLK
GRN
CPU BD. CN7
CPU BD. CN6
Memory Protect Switch
BLK-RED
GRY-BLK
GRY-VIO
GRY-BLU
GRY-GRN
GRY-ORG
GRY-BRN
PORTALS™ SERVICE BUTTONS
BEGIN TEST / ENTER: BLACK BUTTON
SERVICE CRED. ITS / RT.: GREEN BUTTON
VOLUME / LEFT: RED BUTTON
RIGHT FLIPPER BUTTON
LEFT FLIPPER BUTTON
DEDICATED SWITCHES
G.I. 6.3V AC
I/O DRVR BD J15
WHT-GRN
GRN
YEL-WHT
YEL
G.I. LAMPS on COIN DOOR
COIL POWER INTERLOCK SWITCH
I/O DRVR BD J17
Normally Open - 1
RED-WHT 16 VAC
20v DC COILS
XFRMR
Common - 1
WHT-RED 16 VAC
I/O DRVR BD J11
Normally Open - 2
BLK-YEL 48 VAC
50v DC COILS
Common - 2
BLK-YEL 48 VAC
FOR USA 2 SLOT COIN DOOR ONLY
AMP CONNECTOR TO $ BILL VALIDATOR
115v AC LINE VOLTAGE
(AC) BLK
(AC) WHT
DIODE
112-5001-00 1N4001 DIODE
SW DRV 1
SW RET 6
GRN-BRN
WHT-GRN
FOR USE ONLY IN SENTINEL COIN DOOR
CPU CN7
TO SENTINEL COIN MECH. WIRING CONFIGURATION WILL VARY ACCORDING TO COUNTRY
CN8
CN1
CN2
SENTINEL INTERFACE BOARD 520-5037-01
+12 VDC
SW RET
GND
20VDC
COIN DOOR
CPU/SND CN5
MONO SPEAKERS X3
RED-WHT
BLK-RED
RED-BLK
BACKBOX LEFT SPEAKER (SP2)
BACKBOX RT. SPEAKER (SP2)
CPU/SND CN4
YEL-WHT
YEL-BLK
CABINET BOT. SPEAKER (SP3)
TO COIN METER
22 RED
78 VIO-GRY
N/C
FOR THE PRINTER SUB-ASSEMBLY
00 BLK
22 RED
82 GRY-RED
LAUNCH BUTTON
LAMP 8 ROW 1, COL 8
I/O DRVR BD J12
RED-BRN
YEL-GRY
J13
EXTRA CABINET BUTTONS (SAV-A-BALL)
CPU/SND CN5
GRN-BRN
LEFT SAV-A-BALL
RIGHT SAV-A-BALL
N.O.
WHT-GRY
WHT-BRN
CPU/SND CN7
*** UK ONLY ***
PRINTER INTERFACE OPTIONAL
Cable Wiring Harness Part №: 036-5408-00
RS-232 Printer Interface Board Part №: 520-5069-00
Connection Notes:
PRINTER BOARD
I/O DRVR BD J16-3: +12V DC
I/O DRVR BD J3-10: PRNTR CNT
I/O DRVR BD J3-9: PRNTR CLK
I/O DRVR BD J2-10: PRNTR ENABLE
I/O DRVR BD J3-1: PRNTR BUSY
I/O DRVR BD J16-7: +5V DC
CPU BD CN7-10: GND
DATA LINES I/O DRVR BD
J3 P1-P9

Printed Circuit Boards (PCBs)

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

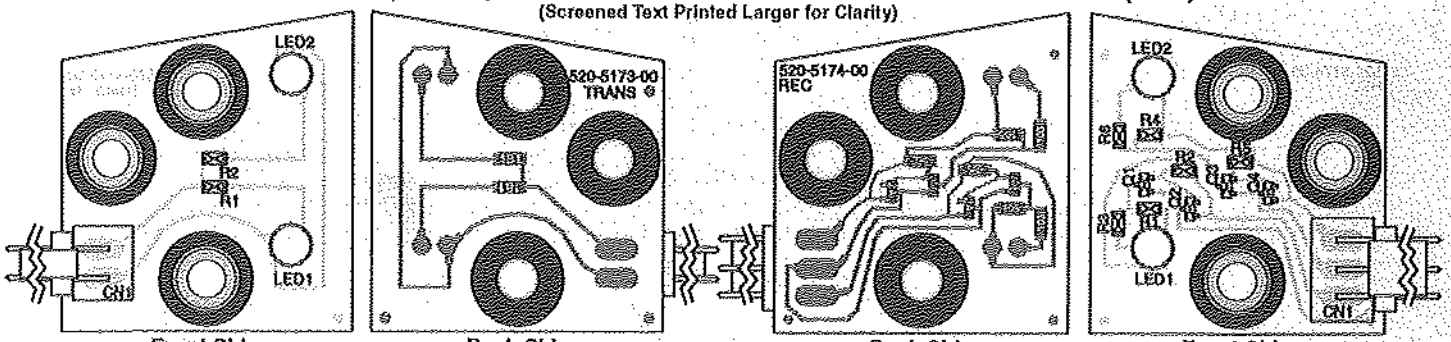
As light from the **Transmitter LED1** falls on the **Receiver LED1**, it generates a Positive Bias Voltage (0.7v to 1.5v) which is applied to the **Gate** (G) of **Q1** (Fet 2N5460), turning **Q1** off. When **Q1** is held off, no current flows through **Q2**'s (Fet 2N3906) **Base** (B). With no *base 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 the same.



Trough Up-Kicker Dual OPTO Boards Component Layout & Parts

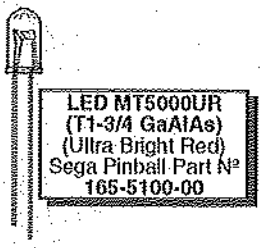
520-5173-00 (TRANS) **Boards Actual Size** 520-5174-00 (REC)

(Screened Text Printed Larger for Clarity)



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	110-0069-00	Q2, Q4
7	1	045-5111-03	CN1
8	3	545-5518-00	n/a
9	3	530-5308-02	n/a



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)
2N3904, Transistor
3X, .156" Rt. Angle (26-60-5030) Conn.
OPTO PCB Rubber Grommet
OPTO PCB Brass Tube Spacer

OPTO Troubleshooting

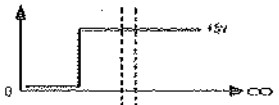
1. Volt Meter Test (indicates normal operating condition):

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.

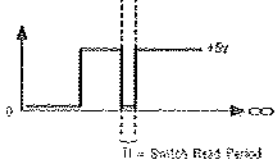
2. Oscilloscope Test (indicates normal operating condition):

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

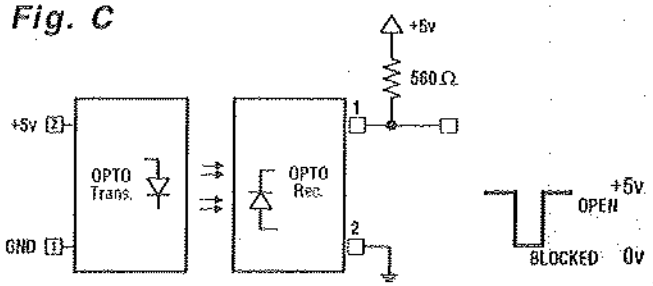


B. **CLOSED OPTO** (Light Blocked) = *SWITCH CLOSED.* Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (see Schematic). The Scope should display a **PULSE STREAM** indicating **Q2** has switched "On" as shown in **Fig. B**, Wave Form Diagram. This is your Switch Drive Pulse.

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

Fig. C

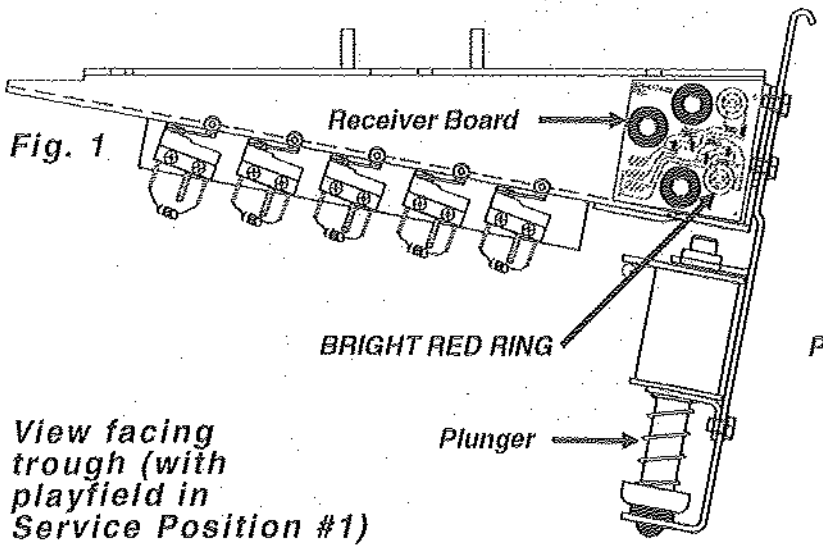


Disconnect the OPTO Transmitter / Receiver Board from the circuit. Connect one side of a 560Ω Pull-Up Resistor to **Pin-1** of the OPTO Receiver Bd. and the other side of the resistor to a 5v DC source. Connect **Pin-2** to GND. Connect a +5v DC source to **Pin-1** of the Transmitter & GND to **Pin-2**.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

Trough Dual OPTO Boards Alignment / Test for LED1

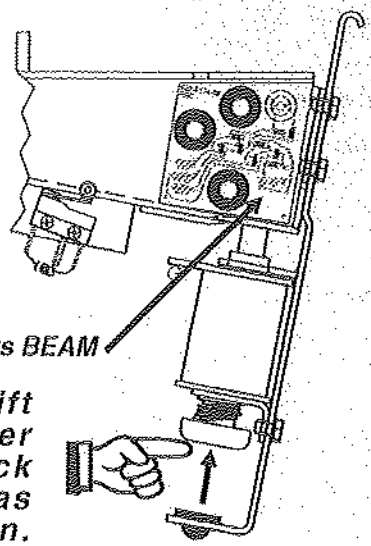
When a working **OPTO** is installed and connected in a game, the transmitter should light (LED1 lower & LED2 upper) when the power is switched on. With the playfield in Service Position #1 (playfield lifted up in the half-way position resting on the Prop Rod or edge slide support brackets) and the game 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



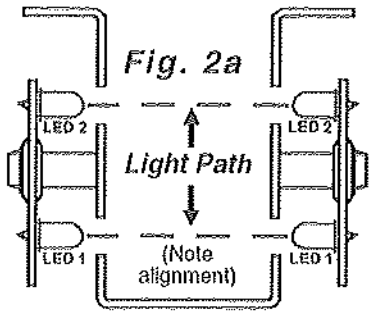
View facing trough (with playfield in Service Position #1)

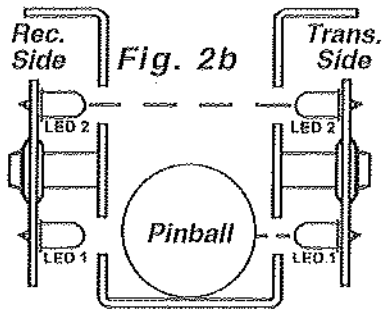
Fig. 2



Lift plunger to check switch as shown.

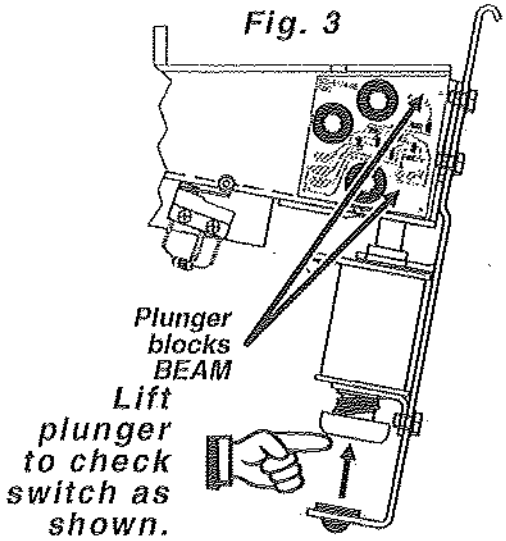
Sectional view from right (Fig. 2a & 2b)

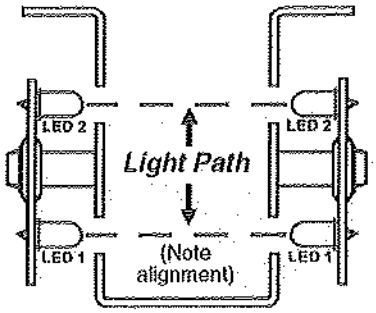


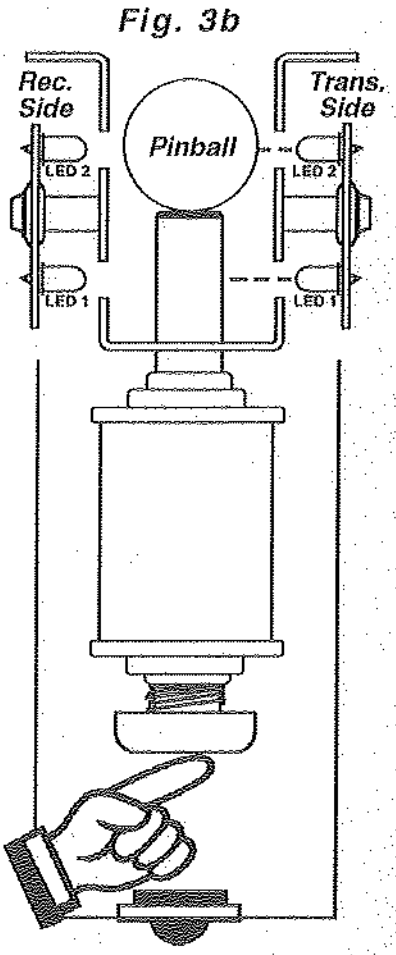


Trough Dual OPTO Boards Alignment / Test for LED2

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).***

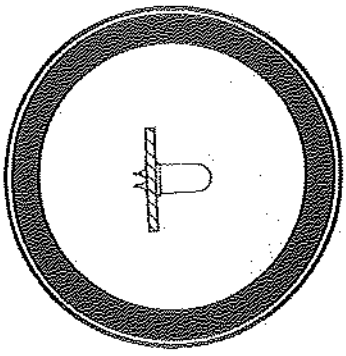


Fig. 4a
Correct Position

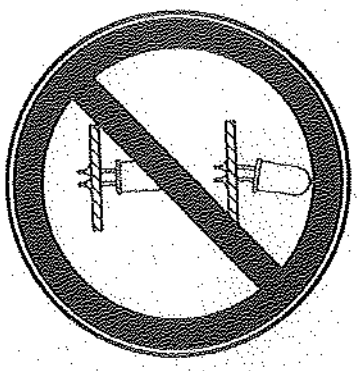
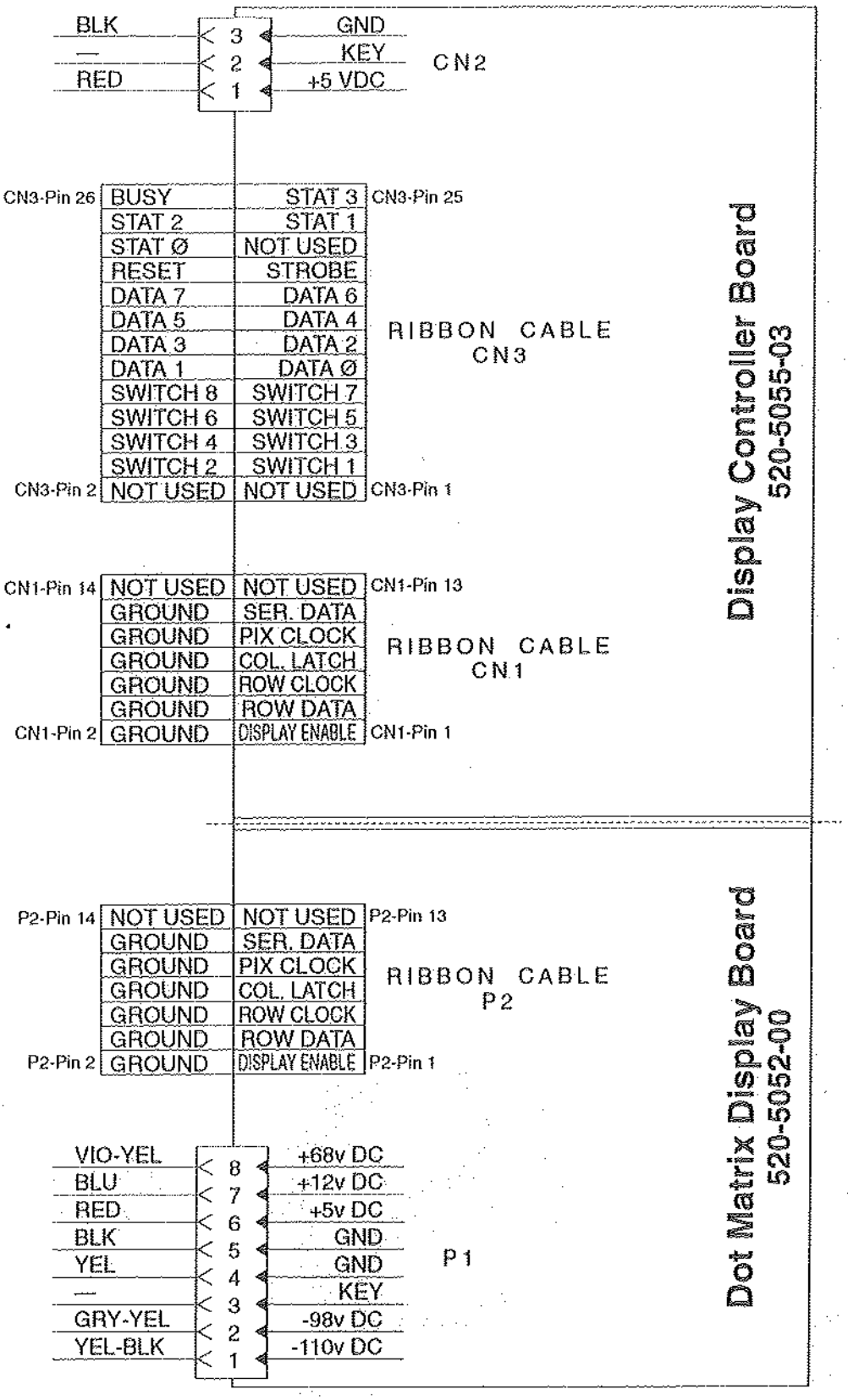
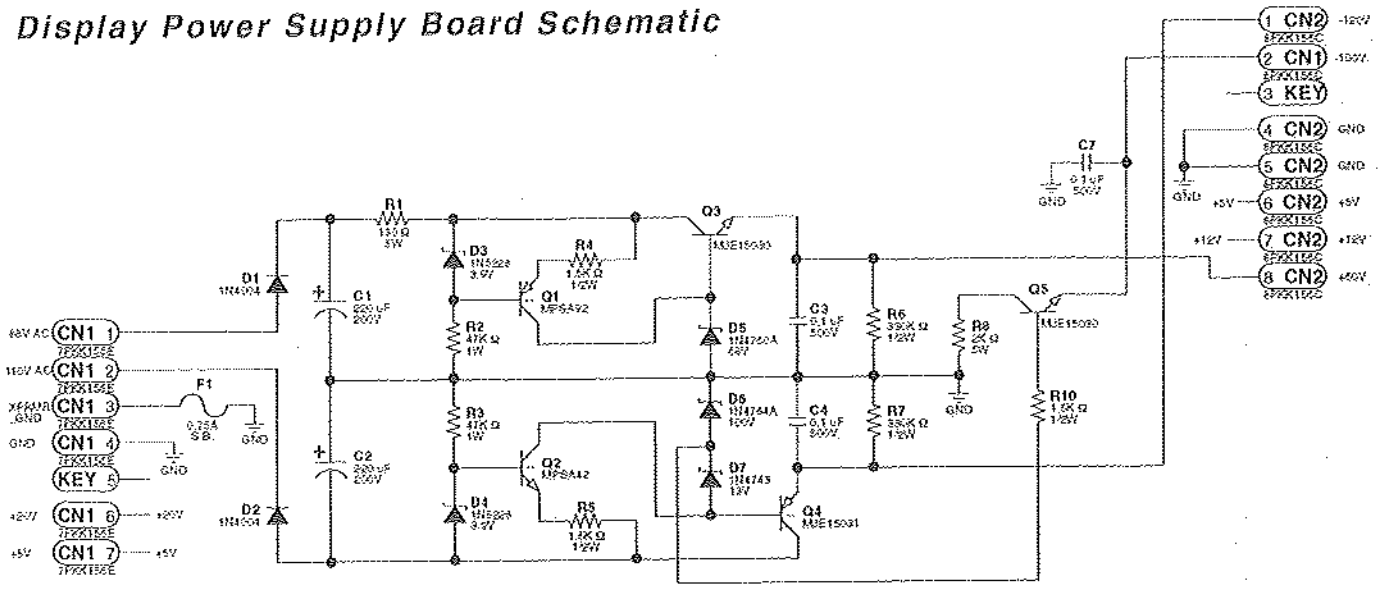


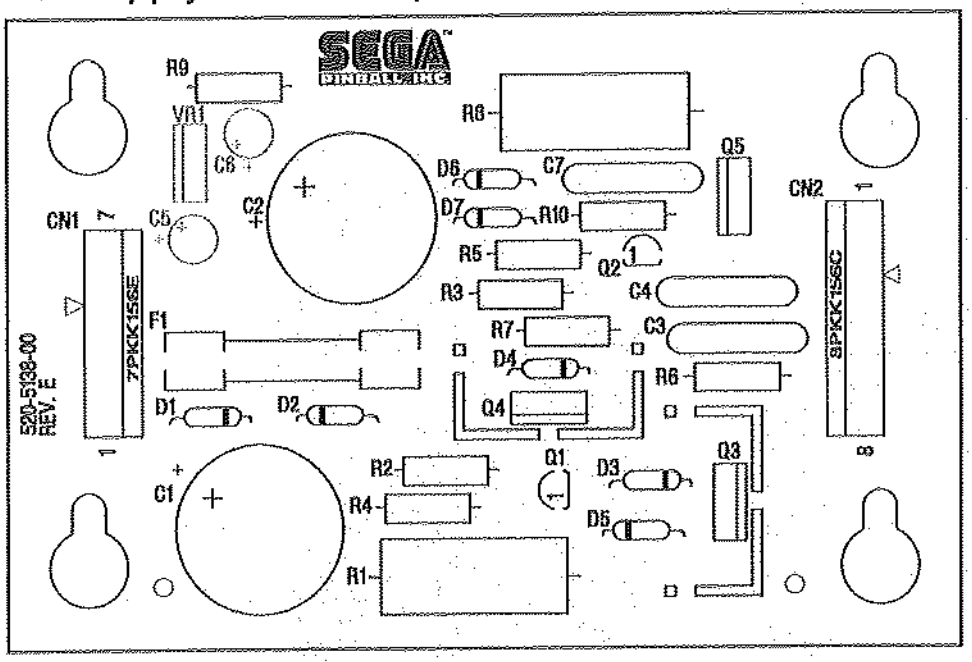
Fig. 4b
Incorrect Position


BLK
—
RED
3
2
1
GND
KEY
+5 VDC
CN2
CN3-Pin 26
BUSY
STAT 2
STAT Ø
RESET
DATA 7
DATA 5
DATA 3
DATA 1
SWITCH 8
SWITCH 6
SWITCH 4
SWITCH 2
CN3-Pin 2
NOT USED
STAT 3
STAT 1
NOT USED
STROBE
DATA 6
DATA 4
DATA 2
DATA Ø
SWITCH 7
SWITCH 5
SWITCH 3
SWITCH 1
NOT USED
CN3-Pin 25
CN3-Pin 1
RIBBON CABLE
CN3
CN1-Pin 14
NOT USED
GROUND
GROUND
GROUND
GROUND
GROUND
CN1-Pin 2
GROUND
NOT USED
SER. DATA
PIX CLOCK
COL. LATCH
ROW CLOCK
ROW DATA
DISPLAY ENABLE
CN1-Pin 13
CN1-Pin 1
RIBBON CABLE
CN1
Display Controller Board
520-5055-03
P2-Pin 14
NOT USED
GROUND
GROUND
GROUND
GROUND
GROUND
P2-Pin 2
GROUND
NOT USED
SER. DATA
PIX CLOCK
COL. LATCH
ROW CLOCK
ROW DATA
DISPLAY ENABLE
P2-Pin 13
P2-Pin 1
RIBBON CABLE
P2
VIO-YEL
BLU
RED
BLK
YEL
—
GRY-YEL
YEL-BLK
8
7
6
5
4
3
2
1
+68v DC
+12v DC
+5v DC
GND
GND
KEY
-98v DC
-110v DC
P1
Dot Matrix Display Board
520-5052-00

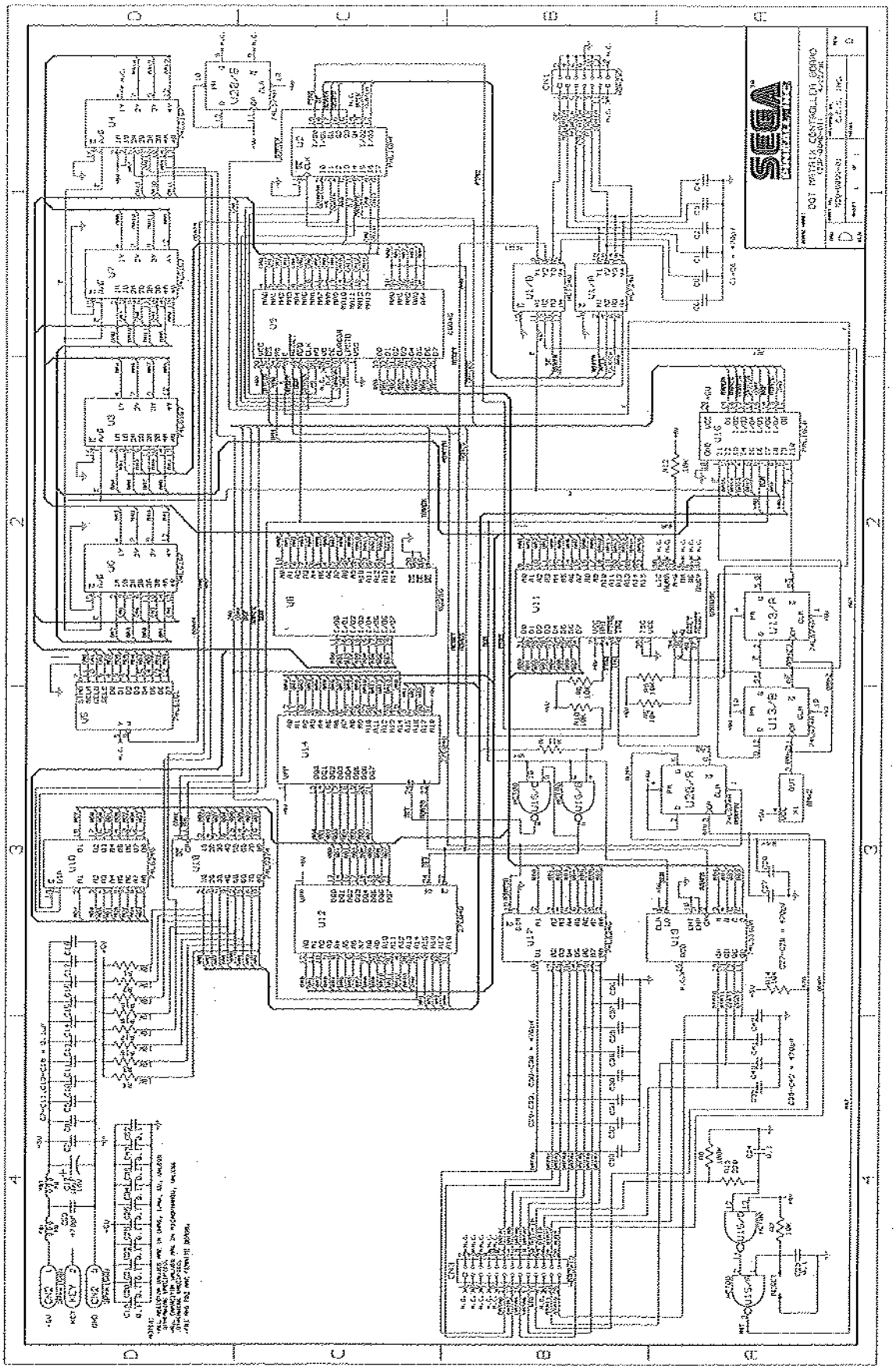
Display Power Supply Board Schematic

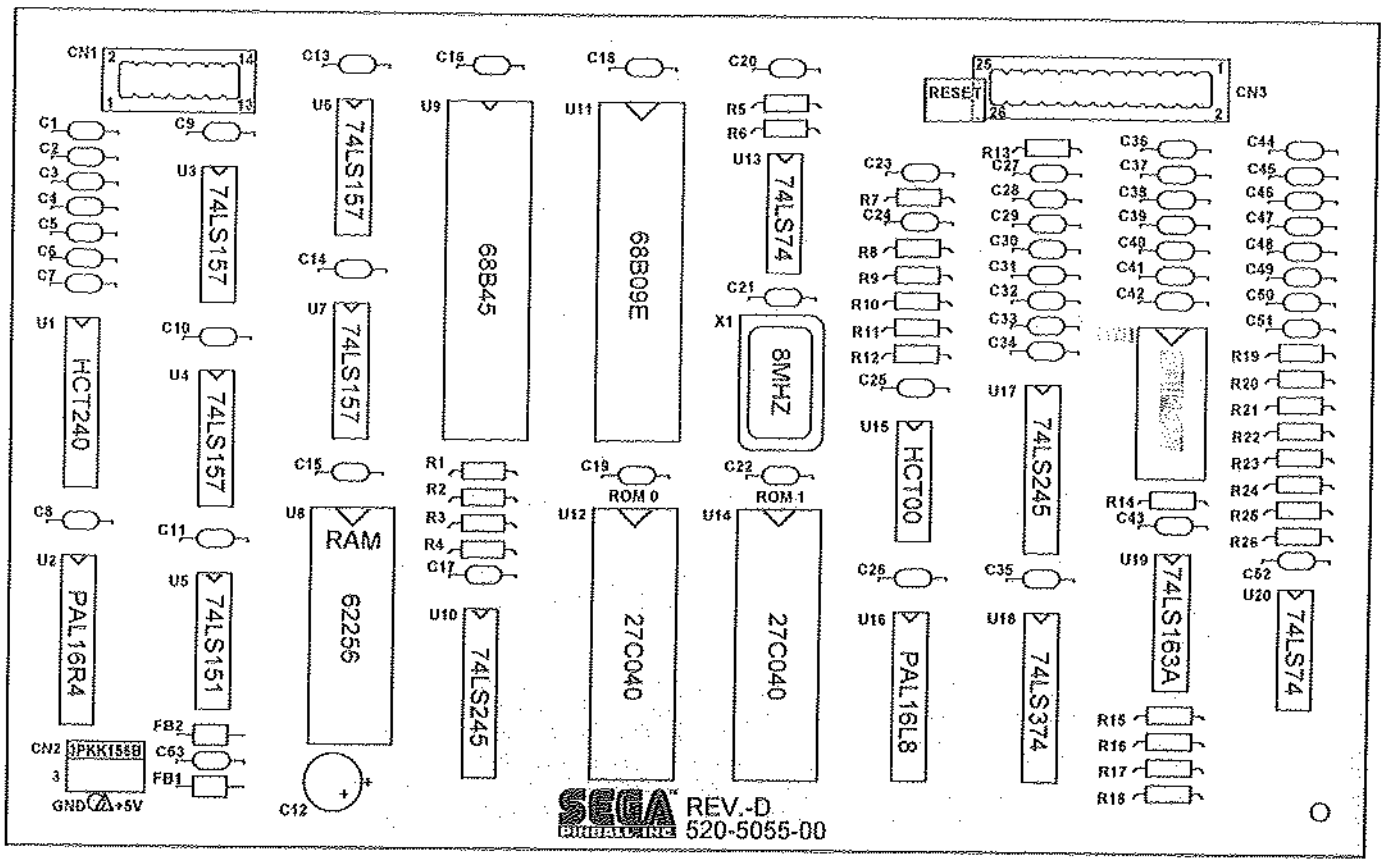


Display Power Supply Board Component Layout & Parts



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	7812CT (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





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	PAL16L8 (15CN), (Programmed) - ORANGE DOT (Note the type of PAL)
14	1	965-0108-00	U2 - ORANGE DOT	PAL16R4 (25CN), (Programmed) - ORANGE DOT (Note the type of PAL)
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), Axial Cap (C44>C51: NS)
21	2	n/a	FB1, FB2	Ferrite Bead (2743001182)
22	1	125-5016-00	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. 6 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 11VDC which is inserted into a linear voltage regulator for the output of 5VDC. 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 Display and Plasma Controller Board. Power for these devices comes off the I/O Board on [J16-(4-8)].

+5 +12 +50V +18V +20V 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	LED	Supply Voltage
L2	+5	L200	+20V
L201	+50V	L202	+18V
L203	+12V		

Reset Circuitry:
The I/O will reset in three 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 5VDC is below 4.75V or the CPU 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 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 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.

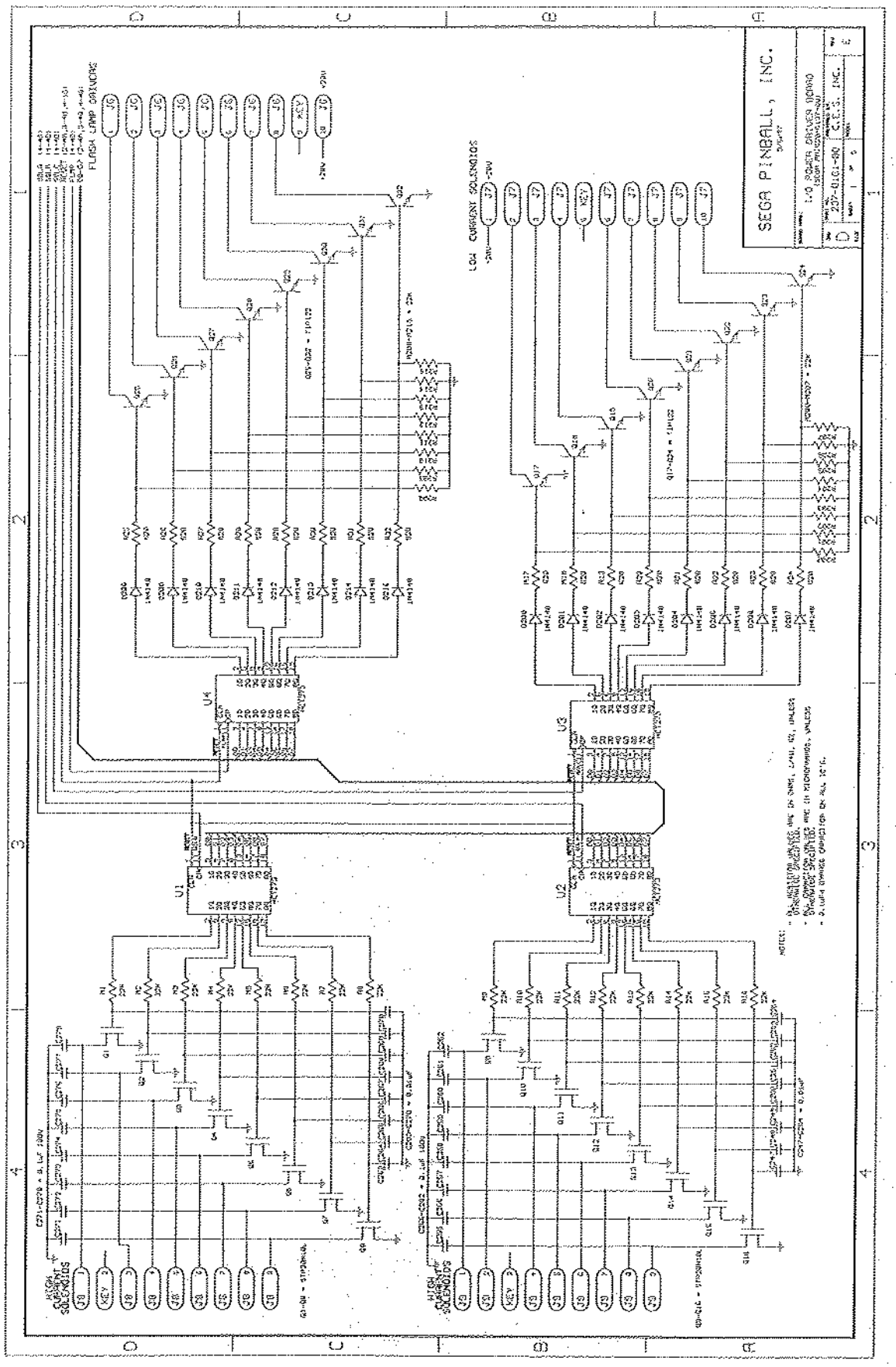
Solenoid Drivers & Flash Lamps:
J8 & J9 are high side drivers for driving solenoids and other heavy loads. Each connector has its own buffer driving 8 drivers. J8 & J9 consist of MOSFET drivers 20N10L which can easily & safely be tested by clipping one end of a clip-lead to test point FET TPL1 and then 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. 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).

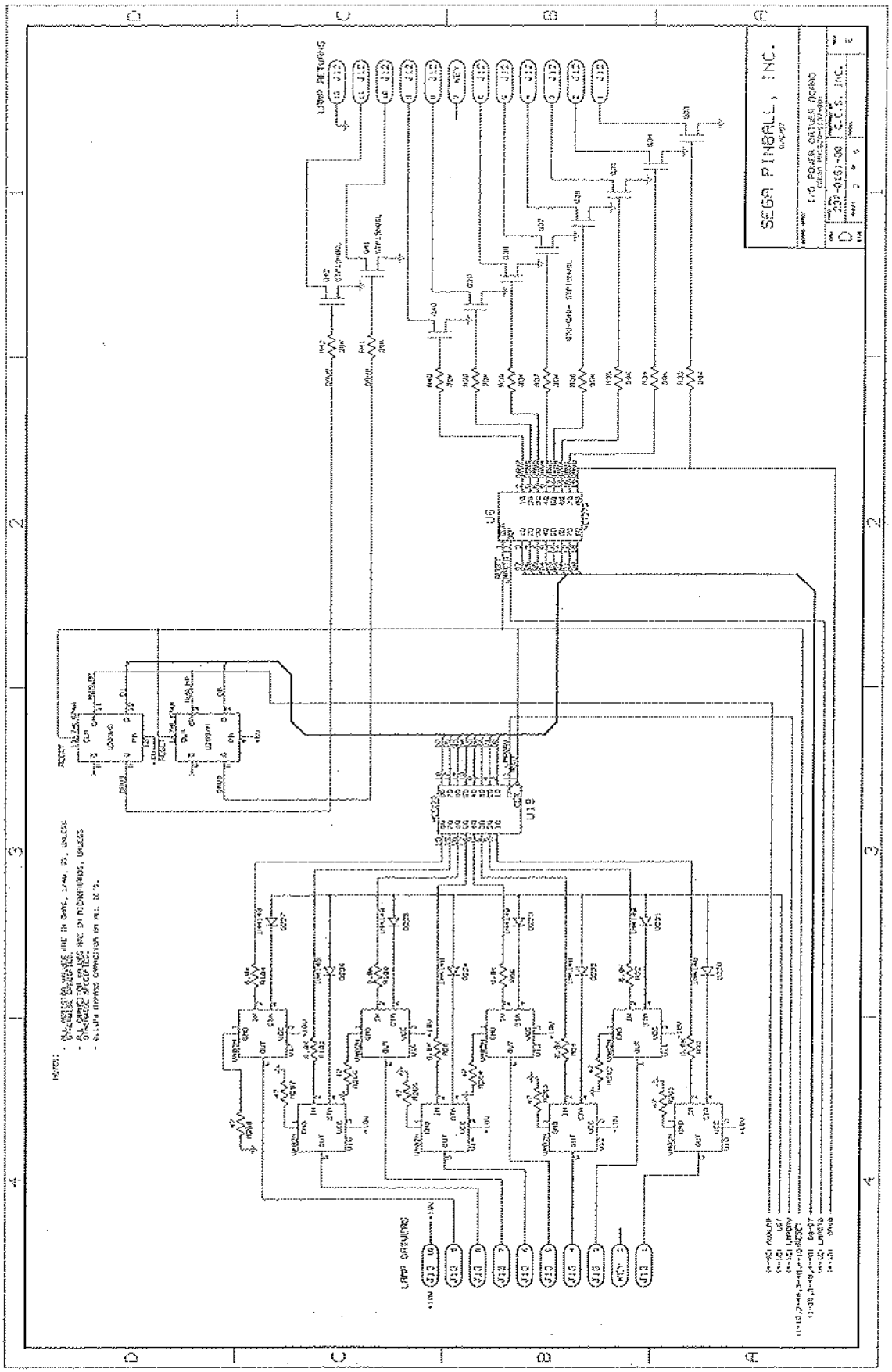
Note 1 * Clip on the resistor side with the white stripe.
** R1 controls Q1 and R2 controls Q etc...

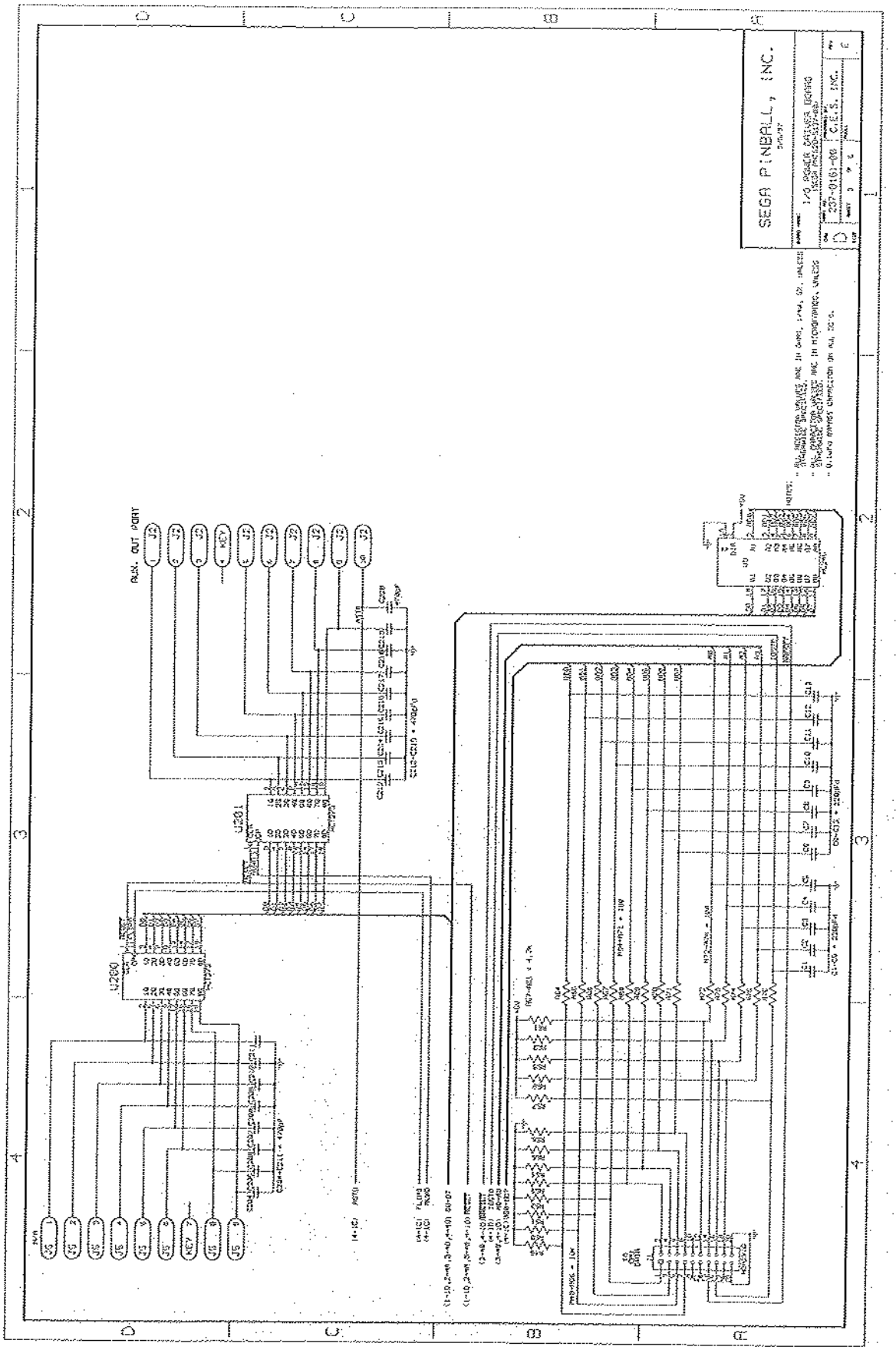
Auxiliary In & Out:
J2 8 CMOS Outputs sometimes used for a printer interface.
J3 8 CMOS Inputs general purpose inputs.

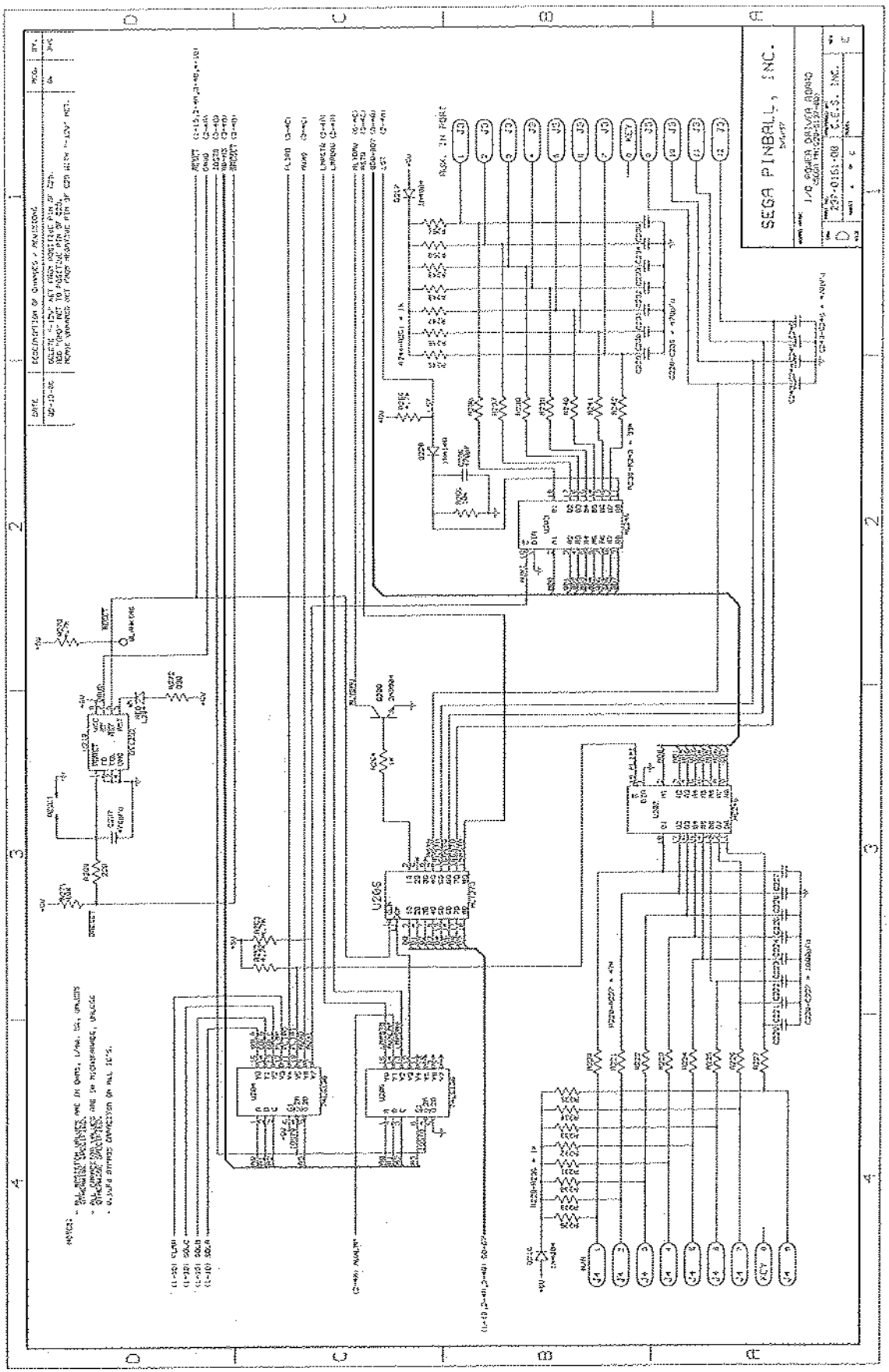
Lamp Matrix:
J12 has 10 low side drivers for the lamp strobes which consist of 19N06L MOSFETS. Only one lamp strobe should be low at any time. Again the scanning of the lamp strobes keeps the I/O from resetting. J13 has 8 high side drivers with each having a status indicator. All the status indicators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

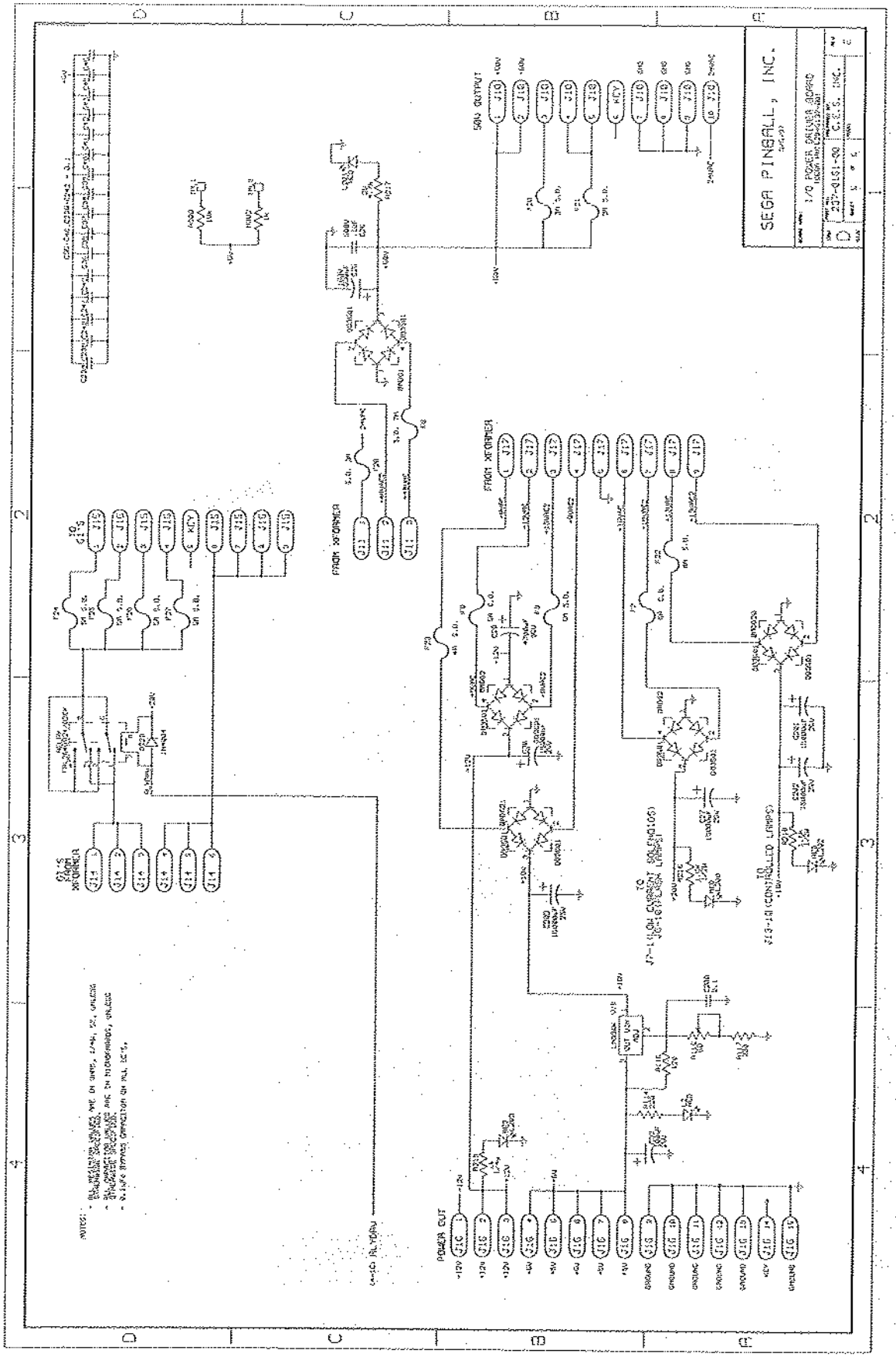
General Illumination (G.I.) Lights:
J15 has 6VAC switched on and off by a relay on the I/O Board. The relay is controlled by Q200 which supplies power to the 24V coil winding to activate the relay. There are 4 taps on J15 each fused at 5A for this 6VAC source.

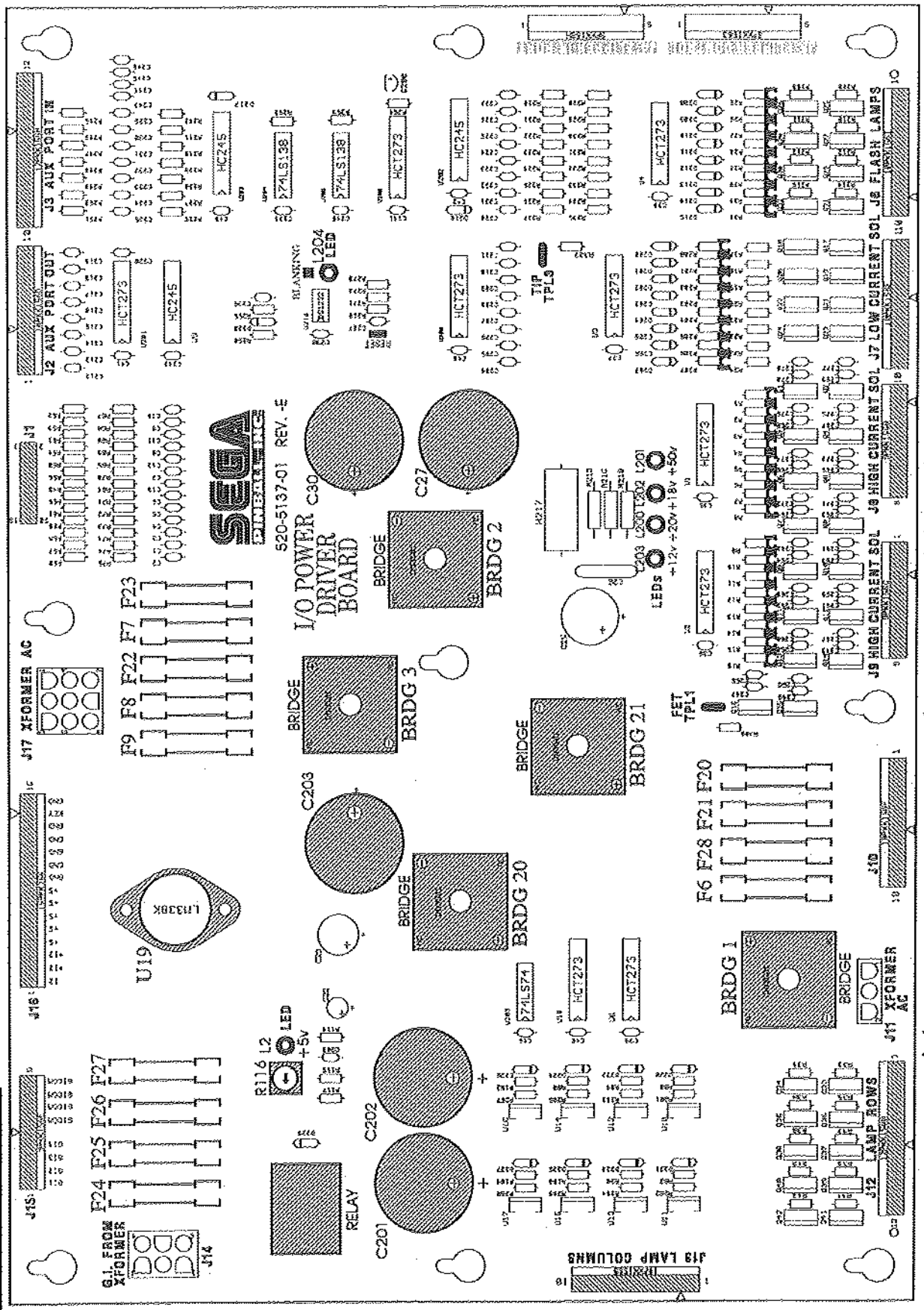

SEGA PINBALL, INC.
I/O POWER DRIVER BOARD
FLASH LAMP DRIVERS
LOW CURRENT SOLENOIDS
HIGH CURRENT SOLENOIDS
U1
U2
U3
U4


SEGA PINBALL, INC.
I/O POWER DRIVER BOARD
LAMP RETURNS
LAMP DRIVERS


SEGA PINBALL, INC.
AUX. OUT PORT


SEGA PINBALL, INC.
I/O POWER DRIVER BOARD
U20S


SEGA PINBALL, INC.
I/O POWER DRIVER BOARD
SOL OUTPUT
FROM MOTHERBOARD
TO LAMP CONTROLLED LAMPS
POWER OUT


TEST POINTS:
TIP TPL3
BLANKING
L204 LED
RESET
L201 LED+50v
L202 LED+18v
L200 LED+20v
L200 LED+12v
FET TPL1
L2 LED +5v
R116 POT
J3 AUX PORT IN
J2 AUX PORT OUT
J8 FLASH LAMPS
J7 LOW CURRENT SOL
J9 HIGH CURRENT SOL
J17 XFORMER AC
J11 XFORMER AC
J12 LAMP ROWS
J13 LAMP COLUMNS
J14 G1 FROM XFORMER
J15
J16
J10
SEGA
520-5137-01 REV. -E
I/O POWER DRIVER BOARD
BRDG 1
BRDG 2
BRDG 3
BRDG 20
BRDG 21
BRIDGE
RELAY
LED
U19
L7330K
C27
C30
C201
C202
C203
F6 F7 F8 F9 F20 F21 F22 F23 F24 F25 F26 F27 F28
HC245
HCT273
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	124-5000-00	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.)

CPU Section:
The CPU is a 68B09E (U209) with up to 8Mbytes of CPU code space (U210). The CPU code is bank selected by the use of U211and each bank consists of 16Kbytes. 8Kbytes 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 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 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 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 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.

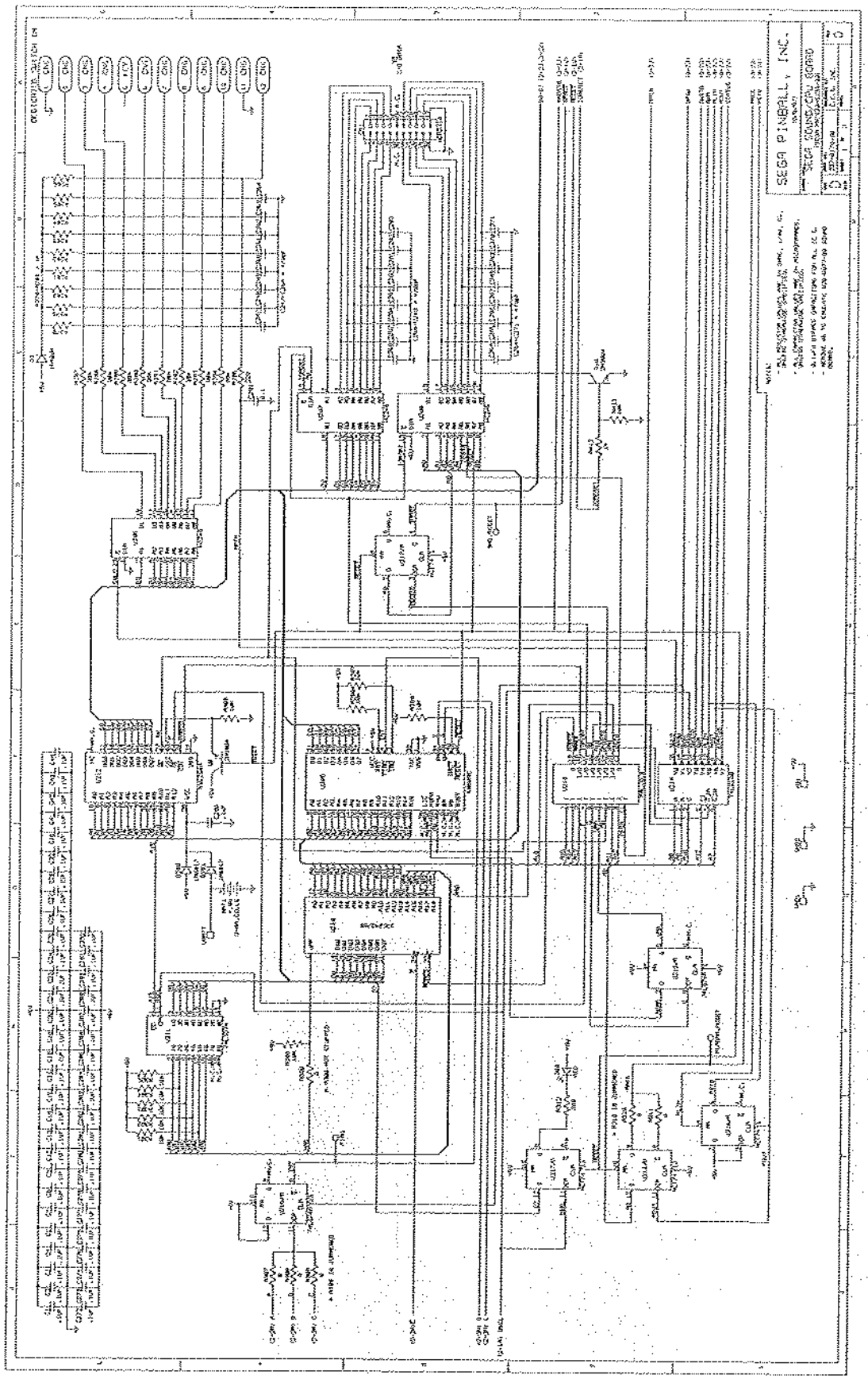
Sound calls are made from the CPU's 68B09E U200 to the sound section by latching data into U5. The sound section's CPU 68BO9E (U6) reads in this data and handles the interfacing to the BSMT.

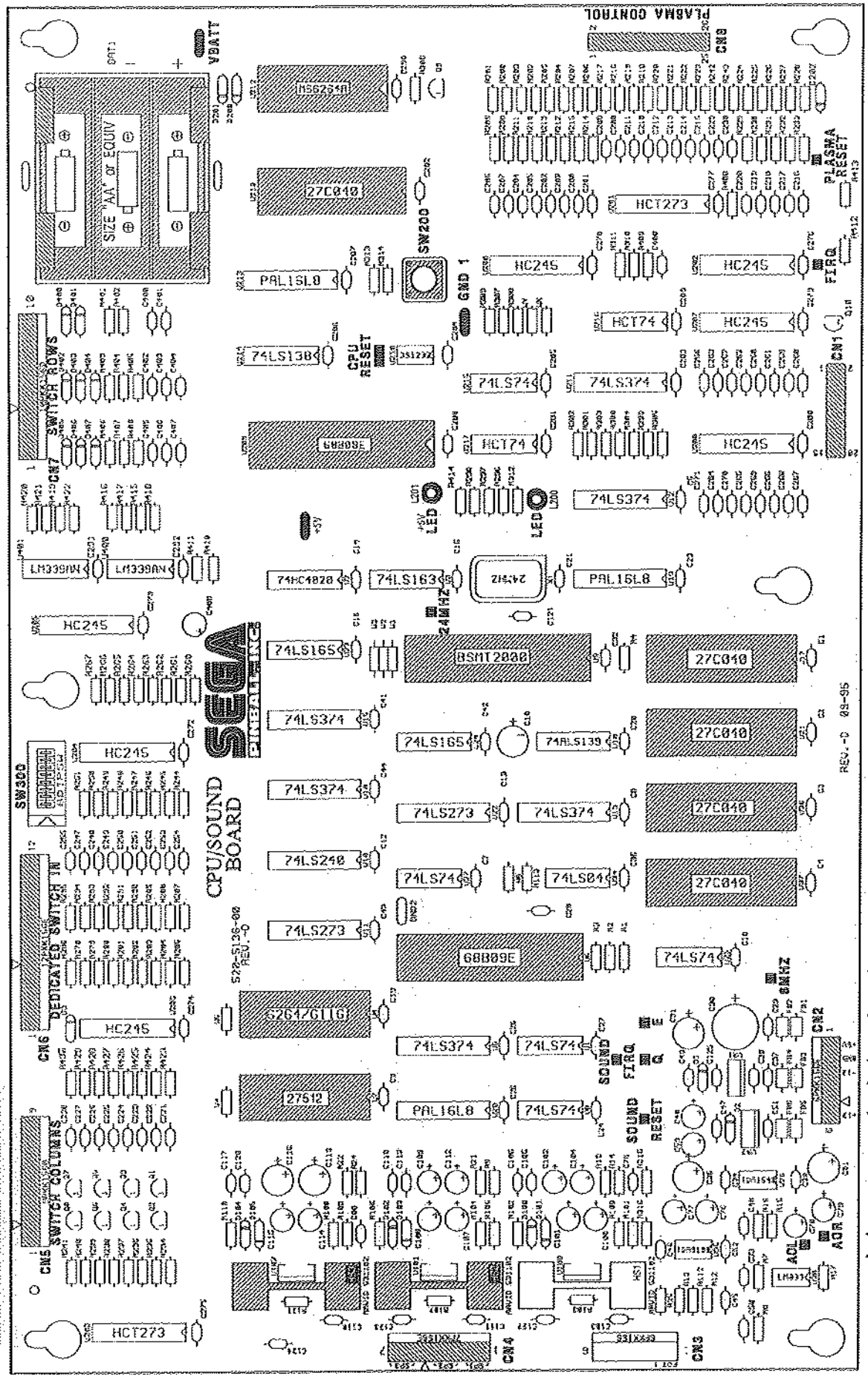
Other Test Points:
E & Q - The CPU signals for both 68B09E processors. Should be at 2Mhz with Q leading E by 500 nsec.

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.


SEGA PINBALL, INC.


TEST POINTS:
VBATT
PLASMA RESET
FIRQ
SW200
GROUND 1
CPU RESET
L201 LED+5v
L200 LED
+5v
24 Mhz
6 Mhz
E
SOUND FIRQ
Q
SOUND RESET
AOR
AOL
CPU/SOUND BOARD
SEGA
EDITION INC
SWITCH ROWS
SWITCH COLUMNS
DEDICATED SWITCH IN
SIZE "AA" or EQUIV
PLASMA CONTROL
68B09E
BSMT2000
S261/G116
27512
27C010
74LS374
74LS165
74LS273
74LS240
74LS74
74LS04
74LS139
74LS163
74HC4020
74LS374
HC245
HCT74
HCT273
PAL16L8
PAL16L8
74LS138
LM339AN
LM339AN
24MHZ
6MHZ
SOUND FIRQ
SOUND RESET
AOR
AOL
CN1
CN2
CN3
CN4
CN5
CN6
CN7
CN8
SW200
SW300
GND 1
CPU RESET
FIRQ
PLASMA RESET
LED
+5V LED
REV. -0 03-95
520-5136-00 REV. -0

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. ⓫ 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. ⓫ 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, C107 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	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.

THIS PAGE IS INTENTIONALLY BLANK.

Appendixes A through I

Appendix
Table of Contents

- Appendix A, Pinball Game Firmware Table 112-113
  ...describes the EPROM with its chip size, the Sega Pinball Inc. (SPI) Part Nº, version (if applicable), and CPU Board & CPU/Sound Board Pin location(s).
- Appendix B, Semi-Conductors / Integrated Circuits / Relay Cross-Reference Table 114
  ...describes diodes and transistors with Source Nº, SPI Part Nº, NTE Nº, ECG Nº, Radio Shack Nº and RCA Part Nº (If applicable).
- Appendix C, Game Mfg. Date, Manual Part Nº and CPU Jumper Table 115
  ...provides the Game Manufactured Date and Manual Part Nº, the CPU version, the EPROM Position (Jumpers Installed and Removed for Games Laser War through Batman Forever (1-28) only)
- Appendix D, Board Type Table..... 116-117
  ...provides Board Part Nºs for Games Laser War through Batman Forever (Flipper, Sound, Power Supply, Dot Matrix Display, Display Controller & OPTOs) and the White Star Board System, Games Apollo 13 through current (Flipper, I/O Power Driver, CPU/Sound, Display Power Supply, Dot Matrix Display, Display Controller & OPTOs)
- Appendix E, Generic Coil Cross-Reference Guide and Flipper Coil Table 118-119
  ...provides the Coils used with Part Nº and Gauge-Turns (of the coil).
- Appendix F, Motor Specification Table 120-121
  ...provides all the Motor Function, Specifications and Part Nº for Games Laser War through current.
- Appendix G, Part Number Prefix Classification Codes 122
  ...explains how our Part Numbers are developed to help sort parts easier.
- Appendix H, Playfield Inserts (Plastic Light Covers) 123
  ...gives a pictoral view with the name and Part Nº of all the inserts used (also gives the Color Code Chart).
- Appendix I, Stand-Up Targets (Happ Modular & Regular) 124
  ...gives a pictoral view with the name and Part Nº of all the Single Stand-Up Targets used (also gives the Color Code Chart).
- Glossary of Terms 125
  ...gives definitions or explanations of some pinball terms and acronyms.
- Parts Order Checklist Notes 126
  ...keep track of your parts ordered through your distributor for this game.

APPENDIX B
Semi-Conductors / Integrated Circuits / Relays Cross-Reference Table

Table №	Type	Source Number	SEGA PINBALL™	N T E®	E C G®	Radio Shack®	R C A®
	RECTIFICATION, BLOCKING AND/OR DAMPENING DIODES						
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
	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.	VN02	110-0089-00	- — - — -	- — - — -	- — - — -	- — - — -
	NPN Trans.	2N4401	- — - — -	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)	DB or CM3501	124-5000-00	For WhiteStar I/O Bds., BR = 35 Amp @ 100v P.I.V.			
	BR (Old)	MDA2501	124-2501-00	BR = 25 Amp @ 100v P.I.V.			
	BR (Old)	MDA3502	124-3502-00	BR = 35 Amp @ 200v 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 (1-28 only)

Game Name	Game Mfg. Date and Manual PN°	CPU Ver.	EPROM Position	Jumpers Installed	Jumpers Removed
1. Laser War	MAY 87 780-5001-00	1 2	5C 5B, 5C	J4 J6a J7a J4 J5a J6a	J5 J6 J7b J5 J5b J6b
2. Secret Service	MAR 88 780-5002-00	2	5B, 5C	J4	J5
3. Torpedo Alley	AUG 88 780-5003-00	2	5B, 5C	J4	J5
4. Time Machine	DEC 88 780-5004-00	2	5B, 5C	J4	J5
5. Playboy 35th Anniversary	MAY 89 780-5005-00	2	5B, 5C	J4	J5
6. ABC Monday Night Football	SEP 89 780-5007-00	2	5B, 5C	J4	J5
7. Robocop	NOV 89 780-5006-00	2	5B, 5C	J4	J5
8. Phantom of the Opera	JAN 90 780-5008-00	2	5B, 5C	J4	J5
9. Back to the Future	JUN 90 780-5009-00	3	5B, 5C	J4	J5
10. The Simpsons	SEP 90 780-5012-00	3	5B, 5C	J4	J5
11. Checkpoint	FEB 91 780-5010-00	3	5B, 5C	J4	J5
12. Teenage Mutant Ninja Turtles	MAY 91 780-5017-00	3	5B, 5C	J4	J5
13. Batman	JUL 91 780-5011-00	3	5B, 5C	J4	J5
14. Star Trek 25th Anniversary	OCT 91 780-5014-00	3	5C	J5	J4
15. Hook	JAN 92 780-5019-00	3	5C	J5	J4
16. Lethal Weapon 3	JUN 92 780-5026-00	3	5C	J5	J4
17. Star Wars	OCT 92 780-5024-00	3	5C	J5	J4
18. Rocky & Bullwinkle & Friends	FEB 93 780-5022-00	3	5C	J5	J4
19. Jurassic Park	APR 93 780-5020-00	3	5C	J5	J4
20. Last Action Hero	AUG 93 780-5027-00	3	5C	J5	J4
21. Tales from the Crypt	NOV 93 780-5018-00	3	5C	J5	J4
22. The Who's Tommy	FEB 94 780-5028-00	3	5C	J5	J4
23. WWF Royal Rumble	MAY 94 780-5023-00	3	5C	J5	J4
24. Guns N' Roses	JUL 94 780-5029-00	3	5C	J5	J4
25. Maverick	SEP 94 780-5031-00	3	5C	J5	J4
26. Mary Shelley's Frankenstein	DEC 94 780-5036-00	3	5C	J5	J4
27. Baywatch	MAR 95 780-5033-00	3	5C	J5	J4
28. Batman Forever	JUL 95 780-5038-00	3	5C	J5	J4

Game Name	Game Mfg. Date and Manual PN°	CPU Ver.	EPROM Position	Jumpers Installed	Jumpers Removed
29. Apollo 13	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: Independence 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

† 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+, 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: 7 Digit Alpha/Numeric 520-5005-00 (Qty. 2) 7 Digit Numeric 520-5006-00 (Qty. 2) 4 Digit Numeric 520-5007-00
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-Flip. (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-Flip. (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 TRANS./REC.	OPTO APPLICATION
Checkpoint	520-5033-00 2-Flipper	520-5002-03	520-5047-00	520-5042-00 128 X 16	Not Used w/ 128 X 16	None Used	None Used
Teenage Mutant Ninja Turtles	520-5033-00 2-Flipper	520-5002-03	520-5047-00	520-5042-00 128 X 16	Not Used w/ 128 X 16	None Used	None Used
Batman	520-5033-00 2-Flipper	520-5050-01	520-5047-00	520-5042-00 128 X 16	Not Used w/ 128 X 16	None Used	None Used
Star Trek 25th Anniversary	520-5033-00 2-Flipper	520-5050-01	520-5047-00	520-5042-00 128 X 16	Not Used w/ 128 X 16	None Used	None Used
Hook	520-5033-00 2-Flipper	520-5050-01	520-5047-00	520-5042-00 128 X 16	Not Used w/ 128 X 16	None Used	None Used
Lethal Weapon 3	520-5033-00 2-Flipper	520-5050-01	520-5047-01	520-5052-00 128 X 32	520-5055-00	None Used	None Used
Star Wars	520-5033-00 2-Flipper	520-5050-02	520-5047-01	520-5052-00 128 X 32	520-5055-00	None Used	None Used
Rocky & Bullwinkle & Friends	520-5033-00 2-Flipper	520-5050-02	520-5047-01	520-5052-00 128 X 32	520-5055-00	None Used	None Used
Jurassic Park	520-5076-00 3-Flipper	520-5050-02	520-5047-02	520-5052-00 128 X 32	520-5055-00	None Used	None Used
Last Action Hero	520-5070-00 2-Flipper	520-5050-03	520-5047-02	520-5052-00 128 X 32	520-5055-00	None Used	None Used
Tales from the Crypt	520-5076-00 3-Flipper	520-5050-03	520-5047-02	520-5052-00 128 X 32	520-5055-01	None Used	None Used
The Who's Tommy	520-5076-00 3-Flipper	520-5077-00	520-5047-02	520-5052-00 128 X 32	520-5055-01	None Used	None Used
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	None Used	None Used
Guns N' Roses	520-5076-00 3-Flipper	520-5077-00	520-5047-02	520-5052-00 128 X 32	520-5055-01	None Used	None Used
Maverick	520-5076-00 3-Flipper	520-5050-03	520-5047-03	520-5075-00 192 X 64	520-5092-01	520-5102-00 520-5103-00	Single OPTO: Paddle Boat
Mary Shelley's Frankenstein	520-5076-00 3-Flipper	520-5077-00	520-5047-03	520-5075-00 192 X 64	520-5092-01	None Used	None Used
Baywatch	520-5070 / 5080 -00 4-Flipper (2X2)	520-5126-02	520-5047-03	520-5075-00 192 X 64	520-5092-01	520-5124-00 520-5125-00	Single OPTO: Ball Trough
Batman Forever	520-5076-00 3-Flipper	520-5126-02	520-5047-03	520-5075-00 192 X 64	520-5092-01	520-5124-00 520-5125-00	Single OPTO: Ball Trough

Table continued on the next page.

APPENDIX D
Board Type Table

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 TRANS./REC.	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 / 520-5125-00	Single OPTO: Ball Trough
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 / 520-5125-00	Single OPTO: Ball Trough

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 TRANS./REC.	OPTO APPLICATION
Twister	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 / 520-5125-00	Single OPTO: Ball Trough
ID4: Independence Day	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 / 520-5125-00	Single OPTO: Ball Trough
						520-5082-00 / 520-5083-00	Long Hop OPTO: Alien Head
Space Jam	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 / 520-5125-00	Single OPTO: Ball Trough
The Star Wars Trilolgy - S.E.	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 / 520-5125-00	Single OPTO: Ball Trough
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 / 520-5125-00	Single OPTO: Ball Trough
						520-5162-00 (combo)	Slotted OPTO: Snagger Motor
The X-Files	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 / 520-5125-00	Single OPTO: Ball Trough
						520-5082-00 / 520-5083-00	Long Hop OPTO: File Cab. Enter
						520-5155-00 (combo)	Slotted OPTO: File Cab. Motor
Starship Troopers	520-5137-01	520-5136-15	520-5138-00	520-5052-00 128 X 32	520-5055-02	520-5124-00 / 520-5125-00	Single OPTO: Ball Trough
						520-5082-00 / 520-5083-01	Long Hop OPTO: L/R Orbit Lane
Viper Night Drivin'	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5124-00 / 520-5125-00	Single OPTO: Ball Trough
						520-5082-00 / 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 / 520-5174-00	Dual OPTO: Ball Trough
Godzilla	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 / 520-5174-00	Dual OPTO: Ball Trough

† ***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
						25-1800	13.8 Ω	BLU/GRN	090-5041-00

NOTE: Ohm values may vary +/- .03Ω depending on meter calibration.

† 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.

MINI-COILS		
GA-TURNS	Res. (Ω)	SPI PART Nº
31-1500	52.0 Ω	090-5054-00
32-1800	50.2 Ω	090-5031-00

LUGLESS COILS		
GA-TURNS	Res. (Ω)	SPI PART Nº
23-800	3.6 Ω	090-5053-00

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 SPI Nº / Gauge-Turns / Color		UPPER FLIPPERS 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	090-5030-00T 23-1100 -ORG-	090-5030-00T 23-1100 -ORG-	Not Used	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

Game Name	Function	Specifications	Part Nº
Laser War Secret Service Torpedo Alley Time Machine Playboy 35th Anniversary	No motors were used on the games listed on the shaded lines.		
ABC Monday Night Football	Goal Post Up/Down Movement	Motor 24v A.C. 60 RPM CW	515-5222-00
Robocop			
Phantom of the Opera	Organ Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Back to the Future The Simpsons			
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
Hook			
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

Table continued on the next page.

APPENDIX F
Motor Specification Table

Game Name	Function	Specifications	Part Nº
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
Guns N' Roses			
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
Baywatch			
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
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
Space Jam			
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
Viper Night Drivin'			
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
	‡ Please Note: Not Compatible with old 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 AND ENERGY AND SIGNAL CONVERTERS**	
	010-	Transformers
	031-	Speakers
	090-	Solenoids
II.	**CONDUCTORS, CONNECTORS AND INSULATORS**	
	034-	Line Cords
	036-	Cable and Harness Assemblies
	041-	Motors
	045-	Connectors (All Types)
	077-	Lamp Sockets
III.	**CIRCUITS AND 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, AND WASHERS**	
	231-	Bolts
	232-	Screws (Pan Head)
	234-	Screws (HXW)
	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-	P.C. Boards
	522-	Display Glass
	525-	Wood Parts
	530-	Screw Machined Parts
	535-	Fabricated Parts
	545-	Molded (Extruded) Parts (Rubber Rings, Molded Plastic)
	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.)
	820-	Butyrate
	900-	Game Posters
	960-	EPROM (Raw Part)
	965-	EPROM (Programmed Part)

APPENDIX H
Playfield Inserts (Plastic Light Covers)

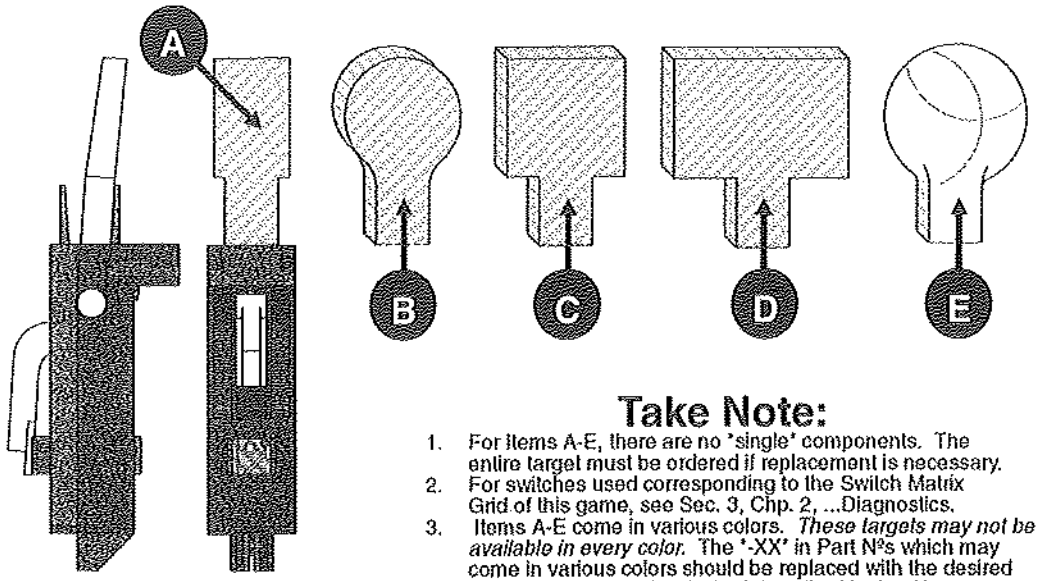
Patterns: STARBURST  STIPPLE 	STARBURST CIRCULAR 5/8" ø 550-5000-XX	STARBURST CIRCULAR 3/4" ø 550-5001-XX	STARBURST CIRCULAR 1" ø 550-5002-XX	STARBURST CIRCULAR 1-3/16" ø 550-5003-XX	STARBURST CIRCULAR 1-1/2" ø 550-5004-XX
STARBURST CIRCULAR 2-1/4" ø 550-5005-XX	STARBURST CIRCULAR 2-3/4" ø 550-5006-XX	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-SHORT 550-5013-XX	STARBURST ARROW-LARGE 550-5014-XX	STARBURST ARROW-HEAD 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	-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		

APPENDIX I
Stand-Up Targets

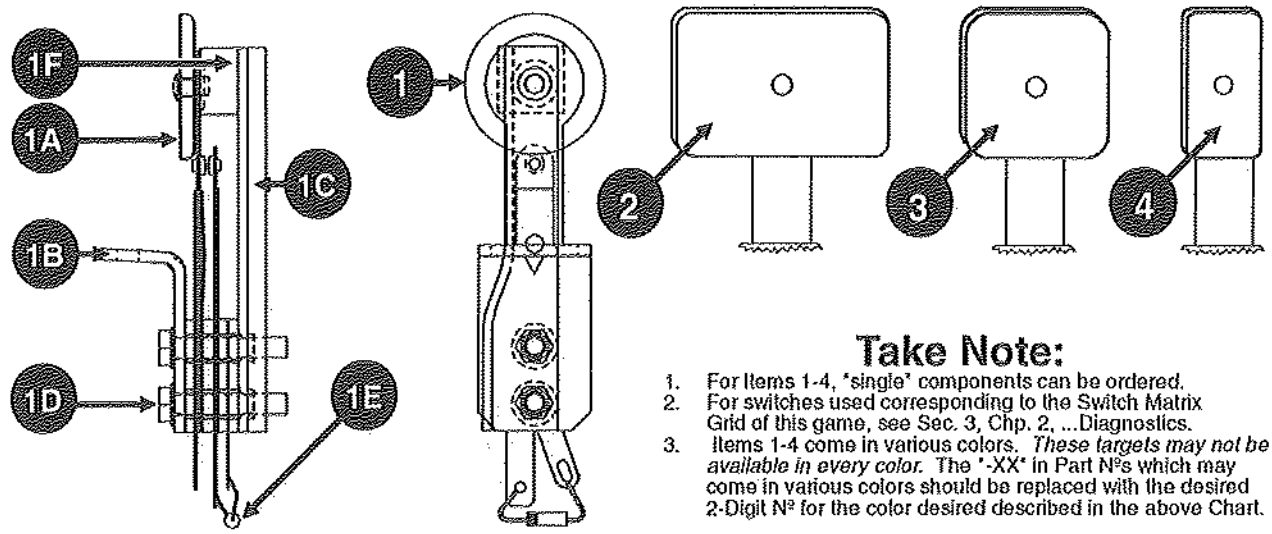


Take Note:

1. For items A-E, there are no "single" components. The entire target must be ordered if replacement is necessary.
2. For switches used corresponding to the Switch Matrix Grid of this game, see Sec. 3, Chp. 2, ...Diagnostics.
3. Items A-E come in various colors. *These targets may not be available in every color.* The "-XX" in Part Nºs which may come in various colors should be replaced with the desired 2-Digit Nº for the color desired described in the Chart.

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

Nº	Stand-Up Target Name	Part Nº
A	Modular Stand-Up Target Narrow	500-6138-XX
B	Modular Stand-Up Target Round	500-6075-XX
C	Modular Stand-Up Target Square	500-6139-XX
D	Modular Stand-Up Target Rectangle	500-6228-XX
E	Modular Stand-Up Target 1" Spherical	500-6189-XX



Take Note:

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

Nº	Stand-Up (Flat) Target Name	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).

Nº	Stand-Up (Flat) Target Name	Part Nº
2	1" X 1½" Stand-Up Rect. Target Assy.	500-5321-XX
ORDERING ABOVE (ITEM 2) ASSY. PART Nº WILL INCLUDE:		
2A‡	Sw. & Target Assy. 1" X 1½" Rect.	515-6027-XX
	Items 2B-F are identical to 1B-F	Same as 1B-F

Item 2 Table Note continued in the next column.

‡ Note: Item 2A, is a riveted Sub-Assy. which includes the following items for reference: A1— Stack Switch Radius End (180-5133-00), A2— Washer 5/16" (242-5017-00), A3— Rivet 1/8" ø X 3/16" (249-5001-00) and A4— Rectangular Target (545-5145-XX).

Nº	Stand-Up (Flat) Target Name	Part Nº
3	1" Sq. Stand-Up Target Assy.	500-5232-XX
ORDERING ABOVE (ITEM 3) ASSY. PART Nº WILL INCLUDE:		
3A‡	Sw. & Target Assy. 1" Square	515-5162-XX
	Items 3B-F are identical to 1B-F	Same as 1B-F

‡ Note: Item 3A, is a riveted Sub-Assy. which includes the following items for reference: A1— Stack Switch Radius End (180-5133-00), A2— Washer 5/16" (242-5017-00), A3— Rivet 1/8" ø X 3/16" (249-5001-00) and A4— 1" Square Target (545-5470-XX).

Nº	Stand-Up (Flat) Target Name	Part Nº
4	Narrow Stand-Up Target Assy.	500-5835-XX
ORDERING ABOVE (ITEM 4) ASSY. PART Nº WILL INCLUDE:		
4A‡	Sw. & Target Assy. Narrow	515-5967-XX
	Items 4B-F are identical to 1B-F	Same as 1B-F

‡ Note: Item 4A, is a riveted Sub-Assy. which includes the following items for reference: A1— Stack Switch Square End (180-5132-00), A2— Washer 5/16" (242-5017-00), A3— Rivet 1/8" ø X 3/16" (249-5001-00) and A4— Narrow Target (545-5210-XX).

GLOSSARY OF TERMS

A Followed after a number means "Amp." or Ampage in an expression relating to an electrical object. (e.g. 8A).

AC (Acronym) Alternating Current.

Adj. (Abbreviation) Adjustment(s).

Assy. (Abbreviation) Assembly.

Au. (Abbreviation) Audit(s).

Bd. (Abbreviation) Board.

BOT (Abbreviation) Bottom.

Brkt. (Abbreviation) Bracket.

Bridge Rectifier A configuration of a diode that allows current to flow in one direction producing both positive and negative pulsating DC Voltages.

Color Coding See Appendix H or I, Plastic Part Color Chart or Section 4, Chapter 1, Playfield - Plastic Posts & Spacers.

Combination (Combo) [Shot] Any variable pinball shot(s) made successively.

Conn. (Abbreviation) Connector.

CMOS Short for COSMOS (Complementary Symmetry M.O.S.); Complementary Metal-Oxide Semi-Conductor.

CN (Abbreviation) Connector (e.g. CN5-P3).

CT (Abbreviation) Center.

DC (Abbreviation) Direct Current.

DT (Abbreviation) Drop Target(s).

DOTS (Acronym) Diode On Terminal Strip.

EB (Abbreviation) Extra Ball.

Eject Playfield surface device to kick ball back into play; Saucer.

EPROM (Acronym) Erasable Programmable Read Only Memory. Can be erased using UV Light and re-programmed.

e.g. (Abbreviation) Latin- Exempli gratia. For Example.

EOS (Acronym) End-Of-Stroke (i.e. Switch for flipper).

F (Abbreviation) Fuse (i.e. F23).

GA-Turn Gauge & Turn describing the windings on a coil (e.g. 23-800, 23 is the gauge of wire and 800 is the amount of windings.

G.I. (Abbreviation) General Illumination (Lamps).

HWH (Abbreviation) Hex Washer Head.

IC (Acronym) Integrated Circuit (As in after 24-Pin IC).

ID or I.D. (Acronym) Inside Dimension.

I.e. (Abbreviation) Latin- Id est. That is.

IO or I/O (Abbreviation) Input / Output (e.g. I/O Power Driver Bd.)

LT, Lt. or L. (Abbreviation) Left.

Laser Kick A coil/plunger used above the playfield to kick pinball back into play.

LED (Acronym) Light Emitting Diode.

Loop [Shot] Continuously up a ramp and back to the flipper.

Lwr. (Abbreviation) Lower.

Orbit [Shot] From the left or right flipper around the back rail of the playfield back to the flipper.

MB (Abbreviation) Magnet Board.

M-BALL or MBALL (Abbreviation) Multiball™ More than 1 ball in game play.

MID (Abbreviation) Middle

Non-Reflexive See Reflexive.

No. or N° or # (Abbreviation) Number

NPF (Acronym) No Problem Found.

N.C. or NC (Abbreviation) Normally Closed.

N.O. or NO (Abbreviation) Normally Open.

NS (Abbreviation) Not Stuffed. (Use in Part Listings, Sec. 5)

OD or O.D. (Abbreviation) Outside Dimension.

P (Abbreviation) Pin (e.g. CN5-P3).

PCB (Acronym) Printed Circuit Board

P/F (Abbreviation) Playfield.

PIA LED (Acronym) Peripheral Interface Adapter Light Emitting Diode.. This is a diagnostic LED on the CPU; it should not be lit during normal operation of a pinball game.

Plumb Bob Tilt Weight on Tilt Assembly.

PPH (Abbreviation) Phillips Pan Head.

Pop(s) Another term for Turbo Bumper(s).

PPB (Acronym) Playfield Power Board ("Popcorn-Popping Bd.").

PREV (Abbreviation) Previous.

PSB (Abbreviation) Power Supply Board

RAM (Acronym) Random Access Memory. RAM can store input instructions and supply output information.

Reflexive/Non-Reflexive **Reflexive**—Solenoid Drive Transistor is enabled directly by a switch closure on the (Relating to CPU Boards) solenoid assembly (Ver. 1/2).
Non-Reflexive—Solenoid Drive Transistor is enabled by the CPU after reading a switch closure in the Switch Matrix (Ver. 3). Also note: All CPU Boards are backwards compatible (e.g. Jurassic Park/Ver. 3 to Time Machine/ Ver. 2). Swapping a Ver. 2 Board to a Ver. 3 is not possible due to the special solenoids section (i.e. Slingshots, Turbo Bumpers, etc.) changing from ***REFLEXIVE*** to ***NON-REFLEXIVE*** on Ver. 3 Boards.

Relay An automatic switch operated by current in a coil.

ROM (Acronym) Read Only Memory. ROM **cannot** store input instructions but can supply output information. ROM can be programmed only once.

RMA (Abbreviation) Return Merchandise Authorization Number

RT, Rt. or R. (Abbreviation) Right.

RO (Abbreviation) Rollover (switches).

Saucer See Eject.

Scoop A hole into the playfield. A metal scoop is in place to guide the ball into the kick-back under the playfield.

Slam Tilt A switch which closes when the game is slammed into or the Coin Door is slammed shut. Depending on adjustable settings, will cancel game in play when the number of closures required is achieved.

SMB (Abbreviation) Shaker Motor Board.

Solenoid A coil used for Electro Magnetic devices such as relays, flippers, slingshots, etc.

SSFB (Abbreviation) Solid State Flipper Board.

STEP Refers to the service switches on the coin door.

Sub-Assy. (Abbreviation) Sub-Assembly.

S-U or S/U (Abbreviation) Stand-Up (targets).

TM (Abbreviation) Trademark

Transfer [Shot] Maneuvering the ball in play from one flipper to the other. With flipper in the up position and the ball cradled by that flipper one would activate the flipper button in a quick repetitive manner to bounce the ball to the other side. Skilled players can rebound the ball off the slingshot.

Tri-Ball Three balls in play.

TTL (Abbreviation) Transistor-Transistor Logic

Upr. (Abbreviation) Upper.

V or v (Abbreviation) Volt(s).

Ver. (Abbreviation) Version.

VUK (Acronym) Vertical Up-Kicker (Super or Standard).

X (Abbreviation) "Times" A multiplier; also used in dimensions.

X-Ball An undetermined number of ball(s) during game play.

Zener Diode A semi-conductor diode used for voltage regulation. Application depends on reverse break-down voltage.

"-00B" "B" at the end of Coil Part Numbers signifies that the diode is attached to the bottom of the lug.

"-00T" "T" at the end of Coil Part Numbers signifies that the diode is attached to the top of the lug (the side nearest the coil-winding).

Parts Order Checklist Notes

Date Ordered	Part Nº	Qty.	Description	Date Received

SEGA PINBALL, INC. LIMITED WARRANTY

SEGA PINBALL, INC., ("SELLER") WARRANTS ONLY TO THE INITIAL PURCHASER OF ITS PRODUCTS THAT THE ITEMS LISTED BELOW ARE FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP UNDER NORMAL USE AND SERVICE FOR THE *WARRANTY PERIOD SPECIFIED:*

PRINTED CIRCUIT BOARDS (GAME LOGIC): 2 MONTHS
DOT MATRIX DISPLAY BOARDS: 9 MONTHS

NO OTHER PARTS OF SELLER'S PRODUCT ARE WARRANTED.

WARRANTY PERIODS ARE EFFECTIVE FROM THE INITIAL DATE OF SHIPMENT FROM SELLER TO ITS AUTHORIZED DISTRIBUTORS.

SELLER'S SOLE LIABILITY SHALL BE, AT ITS OPTION, TO REPAIR OR REPLACE PRODUCTS WHICH ARE RETURNED TO SELLER DURING THE WARRANTY PERIODS SPECIFIED, PROVIDED:

1. SELLER IS NOTIFIED PROMPTLY UPON DISCOVERY BY PURCHASER THAT STATED PRODUCTS ARE DEFECTIVE.
2. SUCH PRODUCTS ARE PROPERLY PACKAGED AND THEN RETURNED FREIGHT PREPAID, TO SELLER'S PLANT.

THIS WARRANTY DOES NOT APPLY TO ANY PARTS DAMAGED DURING SHIPMENT AND/OR DUE TO IMPROPER HANDLING, OR DUE TO IMPROPER INSTALLATION OR USAGE, OR ALTERATION. IN NO EVENT SHALL THE SELLER BE LIABLE FOR ANY ANTICIPATED PROFITS, LOSS OF PROFITS, LOSS OF USE, ACCIDENTAL OR CONSEQUENTIAL DAMAGES OR ANY OTHER LOSSES INCURRED BY THE CUSTOMER IN CONNECTION WITH THE PURCHASE OF A SEGA PINBALL, INC. PRODUCT.

WARRANTY DISCLAIMER

EXCEPT AS SPECIFICALLY PROVIDED IN A WRITTEN CONTRACT BETWEEN SELLER AND PURCHASER, THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

CAUTIONS, WARNINGS & NOTICES

Caution

FOR SAFETY AND RELIABILITY, SUBSTITUTE PARTS AND EQUIPMENT MODIFICATIONS ARE NOT RECOMMENDED (AND MAY VOID ANY WARRANTIES). USE OF NON-SEGA PINBALL INC. PARTS OR MODIFICATIONS OF GAME CIRCUITRY, MAY ADVERSELY AFFECT GAME PLAY, OR MAY CAUSE INJURIES. TRANSPORT PINBALL GAMES WITH HINGED BACKBOX DOWN ONLY! ALWAYS TAKE GREAT CARE WHEN SERVICING ANY GAME. ALWAYS DISCONNECT THE LINE VOLTAGE BEFORE SERVICING. SOME PARTS MAY STILL HOLD CURRENT WHEN UNPLUGGED. ALWAYS READ THE SERVICE MANUAL BEFORE REPLACING OR SERVICING COMPONENTS.

SUBSTITUTIONS OF PARTS OR EQUIPMENT MODIFICATIONS MAY VOID FCC TYPE ACCEPTANCE.

Warning

THIS EQUIPMENT GENERATES, USES, AND CAN RADIATE RADIO FREQUENCY ENERGY, AND IF NOT INSTALLED AND USED IN ACCORDANCE WITH THE INSTRUCTIONS MANUAL, MAY CAUSE INTERFERENCE TO RADIO COMMUNICATIONS. IT HAS BEEN TESTED AND FOUND TO COMPLY WITH THE LIMITS FOR A CLASS A COMPUTING DEVICE PURSUANT TO SUBPART J OF PART 15 OF FCC RULES, WHICH ARE DESIGNED TO PROVIDE REASONABLE PROTECTION AGAINST SUCH INTERFERENCE WHEN OPERATED IN A COMMERCIAL ENVIRONMENT. OPERATION OF THIS EQUIPMENT IN A RESIDENTIAL AREA IS LIKELY TO CAUSE INTERFERENCE IN WHICH CASE THE USER AT HIS OWN EXPENSE WILL BE REQUIRED TO TAKE WHATEVER MEASURES MAY BE REQUIRED TO CORRECT THE INTERFERENCE.

RF INTERFERENCE NOTICE, CABLE HARNESS PLACEMENTS AND GROUND STRAP ROUTING ON THIS GAME HAVE BEEN DESIGNED TO KEEP RF RADIATION AND CONDUCTION WITHIN LEVELS ACCEPTED BY THE FCC RULES. TO MAINTAIN THESE LEVELS, REPOSITION HARNESSES AND RECONNECT GROUND STRAPS TO THEIR ORIGINAL PLACEMENTS, IF THEY BECOME DISCONNECTED DURING MAINTENANCE.

Notices

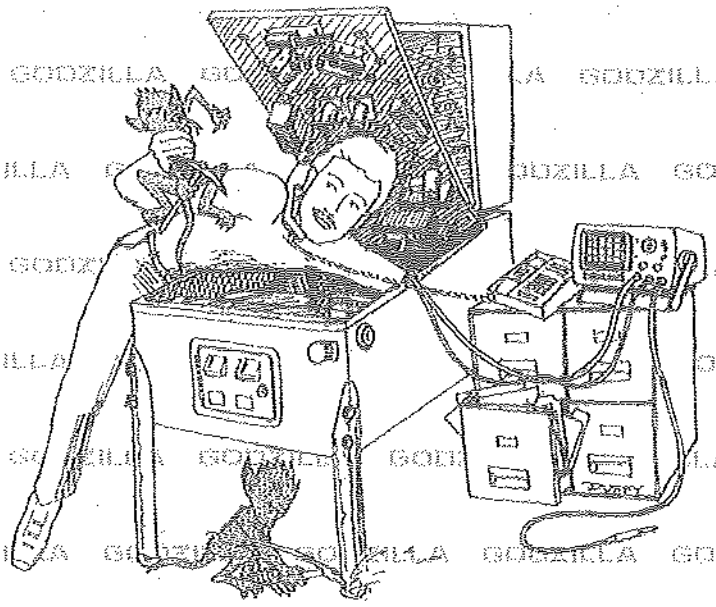
THIS DOCUMENT AND THE DATA DISCLOSED HEREIN OR HEREWITH IS NOT TO BE REPRODUCED (EXCEPT WHERE NOTED), USED OR OTHERWISE DISCLOSED IN WHOLE OR IN PART TO ANYONE WITHOUT WRITTEN CONSENT OF SEGA PINBALL, INC.. ***WARNING:*** PRODUCTS IN THIS MANUAL, THE COMPANY NAME AND DEVICES AND THE DESIGN OF THE MANUAL ITSELF, ARE PROTECTED BY FEDERAL PATENTS (AND PATENTS PENDING), DESIGN REGISTRATIONS, TRADEMARKS AND COPYRIGHTS. ACTION WILL BE TAKEN IN THE EVENT OF INFRINGEMENT OR IMITATION. THE RIGHT IS RESERVED TO CHANGE SPECIFICATIONS WITHOUT PRIOR NOTICE.

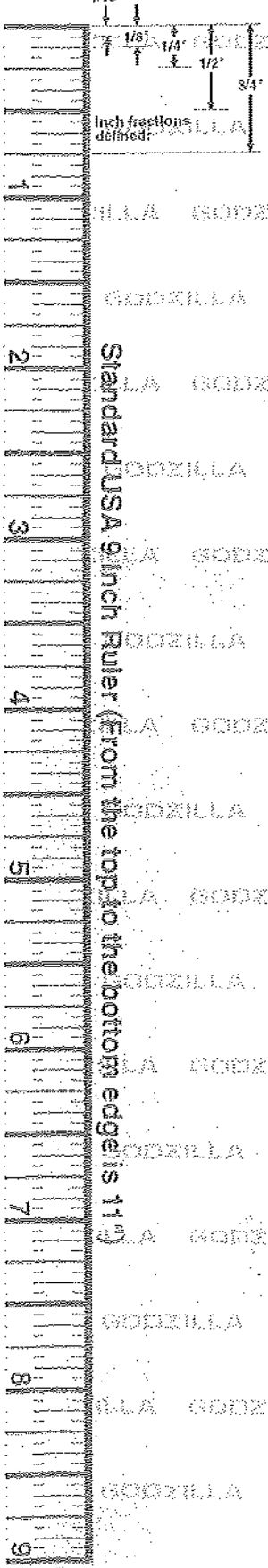
Sonic The Hedgehog™ is a TM of SEGA ©1998. *Portals, Icon Designs, logos, names, characters, & all related indicia* are trademarks of Sega Pinball, Inc.® ©1998. All Rights Reserved. "Multiball" is a registered trademark of Williams Electronics Games, Inc. Used by permission. PCB Schematics (Section 5, Chapter 4) by *CES*, Creative Electronics & Software, Inc. © 1995.

Sony Signatures Worldwide Licensing & Merchandising.

TOHO CO., LTD. Godzilla® and the Godzilla® Character & Design are Copyrighted works and is a Registered Trademark of Toho Co., Ltd.

TRISTAR PICTURES © 1997 All Rights Reserved.





GODZILLA™

ALTHOUGH EVERY EFFORT IS PUT INTO MAKING THIS MANUAL (AND ALL OTHER DOCUMENTS RELATING TO THIS PRODUCT) ACCURATE AND COMPLETE, PLAYFIELD COMPONENTS, FEATURES, RULES, PROGRAMMING AND OPERATION ARE SUBJECT TO CHANGE WITH OR WITHOUT NOTICE.

H E L P U S H E L P Y O U

IF YOU HAVE ANY SUGGESTIONS, QUESTIONS, NEED TECHNICAL ADVICE, FIND ERRORS OR HAVE COMMENTS, CALL US TOLL-FREE (USA or CANADA) AT

1-800-KICKERS
(1-800-542-5377)

or

1-708-345-7700

Fax

1-708-345-7889

PARTS SALES & TECHNICAL SUPPORT

SEGA™ PINBALL INC.

1990 Janice Avenue
Melrose Park, IL 60160

CE *Games shipped factory direct to Europe from Sega Pinball, Inc. are CE approved and will have a CE profile attached to the Serial Number.*