SEGA
PINBALL, INC.

BATMAN™
FOREVER

THIS GAME MANUAL IS 100% COMPLETE WITH ALL SCHEMATICS!

JOE BLACKWELL
TECHNICAL SUPPORT MANAGER

ERIC WINSTON
TECHNICAL SUPPORT ENGINEER

TED KILPIN
TECHNICAL SUPPORT ENGINEER

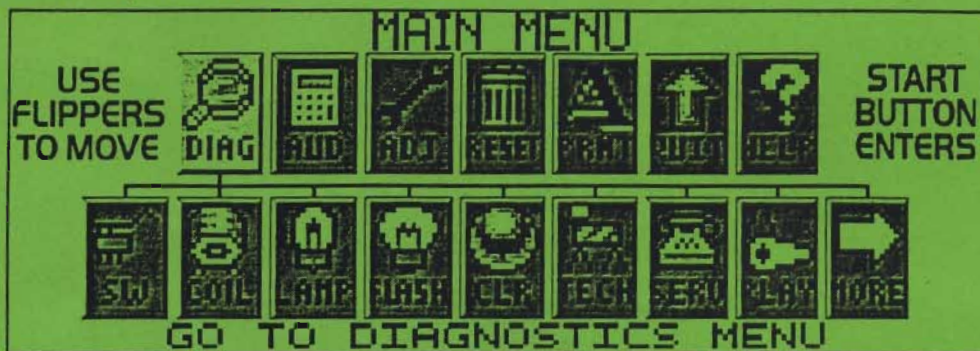**JAY ALFER**
TECH. DOCUMENTATION ADMINISTRATOR

Sega Pinball, Inc.™
© 1995. All Rights Reserved.

780-5038-00

❋ NEW ❋ NEW ❋ NEW ❋ NEW ❋ NEW ❋ NEW ❋ NEW ❋ NEW ❋

Portals™ Service Menu System

The manual has been reformatted to coincide with the Portals™ Service Menu. As the operator navigates through the new system on the display, the operator can follow along with this manual. This manual will be divided into Sections and Chapters. The entire Portals™ Service Menu is covered in Section 3 with all its chapters. For instructions and details of this Portals™ Service Menu please read through the entire Section 3 before operating the Portals™ Service Menu. The other Sections and Chapters will cover the remainder of information as covered in previous manuals.


```
                        MAIN MENU
USE                                                      START
FLIPPERS    DIAG  AUD  ADJ  RESET  PRNT  QUICK  HELP      BUTTON
TO MOVE                                                   ENTERS

            SW  COIL  LAMP  FLASH  CLR  TECH  SERU  PLAY  MORE
            GO TO DIAGNOSTICS MENU
```

Board Compatibility (Reflexive & Non-Reflexive) of CPU Boards

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

Power-Up CPU Self Tests

Upon power-up, the **CPU** Board performs a series of self tests of major components. Turn the game on while observing the **LEDs** on the **CPU** Board. Tests of the **PIAs**, **RAM**, and **EPROMs** are performed automatically and results of the tests are indicated by the **PIA LED**.

With all tests passed, the **LEDs** illuminate in the following sequence at power turn-on. The **PIA** and **+5v LEDs** illuminate immediately. Approximately ½-second later, the **PIA LED** goes out and the Blanking **LED** illuminates; the Blanking and **+5v LEDs** remain illuminated (normal operation) until the game is turned off (see Fig. 1). Test failures are indicated with the **PIA LED** lit.

Fig. 1


```
Blank   +5V   PIA
 on     on   (off)
```
Normal Operation
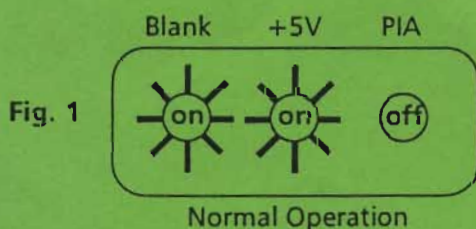
PIA LED	SUSPECT COMPONENT
Stays On:	One of the 6821 PIAs
Flashes 1 Time:	6264 RAM at location D5
Flashes 2 Times:	EPROM at location C5

The *display flashes* "OPEN THE COIN DOOR" — This indicates that memory 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.

QUICK REFERENCE FUSE CHART

PPB BOARD		POWER SUPPLY BOARD	
Fuse		**Fuse**	
F1	5A Slo-Blo G.I. 6.3v AC	F1	7A Slo-Blo +5vDC Regulator Input (9v AC)
F2	5A Slo-Blo G.I. 6.3v AC	F2	7A Slo-Blo +5vDC Regulator Input (9v AC)
F3	5A Slo-Blo G.I. 6.3v AC	F3	Not Used
F4	5A Slo-Blo G.I. 6.3v AC	F4	8A Slo-Blo Switched Illumination Buss (18v DC)
F5	5A Slo-Blo Flipper Power & 50v coils	F5	4A Slo-Blo Solenoid (32v DC)... Bumpers, Slingshots, etc.
F6	5A Slo-Blo Flash Lamps (32v DC) Right		
F7	3A Slo-Blo Flipper Power & 32v coils Left	F6	5A Slo-Blo Solenoid Buss (32v DC)
F8	4A Slo-Blo 50v coils		
F9	5A Slo-Blo 50v coils		

INSTALL ④ BALLS! Batman Forever™ is a ❹-Ball Game!

❊ NEW DIAGNOSTIC AID ❊

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 Autolaunch, 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 AUTOLAUNCH NOT WORKING**"). This not only warns the operator of a problem immediately, but indicates exactly where the operator should look to resolve it.

EPROM SUMMARY TABLE

I.C. NAME	TYPE	BOARD NAME	LOCATION	PART Nº
Game EPROM	512K	CPU Board	C5	965-0202-00
Display EPROM	4MB	Display Controller Bd.	ROM Ø	965-0206-00
Display EPROM	4MB	Display Controller Bd.	ROM 3	965-0207-00
Voice EPROM 1	4MB	Sound Board	U17	965-0203-00
Voice EPROM 2	4MB	Sound Board	U21	965-0204-00
Voice EPROM 3	Not Used	Sound Board	U36	Not Used
Voice EPROM 4	Not Used	Sound Board	U37	Not Used
Sound EPROM	512K	Sound Board	U7	965-0205-00

SEGA™
PINBALL, INC.

1990 JANICE AVENUE
MELROSE PARK, IL 60160

TEL 1-708-345-7700
FAX 1-708-345-7889

Technical Support
Toll-Free (USA & Canada):
1-800-KICKERS (542-5377)

780-5038

www.multi2net.com

B A T M A N™
F O R E V E R
Table of Contents
See Section 3, Table of Contents, for details of that section and it's chapters.

Game Specifications

⚠ Power Requirements ⚡

This game *must be connected to a properly grounded outlet to reduce shock hazard* and insure proper game operation. See Section 5, Chapter 1, Cabinet Schematics & Troubleshooting (AC Power Wiring Diagram), for transformer connections required for **Normal, High,** and **Low Line** conditions.

Normal Line:	110v AC - 125v AC @ 60Hz			
Domestic uses an 8AMP 250v Slo-Blo Fuse.	**AVG OPERATION**		**MAX OPERATION**	
	CURRENT: 2.8AMP		CURRENT: 8AMP	
	WATTAGE: 329w		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		CURRENT: 5AMP | 8AMP*	England & Hong Kong use an 8A F.
	WATTAGE: 412w		WATTAGE: 1145w | 1832w*	
Low Line:	95v AC - 108v AC @ 50Hz / 60Hz			
Export Japan Only uses an 8AMP 250v Slo-Blo Fuse.	**AVG OPERATION**		**MAX OPERATION**	
	CURRENT: 2.6AMP		CURRENT: 8AMP	
	WATTAGE: 264w		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.

Overall Dimensions

Please Note: An addition of a Marquee to the top of the backbox will increase the overall height of the back dimensions.

Shipping Crate Dimensions	
Height:	55½"
Width:	30½"
Length:	31"
Weight:	300lbs. (+/- 10lbs.)
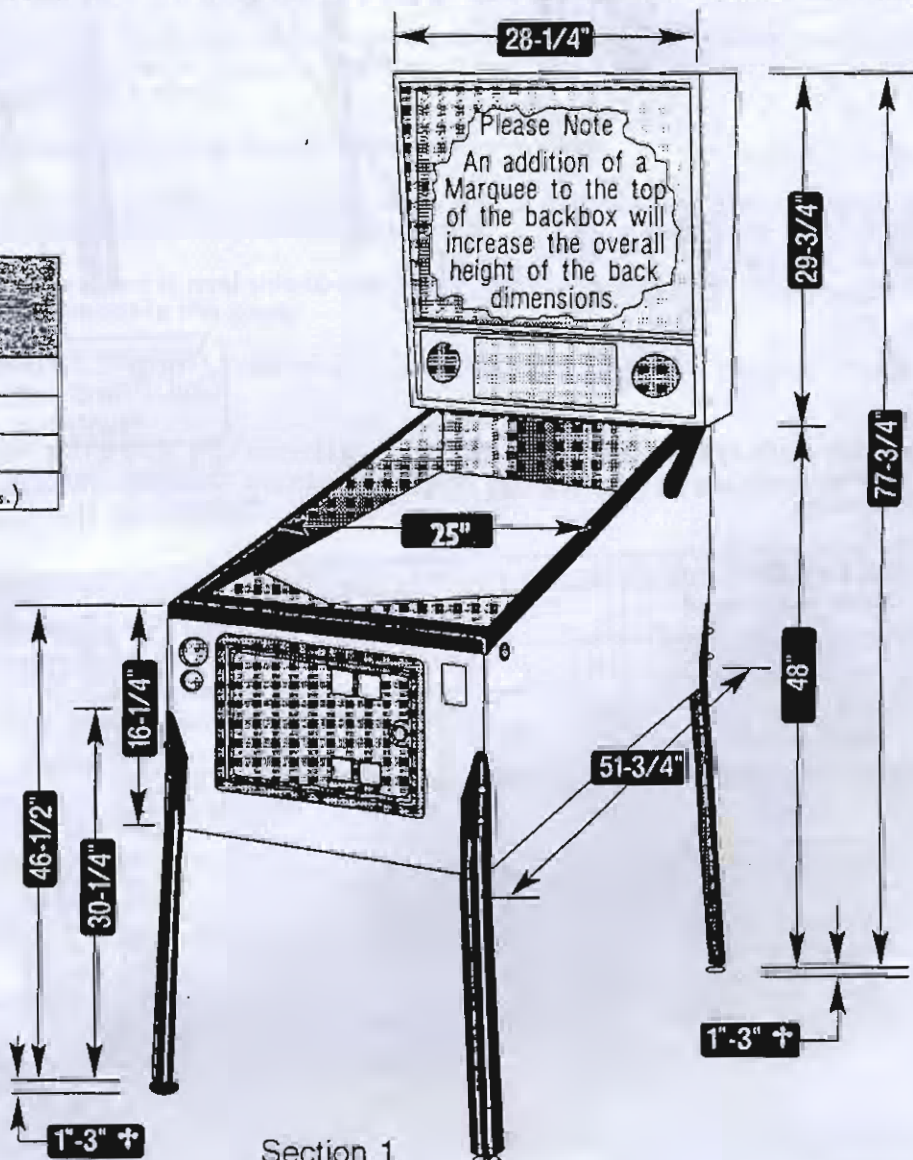
† Note:
The Leg Levelers can add up to two (2) inches to the overall height of the front and back dimensions.

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

⚠ Backbox Layout, Fuse & Relay Locations ⚡

PSB Power Supply Board → A

— G.I. RELAY
F1 F2 F4 F6 F5

Backbox Bridges →
F3 BR3
BR1 BR2
F2 F1

Filter Capacitors

PPB Playfield Power Board → B
F4 F5
F3 F2
F1 F8 F9
F7 F6

LEFT/RIGHT RELAY

SSFB Solid State 3-Flipper Board → C
F2 F1
F4 F3
F5

CPU BOARD

FLIPPER ENABLE RELAY

SOUND BOARD (no fuses)

DISPLAY BOARD (no fuses)

VOLUME CONTROL

8 AMP SLO-BLO* FUSE & SERVICE OUTLET (ON/OFF Switch Under Cabinet)

* Internal use 2 X 5 250V SL FUS

Memory Protect & Coil Power Interlock Switches

See Section 4, Chapter 2, for Backbox and Cabinet Part Numbers.

Service Switches are located on the Coin Door.

A: In the Backbox Power Supply Board P S B	
F1	7A Slo-Blo +5vDC Regulator Input (9vAC)
F2	7A Slo-Blo +5vDC Regulator Input (9vAC)
F3	Not Used
F4	8A Slo-Blo Switched Illumination Buss (18vDC)
F5	4A Slo-Blo Solenoid (32vDC) Bumpers, Slingshots, etc.
F6	5A Slo-Blo Solenoid Buss (34vDC) L/R Relay Coils/Flash

B: In the Backbox Playfield Power Board P P B	
F1	G.I. 5A Slo-Blo Playfield
F2	G.I. 5A Slo-Blo Backbox Dr./Spkr. Panel
F3	G.I. 5A Slo-Blo Playfield & Coin Door
F4	G.I. 5A Slo-Blo Backbox Door
F5	50v 5A Flippers /All 50v Coils
F6	32v Flash Lamps 3A Slo-Blo/Right
F7	32v 3A Coils/Flash Right/Left
F8	50v 4A / 50v Coils
F9	50v 5A Laser Kick

C: In the Cabinet Solid State 3-Flipper Bd. S S F B	
F1	3A 250v Slo-Blo 50v DC Output (All Fuses) Lower Right Flipper
F2	3A 250v Slo-Blo 9v AC Holding
F3	3A 250v Slo-Blo 50v DC Output Lower Left Flipper
F4	3A 250v Slo-Blo 9v AC Holding
F5	3A 250v Slo-Blo 50v DC Output Upper Right Flipper

...In the Backbox Backbox Bridges Mounted in Backbox	
F1	8A 250V Slo-Blo 32v DC (BR2) Coils/Flashers
F2	8A 250V Slo-Blo 18v DC (BR1) Lamps
F3	8A 250V Slo-Blo 18v DC (BR3) Display

Cabinet Fuses	
Main Fuse Line: 1X 8A 250V Slo-Blo	
International 2X 250V 5A Slo-Blo	

Game Assembly Procedures
(Refer to the Illustrations on pages 3 & 4)

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.

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 Board, Sound Board, Power Supply Board, and Display Board to check that they are properly seated.

8. Check that the fuses on the Power Supply Board, PPB Board and Back Panel are seated properly.

9. Carefully remove the playfield glass and set it aside.

10. Remove all shipping tie downs, shipping instruction pages, packing foam, etc. Read all printed information taken from the playfield. It contains warning(s), caution(s) and/or 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 locking it into the slotted bracket on the playfield. (Use the instruction sheet provided in the game to see alternative methods of accessing the playfield bottom.)

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 illustration "Leg Leveler Adjustment" opposite this page.

15. The game pitch should be at a 6.5° pitch. Depending on the condition of the floor, adjust 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 Play Test.

18. With the insert door closed, carefully reinstall and lock the backglass.

19. **INSTALL ❹ 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 3, Adjustments, for instrucitons 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!

Cabinet Leg

⅜-16 Hex Nut

Leg Leveler
(turned all the way up)
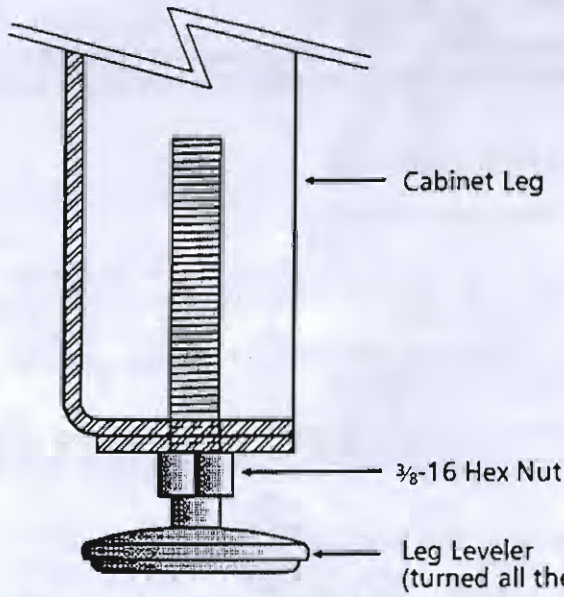
STEP 1

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

Easy Access Service System

Support Bracket

LINE OF SIGHT

Fig. 2.1   Fig. 2.2   Fig. 2.3
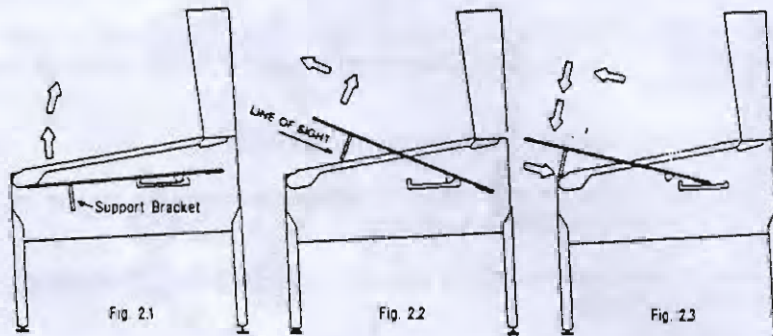
Service Position 1
This position is useful to service:

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 clears 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.*

Slider Bracket

Fig. 3.1   Fig. 3.2   Fig. 3.3
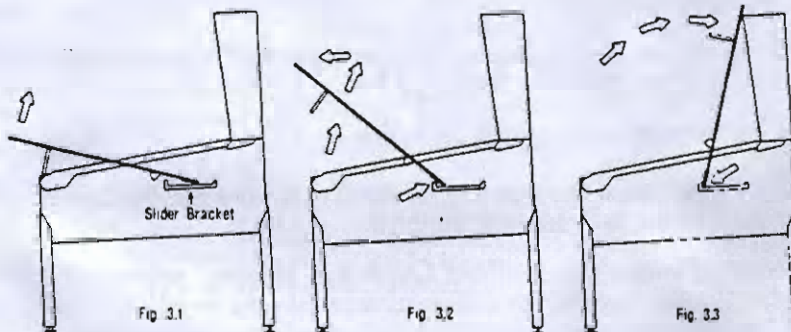
Service Position 2
This position is useful to service:

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. The display now indicates the player or # of players selected from the total depressions of the START BUTTON. 1 to 6 can play! The display indicates the ball in play, and a ball is served to the *Shooter Lane*. Additional players may be added by pressing the START BUTTON *before* the end of ball 1. At game start, 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 ½ credit remaining during game play after the end of ball 1, or power down, will be eliminated.)

Starting Team Play (Doubles!)

Team Play is a four player game. The totals for players 1 & 3 (Team 1) and players 2 & 4 (Team 2) are displayed individually as well as the combined score for both teams. Team Play 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/Tournmanent Play

After credit is posted, press the **EXTRA BALL BUYIN/LEAGUE BUTTON** instead of 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 Novice Play Features.

Extra Ball (EB) Buyin

An option to add an extra ball(s) after the game is finished is given (it doesn't matter if the game is set as a 2-, 3-, 4-, or 5-Ball Game). The score and game features already earned are retained and the player can add to the score with this extra ball. To activate the *EXTRA BALL BUY-IN FEATURE*, the player must press the **EXTRA BALL BUYIN BUTTON** after pressing the **START BUTTON**. At the end of normal game play, the same player may choose to continue the game at the same score and features active by pressing the **EXTRA BALL BUTTON** prior to the expiration of the "countdown timer." The posted credit will be reduced by one. Letting the timer to expire, pressing the **START BUTTON** or *BOTH* flippers simultaneously cancels this feature. If the player does not have any credits, the player will get *"more time"* to add credit.

This feature can be adjusted with Adj. 34, Buyin Type (Default=EXTRA BALL, adjustable). Changing the setting to **FEATURE** will give the below option. Changing the setting to **NONE** will turn off both features. The number of extra balls which can be added to a game can be adjusted with Adj. 35, Extra Ball Buyin Count. Default is 1. Set to 1, will allow only 1 extra ball to be purchased per game. Set to **UNLIMITED**, after the end of the game the count- down will appear after the end of each ball for the option of purchasing another extra ball. Set to 0, will also make this feature unavailable. Adj. 12, Balls Per Game, the factory default is 3. The game can be set to allow how many balls are given in normal game play. This can be set from 2 to 5.

Feature Buyin

This option starts a new game, however, the score is reset but the game features already earned are retained. To activate this *FEATURE*, the player must press the **EXTRA BALL BUYIN BUTTON** after pressing the **START BUTTON** to start a game or during the course of the game. At the end of normal game play, the same player may choose to restart the game with game features already earned by pressing the **EXTRA BALL BUTTON** prior to the expiration of the "countdown timer." The amount of balls per game is adjustable (see below). The posted credit will be reduced by one. Letting the timer to expire, pressing the **START BUTTON** or *BOTH* flippers simultaneously cancels this feature. If the player does not have any credits, the player will get "more time" to add credit. (This feature can be turned off with Adj. 34, Buyin Type.)

During Game Features

Video Mode

Our games feature elaborate video modes and video graphics. Don't forget to watch the display for hints or feature demonstrations. The video modes require the player to play on-screen. When in video mode, the ball-in-play is "held" (usually in a Scoop, Eject Saucer or lock of some sort). The interactive video play requires the player to use the flipper buttons to play the mode.

Feature Mode & Combination Shots

Features are lit on the playfield and started by completing certain play shots (e.g. completion of target bank, orbit shots, ramp shots 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 the Left Outlane then immediately shot to the Orbit of the playfield returning to the Upper Flipper and then shot to another Ramp is a hard combo shot worthy of many points. For feature modes and 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 and play. Multiball may vary with the amount of balls used in Multiball depending on game style. Typically 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=9%, adjustable) can be changed from 0-10%. Changing the percentage to 0% displays the "Match Animation" at the end of the game, however, will never match (to award a credit). Changing this adjustment to OFF will not display the "Match Animation" nor award a credit.

Entering Initials

If player achieved a new high score, 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. Procede 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 3, 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 a recommended replay score to beat and make a sound to alert the operator. By pressing the start button, the score to beat will be changed to the recommended 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.

Game Rules

Overview

Below is the Batman Forever™ Playfield with all of it's 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. Each rule is numbered with it's corresponding number describing the elements related, and/or ball path the rule is describing on the playfield.

1-WAY GATE
(Under Left Ramp
Between the Ball
Eject & Left Top Lane)

TOP 3 ROLLOVER
LANES (•B•A•T•)

BALL EJECT (SAUCER)

VERTICAL UP-KICKER
WIRE RAMP TO BATCAVE

TURBO BUMPERS

LEFT & MIDDLE PLASTIC
RAMP (Combined)

DOUBLE STACK WIRE RAMP
(FROM LEFT RAMP EXIT)

RAMP BALL DIVERTER
(Diverts ball to under Wire
Ramp to deliver ball to
Batwing Cannon Launch)

BATCAVE BALL LOCK
(Batcave not shown
for clarity)

LEFT PLASTIC RAMP
ENTRANCE GATE

BATCAVE EXIT BALL
LAUNCH (Kicks ball down
the Wire Ramp over the
Lower Arch to deliver the
ball onto the playfield)

LOWER OF DOUBLE STACK
WIRE RAMP TO CANNON.

4-BANK DROP TARGET
(•C•A•V•E•)

BATWING CANNON
BALL LAUNCH (Batwing
not shown for clarity)

LEFT OUTLANE

LEFT RETURN LANE

BATCAVE EXIT WIRE RAMP

LASER KICK (Under Arch)

BOTTOM ARCH

OUTHOLE

RIGHT PLASTIC RAMP

U-TURN MINI-RAMP

VERTICAL UP-KICKER

RIGHT PLASTIC RAMP
ENTRANCE GATE

MIDDLE RAMP EXIT
WIRE RAMP

RIGHT PLASTIC RAMP
EXIT ONTO MIDDLE
RAMP EXIT WIRE RAMP

SHOOTER LANE &
SHOOTER LANE RAMP

UPPER RIGHT FLIPPER

TOP 2-BANK STAND-UP
TARGETS

RIGHT 2-BANK STAND-UP
TARGETS

NARROW STAND-UP
TARGETS X5

Adjustable Post
(To widen/shorten
Right Outlane Opening)

RIGHT OUTLANE

RIGHT INSIDE RETURN
LANE

RIGHT OUTSIDE RETURN
LANE

SLINGSHOTS

LOWER FLIPPERS

AUTOLAUNCH
(Under Butyrate)

BATMAN™
FOREVER

BATCAVE & BATWING OVER CANNON ARE NOT SHOWN FOR CLARITY.

START & EXTRA BALL
BUY-IN/LEAGUE BUTTON (On Cabinet)

GUN TRIGGER
BALL LAUNCH (On Cabinet)

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

SKILL SHOT - Pull *Gun Trigger* for award shown in the *Video Display*.
TOP LANES - Complete "BAT" to advance *Bonus X*.
MULTIBALL - Complete the **CAVE** targets to lite lock at Vertical Up-Kicker next to the "U-Turn Mini" Ramp. Lock 3 balls to start *Multiball*.
BATWING - Shoot the Middle, Right, & "U-Turn Mini" Ramps to ready the BATWING CANNON. Shoot the Left Ramp when lit to arm the *BAT-WING: pull the trigger to shoot the ball at the lit targets.*
ROVING BATS - Shoot the flashing *Bat Shots* during single ball play. Completing all shots begins the **CIRCUS COUNTDOWN**.
TWO FACE COINS - Match *Good Heads Coins* for **Hold** Bonus. Match *Bad Heads Coins* for 22 million. Mismatch and rematch *Good Heads* & *Bad Heads Coins* to relite *Laser Kick* and 10 million.
GOTHAM EVENTS - Complete the "?" targets to light *GOTHAM EVENT*. The *Gun Trigger* locks in the event. Play all of the 7 *GOTHAM EVENTS*, match both pairs of *Coins*, and complete the *Roving Bats* to play the **FOREVER GOTHAM EVENT!**

BATMAN FOREVER
Sega Pinball, Inc.™
© 1995. Batman
Forever.™ ® ™ DC
Comics © 1994.
Warner Bros.
Licensed © 1995.
755-5075-00

The remainder of this chapter is Batman Forever 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 3, 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. The latest revision code for all games prior to this game are described in Section 7, Chapter 1, Appendix B, Pinball Game Firmware.

See Section 7, Chapter 2, Glossary of Terms, for words or acronymns you may not understand. If an acronym or expression is not in this glossary, please call our Technical Support Department, so we made add it in the next game manual. Any other suggestions or comments are always welcome!

Gamestart

1 Gotham Events

Collect flashing Gotham Event in "?" logo by shooting *Upper Left Eject Saucer* when **"GOTHAM EVENT"** is lit. Gotham Events are not available while another **Gotham Event** is running. **Gotham Events** are lit during regular play by completing the 5 *Green* "?" Stand-Up Targets. "?" targets may also be spotted by completing various ramp shots.

2 Change Gotham Event

Hitting the *Turbo Bumpers* change the lit **Gotham Event**. Pull the *Gun Trigger* to lock/unlock the currently lit **Gotham Event**.

7 Main Gotham Events:

3 Rooftop Chase Video Mode

Drive the Batmobile over the rooftops of Gotham City! Avoid obstacles and drive through targets to collect the indicated values using the left and right flipper buttons.

4 ?????????? Mode

(Too many question marks mode...) Shoot the *Green* "?" Stand-Up Targets repeatedly to collect multimillions before the timer expires.

5 Face Two-Face Mode

Hit each of the Two-Face Coin Targets TWICE to battle *TWO-FACE* in the helicopter. Each hit scores *Increasing Millions*.

6 Crime Spree Mode

Fast Scoring. Each Switch scores 250K and adds 250K to the **Crime Jackpot**. Every 10 switch closures increase the value awarded by a switch closure another 250K. Shoot the *Right Ramp* to collect the value of the **Crime Jackpot**.

Gotham Events

B A T M A N™
F O R E V E R

RAMPS, BATCAVE & BATWING CANNON ARE NOT SHOWN FOR CLARITY

2

7 Main Gotham Events Continued:

Brain Drain Mode

7

Spell • C • A • V • E • by completing the *4-Bank Drop Targets* in sequence. Each consecutive hit is worth *Increasing Millions*, but an out-of-sequence hit will award 10M and reset the sequence from the beginning.

Safe Trap Mode

8

Shoot the four ramps (*Left, Mid Right,* and *U-Turn Mini-Ramp*) f 25M to help Batman save the g and escape the boiling acid.

Lite Extra Ball Mode

9

Shoot the ball into the *U-Turn Mini-Ramp* to lite the **Extra Bal**

Regular Play Event

Roving Batsignals

10

Making a shot while the *Batsig* front of that shot is lit awards *Increasing Millions.* Completing roving *Batsignals* lites ALL BAT SIGNALS SIGHTED in the center of the playfield starts the **CIRCUS COUNTDOWN HURRY-UP AT** Shoot the *Right Orbit* to collect the value befor reaches its minimum value.

Two-Face Coins

11

Shoot a flashing **Two-Face Coi Target** on either the top or righ 2-bank to lock it in as it alterna between GOOD HEADS and B**A** HEADS. Then try to match the same coin on th other 2-bank. Matching GOOD HEADS award *HOLD BONUS* and lites *GOOD HEADS MATCH* the center of the playfield. Matching BAD HEA awards 22M and lites *BAD HEADS MATCHED* center of the playfield. Mismatch ing the coins awards 2M. Re-matching previously matched c re-lites the *Laser Kick* or awards 10M if the *Lase* is already lit.

B A T M A N
F O R E V E R

BATCAVE & BATWING OVER CANNON ARE NOT SHOWN FOR CLARITY.

Forever Mode

12 Once all regular modes have been played in the "?" logo and the player has **ALL BATSIGNALS SIGHTED**, **GOOD HEADS MATCHED**, and **BAD HEADS MATCHED**, the player can start *FOREVER* Mode. Complete the "?" targets and shoot the Eject Saucer to start it like any other *Gotham Event.* When FOREVER starts, all balls will be kicked into play and the Batwing Cannon will begin to oscillate. A *FOREVER JACKPOT* begins at 50M and all switches add to this a minimum of 1M x number of balls in play. Players must shoot the Left Ramp and catch a ball in the Batwing Cannon **AS IT PASSES THROUGH THE HOME POSITION** to collect the current value of the **FOREVER JACKPOT**. Once collected, the jackpot resets to 50M and begins re-building. Players are protected from drains during the first 60 seconds of FOREVER - lost balls will be kicked back into play. FOREVER ends once the player drains or returns to single ball play after the first 60 seconds of FOREVER.

Skill Shot

13 Select 1 of 4 awards at the start of each ball (shown in the display). Pull the *Gun Trigger* to select the award & launch the ball into play. The awards are: *Lock Ball, Mr. E Mystery Award, Start Gotham Event,* & *Two-Face Pops.* If all locks are lit, then a point value is substituted for *Lock Ball.*

Turbo Bumpers

14 *Bumpers* start at 250K per hit each ball and increase by 250K per hit every 10 hits to a maximum of 1M.
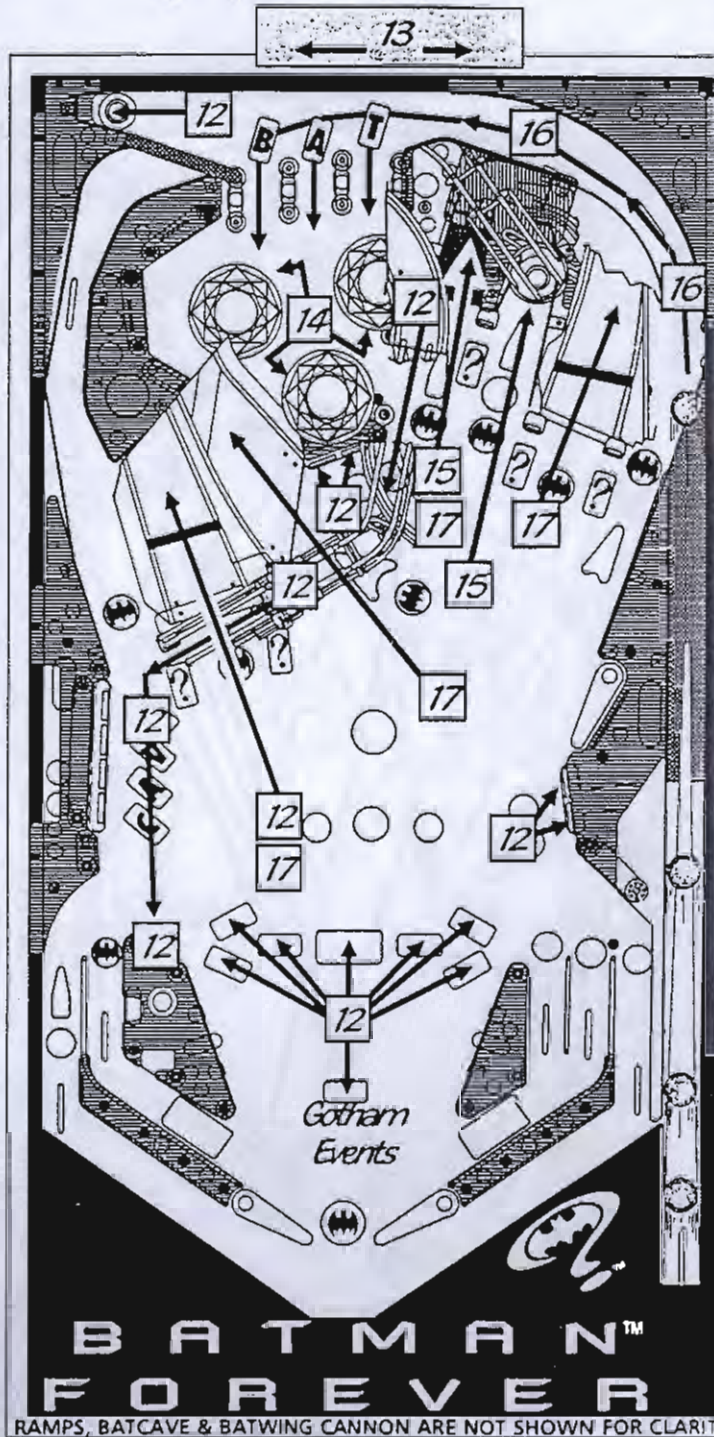
Mr. E Mystery Award

15 A number of randomly selected awards are available for collection at the VUK when Mr. E is lit via shots through the *U-Turn Mini-Ramp.* Awards are given in a fized order during tournament play.

• B • A • T • Top Lanes

16 Completing the *Tops Lanes* advance the bonus multiplier 2X, 4X, 6X, 8X, 10X = maximum. Subsequent completions score 20M. The top lanes will also relite the *Laser Kick* if it is not already lit. Bonus multiplier resets at the beginning of each ball, unless held over by a **HOLD BONUS AWARD.**

Batwing Cannon

17 Completing the required number of shots through the *U-Turn, Middle,* and *Right Ramps* will lite ARM **BATWING** on the Left Ramp. Shoot the Left Ramp to load the ball into the Batwing Cannon. Pull the Gun Trigger to shoot the ball at the flashing targets. Hitting a flashing target awards 10M. Hitting an unlit target awards 1M. Complete all Batwing Targets to collect an **EXTRA BALL.**

BATMAN™ FOREVER

RAMPS, BATCAVE & BATWING CANNON ARE NOT SHOWN FOR CLARITY

13

18 Batarang Combo

Players shooting the *Left Orbit* to *Middle Ramp* receive credit for a **BATARANG COMBO**. The player with the most batarang combos enters their initials as the batarang champ. Each **BATARANG COMBO** is worth 10M.

19 Two-Face's Rt. Return Lane

Rolling through the *Outer Right Return Lane* when lit (DOUBLE BATWING) and quickly loading the *Batwing Cannon* will allow the player to shoot for double the usual award from the cannon. Rolling through the *Inner Right Return Lane* when lit (2 BATARANGS) will give the player credit for 2 *BATARANG COMBOS* instead of 1 if the player completes a BATARANG COMBO (including double the score).

20 Left Return Lane

Rolling through the *Left Return Lane* when lit (X2 BATWING) and quickly shooting the *Right Ramp* will give the player credit for 2 hits toward the next ARM BATWING.

21 Batboat Cruising

Maintaining a fast sequence of shots between the ramps and the orbits awards *Increasing Millions* per shot to a maximum of 30M.
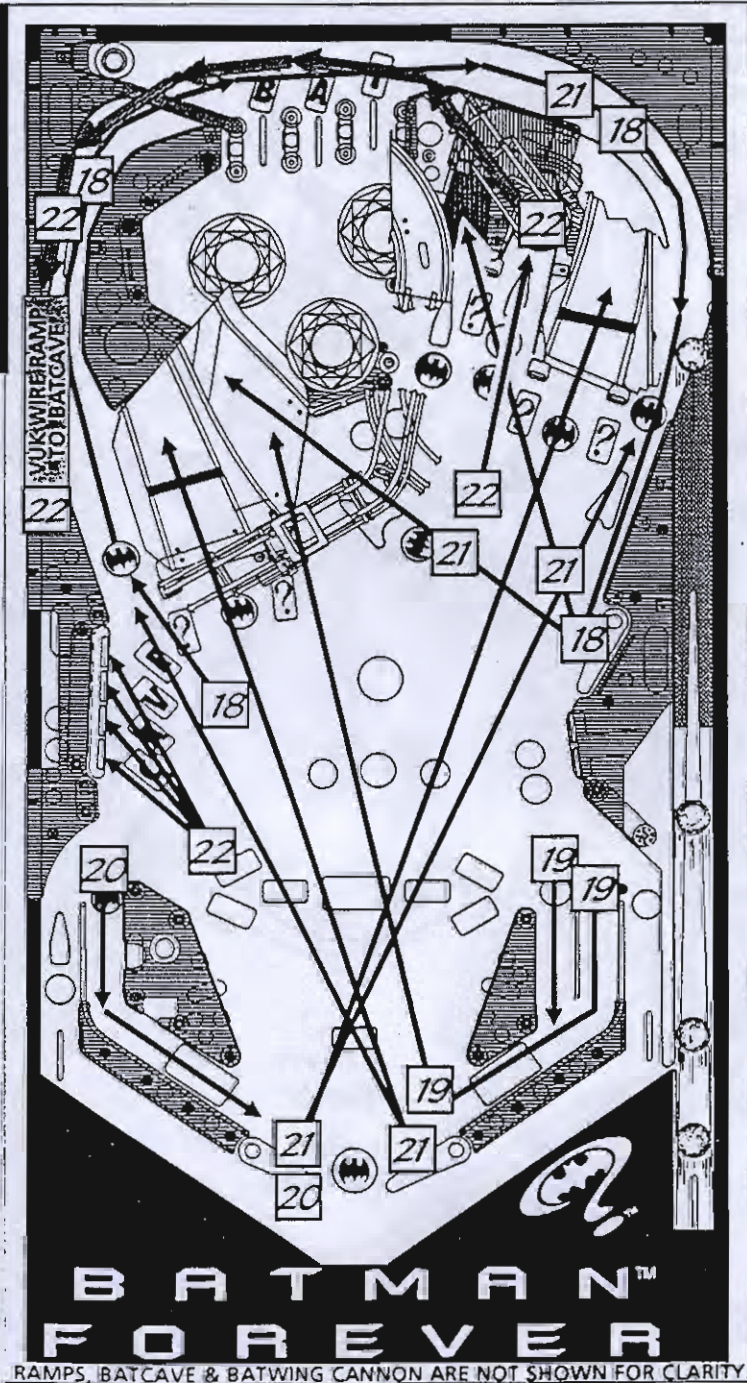
Multiball & Jackpots

22 Multiball Ready

Complete the *4-Bank Drop Targets* (• C • A • V • E •) during regular play to lite locks at the *VUK*. Shoot the *VUK* to lock balls in the BAT CAVE. Lock 3 balls to start *Multiball*. Lock the 3rd ball from a *Cannon* shot to start *Multiball* with increased base *Jackpots* and play *4-Ball Multiball*.

23 Multiball Sequence

Multiball consists of 3 phases:
 a: *The Riddler's Dual Jackpot*
 b: *Two-Face's Double Jackpot*
 c: *Super Jackpot*

RAMPS, BATCAVE & BATWING CANNON ARE NOT SHOWN FOR CLARITY.

BATMAN FOREVER

Section 2 | Rules

VUK WIRE RAMP TO BATCAVE

Multiball & Jackpots Continued:

23 a

Riddler's Dual Jackpots

Save Chase and Robin by shooting the *Left & Right Ramp* to collect the corresponding *Jackpot*. *Jackpot* values may be increased before collecting them by hitting the *Stand-Up* "?" *Targets* at the ramp entrances for 5M increments for 30 seconds. Collect both *Jackpots* to proceed to the DOUBLE JACKPOT phase.

23 b

Two-Face's Double Jackpot

Shoot the *Middle* Ramp when lit to collect TWO-FACE's DOUBLE JACKPOT (the SUM of the two *Riddler Jackpots* the player just collected). Players may have to qualify the DOUBLE JACKPOT by first completing the *Two-Face Coins Targets* on subsequent *Multiballs*. Collecting the DOUBLE JACKPOT allows the player to proceed to the SUPER JACKPOT phase.

23 c

Super Jackpot

While keeping at least two balls in play, load the *Batwing Cannon* by shooting the Left Ramp. Shoot the ball from the *Cannon* through the *U-Turn Mini-Ramp* to score the 250M point SUPER JACKPOT. Players may be offered chances to reload the Cannon if the player misses the initial SUPER JACKPOT *Shot*. When the player makes a successful SUPER JACKPOT *Shot* (or exhausts the reloads), the *Multiball Sequence* will start over at the RIDDLER's DUAL JACKPOTS Phase as long as the player remains in *Multiball*.
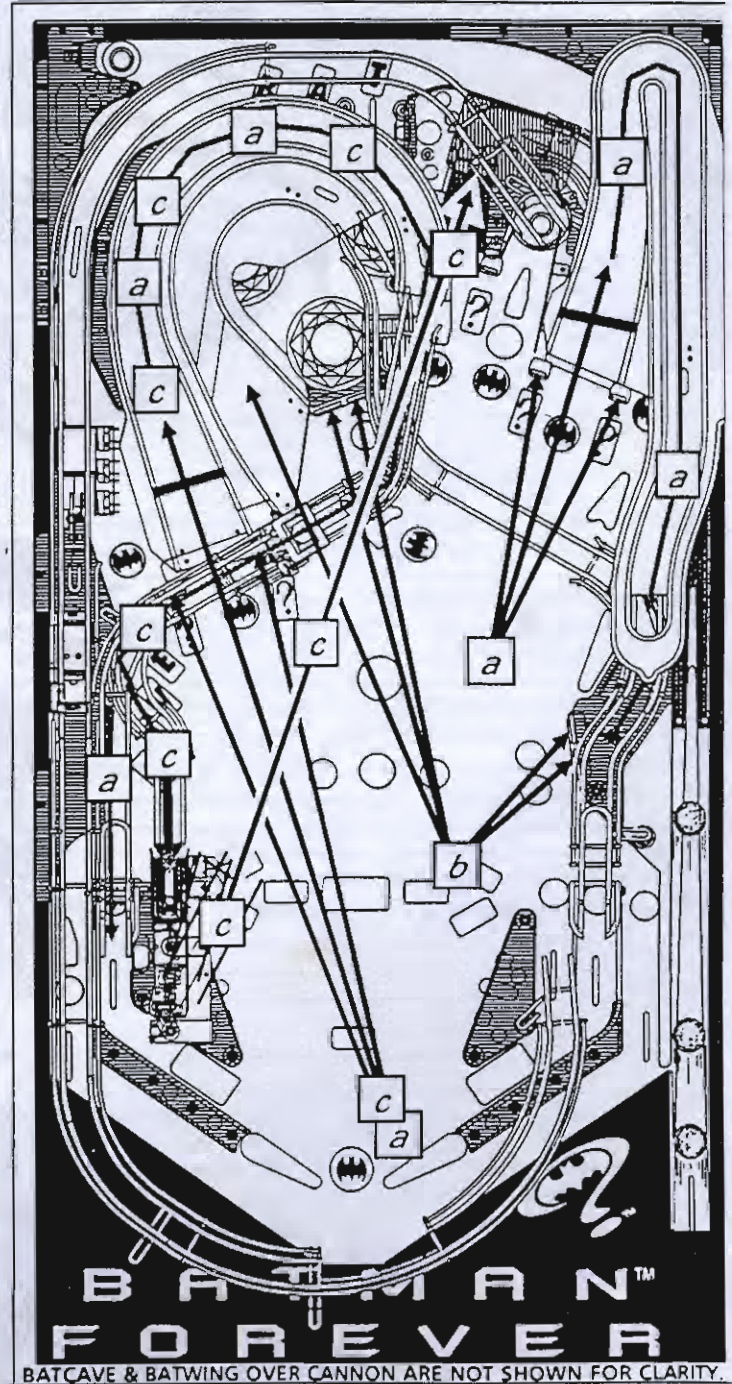
Bat Notes

Combination Shots

Batman Forever™ features several *Multi-Way Combos*. These *Combo Shots* involve natural sequences of key shots in the game. Several undocumented difficult combos may also be present.

End-Of-Ball Bonus Calculation

The Bonus is calculated as the sum of:

Current Ball BonusX (e.g. 2X, 3X, 4X... from Top Lanes)
X   (500K x # of Ramp Shots on current ball)
+   (2M x # of Cannon Shots on current ball)
+   (3M x # of Gotham Events completed)

BATCAVE & BATWING OVER CANNON ARE NOT SHOWN FOR CLARITY.

Notice:

Just like fighting crime, rules and point values are subject to change without notice. Call Commissioner Gordon!

Game Rule Notes:

Portals™ Service Menu Introduction

Section 3
Table of Contents

Bullet Notes: • From Main Menu, Level 1.   ••• From the Sub-Menu, Level 3
  •• From the Sub-Menu, Level 2.   ¤ Added Information/Instruction
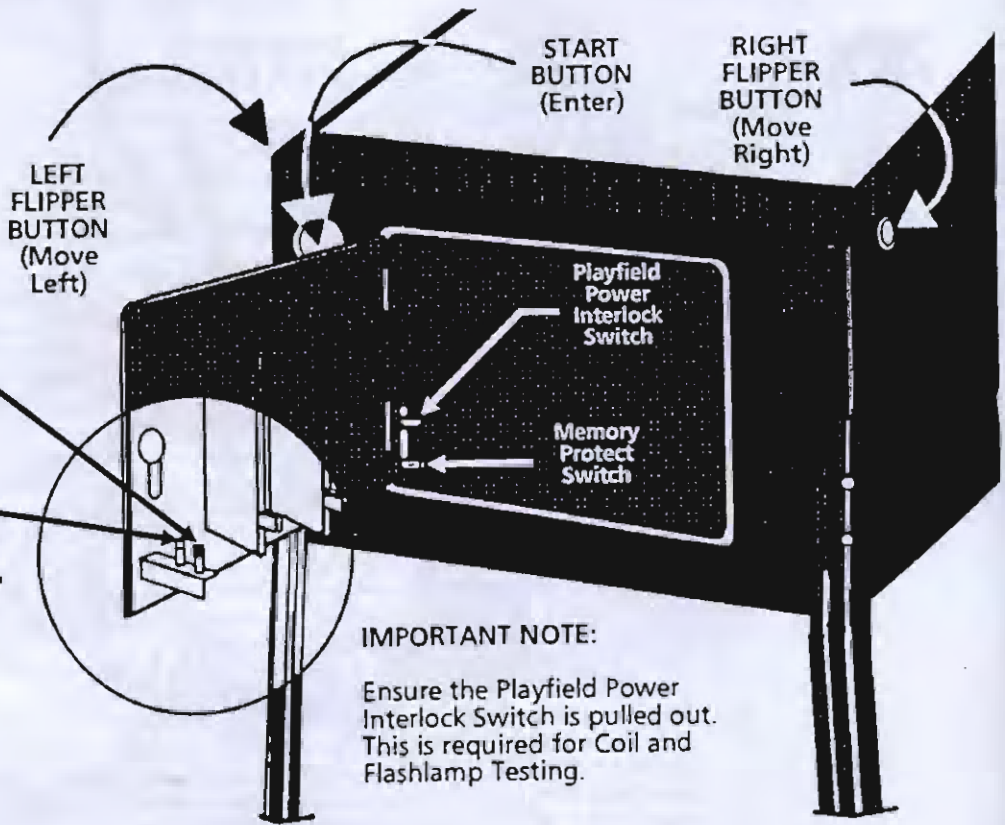
Access & Use

Step 1

Open Coin Door and view Service Switch Set. (Memory Protect is now disabled.)

Step 2

Enter the Portals™ Service Menu by pushing the Black "BEGIN TEST" Button.

Step 3

Use the Green "SELECT" Button or Flipper Buttons to navigate through the menus. Use the Black "ENTER" Button or Start Button to activate icons.

LEFT FLIPPER BUTTON (Move Left)

START BUTTON (Enter)

RIGHT FLIPPER BUTTON (Move Right)

Playfield Power Interlock Switch

Memory Protect Switch

IMPORTANT NOTE:

Ensure the Playfield Power Interlock Switch is pulled out. This is required for Coil and Flashlamp Testing.

GREEN BUTTON:

FUNCTION 1:
(Not in the Service Mode)

SERVICE CREDITS:
Allows the technician to add Service Credits without adding any counts to the Coin Audits. Up to 30 credits can be applied.

FUNCTION 2:
(In the Service Mode)

SELECT:
Allows the technician to select an Icon by moving right (forward) only.

BLACK BUTTON:

FUNCTION 1:
(Not in the Service Mode)

BEGIN TEST:
Allows the technician to begin the Portals™ Service Menu.

FUNCTION 2:
(In the Service Mode)

ENTER:
Allows the technician to activate Icon selected.

PORTALS™
SERVICE CREDITS   BEGIN TEST
SELECT   ENTER

GREEN   BLACK

READ THIS:

The Green "SELECT" Button will change the selection by moving *right (forward)* only. For left/right (forward/backward) movement, use the Left & Right Flipper Buttons accordingly. The Start "ENTER" Button is used like the Black "ENTER" Button. When using the Portals™ Service Menu, use the Flipper and Start Buttons to navigate through the menu(s). Use the Black "ENTER" and Green "SELECT" Buttons only while in Switch Test as the Start Button & Flipper Buttons are a part of this test. *Please Note: The Coin Door must be open when changing Adjustments, so that the MEMORY PROTECT SWITCH is disabled.*

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 navigate 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. Push down the Black "BEGIN TEST" Button.

Looking at the Video Display you will momentarily see the introductory screen, 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 **Left & Right Flipper Buttons** to change the selected ICON left or right, and the **Start Button** (or **Extra Ball Button**) to activate the selected ICON. The Green "SELECT" & Black "ENTER" Buttons can be used at any time as well as the **Left & Right Flipper Buttons** (to select) and **Start Button** (to enter). The use of the Green "SELECT" & Black "ENTER" Buttons are 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:
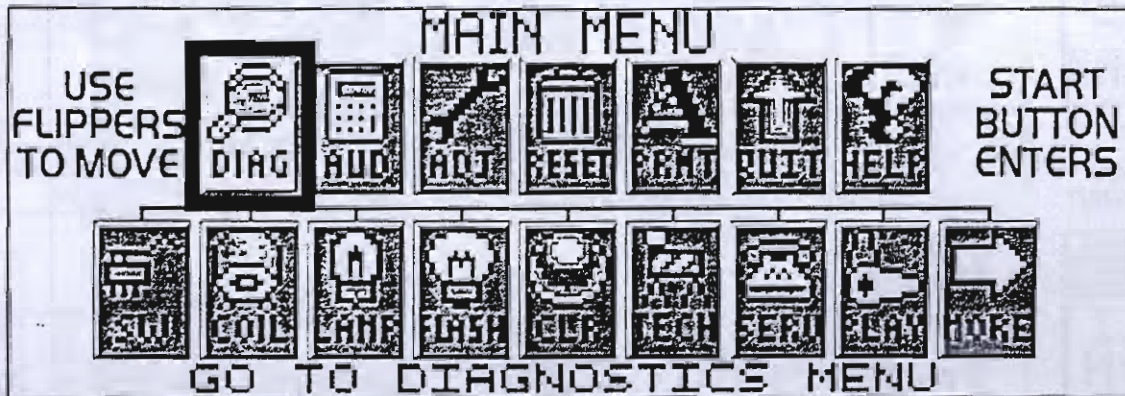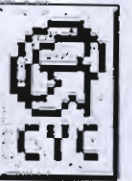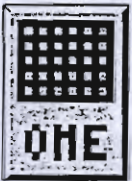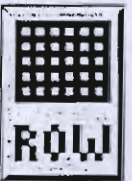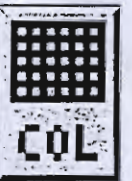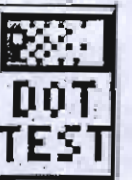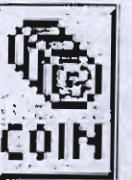
See the sample of an activation of an *Icon* following the Portals™ Service Menu Icons and Tree. View the last chapter (HELP) if more information is required. Selecting the "QUIT" *Icon* with the Green "SELECT" or either Flipper Button, then pressing the Start Button will exit the Service Mode. This 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 Icons

Numbers with ICONS correlate to Menu Tree →

1 GO TO DIAGNOSTICS MENU — **DIAG**	2 GO TO SWITCH MENU — **SW**	3 SWITCH TEST — **TST**	4 ACTIVE SWITCH TEST — **ACT**	5 GO TO COIL MENU — **COIL**	6 COIL TEST — **TST**	7 CYCLING COIL TEST — **CYC**
8 GO TO LAMP MENU — **LAMP**	9 SINGLE LAMP TEST — **ONE**	10 TEST ALL LAMPS — **ALL**	11 ROW LAMP TEST — **ROW**	12 COLUMN LAMP TEST — **COL**	13 TEST FLASH LAMPS — **FLASH**	14 CLEAR BALL TROUGH — **CLR**
15 TECHNICIAN ALERTS — **TECH**	16 SERVICE PHONE # — **SERV**	17 BEGIN PLAY TEST — **PLAY**	18 SOUND/SPEAKER TEST — **SPKR**	19 BEGIN BURN IN — **BURN**	20 DOT MATRIX TEST — **DOT TEST**	21 GO TO AUDITS MENU A — **AUD**
22 EARNINGS AUDITS — **EARN**	23 GO TO ADJUSTMENTS MENU — **ADJ**	24 GO TO RESET MENU B — **RESET**	25 FACTORY RESET — **FACT**	26 RESET COIN AUDITS — **COIN**	27 GO TO PRINTER MENU — **PRNT**	28 QUICK PRINTOUT — **QUIK**
29 FULL PRINTOUT — **ALI SON**	30 GAME GENERIC AUD/ADJ C — **SEGA**	31 GAME SPECIFIC AUD/ADJ D — **BAT**	32 "SHOWS MORE ICONS LEFT" — **MORE**	33 "SHOWS MORE ICONS RIGHT" — **MORE**	34 GO TO MAIN MENU E — **PREV**	35 QUIT THIS SESSION — **QUIT**

36 GO TO HELP SCREEN — **HELP**

Letters with ICONS are duplicated and are used in different sub-menus.

A 'Go to Audits Menu' is used also as 'Reset All Audits' under 'Reset Menu.'
B 'Go to Reset Menu' is used also as 'Reset Printer' under 'Printer Menu.'
C The 'Sega' Icon is displayed to represent Game Generic Audits or Adjustments.
D The current game icon is displayed to represent Game Specific Audits or Adjustments and is also used under 'Diagnostics Menu' for Game Specific Tests. Each game will have it's own icon.
E 'Go to Main Menu' is used also as 'Go to Diagnostics Menu' under Switch, Coil and Lamp Tests.

Go to previous Aud / Adj / Diagnostic (Backward/Left)	Go to next Aud / Adj / Diagnostic (Forward/Right)	Run (or activate) selected test	Exit to the previous menu	Quit this service session	Go to this Help Screen (of the current sub-menu)

↵   ↓   −   +   **RUN**   **PREV**   **QUIT**   **?**

— Increment displayed value or select next...
— Decrement displayed value or select previous...

Portals™ Service Menu Tree

Numbers with TEXT correlate to Menu Icons ◄

ATTRACT MODE

Push the Black "BEGIN TEST" Button to start.

MAIN MENU

1 GO TO DIAGNOSTICS MENU

DIAGNOSTICS MENU

2 GO TO SWITCH MENU → SWITCH MENU
- 3 SWITCH TEST — Test Display
- 4 ACTIVE SWITCH TEST — Test Display
- 34 GO TO DIAGNOSTICS MENU — Back To Diag. Menu
- 35 QUIT THIS SESSION — Back To Attract Mode
- 36 GO TO HELP SCREEN — Help Display *

5 GO TO COIL MENU → COIL MENU
- 6 COIL TEST — Test Display
- 7 CYCLING COILS — Test Display
- 34 GO TO DIAGNOSTICS MENU — Back To Diag. Menu
- 35 QUIT THIS SESSION — Back To Attract Mode
- 36 GO TO HELP SCREEN — Help Display *

8 GO TO LAMP MENU → LAMP MENU
- 9 SINGLE LAMP TEST — Test Display
- 10 TEST ALL LAMPS — Test Display
- 11 ROW LAMP TEST — Test Display
- 12 COLUMN LAMP TEST — Test Display
- 34 GO TO DIAGNOSTICS MENU — Back To Diag. Menu
- 35 QUIT THIS SESSION — Back To Attract Mode
- 36 GO TO HELP SCREEN — Help Display *

- 13 TEST FLASH LAMPS — Test Display
- 14 CLEAR BALL TROUGH — Test Display
- 15 TECHNICIAN ALERTS — Playfield Status
- 16 SERVICE PHONE # — 1-800-KICKERS
- 17 BEGIN PLAY TEST — Test Display
- 18 SOUND/SPEAKER TEST — Test Display
- 19 BEGIN BURN IN — Test Display
- 20 DOT MATRIX TEST — Test Display
- 31 GAME SPECIFIC — Test Display
- 34 GO TO MAIN MENU — Back To Main Menu
- 35 QUIT THIS SESSION — Back To Attract Mode
- 36 GO TO HELP SCREEN — Help Display *

21 GO TO AUDITS MENU → AUDITS MENU
- 22 EARNINGS AUDITS — 1st Audit Of Group
- 30 SEGA (GENERIC) AUDITS — 1st Audit Of Group
- 31 GAME (SPECIFIC) AUDITS — 1st Audit Of Group
- 34 GO TO MAIN MENU — Back to Main Menu
- 35 QUIT THIS SESSION — Back to Attract Mode
- 36 GO TO HELP SCREEN — Help Display *

23 GO TO ADJUSTMENTS MENU → ADJ. MENU
- 30 SEGA (GENERIC) ADJUSTMENTS — 1st Adjustment Of Group
- 31 GAME (SPECIFIC) ADJUSTMENTS — 1st Adjustment Of Group
- 34 GO TO MAIN MENU — Back to Main Menu
- 35 QUIT THIS SESSION — Back to Attract Mode
- 36 GO TO HELP SCREEN — Help Display *

24 GO TO RESET MENU → RESET MENU
- 25 FACTORY RESET — Request Installed & Returns Back To Attract Mode
- 26 RESET COIN AUDITS — Request Installed
- 21 RESET ALL AUDITS — Request Installed
- 34 GO TO MAIN MENU — Back to Main Menu
- 35 QUIT THIS SESSION — Back to Attract Mode
- 36 GO TO HELP SCREEN — Help Display *

27 GO TO PRINTER MENU → PRINTER MENU
- 28 QUICK PRINTOUT — Printer Interface Adjustment
- 29 FULL PRINTOUT — Alison Interface Adjustment
- 24 RESET PRINTER — Reset Printer Adjustment
- 34 GO TO MAIN MENU — Back to Main Menu
- 35 QUIT THIS SESSION — Back to Attract Mode
- 36 GO TO HELP SCREEN — Help Display *

35 QUIT THIS SESSION → Back to Attract Mode

36 GO TO HELP SCREEN → Help Display * *Note: Press any button to return to previous display.*

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 the "All Icons" Table and "Tree" on the previous pages to help navigate through the system. Through the following chapters, any special notes and explanation regarding the Menu of Sub-Menu will be explained.

If the display is in any other menu other than the MAIN MENU, use the Left or Right Flipper Button to select the "PREV" *Icon* and press the Start 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 Green "SELECT" or Flipper 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" *Icons* are indicating that "*more options*" are available which don't appear in the display and which way to move the selection to view the *Icons*.

Important Note:

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

Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.
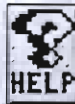
Selecting & activating the "HELP" *Icon* will show a help screen.

Example: From the MAIN MENU, use the Left or Right Flipper Button to select the "DIAG" *Icon* (GO TO DIAGNOSTICS MENU).

Press the Start 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 Start 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 Start Button to *activate* this icon. This will bring up the Switch Test Display.

SWITCH TEST MENU

SWITCH TEST

The **Switch Test Display** now appears. All switches can be tested one at a time.

SWITCH TEST HOME

COIN DOOR BUTTONS OPERATE MENU
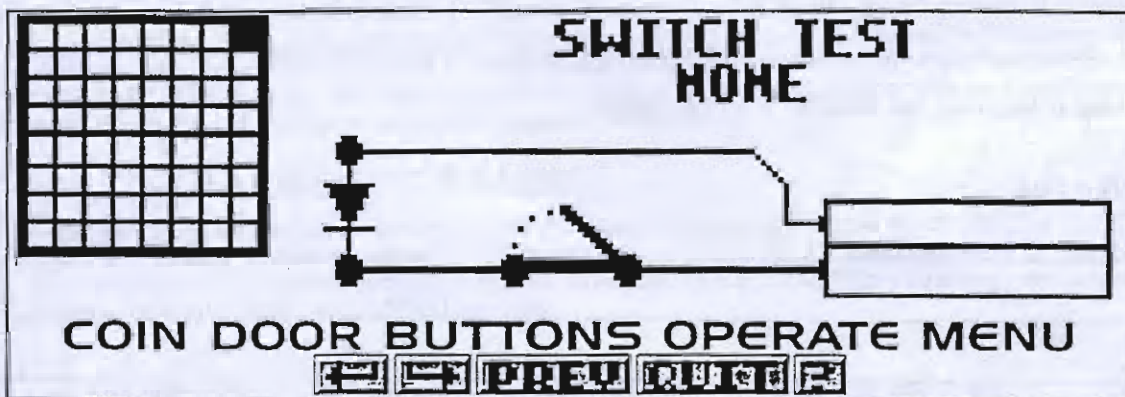
A fictitious example is shown with Switch #57 being closed:

SWITCH TEST
LEFT OUTLANE #57
WHT-BRN RETURN
515-5138-00   CPU
DRIVE   CN 10-P9
GRN-GRY   CN 08-P9 Q48

COIN DOOR BUTTONS OPERATE MENU
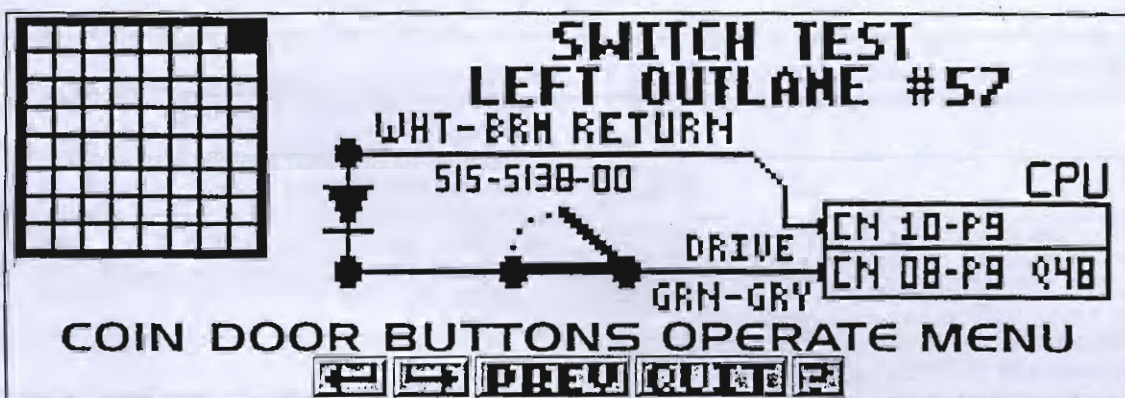
As each switch is closed, the respective Switch Matrix grid position (1-64) will be lit. In the example, the grid is lit (right corner). Under "SWITCH TEST", describes the switch in the Switch Matrix which includes the name (e.g. Left Outlane #57), the Return (Row) Wire (WHT- BRN) and the Drive (Column) Wire (GRN-GRY), drive transistor, the part number and the "Pin-Outs" from the CPU Board.

While in Switch Test or Active Switch Test, the **Flipper & Start Buttons** are deactivated. Use the **Green** "SELECT" 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 diagnostic, which is the Active Switch Test and vice versa. Use the **Green** "SELECT" Button to change the selected *ICON* to "PREV" *Icon*. Press the **Black** "ENTER" Button to go to the previous menu.

Note:
The use of the Start & Flipper Buttons may be used again outside of the Switch & Active Switch Tests.

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. Note: Activating the "QUIT" *Icon* in any display will completely exit the Service Session.

Exiting the Portals™ Service Menu

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

```
┌─────────────────────────────────────────────┐
│              MAIN MENU                        │
│  USE      [icons]              START          │
│  FLIPPERS [DIAG][ADJ][ADJ]     BUTTON         │
│  TO MOVE  [RESET][PRAL][QUIT][HELP]  ENTERS    │
│                                               │
│         QUIT THIS SESSION                     │
│                                               │
└─────────────────────────────────────────────┘
```

If more help is required, see Chapter 7 of this section.

Your Notes

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 be either failure in memory (e.g. batteries are dead and/or faulty RAM) or upon installation of updated version of game code. Opening the Coin Door will initiate a *Factory Restore*, by opening the *Memory Protect Switch*. Check battery voltage at CMOS RAM with the power off.

Overview

The Portals™ Service Menu System provides tests for sounds, display, lamps, switches and coils. Each feature may be tested manually or automatically after entering the Portals™ Service Menu (see Chapter 1 of this section). Select the "DIAG" *Icon* from the MAIN MENU to go to the DIAGNOSTICS MENU. The automatic tests (e.g. Cycling Coils, 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 Button (upon entry of the Portals™ Service Menu, the system defaults with the selection of the "DIAG" *Icon* flashing) and press the Start Button. The DIAGNOSTICS MENU appears.

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

Important Notes:

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

Selecting & activating the "HELP" *Icon* from any display will show a help screen. (See chapter 7 of this section for more help.)

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

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

Some tests require navigation through the menu(s) and selection of the *Icons* with the Green "SELECT" and Black "ENTER" Buttons. This is required is 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 automa- tically 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 Flipper Button and press the Start 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 two parts: Switch Test and Active Switches. (Reminder: The Flipper & Start Buttons are deactivated during Switch Tests.)

Switch Test

To initiate, from the SWITCH MENU, select the "TST" Icon with the Green "SELECT" Button & press the Black "Enter" Button. In Switch Test, close each switch and observe the display. The display will describe the switch in the Switch Matrix, which includes the switch name, Return (Row) Wire, Drive (Column) Wire, Part Nº, and the "Pin-Outs" from the CPU 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.

Active Switch Test

To initiate, from the SWITCH MENU, select the "ACT" Icon with either Green "SELECT" Button & press the Black "ENTER" Button. If still in Switch Test, select the "PREV" Icon to return to Switch Menu or select either of the "ARROW" Icons will move to Active Switch Test (selecting again will return to Switch Test). If any switches are stuck closed (or made from the presence of a pinball), the display sequences through the switch names, Return (Row) Wire, Drive (Column) Wire, drive transistor, Part Nº, and the "Pin-Outs" from the CPU Board. This cycle continues until all switches are cleared or until the test is exited.

Typical Switch Schematic & Side View

(Column: Switch Drive Wire)
GRN-XXX

(Row: Switch Return Wire)
WHT-XXX

Blocking Diode

N.O.
Normally Open
Switch Terminal

COM.
Common
Switch Terminal

N.C.
Normally Closed
Switch Terminal

N.C. N.O. COM
WHT   GRN
1N4001   Diode 1N4001
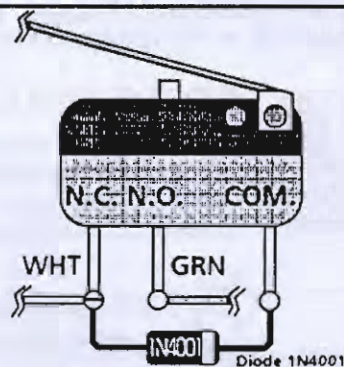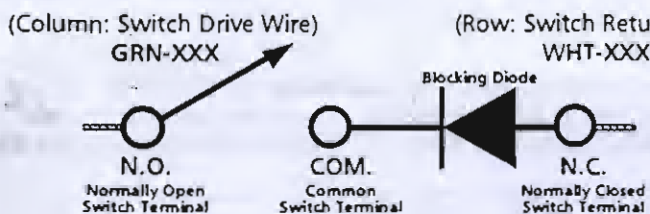
SWITCH MATRIX GRID

Column (Drive) → Row (Return) ↓	1 Q55 GRN-BRN CN8-1	2 Q54 GRN-RED CN8-2	3 Q53 GRN-ORG CN8-3	4 Q52 GRN-YEL CN8-4	5 Q51 GRN-BLK CN8-5	6 Q50 GRN-BLU CN8-7	7 Q49 GRN-VIO CN8-8	8 Q48 GRN-GRY CN8-9
1 WHT-BRN CN10-9	PLUMB BOB TILT [1]	NOT USED [9]	NOT USED [17]	LEFT RAMP S-U L (?) [25]	LASER KICK [33]	TOP EJECT [41]	GUN TRIGGER [49]	LEFT TURBO BUMPER [57]
2 WHT-RED CN10-8	4TH COIN SLOT [2]	NOT USED [10]	4-BANK DROP (C)AVE [18]	LEFT RAMP S-U R (?) [26]	LEFT RETURN LANE [34]	TOP GOOD HEADS S-U [42]	RIGHT GOOD HEADS S-U [50]	BOTTOM TURBO BUMPER [58]
3 WHT-ORG CN10-7	START BUTTON [3]	#1 BALL TROUGH (LEFT) [11]	4-BANK DROP C(A)VE [19]	VUK S-U (?) [27]	LEFT SLINGSHOT [35]	TOP BAD HEADS S-U [43]	RIGHT BAD HEADS S-U [51]	RIGHT TURBO BUMPER [59]
4 WHT-YEL CN10-6	RIGHT COIN SLOT [4]	#2 BALL TROUGH [12]	4-BANK DROP CA(V)E [20]	RIGHT RAMP S-U L (?) [28]	RIGHT SLINGSHOT [36]	BATWING CANNON LOADED [44]	LEFT RAMP ENTER [52]	LOCK #3 (TOP) [60]
5 WHT-GRN CN10-5	CENTER COIN SLOT OR DBA [5]	#3 BALL TROUGH [13]	4-BANK DROP CAV(E) [21]	RIGHT RAMP S-U R (?) [29]	RIGHT RETURN INSIDE [37]	BATWING CANNON SAFETY [45]	LEFT RAMP EXIT [53]	LOCK #2 (MIDDLE) [61]
6 WHT-BLU CN10-3	LEFT COIN SLOT [6]	#4 BALL TROUGH (RIGHT) [14]	TOP LANE (B)AT [22]	BATCAVE EXIT KICKER [30]	RIGHT RETURN OUTSIDE [38]	BATWING CANNON HOME [46]	MIDDLE RAMP EXIT [54]	LOCK #1 (BOTTOM) [62]
7 WHT-VIO CN10-2	SLAM TILT [7]	4-BALL TRGH. VUK OPTO [15]	TOP LANE B(A)T [23]	NOT USED [31]	RIGHT OUTLANE [39]	LEFT ORBIT [47]	RIGHT RAMP ENTER [55]	LT FLIPPER BUTTON VIA Q7, ON SSFB [63]
8 WHT-GRY CN10-1	EB / LEAGUE BUTTON [8]	SHOOTER LANE [16]	TOP LANE BA(T) [24]	VUK [32]	U-TURN MINI-RAMP [40]	RIGHT ORBIT [48]	RIGHT RAMP EXIT [56]	RT FLIPPER BUTTON VIA Q5, ON SSFB [64]

Switch Matrix Descriptions with Part Numbers and Locations †

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

Sw. N°	Col. N°	Row N°	Switch Matrix Description	Part N°
1	1	1	* PLUMB BOB TILT (See Section 4, Chapter 1)	
2	1	2	* 4TH COIN SLOT (On Coin Door)	
3	1	3	* START BUTTON (Left of Coin Door)	500-5097-02
4	1	4	* RIGHT COIN SLOT (On Coin Door)	180-5024-00
5	1	5	* CENTER COIN SLOT OR DBA	180-5024-00
6	1	6	* LEFT COIN SLOT (On Coin Door)	180-5024-00
7	1	7	* SLAM TILT	180-5022-00
8	1	8	* EXTRA BALL BUYIN/LEAGUE BUTTON	180-5073-00
9	2	1	(X) NOT USED	
10	2	2	(X) NOT USED	
11	2	3	#1 BALL TROUGH (LEFT)	180-5119-00
12	2	4	#2 BALL TROUGH	180-5119-00
13	2	5	#3 BALL TROUGH	180-5119-00
14	2	6	#4 BALL TROUGH	180-5119-00
15	2	7	#4 BALL TROUGH VUK OPTO (TRANS) (REC)	520-5124-00 520-5125-00
16	2	8	SHOOTER LANE	180-5100-00
17	3	1	NOT USED	
18	3	2	4-BANK DROP TARGET (C)AVE	180-5104-00
19	3	3	4-BANK DROP TARGET C(A)VE	180-5104-00
20	3	4	4-BANK DROP TARGET CA(V)E	180-5104-00
21	3	5	4-BANK DROP TARGET CAV(E)	180-5104-00
22	3	6	TOP LANE LEFT (B)AT	500-5706-00
23	3	7	TOP LANE MIDDLE B(A)T	500-5707-00
24	3	8	TOP LANE RIGHT BA(T)	500-5707-00
25	4	1	LEFT RAMP STAND-UP LEFT (?)	515-5967-11
26	4	2	LEFT RAMP STAND-UP RIGHT (?)	515-5967-11
27	4	3	VUK STAND-UP (?)	515-5967-11
28	4	4	RIGHT RAMP STAND-UP LEFT (?)	515-5967-11
29	4	5	RIGHT RAMP STAND-UP RIGHT (?)	515-5967-11
30	4	6	BATCAVE EXIT KICKER	500-5706-01
31	4	7	NOT USED	
32	4	8	VUK	180-5116-00
33	5	1	LASER KICK (LEFT OUTLANE)	500-5142-00
34	5	2	LEFT RETURN LANE	500-5706-00
35	5	3	LEFT SLINGSHOT	180-5054-00
36	5	4	RIGHT SLINGSHOT	180-5054-00
37	5	5	RIGHT RETURN INSIDE LANE	500-5706-00
38	5	6	RIGHT RETURN OUTSIDE LANE	500-5706-00
39	5	7	RIGHT OUTLANE	500-5706-00
40	5	8	U-TURN MINI-RAMP	180-5093-00
41	6	1	TOP EJECT	180-5027-01
42	6	2	TOP GOOD HEADS STAND-UP LEFT	515-5162-08
43	6	3	TOP BAD HEADS STAND-UP RIGHT	515-5162-08
44	6	4	BATWING CANNON LOADED (On Asm)	180-5057-00
45	6	5	BATWING CANNON SAFETY (On Asm.)	180-5119-00
46	6	6	BATWING CANNON HOME	180-5119-00
47	6	7	LEFT ORBIT	500-5706-00
48	6	8	RIGHT ORBIT	500-5706-00
49	7	1	GUN TRIGGER	180-5111-00
50	7	2	RIGHT GOOD HEADS STAND-UP TOP	515-5162-08
51	7	3	RIGHT GOOD HEADS STAND-UP BOTTOM	515-5162-08
52	7	4	LEFT RAMP ENTER (On Ramp)	180-5087-00
53	7	5	MIDDLE RAMP EXIT (On Ramp)	180-5093-00
54	7	6	LEFT RAMP EXIT (On Ramp)	180-5093-00
55	7	7	RIGHT RAMP ENTER (On Ramp)	180-5087-00
56	7	8	RIGHT RAMP EXIT (On Ramp)	180-5093-00
57	8	1	LEFT TURBO BUMPER	180-5015-03
58	8	2	BOTTOM TURBO BUMPER	180-5015-03
59	8	3	RIGHT TURBO BUMPER	180-5015-03
60	8	4	LOCK #3 (TOP) (On Ramp)	180-5119-00
61	8	5	LOCK #2 (MIDDLE) (On Ramp)	180-5119-00
62	8	6	LOCK #1 (BOTTOM) (On Ramp)	180-5119-00
63	8	7	* LOWER LEFT FLIPPER SWITCH STACK	180-5048-01
64	8	8	* UPPER & LOWER RIGHT FLIPPER SWITCH STACK	180-5151-00

Legend Note:

☐ = Switches located above playfield.

■ = Switches located below playfield.

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

1 **2** **4** **5** **6** **7**

The following switches are not used:

9 **10** **17** **31**

GO TO COIL MENU

From the DIAGNOSTICS MENU, select the "COIL" *Icon* with either Flipper Button and press the Start Button. Twenty-Two regular coil drivers (pulsed under microprocessor control) are provided to switch ground to coils. The Left/Right Relay is used in conjunction with Drives 1 through 8 to switch +32/50 volts between coils or flash lamps; these sets are termed "left" and "right". The first 8 coil numbers are followed by "L" for left; the first 8 flash lamp numbers are followed by "R". This relay is located on the PPB Board which provides isolation diodes and current limiting resistors. This effectively provides up to 30 drive controlled devices. The remaining (9-22) can be either coils or flashlamps (indicated in the display and the tables below).

Coil Test

To initiate, from the COIL MENU, select the "TST" *Icon* with either Flipper Button and press the Start 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 #1L (The test runs through #1L - 22). Press the Start 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 CPU & PPB Boards, the coil voltage and gauge-turns (e.g. 23-800). Press the Start 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 Start Button. Each time the Start 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 Flipper Button and press the Start Button.. If still in Coil Test, select the "PREV" *Icon* to return to Coil Menu or select 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".

Backbox Insert Flash Lamps Locations

Below are the flash lamp locations in the backbox (General Illumination (G.I.s) Lamps are also shown for reference). The flash lamp locations correspond with the coil numbers as seen in the Coil Test. The table below indicates the numbers for the flash lamps in the backbox.
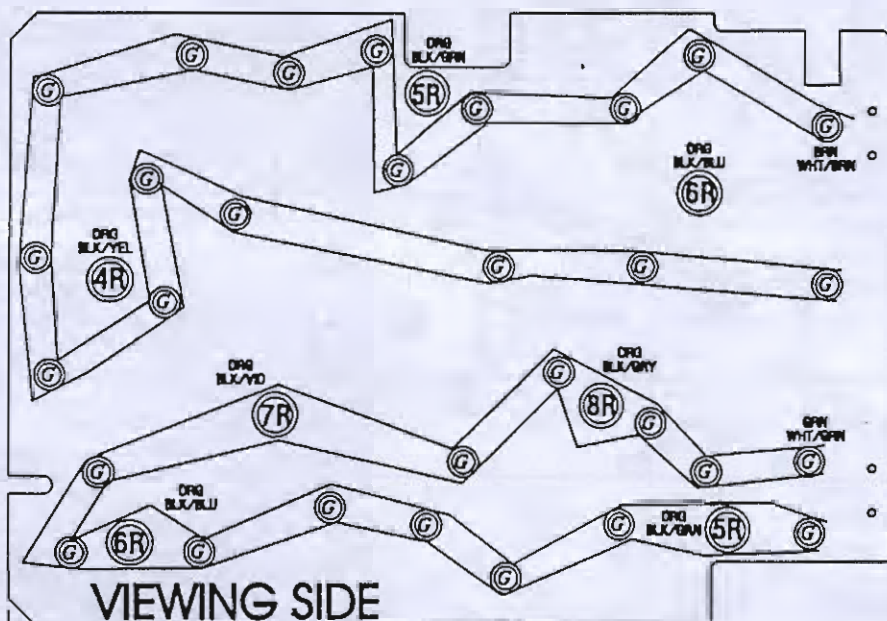
G = General Illumination

#555 Bulb (Wedge Base) 165-5002-00

#R = Flasher

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

Both bulbs use an IDC Wedge Base Socket (077-5110-00).

VIEWING SIDE

G = General Illumination

#44 Bulb (Bayonet) 165-5000-44

#R = Flasher

#89 Bulb (Bayonet) 165-5000-89

#44 Bulb uses 2-Lug Socket (077-5000-00). #89 Bulb uses a Stand-Up Short Socket (077-5101-00)

Coil N°	Type	Qty.	Coil N°	Type	Qty.
1R	Flash	Not used.	5R	Flash	Insert X2
2R	Flash	Not used.	6R	Flash	Insert X2
3R	Flash	Not used.	7R	Flash	Insert X1
4R	Flash	Insert X1	8R	Flash	Insert X1

Look at bulb style above to determine which Bulb & Sockets are required for replacements.

Playfield Coil Locations

Playfield Flash Lamp Locations

On the Ramp.

All Flash Lamps which are located above the playfield are under Mini-Mars.

Coil N°	Type	Coil Description
1L	Coil	4-Ball Trough Lock Ball (25-1240)
2L	Coil	Trough Up-Kicker (23-800)
3L	Coil	Auto Ball Launch 50v (23-800)
4L	Coil	VUK 50v (24-940)
5L	Coil	Top Eject (24-940)
6L	Coil	NOT USED
7L	Coil	4-Bank Drop Target Reset (23-700)
8L	Coil	Knocker 32v (23-800)
9	Coil	Bat Cave Ball Lock (24-900)
10	Relay	Left / Right (A/B) Relay (24v DC 10A DPDT)
11	Relay	G.I. (General Illumination) Relay (24v DC 10A DPDT)
12	Coil	Batwing Ramp Ball Diverter (27-1500)
13	Coil	NOT USED
14	Coil	Batwing Motor Relay (24v DC 10A DPDT)
15	Coil	Batwing Cannon Ball Launch 50v (23-800)
16	Coil	Bat Cave Ramp Ball Kicker 50v (24-940)
17	Coil	Left Turbo Bumper (23-700)
18	Coil	Bottom Turbo Bumper (23-700)
19	Coil	Right Turbo Bumper (23-700)
20	Coil	Left Slingshot (23-800)
21	Coil	Right Slingshot (23-800)
22	Coil	Laser Kick 50v (23-800)

Coil N°	Type	Flash Lamps Description & Qty.
1R	Flash	4-Bank x2 Left Bottom x2
2R	Flash	Left Ramp X4
3R	Flash	Left Orbit X4
4R	Flash	Top Left X2 Backpanel X1
5R	Flash	Middle Ramp X1 Backpanel X1
6R	Flash	U-Turn X1 Backpanel X1
7R	Flash	Top Right X2 Backpanel X1
8R	Flash	Right Bottom X2 Right Stand-Up X1

See previous page for Backbox Insert Flash Lamp Locations.

Legend Note:

☐ = Coils or Flash Lamps located above playfield.

■ = Coils or Flash Lamps located below playfield.

#R = Flasher

#89 Bulb (Bayonet) 165-5000-89
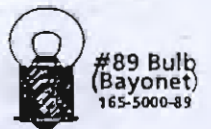
The following coils/relays are not noted in the Coil Diagram above (Location: 8L-Cabinet; 10/11-Backbox):

8L **10** **11**

The following coils are not used:

6L **13**

Coils (1L-8L), Flashers (1R-8R) and Constant Power Coils (9-22)

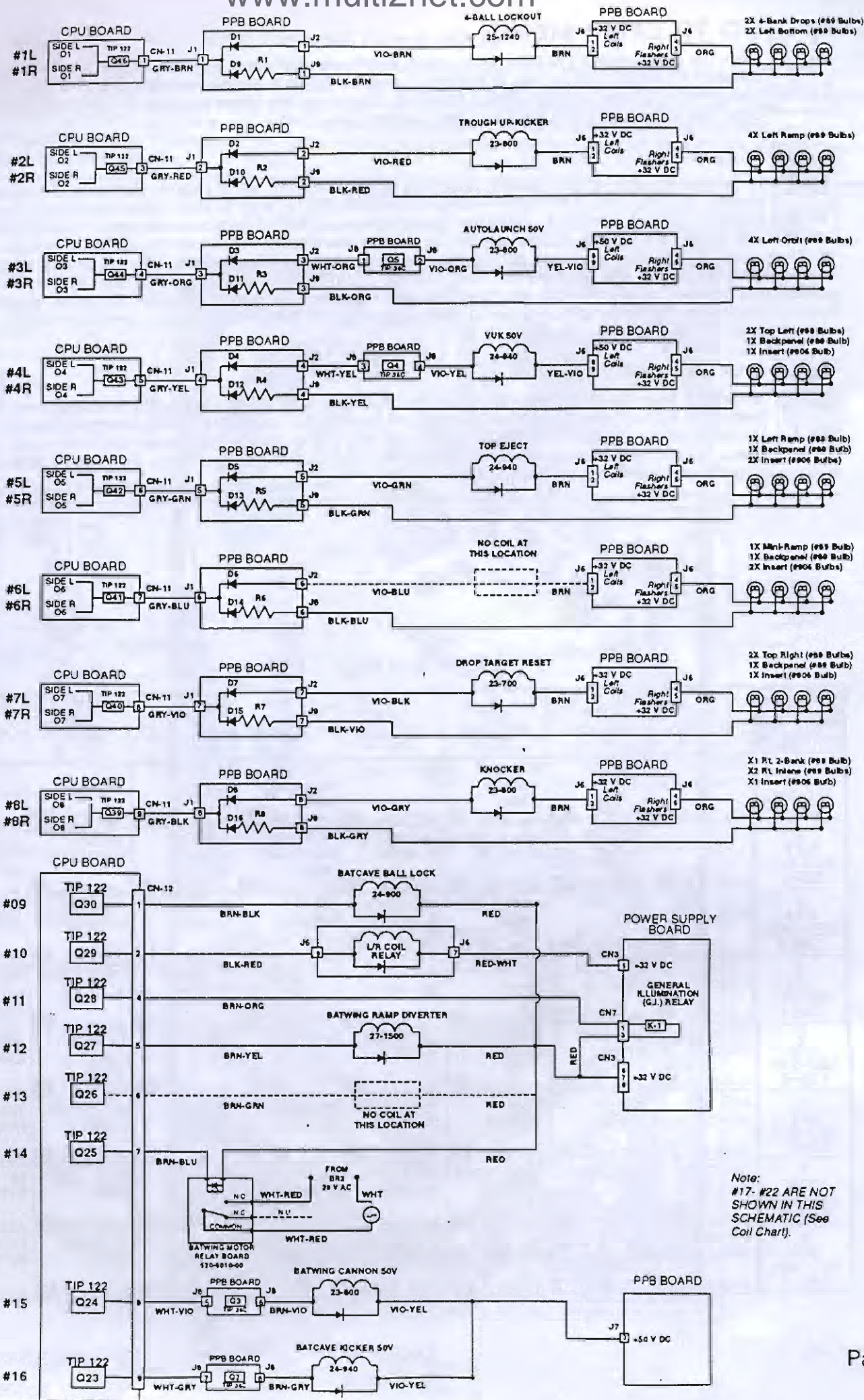| Coils (1L-8L) & Flashers (1R-8R)	Drive Transistor (D.T.)	On Which Board?	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn or Bulb Type
#1L: 4-BALL LOCKOUT	Q46	CPU	VIO-BRN	PPB J2-1	BRN	PPB J6-1, 2	32v L	25-1240 090-5034-00
#1R: *FLASH* 4-BANK X2 LEFT INLANE X2			BLK-BRN	PPB J9-1	ORG	PPB J6-4, 5	32v R	4X #89 0X #906
#2L: TROUGH UP-KICKER	Q45	CPU	VIO-RED	PPB J2-2	BRN	PPB J6-1, 2	32v L	23-800 090-5001-00
#2R: *FLASH* LEFT RAMP X4			BLK-RED	PPB J9-2	ORG	PPB J6-4, 5	32v R	4X #89 0X #906
#3L: AUTOLAUNCH 50V	Q44/Q5	CPU/PPB	VIO-ORG	PPB J8-2	YEL-VIO	PPB J7-8	50v L	23-800 090-5001-00
#3R: *FLASH* LEFT ORBIT X4	Q44	CPU	BLK-ORG	PPB J9-3	ORG	PPB J6-4, 5	32v R	4X #89 0X #906
#4L: VUK 50V	Q43/Q4	CPU/PPB	VIO-YEL	PPB J8-4	YEL-VIO	PPB J7-8, 9	50v L	24-940 090-5036-00
#4R: *FLASH* TOP LEFT X2 BACK PANEL X1 INSERT X1	Q43	CPU	BLK-YEL	PPB J9-4	ORG	PPB J6-4, 5	32v R	3X #89 1X #906
#5L: TOP EJECT	Q42	CPU	VIO-GRN	PPB J2-5	BRN	PPB J6-1, 2	32v L	24-940 090-5036-00
#5R: *FLASH* LEFT RAMP X1 BACK PANEL X1 INSERT X2			BLK-GRN	PPB J9-5	ORG	PPB J6-4, 5	32v R	3X #89 1X #906
#6L: NOT USED	Q41	CPU	VIO-BLU	PPB J2-6	BRN	PPB J6-1, 2	32v L	
#6R: *FLASH* MINI RAMP X1 BACK PANEL X1 INSERT X2	Q41	CPU	BLK-BLU	PPB J9-6	ORG	PPB J6-4, 5	32v R	2X #89 2X #906
#7L: 4-BANK DROP TARGET RESET	Q40	CPU	VIO-BLK	PPB J2-7	BRN	PPB J6-1, 2	32v L	23-700 090-5022-00
#7R: *FLASH* TOP RIGHT X2 BACK PANEL X1 INSERT X1			BLK-VIO	PPB J9-7	ORG	PPB J6-4, 5	32v R	3X #89 1X #906
#8L: KNOCKER	Q39	CPU	VIO-GRY	PPB J2-8	BRN	PPB J6-1, 2	32v L	23-800 090-5001-00
#8R *FLASH* RIGHT 2-BANK X1 RIGHT INLANE X2 INSERT X1			BLK-GRY	PPB J9-8	ORG	PPB J6-4, 5	32V R	3X #89 1X #906

Constant Power Coils (9-22)	Drive Transistor (D.T.)	On Which Board?	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn or Relay Type
#9: BATCAVE BALL LOCK	Q30	CPU	BRN-BLK	CPU CN 12-1	RED	PS CN 3-6, 7	32v	24-940 090-5002-00
#10: LEFT & RIGHT (A/B) RELAY Loc: PPB (Not Shown in Display)	Q29	CPU	BLK-RED	CPU CN 12-2	RED	PS CN 3-6, 7	32v	24v DC 10A DPDT
#11: G.I. RELAY Loc: Power Supply	Q28	CPU	BRN-ORG	CPU CN 12-4	RED	PS CN 3-6, 7	32v	24v DC 10A DPDT
#12: BATWING RAMP DIVERTER	Q27	CPU	BRN-YEL	CPU CN 12-5	RED	PS CN 3-6, 7	32v	27-1500 090-5004-00
#13: NOT USED	Q26	CPU	BRN-GRN	CPU CN12-6	RED	PS CN 3-6, 7	32V	---
#14: BATWING MOTOR RELAY	Q25	CPU	BRN-BLU	CPU CN 12-7	RED	PS CN 3-6, 7	32v	24v DC 10A DPDT
#15: BATWING CANNON 50V	Q24/Q3	CPU/PPB	BRN-VIO	PPB J8-6	VIO-YEL	PPB J7-6, 7	50v	23-800 090-5001-00
#16: BATCAVE KICKER 50V	Q23/Q2	CPU/PPB	BRN-GRY	PPB J8-8	VIO-YEL	PPB J7-6, 7	50v	24-940 090-5036-00
#17: LEFT TURBO BUMPER	Q11	CPU	BLU-BRN	CPU CN 19-7	RED	PS CN 3-6	32v	23-700 090-5022-00
#18: BOTTOM TURBO BUMPER	Q9	CPU	BLU-RED	CPU CN 19-4	RED	PS CN 3-6	32v	23-700 090-5022-00
#19: RIGHT TURBO BUMPER	Q8	CPU	BLU-ORG	CPU CN 19-3	RED	PS CN 3-6	32v	23-700 090-5022-00
#20: LEFT SLINGSHOT	Q10	CPU	BLU-YEL	CPU CN 19-6	RED	PS CN 6-6, 7	32v	23-800 090-5001-00
#21: RIGHT SLINGSHOT	Q12	CPU	BLU-GRN	CPU CN 19-8	RED	PS CN 6-6, 7	32v	23-800 090-5001-00
#22: LASER KICK 50V	Q13/Q1	CPU/PPB	BLU-BLK	PPB J8-10	VIO-YEL	PPB J7-6, 7	50v	23-800 090-5001-00

Flipper Coils

SSFB N°	Flipper Coil	Cabinet Switch	Switch Drive	Switch Return	F.O.S.	GND	Flipper 50vDC Power	Flipper 8vAC Hold	Flipper Coil Output	
SSFB 1	Lwr. Rt. Flipper 22-900	BLU-VIO SSFB CN1-7	GRN-GRY CPU CN8-9 TO SSFB CN1-4	WHT-GRY CPU CN10-1 TO SSFB CN1-3	BRN-VIO RT. EOS SW. TO CN1-1	BLK CPU CN5 TO CN1-6	BLK-WHT PPB J7-1, -5 to SSFB CN2-11, 12	GRY-GRN-GRY P/S CN1-10, -11, to SSFB CN2-9, 10	50v Q2, Q3, CN2-7, 8	8vAC SR1
SSFB 1	Lwr. Lt. Flipper 22-1080	BLU-GRY SSFB CN1-10	GRN-GRY CPU CN8-9 TO SSFB CN1-4	WHT-VIO CPU CN10-2 TO SSFB CN1-5	BRN-GRY LT. EOS SW. TO CN1-9	BLK CPU CN5 TO CN1-6	BLK-WHT PPB J7-1, -5 to SSFB CN2-11, 12	GRY-GRN-GRY P/S CN1-10, -11, to SSFB CN2-9, 10	50v Q2, Q10, CN2-4, 5	8vAC R2
SSFB 1	Upr. Rt. Flipper 23-900	GRY-VIO SSFB CN1-10	GRN-GRY CPU CN8-9 TO SSFB CN1-4	WHT-GRY CPU CN10-1 TO SSFB CN1-3	Not Used	BLK CPU CN5 TO CN1-6	BLK-WHT PPB J7-1, -5 to SSFB CN2-11, 12	GRY-GRN-GRY P/S CN1-10, -11, to SSFB CN2-9, 10	50v Q16, Q15 CN2-1, 2	8vAC SR3

CPU BOARD | PPB BOARD | 4-BALL LOCKOUT | PPB BOARD | 2X 4-Bank Drops (#89 Bulbs)
2X Left Bottom (#89 Bulbs)

#1L #1R — SIDE L O1 — TIP 122 Q46 — CN-11 J1 — D1 D9 R1 — J2 J9 — 25-1240 — VIO-BRN — BRN — +32 V DC Left Coils / Right Flashers +32 V DC — ORG — BLK-BRN

#2L #2R — SIDE L O2 — TIP 122 Q45 — CN-11 J1 — D2 D10 R2 — J2 J9 — TROUGH UP-KICKER 23-800 — VIO-RED — BRN — +32 V DC Left Coils / Right Flashers +32 V DC — ORG — BLK-RED — 4X Left Ramp (#89 Bulbs)

#3L #3R — SIDE L O3 — TIP 122 Q44 — CN-11 J1 — D3 D11 R3 — J2 J9 — PPB BOARD Q5 TIP 36C — WHT-ORG — VIO-ORG — AUTOLAUNCH 50V 23-800 — YEL-VIO — +50 V DC Left Coils / Right Flashers +32 V DC — ORG — BLK-ORG — 4X Left Orbit (#89 Bulbs)

#4L #4R — SIDE L O4 — TIP 122 Q43 — CN-11 J1 — D4 D12 R4 — J2 J9 — PPB BOARD Q4 TIP 36C — WHT-YEL — VIO-YEL — VUK 50V 24-640 — YEL-VIO — +50 V DC Left Coils / Right Flashers +32 V DC — ORG — BLK-YEL — 2X Top Left (#89 Bulbs) 1X Backpanel (#89 Bulb) 1X Insert (#906 Bulb)

#5L #5R — SIDE L O5 — TIP 122 Q42 — CN-11 J1 — D5 D13 R5 — J2 J9 — TOP EJECT 24-940 — VIO-GRN — BRN — +32 V DC Left Coils / Right Flashers +32 V DC — ORG — BLK-GRN — 1X Left Ramp (#89 Bulb) 1X Backpanel (#89 Bulb) 2X Insert (#906 Bulbs)

#6L #6R — SIDE L O6 — TIP 122 Q41 — CN-11 J1 — D6 D14 R6 — J2 J9 — NO COIL AT THIS LOCATION — VIO-BLU — BRN — +32 V DC Left Coils / Right Flashers +32 V DC — ORG — BLK-BLU — 1X Mini-Ramp (#89 Bulb) 1X Backpanel (#89 Bulb) 2X Insert (#906 Bulbs)

#7L #7R — SIDE L O7 — TIP 122 Q40 — CN-11 J1 — D7 D15 R7 — J2 J9 — DROP TARGET RESET 23-700 — VIO-BLK — BRN — +32 V DC Left Coils / Right Flashers +32 V DC — ORG — BLK-VIO — 2X Top Right (#89 Bulbs) 1X Backpanel (#89 Bulb) 1X Insert (#906 Bulb)

#8L #8R — SIDE L O8 — TIP 122 Q39 — CN-11 J1 — D8 D16 R8 — J2 J9 — KNOCKER 23-800 — VIO-GRY — BRN — +32 V DC Left Coils / Right Flashers +32 V DC — ORG — BLK-GRY — X1 Rt 2-Bank (#89 Bulb) X2 Rt Inlane (#89 Bulb) X1 Insert (#906 Bulb)

CPU BOARD

#09 — TIP 122 Q30 — CN-12 1 — BRN-BLK — BATCAVE BALL LOCK 24-900 — RED

#10 — TIP 122 Q29 — 2 — BLK-RED — L/R COIL RELAY — RED-WHT — POWER SUPPLY BOARD CN3 +32 V DC

#11 — TIP 122 Q28 — 4 — BRN-ORG — GENERAL ILLUMINATION (G.I.) RELAY CN7 K-1

#12 — TIP 122 Q27 — 5 — BRN-YEL — BATWING RAMP DIVERTER 27-1500 — RED — CN3 +32 V DC

#13 — TIP 122 Q26 — 6 — BRN-GRN — NO COIL AT THIS LOCATION — RED

#14 — TIP 122 Q25 — 7 — BRN-BLU — RED — FROM BR2 29 V AC — WHT-RED — WHT — NC NC NU COMMON — WHT-RED — BATWING MOTOR RELAY BOARD 120-5010-00

#15 — TIP 122 Q24 — 9 — WHT-VIO — PPB BOARD Q3 TIP 36C — BRN-VIO — BATWING CANNON 50V 23-800 — VIO-YEL — PPB BOARD J7 +50 V DC

#16 — TIP 122 Q23 — 9 — WHT-GRY — PPB BOARD Q2 TIP 36C — BRN-GRY — BATCAVE KICKER 50V 24-940 — VIO-YEL

Note:
#17- #22 ARE NOT SHOWN IN THIS SCHEMATIC (See Coil Chart).
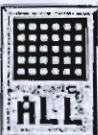
GO TO LAMP MENU

From the DIAGNOSTICS MENU, select the "LAMP" Icon with either Flipper Button and press the Start Button. Controlled lamps are configured in and 8 x 8 Matrix of Columns (Lamp Drives) and Rows (Lamp Returns) with up to 64 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 Flipper Button and press the Start 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 Start Button on the "+" Icon, as each lamp is selected, the lamp will light at it's location on the playfield as well as the display, indicating the Lamp Matrix Grid position, lamp name with the corresponding number, Return (Row) Wire & Color, Drive (Column) Wire & Color, and associated drive transistors. Press the Start Button again to move forward in the test. To test and view a particular lamp, select the "RUN" Icon and press the Start Button. Each time the Start 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 Flipper Button and press the Start Button. If still in Single Lamp Test (or any 1 of the 4 tests), select the "PREV" Icon to return to Lamp Menu or select 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.

Section 3 | Diags.

YEL 18V COL — RED GND ROW

LAMP MATRIX GRID

YEL — COMMON — RED
Diode 1N4001
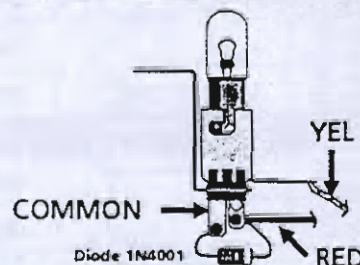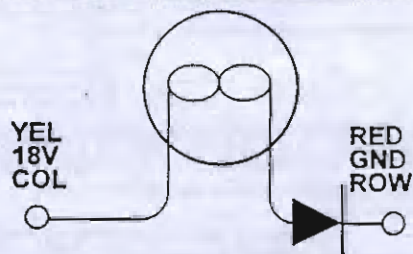
Column (18v) / Row (GND)	1 Q71 YEL-BRN CN7-1	2 Q70 YEL-RED CN7-2	3 Q69 YEL-ORG CN7-3	4 Q68 YEL-BLK CN7-4	5 Q67 YEL-GRN CN7-5	6 Q66 YEL-BLU CN7-7	7 Q65 YEL-VIO CN7-8	8 Q64 YEL-GRY CN7-9
1 Q72 RED-BRN CN6-1	ROOFTOP CHASE (GRID) #555 Bulb 1	TOP LANE (B)AT #555 Bulb 9	RIDDLER'S THRONE (GRID) #44 Bulb 17	MR. E (VUK) #555 Bulb 25	SPOT-LITE MID RAMP LEFT #555 Bulb 33	TOP GOOD HEADS #555 Bulb 41	ARM BATWING #44 Bulb 49	LEFT TURBO BUMPER #555 Bulb 57
2 Q73 RED-BLK CN6-2	??????? (GRID) #555 Bulb 2	TOP LANE B(A)T #555 Bulb 10	4-BANK DROP (C)AVE #555 Bulb 18	BAT SIGNAL (L ORBIT) #44 Bulb 26	SPOT-LITE MID RAMP RIGHT #555 Bulb 34	TOP BAD HEADS #555 Bulb 42	JACKPOT (LEFT RAMP) #555 Bulb 50	BOTTOM TURBO BUMPER #555 Bulb 58
3 Q74 RED-ORG CN6-3	FACE TWO-FACE (GRID) #555 Bulb 3	TOP LANE BA(T) #555 Bulb 11	4-BANK DROP C(A)VE #555 Bulb 19	BAT SIGNAL (L RAMP) #555 Bulb 27	SUPER JACKPOT (U-TURN) #44 Bulb 35	RIGHT GOOD HEADS #555 Bulb 43	DOUBLE JACKPOT #555 Bulb 51	RIGHT TURBO BUMPER #555 Bulb 59
4 Q75 RED-YEL CN6-5	CRIME SPREE (GRID) #555 Bulb 4	LEFT RAMP L (?) #555 Bulb 12	4-BANK DROP CA(V)E #555 Bulb 20	BAT SIGNAL (M. RAMP) #555 Bulb 28	NOT USED 36	RIGHT BAD HEADS #555 Bulb 44	CRIME SPREE (R. RAMP) #44 Bulb 52	NOT USED 60
5 Q76 RED-GRN CN6-6	BRAIN DRAIN (GRID) #555 Bulb 5	LEFT RAMP R (?) #555 Bulb 13	4-BANK DROP CAV(E) #555 Bulb 21	BAT SIGNAL (U-TURN) #555 Bulb 29	NOT USED 37	LASER KICK #555 Bulb 45	JACKPOT (RIGHT RAMP) #44 Bulb 53	BATWING CANNON #44 Bulb 61
6 Q77 RED-BLU CN6-7	SAFE TRAP (GRID) #555 Bulb 6	VUK (?) #555 Bulb 14	ALL BAT SIGNALS... #44 Bulb 22	BAT SIGNAL (R. RAMP) #555 Bulb 30	NOT USED 38	RIGHT RETURN INSIDE #555 Bulb 46	EXTRA BALL (U-TURN) #555 Bulb 54	THE BAT LIVES #44 Bulb 62
7 Q78 RED-VIO CN6-8	LITE EXTRA BALL (GRID) #44 Bulb 7	RIGHT RAMP L (?) #555 Bulb 15	GOOD HEADS MATCHED #44 Bulb 23	BAT SIGNAL (R. ORBIT) #555 Bulb 31	LEFT RETURN LANE #44 Bulb 39	RIGHT RETURN OUTSIDE #555 Bulb 47	LOCK ARROW (VUK) #555 Bulb 55	EB / LEAGUE BUTTON #555 Bulb 63
8 Q79 RED-GRY CN6-9	FOREVER (GRID) #555 Bulb 8	RIGHT RAMP R (?) #555 Bulb 16	BAD HEADS MATCHED #44 Bulb 24	BAT SIGNAL (VUK) #555 Bulb 32	LEFT OUTLANE SPECIAL #555 Bulb 40	RIGHT OUTLANE SPECIAL #44 Bulb 48	GOTHAM EVENT #555 Bulb 56	START BUTTON #555 Bulb 64

Row and Column Lamp Tests

To initiate, from the LAMP MENU, select the "COL" *Icon* with either Flipper Button and press the Start Button. If still in a previous test, select the "PREV" *Icon* to return to Lamp Menu or select 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 Maxtrix Grid on the previous page.

Legend Note:

☐ =
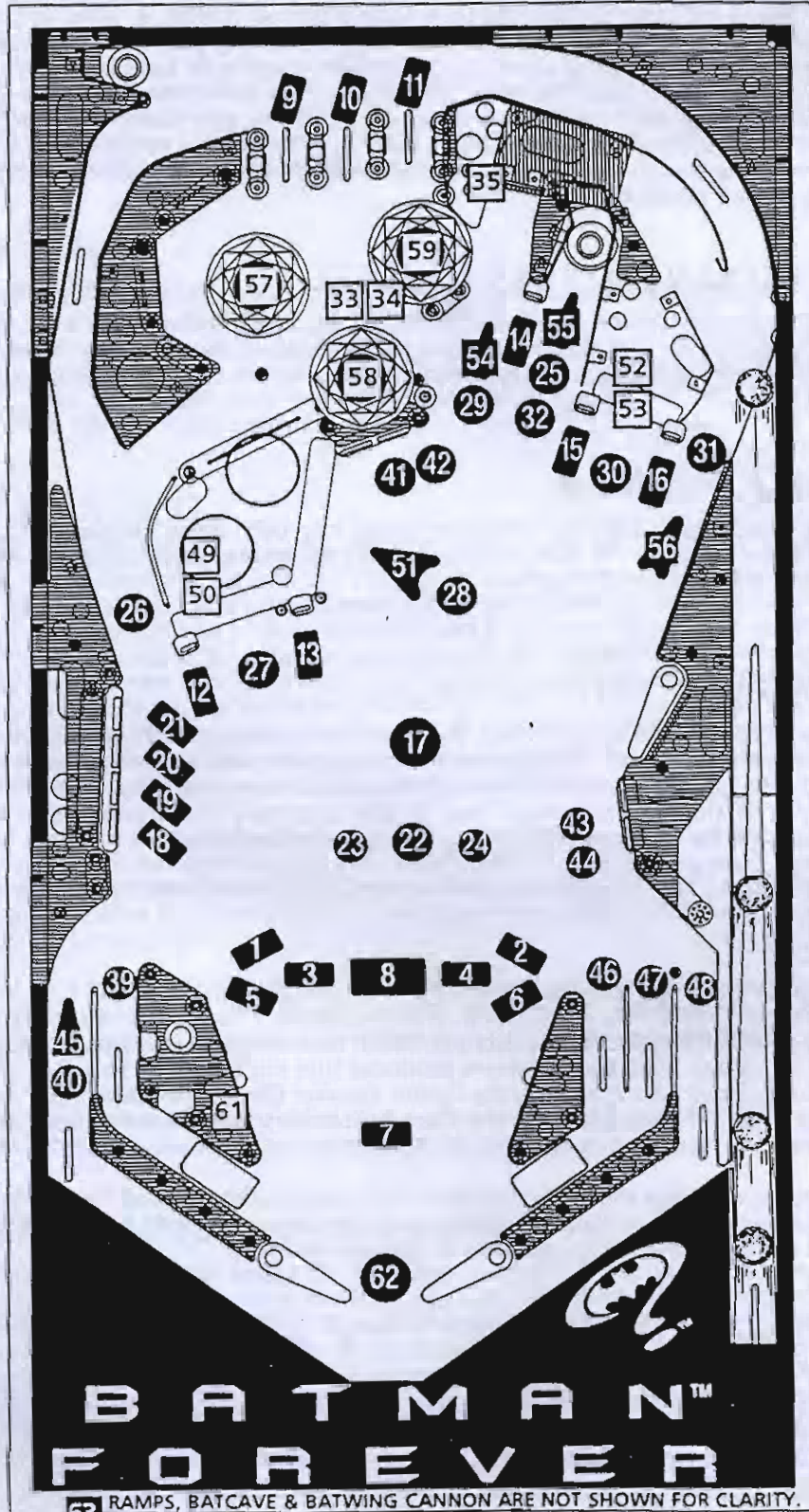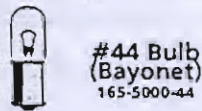Lamps located above playfield.

■ =
Lamps located below playfield.

The following Lamps are not used:

36 **37** **38**
60

The following Bulb is used over the ramps & in the Pop Bumpers:

#555 Bulb
(Wedge)
165-5002-00
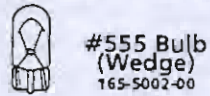
The following Bulb is used in the remainder of the matrix:

#44 Bulb
(Bayonet)
165-5000-44

RAMPS, BATCAVE & BATWING CANNON ARE NOT SHOWN FOR CLARITY.

TEST FLASH LAMPS

From the DIAGNOSTICS MENU, select the "FLASH" *Icon* with either Flipper Button and press the Start Button. After selecting this *Icon* the display will indicated "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. Note: This test is also good to verify operation of the Left/Right Relay. If the relay does not function properly, coils may energize instead of the flash lamps.

CLEAR BALL TROUGH

From the DIAGNOSTICS MENU, select the "CLR" *Icon* with either Flipper Button and press the Start 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 this test may overheat the Trough Up-Kicker Coil.)

TECHNICIANS ALERTS

From the DIAGNOSTICS MENU, select the "TECH" *Icon* with either Flipper Button and press the Start 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 Flipper Button and press the Start 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 Flipper Button and press the Start 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.

SOUND/SPEAKER TEST

From the DIAGNOSTICS MENU, select the "SPKR" *Icon* with either Flipper Button and press the Start Button. The BSMT 2000 Sound System produces true digital stereo sound on the Left & Right Speakers (Backbox) and "Mono" on the Center Speaker (Bottom of Cabinet). After selecting this *Icon*, select the "-" or "+" *Icons* and press the Start 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 sound board circuit under test and the corresponding sounds. The sound functions allow verification that all channels are functioning properly & that the speaker connections are correct. (Refer to the game manual for detailed testing procedures).

Automatic / Manual Tests	Sounds Produced	Automatic / Manual Tests	Sounds Produced
Left Speaker	Left Sine	Voice Rom 2 (Loc. U21)	Speech Pattern 2
Both Left & Right Speakers	Center Sine	Voice Rom 3 (Loc. U36)	Not Used
Right Speaker	Right Sine	Voice Rom 4 (Loc. U37)	Not Used
Voice Rom 1 (Loc. U17)	Speech Pattern 1	Sound Rom (Loc. U7)	Level 1-3 (Music Test)

Speaker Phase Testing

Continued

Connections to each of the three 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 two, 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 Left, Center, and Right Sine functions. If the Center Sine produces more volume and bass than the Left and Right Sines, 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 single-color wire (BLK, YEL or RED) is connected to the negative (-) terminal.

2. Disconnect the speaker output connector from the 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 (CN1- Pin 1, 3 or 6) each time. As the connection is made, check speaker cone movement; proper connections are indicated by outward movement.

BEGIN BURN IN

From the DIAGNOSTICS MENU, select the "BURN" *Icon* with either Flipper Button and press the **Start 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 Flipper **Button** and press the **Start Button**. After selecting this *Icon* the Dot Matrix Display Test immediately begins. The display will immediately illuminate and cycle for one pass of each test continuously for each of the following tests: A. 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. B. 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. C. Illuminates all the dots, except for one column from left to right. D. Illuminates all the dots except for one row from top to bottom. E. Illuminates every other dot lit, in both the rows and columns. F. Illuminates all dots at 30%, 70% & 100% brightness. The test will repeat these cycles indefinitely until any button is pressed. Pressing any button will exit the test and return to DIAGNOSTICS MENU.

Dot Matrix Display Explained

The display utilizes a Micro-Processor Control Board mounted in piggyback fashion to the Dot Matrix Display Driver Board. The purpose behind this board is to provide more information (192 X 64 Dots) to the operator as well as displaying graphics to the player.

The board is controlled by a 68000 Microprocessor and its personality ROMs (Unique to the Game). It receives Data, Reset & Clock Information from the CPU 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.
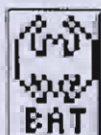
GAME SPECIFIC (Batwing Cannon: Test & Adjustment)

From the DIAGNOSTICS MENU, select the "BAT" *Icon* with either Flipper **Button** and press the **Start Button**. After selecting this *Icon* the technician can test and adjust any game specific function(s). Similar to "BEGIN PLAY TEST", this menu is used to customize a game specific feature. The feature is the Batwing Cannon. Press the Start Button to move position of Cannon to the Safety Position (the display will indicate the position of the cannon). With the cannon in the Safety Position, place a pinball into the opening and pull the Gun Trigger. The ball should be shot out. All coils should operate.

B A T M A N
F O R E V E R
GAME AUDIT TABLE
Photocopy for Field Audit Tracking Performance (Use blank column to fill-in game audit totals)

EARNINGS AUDITS 1-12

Nº	Audit Name	Fill-In
1	TOTAL PAID CREDITS	
2	FREE GAME PERCENTAGE	
3	AVERAGE BALL TIME	
4	AVERAGE GAME TIME	
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	

SEGA AUDITS 13-46

Nº	Audit Name	Fill-In
13	TOTAL BALLS PLAYED	
14	TOTAL EXTRA BALLS	
15	EXTRA BALL PERCENT	
16	REPLAY 1 AWARDS	
17	REPLAY 2+ AWARDS	
18	TOTAL REPLAYS	
19	REPLAY PERCENT	
20	TOTAL SPECIALS	
21	SPECIAL PERCENT	
22	TOTAL MATCHES	
23	HIGH SCORE AWARDS	
24	HIGH SCORE PERCENT	
25	TOTAL FREE PLAYS	
26	TOTAL PLAYS	
27	0.0M TO 99.9M	
28	100.0M TO 199.9M	

SEGA AUDITS 13-46 (Continued)

Nº	Audit Name	Fill-In
29	200.0M TO 399.9M	
30	400.0M TO 799.9M	
31	800.0M TO 1.19B	
32	1.2B+ SCORES	
33	AVERAGE SCORES	
34	SERVICE CREDITS	
35	PROPRIETARY	
36	PROPRIETARY	
37	PROPRIETARY	
38	TOTAL BUYIN GAMES	
39	TOTAL EXTRA BALL BUYINS	
40	EXTRA BALL BUYIN REPLAYS	
41	EXTRA BALL BUYIN HSTDS	
42	LEFT DRAINS	
43	CENTER DRAINS	
44	RIGHT DRAINS	
45	TOTAL SLAM TILTS	
46	TOTAL BALLS SAVED	
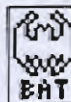
BATMAN FOREVER AUDITS 47-84

Nº	Audit Name	Fill-In
47	TOP LANES (B-A-T) COMPLETED	
48	LEFT RAMP SHOTS	
49	CENTER RAMP SHOTS	
50	U-TURN MINIRAMP	
51	RIGHT RAMP SHOTS	
52	DROP TARGET 4-BANK (C-A-V-E) COMPLETED	
53	MR. E (MYSTERY) LIT FROM U-TURN	
54	MR. E COLLECTED AT VUK	
55	TOTAL BATCAVE VUK SHOTS	
56	LASER KICK LIT	

BATMAN FOREVER AUDITS 47-84 (Continued)

Nº	Audit Name	Fill-In
57	LASER KICK USED	
58	BATARANG ORBITS COMPLETED	
59	BATARANG ORBITS DOUBLED BY INLANE	
60	ARM BATWING LIT	
61	2 ARM BATWING HITS AWARDED VIA INLANE	
62	BATWING CANNON SHOTS FIRED	
63	BATWING SHOT VALUE DOUBLED BY INLANE	
64	BATWING TARGETS COMPLETED	
65	HURRY-UP EXTRA BALL COLLECTED	
66	FLOW COMBOS AT LEAST 5 SHOTS LONG	
67	GOTHAM EVENT STARTED AT SKILL SHOT	
68	GOTHAM EVENT STARTED AT EJECT SAUCER	
69	ROVING BATSIGNALS FEATURE COMPLETED	
70	GOOD SIDE COINS FEATURE AWARDED	
71	BAD SIDE COINS FEATURE AWARDED	
72	MISMATCHED COINS FEATURE AWARDED	
73	REMATCHED COINS FEATURE AWARDED	
74	FOREVER MODE STARTED	
75	FOREVER JACKPOTS SCORED	
76	TOTAL BALLS LOCKED	
77	MULTIBALL READY (LOCK 3 LIT)	
78	REGULAR MULTIBALL STARTS	
79	MULTIBALL STARTS FROM CANNON (BONUS BALL)	
80	MULITBALL RESTARTS	
81	2ND+ MULTIBALL STARTS	
82	SINGLE JACKPOTS SCORED	
83	DOUBLE JACKPOTS SCORED	
84	SUPER JACKPOTS SCORED	

Go To Audits Menu

Overview

The Portals™ Service Menu System provides 84 Audit Functions for accounting purposes and for evaluation of game difficulty adjustments. The Audit Functions are split into 3 groups. The first group, Earnings Audits, are the first 12 most-used audits. The second group, Sega Audits, are the game play generic audits (13-46). The last group, Batman Forever Audits, are the game play specific audits (47-84). Each group may be viewed manually after entering the Portals™ Service Menu (see Chapter 1, Introduction, of this section). All audits can be viewed at a glance with the **Game Audit Table** provided on the previous page.

GO TO AUDITS MENU

With the game in the Attract Mode, open the Coin Door and press the Black "BEGIN TEST" Button. Select the "AUD" *Icon* in the **MAIN MENU** with either Flipper Button and press the Start 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. (See chapter 7 of this section for more help.)
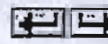
Selecting & activating the "ARROW" *Icons* selects the next or previous audit in the group.

EARNINGS AUDITS (1-12)

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

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

SEGA AUDITS (13-46)

From the AUDITS MENU, select the "SEGA" *Icon* with either Flipper Button and press the Start 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 of regular and extra balls.
Au. 14	Total Extra Balls	Provides the total number of extra balls awarded.
Au. 15	Extra Balls Percent	This percentage is derived 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	The replay total awards for exceeding replay score levels. This percentage is derived from dividing Audit 18, Total Replays, by Audit 26, Total Plays.
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 to 99.9M	Provides the total number of games the Player's final score was between 0 and 99,999,990 points.
Au. 28	100.0M to 199.9M	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 to 399.9M	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 to 799.9M	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 to 1.19B	Provides the total number of games the Player's final score was between 800,000,000 and 1,199,999,990 points.
Au. 32	1.20B+ 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 Service credits added to the game. (See Chapter 1, Introduction [*Access & Use*] for instructions on how to receive Service Credits.)
Au. 35, 36, 37	Proprietary	Provides information to the game designer to aid in design development (not for consumer use).
Au. 38	Total Buyin Games	Provides the number of times a player utilized the Buyin Feature. The Buyin Feature is adjustable using Ad. 34, Buyin Type. (See Chapter 4, Go to Adjustments Menu, of this section.)
Au. 39	Total Extra Ball Buyins	Provides the total number of times the Extra Ball Buyin Feature was used. The Extra Ball Buyin Feature is adjustable using Ad. 34, Buyin Type. (See Chapter 4, Go to Adjustments Menu, of this section.)
Au. 40	Extra Ball Buyin Replays	Provides the total number of replay awards that resulted from the use of Audit 39, Total Extra Ball Buyins.
Au. 41	Extra Ball Buyin HSTDS	Provides the total number of times in which use of the Extra Ball Buyin Feature resulted from beating the High-Score-To-Date (HSTD).
Au. 42	Left Drains	Provides the number of times the ball drained out the left drain.
Au. 43	Center Drains	Provides the number of times the ball drained out the center drain.
Au. 44	Right Drains	Provides the number of times the ball drained out the right drain.
Au. 45	Total Slam Tilts	Provides the number of times the Slam Tilt switch was activated.
Au. 46	Total Balls Saved	Provides the total number of times the Total Balls Saved 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.

BATMAN FOREVER AUDITS (47-84)

From the AUDITS MENU, select the "BAT" *Icon* with either Flipper Button and press the Start 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. 47	Top Lanes (B-A-T) Completed	Provides the number of times the Top Lanes were completed.
Au. 48	Left Ramp Shots	Provides the number of times the Left Ramp was shot.
Au. 49	Center Ramp Shots	Provides the number of times the Center Ramp was shot.
Au. 50	U-Turn Miniramp	Provides the number of times the U-Turn Miniramp was shot.
Au. 51	Right Ramp Shots	Provides the number of times the Right Ramp was shot.
Au. 52	Drop Target 4-Bank (C-A-V-E) Completed	Provides the number of times the Drops were completed.
Au. 53	Mr. E. (Mystery) Lit From U-Turn	Provides the number of times the Mystery was lit via the U-Turn Ramp.
Au. 54	Mr. E Collected at VUK	Provides the number of times the Mr. E Feature was collected.
Au. 55	Total Batcave VUK Shots	Provides the number of times the ball was locked in the Batcave via the VUK.
Au. 56	Laser Kick Lit	Provides the number of times the Laser Kick was lit in the outlane.
Au. 57	Laser Kick Used	Provides the number of times the Laser Kick was used.

Batman Forever Audits Continued.

	Audit Name	Audit Definition
Au. 58	Batarang Orbits Completed	Provides the number of times the Left Or Right Orbits were shot.
Au. 59	Batarang Orbits Doubled by Inlane	Provides the number of times the Left Or Right Orbits were shot after the Inlane was completed doubling the orbits score.
Au. 60	Arm Batwing Lit	Provides the number of times the Arm Batwing was lit.
Au. 61	2 Arm Batwing Hits Awarded via Inlane	Provides the number of times the 2 Arm Batwing Hits were made via the Inlane.
Au. 62	Batwing Cannon Shots Fired	Provides the number of times the Batwing Cannon was fired.
Au. 63	Batwing Shot Value Doubled by Inlane	Provides the number of times the Batwing Cannon was fired and scored doubled with previous closure of Inlane doubling score.
Au. 64	Batwing Targets Completed	Provides the number of times the Stand-Up Targets were completed
Au. 65	Hurry-Up Extra Ball · Collected	Provides the number of times the Hurry-Up Extra Ball Feature was collected.
Au. 66	Flow Combos at Least 5 Shots Long	Provides the number of times a minimum of 5 consecutive combo shots were achieved.
Au. 67	Gotham Event Started at Skill Shot	Provides the number of times the Gotham Event Feature was started via the initial Skill Shot.
Au. 68	Gotham Event Started at Eject Saucer	Provides the number of times the Gotham Event Feature was started via the Eject Shot.
Au. 69	Roving Batsignals Feature Completed	Provides the number of times all of the Roving Batsignals were shot and completed (Orbits, Ramps, and VUK).
Au. 70	Good Side Coins Feature Awarded	Provides the number of times the Good Heads Targets were completed.
Au. 71	Bad Side Coins Feature Awarded	Provides the number of times the Bad Heads Targets were completed.
Au. 72	Mismatched Coins Feature Awarded	Provides the number of times the Mismatched Heads Targets were completed.
Au. 73	Rematched Coins Feature Awarded	Provides the number of times the Good or Bad Heads Targets were completed after Mismatched Heads Targets were awarded.
Au. 74	Forever Mode Started	Provides the number of times the Forever Mode was started.
Au. 75	Forever Jackpots Scored	Provides the number of times the Forever Jackpots were scored.
Au. 76	Total Balls Locked	Provides the number of times the Balls were locked in the Batcave via the VUK Shot.
Au. 77	Multiball Ready (Lock 3 Lit)	Provides the number of times the Multiball was ready but not collected.
Au. 78	Regular Multiball Starts	Provides the number of times the Multiball was started via Multiball Ready from the Batcave.
Au. 79	Multiball Starts from Cannon (Bonus Ball)	Provides the number of times a Special Multiball was started via the Cannon.
Au. 80	Multiball Restarts	Provides the number of times the Multiball was restarted by completing required shots after a short Multiball Round.
Au. 81	2nd+ Multiball Starts	Provides the number of times the a 2nd or more Multiballs were started.
Au. 82	Single Jackpots Scored	Provides the number of times a Single Jackpot was scored.
Au. 83	Double Jackpots Scored	Provides the number of times a Double Jackpot was scored.
Au. 84	Super Jackpots Scored	Provides the number of times a Super Jackpot was scored.

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).

B A T M A N
F O R E V E R
GAME ADJUSTMENT TABLE
Some adjustments have a "Drop-Down" Table where further customization is required.

SEGA
ADJUSTMENTS 1-43

№	Adjustment Name	Factory Setting
1	REPLAYS: FIXED/MANUAL *Drop-Down*	10%
2	REPLAY LEVELS *Drop-Down*	1
3	REPLAY AWARD	CREDIT
4	FREE GAME LIMIT	5
5	EXTRA BALL LIMIT	3
6	GAME DIFFICULTY *Drop-Down*	MODERATE
7	GAME PRICING *Drop-Down*	USA7
8	RESET COIN AUDITS	NO
9	RESET GAME AUDITS	NO
10	RESTORE HIGH SCORES	NO
11	MATCH PERCENTAGE	9%
12	BALLS PER GAME	3
13	TILT WARNINGS	1
14	REPLAY BOOST	YES
15	CREDIT LIMIT	30
16	ALLOW HIGH SCORES	YES
17	AWARD FOR HIGH SCORE #1	3
18	AWARD FOR HIGH SCORE #2	1
19	AWARD FOR HIGH SCORE #3	0
20	AWARD FOR HIGH SCORE #4	0
21	DEFAULT HIGH SCORE #1	2,400,000
22	DEFAULT HIGH SCORE #2	2.100,000
23	DEFAULT HIGH SCORE #3	1,950,000
24	DEFAULT HIGH SCORE #4	1,800,000
25	DEFAULT HIGH SCORE #5	1,650,000
26	DEFAULT HIGH SCORE #6	1,500,000
27	HSTD RESET COUNT	700
28	FREE PLAY	NO
29	CUSTOM MESSAGE	ENABLE
30	ATTRACT MODE MUSIC	ON
31	FLASH LAMP POWER	NORMAL

Continued

SEGA
ADJUSTMENTS 1-43

№	Adjustment Name	Factory Setting
32	COIL PULSE POWER	NORMAL
33	MINIMUM GAME TIME	0:00
34	BUYIN TYPE	EXTRA BALL
35	EXTRA BALL BUYIN COUNT	1
36	GAME RESTART	YES
37	EXTRA BALL PERCENTAGE	25%
38	BILL VALIDATOR	NO
39	TOURNAMENT MODE	OFF
40	EXTERNAL REPLAY KNOCKER	OFF
41	SPECIAL MEMORY	YES
42	LOCATION ID	0
43	GAME ID	0

BATMAN FOREVER
ADJUSTMENTS 44-51

№	Adjustment Name	Factory Setting
44	BATWING CANNON DISABLE	NO
45	LASER KICK CRITERION	MODERATE
46	MBALL RESTART CRITERION	MODERATE
47	EXTRA BALL MEMORY	YES
48	LOCK QUALIFY CRITERION	MODERATE
49	QUALIFY DOUBLE JACKPOT AFTER 1ST MULTIBALL	YES
50	ARM BATWING DIFFICULTY	MODERATE
51	ARM BATWING LIT AT GAMESTART	YES

Section 3 | Adjust,

Go To Adjustments Menu

Overview

The Portals™ Service Menu System provides 51 Adjustment Functions to vary game difficulty or customize (i.e. adjusting High Score Levels, the number of balls per game, Extra Ball Buyin, Game Pricing, Default High Scores, etc.). The Adjustment Functions are split into 2 groups. The first group, Sega Adjustments, are the game play generic adjustments (1-43). The second group, Batman Forever Adjustments, are the game play specific adjustments (44-51). 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 **Flipper Button** and press the **Start 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. (See chapter 7 of this section for more help.)
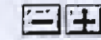
In Adjustments, selecting & activating the **"-"** *Icon* decrements the value setting. Selecting & activating the **"+"** *Icon* increments the value setting.

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 **Flipper Button** and press the **Start 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. N°	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 **Start Button**. (If the coin door is closed or the operator enters the Portals™ Service Menu, the replay level is not changed.)
Adj. 2	Relplay 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 free games that may be accumulated per game; 0 - 9.
Adj. 5 Extra Ball Limit	Adjust the max. # of extra balls that may be accumulated per game; 1- 9 or OFF.
Adj. 6 Game Difficulty	Set to EXTRA EASY, EASY, MODERATE, HARD or EXTRA HARD. (Note: Additional game features which are not adjusted may also change when adjusting this adjustment; see below table.) Default is MODERATE. Any one of the INSTALL settings (in a "Drop-Down" Table) for this adjustment may be activated to automatically select settings for multiple adjustments affecting game difficulty. Select and activate the "-" or "+" Icons to choose the difficulty level required. After activation, the individual adjustments may be readjusted, if desired. Refer to the Install Adjustment Table below for details.

Adjustments which change when set to:	Adj. 6 Extra Easy	Adj. 6 Easy	Adj. 6 Moderate	Adj. 6 Hard	Adj. 6 Extra Hard
(45) Laser Kick Criterion	MODERATE	MODERATE	MODERATE	HARD	EXTRA HARD
(46) Mball Restart Criterion	EXTRA EASY	EASY	EASY	HARD	EXTRA HARD
(47) Extra Ball Memory	YES	YES	YES	YES	NO
(48) Lock Qualify Criterion	EXTRA EASY	EASY	EASY	HARD	EXTRA HARD
(49) Qualify...1st Mball	YES	YES	YES	YES	NO
(50) Arm Batwing Difficulty	EXTRA EASY	EASY	EASY	HARD	EXTRA HARD
(51) Arm...at Gamestart	YES	YES	YES	YES	NO

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	Award for High Score #1	3
4	Free Game Limit	00	18	Award for High Score #2	1

4-Ball Play Rules - Set to establish recommended settings for 5-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	Award for High Score #1	3
			18	Award for High Score #2	1

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	Award for High Score #1 - #4	00
11	Match Percentage	Off			

Standard Pricing Table

Adj. 7 Standard Pricing Select	Coin Mechanisms				Pricing Scheme Explained Number of "Plays" for Price Amount Shown			
	Left 1st Slot	Center 2nd Slot	Right 3rd Slot	Right 4th Slot				
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/'4X25¢'	3/$1(bill) ←	Used to promote the Bill Validator
USA 7 ★	25¢	$1	25¢		1/50¢	4/$1.50	6/$2	
Austria	5S	10S	10S		1/10S	2/15S	3/20S	
Australia	20¢	$A 1	$A 2		1/$A 1	3/$A 2		
Australia 2	20¢	$1	$2		1/$1	2/$2		
Belgium	5 BF	20 BF	50 BF		1/20 BF	3/50 BF		
Canada	25¢	25¢	Can$ 1		1/50¢	2/75¢	3/Can$ 1	
Denmark 1	1DKr	5 DKr	10 DKr	20 DKr	1/3 DKr	2/5 DKr		
Denmark 2	1DKr	5 DKr	10 DKr	20 DKr	1/2 DKr	3/5 DKr	7/10 DKr	
Finland	1Fmk	5Fmk			1/5Fmk	4/10Fmk		
France 1 ★	1 Fr	5 Fr	10 Fr	20 Fr	1/3 Fr	2/5 Fr	5/10 Fr	11/20 Fr
France 2	1 Fr	5 Fr	10 Fr	20 Fr	1/5 Fr	3/10 Fr	7/20 Fr	
France 3	1 Fr	5 Fr	10 Fr	20 Fr	1/3 Fr	2/5 Fr	4/10 Fr	9/20 Fr
Germany 1	1DM	2DM	5DM		1/1 DM	5/5DM		
Germany 2	1DM	2DM	5DM		1/1DM	6/5DM		
Germany 3 ★	1DM	2DM	5DM		1/2DM	2/3DM	3/4DM6	6/6DM
Greece	50Dr		100Dr		1/50Dr	3/100Dr		
Holland (See Netherlands 2)								
Hungary	10 Ft	10 Ft	20 Ft		1/20 Ft	3/40 Ft		
Italy 1	500 Lit		500 Lit		1/500 Lit			
Italy 2	500 Lit		500 Lit		1/1000 Lit	3/2000 Lit		
Japan			100¥		1/100¥	3/200¥		
Korea	100Won		100Won		1/100Won			
Netherlands 1	1 Fls.	1 Fls.	2.5 Fls.		1/1Fls.	3/2.5 Fls.		
Netherlands 2 ★	1 Fls.	2.5 Fls.	5 Fls.		1/1Fls.	3/2.5 Fls.	6/5 Fls.	
New Zealand 1	$NZ 1		$NZ 2		1/$NZ 1	2/$NZ 2		
New Zealand 2	$NZ 1		$NZ 2		1/$NZ 1	3/$NZ 2		
Norway 1	10 NKr	5 NKr	20 NKr		2/10 NKr	1/5 NKr	4/20 NKr	
Norway 2	10 NKr	5 NKr	20 NKr		1/10 NKr	3/20 NKr		
Spain	100Pts		500Pts		1/100Pts	6/500Pts		
Sweden	1 SKr	5 SKr	10 SKr		1/10 SKr	2/15 SKr	3/20 SKr	
Switzerland 1 ★	1 SwF	2 SwF	5 SwF		1/1 SwF	6/5 SwF		
Switzerland 2	1 SwF	2 SwF	5 SwF		1/1 SwF	3/2 SwF	9/5 SwF	
UK 1	10p	50p	1£	20p	1/50p	3/1£		
UK 2	10p	50p	1£	20p	1/40p	3/1£		
UK 3 ★	10p	50p	1£	20p	1/50p			
Yugoslavia	5 Din		5 Din		1/5 Din			

★ Default Factory Setting.

Sega Adjustments Continued.

	Adjustment Name	Adjustment Definition
Adj. 8	Reset Coin Audits	Default is **NO**. Select the "+" *Icon* to change to YES. ⚠ When enabled, all *Coin Audits* (Audits 5-11), will be reset to zero.
Adj. 9	Reset Game Audits	Default is **NO**. Select the "+" *Icon* to change to YES. ⚠ When enabled, all audits will be reset to zero, except for the *Coin Audits* (Audits 5-11) and Audit 12, Software Meter (the only audit which cannot be reset to zero).
Adj. 10	Restore High Scores	When enabled (set to YES) the High Score Levels and associated initials will be restored to the backup settings when the "+" *Icon* is selected and activated.
Adj. 11	Match Percentage	Set Match percent from 00% to 10% or OFF. At 00% the match display occurs at the end of the game but never awards a credit.
Adj. 12	Balls Per Game	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.

	Adjustment Name	Adjustment Definition
Adj. 16	Allow High Scores	Set to enable (set to YES) or disable the four high score levels by setting to zero.
Adj. 17	Award for High Score #1	Adjust the number of awards (0 to 4) awarded for exceeding level 1 (the highest of the four levels).
Adj. 18	Award for High Score #2	Adjust the number of awards (0 to 3) awarded for exceeding level 2.
Adj. 19	Award for High Score #3	Adjust the number of awards (0 to 2) awarded for exceeding level 3.
Adj. 20	Award for High Score #4	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. 28, *Reset High Score To Date*. 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 900 or OFF (no reset or adjustment).
Adj. 28	Free Play	When set to YES, no coins are required for games.
Adj. 29	Custom Message	When desired, this function is used to establish a custom message periodically displayed during the attract mode. Set the feature to CHANGE using the Credit button and depress **STEP**. 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. Press the STEP push-button switch to advance to the next adjustment.
Adj. 30	Atrract 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 *increased* by 12.5% of the normal pulse rate. When set to SOFT the coil pulse power is *decreased* by 12.5% of the normal pulse rate. These adjustments are provided to compensate for Low Line or High Line voltage conditions where the solenoids appear to kicking too weak or too hard. Adjust as required.
Adj. 33 Minimum Game Time	Default is 0:00. Set between 0:00 - 8:59 for minimum game time. 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. 34 Buyin Type	Set to Extra Ball Buyin. When set to EXTRA BALL, the game is set to Extra Ball Buyin. When set to FEATURE, the game is set to Game (Feature) Buyin. Set to OFF to make Buyin Type inoperative.
Adj. 35 Extra Ball Buyin Count	1, 0 or UNLIMITED. Default is 1. Allows the operator to adjust the number of Extra Ball Buyins allowed after normal game play. Review Section 2, Chapter 1, Game Operations & Features for details.
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 External Replay Knocker	Set to ON or OFF. When set to ON, the operator can enable the knocker in the cabinet to drive an external device 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	0 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	0 to 9999. Allows the operator to assign a game identifica- tion 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.

Section 3 | Adjust.
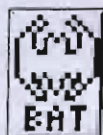
BATMAN FOREVER ADJUSTMENTS (44-51)

From the ADJUSTMENTS MENU, select the "BAT" *Icon* with either Flipper Button and press the Start 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. 44	Batwing Disabled	Set to YES or NO. When set to YES, the Ball Diverter on the Double Stack Ramp is disabled not allowing a pinball to enter the Batwing Cannon.
Adj. 45	Laser Kick Criterion	Set to MODERATE, HARD or EXHARD. Default is MODERATE. When set to MODERATE, the Laser Kick is ON at the beginning of each new ball. Set to HARD, the Laser Kick (whether in active mode or not) carries over from the last ball in play. Set to EXHARD, the Laser Kick is OFF at the beginning of each ball.
Adj. 46	MBall Restart Criterion	Set to EXEASY, EASY, MODERATE, HARD or EXHARD. Default is EASY. Determines how Multiball can restart.
Adj. 47	Extra Ball Memory	Set to YES or NO. When set to YES, the lit 'Extra Ball' light will be retained in memory from ball to ball for the same player. When set to NO, the lit 'Extra Ball' light will go out at the end of each ball.
Adj. 48	Lock Qualify Criterion	Set to EXEASY, EASY, MODERATE, HARD or EXHARD. Default is MODERATE. Determines how Lock Qualify can restart.
Adj. 49	Qualify Double Jackpot after 1st Multiball	Set to YES or NO. When set to YES, from the 2nd+ Multiball, players must complete the Two-Face Coin Targets to qualify the Double Jackpot. When set to NO, the Double Jackpot is automatically qualified.
Adj. 50	Arm Batwing Difficulty	Set to EXEASY, EASY, MODERATE, HARD or EXHARD. Default is MODERATE. Determines how many hits is needed to arm the Batwing.
Adj. 51	Arm Batwing Lit at Gamestart	Set to YES or NO. When set to YES, the Arm Batwing is lit at gamestart. When set to NO, it is not lit.

Adjustment Note: Resetting Adjustments

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

Selection of the "FACT" *Icon*, from the RESET MENU, will reset all adjustments to the *Factory Settings* (except for Proprietary Adjustments). The display will return to the **Attract Mode**. To perform any other functions, the system must be entered again by pressing the **Black** "BEGIN TEST" Button on the coin door (see Chapter 1, Introduction, of this section).

Adjustment Note: Printing Game Information

To print audits, from the MAIN MENU select the "PRNT" *Icon*. See Chapter 6, Go to Printer Menu, of this section (special equipment required).

Selection of the "QUIK" *Icon*, from the PRINTER MENU, will start a quick print.

Selection of the "ALISON" *Icon*, from the PRINTER MENU, will start a Full Printout (Downloads to a PC).

Selection of the "RESET" *Icon*, from the PRINTER MENU, will reset the total Nº of copies value to zero.

Your Notes

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 5, 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 Flipper Button and press the Start 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. (See chapter 7 of this section for more help.)

FACTORY RESET

From the RESET MENU, select the "FACT" *Icon* with either Flipper Button and press the Start 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 Flipper Button and press the Start 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 Flipper Button and press the Start 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 Left or Right Flipper Button to select the "RESET" *Icon* (GO TO RESET MENU).

MAIN MENU

USE FLIPPERS TO MOVE

START BUTTON ENTERS
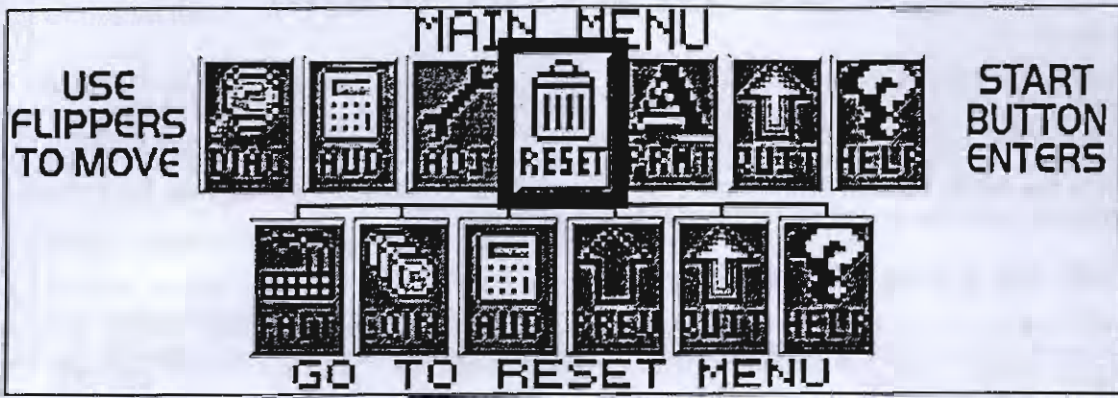
GO TO RESET MENU

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

RESET MENU

FACTORY RESET

The **RESET MENU** now appears with the "FACT" *Icon* (FACTORY RESTORE) flashing:

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

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

REQUEST INSTALLED

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 **Flipper Button** and press the **Start 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.
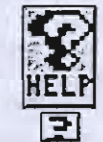
Selecting & activating the "HELP" *Icon* from any display will show a help screen. (See chapter 7 of this section for more help.)

In printer adjustments, selecting & activating the "-" or "+" *Icons* is necessary to start a printout or download.
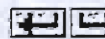
Selecting & activating the "ARROW" *Icons* selects the next /previous *Icon* in the sub-menu.

QUICK PRINTOUT ADJUSTMENT (52)

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

FULL PRINTOUT ADJUSTMENT (53)

From the PRINTER MENU, select the "ALISON" *Icon* with either **Flipper Button** and press the **Start Button**. Select the "+" *Icon* and press the **Start 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.

№ OF COPIES PRINTED ADJUSTMENT (54)

From the PRINTER MENU, select the "RESET" *Icon* with either **Flipper Button** and press the **Start Button**. Select the "+" *Icon* and press the **Start Button** to start the clear the "№ 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 6.

PROBLEM	SOLUTION
Will not enter the Service Mode after depressing the **Black "BEGIN TEST"** Button.	• Check the Service Switch(es) for loose connections or bad Ground. • Check the assoicated wiring harness to/from the CPU Board Connector CN14. • Check CPU Board, possibly failed.
Service Buttons (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 the Game Manual.
Icons "*scroll*" along continuously in the MAIN MENU.	• If the Service Switch Set and/or the Coin Door was replaced, ensure the Locking Mechanism on the Green Button is removed. If the Green Button "clicks" and locks into an up/down position, the Green Button has this lock switch. Remove it. (Ref. to Service Bulletin #74.)
The **Start** and Flipper Buttons do not select or activate *Icons* in the SWITCH TEST MENU.	• This is normal. These switches are deactivated, as they are a part of the Switch Test. Use the Green "SELECT" and Black "ENTER" Buttons in this Sub-Menu (See Chapter 1).
Some *Icons* appear non-functional in the PRINTER MENU(S).	• If no printing equipment is connected, the "-" *Icon*, "+" *Icon* and "RUN" *Icon* will appear not to function (See Chapter 5).
Some *Icons* appear non-functional in the GAME SPECIFIC MENU under the DIAGNOSTICS MENU.	• If there is no other test under this Menu, the "Left Arrow" & "Right Arrow" *Icons* will appear not to function. The remaining *Icons* should function as normal. Note: If there is no Game Specific Special Test, the "GAME SPECIFIC" *Icon* will not invoke another display.
The display returns to the ATTRACT MODE exiting the Service Session from the FACTORY RESET MENU.	• This is normal. After a FACTORY RESET, the Service Session is automatically exited (See Chapter 4).
In **COIL TEST MENU** (1R-8R only) or CYCLING FLASHERS MENU, the coils will fire instead of the flashlamps.	• The Left /Right Relay is not operating correctly. • Check fuse F7 on the PPB. • Check Q29 on the CPU.
In **COIL TEST MENU**, the coils and flashlamps *do not* fire after activating the "RUN" *Icon*.	• Ensure the POWER INTERLOCK SWITCH (See figure on front inside cover) *is pulled out*.
Can't move selection of *Icon* with the **Left** and/or **Right** Flipper Buttons.	• Check the Flipper Buttons for loose connections or bad Ground and refer to the Game Manual Flipper Troubleshooting Flowchart.
Selection using the **Green "SELECT"** Button only moves forward or to the right.	• This is normal. When using the Green "SELECT" Button, the selection is only forward.

Section 3 | 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 **Flipper Button** and press the **Start Button**. The HELP SCREEN appears.
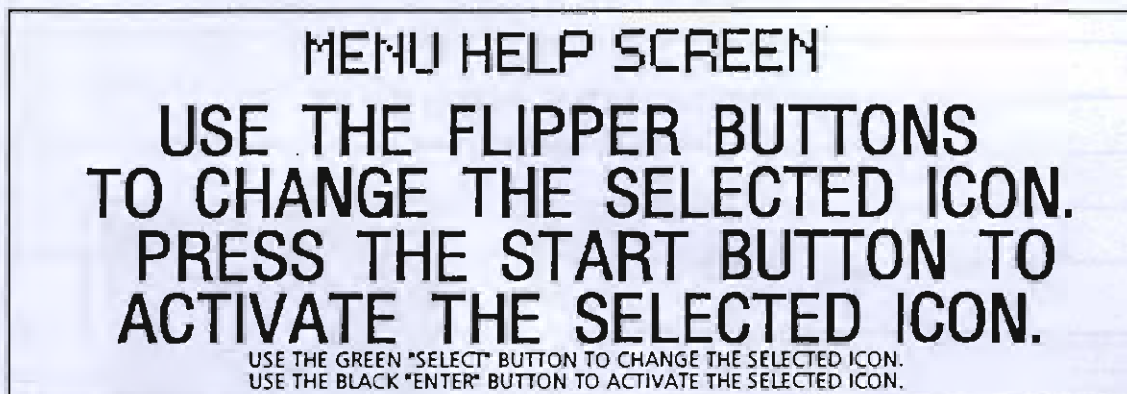
```
MENU HELP SCREEN
USE THE FLIPPER BUTTONS
TO CHANGE THE SELECTED ICON.
PRESS THE START BUTTON TO
ACTIVATE THE SELECTED ICON.
USE THE GREEN "SELECT" BUTTON TO CHANGE THE SELECTED ICON.
USE THE BLACK "ENTER" BUTTON TO ACTIVATE THE SELECTED ICON.
```

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. (See chapter 7 of this section for more help.)

Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.
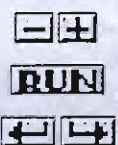
These "Mini-Icons" vary in functionality depending in what sub-menu they are used. Refer to the beginning of each chapter in this section for the function they serve in that menu.

Review Chapter 1, Introduction, on how to enter the **Portals™** Service Menu. The chapter describes all the *Icon* names and the entire menu is shown in a "Tree." 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.

Your Help Notes:

Section 3
Chapter 7

Help

Parts Identifcation & Location
(The Pink Pages)

Overview

This section provides the part numbers and locations of the elements in the pinball game. The parts are arranged in basically four groups: Backbox, Cabinet, Atop Playfield, Below Playfield. (Some parts may be considered both above & below the playfield. The part will be grouped where it is predominant. Generic parts which may change as production continues (quantity and/or size) are listed together. The quantity indicates if that part is used in this game. Since quantity changes may occur, an item indicating "Ø" 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. Some parts which are complex (made up of numerous parts) will be noted in detail in Chapter 2, Assembly Drawings.

Section 4, Chapter 1
Table of Contents

Backbox - General Parts

Power Supply Board (5)

PPB Board (4)

CPU Board (3)

Sound Board (6)

Display Controller Board (8)

Comments:

A. The Speaker Panel Ass'y. is shown broken away to view Display Controller Board.

B. The Back Box Light Insert (Removable) is not shown in this pictorial for clarity.

C. For Fuse descriptions and locations, see Section 1, Chapter 1.

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

Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Speakers 4X4 Quam 89-9572 (Qty. 2)	031-5004-00	15 *	Static Shield *	535-6227-00
2	Back Box Lock	355-5008-00	16 *	Backglass Clear 26½" x 19¾" *	660-5018-00
3	CPU Board Non-Reflective †	520-5003-04	17 *	26-7/16" Plastic Extrusion *	545-5018-08
4	PPB Board Assembly †	520-5021-05	18 *	18¾" Plastic Extr. * (Qty. 2)	545-5018-09
5	Power Supply Board	520-5047-03	19 *	Glass Channel 26-7/16" *	545-5021-02
6	Sound Board 2X 4MB †	500-5126-02	20 *	Batman Forever Lights Insert Assembly *	505-6003-38-38
7	Lg. Dot Matrix Display Bd. 192 X 64! ††	520-5075-00	21 *	Ribbon Cable, 14-Pin Display to Display *	036-5260-01
8	Display Controller Board †	520-5092-01	22 *	Ribbon Cable, 20-Pin CPU to Sound *	036-5000-00
9	Speaker Panel Assembly	500-5833-00-38	23 *	Ribbon Cable, 26-Pin CPU to Display *	036-5001-00
10 *	Batman Forever Backglass Artwork *	830-5238-00	24 *	Insert Door Slide Latch *	535-5001-00
11	Batman Forever Speaker Grill w/Artwork	830-5634-00	25 *	Insert Door Hinge with Pin *	390-5014-01
12	Batman Forever Speaker Plexi w/Artwork	830-5633-00	26 *	Insert Door Hinge without Pin *	390-5014-00
13	7-Vent Hole Grill 2½" x 18"	545-5072-02	27 *	Speaker Panel Metal Hooks * (Qty. 2)	535-7009-01
14	Backbox Header (Not used in this game.)				

† Note 1: When ordering PC Boards with ROMS, please specify the Game.
†† Note 2: Indicate Manufacturer.

Cabinet - General Parts
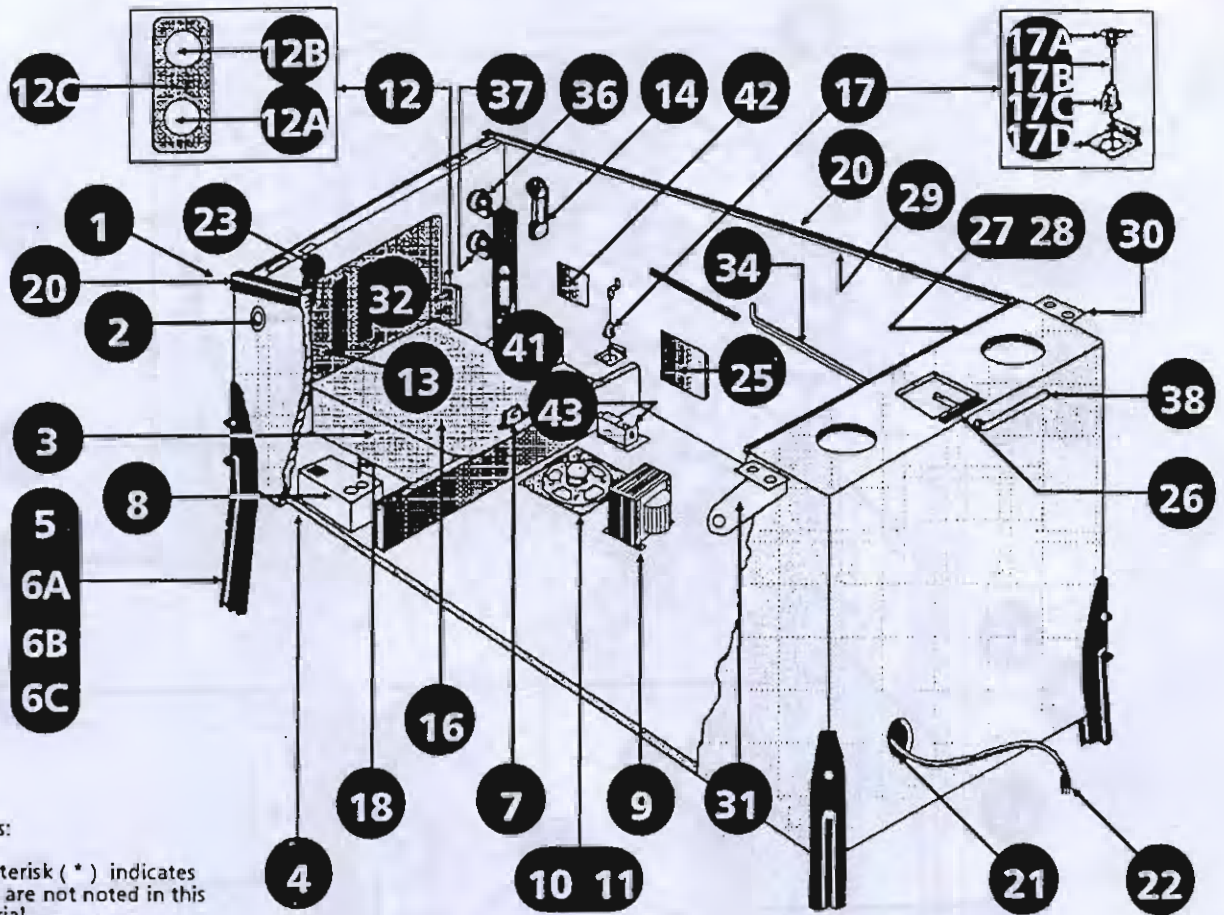
Comments:

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

Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Gun Assy. (See Section 4, Chapter 2)	500-5945-00-38	19 *	Playfield Glass (T.P.) 23¾" x 43" *	660-5014-00
2	Flipper Button Assembly Red (Qty. 2)	500-5026-32	20	Side Armor - Left & Right	535-7297-00
3	Cash Box Plastic Bottom	545-5090-00	21	Recessed Cup for Line Cord	545-5122-00
4	Power Sw. DPST Toggle (Under Cab.)	180-5001-00	22	Line Cord 10' ROJ 3" Maximum	034-5000-01
5	Leg (Black) (Qty. 4)	535-5020-50	23	Front Molding Lockdown Assembly	500-5020-01
6A	Leg Bolt ⅜-16 x 2½ Hex ½ Hd. (Qty. 8)	231-5001-01	24 *	Front Molding - Black *	500-5757-01-00
6B	Leg Bolt Back Plate (Qty. 4)	535-5703-00	25	Solid State 3-Flipper Board	520-5076-00
6C	Leg Leveler ⅜-16 x 3" (Qty. 4)	500-5017-00	26	#1 Roto Lock Male, (Female -02) *	355-5006-01
7	Cash Box Lock Bracket	535-5215-00	27	Rear Plastic Ext. Playfield Glass 20⅜"	545-5038-00
8	Service Outlet	180-5008-01	28	Mounting Foam Rubber for Ext.	626-5001-00
9	Transformer	010-5008-00	29	Plastic Channel Left & Right	545-5017-00
10	Speaker - Round - 8" ⌀	031-5005-00	30	Backbox Hinge Left	515-5987-00
11	Speaker Grill 7" x 7"	535-6830-00	31	Backbox Hinge Right	515-5987-01
12	Dual Switch Assembly (Incl. 12A-12C)	500-5808-00	32	Coin Door (with Validator) USA only	500-5018-17
12A	Memory Protect Switch	180-5000-00	33 *	Slide & Pivot Support Bracket Right *	535-5989-00
12B	Interlock Switch	180-5136-00		Slide & Pivot Support Bracket Left	535-5990-00
12C	Bracket	535-6958-00	34 *	Edge Slide Bracket *	535-5988-00
13	Service Switch Set (Portals™ Buttons)	180-5012-00		Playfield Support Slide *	535-6862-00
14	Flipper Power Switch, Left	180-5048-01	35 *	Playfield Support Bar (Stay Arm) *	535-5019-00
15 *	Flipper Power Switch, Right *	180-5151-00	36	Start Button Switch Assembly	500-5728-07
16	Cash Box Cover (Validator)	535-5013-03	37	Extra Ball Buyin/League Button	500-5815-01
17	Plumb Bob Tilt Assy. (Incl. 17A-17D)	500-5023-00	38	5/16" Hex Key Allen Wrench	777-0001-00
17A	Hanger Bracket (Tilt)	535-5221-00	39 *	Backbox / Cabinet Matrix / Fuse Info *	820-6104-05
17B	Hanger Wire (Tilt) (Attached to "17A")	535-5319-00	40 *	3-Flipper Board Cover *	545-5165-02
17C	Plumb Bob (Tilt) (Attached to "17B")	535-5029-00	41	Shaker Motor (Not used in this game.) *	515-5893-00
17D	Contact Bracket (Tilt)	535-5220-00	42	Shaker Motor P.C. Board (Not Used) *	520-5065-00
18	Volume Control Single 10K Pot	123-5000-02	43	Knocker Assy. (See Section 4, Chapter 2)	500-5081-00
			44 *	Cabinet Back Wire Cover Butyrate *	830-5477-25

Playfield - Major Assemblies † §
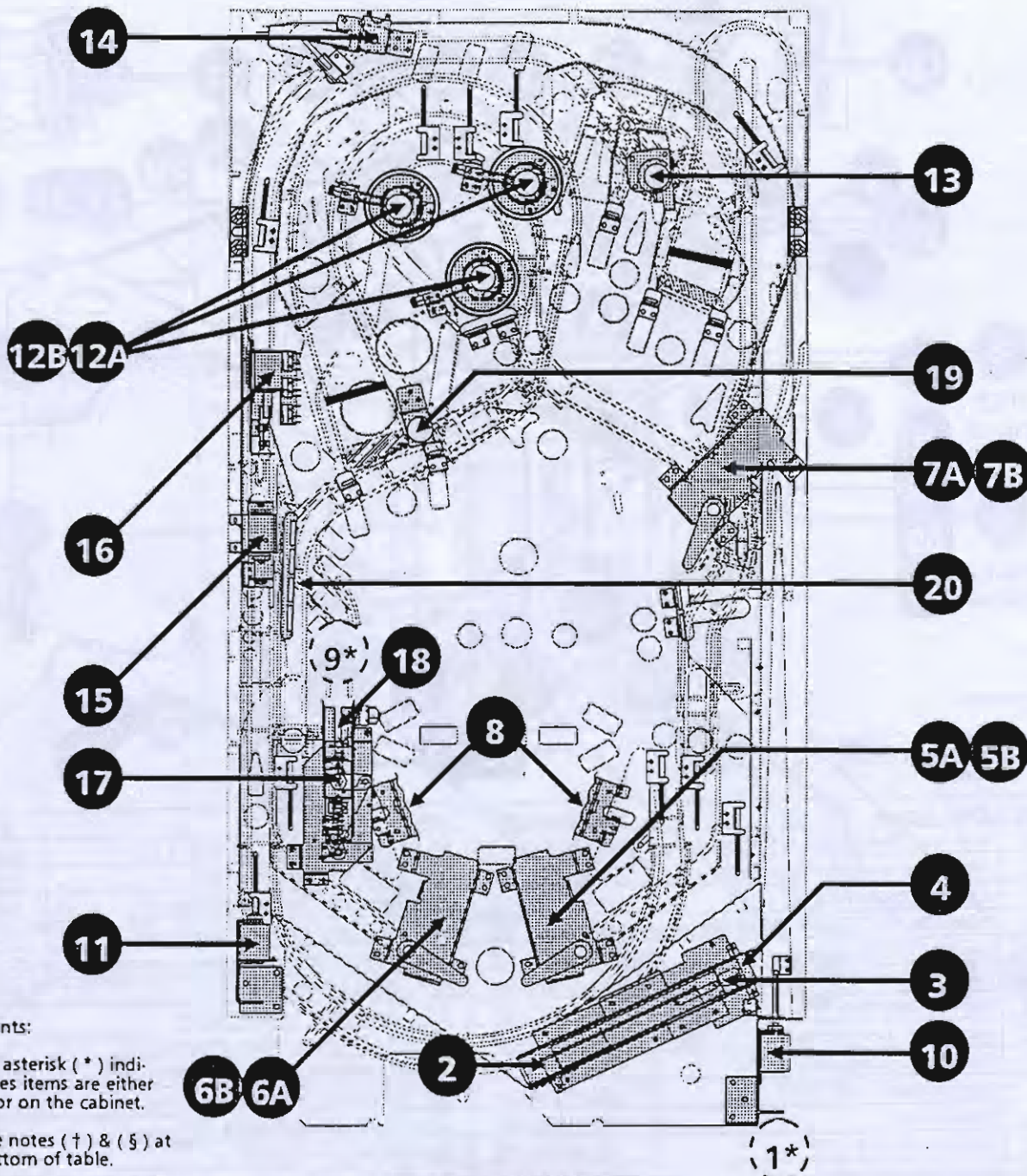
Comments:

A.   An asterisk (*) indicates items are either in or on the cabinet.

B.   See notes (†) & (§) at bottom of table.

Nº	Assembly Name	PG.†	Part Nº	Nº	Assembly Name	PG.†	Part Nº
1 *	Bat Gun Assy. (Cabinet Front) *	pg 72	500-5945-00-38	10	Autolaunch Assembly	pg 79	500-5477-01
2	4-Ball Trough Assembly	pg 73	500-5989-01-38	11	Laser Kick Assembly	pg 79	500-5838-00
3	Lock Ball Assembly	pg 73	500-5684-01-38	12A	Turbo Bumper Assemblies (Qty. 3)	pg 80	500-5966-00
4	Ball Trough Exit Scoop Assembly	pg 73	533-7329-01	12B§	Turbo Bumper Assemblies (Qty. 3)	pg 81	500-5227-02
5A	Flipper Assembly Lower Right	pg 74	500-5944-01	13	Vertical Up-Kicker Assembly	pg 82	500-5839-01
6A	Flipper Assembly Lower Left	pg 74	500-5944-12	14	Ball Eject (Saucer) Assembly	pg 82	500-5664-00
5B§	Flipper Assembly Lower Right	pg 75	500-6045-01	15	Batcave Exit Kicker	pg 83	500-5948-00-38
6B§	Flipper Assy. Lower Left	pg 75	500-5755-02	16	Batcave Ball Lock	pg 83	500-5947-00-38
7A	Flipper Assembly Upper Right	pg 76	500-6029-03	17	Cannon Motor Drive Assembly	pg 84	500-6018-00-38
7B§	Flipper Assy. Upper Right	pg 77	500-5914-01	18	Batwing Cannon Assembly	pg 84	515-6321-00-38
8	Slingshot Assemblies (Qty. 2)	pg 78	500-5849-00	19	Ramp Diverter Assembly	pg 85	500-5940-00-38
9 *	Knocker Assembly (In Cabinet) *	pg 78	500-5081-00	20	4-Bank Drop Target Assembly	pg 86	500-5799-04

§ Shaded items "B" are assemblies used in early production games.
† See Section 4, Chapter 2, Assembly Drawings, to identify your assembly.

Playfield - Ramps †
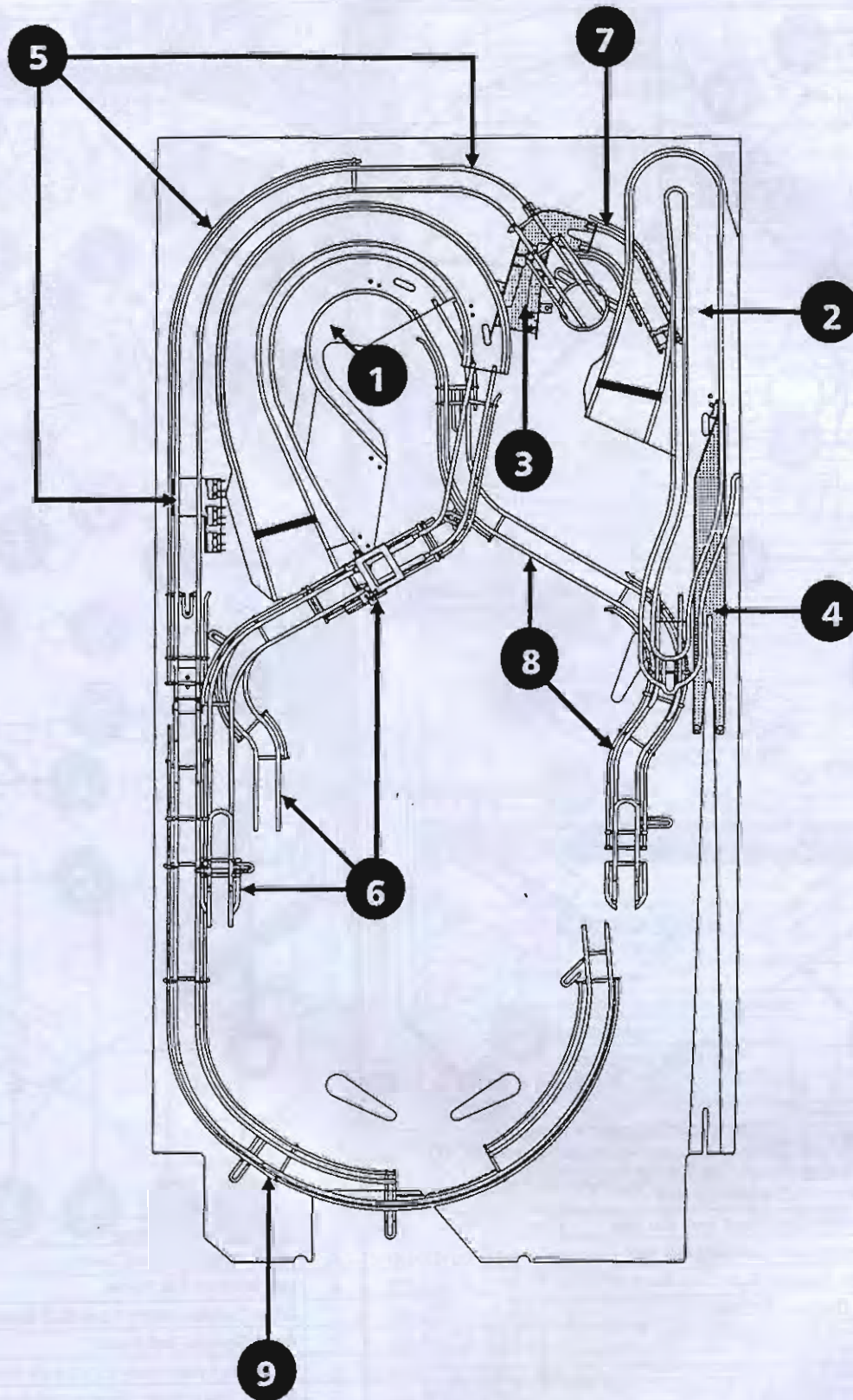
Nº	Plastic/Steel Ramp Name	PG.†	Part Nº	Nº	Wire Ramp Name	PG.†	Part Nº
1	Left/Middle Dual Plastic Ramp	pg 88	500-5930-00-38	5	VUK Wire Ramp	pg 90	500-5934-00-38
2	Right Plastic Ramp	pg 89	500-5931-00-38	6	Double Stack Wire Ramp	pg 91	500-5932-00-38
3	U-Turn Mini-Ramp	pg 90	500-5946-00-38	7	U-Turn Mini-Wire Ramp	n/a	515-6219-00
4	Shooter Lane Launch Ramp	n/a	535-6772-00	8	Middle Ramp Exit Wire Ramp	n/a	535-7109-00

† See Section 4, Chapter 2, Assembly Drawings, for breakdowns. | 9 | Bottom Arch Wire Ramp | n/a | 515-6180-00 |

Playfield - Rails and Ball Guides
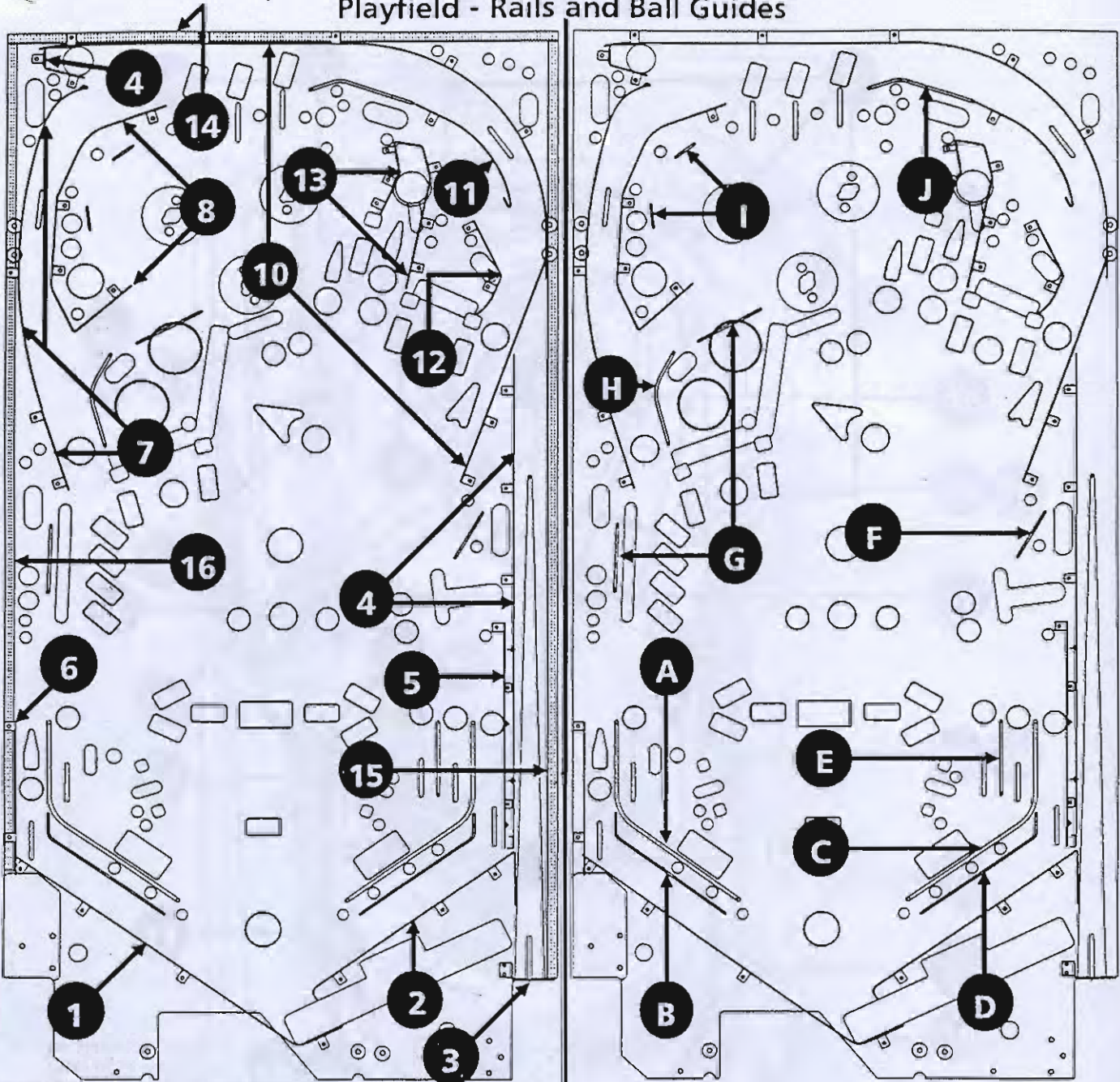
Nº	Rail Name	SPI Part Nº
1	Bottom Arch Left Flat Rail Flat Rail	535-7225-00
2	Bottom Arch Right Flat Rail	535-7224-00
3	Shooter Lane Front Fork Flat Rail	535-7442-00
4	Shooter Lane Left Side Flat Rail	515-6242-00
5	Right Outlane Right Side Flat Rail	515-6243-00
6	Left Outlane Flat Rail	535-7286-00
7	Left Orbit Left Side Flat Rail	515-6241-00
8	Left Orbit Right Side Flat Rail	535-7219-00
9	Behind Ball Eject Flat Rail	535-7218-00
10	Top Playfield / Right Side Orbit Flat Rail	535-7217-00
11	U-Turn Ramp Exit Right Side Flat Rail	515-6239-00
12	Under Rt. Ramp Enter Rt. Side Flat Rail	535-7221-00
13	Around VUK Flat Rail	515-6240-00
14	Top Wood Rail (23")	525-5007-01
15	Right Wood Rail (40-5/32")	525-5010-13
16	Left Wood Rail (36")	525-5397-00

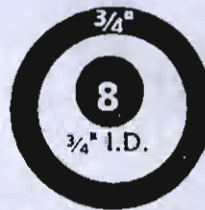| Nº	Ball Guide Name	SPI Part Nº
A	Left Return Lane Ball Guide	535-7444-02
B	Left Outlane Ball Guide	535-7443-02
C	Right Outside Return Lane Ball Guide	535-7444-01
D	Right Outlane Ball Guide	535-7443-01
E	Rt. Inside Return Lane (3⅛") Ball Guide	535-5356-02
F	Behind Upper Right Flipper Ball Guide	535-5441-00
G	4-Bank/Left Ramp (3") Ball Guide (Qty. 2)	535-5356-04
H	Left Ramp Bent Ball Guide	535-7223-00
I	Left of Left Pop (1") Ball Guide (Qty. 2)	535-5300-05
J	Behind U-Turn Ramp Ball Guide	535-7222-00
K *	Bottom Arch Left (Green) Ball Guide *	515-6269-00
L *	Bottom Arch Right (Green) Ball Guide *	515-6268-00

* - An asterisk indicates item is not noted in the illustration.

Playfield - Butyrate, Decals and Mylar
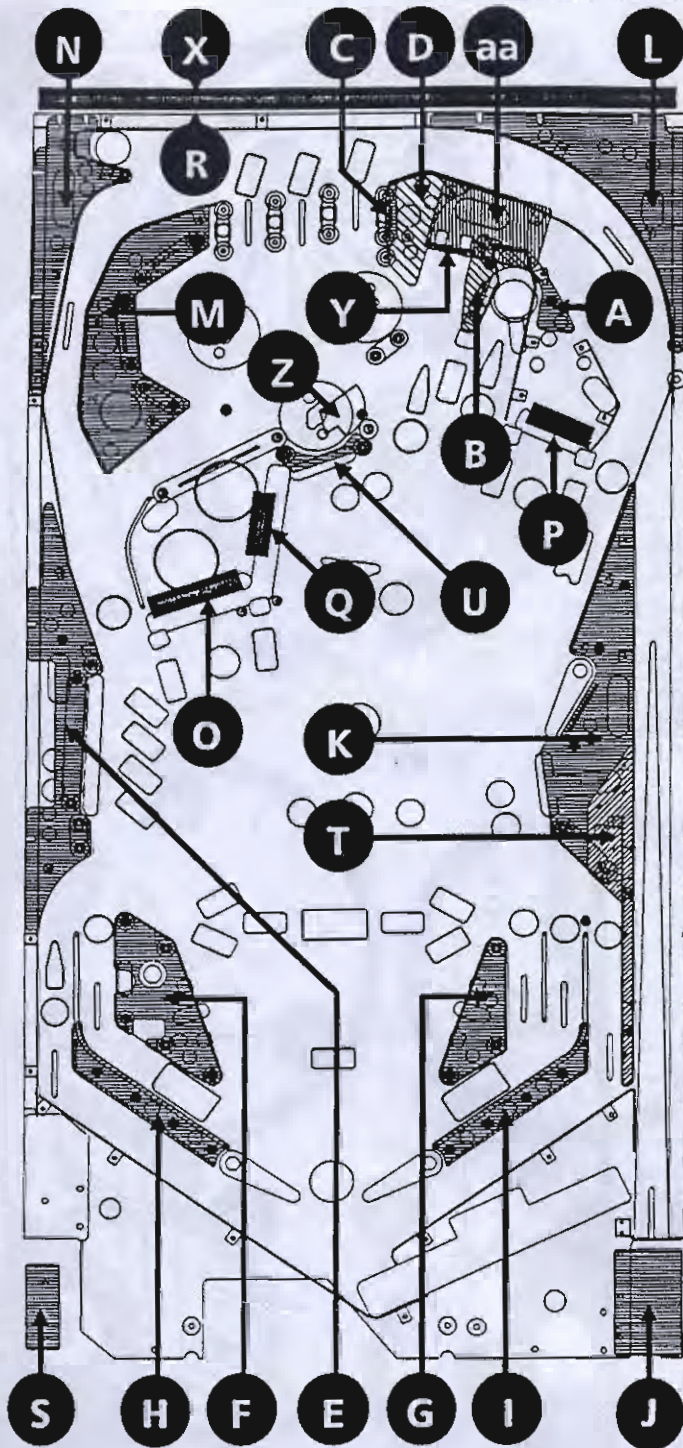
Nº	Screened Butyrate Name	SPI Part Nº
	Butyrate Pieces Screened (1-29)	830-5477-XX
A	Around VUK Lower	830-5477-01
B	Left Side of VUK Upper Over A	830-5477-02
C	Left of U-Turn Mini-Ramp Lower	830-5477-03
D	Left of U-Turn Mini-Ramp Upper Over C	830-5477-04
E	Behind 4-Bank Drop Target	830-5477-05
F	Cannon Cover Bracket	830-5477-06
G	Right Slingshot	830-5477-07
H	Left Outlane / Inlane	830-5477-08
I	Right Outlane / Inlane	830-5477-09
J	Bottom Arch over Autolaunch	830-5477-10
K	Behind Upper Right Flipper Lower	830-5477-11
L	Upper Right Corner	830-5477-12
M	Left Orbit Top Right Side Left of Pop.	830-5477-13
N	Upper Right Corner	830-5477-14
O	Left Ramp Enter Sign	830-5477-15
P	Right Ramp Enter Sign	830-5477-16
Q	Middle Ramp Enter Sign	830-5477-17
R	Backpanel	830-5477-18
S	Bottom Arch over Left Flipper Switch	830-5477-19
T	Left of Shooter Lane Upper Over K	830-5477-20
U	Over Top 2-Bank Stand-Up	830-5477-21
V *	Keychain Batman Forever™ Logo *	830-5477-23
W *	Keychain Riddler Question Mark Logo *	830-5477-24
X	Cabinet Back Wire Cover 40° Angle	830-5477-25
Y	VUK Entrance Sign	830-5477-28
Z	Bottom Pop Bumper Ball Trap Clear	830-5477-29

The following last 2-digits were not used on 830-5477-XX Butyrate: -22, -26, -27

Nº	Clear Butyrate Name	SPI Part Nº
	Butyrate Pieces Clear (1-5)	830-5489-XX
aa	U-Turn Ramp Cover	830-5489-01
bb *	Bottom Arch Behind Guide Rail Right *	830-5489-02
cc*	Middle Ramp Cover *	830-5489-03
dd *	Behind 4-Bank Drop Ball Trap *	830-5489-04
ee *	Over Ball Lock Ball Trap *	830-5489-05

1. An asterisk (*) indicates items are not noted in pictorial.
2. For entire butyrate sheet order part number with -XX.
3. To order individual replacement screened/clear butyrate, replace the *-XX* with the correct 2-digit ending as noted in the table. (The last 2-digits of the part number is screened on each piece.)

Nº	Decal Name	SPI Part Nº
D1 *	Complete Decal Sheet for Playfield	820-6125-XX

Pop Bumpers (-01, -02, -03); 4-Bank Drop Targets (-04, -05, -06, -07); Spare 4-Bank (-16, -17, -18, -19); Coin Door Sega Logo with Sonic the Hedgehog (-08); Portals Switch Set (-09); Arch Middle (-11); Arch Left (-12); Arch Right (-15); Instant 4 Balls (-13); Batwing Cannon Bracket (-14); 1" Targets (-20, -21, -22, -23); (-10 Not used).

Nº	Decal Name	SPI Part Nº
D2 *	Complete Decal Sheet for Ramps	820-6139-XX
D3 *	Additional Ramp Signs	820-6142-XX

Nº	Mylar Name	SPI Part Nº
M1*	Mylar Pieces (Clear Pre-Scored)	820-5843-00
M2*	Mylar Pad (Clear 1") (Qty. 3)	820-5815-00
M3*	Slingshot Area (Clear) (Qty. 2)	820-5821-00

Playfield - General Parts

Nº	Above Playfield Part Name	SPI Part Nº
1	Bottom Arch Assembly (Metal)	500-5933-00
ORDERING ABOVE (ITEM 1) ASSEMBLY PART Nº WILL INCLUDE:		
	Butyrate Left	830-5477-19
	Butyrate Right	830-5477-10
	Plastic Spacer 5/8" (Qty. 5)	254-5000-14
	Screw 6-32 PHMS (Qty. 5)	232-5206-00
	6-32 Stop Nut (Qty. 5)	240-5005-00
	Left Ball Guide Rail (Green)	515-6269-00
	Right Ball Guide Rail (Green)	515-6268-00
	Butyrate with Wire Assy. Right	830-5489-02
	6-32 X ⅝ HWH (Qty. 4)	237-5928-00
	#6 Washer (Qty. 4)	242-5001-00
2	1¹/₁₆" Steel Balls (Qty. 4)	260-5000-00
3	Pop Bumper Cap Blue (Qty. 3)	550-5057-05
4	Lwr./Upr. Rt. Flipper & Shaft Assy. WHT with Sonic the Hedgehog™ Logo	515-5133-01-03
5	Lwr. Lt. Flipper & Shaft Assembly WHT with Sonic the Hedgehog™ Logo	515-5133-01-04
6	Top Left Orbit 1-Way Gate	500-6040-00
ORDERING ABOVE (ITEM 6) ASSEMBLY PART Nº WILL INCLUDE:		
	Wire Form	535-5307-01A
	Bracket	535-5269-01
7 *	Back Panel Assembly *	500-5949-00-38
ORDERING ABOVE (ITEM 7) ASSEMBLY PART Nº WILL INCLUDE:		
	Socket Short S/U 2-Lug (Qty. 4)	077-5101-00
	#89 Bulb (Qty. 4)	165-5000-89
	Screws 6-⅜ HWH (Qty. 4)	234-5000-00
	Mini-Mars Lite Cvr. Yellow (Qty. 4)	550-5031-06
	Screw 6-1/2 PHIL PH (Qty. 12)	237-5805-00
	Butyrate -18	830-5477-18
	Plastic Spacer ⅜	254-5000-12
	with Screw 6-¾ PHIL PH	232-5003-00
	Back Panel (By Itself)	525-5370-00
8	Mini-Mars Lite Cvr. Yellow (Qty. 5)	550-5031-06
9 *	Mini-Mars Lite Cvr. Blue (Qty. 1) *	550-5031-05
10 *	Rubber Lite Cover-Red (Qty. 4) *	545-5014-02
11 *	Rubber Lite Cover-Yellow (Qty. 2) *	545-5014-06
12 *	Rubber Lite Cover-White (Qty. 2) *	545-5014-08
13	Top Lane Mini-Hoods Blue (Qty. 4)	550-5061-05
14 *	Batwing (By Itself) *	545-5632-00

Note: Item 14 is included with the Cannon Assembly (515-6321-00).

15 *	Batcave (By Itself) *	545-5631-00

Note: Item 15 is not included with any other assembly! It is mounted on the VUK Ramp Assembly (500-5934-00) onto existing #6-32 ¾ Flush HD Self-Clinching PEM Studs and is held down with 2 #6 Stop Nuts.

16	Spot-Lite Assembly (By Itself).	500-5818-01

Note: Item 16 is included w/Dual Ramp Assy. (500-5930-00-38).

To only order Reflectors, use this Part Number:		545-5409-01
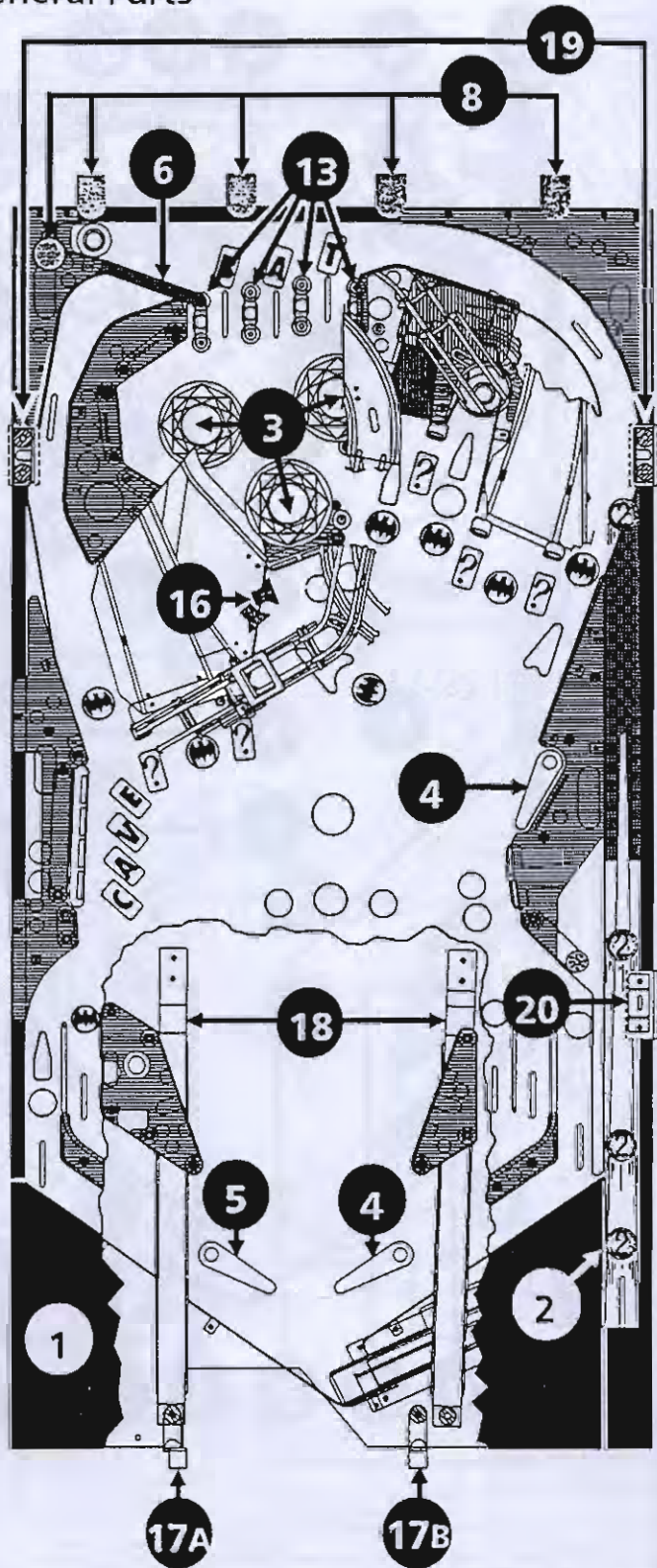
* - An asterisk indicates item is not noted in the illustration.

Nº	Below Playfield Part Name	SPI Part Nº
17A	Playfield Hanging Bracket Left	535-6255-01
17B	Playfield Hanging Bracket Right	535-7027-01
18	Playfield "Slide" Brackets (Qty. 2)	535-6862-01
19	Pivot Pin Bracket Assembly (Qty. 2)	500-5329-00
ORDERING ABOVE (ITEM 19) ASSY. PART Nº WILL NOT INCLUDE:		
	Pivot Bracket Screws (Qty. 4)	237-5907-00
	T-Nuts (Qty. 4)	240-5101-00
20	Stay Arm Bracket	535-5747-00

Nº	The Playfield	SPI Part Nº
P1 *	Playfield Screened (No Parts) *	830-5138-00
P2 *	Playfield Complete with all Parts *	505-6004-38-38

* - An asterisk indicates item is not noted in the illustration.

Playfield - Rubber Parts (Rings Actual Size) †

1 2¾" I.D.

2 2½" I.D.

3 2" I.D.

2¾"
2½"
2¼" I.D.
(does not exist)
2"

2+" I.D.
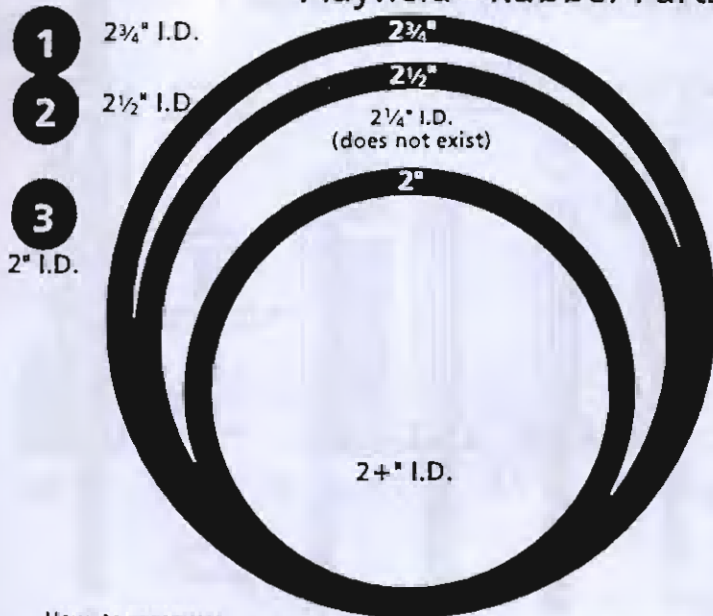
How to measure:
Lay ring over circle of closest size. *If you see the outside edge of the circle, move to one ring smaller.* With the *correct size you will see the inside edge* of the circle around the inside of the rubber ring. Please note: The rings will s t r e t c h with use. Always go to the size smaller. (I.D.=Inside Diameter; O.D.=Outside Diameter)

Inside Edge

4 1¾" I.D.   1¾"

Outside Edge

5 1½" I.D.   1½"

6 1¼" I.D.   1¼"

7 1" I.D.   1"

8 ¾" I.D.   ¾"

9 5/16" I.D.

10 3/16" I.D.

11 ⅜" O.D.
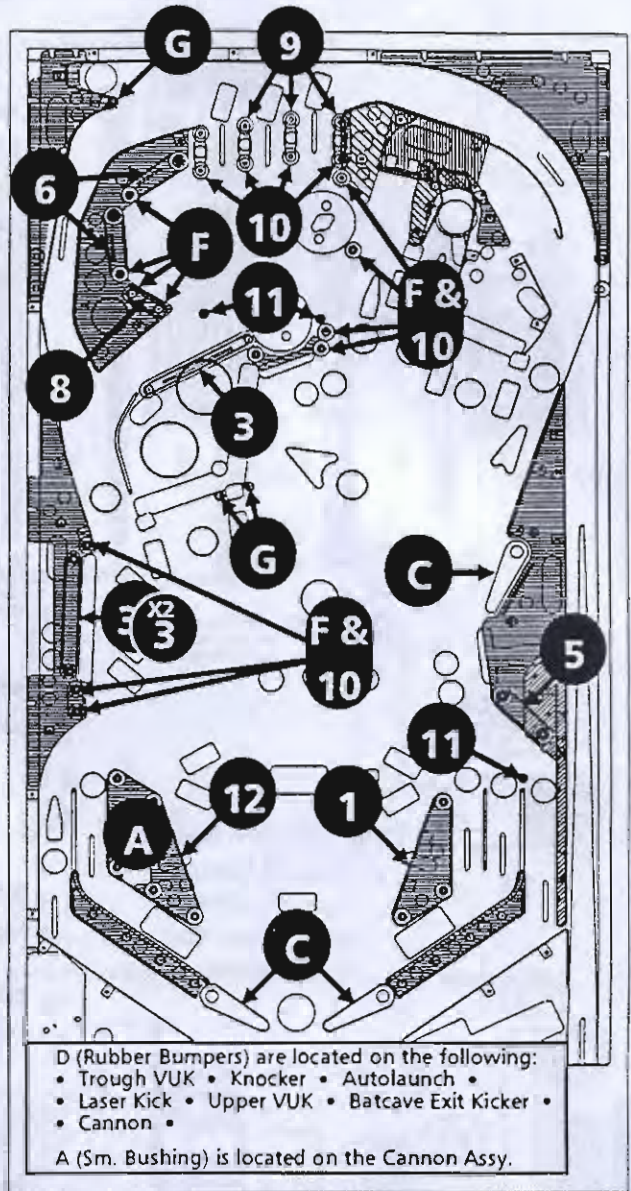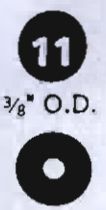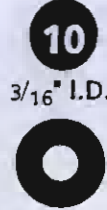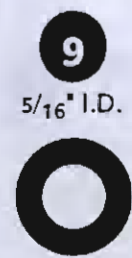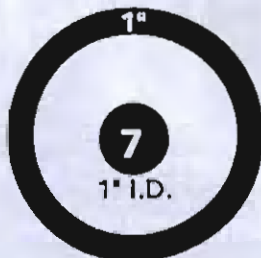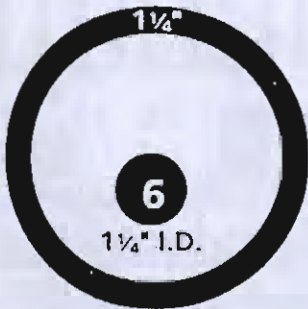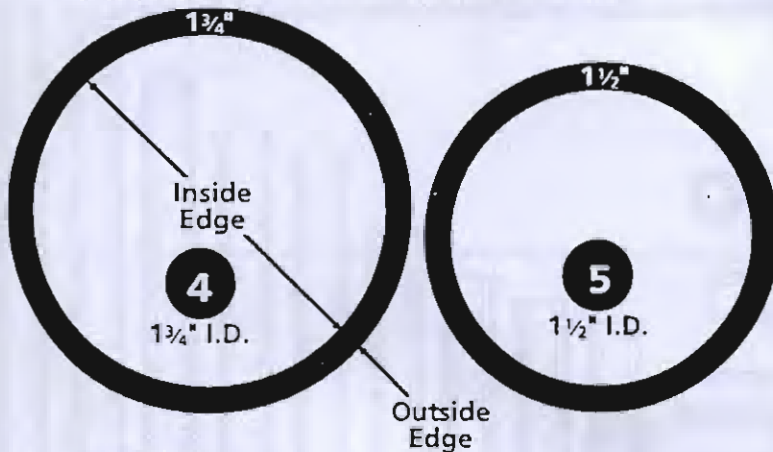
D (Rubber Bumpers) are located on the following:
• Trough VUK • Knocker • Autolaunch •
• Laser Kick • Upper VUK • Batcave Exit Kicker •
• Cannon •

A (Sm. Bushing) is located on the Cannon Assy.

Nº	Rubber Part Name	QTY.	Part Nº	Nº	Rubber Part Name	QTY.	Part Nº
A	Rubber Bushing (Small)	1	545-5192-00	3	2" I.D. Black Rubber Ring	3	545-5348-08
B	Small Flipper Rubber Ring	0	545-5207-00	4	1¾" I.D. Black Rubber Ring	0	545-5348-21
C	Large Flipper Rubber Ring	3	545-5277-00	5	1½" I.D. Black Rubber Ring	1	545-5348-07
D	Rubber Bumper (Grommet)	7	545-5105-00	6	1¼" I.D. Black Rubber Ring	2	545-5348-06
E	Bumper Post Rubber	0	545-5009-00	7	1" I.D. Black Rubber Ring	0	545-5348-05
F	Post Rubber (Sleeve Short)	11	545-5151-00	8	¾" I.D. Black Rubber Ring	1	545-5348-04
G	Post Rubber (Sleeve Tall)	3	545-5308-00	9	5/16" I.D. Black Rubber Ring	3	545-5348-02
1	2¾" I.D. Black Rubber Ring	1	545-5348-20	10	3/16" I.D. Black Rubber Ring	11	545-5348-01
2	2½" I.D. Black Rubber Ring	0	545-5348-09	11	⅜" O.D. Black Rubber Ring	3	545-5348-19
				12	3" I.D. BLK Rubber Ring (Not Shown)	1	545-5348-10

Note: Size and/or quantities may change during production.

† Items with Ø Qty. are not used in this game.

Playfield - Metal Posts and Spacers (Actual Size) †

can use a
#8 STOP Nut
240-5102-00

can use a
#6 Stop Nut
240-5105-00

can use a
#8 Stop Nut
240-5102-00

can use a
#6 Stop Nut
240-5005-00

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

can use a
#6 Stop Nut
240-5005-00

1 2 3 4 5 6A 6B 7A 7B 8 9 10

can use a
#10 KEPS Nut
240-5208-00

can use a
#8 KEPS Nut
240-5104-00

can use a
#6 T-Nut
240-5002-00

can use a
#8 KEPS Nut
240-5104-00

can use a
#6 KEPS Nut
240-5008-00

can use a
#6 T-Nut
240-5002-00

can use a
#8 KEPS Nut
240-5104-00

11

Illustration Note:
Tapped Posts &
Spacers show 1
example of the
top view.
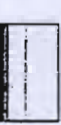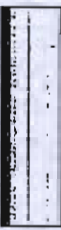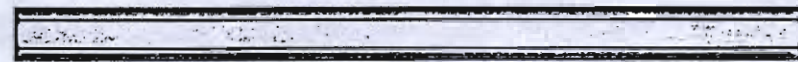
31 4"

18 ¼"

19 ½"

20 ⅝"

21 ¾"

12 13 14 15 16 17
1" ¼" ½" 9/16" ¾" 1⅛"

22 23 24 25 26 27 28 29 30
1" 1⅛" 1¼" 1½" 1⅞" 2" 2¼" 2½" 2⅝"

Nº	Metal Post/Spacer Name	QTY.	Part Nº	Nº	Metal Post/Spacer Name	QTY.	Part Nº
1	Mini-Post-Wood Threaded	4	530-5004-00	15	Spacer 9/16" Long X 5/16" X .144 I.D.	3	254-5014-04
2	Mini-Post-Wood Thd. No Cut-Away	0	530-5004-01	16	Spacer ¾" Long X 5/16" X .144 I.D.	0	254-5014-01
3	Mini-Post-Machine Threaded	0	530-5005-00	17	Spacer 1⅛" Lg. X 5/16" X .144 I.D.	6	254-5014-02
4	Bumper Post-Machine Threaded	0	530-5007-00	18	Spacer ¼" Hex Tapped 6-32	0	254-5008-00
5	Post Fastening Screw Lg. #8-32 Top	8	530-5008-00	19	Spacer ½" Hex Tapped 6-32	3	254-5008-03
6A	Post Machine Screw #6-32 Top	24	530-5012-02	20	Spacer ⅝" Hex Tapped 6-32	0	254-5008-02
6B	Post Wood Screw #6-32 Top	1	530-5010-02	21	Spacer ¾" Hex Tapped 6-32	5	254-5008-04
7A	Bumper Post Hex Base 8-32 Tap	0	530-5332-01	22	Spacer 1" Hex Tapped 6-32	0	254-5008-06
7B	Bumper Post Hex Base Untapped	2	530-5332-00	23	Spcr. 1⅛" Hex Tap. 6-32	1	254-5008-17
8	Bumper Post 6-32 Tapped	0	530-5127-00	24	Spacer 1¼" Hex Tapped 6-32	0	254-5008-11
9	Post Machine Screw	0	530-5263-01	25	Spacer 1½" Hex Tapped 6-32	0	254-5008-09
10	Mini-Playfield Support	0	530-5285-00	26	Spacer 1⅞" Hex Tapped 6-32	0	254-5008-20
11	Spacer Backbox Hinge	2	530-5099-00	27	Spacer 2" Hex Tapped 6-32	0	254-5008-07
12	Spacer 1" Lg Metal 5/16" X .144 I.D.	0	254-5001-00	28	Spacer 2¼" Hex Tapped 6-32	0	254-5008-18
13	Spacer ¼" Long X 5/16" X .144 I.D.	4	254-5014-03	29	Spacer 2½" Hex Tapped 6-32	0	254-5008-16
14	Spacer ½" Long X 5/16" X .144 I.D.	3	254-5014-00	30	Spacer 2⅝" Hex Tapped 6-32	0	254-5008-08
				31	Spacer 4" Hex Tap. 6-32	1	254-5008-21

Note: Size and/or quantities may change during production.

† Items with Ø Qty. are not used in this game.

Page 64

Section 4
Chapter 1

Parts Identification
& Location

Section 4 | Parts

Playfield - Plastic Posts and Spacers (Actual Size) †

Items 1-5 Posts used in pairs can use a 3/4" through 3" Rubber Rings.
(See Rubber Parts for Part N°s.)

can use 3/16" Rubber Ring(s) 545-5348-01

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

can use 5/16" Rubber Ring(s) 545-5348-02

1   **2**   **3** * *Various Colors*   **4** * *Various Colors*   **5** * *Various Colors*
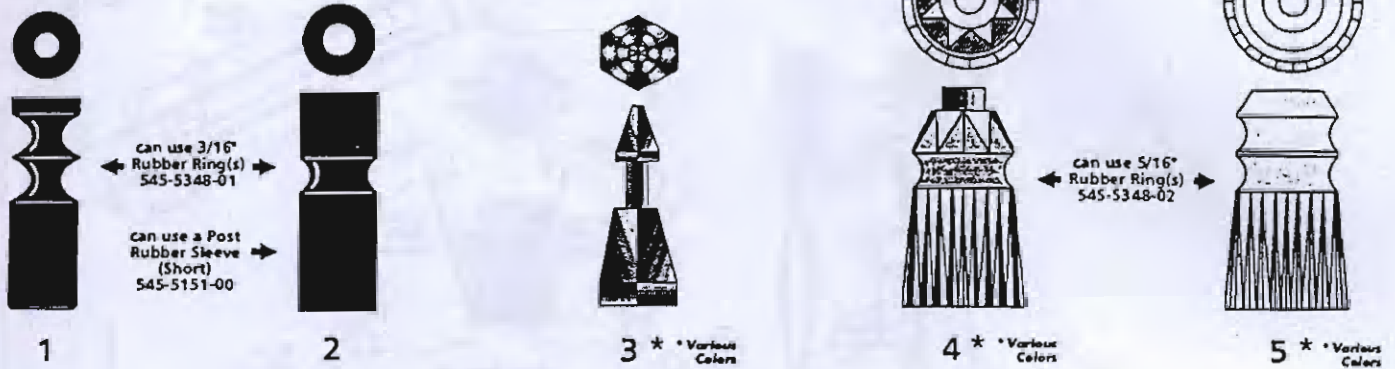
Items 7-9 Spacers are normally used with Lamp Boards.

** 6, 7, & 8 dimension is measured from the point.

6   **7**** ¼"   **8**** ⅜"   **9**** ¾"
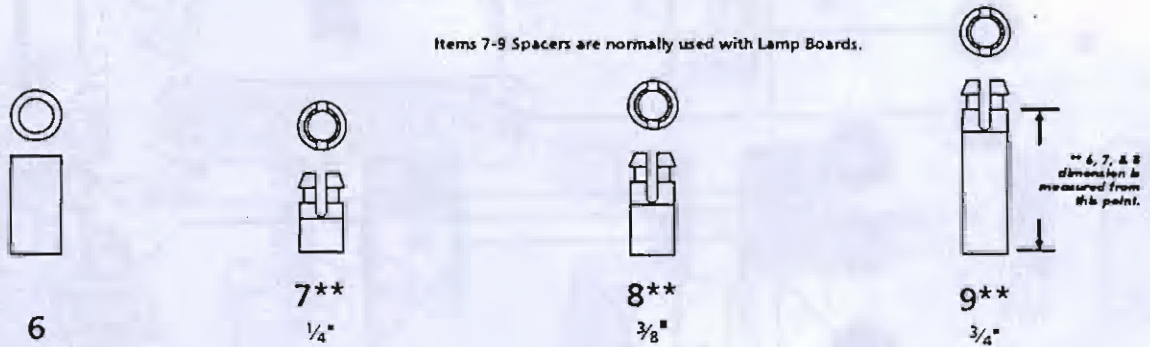
Items 10-17 Spacers are used in conjuntion with Metal Posts (Items 5, 6A & 6B) and/or a #6-32 1¼ PHIL PH Screw (237-5511-00) with #6 Stop Nuts (240-5005-00).

10 ¼"   **11** ⅜"   **12** ½"   **13** ⅝"   **14** ¾"   **15** 1"   **16** 1⅛"   **17** 1¼"
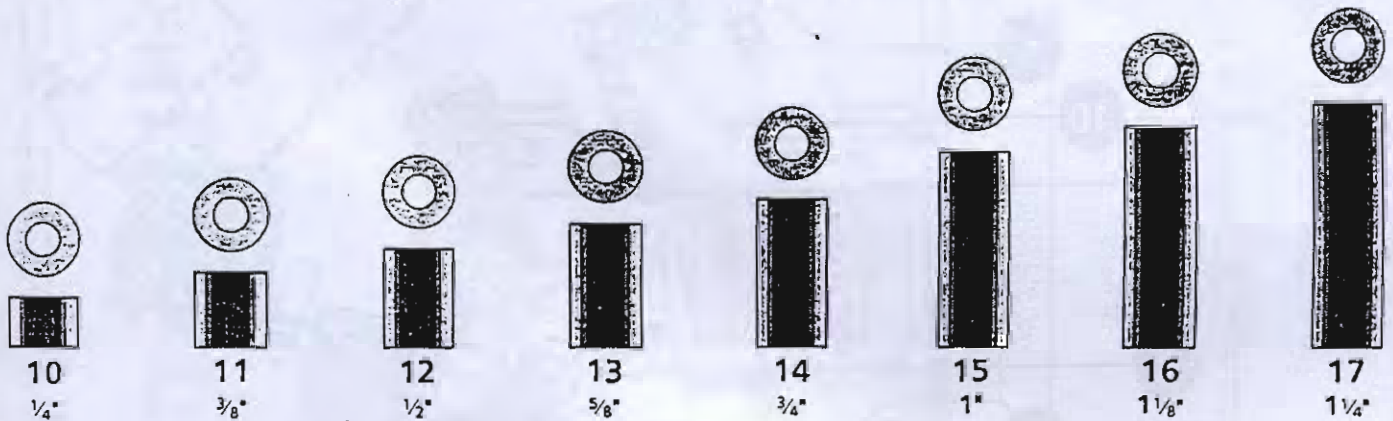
*   For various colors of these items (Jewel Posts), see Color Chart at the end of Section 4, Chapter 2. Replace the last 2-digits with desired color replacement.
** Dimension is measured from bottom to just under cut-away.

N°	Plastic Post/Spacer Name	QTY.	Part N°	N°	Plastic Post/Spacer Name	QTY.	Part N°
1	Stand-Off Double Groove 1-¹/₁₆"	0	530-5102-01	9**	Spacer ¾" Plastic Slf. Rtn. SRS6-12-01	0	254-5007-03
2	Plastic Post (Black)	31	550-5059-00	10	Spacer ¼" Plastic ⅜" (Gray)	2	254-5000-02
3*	Mini-Jewel Post (Clear)	0	550-5052-01	11	Spacer ⅜" Plastic ⅜" (Gray)	1	254-5000-12
4*	Small Jewel Post (Blue)	10	550-5034-05	12	Spacer ½" Plastic (Gray) ⅜"	1	254-5000-01
5*	Double Rubber Jewel Post (Clear)	2	545-5209-01	13	Spacer ⅝" Plastic ⅜" (Gray)	5	254-5000-14
6	Spacer ½" Plstc. Narrow (White) ⅜"	0	254-5000-03	14	Spacer ¾" Plastic ⅜" (Gray)	0	254-5000-07
7**	Spacer ¼" Plastic Slf. Rtn. SRS6-4-01	4	254-5007-02	15	Spacer 1" Plastic ⅜" (Gray)	2	254-5000-04
8**	Spacer ⅜" Plastic Slf. Rtn. SRS6-6-01	36	254-5007-01	16	Spacer 1⅛" Plastic ⅜" (Gray)	0	254-5000-06
				17	Spacer 1¼" Plastic ⅜" (Gray)	0	254-5000-05

Note: Size and/or quantities may change during production.

† Items with Ø Qty. are not used in this game.

Playfield - Lamp Boards †

Bottom of Playfield is Shown.

Auto-launch

4-Ball Trough

Laser Kick

Lower Left Flipper

Lower Right Flipper

Left Sling-Shot

Motor Relay Bd.
520-5010-00

Right Sling-Shot

8

1

9

7

4

4-Bank Drops

5

10

Upper Right Flipper

Ramp Ball Diverter

2

3

6

Turbo Pop Bumpers

VUK

Ball Eject
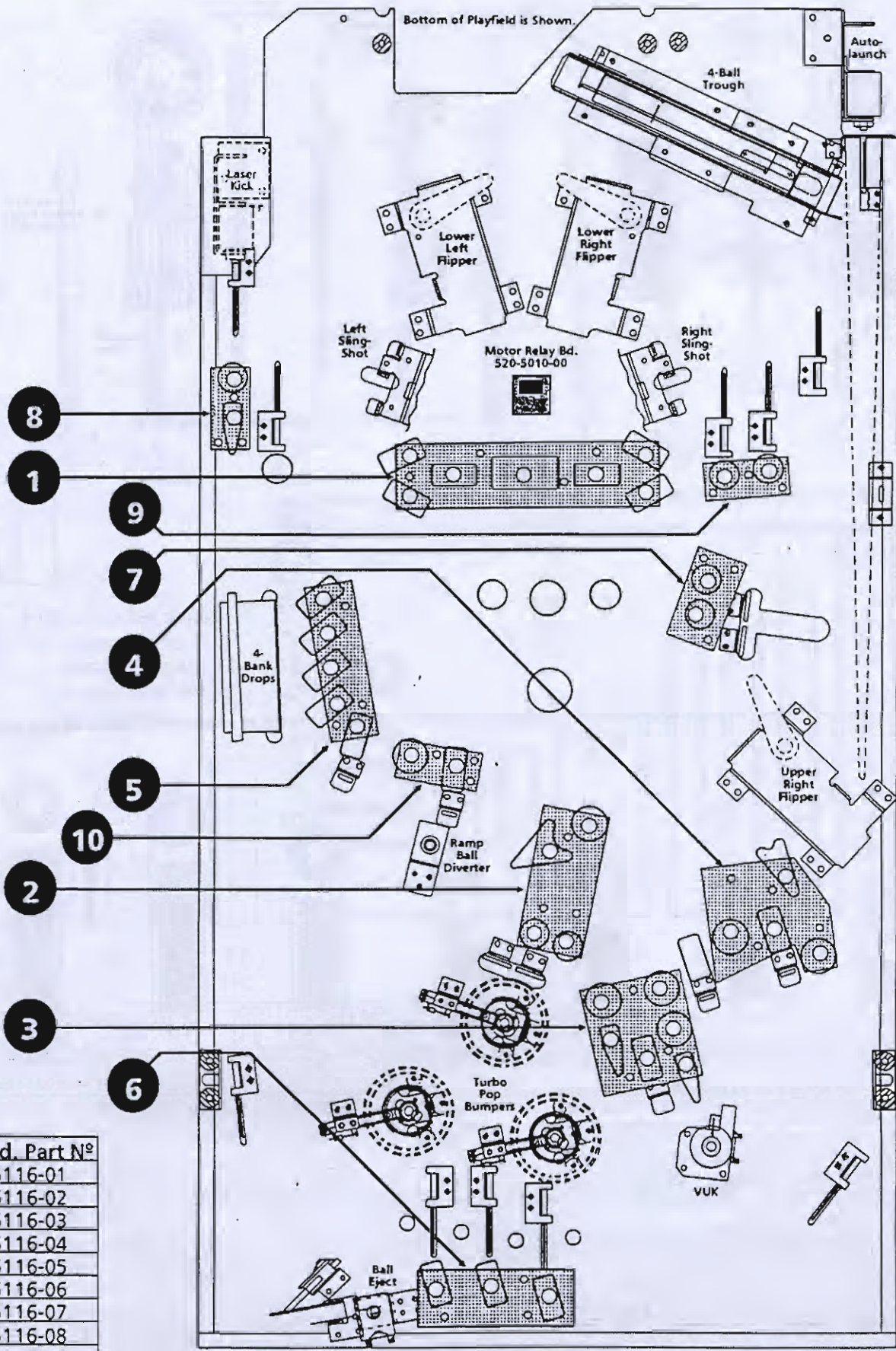
Nº	Lamp Bd. Part Nº
1	520-5116-01
2	520-5116-02
3	520-5116-03
4	520-5116-04
5	520-5116-05
6	520-5116-06
7	520-5116-07
8	520-5116-08
9	520-5116-09
10	520-5116-10

† #555 Wedge Base Bulbs (165-5002-00) and 555 Wedge Base Sockets (077-5007-00) are used on the Lamp Boards.

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

A
#555

1
This socket is normally used on Lamp Boards.

2
This socket is normally used in Pop Bumpers.

3
This socket is normally used on Lamp Boards.

CHRISTIANA 9001
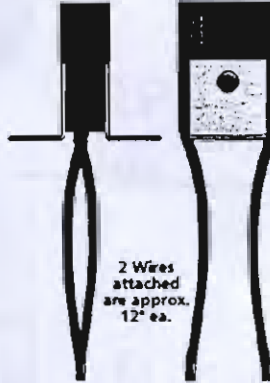
2 Wires attached are approx. 12" ea.
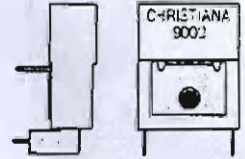
4
This socket is normally used with Reflectors.
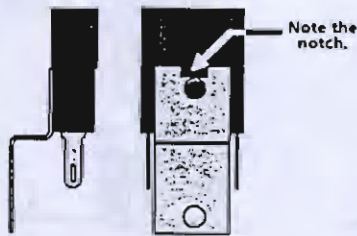
Note the notch.

5
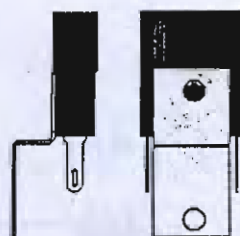
6

replaced with :

B
#906

7
This socket is normally used in conjunction with #906 Bulbs only.
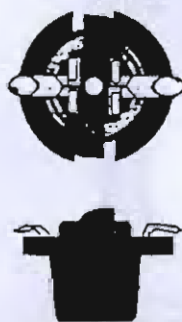
8
This socket is normally used in the Backbox Insert in conjunction with #555 & #906 Bulbs.
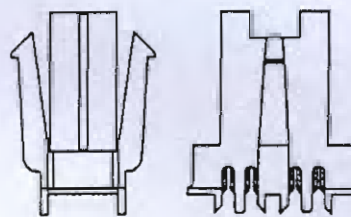
C
Neon

This Neon Bulb is used in Motor Assemblies for voltage spike suppression.

† Items with Ø Qty. are not used in this game.

Special Production Note:
If your Pinball Game's Backbox Insert is equipped with Bayonet Sockets & Bulbs, decrease #555 Bulb by 30 ea., #906 Bulb by 7 ea., and 555/906 IDC Wedge Socket by 37 ea.

Nº	Bulb & Socket Name	QTY.	Part Nº		Nº	Bulb & Socket Name	QTY.	Part Nº
A	#555 Wedge Base Bulb	78	165-5002-00		B	#906 Wedge Base Bulb	7	165-5004-00
1	555 Wedge Base Socket	37	077-5007-00		7	906 Wedge Base Socket	0	077-5016-00
2	Turbo Pop Bumper Socket (New)	3	077-5206-00		8	555/906 IDC Wedge Socket	37	077-5110-00
3	Lamp Board Laydown Wedge Base	0	077-5207-00					
4	Laydown Wedge Base L/R Black	2	077-5026-01		Nº	Bulb Name (Used in Motors)	QTY.	Part Nº
5	Laydown Wedge Base Black	0	077-5026-00		C	Neon NE-2 Bulb	1	165-5021-00
6	Wedge Offset Brckt. Socket 2-Styles	5	077-5029-00					

Note: Size and/or quantities may change during production.

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

A
#44

1

2

3

4

5

6

7

8

B
#455

9
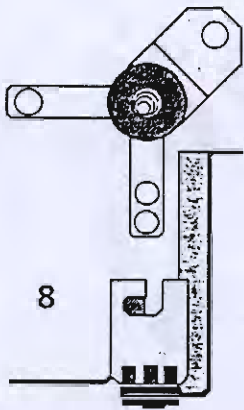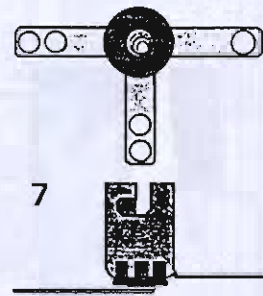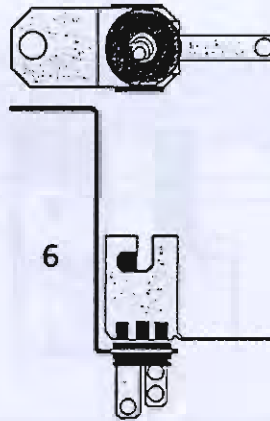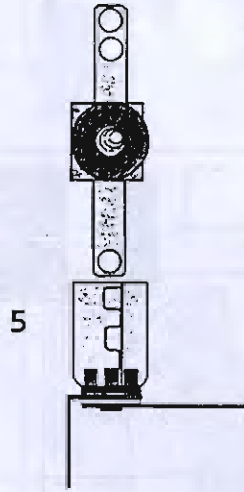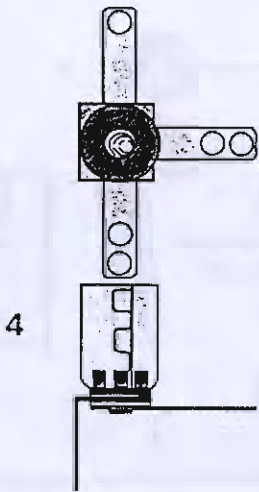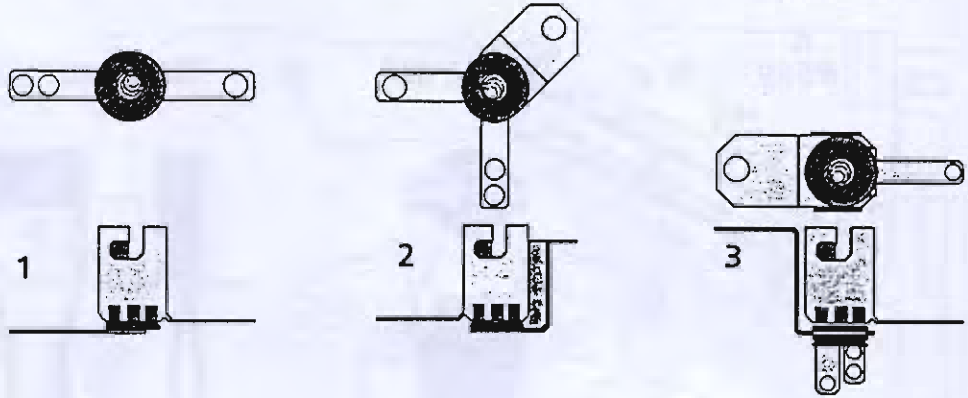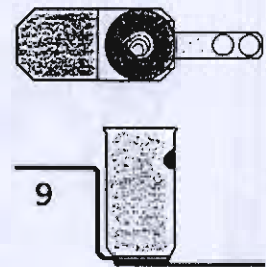
This bulb is normally used in
conjunction with socket 9,
but can be used with
sockets 1-8.

Special Production Note:
If your Pinball Game's Backbox Insert is equipped with Wedge Base Sockets & Bulbs,
decrease #44 Bulb by 30 ea., and 2-Lug Staple Down Socket by 30 ea.

Nº	Bulb & Socket Name	QTY.	Part Nº	Nº	Bulb & Socket Name	QTY.	Part Nº
A	#44 Bulb	77	165-5000-44	6	3-Lug Stand-Up Long Socket	9	077-5009-00
1	2-Lug Staple Down Socket	67	077-5000-00	7	3-Lug Staple Down Socket	0	077-5001-00
2	2-Lug Stand-Up Short Socket	1	077-5002-00	8	2-Lug Stand-Up Long Socket	0	077-5005-00
3	3-Lug Stand-Up Short Socket	0	077-5008-00				
4	3-Lug Laydown Socket	0	077-5006-00	B	#455 Twinkle Bulb	0	165-5003-00
5	2-Lug Laydown Socket	0	077-5003-00	9	1-Lug Stand-Up Long Socket	0	077-5012-00

Note: Size and/or quantities may change during production.

† Items with Ø Qty. are not used in this game.

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

C
#89

1

2

3

4

5

Nº	Bulb & Socket Name	QTY.	Part Nº	Nº	Bulb & Socket Name	QTY.	Part Nº
C	#89 Bulb	32	165-5000-89	3	Stand-Up, Long Socket	10	077-5102-00
1	Laydown Standard Socket	3	077-5100-00	4	Stand-Up, Socket Rev. Short	1	077-5103-00
2	Stand-Up, Short Socket	18	077-5101-00	5	Straight Leg Socket	0	077-5107-00

Note: Size and/or quantities may change during production.

† Items with Ø Qty. are not used in this game.

Parts Order Checklist Notes

Date Ordered	Part Nº	Qty.	Description	Date Received

Assembly Drawings
(The Blue Pages)

Overview

This chapter expands Chapter 1 of this section (The Pink Pages). The Part Numbers for all Major Assemblies are provided and can be ordered as a complete assembly (except for the New Turbo Bumper). Each assembly is broken down, describing the individual parts and/or sub-assemblies (with the part numbers) which can be ordered separately. Where multiple parts are riveted or assembled as sub-assemblies the sub-assembly needs to be ordered. The drawings show the location of the individual parts. Note that minor changes may be made during production (e.g. coil size, addition or deletion of minor parts). Always verify the part to be replaced with the part number and/or description as noted. Replacement parts may be substituted with revised parts which may have a different part number. Any questions, call our Technical Support Dept. (1-800-KICKERS USA & Canada or 708-345-7700).

Page 82
Ball Eject Assy.

Pages 88-91
Ramp
Assemblies

Pages 92
Stand-Up
Targets Assy.

Page 82
VUK Assy.

Page 80
New Turbo
Bumper Assy.

Page 88
Ramp Diverter
Assy.

Page 81
Early Turbo
Bumper Assy.

Page 76
New Upr. Rt.
Flipper Assy.

Page 77
Early Upr. Rt.
Flipper Assy.

Page 83
Batcave Ball
Lock Assy.

Page 86-87
4-Bank Drop
Target Assy.

Page 78
Knocker
Assy.
(In Cabinet)

Page 83
Batcave Exit
Kicker Assy.

Page 74
New Lt. & Rt.
Flipper Assy.

Page 84-85
Batwing
Cannon Assy.
and
Cannon
Motor Drive
Assy.

Page 75
Early Lt. & Rt.
Flipper Assy.

Page 73
4-Ball Trough
Assy. with
Lock Ball
and
Enter/Exit
Scoop Assy.

Page 79
Laser Kick
Assy.

Page 78
Slingshot
Assy.

Page 79
Autolaunch
Assy.

Page 72
Bat Gun Assy.

Bat Gun Assembly
500-5945-00-38

Feed cable through
hatched areas-cable to exit

Locators must be
aligned prior to
tightening Tamper
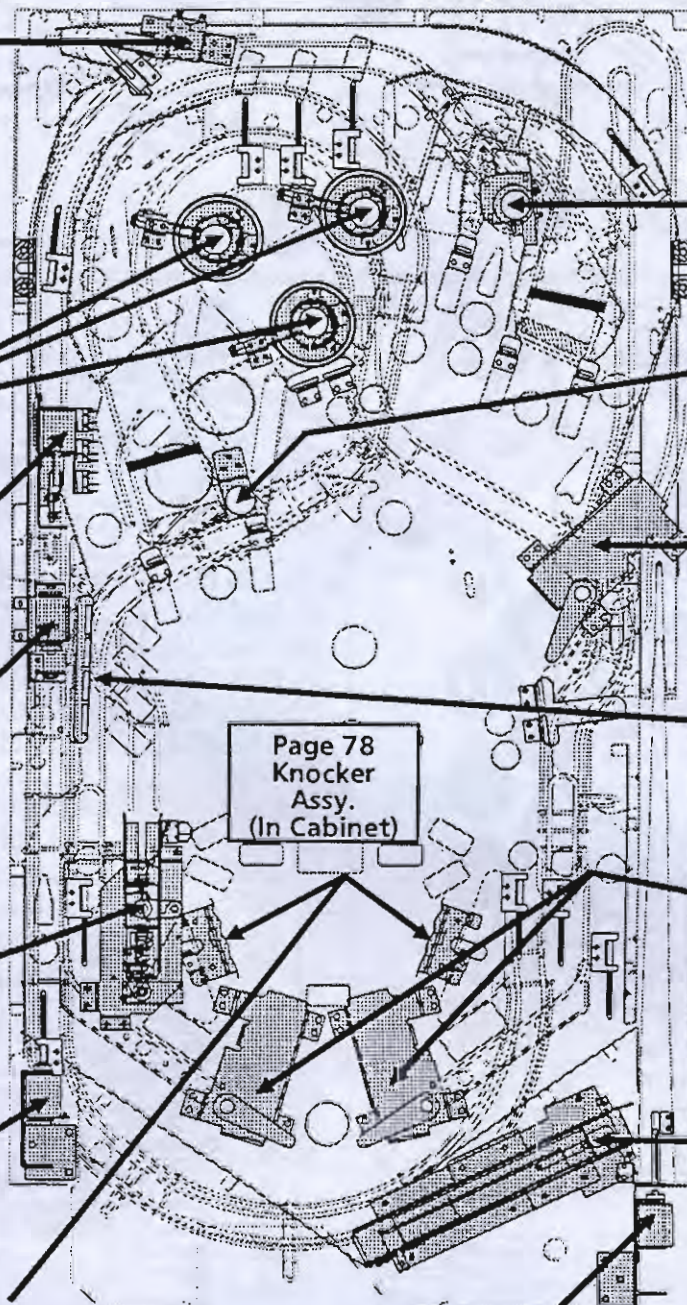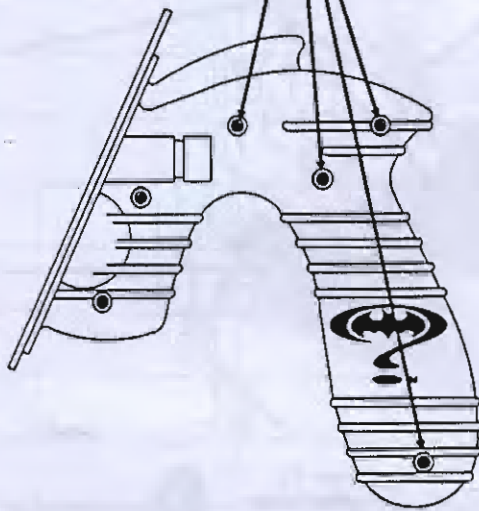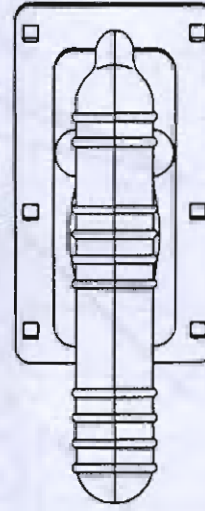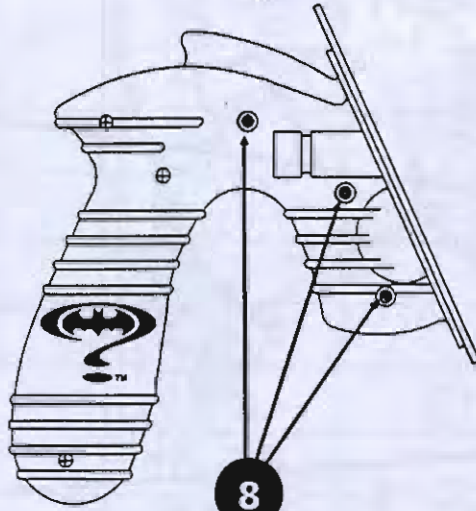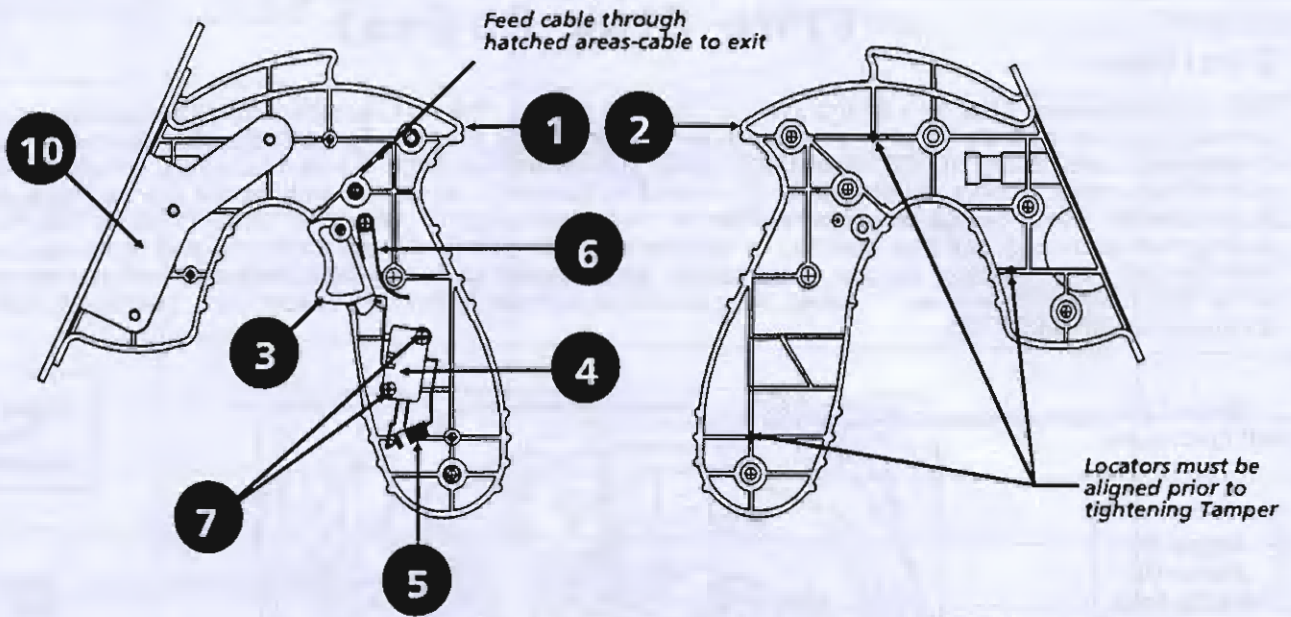
Nº	Part Name	SPI Part Nº
1	Batgun Housing, Right Side	545-5636-00
2	Batgun Housing, Left Side	545-5635-00
3	Trigger-Batgun	545-5408-00
4	Micro Switch	180-5111-00
5	IN4001 Diode	112-5001-00
6	Compression Spring	266-5037-00
7	#4-40 X 3/4" Phillips Round Head (ZINC) (Qty. 2)	237-5873-00
8	#8-32 X 3/8" Tamper Proof Torx BLK Zinc (Qty. 9)	237-5965-00
9	Wire Harness (Not Shown)	036-5375-23
10	Batgun Mounting Sub-Assy. Plate	515-6272-00
	Batgun Mounting Plate	535-7457-00
	Batgun Mounting Bracket	535-7456-00
	#8-32 X 3/8" TF Screw (Qty. 2)	237-5903-00

Section 4
Chapter 2

Assembly
Drawings

4-Ball Trough (OPTO) Assembly
500-5989-01-38
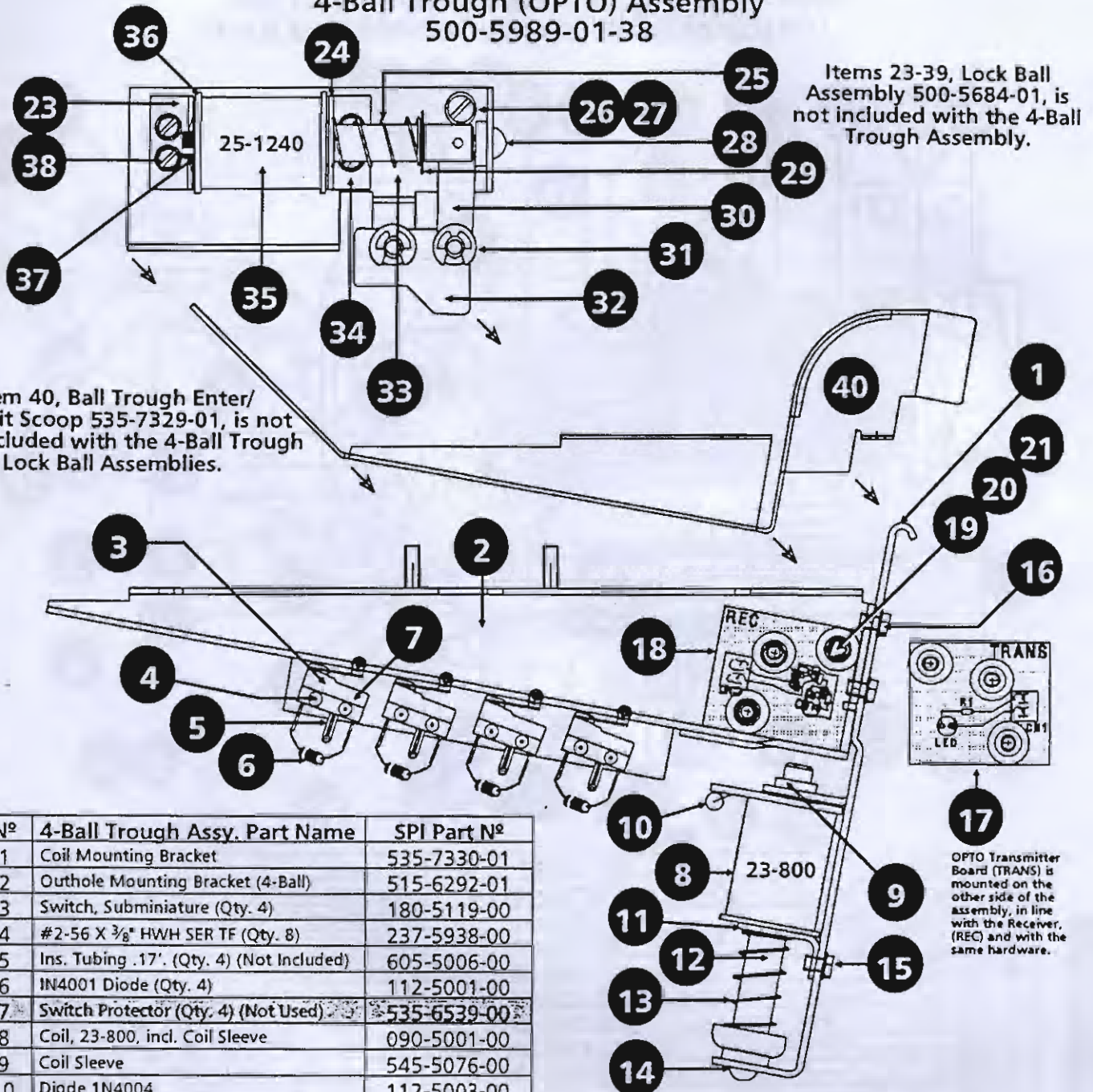
Items 23-39, Lock Ball
Assembly 500-5684-01, is
not included with the 4-Ball
Trough Assembly.

Item 40, Ball Trough Enter/
Exit Scoop 535-7329-01, is not
included with the 4-Ball Trough
or Lock Ball Assemblies.

OPTO Transmitter
Board (TRANS) is
mounted on the
other side of the
assembly, in line
with the Receiver,
(REC) and with the
same hardware.

Nº	4-Ball Trough Assy. Part Name	SPI Part Nº
1	Coil Mounting Bracket	535-7330-01
2	Outhole Mounting Bracket (4-Ball)	515-6292-01
3	Switch, Subminiature (Qty. 4)	180-5119-00
4	#2-56 X 3/8" HWH SER TF (Qty. 8)	237-5938-00
5	Ins. Tubing .17'. (Qty. 4) (Not Included)	605-5006-00
6	1N4001 Diode (Qty. 4)	112-5001-00
7	Switch Protector (Qty. 4) (Not Used)	535-6539-00
8	Coil, 23-800, incl. Coil Sleeve	090-5001-00
9	Coil Sleeve	545-5076-00
10	Diode 1N4004	112-5003-00
11	Coil Retaining Bracket	535-5203-01
12	Plunger Assembly	515-5941-01
13	Spring	266-5020-00
14	Rubber Bumper	545-5105-00
15	#8-32 X .25" HWH SER MS (Qty. 2)	237-5964-00
16	#8-32 X 3/8 HWH SER TF (Qty. 4)	237-5903-00
17	OPTO Transmitter (TRANS) Board	520-5124-00
18	OPTO Receiver (REC) Board	520-5125-00
19	OPTO PCB Tube Spacer (Qty. 6)	530-5308-00
20	OPTO PCB Rubber Grommet (Qty. 6)	545-5518-00
21	#6-32 X 5/8" HWH TF (Qty. 6)	237-5928-00
22 *	Ball Trough Wire Harness (Not Shown)	036-5377-01

Nº	Lock Ball Assembly Part Name	SPI Part Nº
23	Core Stop Assembly	515-5088-00
24	Lock Ball Bracket Assembly	515-5817-01
25	Plunger ø7/16" X 2.25" LG	530-5250-01

Nº	Lock Ball Assy. Part Name	SPI Part Nº
26	Spacer	545-5400-00
27	#8-32 PPH X 1" LG	232-5606-00
28	Rubber Bumper	545-5105-00
29	E-Ring ø.44 Shaft	270-5005-00
30	Link, Lock Ball	545-5058-00
31	E-Ring, .25 Shaft (Qty. 2)	270-5002-00
32	Lock Ball Cam Assembly	515-5815-01
33	Spring	266-5000-00
34	Coil Retaining Bracket	535-6658-00
35	Coil, 25-1240, incl. Coil Sleeve	090-5034-00
36	Coil Sleeve	545-5411-00
37	Diode 1N4004	112-5003-00
38	#6-32 HWH TC X .38 LG (Qty. 4)	237-5898-00
39 *	Lock Ball Wiring Harness (Not Shown)	036-5301-01
40	Ball Trough Enter/Exit Scoop	535-7329-01

Note: An asterisk (*) indicates item is not depicted in pictorial.

Flipper Assemblies, Lower
500-5944-01 (Right), 500-5944-12 (Left)
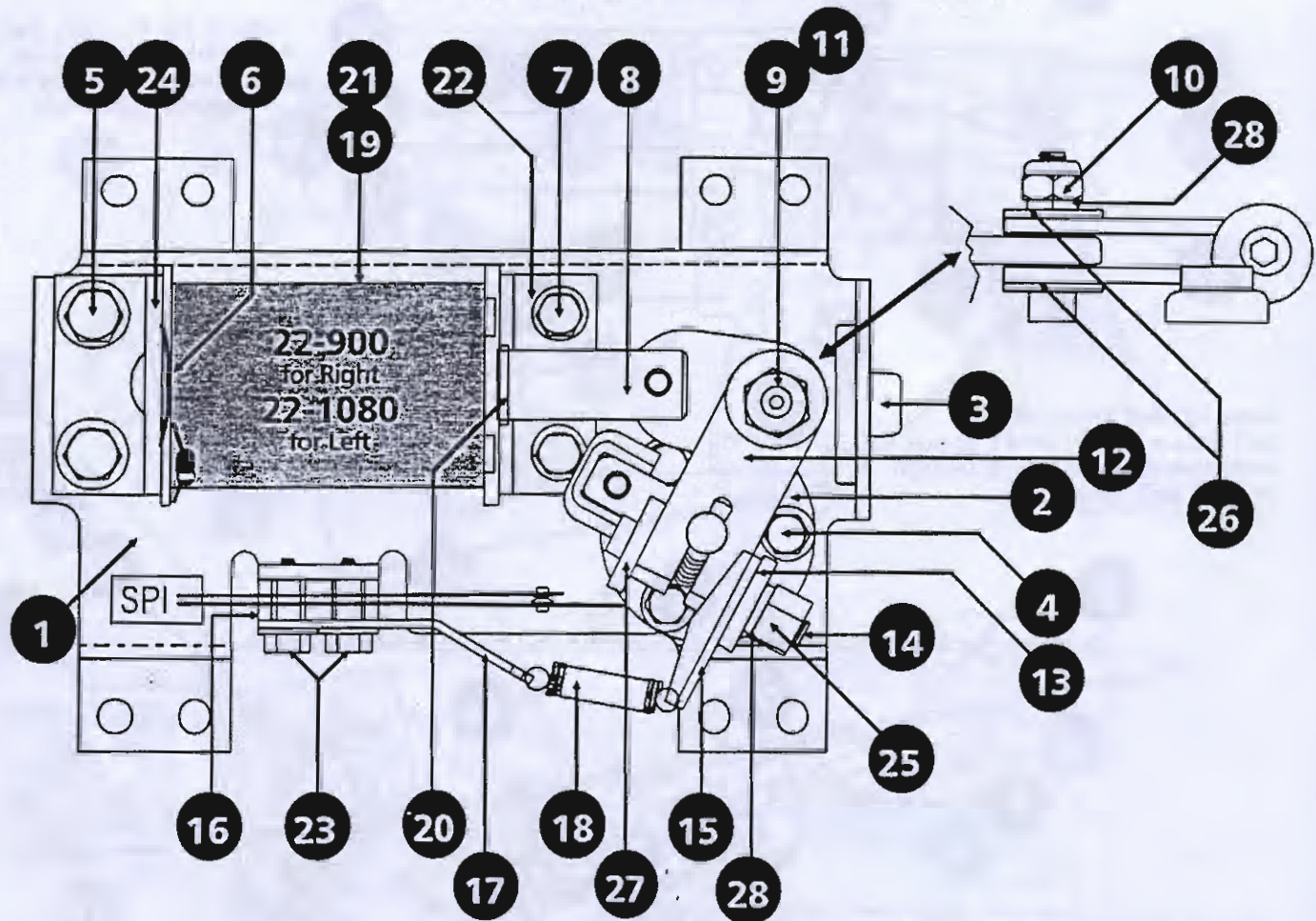
Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1R	Right: Flipper Base	535-7275-00	13	Washer .105" THK .203" I.D. X .63" O.D.	242-5039-00
1L	Left: Flipper Base Left	535-7275-01	14	#10-32 SOC HD X 1.25" Lg. (Qty. 2)	237-5950-00
2	Flipper Bushing	545-5594-00	15	Return Bracket	535-7353-00
3	Bumper	545-5428-00	16	Power (End of Stroke) Switch	180-5149-00
4	#6-32 X .38" Lg. HWH TF SERR (Qty.3)	237-5910-01	17R	Right: Switch Plate/Spring Return Brckt.	535-7354-00
5	#10-32 X .38 Lg. HWH TF SERR (Qty. 2)	237-5961-00	17L	Left: Switch Plate/Spring Return Bracket	535-7354-01
6	Spring Washer	269-5002-00	18	Flipper Return Spring	265-5035-00
7	#8-32 X .38" Lg. HWH TF (Qty. 2)	237-5903-00	19R	Right: Coil 22-900 incl. Coil Sleeve	090-5020-20
8	Plunger/Link Sub-Assembly	515-6304-00	19L	Left: Coil 22-1080 incl. Coil Sleeve	090-5032-00
	Flipper Link	545-5611-00	20	Coil Sleeve	545-5388-00
	Roll Pin ø 0.156" X .44" Lg.	251-5000-00	21	Diode 1N4004	112-5003-00
	Flipper Plunger	530-5349-00	22	Coil Support Bracket	535-7356-00
9	Bushing	530-5139-00	23	#6-32 X .63" HWH TF (Qty.2)	237-5928-00
10	#10-32 X 7/8" Lg. SOC HD	237-5966-00		Coil Stop Sub-Assembly	515-6308-00
11	Washer .06" THK .203" I.D. X .63" O.D.	240-5203-00	24	Coil Stop	530-5350-00
12R	Right: Flipper Mounting Sub-Assembly	515-6305-00		Shading Ring	530-5123-00
12R	Right: Flipper Mounting Link	535-7271-00		Coil Stop Bracket	535-7355-00
12L	Left: Flipper Mounting Sub-Assembly	515-6305-01	25	#10-32 X 9/32" Long 3/8" Hex Nut	240-5209-00
12L	Left: Flipper Mounting Link	535-7271-01	26	Wshr. .06" THK (same I.D./O.D.) (Qty. 2)	242-5038-00
12	Switch Actuator (for both)	545-5612-00	27	Washer .105" THK .203" I.D. X .63" O.D.	242-5039-01
	Rivet .125" ø X .25" L g. for both)	249-5003-00	28	#10-32 Split Lock Washer (Qty. 2)	244-5003-00

ASSOCIATED PART(S) NOT INCLUDED WITH THE ABOVE ASSEMBLY (ALSO NOTED IN CHAPTER 1 OF THIS SECTION)

| Nº	Associated Part Name	SPI Part Nº	Nº	Associated Part Name	SPI Part Nº
n/a	Lwr. Rt. Flipper Bat & Shaft Assy. Color: White w/Sonic the Hedgehog™ Logo	515-5133-01-03	n/a	Lwr. Lt. Flipper Bat & Shaft Assy. Color: White w/Sonic the Hedgehog™ Logo	515-5133-01-04

Early Production Flipper Assemblies, Lower
500-6045-01 (Right), 500-5755-02 (Left)
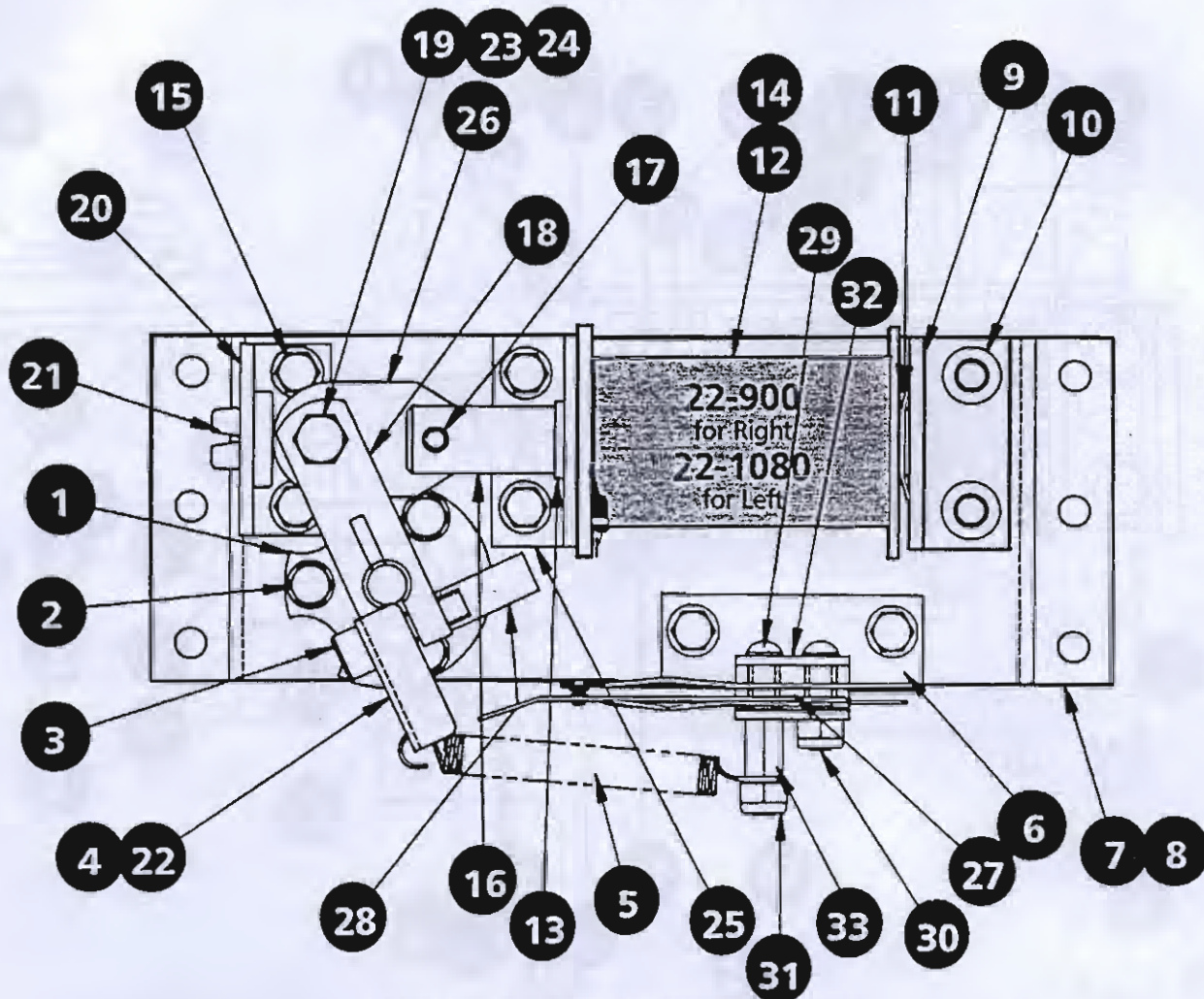
SPECIAL PRODUCTION NOTE:

Early production games used this assembly. Order 500-5944-XX for replacement, if required.

Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Flipper Bushing	545-5070-00	17	ø ⁵⁄₃₂ x ⁵⁄₈ Roll Pin	251-5000-00
2	#6-32 X .38 LG HWH (Qty. 3)	237-5910-00	18	Pawl	530-5070-00
3	#10-32 SOC HD X .75 LG	237-5864-00	19	#10-32 X .75 LG Shoulder Bolt	231-5019-00
4	Spring Bracket (Left)	535-6663-02	20	Plunger Stop Bracket	535-5279-01
5	Flipper Return Spring	265-5029-02	21	Nylon Stop	545-5445-00
6	Switch Mounting Bracket	535-6664-00	22	Spring Bracket (Right)	535-6663-01
7	Flipper Base (Left)	515-5077-02	23	Bushing	530-5139-00
8	Flipper Base (Right)	515-5077-01	24	#10-32 Elastic Stop Nut	240-5203-00
9	Coil Stop Bracket	515-5346-00	25	Front Bracket	535-6453-00
10	¼-20 SOC HD X .38 LG (Qty. 2)	237-5861-00	26	Flipper Link	545-5401-00
11	Spring Washer	269-5002-00	27	Power Switch	180-5124-01
12R	RIGHT: Coil 22-900, incl. Coil Sleeve	090-5020-20	28	Plastic Cap	545-5084-00
12L	LEFT: Coil 21-1080, incl. Coil Sleeve	090-5032-00	29	#6-32 X 1" LG PPH	237-5506-00
13	Coil Sleeve	545-5388-00	30	#6-32 X .63 LG PPH	237-5899-00
14	Diode 1N4004	112-5003-00	31	#6-32 Elastic Stop Nut	240-5005-00
15	#8-32 X .38 LG HWH (Qty. 6)	237-5903-00	32	Switch Plate	535-5045-00
16	Plunger and Link Assembly	515-5822-00	33	¼ Hex Spacer (⅜" Long)	254-5008-12

ASSOCIATED PART(S) NOT INCLUDED WITH THE ABOVE ASSEMBLY (ALSO NOTED IN CHAPTER 1 OF THIS SECTION)

Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
n/a	Lwr. Rt. Flipper Bat & Shaft Assy. Color: White w/Sonic the Hedgehog™ Logo	515-5133-01-03	n/a	Lwr. Lt. Flipper Bat & Shaft Assy. Color: White w/Sonic the Hedgehog™ Logo	515-5133-01-04

№	Part Name	SPI Part №	№	Part Name	SPI Part №
1R	Right: Flipper Base	535-7275-00	12L	Left: Flipper Mounting Link (Not Used)	535-7271-01
1L	Left: Flipper Base (Not Used)	535-7275-01	12	Switch Actuator (for both)	545-5612-00
2	Flipper Bushing	545-5594-00		Rivet .125" ø X .25" Lg. (for both)	249-5003-00
3	Bumper	545-5428-00	13	Washer .105" THK .203" I.D. X .63" O.D.	242-5039-00
4	#6-32 X .38" Lg. HWH TF SERR (Qty.3)	237-5910-01	14	#10-32 SOC HD X 1.25" Lg. (Qty. 2)	237-5950-00
5	#10-32 X .38 Lg. HWH TF SERR (Qty. 2)	237-5961-00	15	Return Bracket	535-7353-00
6	Spring Washer	269-5002-00	16	Flipper Return Spring	266-5020-00
7	#8-32 X .38 Lg. HWH TF (Qty. 2)	237-5903-00	17	Coil 23-900 incl. Coil Sleeve	090-5020-30
8	Plunger/Link Sub-Assembly	515-6304-00	18	Coil Sleeve	545-5388-00
	Flipper Link	545-5611-00	19	Diode 1N4004	112-5003-00
	Roll Pin ø 0.156" X .44" Lg.	251-5000-00	20	Coil Support Bracket	535-7356-00
	Flipper Plunger	530-5349-00	21	Coil Stop Sub-Assembly	515-6308-00
9	Bushing	530-5139-00		Coil Stop	530-5350-00
10	#10-32 X 7/8" Lg. SOC HD	237-5966-00		Shading Ring	530-5123-00
11	Washer .06" THK .203" I.D. X .63" O.D.	240-5203-00		Coil Stop Bracket	535-7355-00
12R	Right: Flipper Mounting Sub-Assembly	515-6305-00	22	#10-32 X 9/32" Long 3/8" Hex Nut	240-5209-00
12R	Right: Flipper Mounting Link	535-7271-00	23	Wshr .06" THK (same I.D./O.D.) (Qty. 2)	242-5038-00
12L	Left: Flip. Mntng. Sub-Assy. (Not Used)	515-6305-01	24	Washer .105" THK .203" I.D. X .63" O.D.	242-5039-01
	Item 12 is continued in the next column.		25	#10-32 Split Lock Washer (Qty. 2)	244-5003-00

ASSOCIATED PART(S) NOT INCLUDED WITH THE ABOVE ASSEMBLY (ALSO NOTED IN CHAPTER 1 OF THIS SECTION)

№	Associated Part Name	SPI Part №	№	Associated Part Name	SPI Part №
n/a	Lwr. Rt. Flipper Bat & Shaft Assy. Color: White w/Sonic the Hedgehog™ Logo	515-5133-01-03	n/a	Lwr. Lt. Flipper Bat & Shaft Assy. Color: White w/Sonic the Hedgehog™ Logo	515-5133-01-04

Early Production Flipper Assembly, Upper
500-5914-01 (Right)


SPECIAL PRODUCTION NOTE:

Early production games used this assembly. Order 500-6029-03 for replacement, if required.

Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Flipper Bushing	545-5070-00	14	Diode 1N4004	112-5003-00
2	#6-32 X .38 LG HWH (Qty. 3)	234-5000-00	15	#8-32 X .38 LG HWH (Qty. 6)	234-5100-00
3	#10-32 SOC HD X .75 LG	237-5864-00	16	Plunger and Link Assembly	515-5822-00
4	Item Number Not Used.	—-—-—	17	ø 5/32 x 5/8 Roll Pin	251-5000-00
5	Flipper Return Spring (Compression)	266-5020-00	18	Pawl	530-5070-00
6	Item Number Not Used.	—-—-—	19	#10-32 X .75 LG Shoulder Bolt	231-5019-00
7	Flipper Base	515-5077-01	20	Plunger Stop Bracket	535-5279-01
8	Item Number Not Used.	—-—-—	21	Nylon Stop	545-5445-00
9	Coil Stop Bracket	515-5346-00	22	Flipper Plunger	530-5069-00
10	¼-20 SOC HD X .38 LG (Qty. 2)	237-5861-00	23	Bushing	530-5139-00
11	Spring Washer	269-5002-00	24	#10-32 Elastic Stop Nut	240-5206-00
12	Coil 23-900, incl. Coil Sleeve	090-5020-30	25	Front Bracket	535-6453-00
13	Coil Sleeve	545-5388-00	26	Flipper Link	545-5401-00

ASSOCIATED PART(S) NOT INCLUDED WITH THE ABOVE ASSEMBLY (ALSO NOTED IN CHAPTER 1 OF THIS SECTION)

Nº	Part Name	SPI Part Nº
n/a	Lwr. Rt. Flipper Bat & Shaft Assy. Color: White w/Sonic the Hedgehog™ Logo	515-5133-01-03

Slingshot Assemblies
500-5849-00

№	Part Name	SPI Part №
1	Slingshot Bracket Assembly	515-5339-01
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
3	Link	545-5062-00
4	Plunger & Link Assembly	515-5338-00
5	Comp. Spring	266-5020-00
6	Diode 1N4004	112-5003-00
7	Coil 23-800, incl. Coil Sleeve	090-5001-02
8	Coil Sleeve	545-5031-00
9	Coil Retaining Bracket	535-5203-03
10	#8-32 X ¼" Screw (Qty. 2)	232-5300-00
11	Diode 1N4001	112-5001-00
12	Slingshot Switch (Qty. 2)	180-5054-00
13	Tension Switch Plate (Qty. 2)	535-5846-00
14	#4-40 X ½" Screw (Qty. 4)	237-5837-00
15	¼" Retaining Ring (Qty. 2)	270-5002-00
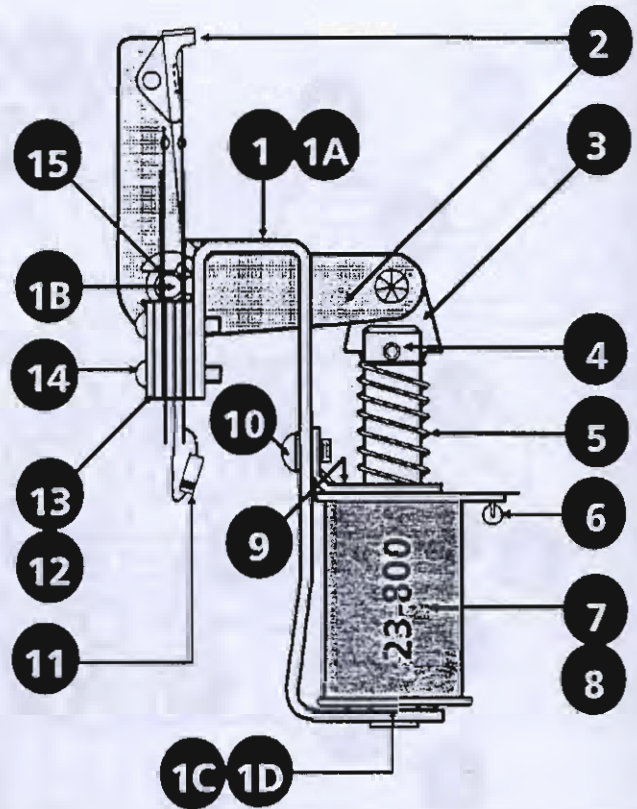
Knocker Assembly (In Cabinet) †
500-5081-00

(Behind 6)
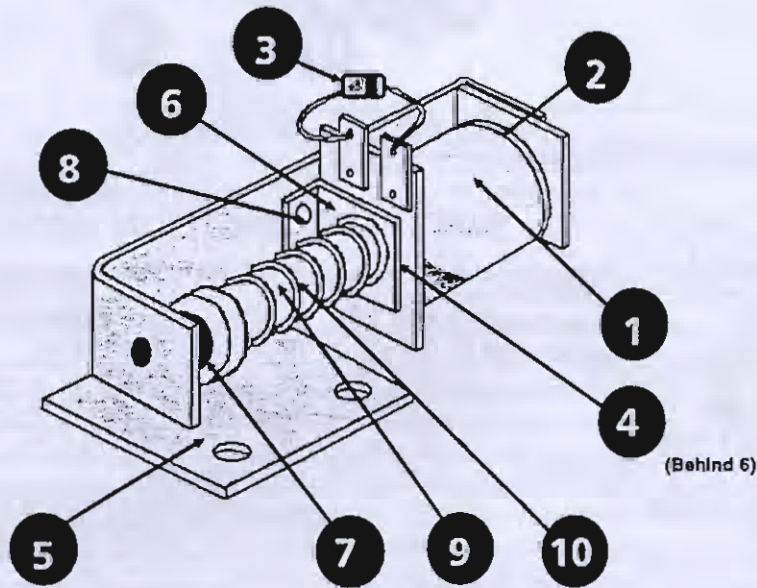
† Note: The Knocker Assembly is interchangeable with the Laser Kick Assembly (500-5838-00) except for the Diode Position @ 90° Diff.

№	Part Name	SPI Part №	№	Part Name	SPI Part №
1	Coil 23-800, incl. Coil Sleeve	090-5001-01	6	Coil Retainer Bracket	535-5203-03
2	Coil Sleeve	545-5076-00	7	Bumper Pad	545-5105-00
3	Diode 1N4004	112-5003-00	8	#8-32 X ¼" PH PAN SEMS (Qty. 2)	232-5300-00
4	Crescent Spring Washer	269-5002-00	9	Plunger Assembly	515-5000-02
5	Kickback/Knocker Bracket	535-5265-00	10	Spring	266-5020-00

Section 4 | Drawings

Autolaunch Assembly (Shooter Lane)
500-5477-01

Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Coil Mounting Bracket	535-6385-00	6	Plunger Assembly	515-5000-02
2	8-32 X 1/4" PPH SEMS (Qty. 2)	232-5300-04	7	Relay Spring	266-5020-00
3	Coil, 24-940, incl. Coil Sleeve	090-5036-01	8	Rubber Bumper (Grommet)	545-5105-00
4	Coil Sleeve	545-5076-00	9	Coil Retainer Bracket	535-5203-01
5	Diode, 1N4004	112-5003-00	10	Spring Washer	266-5002-00

Laser Kick Assembly
500-5838-00
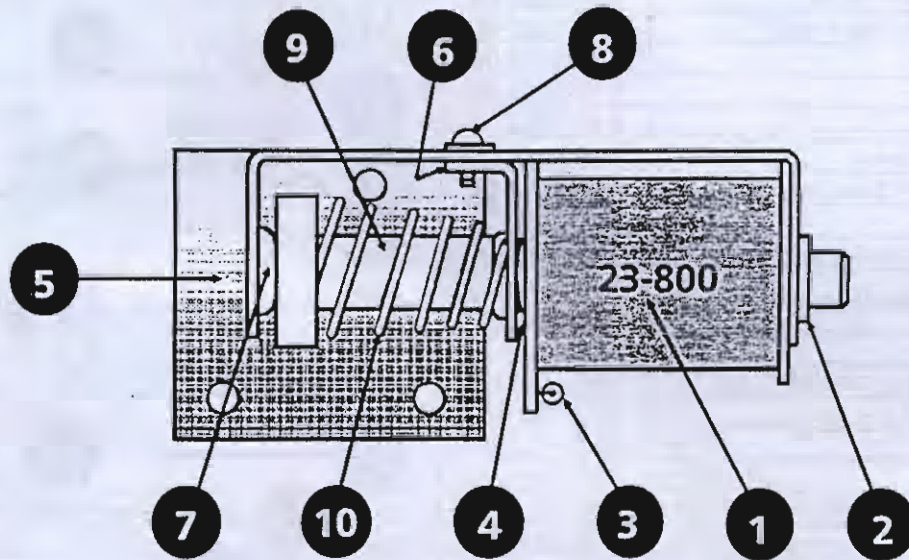
† Note: The Laser Kick Assembly is interchangeable with the Knocker Assembly (500-5081-00) except for the Diode Position @ 90° Diff.

Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Coil 23-800, incl. Coil Sleeve	090-5001-01	6	Coil Retainer Bracket	535-5203-03
2	Coil Sleeve	545-5076-00	7	Bumper Pad	545-5105-00
3	Diode 1N4004	112-5003-00	8	#8-32 X 1/4" PH PAN SEMS (Qty. 2)	232-5300-00
4	Crescent Spring Washer	269-5002-00	9	Plunger Assembly	515-5000-02
5	Kickback/Knocker Bracket	535-5265-00	10	Spring	266-5020-00

New Turbo Bumper

⚠ Not available as an assembly. Use the table below to order specific part(s) required.

Assembled View

PLAYFIELD WOOD

23-700

Exploded View

PLAYFIELD WOOD

23-700
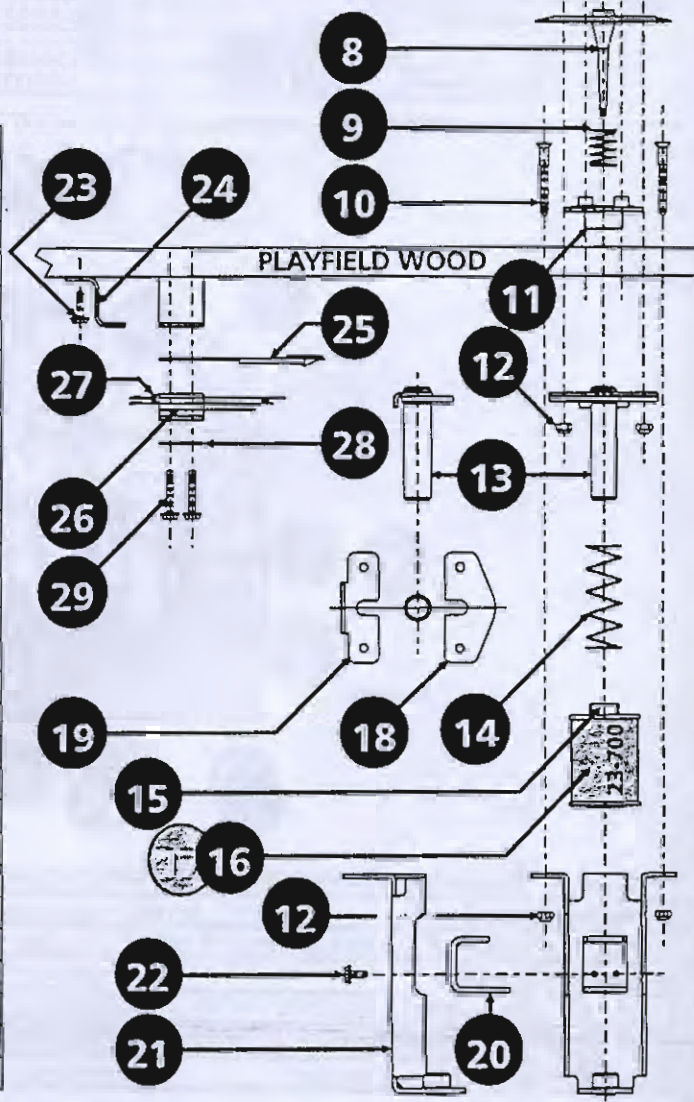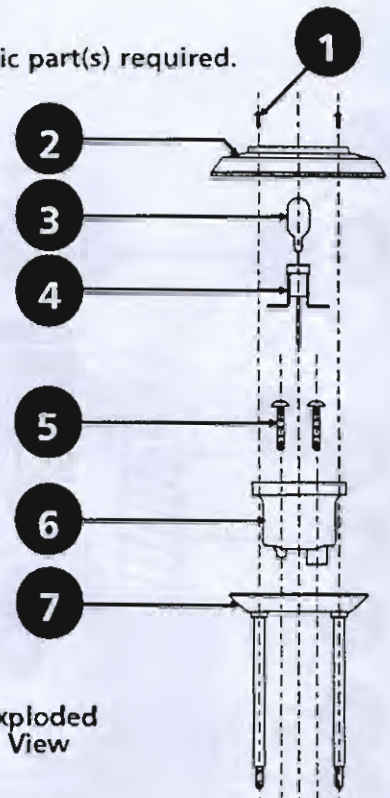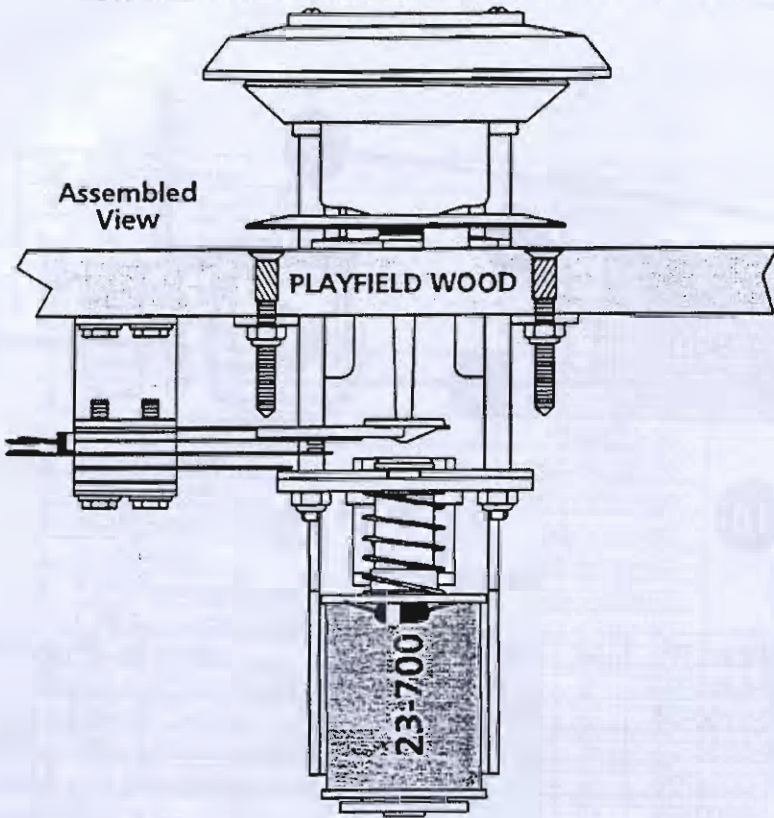
Nº	Part Name (PARENT: 500-5966-00)	SPI Part Nº
1	#4 X 3/4" PH RH (T25) (Qty. 2)	237-5873-00
2 *	Plastic Bumper Cap Cover *	550-5057-XX
3	#555 Wedge Base Bulb	165-5002-00
4	#555 Wedge Base Socket	077-5206-00
5	#5 X 7/8" PH RH (AB) (Qty. 2)	237-5826-00
6	Bumper Body	545-5197-00
7	Ring Assembly	515-5085-00
8	Bumper Skirt	545-5607-00
9	Bumper Skirt Spring	266-5048-00
10	#6-32 X 1-3/16" Spiral Shank (Qty. 3)	237-5957-00
11	Bumper Base	545-5195-00
12	#6-32 Nylon Stop Nut (Qty. 5)	240-5005-00
13	Plunger	530-5348-00
14	Coil Spring	266-5047-00
15	Coil Sleeve	545-5031-00
16	Coil 23-700, incl. Coil Sleeve	090-5022-02
17	Diode 1N4004 (Not Shown)	112-5003-00
18	Fiber Yoke	545-5609-00
19	Metal Yoke	535-7346-00
20	Metal Yoke Stop	535-7347-00
21	Coil Bracket Sub-Assembly	515-5939-00
22	#6-32 X 1/4" HWHTF (SERR) (Qty. 2)	237-5952-00
23	#6 X 1/2" HWH (AB) (Qty. 2)	234-5001-02
24	Switch Bracket	535-7342-00
25	Spoon Switch Actuator	545-5610-01
26	Stack Switch	180-5015-03
27	Diode 1N4001	112-5001-00
28	Switch Plate	535-7344-00
29	#6-32 X 3/4" HWHMS (SERR) (Qty. 2)	237-5958-00

* Note: Item 2, this game the "-XX" should be replaced with -05, Blue.
SEE THE COLOR CHART AT THE END OF THIS CHAPTER FOR ALTERNATE COLORS

Section 4
Chapter 2

Assembly
Drawings

Early Production Turbo Bumper Assemblies
500-5227-02
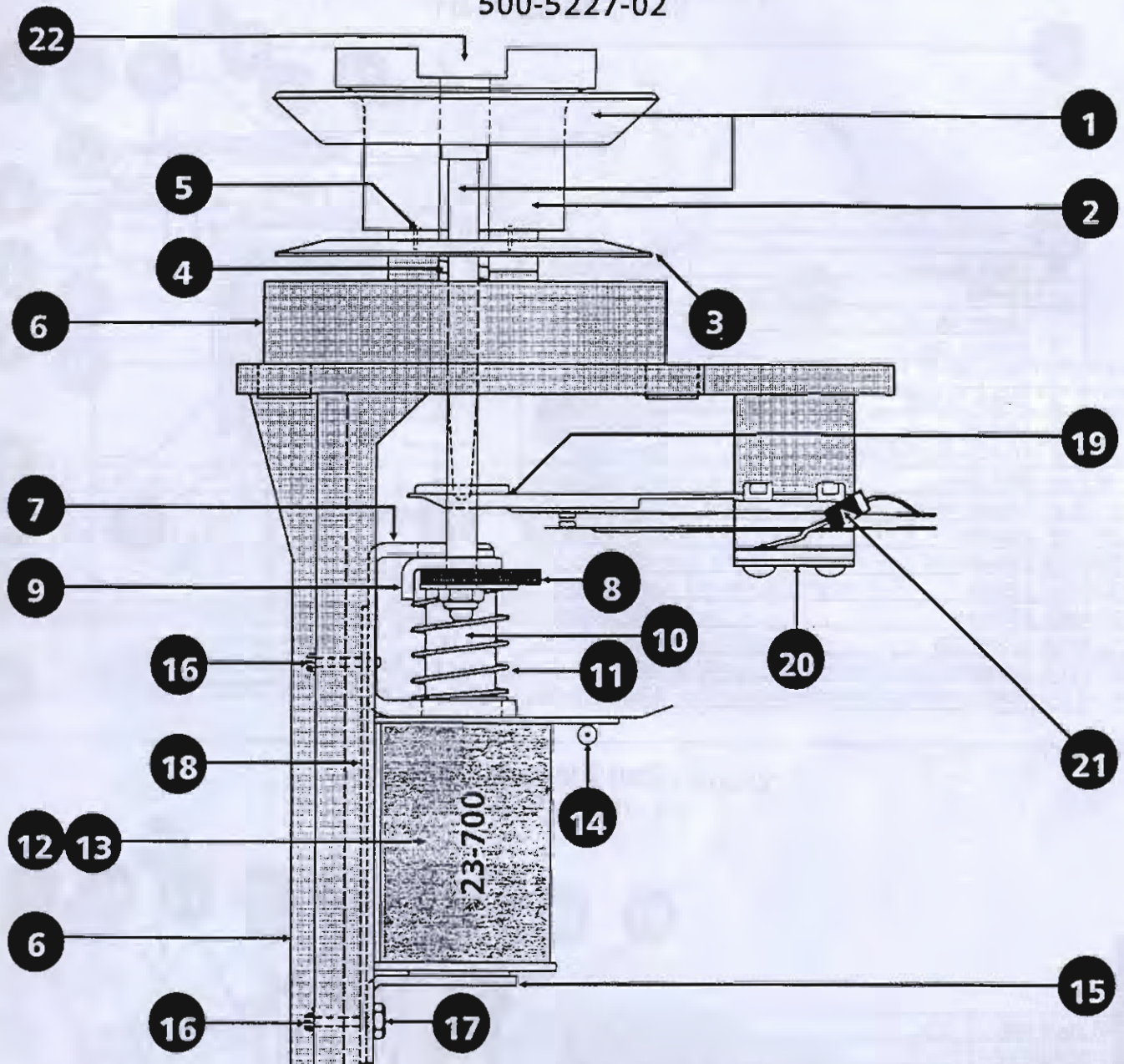
SPECIAL PRODUCTION NOTE:

Early production games used this assembly. Order 500-5966-00 for replacement, if required.

Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Rod & Ring Assembly	515-5085-00	12	Coil 23-700, incl. Coil Sleeve	090-5022-02
2	Bumper Housing	545-5197-00	13	Coil Sleeve	545-5031-00
3	Bumper Skirt	545-5098-00	14	Diode 1N4004	112-5003-00
4	Bumper Skirt Spring	266-5048-00	15	Coil Stop Assembly	515-5088-00
5	#6-32 X 3/4 PPH Screw (Qty. 2)	237-5504-00	16	#6-32 X 1/2 PPH Screw (Qty. 4)	237-5502-00
6	Bumper Body	545-5100-00	17	#6-32 Nyloc Nut (Qty. 2)	240-5005-00
7	Plunger Bracket	535-5277-00	18	Backplate	535-7419-00
8	Fiber Yoke	545-5120-00	19	Spoon Switch	545-5542-00
9	Metal Yoke	535-5877-00	20	Switch	180-5015-02
10	Plunger	530-5062-00	21	Diode 1N4001	112-5001-00
11	Spring	266-5009-00	22	Lamp Socket	077-5205-00

	ASSOCIATED PART(S) NOT INCLUDED WITH THE ABOVE ASSEMBLY (ALSO NOTED IN CHAPTER 1 OF THIS SECTION)		
Nº	Part Name	SPI Part Nº	See the Color Chart at the end of this chapter for alternate colors.
n/a	Plastic Bumper Cap Cover	550-5057-XX	This game the "-XX" should be replaced with -05, Blue.

Vertical Up-Kicker (VUK) Assembly
500-5839-01

Nº	Part Name	SPI Part Nº
1	Switch	180-5116-00
2	Screw (Qty. 2)	237-5806-00
2	Washer (Qty. 2)	244-5001-00
3	Protector	535-6539-00
4	Diode 1N4001	112-5001-00
5	Bracket	535-6607-01
6	Coil 24-940, incl. Coil Sleeve	090-5036-01
7	Coil Sleeve	545-5076-00
8	Diode, 1N4004	112-5003-00
9	Bracket	535-5203-01
10	Bumper Pad	545-5105-00
11	Spring	266-5020-00
12	Plunger	515-5941-01
13	Screw (Qty. 2)	232-5300-00
14	Insulation	545-5431-00
15	Crescent Spring Washer	269-5000-02
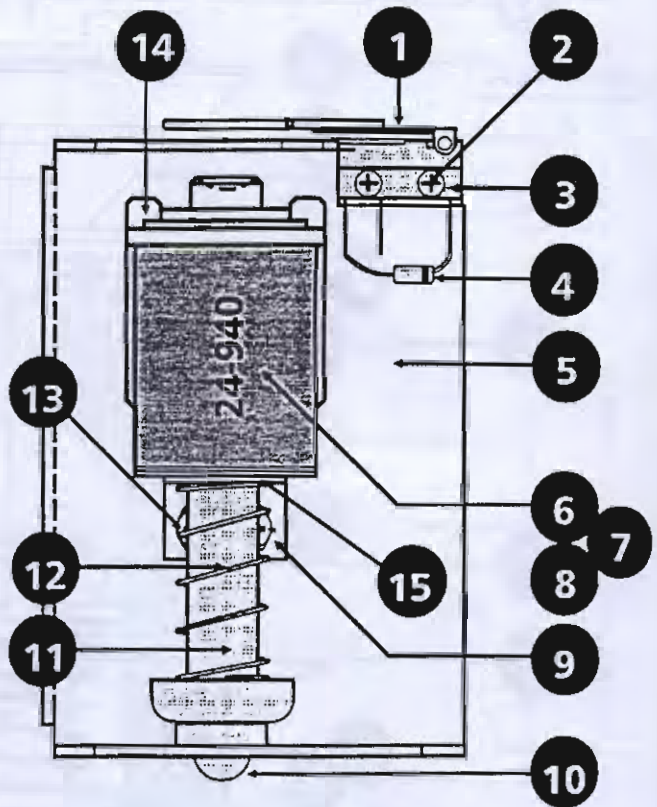
Ball Eject Assembly
500-5664-00

Nº	Part Name	SPI Part Nº
1	Eject Cam Assembly	515-5042-00
2	Coil 24-940, incl. Coil Sleeve	090-5036-01
3	Coil Sleeve	545-5031-00
4	Diode 1N4004	112-5003-00
5	Coil Retainer Bracket	535-5203-01
6	8-32 ¼ SEMS (Qty. 2)	232-5300-04
7	Plunger Spring	266-5000-00
8	Plunger & Link Assembly	515-5338-00
9	Bracket & Stop Assembly	515-5011-00
10	"E" Ring (Qty. 2)	270-5002-00
11	Fulcrum Bracket	535-6446-01
12	Fulcrum Pin	530-5207-00
13	Shim Washer (Qty. 2) (If Required)	242-5013-00
14	Ext. Spring	265-5017-00
15	Spring Plate Assembly	515-5009-00
16	Insulator	545-5431-00
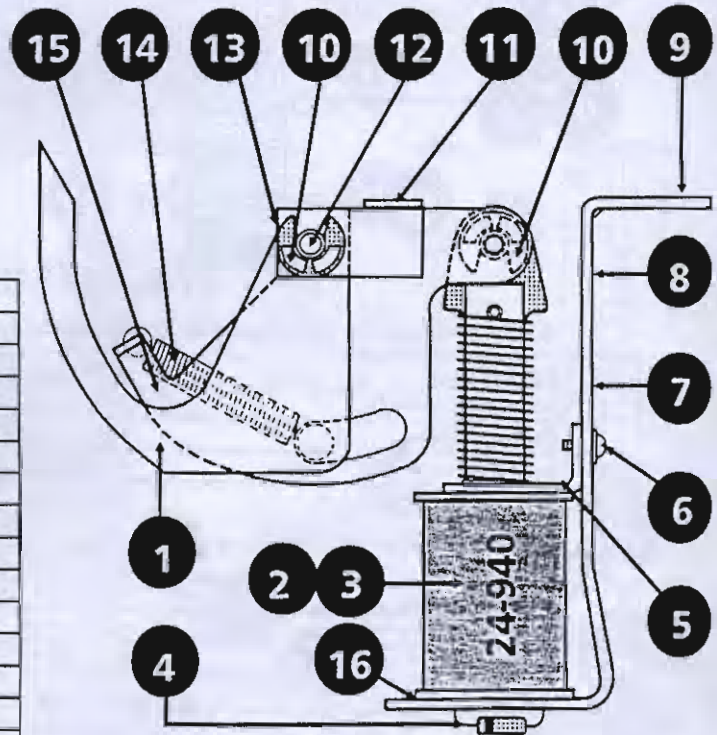
Batcave Exit Kicker Assembly
500-5948-00-38
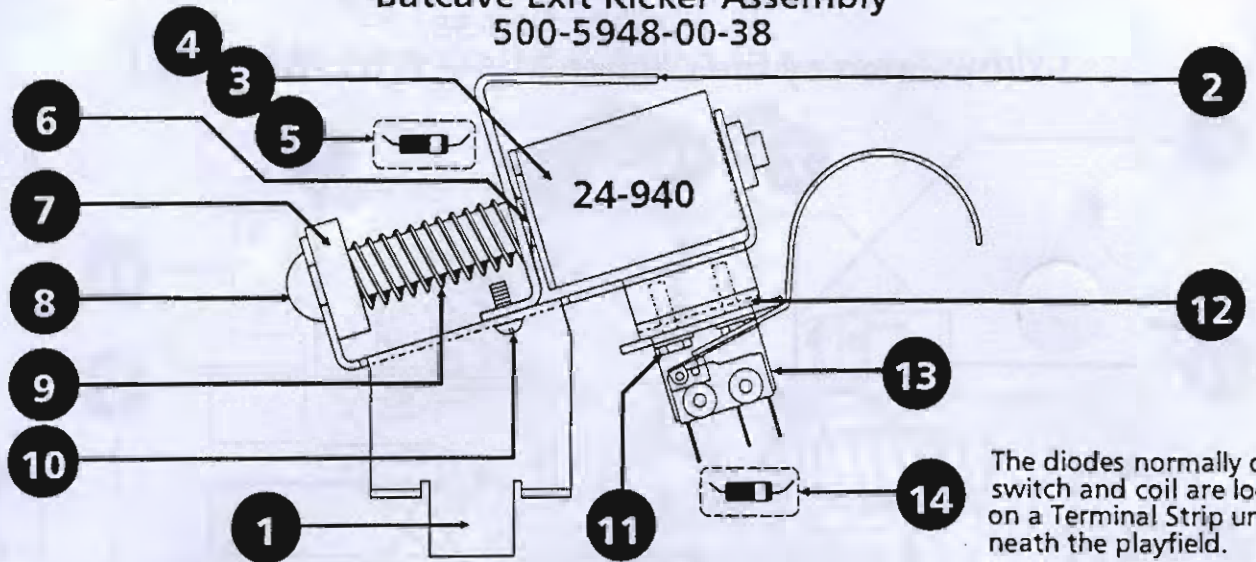
The diodes normally on the switch and coil are located on a Terminal Strip underneath the playfield.

Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Shooter Mounting Bracket	535-7438-00	8	Rubber Bumper (Grommet)	545-5105-00
2	Coil Retainer Rracket	535-7437-00	9	Relay Spring	266-5020-00
3	Coil 24-940, LUG-LESS, incl. Coil Sleeve	090-5051-01	10	#8-32 X 1/4" PPH SEMS (Qty. 2)	232-5300-00
4	Coil Sleeve	545-5031-00	11	#6 X 3/8" HWH TC (Qty. 2)	234-5000-00
5	Diode, 1N4004 *	112-5003-00	12	Shock Pad	545-5640-00
6	Spring Washer, 17/32" I.D. X 3/4" X 1/64"	269-5002-00	13	Micro Switch Assembly	500-5706-01
7	Plunger Assembly	515-5000-02	14**	Diode, 1N4001 **	112-5001-00

* Item 5 is not included with this assy. Diode is located in cabinet.   ** Item 14 is not included with this assy. Diode is located in cabinet.

Batcave Ball Lock Assembly
500-5947-00-38
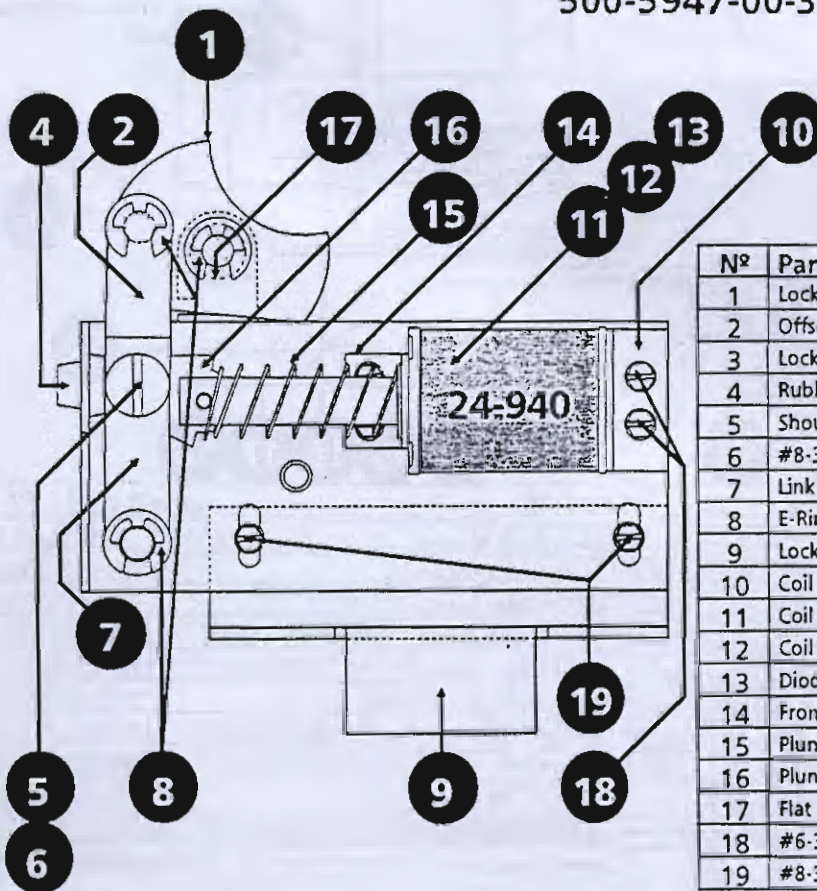
Nº	Part Name	SPI Part Nº
1	Lock Ball Cam Assembly	515-5130-01
2	Offset Link	535-5095-00
3	Lock Ball Bracket Sub-Assembly	515-5132-01
4	Rubber Bumper (Grommet)	280-5002-00
5	Shoulder Screw	530-5064-00
6	#8-32 Elastic Stop Nut	240-5102-00
7	Link	535-5085-00
8	E-Ring (Qty. 3)	270-5002-00
9	Lock Ball Mounting Bracket	535-7247-00
10	Coil Stop Bracket Assembly	515-5088-00
11	Coil 24-940, incl. Coil Sleeve	090-5002-02
12	Coil Sleeve	545-5031-00
13	Diode, 1N4004 (Not Shown)	112-5003-00
14	Front Coil Bracket	535-5203-02
15	Plunger Spring	266-5019-00
16	Plunger Assembly	515-5338-00
17	Flat Washer (.031" THK - .437" O.D. X .255" I.D.)	242-5012-00
18	#6-32 X 1/4" HWH (SERR) (Qty. 4)	237-5952-00
19	#8-32 X 3/8" HWH (SERR) (Qty. 2)	237-5910-01

Batwing Cannon Assembly
515-6321-00-38
(Operated by the Cannon Motor Drive Assembly.)

Top View

Side View

23-800

The diode normally on the switch is located on a Terminal Strip underneath the playfield.
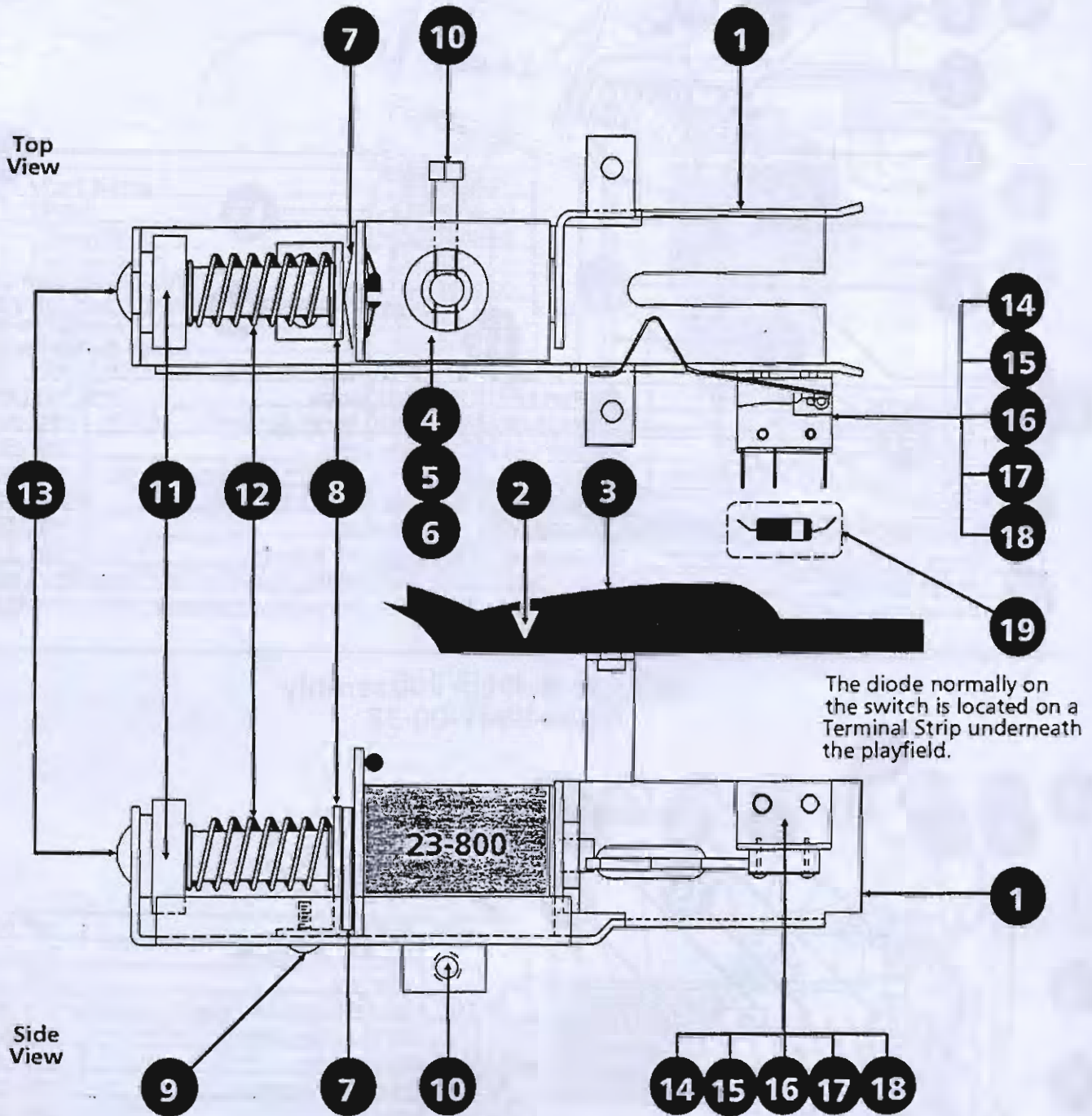
№	Part Name	SPI Part №	№	Part Name	SPI Part №
1	Cannon Frame Bracket	515-6322-00	11	Plunger Assembly	515-5000-02
2	Batwing	545-5632-00	12	Return Spring	266-5020-00
3	#6 X 3/8" HWH SMS (Qty. 2)	234-5000-00	13	Rubber Bumper (Grommet)	545-5105-00
4	Coil 23-800, incl. Coil Sleeve	090-5001-01	14	Micro Switch	180-5057-00
5	Diode, 1N4004	112-5003-00	15	Switch Protect Plate	535-6539-00
6	Coil Sleeve	545-5076-00	16	#2-56 X 3/8" Thread Former (Qty. 2)	237-5938-00
7	Spring Washer	269-5002-00	17	Micro Bracket	535-6173-00
8	Coil Retainer Bracket	535-5203-01	18	#6-32 PHMS (Qty. 2)	232-5209-00
9	#8-32 X 1/4" PHMS SEMS (Qty. 2)	232-5300-00	19 *	Diode, 1N4001 *	112-5001-00
10	#8-32 X 1" HWH MS	237-5890-01			

* Item 19 is not included with this assy. Diode is located in cabinet.

www.multi2net.com

Cannon Motor Drive Assembly
500-6018-00-38
(Used to operate the Batwing Cannon Assembly.)

Top View

Side View
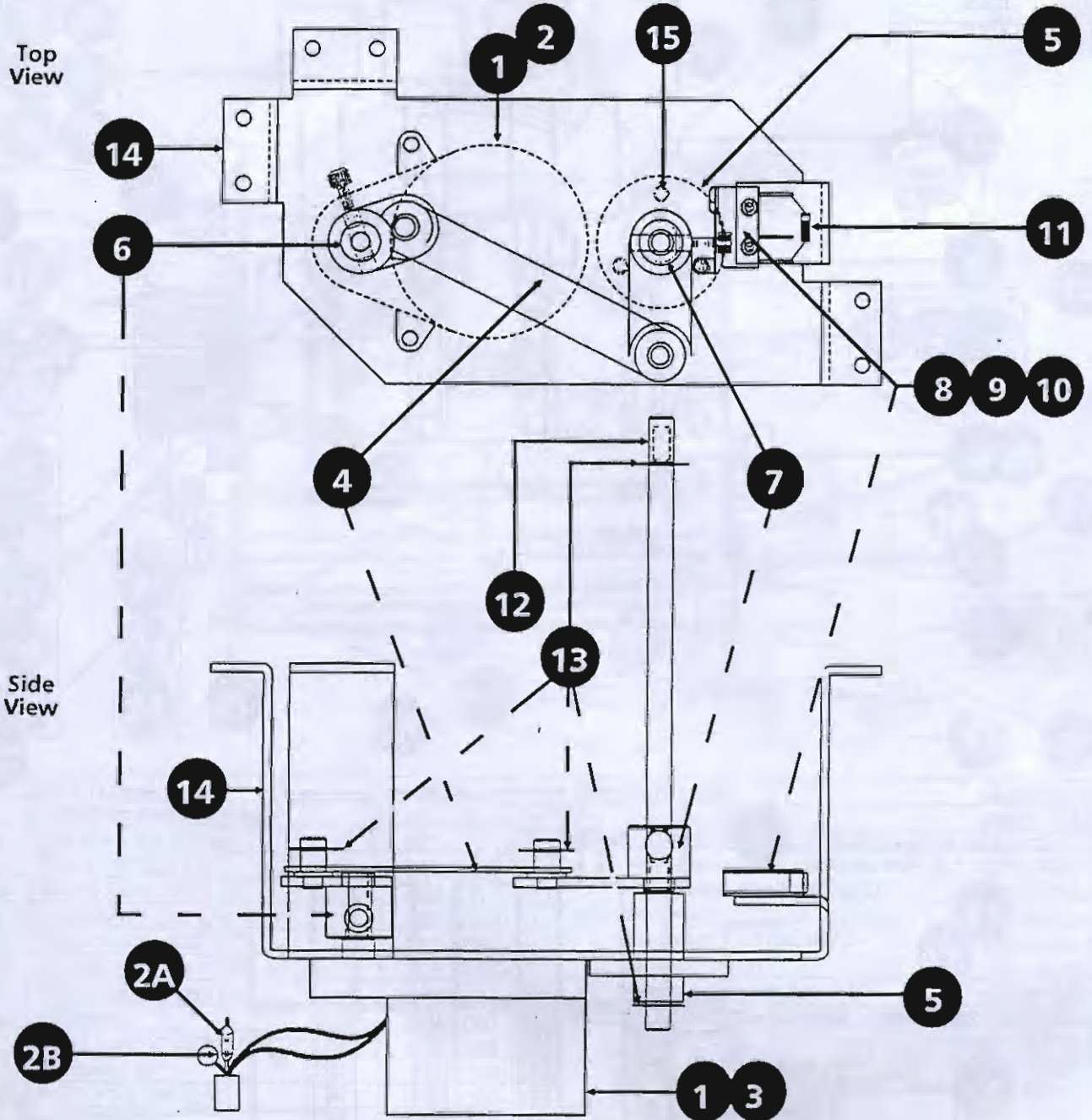
Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Motor Assembly	515-6383-00	7	Cam Link Sub-Assembly (Large)	515-6382-00
2A †	Neon NE-2 Bulb	165-5021-00		ORDERING ABOVE (ITEM 7) SUB-ASSEMBLY PART Nº WILL INCLUDE:	
2B †	Capacitor Tecate .1 MFD 500v Disc	130-5000-00		Cam Link Large	535-7454-00
3	#6-32 X 3/8" PHMS (SEMS) (Qty. 2)	232-5201-02		Hub, Sckt. Hd. Cap Screw, Shoulder Pin	(Same as Item 6)
4	Large & Small Cam Connecting Link	535-7452-00	8	Micro Switch	180-5119-00
5	Bushing	545-5729-00	9	Fiche Paper (Not Shown)	545-5633-00
6	Cam Link Sub-Assembly (Small)	515-6381-00	10	#2-56 X 3/8" Thread Former (Qty. 2)	237-5938-00
	ORDERING ABOVE (ITEM 6) SUB-ASSEMBLY PART Nº WILL INCLUDE:		11	Diode, 1N4001	112-5001-00
	Cam Link Small	535-7453-00	12	Shaft	530-5365-00
	Hub	530-5364-00	13	1/4" E-Ring (Qty. 5)	270-5002-00
	Socket Head Cap Screw	237-5897-00	14	Mounting Bracket	535-7455-00
	Shoulder Pin	530-5366-00			

† Items 2A, Neon Bulb, & 2B, Capacitor, are included with Item 1, Motor Assembly. Items 2A / 2B can be ordered separately, if required. (Operation Note: The bulb is used for spike suppression and the capacitor is used to eliminate line noise.)

4-Bank Drop Target Assembly
500-5799-04
Back & Front Views

Back View

23

1

3

2

6

17

7

9

20 21 22

13

14

18

19

24

Front View

5

See Sec. 4, Chap. 1, Butyrate, Decals & Mylar for Decals.

11

12

27

8

14

4

16

10

24

15

23-700
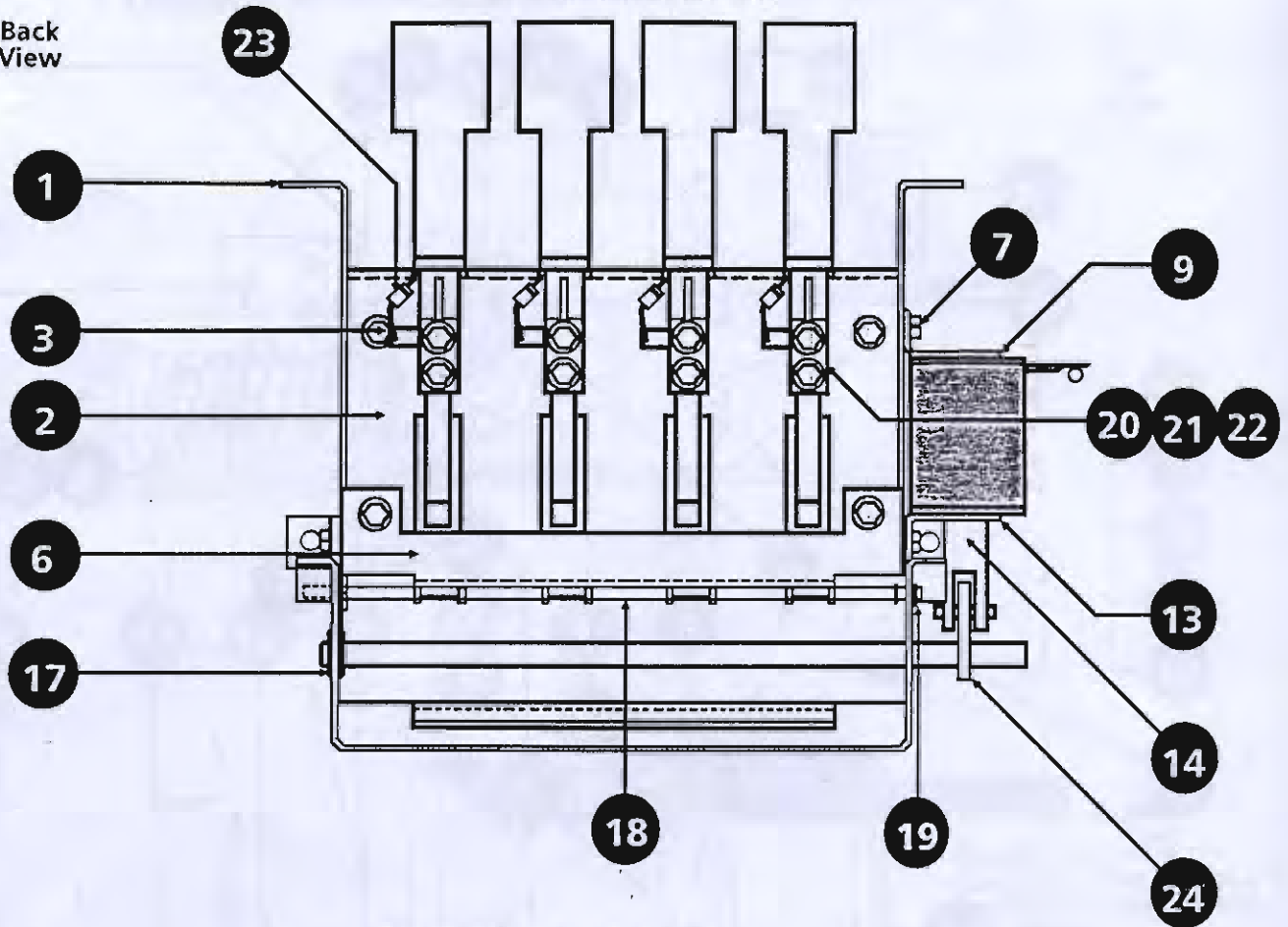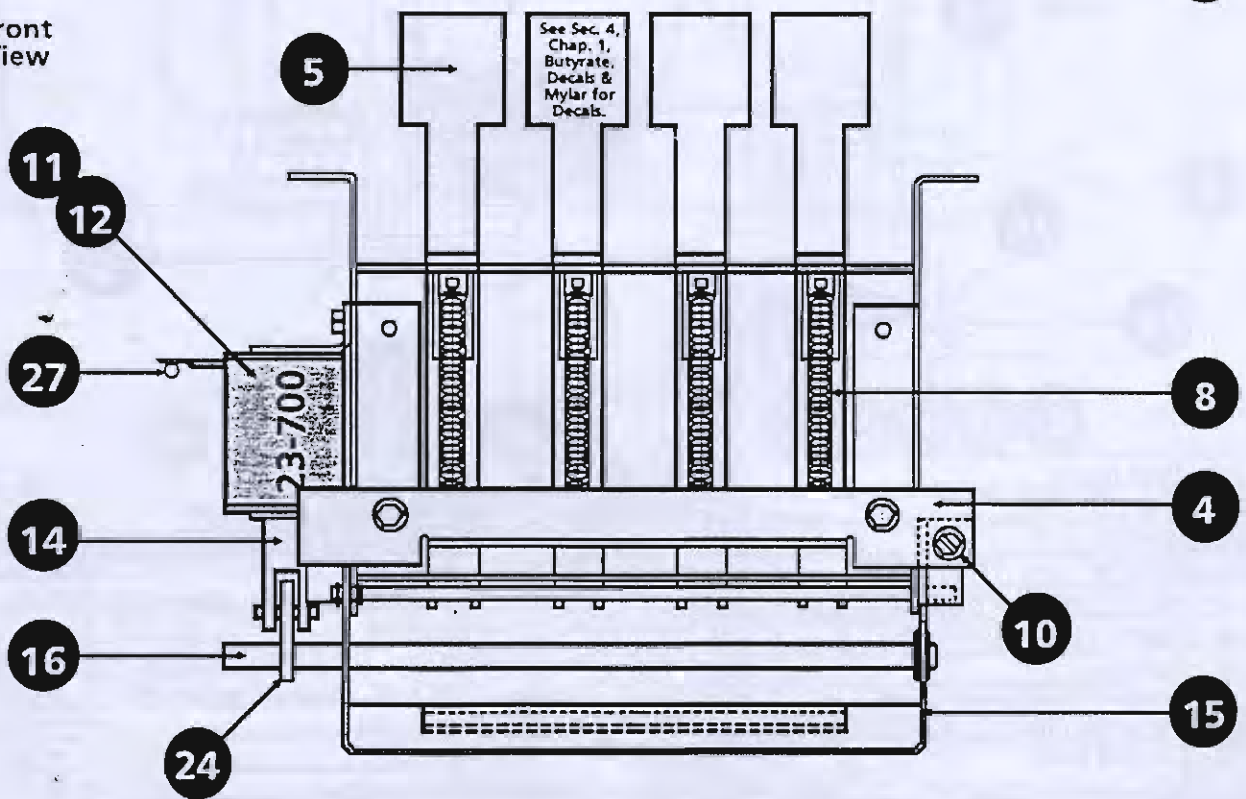
(View the next page for the parts table & notes)

Left/Middle Dual Plastic Ramp Assembly
500-5930-00-38
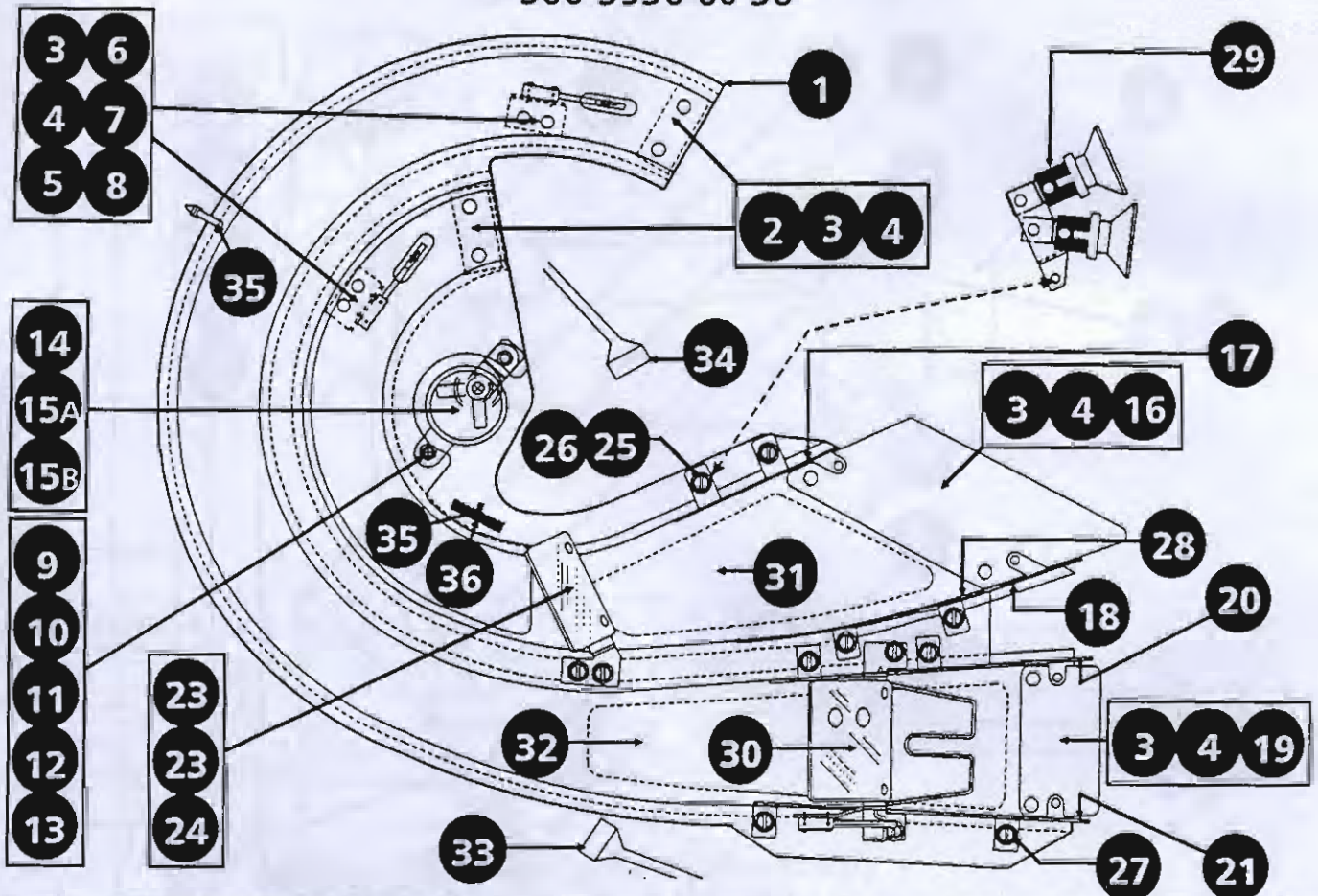
Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Left/Middle Dual Plastic Ramp	545-5581-01	29	Spot-Lite Assembly	500-5818-01
2	Wire Ramp Bracket (Qty. 2)	535-5291-00	ORDERING ABOVE (ITEM 29) ASSEMBLY PART Nº WILL INCLUDE:		
3	Rivet ø 1/8" (Qty. 12)	249-5009-00		Wdge Laydown Sckt. (Notched) (Qty. 2)	077-5026-01
4	Washer ø 5/16" (Qty. 10)	242-5017-00		#555 Wedge Base Bulb (Qty. 2)	165-5002-00
5	Micro Switch (Exit) (Qty. 2)	180-5093-00		Bracket	535-6992-00
6	Diode, 1N4001 (Qty. 2)	112-5001-00		Rivet ø 1/8" X 1/8 (Nickel)	249-5008-00
7	#2-56 X 3/8" HWH TF (Qty. 4)	237-5938-00		Reflector (Qty. 2)	545-5409-01
8	Micro Switch Bracket (Qty. 2)	535-7319-00	30	Rollunder Gate Sub-Assembly	515-6251-00
9	#6 Washer	242-5001-00	ORDERING ABOVE (ITEM 30) SUB-ASSEMBLY PART Nº WILL INCLUDE:		
10	#6-32 X 3/8" PPH SEMS (Qty. 2)	232-5201-00		Butyrate -15	830-5477-15
11	Hex Spacer 3/4"	254-5008-04		Wedge Laydown Socket (Qty.2)	077-5026-00
12	#6-32 X 1/2" PPH SEMS	232-0000-00	LIGHTS on Sign	#555 Wedge Base Bulb (Qty. 2)	165-5002-00
13	#6-32 Stop Nut	240-5005-00		Rubber Light Cover Red	545-5014-02
14	Mini-Mars Lite Cover (Blue)	550-5031-05		Rubber Light Cover Yellow	545-5014-06
15A	Stand-Up, Short Socket	077-5101-00		Rivet ø 1/8" x 3/16 (Qty. 2)	249-5001-00
15B	#89 Bulb	165-5000-89		Washer (Qty. 2)	246-5000-00
16	Middle Ramp Flap	535-7209-00		Gate Mounting Bracket	535-7250-01
17	Middle Ramp Protect Right	535-7213-00		Wire Form Gate	535-7246-02
18	Middle Ramp Protect Left	535-7212-00	GATE	#6 X 3/8" HWH (Qty. 2)	234-5000-00
19	Left Ramp Flap	535-7208-00		Micro Switch (Enter)	180-5087-00
20	Left Ramp Protect Right	535-7207-01		Switch Protect Plate	535-6539-00
21	Left Ramp Protect Left	535-7206-01		Diode, 1N4001	112-5001-00
22	Middle Ramp Sign	535-7376-00		#2-56 X 3/8" HWH TF (Qty. 2)	237-5938-00
23	Butyrate -17	830-5477-17	31	Middle Ramp Decal (Bottom Side)	820-6139-02
24	#6-32 X 3/8" HWH (Qty. 2)	234-5000-00	32	Left Ramp Decal (Bottom Side)	820-6139-01
25	#6-32 X 1/2" HWH MS	237-5924-00	33	Wire Harness #1 (Entrance Switch)	036-5375-04
26	Nylon Stop Nut	240-5005-00	34	Wire Harness #2 (Exit Switches)	036-5375-05
27	#8 HWH Sheet Metal Screw (Qty. 11)	234-5101-05	35	Wire Tie (Qty. 2)	040-5001-00
28	Spectape (Between Item 18 & Ramp)	626-5027-00	36	Tie Holder	040-5002-00
			37	Clear Plastic (Not Shown)	830-5489-03

Right Plastic Ramp Assembly
500-5931-00-38
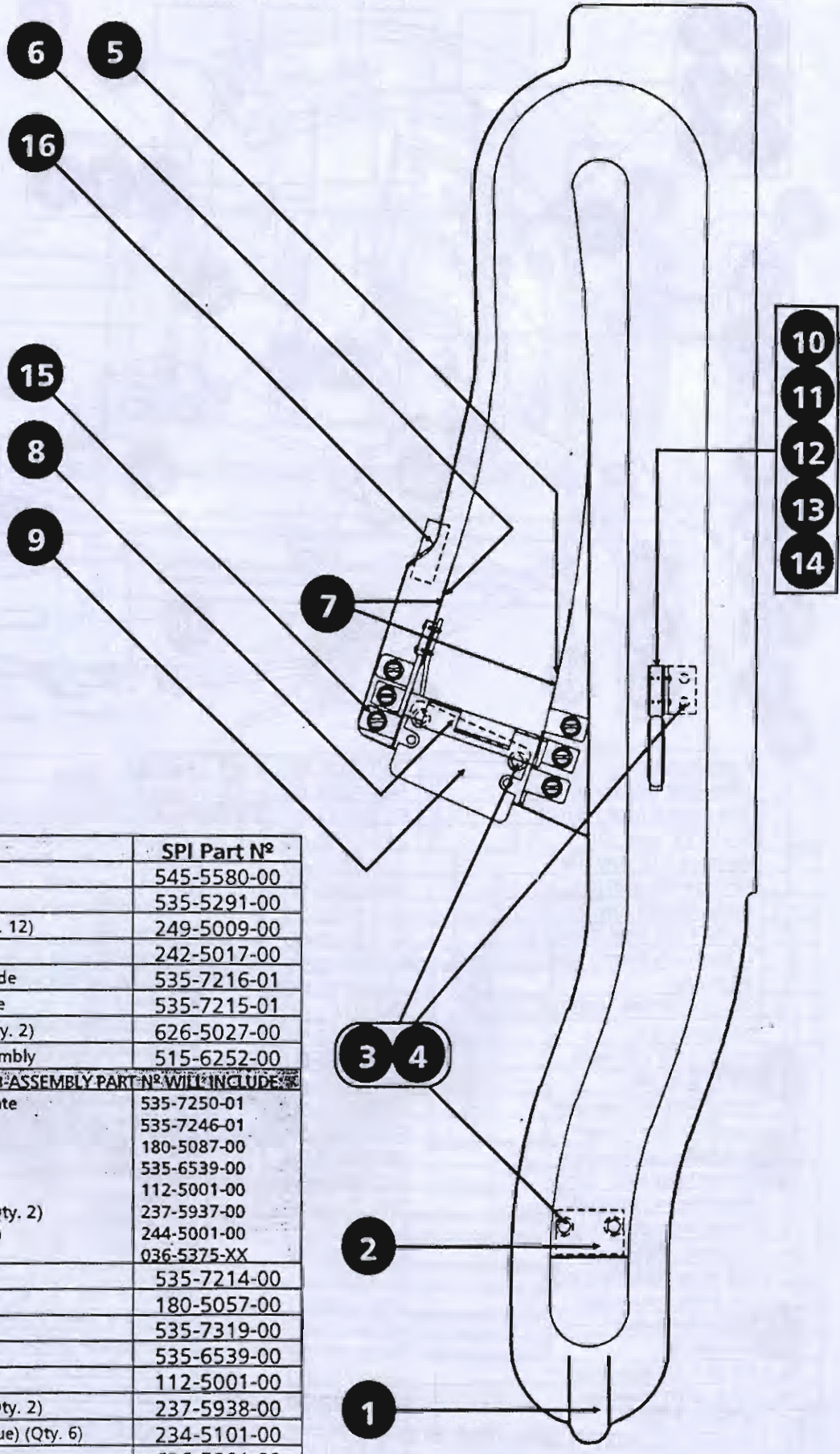
Nº	Part Name	SPI Part Nº
1	Right Plastic Ramp	545-5580-00
2	Ramp Bracket	535-5291-00
3	Rivet ø 1/8" X 9/32" (Qty. 12)	249-5009-00
4	#6 Washer (Qty. 12)	242-5017-00
5	Ramp Protector Right Side	535-7216-01
6	Ramp Protector Left Side	535-7215-01
7	Clear Dbl. Stick Tape (Qty. 2)	626-5027-00
8	Entrance Gate Sub-Assembly	515-6252-00
ORDERING ABOVE (ITEM 8) SUB-ASSEMBLY PART Nº WILL INCLUDE:		
	Right Ramp Entrance Gate	535-7250-01
	Wire Gate	535-7246-01
	Micro Switch (Enter)	180-5087-00
	Switch Protect Plate	535-6539-00
	Diode, 1N4001	112-5001-00
	#2-56 X 1/2" HWH TF (Qty. 2)	237-5937-00
	#2 Lock Washer (Qty. 2)	244-5001-00
	Wire Harness	036-5375-XX
9	Ramp Flap	535-7214-00
10	Micro Switch (Exit)	180-5057-00
11	Switch Bracket	535-7319-00
12	Switch Protect Plate	535-6539-00
13	Diode, 1N4001	112-5001-00
14	#2-56 X 3/8" HWH TF (Qty. 2)	237-5938-00
15	#8 X 1/2" HWH SMS (Blue) (Qty. 6)	234-5101-00
16	Foam Pad	626-5001-00

U-Turn Mini-Ramp Assembly
500-5946-00-38
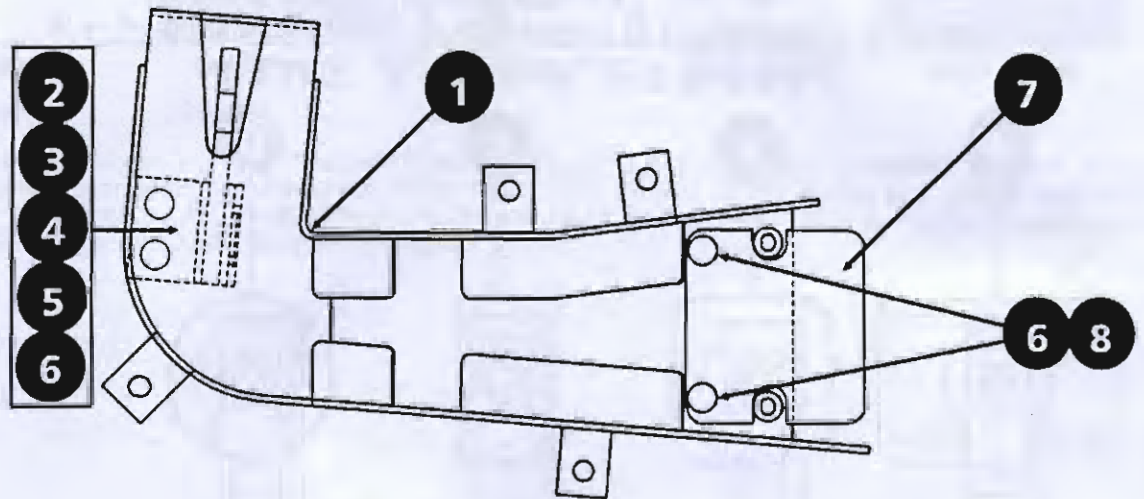
Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Mini-Steel Ramp	515-6220-00	6	Rivet ø 1/8" X 5/32" Lg. (Qty. 4)	249-5009-00
2	Micro Switch (Exit)	180-5093-00	7	Mini Ramp Flap	535-7254-01
3	Micro Switch Bracket	535-7319-00	8	Lock Washer (Qty. 2)	246-5000-00
4	Diode, 1N4001	112-5001-00	9	Wire Harness (Not Shown)	036-5375-08
5	#2-56 X 3/8" HWH (Qty. 2)	237-5938-00			

VUK Wire Ramp Assembly
500-5934-00-38
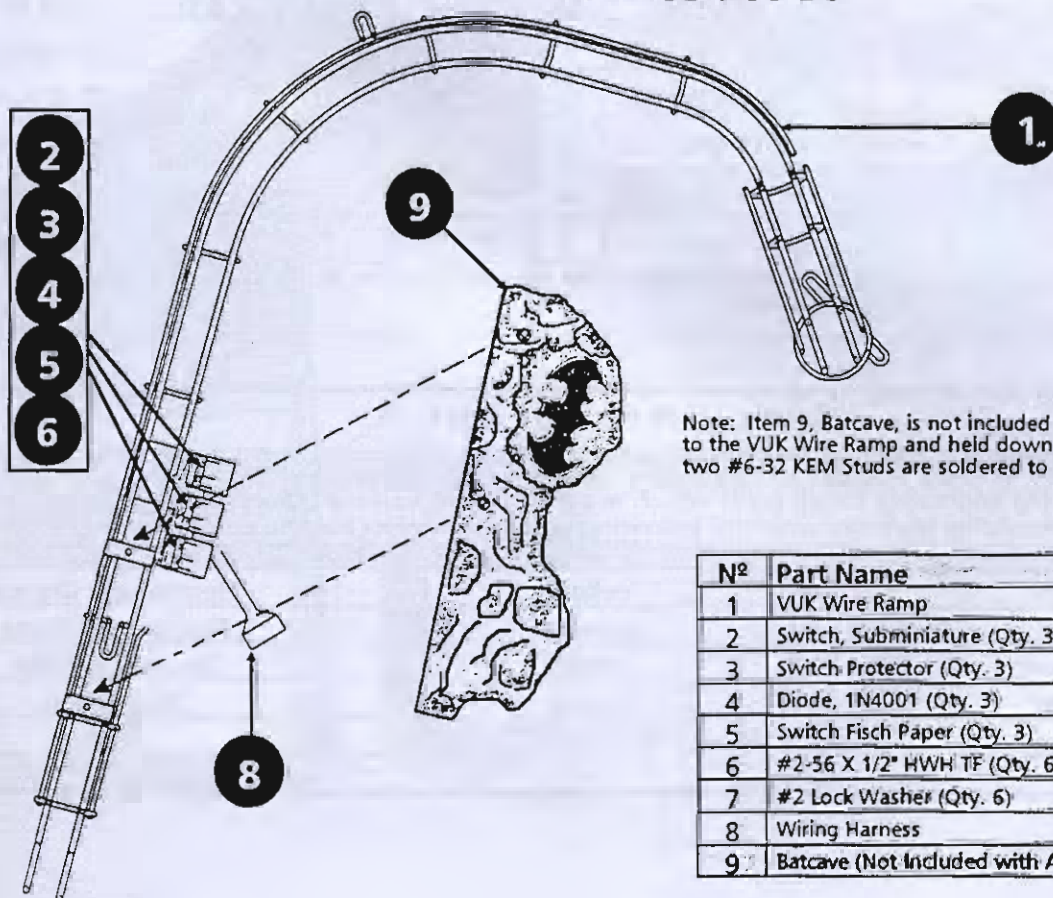
Note: Item 9, Batcave, is not included with this assembly. It is attached to the VUK Wire Ramp and held down with two # 6-32 Stop Nuts. The two #6-32 KEM Studs are soldered to the ramp and cannot be ordered.

Nº	Part Name	SPI Part Nº
1	VUK Wire Ramp	515-6178-00
2	Switch, Subminiature (Qty. 3)	180-5119-00
3	Switch Protector (Qty. 3)	535-6539-00
4	Diode, 1N4001 (Qty. 3)	112-5001-00
5	Switch Fisch Paper (Qty. 3)	545-5633-00
6	#2-56 X 1/2" HWH TF (Qty. 6)	237-5937-00
7	#2 Lock Washer (Qty. 6)	244-5001-00
8	Wiring Harness	036-5375-16
9	Batcave (Not Included with Assembly)	545-5631-00

Stand-Up Target Assemblies: †

500-5321-XX 1" X 1-1/2" Rectangle	500-5232-XX 1" Square	500-5857-XX Narrow Rectangle	500-5835-XX 1" Round	All
(Front View)	(Front View)	(Front View)	(Front View)	(Side View)
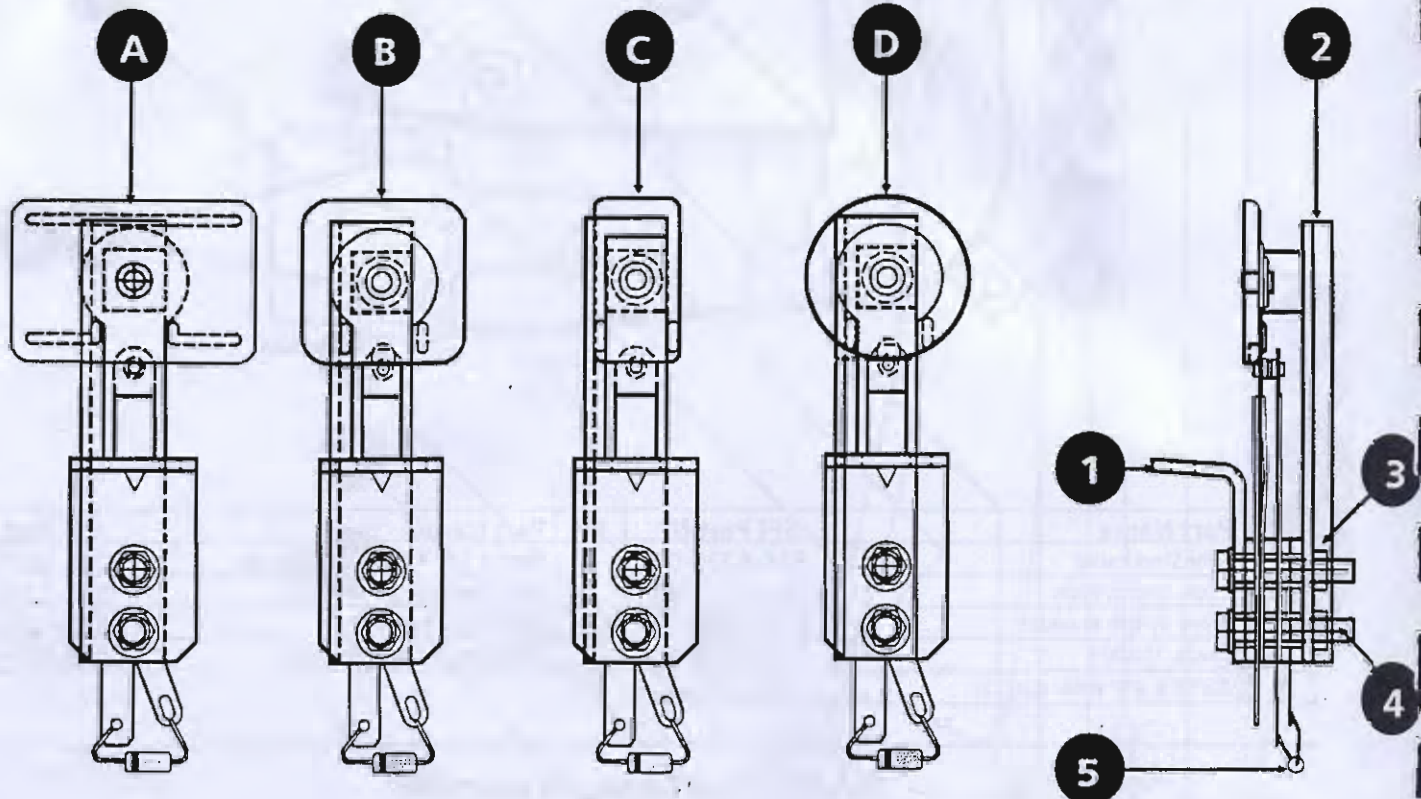
Nº	Switch & Target Name	QTY.	Part Nº	Nº	Part Names for A, B, C & D	Part Nº
A	Switch & Target Assembly 1" X 1½" Rectangle (Flat)	0	515-6027-XX	1	Mounting Bracket	535-6896-00
B	Switch & Target Assembly 1" Square (Flat)	4	515-5162-XX	2	Back Plate	535-6542-00
C	Switch & Target Assembly Narrow Rectangle (Flat)	5	515-5967-XX	3	6-32 Nyloc	240-5010-00
D	Switch & Target Assembly 1" Round	2	515-5966-XX	4	6-32 X ¾ HWH Ser. (Type C)	237-5958-00
				5	Diode 1N4001	112-5001-00

† Items with a Ø quantity are not used in this game. The following are the color breakdowns for items B & C (replace the "-XX"):
B: 4 ea. "-08, White", C: 5 ea. "-11, Flourescent Green".

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	-10:	Flourescent Orange
-02:	Red	-07:	Orange	-11:	Flourescent Green
-03:	Amber	-08:	White	-12:	Flourescent Blue
-04:	Green	-09:	Purple	-13:	Teal Green
-05:	Blue			-14:	Gray

Section 4
Chapter 2

Assembly Drawing

Cabinet
Schematics & Troubleshooting
(The Yellow Pages)

Overview

This section is broken down into five chapters ("Cabinet", "Playfield Switches, Coils & Lamps", "Flippers", "Display" and "Backbox") which provides all schematics and/or component layouts for the wiring and boards used in the game. Theory of Operations and Troubleshooting Tips are also provided for Chapter 2, Playfield Switches, Coils & Lamps (OPTO Adjustments) and Chapter 3, Flippers.

Section 5
Table of Contents

Section 5 | Cabinet

4-Bank Drop Target Assembly
500-5799-04
Side Views

Right Side View

Left Side View

Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Target End Plate (Qty. 2)	535-6162-00	13	Plunger Stop Bracket	515-5088-00
2	Target Frame for 5-Bank	535-6159-05	14	Plunger & Link Assembly	515-5338-00
2	Target Frame for 4-Bank	535-6159-04	15	Target Lift Bracket for 5-Bank	535-6509-05
2	Target Frame for 3-Bank	535-6159-03	15	Target Lift Bracket for 4-Bank	535-6509-04
3	#8-32 X 3/8" HWH (Qty. 6)	237-5879-00	15	Target Lift Bracket for 3-Bank	535-6509-03
4	Spring Mount. Plate for 5-Bank	535-6510-05	16	Target Shaft for 5-Bank	530-5179-05
4	Spring Mount. Plate for 4-Bank	535-6510-04	16	Target Shaft for 4-Bank	530-5179-04
4	Spring Mount. Plate for 3-Bank	535-6510-03	16	Target Shaft for 3-Bank	530-5179-03
5 †	Target (Specify Game) †	545-5048-01	17	E-Ring (¼")	270-5002-00
6	Trgt. Retaining Brkt. for 5-Bank	535-5042-05	18	Pivot Shaft for 5-Bank	530-5180-05
6	Trgt. Retaining Brkt. for 4-Bank	535-5042-04	18	Pivot Shaft for 4-Bank	530-5180-04
6	Trgt. Retaining Brkt. for 3-Bank	535-5042-03	18	Pivot Shaft for 3-Bank	530-5180-03
7	#6-32 X 3/8" HWH MS (Z) T-23 (Qty. 6)	237-5891-00	19	E-Ring (⅛")	270-5000-00
8 †	Target Reset Spring †	265-5003-00	20 †	Switch Assembly †	180-5104-00
9	Coil Support Bracket	535-6154-00	21 †	Switch Protect Plate †	535-5045-00
10	8-32 Nylon Stop Nut	240-5102-00	22 †	#6-32 X 1/2" HWH †	237-5878-00
11	Coil, 23-700 for 5-Bank incl. Coil Sleeve	090-5022-02	23 †	Diode, 1N4001 (on switch) †	112-5001-00
11	Coil, 23-700 for 4-Bank incl. Coil Sleeve	090-5022-02	24	Plunger Link	545-5293-00
11	Coil, 23-800 for 3-Bank incl. Coil Sleeve	090-5001-02	25	Adjustment Bracket	535-6508-00
12	Coil Sleeve	545-5031-00	26	8-32 X 3/8" HWH	237-5890-00
			27	Diode, 1N4004 (on coil)	112-5003-00

† - Note: The table above shows common parts and unique parts for the 3, 4 & 5 Bank Drop Target Assemblies. The shaded areas (X-Bank D.T.) are not used in this game. Qty. is designated by bank size (see Dwg.) (e.g. 1 diode per target, thus if a 4-Bank is ordered, diode Qty. = 4) When ordering any part always reference game name for proper decals (See Section 4, Chapter 2, Butyrate, Decals & Mylar).

Double Stack Wire Ramp Assembly
500-5932-00-38

(The below Ramp Diverter Assembly is used to operate the Bridge Diverter)
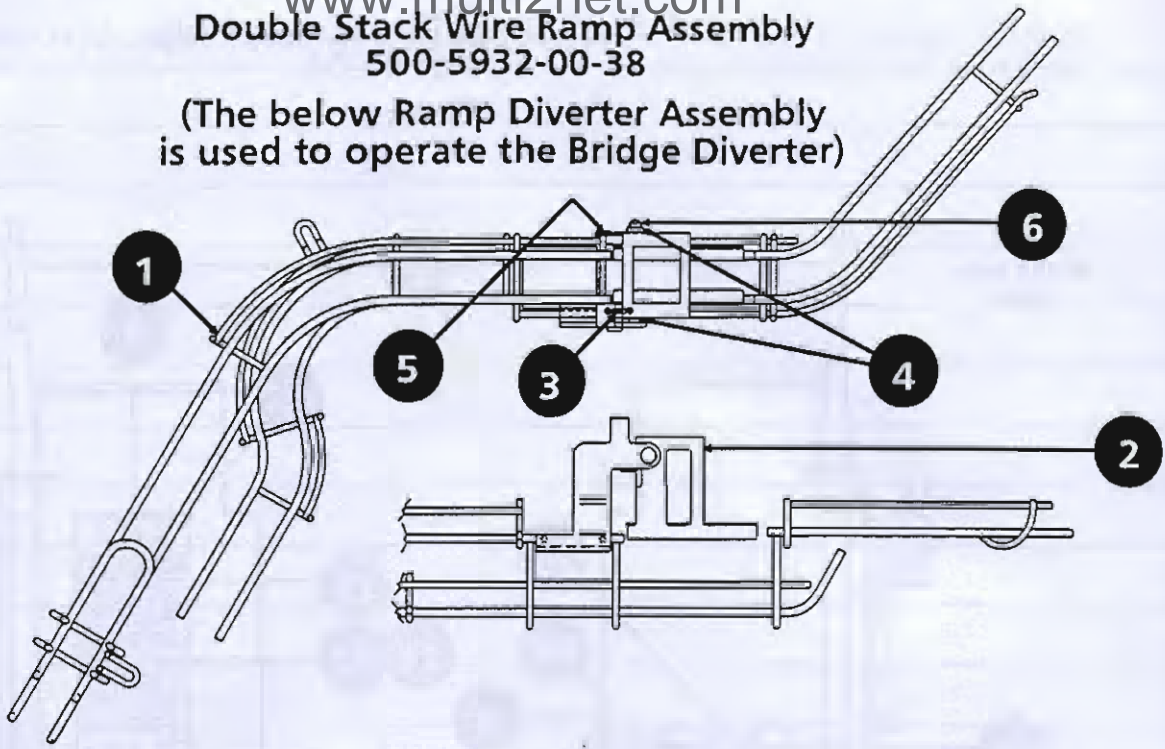
Nº	Part Name	SPI Part Nº	Nº	Part Name	SPI Part Nº
1	Double Stack Wire Ramp Sub-Assembly	515-6231-00	4	1/4" Nyliner (Qty. 2)	545-5050-00
2	Bridge Diverter	535-7200-00	5	1/8" Nyliner	545-5335-00
3	Spring	266-5024-00	6	1/4" E-Ring	270-5002-00

Ramp Diverter Assembly
500-5940-00-38

(Used to operate Bridge Diverter on above Double Stack Wire Ramp)
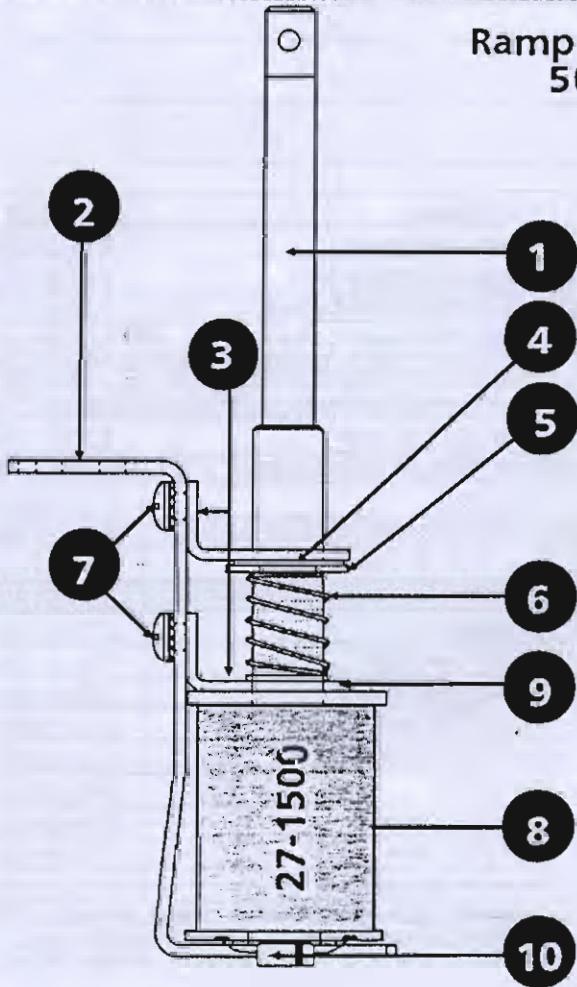
Nº	Part Name	SPI Part Nº
1	Plunger Sub-Assembly	515-6258-00
2	Mounting Bracket Sub-Assembly	515-6118-01
3	Coil Bracket (Qty. 2)	535-5203-01
4	Nyliner, 7/16 Shaft	545-5418-00
5	E-Ring, 7/16 Shaft	270-5005-00
6	Spring	266-5020-00
7	#8-32 X 1/4 PPHW/SEMS (Qty. 4)	232-5300-00
8	Coil 27-1500, incl. Coil Sleeve	090-5004-00
9	Coil Sleeve	545-5411-00
10	Diode, 1N4004	112-5003-00

Power Wiring Diagram

FLIPPER BOARD

PS CN1 11	9VAC
PS CN1 10	9VAC
FLIPPER BD 1 CN2 6	GRY
FLIPPER BD 1 CN2 7	GRY/GRN

UPPER RIGHT FLIPPER POWER — BLK/YEL — CN2 1-2
PLD RIGHT FLIPPER POWER — BLU/YEL — CN2 7-8
PLD LEFT FLIPPER POWER — GRY/YEL — CN2 4-5
RIGHT FLIPPER ENABLE — BRN/VIO — CN1 7, 1
UPPER FLIPPER ENABLE — GRY/VIO — CN1 12
LEFT FLIPPER ENABLE — BRN/GRY — CN1 11, 9
RIGHT FLIPPER EOS
LEFT FLIPPER EOS

PS J3 1-4 GND — BLK

PPB J7 1 / 2 — BLK/WHT — 50VDC
PS J3 8 / 9 — 50VDC

RIGHT FLIPPER SWITCH — BLU/VIO
UPPER RIGHT FLIPPER SWITCH — GRY/VIO
LEFT FLIPPER SWITCH — BLU/GRY

PPB J4 1 +32VL
PPB J4 2 COIL DRIVE BL Q39

KNOCKER — BRN / VIO/GRY

COIN DOOR

PS CN6 3 — 6.3 VAC G.I. — GRN
PPB J5 7 — 6.3 VAC GI — WHT/GRN
CPU CN14 4 — PORTAL SERVICE SWITCHES — BLU
CPU CN14 3 — GRN
CPU CN14 2 — GND — WHT
CPU CN14 1 — MEMORY LOCK SWITCH — BLK/RED

CN8 1 — SWITCH DRIVE 1 — GRN/BRN
CN8 8 — SWITCH DRIVE 8 — GRN/VIO
CN8 9 — SWITCH DRIVE 9 — GRN/GRY

CN10 9 — SWITCH RETURN 1 — WHT/BRN
CN10 8 — SWITCH RETURN 2 — WHT/RED
CN10 7 — SWITCH RETURN 3 — WHT/ORG
CN10 6 — SWITCH RETURN 4 — WHT/YEL
CN10 5 — SWITCH RETURN 5 — WHT/GRN
CN10 3 — SWITCH RETURN 6 — WHT/BLU
CN10 2 — SWITCH RETURN 7 — WHT/VIO
CN10 1 — SWITCH RETURN 8 — WHT/GRY

TO SSFB CN1-4
PLUMB TILT SWITCH
CREDIT BUTTON
EXTRA BALL / LOCK BUTTON
GUN TRIGGER
MEMORY LOCK SWITCH

PORTAL SERVICE BUTTONS

(EUROPEAN USE) 4TH COIN
RIGHT COIN
(U.S. BILL ACCEPTOR) CENTER COIN
LEFT COIN
SLAM TILT

TO METER BOARD
99 WHT — CPU CN14/2 GRND
80 GRY/BLK — CPU CN2/1 DISABLE
82 GRY/RED — KEY
KEY — SIGNAL TO COIN METER
81 GRY/BRN — CPU CN14/9 +18V
69 BLU/WHT — SWITCH DRIVE

AMP CONNECTOR TO $ BILL VALIDATOR
BLK
WHT
DIODE
112-5001-00 1N4001 DIODE
GRN/BRN — SWITCH DRIVE
WHT/GRN — SWITCH RETURN

LINE VOLTAGE (AC)

TO COIN METER

CPU CN6 8 — LAMP RETURN 8 — RED/VIO
CPU CN6 9 — LAMP RETURN 9 — RED/GRY
CPU CN7 9 — LAMP DRIVE 8 — YEL/GRY

SND BD CN4 7 — CONTER 8 — YEL/WHT
SND BD CN4 6 — CONTER 4 — YEL/BLK

SND BD CN3 1 — RED
SND BD CN3 2 — WHT
SND BD CN3 3 — BLK

EXTRA BALL / LOCK BUTTON
CREDIT BUTTON

CABINET SPEAKER MONO

STEREO VOLUME CONTROL 10K

PRINTER BOARD CN1
ORG/BRN
ORG/RED
ORG/BLK
KEY
ORG/YEL
ORG/GRN
ORG/BLU
ORG/VIO
ORG/GRY

CN?
GRY/RED
YEL/VIO
VIO
GRY/BLK
N.C.
N.C.
ORG/GRN
GRY/WHT
BLK

DATA LINES CPU CN2/1-5
PS CN6/10 +5VDC
CPU CN3/7 GRND

Playfield Switches, Coils & Lamps
Schematics & Troubleshooting
(The Yellow Pages)

Overview

This section is broken down into five chapters ("Cabinet", "Playfield Switches, Coils & Lamps", "Flippers", "Display" and "Backbox") which provides all schematics and/or component layouts for the wiring and boards used in the game. Theory of Operations and Troubleshooting Tips are also provided for Chapter 2, Playfield Switches, Coils & Lamps (OPTO Adjustments) and Chapter 3, Flippers.

Section 5
Table of Contents

Sw#	Col	Row	Switch Matrix Description	Part N°
1	1	1	PLUMB BOB TILT (See Section 4, Chapter 1)	
2	1	1	4TH COIN SLOT (On Coin Door)	500-5092-02
3	1	1	START BUTTON (Left of Coin Door)	500-5024-00
4	1	1	RIGHT COIN SLOT (On Coin Door)	180-5024-00
5	1	1	CENTER COIN SLOT OR DBA	500-5024-00
6	1	1	LEFT COIN SLOT (On Coin Door)	180-5024-00
7	1	1	SLAM TILT	180-5022-00
8	1	1	EXTRA BALL BUY-IN GAME BUTTON	180-202?-00
15	2	7	#4 BALL TROUGH VUK OPTO (TRANS) (REC)	520-5124-00 / 520-5125-00
16	2	7	SHOOTER LANE	500-5100-00

Sw#	Col	Row	Switch Matrix Description	Part N°
17	3	1	ROTATE??	180-5104-00
18	3	1	4-BANK DROP TARGET 1 CAVE	180-5104-00
19	3	1	4-BANK DROP TARGET 1 CAVE	180-5104-00
20	3	4	4-BANK DROP TARGET 1 CAVE	180-5104-00
21	3	5	4-BANK DROP TARGET 1 CAVE	180-5024-00
22	3	6	TOP LANE LEFT (BAT)	500-5206-00
23	3	7	TOP LANE MIDDLE (BAT)	180-5022-00
24	3	8	TOP LANE RIGHT (BAT)	180-202?-00
25	4	1	LEFT RAMP STAND-UP LEFT (I)	515-5962-11
26	4	1	LEFT RAMP STAND-UP RIGHT (I)	515-5962-11
27	4	1	VUK STAND-UP (I)	515-5962-31
28	4	1	RIGHT RAMP STAND-UP LEFT (I)	515-5962-11
29	4	1	RIGHT RAMP STAND-UP RIGHT (I)	515-5967-11
30	4	1	BAT CAVE EXIT KICKER	500-5206-00
31	4	4	???	180-5116-00
32	4	5	VUK	500-5142-00
33	5	1	LASER KICK (LEFT OUTLANE)	515-5162-00

Sw#	Col	Row	Switch Matrix Description	Part N°
34	5	2	LEFT RETURN LANE	500-5706-00
35	5	2	LEFT SLINGSHOT	180-5054-00
36	5	4	RIGHT SLINGSHOT	180-5054-00
37	5	5	RIGHT RETURN INSIDE LANE	500-5206-00
38	5	6	RIGHT RETURN OUTSIDE LANE	500-5206-00
39	5	7	RIGHT OUTLANE	500-5206-00
40	5	7	U-TURN MINI-RAMP	180-5093-00
41	6	1	TOP EJECT	500-5707-00
42	6	3	TOP GOOD HEADS STAND-UP LEFT (I)	180-5022-01
43	6	3	TOP BAD HEADS STAND-UP RIGHT (I)	515-5162-08
44	6	4	BATWING CANNON LOADED (On Asm)	180-5052-00
45	6	4	BATWING CANNON SAFETY (On Asm)	515-5962-31
46	6	5	BATWING CANNON HOME	180-5119-00
47	6	6	LEFT ORBIT	500-5206-00
48	6	6	RIGHT ORBIT	500-5206-00
49	6	6	GUN TRIGGER	180-5111-00
50	7	1	RIGHT GOOD HEADS STAND-UP TOP	515-5162-00

Sw#	Col	Row	Switch Matrix Description	Part N°
51	7	3	RIGHT GOOD HEADS STAND-UP BOTTOM	515-5162-08
52	7	3	LEFT RAMP ENTER (On Ramp)	180-5054-00
53	7	3	MIDDLE RAMP EXIT (On Ramp)	180-5054-00
54	7	3	LEFT RAMP EXIT (On Ramp)	180-5023-00
55	7	3	RIGHT RAMP ENTER (On Ramp)	180-5023-00
56	7	3	RIGHT RAMP EXIT (On Ramp)	180-5092-00
57	7	3	LEFT TURBO BUMPER	180-5092-00
58	8	3	BOTTOM TURBO BUMPER	180-5015-01
59	8	3	RIGHT TURBO BUMPER	180-5015-01
60	8	3	LOCK #3 (TOP) (On Ramp)	180-5015-01
61	8	3	LOCK #2 (MIDDLE) (On Ramp)	180-5119-00
62	8	3	LOCK #1 (BOTTOM) (On Ramp)	180-5119-00
63	8	3	*LOWER LEFT FLIPPER	180-5044-01
64	8	3	*UPPER & LOWER RIGHT FLIPPER SWITCH STACK	180-5151-00

CPU BOARD

CN8
- 2 — SWITCH DRIVE 2 — GRN - RED
- 3 — SWITCH DRIVE 3 — GRN - ORG
- 4 — SWITCH DRIVE 4 — GRN - YEL
- 5 — SWITCH DRIVE 5 — GRN - BLK
- 7 — SWITCH DRIVE 6 — GRN - BLU
- 8 — SWITCH DRIVE 7 — GRN - VIO
- 9 — SWITCH DRIVE 8 — GRN - GRY

CN10
- 9 — SWITCH RETURN 1 — WHT - BRN
- 8 — SWITCH RETURN 2 — WHT - RED
- 7 — SWITCH RETURN 3 — WHT - ORN
- 6 — SWITCH RETURN 4 — WHT - YEL
- 5 — SWITCH RETURN 5 — WHT - GRN
- 4 — SWITCH RETURN 6 — WHT - BLU
- 2 — SWITCH RETURN 7 — WHT - VIO
- 1 — SWITCH RETURN 8 — WHT - GRY

Switch matrix grid: SW9–SW16, SW17–SW24, SW25–SW32, SW33–SW40, SW41–SW48, SW49–SW56, SW57–SW64.

Playfield Coil / Flashlamp Wiring Diagram

Section 5
Chapter 2

Playfield Switches, Coils & Lamps
Schematics & Troubleshooting

Playfield Special Coil Diagram

POWER SUPPLY

CN 3

RED

RIGHT TURBO BUMPER 23-700

*l*19

BOTTOM TURBO BUMPER 23-700

*l*18

LEFT SLINGSHOT 23-800

*l*20

LEFT TURBO BUMPER 23-700

*l*17

RIGHT SLINGSHOT 23-800

*l*21

LASER KICK 23-800

*l*22

50V PPB J7-3 VIO/YEL

BLU/BLK

TIP 36C

Q1

CN 19

3 DRIVE 19Q8
4 DRIVE 18Q9
6 DRIVE 20Q10
7 DRIVE 17Q11
8 DRIVE 21Q12
9 DRIVE 22Q13

BLU-ORG
BLU-RED
BLU-YEL
BLU-BRN
BLU-GRN
WHT
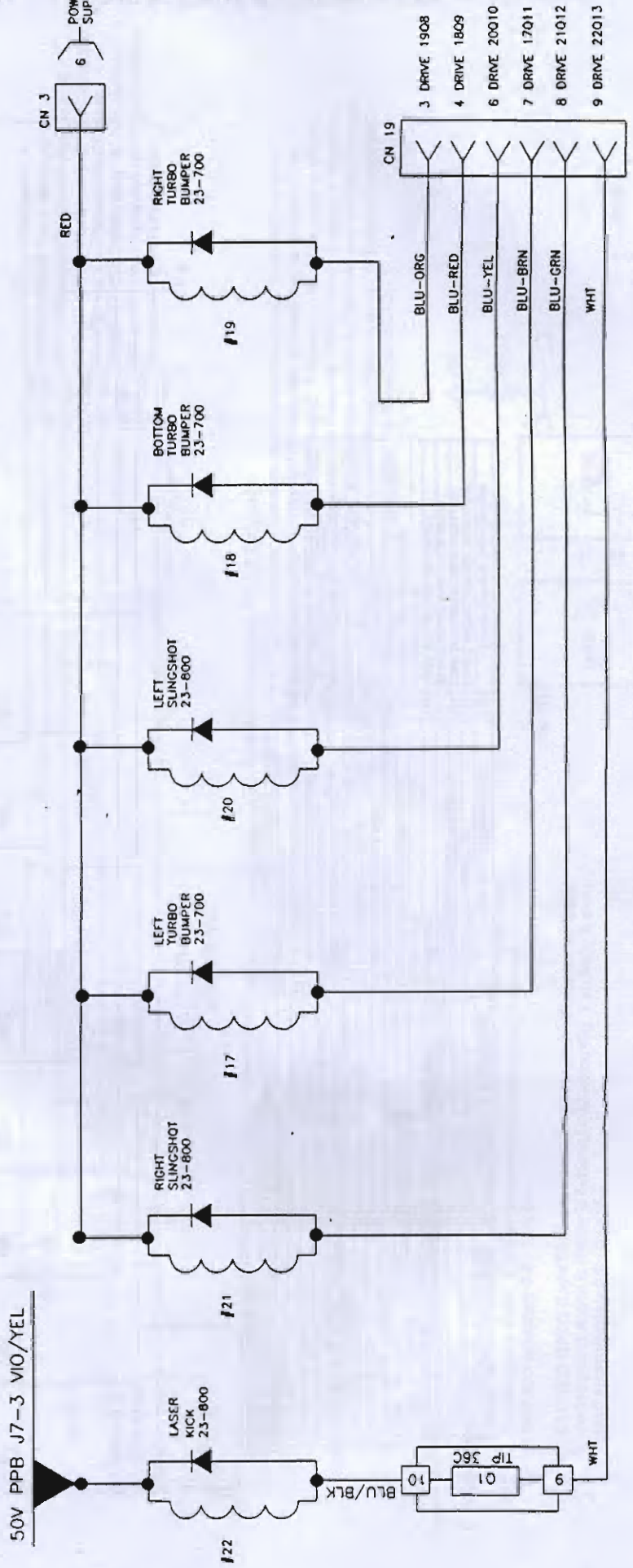
Playfield Lamp Wiring Diagram

#	Lamp Matrix Description
1	ROOFTOP CHASE (GRID)
2	?????? (GRID)
3	FACE TWO-FACE (GRID)
4	CRIME SPREE (GRID)
5	BRAIN DRAIN (GRID)
6	SAFE TRAP (GRID)
7	LITE EXTRA BALL (GRID)
8	FOREVER (GRID)
9	TOP LANE (BAT) LEFT
10	TOP LANE BALL (MIDDLE)
11	TOP LANE (BAT) (RIGHT)
12	LEFT RAMP LEFT (2)
13	LEFT RAMP RIGHT (2)
14	YUK (2)
15	RIGHT RAMP (2)
16	RIGHT RAMP (2)
17	RIDDLER'S THRONE (GRID)

#	Lamp Matrix Description
18	4-BANK DROP TARGET (CAVE)
19	4-BANK DROP TARGET (CAVE)
20	4-BANK DROP TARGET (CAVE)
21	4-BANK DROP TARGET (CAVE)
22	ALL BAT SIGNALS
23	GOOD HEADS MATCHED
24	BAD HEADS MATCHED
25	MR. E (YUK)
26	BAT SIGNAL (LEFT ORBIT)
27	BAT SIGNAL (LEFT RAMP)
28	BAT SIGNAL (MIDDLE RAMP)
29	BAT SIGNAL (U-TURN MINI-RAMP)
30	BAT SIGNAL (RIGHT RAMP)
31	BAT SIGNAL (RIGHT ORBIT)
32	BAT SIGNAL (YUK)
33	SPOT-LITE MID RAMP LEFT

#	Lamp Matrix Description
34	SPOT-LITE MID RAMP RIGHT
35	SUPER JACKPOT (U-TURN MINI-RAMP)
36	NOT USED
37	NOT USED
38	NOT USED
39	LEFT RETURN LANE (BAT SIGNAL X2)
40	LEFT OUTLANE SPECIAL
41	TOP GOOD HEADS (TOP 2 BANK)
42	TOP BAD HEADS (TOP 2 BANK)
43	RIGHT GOOD HEADS (RIGHT 2 BANK)
44	RIGHT BAD HEADS (RIGHT 2 BANK)
45	LASER KICK (LEFT OUTLANE)
46	RIGHT RETURN INSIDE (2 BATARANGS)
47	RIGHT RETURN OUTSIDE (DOUBLE BATWING)
48	RIGHT OUTLANE SPECIAL
49	ARM BATWING (LEFT RAMP ENTER LEFT)
50	JACKPOT (LEFT RAMP ENTER RIGHT)

#	Lamp Matrix Description
51	DOUBLE JACKPOT (MIDDLE RAMP ENTER)
52	CRIME SPREE (RIGHT RAMP ENTER LEFT)
53	JACKPOT (RIGHT RAMP ENTER RIGHT)
54	EXTRA BALL (U-TURN MINI-RAMP)
55	LOCK ARROW (YUK)
56	GOTHAM EVENT (RIGHT ORBIT)
57	LEFT TURBO BUMPER
58	BOTTOM TURBO BUMPER
59	RIGHT TURBO BUMPER
60	NOT USED
61	BATWING CANNON (LEFT SLINGSHOT)
62	THE BAT LIVES (LOWER FLIPPERS)
63	EXTRA BALL BUY-IN (LEAGUE BUTTON (CABINET)
64	START BUTTON (CABINET)

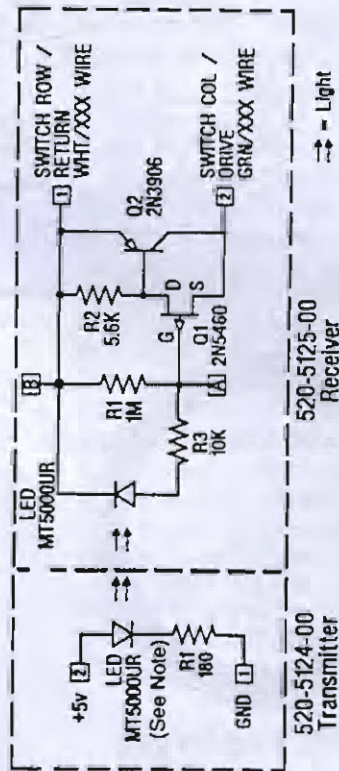# Trough Up-Kicker OPTO Theory of Operation and Schematic

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 (BLOCKED) R1 bleeds the gate voltage off of Q1 allowing it to conduct, switching Q2 on, which acts as a CLOSED SWITCH.

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

LED MT5000UR

520-5124-00 Transmitter

520-5125-00 Receiver

↑↑ = Light

SWITCH ROW / RETURN WHT/XXX WIRE

SWITCH COL / DRIVE GRN/XXX WIRE

Q2 2N3906

Q1 2N5460

R1 1M

R2 5.6K

R3 10K

R1 180

+5v

GND

Note: The RADIO SHACK part number for the LED MT5000UR is 276-087.

Troubleshooting Continued

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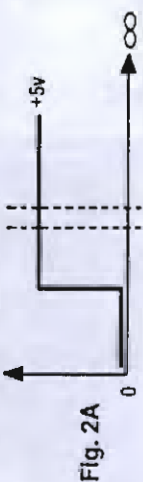
A. **OPEN OPTO** (Light Falling on LED) = SWITCH OPEN. Place Scope lead at Pin-1 of OPTO Rec. Bd. with Scope Grounded (See Fig. 1). The Scope should display a STEADY +5v as shown in Fig. 2A, Wave Form Diagram.

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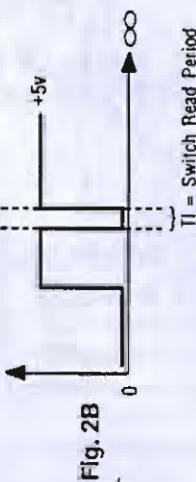
B. **CLOSED OPTO** (Light Blocked) = SWITCH CLOSED. Place Scope lead at Pin-1 of OPTO Rec. Bd. with Scope Grounded (See Fig. 1). The Scope should display a PULSE STREAM indicating Q2 has switched "On" as shown in Fig. 2B, Wave Form Diagram. This is your Switch Drive Pulse.

Fig. 2B

T1 = Switch Read Period

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 Ground. Connect a +5v DC source to Pin-1 of the Transmitter and GND to Pin-2. Align with the Receiver OPTO approximately 3" distance. Using your Volt-Meter or an Oscilloscope, monitor Pin-1 while BLOCKING and UN-BLOCKING the BEAM from the Transmitter. The output will be approximately +5v DC when the BEAM is not BLOCKED and approximately 0 volts when the BEAM is BLOCKED.
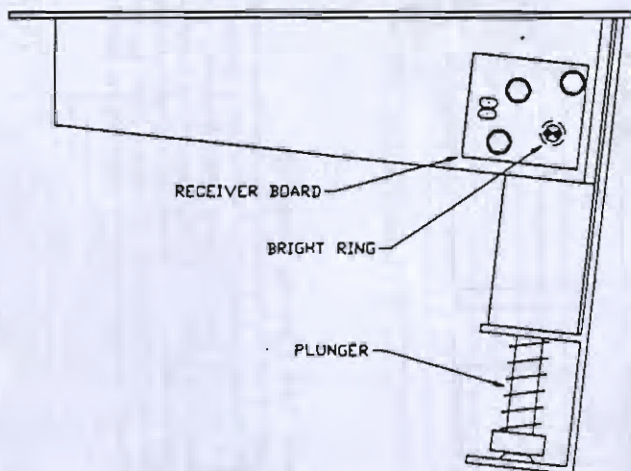
Fig. 3

+5v

560Ω

OPTO Rec.

OPTO Trans.

+5v

GND

OPEN

Troubleshooting

(The following tests indicate normal operating conditions)

1. Volt Meter Test:

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.

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 *"RED RING"* through the back of the Receiver Board around the Receiver LED. 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.

VIEW FACING TROUGH
(PLAYFIELD IN SERVICE POSITION #1)

SECTIONAL VIEW FROM RIGHT

RECEIVER BOARD

BRIGHT RING

PLUNGER

LIGHT PATH (NOTE ALIGNMENT)

PINBALL

TRANSMITTER

RECEIVER
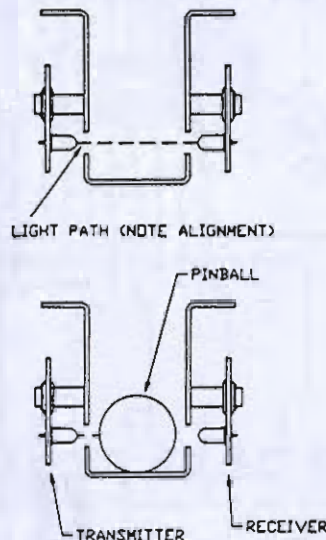
LIFT PLUNGER TO CHECK SWITCH AS SHOWN

PLUNGER BLOCKS BEAM
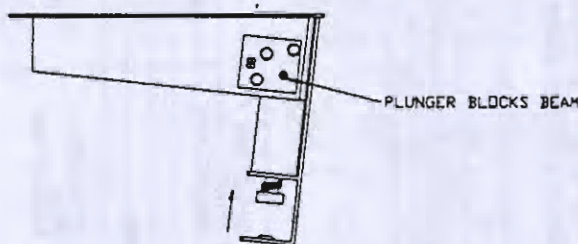
NOTE: If replacement of L.E.D. is required, insure that it is mounted correctly before and after soldering. See example below:
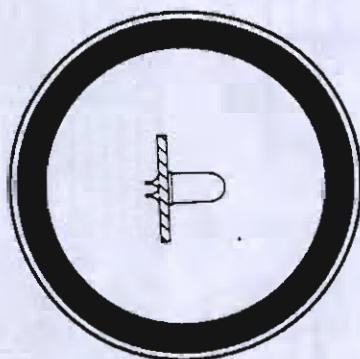
CORRECT POSITION
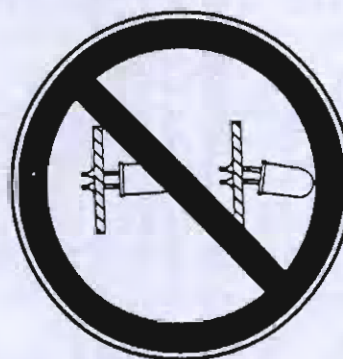
INCORRECT POSITION

Flippers
Schematics & Troubleshooting
(The Yellow Pages)

Overview

This section is broken down into five chapters ("Cabinet", "Playfield Switches, Coils & Lamps", "Flippers", "Display" and "Backbox") which provides all schematics and/or component layouts for the wiring and boards used in the game. Theory of Operations and Troubleshooting Tips are also provided for Chapter 2, Playfield Switches, Coils & Lamps (OPTO Adjustments) and Chapter 3, Flippers.

Section 5
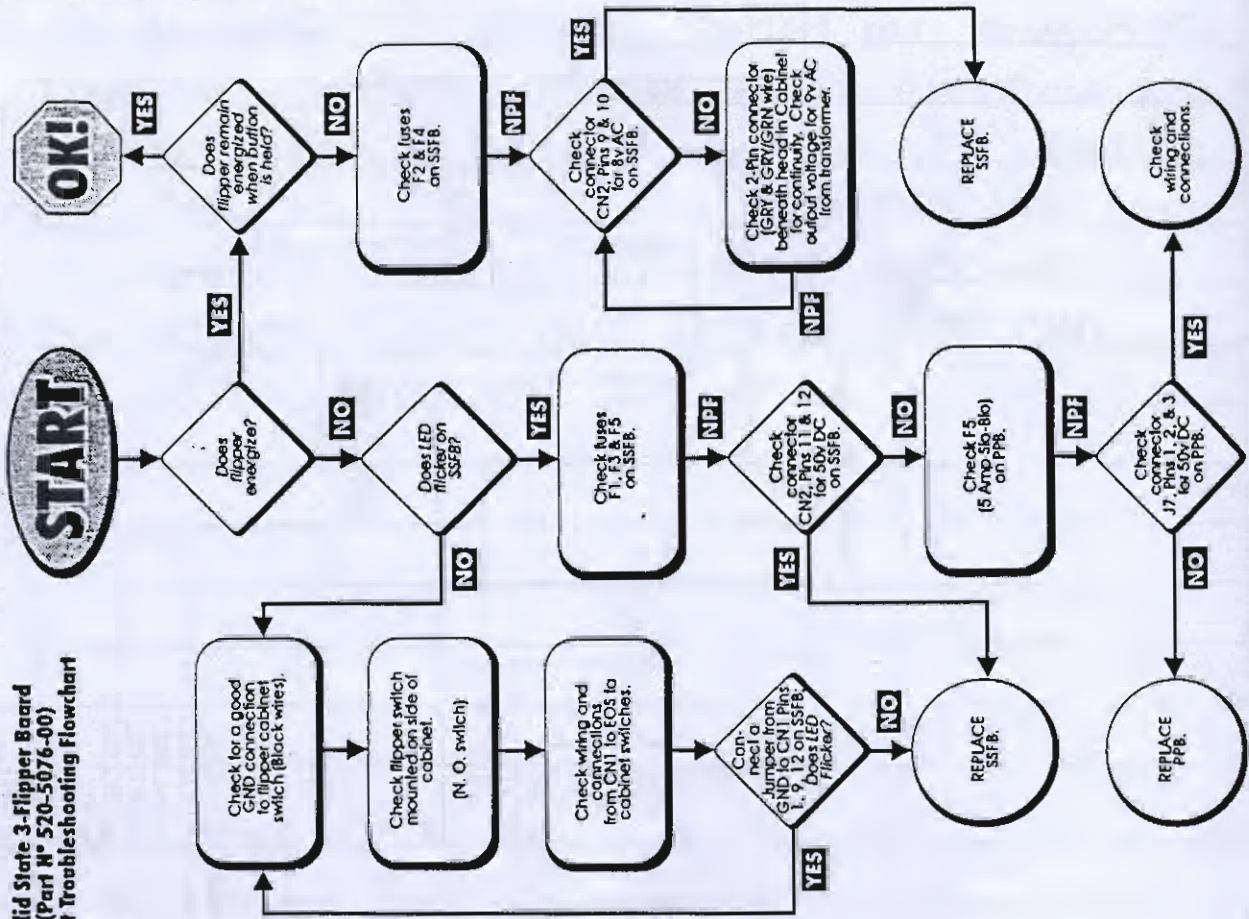## Table of Contents

Schematics /Troubleshooting Flippers Notes

DRIVERS CAN BE TESTED BY PULLING SWITCH IN COIN DOOR AND CREATING A SHORT CIRCUIT ACROSS THE BINDINGS FOR A SPLIT SECOND. THE SWITCH IN THE DOOR ACTIVATES THE 50v DC. YOU CAN CROSSREFER THE DRIVER ON THE PPB WITH PAGE 100. SEC 5 CHAP2. SELF DIAGNOSTIC INFORMS OF WHAT ISN'T WORKING AND P100 SHOWS THE OTHER DRIVER ON THE CPU.

Page 106

Section 5
Chapter 3

Flippers
Schematics & Troubleshooting

Section 5 | Flippers
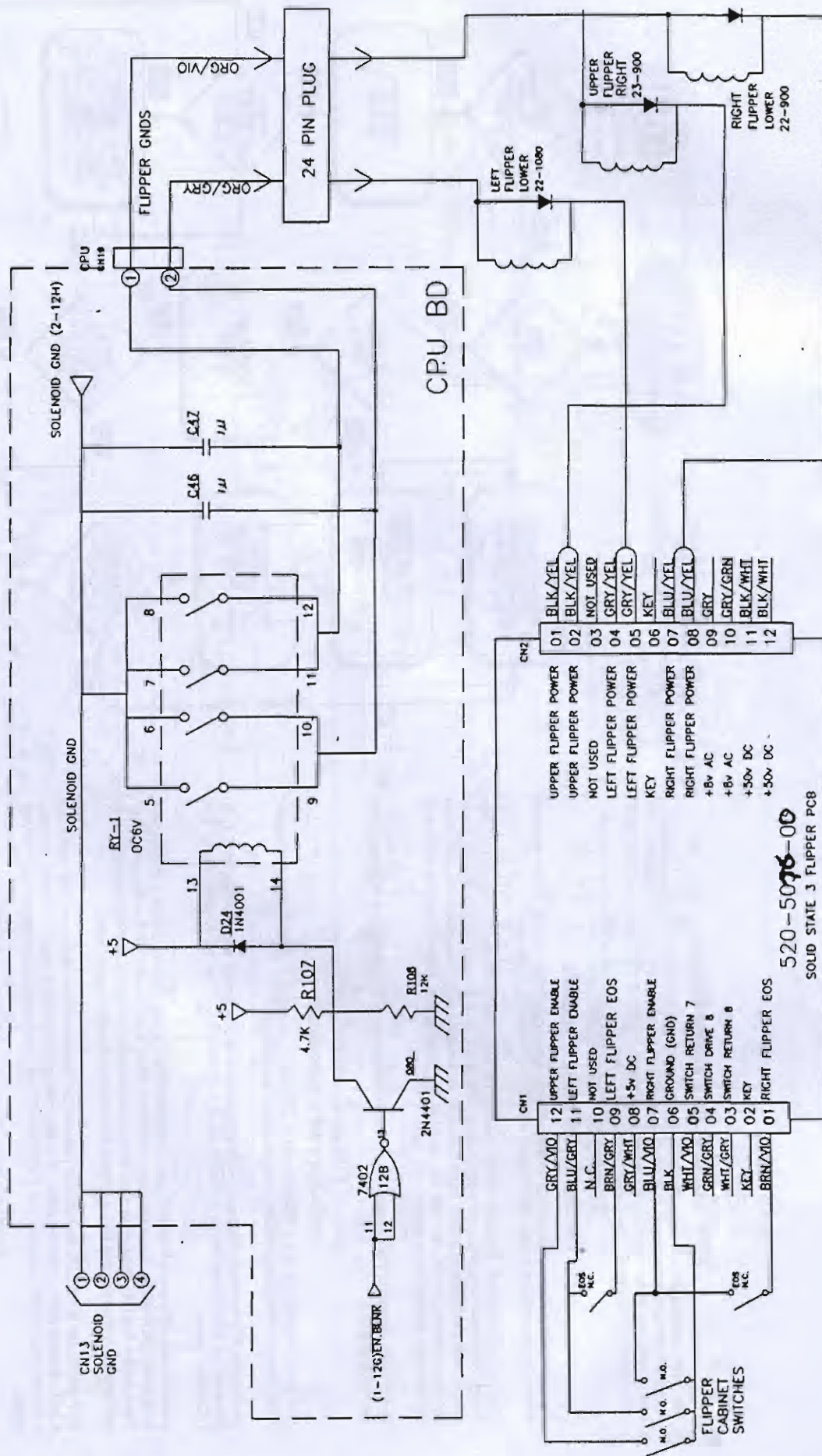
Solid State 3-Flipper Board Theory of Operation and Circuit Troubleshooting Flowchart

Solid State 3-Flipper Board (Part N° 520-5076-00) Circuit Troubleshooting Flowchart

Flowchart elements:

- **START**
- Does flipper energize? — YES → Does flipper remain energized when button is held? — YES → **OK!**
- Does flipper remain energized when button is held? — NO → Check fuses F2 & F4 on SSFB.
- Check fuses F2 & F4 on SSFB. — NPF → Check connector CN2, Pins 8 & 10 for 8V AC on SSFB.
- Check connector CN2, Pins 8 & 10 for 8V AC on SSFB. — NO → Check 2-Pin connector (GRY & GRY/GRN wire) beneath head in Cabinet for continuity. Check output voltage for 9v AC from transformer. — YES → **REPLACE SSFB.**
- Check 2-Pin connector ... — NPF → **Check wiring and connections.** — YES
- Does flipper energize? — NO → Does LED flicker on SSFB?
- Does LED flicker on SSFB? — YES → Check fuses F1, F3 & F5 on SSFB. — NPF → Check connector CN2, Pins 11 & 12 for 50V DC on SSFB. — NO → Check F5 (5 Amp Slo-Blo) on PPB. — NPF → Check connector J7, Pins 1, 2, & 3 for 50v DC on PPB. — YES → **Check wiring and connections.**
- Check connector CN2, Pins 11 & 12 for 50V DC on SSFB. — YES → **REPLACE SSFB.**
- Check connector J7, Pins 1, 2, & 3 for 50v DC on PPB. — NO → **REPLACE PPB.**
- Does LED flicker on SSFB? — NO → Check for a good GND connection to flipper cabinet switch (Black wires). → Check flipper switch mounted on side of cabinet. (N. O. switch) → Check wiring and connections from CN1 to EOS to cabinet switches. → Connect a jumper from GND to CN1 Pins 1, 9, 12 on SSFB. Does LED Flicker? — NO → **REPLACE SSFB.** — YES → (loop back to Check for a good GND connection...)

New Solid State Flipper Board

We have redesigned our Solid State Flipper Board (S.S.F.B.) so that a misadjustment or failure of the End-of-Stroke (E.O.S.) Switch will not affect the operation of the flippers. The flippers will still work! The E.O.S. switch is strictly an added feature, not a functional part of the circuit (see E.O.S. Theory of Operation).

Theory of Operation for the Solid State Flippers

The Solid State Flipper Board is a Multiple Flipper Solenoid Driver Circuit. Each solenoid driver circuit contains a One Shot Timer, a 50V Driver, and an 8V Driver.

Looking at one circuit, Schmidt NAND gates U1A, U1b, and U1D make up the One Shot Timer. The timer length is controlled by R10, R33 and C2. The output of the timer is gated at U1C with the buffered switch input from Q6. The output of U1C controls the 50V driver circuit consisting of Q4, Q1, Q2, Q3, and D1. As long as the flipper button is activated, Q6 will keep the 8V driver circuit, SR1, on.

The 50 volts provides the actuation power to the flipper solenoid while the 8 volts provides the holding power.

E.O.S. Switch Theory of Operation

The End of Stroke (E.O.S.) Switch used in our flipper circuit is a Gold Peened Contact, Blade Switch Assembly, mounted on the flipper assembly.

Electrically, it is connected in series with the Cabinet Flipper Switch and the Flipper E.O.S. input on the Solid State Flipper Board (S.S.F.B.) connector CN1 which enables the 50 Volt DC Drive Circuit.

Referring to the Flipper Wiring Diagram, one side of the Flipper Cabinet Switch is connected to ground (BLK-Wire), the other side (BLU-VIO Wire) is connected to the flipper switch input on the S.S.F.B. connector CN1 which enables your 9 Volt DC holding voltage and is connected in series to the E.O.S. switch which is a normally closed switch.

The function of the E.O.S. switch is to prevent the flipper bat from being knocked back by a high velocity shot on the playfield. If while holding the flipper in the up position, the bat is moved back 1/16" or more, the E.O.S. switch will close giving the coil another 50 Volt pulse.
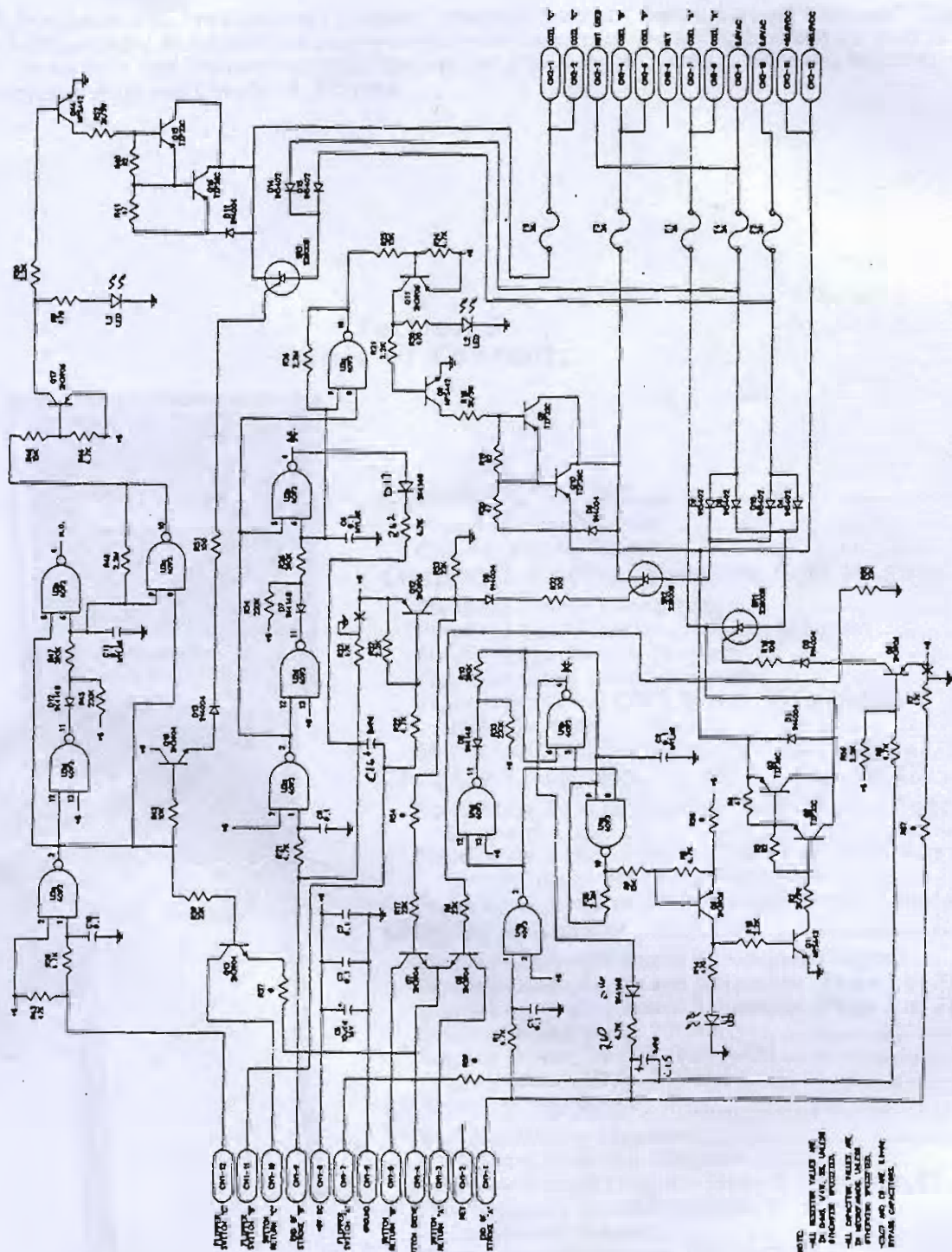
E.O.S. Switch Adjustment

The switch contacts should be adjusted so that when the solenoid is energized, the contacts stay closed for almost the full travel of the plunger. The contacts should open 1/16" before the plunger bottoms out or reaches maximum travel.
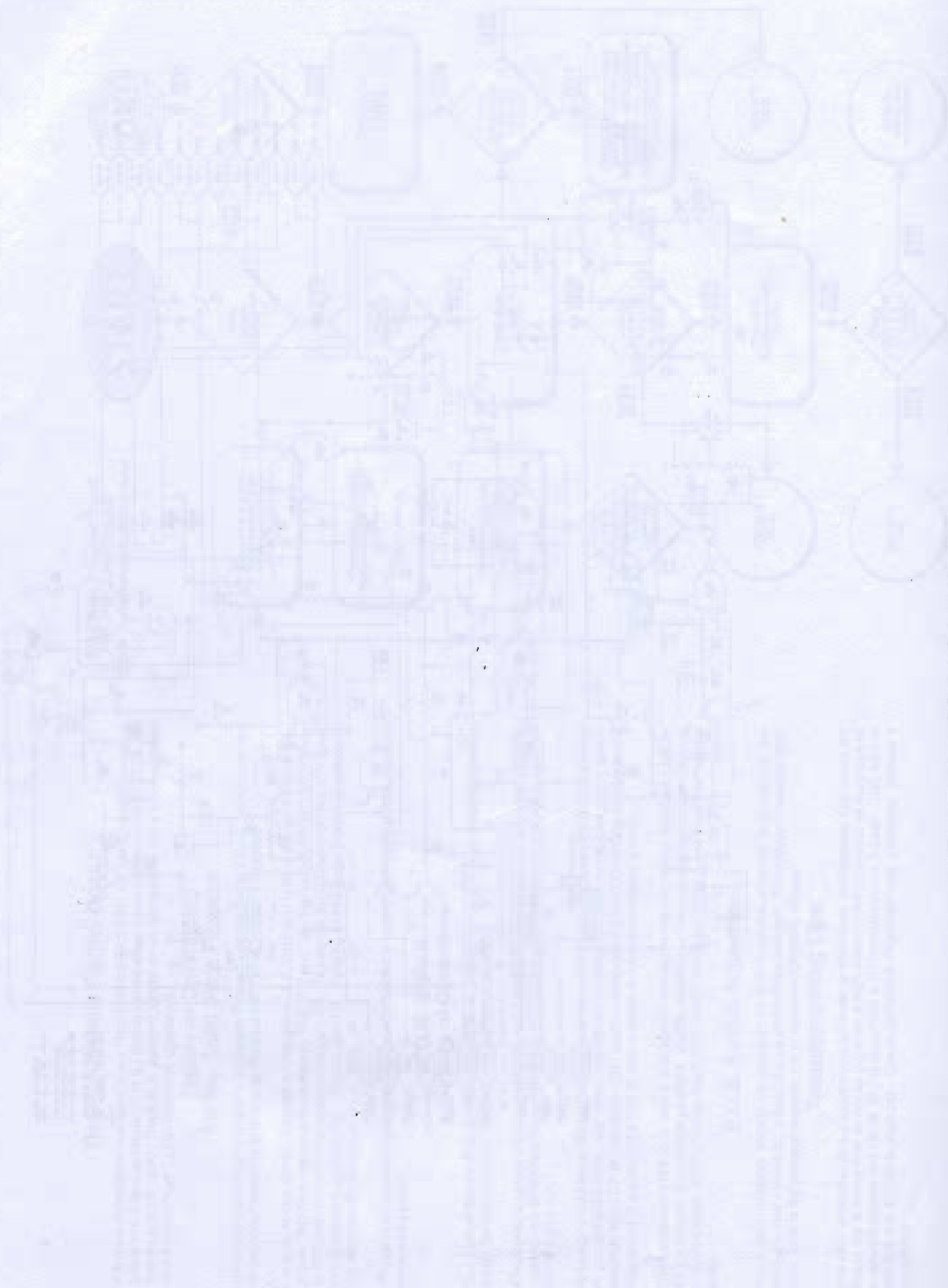
Troubleshooting Tips

The only indication of a problem you will have is the player complaining that when the flipper bat is being held in the up position, a high velocity shot from one of the playfield solenoids causes the ball to hit the flipper bat and physically knock it back. This will not occur if the E.O.S. is working. Check switch for alignment and continuity, replace if necessary.

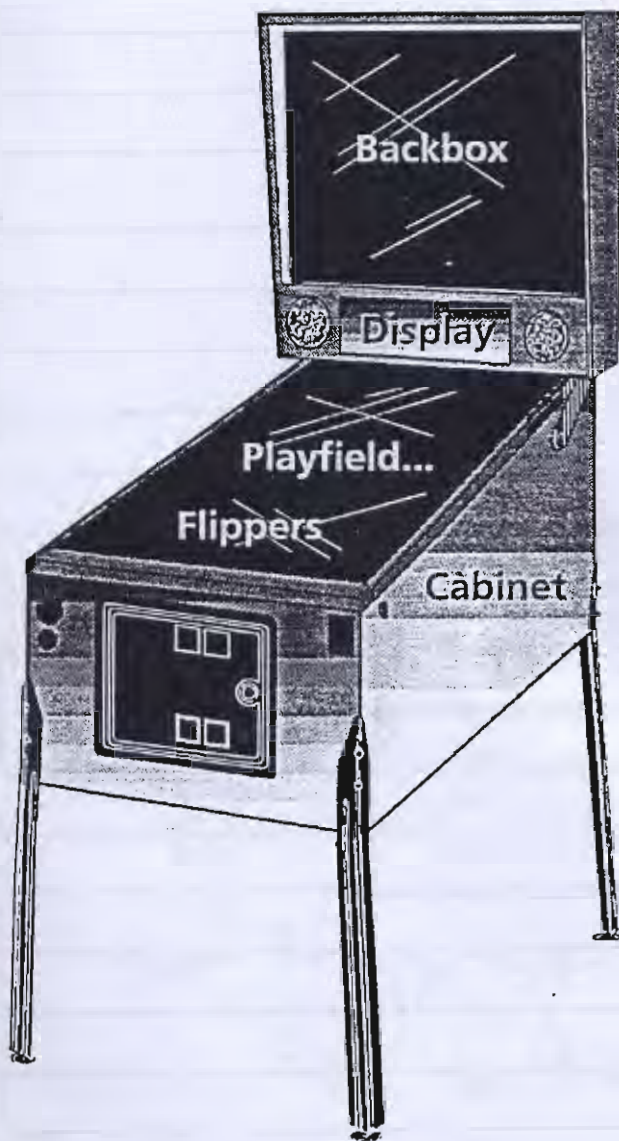# Solid State 3-Flipper Board (520-5076-00) Diagram

This Page Is Blank

Display
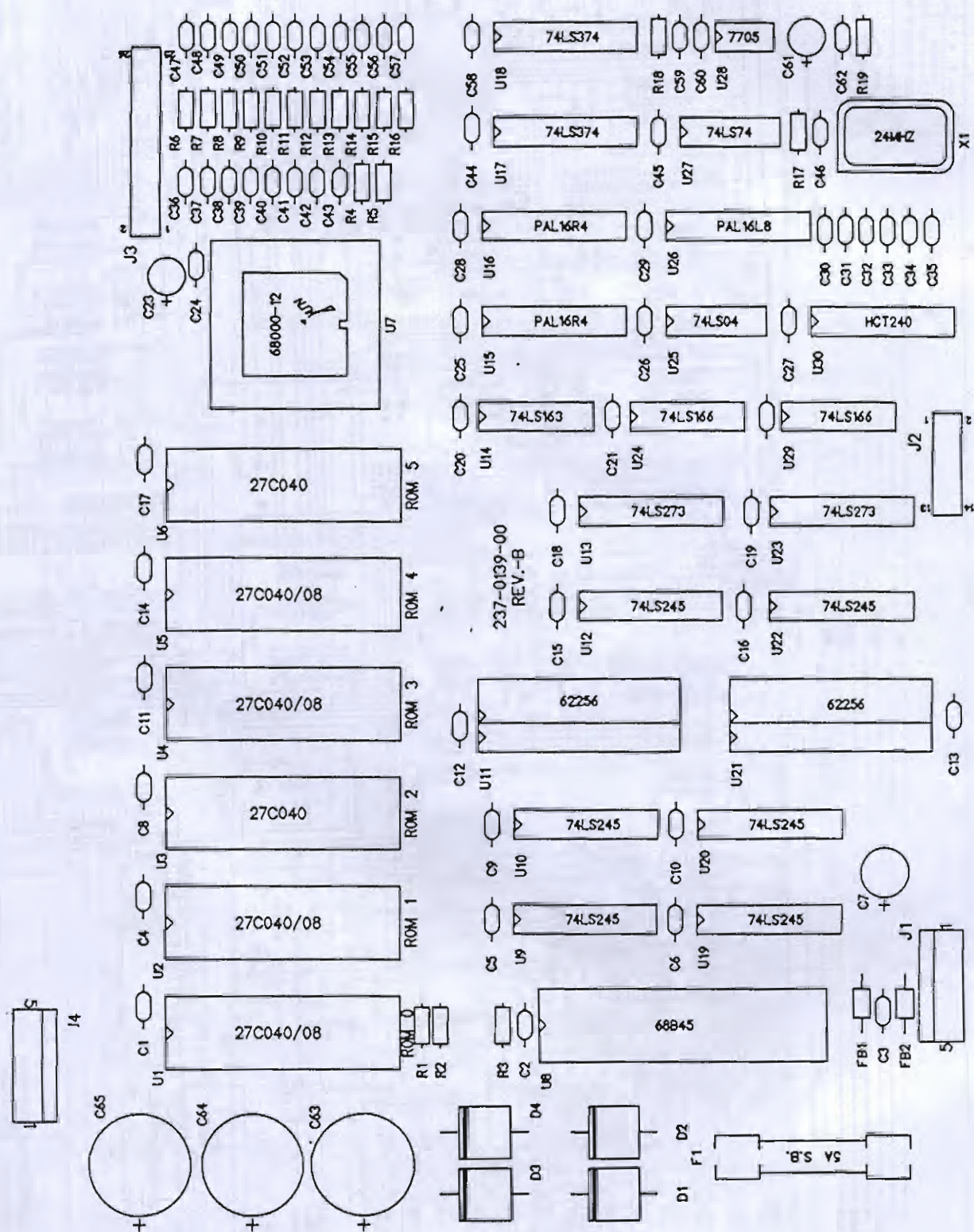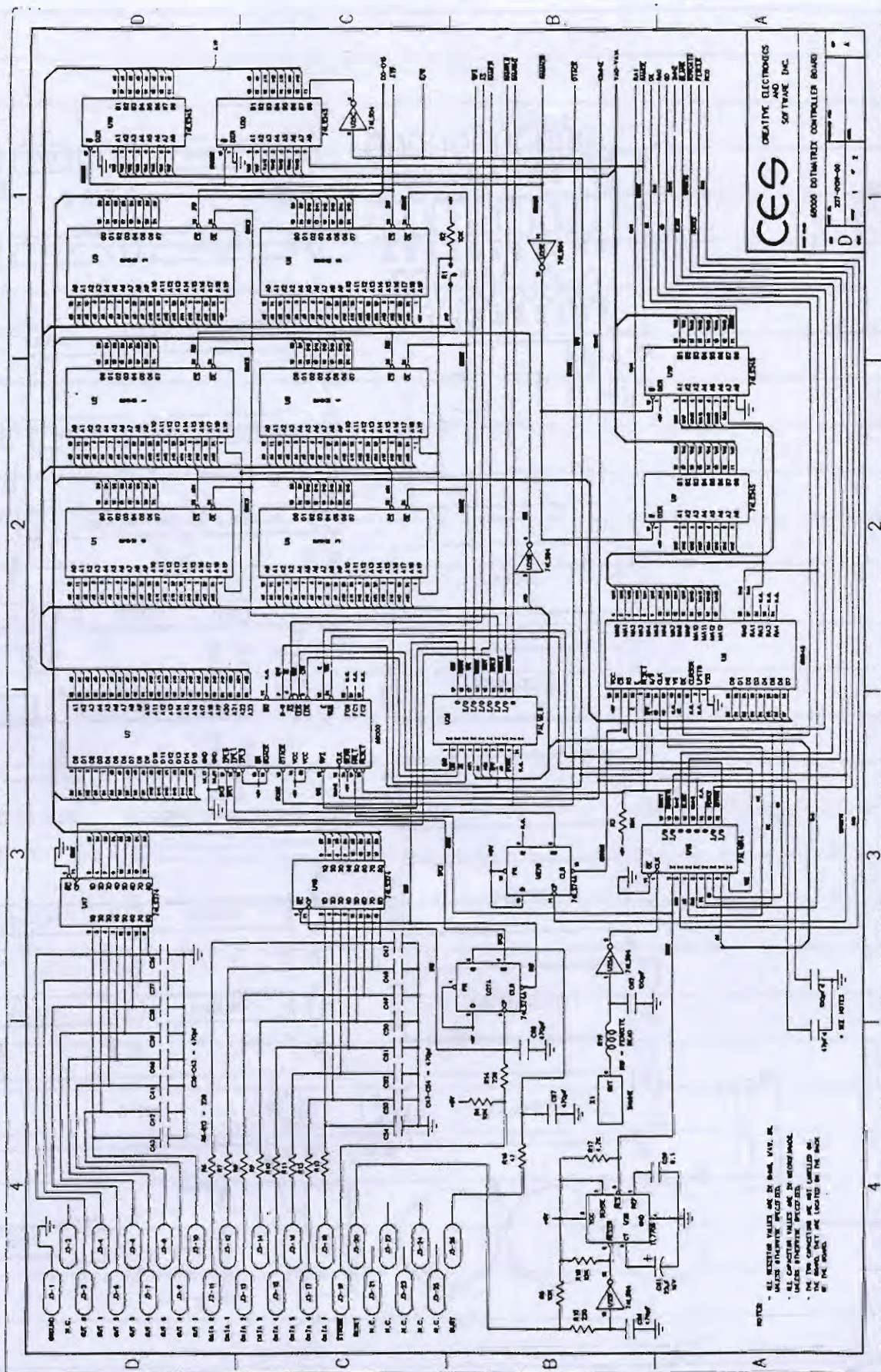# Schematics & Troubleshooting
(The Yellow Pages)

Overview

This section is broken down into five chapters ("Cabinet", "Playfield Switches, Coils & Lamps", "Flippers", "Display" and "Backbox") which provides all schematics and/or component layouts for the wiring and boards used in the game. Theory of Operations and Troubleshooting Tips are also provided for Chapter 2, Playfield Switches, Coils & Lamps (OPTO Adjustments) and Chapter 3, Flippers.
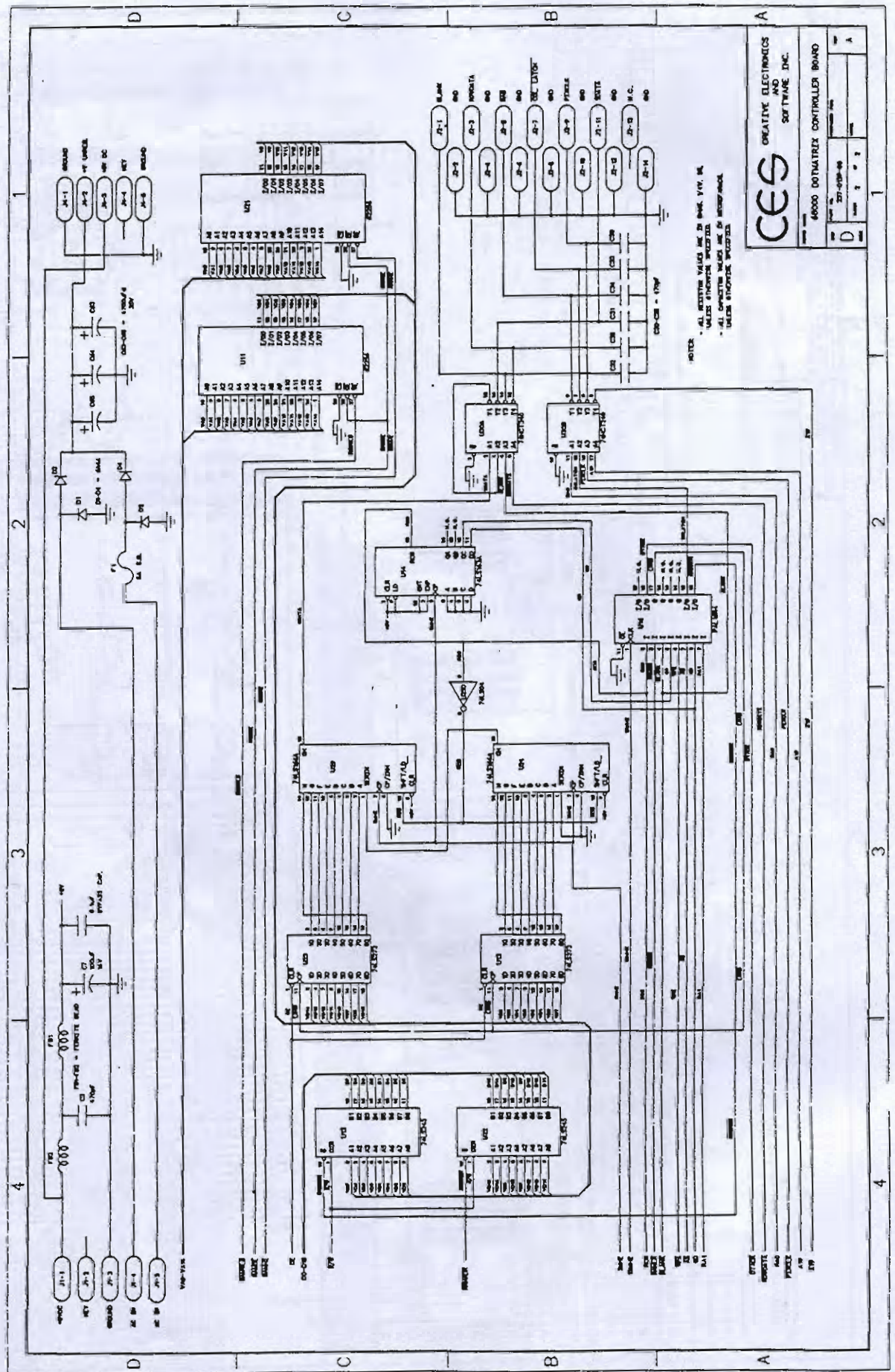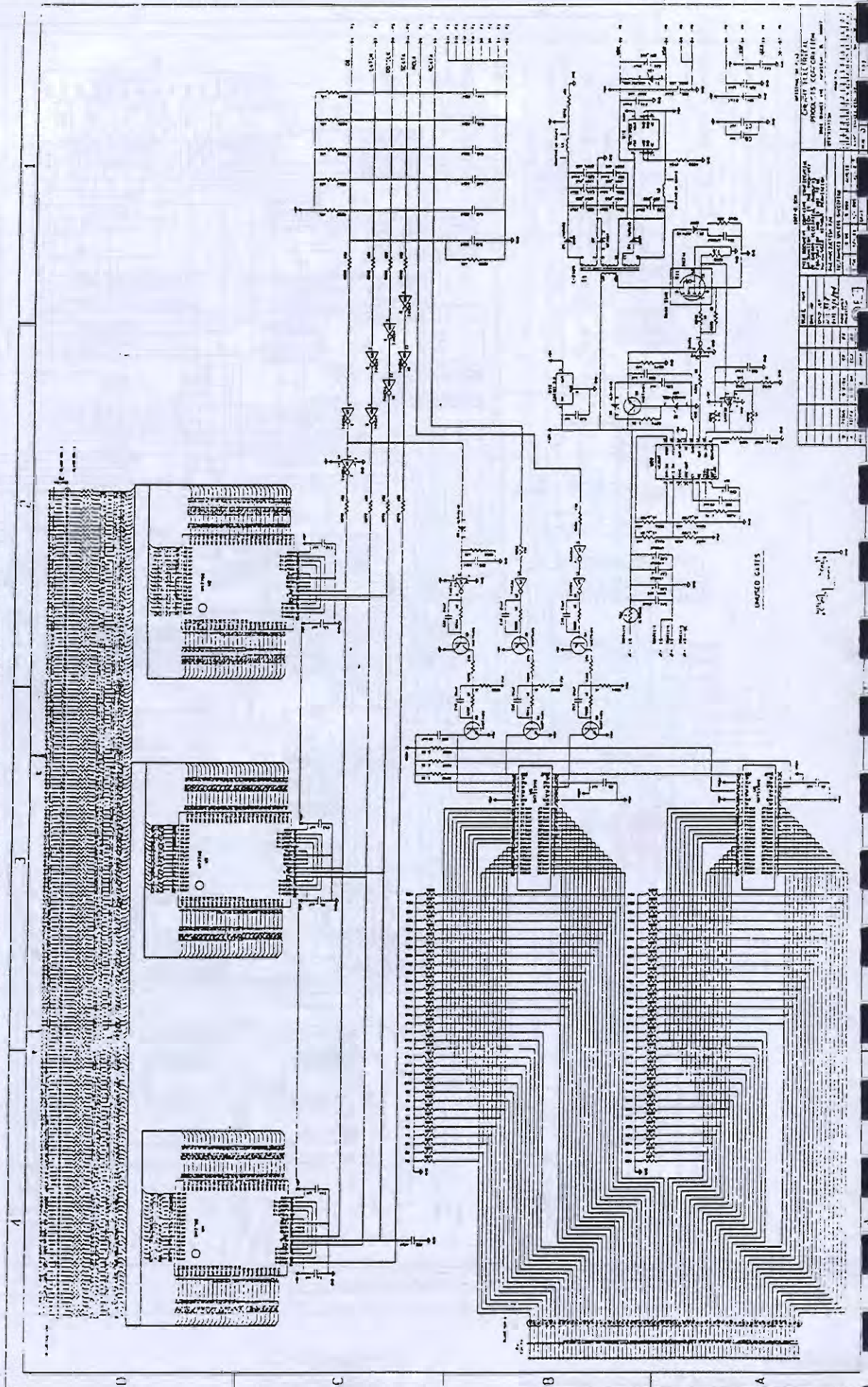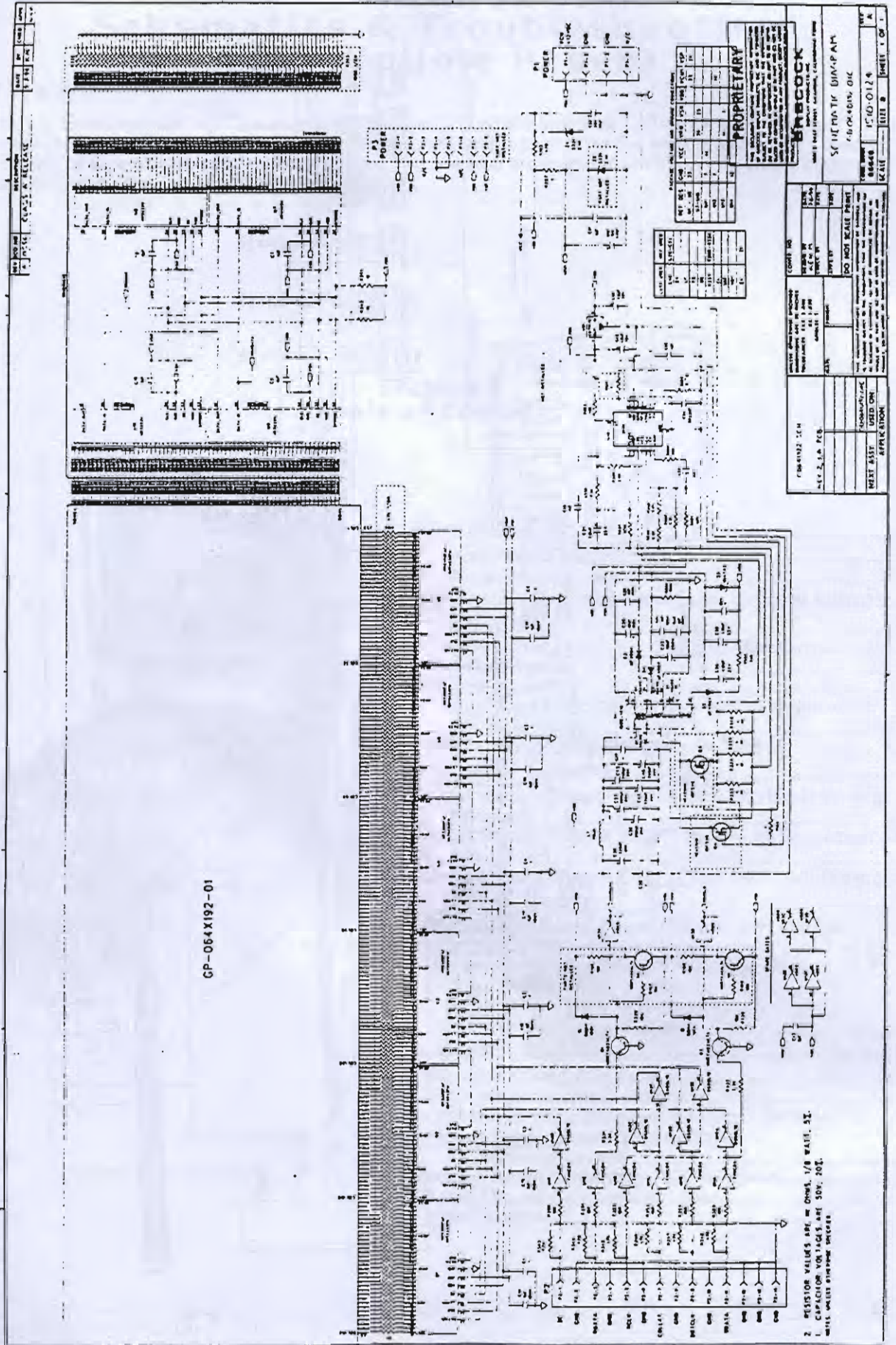
Section 5
Table of Contents

Section 5
Chapter 4

Display
Schematics & Troubleshooting

Display Controller Board Component Layout

Section 5
Chapter 4

Display
Schematics & Troubleshooting

www.multi2net.com

www.multi2net.com

GP-064X192-01

Display Driver, Dwg. 3 (Dale)

Backbox
Schematics & Troubleshooting
(The Yellow Pages)

Overview

This section is broken down into five chapters ("Cabinet", "Playfield Switches, Coils & Lamps", "Flippers", "Display" and "Backbox") which provides all schematics and/or component layouts for the wiring and boards used in the game. Theory of Operations and Troubleshooting Tips are also provided for Chapter 2, Playfield Switches, Coils & Lamps (OPTO Adjustments) and Chapter 3, Flippers.

Section 5
Table of Contents

Section 5 | Backbox

Backbox Wiring Diagram

SOUND

CPU

PS
POWER SUPPLY

PPB BOARD

CPU Board Assembly Diagram

Section 5
Chapter 5
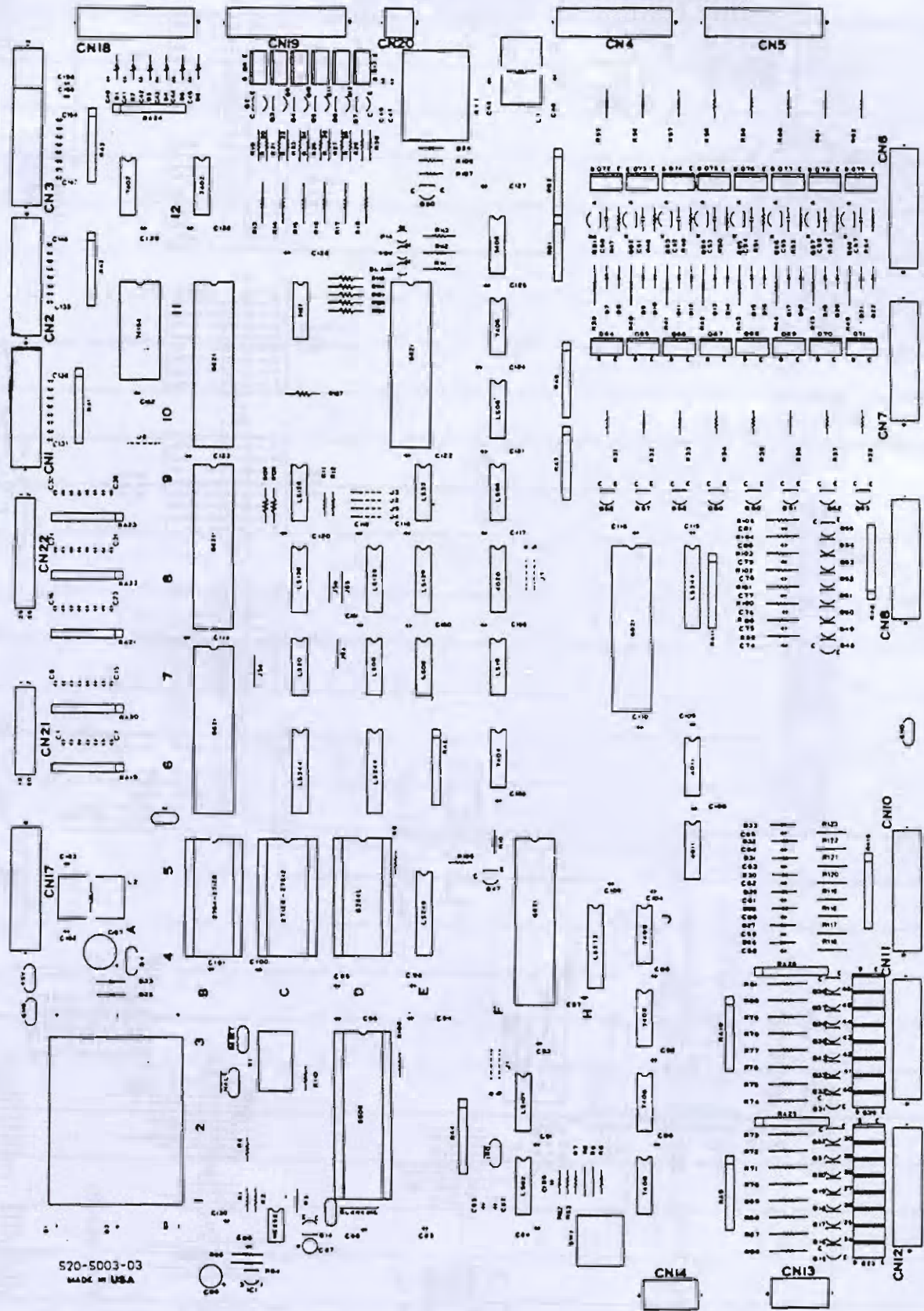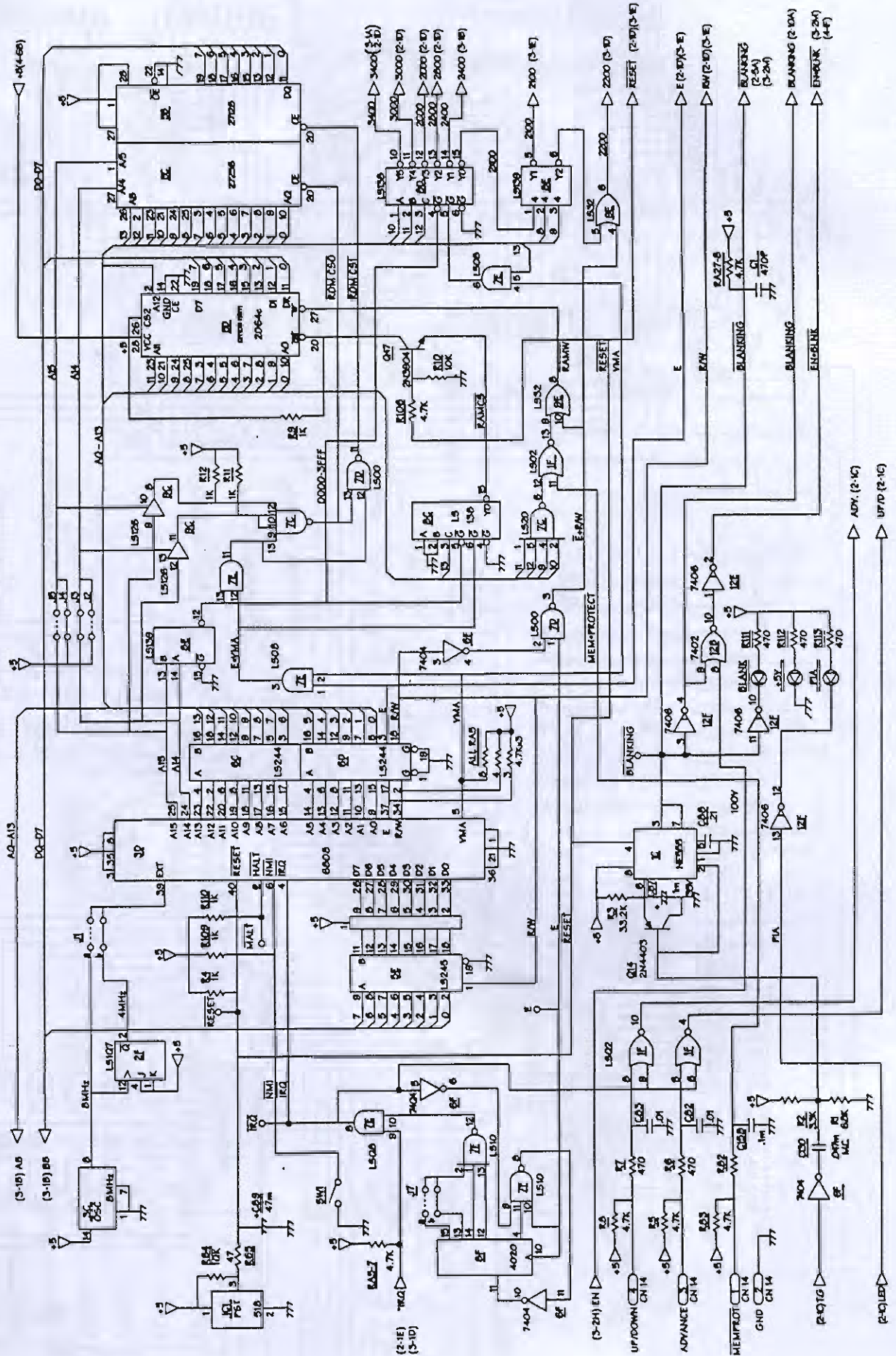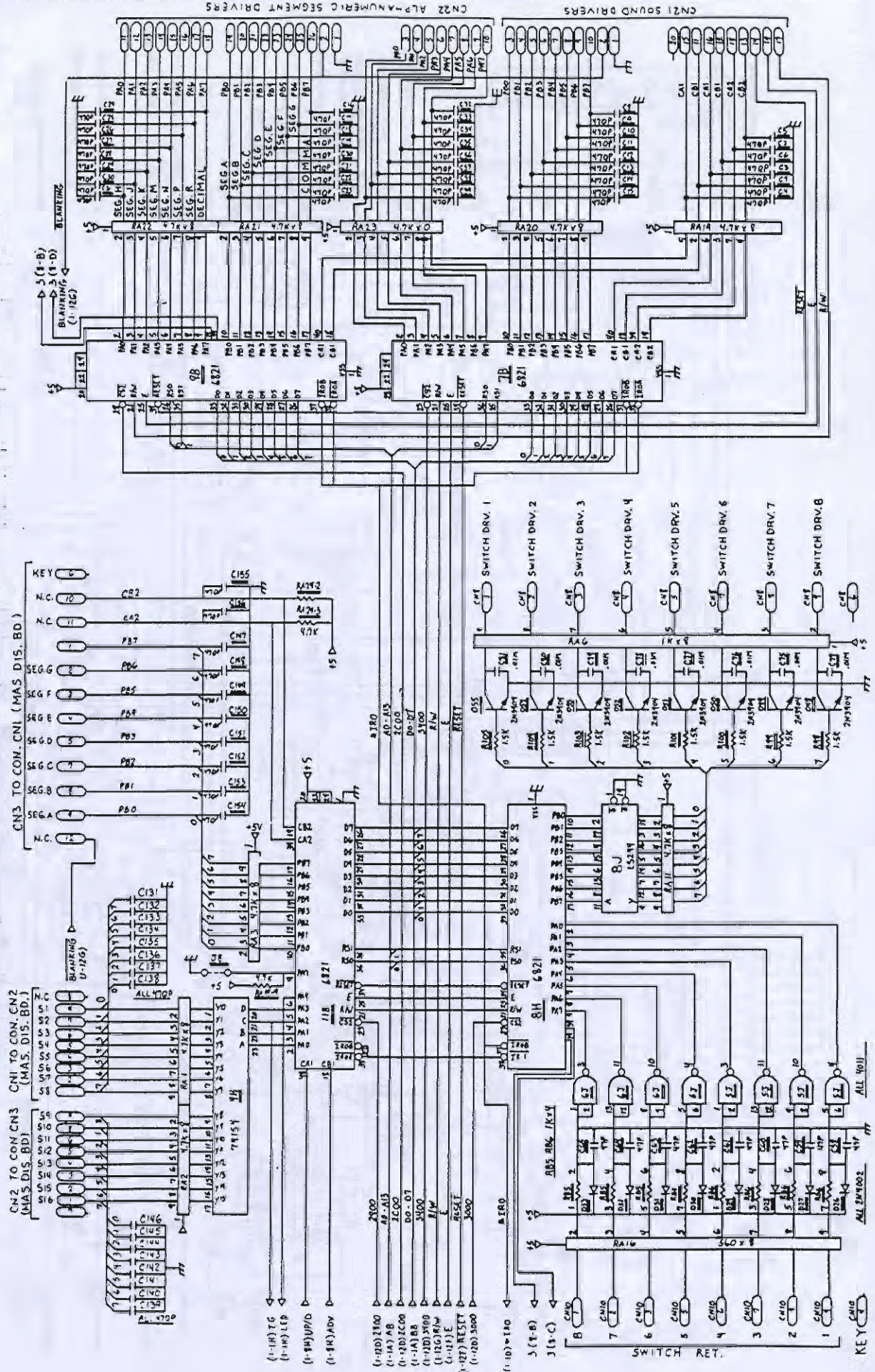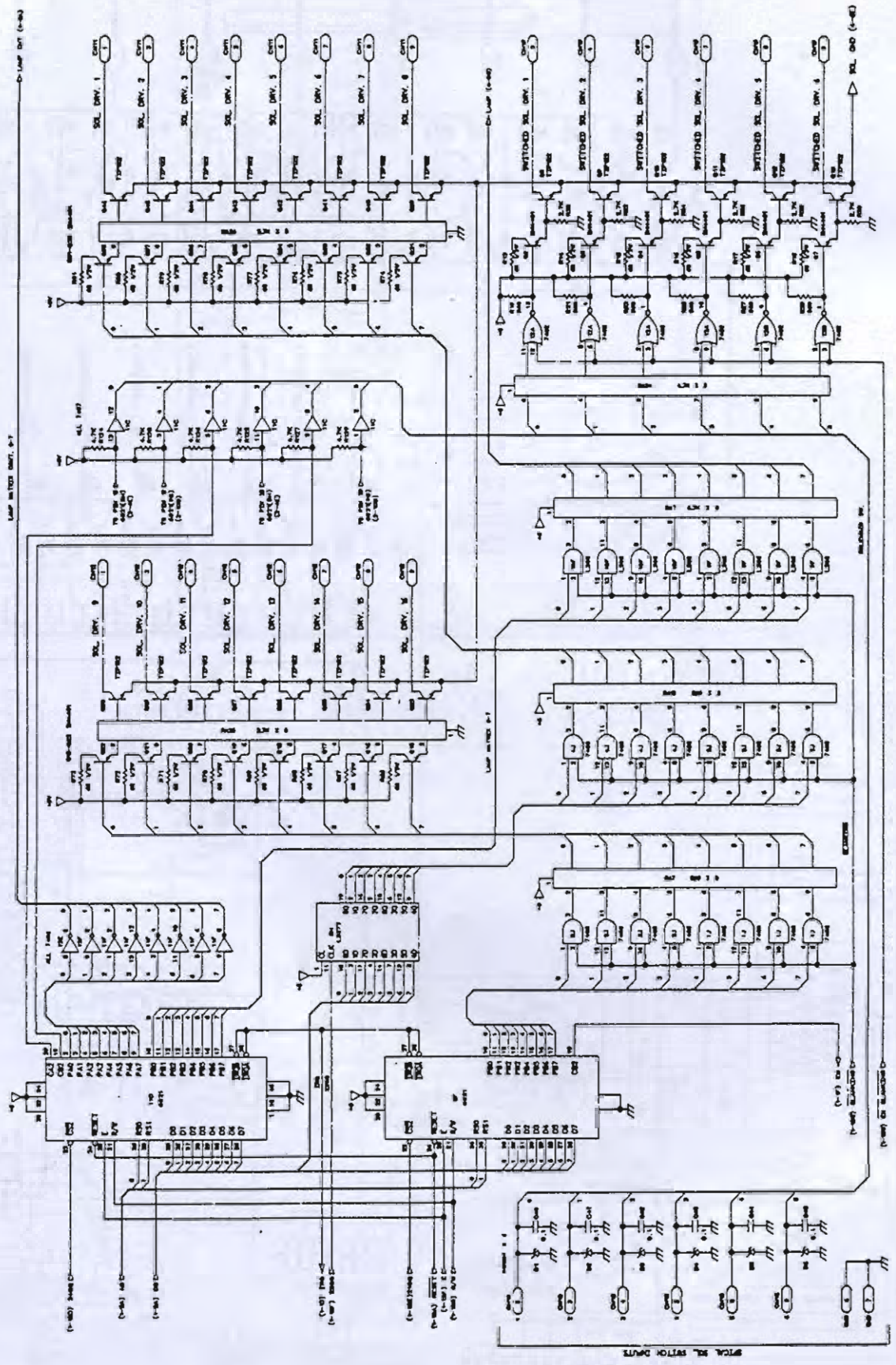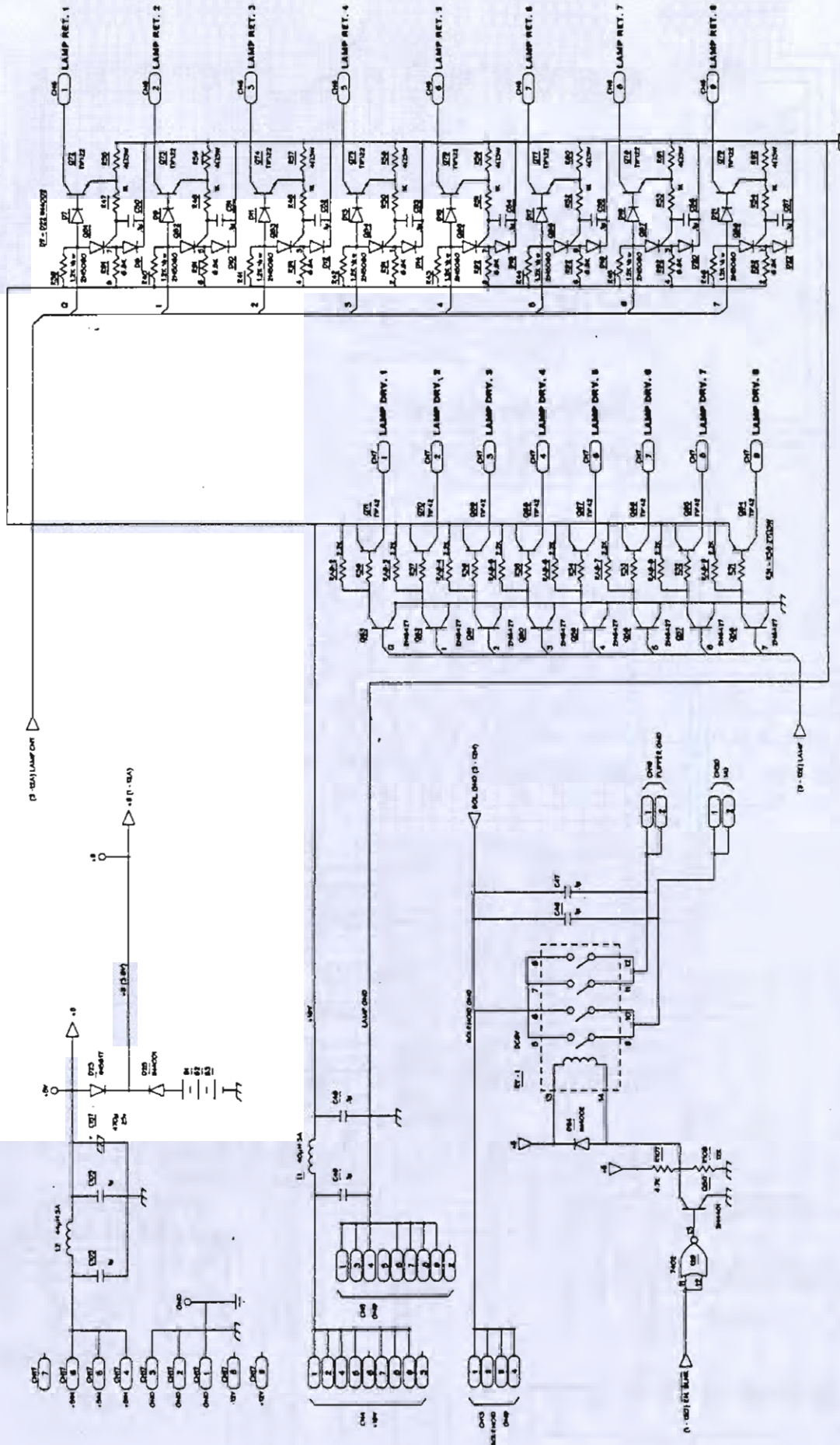
DATA EAST PINBALL
POWER SUPPLY BOARD SCHEMATIC

NOTES:
- ALL RESISTOR VALUES ARE IN OHMS, 5%, 1/4W, UNLESS OTHERWISE SPECIFIED.
- ALL CAPACITOR VALUES ARE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.

SEGA PINBALL, INC.

Sound Board Component Layout
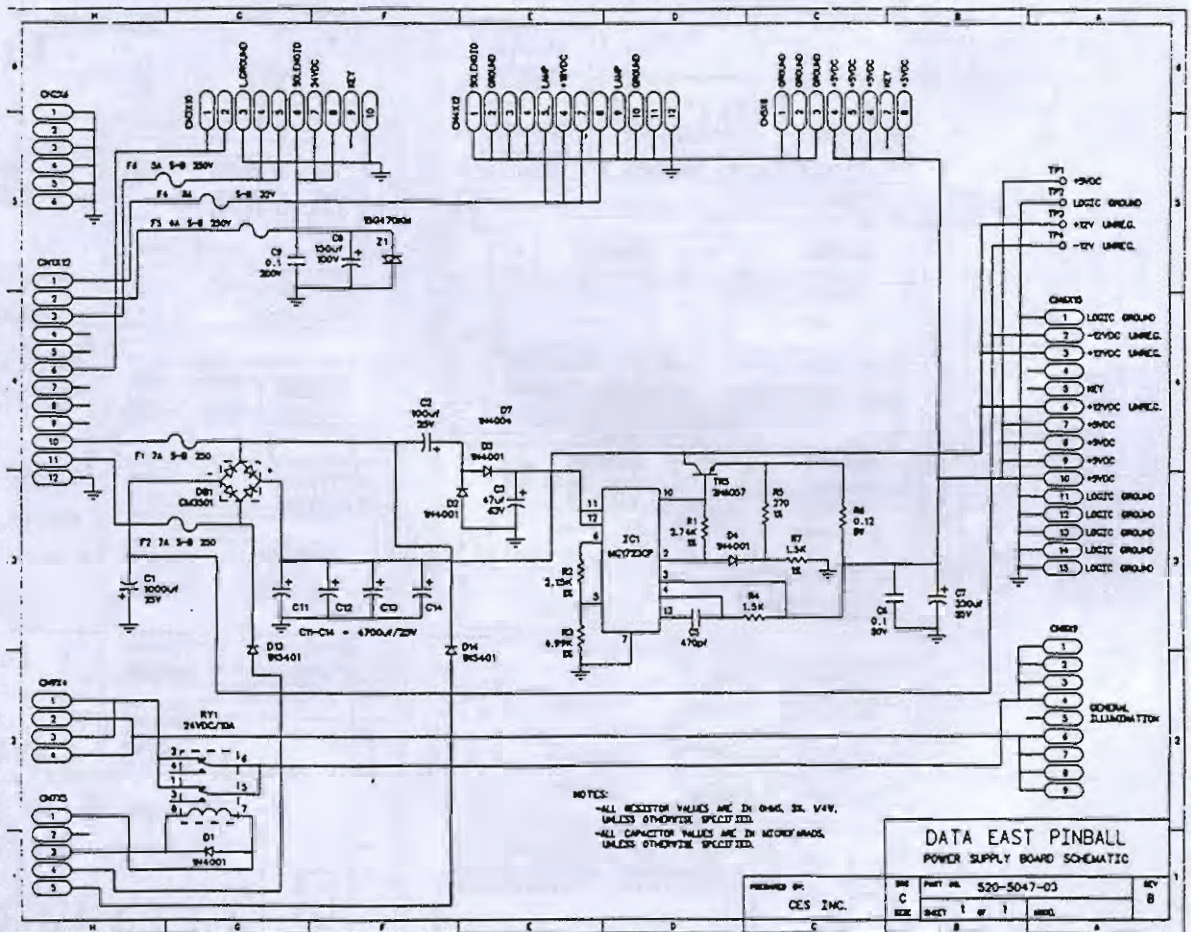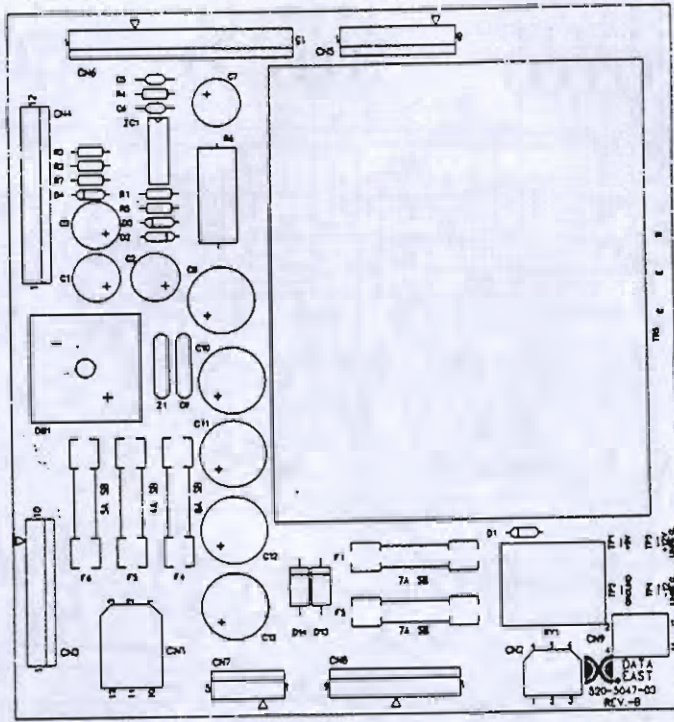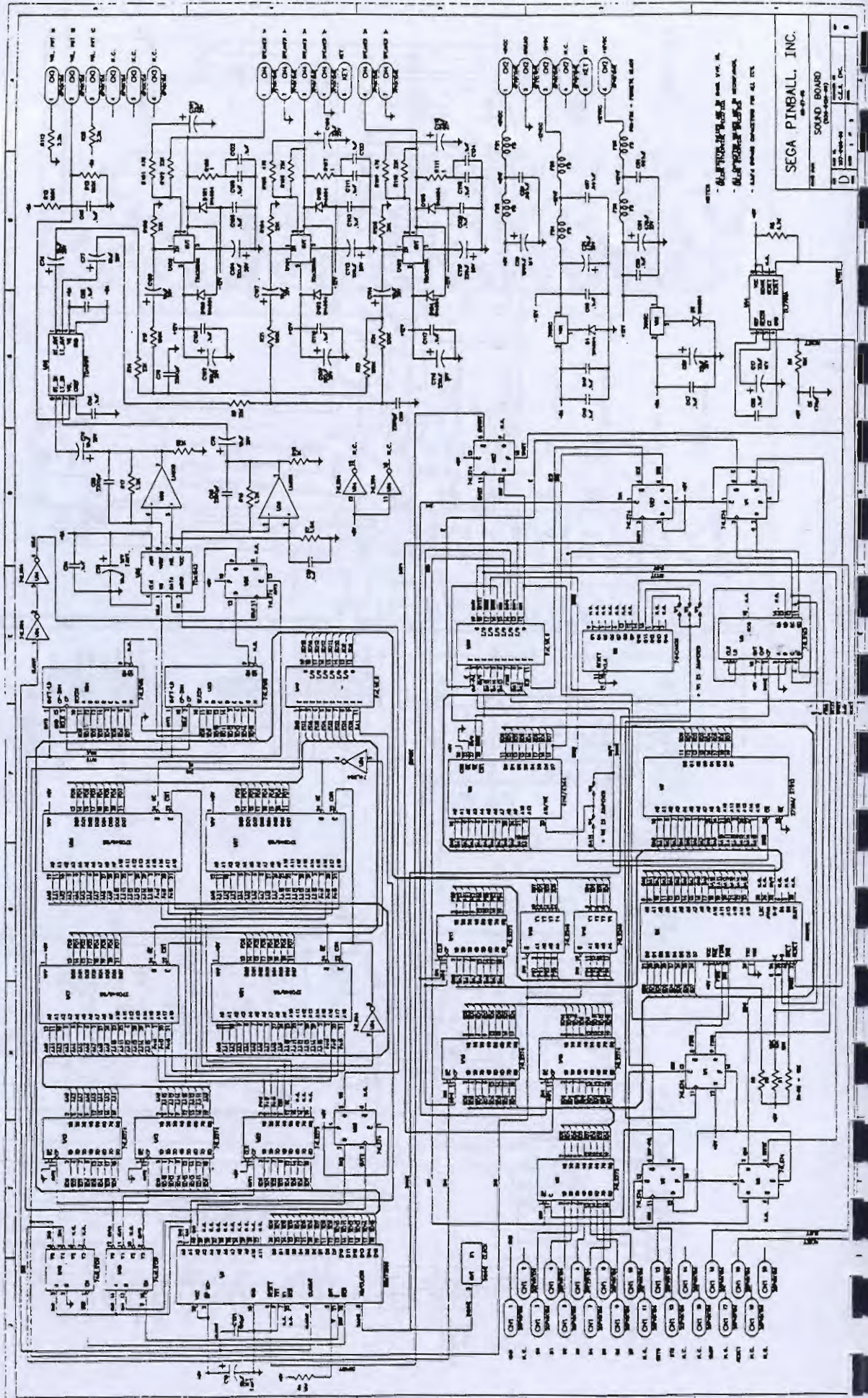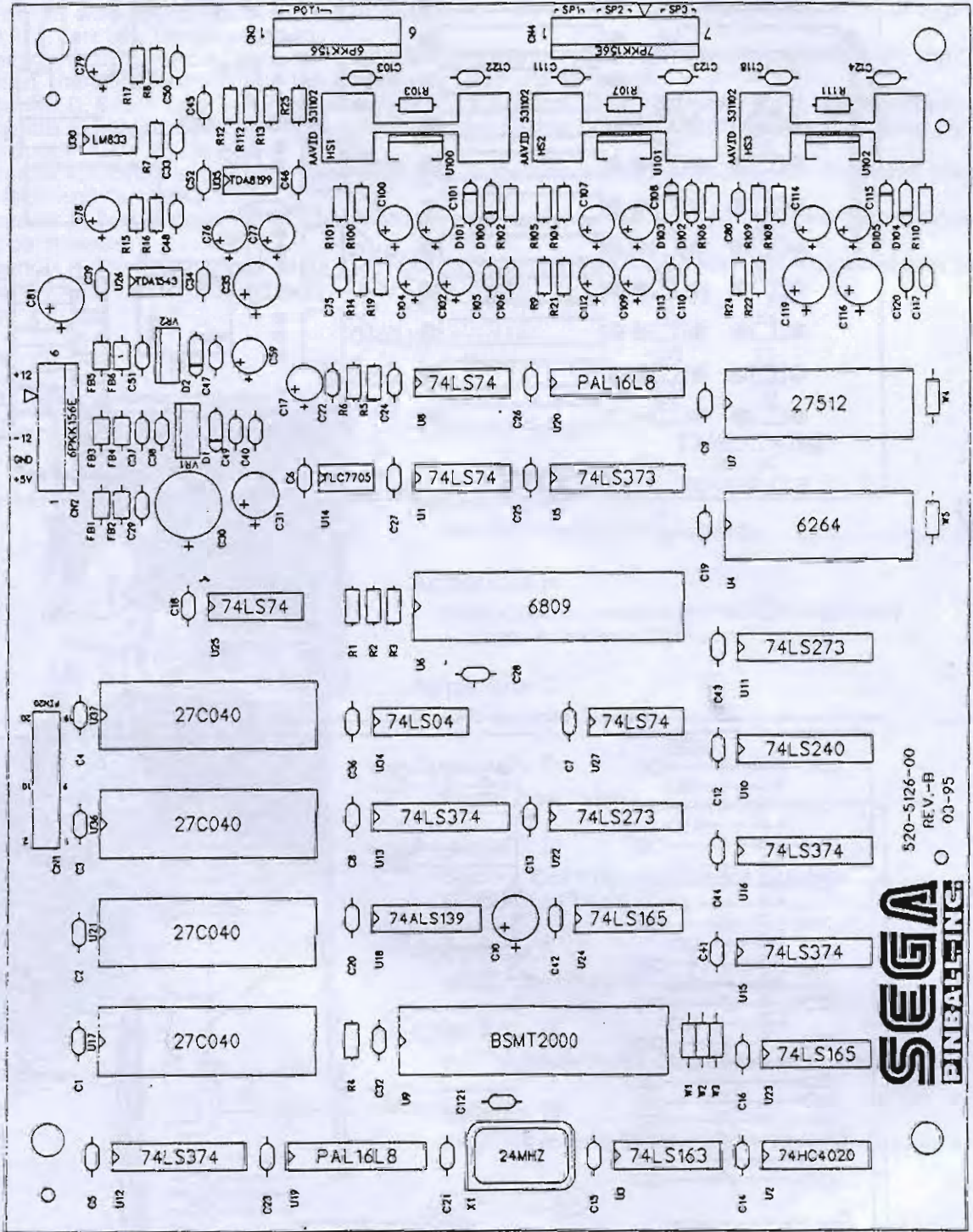
PPB Diagram
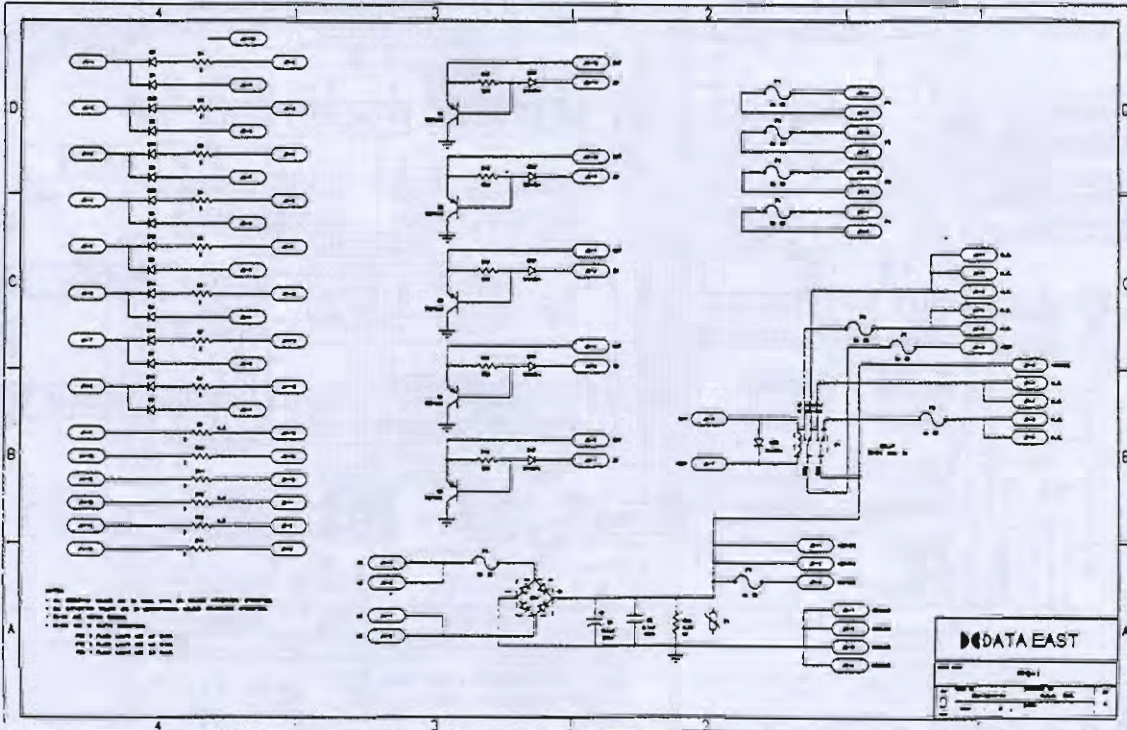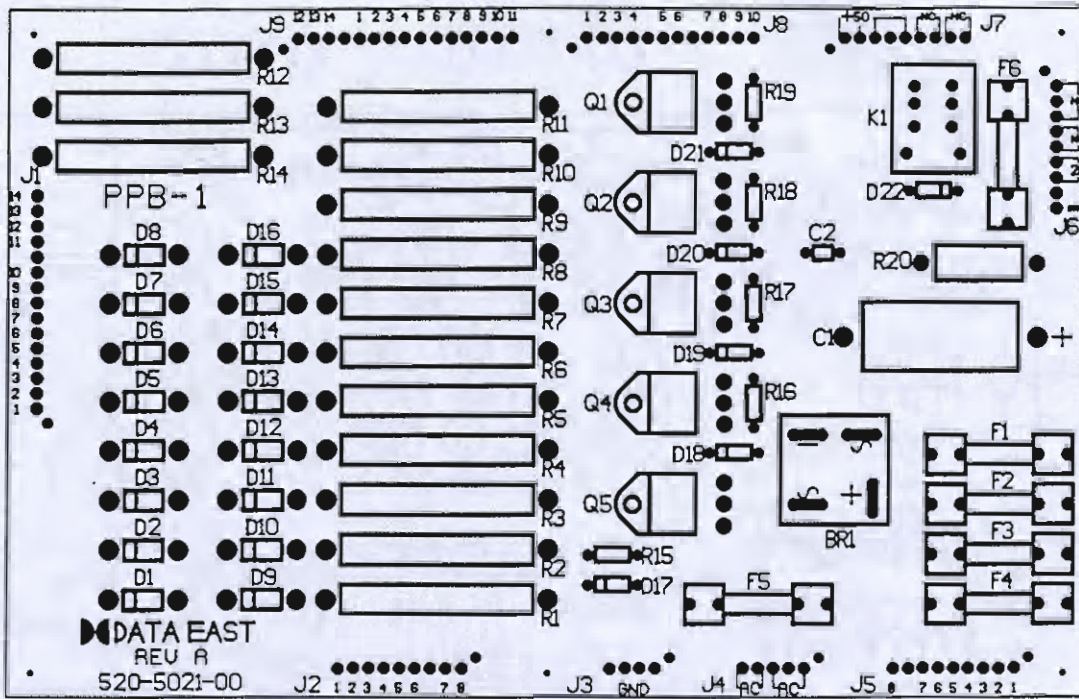
APPENDIXES A THROUGH H

Overview

The appendixes provide certain useful information for the operator for game number 1 to present.

- Appendix A, Pinball Game Firmware Table, describes the EPROM with its chip size, the Sega Pinball Inc. Part N°, version (if applicable), and CPU Board pin location.
- Appendix B, Semi-Conductors/Integrated Circuits/Relay Cross-Reference Table, describes diodes and transistors with Source N°, Sega Pinball Inc. Part N°, NTE N°, ECG N°, Radio Shack Part N° (If applicable) and RCA Part N° (If applicable).
- Appendix C, CPU Jumper Table, provides the Game Manufactured Date and Manual Part N°, the CPU version, the EPRO Position, and the Jumpers Installed and Removed.
- Appendix D, Board Type Table, provides Part N° for Flippers, Sound, Power Supply, and Display boards.
- Appendix E, Generic Coil Cross-Reference Guide and Flipper Coil Table, provides the Coils used with Part N° and Gauge-Turns (of the coil).
- Appendix F, Motor Specification Table, provides all the Motor information used on the games (Motor Type, Function and Part N°).
- Appendix G, Part Number Prefix Classification Codes, explains how our Part Numbers are developed to help sort parts easier.
- Appendix H, Playfield Inserts (Plastic Light Covers), gives a pictoral view with the name and part number of all the inserts used (also gives the Color Code Chart).

Appendix
Table of Contents

APPENDIX A
Pinball Game Firmware Table

Laser War

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(256K)	965-0004-00		C5	960-5007-00
Sound (Old)	(256K)	965-0005-00		J5	960-5007-00
Sound (Old)	(256K)	965-0006-00		J6	960-5007-00
Sound (Old)	(256K)	965-0007-00		J7	960-5007-00
		- OR -			
Sound	(256K)	965-0008-00		7F	960-5007-00
Sound 1	(512K)	965-0009-00		6F	960-7001-02
Sound 2	(512K)	965-0010-00		4F	960-7001-02

Secret Service

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(256K)	965-0011-00	A-6	B5	960-5007-00
CPU	(256K)	965-0012-00	A-6	C5	960-5007-00
Voice 1	(512K)	965-0014-00		6F	960-7001-02
Voice 2	(512K)	965-0015-00		4F	960-7001-02
Sound	(256K)	965-0013-00		7F	960-5007-00

Torpedo Alley

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(256K)	965-0016-00	A02-1	B5	960-5007-00
CPU	(256K)	965-0017-00	A02-1	C5	960-5007-00
Voice 1	(512K)	965-0019-00		6F	960-7001-02
Voice 2	(512K)	965-0020-00		4F	960-7001-02
Sound	(256K)	965-0018-00		7F	960-5007-00

Time Machine

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(256K)	965-0021-00	A02-3	B5	960-5007-00
CPU	(256K)	965-0022-00	A02-3	C5	960-5007-00
Voice 1	(512K)	965-0024-00		6F	960-7001-02
Voice 2	(512K)	965-0025-00		4F	960-7001-02
Sound	(256K)	965-0023-00		7F	960-5007-00

Playboy 35th Anniversary

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(256K)	965-0046-00	A02-3	B5	960-5007-00
CPU	(256K)	965-0047-00	A02-3	C5	960-5007-00
Voice 1	(512K)	965-0049-00		6F	960-7001-02
Voice 2	(512K)	965-0050-00		4F	960-7001-02
Sound	(256K)	965-0048-00		7F	960-5007-00

ABC Monday Night Football

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(256K)	965-0031-00	A02-7	B5	960-5007-00
CPU	(256K)	965-0032-00	A02-7	C5	960-5007-00
Voice 1	(512K)	965-0034-00		6F	960-7001-02
Voice 2	(512K)	965-0035-00		4F	960-7001-02
Sound	(256K)	965-0033-00		7F	960-5007-00

Robocop

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(256K)	965-0036-00	A03-4	B5	960-5007-00
CPU	(256K)	965-0037-00	A03-4	C5	960-5007-00
Voice 1	(512K)	965-0039-00		6F	960-7001-02
Voice 2	(512K)	965-0040-00		4F	960-7001-02
Sound	(256K)	965-0038-00		7F	960-5007-00

Phantom of the Opera

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(256K)	965-0026-00	A03-2	B5	960-5007-00
CPU	(256K)	965-0027-00	A03-2	C5	960-5007-00
Voice 1	(512K)	965-0029-00		6F	960-7001-02
Voice 2	(512K)	965-0030-00		4F	960-7001-02
Sound	(256K)	965-0028-00		7F	960-5007-00

Back to the Future

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(256K)	965-0041-00	SA-2	B5	960-5007-00
CPU	(256K)	965-0042-00	SA-2	C5	960-5007-00
Voice 1	(512K)	965-0044-00		6F	960-7001-02
Voice 2	(512K)	965-0045-00		4F	960-7001-02
Sound	(256K)	965-0043-00		7F	960-5007-00

The Simpsons

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(256K)	965-0051-00	A02-7	B5	960-5007-00
CPU	(256K)	965-0052-00	A02-7	C5	960-5007-00
Voice 1	(512K)	965-0054-00		6F	960-7001-02
Voice 2	(512K)	965-0055-00		4F	960-7001-02
Sound	(256K)	965-0053-00		7F	960-5007-00

Checkpoint

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(256K)	965-0056-00	A1-7	B5	960-5007-00
CPU	(256K)	965-0134-00	A1-7	C5	960-5007-00
Voice 1	(1M)	965-0057-00		F7	960-5009-00
Voice 2	(1M)	965-0058-00		F5	960-5009-00
Sound	(256K)	965-0059-00		F4	960-5007-00
Display	(512K)	965-0060-00	CP80	U8	960-7001-02

Teenage Mutant Ninja Turtles

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(256K)	965-0061-00	A1.04	B5	960-5007-00
CPU	(256K)	965-0062-00	A1.04	C5	960-5007-00
Voice 1	(1M)	965-0063-00		F5/6	960-5009-00
Voice 2	(1M)	965-0064-00		F4/5	960-5009-00
Sound	(256K)	965-0065-00		F7	960-5007-00
Display	(512K)	965-0066-00		U8	960-7001-02

Batman

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(128K)	965-0067-00	A1.06	B5	960-5006-00
CPU	(256K)	965-0135-00	A1.06	C5	960-5007-00
Voice 1	(2M)	965-0068-00		U17	960-5010-00
Voice 2	(1M)	965-0069-00		U21	960-5009-00
Sound	(256K)	965-0070-00		U7	960-5007-00
Display	(1M)	965-0071-00	A1.02	U8	960-5009-00

Star Trek 25th Anniversary

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(512K)	965-0072-00	A2.00	B5	960-7001-02
Voice 1	(2M)	965-0073-00		U17	960-5010-00
Voice 2	(2M)	965-0074-00		U21	960-5010-00
Sound	(256K)	965-0075-00		U7	960-5007-00
Display	(1M)	965-0076-00	A1.09	U8	960-5009-00

Hook

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(512K)	965-0077-00	A4.08	C5	960-7001-02
Voice 1	(2M)	965-0078-00		U17	960-5010-00
Voice 2	(2M)	965-0079-00		U21	960-5010-00
Sound	(256K)	965-0080-00		U7	960-5007-00
Display	(1M)	965-0081-00	A4.01	U8	960-5009-00

Lethal Weapon 3

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(512K)	965-0082-00	A2.07	C5	960-7001-02
Voice 1	(2M)	965-0083-00		U17	960-5010-00
Voice 2	(2M)	965-0084-00		U21	960-5010-00
Sound	(256K)	965-0085-00		U7	960-5007-00
Display	(2M)	965-0086-00		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

Star Wars

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(512K)	965-0119-00	A1.03	C5	960-7001-02
Voice 0	(4M)	965-0132-00		U17	960-5015-00
Voice 1	(2M)	965-0133-00		U21	960-5010-00
Sound	(256K)	965-0131-00		U7	960-5007-00
Display	(2M)	965-0120-00	A1.04	ROM 0	960-5010-00
Display	(2M)	965-0121-00	A1.04	ROM 1	960-5010-00
	(Used on Display PCB 520-5055-00)				
	-OR-				
Display	(4M)	965-0122-00	A1.05	ROM 0	960-5015-00
	(Used on Display PCB 520-5055-01)				

Rocky & Bullwinkle & Friends

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(512K)	965-0138-00	A1.30	C5	960-7001-02
Voice 0	(4M)	965-0139-00		U17	960-5015-00
Voice 1	(2M)	965-0140-00		U21	960-5010-00
Sound	(256K)	965-0141-00		U7	960-5007-00
Display	(4M)	965-0142-00	A1.30	ROM 0	960-5015-00

Jurassic Park

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(512K)	965-0143-00	A5.10	C5	960-7001-02
Voice 0	(4M)	965-0144-00		U17	960-5015-00
Voice 1	(2M)	965-0145-00		U21	960-5010-00
Sound	(256K)	965-0146-00		U7	960-5007-00
Display	(4M)	965-0147-00	A5.10	ROM 0	960-5015-00

Last Action Hero

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(512K)	965-0148-00	A1.12	C5	960-7001-02
Voice 0	(4M)	965-0149-00		U17	960-5015-00
Voice 1	(2M)	965-0150-00		U21	960-5010-00
Sound	(256K)	965-0151-00		U7	960-5007-00
Display	(4M)	965-0152-00	A1.06	ROM 0	960-5015-00

Tales from the Crypt

EPROM	Chip Size	Part Nº	Ver.	Loc.	Raw Part Nº
CPU	(512K)	965-0157-00	A3.00	C5	960-7001-02
Voice 0	(4M)	965-0158-00		U17	960-5015-00
Voice 1	(2M)	965-0159-00		U21	960-5010-00
Sound	(256K)	965-0160-00		U7	960-5007-00
Display	(4M)	965-0161-00	A3.00	ROM 0	960-5015-00

Table continued on the next page.

APPENDIX A
Pinball Game Firmware Table

EPROM	Chip 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	IN PRODUCTION	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		ROM 0	960-5015-00
Display*	(4M)	965-0207-00		ROM 3	960-5015-00

* Note: Display EPROMS (4M) for Maverick and games thereafter require an access time of 120 Nsec or faster.

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

Table 1 Diodes	Source Nº	SEGA PINBALL™ Part Nº	NTE Nº	ECG Nº	Radio Shack ® Part Nº	RCA ® Part Nº
Rectification, Blocking and/or Dampening						
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

Table 2 Diodes	Source Nº	SEGA PINBALL™ Part Nº	NTE Nº	ECG Nº	Radio Shack ® Part Nº	RCA ® Part Nº
Zener						
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

Table 3 Bridge Rectifiers	Source Nº	SEGA PINBALL™ Part Nº	Comments			
Bridge Rectifier	CM3501	112-0052-00	35 Amp @ 100v P.I.V.			
Bridge Rectifier	MDA2501	112-0054-00	25 Amp @ 100v P.I.V.			
Bridge Rectifier	MDA3502	112-0057-00	35 Amp @ 200v P.I.V.			

Table 4 Transistors	Source Nº	SEGA PINBALL™ Part Nº	NTE Nº	ECG Nº	Radio Shack ® Part Nº	RCA ® Part Nº
Transistor	2N4401	- — - —	NTE85	ECG85	276-2009	SK3124A
Transistor	2N5060, SCR	110-0074-00	NTE5400	ECG5400	276-1067	SK3950
Transistor	2N5401	110-0078-00	NTE288	ECG288	- — - —	SK3434
Transistor	2N5427	110-0070-00	NTE48	ECG48	- — - —	SK4906
Transistor	MJE15031	110-0103-00	NTE375	ECG375	- — - —	SK9118
Transistor	MJE340	110-0071-00	NTE157	ECG157	- — - —	SK3747
Transistor	MJE350	110-0072-00	NTE374	ECG374	- — - —	SK9042
Transistor	MPSA92	110-0100-00	NTE288	ECG278	- — - —	SK3434
Transistor	MPSA42	110-0082-00	NTE287	ECG287	- — - —	SK3232
Transistor	NPN, 2N3904	110-0069-00	NTE85	ECG85	276-2009	SK3124A
Transistor	NPN, TIP122	110-0067-00	NTE261	ECG261	276-2068	SK3896
Transistor	PNP, TIP42	110-0068-00	NTE332	ECG332	- — - —	SK9236
Transistor	TIP32C	110-0071-00	NTE292	ECG292	- — - —	SK3441
Transistor	TIP36C	110-0077-00	NTE393	ECG393	- — - —	SK3961

Table 5 Relays	Source Nº	SEGA PINBALL™ Part Nº	Comments			
PPB Relay	FRL264 P024/02CK	190-5002-00	24v DC 10 Amp DPDT			
Power Supply Relay	FRL264 P024/02CK	190-5003-00	24v DC 10 Amp DPDT			
CPU Relay	- — - —	190-5001-00	6v DC 5 Amp 4 Pole			

APPENDIX C
CPU Jumper Table

Game Name	Game Mfg. Date and Manual PN	CPU Ver.	EPROM Position	Jumpers Installed	Jumpers Removed	Game Name	Game Mfg. Date and Manual PN	CPU Ver.	EPROM Position	Jumpers Installed	Jumpers Removed
1. Laser War	MAY 87 780-5001-00	1 / 2	5C / 5B, 5C	J4 J6a J7a / J4 J5a J6a	J5 J6 J7b / J5 J5b J6b	28. Batman Forever	JUL 95 780-5038-00	3	5C	J5	J4
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						

† Additional Information for Installed / Removed Jumpers

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	Flippers	Sound	Power Supply	Display
Laser War	NO FLIPPER BOARD (NFB) 2-Flipper	Initial: 520-5002-00 Replaced with: 520-5002-02 520-5002-01 was not used.	520-5000-00	Master: 520-5004-00 plus: 7 Digit Alpha/Numeric 520-5005-00 (Qty. 2) 7 Digit Numeric 520-5006-00 (Qty. 2) 4 Digit Numeric 520-5007-00
Secret Service	NFB 3-Flipper	520-5002-02	520-5000-00	7 Digit A/N Combined: 520-5014-01
Torpedo Alley	NFB 3-Flipper	520-5002-02	520-5000-00	7 Digit A/N Combined: 520-5014-01
Time Machine	NFB 2-Flipper	520-5002-02	520-5000-00	7 Digit A/N Combined: 520-5014-01
Playboy 35th Anniversary	520-5033-00 2-Flip. (for 100 games)	520-5002-02	520-5000-00	7 Digit A/N Combined: 520-5014-01
ABC Monday Night Football	520-5033-00 2-Flip. (for 100 games)	520-5002-02	520-5000-00	16 Digit A/N Combined: 520-5030-00
Robocop	520-5033-00 2-Flipper	520-5002-02	520-5000-00	16 Digit A/N Combined: 520-5030-00
Phantom of the Opera	520-5033-00 2-Flipper	520-5002-02	520-5000-00	16 Digit A/N Combined: 520-5030-00
Back to the Future	520-5033-00 2-Flipper	520-5002-02	520-5000-00	16 Digit A/N Combined: 520-5030-00
The Simpsons	520-5033-00 2-Flipper	520-5002-03	520-5000-00	16 Digit A/N Combined: 520-5030-00
Checkpoint	520-5033-00 2-Flipper	520-5002-03	520-5047-00	128 X 16 Dot Matrix 520-5042-00
Teenage Mutant Ninja Turtles	520-5033-00 2-Flipper	520-5002-03	520-5047-00	128 X 16 Dot Matrix 520-5042-00
Batman	520-5033-00 2-Flipper	520-5050-01	520-5047-00	128 X 16 Dot Matrix 520-5042-00
Star Trek 25th Anniversary	520-5033-00 2-Flipper	520-5050-01	520-5047-00	128 X 16 Dot Matrix 520-5042-00
Hook	520-5033-00 2-Flipper	520-5050-01	520-5047-00	128 X 16 Dot Matrix 520-5042-00
Lethal Weapon 3	520-5033-00 2-Flipper	520-5050-01	520-5047-01	128 X 32 Dot Matrix 520-5052-00
Star Wars	520-5033-00 2-Flipper	520-5050-02	520-5047-01	128 X 32 Dot Matrix 520-5052-00
Rocky & Bullwinkle & Friends	520-5033-00 2-Flipper	520-5050-02	520-5047-01	128 X 32 Dot Matrix 520-5052-00
Jurassic Park	520-5076-00 3-Flipper	520-5050-02	520-5047-02	128 X 32 Dot Matrix 520-5052-00
Last Action Hero	520-5070-00 2-Flipper	520-5050-03	520-5047-02	128 X 32 Dot Matrix 520-5052-00
Tales from the Crypt	520-5076-00 3-Flipper	520-5050-03	520-5047-02	128 X 32 Dot Matrix 520-5052-00
The Who's Tommy	520-5076-00 3-Flipper	520-5077-00	520-5047-02	128 X 32 Dot Matrix 520-5052-00
WWF Royal Rumble	520-5070-00 (Qty. 2) 4-Flipper (2X2)	520-5077-00	520-5047-02	128 X 32 Dot Matrix 520-5052-00

APPENDIX D
Board Type Table

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

APPENDIX E
Generic Coil Cross-Reference Guide

SEGA PINBALL™ Part Nº	Gauge-Turns	SEGA PINBALL™ Part Nº	Gauge-Turns	SEGA PINBALL™ Part Nº	Gauge-Turns	SEGA PINBALL™ Part Nº	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 Nº w/Ga.-Turns	Flipper: Lower Left SEGA PINBALL™ Part Nº w/Ga.-Turns	Flipper: Upper Right SEGA PINBALL™ Part Nº w/Ga.-Turns	Flipper: Upper Left SEGA PINBALL™ Part Nº 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 Nº w/Ga.-Turns	Flipper: Lower Left SEGA PINBALL™ Part Nº w/Ga.-Turns	Flipper: Upper Right SEGA PINBALL™ Part Nº w/Ga.-Turns	Flipper: Upper Left SEGA PINBALL™ Part Nº 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

APPENDIX F
Motor Specification Table

Game Name	Function	Specifications	Part Nº
Laser Wars Secret Service Torpedo Alley Time Machine Playboy 35th Anniversary	Shaded Games: No Motor Used.		
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	(Correction Note: No motor was used on this game.)		
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	Bowman Model E Motor 24v 11 RPM 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
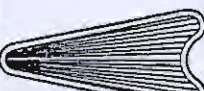
APPENDIX F
Motor Specification Table

Game Name	Function	Specifications	Part №
Last Action Hero	Crane Left/Right Movement	Multi Mod #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	515-5900-00
The Who's Tommy	Mirror Up/Down	Bowman Motor 24v A.C. 6 RPM	515-5900-00
	Flipper Blinders	Servo Motor	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	041-5032-00
Baywatch			
Batman Forever	Cannon Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CCW	515-6383-00

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	STARBURST CIRCULAR	STARBURST CIRCULAR	STARBURST CIRCULAR	STARBURST CIRCULAR
	5/8" ø	3/4" ø	1" ø	1-3/16" ø	1-1/2" ø
	550-5000-XX	550-5001-XX	550-5002-XX	550-5003-XX	550-5004-XX
STARBURST CIRCULAR	**STARBURST CIRCULAR**	**PLAIN CIRCULAR**	**PLAIN CIRCULAR**	**PLAIN CIRCULAR**	**PLAIN CIRCULAR**
2-1/4" ø	2-3/4" ø	3/4" ø	1" ø	1-3/16" ø	1-1/2" ø
550-5005-XX	550-5006-XX	550-5007-XX	550-5008-XX	550-5009-XX	550-5010-XX
PLAIN CIRCULAR	**PLAIN CIRCULAR**	**STIPPLE CIRCULAR**	**STIPPLE 1" SQUARE**	**ROLLOVER BUTTON BASE**	**WHITE STAR** (only in white)
2-1/4" ø	2-3/4" ø	1" ø	1²"		
550-5011-XX	550-5012-XX	550-5048-XX	550-5019-XX	550-5026-XX	545-5015-00
STIPPLE RECTANGULAR	**STIPPLE RECTANGULAR**	**STARBURST RECTANGULAR**	**PLAIN RECTANGULAR**	**PLAIN RECTANGULAR**	**PLAIN RECTANGULAR**
1-1/2" X 3/4"	1-3/5" X 1-1/2"	2-1/4" X 1-1/8"	2-1/4" X 1-1/8"	1-3/5" X 1-1/2"	2" X 2-1/2"
550-5018-XX	550-5051-XX	550-5044-XX	550-5049-XX	550-5050-XX	550-5063-XX
STARBURST MINI SHIELD	**STARBURST LARGE SHIELD**	**MINI HOT DOG**	**BEVEL HOT DOG**	**PLAIN HOT DOG**	**BANANA**
1" X 1"	2-1/5" X 2"	1-5/8"	3-1/2"	3-1/2"	
550-5024-XX	550-5025-XX	550-5020-XX	550-5021-XX	550-5022-XX	550-5023-XX
STARBURST ARROW-SHORT	**STARBURST ARROW-LARGE**	**STARBURST ARROW-HEAD**	**STARBURST BULLET**	**STARBURST TRIANGLE**	
550-5013-XX	550-5014-XX	550-5015-XX	550-5016-XX	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	-10	FLUORESCENT ORANGE
-02:	RED	-07:	ORANGE	-11	FLUORESCENT GREEN
-03:	AMBER	-08:	WHITE	-12	FLUORESCENT BLUE
-04:	GREEN	-09:	PURPLE	-13	TEAL GREEN
-05:	BLUE			-14	GRAY

GLOSSARY OF TERMS

A	Followed after a number means "Amp." or Ampage in an expression relating to an electrical object. e.g. 8A (eight amps).
AC	Acronym: Alternating Current.
Adj.	Abbreviation: Adjustment(s).
A.L.I.S.O.N. Interface	See Section 3, Chapter 6.
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.
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 Nº 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
RAM	Acronym: Random Access Memory. RAM **can** store input instructions and supply output information.
RED	Abbreviation: Red.
Reflexive/Non-Reflexive	Reflexive—Solenoid Drive Transistor is enabled directly by a switch closure on the solenoid assembly. (Non-Reflexive—Solenoid Drive Transistor is enabled by the CPU after reading a switch closure in the Switch Matrix.
Relay	An automatic switch operated by current in a coil.
ROM	Aconym: 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 repetive 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.

SEGA PINBALL, INC. LIMITED WARRANTY

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

PRINTED CIRCUIT BOARDS (GAME LOGIC) 60 DAYS

NO OTHER PARTS OF SELLER'S PRODUCT ARE WARRANTED.

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

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

1. SELLER IS NOTIFIED PROMPTLY UPON DISCOVERY BY PURCHASER THAT STATED PRODUCTS ARE DEFECTIVE.

2. SUCH PRODUCTS ARE PROPERLY PACKAGED AND THEN RETURNED FREIGHT PREPAID, TO SELLER'S PLANT.

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

WARRANTY DISCLAIMER

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

CAUTIONS, WARNINGS & NOTICES

Caution

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

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

Warning

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

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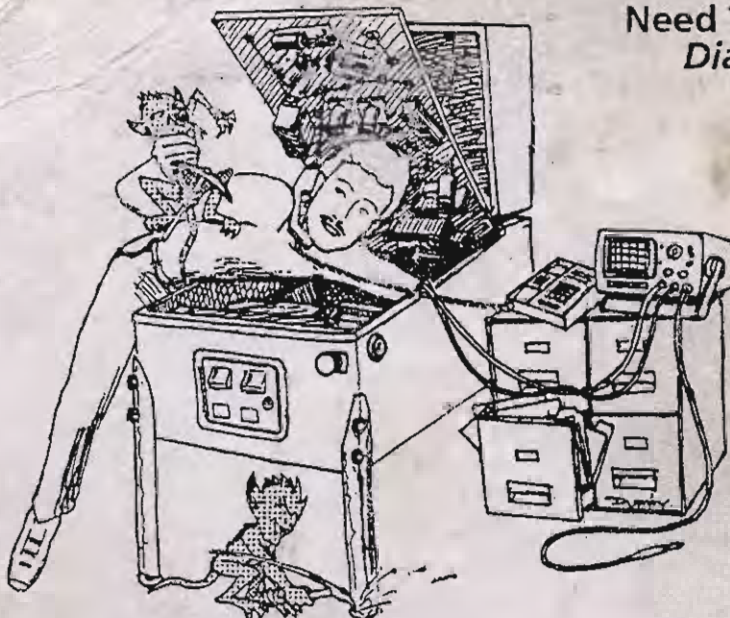
Notices

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

PORTALS, ICON DESIGNS, AND SONIC THE HEDGEHOG™ IS A TRADEMARKS OF SEGA. ALL RIGHTS RESERVED.

"MULTIBALL" IS A REGISTERED TRADEMARK OF WILLIAMS ELECTRONICS GAMES, INC. USED WITH PERMISSION.

BATMAN, BATMAN FOREVER, LOGOS AND CHARACTERS AND ALL ELEMENTS ARE THE PROPERTY OF DC COMICS. LICENSEE FROM WARNER BROS. USED WITH PERMISSION.

Need Technical Advice?
Dial 1-800-KICKERS!

ALTHOUGH EVERY EFFORT IS PUT INTO MAKING THIS MANUAL AND ALL OTHER DOCUMENTS RELATING TO THIS PRODUCT ARE ACCURATE AND COMPLETE, GAMES, FEATURES, RULES, PLAYFIELD, PROGRAMMING AND OPERATION ARE SUBJECT TO CHANGE WITHOUT NOTICE. IF YOU HAVE ANY QUESTIONS OR PROBLEMS, CALL US AT 1-800-KICKERS OR (708) 345-7700.

SEGA ™
PINBALL, INC.

1990 JANICE AVENUE
MELROSE PARK, IL 60160

TEL 1-708-345-7700
FAX 1-708-345-7889

Technical Support
Toll-Free (USA):
1-800-KICKERS (542-5377)

FOREVER

Service Bulletin N° 83
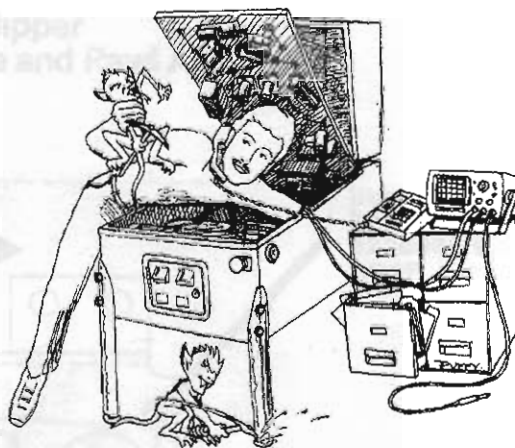
SEGA™
PINBALL, INC.

1990 Janice Avenue
Melrose Park, IL 60160
• ✆ Tel 708-345-7700 •

Technical Support

• 1-800-KICKERS (800-542-5377) •
• Fax 708-345-7889 •

Joe Blackwell	Eric Winston	Ted Kilpin	Jay Alfer
Technical Support Manager	Technical Support Engineer	Technical Support Engineer	Tech. Doc. Administrator

TO: Parts & Service Managers

DATE: January 23, 1996

SUBJ: B A T M A N™ F O R E V E R **Premature failure of the New Style Flipper Pawl Assy.**

We have discovered that a number of the pawls used with our new Flipper Assembly on Batman Forever Pinball were manufactured with a softer material than specified by our Engineering Department (see Fig. 1). This can lead to a premature failure of the Flipper Pawl (Mounting Link) producing "weak" flipper action caused by excessive wear where the pawl connects to the link.

Note:
Earlier production games used the old style Flipper Assy. which would not have this problem.

Please view the next page with Fig. 1 & 2 to match your flipper with the one shown, ensuring your game has the new style flipper. Then inspect the pawl to verify it does not have this potential problem.

If you experience this problem, please call our 1-800-542-5377 Technical Support Line or the distributor you purchased the game from and we will send you a complete replacement Plunger, Link and Pawl Assembly, if required.
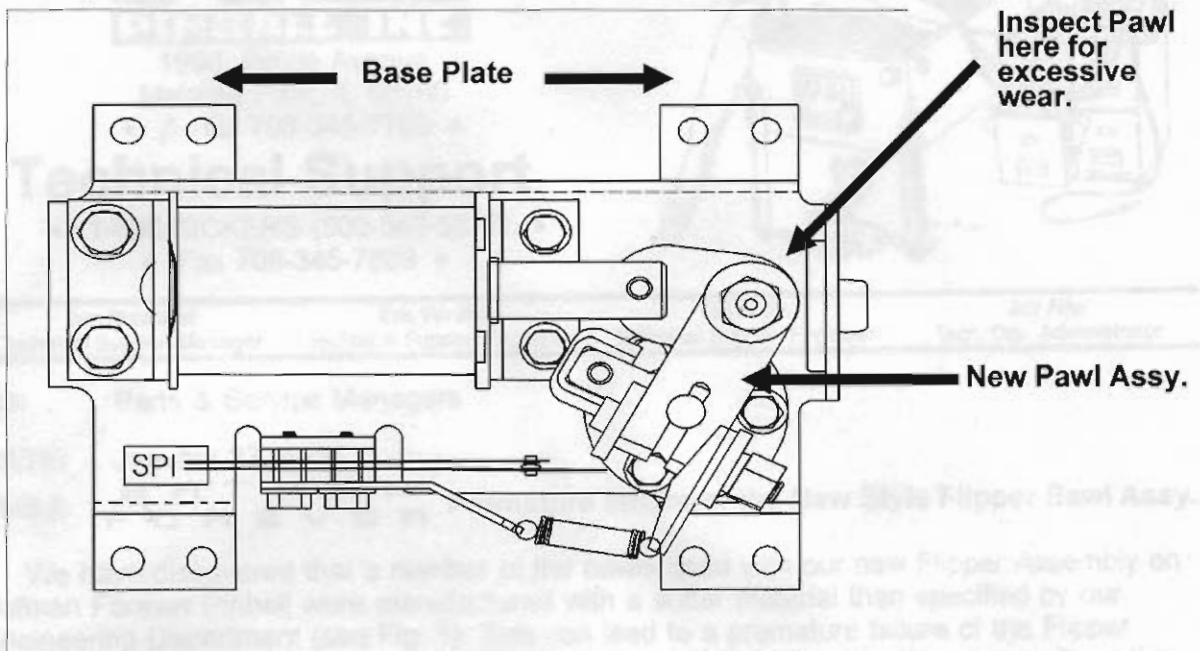
Note - We will require the serial # of the game , the date the game was purchased and the name of the distributor it was purchased from.

① Batman Forever New Style Flipper Assy. (Lwr. Rt. Side, Coil 22-900), Part N° 500-5944-01
Batman Forever New Style Flipper Assy. (Upr. Rt. Side, Coil 23-900), Part N° 500-6029-03
Batman Forever New Style Flipper Assy. (Left Side, Coil 22-1080), Part N° 500-5944-12

② Pawl (Mounting Link) for the Right Flippers, Part N° 535-7271-00
Pawl (Mounting Link) for the Left Flipper, Part N° 535-7271-01

③ Replacement Plunger, Link & Pawl Assy. for the Right Flippers, Part N° 515-6518-00
Replacement Plunger, Link & Pawl Assy. for the Left Flippers, Part N° 515-6518-01

If you have any questions or concerns, please feel free to call us at 1-800-542-5377 or 708-345-7700.

Sega Pinball Inc. © 1996
Technical Service Bulletin 83

New Style Flipper
(identified by new Base Plate and Pawl Assembly)

Fig. 1

Inspect Pawl here for excessive wear.

← **Base Plate** →

New Pawl Assy.

SPI

Replacement Plunger, Link & Pawl Assembly

Fig. 2

Pawl Assembly

Plunger   **Link**

Sega Pinball Inc. © 1996
Technical Service Bulletin 83