


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

SEGA™
PINBALL, INC.

INDEPENDENCE DAY
INDEPENDENCE DAY
INDEPENDENCE DAY
INDEPENDENCE DAY

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...why can't a flipper coil be flipped or energized like any other coil?

It can, it should...and now it is! NEW FLIPPER DESIGN - NO FLIPPER BOARD!



One of the objectives in going to the **White Star Board System™** was to simplify the system for the Operator. We have taken this line of thinking one step farther by simplifying our flipper circuit. Our pinballs were the first to utilize a **Solid State Flipper System**. This required more complex circuitry in the form of the Solid State Flipper Board but reduced the overall amount of service calls on the pinball by a good 25% due to increased reliability.



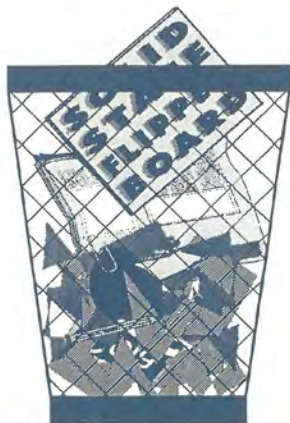
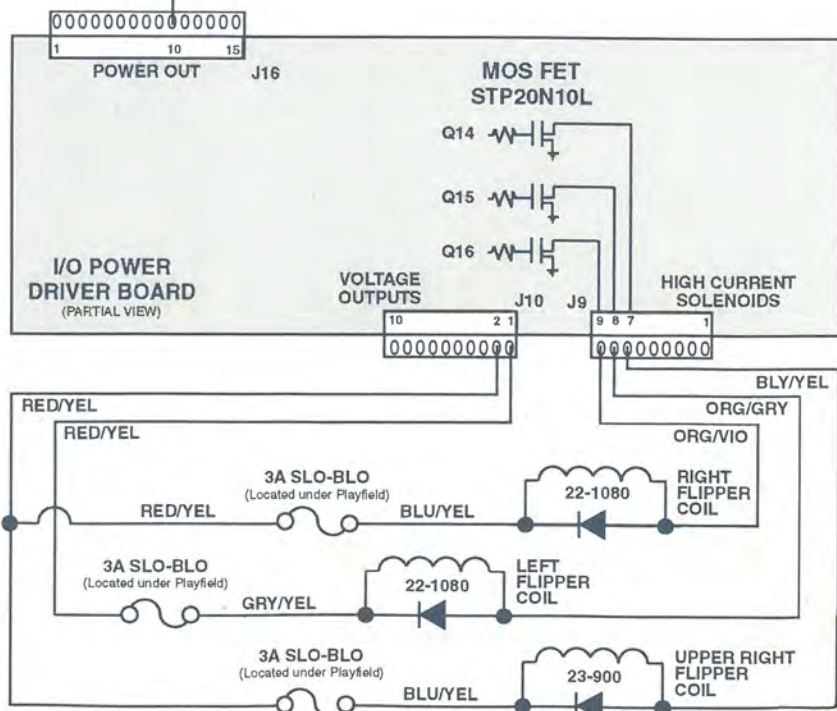
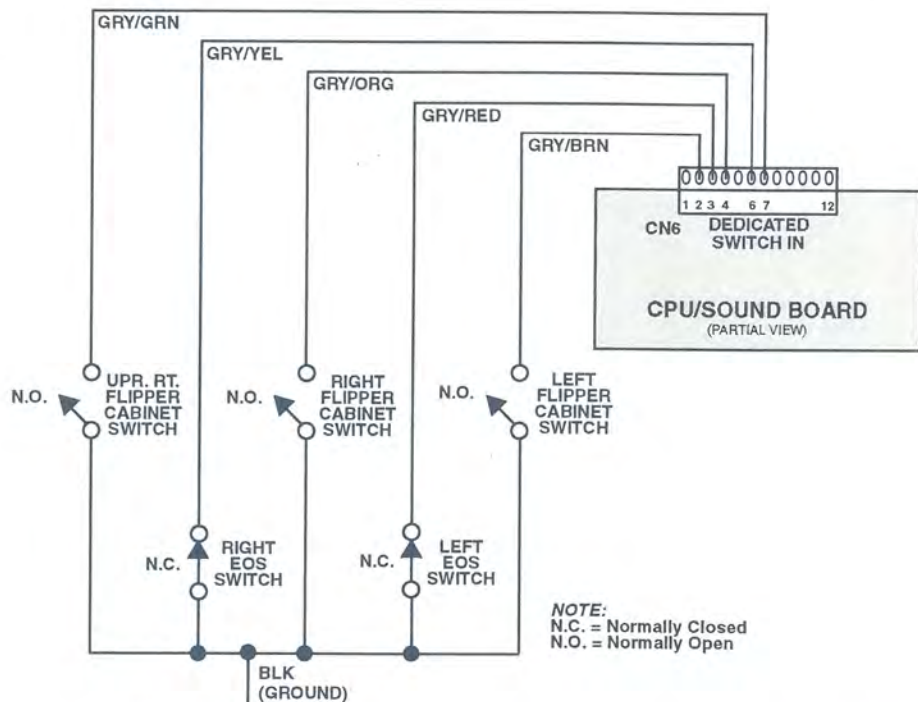
The **White Star Board System™** has allowed us to *simplify* the flipper circuit to the point where we have *eliminated the flipper board* altogether. The flipper circuit is now configured the same as any other solenoid drive circuit (see below).



Technical Overview

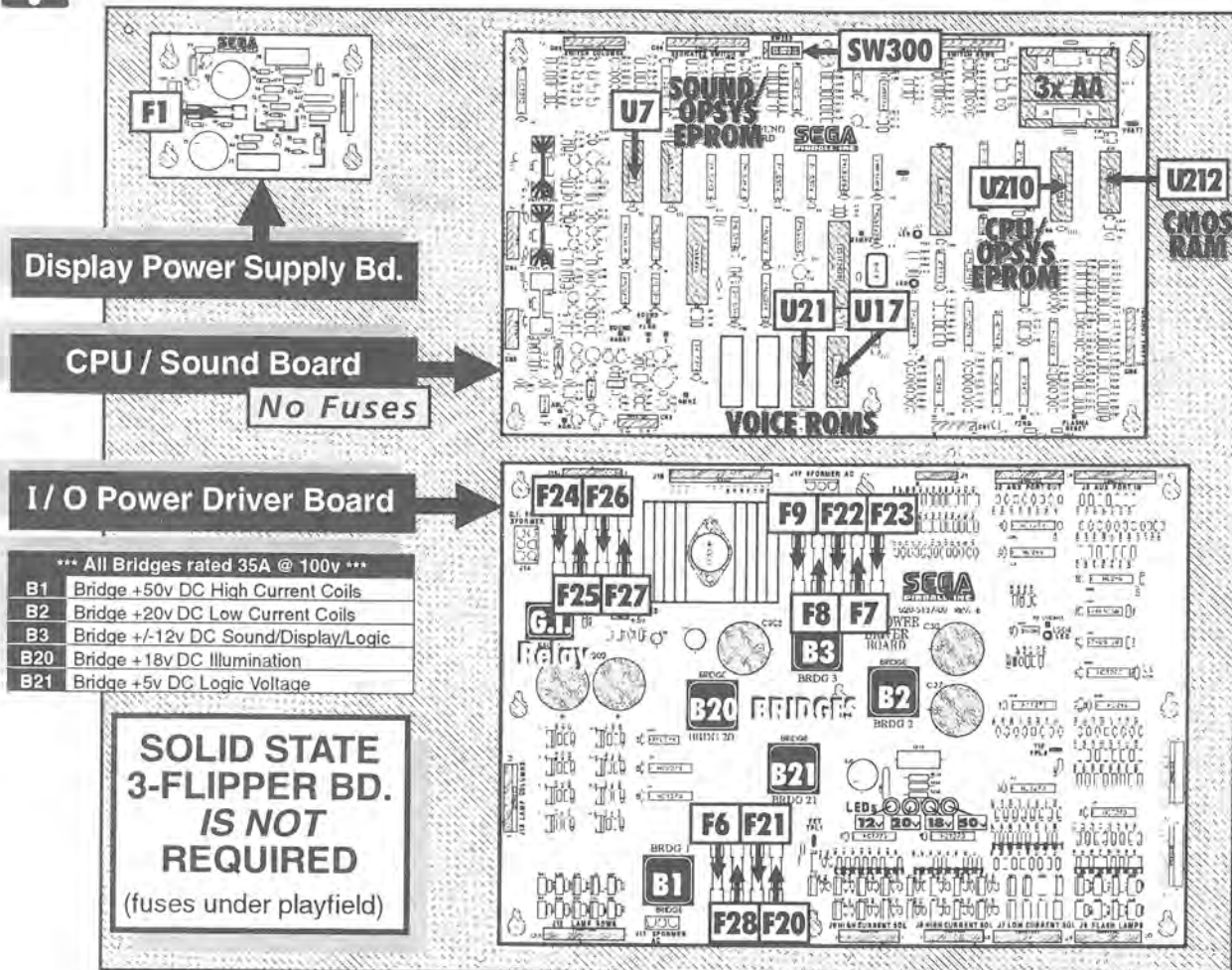
Our **New Flipper System** uses one supply voltage (50v DC) for both kick and hold. Once the **Game CPU** detects a flipper cabinet switch closure (during game play) it applies a 40 msec pulse to the gate of the flipper drive transistor (STP20N10L). If it continues to detect a flipper cabinet switch closure (the player holding the button in) it will continue to pulse the flipper drive transistor 1 msec every 12 msec 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.





NEW BACKBOX LAYOUT, FUSE & RELAY LOCATIONS



INDEPENDENCE DAY

QUICK REFERENCE FUSE CHART

Backbox Fuses DISPLAY POWER SUPPLY BOARD

F1	3/4A 250v S.B.	90v DC	High Voltage Display
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	Not Used / Spare
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. Lamp Top Left Playfield (P/F)
F25	5A 250v S.B.	6.3v AC	G.I. Lamp Bottom Middle Left P/F
F26	5A 250v S.B.	6.3v AC	G.I. Lamp Rt. Side P/F & Coin Door
F27	5A 250v S.B.	6.3v AC	G.I. Lamp Top Right Playfield
F28	3A 250v S.B.	24v AC	Not Used / Spare

Cabinet Fuses SERVICE (AC) OUTLET BOX (CABINET BOTTOM)

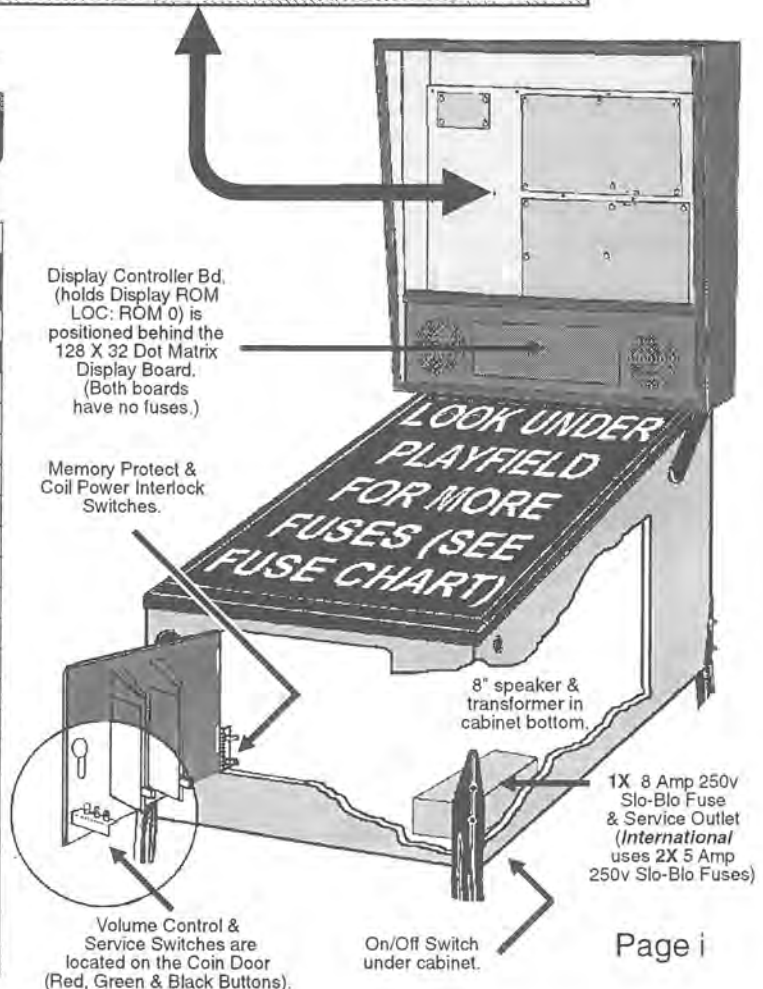
Main Fuse Line: 1X 8A 250v S.B. (Int'l) 2X 5A 250v S.B.

Under Playfield Fuses BY FLIPPER ASSEMBLIES

n/a	3A 250v S.B.	50v DC	Output Up/Lwr. Rt. Flippers
n/a	3A 250v S.B.	50v DC	Output Left Flipper

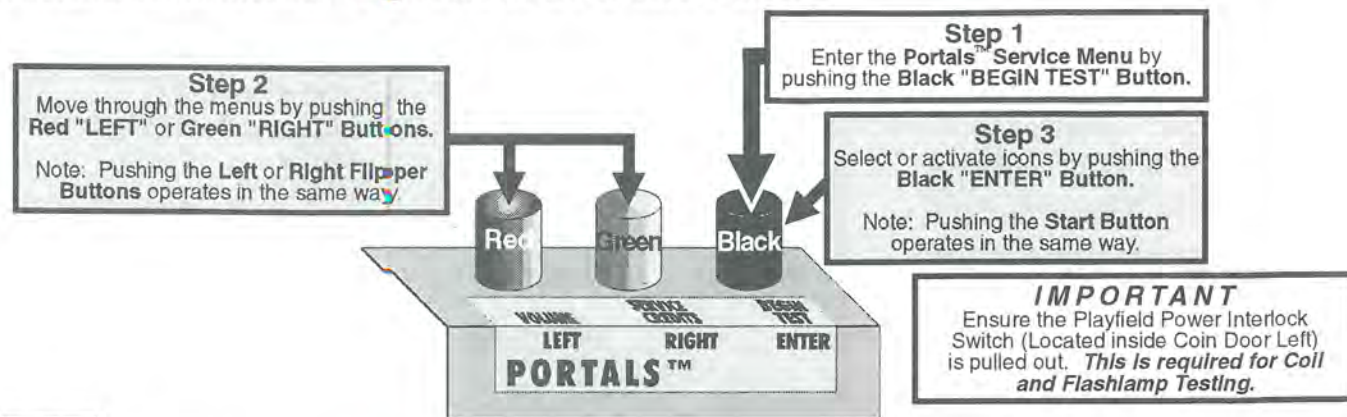
Display Controller Bd.
(holds Display ROM
LOC: ROM 0) is
positioned behind the
128 X 32 Dot Matrix
Display Board.
(Both boards
have no fuses.)

Memory Protect &
Coil Power Interlock
Switches.



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

The key technical data from various parts of the manual was extracted and combined into the "Find-It-In-Front: Dr. Pinball Section." This new section will assist the technician in locating important technical information needed to troubleshoot the machine. To get into the **Portals™ Service Menu**:



We are introducing in our **Portals™ Service Menu** a new icon and diagnostic aid called **Dr. Pinball** (Flow Chart Menus). This is a feature that will allow the operator/technician to utilize the power of the micro-processor assisting in troubleshooting a problem with the machine.

★ ★ ★ ★ 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™ © 1996 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 four sub-menus: Flipper "DR.," 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.



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

INSTALL 4 BALLS!



INDEPENDENCE DAY

Is a 4-Ball Game!

* 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*



From the Main Menu
In Portals™
GO TO DIAGNOSTICS
MENU



From the Diagnostics
Menu
GO TO SWITCH
MENU



From the Switch
Menu
GO TO DIP
SWITCH TEST

*All countries not noted
below use the "USA CPU
Country Setting"

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

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

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
HOLLAND (DUTCH) & NETHERLANDS	ON								
	OFF								

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

I.C. NAME	TYPE	BOARD NAME	LOC.	PART N°
Game ROM	1MB	CPU / Sound Board	U210	965-0224-45
Voice ROM 1	4MB	CPU / Sound Board	U17	965-0225-45
Voice ROM 2	4MB	CPU / Sound Board	U21	965-0226-45
Voice ROM 3	Not Used	CPU / Sound Board	U36	Not Used
Voice ROM 4	Not Used	CPU / Sound Board	U37	Not Used
Sound EPROM	512K	CPU / Sound Board	U7	965-0227-45

Display EPROM	4MB	Display Controller Bd.	ROM Ø	965-0228-45
Display EPROM	Not Used	Display Controller Bd.	ROM 3	Not Used



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

Column (Drive)	1 Q1 GRN-BRN CN5-P1	2 Q2 GRN-RED CN5-P3	3 Q3 GRN-ORG CN5-P4	4 Q4 GRN-YEL CN5-P5	5 Q5 GRN-BLK CN5-P6	6 Q6 GRN-BLU CN5-P7	7 Q7 GRN-VIO CN5-P8	8 Q8 GRN-GRY CN5-P9
Row (Return)	1 U400 WHT-BRN CN7-P9	NOT USED 1	MINI- LOOP 9	NOT USED 17	MINI- LOOP S-U 25	AREA 51 3-BANK TOP 33	SUPER VUK ENTER SIDE 41	LEFT TURBO BUMPER 49
2 U400 WHT-RED CN7-P8	4TH COIN SLOT 2	NOT USED 10	LEFT RAMP ENTER 18	NOT USED 26	AREA 51 3-BANK MID 34	ALIEN HEAD OPTO 42	BOTTOM TURBO BUMPER 50	LEFT RETURN LANE 58
3 U400 WHT-ORG CN7-P7	6TH COIN SLOT 3	4-BALL TROUGH #1 (LEFT) 11	LEFT RAMP EXIT 19	CENTER RAMP S-U 27	HURRY-UP 3-BANK TOP 35	HEAD UNDER- TROUGH REAR 43	TOP TURBO BUMPER 51	LEFT SLINGSHOT 59
4 U400 WHT-YEL CN7-P6	RIGHT COIN SLOT 4	4-BALL TROUGH #2 12	CENTER RAMP ENTER 20	RIGHT RAMP S-U LEFT 28	HURRY-UP 3-BANK MID 36	SUPER VUK 44	SERVO OPEN / CLOSE 52	RIGHT OUTLANE 60
5 U401 WHT-GRN CN7-P5	CENTER COIN SLOT / DBA 5	4-BALL TROUGH #3 13	CENTER RAMP EXIT 21	RIGHT RAMP S-U RIGHT 29	LEFT ORBIT BOTTOM 37	SUPER VUK ENTER FRONT 45	LAUNCH BUTTON 53	RIGHT RETURN LANE 61
6 U401 WHT-BLU CN7-P3	LEFT COIN SLOT 6	4-BALL TROUGH #4 (RIGHT) 14	RIGHT RAMP ENTER 22	LEFT TOP LANE 30	LEFT ORBIT TOP 38	HEAD UNDER- TROUGH FRONT 46	START BUTTON 54	RIGHT SLINGSHOT 62
7 U401 WHT-VIO CN7-P2	5TH COIN SLOT 7	4-BALL TROUGH VUK OPTO 15	RIGHT RAMP EXIT 23	MIDDLE TOP LANE 31	RIGHT ORBIT TOP 39	AREA 51 3-BANK BOT 47	SLAM TILT 55	NOT USED 63
8 U401 WHT-GRY CN7-P1	NOT USED 8	SHOOTER LANE 16	SUPER JACKPOT S-U 24	RIGHT TOP LANE 32	RIGHT ORBIT BOTTOM 40	HURRY-UP 3-BANK BOT 48	PLUMB BOB TILT 56	NOT USED 64

GND	Ground
IC U206 INPUTS	BLK CN6-P1, -P11
1 GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON DS-1
2 GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke) DS-2
3 GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON DS-3
4 GRY-YEL CN6-P6	#4 RIGHT FLIPPER E.O.S. (End-of-Stroke) DS-4
5 NOT USED CN6-P7	#5 UPPER FLIPPER BUTTON DS-5
6 GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (Normal) (In Test: LEFT) DS-6
7 GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (Normal) (In Test: RIGHT) DS-7
8 GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (Normal) (In Test: ENTER) 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



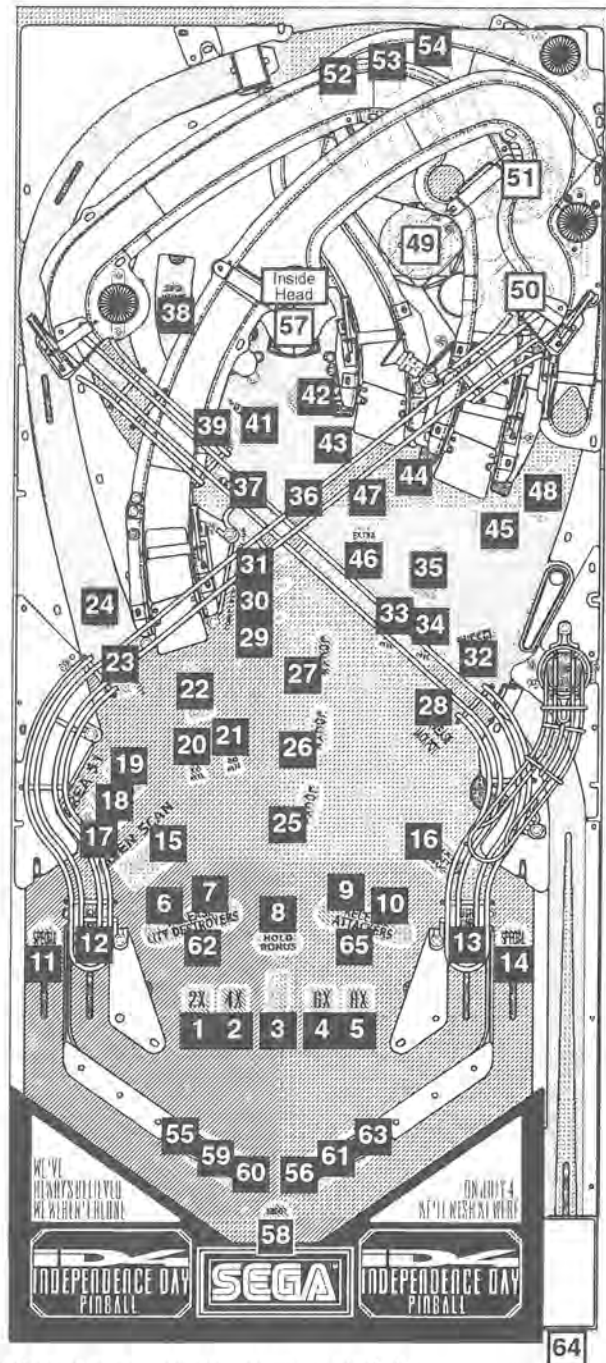
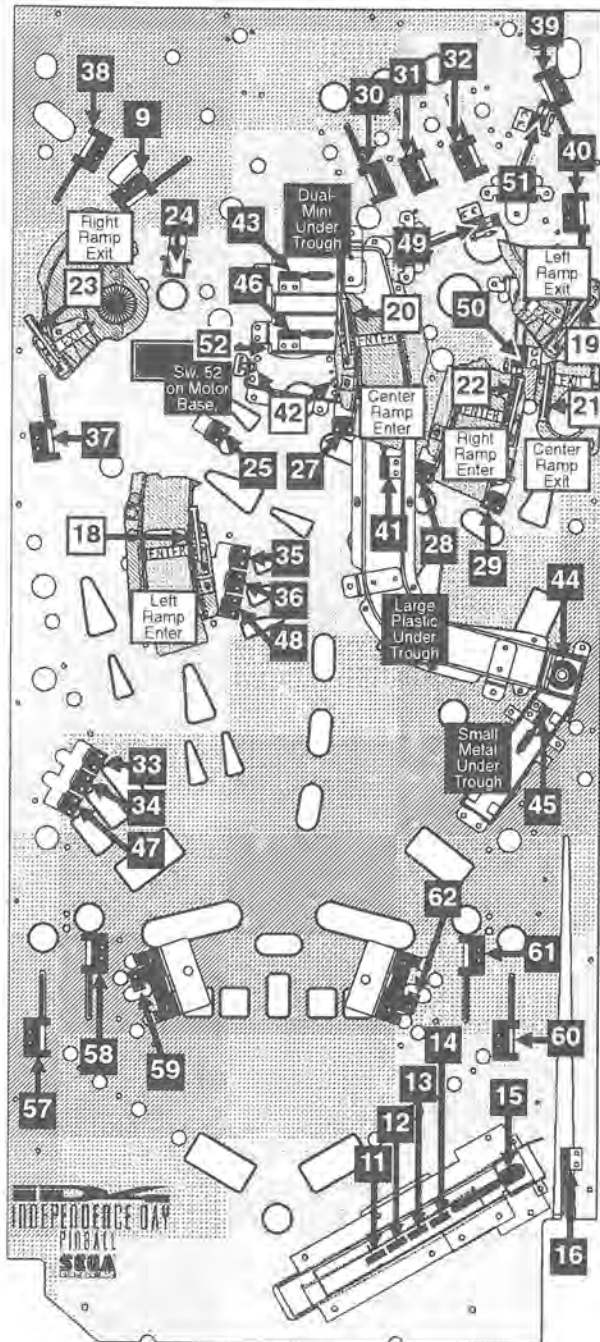
From the Lamp
Menu
GO TO ROW OR
COLUMN TEST

LAMP MATRIX GRID

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	
Row (GND)	1: Q33 RED-BRN J12-P1	2X	4X	10X	6X	8X	RELEASE CITY DESTROYERS	RELEASE CITY DESTROYERS	HOLD BONUS
	#555 Bulb 1	#555 Bulb 2	#555 Bulb 3	#555 Bulb 4	#555 Bulb 5	#555 Bulb 6	#555 Bulb 7	#44 Bulb 8	
2: Q34 RED-BLK J12-P2	RELEASE ATTACKERS	RELEASE ATTACKERS	SPECIAL (LEFT)	LIGHT COM- BO (LEFT)	LIGHT COM- BO (RIGHT)	SPECIAL (RIGHT)	ALIEN SCAN	INITIATE COM- PUTER VIRUS	
	#555 Bulb 9	#555 Bulb 10	#44 Bulb 11	#44 Bulb 12	#44 Bulb 13	#44 Bulb 14	#555 Bulb 15	#44 Bulb 16	
3: Q35 RED-ORG J12-P3	AREA 51 3-BANK BOT	AREA 51 3-BANK MID	AREA 51 3-BANK TOP	LEFT RAMP 10 MIL	LEFT RAMP 20 MIL	LEFT RAMP ARROW	F-18 HURRY-UP	LEFT ORBIT ARROW	
	#555 Bulb 17	#555 Bulb 18	#555 Bulb 19	#555 Bulb 20	#555 Bulb 21	#555 Bulb 22	#44 Bulb 23	#44 Bulb 24	
4: Q36 RED-YEL J12-P4	LOCK 1	LOCK 2	LOCK 3	INCREASE JACKPOT	HURRY-UP 3-BANK BOT	HURRY-UP 3-BANK MID	HURRY-UP 3-BANK TOP	RUSSELL	
	#555 Bulb 25	#555 Bulb 26	#555 Bulb 27	#555 Bulb 28	#555 Bulb 29	#555 Bulb 30	#555 Bulb 31	#555 Bulb 32	
5: Q37 RED-GRN J12-P5	RIGHT RAMP 10 MIL	RIGHT RAMP 20 MIL	RIGHT RAMP ARROW	MINI-LOOP ARROW	AREA 51 ARROW	SUPER JACKPOT	MINI-LOOP STAND-UP	NOT USED	
	#555 Bulb 33	#555 Bulb 34	#44 Bulb 35	#555 Bulb 36	#555 Bulb 37	#44 Bulb 38	#555 Bulb 39	40	
6: Q38 RED-BLU J12-P6	COMBO	ALIEN HEAD CIRCLE	CENTER RAMP S-U	RIGHT RAMP S-U LEFT	RIGHT RAMP S-U RIGHT	EXTRA BALL	CENTER RAMP ARROW	RIGHT ORBIT	
	#555 Bulb 41	#555 Bulb 42	#555 Bulb 43	#555 Bulb 44	#44 Bulb 45	#555 Bulb 46	#555 Bulb 47	#44 Bulb 48	
7: Q39 RED-VIO J12-P8	LEFT TURBO BUMPER	BOTTOM TUR- BO BUMPER	RIGHT TUR- BO BUMPER	LEFT TOP LANE	MIDDLE TOP LANE	RIGHT TOP LANE	LEFT FLIPPER	RIGHT FLIPPER	
	#555 Bulb 49	#555 Bulb 50	#555 Bulb 51	#44 Bulb 52	#44 Bulb 53	#44 Bulb 54	#44 Bulb 55	#44 Bulb 56	
8: Q40 RED-GRY J12-P9	ALIEN EYES	SHOOT AGAIN	LEFT FLIPPER	LEFT FLIPPER	RIGHT FLIPPER	RELEASE CITY DESTROYERS	RIGHT FLIPPER	LAUNCH BUTTON	
	#44 Bulb 57	#44 Bulb 58	#44 Bulb 59	#44 Bulb 60	#44 Bulb 61	#555 Bulb 62	#44 Bulb 63	#44 Bulb 64	
9: Q41 RED-WHT J12-P10	RELEASE ATTACKERS	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	
	#555 Bulb 65	66	67	68	69	70	71	72	
10: Q42 NOT USED J12-P11	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	
	73	74	75	76	77	78	79	80	

SWITCH MATRIX GRID LOCATIONS

LAMP MATRIX GRID LOCATIONS

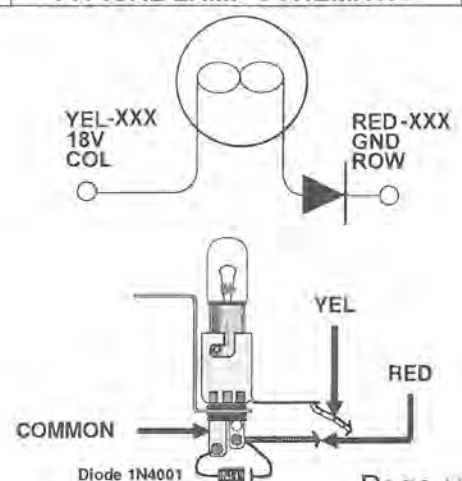
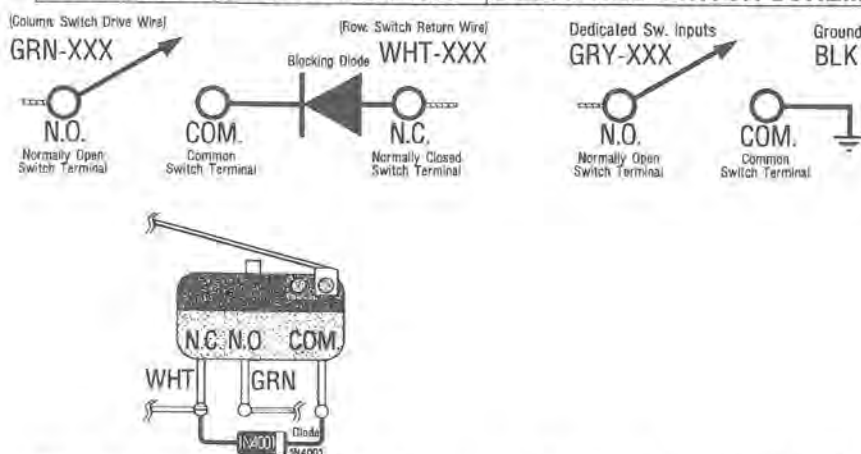


Legend Note: = Switches/Lamps mounted above playfield. = Switches/Lamps mounted below the playfield.

TYPICAL SWITCH SCHEMATIC

DEDICATED SWITCH SCHEMATIC

TYPICAL LAMP SCHEMATIC





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

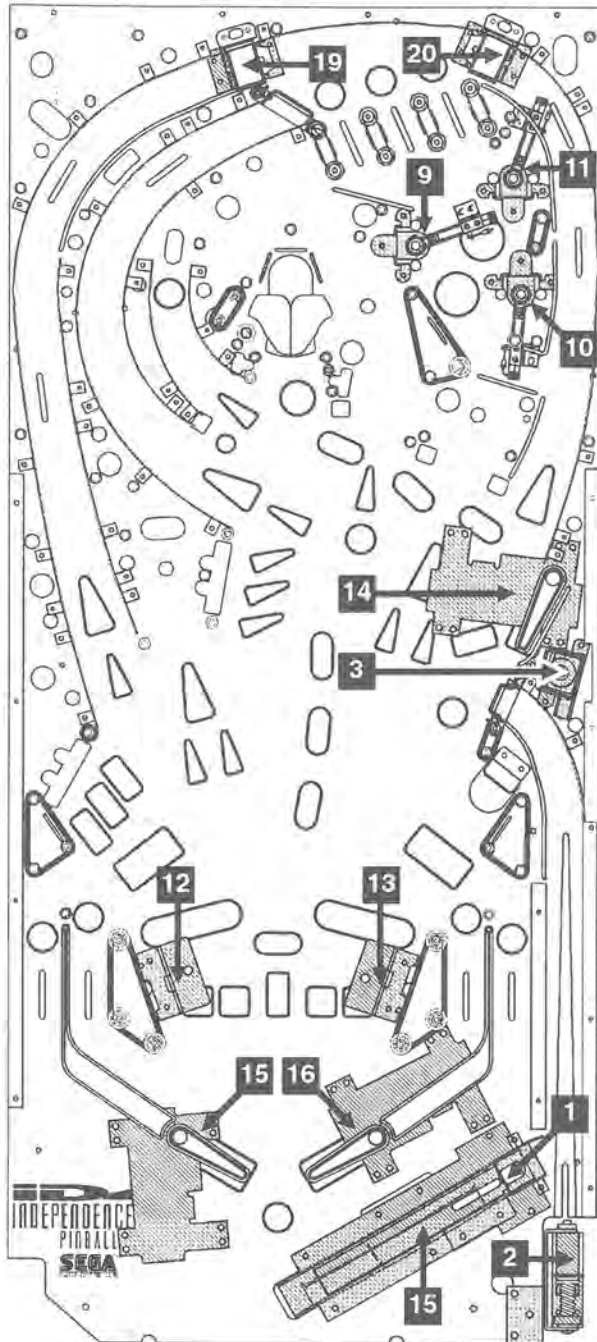
High Current Coils Group 1		Drive Trans-istor (D.T.)	Driver Output Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connection	Power Voltage	Coil GA/Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	I/O Pwr. Drvr.	BRN-BLK	J8-P1	YEL-VIO	J10-P4/5	50v	24-940 090-5036-01
#2	AUTO LAUNCH	Q2	I/O Pwr. Drvr.	BRN-RED	J8-P3	YEL-VIO	J10-P4/5	50v	23-700 090-5022-01
#3	SUPER VUK	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	YEL-VIO	J10-P4/5	50v	23-800 090-5001-01
#4	NOT USED / SPARE	Q4	I/O Pwr. Drvr.						
#5	NOT USED / SPARE	Q5	I/O Pwr. Drvr.						
#6	FLASH BOTTOM-LT*2	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	ORG	J6-P10	20v	#89 165-5000-89
#7	FLASH LT*1 RT-RAMP*1	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	ORG	J6-P10	20v	#89 165-5000-89
#8	EUROPEAN TOKEN DISPENSER	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	YEL-VIO	J10-P4/5	50v	N/A

High Current Coils Group 2		Drive Trans-istor (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 or Bulb Type
#9	LEFT TURBO BUMPER	Q9	I/O Pwr. Drvr.	BLU-BRN	J9-P1	YEL-VIO	J10-P4/5	50v	26-1200 090-5044-00
#10	BOTTOM TURBO BUMPER	Q10	I/O Pwr. Drvr.	BLU-RED	J9-P2	YEL-VIO	J10-P4/5	50v	26-1200 090-5044-00
#11	RIGHT TURBO BUMPER	Q11	I/O Pwr. Drvr.	BLU-ORG	J9-P4	YEL-VIO	J10-P4/5	50v	26-1200 090-5044-00
#12	LEFT SLINGSHOT	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	YEL-VIO	J10-P4/5	50v	26-1200 090-5044-00
#13	RIGHT SLINGSHOT	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	YEL-VIO	J10-P4/5	50v	26-1200 090-5044-00
#14	UPPER FLIPPER (50v RED/YEL)	Q14	I/O Pwr. Drvr.	BLK-YEL	J9-P7	RED-YEL BLU-YEL	J10-P1/2	50v	23-900 090-5020-30
#15	LEFT FLIPPER (50v RED/YEL)	Q15	I/O Pwr. Drvr.	ORG-GRY	J9-P8	RED-YEL GRY-YEL	J10-P1/2	50v	22-1080 090-5032-00
#16	RIGHT FLIPPER (50v RED/YEL)	Q16	I/O Pwr. Drvr.	ORG-VIO	J9-P9	RED-YEL BLU-YEL	J10-P1/2	50v	22-1080 090-5032-00

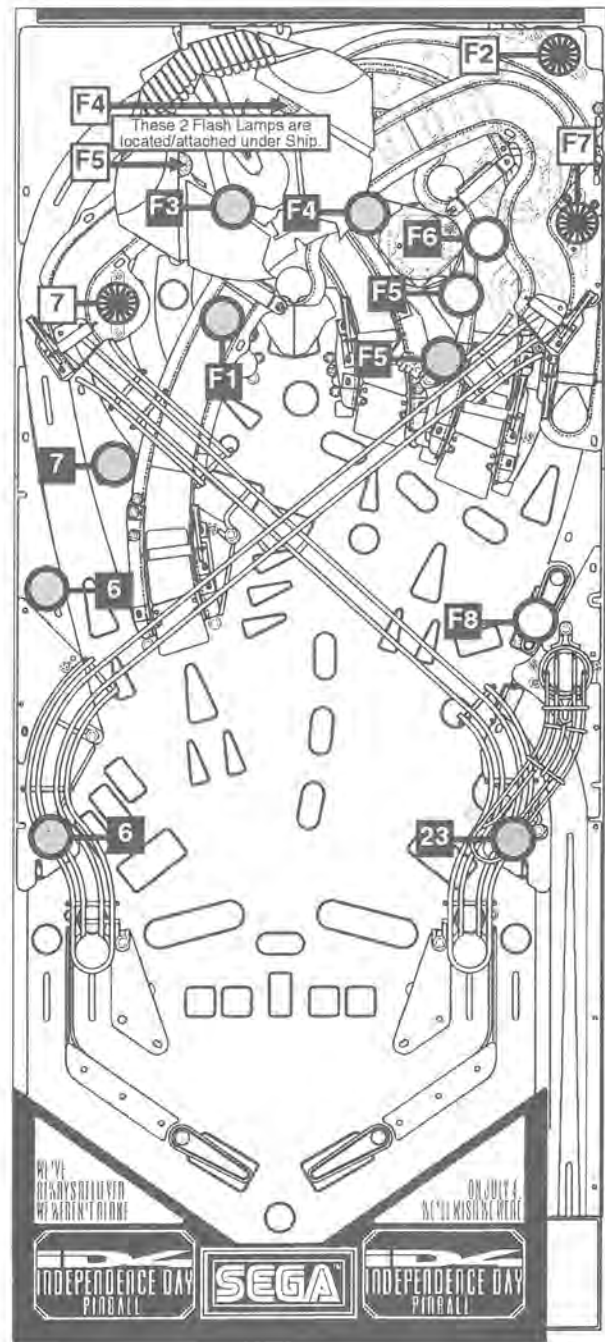
Low Current Coils Group 1		Drive Trans-istor (D.T.)	Driver Output Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connection	Power Voltage	Coil GA/Turn or Bulb Type
#17	4-BALL TROUGH LOCK BALL	Q17	I/O Pwr. Drvr.	VIO-BRN	J7-P2	BRN	J7-P1	20v	24-940 090-5036-00
#18	NOT USED / SPARE	Q18	I/O Pwr. Drvr.						
#19	LEFT CONTROL GATE	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	BRN	J7-P1	20v	32-1800 090-5031-00
#20	RIGHT CONTROL GATE	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	BRN	J7-P1	20v	32-1800 090-5031-00
#21	NOT USED / SPARE	Q21	I/O Pwr. Drvr.						
#22	NOT USED / SPARE	Q22	I/O Pwr. Drvr.						
#23	FLASH BOTTOM-RT*1	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	ORG	J6-P10	20v	#89 165-5000-89
#24	OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v	5v Meter (If Required)

Flash Lamps (FLASH)		Drive Trans-istor (D.T.)	Driver Output Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connection	Power Voltage	Bulb Type
#F1	FLASH MID PLAYFIELD*1	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	ORG	J6-P10	20v	#89 165-5000-89
#F2	FLASH CENTER RAMP*1	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	ORG	J6-P10	20v	#89 165-5000-89
#F3	FLASH TOP-LT PLAYFIELD*1	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	ORG	J6-P10	20v	#89 165-5000-89
#F4	FLASH SHIP*1 POPS*1	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	ORG	J6-P10	20v	#906 / #89 165-5004-00
#F5	FLASH SHIP*1 POPS*2	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	ORG	J6-P10	20v	#906 / #89 165-5004-00
#F6	FLASH POPS*1	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	ORG	J6-P10	20v	#89 165-5000-89
#F7	FLASH LEFT RAMP*1	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	ORG	J6-P10	20v	#89 165-5000-89
#F8	FLASH UPPER RT FLIPPER *1	Q32	I/O Pwr. Drvr.	BLK-GRY	J6-P8	ORG	J6-P10	20v	#89 165-5000-89

COIL LOCATIONS

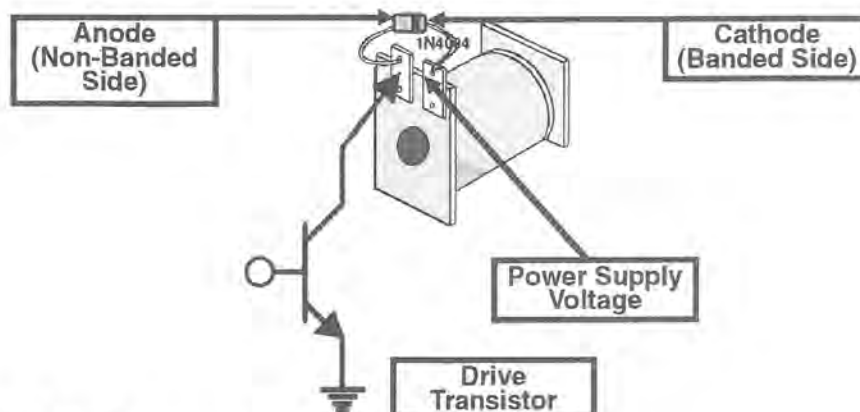


FLASH LAMP LOCATIONS



Legend Note: = Coil/Flash Lamp mounted above playfield. = Coil/Flash Lamp mounted below the playfield. = Bulb goes through hole in the playfield. = Bulb is under playfield insert. = Bulb under Mini-Mar (Light Cover).

TYPICAL COIL WIRING



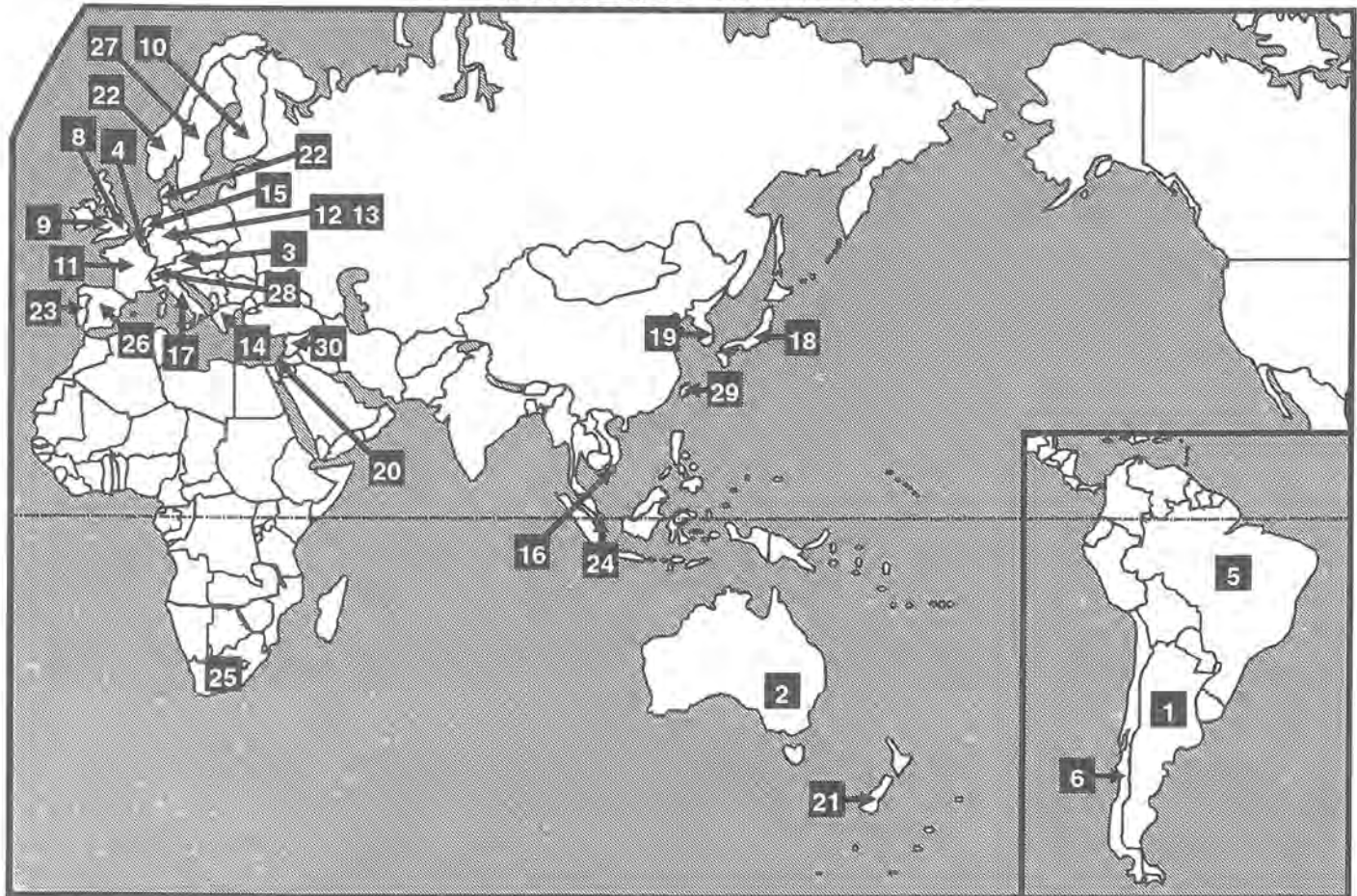
DOMESTIC DISTRIBUTORS



#	STATE/PROVINCE AND CITY	NAME	PHONE	#	STATE/PROVINCE AND CITY	NAME	PHONE
1	AL Birmingham	Birmingham Vending	205-324-7526	26	MO St. Louis	J. & J. Distributing	314-645-3393
2	AR N. Little Rock	Godwin Distributing	501-753-1138	27	MX Col. Napoles	James Industries	011-525-543-1174
3	AZ Phoenix	Betson Pacific	602-233-0190	28	NC Archdal	Operators Distributing	910-884-5714
4	BC Burnaby (Can.)	Can. Coin Machine	604-420-4008	29	ND Fargo	M.H. Associates, Inc.	701-282-7877
5	CA Buena Park	Betson Pacific	714-228-7500	30	NE Omaha	Greater American Dist.	402-553-2812
6	CA S. San Francisco	Betson Pacific	415-952-4220	31	NJ Springfield	Mondial Int'l. Dist.	201-467-9700
7	CA San Diego	Betson Pacific	619-459-0871	32	NV Reno	Reno Game Sales	702-829-2080
8	CO Denver	Col. Game Exchange	303-893-4300	33	NY Rochester	Mondial Dist.	716-586-1100
9	CO Denver	Mountain Coin	303-427-2133	34	OH Cincinnati	Atlas Distributing	513-771-1909
10	FL Orlando	Birmingham Vending	407-425-1505	35	OK Tulsa	Galaxy Distributing, Co.	918-835-1166
11	HI Ewa Beach	50th State Coin Op.	808-682-4561	36	ON Rexdale (Can.)	New Way Sales	416-674-8000
12	IA Des Moines	Greater American Dist.	515-244-2828	37	OR Portland	American Coin	503-233-7000
13	IL Chicago	Atlas Distributing	312-276-5005	38	PA Bensalem	Mondial Int'l. Dist.	215-638-1122
14	IL Inverness	James Industries	708-358-8000	39	PA Pittsburgh	Mondial Int'l. Dist.	412-881-8804
15	IN Indianapolis	J. & J. Distributing	317-899-2530	40	PA Wilkes-Barre	Roth Novelty	717-824-9994
16	KS Lenexa	Bird Distributing	913-888-8877	41	PR Carolina	James Industries	809-253-7149
17	KS Wichita	United Distributing	316-263-6181	42	TN Memphis	Games Sales Co., Inc.	901-525-8351
18	KY Louisville	Kentucky Coin Machine	502-966-5266	43	TN Memphis	Green G.A.M.E.S.	901-353-1000
19	LA Metairie	New Orleans Novelty	504-888-3500	44	TN Nashville	Sammons-Pennington	615-244-3020
20	MA E. Long Meadow	Gekay Sales	413-525-2700	45	TX Dallas	Commercial Music	214-741-6381
21	MA Norwood	Mondial Int'l. Dist.	617-769-9966	46	TX Corsicana	Master Sales	903-874-4740
22	MD Baltimore	Automated Services	410-646-4100	47	UT Salt Lake City	Struve Distributing	801-328-1636
23	MI Farmington Hills	Atlas Distributing	810-615-1703	48	WA Seattle	American Coin	206-764-9020
24	MI Wyoming	Atlas Distributing	616-241-1472	49	WI Menomonee Falls	Pioneer Sales & Svc.	414-781-1420
25	MN Bloomington	Hanson Distributing	612-884-6604	50	WI Green Bay	Pioneer Sales & Svc.	414-468-5200

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 (1-708-345-7700).

INTERNATIONAL DISTRIBUTORS



#	COUNTRY AND CITY	NAME	PHONE (-011)	#	COUNTRY AND CITY	NAME	PHONE (-011)
1	Argentina, Urquiza	Florencia	54-232-5532	16	Hong Kong, Kwai Fong	Bondeal Limited	85-2-487-9089
2	Australia, Matraville	Amusement Machine Dist.	61-2-316-6000	17	Italy (RSM), Serravalle	Technoplay Sa	39-54-990-0361
3	Austria, Ansfelden	TAB Austria	43-72-297-8040	18	Japan, Tokyo	Data East, Corp.	81-35-370-0708
4	Belgium, Brussels	Splin S.A.	32-4-162-7677	19	Korea, Seoul	Myung Sun Trading	82-2-771-0461
5	Brazil, Sao Paulo	Poara Enterprises Ltd.	55-11-278-6838	20	Lebanon, Beirut	Tinker Int'l. Corp.	35-7961141-3688
6	Chile, Santiago	Cuinsa	56-2-696-0167	21	New Zealand, Auckland	Amco Machine Supp.	64-9-846-7606
7	Denmark, Glostrup	Dau Dansk	45-3-670-1087	22	Norway, Oslo	Vendomatic	47-2-216-0830
8	England, London	Electrocoin	44-81-965-6899	23	Portugal, Amadora	Jacinto & Martins	35-11-495-1868
9	So. Wales, Cardiff	Electrocoin	44-22-261-5100	24	Singapore, Singapore	Valibel Technologies	65-748-8404
10	Finland, Espoo	Pelika Ray Oy	35-804-37091	25	South Africa, Lalucia	Unimac	27-3-152-5544
11	France, Aubervilliers	PLF Sa	33-14-811-3131	26	Spain, Madrid	Dast Pim	34-1-541-7112
12	Germany, Berlin	Bally Wulff	49-3-062-0020	27	Sweden, Bromma	A-Gruppen Holding	46-8-704-6570
13	Germany, Hannover	Bally Wulff	49-511-358-5343	28	Switzerland, Harkingen	Novomat Ag	41-6-261-4061
14	Greece, Athens	Alpha Distributing	30-1-554-1608	29	Taiwan ROC, Taipei Hsien	Laxan Corp.	88-62-299-1722
15	Holland, Sittart	Veltmeijer Automaten	31-46-526-4444	30	Turkey, Iclevent-Istanbul	Emperyal	90-212-663-2081

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



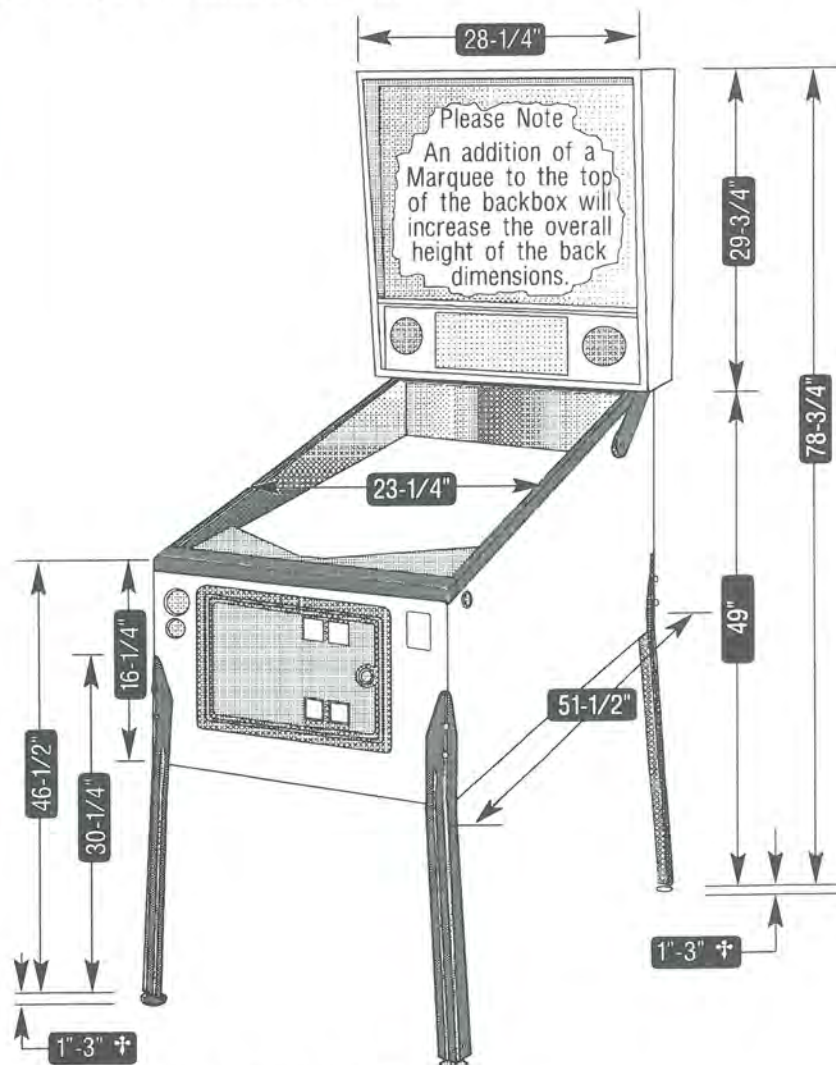
Normal Line:		110v AC - 125v AC @ 60Hz	
Domestic uses an 8AMP 250v Slo-Blo Fuse.	AVG OPERATION	MAX OPERATION	
	CURRENT: 2.8AMP WATTAGE: 329w	CURRENT: 8AMP WATTAGE: 940w	
High Line:		218v AC - 240v AC @ 50Hz	
Export uses 2 X 5AMP 250v Slo-Blo Fuses. (*England & Hong Kong use an 8AMP 250v S/B Fuse.)	AVG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

TRANSPORTATION

To reduce the possibility of damage, observe the following precautions whenever transporting the game. Lower the backbox and secure it to the cabinet. Remove the legs and secure the game within the transporting vehicle. Reference Section 1, Chapter 1, Game Set-Up for assembly (for disassembly reverse instruction order).

OVERALL DIMENSIONS †

Shipping Crate Dimensions	
Height:	55½"
Width:	30½"
Length:	31"
Weight:	250lbs. (+/- 10lbs.)



† **Note:**

The Leg Levelers can add up to two (2) inches to the overall height of the front & back dimensions.

The cabinet is designed to give a 6.5° pitch with the Leg Levelers turned all the way in.

ID4 INDEPENDENCE DAY

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Game Set-Up

Game Assembly Procedures

(Reference Find-It-In-Front: Dr. Pinball, taking note of pages ii, iii & 2)

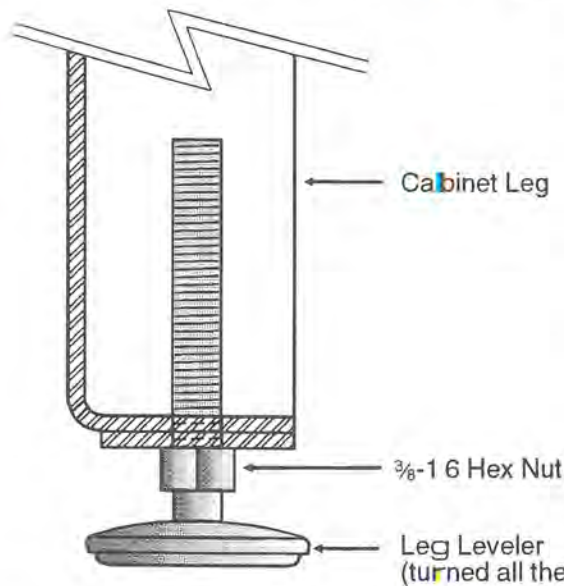
1. Open the top of the carton and lay it on its side with the bottom of the cabinet down. Using the plastic banding strip as a handle, slide the game out of the carton.
2. Remove all packing material. 4 cabinet legs & levelers (attached) are in the corner packing material of the crate. A large Allen Wrench (use for securing the backbox) is inserted and taped to the rear of the cabinet. Miscellaneous parts are in the cash box.
3. Support rear of cabinet and attach rear legs using two leg bolts for each leg.
4. Support front of cabinet and attach front legs using two leg bolts for each leg.
5. 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).
6. Remove the backbox keys from the playfield glass, unlock and carefully remove the backglass. Set the backglass aside. Undo latch on the Backbox Light Insert and slowly swing open (can be removed).
7. 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 to check that they are properly seated.
8. Check that all fuses are seated properly.
9. Carefully remove the playfield glass and set it aside.
10. Remove all shipping tie downs, shipping blocks, packing foam, shipping instruction pages, etc. (if any). **READ ALL PRINTED INFORMATION!** Shipping instructions, labels and/or decals describe warnings, cautions, and/or important information specific to the game.
11. Raise the playfield and support it, by lifting the Stay Arm on the Right Side of the Cabinet and placing the notched end into the hole on the under playfield. See the illustration "Easy Access Service System" opposite this page.
12. Check all cabinet cables and playfield Lamp Boards connector terminations.
13. Remove the Plumb Bob tilt from the parts package and install on the pendulum wire on the inside left of the cabinet. See Section 4, Chapter 1, Parts Identification & Location.
14. 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.
15. With the Leg Levelers turned all the way in, 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.

16. Check the plumb tilt and adjust as required.
17. If desired, perform any self tests at this time. See Section 3, Chapter 1, Portals™ Service Menu Introduction, and Chapter 2, Diagnostics, for instructions on how to enter "Begin Play Test" and "Game Specific" to test components on the game.
18. Slowly swing Backbox Light Insert closed and secure latch. Carefully reinstall and lock the backglass.
19. **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.)
20. 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, Adjustments, for instructions on how to enter adjustments. Follow instructions in the tables provided in the manual for suggestions of customizing changes.

Leg Leveler Adjustment

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



STEP 1

Assemble all (4) legs and levelers as shown in the diagram. Be sure the leveler is turned all the way in.

STEP 2

Attach leg assemblies to cabinet with leg bolts provided.

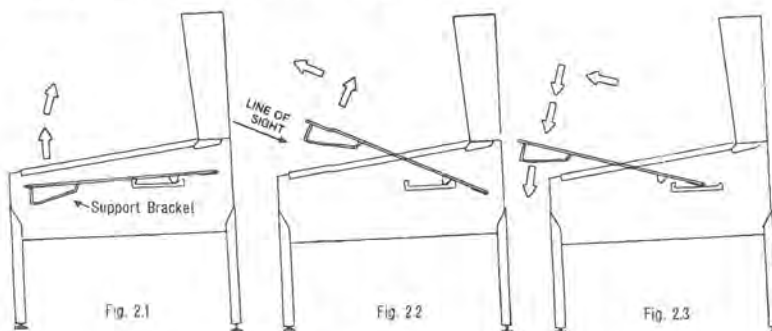
YOUR PLAYFIELD PITCH IS NOW AT 6.5° AS REQUIRED FOR PROPER GAME PLAY!

STEP 3

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 achieved by turning out the rear leg leveler(s), however, it is not recommended.

Easy Access Service System

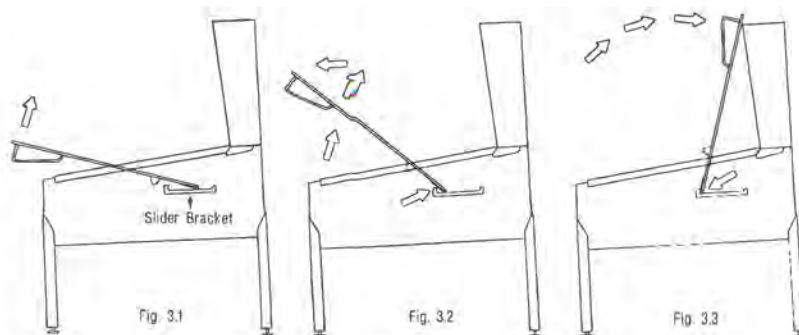


Service Position 1

This position is useful to service:

Trough Switches, Connectors at back of cabinet, Cleaning the Playfield, etc.

Lift the playfield **using the left and right ball guides** upward (Fig. 2.1) until the playfield support brackets can be seen to clear cabinet front (Fig. 2.2). At this time, pull playfield toward the front of the cabinet, checking that the mechanical components clear the cabinet front (Fig. 2.3). Then rest the playfield on the support brackets at the front channel of cabinet. **Reverse procedure when service is complete.**



Service Position 2

This position is useful to service:

All Playfield Bottom Components, Cabinet Components, etc.

With the playfield at rest (Fig. 3.1), hold sides of playfield and pull toward the front of the cabinet (approx. 6" to 8"), until resistance is felt from the slider brackets located on either side of the cabinet (Fig. 3.2). At this time, swivel playfield toward the backbox, then rest on top edge of the backbox. **Reverse procedure when service is complete.**

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(s) with the display indicating the number of credit(s) posted. Press the **START BUTTON** and a start-up sound is produced, and the posted credit(s) are reduced by one. If the last Game Specific Adjustment, Novice Mode Enabled, is changed to **YES** (Default = **NO**), the display awaits choice from player 1 to select **REGULAR GAME** rules or **NOVICE GAME** rules with the *flipper buttons*. If the player *does not select rules*, the game will default to **Regular Rules**. After selection (or time-out default to Regular Game) subsequent players can be added (**up to 6 can play!**) by pressing the **START BUTTON** before the end of ball 1. **Note 1:** The subsequent players will play the same game (Novice or Regular) determined by Player's 1 choice.

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. 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 $\frac{1}{2}$ 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 does not work with less than or more than 4 players. 1-, 2-, 3-, 5- & 6-Player games, 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 oooooooh! so much gosh darn harder!

During Game Features

Video Mode

This game features a Video Mode opening Skill Shot. The video modes require the player to play on-screen. The interactive video play requires the player to use the flipper buttons to play the mode. Also, don't forget to watch the display for hints or feature demonstrations.

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 is 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. Watch the Video Display for feature details, etc.

Multiball

Multiball is started after completion of certain Feature Modes or may be a mode itself depending on game rules and 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 Video 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 a **CREDIT**, an **EXTRA BALL**, or **SPECIAL**. Adjust to **NONE** if a replay award is not desired.

End of Game Features

Game Endings

When all player(s) have played all balls (including any Extra Ball Buyin's), the game ends. If power is interrupted during the course of a game, it will end that game (see **Starting a Normal Game**). Depending on the number of tilts set (Default=2, adjustable), or prolonged closure of the Plumb Bob Tilt Switch, tilts the 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 two 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.

Entering Initials

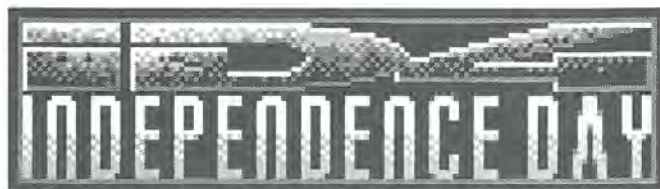
If player achieved a new high score in any of the 3 categories (Regular, Novice or Wizard), the player may enter his/her initials. To enter your initials, use the left & right flipper buttons to choose letter or character as seen on the Visual Display. Hitting the Start Button locks the letter or character in. Proceed with the 2nd & 3rd letter. The game then proceeds into the game-over mode and then to the attract mode. A custom message (adjustable) can be displayed during the attract mode.

Manual Percentaging

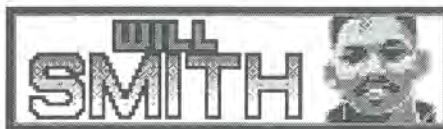
This game is equipped with Manual Percentage Adjustment. As previously with our games, you can either set operator adjustments for a replay percent or you can set a fixed replay score. See Section 3, Chapter 4, Adjustments, Adjustment 1 & 2.

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 correct 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.



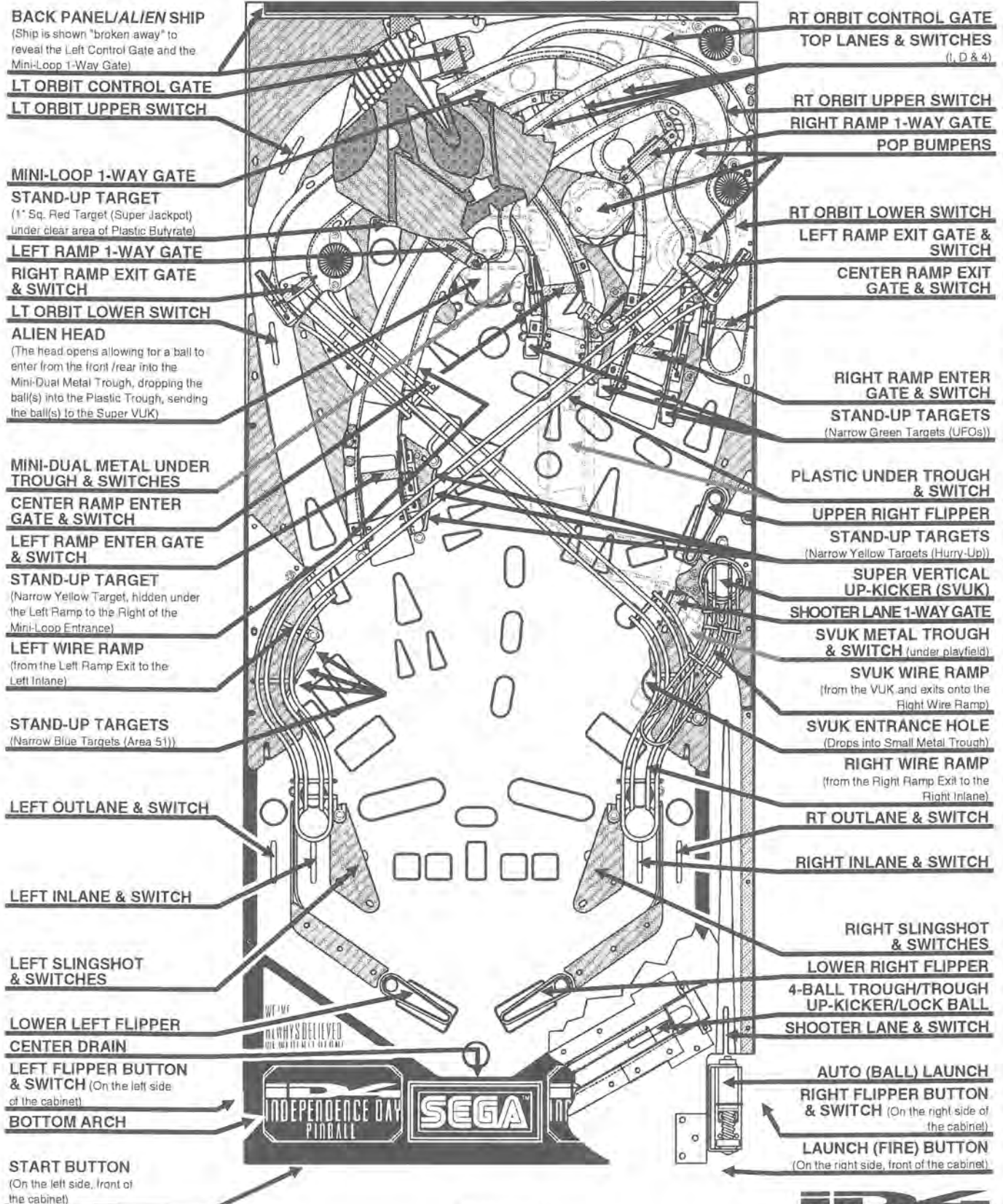
The Cast —



ID4: Independence Day Game Rules

Overview

Below is the ID4 Playfield with all of its component locations indicated (for details on these parts, see Section 4). Read over the components below to help in understanding the effects of the game rules. The rules are numbered and divided into four groups: **Single Ball Play**, **Multiball & Jackpots**, **ID4 Features**, **Playfield Shot Map** and **ID4 Rule Notes**.



ID4: Independence Day Game Rules

Instruction Card

Below is a copy of the game instruction card which is included with every game. If this 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. This will keep the "copy" sturdy.)

Copy & Cut



Fold

Fold

INDEPENDENCE DAY

- 1 Lock balls in the *Alien Head* to start **MULTIBALL**, shoot flashing lights for **JACKPOT**.
- 2 Shoot the *Middle Ramp* for **EXTRA BALL**.
- 3 Shoot the *Left and Right Ramps* to start **RED ALERT**.
- 4 Shoot the *Hole* to **INITIATE COMPUTER VIRUS**.
- 5 Complete the *F-18 Stand-Up Targets* for **HURRY-UP** at the *Left Orbit*.
- 6 Complete the *Area 51 Stand-Up Targets* to light **ALIEN SCAN**, then shoot the same *target bank* for award.
- 7 Shoot *Loops when lit* for **COMBOS**. Collect the **COMBO JACKPOT** at the target when *lit*.

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

Sega Pinball, Inc.™ & © 1996 ID4 Independence Day™ & © 1996 20th Century Fox Film Corp. All Rights Reserved. Part N° 755-5081-00 USA

The remainder of this chapter are the detailed ID4 Game Rules. Please read through for a better understanding of the operation of this game. Some game rules, point values and/or features may change as production continues. The changes, if any, will be describe in manual addendums, if warranted. Please note, that some adjustments (see Section 3, Chapter 4, Adjustments) are designed to customize game play, (i.e. making it harder or easier as players get more familiar with the game).

Code revisions and updates may change as production continues. Code updates will be made available to distributors via ROM, diskette or modem. Changes, if any, will be described with the code updates. See the end of this manual for "Appendix A - Pinball Game Firmware Table," for the latest revision code for all games prior to this game.

See the end of this manual for "Glossary of Terms," for words or acronyms you may not understand. If an acronym or expression is not in this glossary, please call our Technical Support Department, so we may add it in the next game manual. Any other suggestions or comments are always welcome!

SINGLE BALL PLAY



TOP LANES

Complete the **Top Lanes** to advance the *Bonus Multiplier*.



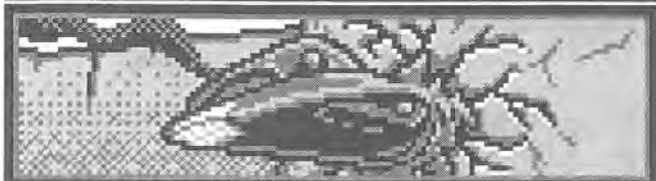
POP BUMPERS

At the beginning of the ball, **Pop Bumpers** score 250K per hit - shooting an unlit **Orbit** increases this value by 50K, with a maximum value of 1M per hit.



F-18 HURRY-UP

In addition to scoring points, each **Pop Bumper** hit adds to the *F-18 Hurry-Up Value* - the same number of points that the **Pop Bumper** scores is added to the *Hurry-Up Value*, which has a base value of 20M. To start the *F-18 Hurry-Up* complete the **3-Bank Targets** in the center of the playfield. When the *Hurry-Up* starts, the accumulated value counts down and the **Left Orbit F-18 Lamp** flashes. If the player shoots the **Left Orbit** before time runs out (the countdown ends at 10M), the value locks in and is scored. Then for a period of time, the **Left Orbit** scores the locked in value.



Playfield Overview
& Game Rules

SINGLE BALL PLAY



RAMP TARGETS

Complete the **Ramp Stand-Up Targets** for increasing *Attacker Millions*.



ALIEN TARGETS/ALIEN SCAN

Complete the **Area 51 (left) 3-Bank Targets** to light *Alien Scan* - then shoot the **3-Bank** one more time for the *Alien Scan Award*. Awards include *Area 51 Multiball Ready*, *Hold Bonus*, *Add Bonus X*, *50M*, *Extra Ball Lit*, *Special Lit*, etc.

MULTIBALL



AREA 51 MULTIBALL

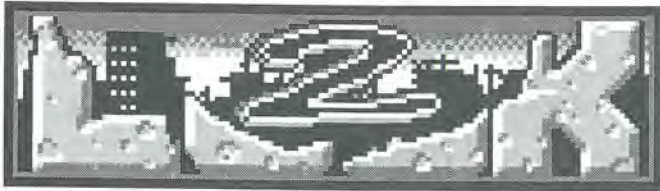
Shooting the **Mini-Loop** when *Area 51* is lit will start **Area 51 Multiball**. Initially 2 balls are released, and the **Mini-Loop** scores **Jackpots**. Shooting flashing **Targets** during this **Multiball** will add 1 ball into play, and shooting lit **Targets** will increase the **Jackpot Value** by 1M per hit. **Targets** do not flash when there are no balls in the **Trough** to add.



LOCKING BALLS

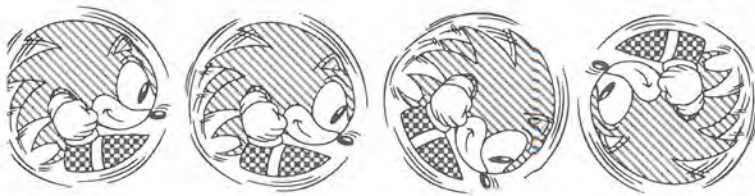
To start **Multiball**, the player must **Lock 3-Balls** inside the **Alien Head** at the center of the playfield. When the **Lamp** in front of the is **Alien Head** flashing, one more *hit* will open the **Alien Head** - when the **Lamp** is solid, more than one *hit* is needed to open the **Alien Head**. Shooting the *ball inside the head* when it is open will score a **Lock** (Note: **Locks** may be scored from the **OPTO** in front of the head) - when **3-Locks** are complete, **Multiball** begins.

MULTIBALL & JACKPOTS



ADDING BALLS

When the player completes the 2 **Double Jackpots** for the 1st time in a **Multiball**, the **Alien Targets** will flash - hitting each **Target** when flashing will put an additional ball into play. Each **Target** will add one ball and then the associated lamp will shut off. **Lamps** will be solid rather than flashing if there are no balls in the **Trough** to add.



JACKPOTS



LOOP COMBOS/COMBO JACKPOT

When the **Light Combo Inlane Inserts** are lit, a ball rolling through the **Inlane** lights the opposite **Orbit** for a **Loop Combo Shot**. The 1st **Loop Combo Shot** each ball scores 5M, the second 6M, etc., with a cap of 10M per shot. This value is also added to the **Combo Jackpot Value** - collected by shooting the **Combo Target** when flashing. The maximum **Combo Jackpot** is 99M, and it resets at the start of each ball.

JACKPOTS



SINGLE JACKPOT/INCREASE JACKPOT

At the start of **Multiball** the **Alien Head** opening is lit for a **Jackpot** - the **Jackpot** starts at a base value and may be increased by 5M for every shot to the **Right Orbit**. Increase **Jackpot Value** is only lit when the **Single Jackpot** is lit. Scoring the **Single Jackpot** advances the player to the **Double Jackpots**...



DOUBLE JACKPOT

2 **Double Jackpots** are lit, 1 at the **Left Orbit** and 1 at the **Right Orbit**. Each **Jackpot** is twice the value of the **Single Jackpot** previously scored - these **Jackpot Values** may not be increased during this round. Scoring both **Double Jackpots** advances the player to the **Triple Jackpots**...



TRIPLE JACKPOT

3 **Triple Jackpots** are lit, 1 at each **Ramp**. Each **Jackpot** is three times the value of the **Single Jackpot** - these **Jackpot Values** may not be increased during this round. Scoring all three **Triple Jackpots** lights the **Super Jackpot**.



SUPER JACKPOT

Shoot the **Super Jackpot Target** (at end of lane just to the left of the **Alien Head**) to collect **Super Jackpot**. The **Super Jackpot Value** is four times the **Single Jackpot Value** previously scored. After the **Super Jackpot** is scored the **Multiball** sequence starts over with **Single Jackpot** and increase **Jackpot Value** available. (Note: Increases in the **Jackpot Value** are held throughout the **Multiball** - but the **Jackpot Value** resets when **Multiball** is over - e.g., increases during the 1st **Multiball** do not carry over to the 2nd **Multiball**, and so on...)



ID4 FEATURES



CENTER RAMP/EXTRA BALL

Each shot to the **Center Ramp** awards 1 Alien - scoring a percentaged number of Aliens will light the **Ramp** for **Extra Ball**. **Extra Ball** may also be lit through percentaging or from Alien Scan. After the **1st Extra Ball** is collected, scoring subsequent Aliens will award points at various thresholds.



LT. & RT. RAMPS/RED ALERT

At game start a shot to the **Left** or **Right Ramp** will score 5M and light the **10m Arrow** in front of that **Ramp**. The next shot to the **Ramp** will score 10M and light the **20m Arrow**. The 3rd shot will score 20M and "complete" the **Ramp** - both the **10M** and **20M Lamps** will be on. Completing both **Ramps** starts **Red Alert**, a timed feature where each **Ramp** scores 50M per shot. To start **Red Alert** a 2nd time in a game, more shots will be necessary, and on extra hard settings the flashing arrows will back up over time.



COMPUTER VIRUS

Shots to the **Right Hole** score a letter of **VIRUS** when lit. Completing **VIRUS** starts the **Computer Virus Feature** - the player must shoot the **Right Orbit** to destroy the **Alien Ship** for **BIG Points**.



ID4 FEATURES



MINI-LOOP

Successive shots around the **Mini-Loop** score 5M, 10M, 15M, 20M, 25M, 30M, 30M, 30M. Percentaging may also allow an **Extra Ball** to be lit if consecutive **Mini-Loop** shots are made.



UNLIT COMBO TARGET

Each shot to this **Target** kills an Alien on the **Display** — kill all Aliens to reveal Award behind them (a Hold Bonus or 50M).



SINGLE STAND-UP TARGET

Each shot to this **Target** scores Millions, plus spots a **Top Lane Light** (I, D or 4).



SKILL SHOT (VIDEO MODE)

At the beginning of each ball is the Skill Shot. Hit the **Launch Button** [FIRE]...don't be hasty, wait until the **Alien Ship** is in your sights!



HIDDEN FEATURES

ID4 features several **Hidden Features**! These rules may include difficult **Combo Shots**, **Sneakins**, etc.

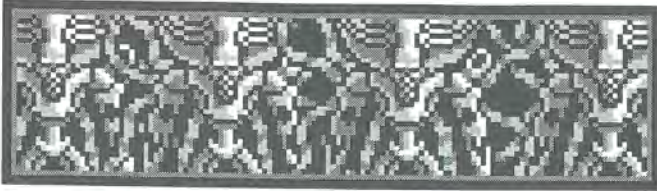


END OF BALL BONUS

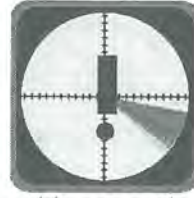
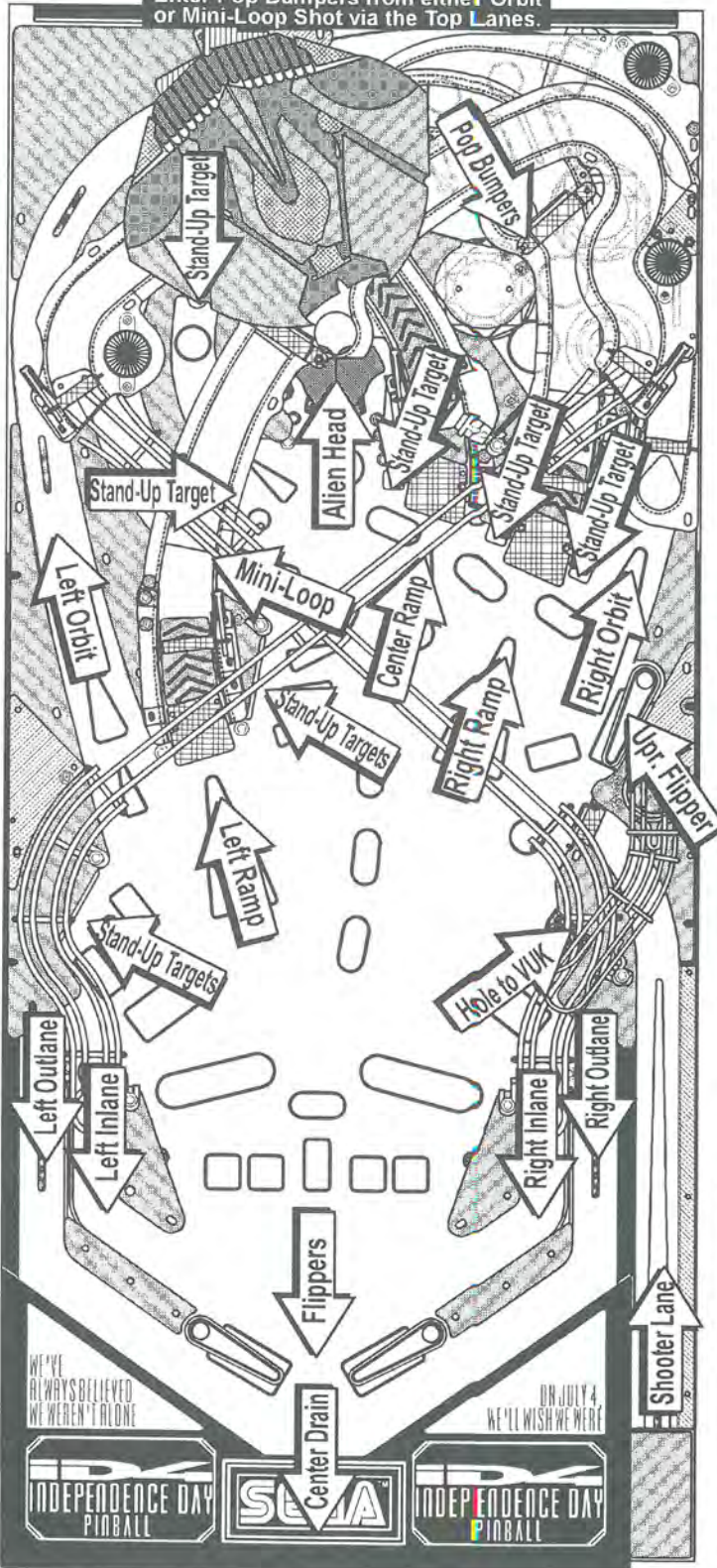
The **BONUS (calculation)** is awarded based on the number of **Balls Locked**, **Ramp Shots**, **Loop Shots**, **Target Hits**, **Feature Completions** and the **Bonus Multiplier**. The **BONUS** can be carried over from ball to ball via **BONUS HOLD**.

PLAYFIELD SHOT MAP

ID4 RULE NOTES

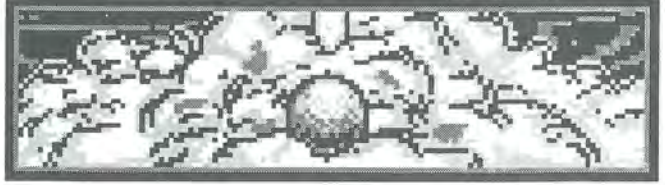
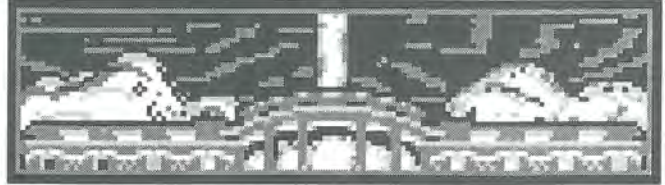
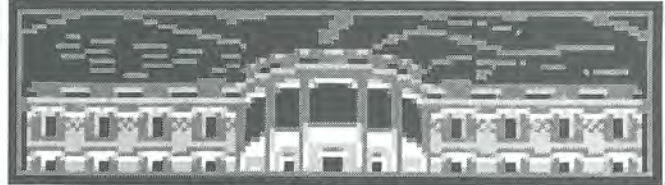
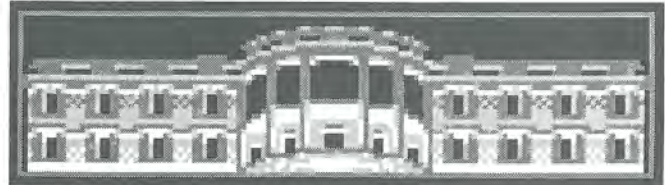


Enter Pop Bumpers from either Orbit or Mini-Loop Shot via the Top Lanes.



INDEPENDENCE DAY NOTE

To keep the world from being destroyed, all rules & point values are subject to change without notice. Seek shelter!



Portals™ Service Menu Introduction

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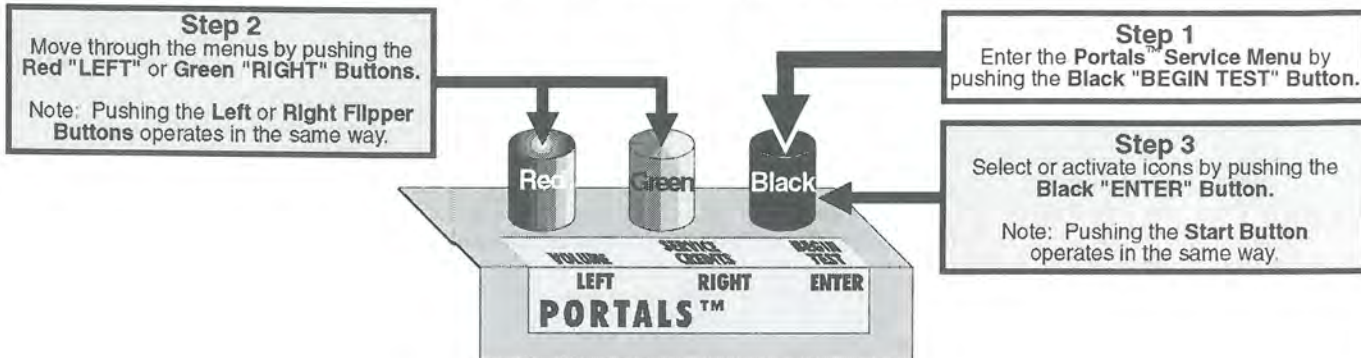
Bullet Legend:

- From Main Menu, Level 1.
- From Sub-Menu, Level 2.
- From Sub-Menu, Level 3.
- ✧ Added Information / Instruction.

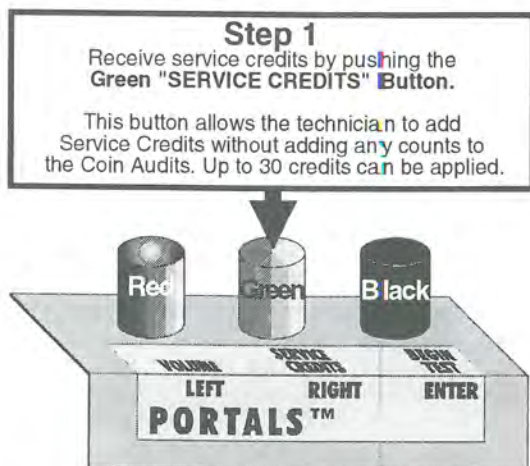
Service Switch Set (Red, Green & Black Buttons) Access & Use

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. **Please ensure the Playfield Power Interlock Switch is pulled out for Coil and Flashlamp testing (this is required).**

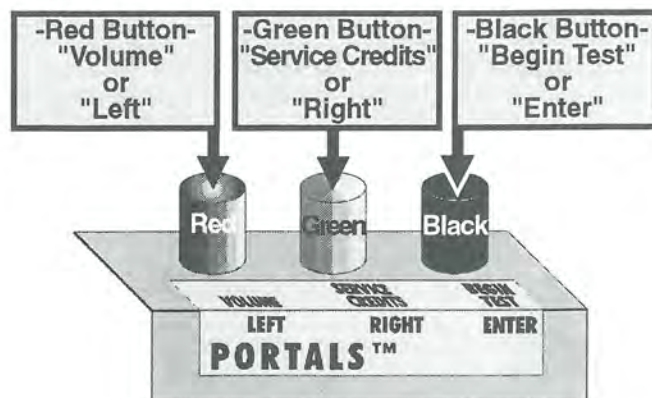
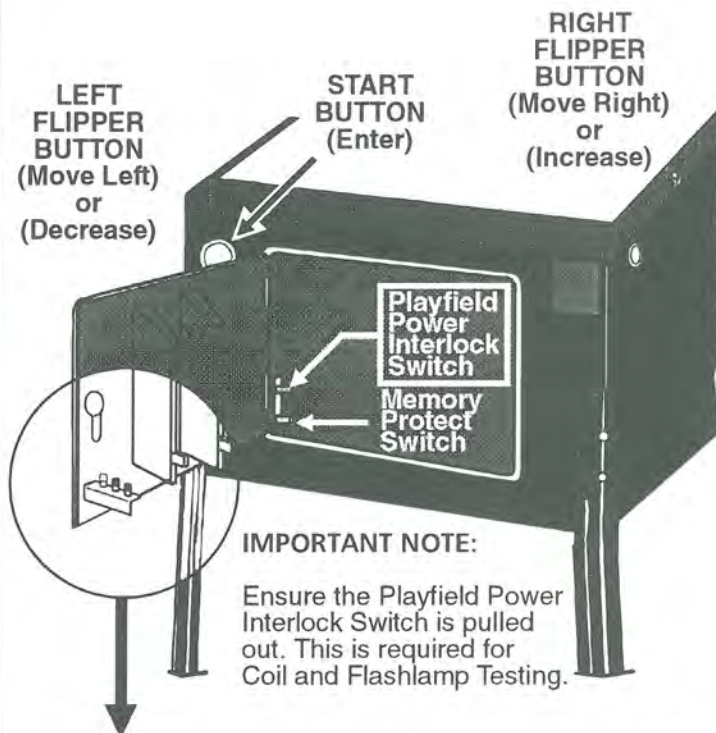
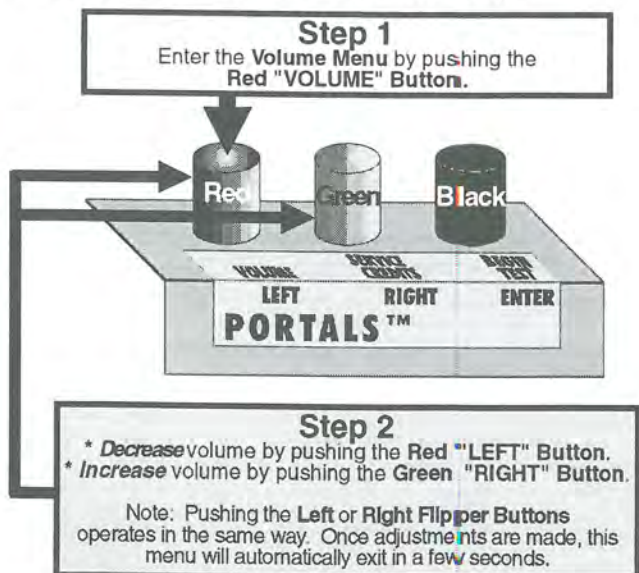
① Entering Portals™ Service Menu (will not operate in Volume Mode):



② Adding Service Credits (will not operate in Service or Volume Modes):



③ Entering the Volume Menu (will not operate in Service Mode):

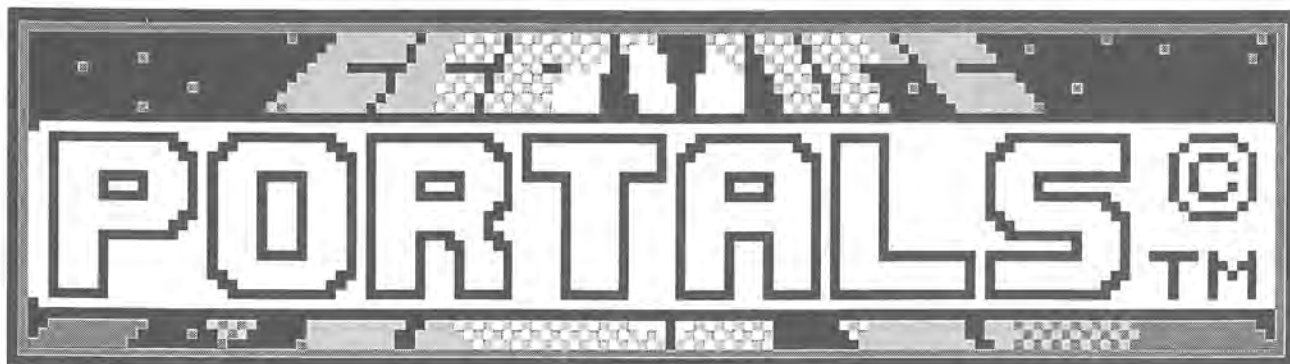


How to Use This Section

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™ © 1996 SEGA PINBALL, INC.," 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:

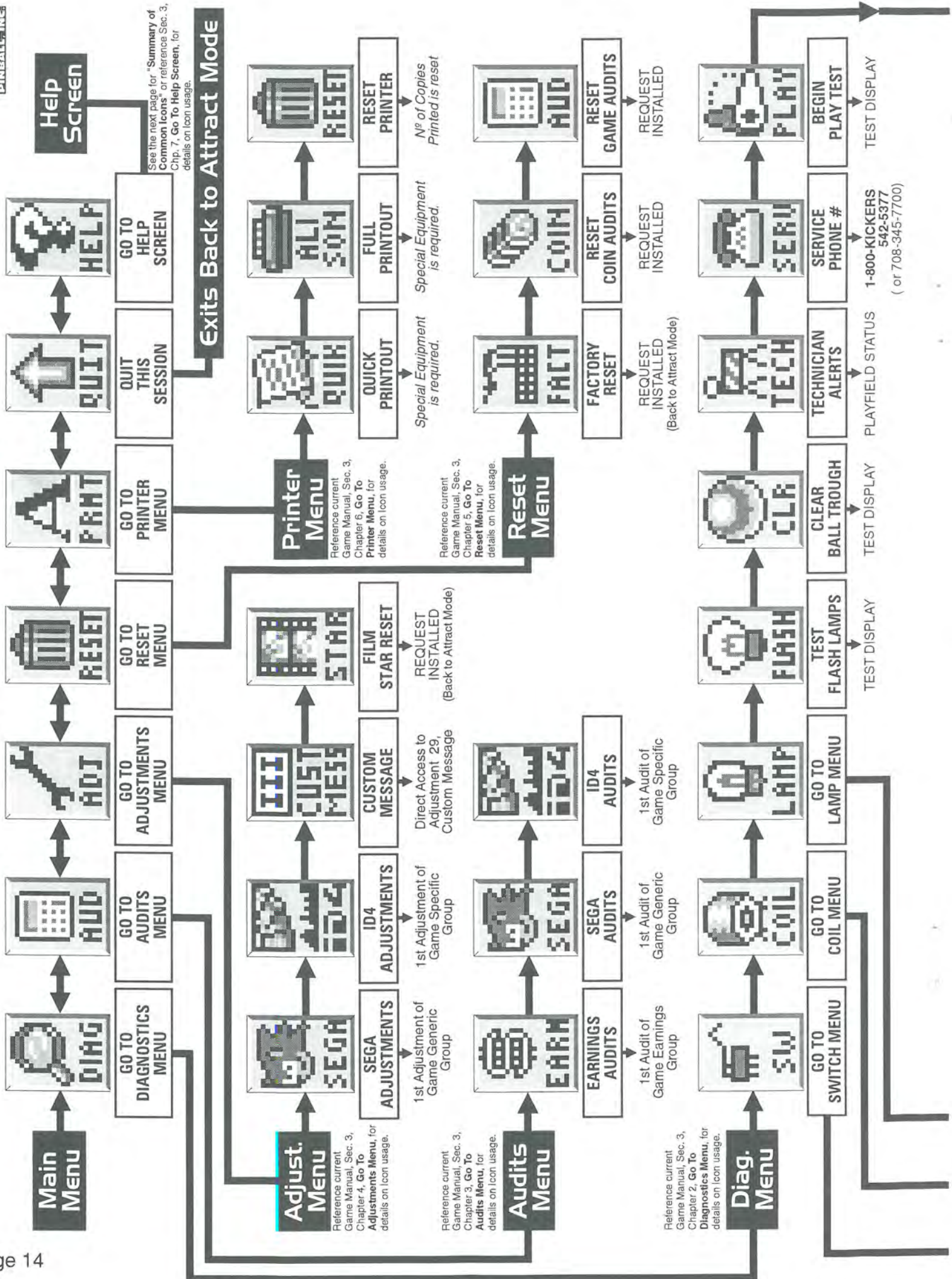


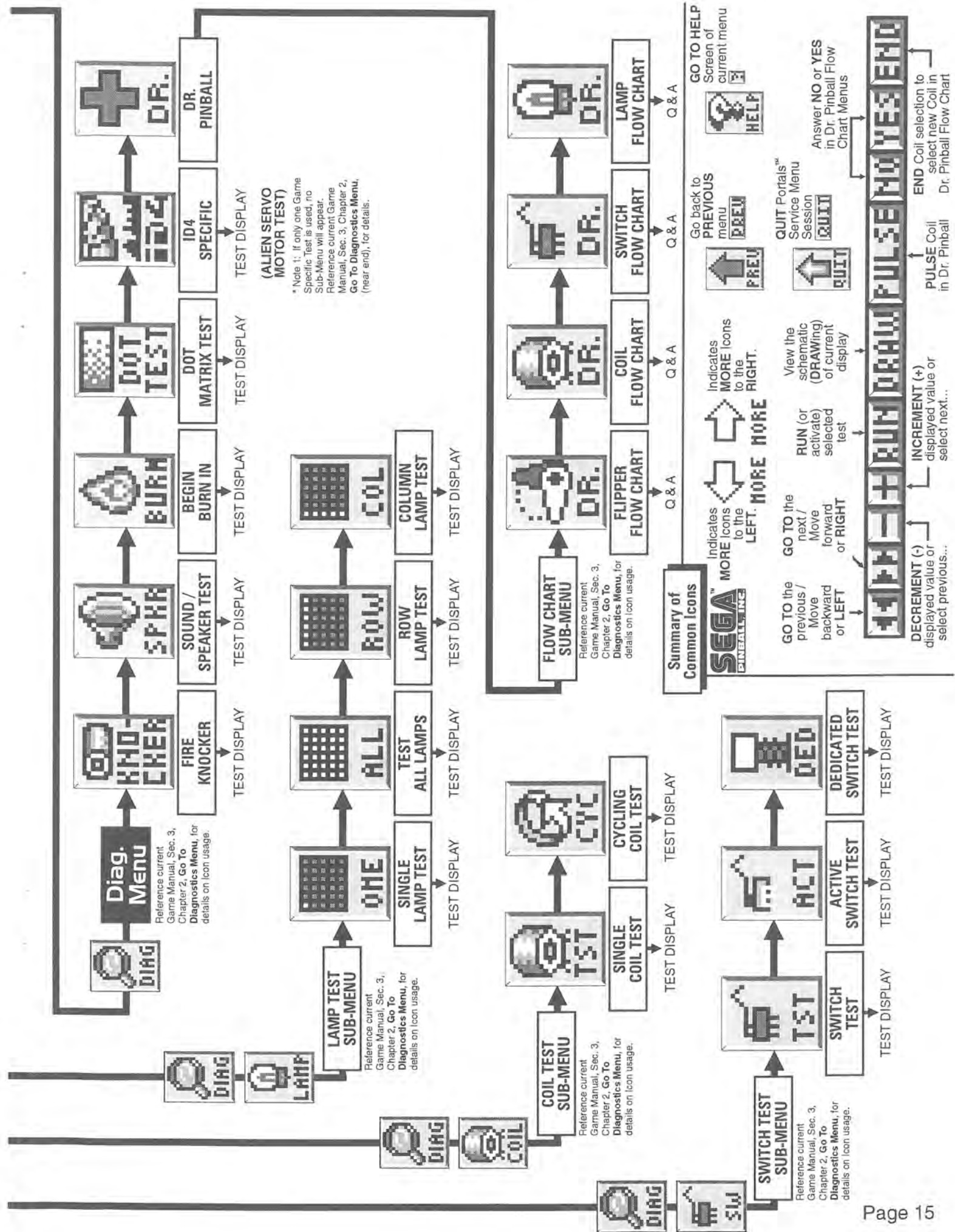
As the operator views the Menu Screen(s), the   symbols indicates that there are more *Icons* to select in each direction. The *Icon* selected will blink. Pushing the **Black "ENTER" Button** (or **Start Button**) will select the *Icon* and the Menu Screen will change to the menu selected. Select the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





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:



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, Schematic Display, etc.), press any service button to exit to the previous menu or sub-menu.



QUIT

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



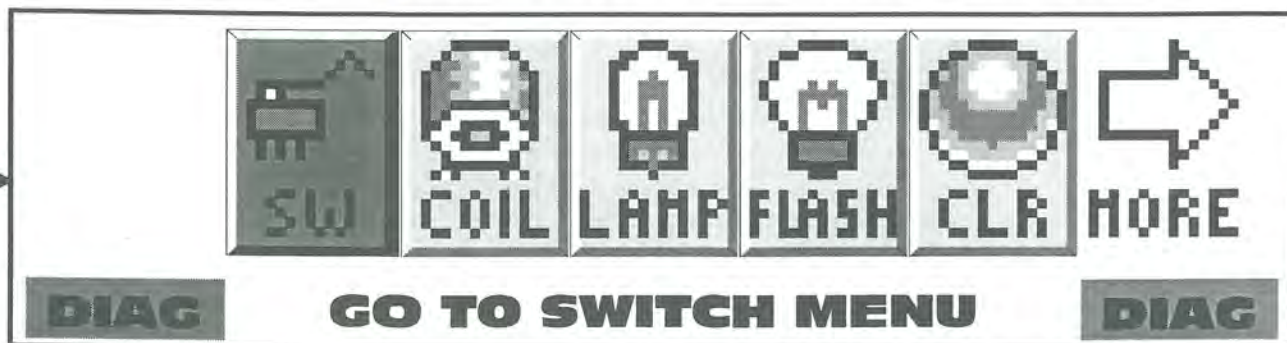
?

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).

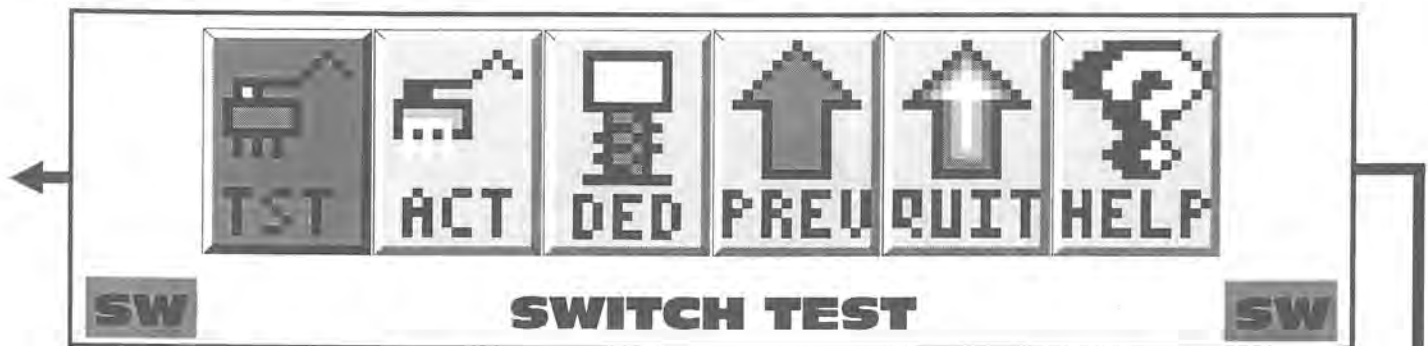


Press the Black "ENTER" Button to activate this **ICON**. This will bring up the **DIAGNOSTICS MENU**.



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**.

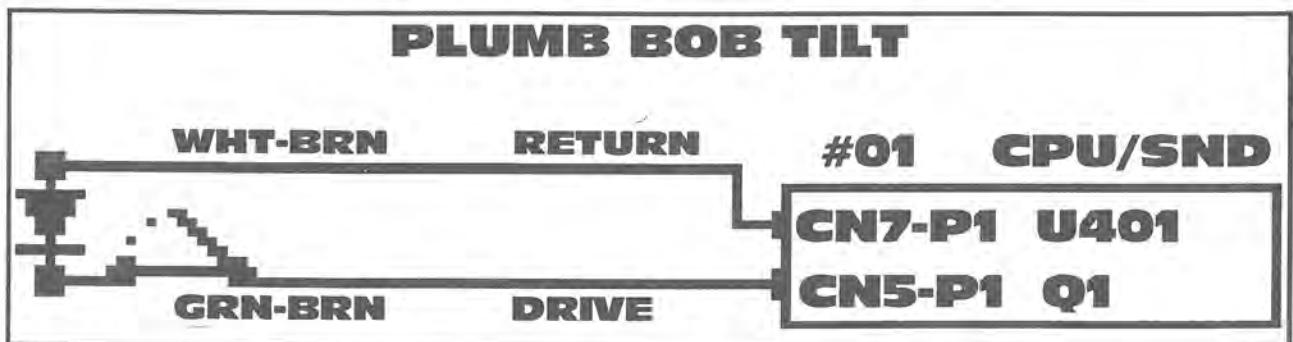
The **SWITCH TEST MENU** now appears with the "TST" *Icon* (SWITCH TEST) flashing:
Press the **Black "ENTER" Button** to *activate* this icon. This will bring up the **Switch Test Display**.



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, Dip & 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**.

Section 3 | Icon Intro

The image shows a main menu screen with a black background. At the top, there are seven square buttons arranged horizontally. Each button contains a white icon and a label below it: a magnifying glass for 'DIAG', a calculator for 'AUD', a wrench for 'ADJ', a trash can for 'RESET', a printer for 'PRNT', a house with an arrow for 'QUIT', and a question mark for 'HELP'. Below these buttons is a large, dark gray rectangular button with the text 'QUIT THIS SESSION' in white. On the far left and right sides of this large button, there are smaller, lighter gray rectangular buttons with the text 'MAIN' in black.

Your Notes

[illegible]

Go To Diagnostics Menu

Special Note: If the **display flashes "OPEN THE COIN DOOR"** the game is indicating that memory has been corrupted. This is caused by either failure in memory (e.g. batteries are dead and/or faulty **RAM**) or upon installation of updated version of game code. Opening the Coin Door will initiate a *Factory Restore*, 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, Flash Lamps, etc.) may be used for a quick verification of automatic test functions and the manual tests (Begin Play Test, Single Lamp/All/Row/Column Tests, etc.) may be used for troubleshooting.

During game play, activation of switches and operation of coils with associated switches are monitored. If the CPU 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 Alerts, 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.



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:



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.



HELP

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.)



QUIT

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



LEFT RIGHT

LEFT RIGHT

LEFT RIGHT

LEFT RIGHT

LEFT RIGHT

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 the **Red "LEFT," Green "RIGHT" and Black "ENTER" Buttons**. This is required for Switch and Active Switch Tests, as the **Flipper** and **Start Buttons** are a part of the test.

In Coil Test, ensure the **Power Interlock Switch** is pulled out. (See **Access & Use** of Chapter 1 of this section for the location.) If the switch is not pulled out, the coils and flash lamps cannot be tested (32v DC and 50v DC are disabled). Closing the Coin Door will automatically reset this switch. Coils and Flash Lamps are checked manually in Coil Test. To automatically check coils, go to Cycling Coils from the **COIL TEST MENU**. To automatically check flash lamps, go to Flash Lamp Test, from the **DIAGNOSTICS MENU**.



GO TO SWITCH MENU

From the **DIAGNOSTICS MENU**, select the "SW" *Icon* with either **Red "LEFT"** or **Green "RIGHT"** **Button** and press the **Black "ENTER" Button**. Switches are configured in an 8 x 8 Matrix of Columns (Switch Drives) and Rows (Switch Returns) with up to 64 switches possible. The Switch Test Menu consists of three parts: Switch Test, Active Switches, and Dedicated Switch Test.

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



Switch Test

To initiate, from the **SWITCH MENU**, select the "TST" *Icon* with the **Red** or **Green Button** & press the **Black Button**. In Switch Test, close each switch and observe the display. The display will describe the switch in the Switch Matrix, which includes the switch name, Return (Row) Wire, Drive (Column) Wire, Part N^o, and the "Pin-Outs" from the CPU/SOUND Board. When the switch is released, the information of the last switch closed will remain in the display until another switch is closed or the test is exited. To view the switch schematic, select the mini "DRAW" *Icon* with the **Red** or **Green Button** & press the **Black Button**.



Active Switch Test

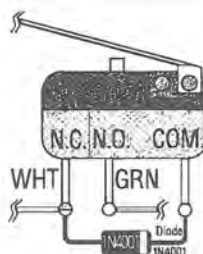
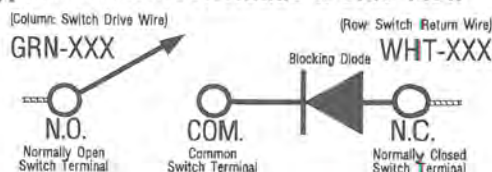
To initiate, from the **SWITCH MENU**, select the "ACT" *Icon* with either **Red** or **Green Button** & press the **Black Button**. If still in a previous test, select the "PREV" *Icon* to return to Switch Menu or selecting either of the "ARROW" *Icons* will move through the tests. If any switches are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



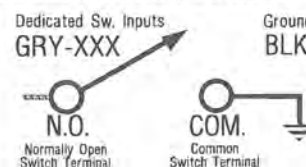
Dedicated Switch Test

To initiate, from the **SWITCH MENU**, select the "DED" *Icon* with either **Flipper Button** & press the **Start Button** (The service switches are deactivated during this test.). The display will describe the switch which includes the Switch Name, Return (Row) Wire, Drive (Column) Wire, Part N^o, and the "Pin-Outs" from the CPU/SOUND Board.

Typical Switch Schematic & Side View



Dedicated Switch Schematic



SWITCH MATRIX GRID

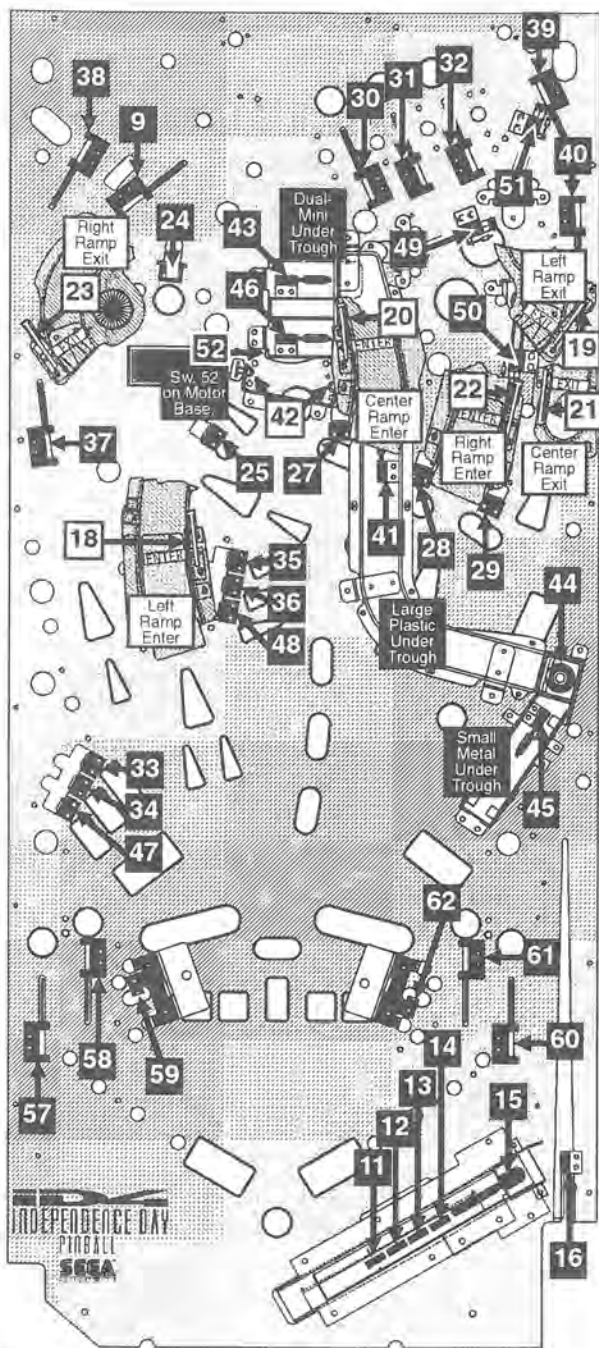
Column (Drive)	1 Q1 GRN-BRN CN5-P1	2 Q2 GRN-RED CN5-P3	3 Q3 GRN-ORG CN5-P4	4 Q4 GRN-YEL CN5-P5	5 Q5 GRN-BLK CN5-P6	6 Q6 GRN-BLU CN5-P7	7 Q7 GRN-VIO CN5-P8	8 Q8 GRN-GRY CN5-P9
Row (Return)	1 U400 WHT-BRN CN7-P9 NOT USED	MINI-LOOP	NOT USED	MINI-LOOP S-U	AREA 51 3-BANK TOP	SUPER VUK ENTER SIDE	LEFT TURBO BUMPER	LEFT OUTLANE
2 U400 WHT-RED CN7-P8	4TH COIN SLOT	NOT USED	LEFT RAMP ENTER	NOT USED	AREA 51 3-BANK MID	ALIEN HEAD OPTO	BOTTOM TURBO BUMPER	LEFT RETURN LANE
3 U400 WHT-ORG CN7-P7	6TH COIN SLOT	4-BALL TROUGH #1 (LEFT)	LEFT RAMP EXIT	CENTER RAMP S-U	HURRY-UP 3-BANK TOP	HEAD UNDER-TROUGH REAR	TOP TURBO BUMPER	LEFT SLINGSHOT
4 U400 WHT-YEL CN7-P6	RIGHT COIN SLOT	4-BALL TROUGH #2	CENTER RAMP ENTER	RIGHT RAMP S-U LEFT	HURRY-UP 3-BANK MID	SUPER VUK	SERVO OPEN / CLOSE	RIGHT OUTLANE
5 U401 WHT-GRN CN7-P5	CENTER COIN SLOT / DBA	4-BALL TROUGH #3	CENTER RAMP EXIT	RIGHT RAMP S-U RIGHT	LEFT ORBIT BOTTOM	SUPER VUK ENTER FRONT	LAUNCH BUTTON	RIGHT RETURN LANE
6 U401 WHT-BLU CN7-P3	LEFT COIN SLOT	4-BALL TROUGH #4 (RIGHT)	RIGHT RAMP ENTER	LEFT TOP LANE	LEFT ORBIT TOP	HEAD UNDER-TROUGH FRONT	START BUTTON	RIGHT SLINGSHOT
7 U401 WHT-VIO CN7-P2	5TH COIN SLOT	4-BALL TROUGH VUK OPTO	RIGHT RAMP EXIT	MIDDLE TOP LANE	RIGHT ORBIT TOP	AREA 51 3-BANK BOT	SLAM TILT	NOT USED
8 U401 WHT-GRY CN7-P1	NOT USED	SHOOTER LANE	SUPER JACKPOT S-U	RIGHT TOP LANE	RIGHT ORBIT BOTTOM	HURRY-UP 3-BANK BOT	PLUMB BOB TILT	NOT USED

Dedicated Switches

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

Switch Matrix Descriptions with Part Numbers and Locations †

The switch locations correspond with the Switch N° in the table below and the Switch Matrix Grid.



Legend Note:

□ = Switches mounted above playfield.

■ = Switches mounted below playfield.

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

2 3 4 5 6 7 54 55 56

The following switches are not used:

1 8 10 17 26 63 64

TAKE NOTE: For Ded. Switch Part N°s see Sec. 4, Chp. 1, Cabinet - General Parts or Chp. 2, Flipper Assy.

Sw. N°	Col. N°	Row N°	Switch Matrix Description	Part N°
Note: The ¥ Coin Switch (for Japan) is 180-5091-00				
1	1	1	NOT USED	
2*	1	2	4TH COIN SLOT (On Coin Door)	
3*	1	3	6TH COIN SLOT (FUTURE USE)	
4*	1	4	RIGHT COIN SLOT (On Coin Door, USA)	
5*	1	5	CENTER COIN SLOT / DBA (USA)	180-5024-00
6*	1	6	LEFT COIN SLOT (On Coin Door) (USA)	
7*	1	7	5TH COIN SLOT (FUTURE USE)	
8	1	8	NOT USED	
9	2	1	MINI-LOOP	500-5707-00
10	2	2	NOT USED	
11	2	3	4-BALL TROUGH #1 (LEFT)	
12	2	4	4-BALL TROUGH #2	180-5119-00
13	2	5	4-BALL TROUGH #3	
14	2	6	4-BALL TROUGH #4 (RIGHT)	
15	2	7	4-BALL TROUGH VUK OPTO TRANS REC	520-5124-00 520-5125-00
16	2	8	SHOOTER LANE	180-5100-01
17	3	1	NOT USED	
18	3	2	LEFT RAMP ENTER	
19	3	3	LEFT RAMP EXIT	
20	3	4	CENTER RAMP ENTER	180-5087-00
21	3	5	CENTER RAMP EXIT	
22	3	6	RIGHT RAMP ENTER	
23	3	7	RIGHT RAMP EXIT	
24	3	8	SUPER JACKPOT S-U	500-5232-02
25	4	1	MINI-LOOP S-U	500-5857-06
26	4	2	NOT USED	
27	4	3	CENTER RAMP S-U	
28	4	4	RIGHT RAMP S-U LEFT	500-5857-04
29	4	5	RIGHT RAMP S-U RIGHT	
30	4	6	LEFT TOP LANE	500-5706-00
31	4	7	MIDDLE TOP LANE	500-5707-00
32	4	8	RIGHT TOP LANE	
33	5	1	AREA 51 3-BANK TOP	500-5857-06
34	5	2	AREA 51 3-BANK MID	
35	5	3	HURRY-UP 3-BANK TOP	500-5857-05
36	5	4	HURRY-UP 3-BANK MID	
37	5	5	LEFT ORBIT BOTTOM	
38	5	6	LEFT ORBIT TOP	500-5707-00
39	5	7	RIGHT ORBIT TOP	
40	5	8	RIGHT ORBIT BOTTOM	500-5706-00
41	6	1	SUPER VUK ENTER SIDE	180-5057-00
42	6	2	ALIEN HEAD OPTO TRANS REC	520-5082-00 520-5083-00
43	6	3	HEAD UNDER TROUGH REAR	180-5057-00
44	6	4	SUPER VUK	180-5116-00
45	6	5	SUPER VUK ENTER FRONT	180-5057-00
46	6	6	HEAD UNDER TROUGH FRONT	
47	6	7	AREA 51 3-BANK BOT	500-5857-06
48	6	8	HURRY-UP 3-BANK BOT	500-5857-05
49	7	4	LEFT TURBO BUMPER	
50	7	2	BOTTOM TURBO BUMPER	180-5015-03
51	7	3	RIGHT TURBO BUMPER	
52	7	4	SERVO OPEN / CLOSE (On Motor Base)	180-5119-00
53	7	5	LAUNCH BUTTON	500-6121-06
54*	7	6	START BUTTON	500-6090-02
55*	7	7	SLAM TILT (On Coin Door)	180-5022-00
56*	7	8	PLUMB BOB TILT HANGER CONTACT	535-5319-00 535-7563-01
57	8	1	LEFT OUTLANE	500-5707-00
58	8	2	LEFT RETURN LANE	
59	8	3	LEFT SLINGSHOT	180-5054-00
60	8	4	RIGHT OUTLANE	500-5707-00
61	8	5	RIGHT RETURN LANE	
62	8	6	RIGHT SLINGSHOT	180-5054-00
63	8	7	NOT USED	
64	8	8	NOT USED	



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. The first 2 groups are the High Current Coils. The next group is the Low Current Coils. The next group is the Flash Lamps. The remaining coils are special coils. These coils are listed in a Coils Detailed Chart Table following the Playfield Coil & Flash Lamp Locations.



Single Coil Test

To initiate, from the **COIL MENU**, select the "TST" *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; some Flash Lamps may be positioned within Coils 1-24.). 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 and gauge-turns (e.g. 23-800). Press the **Black Button** again to move forward in the test. To test and view a particular coil or flash lamp, select the "RUN" *Icon* and press the **Black Button**. Each time the **Black Button** is pushed, the coil or flash lamp will fire on the playfield and/or backbox, with the display indicating the coil or flash lamp information. Continue with the same procedure to run through the entire test.



Cycling Coil Test

To initiate, from the **COIL MENU**, select the "CYC" *Icon* with either **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."

Playfield Flash Lamp Locations

Type	Description
#6 FLASH	BOTTOM-LT*2
#7 FLASH	LT*1 RT-RAMP*1
#23 FLASH	BOTTOM-RT*1
#F1 FLASH	MID PLAYFIELD*1
#F2 FLASH	CENTER RAMP*1
#F3 FLASH	TOP-LT PLAYFIELD*1
#F4 FLASH	SHIP*1 POPS*1
#F5 FLASH	SHIP*1 POPS*2
#F6 FLASH	POPS*1
#F7 FLASH	LEFT RAMP*1
#F8 FLASH	UPPER RT FLIPPER*1

Legend Note:

□ = Flash Lamps mounted above playfield.

■ = Flash Lamps mounted below playfield.

Spots Actual Location:

● = Bulb goes through hole in the playfield.

○ = Bulb is under playfield insert.

⊙ = Bulb under Mini-Mar (Light Cover).

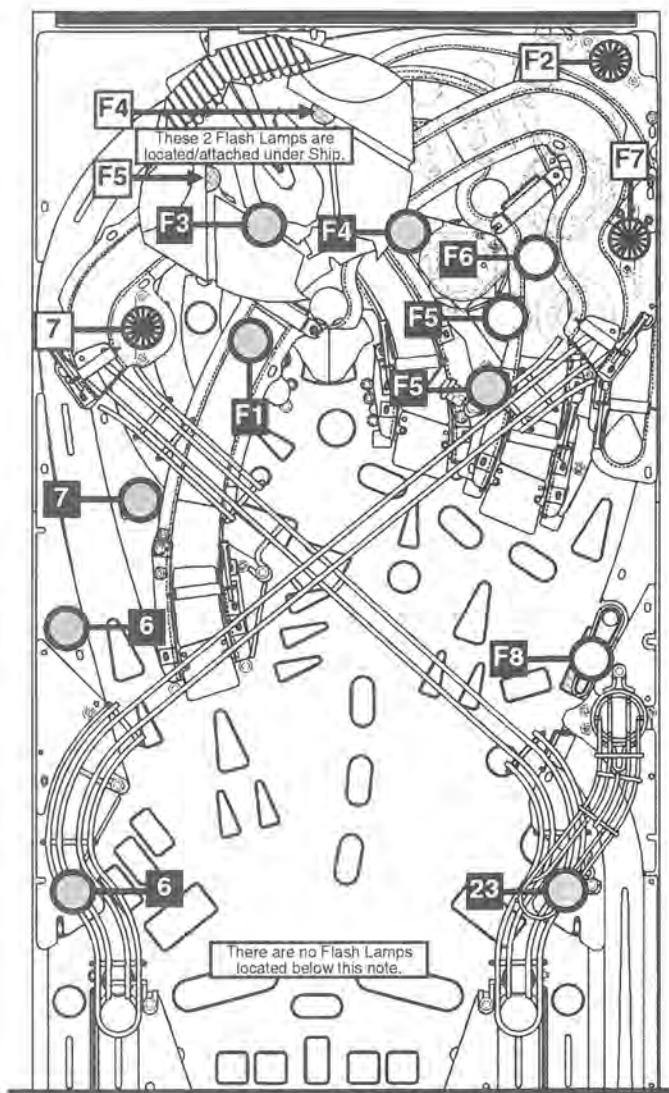
The following bulbs are used for Flash Lamps (The two [2] #906 Bulbs are used under the Alien Ship Assembly):



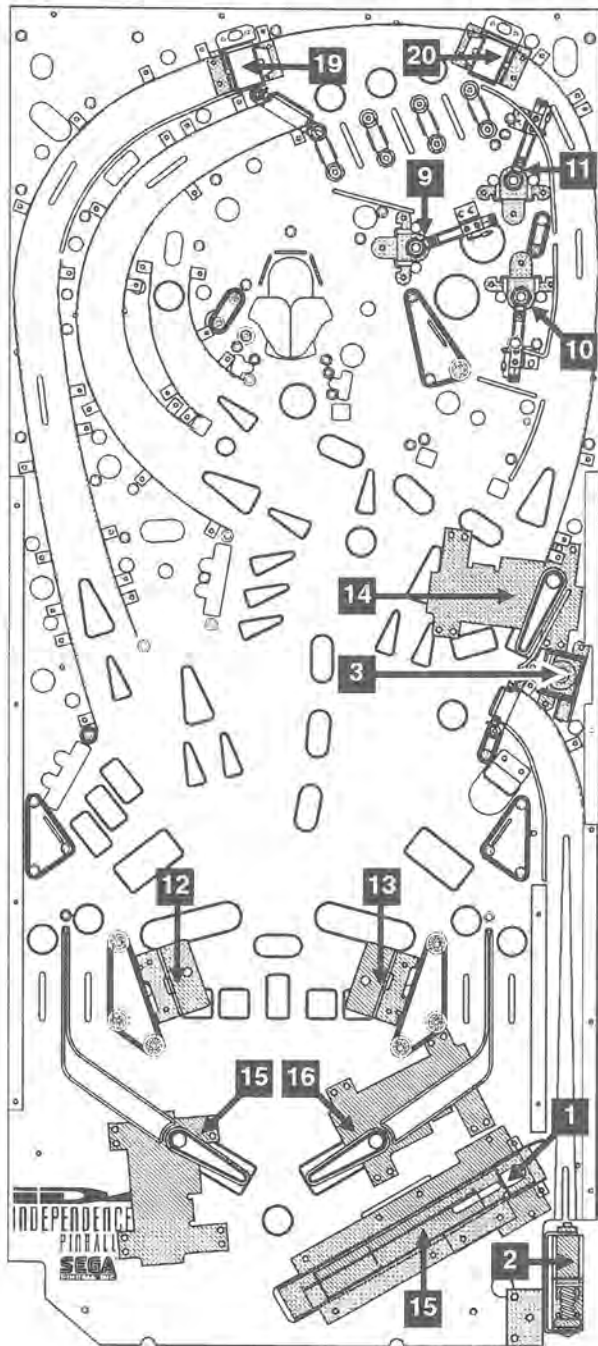
#89 Bulb
(Bayonet)
165-5000-89



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



Playfield Coil Locations



Type	Coil Description
COIL 1	TROUGH UP-KICKER (VUK) (24-940) ✓
COIL 2	AUTO LAUNCH 50V (23-700) ✓
COIL 3	SUPER VUK (23-800) ✓
COIL 4	NOT USED / SPARE
COIL 5	NOT USED / SPARE
COIL 6	FLASH BOTTOM-LT*1 (See previous page) ✓
COIL 7	FLASH LT*1 RT-RAMP*1 (See previous page) ✓
COIL 8	(EUROPEAN TOKEN DISPENSER)
COIL 9	LEFT TURBO BUMPER (26-1200) ✓
COIL 10	BOTTOM TURBO BUMPER (26-1200) ✓
COIL 11	RIGHT TURBO BUMPER (26-1200) ✓
COIL 12	LEFT SLINGSHOT (26-1200) ✓
COIL 13	RIGHT SLINGSHOT (26-1200) ✓
COIL 14	UPPER FLIPPER [50v RED/YEL] (23-900) ✓
COIL 15	LEFT FLIPPER [50v RED/YEL] (22-1080) ✓
COIL 16	RIGHT FLIPPER [50v RED/YEL] (22-1080) ✓
COIL 17	4-BALL TROUGH LOCK BALL (24-940) ✓
COIL 18	NOT USED / SPARE
COIL 19	LEFT CONTROL GATE (32-1800) ✓
COIL 20	RIGHT CONTROL GATE (32-1800) ✓
COIL 21	NOT USED / SPARE
COIL 22	NOT USED / SPARE
COIL 23	FLASH BOTTOM RT*1 (See previous page) ✓
COIL 24	(OPTIONAL COIN METER)

Legend Note:

□ = Coils mounted above playfield (No Coils are mounted above the playfield in this game).

■ = Coils mounted below playfield.

The following coils are not used:

4 5 18 21 22

The following coils are optional:

8 24

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 or Bulb Type
#1	TROUGH UP-KICKER	Q1	I/O Pwr. Drvr.	BRN-BLK	J8-P1	YEL-VIO	J10-P4/5	50v	24-940 090-5036-01
#2	AUTO LAUNCH	Q2	I/O Pwr. Drvr.	BRN-RED	J8-P3	YEL-VIO	J10-P4/5	50v	23-700 090-5022-01
#3	SUPER VUK	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	YEL-VIO	J10-P4/5	50v	23-800 090-5001-01
#4	NOT USED / SPARE	Q4	I/O Pwr. Drvr.						
#5	NOT USED / SPARE	Q5	I/O Pwr. Drvr.						
#6	FLASH BOTTOM-LT*2	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	ORG	J6-P10	20v	#89 165-5000-89
#7	FLASH LT*1 RT-RAMP*1	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	ORG	J6-P10	20v	#89 165-5000-89
#8	EUROPEAN TOKEN DISPENSER	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	YEL-VIO	J10-P4/5	50v	N/A

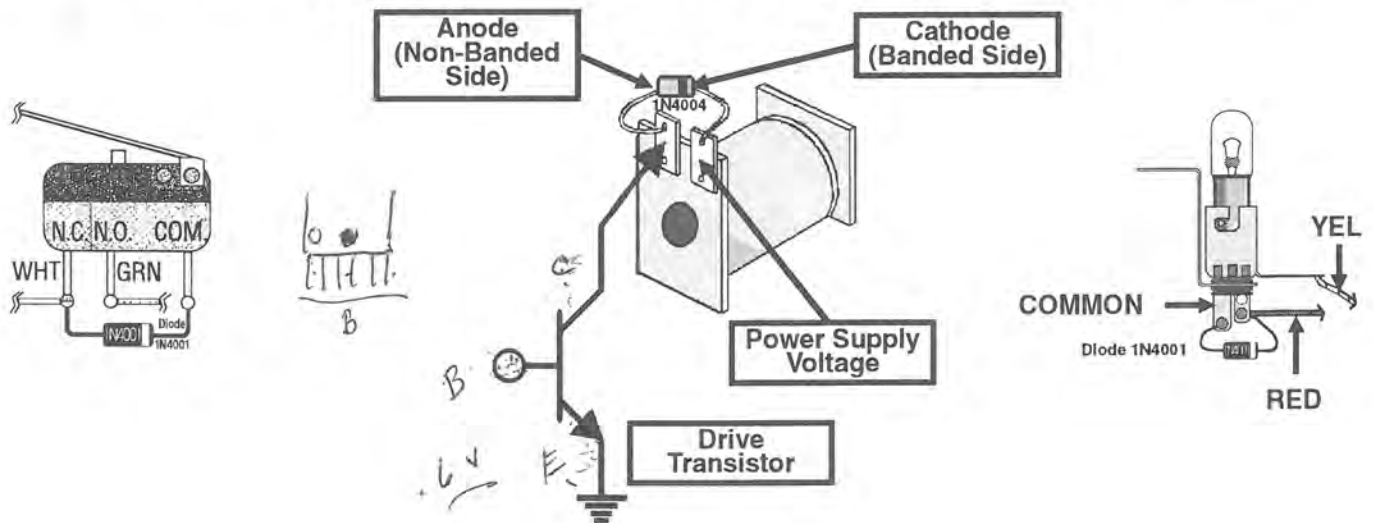
High Current Coils Group 2		Drive Transistor (D.T.)	Driver Output Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connection	Power Voltage	Coil GA/Turn or Bulb Type
#9	LEFT TURBO BUMPER	Q9	I/O Pwr. Drvr.	BLU-BRN	J9-P1	YEL-VIO	J10-P4/5	50v	26-1200 090-5044-00
#10	BOTTOM TURBO BUMPER	Q10	I/O Pwr. Drvr.	BLU-RED	J9-P2	YEL-VIO	J10-P4/5	50v	26-1200 090-5044-00
#11	RIGHT TURBO BUMPER	Q11	I/O Pwr. Drvr.	BLU-ORG	J9-P4	YEL-VIO	J10-P4/5	50v	26-1200 090-5044-00
#12	LEFT SLINGSHOT	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	YEL-VIO	J10-P4/5	50v	26-1200 090-5044-00
#13	RIGHT SLINGSHOT	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	YEL-VIO	J10-P4/5	50v	26-1200 090-5044-00
#14	UPPER FLIPPER (50v RED/YEL)	Q14	I/O Pwr. Drvr.	BLK-YEL	J9-P7	RED-YEL BLU-YEL	J10-P1/2	50v	23-900 090-5020-30
#15	LEFT FLIPPER (50v RED/YEL)	Q15	I/O Pwr. Drvr.	ORG-GRY	J9-P8	RED-YEL GRY-YEL	J10-P1/2	50v	22-1080 090-5032-00
#16	RIGHT FLIPPER (50v RED/YEL)	Q16	I/O Pwr. Drvr.	ORG-VIO	J9-P9	RED-YEL BLU-YEL	J10-P1/2	50v	22-1080 090-5032-00

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 or Bulb Type
#17	4-BALL TROUGH LOCK BALL	Q17	I/O Pwr. Drvr.	VIO-BRN	J7-P2	BRN	J7-P1	20v	24-940 090-5036-00
#18	NOT USED / SPARE	Q18	I/O Pwr. Drvr.						
#19	LEFT CONTROL GATE	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	BRN	J7-P1	20v	32-1800 090-5031-00
#20	RIGHT CONTROL GATE	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	BRN	J7-P1	20v	32-1800 090-5031-00
#21	NOT USED / SPARE	Q21	I/O Pwr. Drvr.						
#22	NOT USED / SPARE	Q22	I/O Pwr. Drvr.						
#23	FLASH BOTTOM-RT*1	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	ORG	J6-P10	20v	#89 165-5000-89
#24	OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v	5v Meter (If Required)

Coils Detailed Chart Table

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 Type
#F1 FLASH MID PLAYFIELD*1	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	ORG	J6-P10	20v	#89 165-5000-89
#F2 FLASHCENTER RAMP*1	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	ORG	J6-P10	20v	#89 165-5000-89
#F3 FLASH TOP-LT PLAYFIELD*1	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	ORG	J6-P10	20v	#89 165-5000-89
#F4 FLASH SHIP*1 POPS*1	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	ORG	J6-P10	20v	#906 / #89 165-5004-00
#F5 FLASH SHIP*1 POPS*2	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	ORG	J6-P10	20v	#906 / #89 165-5004-00
#F6 FLASH POPS*1	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	ORG	J6-P10	20v	#89 165-5000-89
#F7 FLASH LEFT RAMP*1	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	ORG	J6-P10	20v	#89 165-5000-89
#F8 FLASH UPPER RT FLIPPER *1	Q32	I/O Pwr. Drvr.	BLK-GRY	J6-P8	ORG	J6-P10	20v	#89 165-5000-89

TYPICAL SWITCH, COIL & LAMP WIRING





GO TO LAMP MENU

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

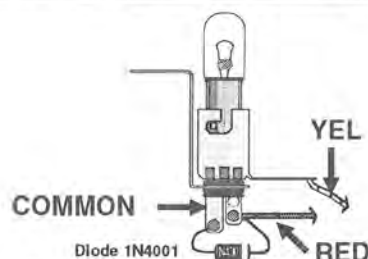
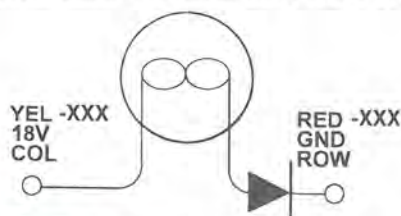


Test All Lamps

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.

Continued on the next page with Row & Column Lamp Tests.

Typical Lamp Schematic & Side View



LAMP MATRIX GRID

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
Row (GND)								
1: Q33 RED-BRN J12-P1	2X #555 Bulb 1	4X #555 Bulb 2	10X #555 Bulb 3	6X #555 Bulb 4	8X #555 Bulb 5	RELEASE CITY DESTROYERS #555 Bulb 6	RELEASE CITY DESTROYERS #555 Bulb 7	HOLD BONUS #44 Bulb 8
2: Q34 RED-BLK J12-P2	RELEASE ATTACKERS #555 Bulb 9	RELEASE ATTACKERS #555 Bulb 10	SPECIAL (LEFT) #44 Bulb 11	LIGHT COM- BO (LEFT) #44 Bulb 12	LIGHT COM- BO (RIGHT) #44 Bulb 13	SPECIAL (RIGHT) #44 Bulb 14	ALIEN SCAN #555 Bulb 15	INITIATE COM- PUTER VIRUS #44 Bulb 16
3: Q35 RED-ORG J12-P3	AREA 51 3-BANK BOT #555 Bulb 17	AREA 51 3-BANK MID #555 Bulb 18	AREA 51 3-BANK TOP #555 Bulb 19	LEFT RAMP 10 MIL #555 Bulb 20	LEFT RAMP 20 MIL #555 Bulb 21	LEFT RAMP ARROW #555 Bulb 22	F-18 HURRY-UP #44 Bulb 23	LEFT ORBIT ARROW #44 Bulb 24
4: Q36 RED-YEL J12-P4	LOCK 1 #555 Bulb 25	LOCK 2 #555 Bulb 26	LOCK 3 #555 Bulb 27	INCREASE JACKPOT #555 Bulb 28	HURRY-UP 3-BANK BOT #555 Bulb 29	HURRY-UP 3-BANK MID #555 Bulb 30	HURRY-UP 3-BANK TOP #555 Bulb 31	RUSSELL #555 Bulb 32
5: Q37 RED-GRN J12-P5	RIGHT RAMP 10 MIL #555 Bulb 33	RIGHT RAMP 20 MIL #555 Bulb 34	RIGHT RAMP ARROW #44 Bulb 35	MINI-LOOP ARROW #555 Bulb 36	AREA 51 ARROW #555 Bulb 37	SUPER JACKPOT #44 Bulb 38	MINI-LOOP STAND-UP #555 Bulb 39	NOT USED #44 Bulb 40
6: Q38 RED-BLU J12-P6	COMBO #555 Bulb 41	ALIEN HEAD CIRCLE #555 Bulb 42	CENTER - RAMP S-U #555 Bulb 43	RIGHT RAMP S-U LEFT #555 Bulb 44	RIGHT RAMP S-U RIGHT #44 Bulb 45	EXTRA BALL #555 Bulb 46	CENTER - RAMP ARROW #555 Bulb 47	RIGHT ORBIT #44 Bulb 48
7: Q39 RED-VIO J12-P8	LEFT TURBO BUMPER #555 Bulb 49	BOTTOM TUR- BO BUMPER #555 Bulb 50	RIGHT TUR- BO BUMPER #555 Bulb 51	LEFT TOP LANE #44 Bulb 52	MIDDLE TOP LANE #44 Bulb 53	RIGHT TOP LANE #44 Bulb 54	LEFT FLIPPER #44 Bulb 55	RIGHT FLIPPER #44 Bulb 56
8: Q40 RED-GRY J12-P9	ALIEN EYES #44 Bulb 57	SHOOT AGAIN #44 Bulb 58	LEFT FLIPPER #44 Bulb 59	LEFT FLIPPER #44 Bulb 60	RIGHT FLIPPER #44 Bulb 61	RELEASE CITY DESTROYERS #555 Bulb 62	RIGHT FLIPPER #44 Bulb 63	LAUNCH BUTTON #44 Bulb 64
9: Q41 RED-WHT J12-P10	RELEASE ATTACKERS #555 Bulb 65	NOT USED #44 Bulb 66	NOT USED #44 Bulb 67	NOT USED #44 Bulb 68	NOT USED #44 Bulb 69	NOT USED #44 Bulb 70	NOT USED #44 Bulb 71	NOT USED #44 Bulb 72
10: Q42 NOT USED J12-P11	NOT USED #44 Bulb 73	NOT USED #44 Bulb 74	NOT USED #44 Bulb 75	NOT USED #44 Bulb 76	NOT USED #44 Bulb 77	NOT USED #44 Bulb 78	NOT USED #44 Bulb 79	NOT USED #44 Bulb 80



Row and Column Lamp Tests

To initiate, from the **LAMP MENU**, select the "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 (respective to each test) will light-up on the playfield and is indicated in the display.

Lamp Matrix Location

The lamp locations correspond with the Lamp Number in the Lamp Matrix Grid on the previous page.

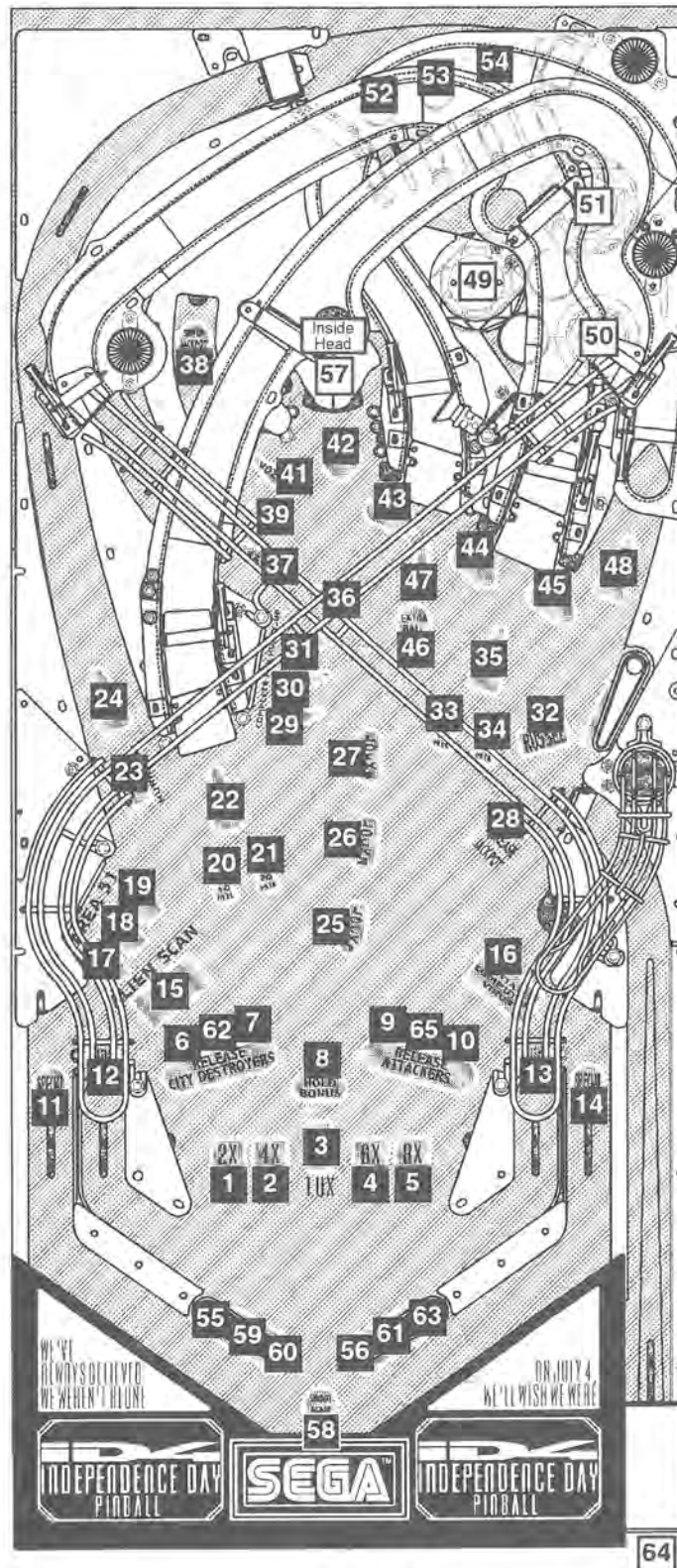
Legend Note:

 = Lamps mounted above playfield.

 = Lamps mounted below playfield.

The following Lamps are not used:

40	66	67	68
69	70	71	72
73	74	75	76
77	78	79	80



The following Bulb is used on the Light Boards and Pop Bumpers:



#555 Bulb
(Wedge)
165-5002-00

The following Bulb is used in the remainder of the matrix:



#44 Bulb
(Bayonet)
165-5000-44



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.



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.

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



TECHNICIAN ALERTS

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.



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 Vertical Up-Kickers, Ejects, Pop Bumpers, etc. in the game. For unique Play Test functions, select the "GAME SPECIFIC" *Icon* in the **DIAGNOSTICS MENU**.



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 "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.

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 Masked ROM 1 (Loc. U17)	Speech Pattern 1

Auto / Manual Tests	Sounds Produced
Voice Masked ROM 2 (Loc. U21)	Speech Pattern 2
Voice Masked ROM 3 (Loc. U36)	Not Used
Voice Masked ROM 4 (Loc. U37)	Not Used



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

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.

Dot Matrix Display Explained

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



ID4: SPECIFIC (Servo Motor Test - for Alien Head)

From the **DIAGNOSTICS MENU**, select the "ID4" *Icon* with either **Red "LEFT"** or **Green "RIGHT"** **Button** and press the **Black "ENTER" Button**. After selecting this *Icon* the technician can test and adjust any game specific function(s) from the sub-menu. Similar to "BEGIN PLAY TEST," this menu is used to test the game specific features. In Servo Motor Test, press and release the **Start Button** to open the Alien Head. Press and release again to close. The display will also indicate the status of the Motor Base Switch (Sw. 52). Note: When the switch is "closed" the head is open; when the switch is "open" the head is closed.

Servo Controller Board Calibration / Adjustment Procedure

"RUN" the Servo Test so the "head closed" position is achieved. Rotate "**POS 1**" **POT** & "**POS 2**" **POT** to the center position. Plug in the Servo Motor and by hand, open the Alien Head Mechanism half-way (open). Adjust "**POS 1**" **POT** until the "HEAD CLOSES" and the **LED** just barely lights (or blinks). The Alien Head should now be closed with no *Air Gap* in-between the Head Halves. Advance (RUN) to the "HEAD OPEN" Test and adjust "**POS 2**" **POT** until the the **LED** just barely lights (or blinks). It is important to adjust **POS 1** first as it affects the other setting.

Proper position of the Head should be when the Head opens, the left & right sides stop **before** touching the posts on either side (leaving a 1/32" - 1/16" gap). When the Head closes, the 2 halves should just **gently touch closed** (Note: Use a piece of paper to determine if closure is too tight).



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 four sub-menus: Flipper "DR.," 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.

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



- 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. 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).



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



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.



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.



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.

Your Notes

[illegible]



INDEPENDENCE DAY GAME AUDIT TABLE



Photocopy for Field Audit Tracking Performance (Use blank columns to fill-in game audit information).



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		28 100.0M—199.9M SCORES		43 TOTAL REGULAR PLAYS	
14 TOTAL EXTRA BALLS		29 200.0M—399.9M SCORES		44 AVG. REGULAR GAME TIME	
15 EXTRA BALL PERCENT		30 400.0M—799.9M SCORES		45 REGULAR GAME MBALLS	
16 REPLAY 1 AWARDS		31 800.0M—1.19B SCORES		46 REGULAR GAME REPLAYS	
17 REPLAY 2+ AWARDS		32 1.2B+ SCORES		47 TOTAL NOVICE PLAYS	
18 TOTAL REPLAYS		33 AVERAGE SCORES		48 AVG. NOVICE GAME TIME	
19 REPLAY PERCENT		34 SERVICE CREDITS		49 NOVICE GAME MBALLS	
20 TOTAL SPECIALS		35 BALL SEARCH STARTED		50 NOVICE GAME REPLAYS	
21 SPECIAL PERCENT		36 LOST BALL FEEDS		51 AVG. NOVICE BALL SAVES	
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 0.0M—99.9M SCORES		42 TOTAL BALLS SAVED			



ID4: INDEPENDENCE DAY AUDITS 56-89

Audit Name	Fill-In	Audit Name	Fill-In	Audit Name	Fill-In
56 ALIEN 3-BANK COMPLETED		68 TOP LANES COMPLETED		80 HEAD OPEN SWITCH FAILURE	
57 F-18 3-BANK COMPLETED		69 MBALL READY SPOTTED		81 ALIEN SCAN EXTRA BALLS	
58 RAMP TARGETS COMP.		70 MBALL READY EARNED		82 CENTER RAMP E.B. LIT	
59 RIGHT ORBITS		71 MULTIBALL START		83 MBALL FROM ALIEN SCAN	
60 LEFT ORBITS		72 MULTIBALL PERCENT		84 POP BUMPER VISITS	
61 MINI-LOOPS		73 2+ MULTIBALLS		85 RED ALERT	
62 RIGHT RAMP		74 MULTIBALL RESTART LIT		86 AREA 51 MULTIBALL	
63 CENTER RAMP		75 MULTIBALL RESTARTED		87 F-18 HURRY-UP	
64 LEFT RAMP		76 SINGLE JACKPOTS		88 VIRUS COMPLETED	
65 SVUK FROM HEAD FRONT		77 DOUBLE JACKPOTS		89 TROUGH FAILURE	
66 SVUK FROM RIGHT HOLE		78 TRIPLE JACKPOTS			
67 SVUK FROM HEAD REAR		79 SUPER JACKPOTS			

CPU Ver.:

Display Ver.:

Replay Level Score:

Section 3
Chapter 3

Date Audited:

Audited By:

Location:

Audits

Go To Audits Menu

Overview

The **Portals™ Service Menu System** provides 89 Audit Functions for accounting purposes and for evaluation of game difficulty adjustments. The Audit Functions are divided into 3 groups. The 1st group, **Earnings (Coin) Audits**, are the first 12 most-used audits. The 2nd group, **Sega Audits**, are the game play generic audits 13-55. The 3rd group, **ID4 Audits**, are the game play specific audits 56-89; Audits 54-55 are currently **Not Used**, allowing for **Future Expansion**, if any. If the code version is upgraded, view Audits in the display and 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 Introduction, of this Section). View all audits with the **Game Audit Table** provided (on the prev. page).



GO TO AUDITS MENU

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

Important Notes:



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



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



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



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



EARNINGS AUDITS (1-12)

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

Au. N°	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 this switch (Sw. 6) was closed.
Au. 6	Coins Thru Right Slot	Provides the total number of times this switch (Sw. 4) was closed.
Au. 7	Coins Thru Center Slot	Provides the total number of times this switch (Sw. 5) was closed.
Au. 8	Coins Thru 4th Slot	Provides the total number of times this 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 <i>Factory Restore</i> 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 Ad. 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	0.0M—99.9M Scores	Provides the total number of games the Player's final score was between 0 and 99,999,990 points.
Au. 28	100.0M—199.9M Scores	Provides the total number of games the Player's final score was between 100,000,000 and 199,999,990 points.
Au. 29	200.0M—399.9M Scores	Provides the total number of games the Player's final score was between 200,000,000 and 399,999,990 points.
Au. 30	400.0M—799.9M Scores	Provides the total number of games the Player's final score was between 400,000,000 and 799,999,990 points.
Au. 31	800.0M—1.19B Scores	Provides the total number of games the Player's final score was between 800,000,000 and 1,199,999,990 points.
Au. 32	1.2B+ Scores	Provides the total number of games the Player's final score was over 1,200,000,000 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.



Sega Audits Continued.

Audit Name		Audit Definition
Au. 34	Service Credits	Provides the total number of times this 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.
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 this switch (Sw. 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 this switch (Sw. 60) was closed.
Au. 41	Slam Tilts	Provides the total number of times this switch (Sw. 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	Total Regular Plays	Provides the total number of times Regular Games were played.
Au. 44	Avg. Regular Game Time	Provides the average game time of Regular played games.
Au. 45	Regular Game MBalls	Provides the number of times this feature was played in a Regular Game.
Au. 46	Regular Game Replays	Provides the total number of times this feature was awarded in a Regular Game.
Au. 47	Total Novice Plays	Provides the total number of times Novice Games were played.
Au. 48	Avg. Novice Game Time	Provides the average game time of Novice played games.
Au. 49	Novice Game MBalls	Provides the total number of times this feature was played in a Novice Game.
Au. 50	Novice Game Replays	Provides the total number of times this feature was awarded in a Novice Game.
Au. 51	Avg. Novice Ball Saves	Provides the average number of times this feature was used to maintain the ball time criteria for a Novice Game.
Au. 51	Left Flipper Used	Provides the total number of times this Dedicated Switch (DS-1) was closed.
Au. 52	Right Flipper Used	Provides the total number of times this Dedicated Switch (DS-3) was closed.
Au. 53		This audit is Not Used , allowing for Future Expansion , if any.
Au. 54		This audit is Not Used , allowing for Future Expansion , if any.



ID4: INDEPENDENCE DAY AUDITS (56-89)

From the **AUDITS MENU**, select the "ID4" *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	Alien 3-Bank Completed	Provides the total number of times this feature bank of switches (Sw. 33, 34 & 47) were closed.
Au. 57	F-18 3-Bank Completed	Provides the total number of times this feature bank of switches (Sw. 35, 36, & 48) were closed.
Au. 58	Ramp Targets Completed	Provides the total number of times this feature target switches (Sw. 27, 28 & 29) were closed.
Au. 59	Right Orbits	Provides the total number of times either/both feature switches (Sw. 39 & 40) were closed.
Au. 60	Left Orbits	Provides the total number of times either/both feature switches (Sw. 37 & 38) were closed.
Au. 61	Mini-Loops	Provides the total number of times this feature switch (Sw. 9) was closed.
Au. 62	Right Ramp	Provides the total number of times these feature switches (Sw. 22 & 23) were closed in conjunction.
Au. 63	Center Ramp	Provides the total number of times these feature switches (Sw. 20 & 21) were closed in conjunction.
Au. 64	Left Ramp	Provides the total number of times these feature switches (Sw. 18 & 19) were closed in conjunction.
Au. 65	SVUK From Head Front	Provides the total number of times this feature switch (Sw. 44) was closed in conjunction with any other switch, but not Sw. 43 or Sw. 46.
Au. 66	SVUK From Right Hole	Provides the total number of times these feature switches (Sw. 44 & 45) were closed in conjunction.
Au. 67	SVUK From Head Rear	Provides the total number of times these feature switches (Sw. 44 & 43) were closed in conjunction.
Au. 68	Top Lanes Completed	Provides the total number of times this feature bank of switches (Sw. 30, 31 & 32) were closed in any sequence. (Note: This first time the switch is closed, the feature lamp is lit; until all 3 switches are closed and lit is when this feature is considered completed.)
Au. 69	MBall Read Spotted	Provides the total number of times this feature was lit.
Au. 70	MBall Ready Earned	Provides the total number of times this feature was awarded.
Au. 71	Multiball Start	Provides the total number of times this feature was played.
Au. 72	Multiball Percent	Provides the percentage total from Au. 71, MBall Start, divided by Au. 26, Total Plays. (Note: Percentage should be 80% - 95%; lower % may indicate mechanical problems not allowing for Multiball Play.)
Au. 73	2+ Multiballs	Provides the total number of times this feature was played.
Au. 74	Multiball Restart Lit	Provides the total number of times this feature was lit.
Au. 75	Multiball Restarted	Provides the total number of times this feature was played.
Au. 76	Single Jackpots	Provides the total number of times this feature was awarded.
Au. 77	Double Jackpots	Provides the total number of times this feature was awarded.
Au. 78	Triple Jackpots	Provides the total number of times this feature was awarded.
Au. 79	Super Jackpots	Provides the total number of times this feature was awarded.
Au. 80	Head Open Switch Failure	Provides the total number of times the Head (Sw. 52) did not open in 3+ seconds after a software command to open the head. This may indicate an inoperative Servo Motor, Servo Board, and/or Alien Head.



ID4: Independence Day Audits Continued.

	Audit Name	Audit Definition
Au. 81	Alien Scan Extra Balls	Provides the total number of times this feature was collected.
Au. 82	Center Ramp E.B. Lit	Provides the total number of times this feature was lit.
Au. 83	MBall from Alien Scan	Provides the total number of times this feature was played.
Au. 84	Pop Bumper Visits	Provides the total number of times any or all of these feature switches (Sw. 49, 50 & 51) are closed until one other switch (other than Sw. 49, 50 & 51) is closed. (Note: Multiple switch closures count as one visit.)
Au. 85	Red Alert	Provides the total number of times this feature was played.
Au. 86	Area 51 Multiball	Provides the total number of times this feature was played.
Au. 87	F-18 Hurry-Up	Provides the total number of times this feature was played.
Au. 88	Virus Completed	Provides the total number of times this feature was completed.
Au. 89	Trough Failure	Provides the total number of times the 4-Ball Trough failed.



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).



INDEPENDENCE DAY GAME ADJUSTMENT TABLE

Some adjustments have a "Drop-Down" Table where further customization is required.



SEGA ADJUSTMENTS 1-43

Adjustment Name		Factory Setting	Adjustment Name		Factory Setting
1	REPLAYS: FIXED/MANUAL <i>"Drop-Down"</i>	10%	23	DEFAULT HIGH SCORE #3	1,950,000,000
2	REPLAY LEVELS <i>"Drop-Down"</i>	1	24	DEFAULT HIGH SCORE #4	1,800,000,000
3	REPLAY AWARD	CREDIT	25	DEFAULT HIGH SCORE #5	1,650,000,000
4	FREE GAME LIMIT	5	26	DEFAULT HIGH SCORE #6	1,500,000,000
5	EXTRA BALL LIMIT	3	27	HSTD RESET COUNT	2,000
6	GAME DIFFICULTY <i>"Drop-Down"</i>	MODERATE	28	FREE PLAY	NO
7	GAME PRICING <i>"Drop-Down"</i>	USA7	29	CUSTOM MESSAGE	ON
8	RESET COIN AUDITS	NO	30	ATTRACT MODE MUSIC	ON
9	RESET GAME AUDITS	NO	31	FLASH LAMP POWER	NORMAL
10	RESET HIGH SCORES	NO	32	COIL PULSE POWER	NORMAL
11	MATCH PERCENTAGE	9%	33	KNOCKER VOLUME	NORMAL
12	BALLS PER GAME	3	34	MINIMUM GAME TIME	OFF
13	TILT WARNINGS	1	35	NOVICE MODE ENABLED	NO
14	REPLAY BOOST	YES	36	GAME RESTART	YES
15	CREDIT LIMIT	30	37	EXTRA BALL PERCENTAGE	25%
16	ALLOW HIGH SCORES	YES	38	BILL VALIDATOR	NO
17	HIGH SCORE #1 AWARDS	1	39	TOURNAMENT MODE	NONE
18	HIGH SCORE #2 AWARDS	0	40	EURO. TOKEN DISP.	OFF
19	HIGH SCORE #3 AWARDS	0	41	SPECIAL MEMORY	YES
20	HIGH SCORE #4 AWARDS	0	42	LOCATION ID	00
21	DEFAULT HIGH SCORE #1	2,400,000,000	43	GAME ID	00
22	DEFAULT HIGH SCORE #2	2,100,000,000			



ID4: INDEPENDENCE DAY ADJUSTMENTS 44-48

Adjustment Name		Factory Setting	Adjustment Name		Factory Setting
44	MBALL RESTART	MODERATE			
45	EXTRA BALL MEMORY	ON			
46	LOCK BALL CRITERION	MODERATE			
47	ADULT LANGUAGE	YES			
48	ALIEN HEAD USAGE	CLOSES...			

Go To Adjustments Menu

Overview

The **Portals™ Service Menu System** provides 48 Adjustment Functions to vary game difficulty or to customize (e.g. Adjusting: High Score Levels; Number of balls per game; Game Pricing; Default High Scores; et cetera). The Adjustment Functions are divided into 2 groups. The 1st group, **Sega Adjustments**, are the game play generic adjustments (1-43). The 2nd group, **ID4 Adjustments**, are the game play specific adjustments (44-48). Each group may be viewed manually after entering the **Portals™ Service Menu** (see Chapter 1, 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 (1-43)

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 100M - 9.99B. Adjust Replay Level 2, 3 and/or 4 respectively.



Sega Adjustments Continued.

Adjustment Name		Adjustment Definition
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.)
Adj. 4	Free Game Limit	Adjust the max. # of <i>Free Games</i> that may be accumulated per game; 0 - 9 .
Adj. 5	Extra Ball Limit	Adjust the max. # of <i>Extra Balls</i> 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:	Adj. 6 Extra Easy	Adj. 6 Easy	Adj. 6 Moderate	Adj. 6 Hard	Adj. 6 Extra Hard
(44) MBall Restart	EXTRA EASY	EASY	MODERATE	HARD	EXTRA HARD
(45) Extra Ball Memory	ON	ON	ON	ON	OFF
(46) Lock Ball Criterion	EXTRA EASY	EASY	MODERATE	HARD	EXTRA HARD

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

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

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

Adj.	Adjustment Name	Setting	Adj.	Adjustment Name	Setting
1	Replays: Fixed/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			



Sega Adjustments Continued.

Adjustment Name	Adjustment Definition
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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 Enter Button again initiates a drop down menu representing coin switch pulses for the left, right, center and fourth coin slots. The prescribed the number of pulses are required for one 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 two credits. Further, if *Left Coin Pulses*, was set to 01 and *Coin Switch Pulses Required for 1 Credit*, to 02, two coins in the left slot would be required for one 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, one credit would be posted for each of the first three coins in the left slot and two credits for the fourth coin.

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 coin switch pulses required to post one credit; 00 to 99.

Coin Switch Pulses Required for Bonus Credit - Set the number of coin switch pulses required to award the 1st bonus credit(s); 00 to 99.

Coin Switch Pulses Required for 2nd Bonus Credit - Set the number of coin switch 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 Mechs				Adjustments								
Left	Right	Center	4th	Plays/Coins	Left Pulses	Right Pulses	Mid Pulses	4th Pulses	Pulses /Credit	Pulses /Bonus	Pulses /2nd Bonus	Credit /1st Bonus
25¢	25¢	\$1.00	N/U	1/25¢ 3/50¢	01	01	04	00	01	02	00	01
				1/25¢ 5/\$1.00	01	01	04	00	01	04	00	01
				1/25¢ 6/\$1.00	05	05	20	00	04	20	00	01
5SCH	10SCH	10SCH	N/U	1/10 S	01	02	02	00	02	00	00	00
				1/10 S 4/30 S	04	08	08	00	06	00	00	00
10p	£1	50p	20p	1/30p 2/50p 5/£1	01	15	06	02	03	00	00	00
				1/50p 3/£1	01	15	05	02	05	00	00	00
				1/30p 4/£1	01	12	05	02	03	00	00	00
20¢	\$1.00	N/U	N/U	1/60¢ 2/\$1.00	01	05	00	00	03	05	00	01

Standard Pricing Table

on the next page.

Adj. 7 Standard Pricing Select Table

CPU Dip Switch Settings ★ ↕		Coin Mechanisms				Pricing Scheme Explained			
Country Setting Option		Coins thru ... slot:				Number of "Plays" for Price Amount Shown			
		Left	Center	Right	4th				
Pos. 1 2 3 4 5 6 7 8 ON OFF	USA 1	25¢	\$1	25¢		1/25¢			
	USA 2	25¢	\$1	25¢		1/50¢	2/75¢	3/\$1	
	USA 3	25¢	\$1	25¢		1/50¢			
	USA 4	25¢		25¢		1/50¢			
	USA 5	25¢	\$1	25¢		1/50¢	5/\$2		
	USA 6	25¢	\$1	25¢		1/50¢	2/4 X 25¢	3/\$1 (\$ Bill)	Used to promote the Bill Validator
	USA 7 ★	25¢	\$1	25¢		1/50¢	4/\$1.50	6/\$2	
Pos. 1 2 3 4 5 6 7 8 ON OFF	Austria ★	5S	10S	10S		1/10S	2/15S	3/20S	
Pos. 1 2 3 4 5 6 7 8 ON OFF	Australia 1 ↕	20¢	\$A 1	\$A 2		1/\$A 1	2/\$A 2		
Pos. 1 2 3 4 5 6 7 8 ON OFF	Australia 2 ↕	20¢	\$A 1	\$A 2		1/\$A 1	2/\$A 2		
Pos. 1 2 3 4 5 6 7 8 ON OFF	Belgium ★	5 BF	20 BF	50 BF		1/20 BF	3/50 BF		
Pos. 1 2 3 4 5 6 7 8 ON OFF	Canada ★	25¢	25¢	Can\$ 1		1/50¢	2/75¢	3/Can\$ 1	
Pos. 1 2 3 4 5 6 7 8 ON OFF	Denmark 1 ↕	1DKr	5 DKr	10 DKr	20 DKr	1/3 DKr	2/5 DKr		
Pos. 1 2 3 4 5 6 7 8 ON OFF	Denmark 2 ↕	1DKr	5 DKr	10 DKr	20 DKr	1/2 DKr	3/5 DKr	7/10 DKr	
Pos. 1 2 3 4 5 6 7 8 ON OFF	Finland ↕	1 Fmk	5 Fmk			1/5 Fmk	4/10 Fmk		
Pos. 1 2 3 4 5 6 7 8 ON OFF	France 1 ★	1 Fr	5 Fr	10 Fr	20 Fr	1/3 Fr	2/5 Fr	5/10 Fr	11/20 Fr
Pos. 1 2 3 4 5 6 7 8 ON OFF	France 2	1 Fr	5 Fr	10 Fr	20 Fr	1/5 Fr	3/10 Fr	7/20 Fr	
Pos. 1 2 3 4 5 6 7 8 ON OFF	France 3	1 Fr	5 Fr	10 Fr	20 Fr	1/3 Fr	2/5 Fr	4/10 Fr	9/20 Fr
Pos. 1 2 3 4 5 6 7 8 ON OFF	Germany 1	1 DM	2 DM	5 DM		1/1 DM	6/1 X 5 DM		
Pos. 1 2 3 4 5 6 7 8 ON OFF	Germany 2	1 DM	2 DM	5 DM		1/2 DM	2/3 DM	3/4 DM	4/5 DM
Pos. 1 2 3 4 5 6 7 8 ON OFF	Germany 3 ★	1 DM	2 DM	5 DM		1/2 DM	2/3 DM	3/4 DM	5/5 DM
Pos. 1 2 3 4 5 6 7 8 ON OFF	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	Greece ↕	50 Dr		100 Dr		1/50 Dr	3/100 Dr		
Pos. 1 2 3 4 5 6 7 8 ON OFF	Hong Kong	1 HK\$	2 HK\$	5 HK\$		1/5 HK\$			
Pos. 1 2 3 4 5 6 7 8 ON OFF	Hungary ↕	10 Ft	10 Ft	20 Ft		1/20 Ft	3/40 Ft		
Pos. 1 2 3 4 5 6 7 8 ON OFF	Italy 1 ★	500 Lit		500 Lit		1/500 Lit			
Pos. 1 2 3 4 5 6 7 8 ON OFF	Italy 2	500 Lit		500 Lit		1/1000 Lit	3/2000 Lit		
Pos. 1 2 3 4 5 6 7 8 ON OFF	Japan 1 ★			100¥		1/100¥			
Pos. 1 2 3 4 5 6 7 8 ON OFF	Japan 2			100¥		1/100¥	3/200¥		
Pos. 1 2 3 4 5 6 7 8 ON OFF	Korea ↕	100 Won		100 Won		1/100Won			
Pos. 1 2 3 4 5 6 7 8 ON OFF	Netherlands 1	1 Fls.	1 Fls.	2.5 Fls.		1/1Fls.	3/2.5 Fls.		
Pos. 1 2 3 4 5 6 7 8 ON OFF	Netherlands 2 ★	1 Fls.	2.5 Fls.	5 Fls.		1/1Fls.	3/2.5 Fls.	6/5 Fls.	
Pos. 1 2 3 4 5 6 7 8 ON OFF	New Zealand 1 ↕	\$NZ 1		\$NZ 2		1/\$NZ 1	2/\$NZ 2		
Pos. 1 2 3 4 5 6 7 8 ON OFF	New Zealand 2 ↕	\$NZ 1		\$NZ 2		1/\$NZ 1	3/\$NZ 2		
Pos. 1 2 3 4 5 6 7 8 ON OFF	Norway 1 ★	10 NKr	5 NKr	20 NKr		2/10 NKr	1/5 NKr	4/20 NKr	
Pos. 1 2 3 4 5 6 7 8 ON OFF	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	Spain ↕	100 Pts		500 Pts		1/100 Pts	6/500 Pts		
Pos. 1 2 3 4 5 6 7 8 ON OFF	Sweden 1 ★	1 SKr	5 SKr	10 SKr		1/10 SKr	2/15 SKr	3/20 SKr	
Pos. 1 2 3 4 5 6 7 8 ON OFF	Sweden 2	1 SKr	5 SKr	10 SKr		1/5 SKr			
Pos. 1 2 3 4 5 6 7 8 ON OFF	Switzerland 1 ★	1 SwF	2 SwF	5 SwF		1/1 SwF	6/5 SwF		
Pos. 1 2 3 4 5 6 7 8 ON OFF	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 OFF	UK 1	10p	50p	1£	20p	1/50p	3/1£		
Pos. 1 2 3 4 5 6 7 8 ON OFF	UK 2	10p	50p	1£	20p	1/40p	3/1£		
Pos. 1 2 3 4 5 6 7 8 ON OFF	UK 3 ★	10p	50p	1£	20p	1/50p			

Notes: ★ indicates Factory Default for that setting. ↕ indicates a USA Dip Sw. Setting, with Factory Default of USA7.



Sega Adjustments Continued.

Adjustment Name		Adjustment Definition
Adj. 8	Reset Coin Audits	Default is NO . Select the "+" <i>Icon</i> to change to YES . ⚠ When enabled, all <i>Coin Audits</i> (Audits 5-11), will be reset to zero.
Adj. 9	Reset Game Audits	Default is NO . Select the "+" <i>Icon</i> to change to YES . ⚠ When enabled, all audits will be reset to zero, except for the <i>Coin Audits</i> (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 "+" <i>Icon</i> 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	Adjust the number of balls per game; 2 to 5 . Default is 3 .
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	Adjust the maximum number of credits that may be posted; 4 to 50 . Default is 30 .
Note: There are 4 of the 6 High Score Levels with associated player initials that are displayed during the attract mode. This provides a High-Score-To-Date feature. When players exceed these levels, the player initials may be entered to replace the previous ones. These levels may be adjusted to award credits and to be reset to backup values after a selected number of games.		
Adj. 16	Allow High Scores	Set to enable (set to YES) or disable the four high score levels by setting to zero.
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. 21-26	Default High Score #1 - #6	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. 27, HSTD Reset Count. Adjust the backup score to which levels 2 - 6 may be reset, respectively.
Adj. 27	HSTD Reset Count	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). Default is 2,000 .
Adj. 28	Free Play	When set to YES , no coins are required for games.
Adj. 29	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 "+" <i>Icon</i> . The letter A is indicated in the first position in the display. Vary the letter by operating the left and right flippers. 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.
Adj. 30	Attract Mode Music	Set to ON or OFF . When set to ON , attraction music is played between games.



Sega Adjustments Continued.

Adjustment Name	Adjustment Definition
Adj. 31 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. 32 Coil Pulse Power	Set to NORMAL , HARD or SOFT . When HARD the coil pulse power is <i>increased</i> by 12.5% of the normal pulse rate. When set to SOFT the coil pulse power is <i>decreased</i> 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. 33 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. 34 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. 35 Novice Mode Enabled	Set to YES or NO . Default is YES . When set to YES , before game play, the player can choose Novice Play (a 1-Ball Game with a guaranteed play time). NOVICE GAME rules give the player a guaranteed minimum game time - <i>if the ball drains before the time is up, it will be returned to the player</i> . When the ball drains after the time is up, the game ends). When set to NO , this feature is turned off, and defaults to Regular Game Play.
Adj. 36 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. 37 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. 38 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. 39 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 & Extra Ball percent 30% .
Adj. 40 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. 41 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. 42 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 Chp. 5, Go to Reset Menu & Chp. 6, Go to Printer Menu, of this section for more details on Factory Reset & Printing.
Adj. 43 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 Chp. 5, Go to Reset Menu & Chp. 6, Go to Printer Menu, of this section for more details on Factory Reset & Printing.



ID4: INDEPENDENCE DAY ADJUSTMENTS (44 - 48)

From the **ADJUSTMENTS MENU**, select the "ID4" *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. №	Adjustment Name	Adjustment Definition
Adj. 44	MBall Restart	Set to EXEASY, EASY, MODERATE, HARD or EXHARD . Default is EASY . Determines how Multiball can restart.
Adj. 45	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. 46	Lock Ball Criterion	Set to EXEASY, EASY, MODERATE, HARD or EXHARD . Default is MODERATE . Determines how the Lock Ball Feature is played.
Adj. 47	Adult Language	Set to YES or NO . Default is YES . When set to YES , typical American Adult Language is used. Set to NO , for sensitive ears.
Adj. 48	Alien Head Usage	Set to CLOSES AFTER LOCK or STAYS OPEN AFTER LOCK . Default is CLOSES AFTER LOCK . When set to CLOSES AFTER LOCK , the Alien Head operates in the normal fashion. Set to STAYS OPEN AFTER LOCK and the Alien Head once opened will remain open until all balls are locked. This setting can be used to reduce wear and tear on the Alien Head and Servo Motor.

CUSTOMER MESS

STAR

RESET

RESET



FACT

FRNT



ALI
SON


RESET[illegible]

Go To Reset Menu

Overview

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



GO TO RESET MENU

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

Important Notes:



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



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



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



FACTORY RESET

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



RESET COIN AUDITS

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



RESET GAME AUDITS

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

Fig. 1

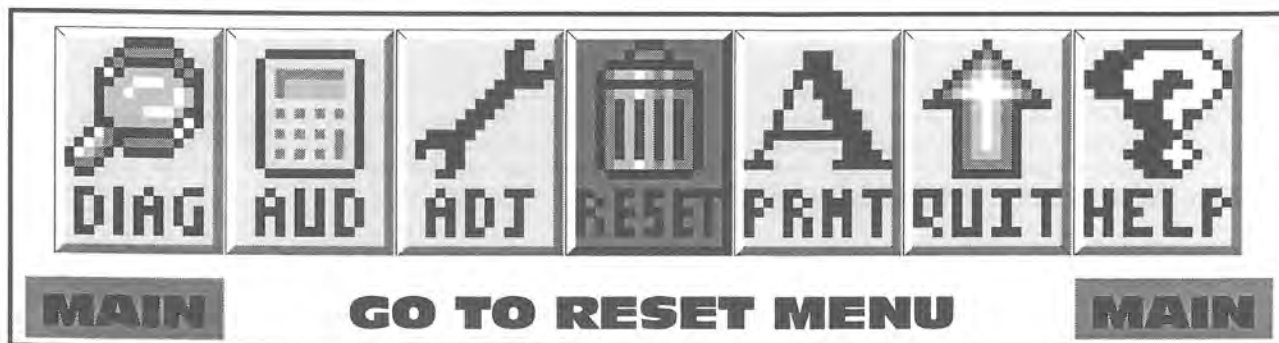
• Reset Coin Audits	
Earnings Audits (Coin Audits Only 5-11)	
Au. Nº	Description
1-4	The first 4 Audits in the game.
5	Coins Thru Left Slot
6	Coins Thru Right Slot
7	Coins Thru Center Slot
8	Coins Thru 4th Slot
9	Total Coins
10	Total Earnings
11	Meter Clicks
12	Software Meter
13 +	The remainder of the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

Fig. 2

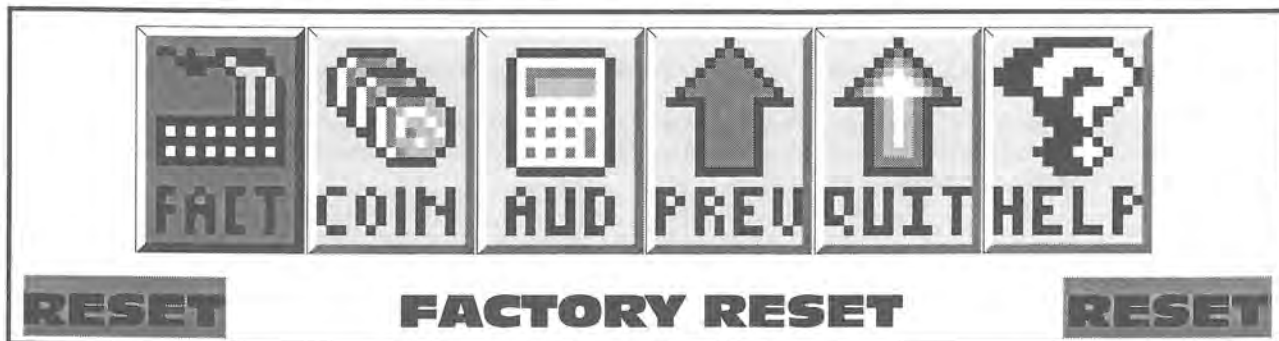
• Reset Game Audits	
Earnings (1-4), Generic/Specific Audits (13+)	
Au. Nº	Description
1-4	The first 4 Audits in the game.
5	Coins Thru Left Slot
6	Coins Thru Right Slot
7	Coins Thru Center Slot
8	Coins Thru 4th Slot
9	Total Coins
10	Total Earnings
11	Meter Clicks
12	Software Meter
13 +	The remainder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

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 "FACT" *Icon* (FACTORY RESET) flashing:

CAUTION: IF CUSTOMIZED SETTINGS ARE MADE TO THE GAME, DO NOT PRESS THE START BUTTON OR THESE SETTINGS WILL BE LOST!

Press the **Black Button** to activate this icon. This will reset all adjustments back to *Factory Settings*.



The **REQUEST INSTALLED** now appears momentarily and the *Service Session* is automatically exited with the display returning to the **ATTRACT MODE**.

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 return to the **RESET MENU**.

Go To Printer Menu

Overview



SPECIAL EQUIPMENT IS REQUIRED FOR THIS MENU

The **Portals™ Service Menu System** provides 3 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.



GO TO PRINTER MENU

With the game in the Attract Mode, open the Coin Door and press the **Black "BEGIN TEST" Button**. Select the "PRNT" *Icon* in the **MAIN MENU** with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The **PRINTER 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 printer adjustments, selecting & activating the "-" or "+" *Icons* is necessary to start a printout or download.



Selecting & activating the "ARROW" *Icons* selects the next /previous *Icon* in the sub-menu.



QUICK PRINTOUT ADJUSTMENT (49) (Printer Interface)

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



FULL PRINTOUT ADJUSTMENT (50) (Alison Interface)

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.



Nº OF COPIES PRINTED ADJUSTMENT (51)

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.



PORTALS™ SERVICE MENU
PROBLEM/SOLUTION TABLE

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



PROBLEM	SOLUTION
Will not enter the Service Mode after depressing the Black "BEGIN TEST" Button .	• Check the Service Switch(es) (Red, Green & Black Buttons) for loose connections or bad Ground. • Check the associated wiring harness to/from the CPU Board Connector 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 " <i>scroll</i> " 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 "<i>clicks</i>" 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 <i>Icons</i> 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 <i>Icon</i> 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 <i>only</i> in Diagnostic's Switch & Active Switch Tests (see previous Problem).
Some <i>Icons</i> appear non-functional in the PRINTER MENU(S) .	• If no printing equipment is connected, the "-" <i>Icon</i>, "+" <i>Icon</i> and "RUN" <i>Icon</i> will appear not to function (See Chapter 5).
Some <i>Icons</i> 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" <i>Icons</i> will appear not to function. The remaining <i>Icons</i> should function as normal. Note: If there is no Game Specific Special Test, the "GAME SPECIFIC" <i>Icon</i> 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).
In COIL TEST MENU , the coils and flashlamps <i>do not</i> fire after activating the "RUN" <i>Icon</i> .	• Ensure the POWER INTERLOCK SWITCH (See figure on front inside cover) <i>is pulled out</i>.
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.

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, on 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, to find all the tests needed to troubleshooting the game.

Review Chapter 3, Go to Audits Menu, and Chapter 4, Go to Adjustments Menu, to gather play information and to customize the game to vary difficulty of play or to change functions of the game.

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

Review Chapter 6, Go to Printer Menu, to start downloading or printing functions. Special equipment is required for this function.

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.

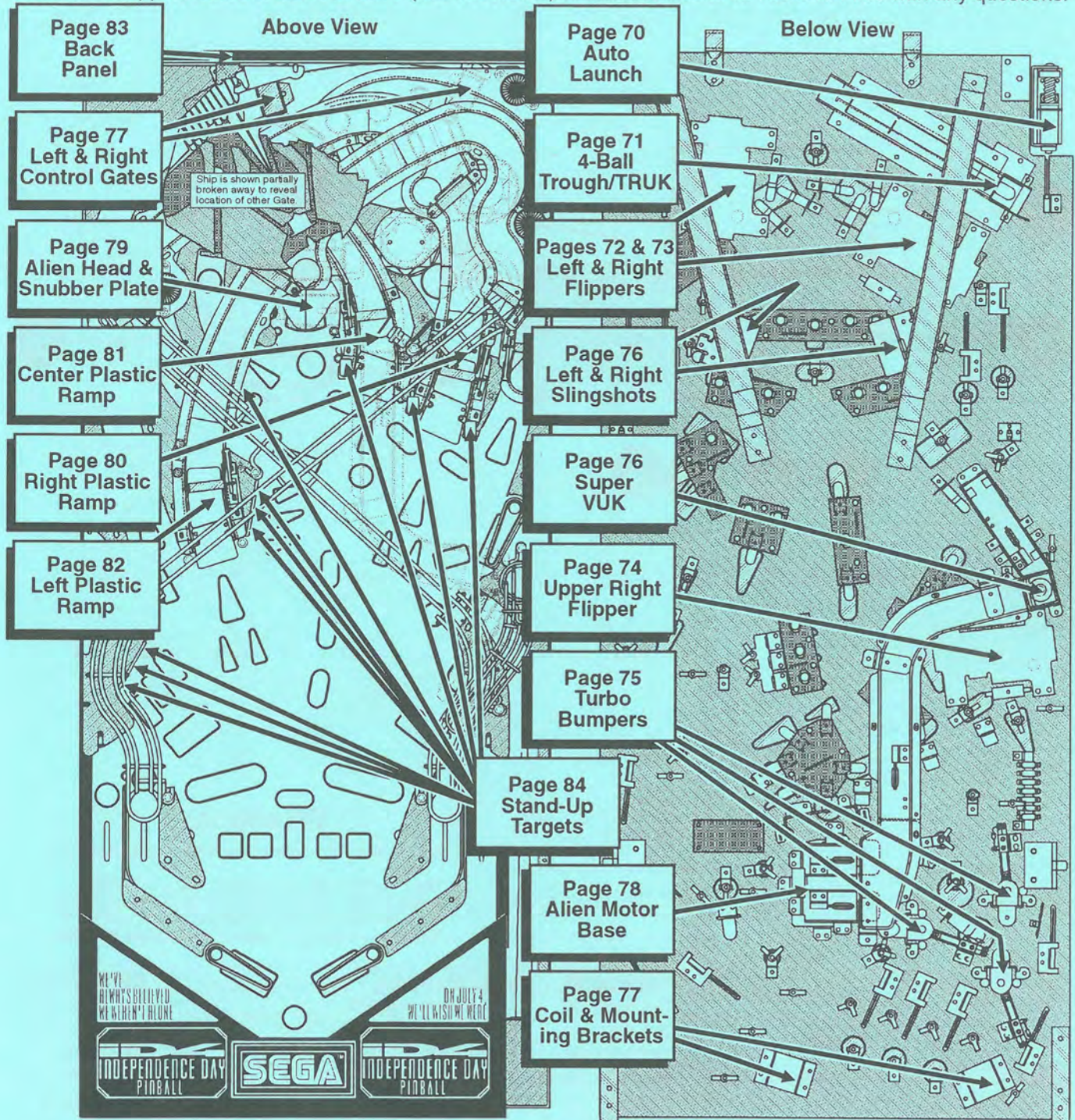
Section 3 | Help!

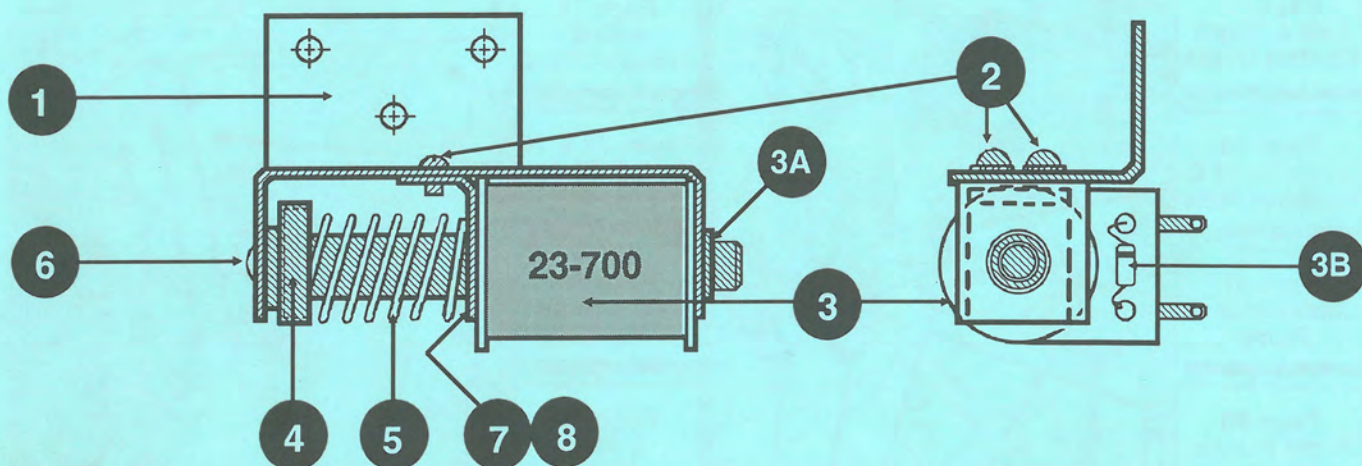
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Drawings for Major Assemblies & Ramps (The Blue Pages)

Overview

Drawings are provided for the Major Assemblies noted with page numbers in from the tables in the Pink Pages: Chapter 1, Playfield - Major Assemblies and Playfield - Ramps & Troughs. Individual parts of each assembly are numbered, describing the name, quantity & part number. Where multiple parts are riveted and/or assembled as sub-assemblies, the sub-assembly needs to be ordered. Note 1: The Turbo Pop Bumpers are only available as individual pieces. Note 2: Minor changes may be made during production (e.g. coil size, addition/deletion of minor parts). Always verify the part to be replaced with the Part N° and/or description as noted. Replacement parts may be substituted with revised parts which may have a different Part N°. Note 3: Items noted with a white circle (①) are mounted above the playfield and items noted with a black circle (●) are mounted below. Call our Technical Support Office at 800-542-5377 (800-KICKERS) in USA/Canada or at 708-345-7700 with any questions.



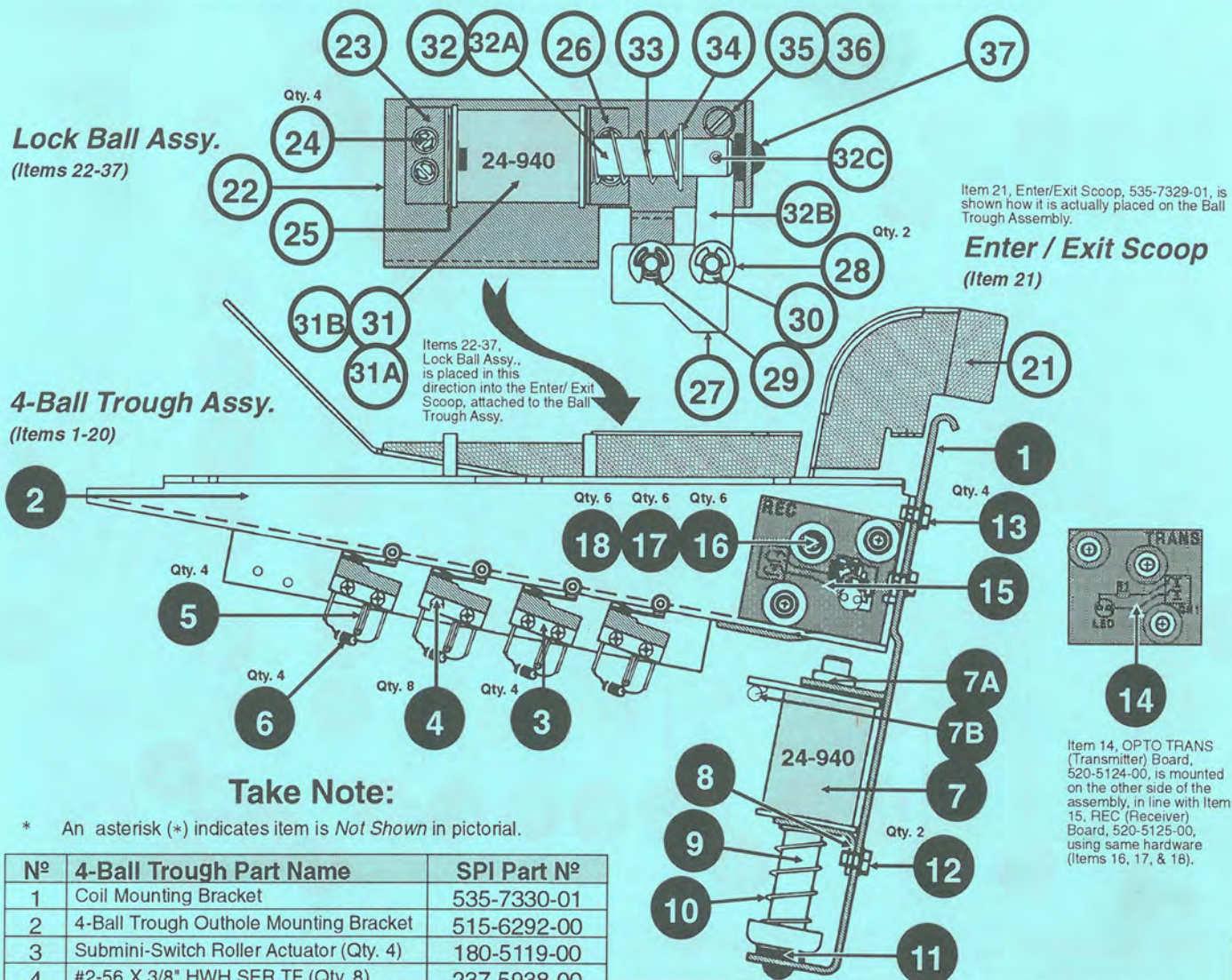
**Take Note:**

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

1. The Shooter Lane Micro-Switch Assy., 500-5498-01-XX, is *Not Shown, Nor Included* with the above assembly. For a breakdown of the Switch Assy., see Section 4, Chapter 1, Playfield - General Parts (Below Playfield...).

Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Coil Mounting Bracket	535-6385-00	4	Plunger Assembly	515-5000-02
2	#8-32 X 1/4" PPH (Qty. 2)	232-5300-00	5	Compression (Relay) Spring	266-5020-00
3	Coil, 23-700	090-5022-01	6	Rubber Bumper (Grommet)	545-5015-00
ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:			7	Coil Retaining Bracket	535-5203-01
3A	Coil Sleeve	545-5076-00	8	Spring Washer	266-5002-00
3B	Diode, 1N4004	112-5003-00	9 *	Cable Wiring Harness	036-5390-16-45

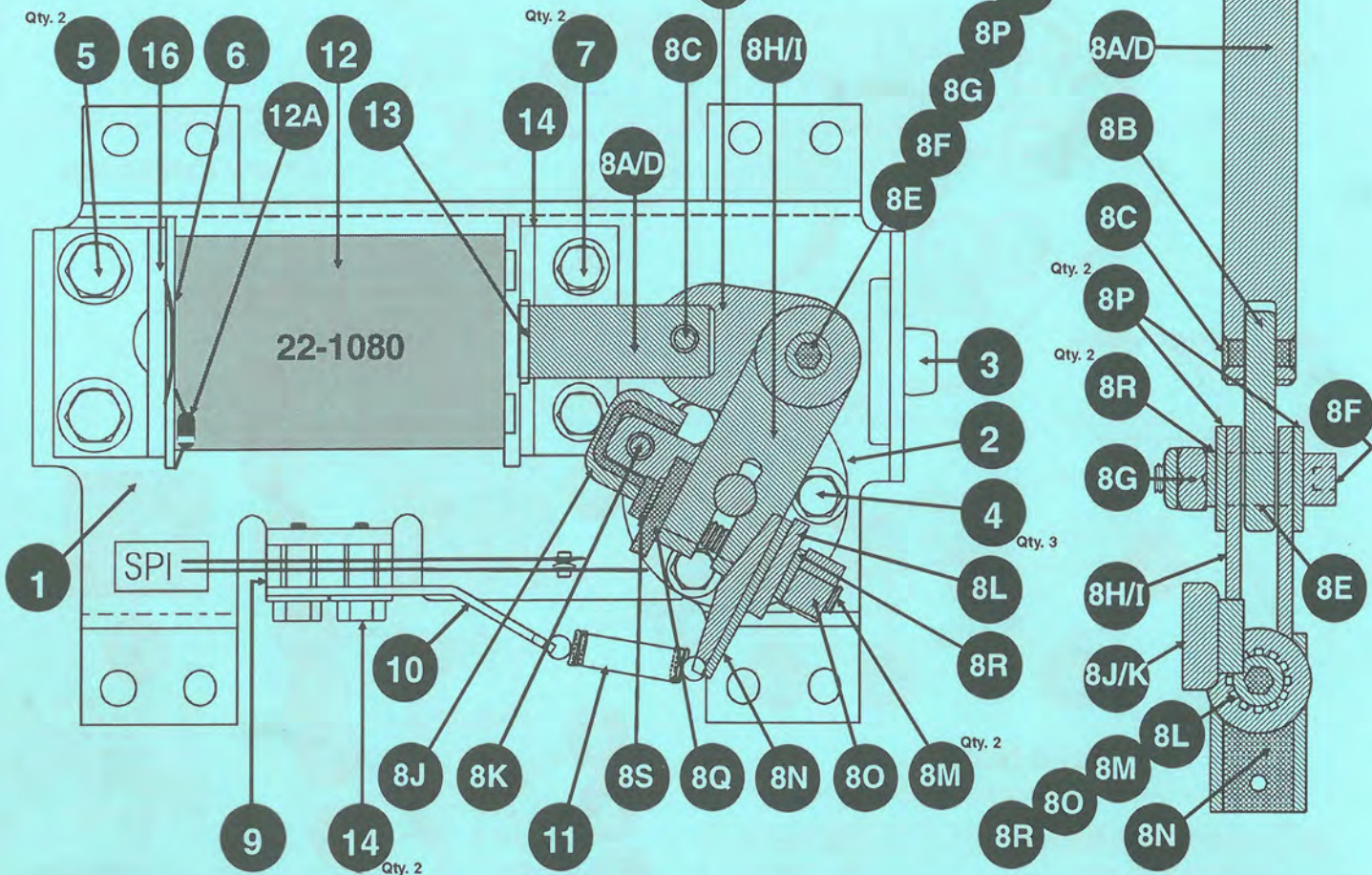
4-Ball Trough (OPTO) Assembly, 500-5989-14-45 (Items 1-20), and Lock Ball Assembly, 500-5684-02-XX (Items 22-37)



Nº	4-Ball Trough Part Name	SPI Part Nº
1	Coil Mounting Bracket	535-7330-01
2	4-Ball Trough Outhole Mounting Bracket	515-6292-00
3	Submini-Switch Roller Actuator (Qty. 4)	180-5119-00
4	#2-56 X 3/8" HWH SER TF (Qty. 8)	237-5938-00
5	Ins. Tubing 1.47" (cut to .37" for 4 ea.)	605-5006-00
6	Switch Diode, 1N4001 (Qty. 4)	112-5001-00
7	Coil, 24-940	090-5036-01
ORDERING ABOVE (ITEM 7) COIL PART Nº WILL INCLUDE:		
7A	Coil Sleeve	545-5076-00
7B	Diode, 1N4004	112-5003-00
8	Coil Retaining Bracket	535-5203-01
9	Plunger Assembly	515-5941-01
10	Compression Spring	266-5020-00
11	Rubber Bumper (Grommet)	545-5105-00
12	#8-32 X 1/4" HWH SER TF (Qty. 2)	237-5964-00
13	#8-32 X 3/8" HWH SWAGE (Qty. 4)	237-5975-00
14	OPTO Transmitter (TRANS) Board	520-5124-00
15	OPTO Receiver (REC) Board	520-5125-00
16	OPTO PCB Tube Spacer (Qty. 6)	530-5308-02
17	OPTO PCB Rubber Grommet (Qty. 6)	545-5518-00
18	#6-32 X 5/8" HWH SWAGE (Qty. 6)	237-5976-04
19	Not Used (Trough Ball Guide is <i>Not Required</i> in this game.)	
20 *	Cable Wiring Harness (Ball Trough)	036-5399-05-45
ASSOCIATED PARTS ARE NOT INCLUDED WITH THE ABOVE ASSEMBLIES.		
Nº	Associated Part Name	SPI Part Nº
21	Ball Trough Enter / Exit Scoop	535-7329-01
n/a *	Cable Wiring Harness (Lock Ball)	036-5400-00-45

Nº	Lock Ball Part Name	SPI Part Nº
22	Lock Ball Bracket Assembly	515-5817-01
23	Plunger/Core Stop Assembly	515-5088-00
24	#6-32 X 3/8" HWH SWAGE (Qty. 4)	237-5976-02
25	Spring Washer	269-5002-00
26	Coil Retaining/Support Bracket	535-6658-00
27	Lock Ball Cam Assy. (Stainless Steel)	515-5815-02
28	Retaining Ring, 1/4" ø (Qty. 2)	270-5002-00
29	Washer 1/4" ID X 1/2" OD X 1/16" THK	242-5008-00
30	Washer 1/4" ID X 7/16" OD X 1/32" THK	242-5012-00
31	Coil, 24-940	090-5036-00
ORDERING ABOVE (ITEM 31) COIL PART Nº WILL INCLUDE:		
31A	Coil Sleeve	545-5031-00
31B	Diode, 1N4004	112-5003-00
32	Plunger & Link Assembly	515-5473-01
ORDERING ABOVE (ITEM 32) COIL PART Nº WILL INCLUDE:		
32A	Plunger ø 7/16" X 2.25" Lg.	530-5250-01
32B	Link, Lock Ball (Stainless Steel)	535-6649-00
32C	Roll Pin 1/8" ø X 5/8" Lg.	251-5008-00
33	Compression Spring	266-5000-00
34	Retaining Ring 7/16" ø	270-5005-00
35	3/4" X 3/8" Spacer Gray	254-5000-07
36	#8-32 PPH X 1" Lg.	232-5606-00
37	Rubber Bumper (Grommet)	545-5105-00

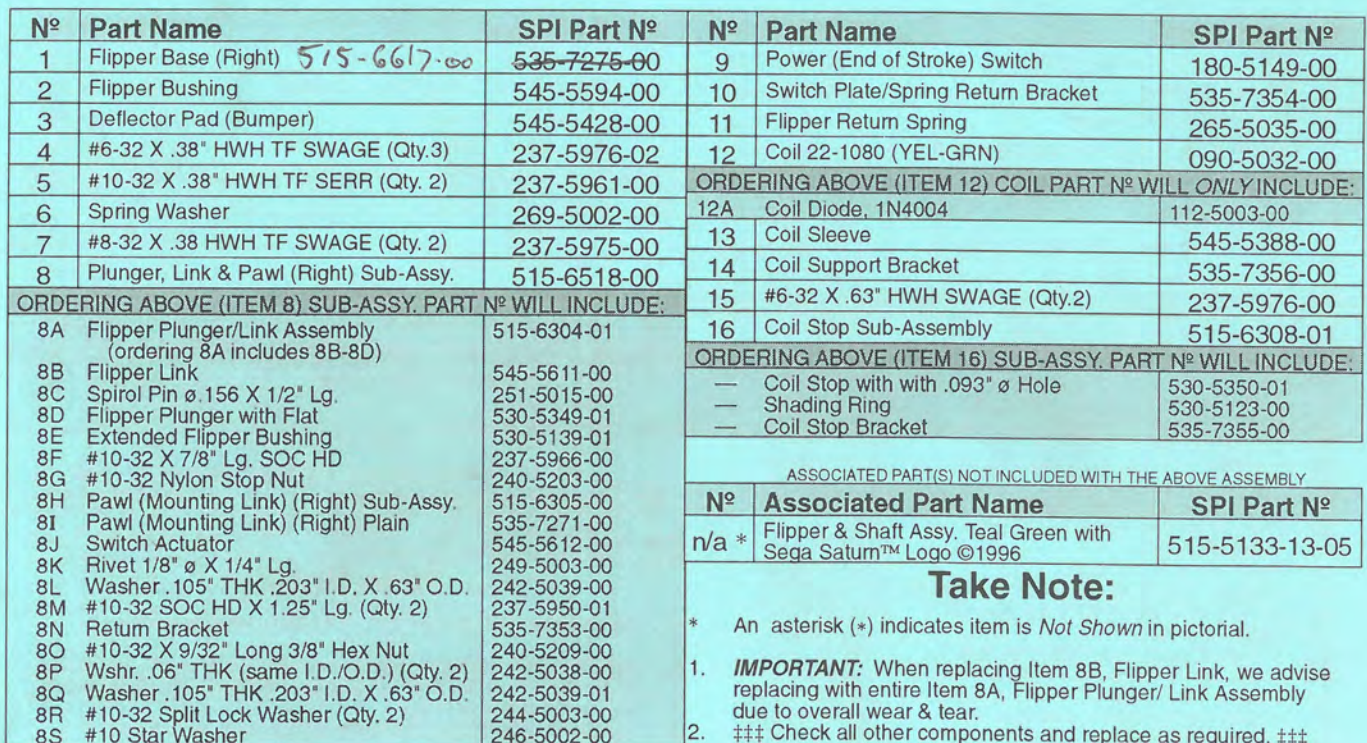
Flipper (Left) Assembly, 500-5944-12 (Items 1-16)



Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Flipper Base (Left) <i>515-6617-01</i>	535-7275-01	9	Power (End of Stroke) Switch	180-5149-00
2	Flipper Bushing	545-5594-00	10	Switch Plate/Spring Return Bracket	535-7354-00
3	Deflector Pad (Bumper)	545-5428-00	11	Flipper Return Spring	265-5035-00
4	#6-32 X .38" HWH TF SWAGE (Qty.3)	237-5976-02	12	Coil 22-1080 (YEL-GRN)	090-5032-00
5	#10-32 X .38" HWH TF SERR (Qty. 2)	237-5961-00	ORDERING ABOVE (ITEM 12) COIL PART Nº WILL ONLY INCLUDE:		
6	Spring Washer	269-5002-00	12A	Coil Diode, 1N4004	112-5003-00
7	#8-32 X .38 HWH TF SWAGE (Qty. 2)	237-5975-00	13	Coil Sleeve	545-5388-00
8	Plunger, Link & Pawl (Left) Sub-Assy.	515-6518-01	14	Coil Support Bracket	535-7356-00
ORDERING ABOVE (ITEM 8) SUB-ASSY. PART Nº WILL INCLUDE:			15	#6-32 X .63" HWH SWAGE (Qty.2)	237-5976-00
8A	Flipper Plunger/Link Assembly (ordering 8A includes 8B-8D)	515-6304-01	16	Coil Stop Sub-Assembly	515-6308-01
8B	Flipper Link	545-5611-00	ORDERING ABOVE (ITEM 16) SUB-ASSY. PART Nº WILL INCLUDE:		
8C	Spiral Pin ø .156" X 1/2" Lg.	251-5015-00	—	Coil Stop with with .093" ø Hole	530-5350-01
8D	Flipper Plunger with Flat	530-5349-01	—	Shading Ring	530-5123-00
8E	Extended Flipper Bushing	530-5139-01	—	Coil Stop Bracket	535-7355-00
8F	#10-32 X 7/8" Lg. SOC HD	237-5966-00	ASSOCIATED PART(S) NOT INCLUDED WITH THE ABOVE ASSEMBLY		
8G	#10-32 Nylon Stop Nut	240-5203-00	Nº	Associated Part Name	SPI Part Nº
8H	Pawl (Mounting Link) (Left) Sub-Assy.	515-6305-01	n/a *	Flipper & Shaft Assy. Teal Green with Sega Saturn™ Logo ©1996	515-5133-13-05
8I	Pawl (Mounting Link) (Left) Plain	535-7271-01	Take Note:		
8J	Switch Actuator	545-5612-00			
8K	Rivet 1/8" ø X 1/4" Lg.	249-5003-00	* An asterisk (*) indicates item is <i>Not Shown</i> in pictorial.		
8L	Washer .105" THK .203" I.D. X .63" O.D.	242-5039-00	1. IMPORTANT: When replacing Item 8B, Flipper Link, we advise replacing with entire Item 8A, Flipper Plunger/ Link Assembly due to overall wear & tear.		
8M	#10-32 SOC HD X 1.25" Lg. (Qty. 2)	237-5950-01	2. +++ Check all other components and replace as required. +++		
8N	Return Bracket	535-7353-00			
8O	#10-32 X 9/32" Long 3/8" Hex Nut	240-5209-00			
8P	Wshr. .06" THK (same I.D./O.D.) (Qty. 2)	242-5038-00			
8Q	Washer .105" THK .203" I.D. X .63" O.D.	242-5039-01			
8R	#10-32 Split Lock Washer (Qty. 2)	244-5003-00			
8S	#10 Star Washer	246-5002-00			

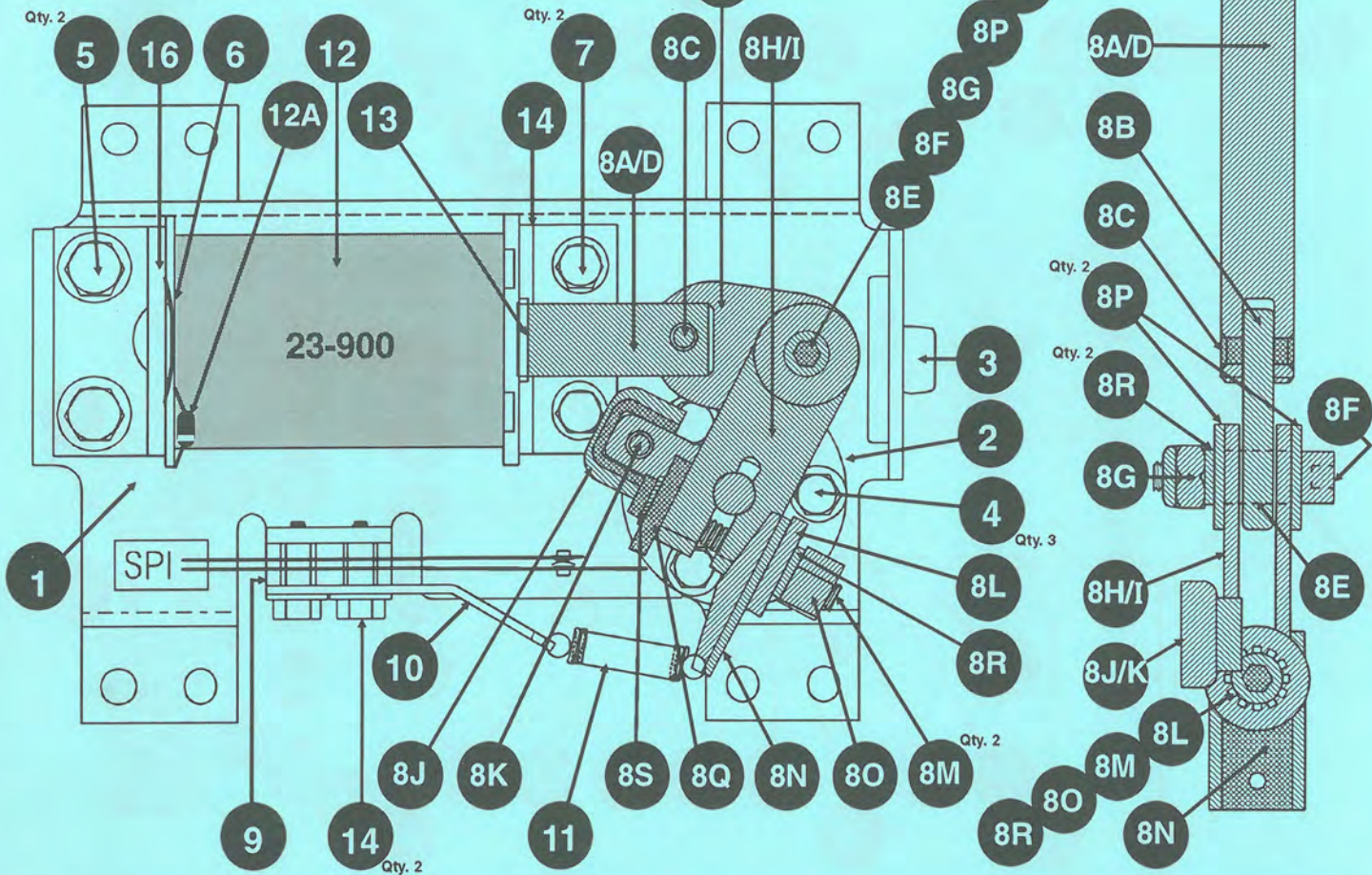
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SIDE VIEW



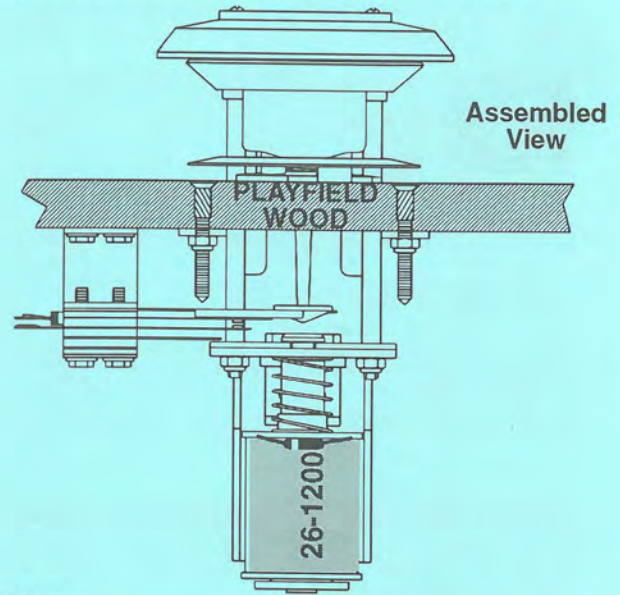
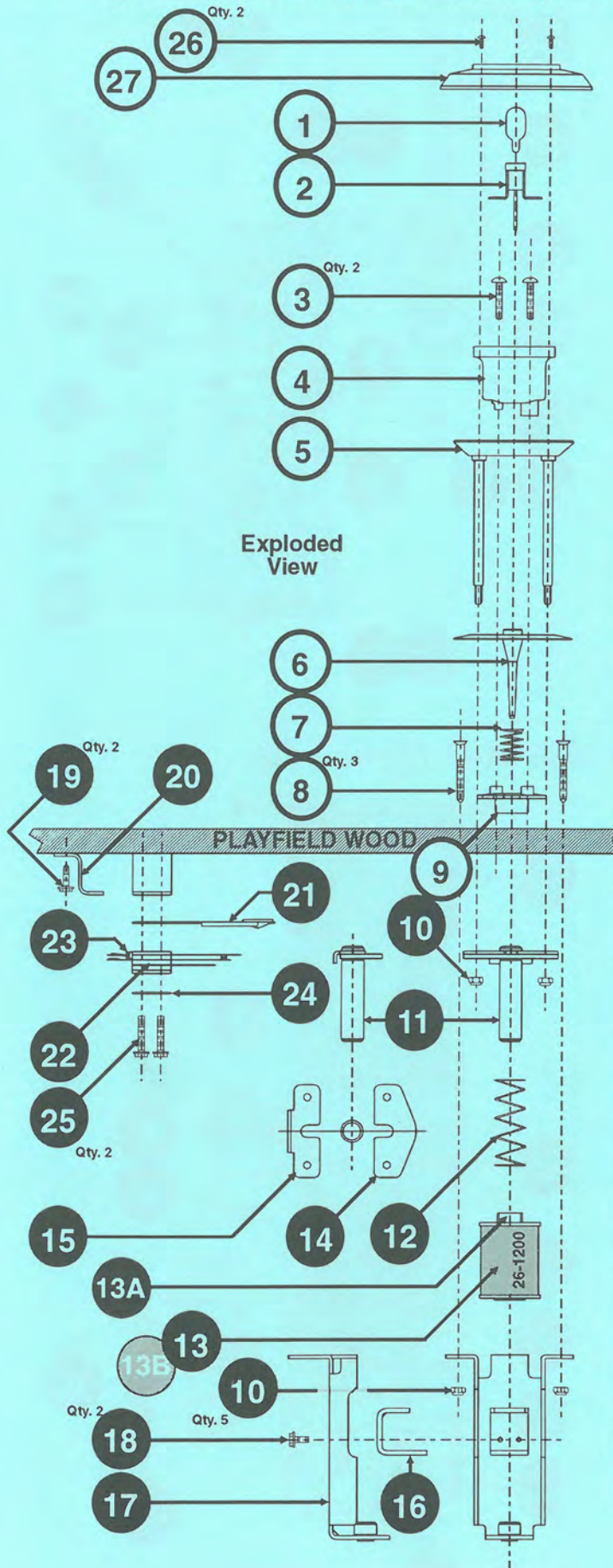
Section 4 | Drawings

Flipper (Upper) Assembly, 500-5944-03 (Items 1-16)



Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Flipper Base (Upper Right)	535-7275-00	9	Power (End of Stroke) Switch	180-5149-00
2	Flipper Bushing	545-5594-00	10	Switch Plate/Spring Return Bracket	535-7354-00
3	Deflector Pad (Bumper)	545-5428-00	11	Flipper Return Spring	265-5035-00
4	#6-32 X .38" HWH TF SWAGE (Qty.3)	237-5976-02	12	Coil 23-900 (GRN)	090-5020-30
5	#10-32 X .38" HWH TF SERR (Qty. 2)	237-5961-00	ORDERING ABOVE (ITEM 12) COIL PART Nº WILL ONLY INCLUDE:		
6	Spring Washer	269-5002-00	12A	Coil Diode, 1N4004	112-5003-00
7	#8-32 X .38 HWH TF SWAGE (Qty. 2)	237-5975-00	13	Coil Sleeve	545-5388-00
8	Plunger, Link & Pawl (Left) Sub-Assy.	515-6518-00	14	Coil Support Bracket	535-7356-00
ORDERING ABOVE (ITEM 8) SUB-ASSY. PART Nº WILL INCLUDE:			15	#6-32 X .63" HWH SWAGE (Qty.2)	237-5976-00
8A	Flipper Plunger/Link Assembly (ordering 8A includes 8B-8D)	515-6304-01	16	Coil Stop Sub-Assembly	515-6308-01
8B	Flipper Link	545-5611-00	ORDERING ABOVE (ITEM 16) SUB-ASSY. PART Nº WILL INCLUDE:		
8C	Spirol Pin ø.156" X 1/2" Lg.	251-5015-00	—	Coil Stop with with .093" ø Hole	530-5350-01
8D	Flipper Plunger with Flat	530-5349-01	—	Shading Ring	530-5123-00
8E	Extended Flipper Bushing	530-5139-01	—	Coil Stop Bracket	535-7355-00
8F	#10-32 X 7/8" Lg. SOC HD	237-5966-00	ASSOCIATED PART(S) NOT INCLUDED WITH THE ABOVE ASSEMBLY		
8G	#10-32 Nylon Stop Nut	240-5203-00	Nº	Associated Part Name	SPI Part Nº
8H	Pawl (Mounting Link) (Right) Sub-Assy.	515-6305-00	n/a *	Flipper & Shaft Assy. Teal Green with Sega Saturn™ Logo ©1996	515-5133-13-05
8I	Pawl (Mounting Link) (Right) Plain	535-7271-00	Take Note:		
8J	Switch Actuator	545-5612-00	* An asterisk (*) indicates item is <i>Not Shown</i> in pictorial.		
8K	Rivet 1/8" ø X 1/4" Lg.	249-5003-00	1. IMPORTANT: When replacing Item 8B, Flipper Link, we advise replacing with entire Item 8A, Flipper Plunger/ Link Assembly due to overall wear & tear.		
8L	Washer .105" THK .203" I.D. X .63" O.D.	242-5039-00	2. ### Check all other components and replace as required. ###		
8M	#10-32 SOC HD X 1.25" Lg. (Qty. 2)	237-5950-01			
8N	Return Bracket	535-7353-00			
8O	#10-32 X 9/32" Long 3/8" Hex Nut	240-5209-00			
8P	Wshr. .06" THK (same I.D./O.D.) (Qty. 2)	242-5038-00			
8Q	Washer .105" THK .203" I.D. X .63" O.D.	242-5039-01			
8R	#10-32 Split Lock Washer (Qty. 2)	244-5003-00			
8S	#10 Star Washer	246-5002-00			

Turbo Bumper Individual Parts (Items 1-27)
(Not available as an assembly. Parts are grouped for easy reference.)



TOP GROUP

Nº	Part Name	SPI Part Nº
1	#555 Wedge Base Bulb	165-5002-00
2	#555 Wedge Base Socket	077-5206-00
3	#5 X 7/8" PH RH (AB) (Qty. 2)	237-5826-00
4	Bumper Body	545-5197-00
5	Ring Assembly	515-5085-00
6	Bumper Skirt	545-5607-00
7	Bumper Skirt Spring	266-5048-00
8	#6-32 X 1-3/16" Spiral Shank (Qty. 3)	237-5957-00
9	Bumper Base	545-5195-00
10	#6-32 Nylon Stop Nut (Qty. 5)	240-5005-00

BOTTOM GROUP

Nº	Part Name	SPI Part Nº
11	Plunger	530-5348-00
12	Coil Spring	266-5047-00
13	Coil 26-1200	090-5044-00

ORDERING ABOVE (ITEM 13) COIL PART Nº WILL INCLUDE:

13A	Coil Sleeve	545-5031-00
13B	Coil Diode, 1N4004	112-5003-00
14	Fiber Yoke	545-5609-00
15	Metal Yoke	535-7346-00
16	Metal Yoke Stop	535-7347-00
17	Coil Bracket Welded Assembly	515-5939-00
18	#6-32 X 1/4" HWHTF (SERR) (Qty. 2)	237-5952-00

SWITCH GROUP

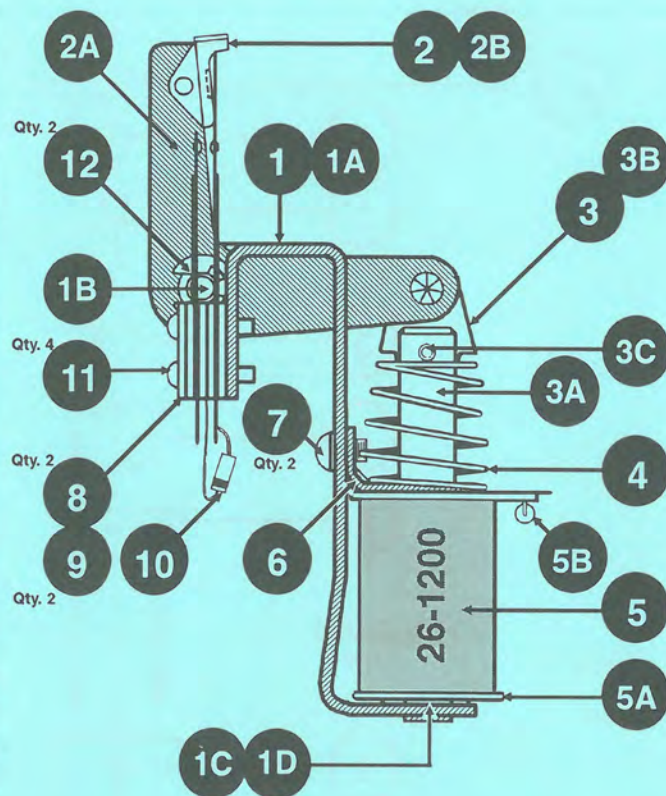
Nº	Part Name	SPI Part Nº
19	#6 X 1/2" HWH (AB) (Qty. 2)	234-5001-02
20	Switch Bracket	535-7342-00
21	Spoon Switch Actuator	545-5610-01
22	Stack Switch	180-5015-03
23	Switch Diode, 1N4001	112-5001-00
24	Switch Plate	535-7344-00
25	#6-32 X 3/4" HWHMS (SERR) (Qty. 2)	237-5958-00

ASSOCIATED GROUP

Nº	Associated Part Name	SPI Part Nº
26	#4 X 3/4" PH RH (T25) (holds cap) (Qty. 2)	237-5873-00
27	Plastic Bumper Cap Cover Clear	550-5057-01

Slingshot (Left & Right) Assemblies, 500-5849-01-XX (Items 1-12)

Nº	Part Name	SPI Part Nº
1	Slingshot Bracket Assembly	515-5339-01
ORDERING ABOVE (ITEM 1) SUB-ASSY. PART Nº WILL INCLUDE:		
1A	Slingshot Bracket	535-5919-01
1B	Hinge Stud	530-5034-01
1C	Armature Stop	530-5017-01
1D	Shading Ring	530-5307-00
2	Arm & Tip Assembly	515-5340-01-XX
ORDERING ABOVE (ITEM 2) COIL PART Nº WILL INCLUDE:		
2A	Arm	515-5341-01
2B	Kicker Tip	545-5216-01
2C	Rivet 1/8" ø x 1/4" Lg.	249-5003-00
3	Plunger & Link Assembly	515-5338-00-XX
ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:		
3A	Plunger 2" Lg.	530-5025-01
3B	Plunger Link	545-5293-00
3C	Roll Pin 1/8" ø x 5/8" Lg.	251-5008-00
4	Compression Spring	266-5020-00
5	Coil 26-1200	090-5044-00
ORDERING ABOVE (ITEM 5) COIL PART Nº WILL INCLUDE:		
5A	Coil Sleeve	545-5031-00
5B	Coil Diode, 1N4004	112-5003-00
6	Coil Retaining Bracket	535-5203-03
7	#8-32 X 1/4" PPH MS (SEMS) (Qty. 2)	232-5300-00
8	Slingshot Switch (Qty. 2)	180-5054-00
9	Tension Switch Plate (Qty. 2)	535-7344-00
10	Switch Diode, 1N4001	112-5001-00
11	#6-32 X 5/8" HWH TF (Qty. 4)	237-5928-00
12	Retaining Ring 1/4" ø (Qty. 2)	270-5002-00

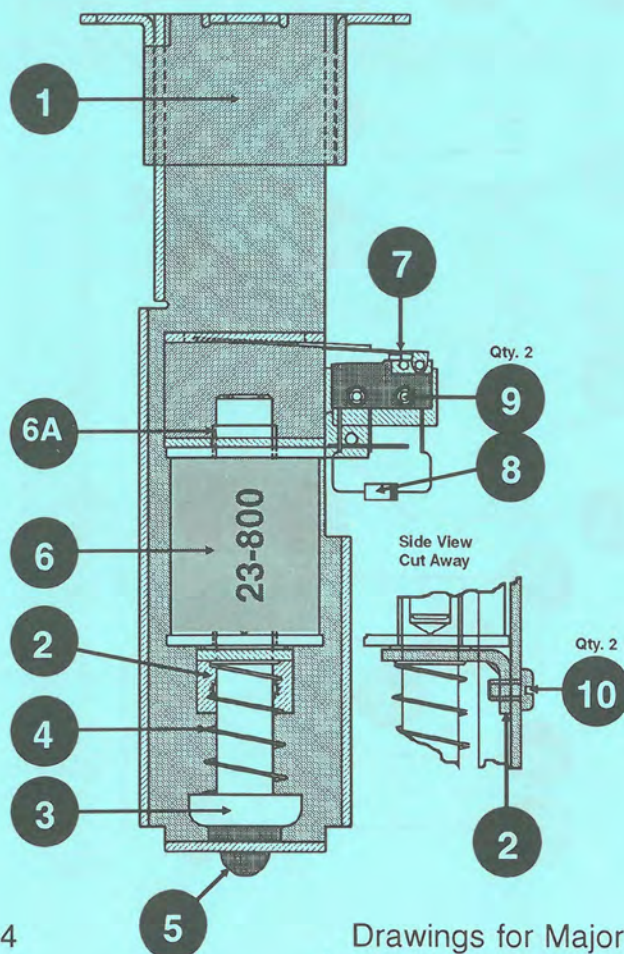


Super VUK Assembly, 500-5996-01-45 (Items 1-10)

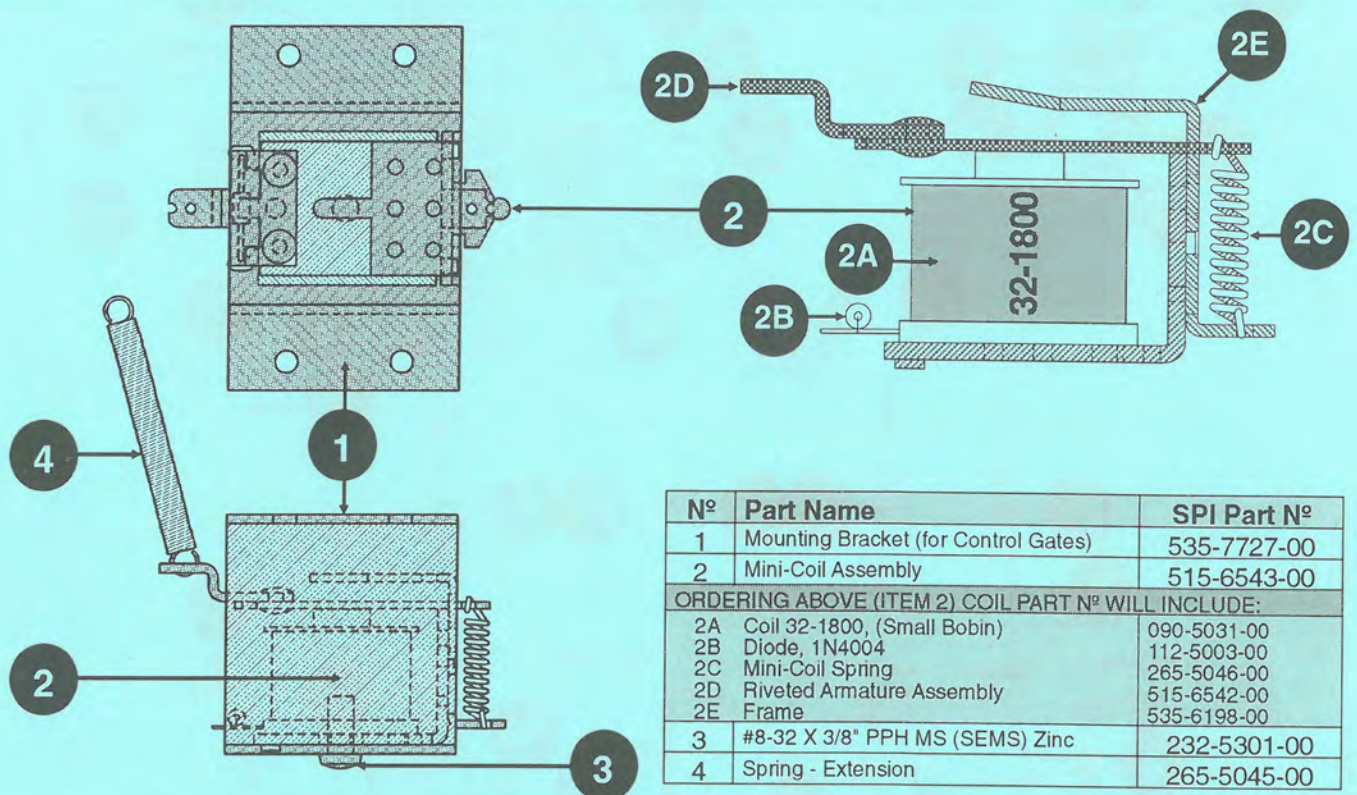
Take Note:

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

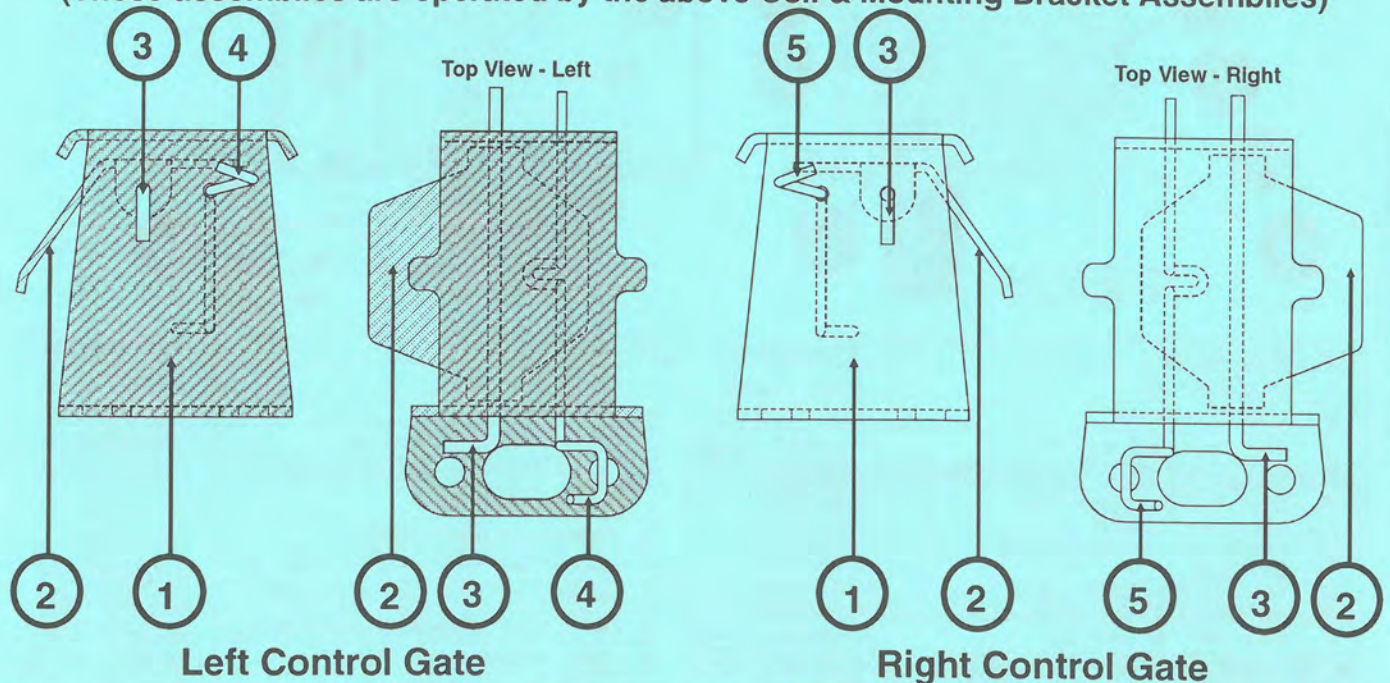
Nº	Part Name	SPI Part Nº
1	VUK Bracket Weld Assembly	515-6575-00
2	Coil Retaining Bracket	535-5203-01
3	Plunger Assembly	515-5941-01
4	Compression Spring	266-5020-00
5	Rubber Bumper (Grommet)	545-5105-00
6	Coil, 23-800	090-5001-01
ORDERING ABOVE (ITEM 6) COIL PART Nº WILL INCLUDE:		
6A	Coil Sleeve	545-5076-00
6B*	Coil Diode, 1N4004	112-5003-00
7	Micro Switch (Loop Type)	180-5116-00
8	Switch Diode, 1N4001	112-5001-00
9	#2-56 X 1/2" HWH MS TF (Qty. 2)	237-5937-00
10	#8-32 X 1/4" PPH (Lock-Tite) (Qty. 2)	232-5300-00



Coil & Mounting Bracket Assemblies (Qty. 2), 515-6544-00-45 (Items 1-4)
 (These assemblies operate the below Control Gate Assemblies)

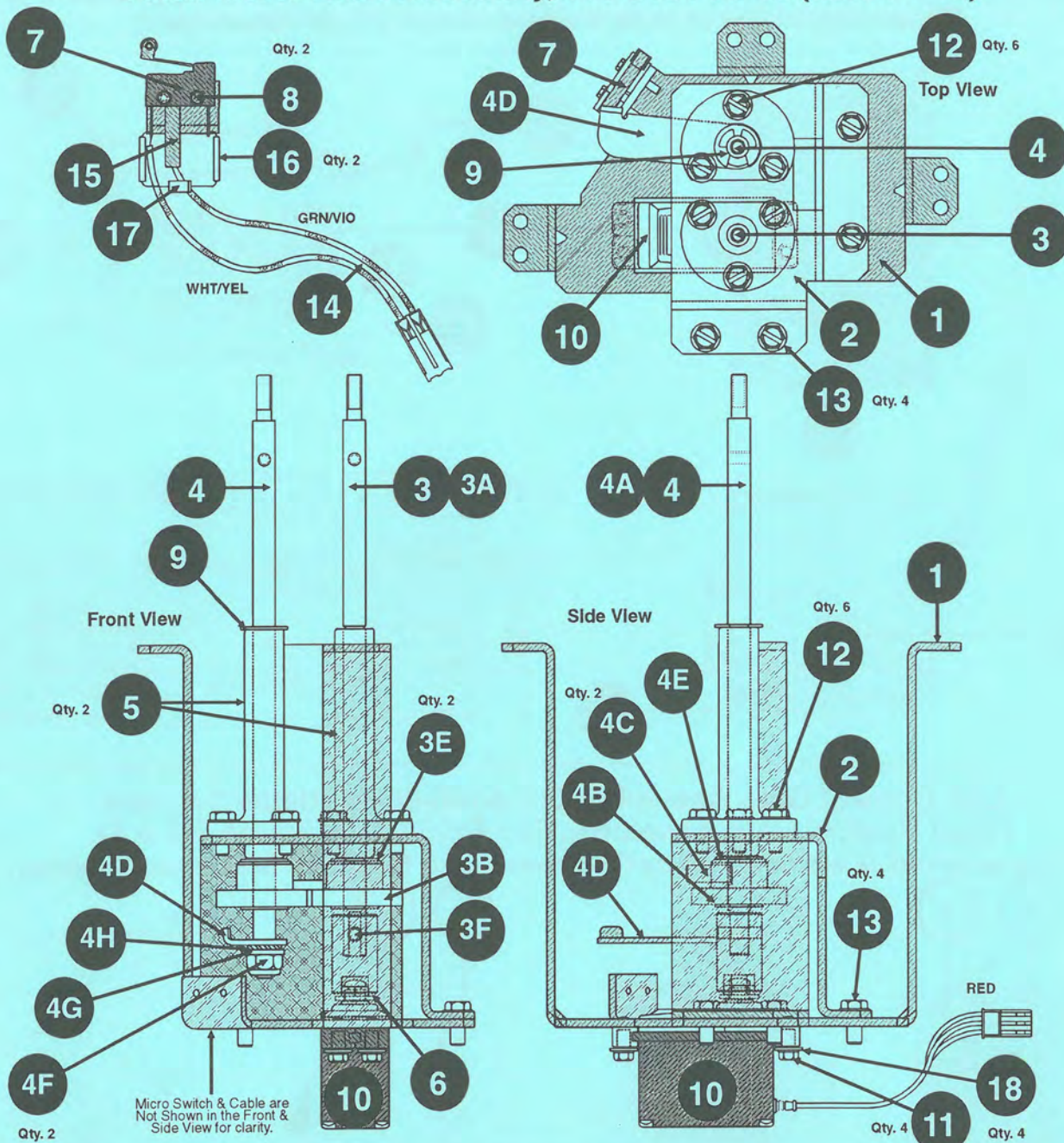


**Left Control Gate Assembly, 500-6100-00-45 (Items 1-4) and
 Right Control Gate Assembly, 500-6100-01-45 (Items 1-3 & 5)**
 (These assemblies are operated by the above Coil & Mounting Bracket Assemblies)



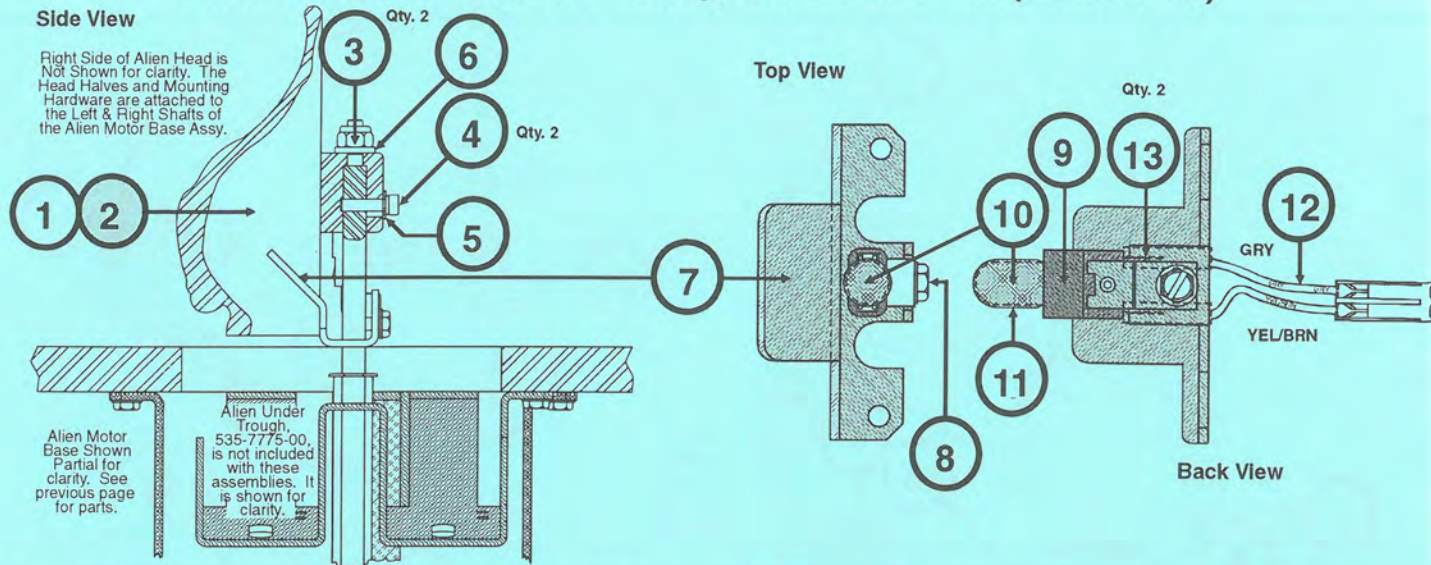
Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Ball Gate Mounting Bracket (for both)	535-7720-00	4	Wire Form (for Left Control Gate)	535-7721-01
2	Ball Gate (for both)	535-7722-00	5	Wire Form (for Right Control Gate)	535-7721-00
3	Rebound Hinge (for both)	535-5372-04			

Alien Motor Base Assembly, 500-6104-00-45 (Items 1-18)



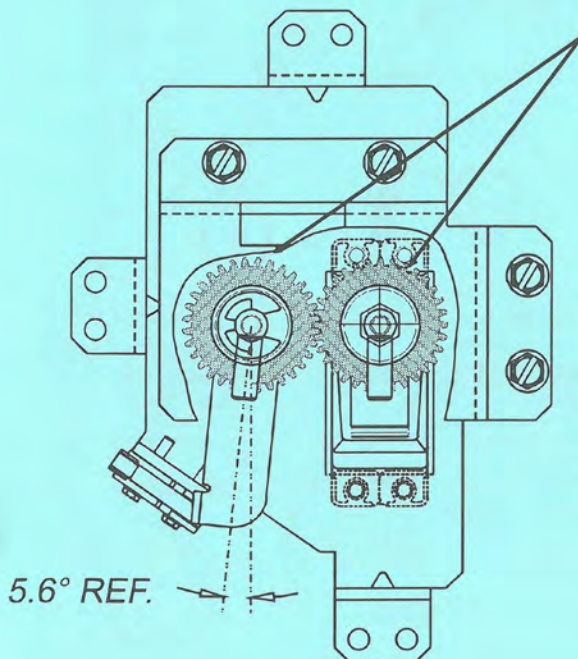
Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Alien Motor Base	535-7770-00	5	Bushing (Qty. 2)	545-5715-00
2	Gear Base Bracket	535-7769-00	6	Hex Adaptor	545-5616-00
3	Alien Shaft Right Assembly	515-6615-00-45	7	Micro Switch Roller Actuator	180-5119-00
ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:			8	#2-56 X 1/2" HWH MS (SERR) (Qty. 2)	237-5937-00
3A	Alien Head Shaft Right Side	530-5426-00	9	Retaining Ring 1/4" ø	270-5002-00
3B	Spur Gear 1.000 PD	530-5412-00	10	Servo Motor (Part #94322)	041-5045-00
3C	#10-32 X 1/2 Set SCR Cup Point	237-5980-00	11	#4-40 X 5/8" HWH MS (SERR) (Qty. 4)	237-5945-00
3D	Drive Link	545-5617-01	12	#6-32 X 3/8" HWH SWAGE (Qty. 6)	237-5976-02
3E	Retaining Ring 1/4" ø (Qty. 2)	270-5002-00	13	#8-32 X 3/8" HWH MS (Tapite) (Qty. 4)	237-5967-00
3F	Roll Pin 1/8" ø X 5/8" Long	251-5008-00	14	Cable Wiring Harness (Servo Opn./Cl.)	036-5407-11-45
4	Alien Shaft Left Assembly	515-6616-00-45	15	Shrink Tubing 1/8" I.D. .08"	605-5002-00
ORDERING ABOVE (ITEM 4) COIL PART Nº WILL INCLUDE:			16	#18 Ins. Tubing (Teflon) (Qty. 2)	605-5003-00
4A	Alien Head Shaft Left Side	530-5427-00	17	Diode, 1N4001	112-5001-00
4B	Spur Gear 1.000 PD	530-5412-00	18	Washer 9/64" I.D. X 5/16" O.D. X 1/32" (Qty. 4)	242-5017-00
4C	#10-32 X 1/2 Set SCR Cup Point	237-5980-00			
4D	Switch Actuator Bracket	535-7763-00			
4E	Retaining Ring 1/4" ø (Qty. 2)	270-5002-00			
4F	#8-32 Nylon Stop Nut (Qty. 2)	240-5102-00			
4G	#8 Lock Washer	246-5001-00			
4H	#8 Star Washer	242-5005-00			

Alien Head Assembly, 500-6145-00-45 (Items 1-6) and Alien Snubber Plate Assembly, 500-6142-00-45 (Items 7-13)



Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Alien Head Left Side	545-5717-01	7	Alien Snubber Plate	535-7771-00
2	Alien Head Right Side	545-5718-01	8	#6-32 X 3/8" HWH SWAGE (SERR)	237-5976-02
3	#8-32 Nylon Stop Nut (Qty. 2)	240-5102-00	9	Laydown Wedge Base Socket (w/ notch)	077-5026-01
4	#6-32 X 1/2" Cap Screw (Qty. 2)	237-5982-00	10	#555 Wedge Base Bulb	165-5002-00
5	#6 Star Washer	246-5000-00	11	Rubber Light Cover Green	545-5014-04
6	#8 Washer	242-5005-00	12	Cable Wiring Harness (Alien Eyes)	036-5407-13-45
			13	Shrink Tubing 1/8" I.D. (Qty. 2)	605-5002-00

Alien Motor Base & Head Adjustment Procedures



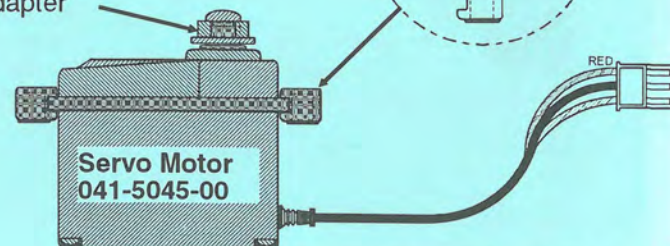
- Position Spur Gears as Shown.
- Assembly of Spur Gears to Servo Motor: Use Servo Board to calibrate Servo to 0° when positioning Spur Gears.

See Diagnostics, ID4 Specific and Schematics & Troubleshooting for Servo Board Adjustments.

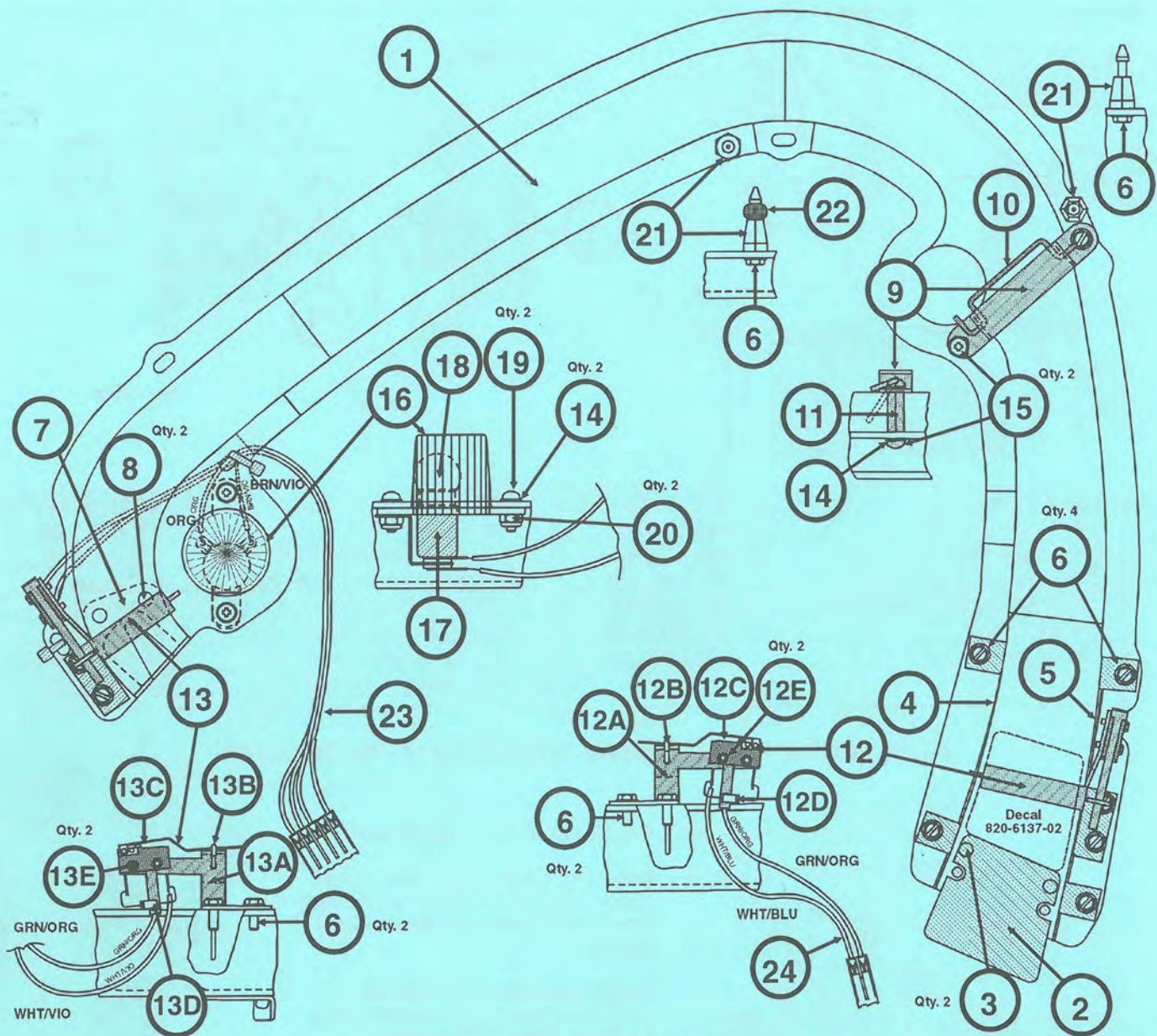
Must try every corner of Hex Adapter to position on centerline as shown when attaching to Motor Base.

- Rubber Bushings with Brass Sleeve Assy. (X4)

Hex Adapter

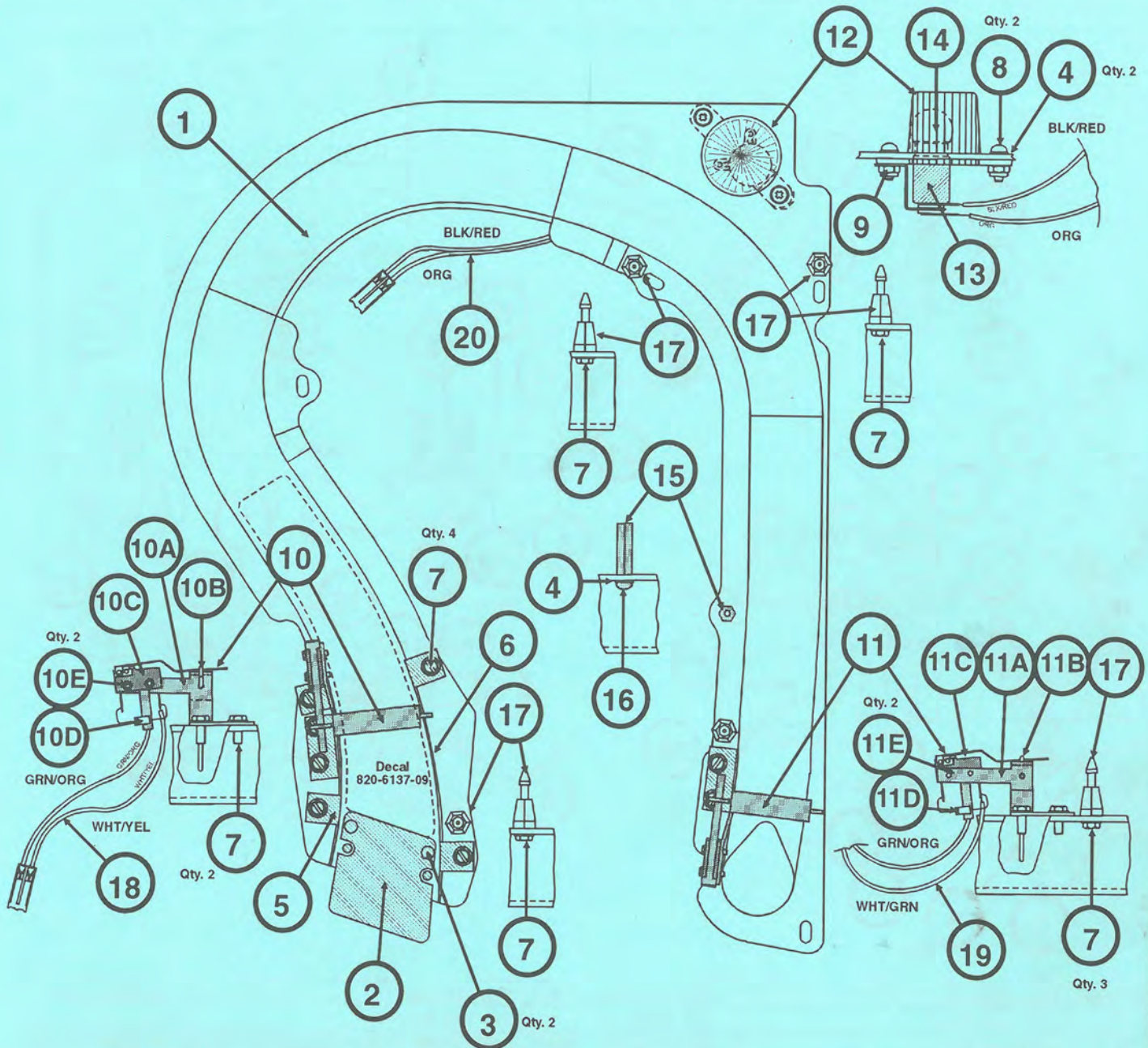


Right Plastic Ramp Assembly, 500-6081-00-45 (Items 1-24)



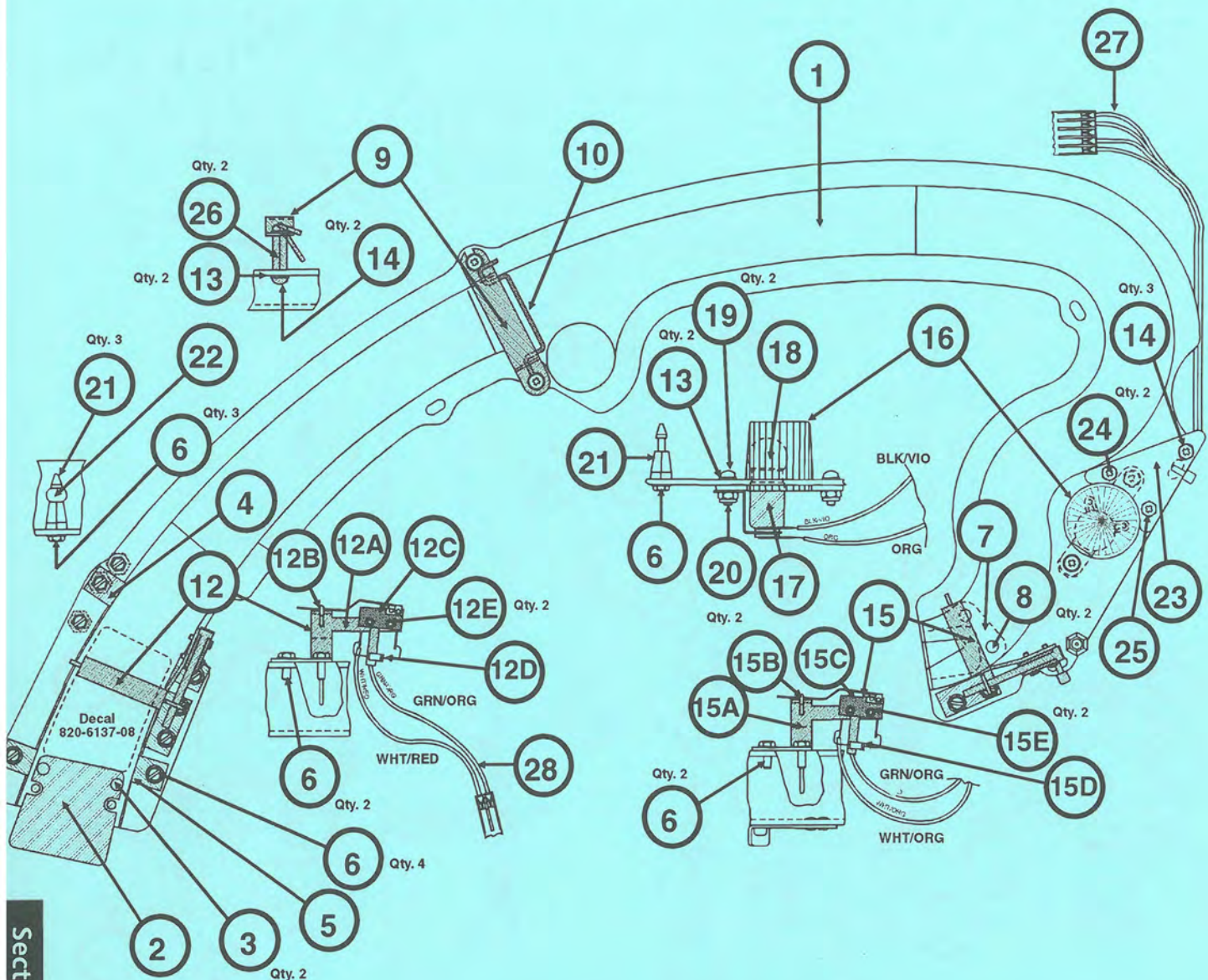
Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Right Plastic Ramp	545-5696-00	13	Exit Gate Assembly	515-6556-01-45
2	Right Ramp Flap	535-7741-00	ORDERING ABOVE (ITEM 13) COIL PART Nº WILL INCLUDE:		
3	Rivet 1/8" ø X 5/32" Lg. (Qty. 2)	249-5009-00	13A	Gate Bracket	535-7756-01
4	Right Ramp Protector Left Side	535-7792-00	13B	Wire Form	535-7755-01
5	Right Ramp Protector Right Side	535-7793-00	13C	Switch Wire Gate	180-5087-00
6	#6 X 3/8" HWH AB (Zinc) (Qty. 10)	234-5000-00	13D	Diode, 1N4001	112-5001-00
7	Right Ramp Mounting Bracket	535-7746-00	13E	#2-56 X 3/8" HWH MS (SERR) (Qty. 2)	237-5938-00
8	Rivet 1/8" ø X 3/16" Lg. (Qty. 2)	249-5001-00	14	Washer 9/64" ID X 5/16" OD X 1/32" (Qty. 3)	242-5017-00
9	Mounting Bracket (Wire Gate)	535-5269-06	15	#6-32 X 3/8" PPH MS (SEMS) (Qty. 2)	232-5201-00
10	Wire Gate	535-5307-09	16	Mini-Mars Red	550-5031-02
11	5/8" X 1/4" Hex Spacer #6-32 Tap	254-5008-02	17	2-Lug Stand-Up Short Socket	077-5101-00
12	Entrance Gate Assembly	515-6490-00-45	18	#89 Bulb	165-5000-89
ORDERING ABOVE (ITEM 12) COIL PART Nº WILL INCLUDE:			19	#6-32 X 1/2" PPH MS (SEMS) (Qty. 2)	232-5202-00
12A	Gate Bracket	535-7613-01	20	#6-32 Nylon Stop Nut (Qty. 2)	240-5005-00
12B	Wire Form	535-6304-03	21	Mini-Jewel Post Clear (Qty. 2)	550-5052-01
12C	Switch Wire Gate	180-5087-00	22	3/8" O.D. Black Rubber Ring	545-5348-19
12D	Diode, 1N4001	112-5001-00	23	Cable Wiring Harness (Exit Switch)	036-5407-01-45
12E	#2-56 X 3/8" HWH MS (SERR) (Qty. 2)	237-5938-00	24	Cable Wiring Harness (Enter Switch)	036-5407-04-45

Center Plastic Ramp Assembly, 500-6082-00-45 (Items 1-20)



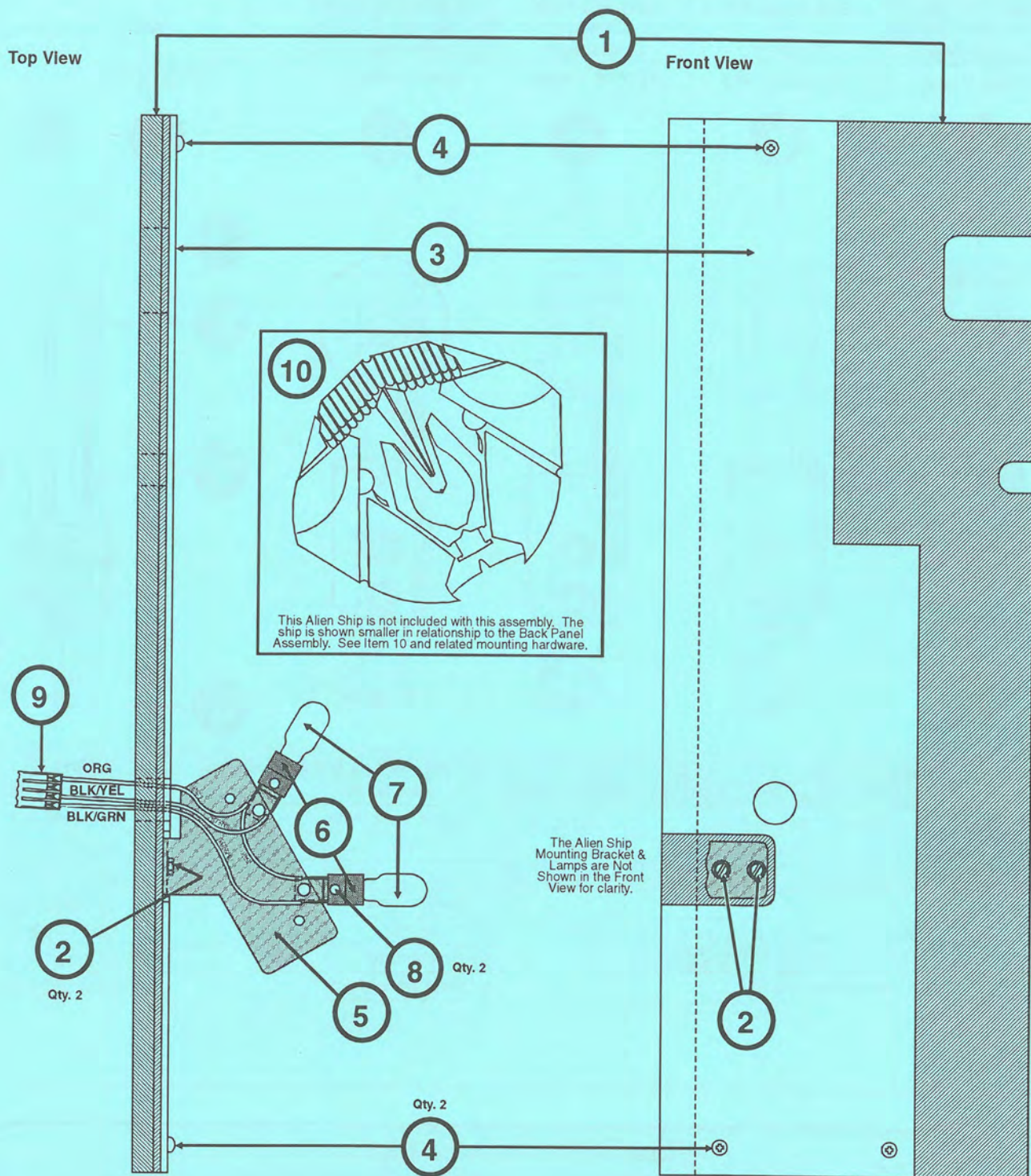
Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Center Plastic Ramp	545-5697-00	11	Exit Gate Assembly	515-6556-02-45
2	Center Ramp Flap	535-7743-00	ORDERING ABOVE (ITEM 11) COIL PART Nº WILL INCLUDE:		
3	Rivet 1/8" Ø X 5/32" Lg. (Qty. 2)	249-5009-00	11A	Gate Bracket	535-7756-02
4	Washer 9/64" ID X 5/16" OD X 1/32" (Qty. 3)	242-5017-00	11B	Wire Form	535-7755-02
5	Center Ramp Protector Left Side	535-7796-00	11C	Switch Wire Gate	180-5087-00
6	Center Ramp Protector Right Side	535-7797-00	11D	Diode, 1N4001	112-5001-00
7	#6 X 3/8" HWH AB (Zinc) (Qty. 12)	234-5000-00	11E	#2-56 X 3/8" HWH MS (SERR) (Qty. 2)	237-5938-00
8	#6-32 X 1/2" PPH MS (SEMS) (Qty. 2)	232-5202-00	12	Mini-Mars Red	550-5031-02
9	#6-32 Nylon Stop Nut (Qty. 2)	240-5005-00	13	2-Lug Stand-Up Short Socket	077-5101-00
10	Entrance Gate Assembly	515-6490-01-45	14	#89 Bulb	165-5000-89
ORDERING ABOVE (ITEM 10) COIL PART Nº WILL INCLUDE:			15	7/8" X 1/4" Hex Spacer #6-32 Tap	254-5008-05
10A	Gate Bracket	535-7613-02	16	#6-32 X 3/8" PPH MS (SEMS)	232-5201-00
10B	Wire Form	535-6304-03	17	Mini-Jewel Post Clear (Qty. 4)	550-5052-01
10C	Switch Wire Gate	180-5087-00	18	Cable Wiring Harness (Enter Switch)	036-5407-05-45
10D	Diode, 1N4001	112-5001-00	19	Cable Wiring Harness (Exit Switch)	036-5407-06-45
10E	#2-56 X 3/8" HWH MS (SERR) (Qty. 2)	237-5938-00	20	Cable Wiring Harness (Upper Rt. Flash)	036-5407-10-45

Left Plastic Ramp Assembly, 500-6083-00-45 (Items 1-28)



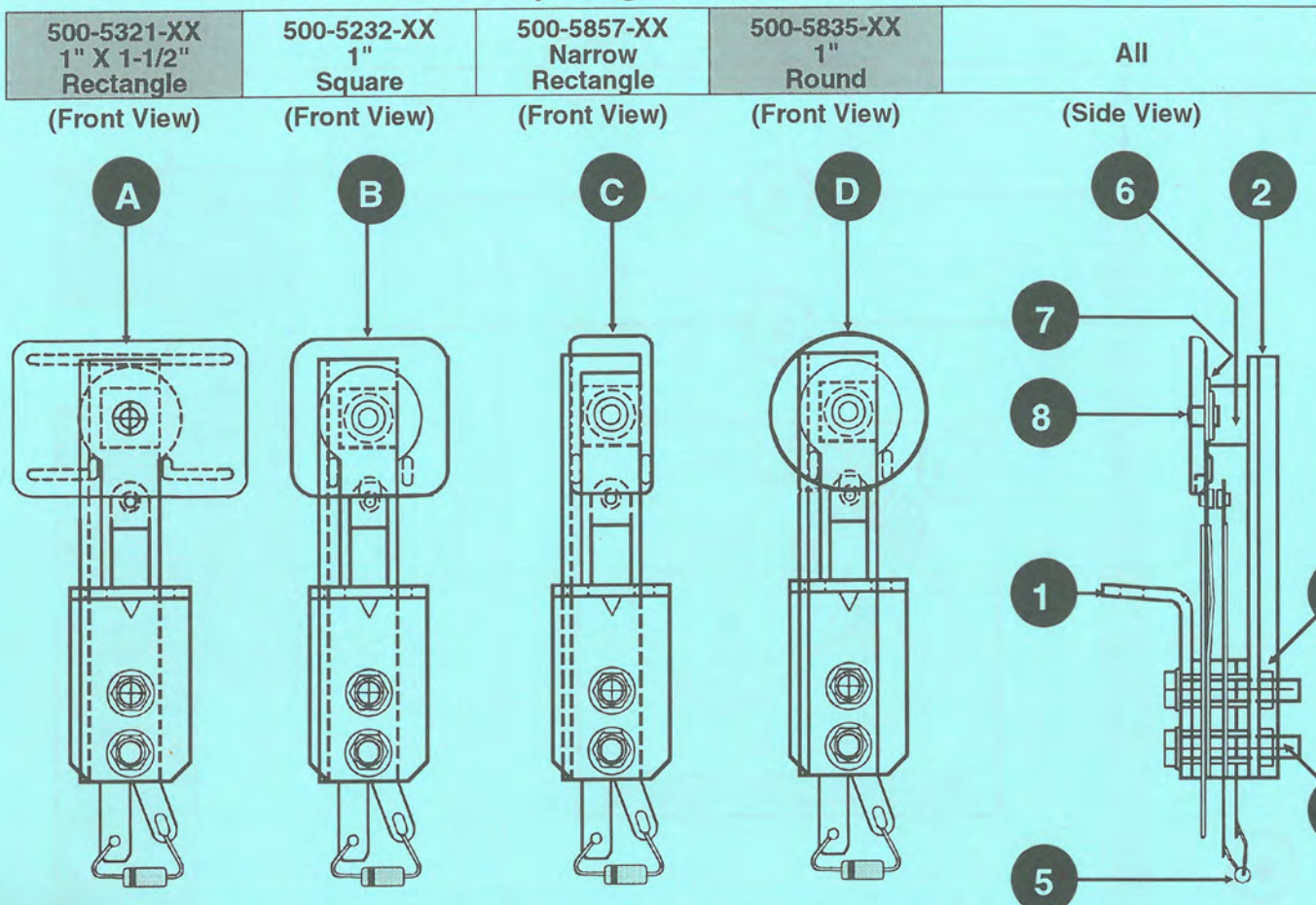
Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Left Plastic Ramp	545-5698-00	15	Exit Gate Assembly	515-6556-01-45
2	Left Ramp Flap	535-7742-00	ORDERING ABOVE (ITEM 15) COIL PART Nº WILL INCLUDE:		
3	Rivet 1/8" ø X 5/32" Lg. (Qty. 2)	249-5009-00	15A	Gate Bracket	535-7756-01
4	Left Ramp Protector Left Side	535-7794-00	15B	Wire Form	535-7755-01
5	Left Ramp Protector Right Side	535-7795-00	15C	Switch Wire Gate	180-5087-00
6	#6 X 3/8" HWH AB (Zinc) (Qty. 11)	234-5000-00	15D	Diode, 1N4001	112-5001-00
7	Left Ramp Mounting Bracket	535-7745-00	15E	#2-56 X 3/8" HWH MS (SERR) (Qty. 2)	237-5938-00
8	Rivet 1/8" ø X 3/16" Lg. (Qty. 2)	249-5001-00	16	Mini-Mars Red	550-5031-02
9	Mounting Bracket (Wire Gate)	535-5269-06	17	2-Lug Stand-Up Short Socket	077-5101-00
10	Wire Gate	535-5307-09	18	#89 Bulb	165-5000-89
11	5/8" X 1/4" Hex Spr. #6-32 Tap (Qty. 2)	254-5008-02	19	#6-32 X 1/2" PPH MS (SEMS) (Qty. 2)	232-5202-00
12	Entrance Gate Assembly	515-6490-01-45	20	#6-32 Nylon Stop Nut (Qty. 2)	240-5005-00
ORDERING ABOVE (ITEM 12) COIL PART Nº WILL INCLUDE:			21	Mini-Jewel Post Clear (Qty. 4)	550-5052-01
12A	Gate Bracket	535-7613-02	22	3/8" O.D. Black Rubber Ring	545-5348-19
12B	Wire Form	535-6304-03	23	Butyrate 10 - Left Plastic Ramp Cover	830-5902-10
12C	Switch Wire Gate	180-5087-00	24	1/4" X 1/4" Hex Spr. #6-32 Tap (Qty. 2)	254-5008-00
12D	Diode, 1N4001	112-5001-00	25	3/8" X 1/4" Hex Spacer #6-32 Tap	254-5008-12
12E	#2-56 X 3/8" HWH MS (SERR) (Qty. 2)	237-5938-00	26	5/8" X 1/4" Hex Spr. #6-32 Tap (Qty. 2)	254-5008-02
13	Washer 9/64" ID X 5/16" OD X 1/32" (Qty. 6)	242-5017-00	27	Cable Wiring Harness (Exit Switch/Flash)	036-5407-02-45
14	#6-32 X 3/8" PPH MS (SEMS) (Qty. 5)	232-5201-00	28	Cable Wiring Harness (Enter Switch)	036-5407-03-45

Back Panel Assembly, 500-6034-00-45 (Items 1-9)



Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Back Panel (Plain)	525-5399-00	9	Cable Wiring Harness	036-5407-12-45
2	#8-1/2" HWH AB (Zinc) Blue (Qty. 2)	234-5101-05			
3	Mirror Back Panel	545-5726-00	Nº	Associated Part Name	SPI Part Nº
4	#6 X 1/2" PPH A (Black) (Qty. 3)	237-5805-00	10	Alien Ship	545-5700-01
5	Alien Ship Mounting Bracket	535-7826-00		Ship Mounting Hardware:	
6	Laydown Wedge Base Socket (Qty. 2)	077-5026-01		#8-32 X 1" PPH MS (SEMS) (Qty. 2)	232-5306-00
7	#906 Wedge Base Bulb (Qty. 2)	165-5004-00	n/a *	#8-32 Nylon Stop Nut (Qty. 2)	240-5102-00
8	Rivet 1/8" Ø X 5/32" Lg. (Qty. 2)	249-5009-00		Washer 1/4" ID X 1" OD X .049" (Qty. 2)	242-5009-00

Stand-Up Target Assemblies: †



Nº	Switch & Target Name	QTY.	Part Nº	Nº	Part Names for A, B, C & D	Part Nº
A	Sw. & Target Assy. 1" X 1½" Rect. (Flat)	0	515-6027-XX	1	Mounting Bracket	535-6896-00
B	Switch & Target Assembly 1" Square (Flat)	1	515-5162-XX	2	Switch Back Plate	535-6452-00
C	Sw. & Target Assy. Narrow Rectangle (Flat)	10	515-5967-XX	3	6-32 Nyloc	240-5010-00
D	Switch & Target Assembly 1" Round (Flat)	0	515-5966-XX	4	6-32 X ¾ HWH Ser. (Type C) (Qty. 2)	237-5958-00
				5	Switch Diode, 1N4001	112-5001-00
				6	Foam Pad	626-5029-00
				7	Washer 5/16"	242-5017-00
				8	Rivet 1/8" ø X 3/16"	249-5001-00

† Items with a 0 quantity are not used in this game. The following are the color breakdowns for item(s) B & C (replace the "-XX"):
 B -02 Red (Qty. 1); C -04 Green (Qty. 3), -05 Blue (Qty. 3) and
 -06 Yellow (Qty. 4)

Plastic Part Color Chart

(As applicable for all parts which are available in various colors.)
 The "-XX" should be replaced with the following 2-Digit Number for the color desired:

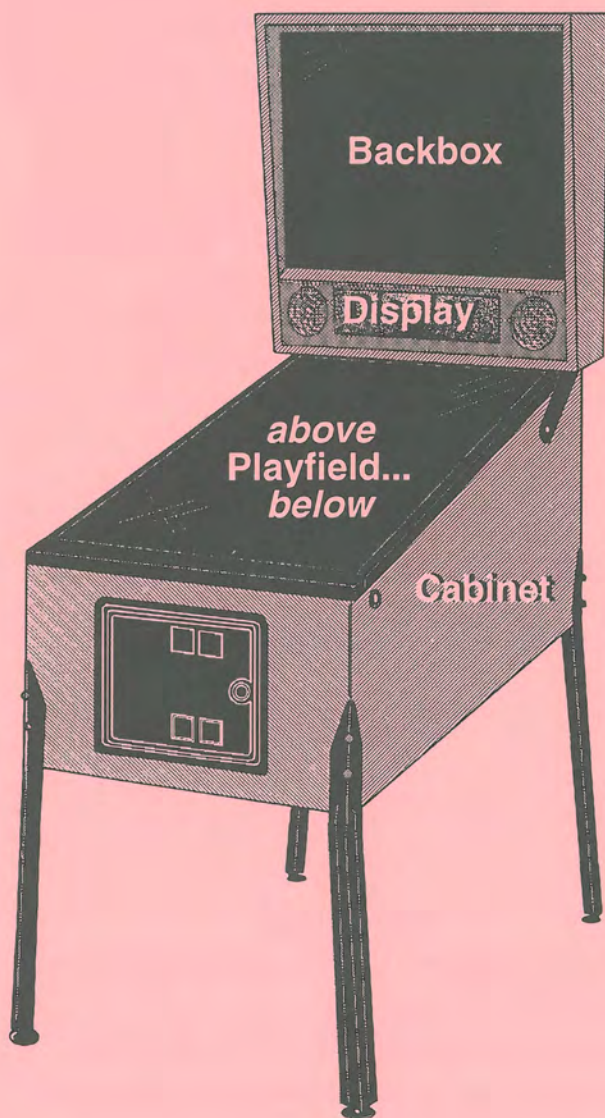
-01: Clear	-06: Yellow	-11: Fluorescent Green
-02: Red	-07: Orange	-12: Fluorescent Blue
-03: Amber	-08: White	-13: Teal Green
-04: Green	-09: Purple	-14: Gray
-05: Blue	-10: Fluorescent Orange	-15: Luminescent

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 four groups: Backbox, Cabinet, Above and Below Playfield. Some parts may be considered both above & below the playfield, like sockets & bulbs; the part will be grouped where it is mostly used. 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). Assemblies listed & noted with page numbers in the tables will detailed in the Blue Pages, Chapter 2, Assembly Drawings.

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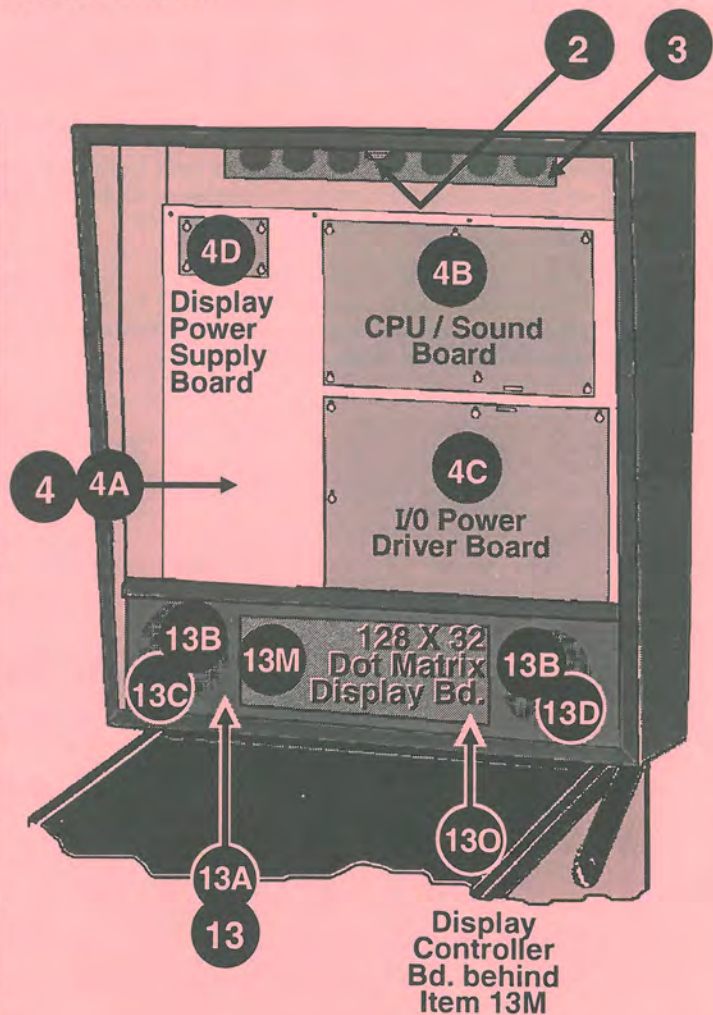
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Backbox - General Parts

Nº	Part Name	SPI Part Nº
1	Backbox Header (Not Used)	
	Backbox Lock Plate	535-5860-00
2	Backbox Lock	355-5008-00
	#8 X 5/8" Tamper Proof (Qty. 2)	237-5947-00
3	7-Vent Hole Grill 2½" x 18"	545-5072-02
4	PCB Mounting Plate Assembly	500-5126-45-45
ORDERING ABOVE (ITEM 4) ASSEMBLY PART Nº WILL INCLUDE:		
4A	PCB Mounting Plate	535-5809-03
4B†	CPU / Sound (1 X 4MB) Board	520-5136-45
4C	I/O Power Driver Board	520-5137-01
4D	Display Power Supply Board	520-5138-00
4E†	#6 X 3/4" HWH Screw (Qty. 4)	234-5003-00
4F*	#8-32 X 3/8" HWH Screw (Qty. 15)	237-5967-00
5 *	ID4 Back Glass Assembly	515-5450-00-45
ORDERING ABOVE (ITEM 5) ASSEMBLY PART Nº WILL INCLUDE:		
5A*	Plastic Extrusion 26" (Top)	545-5018-04
5B*	Plastic Extrusion 21-3/8" (Left & Right)	545-5018-07
5C*	Glass Channel 26-1/16" (Bottom)	545-5021-01
5D*	ID4 Artwork Film	830-5245-00
5E*	Glass 26" X 22-1/2"	660-5008-00
5F*	2-Side Tape (.5")	626-5005-00
6 *	Fluorescent Light Bracket Right Assy.	515-6545-00-XX
ORDERING ABOVE (ITEM 6) ASSEMBLY PART Nº WILL INCLUDE:		
6A*	Fluorescent Light Bracket Left	535-7739-01
6B*	Lamp Holder (Self-Locking)	077-5214-00
6C*	#6-32 X 5/8" PPH Mach. SEMS Screw	232-5203-00
6D*	Starter Base (with Leads)	077-5213-00
6E*	#4-40 X 1/2" PPH Mach. SEMS (Qty. 2)	237-5813-00
7 *	Fluorescent Light Bracket Right Assy.	515-6545-01-XX
ORDERING ABOVE (ITEM 7) ASSEMBLY PART Nº WILL INCLUDE:		
7A*	Fluorescent Light Bracket Right	535-7739-00
7B*	Lamp Holder (Self-Locking)	077-5214-00
7C*	#6-32 X 5/8" PPH Mach. SEMS Screw	232-5203-00
8 *	#10-24 X 1-1/4" Car. Bolt Sq. Neck (Qty. 4)	231-5012-00
9 *	#10-24 Keps Nut (Qty. 4) (with Item 8)	240-5207-00
10 *	Fluorescent Tube - F20R12-SPX30	165-5031-00
11 *	Starter - Fluorescent FS2 Light	165-5011-01
12 *	Ballast - SP2 120v 60Hz 13W (UL)	010-5007-00
13 *	ID4 Speaker Panel Assembly	500-5995-02-45
ORDERING ABOVE (ITEM 13) ASSEMBLY PART Nº WILL INCLUDE:		
13A	Speaker Housing (includes spkr. hooks)	545-5180-02
	Speaker Hook (Qty. 2)	545-5555-00
13B	Speaker Grill with Artwork (Qty. 2)	545-5072-05
13C	Speaker Backplate (cover unused side)	820-6157-00
13D	Speaker 4X4 QUAM (Right Side Only)	031-5004-00
13E*	#6 X 3/8" HWH Screw (Qty. 8)	234-5000-00
13F*	Speaker Butyrate (Lexan)	830-5436-00
13G*	Foam (3/16" Thick) (Qty. 2.8')	626-5026-00
13H*	Post Machine Screw (Hi-Lo) (Qty. 5)	530-5263-01
13I*	Spacer (.144" ID X .31 OD X 1) (Qty. 5)	254-5001-00
13J*	Static Shield (Between Items M & O)	535-6437-00
13K*	Edge Protector (Qty. 2)	545-5592-01
13L*	#6-32 Keps Nut (Qty. 2)	240-5008-00
13M††	128 X 32 Dot Matrix Display Board	520-5052-00
13N*	1/4" Hex Spacer (1/2") (Qty. 4)	254-5008-03
13O†	Display Controller Board	520-5055-01
13P*	RF Shield (above Item O facing Item J)	820-5092-00
13Q*	#6-32 X 1/4" PPH (SEMS) (Qty. 5)	232-5200-00
13R*	Ground Strap (4") (Qty. 2)	600-5006-04
13S*	Ground Strap (12") (Qty. 2)	600-5006-12
13T*	Speaker Wiring Harness/Cable	036-5388-01-45
14 *	Ribbon Cable, 14-Pin (Display Controller Board to Dot Matrix Display Board)	036-5260-00-45
15 *	Ribbon Cable, 20-Pin (CPU/Sound Board to I/O Power Driver Board)	036-5000-04
16 *	Ribbon Cable, 26-Pin (CPU/Sound Board to Display Controller Board)	036-5001-00
17 *	Fuse Description Decal (See Page i in front of manual for fuse locations.)	820-6152-45



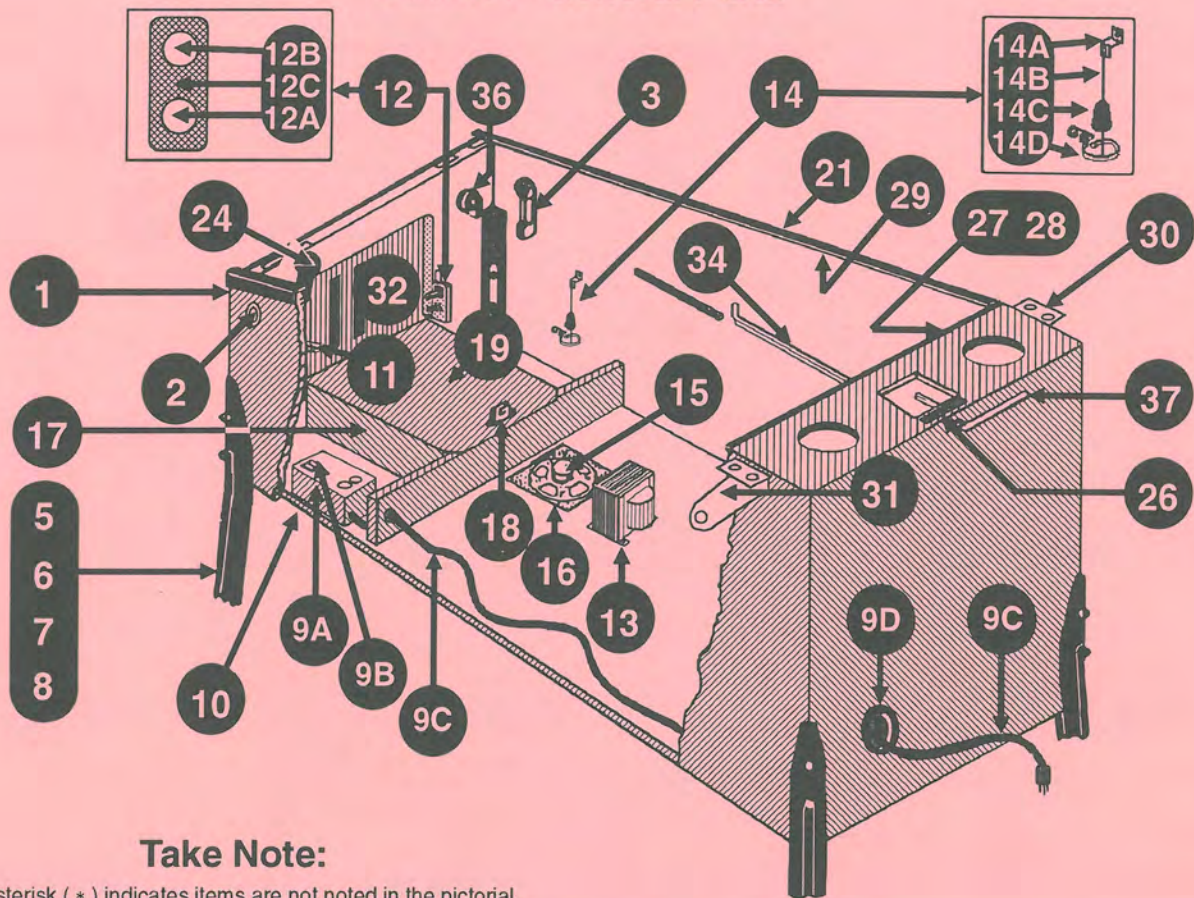
Take Note:

- † When ordering PC Boards with ROMS, please specify the Game (Items 4B, 4D & 13O)
 †† Indicate Manufacturer (Item 13M).

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

- Items 6 & 7 the "-XX" needs to be included when ordering these parts. The -XX indicates use for all games & will include any revisions as production of future games warrants.
- Item 8 fastens Items 6 & 7 to the inside of the Back Box.
- Most parts included in assemblies can be ordered separately.

Cabinet - General Parts



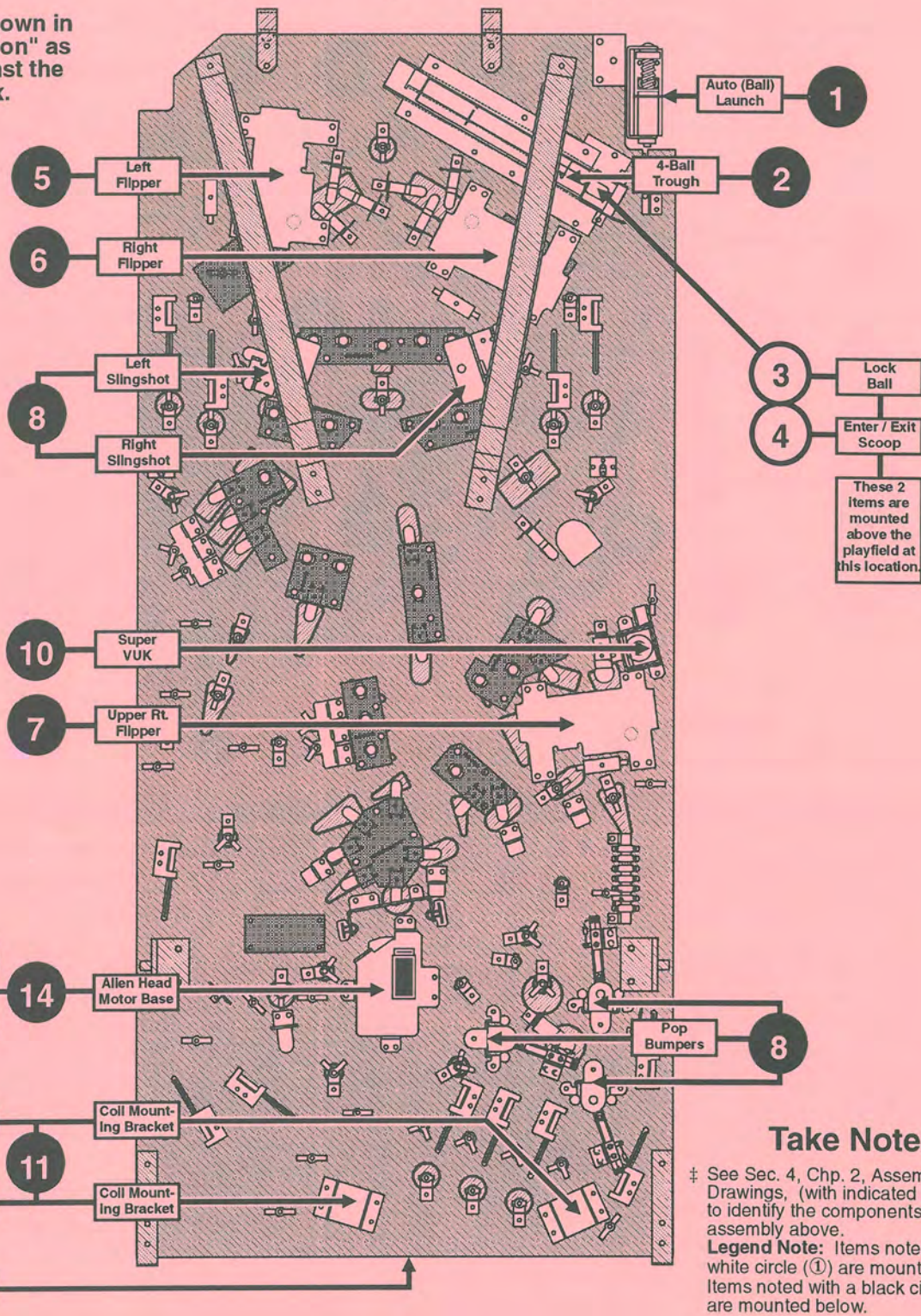
Take Note:

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

Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Large Round Auto Launch Assy. (Yellow)	500-6121-06	15	Speaker - Round - 8" ø	031-5005-00
2	Flipper Button Assembly Red (Qty. 2)	500-5026-32	16	Speaker Grill 7" x 7"	545-5072-03
3	Flipper Cabinet Switch, Left	180-5048-01	17	Cash Box Plastic Bottom	545-5090-00
4 *	Flipper Cabinet Switch, Right	180-5151-00	18	Cash Box Lock Bracket (wire)	535-7562-00
5	Leg (Black) (Qty. 4)	535-5020-50	19	Cash Box Cover (Validator)	535-5013-03
6	Bolt 3/8" X 16 X 2-1/2" Hex 5/8" Hd. (Qty. 8)	231-5001-01	20 *	Playfield Glass (T.P.) 21" x 43"	660-5001-00
7	Leg Bolt Back Plate (Qty. 4)	535-5703-00	21	Side Armor (Qty. 2) (Left & Right Same)	535-7297-02
8	Leg Leveler 3/8" - 16 X 3" (Qty. 4)	500-5017-00	ABOVE (ITEM 21) IS HELD SECURED BY:		
9 *	Power Box Sub-Assembly	515-5360-00	Front	#10-24 X 1-1/4" Carriage Bolt and #10-24 Hex Nut	231-5012-00 240-5202-00
ORDERING ABOVE (ITEM 9) SUB-ASSY. PART Nº WILL INCLUDE:			Middle	#8 X 5/8" Tmpr. Proof Trq. Scrw. (Qty. 2)	237-5947-00
9A	Power Box	535-5932-00	Back	#8 X 3/4" Phil. Flat Head Screw (Qty. 2)	237-5822-00
9B	Service Outlet (for USA)	180-5008-01	24	Front Molding Lockdown Assembly	500-5020-01
9C	Line Cord 10' ROJ 3" Max.	034-5000-10	25 *	Front Molding - Black	500-5757-01-00
9D	Recessed Cup for Line Cord	545-5122-00	26	#1 Roto Lock Male	355-5006-01
9E*	Line Filter	150-5000-00		#1 Roto Lock Female	355-5006-02
9F*	Varistor TNR159211KM	150-5001-00	27	Rear Plastic Ext. Playfield Glass 20-3/8"	545-5038-00
9G*	Fuse 8 Amp (Domestic)	200-5000-05	28	Mounting Foam Rubber for Ext.	626-5001-00
9H*	Fuse Holder	205-5001-00	29	Plastic Channel Left & Right	545-5017-00
9I*	Power Box Decal	820-6123-00	30	Backbox Hinge Left	535-6172-00
10	Power Sw. DPST Toggle (Under Cab.)	180-5001-00	31	Backbox Hinge Right	535-6172-01
11	Service Switch Set (RED, GRN, BLK BUTTONS)	180-5012-03		Coin Door (with Validator) USA only	500-5018-172
12	Dual Switch Assembly	500-5808-00	32	USA ¢ Coin Switch	180-5024-00
ORDERING ABOVE (ITEM 12) ASSEMBLY PART Nº WILL INCLUDE:				JAPAN ¥ Coin Switch	180-5091-00
12A	Memory Protect Switch	180-5000-00 *	33 *	Slide & Pivot Support Bracket - Right	535-5989-00
12B	Interlock Switch	180-5136-00	34	Slide & Pivot Support Bracket - Left	535-5990-00
12C	Bracket	535-6958-00	35 *	Prop Rod	535-7553-00
13	Transformer	010-5011-00	36	Start Button Switch Assy. (Red) (Flip. Style)	500-6090-02
14	Plumb Bob Tilt Assembly	500-5023-00	37	Hex Key Allen Wrench 5/16"	777-0001-00
ORDERING ABOVE (ITEM 14) ASSEMBLY PART Nº WILL INCLUDE:					
14A	Tilt Hanger Bracket	535-5221-00			
14B	Tilt Hanger Wire (Attached to "16A")	535-5319-00			
14C	Tilt Plumb Bob (Attached to "16B")	535-5029-00			
14D	Tilt Contact Wire	535-7563-01			

Playfield - Major Assemblies ‡

Playfield is shown in the "Up Position" as leaning against the Backbox.

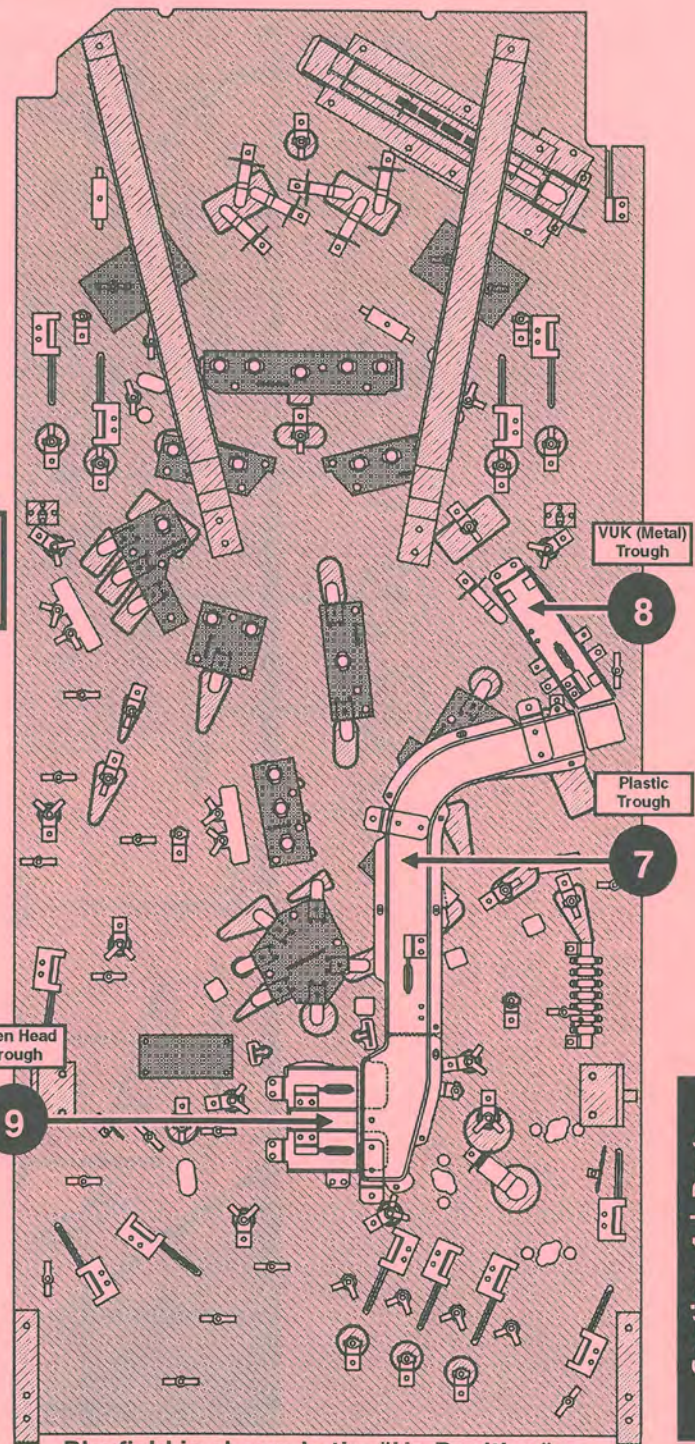
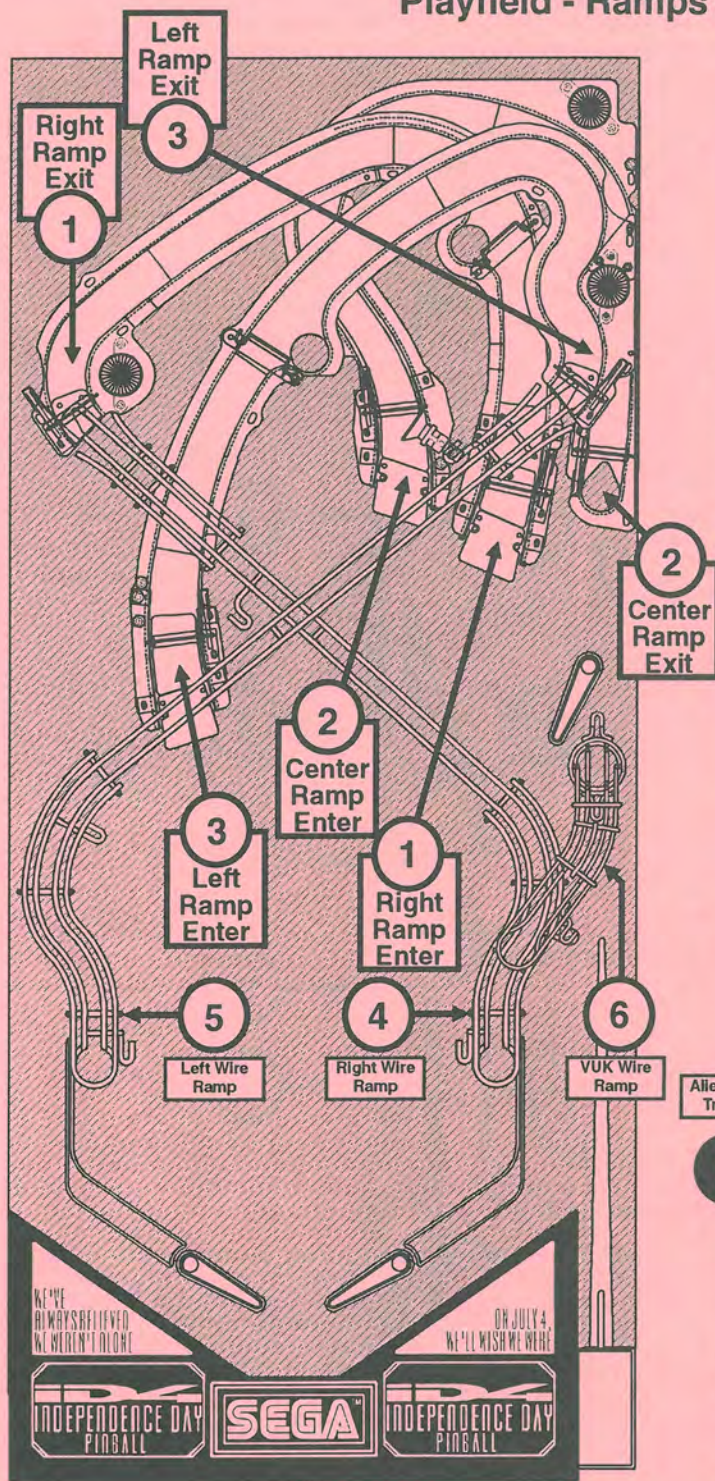


Take Note:

‡ See Sec. 4, Chp. 2, Assembly Drawings, (with indicated page) to identify the components of each assembly above.
Legend Note: Items noted with a white circle (①) are mounted above. Items noted with a black circle (●) are mounted below.

Nº	Assembly Name	PG.†	Part Nº	Nº	Assembly Name	PG.†	Part Nº
1	Auto Launch Assembly	pg 70	500-5477-05-45	9	Slingshot (Lt. & Rt.) Assy. (Qty. 2)	pg 76	500-5849-01-XX
2	4-Ball Trough Assembly	pg 71	500-5989-14-45	10	Super VUK Assembly	pg 76	500-5996-01-45
3	Lock Ball Assembly	pg 71	500-5684-02-XX	11	Coil & Mntg. Brckt. Assy. (Qty. 2)	pg 77	515-6544-00-45
4	Ball Trough Enter/Exit Scoop Assy.	pg 71	535-7329-01	12	Left Control Gate Assembly	pg 77	500-6100-00-45
5	Flipper (Left) Assembly	pg 72	500-5944-12	13	Right Control Gate Assembly	pg 77	500-6100-01-45
6	Flipper (Right) Assembly	pg 73	500-5944-02	14	Alien Motor Base Assembly	pg 78	500-6104-00-45
7	Flipper (Upper) Assembly	pg 74	500-5944-03	15	Alien Head Assembly	pg 79	500-6145-00-45
8	Turbo Bumper Ind. Parts (Qty. 3)	pg 75	See Sec. 4, Chp. 2	16	Alien Snubber Plate Assembly	pg 79	500-6142-00-45
				17	Back Panel Assembly	pg 83	500-6034-00-45

Playfield - Ramps and Troughs ‡



Playfield is shown in the "Up Position" as leaning against the Backbox.

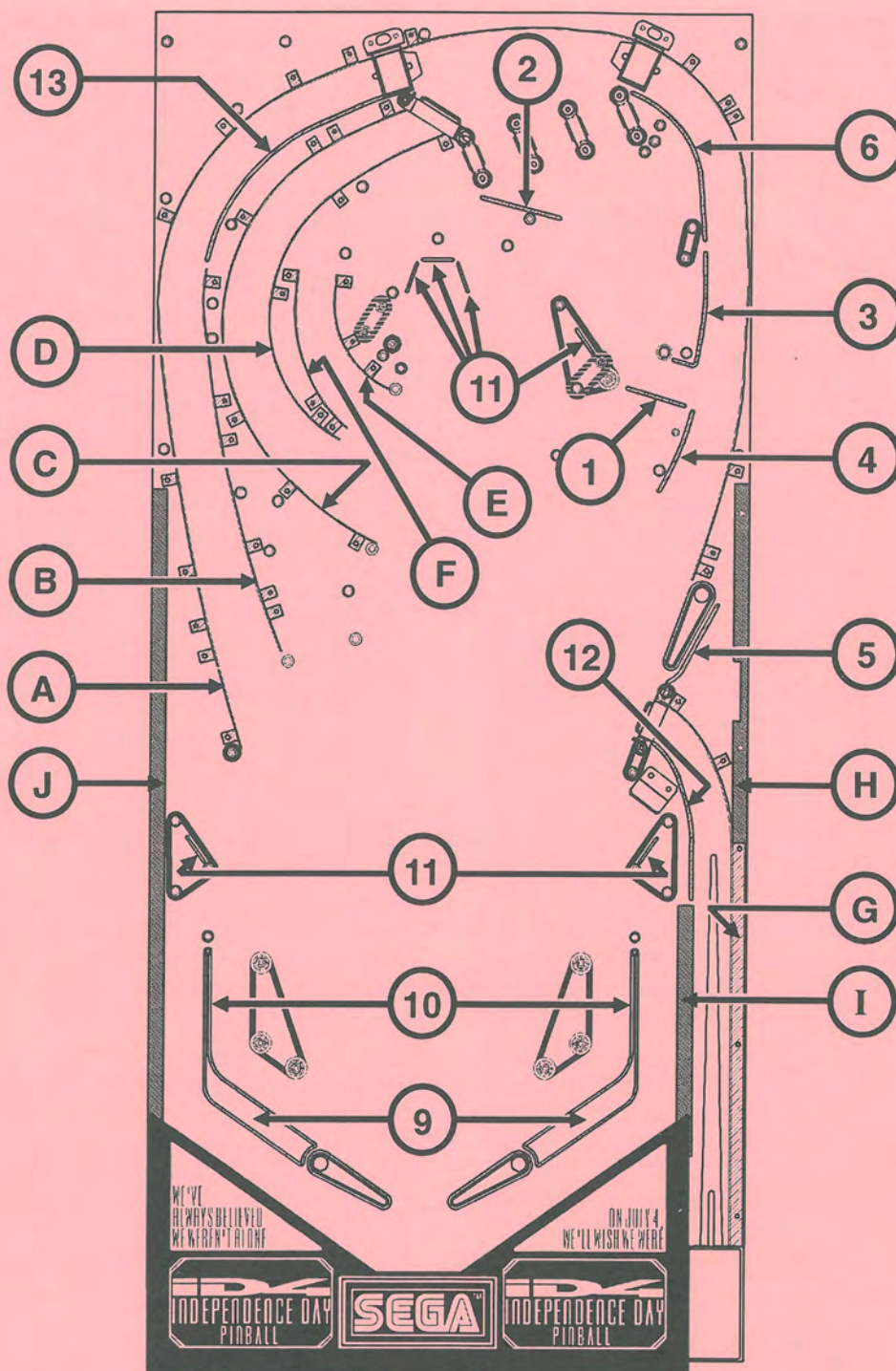
Take Note:

‡ See Section 4, Chapter 2, Assembly Drawings, (with indicated page) to identify the components of each assembly above. Items 4-9 are single part items and are not detailed in Sec. 4, Chapter 2.
Legend Note: Items noted with a white circle (①) are mounted above. Items noted with a black circle (●) are mounted below.

Nº	Assembly Ramp Name	PG.†	Part Nº
1	Right Plastic Ramp Assembly	pg 80	500-6081-00-45
2	Center Plastic Ramp Assembly	pg 81	500-6082-00-45
3	Left Plastic Ramp Assembly	pg 82	500-6083-00-45

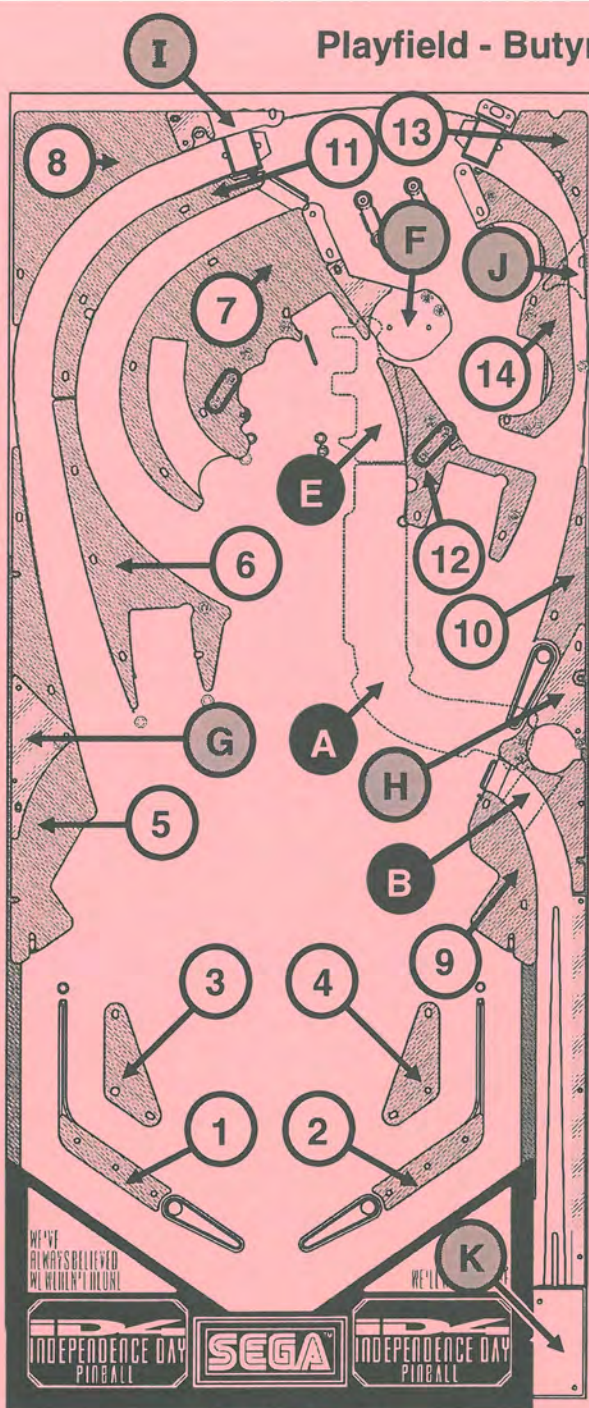
Nº	Wire Ramp Name	PG.	Part Nº	Nº	Trough Name	PG.†	Part Nº
4	Right Side Wire Ramp	n/a	515-6521-00	7	Plastic Under Trough (Large)	n/a	545-5695-00
5	Left Side Wire Ramp	n/a	515-6522-00	8	Metal Under Trough (to VUK)	n/a	515-6573-00
6	VUK Wire Ramp	n/a	515-6575-00	9	Metal Under Trough (Alien Head)	n/a	535-7775-00

Playfield - Rails and Ball Guides



Nº	Rail Name	SPI Part Nº	Nº	Ball Guides / Wire Forms Name	SPI Part Nº
A	Flat Rail #1 - Loop	515-6510-00	1	Ball Guide Rail - 2" (Pops Bottom)	535-5356-01
B	Flat Rail #2 - Inner Left Loop	515-6511-00	2	Ball Guide Rail - 2-3/4" (Pops Top)	535-5356-15
C	Flat Rail #3 - Outer Inside Loop	515-6512-00	3	Ball Guide Rail #3 - Right Orbit Middle	535-7733-00
D	Flat Rail #4 - Inner Inside Loop	515-6513-00	4	Ball Guide Rail #4 - Right Orbit Bottom	535-7734-00
E	Flat Rail #5 - Right Target	535-7659-00	5	Ball Guide Rail #5 - Upper Flipper	535-7735-00
F	Flat Rail #6 - Left Target	535-7660-00	6	Ball Guide Rail #6 - Right Orbit Top	535-7736-00
G	Flat Rail #12 - Right Shooter Lane	535-7667-00	7	Ball Guide Rail #12 - Shooter Lane Left	535-7737-00
H	Routed Wood Rail - 25-3/4"	525-5010-14	8	Ball Guide Rail #13 - Left Orbit Top	535-7738-00
I	Wood Rail - 8-1/2"	525-5007-42	9	Ball Guide Return Lanes (Qty. 2)	550-5037-01
J	Wood Rail - 22-1/2"	525-5007-41	10	Ball Guide Wire Form (Qty. 2)	535-5642-00
			11	Wire Form - 1" (Qty. 6)	535-5300-05

Playfield - Butyrate, Decals and Mylar



Take Note:

- * An asterisk (*) indicates items are not noted in the pictorial.
- 1. To order the entire decal, screened butyrate or clear butyrate sheets, use the Part N° with the "-XX" ending. For individual pieces replace the "-XX" with appropriate last 2-digit number. *Attention: Individual pieces may not be available.*
- 2. **Legend Note:** Items noted with a white circle (I) are mounted above. Items noted with a black circle (1) are "clear" & mounted below; Items with a gray circle (1) are "clear" & mounted above.

N°	Generic Decal Name	SPI Part N°
n/a	"Suitable for Indoor Use Only (UL)"	820-6001-01
n/a	"High Voltage Label (UL)" (Qty. 2)	820-6082-01
n/a	"Pricing Decal Sheet"	820-6094-00
n/a	"Power Box Decal - USA"	820-6123-01
n/a	"Danger Coin Door Label (UL)"	820-6140-00
n/a	"UL Listing Label"	820-6141-00
n/a	"Fuse Lable (UL)"	820-6143-00

N°	Screened Butyrate Name	SPI Part N°
	Buty. Sheet Screened (01-31) (Complete)	830-5485-XX
1	Butyrate 1 - Left Return Lane	830-5485-01
2	Butyrate 2 - Right Return Lane	830-5485-02
3	Butyrate 3 - Left Slingshot	830-5485-03
4	Butyrate 4 - Right Slingshot	830-5485-04
5	Butyrate 5 - Left Side	830-5485-05
6	Butyrate 6 - Left Side Center	830-5485-06
7	Butyrate 7 - Left Top Center	830-5485-07
8	Butyrate 8 - Left Top Corner	830-5485-08
9	Butyrate 9 - Shooter Lane	830-5485-09
10	Butyrate 10 - Right Side	830-5485-10
11	Butyrate 11 - Left Top Middle	830-5485-11
12	Butyrate 12 - Right Top Center	830-5485-12
13	Butyrate 13 - Right Top Corner	830-5485-13
14	Butyrate 14 - Pop Bumper Area	830-5485-14
15 *	Butyrate 15 - Keychain (Alien Body)	830-5485-15
16 *	Butyrate 16 - Keychain (Rt. Upr. Arm)	830-5485-16
17 *	Butyrate 17 - Keychain (Lt. Upr. Arm)	830-5485-17
18 *	Butyrate 18 - Keychain (Rt. Lwr. Arm)	830-5485-18
19 *	Butyrate 19 - Keychain (Lt. Lwr. Arm)	830-5485-19
20 *	Butyrate 20 - Keychain (Right Hand)	830-5485-20
21 *	Butyrate 21 - Keychain (Left Hand)	830-5485-21
22 *	Butyrate 22 - Keychain (Rt. Upr. Leg)	830-5485-22
23 *	Butyrate 23 - Keychain (Lt. Upr. Leg)	830-5485-23
24 *	Butyrate 24 - Keychain (Rt. Lwr. Leg)	830-5485-24
25 *	Butyrate 25 - Keychain (Lt. Lwr. Leg)	830-5485-25
26 *	Butyrate 26 - Keychain (Right Foot)	830-5485-26
27 *	Butyrate 27 - Keychain (Left Foot)	830-5485-27
28 *	Butyrate 28 - Keychain (Right Face)	830-5485-28
29 *	Butyrate 29 - Keychain (Left Face)	830-5485-29
30 *	Butyrate 30 - Keychain (Alien Head)	830-5485-30
31 *	Butyrate 31 - Keychain (Destroyer Ship)	830-5485-31

Make a puppet with Items 15-29, assemble with screws or rivets!

N°	Clear Butyrate Name	SPI Part N°
	Buty. Sheet Clear (01-11) (Complete)	830-5902-XX
A	Butyrate 01 - Plastic Under Trough	830-5902-01
B	Butyrate 02 - Metal Under Trough	830-5902-02
C	Butyrate 03 - Extra Left Slingshot	830-5902-03
D	Butyrate 04 - Extra Right Slingshot	830-5902-04
E	Butyrate 05 - Plastic Under Trough	830-5902-05
F	Butyrate 06 - Pop Bumper Area	830-5902-06
G	Butyrate 07 - Left Side	830-5902-07
H	Butyrate 08 - Right Side	830-5902-08
I	Butyrate 09 - Left Top Corner	830-5902-09
J	Butyrate 10 - On Left Plastic Ramp	830-5902-10
K	Butyrate 11 - Bottom Arch	830-5902-11

N°	Mylar Name	SPI Part N°
n/a	ID4 Mylar Sheet (Complete)	820-5859-00
n/a	Mylar Slingshot Area (Qty. 2)	820-5821-00
n/a	Mylar Pad - Ball Drop (Qty. 2)	820-5815-00
n/a	Mylar Cover Discs (Cabinet) (Qty. 2)	820-5041-00

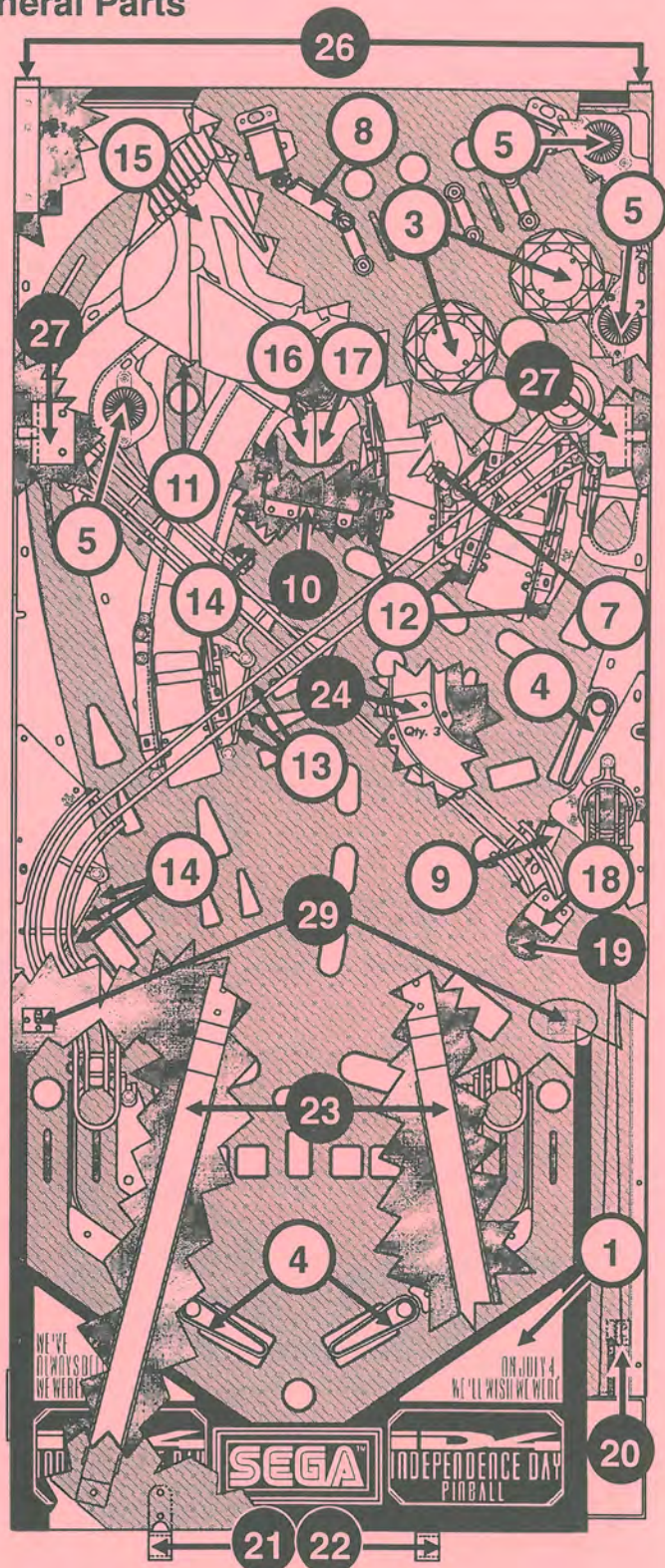
N°	ID4 Decal Name	SPI Part N°
	ID4 Decal Sheet (Complete)	820-6137-XX
Bottom Arch: -01 Left; -02 Right; -03 Center; -06 Ball Shooter;		
Ramps: -07 Rt. Entrance; -08 Lt. Entrance; -09 Center Entrance;		
Misc: -04 Service Switch Set; -05 Install 4 Balls;		
n/a	"ID4 Backbox Fuse Locations"	820-6152-45

Playfield - General Parts

Nº	Above Playfield Name	SPI Part Nº
1	Bottom Arch Assembly (Plastic)	500-6005-00-45
ORDERING ABOVE (ITEM 1) ASSEMBLY PART Nº WILL INCLUDE:		
1A*	Bottom Arch with "Fork" (Plain)	545-5302-07
1B*	#6-32 X 1-1/4" PPH MS (Qty. 2)	237-5508-00
1C*	Spacer 3/4" Plastic 3/8" (Gray) (Qty. 2)	254-5000-07
1D*	#6-32 Nylon Stop Nut (Qty. 2)	240-5005-00
1E*	Bottom Arch Shooter Lane Butyrate -11	830-5902-11
1F*	Nelson Protect Strip 8-9/16" (Qty. 2)	545-5212-02
2 *	1-1/16" Steel Balls (Qty. 4)	260-5000-00
3	Pop Bumper Cap Clear (Qty. 2)	550-5057-01
4	Flipper & Shaft Assy. Teal Green with Sega Saturn™ Logo ©96 (Qty. 3)	515-5133-13-05
5	Mini-Mars Light Cover Red (Qty. 3)	550-5031-02
6 *	Rubber Light Cover Green (Qty. 5)	545-5014-04
7	Light Reflector	545-5409-01
8	1-Way Gate Mounting Bracket	535-5269-06
	Wire Gate (for above)	535-5307-09
9	1-Way Gate Mounting Bracket	535-5269-03
	Wire Gate (for above)	535-5307-03
Note: For Control Gates or 1-Way Gates on Ramps, see Section 4, Chapter 2, Assembly Drawings.		
10	OPTO Assembly	515-6583-00-45
ORDERING ABOVE (ITEM 10) SUB-ASSY. PART Nº WILL INCLUDE:		
10A*	OPTO Bracket	515-6579-00
10B*	OPTO Transmitter Board	520-5082-00
10C*	OPTO Receiver Board	520-5083-00
10D*	Washer - 9/64 (Qty. 4)	242-5019-00
10E*	#4-40 X 5/8" PPH Screw (Qty. 4)	237-5832-00
11	1" Sq. S-U Target Red	500-5232-02
12	Narrow S-U Target Green (Qty. 3)	500-5857-04
13	Narrow S-U Target Blue (Qty. 3)	500-5857-05
14	Narrow S-U Target Yellow (Qty. 4)	500-5857-06
Note: For Items 11-14, see Section 4, Chapter 2, (last page) for balance of items of above Target Assemblies.		
15	ID4 Toy Ship (shown partial)	545-5700-01
Note: The above Item 15 is attached to the Back Panel Assembly, 500-6034-00-45, a Major Assembly.		
16	Plastic Alien Head Left Side	545-5717-01
17	Plastic Alien Head Right Side	545-5718-01
Note: The above Items 16 & 17 are parts of the Alien Head Assy., 500-6145-00-45, a Major Assy.		
18	Ball Stop Bracket	535-7280-01
19	Anti-Ball Jam Bracket (in VUK Trough)	535-7870-00

Nº	Below Playfield Name	SPI Part Nº
20	Shooter Lane Micro-Switch Assembly	500-5498-01-XX
ORDERING ABOVE (ITEM 20) ASSY. PART Nº WILL INCLUDE:		
20A*	Micro Switch Bracket	535-6173-00
20B*	Micro Switch	180-5100-01
20C*	#2-56 X 3/8" HWH TF SERR (Qty. 2)	237-5938-00
20D*	Diode, 1N4003	112-5001-00
21	Playfield Hanging Bracket (Qty. 2)	535-5216-04
22	Hanging Bracket Support Block (Qty. 2)	525-5433-00
23	Playfield Support Slide Bracket (Qty. 2)	535-6862-02
24	Plastic Trough Hanging Brackets (Qty. 3)	535-7764-00
25 *	Switch Bracket (for all troughs) (Qty. 5)	535-7319-00
26	Edge Slide Bracket (Qty. 2)	535-5988-00
27	Pivot Pin Bracket Assembly (Qty. 2)	500-5329-01
ORDERING ABOVE (ITEM 27) ASSY. PART Nº WILL NOT INCLUDE:		
27A*	Pivot Bracket Screws (Qty. 4)	237-5907-00
27B*	T-Nuts (Qty. 4)	240-5101-00
28 *	Lamp Protect Fiche Paper (Qty. 2)	545-5721-00
29	Outlane Adjustable Post Plate (Qty. 2)	535-5091-02

P1 *	Playfield Screened (No Parts)	830-5145-00
P2 *	Playfield Complete with all Parts	505-6004-45-45

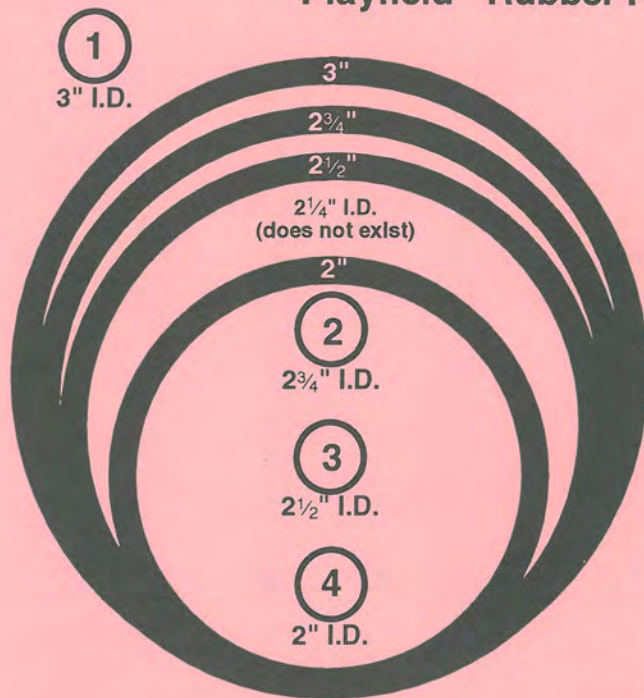


Take Note:

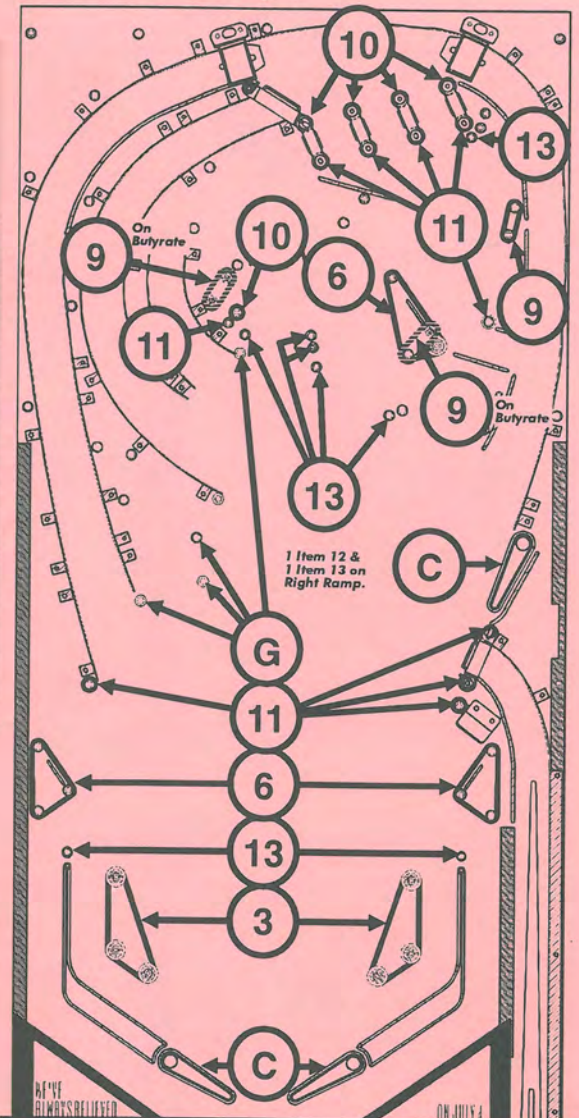
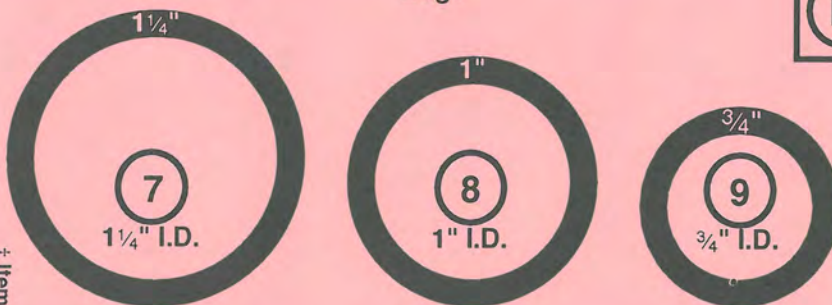
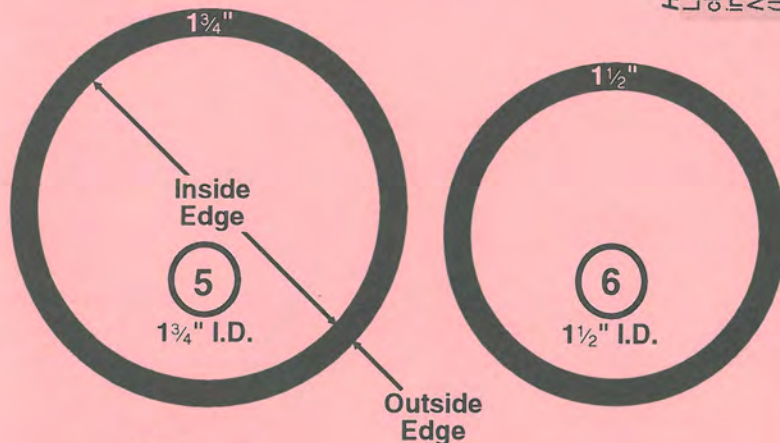
* An asterisk (*) indicates items are not noted in the pictorial.

- For rubber parts, metal & plastic posts, sockets & bulbs, see the following pages in this chapter.
- See Section 4, Chapter 2, for balance of items which are part of or attached to a Major Assembly.
- Legend Note:** Items noted with a white circle (1) are mounted above. Items noted with a black circle (2) are mounted below.

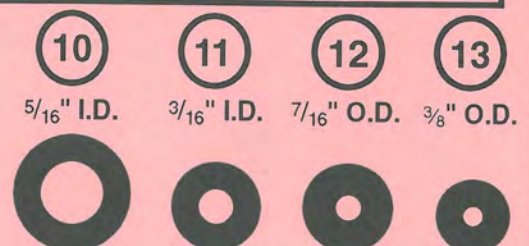
Playfield - Rubber Parts (Rings Actual Size) †



How to measure:
Lay ring over circle of closest size. If you see the outside edge of the circle, move to one ring smaller. With the correct size you will see the inside edge of the circle around the inside of the rubber ring.
Note: The rings will *stretch* with use. Always go to the size smaller.
(I.D. = Inside Diameter; O.D. = Outside Diameter)



D Rubber Bumpers (Qty. 4) are all located on the following assemblies: • Auto (Ball) Launch • Trough VUK • Lock Ball • Super VUK



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

Nº	Rubber Part Name	QTY.	Part Nº	Nº	Rubber Part Name	QTY.	Part Nº
A	Rubber Bushing (Small)	0	545-5192-00	4	2" I.D. Black Rubber Ring	0	545-5348-08
B	Small Flipper Rubber Ring	0	545-5207-00	5	1 3/4" I.D. Black Rubber Ring	0	545-5348-21
C	Large Flipper Rubber Ring	3	545-5277-00	6	1 1/2" I.D. Black Rubber Ring	3	545-5348-07
D	Rubber Bumper (Grommet)	4	545-5105-00	7	1 1/4" I.D. Black Rubber Ring	0	545-5348-06
E	Bumper Post Rubber	0	545-5009-00	8	1" I.D. Black Rubber Ring	0	545-5348-05
F	Post Rubber (Sleeve Short)	0	545-5151-00	9	3/4" I.D. Black Rubber Ring	3	545-5348-04
G	Post Rubber (Sleeve Tall)	4	545-5308-00	10	5/16" I.D. Black Rubber Ring	5	545-5348-02
1	3" I.D. BLK Rubber Ring	0	545-5348-10	11	3/16" I.D. Black Rubber Ring	10	545-5348-01
2	2 3/4" I.D. Black Rubber Ring	0	545-5348-20	12	7/16" O.D. Black Rubber Ring	1	545-5348-17
3	2 1/2" I.D. Black Rubber Ring	2	545-5348-09	13	3/8" O.D. Black Rubber Ring	9	545-5348-19

Playfield - Metal Posts and Nuts (Actual Size) †

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



Item 1 Post used in pairs can use 3/16" Rubber Rings 545-5348-01 (See Rubber Parts for Part N's)



Top & Side Views

Not Shown:
• #6-32 Nylon Stop Nut with 1/4" Hex Body: 240-5010-00
• #8-32 Nylon Stop Nut: 240-5102-00
• #10-32 Nylon Stop Nut: 240-5203-00

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



Bottom & Side Views

Not Shown:
• #6-32 KEPS Nut with 1/4" Hex Body: 240-5011-00
• #8-32 KEPS Nut: 240-5104-00
• #10-32 KEPS Nut: 240-5208-00

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



Bottom & Side Views

Not Shown:
• #6-32 T-Nut with Side Cut Off: 240-5002-01
• #8-32 T-Nut: 240-5101-00
• #10-32 T-Nut: 240-5007-00
• #10-32 T-Nut with Side Cut Off: 240-5205-00

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



Top View

Not Shown:
• #8-32 Hex Nut: 240-5003-00
• #10-32 Hex Nut: 240-5201-00



can use a Post Rubber Sleeve (Tail) 545-5308-00



can use a Post Rubber Sleeve (Tail) 545-5308-00



can use a Post Rubber Sleeve (Tail) 545-5308-00



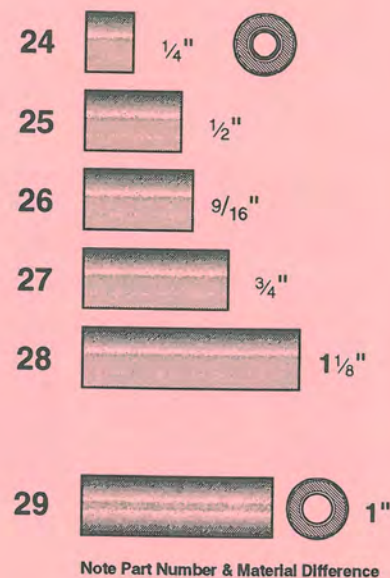
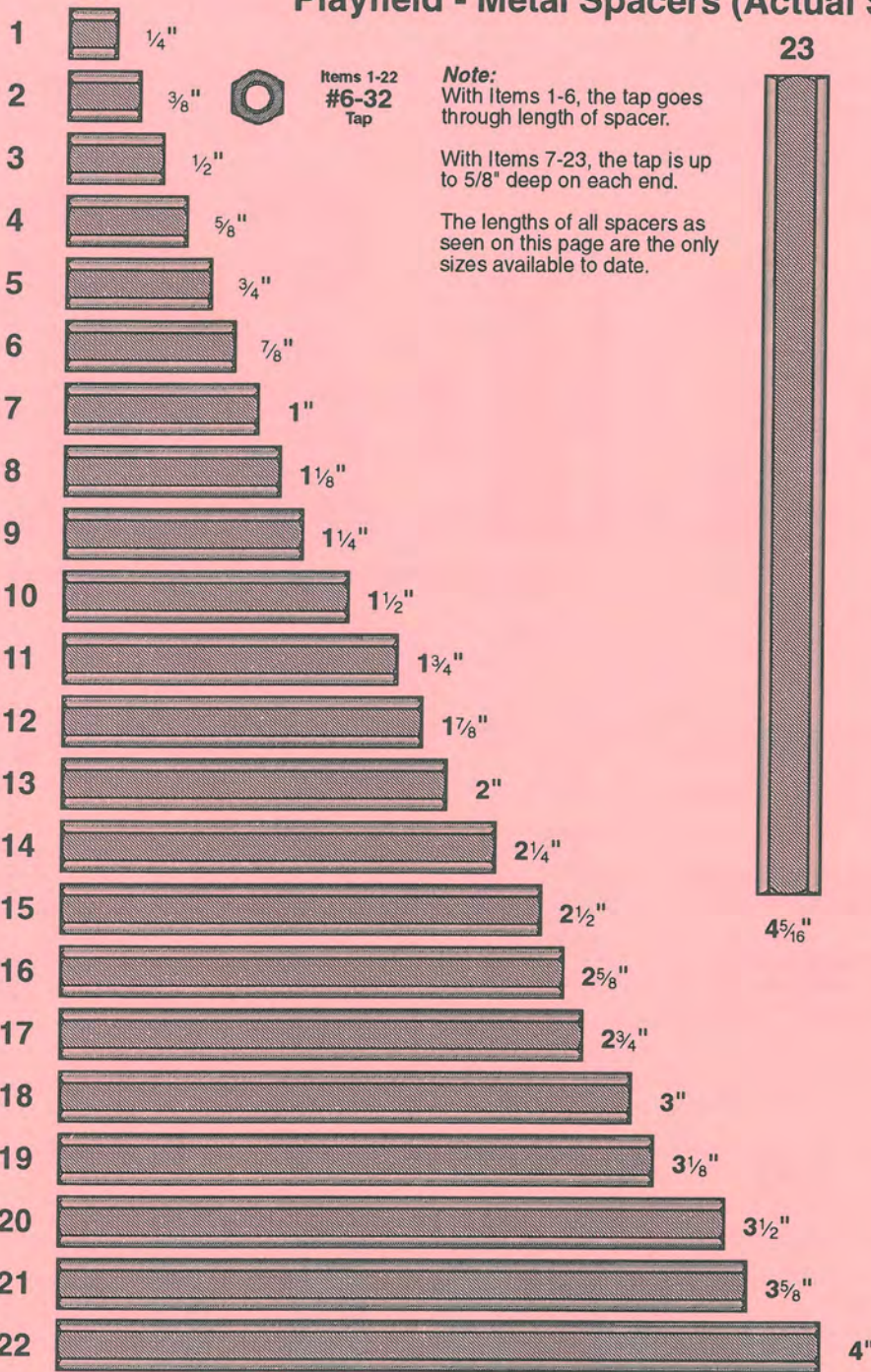
Nº	Metal Post Name	QTY.	Part N°	Nº	Metal Post Name	QTY.	Part N°
1	Stand-Off Double Groove Post 1 1/16"	0	530-5102-00	7B	Post #6-32 Top / Wood Screw Bottom	15	530-5010-02
2	Mini-Post Wood Screw	3	530-5004-00	8A	Post Hex Base #8-32 Tap/#10-32 Bot.	4	530-5332-01
3	Mini-Post Wood Screw (no cut-away)	0	530-5004-01	8B	Post Hex Base (No Tap)/#10-32 Bot.	1	530-5332-00
4	Mini-Post #10-32 Bottom	7	530-5005-00	8C	Post Hex Base #8-32 Top/#10-32 Bot.	0	530-5332-02
5	Post #6-32 Top / #8-32 Bottom	0	530-5007-00	8D	Post Hex Base #6-32 Top/#10-32 Bot.	1	530-5332-03
6	Post #8-32 Top / #6-32 Bottom	3	530-5008-00	9	Post #6-32 Tap / #6-32 Bottom	0	530-5127-00
7A	Post #6-32 Top / #6-32 Bottom	19	530-5012-02	10	Post #6-32 Top / Wood Screw Bottom	5	530-5263-01
				11	Playfield Support #8-32 Top/Bottom	0	530-5285-00

Some other nuts (Not Shown / Not Used with above posts):

• #10-24 T-Nut, 240-5200-00 • #10-24 Hex, 240-5202-00 • #10-24 Nylon Stop, 240-5206-00 • #10-24 KEPS, 240-5207-00
• #6-32 Acorn Cap (WHT), 240-5000-00 • #6-32 Acorn Cap (BLK), 240-5006-00 • #6-32 Wing, 240-5001-00 • #8-32 Wing, 240-5100-00

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

Playfield - Metal Spacers (Actual Size) †



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

Nº	Metal Spacer Name	QTY.	Part Nº	Nº	Metal Spacer Name	QTY.	Part Nº
1	1/4" X 1/4" Hex Spacer #6-32 Tap	6	254-5008-00	16	2 5/8" X 1/4" Hex Spacer #6-32 Tap	0	254-5008-08
2	3/8" X 1/4" Hex Spacer #6-32 Tap	1	254-5008-12	17	2 3/4" X 1/4" Hex Spacer #6-32 Tap	0	254-5008-15
3	1/2" X 1/4" Hex Spacer #6-32 Tap	8	254-5008-03	18	3" X 1/4" Hex Spacer #6-32 Tap	0	254-5008-14
4	5/8" X 1/4" Hex Spacer #6-32 Tap	4	254-5008-02	19	3 1/8" X 1/4" Hex Spacer #6-32 Tap	1	254-5008-19
5	3/4" X 1/4" Hex Spacer #6-32 Tap	3	254-5008-04	20	3 1/2" X 1/4" Hex Spacer #6-32 Tap	1	254-5008-27
6	7/8" X 1/4" Hex Spacer #6-32 Tap	2	254-5008-05	21	3 5/8" X 1/4" Hex Spacer #6-32 Tap	0	254-5008-25
7	1" X 1/4" Hex Spacer #6-32 Tap	0	254-5008-06	22	4" X 1/4" Hex Spacer #6-32 Tap	0	254-5008-21
8	1 1/8" X 1/4" Hex Spacer #6-32 Tap	1	254-5008-17	23	4 5/16" X 5/16" Hex Spacer #6-32 Tap	0	254-5018-00
9	1 1/4" X 1/4" Hex Spacer #6-32 Tap	1	254-5008-11	24	1/4" X 5/16" X .144" I.D. Spacer Tap.	0	254-5014-03
10	1 1/2" X 1/4" Hex Spacer #6-32 Tap	4	254-5008-09	25	1/2" X 5/16" X .144" I.D. Spacer Tap.	0	254-5014-00
11	1 3/4" X 1/4" Hex Spacer #6-32 Tap	0	254-5008-10	26	9/16" X 5/16" X .144" I.D. Spacer Tap.	0	254-5014-04
12	1 7/8" X 1/4" Hex Spacer #6-32 Tap	0	254-5008-20	27	3/4" X 5/16" X .144" I.D. Spacer Tap.	0	254-5014-01
13	2" X 1/4" Hex Spacer #6-32 Tap	2	254-5008-07	28	1 1/8" X 5/16" X .144" I.D. Spacer Tap.	0	254-5014-02
14	2 1/4" X 1/4" Hex Spacer #6-32 Tap	0	254-5008-18	29	1" X 5/16" X .144" I.D. Spacer Tap.	5	254-5001-00
15	2 1/2" X 1/4" Hex Spacer #6-32 Tap	1	254-5008-16	30	Spacer (for Backbox Hinge)	2	530-5099-00

Playfield - Plastic Posts and Spacers (Actual Size) †

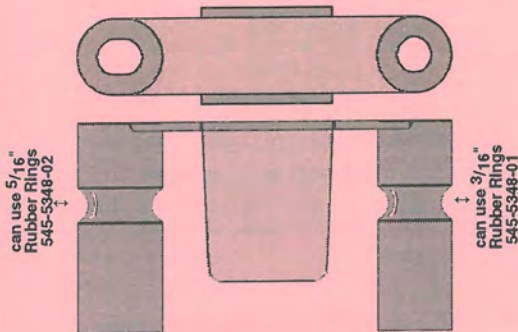
1 * Various Colors

2 * Various Colors

3 * New Color

4 * Various Colors

5 * Various Colors



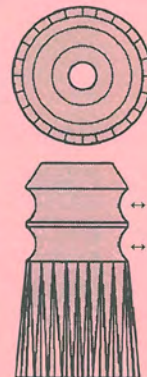
can use a Post Rubber Sleeve (Short) 545-5151-00



can use 3/16" Rubber Rings 545-5348-01



can use 5/16" Rubber Rings 545-5348-02



can use 5/16" Rubber Rings 545-5348-02

Items 3-5 Posts used in pairs can use 3/4" through 3" Rubber Rings (See Rubber Parts for Part N^os)

Take Note:

* Items 1-2 and 4-5 come in various colors, see the Plastic Part Color Chart at the end of Section 4, Chapter 2. Replace the last 2-digits (or -XX) with desired color replacement (These posts may not be available in every color.). Item 3 is currently available in Teal Green for this game only; normally it is Black.

‡ Items 6, 7 & 8 (Light Board Spacers) dimensions are measured from bottom to just under cut-away (see pictorial to the right).

—Items 10-17 Spacers are used in conjunction with Metal Posts (see Items 6, 7A & 7B on that page) and/or a #6-32 1 3/4" PPH Screw (237-5511-00) with a #6-32 Nylon Stop Nut (240-5005-00).

6 ‡



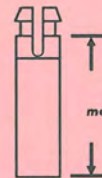
1/4"

7 ‡



3/8"

8 ‡



3/4"

‡ 6, 7, & 8 dimension is measured from this point.

9



1/2"

10

11

12

13

14

15

16

17



1/4"



3/8"



1/2"



5/8"



3/4"



1"



1 1/8"



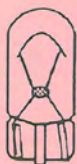
1 1/4"

N ^o	Plastic Post/Spacer Name	QTY.	Part N ^o	N ^o	Plastic Post/Spacer Name	QTY.	Part N ^o
1 *	Top Lane Mini-Light Hood Teal Green	4	550-5061-13	9	1/2" X 1/4" Spacer White (Narrow)	0	254-5000-03
2 *	Mini-Jewel Post Clear	26	550-5052-01	10	1/4" X 3/8" Spacer Gray	0	254-5000-02
3 *	1 1/16" Stand-Off Single Groove Post	43	550-5059-13	11	3/8" X 3/8" Spacer Gray	0	254-5000-12
4 *	Single Groove Jewel Post Clear	7	550-5034-01	12	1/2" X 3/8" Spacer Gray	0	254-5000-01
5 *	Double Groove Jewel Post	0	545-5209-XX	13	5/8" X 3/8" Spacer Gray	0	254-5000-14
6 ‡	1/4" Sif. Rtn. Spacer White	0	254-5007-02	14	3/4" X 3/8" Spacer Gray	3	254-5000-07
7 ‡	3/8" Sif. Rtn. Spacer White	30	254-5007-01	15	1" X 3/8" Spacer Gray	2	254-5000-04
8 ‡	3/4" Sif. Rtn. Spacer White	0	254-5007-03	16	1 1/8" X 3/8" Spacer Gray	0	254-5000-06
				17	1 1/4" X 3/8" Spacer Gray	1	254-5000-05

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

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

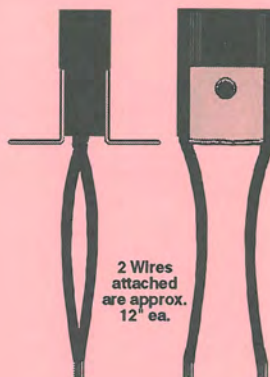
A
#555



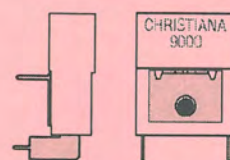
1
This socket is normally used on Light Boards to position bulbs vertically. (Use w/#555 & #906 Bulbs.)



2
This socket is normally used in Pop Bumpers. (Use #555 Bulbs only.)



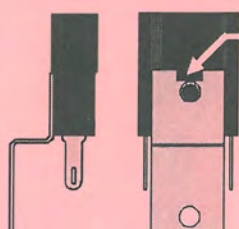
3
This socket is normally used on Light Boards to position bulbs horizontally. (Use w/#555 & #906 Bulbs.)



Replacement Note:
Socket color may be either black or white.

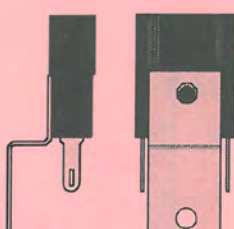
4

This socket is normally used with Reflectors.

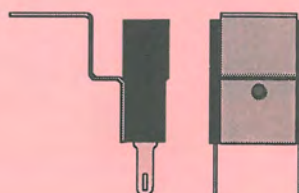


Note the notch.

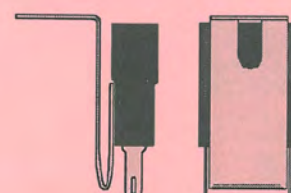
5



6



7



Replacement Note:
If this style socket is desired, order Item 6 for replacement. This socket is not available.

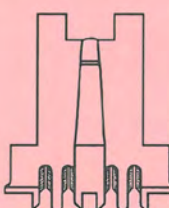
B
#906



8
This socket is sometimes used in conjunction with Mini-Mars or special Butyrate assemblies.



9
This socket was used with an alternate insert using Insulation Displacement Connection vs. a Soldered-On Connection.



C
Neon



This Neon Bulb is used with Motors for voltage spike suppression.

D
OPTO LED



This OPTO LED (Ultra Bright Red) is used on OPTO Boards only.

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

Nº	#555 Bulb & Socket Name	QTY.	Part Nº	Nº	#906 Bulb & Socket Name	QTY.	Part Nº
A	#555 Wedge Base Bulb	42	165-5002-00	B	#906 Wedge Base Bulb	2	165-5004-00
1	#555 Wedge Base (WB) Socket	21	077-5007-00	8	#906 Wedge Base Socket	0	077-5016-00
2	Turbo Pop Bumper Socket	3	077-5206-00	9	#555/#906 IDC Wedge Base Socket	0	077-5110-00
3	Light Board Laydown WB Socket	16	077-5207-00				
4	Laydown WB Socket (with notch)	4	077-5026-01	Nº	Miscellaneous Bulb Name	QTY.	Part Nº
5	Laydown WB Socket (without notch)	0	077-5026-00	C	Neon NE-2 Bulb (used with Motors)	0	165-5021-00
6	WB Offset Socket (Step-Bracket)	0	077-5029-00	D	LED (MT5000UR) Ultra Bright OPTO	4	165-5100-00
7	WB Offset Socket (use Item 6)	0	077-5029-01				

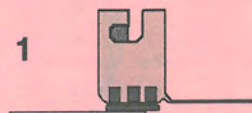
See start of this chapter for Fluor. Bulb & assoc. parts.

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

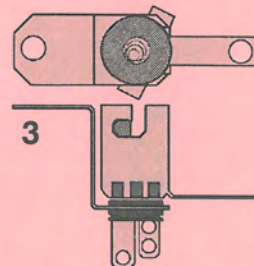
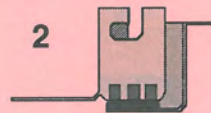
**A
#44**



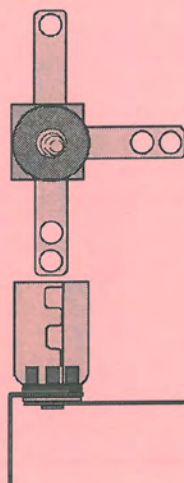
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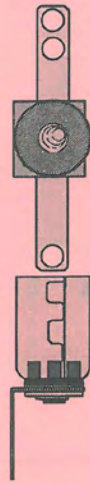
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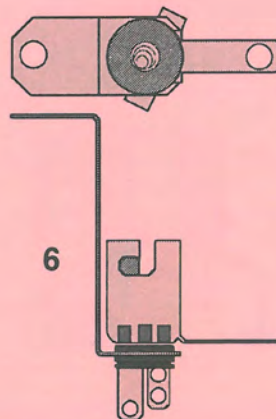
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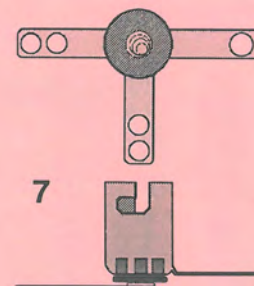
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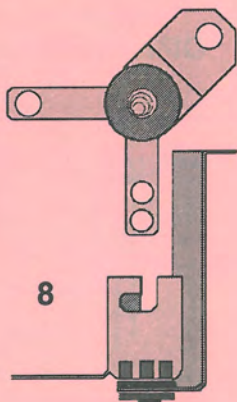
5



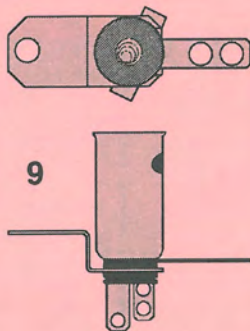
6



7



8

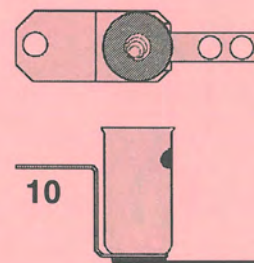


9

**B
#455**



This bulb is normally used in conjunction with this socket (Item 10), but can be used with the other sockets (Items 1-9).



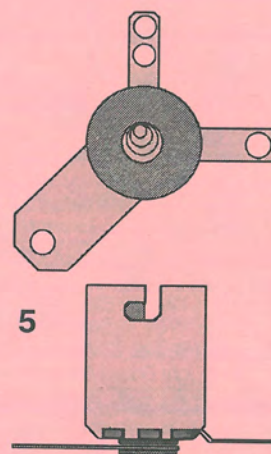
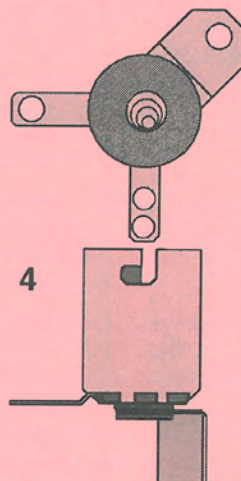
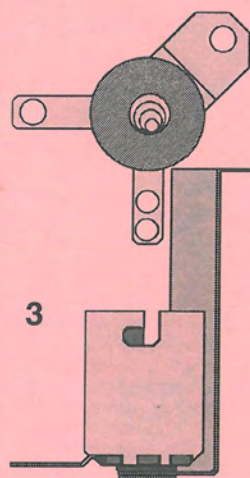
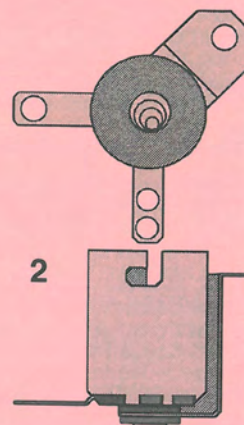
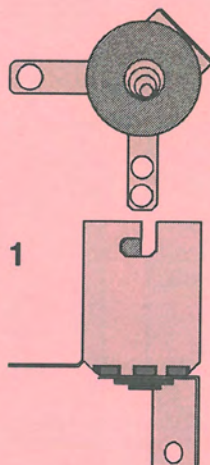
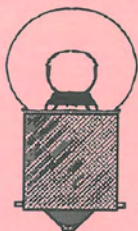
10

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

Nº	#44 Bulb & Socket Name	QTY.	Part Nº	Nº	#44 Socket Name	QTY.	Part Nº
A	#44 Bulb	60	165-5000-44	7	3-Lug Staple Down Socket	0	077-5001-00
1	2-Lug Staple Down Socket	32	077-5000-00	8	2-Lug Stand-Up Long Socket	0	077-5005-00
2	2-Lug Stand-Up Short Socket	6	077-5002-00	9	3-Lug Stand-Up Long Shell Socket	0	077-5013-00
3	3-Lug Stand-Up Short Socket	0	077-5008-00				
4	3-Lug Laydown Socket	7	077-5006-00	Nº	#455 Bulb & Socket Name	QTY.	Part Nº
5	2-Lug Laydown Socket	0	077-5003-00	B	#455 Twinkle Bulb	0	165-5003-00
6	3-Lug Stand-Up Long Socket	15	077-5009-00	10	1-Lug Stand-Up Long Shell Socket	0	077-5012-00

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

C
#89

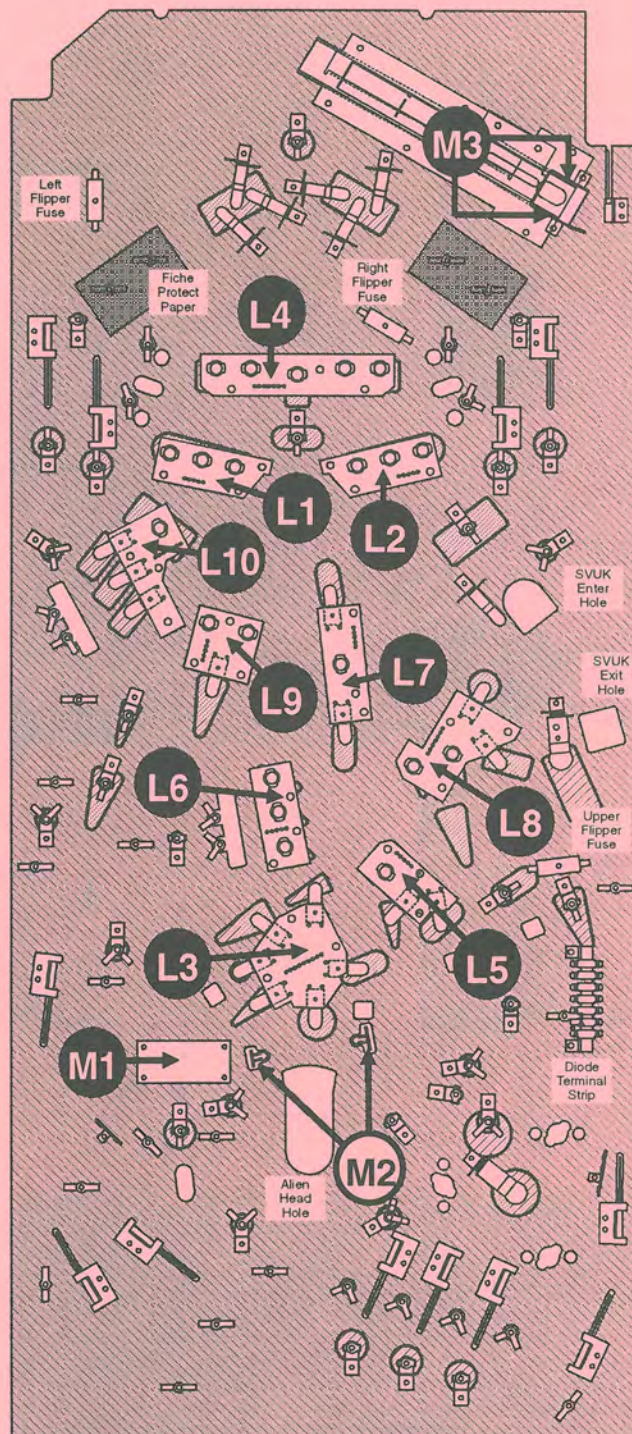


† Items with Ø Qty. are not used in this game.
Size and/or quantities may change during production.

Nº	#89 Bulb & Socket Name	QTY.	Part Nº	Nº	#89 Socket Name	QTY.	Part Nº
C	#89 Bulb	14	165-5000-89	3	2-Lug Stand-Up Long Socket	2	077-5102-00
1	Laydown Standard Socket	1	077-5100-00	4	Stand-Up Socket Rev. Short	0	077-5103-00
2	2-Lug Stand-Up Short Socket	11	077-5101-00	5	Straight Leg Socket	0	077-5107-00

Playfield - Light, Servo Motor and OPTO Boards

Nº	Light Board Name	SPI Part Nº
L1	ID4 Light Board Assembly - 1	515-6399-01-45
ORDERING ABOVE (ITEM L1) ASSEMBLY PART Nº WILL INCLUDE:		
—	Light Board -01	520-5149-01
—	#555 Wedge Base Socket (Qty. 3)	077-5007-00
—	#555 Wedge Base Bulb (Qty. 3)	165-5002-00
—	Spacer 3/8" Plastic Slf. Rtn. (Qty. 3)	254-5007-01
L2	ID4 Light Board Assembly - 2	515-6399-02-45
ORDERING ABOVE (ITEM L2) ASSEMBLY PART Nº WILL INCLUDE:		
—	Light Board -02	520-5149-02
—	#555 Wedge Base Socket (Qty. 3)	077-5007-00
—	#555 Wedge Base Bulb (Qty. 3)	165-5002-00
—	Spacer 3/8" Plastic Slf. Rtn. (Qty. 3)	254-5007-01
L3	ID4 Light Board Assembly - 3	515-6399-03-45
ORDERING ABOVE (ITEM L3) ASSEMBLY PART Nº WILL INCLUDE:		
—	Light Board -03	520-5149-03
—	#555 Wedge Base Bulb (Qty. 6)	165-5002-00
—	Laydown Wedge Base Socket (Qty. 6)	077-5207-00
—	Spacer 3/8" Plastic Slf. Rtn. (Qty. 3)	254-5007-01
L4	ID4 Light Board Assembly - 4	515-6399-04-45
ORDERING ABOVE (ITEM L4) ASSEMBLY PART Nº WILL INCLUDE:		
—	Light Board -04	520-5149-04
—	#555 Wedge Base Socket (Qty. 5)	077-5007-00
—	#555 Wedge Base Bulb (Qty. 5)	165-5002-00
—	Spacer 3/8" Plastic Slf. Rtn. (Qty. 3)	254-5007-01
L5	ID4 Light Board Assembly - 5	515-6399-05-45
ORDERING ABOVE (ITEM L5) ASSEMBLY PART Nº WILL INCLUDE:		
—	Light Board -05	520-5149-05
—	#555 Wedge Base Socket	077-5007-00
—	#555 Wedge Base Bulb (Qty. 3)	165-5002-00
—	Laydown Wedge Base Socket (Qty. 2)	077-5207-00
—	Spacer 3/8" Plastic Slf. Rtn. (Qty. 3)	254-5007-01
L6	ID4 Light Board Assembly - 6	515-6399-06-45
ORDERING ABOVE (ITEM L6) ASSEMBLY PART Nº WILL INCLUDE:		
—	Light Board -06	520-5149-06
—	#555 Wedge Base Socket (Qty. 3)	077-5007-00
—	#555 Wedge Base Bulb (Qty. 3)	165-5002-00
—	Spacer 3/8" Plastic Slf. Rtn. (Qty. 3)	254-5007-01
L7	ID4 Light Board Assembly - 7	515-6399-07-45
ORDERING ABOVE (ITEM L7) ASSEMBLY PART Nº WILL INCLUDE:		
—	Light Board -07	520-5149-07
—	#555 Wedge Base Socket	077-5007-00
—	#555 Wedge Base Bulb (Qty. 3)	165-5002-00
—	Laydown Wedge Base Socket (Qty. 2)	077-5207-00
—	Spacer 3/8" Plastic Slf. Rtn. (Qty. 3)	254-5007-01
L8	ID4 Light Board Assembly - 8	515-6399-08-45
ORDERING ABOVE (ITEM L8) ASSEMBLY PART Nº WILL INCLUDE:		
—	Light Board -08	520-5149-08
—	#555 Wedge Base Socket (Qty. 2)	077-5007-00
—	#555 Wedge Base Bulb (Qty. 4)	165-5002-00
—	Laydown Wedge Base Socket (Qty. 2)	077-5207-00
—	Spacer 3/8" Plastic Slf. Rtn. (Qty. 3)	254-5007-01
L9	ID4 Light Board Assembly - 9	515-6399-09-45
ORDERING ABOVE (ITEM L9) ASSEMBLY PART Nº WILL INCLUDE:		
—	Light Board -09	520-5149-09
—	#555 Wedge Base Socket (Qty. 2)	077-5007-00
—	#555 Wedge Base Bulb (Qty. 3)	165-5002-00
—	Laydown Wedge Base Socket	077-5207-00
—	Spacer 3/8" Plastic Slf. Rtn. (Qty. 3)	254-5007-01
L10	ID4 Light Board Assembly - 10	515-6399-10-45
ORDERING ABOVE (ITEM L10) ASSEMBLY PART Nº WILL INCLUDE:		
—	Light Board -10	520-5149-10
—	#555 Wedge Base Socket	077-5007-00
—	#555 Wedge Base Bulb (Qty. 4)	165-5002-00
—	Laydown Wedge Base Socket (Qty. 3)	077-5207-00
—	Spacer 3/8" Plastic Slf. Rtn. (Qty. 3)	254-5007-01



Playfield is shown in the "Up Position" as leaning against the Backbox.

Take Note:

1. Individual Light Boards can only be ordered as assemblies.
2. Sockets, bulbs & spacers may be ordered separately.
3. For pictorials of Sockets, Bulbs & Spacers, view previous pages.
4. **Legend Note:** Items noted with a white circle (①) are mounted above. Items noted with a black circle (●) are mounted below.

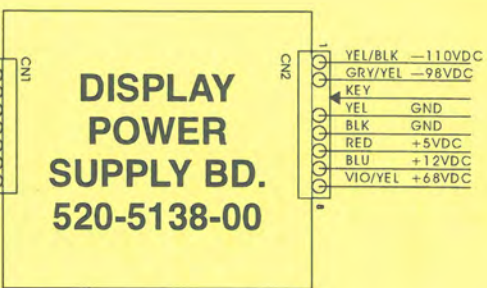
Section 5 Schematics & Troubleshooting



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Chapter 1 of 4



INDEPENDENCE DAY
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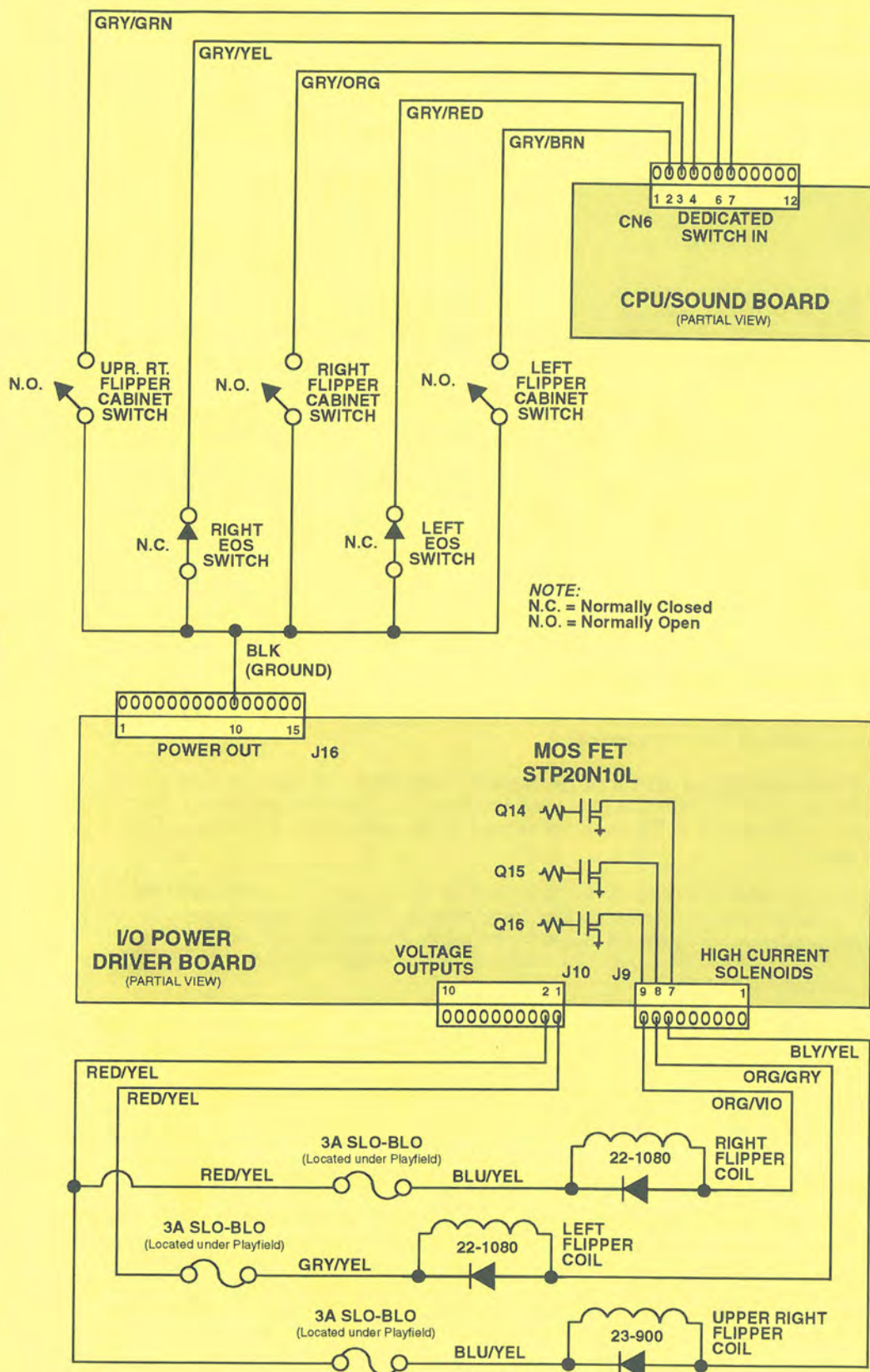
Section 5 | Backbox



Playfield Wiring

New 3-Flipper Circuit Wiring Diagram (No SSFB Required!)

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 msec for the duration of the hold cycle.

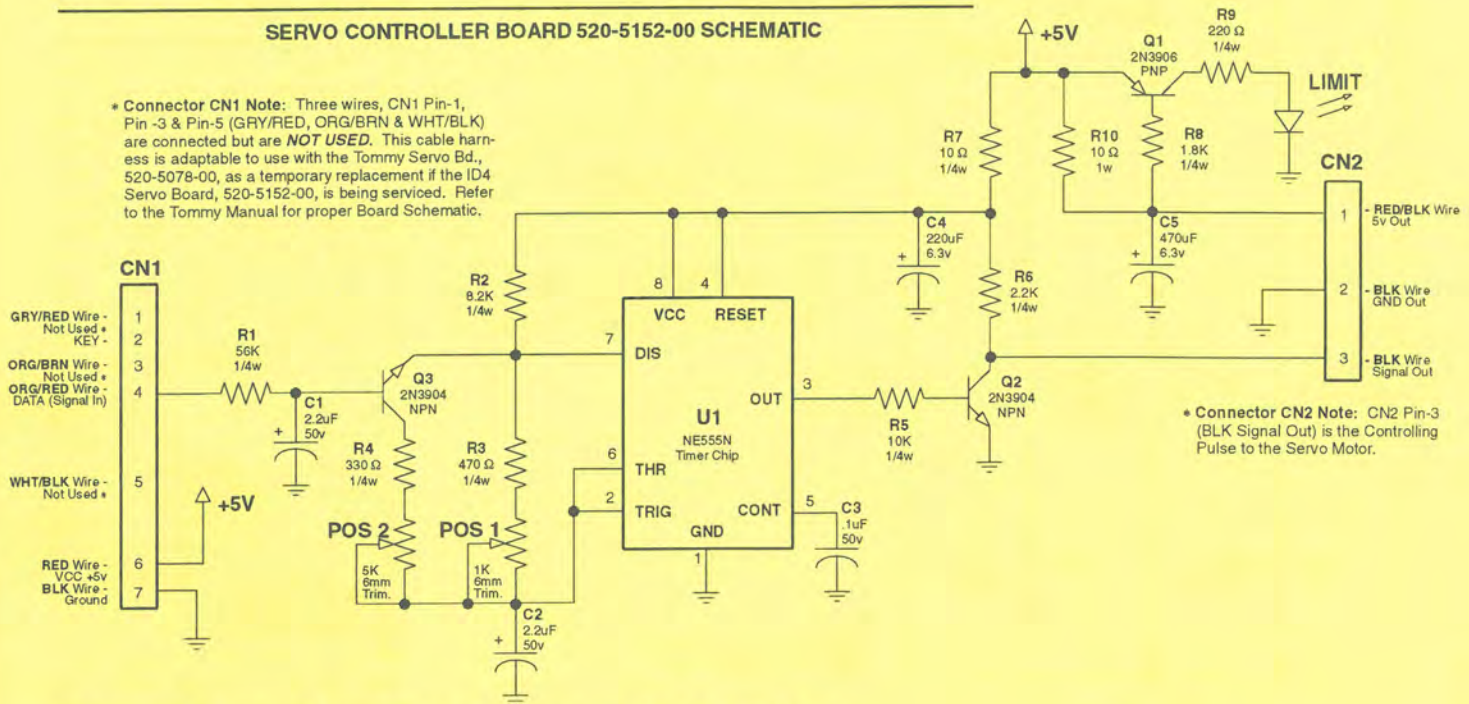
The **E.O.S.** (End-Of-Stroke) **Switch** serves the same function as before as it prevents foldback when the player has the flipper energized to capture balls. The **E.O.S. Switch** is a normally closed switch which opens approximately a 1/16" when the flipper is energized. The **Game CPU** will detect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

Servo Controller Board Theory of Operation & Schematic

Theory of Operation

The Servo Controller Board has been designed to interface between the microprocessor system and the Servo Motor operating the "Alien Head." The servo used is a conventional radio control model servo and is a mechanical motor drive unit controlled by a servo amplifier that has electro-mechanical feedback positioning. The input signal to these servos is a positive pulse of at least 3.2 volts amplitude and is repeated at 12 to 20 milliseconds intervals. This repetition rate is important to keep the mechanical output resolution smooth, with no "cogging" action, and to provide full torque. The input controlling pulse varies its width to drive the servo output to a required position, and typically varies from 1.0 milliseconds to 2.0 milliseconds for 180 degrees of output rotation by the servo. The operating voltage for full torque is 5.0 volts $\pm$ 0.5 volts, with a current capability of at least 500 milliamps.

SERVO CONTROLLER BOARD 520-5152-00 SCHEMATIC



Servo Controller Board Circuit Description

The "Little Monster" Servo Controller Board, Sega Part N° 520-5152-00, sends a single PWM type servo to one of two positions with limit indication and overtravel burn-out protection.

A standard **RC Style Pulse Width Modulated Servo** uses a single signal to control both angular position and average power. The angle is determined by the width of a pulse and the power by the repetition rate of the pulses. A **Pulse Width** of .001 second corresponds to the center of servo rotation and a repetition rate of .016 seconds corresponds to full output power.

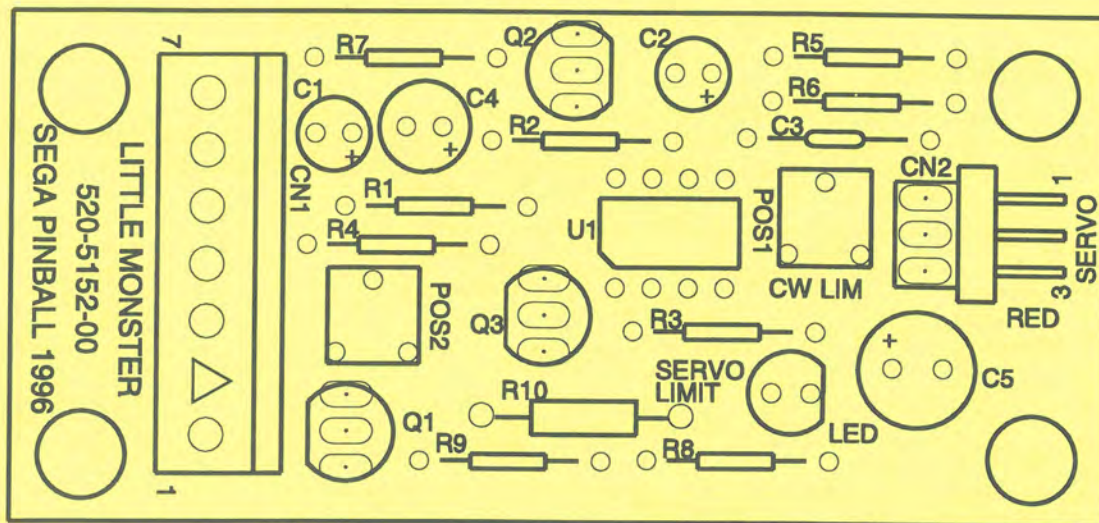
Under microprocessor control (as in the Frankenstein Pinball "Monster Motion" Board) the output power of the servo can be shut off by not sending pulses. A no-processor control application like this one uses a series resistance **R10**. This resistance limits peak power to prevent Servo Motor failure if overheating in a "bind" condition, but more importantly it effectively divides the servo's internal constant of integration of the error signal allowing the servo to be "tightened" without oscillation.

The **555 Timer** is operated in **Astable Mode**, **C2**, **R2**, **R3**, **R4**, and the **POTS** form the RC networks for timing. **Q3** is connected to the collector of an internal transistor in **U1** which switches on only during the discharge cycle. If the processor drives this (via +5v on the "open" line) then the time constant is divided by the "POS 2" POT. **Q2** inverts the signal for the servo, and **Q1** amplifies the error signal for a visible indication of servo power from the LED. **R7** and **C4** form a power line filter, **R1** and **C1** are an input filter, **C5** is the Servo Filter.

Servo Controller Board Calibration / Adjustment Procedure

To set the Servo Controller Board: Enter **PORTALS Diagnostics** and select the "ID4" Icon, "RUN" the Servo Test so the "head closed" position is achieved. Rotate "POS 1" POT & "POS 2" POT to the center position. Plug in the Servo Motor and by hand, open the Alien Head Mechanism half-way (open). Adjust "POS 1" POT until the "HEAD CLOSES" and the LED just barely lights (or blinks). The Alien Head should now be closed with no Air Gap in-between the Head Halves. Advance (RUN) to the "HEAD OPEN" Test and adjust "POS 2" POT until the the LED just barely lights (or blinks). It is important to adjust POS 1 first as it affects the other setting.

Servo Controller Board Component Layout & Parts



Connector CN1

Pin 1 = N/U (GRY/RED)
Pin 2 = Key
Pin 3 = N/U (ORG/BRN)
Pin 4 = DATA (ORG/RED)
Pin 5 = N/U (WHT/BLK)
Pin 6 = VCC +5v (RED)
Pin 7 = GND (BLK)

Adj. Pot POS 2

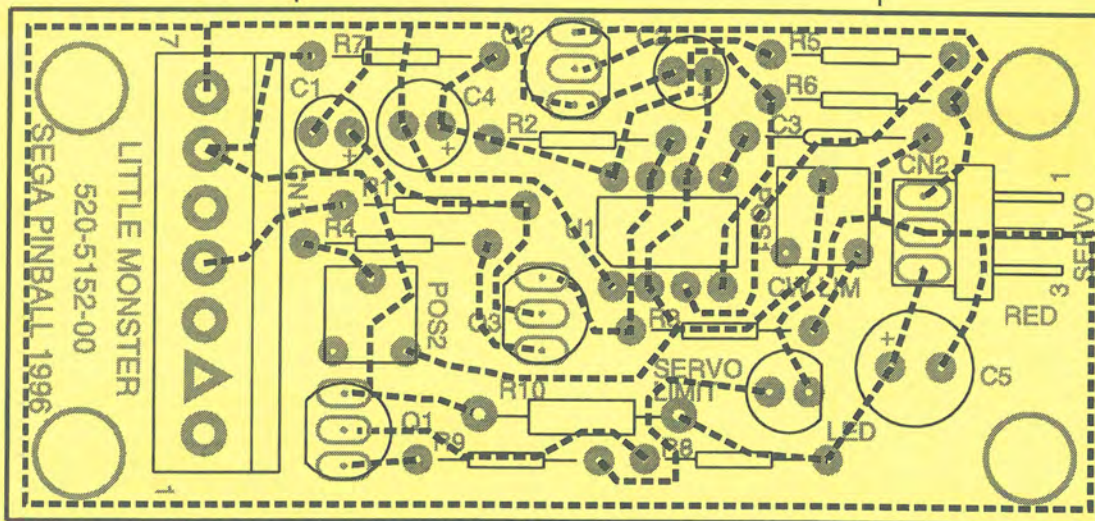
Adjust this
Pot second.

Adj. Pot POS 1

Adjust this
Pot first.

Connector CN2

Pin 1 = +5v OUT (RED/BLK)
Pin 2 = GND OUT (BLK)
Pin 3 = SIGNAL OUT (BLK)



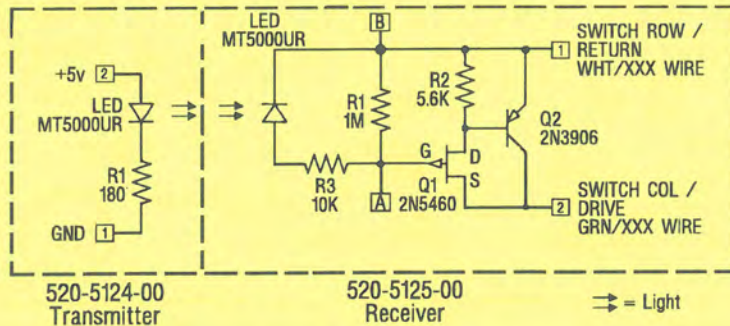
ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
1	1	100-5003-00	U1	NE555N Timer Chip
2	1	110-0086-00	Q1	2N3906 PNP Transistor
3	2	110-0069-00	Q2, Q3	2N3904 NPN Transistor
4	1	165-5099-00	LED	T1-3/4 Red Diffused LED
5	2	125-0013-16	C1, C2	2.2uF 50v Radial Elect. Cap.
6	1	125-5027-00	C3	.1uF 50v Axial Ceramic Cap.
7	1	125-5013-00	C4	220uF 6.3v Radial Elect. Cap.
8	1	125-5012-00	C5	470uF 6.3v Radial Elect. Cap.
9	1	121-5034-00	R1	56K 1/4w c.f. Resistor
10	1	121-5010-00	R2	8.2K 1/4w c.f. Resistor
11	1	121-5046-01	R3	470 Ω 1/4w c.f. Resistor
12	1	121-5036-00	R4	330 Ω 1/4w c.f. Resistor
13	1	121-5011-00	R5	10K 1/4w c.f. Resistor
14	1	121-5043-00	R6	2.2K 1/4w c.f. Resistor
15	1	121-5015-00	R7	10 Ω 1/4w c.f. Resistor
16	1	121-5063-00	R8	1.8K 1/4w c.f. Resistor
17	1	121-5014-00	R9	220 Ω 1/4w c.f. Resistor
18	1	121-5015-01	R10	10 Ω 1w c.f. Resistor
19	1	123-5001-00	POS1	1K 6mm Trimmer - Panasonic #EVN-D8AA03B13
20	1	123-5002-00	POS2	5K 6mm Trimmer - Panasonic #EVN-D8AA03B53
21	1	045-5015-07	CN1	7X .156" Locking Header
22	1	045-5014-03	CN2	3X .100" Locking Right-Angle Header

Trough Up-Kicker OPTO Theory of Operation & Schematic

Theory of Operation

As light from the Transmitter falls on the Receiver LED, it generates a Positive Bias Voltage (0.7v to 1.5v) which is applied to the gate of **Q1**, turning **Q1** off. When **Q1** is held off, no current flows through **Q2**'s Base, the transistor is off acting as an **OPEN SWITCH**. When the light is interrupted (**BLOCKED**) **R1** bleeds the gate voltage off of **Q1** allowing it to conduct, switching **Q2** on, which acts as a **CLOSED SWITCH**.

Fig. 1



TAKE NOTE:
LED MT5000UR
(Ultra Bright Red)
Sega Pinball Part No.
165-5100-00

Troubleshooting

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

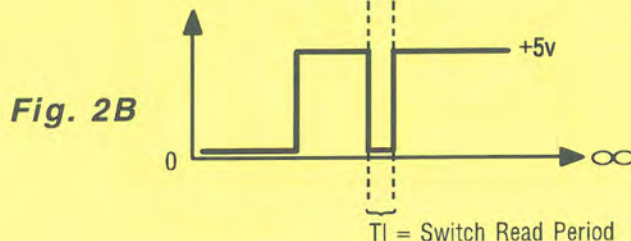
A. **OPEN OPTO** (Light Falling on LED) = **SWITCH OPEN**. Place meter leads across points **A** and **B** (Refer to Schematic Drawing Fig. 1 above). It should read approximately 0.8 - 1.2v DC.

B. **CLOSED OPTO** (Light Blocked) = **SWITCH CLOSED**. Place meter leads across points **A** and **B** (Refer to Schematic Drawing Fig. 1 above). It should read approximately 0.0 - 0.1v DC.

2. Oscilloscope Test (indicates normal operating condition):



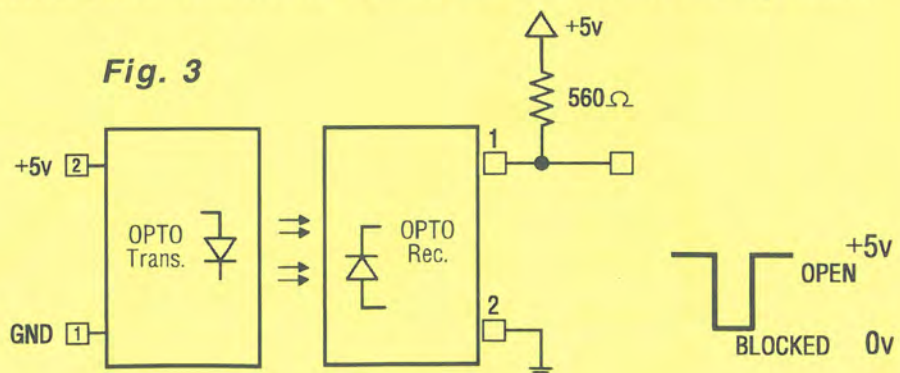
A. **OPEN OPTO** (Light Falling on LED) = **SWITCH OPEN**. Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (See Fig. 1). The Scope should display a **STEADY +5v** as shown in Fig. 2A, Wave Form Diagram.



B. **CLOSED OPTO** (Light Blocked) = **SWITCH CLOSED**. Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (See Fig. 1). The Scope should display a **PULSE STREAM** indicating **Q2** has switched "On" as shown in Fig. 2B, Wave Form Diagram. This is your Switch Drive Pulse.

3. Bench Test (See Fig. 3 Below):

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**.

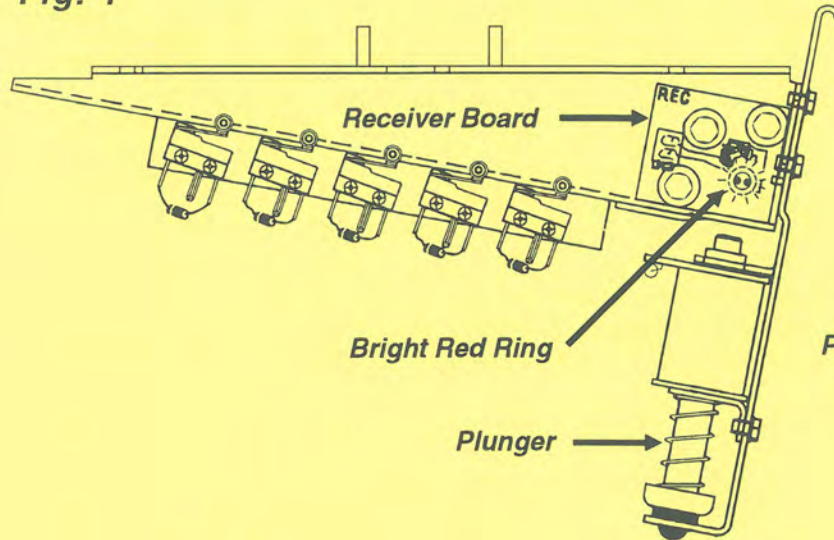


Single Trough OPTO Alignment / Test

When a working OPTO is installed and connected in a game, the transmitter should light when the power is switched on. With the playfield in Service Position #1 (playfield pulled forward resting on the playfield support brackets) and the game on, the light should show up as a "BRIGHT RED RING" through the back of the Receiver Board around the Receiver LED (See Fig. 1). 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. 3a & 3b for a sectional view of the Light Path (note alignment) and what happens as a ball breaks the light beam.

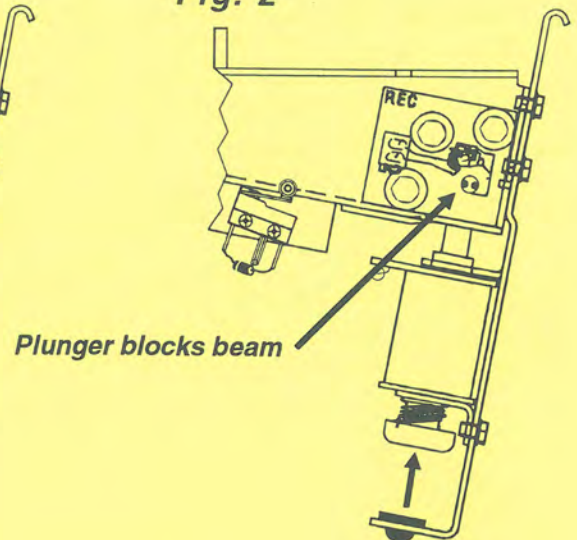
**View facing trough
(with playfield in Service Position #1)**

Fig. 1



**Lift plunger to check
switch as shown.**

Fig. 2



Sectional view from right

Fig. 3a

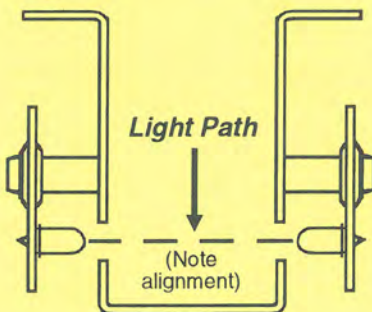
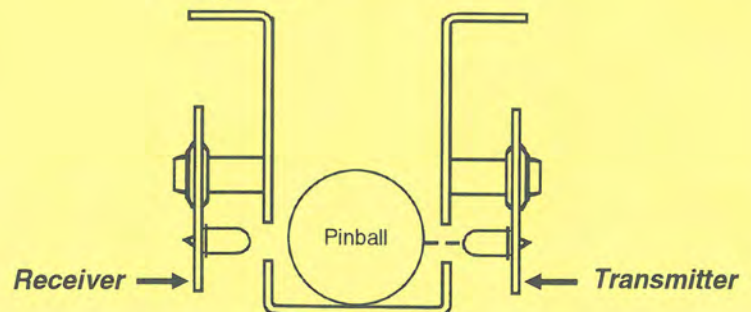


Fig. 3b



IMPORTANT

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

Fig. 4a

**Correct
Position**

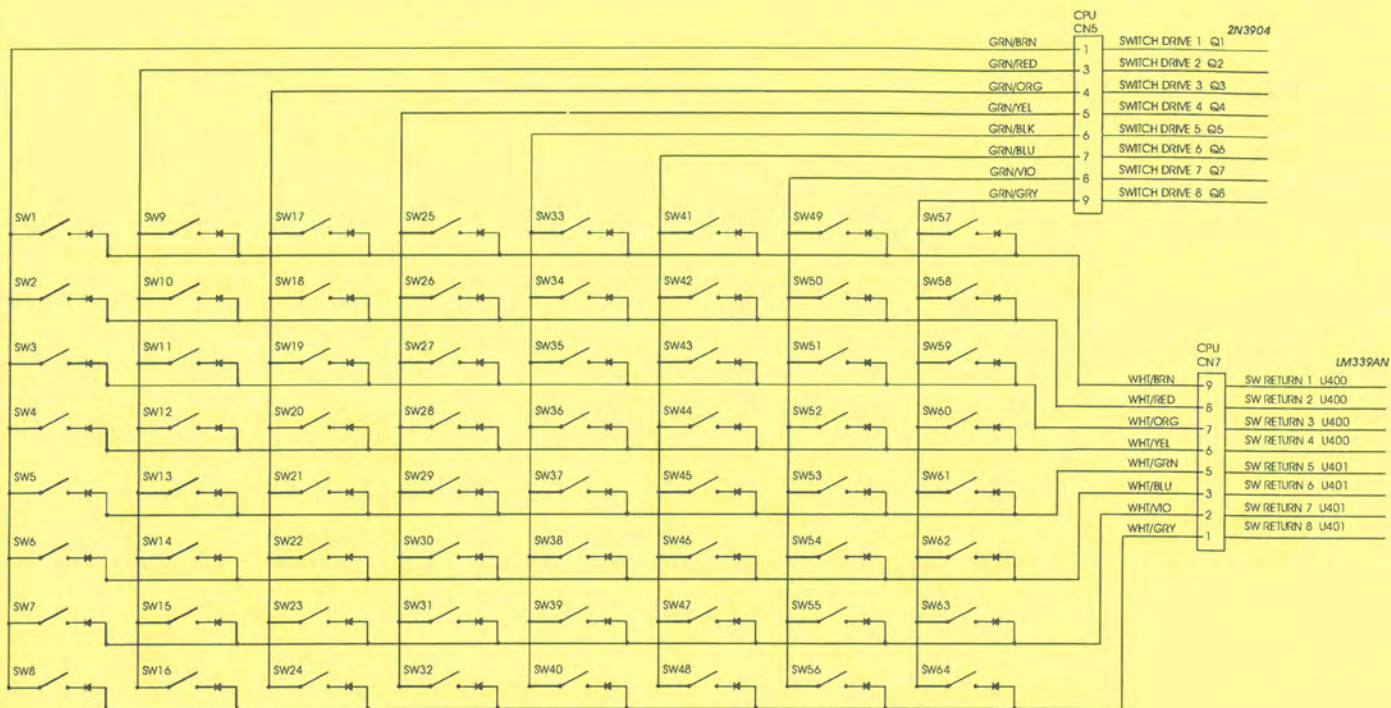


Fig. 4b

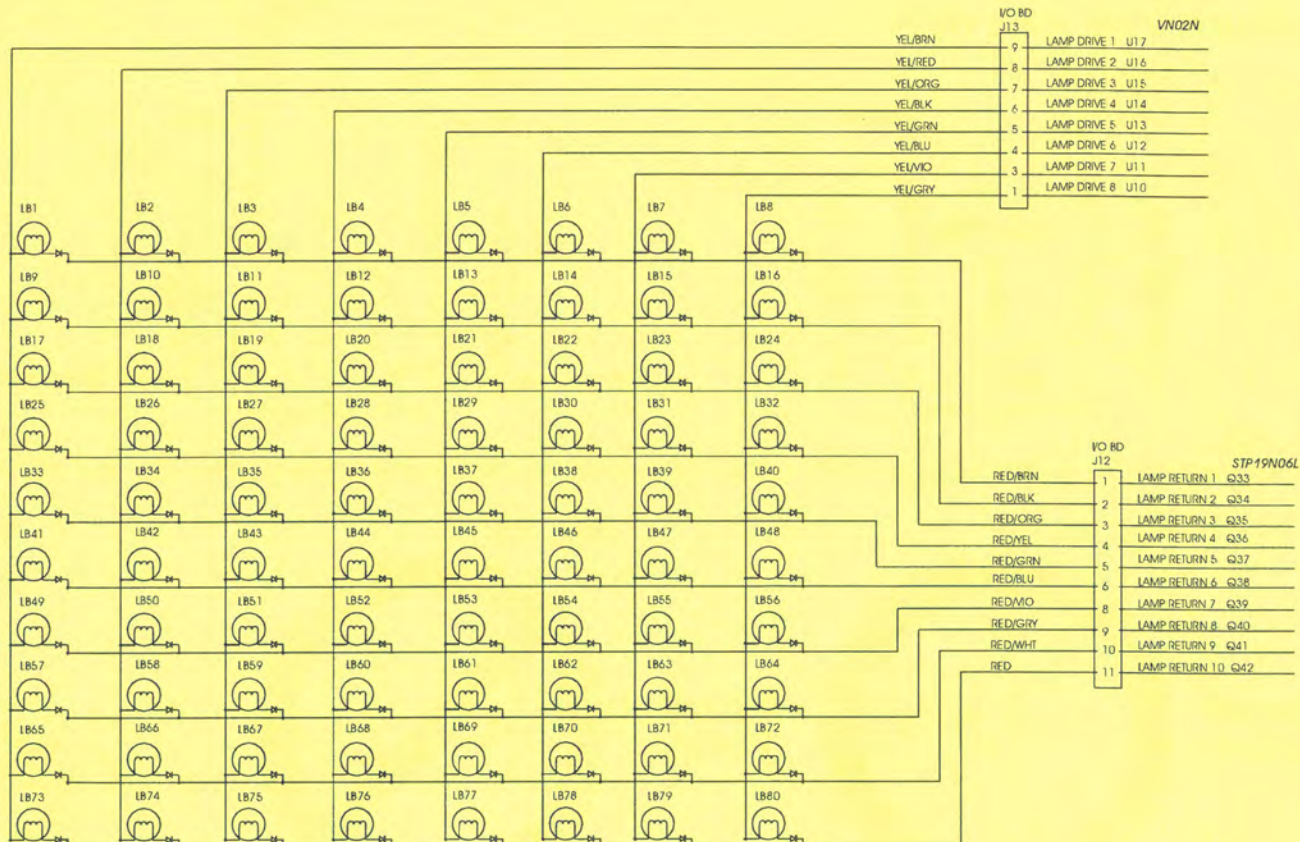
**Incorrect
Position**



Playfield Switch Diagram

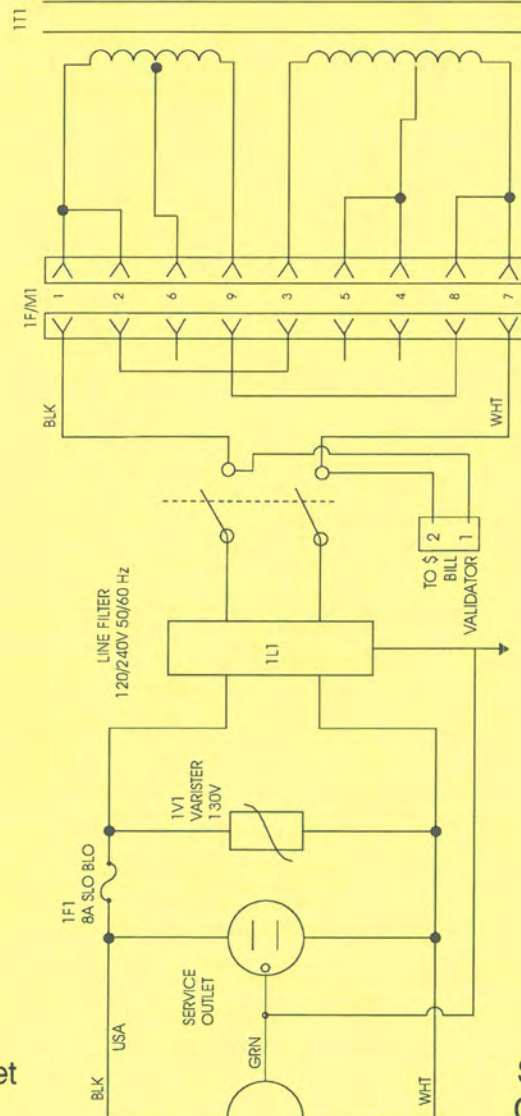
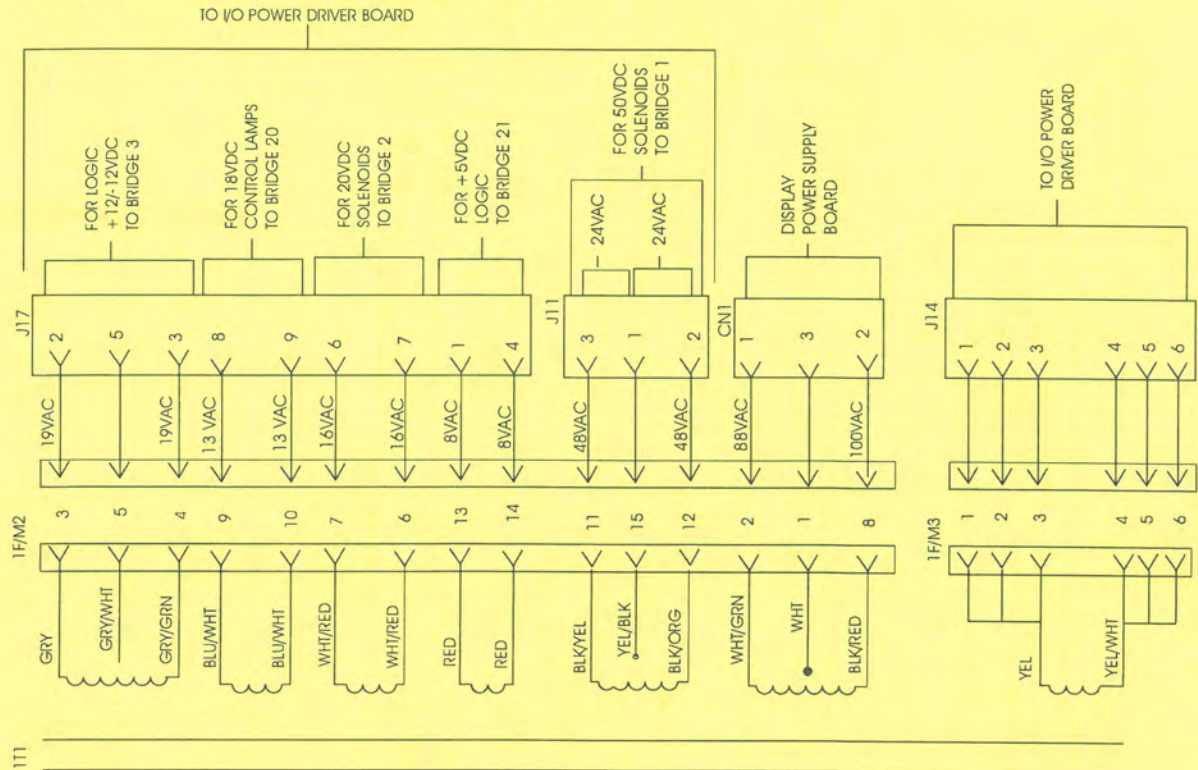


Playfield Lamp Wiring Diagram

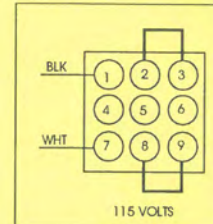


Cabinet Wiring

Transformer Power Wiring Diagram

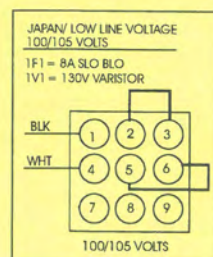
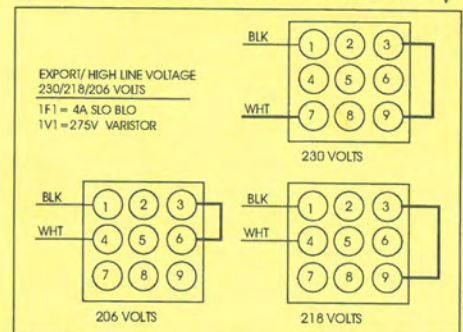


JUMPERS FOR VOLTAGE VARIATION

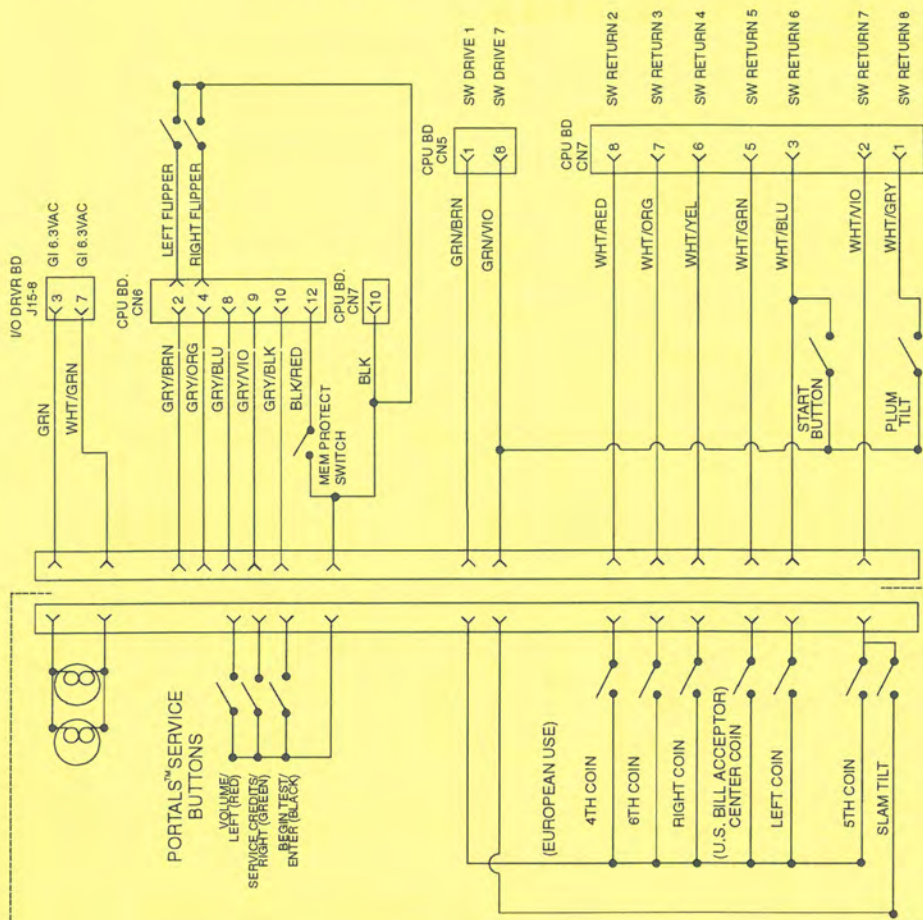


<<<
CONFIGURATION FOR
DOMESTIC 115V
>>>

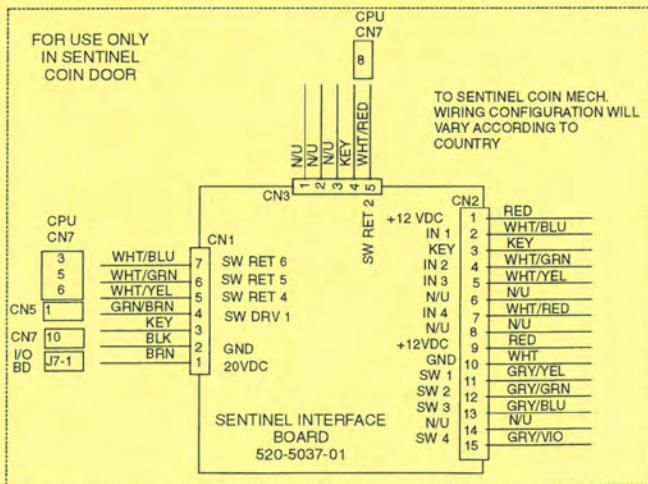
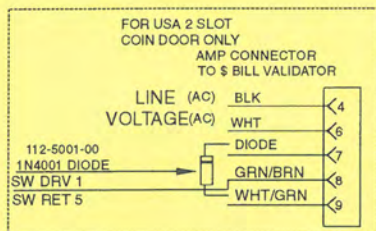
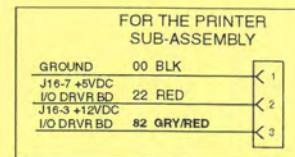
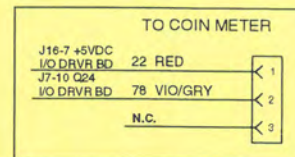
✓ CONFIGURATION OF 220V OR LOWER ✓
✓ LINE VOLTAGES FOR INTERNATIONAL USE ✓



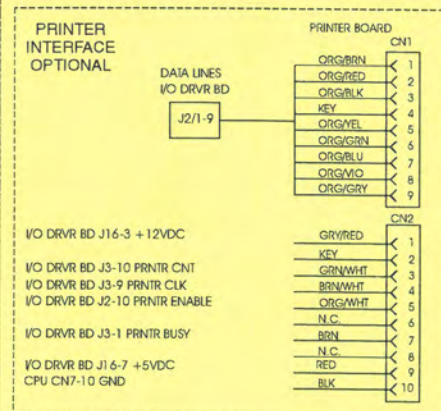
Cabinet/Coin Door Wiring Diagram



CABINET HARNESSES:

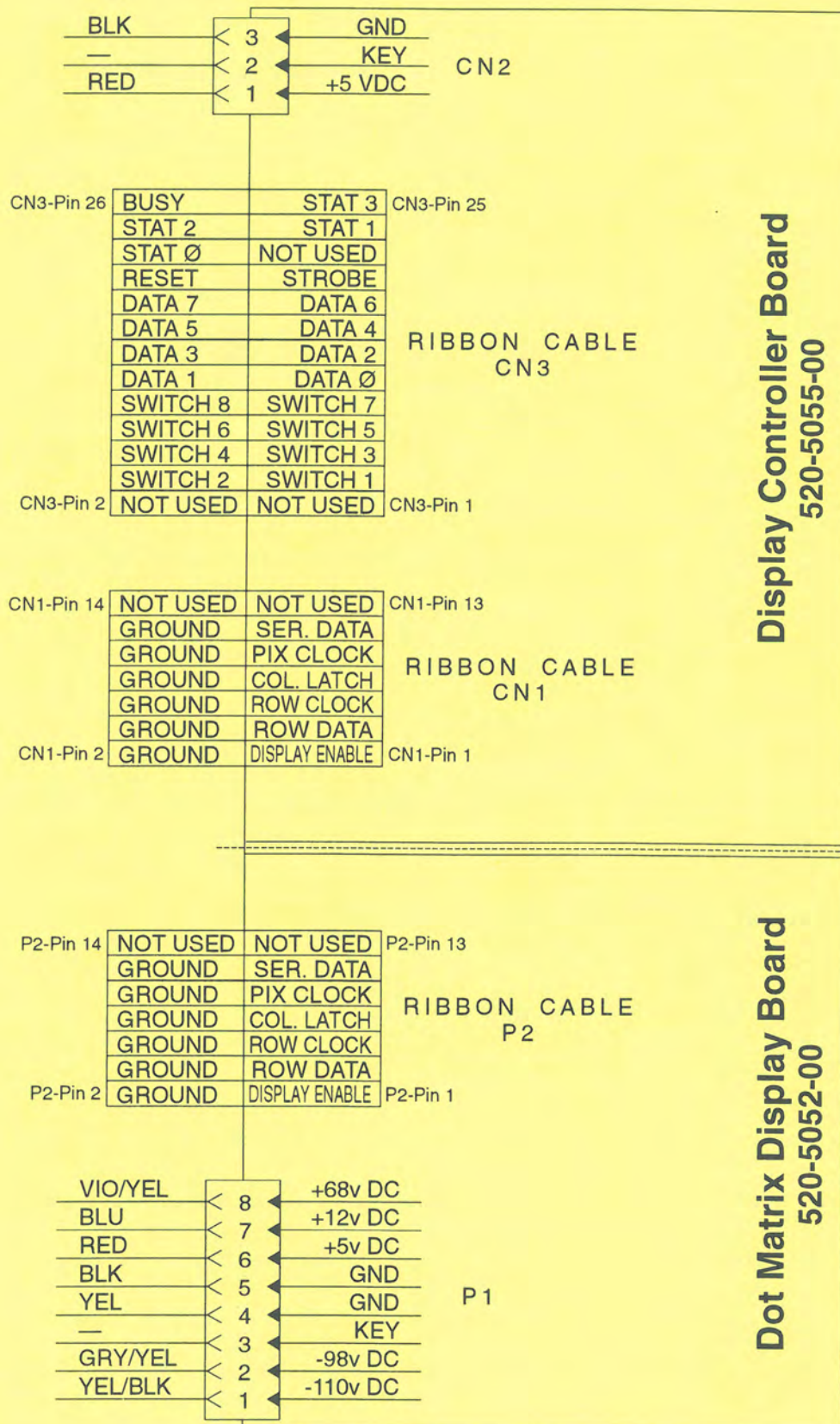


COIN DOOR



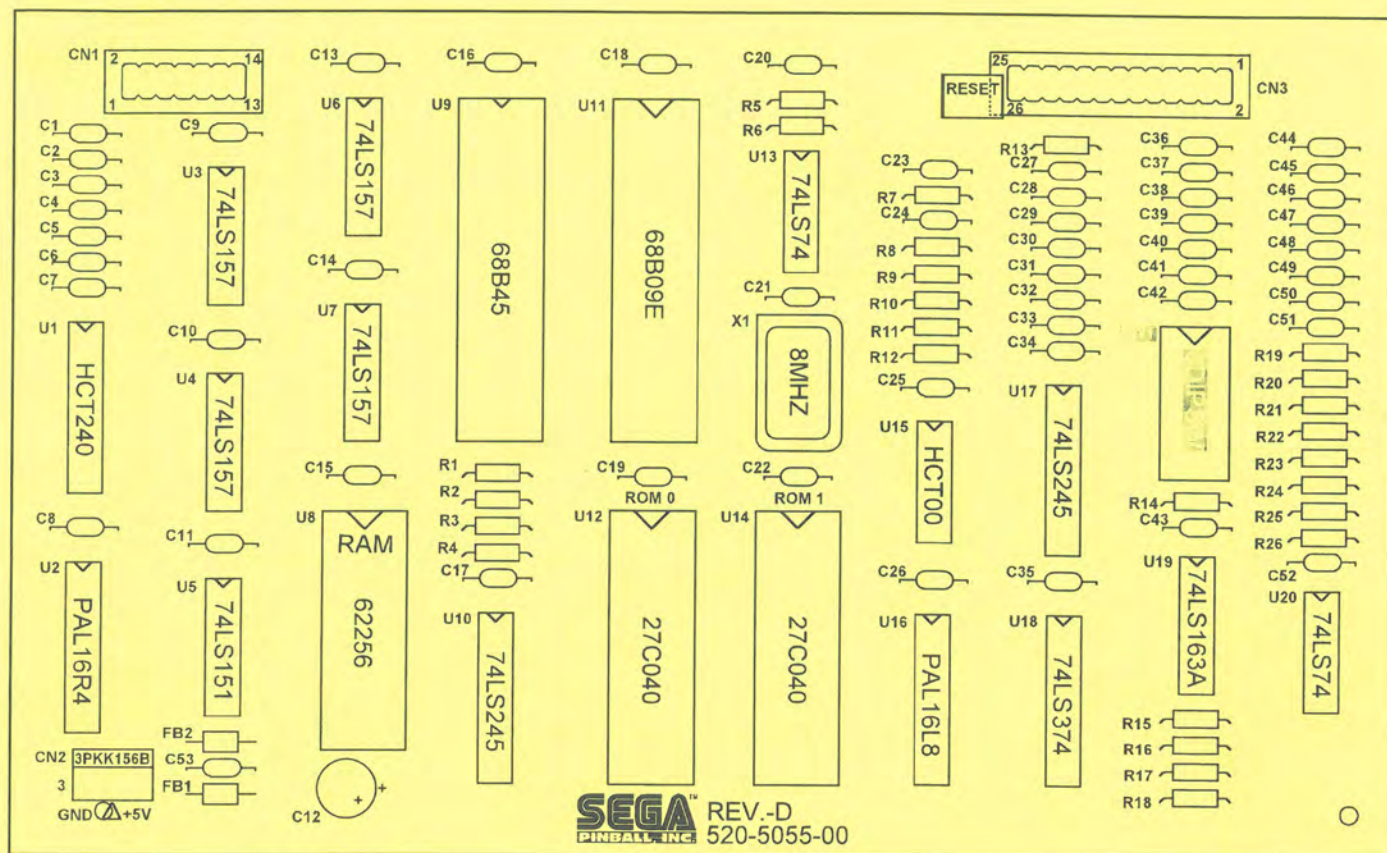
Printed Circuit Boards (PCBs)

Dot Matrix Display/Display Controller Bd. Combined Display Connections

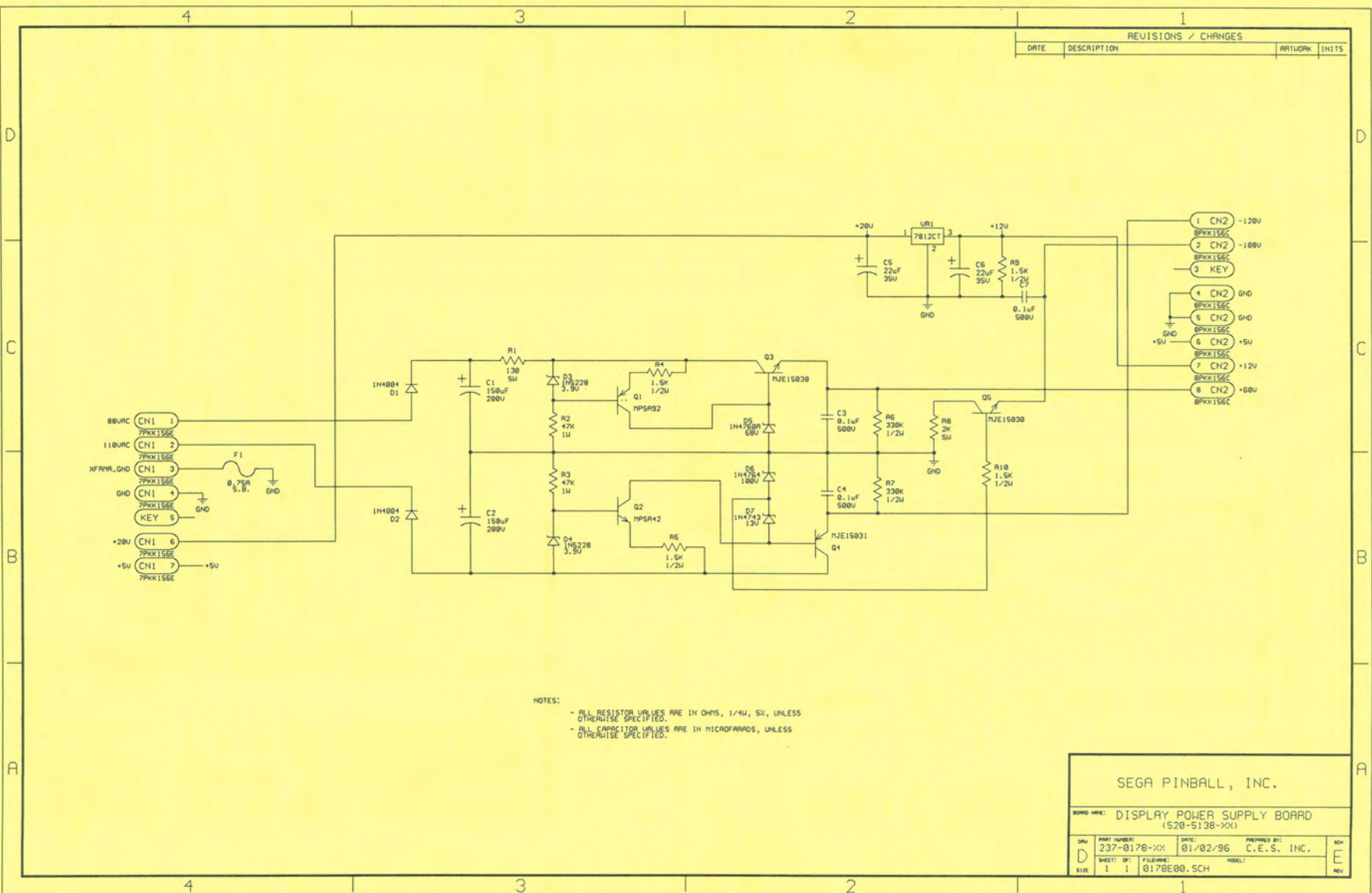


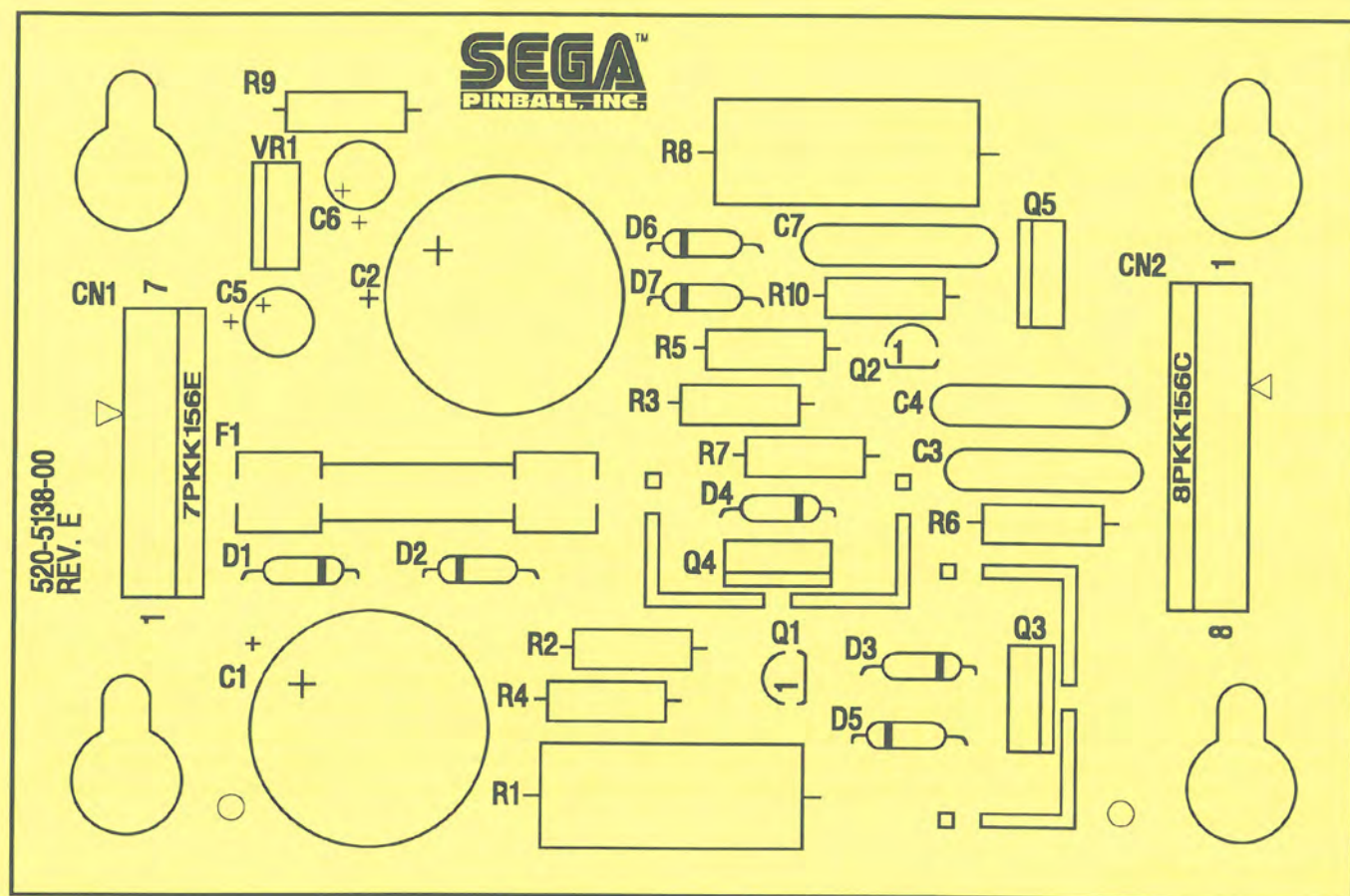


Display Controller Board Component Layout & Parts



ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
1	2	077-5216-00	U12 U14	32-PIN 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	PAL16L8 (15CN)
14	1	965-0108-00	U2	PAL16R4 (25CN)
15	23	125-5031-00	C7 C8 C9 C10 C11 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25 C26 C34 C35 C43 C52	.1 mF (104) AXIAL CER. CAP
16	1	121-5051-00	R8	100K OHM 1/4 W C.F. RES. 5%
17	15	121-5011-00	R1 R2 R3 R4 R5 R6 R7 R9 R10 R12 R14 R15 R16 R17 R18	
18	1	121-5014-00	R13	220 OHM 1/4 W C.F. RES. 5%
19	0	Not Used	R19 R20 R21 R22 R23 R24 R25 R26	NOT STUFFED
20	21	125-5028-00	C1 C2 C3 C4 C5 C6 C27 C28 C29 C30 C31 C32 C33 C36 C37 C38 C39 C40 C41 C42 C44 C45 C46 C47 C48 C49 C50 C51 C53	470 pF (471) AXIAL CER. CAP (C44—C51 NOT STUFFED)
21	2	n/a	FB1 FB2	FERRITE BEAD (2743001182)
22	1	125-5015-00	C12	100uF 25V CAP (RADIAL ELEC)
23	1	045-5015-26	CN3	13-PIN DUAL ROW .1" HDR CONN.
24	1	045-5015-03	CN2	3-PIN KK-156 CONN. (540445-3)
25	1	045-5015-02	CN1	7-PIN DUAL ROW .1" HDR. CONN.
26	1	140-0013-00	X1	8Mhz CLOCK OSCILLATOR
27	0	Not Used	SW1	NOT STUFFED
28	1	See Page iii Table	U12 U14 (ROM 0)	4MB ROM (U14 NOT STUFFED)





ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
1	1	200-5000-10	F1	S.B. 0.5A
2	2	535-5000-11	Q3 Q4	HEATSINKS - AAVID #563002
3	2	125-5041-00	C2 C1	200V 150uF RADIAL LYTIC
4	4	121-5038-00	R10 R9 R5 R4	1/2W 1.5K
5	2	121-5059-00	R7 R6	1/2W 330K
6	2	121-5060-00	R2 R3	1W 47K
7	1	121-5061-00	R1	5W 130
8	1	121-5062-00	R8	5W 2K
9	2	112-0053-00	D3 D4	3.9V 5228
10	1	112-0062-00	D5	68V 4760A
11	1	112-0049-00	D6	100V 4764
12	1	112-0061-00	D7	13V 4743
13	1	110-0100-00	Q1	MPSA92
14	1	110-0082-00	Q2	MPSA42
15	3	125-5035-00	C3 C4 C7	500V 0.1uF CERAMIC DISK
16	1	110-0103-00	Q4	MJE15031
17	2	110-0101-00	Q3 Q5	MJE15030
18	2	125-5003-00	C5 C6	25V 22uF RADIAL LYTIC
19	1	124-5003-00	VR1	7812CT
20	1	045-5015-08	CN2	8pkk156 (PIN3=KEY)
21	2	112-5003-00	D1 D2	1N4004
22	1	045-5015-07	CN1	7PKK156E (PIN5=KEY)
23	2	n/a	Q3 Q4	6/32 KEY NUT
24	2	n/a	Q3 Q4	6/32 X 3/8 SCREW
25	2	205-0004-00	F1	FUSECLIPS

I/O Power Driver Board Theory of Operation

5V Supply:

An AC voltage of approximately 9V comes into the board at [J17-(1-4)] this AC voltage is then full-wave rectified by bridge BRDG 21 and filtered by capacitor C203. The resulting voltage is 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.

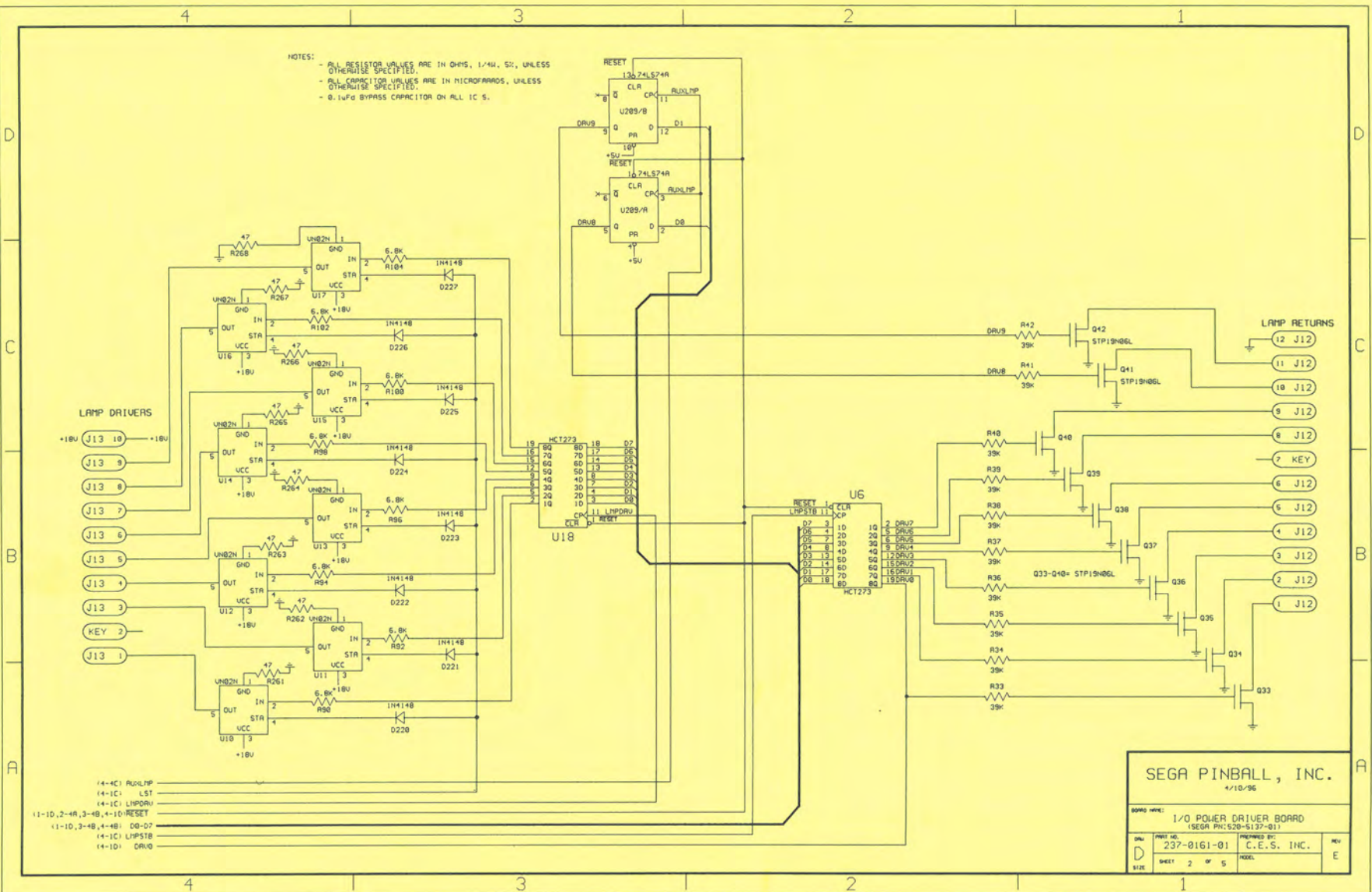
J3 8 CMOS Inputs general purpose inputs.

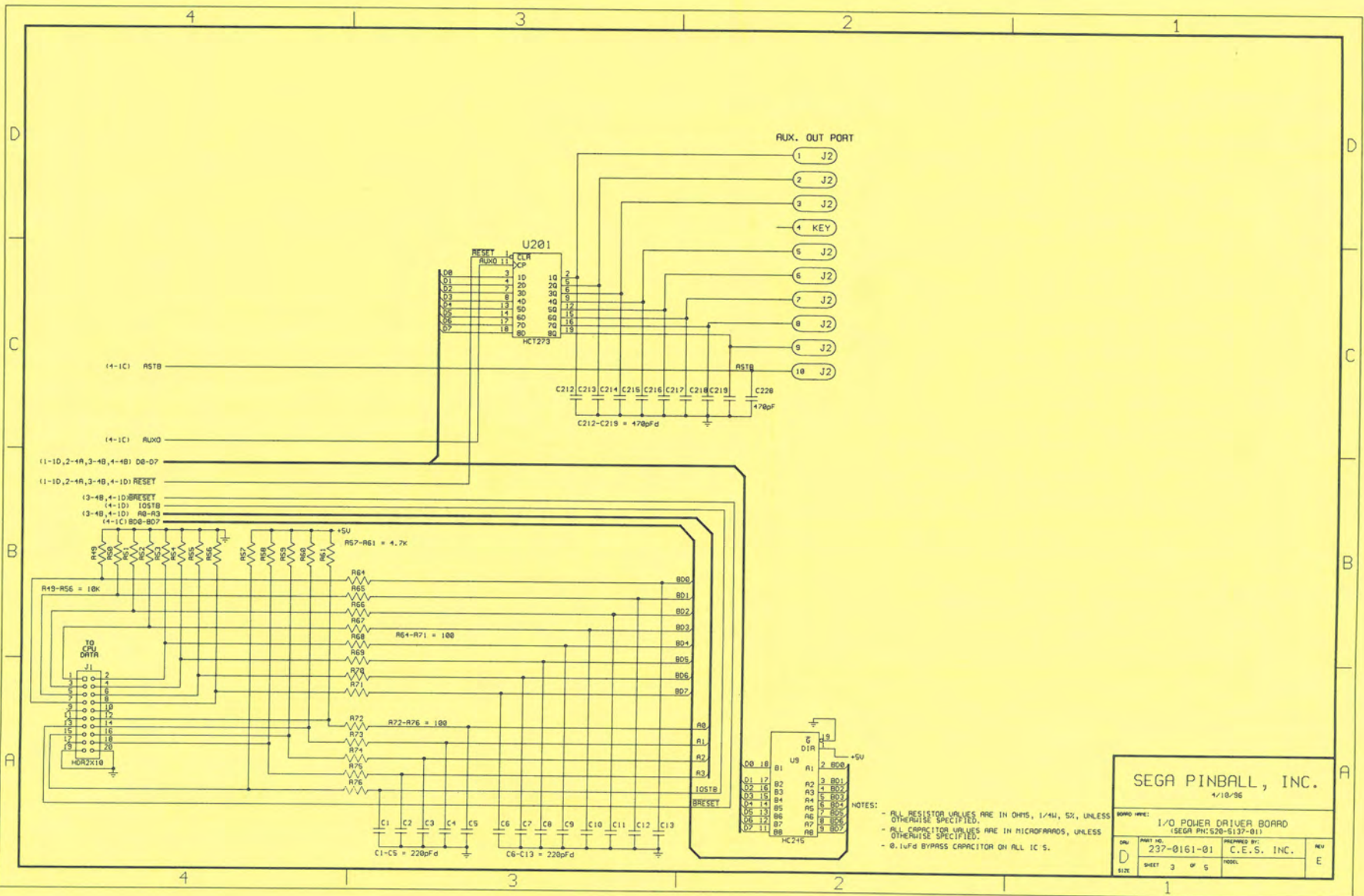
Lamp Matrix:

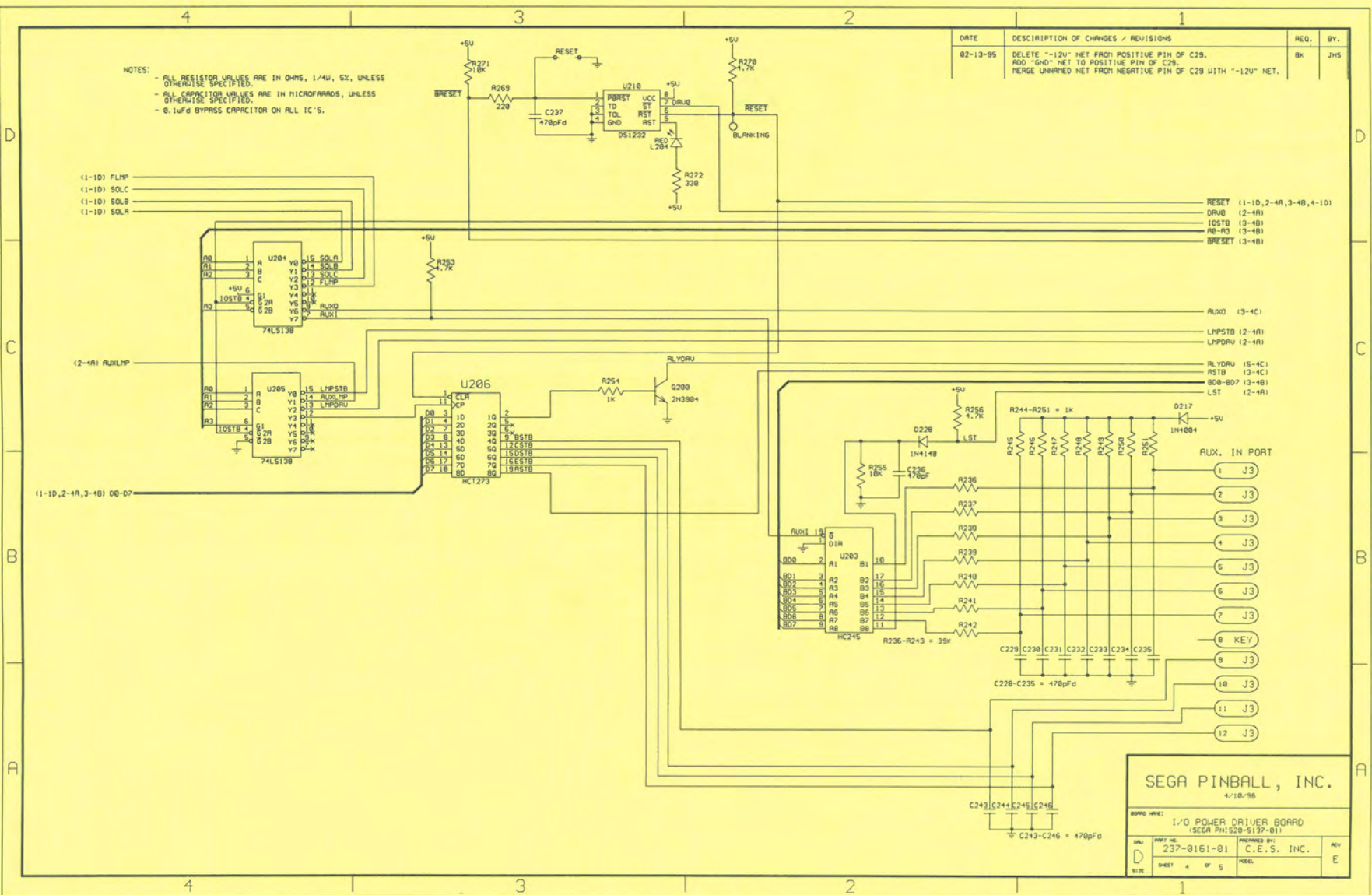
J12 has 10 low side drivers for the lamp strobes which consist of 19N06L MOSFETS. Only one lamp strobe should be low at any time. Again the scanning of the lamp strobes keeps the I/O from resetting. J13 has 8 high side drivers with each having a status indicator. All the status indicators are logically '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.

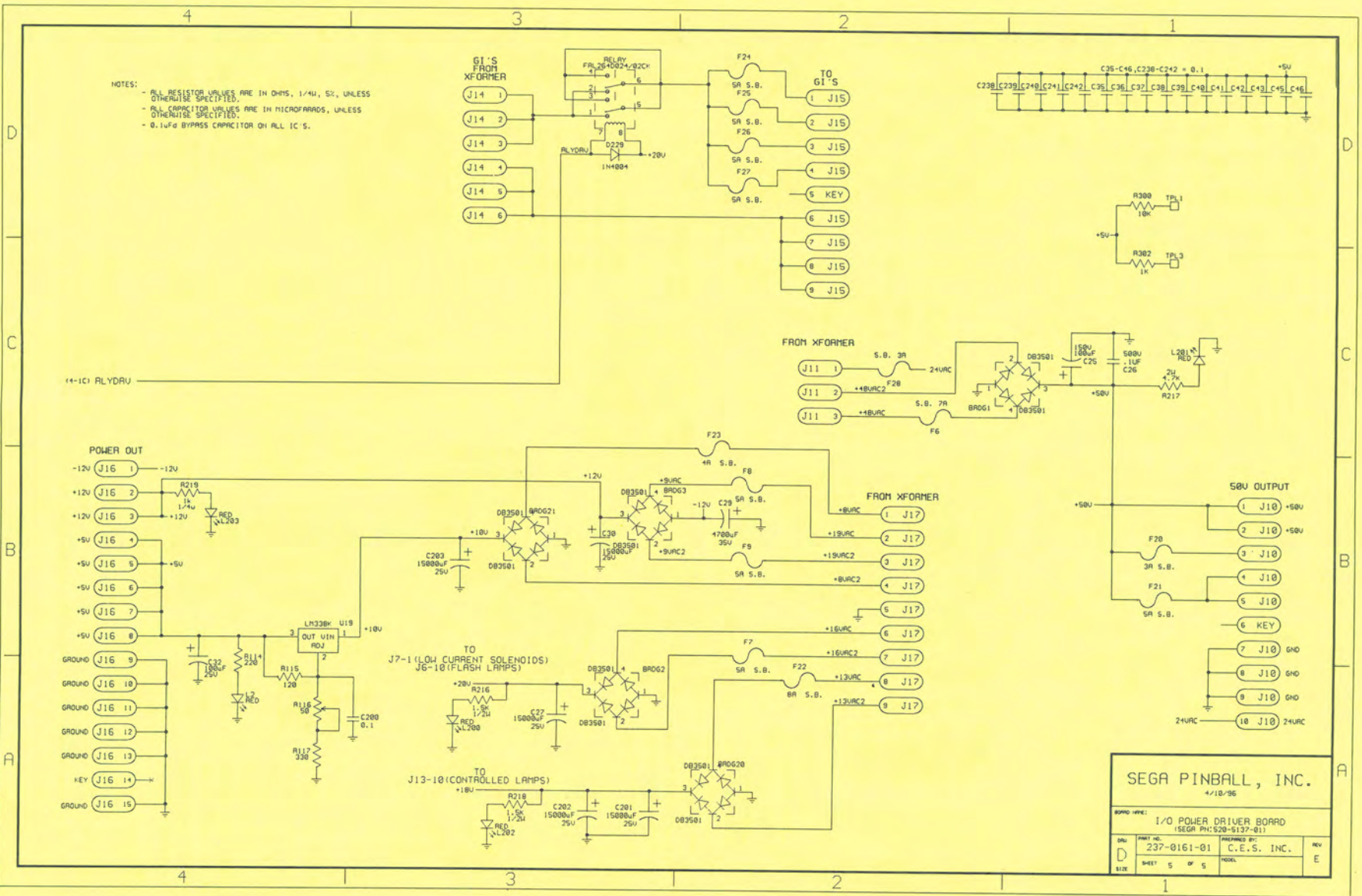
General Illumination (G.I.) Lights:

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.



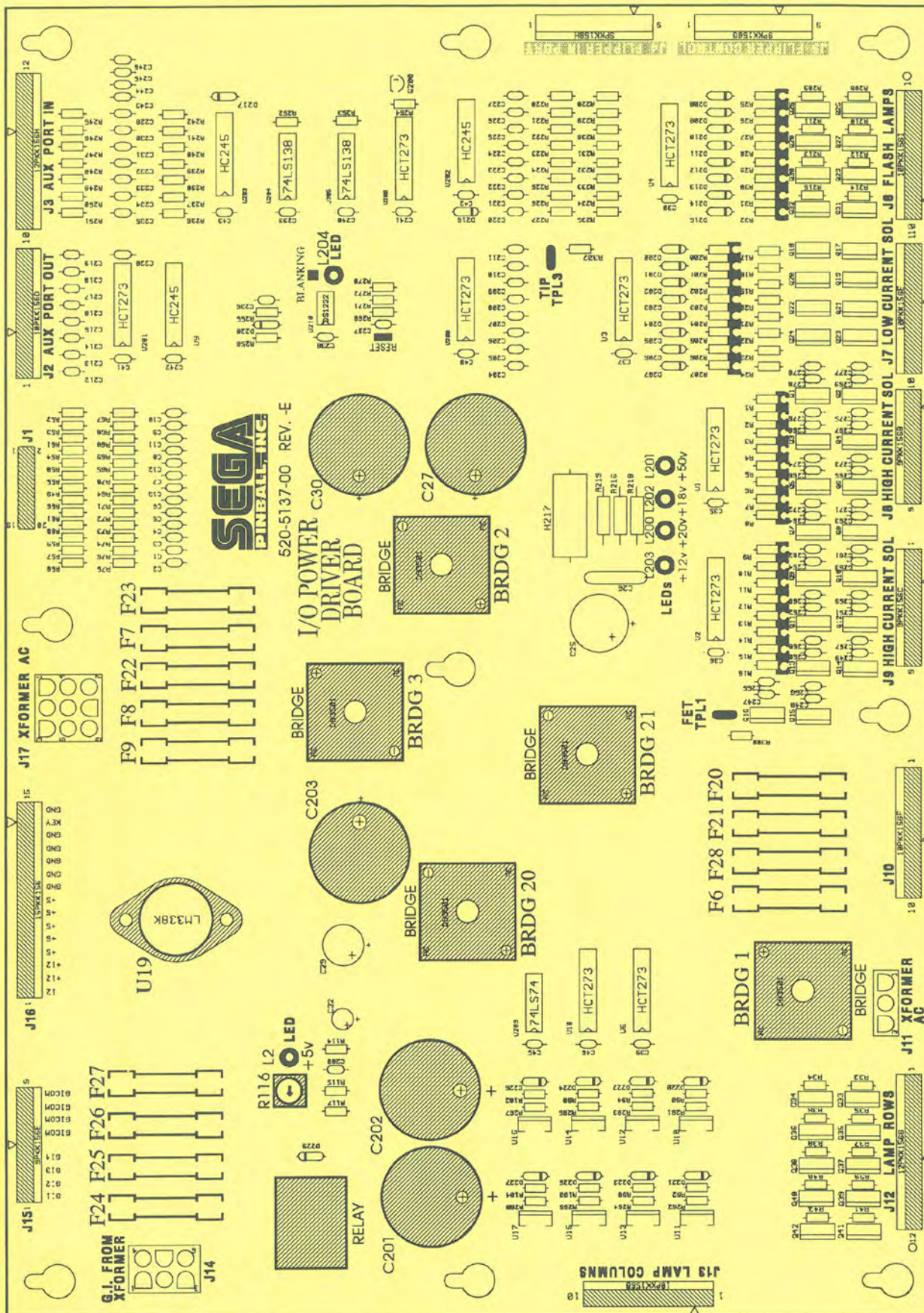






I/O Power Driver Board Component Layout

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

Section 5 | PCBs

I/O Power Driver Board Parts

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
1	16	125-5027-00	C260 C259 C258 C257 C256 C278 C271 C255 C261 C262 C277 C276 C275 C274 C273 C272	100V 104 (0.1uF)
2	22	125-5028-00	C204 C206 C207 C208 C209 C210 C211 C235 C234 C228 C229 C230 C231 C232 C233 C219 C217 C216 C215 C214 C212 C213 C237 C218 C236 C205 C243 C245 C246 C244	471 (470pF) AXIAL CAP (C204—C11 Not Stuffed)
3	16	125-5029-00	C263 C264 C265 C270 C269 C268 C267 C266 C247 C254 C253 C252 C251 C250 C249 C248	103 (0.01uF)
4	13	125-5030-00	C7 C8 C9 C10 C11 C12 C13 C1 C2 C3 C4 C5 C6	221 (220pF)
5	0	Not Used	C227 C226 C220 C221 C222 C223 C224 C225	Not Stuffed
6	17	125-5031-00	C35 C36 C37 C38 C39 C40 C41 C42 C43 C45 C46 C200 C239 C238 C240 C241 C242	104 (0.1uF)
7	16	110-0106-00	Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q16 Q15 Q14 Q13 Q12 Q11 Q10 Q9	20N10L STP
8	32	121-5042-00	R2 R3 R4 R5 R6 R7 R8 R16 R15 R14 R13 R12 R11 R10 R9 R200 R201R202 R203 R204 R205 R206 R207 R215 R214 R213 R212 R211 R210 R209 R208 R1 R17 R32 R18 R19 R20 R21 R22 R23 R24 R31 R30 R29 R28 R27 R26 R25	22K
9	16	121-5003-00	R237 R236 R40 R39 R38 R37 R36 R35 R34 R33 R238 R239 R240 R241 R242 R42 R41	620
10	17	121-5045-00	R64 R72 R73 R74 R75 R76 R71 R70 R69 R68 R67 R66 R65	39K
11	13	121-5007-00	R90 R92 R94 R96 R98 R100 R102 R104 R115	100
12	8	121-5029-00	R221 R220 R222 R223 R224 R225 R226 R227	6.8K
13	1	121-5030-00	R254 R248 R249 R250 R251 R232 R246 R247	120
14	0	Not Used	R245 R233 R234 R235 R230 R231 R228 R229 R302 R262 R261 R263 R264 R265 R266 R267 R268 R269 R114	Not Stuffed
15	9	121-5009-00	R57 R58 R59 R60 R61R252 R253 R256 R270 R49 R271 R56 R55 R54 R53 R52 R51 R50 R255 R300 R117 R272	1K 1/4 W REST. (R228—R235 Not Stuffed)
16	8	121-5032-00	U6 U4 U18 U2 U1 U200 U3 U201 U206	47K 1/4W RESISTOR
17	2	121-5033-00	RESET	220K 1/4W RESISTOR
18	8	121-5021-00	R219	4.7K 1/4W RES. (R252 Not Stuffed)
19	11	121-5011-00	R218 R216	10K
20	2	121-5036-00	F24 F25 F26 F27 F8 F9 F7	330
21	8	100-5019-00	F6	74HCT273 (U200 Not Stuffed)
22	1	Not Used	F23	Not Stuffed
23	1	121-5009-00	F22	1/4W 1K
24	2	121-5038-00	F20 F21 F28	1/2W 1.5K
25	7	200-5000-01	F6	S.B. 5A
26	1	200-5000-03	F23	S.B. 7A
27	1	200-5000-06	F22	S.B. 4A
28	1	200-5000-07	F20 F21 F28	S.B. 8A
29	3	200-5000-08	J15	S.B. 3A
30	1	045-5013-00	J16	9PKK156 (PIN 5=KEY)
31	1	045-5016-00	U210	15PKK156
32	1	100-5023-00	Q200	DS1232
33	1	110-0069-00	C32	2N3904
34	1	125-5032-00	J1	25V 100uF RADIAL LYTIC
35	1	045-5015-01	U202 U203	20 PIN 0.1 DUAL ROW HEADER
36	1	100-0338-00	Q41 Q33 Q34 Q35 Q36 Q37 Q38 Q39 Q40 Q42	74HC245 (U202 Not Stuffed)
37	10	110-0088-00	L203 L202 L204 L200 L2 L201	19N06L STP
38	6	165-5099-00	J2	RED LED
39	1	045-5014-01	R116	10PKK156 (PIN 4=KEY)
40	1	121-5039-00	Q23 Q22 Q21 Q20 Q19 Q18 Q26 Q27 Q28 Q29 Q30 Q31 Q32 Q17 Q25 Q24	50 OHM POT
41	16	110-0067-00	C25	TIP122
42	1	125-5033-00	U9	150V 100uF RADIAL LYTIC
43	1	110-0058-00	C29	74LS245
44	1	125-5034-00	RELAY	35V 4700uF RADIAL LYTIC
45	1	190-5002-00	J5	FRL264D024/02CK RELAY
46	0	Not Used	U209	Not Stuffed
47	1	100-0037-00	J4	74LS74
48	0	Not Used	U204 U205	Not Stuffed
49	2	100-0148-00	C26	74LS138
50	1	125-5035-00	U19	500V .1uF CERAMIC DISK
51	1	100-0356-00	BRDG20 BRDG3 BRDG1 BRDG2 BRDG21	LM338K
52	5	124-5000-00	C202 C203 C201 C30 C27	DB3501
53	5	125-5036-00	D208 D225 D226 D221D220 D223 D227 D224 D222 D200 D201 D202 D203 D204 D205 D206 D207 D209 D210 D211 D212 D213 D214 D215 D228 D217 D216 D229	25V 15000uF RADIAL LYTIC
54	25	112-0054-00	TPL3 TPL1	1N4148
55	2	112-5003-00	J7	1N4004 (D216 Not Stuffed)
56	2	n/a	J6	TEST POINT WIRE (24ga.) LOOPS
57	1	045-5014-01	U17 U16 U15 U14 U13 U12 U11 U10	10PKK156 (PIN 5=KEY)
58	1	045-5014-01	J11	10PKK156 (PIN 9=KEY)
59	8	110-0089-00	J12	VN02N
60	1	045-0014-03	J17	10-84-4030 (3 PIN MOLEX)
61	1	045-5015-00	BLANKING	12PKK156 (PIN 7=KEY)
62	1	045-0014-09	R217	10-84-4090 (9 PIN MOLEX)
63	1	Not Used	J13	TEST POINT - DO NOT STUFF
64	1	121-5050-00	J14	2W 4.7K SANDBAR
65	1	045-5014-01	J10	10PKK156 (PIN 2=KEY)
66	1	045-0014-06	J3	10-84-4060 (6 PIN MOLEX)
67	1	045-5014-01	J9	10PKK156 (PIN 6=KEY)
68	1	045-5015-00	J8	12PKK156 (PIN 8=KEY)
69	1	045-5013-00	-->	9PKK156 (PIN 3=KEY)
70	1	045-5013-00	U19	9PKK156 (PIN 2=KEY)
71	26	205-0004-00		FUSECLIPS
72	1	n/a		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 U211 and 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 eight strobes low to activate a single column of switches. The switch return signals are fed into CN7 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 closer. If false switches are appearing check that none of the 2N3904 transistors are permanently pulling the strobe line low. Only one strobe from CN5 should be low at any time. CN6 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 is 8 bits wide. There are separate input and output busses. The input bus from the plasma controller to the CPU comes in on [CN8-(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-(11-18)]. Status back from the plasma comes in on [CN8-(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 PSTB (Plasma Strobe). 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 68B09E (U6) reads in this data and handles the interfacing to the BSMT.

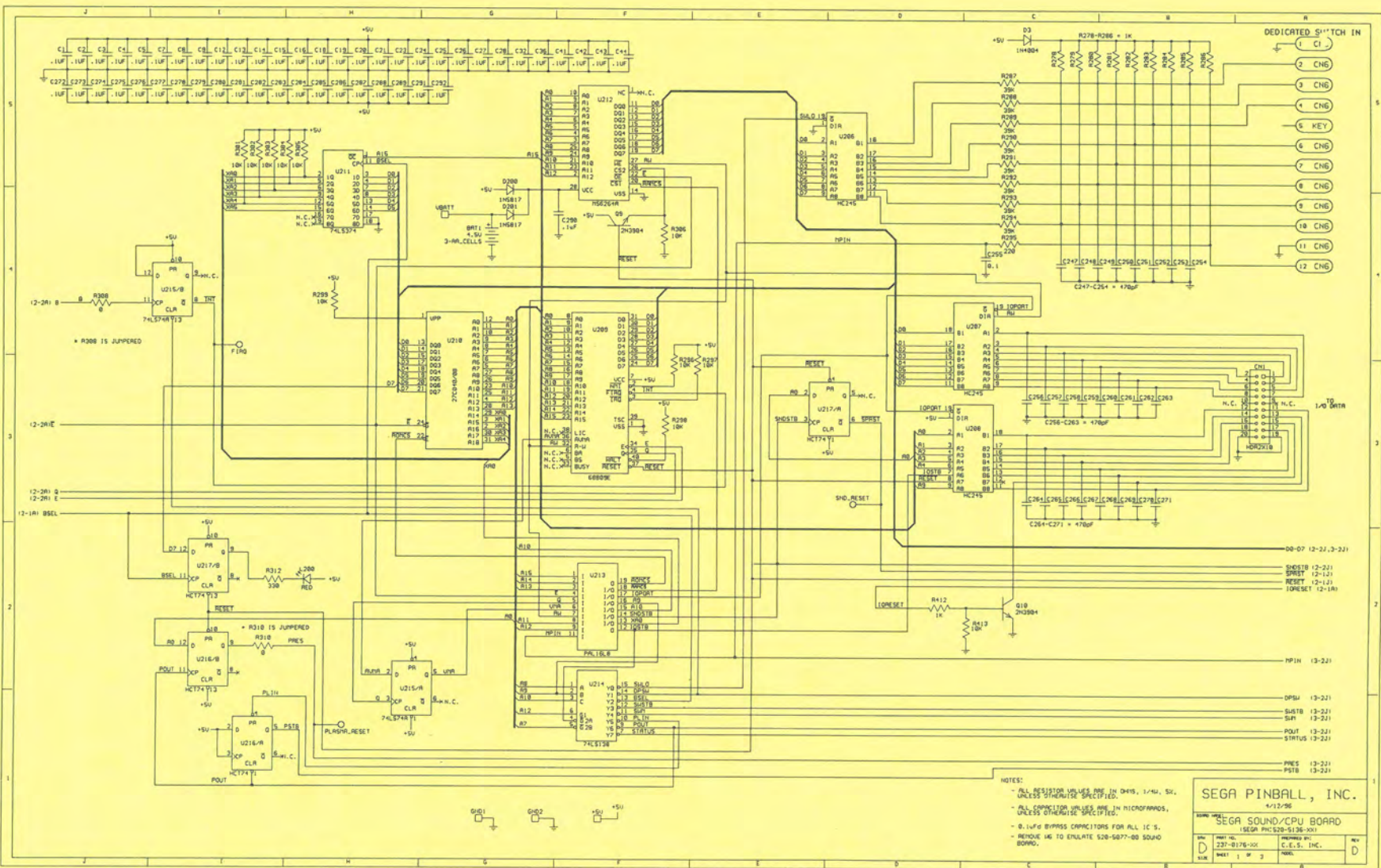
Other Test Points:

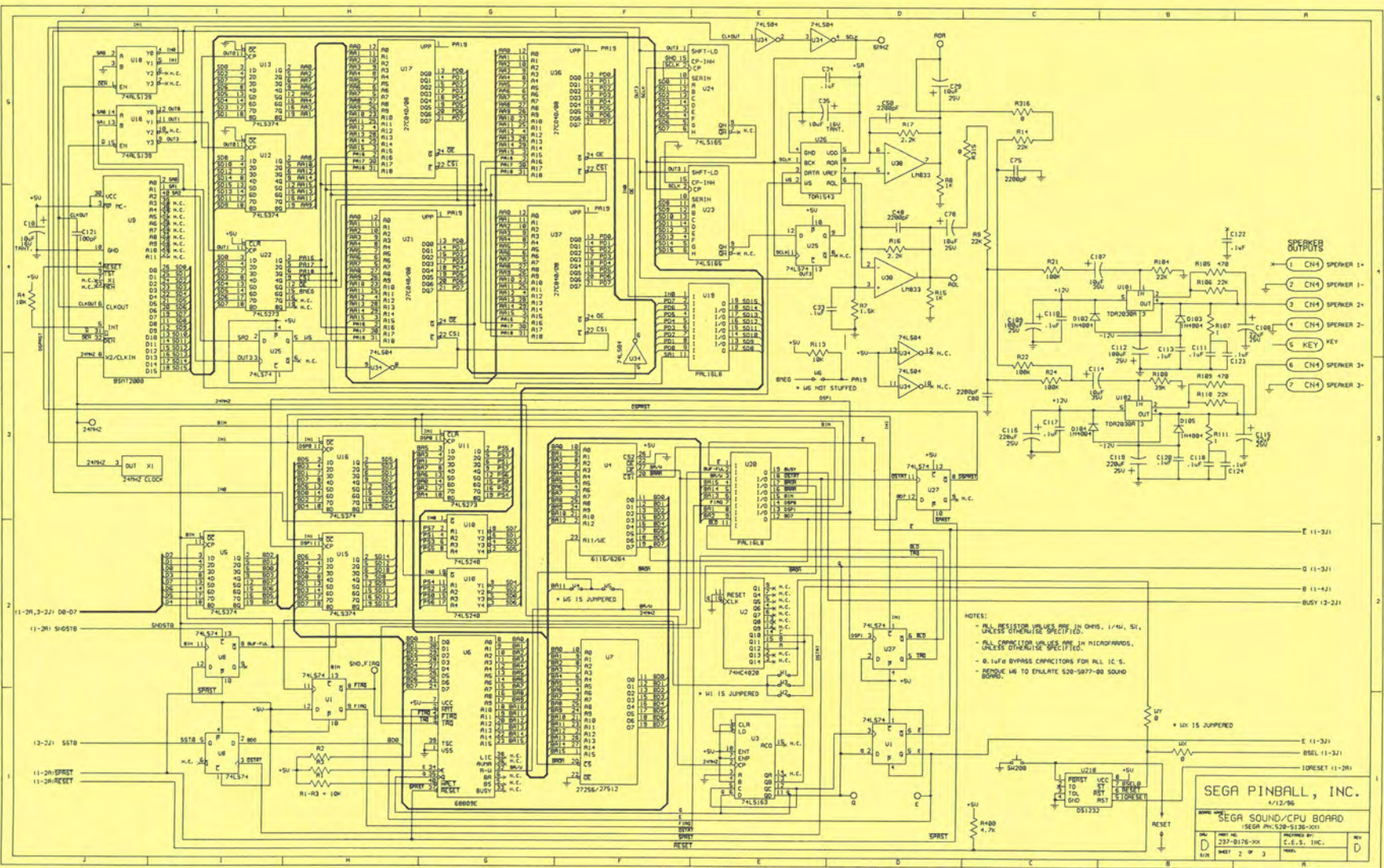
E & Q - The CPU signals for both 68B09E processors. Should be at 2Mhz with Q leading E by 500 nsec.

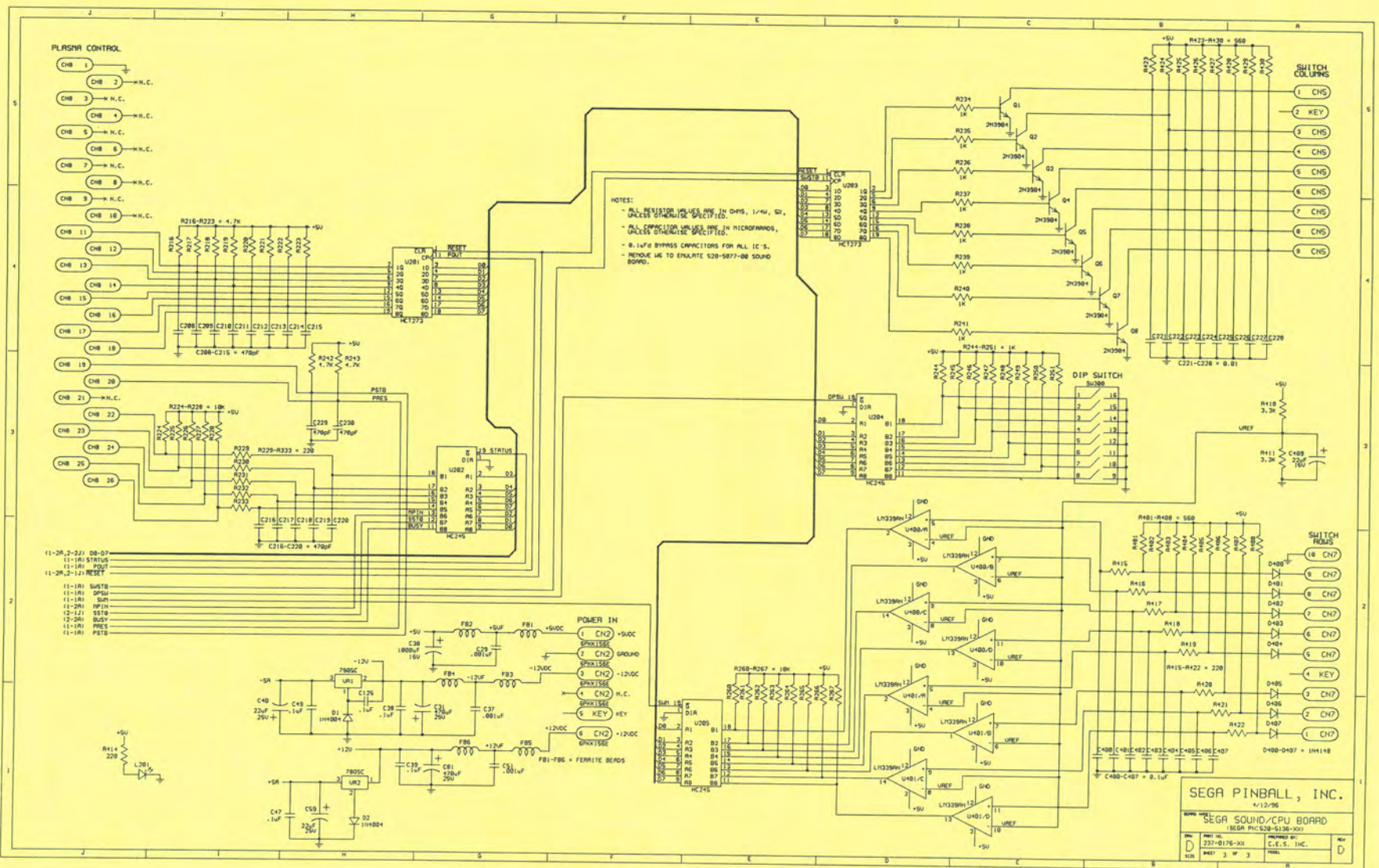
24Mhz - The oscillator used for the BSMT & derivation of E & Q.

SND-FIRQ - The sound sections CPU interrupt.

6Mhz - This clock is generated internally on the BSMT and is used for shifting the data samples into the DAC.







Section 5 | PCBs



Printed Circuit Boards (PCBs)

<< AOL

CPU/Sound Board Parts

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
1	1	124-5001-00	VR2	7805
2	5	121-5051-00	R13 R24 R21 R12 R19 R22	100K 1/4W RES. (R19 Not Stuffed)
3	2	121-5009-00	R111 R103 R107	1K 1/4W RES. (R103 Not Stuffed)
4	38	121-5011-00	R4 R3 R2 R1 R113 R306 R301 R302 R303 R305 R304 R299 R296 R298 R297 R247 R248 R249 R251 R250 R246 R245 R244 R266 R267 R265 R264 R263 R228 R227 R226 R225 R224 R200 R201 R202 R203 R204 R205 R206 R207 R262 R261 R260 R409 R413	10K1/4W RES. (R200-R207 R409 R413 Not Stuffed)
5	5	121-5023-00	R14 R104 R110 R102 R100 R106 R9	22K1/4W RES. (R100 R102 Not Stuffed)
6	20	121-5009-00	R15 R8 R241 R240 R239 R238 R237 R236 R235 R234 R278 R279 R280 R281 R282 R283 R285 R286 R284 R412 R25 R17 R16 R112	1K 1/4W RES.
7	4	121-5043-00	R7	2.2K
8	1	121-5018-00	R105 R101 R109	1.5K
9	2	121-5046-00	R108 R294 R293 R292	470K 1/4W RES. (R101 Not Stuffed)
10	9	121-5045-00	R291 R290 R289 R288 R287	39K
11	1	121-5036-00	R312	330
12	12	n/a	R311 R310 R307 R309 R308 R300 R313 R316 R315 R314 WX WY	0Ω (Jumper Wire 24ga.)
13	15	121-5033-00	R295 R229 R230 R231 R232 R233 R215 R214 R213 R212 R211 R210 R209 R208 R414 R422 R421 R420 R419 R418 R417 R416 R415	220K 1/4W RES. (R208—R215 Not Stuffed)
14	11	121-5021-00	R223 R222 R221 R220 R219 R218 R217 R216 R243 R242 R400	4.7K 1/4W RES.
15	16	121-5047-00	R408 R407 R406 R405 R404 R403 R402 R401 R430 R429 R428 R427 R426 R425 R424 R423 R411 R410	560
16	2	121-5048-00	U3	3.3K 1/4W RES.
17	1	100-0049-00	U7	74LS163
18	1	See Page iii Table	U7	27512 EPROM
19	1	045-5015-07	CN4	7PKK156 (PIN5=KEY)
20	1	Not Used	RESET	DO NOT STUFF
21	5	See Page iii Table	U37 U36 U21 U17 U210	27C040 EPROM
22	2	100-5008-00	U24 U23	74LS165
23	4	125-5017-00	C76 C78 C79 C77	25V 10uF RADIAL LYTIC
24	4	125-5020-00	C59 C101 C108 C115 C40	25V 22uF RADIAL LYTIC (C101 Not Stuffed)
25	2	125-5017-00	C100 C107 C114	35V 10uF RADIAL LYTIC (C100 Not Stuffed)
26	2	125-5015-00	C102 C104 C109 C112	25V 100uF RADIAL LYTIC (C102/104 N.Stiffd)
27	1	125-5014-00	C409	16V 22uF RADILA LYTIC
28	1	100-5016-00	U35	TDA1899
29	1	125-5037-00	C30	16V 1000uF RADIAL LYTIC
30	1	100-0027-00	U34	74LS04
31	1	100-0043-00	U18	74ALS139
32	6	100-0064-00	U16 U12 U13 U15 U211U5	74LS374
33	1	100-0249-00	U2	74HC4020
34	1	100-0149-00	U10	74LS240
35	6	n/a	W2 W3 W1 W4 W5 W6	0Ω (Jumper Wire 24ga.)
36	2	125-5012-00	C81 C31	25V 470uF RADIAL LYTIC
37	2	125-5017-00	C10 C35	16V 10uF RADIAL TANT.
38	2	125-5019-00	C116 C119	25V 220uF RADIAL LYTIC
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	PAL16L8 (Programmed)
42b	1	965-0137-00	U20	PAL16L8 (Programmed)
42c	1	965-6504-00	U213	PAL16L8 (Programmed)
43	5	100-0037-00	U27 U1 U25 U8 U215	74LS74
44	3	125-5043-00	C29 C37 C51	102 (0.001uF)
45	79	125-5031-00	C2 C12 C13 C14 C15 C20 C1 C42 C24 C32 C28 C43 C16 C103 C23 C27 C52 C36 C21 C26 C39 C47 C105 C120 C44 C46 C34 C25 C4 C19 C8 C41 C49 C3 C33 C9 C38 C18 C106 C45 C7 C118 C110 C122 C124 C113 C123 C5 C117 C111 C125 C290 C289 C288 C287 C286 C285 C284 C283 C282 C281 C280 C279 C278 C277 C276 C275 C273 C272 C255 C274 C292 C291 C407 C406 C405 C404 C400 C403 C401 C402 C102 C103	104 (0.1uF) AXIAL CER. CAP. (C102 C103 C105 C106 Not Stuffed)
46	1	125-5038-00	C121	101 (100pF)
47	4	125-5039-00	C48 C50 C75 C80	222 (0.0022uF)
48	41	125-5028-00	C270 C269 C268 C267 C271 C265 C266 C262 C261 C260 C259 C263 C256 C257 C258 C249 C248 C247 C254 C250 C251 C252 C220 C219 C218 C217 C216 C215 C213 C212 C211 C210 C209 C208 C200 C201 C202 C203 C205 C206 C207 C230 C229 C253 C214 C204 C264 C408 C221 C222 C223 C225 C226 C227 C228 C224 C408	471 (470pF) CER. CAP (C200—C107, C408 Not Stuffed)
49	8	125-5029-00	CN3	103 (0.01uF)
50	1	045-5015-06	U30	6PKK156
51	1	100-0375-00	U22 U11	LM833
52	2	100-0022-00	D1 D100 D2 D103 D104 D101 D105 D102 D3	74LS273
53	7	112-5003-00	D201 D200	1N4004 (D100 D101 Not Stuffed)
54	2	112-5008-00	D407 D406 D405 D404 D403 D402 D401 D400 D202	1N5817
55	8	112-0054-00	FB6 FB4 FB5 FB2 FB1 FB3	1N4148 (D202 Not Stuffed)
56	6	n/a	VR1	FB
57	1	124-5002-00	U102 U100 U101	7905
58	2	100-5016-20		TDA2030V (U100 Not Stuffed)

THIS PARTS LIST IS CONTINUED ON THE NEXT PAGE.

Section 5 | PCBs

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
59	1	100-5018-00	U26	TDA1543
60	1	n/a	SW200	B3F4000
61	1	165-5099-00	L200	RED LED
62	1	165-5099-00	L201	RED LED
63	2	100-5015-00	U217 U216	HCT74
64	1	100-0148-00	U214	74LS138
65	1	105-0046-00	U212	MS6264A
66	1	100-0189-01	U209 U6	68B09E
67	1	545-5685-00	BAT1 BATTERY HOLDER	3-AA CELLS 4.5V
68	1	045-5015-01	CN1	20 PIN 0.1 HEADER
69	10	n/a	6MHZ AOR Q AOL 24MHZ	TEST POINTS - Not Stuffed
70	10	110-0069-00	Q9 Q3 Q4 Q5 Q6 Q7 Q8 Q1 Q2 Q10	2N3904
71	1	045-5013-00	CN5	9PKK156 (PIN 2=KEY)
72	2	100-5019-00	U201 U203	74HCT273
73	6	100-0338-00	U207 U206 U202 U200 U205 U208 U204	74HC245 (U200 Not Stuffed)
74	1	100-5023-00	U218	DS1232
75	1	045-5015-26	CN8	26 PIN 0.1 HEADER
76	1	045-5014-01	CN7	10PKK156 (PIN 4=KEY)
77	4	n/a	VBATT +5V GND2 GND1	TEST POINT WIRE (24ga.) LOOPS
78	1	045-5015-00	CN6	12PKK156 (PIN 5=KEY)
79	1	181-5002-00	SW300	8 PIN DIPSWITCH
80	2	100-0377-00	U401 U400	LM339AN
81	1	105-0052-05	U4	6116 RAM
82	3	535-5000-10	U100 U101 U102	AAVID 531102

Your Notes

[illegible]

Appendixes A through H*Appendix
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- **Appendix A, Pinball Game Firmware Table 118-119**
...describes the EPROM with its chip size, the Sega Pinball Inc. Part N^o, version (if applicable), and CPU Board & CPU/Sound Board pin location(s).
- **Appendix B, Semi-Conductors / Integrated Circuits / Relay Cross-Reference Table 120**
...describes diodes and transistors with Source N^o, Sega Pinball Inc. Part N^o, NTE N^o, ECG N^o, Radio Shack Part N^o (If applicable) and RCA Part N^o (If applicable).
- **Appendix C, CPU Jumper Table 121**
...provides the Game Manufactured Date and Manual Part N^o, the CPU version, the ROM Position, and the Jumpers Installed and Removed.
- **Appendix D, Board Type Table..... 122-123**
...provides Part N^o for Flipper Boards, Old Board System (Sound, Power Supply) and New Board System (I/O Power Driver, CU/Sound, Display Power Supply) and Display Boards.
- **Appendix E, Generic Coil Cross-Reference Guide and Flipper Coil Table 124-125**
...provides the Coils used with Part N^o and Gauge-Turns (of the coil).
- **Appendix F, Motor Specification Table 126-127**
...provides all the Motor information used on the games (Motor Type, Function and Part N^o).
- **Appendix G, Part Number Prefix Classification Codes 128**
...explains how our Part Numbers are developed to help sort parts easier.
- **Appendix H, Playfield Inserts (Plastic Light Covers) 129**
...gives a pictorial view with the name and part number of all the inserts used (also gives the Color Code Chart).
- **Glossary of Terms 130-131**
...gives definitions or explanations of some pinball terms and acronyms.

APPENDIX A

Pinball Game Firmware Table

EPROM	Chip Size	Part N°	Ver.	Loc.	Raw Part N°	EPROM	Chip Size	Part N°	Ver.	Loc.	Raw Part N°
Laser War						Teenage Mutant Ninja Turtles					
CPU	(256K)	965-0004-00		C5	960-5007-00	CPU	(256K)	965-0061-00	A1.04	B5	960-5007-00
Sound (old)	(256K)	965-0005-00		J5	960-5007-00	CPU	(256K)	965-0062-00	A1.04	C5	960-5007-00
Sound (old)	(256K)	965-0006-00		J6	960-5007-00	Voice 1	(1M)	965-0063-00		F5/6	960-5009-00
Sound (old)	(256K)	965-0007-00		J7	960-5007-00	Voice 2	(1M)	965-0064-00		F4/5	960-5009-00
		- OR -				Sound	(256K)	965-0065-00		F7	960-5007-00
Sound	(256K)	965-0008-00		7F	960-5007-00	Display	(512K)	965-0066-00		U8	960-7001-02
Sound 1	(512K)	965-0009-00		6F	960-7001-02						
Sound 2	(512K)	965-0010-00		4F	960-7001-02						
Secret Service						Batman					
CPU	(256K)	965-0011-00	A-6	B5	960-5007-00	CPU	(128K)	965-0067-00	A1.06	B5	960-5006-00
CPU	(256K)	965-0012-00	A-6	C5	960-5007-00	CPU	(256K)	965-0135-00	A1.06	C5	960-5007-00
Voice 1	(512K)	965-0014-00		6F	960-7001-02	Voice 1	(2M)	965-0068-00		U17	960-5010-00
Voice 2	(512K)	965-0015-00		4F	960-7001-02	Voice 2	(1M)	965-0069-00		U21	960-5009-00
Sound	(256K)	965-0013-00		7F	960-5007-00	Sound	(256K)	965-0070-00		U7	960-5007-00
						Display	(1M)	965-0071-00	A1.02	U8	960-5009-00
Torpedo Alley						Star Trek 25th Anniversary					
CPU	(256K)	965-0016-00	A02-1	B5	960-5007-00	CPU	(512K)	965-0072-00	A2.00	B5	960-7001-02
CPU	(256K)	965-0017-00	A02-1	C5	960-5007-00	Voice 1	(2M)	965-0073-00		U17	960-5010-00
Voice 1	(512K)	965-0019-00		6F	960-7001-02	Voice 2	(2M)	965-0074-00		U21	960-5010-00
Voice 2	(512K)	965-0020-00		4F	960-7001-02	Sound	(256K)	965-0075-00		U7	960-5007-00
Sound	(256K)	965-0018-00		7F	960-5007-00	Display	(1M)	965-0076-00	A1.09	U8	960-5009-00
Time Machine						Hook					
CPU	(256K)	965-0021-00	A02-3	B5	960-5007-00	CPU	(512K)	965-0077-00	A4.08	C5	960-7001-02
CPU	(256K)	965-0022-00	A02-3	C5	960-5007-00	Voice 1	(2M)	965-0078-00		U17	960-5010-00
Voice 1	(512K)	965-0024-00		6F	960-7001-02	Voice 2	(2M)	965-0079-00		U21	960-5010-00
Voice 2	(512K)	965-0025-00		4F	960-7001-02	Sound	(256K)	965-0080-00		U7	960-5007-00
Sound	(256K)	965-0023-00		7F	960-5007-00	Display	(1M)	965-0081-00	A4.01	U8	960-5009-00
Playboy 35th Anniversary						Lethal Weapon 3					
CPU	(256K)	965-0046-00	A02-3	B5	960-5007-00	CPU	(512K)	965-0082-00	A2.07	C5	960-7001-02
CPU	(256K)	965-0047-00	A02-3	C5	960-5007-00	Voice 1	(2M)	965-0083-00		U17	960-5010-00
Voice 1	(512K)	965-0049-00		6F	960-7001-02	Voice 2	(2M)	965-0084-00		U21	960-5010-00
Voice 2	(512K)	965-0050-00		4F	960-7001-02	Sound	(256K)	965-0085-00		U7	960-5007-00
Sound	(256K)	965-0048-00		7F	960-5007-00	Display	(2M)	965-0086-00		ROM 1	960-5010-00
						Display	(2M)	965-0087-00		ROM 2	960-5010-00
						Display	(4M)	965-0087-04	A2.06	ROM 0	960-5015-00
ABC Monday Night Football						Star Wars					
CPU	(256K)	965-0031-00	A02-7	B5	960-5007-00	CPU	(512K)	965-0119-00	A1.03	C5	960-7001-02
CPU	(256K)	965-0032-00	A02-7	C5	960-5007-00	Voice 0	(4M)	965-0132-00		U17	960-5015-00
Voice 1	(512K)	965-0034-00		6F	960-7001-02	Voice 1	(2M)	965-0133-00		U21	960-5010-00
Voice 2	(512K)	965-0035-00		4F	960-7001-02	Sound	(256K)	965-0131-00		U7	960-5007-00
Sound	(256K)	965-0033-00		7F	960-5007-00	Display	(2M)	965-0120-00	A1.04	ROM 0	960-5010-00
						Display	(2M)	965-0121-00	A1.04	ROM 1	960-5010-00
								(Used on Display PCB 520-5055-01)			
Robocop						-OR-					
CPU	(256K)	965-0036-00	A03-4	B5	960-5007-00	Display	(4M)	965-0122-00	A1.05	ROM 0	960-5015-00
CPU	(256K)	965-0037-00	A03-4	C5	960-5007-00			(Used on Display PCB 520-5055-01)			
Voice 1	(512K)	965-0039-00		6F	960-7001-02						
Voice 2	(512K)	965-0040-00		4F	960-7001-02						
Sound	(256K)	965-0038-00		7F	960-5007-00						
Phantom of the Opera						Rocky & Bullwinkle & Friends					
CPU	(256K)	965-0026-00	A03-2	B5	960-5007-00	CPU	(512K)	965-0138-00	A1.30	C5	960-7001-02
CPU	(256K)	965-0027-00	A03-2	C5	960-5007-00	Voice 0	(4M)	965-0139-00		U17	960-5015-00
Voice 1	(512K)	965-0029-00		6F	960-7001-02	Voice 1	(2M)	965-0140-00		U21	960-5010-00
Voice 2	(512K)	965-0030-00		4F	960-7001-02	Sound	(256K)	965-0141-00		U7	960-5007-00
Sound	(256K)	965-0028-00		7F	960-5007-00	Display	(4M)	965-0142-00	A1.30	ROM 0	960-5015-00
Back to the Future						Jurassic Park					
CPU	(256K)	965-0041-00	SA-2	B5	960-5007-00	CPU	(512K)	965-0143-00	A5.10	C5	960-7001-02
CPU	(256K)	965-0042-00	SA-2	C5	960-5007-00	Voice 0	(4M)	965-0144-00		U17	960-5015-00
Voice 1	(512K)	965-0044-00		6F	960-7001-02	Voice 1	(2M)	965-0145-00		U21	960-5010-00
Voice 2	(512K)	965-0045-00		4F	960-7001-02	Sound	(256K)	965-0146-00		U7	960-5007-00
Sound	(256K)	965-0043-00		7F	960-5007-00	Display	(4M)	965-0147-00	A5.10	ROM 0	960-5015-00
The Simpsons						Last Action Hero					
CPU	(256K)	965-0051-00	A02-7	B5	960-5007-00	CPU	(512K)	965-0148-00	A1.12	C5	960-7001-02
CPU	(256K)	965-0052-00	A02-7	C5	960-5007-00	Voice 0	(4M)	965-0149-00		U17	960-5015-00
Voice 1	(512K)	965-0054-00		6F	960-7001-02	Voice 1	(2M)	965-0150-00		U21	960-5010-00
Voice 2	(512K)	965-0055-00		4F	960-7001-02	Sound	(256K)	965-0151-00		U7	960-5007-00
Sound	(256K)	965-0053-00		7F	960-5007-00	Display	(4M)	965-0152-00	A1.06	ROM 0	960-5015-00
Checkpoint						Tales from the Crypt					
CPU	(256K)	965-0056-00	A1-7	B5	960-5007-00	CPU	(512K)	965-0157-00	A3.00	C5	960-7001-02
CPU	(256K)	965-0134-00	A1-7	C5	960-5007-00	Voice 0	(4M)	965-0158-00		U17	960-5015-00
Voice 1	(1M)	965-0057-00		F7	960-5009-00	Voice 1	(2M)	965-0159-00		U21	960-5010-00
Voice 2	(1M)	965-0058-00		F5	960-5009-00	Sound	(256K)	965-0160-00		U7	960-5007-00
Sound	(256K)	965-0059-00		F4	960-5007-00	Display	(4M)	965-0161-00	A3.00	ROM 0	960-5015-00
Display	(512K)	965-0060-00	CP80	U8	960-7001-02						

Table continued on the next page.

APPENDIX A

Pinball Game Firmware Table

EPROM	Chlp Size	Part N°	Ver.	Loc.	Raw Part N°
The Who's Tommy					
CPU	(512K)	965-0162-00	A4.00	C5	960-7001-02
Voice 1	(4M)	965-0165-00		U17	960-5015-00
Voice 2	(4M)	965-0166-00		U21	960-5015-00
Voice 3	(4M)	965-0167-00		U36	960-5015-00
Voice 4	(4M)	965-0168-00		U37	960-5015-00
Sound	(512K)	965-0164-00		U7	960-7001-02
Display	(4M)	965-0163-00	A4.00	ROM 0	960-5015-00

WWF Royal Rumble					
CPU	(512K)	965-0169-00	A1.06	C5	960-7001-02
Voice 1	(4M)	965-0172-00		U17	960-5015-00
Voice 2	(4M)	965-0173-00		U21	960-5015-00
Voice 3	(4M)	965-0174-00		U36	960-5015-00
Sound	(512K)	965-0171-00		U7	960-7001-02
Display	(4M)	965-0170-00	A1.02	ROM 0	960-5015-00

Guns N' Roses					
CPU	(512K)	965-0175-00	A3.00	C5	960-7001-02
Voice 1	(4M)	965-0178-00		U17	960-5015-00
Voice 2	(4M)	965-0179-00		U21	960-5015-00
Voice 3	(4M)	965-0180-00		U36	960-5015-00
Voice 4	(4M)	965-0181-00		U37	960-5015-00
Sound	(512K)	965-0177-00		U7	960-7001-02
Display	(4M)	965-0176-00	A3.00	ROM 0	960-5015-00

Maverick					
CPU	(512K)	965-0182-00	A4.04	C5	960-7001-02
Voice 1	(4M)	965-0186-00		U17	960-5015-00
Voice 2	(4M)	965-0187-00		U21	960-5015-00
Voice 3	(4M)	965-0187-01		U36	960-5015-00
Sound	(512K)	965-0185-00		U7	960-7001-02
Display*	(4M)	965-0183-00	A4.01	ROM 0	960-5015-00
Display*	(4M)	965-0184-00	A4.01	ROM 3	960-5015-00

Mary Shelley's Frankenstein					
CPU	(512K)	965-0188-00	A1.03	C5	960-7001-02
Voice 1	(4M)	965-0192-00		U17	960-5015-00
Voice 2	(4M)	965-0193-00		U21	960-5015-00
Voice 3	(4M)	965-0194-00		U36	960-5015-00
Sound	(512K)	965-0191-00		U7	960-7001-02
Display*	(4M)	965-0189-00	A1.03	ROM 0	960-5015-00
Display*	(4M)	965-0190-00	A1.03	ROM 3	960-5015-00

Baywatch					
CPU	(512K)	965-0195-00	A4.01	C5	960-7001-02
Voice 1	(4M)	965-0196-00		U17	960-5015-00
Voice 2	(4M)	965-0197-00		U21	960-5015-00
Voice 3	(Correction Note: 2M/U36 was not used in this game.)				
Sound	(512K)	965-0199-00		U7	960-7001-02
Display*	(4M)	965-0200-00	A4.01	ROM 0	960-5015-00
Display*	(4M)	965-0201-00	A4.01	ROM 3	960-5015-00

Batman Forever					
CPU	(512K)	965-0202-00	A3.02	C5	960-7001-02
Voice 1	(4M)	965-0203-00		U17	960-5015-00
Voice 2	(4M)	965-0204-00		U21	960-5015-00
Sound	(512K)	965-0205-00		U7	960-7001-02
Display*	(4M)	965-0206-00	A3.00	ROM 0	960-5015-00
Display*	(4M)	965-0207-00	A3.00	ROM 3	960-5015-00



Games hereon use the White Star Board System™ :

ROM	Chlp Size	Part N°	Ver.	Loc.	Raw Part N°
Apollo 13					
CPU / Sound Board: <<< updated in this manual >>>					
Game ROM	(1M)	965-0208-00	A5.01	U210	960-5009-00
Voice 1	(4M)	965-0209-00		U17	n/a (masked)
Voice 2	(4M)	965-0210-00		U21	n/a (masked)
Voice 3	(4M)	965-0211-00		U36	n/a (masked)
Sound	(512K)	965-0212-00		U7	960-7001-02
Display Controller Board:					
Display	(4M)	965-0213-00	A5.00	ROM 0	960-5015-00

ROM	Chlp Size	Part N°	Ver.	Loc.	Raw Part N°
Golden Eye					
CPU / Sound Board:					
Game ROM	(1M)	965-0214-42	A4.04	U210	960-5009-00
Voice 1	(4M)	965-0215-42		U17	n/a (masked)
Voice 2	(4M)	965-0216-42		U21	n/a (masked)
Sound	(512K)	965-0217-42		U7	960-7001-02
Display Controller Board:					
Display	(4M)	965-0218-42	A4.00	ROM 0	960-5015-00

Twister					
CPU / Sound Board: <<< updated in this manual >>>					
Game ROM	(1M)	965-0219-41	A4.04	U210	960-5009-00
Voice 1	(4M)	965-0220-41		U17	960-5015-00
Voice 2	(4M)	965-0223-41		U21	960-5015-00
Sound	(512K)	965-0221-41		U7	960-7001-02
Display Controller Board:					
Display	(4M)	965-0222-41	A4.01	ROM 0	960-5015-00

ID4: Independence Day					
CPU / Sound Board:					
Game ROM	(1M)	965-0224-45	IN PRODUCTION	U210	960-5009-00
Voice 1	(4M)	965-0225-45		U17	960-5015-00
Voice 2	(4M)	965-0226-45		U21	960-5015-00
Sound	(512K)	965-0227-45		U7	960-7001-02
Display Controller Board:					
Display	(4M)	965-0228-45		ROM 0	960-5015-00

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

Table Notes:
Game Revisions can be updated after the production run. This table is accurate as of the printing of this manual. To see if any changes occurred, the next game manual will include updates. The version stated is USA. If there is a question of what revision number any particular ROM is and the next game manual(s) are not available, call our Technical Support Department.

APPENDIX B

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

Table N°	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	112-0062-00	NTE5092A	ECG5092A	-----	SK68V
	Diode	1N4764 100v	112-0049-00	NTE5096A	ECG5096A	-----	SK100V
	Diode	1N5228 3.9v	112-0053-00	NTE5007A	ECG5007A	-----	SK3A9
	Diode	1N5234B 6.2v	112-0047-00	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	112-5010-00	-----	-----	-----	SK33V
	Diode	1N4736 6.8v 1w	112-5007-00	-----	-----	-----	-----
TRANSISTORS - TYPE FET, NPN, PNP AND/OR SCR							
3	FET Trans.	STP20N10L	110-0106-00	-----	ECG2987	-----	-----
	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	NTE123	ECG123	-----	-----
	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	110-0071-00	NTE292	ECG292	-----	SK3441
	PNP Trans.	TIP36C	110-0077-00	NTE393	ECG393	-----	SK3961
	SCR Trans.	2N5060	110-0074-00	NTE5400	ECG5400	276-1067	SK3950
BRIDGE RECTIFIERS (BR)				Comments:			
4	BR (Present)	DB or CM3501	112-0052-00	For White Star I/O Bds., BR = 35 Amp @ 100v P.I.V.			
	BR (Old)	MDA2501	112-0054-00	BR = 25 Amp @ 100v P.I.V.			
	BR (Old)	MDA3502	112-0057-00	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 CPU Jumper Table

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	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.	ROM 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

† 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

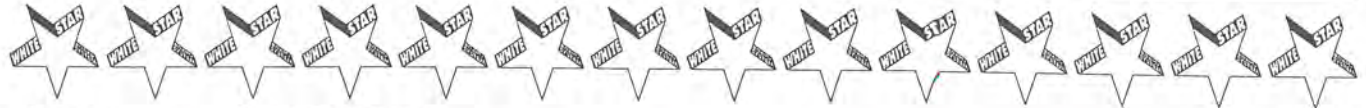
Game Name	Flipper	Sound	Power Supply	Display X-Digit
Laser War	2-Flipper Board Not Required	<i>initial:</i> 520-5002-00 <i>replaced with:</i> 520-5002-02 520-5002-01 was not used.	520-5000-00	Master: 520-5004-00 plus: 7 Digit Alpha/Numeric 520-5005-00 (Qty. 2) 7 Digit Numeric 520-5006-00 (Qty. 2) 4 Digit 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
Checkpoint	520-5033-00 2-Flipper	520-5002-03	520-5047-00	520-5042-00 128 X 16	Not Required with 128 X 16
Teenage Mutant Ninja Turtles	520-5033-00 2-Flipper	520-5002-03	520-5047-00	520-5042-00 128 X 16	Not Required with 128 X 16
Batman	520-5033-00 2-Flipper	520-5050-01	520-5047-00	520-5042-00 128 X 16	Not Required with 128 X 16
Star Trek 25th Anniversary	520-5033-00 2-Flipper	520-5050-01	520-5047-00	520-5042-00 128 X 16	Not Required with 128 X 16
Hook	520-5033-00 2-Flipper	520-5050-01	520-5047-00	520-5042-00 128 X 16	Not Required with 128 X 16
Lethal Weapon 3	520-5033-00 2-Flipper	520-5050-01	520-5047-01	520-5052-00 128 X 32	520-5055-00
Star Wars	520-5033-00 2-Flipper	520-5050-02	520-5047-01	520-5052-00 128 X 32	520-5055-00
Rocky & Bullwinkle & Friends	520-5033-00 2-Flipper	520-5050-02	520-5047-01	520-5052-00 128 X 32	520-5055-00
Jurassic Park	520-5076-00 3-Flipper	520-5050-02	520-5047-02	520-5052-00 128 X 32	520-5055-00
Last Action Hero	520-5070-00 2-Flipper	520-5050-03	520-5047-02	520-5052-00 128 X 32	520-5055-00
Tales from the Crypt	520-5076-00 3-Flipper	520-5050-03	520-5047-02	520-5052-00 128 X 32	520-5055-01
The Who's Tommy	520-5076-00 3-Flipper	520-5077-00	520-5047-02	520-5052-00 128 X 32	520-5055-01
WWF Royal Rumble	520-5070-00 (Qty. 2) 4-Flipper (2X2)	520-5077-00	520-5047-02	520-5052-00 128 X 32	520-5055-01

Table continued on the next page.

APPENDIX D Board Type Table

Game Name	Flipper	Sound	Power Supply	Dot Matrix Display	Display Controller
Guns N' Roses	520-5076-00 3-Flipper	520-5077-00	520-5047-02	520-5052-00 128 X 32	520-5055-01
Maverick	520-5076-00 3-Flipper	520-5050-03	520-5047-03	520-5075-00 192 X 64	520-5092-01
Mary Shelley's Frankenstein	520-5076-00 3-Flipper	520-5077-00	520-5047-03	520-5075-00 192 X 64	520-5092-01
Baywatch	520-5080-00 (Qty. 2) 4-Flipper (2X2)	520-5126-02	520-5047-03	520-5075-00 192 X 64	520-5092-01
Batman Forever	520-5076-00 3-Flipper	520-5126-02	520-5047-03	520-5075-00 192 X 64	520-5092-01



Games hereon use the White Star Board System™ :

Game Name	Flipper	I/O Power Driver	CPU / Sound	Display Power Supply	Dot Matrix Display	Display Controller
Apollo 13	520-5070-00 2-Flipper	520-5137-00	520-5136-44	520-5138-00	520-5052-00 128 X 32	520-5055-01
Golden Eye	520-5070-00 2-Flipper	520-5137-00	520-5136-42	520-5138-00	520-5052-00 128 X 32	520-5055-01
Twister	2-Flipper Bd. Not Required	520-5137-01	520-5136-41	520-5138-00	520-5052-00 128 X 32	520-5055-01
ID4: Independence Day	3-Flipper Bd. Not Required	520-5137-01	520-5136-45	520-5138-00	520-5052-00 128 X 32	520-5055-01

APPENDIX E

Generic Coil Cross-Reference Guide

SEGA PINBALL™ Part N°	Gauge- Turns	SEGA PINBALL™ Part N°	Gauge- Turns	SEGA PINBALL™ Part N°	Gauge- Turns	SEGA PINBALL™ Part N°	Gauge- Turns
090-5000-00	22-700	090-5011-00	22-750	090-5020-00	Not Used	090-5030-00	23-1100
090-5001-00	23-800	090-5012-00	26-800	090-5020-01	21-900	090-5032-00	22-1080
090-5001-01	23-800	090-5013-00	23-700	090-5020-02	22-900	090-5034-00	25-1240
090-5002-00	24-900	090-5014-00	23-600	090-5020-10	21-900	090-5036-00	24-940
090-5003-00	27-1300	090-5015-00	27-1400	090-5020-20	22-900	090-5036-01	24-940
090-5004-00	27-1500	090-5016-00	29-2000	090-5020-30	23-900	090-5037-03	23½-765
090-5005-00	23-840	090-5017-00	22-500	090-5021-00	20-400		
090-5006-00	23-800	090-5018-00	23-800	090-5022-00	23-700	090-5041-00	25-1800
090-5008-00	23-1200	090-5019-00	23-750	090-5023-00	22-600	090-5046-00	28-1050
				090-5025-00	24-1570		

Flipper Coil Table

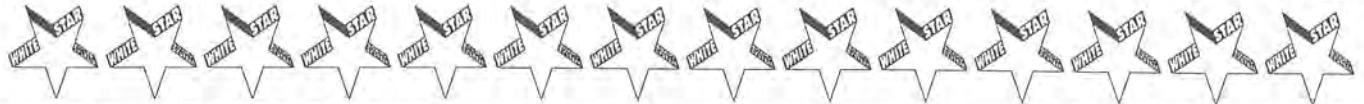
Game Name	Flipper: Lower Right SEGA PINBALL™ Part N° w/Ga.-Turns	Flipper: Lower Left SEGA PINBALL™ Part N° w/Ga.-Turns	Flipper: Upper Right SEGA PINBALL™ Part N° w/Ga.-Turns	Flipper: Upper Left SEGA PINBALL™ Part N° w/Ga.-Turns
Laser Wars	090-5011-00 22-750/30-2600	SAME AS LOWER RIGHT	Not Used	Not Used
Secret Service	090-5006-00 23-620/30-2600	SAME AS LOWER RIGHT	SAME AS LOWER RIGHT	Not Used
Torpedo Alley	090-5013-00 23-700/30-2600	090-5011-00 22-750/30-2600	090-5012-00 26-800	Not Used
Time Machine	090-5011-00 22-750/30-2600	SAME AS LOWER RIGHT	Not Used	Not Used
Playboy 35th Anniversary †	090-5020-02 22-900	SAME AS LOWER RIGHT	Not Used	Not Used
ABC Monday Night Football †	090-5020-02 22-900	SAME AS LOWER RIGHT	Not Used	Not Used
Robocop	090-5020-20 22-900	SAME AS LOWER RIGHT	Not Used	Not Used
Phantom of the Opera	090-5020-20 22-900	SAME AS LOWER RIGHT	Not Used	Not Used
Back to the Future	090-5020-20 22-900	SAME AS LOWER RIGHT	Not Used	Not Used
The Simpsons	090-5020-20 22-900	SAME AS LOWER RIGHT	Not Used	Not Used
Checkpoint	090-5020-20 22-900	SAME AS LOWER RIGHT	Not Used	Not Used
Teenage Mutant Ninja Turtles	090-5020-30 23-900	SAME AS LOWER RIGHT	Not Used	Not Used
Batman	090-5020-30 23-900	SAME AS LOWER RIGHT	Not Used	Not Used
Star Trek 25th Anniversary	090-5020-30 23-900	SAME AS LOWER RIGHT	Not Used	Not Used
Hook	090-5020-30 23-900	090-5030-00 23-1100	Not Used	Not Used
Lethal Weapon 3	090-5030-00 23-1100	SAME AS LOWER RIGHT	Not Used	Not Used
Star Wars	090-5032-00 22-1080	SAME AS LOWER RIGHT	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.

Table continued on the next page.

APPENDIX D Board Type Table

Game Name	Flipper	Sound	Power Supply	Dot Matrix Display	Display Controller
Guns N' Roses	520-5076-00 3-Flipper	520-5077-00	520-5047-02	520-5052-00 128 X 32	520-5055-01
Maverick	520-5076-00 3-Flipper	520-5050-03	520-5047-03	520-5075-00 192 X 64	520-5092-01
Mary Shelley's Frankenstein	520-5076-00 3-Flipper	520-5077-00	520-5047-03	520-5075-00 192 X 64	520-5092-01
Baywatch	520-5080-00 (Qty. 2) 4-Flipper (2X2)	520-5126-02	520-5047-03	520-5075-00 192 X 64	520-5092-01
Batman Forever	520-5076-00 3-Flipper	520-5126-02	520-5047-03	520-5075-00 192 X 64	520-5092-01



Games hereon use the White Star Board System™ :

Game Name	Flipper	I/O Power Driver	CPU / Sound	Display Power Supply	Dot Matrix Display	Display Controller
Apollo 13	520-5070-00 2-Flipper	520-5137-00	520-5136-44	520-5138-00	520-5052-00 128 X 32	520-5055-01
Golden Eye	520-5070-00 2-Flipper	520-5137-00	520-5136-42	520-5138-00	520-5052-00 128 X 32	520-5055-01
Twister	2-Flipper Bd. Not Required	520-5137-01	520-5136-41	520-5138-00	520-5052-00 128 X 32	520-5055-01
ID4: Independence Day	3-Flipper Bd. Not Required	520-5137-01	520-5136-45	520-5138-00	520-5052-00 128 X 32	520-5055-01

APPENDIX E

Generic Coil Cross-Reference Guide

SEGA PINBALL™ Part N°	Gauge- Turns	SEGA PINBALL™ Part N°	Gauge- Turns	SEGA PINBALL™ Part N°	Gauge- Turns	SEGA PINBALL™ Part N°	Gauge- Turns
090-5000-00	22-700	090-5011-00	22-750	090-5020-00	Not Used	090-5030-00	23-1100
090-5001-00	23-800	090-5012-00	26-800	090-5020-01	21-900	090-5032-00	22-1080
090-5001-01	23-800	090-5013-00	23-700	090-5020-02	22-900	090-5034-00	25-1240
090-5002-00	24-900	090-5014-00	23-600	090-5020-10	21-900	090-5036-00	24-940
090-5003-00	27-1300	090-5015-00	27-1400	090-5020-20	22-900	090-5036-01	24-940
090-5004-00	27-1500	090-5016-00	29-2000	090-5020-30	23-900	090-5037-03	23½-765
090-5005-00	23-840	090-5017-00	22-500	090-5021-00	20-400		
090-5006-00	23-800	090-5018-00	23-800	090-5022-00	23-700	090-5041-00	25-1800
090-5008-00	23-1200	090-5019-00	23-750	090-5023-00	22-600	090-5046-00	28-1050
				090-5025-00	24-1570		

Flipper Coil Table

Game Name	Flipper: Lower Right SEGA PINBALL™ Part N° w/Ga.-Turns	Flipper: Lower Left SEGA PINBALL™ Part N° w/Ga.-Turns	Flipper: Upper Right SEGA PINBALL™ Part N° w/Ga.-Turns	Flipper: Upper Left SEGA PINBALL™ Part N° w/Ga.-Turns
Laser Wars	090-5011-00 22-750/30-2600	SAME AS LOWER RIGHT	Not Used	Not Used
Secret Service	090-5006-00 23-620/30-2600	SAME AS LOWER RIGHT	SAME AS LOWER RIGHT	Not Used
Torpedo Alley	090-5013-00 23-700/30-2600	090-5011-00 22-750/30-2600	090-5012-00 26-800	Not Used
Time Machine	090-5011-00 22-750/30-2600	SAME AS LOWER RIGHT	Not Used	Not Used
Playboy 35th Anniversary †	090-5020-02 22-900	SAME AS LOWER RIGHT	Not Used	Not Used
ABC Monday Night Football †	090-5020-02 22-900	SAME AS LOWER RIGHT	Not Used	Not Used
Robocop	090-5020-20 22-900	SAME AS LOWER RIGHT	Not Used	Not Used
Phantom of the Opera	090-5020-20 22-900	SAME AS LOWER RIGHT	Not Used	Not Used
Back to the Future	090-5020-20 22-900	SAME AS LOWER RIGHT	Not Used	Not Used
The Simpsons	090-5020-20 22-900	SAME AS LOWER RIGHT	Not Used	Not Used
Checkpoint	090-5020-20 22-900	SAME AS LOWER RIGHT	Not Used	Not Used
Teenage Mutant Ninja Turtles	090-5020-30 23-900	SAME AS LOWER RIGHT	Not Used	Not Used
Batman	090-5020-30 23-900	SAME AS LOWER RIGHT	Not Used	Not Used
Star Trek 25th Anniversary	090-5020-30 23-900	SAME AS LOWER RIGHT	Not Used	Not Used
Hook	090-5020-30 23-900	090-5030-00 23-1100	Not Used	Not Used
Lethal Weapon 3	090-5030-00 23-1100	SAME AS LOWER RIGHT	Not Used	Not Used
Star Wars	090-5032-00 22-1080	SAME AS LOWER RIGHT	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.

Table continued on the next page.

APPENDIX E Flipper Coil Table

Game Name	Flipper: Lower Right SEGA PINBALL™ Part N° w/Ga.-Turns	Flipper: Lower Left SEGA PINBALL™ Part N° w/Ga.-Turns	Flipper: Upper Right SEGA PINBALL™ Part N° w/Ga.-Turns	Flipper: Upper Left SEGA PINBALL™ Part N° w/Ga.-Turns
Rocky & Bullwinkle & Friends	090-5020-30 23-900	SAME AS LOWER RIGHT	Not Used	Not Used
Jurassic Park	090-5020-30 23-900	SAME AS LOWER RIGHT	090-5030-00 23-1100	Not Used
Last Action Hero	090-5020-30 23-900	SAME AS LOWER RIGHT	Not Used	Not Used
Tales from the Crypt	090-5032-00 22-1080	SAME AS LOWER RIGHT	090-5041-00 25-1800	Not Used
The Who's Tommy	090-5020-30 23-900	SAME AS LOWER RIGHT	Not Used	090-5041-00 25-1800
WWF Royal Rumble	090-5032-00 22-1080	SAME AS LOWER RIGHT	090-5041-00 25-1800	SAME AS UPPER RIGHT
Guns N' Roses	090-5032-00 22-1080	SAME AS LOWER RIGHT	Not Used	090-5030-00 23-1100
Maverick	090-5032-00 22-1080	SAME AS LOWER RIGHT	090-5032-00 22-1080	Not Used
Mary Shelley's Frankenstein	090-5030-00 23-1100	SAME AS LOWER RIGHT	090-5030-00 23-1100	Not Used
Baywatch	090-5020-30 23-900	090-5030-00 23-1100	SAME AS LOWER LEFT	090-5025-00 24-1570
Batman Forever	090-5020-20 22-900	090-5032-00 22-1080	090-5020-30 23-900	Not Used
Apollo 13	090-5032-00 22-1080	SAME AS LOWER RIGHT	Not Used	Not Used
Golden Eye	090-5032-00 22-1080	SAME AS LOWER RIGHT	Not Used	Not Used
Twister	090-5032-00 22-1080	090-5020-20 22-900	Not Used	Not Used
ID4: Independence Day	090-5032-00 22-1080	SAME AS LOWER RIGHT	090-5020-30 23-900	Not Used

APPENDIX F Motor Specification Table

Game Name	Function	Specifications	Part N°
Laser Wars 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	Motor 24v A.C. 60 RPM CW	515-5222-00
Robocop			
Phantom of the Opera	Organ Up/Down	Bowman Motor 24v 60hz 3W 11 RPM CCW	515-5256-00
Back to the Future The Simpsons			
Checkpoint	Shaker	Johnson Motor (Vibrator)	041-5002-00
	Mag Wheel (in Backbox)	Motor D.C. (KEN)	041-5005-00
Teenage Mutant Ninja Turtles	Spinning Pizza Ball Deflector	Gear Motor 24v A.C. 325 RPM CW	515-5397-00
Batman	Bar Target Up/Down	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. 3.5 RPM	500-5421-00
	Cooling Fan for Transporter F/X	4½" Motor 12v	041-5014-00
Hook			
Lethal Weapon 3	Spinning Light	Motor 2.5v A.C. 4000 RPM CCW	041-5017-00
Star Wars	Bar Target Up/Down	Bowman Motor 24v 60hz 3W 11 RPM CCW	515-5256-00
	R2D2 Robot 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" Movement	Autotrol Model E Motor 24v 60hz 4W 3 RMP CCW	041-5023-00
Jurassic Park	Shaker	Johnson Motor Vibrator	041-5002-00
	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

Table Continued on the next page.

APPENDIX E Flipper Coil Table

Game Name	Flipper: Lower Right SEGA PINBALL™ Part N° w/Ga.-Turns	Flipper: Lower Left SEGA PINBALL™ Part N° w/Ga.-Turns	Flipper: Upper Right SEGA PINBALL™ Part N° w/Ga.-Turns	Flipper: Upper Left SEGA PINBALL™ Part N° w/Ga.-Turns
Rocky & Bullwinkle & Friends	090-5020-30 23-900	SAME AS LOWER RIGHT	Not Used	Not Used
Jurassic Park	090-5020-30 23-900	SAME AS LOWER RIGHT	090-5030-00 23-1100	Not Used
Last Action Hero	090-5020-30 23-900	SAME AS LOWER RIGHT	Not Used	Not Used
Tales from the Crypt	090-5032-00 22-1080	SAME AS LOWER RIGHT	090-5041-00 25-1800	Not Used
The Who's Tommy	090-5020-30 23-900	SAME AS LOWER RIGHT	Not Used	090-5041-00 25-1800
WWF Royal Rumble	090-5032-00 22-1080	SAME AS LOWER RIGHT	090-5041-00 25-1800	SAME AS UPPER RIGHT
Guns N' Roses	090-5032-00 22-1080	SAME AS LOWER RIGHT	Not Used	090-5030-00 23-1100
Maverick	090-5032-00 22-1080	SAME AS LOWER RIGHT	090-5032-00 22-1080	Not Used
Mary Shelley's Frankenstein	090-5030-00 23-1100	SAME AS LOWER RIGHT	090-5030-00 23-1100	Not Used
Baywatch	090-5020-30 23-900	090-5030-00 23-1100	SAME AS LOWER LEFT	090-5025-00 24-1570
Batman Forever	090-5020-20 22-900	090-5032-00 22-1080	090-5020-30 23-900	Not Used
Apollo 13	090-5032-00 22-1080	SAME AS LOWER RIGHT	Not Used	Not Used
Golden Eye	090-5032-00 22-1080	SAME AS LOWER RIGHT	Not Used	Not Used
Twister	090-5032-00 22-1080	090-5020-20 22-900	Not Used	Not Used
ID4: Independence Day	090-5032-00 22-1080	SAME AS LOWER RIGHT	090-5020-30 23-900	Not Used

APPENDIX F

Motor Specification Table

Game Name	Function	Specifications	Part N°
Laser Wars 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	Motor 24v A.C. 60 RPM CW	515-5222-00
Robocop			
Phantom of the Opera	Organ Up/Down	Bowman Motor 24v 60hz 3W 11 RPM CCW	515-5256-00
Back to the Future The Simpsons			
Checkpoint	Shaker	Johnson Motor (Vibrator)	041-5002-00
	Mag Wheel (in Backbox)	Motor D.C. (KEN)	041-5005-00
Teenage Mutant Ninja Turtles	Spinning Pizza Ball Deflector	Gear Motor 24v A.C. 325 RPM CW	515-5397-00
Batman	Bar Target Up/Down	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. 3.5 RPM	500-5421-00
	Cooling Fan for Transporter F/X	4½" Motor 12v	041-5014-00
Hook			
Lethal Weapon 3	Spinning Light	Motor 2.5v A.C. 4000 RPM CCW	041-5017-00
Star Wars	Bar Target Up/Down	Bowman Motor 24v 60hz 3W 11 RPM CCW	515-5256-00
	R2D2 Robot 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" Movement	Autotrol Model E Motor 24v 60hz 4W 3 RMP CCW	041-5023-00
Jurassic Park	Shaker	Johnson Motor Vibrator	041-5002-00
	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

Table Continued on the next page.

APPENDIX F

Motor Specification Table

Game Name	Function	Specifications	Part N°
Last Action Hero	Crane Left/Right Movement	Multi Prod. #3312 Motor OSC 12v D.C.	041-5027-00
	Shaker	Motor Vibrator	041-5029-00
Tales from the Crypt	Shaker	Motor Vibrator	041-5029-00
	Tombstone Up/Down	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
The Who's Tommy	Mirror Up/Down	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	Motor Vibrator	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 Up/Down Movement	Multi Products Motor 24v A.C. 50/60Hz 3W 6 RPM CCW	515-6487-00
	Shaker	Motor Vibrator	041-5029-00
Golden Eye	Satellite Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CW	515-6528-00
Twister	Magnet Spinner	Multi Products Motor 24v A.C. 50/60Hz 3W 325 RPM CCW	515-6347-00
	Back Box Fan for 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

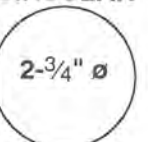
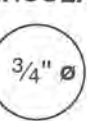
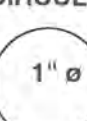
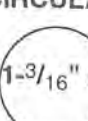
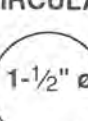
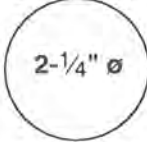
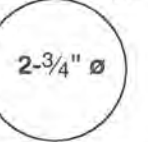
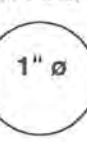
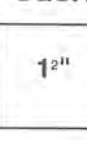
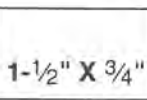
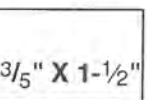
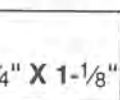
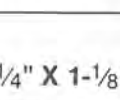
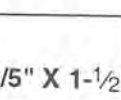
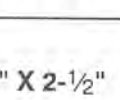
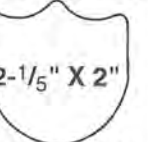
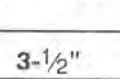
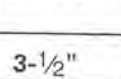
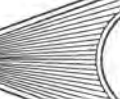
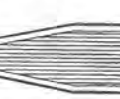
APPENDIX G

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)
	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  550-5000-XX	STARBURST CIRCULAR  550-5001-XX	STARBURST CIRCULAR  550-5002-XX	STARBURST CIRCULAR  550-5003-XX	STARBURST CIRCULAR  550-5004-XX
STARBURST CIRCULAR  550-5005-XX	STARBURST CIRCULAR  550-5006-XX	PLAIN CIRCULAR  550-5007-XX	PLAIN CIRCULAR  550-5008-XX	PLAIN CIRCULAR  550-5009-XX	PLAIN CIRCULAR  550-5010-XX
PLAIN CIRCULAR  550-5011-XX	PLAIN CIRCULAR  550-5012-XX	STIPPLE CIRCULAR  550-5048-XX	STIPPLE 1" SQUARE  550-5019-XX	ROLLOVER BUTTON BASE  550-5026-XX	WHITE STAR (only in white)  545-5015-00
STIPPLE RECTANGULAR  550-5018-XX	STIPPLE RECTANGULAR  550-5051-XX	STARBURST RECTANGULAR  550-5044-XX	PLAIN RECTANGULAR  550-5049-XX	PLAIN RECTANGULAR  550-5050-XX	PLAIN RECTANGULAR  550-5063-XX
STARBURST MINI SHIELD  550-5024-XX	STARBURST LARGE SHIELD  550-5025-XX	MINI HOT DOG  550-5020-XX	BEVEL HOT DOG  550-5021-XX	PLAIN HOT DOG  550-5022-XX	BANANA  550-5023-XX
STARBURST ARROW-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.

Plastic Part Color Chart (As applicable for all parts which can come in various colors.):
The "-XX" should be replaced with the following 2-digit number for the color desired.

-01:	CLEAR	-06:	YELLOW	-11	FLUORESCENT GREEN
-02:	RED	-07:	ORANGE	-12	FLUORESCENT BLUE
-03:	AMBER	-08:	WHITE	-13	TEAL GREEN
-04:	GREEN	-09:	PURPLE	-14	GRAY
-05:	BLUE	-10	FLUORESCENT ORANGE	-15	NEW: LUMINESCENT

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).
Au.	Abbreviation: Audit(s).
BOT	Abbreviation: Bottom.
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, Color Chart (Bottom) or Section 4, Chapter (last page).
Combination (Combo)	[Shot]. Any variable pinball shot(s) made succesively.
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).
EB	Acronym: Extra Ball.
Eject	Playfield surface device to kick ball back into play.
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.
G.I.	Abbreviation: General Illumination (Lamps).
IC	Acronym: Integrated Circuit (As in after 24-Pin IC)
i.e.	Abbreviation: Latin- Id est. That is.
LT	Abbreviation: Left.
Laser Kick	A coil/plunger used above the playfield to kick pinball back into play.
LED	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	Acronym: Magnet Board.
M-BALL or MBALL	Abbreviation: Multiball™.
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.
PCB	Acronym: Printed Circuit Board
PIA LED	Acronym: Peripheral Interface Adapter. 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.
Pop(s)	Another term for Turbo Bumper(s).
PPB	Playfield Power Board (Generic Term to describe Acronym with no true definition).
PSB	Acronym: Power Supply Board

GLOSSARY OF TERMS

P/F	Abbreviation: Playfield
P	Abbreviation: Pin (e.g. CN5-P3).
RAM	Acronym: Random Access Memory. RAM can store input instructions and supply output information.
RED	Abbreviation: Red.
Reflexive/Non-Reflexive (Relating to CPU Boards)	Reflexive —Solenoid Drive Transistor is enabled directly by a switch closure on the 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.
RT	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 sufficed.
SMB	Acronym: Shaker Motor Board.
Solenoid	A coil used for Electro Magnetic devices such as relays, flippers, slingshots, etc.
SSFB	Acronym: Solid State Flipper Board.
STEP	Refers to the service switches on the coin door.
S-U	Abbreviation: Stand-Up (targets).
TM	Acronym: 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.
TTL	Acronym: Transistor-Transistor Logic
Upr.	Abbreviation: Upper.
V or v	Abbreviation: Volt(s).
Ver.	Abbreviation: Version.
VUK	Acronym: Vertical Up-Kicker.
X	Acronym: "Times" A multiplier.
Zener Diode	A semi-conductor diode used for voltage regulation. Application depends on reverse break-down voltage.

Parts Order Checklist Notes

[illegible]

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