CAPCOM®
COIN-OP, INC.

BIG BANG BAR™

OPERATORS MANUAL
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CAPCOM® COIN- INC.

PARTS: (847) 797-6320
SERVICE: (847) 797-6192
FAX: (847) 797-6306

TECHNICAL PUBLICATIONS STAFF:

Steve Wysocki
Editing & Supervision

J. Mark Ashburn
Technical Coordination

Jim Ale
Illustr

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NR = Not Released

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NOTES

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INSTALLATION INSTRUCTIONS

1) To open carton, remove staples and open top flaps (see Figure 1).

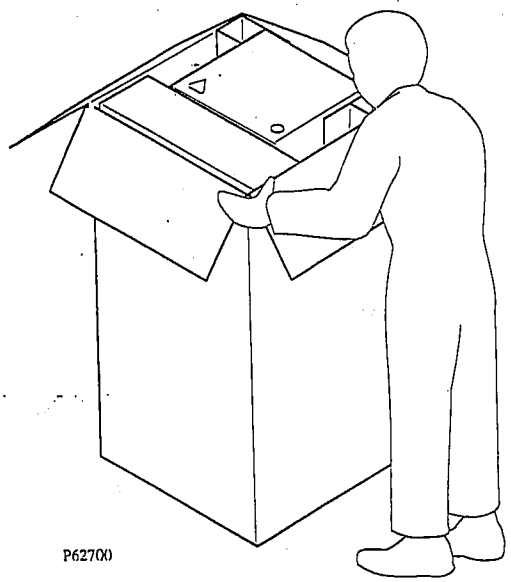

FIGURE 1: OPENING SHIPPING CARTON

2) Two or more people should lay the carton on its side. Slide game and packing materials out from carton (see Figure 2). Open the parts box.

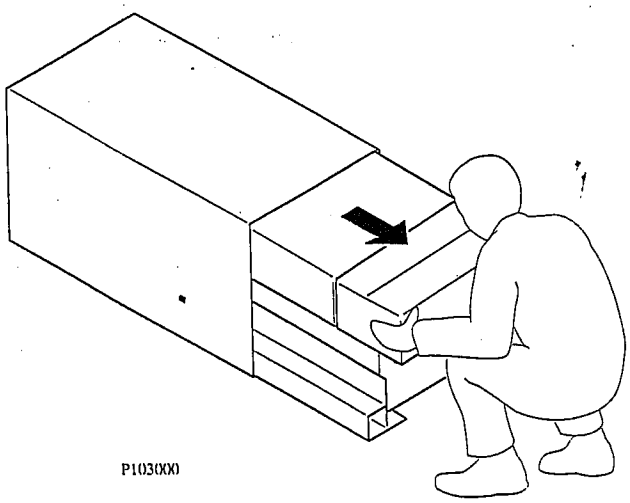

FIGURE 2: REMOVING GAME AND PARTS BOX

3) Check loose parts against packing list. Report any damaged or missing parts.

4) Keys are attached to the ball shooter. Open coin door and install cash box.

5) Raise the backbox to its upright position. Ensure that cables are not pinched (see Figure 3).

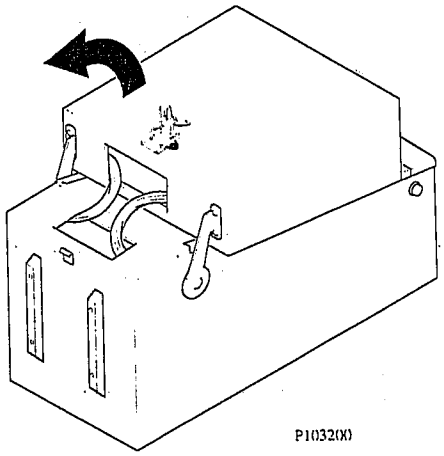

FIGURE 3: RAISING BACKBOX UPRIGHT

6) Lift the cabinet latch and flip key upwards to the upright position. Turn the key counter clockwise (to the left) (see Figure 4).

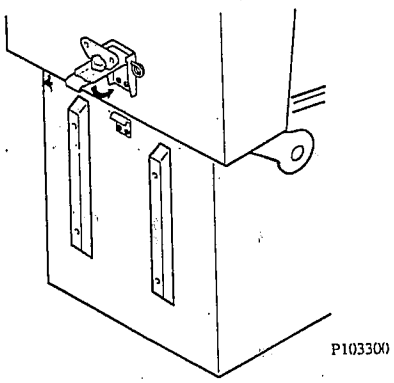

FIGURE 4: LATCH ON BACKBOX

7) Engage the latch and turn key fully clockwise (to the right). Flip the key down to lock (see Figure 5).

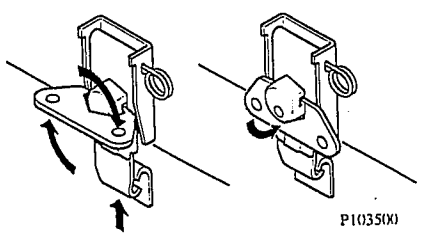

FIGURE 5: LOCKING THE LATCH

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8) Install one hex nut (A) half-way up on each leveler. Then insert levelers into each leg and turn until they contact the stop nut. Using a second nut (B), thread onto each leveler from inside the leg and tighten (see Figure 6).

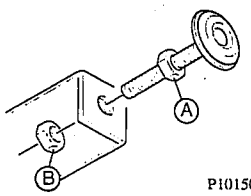

FIGURE 6: INSTALLING LEVELER ON LEG

9) Carefully lift the front of the cabinet and place on a sturdy support. Attach the front legs using two acorn-head bolts. Tighten bolts firmly (see Figure 7).

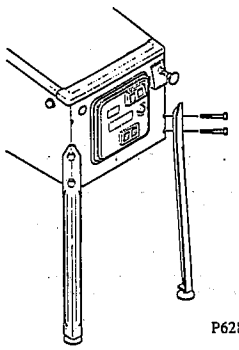

FIGURE 7: INSTALLING LEGS ON CABINET

10) Carefully lift the rear of the cabinet, place on a sturdy support, and attach the legs using the supplied bolts. Tighten firmly.

11) At the rear of the cabinet, connect AC line cord to receptacle. Install cover plate, bushing, and screws.

12) Using two or more people lift the game and move to intended play area. Do not slide legs on floor.

13) Insert key into the lock at the top of the backbox and turn fully clockwise. Lift up on backglass and swing out towards front of game. CAREFULLY remove backglass and set aside.

14) Lift up on latch and open the lamp door. Open display panel by pushing latches, located above the speaker enclosures, out towards the sides of backbox.

15) Attach lock washer and flat washer to thumb screw and fasten to cabinet tee nuts (see figure 8). Tighten firmly.

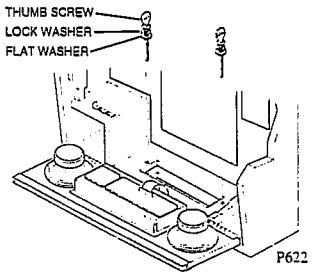

FIGURE 8: INSTALLING BACKBOX LOCKING HARDWARE

16) Check that all fuses, connectors, lamps, and wire harnesses are fully seated. Tighten any loose fasteners snugly. Do not overtighten.

17) Close and latch both sides of the display panel. Re-install the backglass and lock the backbox.

18) Place a level in position "A" on the playfield glass (see Figure 9). Adjust the rear leg levelers, as required, to obtain zero degree(0°) balance. Move the level to position "B" and repeat front & rear adjustments until cabinet appears level. DO NOT tighten leveler nuts firmly at this stage; an additional adjustment is required.

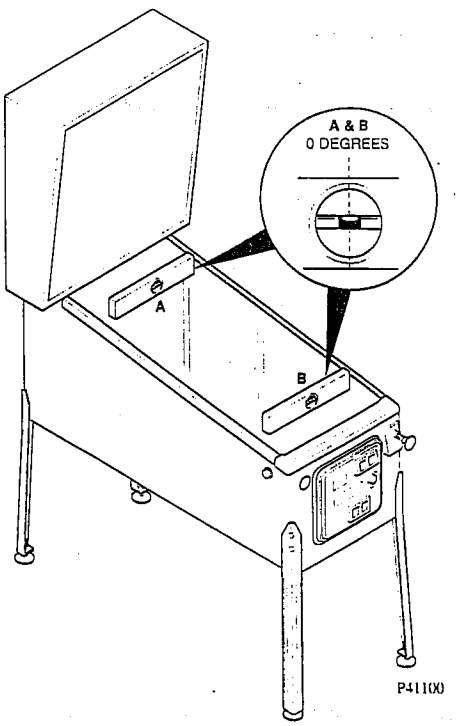

FIGURE 9: CABINET LEVELING

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19) Open the coin door. Locate lock lever and pull towards center of cabinet; remove handrail and set aside. Remove playfield glass by sliding down and out of armor guides. CAREFULLY set glass aside (see Figure 10).

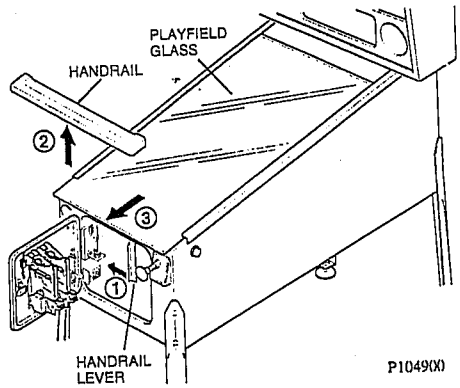

FIGURE 10: REMOVING PLAYFIELD GLASS

20) Lift playfield straight-up until it reaches the locked position. Verify that solenoids, connectors, lamps, and harnesses are fully seated. Tighten any loose fasteners snugly. Do not overtighten.

21) Locate plumb bob parts. Install thumbscrew into threaded hole on lead weight. Insert hook wire into tapered end of lead weight. Raise wire & weight up into bottom tilt bracket and hang from top bracket. Adjust and tighten screw firmly (see Figure 11).

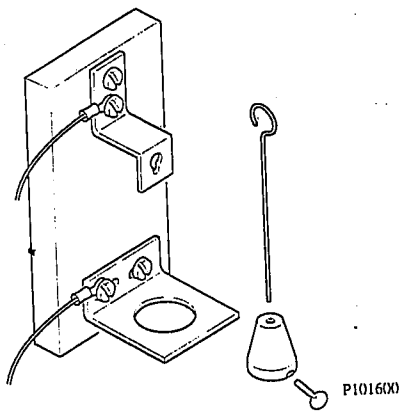

FIGURE 11: PLUMB BOB TILT ASSEMBLY

22) Lower the playfield into the cabinet. Ensure that cables are not pinched when playfield is seated.

23) Place a level or protractor on the playfield surface (see Figure 12). Adjust front and/or rear leg levelers to obtain a 6-1/2° incline. Tighten leg leveler nuts firmly.

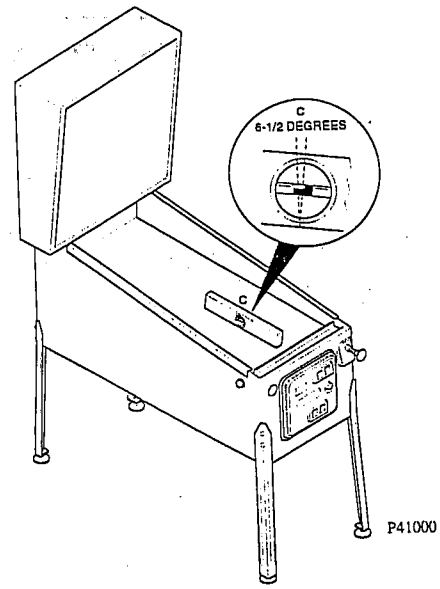

FIGURE 12: PLAYFIELD LEVELING

24) Connect AC line cord to power outlet. Route cord away from foot traffic. Turn the game power ON (switch is under cabinet near right front leg).

25) Open the coin door. Dot matrix display will show the system menu. Follow directions in this manual for changing factory settings.

26) Refer to the TROUBLESHOOTING GUIDE section of the manual for assistance in locating faults, clearing errors, etc.

27) Upon completion, system menu should report "FOUND: 0 ERRORS, 0 INFO" to indicate the game is ready for use.

28) Install required number of balls.

29) Clean both sides of playfield glass. Install glass. Install handrail. Ensure that lever snaps in and locks.

30) Close the coin door. Insert currency or tokens as necessary. Press the START button. Game should begin.

31) Open coin door and retrieve currency or tokens. Set custom messages, difficulty, pricing, replays, etc.

32) Reset all counters to zero. Close and lock coin door. Ensure that the backbox is locked.

BIG BANG BAR begins!

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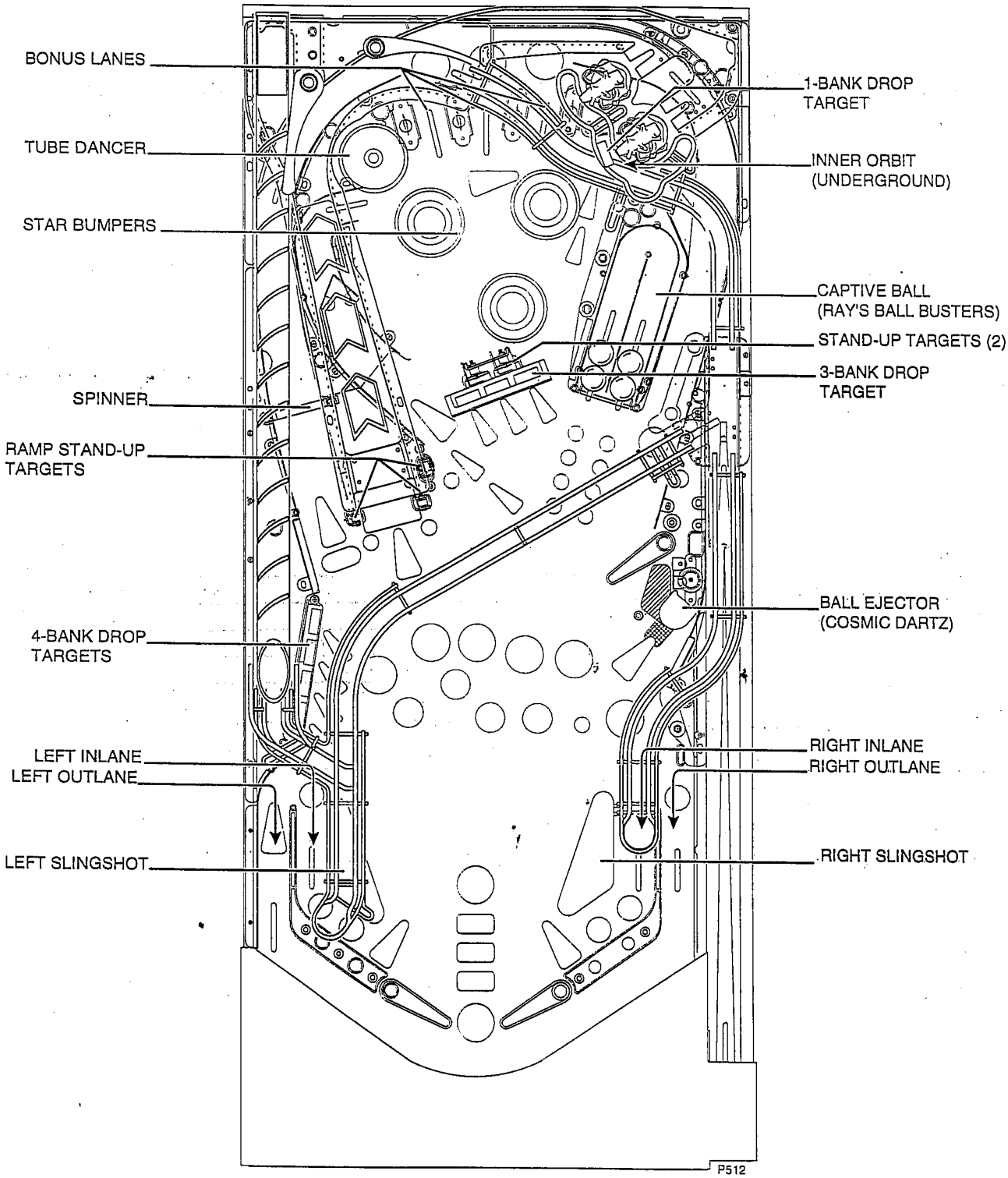
PLAYFIELD FEATURES



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GAME RULES

INTRODUCTION

On the night of July 2nd, 1947 a loud crash was heard near Roswell, New Mexico. Remains of an alien spacecraft were recovered, although this was officially denied by the United States government. Was this craft the advance scout of an impending alien invasion of the Earth? Or was it simply an accident by a group of joyriders after having had one too many at the...

SCORING

In general, the game is scored as follows:

GUIDELINES FOR SCORING			
100	to	10,000	"10 point" targets (slingshots, spinner, etc.)
10,000	to	300,000	Easy shot; low score
300,000	to	600,000	Normal shot; medium score
600,000	to	1,000,000	Difficult shot; high score
1,000,000	to	10,000,000	Jackpot

DIFFICULTY SETTINGS

The following are operator-adjustable difficulty settings for the game (see Menu System, B2 Game Adjustments, for complete instructions):

	Extra Easy	Easy	Normal	Hard	Extra Hard
Ball Saver Time	15 sec	10 sec	7 sec	5 sec	3 sec
Initial Drop Time-out	120 sec	90 sec	60 sec	40 sec	20 sec
Kickback Memory	Yes	Yes	Yes	No	No
Kickback Ballsaver	10 sec	7 sec	5 sec	3 sec	0 sec
Bathroom Delta	2 trips	4 trips	6 trips	8 trips	10 trips
Mode Time	90 secs	60 secs	30 secs	20 secs	15 secs
"BRAWL" Letters Spotted	BRAW	BRA	BR	B	<none>
Tube Dancer Side Standup Spotted	Always	1st time only	1st time only	1st time only	Never
Tube Dancer Memory	Yes	Yes	Yes	No	No
Hits For Underground	2	3	4	4	5

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PLAYFIELD FEATURES

DRAIN
- Left lane
  - Free Shot kicker when lit
  - 1,750 score

RIGHT LANE
- Awards SPECIAL when lit (by repeated Bathroom trips)
  - 1,750 score

CENTER LANE
- No score

INLANES
- Temporarily qualify mode (if not yet qualified)
- 100,000 score, 2,500 bonus

SPINNER
- 110 score per revolution (the opto spinner is fast; about 200 revs per solid hit!)

OUTER ORBIT
- Gates are closed when no mode is qualified, to divert ball to star bumpers
- Gates are open when a mode is qualified, to allow complete orbits
  - Scoring:
    - 100,000 score, 5,000 bonus

INNER ORBIT
- See "Underground" under "Modeless Features".

SLINGSHOTS
- 110 score

STAR BUMPERS
- 7,500 score
- When no mode is qualified or active, changes flashing mode

3-BANK & 4-BANK DROP TARGETS
- Qualify "Looped In Space" (see "Modeless Features")
  - Scoring:
    - Each target down: 15,000 score
    - All targets in bank down: 50,000 score
    - Standup targets behind 3-bank: 10,000 score

1-BANK (DOORMAN)
- See "Underground" under "Modeless Features".

EJECT SAUCER
  - Re-light FREE SHOT kicker
- Scoring:
  - 500,000 score, 20,000 bonus

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ROLLOVERS

- Flippers rotate lit lanes, hitting unlit lane lights it
- Light all three lanes to advance bonus multiplier: 2x, 3x, 4x, 5x
- After 5x, multiplier doesn't increase but lighting all lanes adds 250,000 bonus
  - Scoring:
    - Unlit lane: 100,000 score times current bonus multiplier, 10,000 bonus
    - Lit lane: 50,000 score, 2,500 bonus
    - Lighting all three lanes: 500,000 score

COMBOS

- Hitting any of the following shots without back-to-back without hitting anything else awards a combo:
  - Left orbit
  - Right orbit
  - Inner orbit
  - Ramp
  - 1-Bank (ends combo series)
  - Cosmic Dartz eject hole
- Any combo to captive balls awards "CAPCOMBO"
- Sound calls: "Twosome!" "Threesome!" "Foursome!" "Awesome!"
- Scoring:
  - 2-way combo: 750,000 score, 100,000 bonus
  - Each additional increases award by: 100,000 score, 20,000 bonus
  - CAPCOMBO: Additional 500,000 score, 100,000 bonus

RAMP STANDUPS

- Hit all three standups to qualify Tube Dancer (first time, side standup is given free)
  - Scoring:
    - Front standups, 10,000 score
    - Side standup, 12,750 score

FREE SHOT KICKER

- Light by shooting eject hole
- 110 score, 50,250 bonus when lit

BONUS COUNTDOWN

- Each mode collected is worth 1,000,000 bonus

MATCH SEQUENCE

- Vomit oozes into numbers

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Bar Awards (Modes)

- Star bumpers rotate the current mode when no mode is qualified or active
- Mode is qualified by 3-bank and standups behind 3-bank
- Mode is temporarily qualified by lit inlane. Only one inlane is lit; flippers change which lane is lit. This lets the player choose to qualify a mode or go for more bathroom awards.
- Mode is collected by a ramp shot, which is diverted to the 3-lock while we do a show in the dots.
- Modes are either timed (see table of difficulty settings for Mode Time) or collected instantaneously.

MOSH A-GO-GO (STAR BUMPERS)

Everyone to the dance floor for the Big Bang Bar dance contest! Shoot the for the Dance Floor (Star Bumpers) and mosh it up.

COSMIC DARTZ (RIGHT SAUCER)

What bar is complete without a dart board? Shoot for the bullseye (Right Saucer).

BABESCANNER (LEFT OUTER ORBIT)

The BabeScanner is the latest in modern dating technology. When the scanner is activated, shoot the left orbit to score in more ways than one.

LUNAPALOOZA (RIGHT OUTER ORBIT)

The DJ's taking requests! Shoot the left orbit to change the tune and score. Each right orbit changes the background tune, and dots show.

TOUR THE BAR

There are lots of things to see in the Big Bang Bar. Try to see them all!

- See Ray's Famous Bar! (Right Orbit)
- Ogle the Fabulous Tube Dancer! (Left Orbit)
- Play Street Fighter II Alpha 3 Turbo Deluxe in the Game Room (Eject Hole)
- Taste the Kitchen (not recommended for health inspectors) (Inner Orbit)
- Visit the Bathroom (not recommended for oxygen breathers) (Ramp to the Right Inlane)

HAPPY HOUR

Happy Hour! Ray's serving drinks at half price. Order yours by hitting any target.

CHASE THE WAITRESS

Ever notice that there's never a waitress around when you need a refill? Follow the flashing light and catch the waitress.

EXTRA BALL (1-BANK DROP TARGET)

Shoot for the 1-bank drop target and get an extra ball.

GET LUCKY

Hey, everyone gets lucky at Big Bang! "Get Lucky" and earn big points.

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MODELESS FEATURES

LOOPED IN SPACE (2-BALL MAYHEM)

Every planet has a champion drinker. Challenge them all by dropping the left and right drop target banks (the more times you hit the 3-bank and 4-bank drop targets the higher the jackpot value increase), then shoot the ramp to take on Rosencrantz and Guildenstern, the biggest drinkers in all the galaxy. This will start 2-ball Mayhem. Shoot the ramp to collect the Jackpot.

MULTI-BRAWL (3-BALL MAYHEM)

Looking for a fight? You're in luck! You can always find someone with a chip on his/her/its shoulder hanging around Big Bang. Hit "Ray's Ball Busters" (captive ball) 5 times to spell "BRAWL". This will qualify Multi-Brawl. Once qualified shoot the ramp to lock balls. After 3 balls are locked, they're released one at a time. Shoot the ramp to increase the base jackpot. Then shoot ramp to collect base jackpot value. Also the Inner Orbit can be shot to collect double the base jackpot.

RAY'S BALL BUSTERS (CAPTIVE BALL)

Cosmic Ray serves his "special" drinks only to the most discerning patrons. Move all the balls to the unlit side. Be careful not to hit any balls to the wrong side.

TUBE DANCER

Big Bang's star attraction is its Tube Dancer. She'll dance for you, but don't forget to give her a tip!

- Hit all three ramp standup targets to qualify. (First time, the side standup is spotted free.)
- Black light is on.
- Shoot the ramp->tube to stop the lady dancing and get the current award.
- Awards:
  - Hurry-Up Jackpot (repeat the ramp shot within time allotted for big points)
  - 10 Million
  - Hurry-Up Extra ball (hit 1-bank within time allotted for extra ball)

UNDERGROUND (1-BANK DROP TARGET)

The Underground is Big Bang's bar-within-a-bar. The doorman keeps out the riffraff; only the most elite are privileged enough to enter. Hit the 1-bank to open the Inner Orbit. The 1-bank is held down for 10 seconds to allow inner orbit shots. After 4 hits and or orbits (software adjustable) the Underground is entered. Keep shooting the Inner Orbit for big points.

BIG BANG (4-BALL MAYHEM)

Done everything there is to do in Big Bang? Then slam back a stiff drink and prepare yourself for the biggest bang of them all! Big Bang mode is qualified by collecting all other modes and features. When qualified, Big Bang is started by hitting the 1-bank drop target. This takes you into *TIMED FRENZY*! During Big Bang all four balls are in play; drained balls will be returned to player for as long as the timer is running. Balls in shooter lane are not considered in play.

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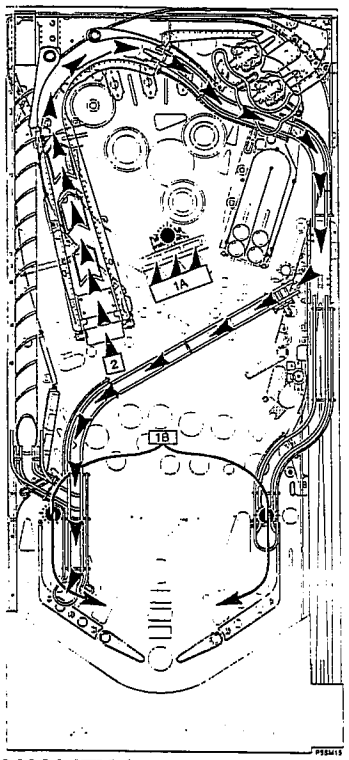
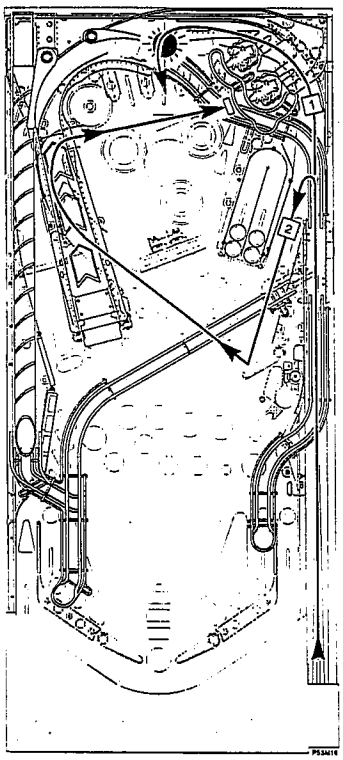
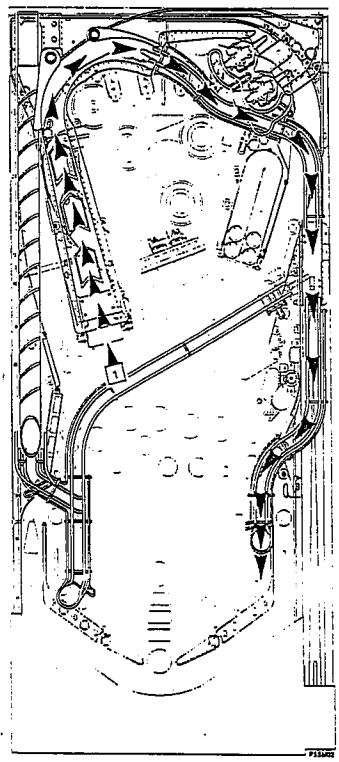
SHOTMAPS



QUALIFY / COLLECT MODE



SKILL SHOTS



BATHROOM

DESCRIPTION	SHOT #	CONDITION / ACTION	SCORING
QUALIFY MODE	1	To qualify a mode, hit 3-bank drop targets or hidden stand-up targets (1A). A mode is temporarily qualified by making lit inlane (1B). Only one inlane is lit at a time. The flippers can change which inlane is lit, and the player can choose to qualify a mode or go for more bathroom awards. "Qualify Mode" lamps in inlanes will light steady until mode is qualified. "Qualify Mode" lamp on top of 3-bank drop target will flash until mode is qualified. **Note:** Star bumpers change the current mode when no mode is qualified or active.	None.
COLLECT MODE	2	All modes are collected by a final ramp shot. Modes are either timed or collected instantaneously.	Per shot rules.
PLUNGER SKILL SHOT	1	A lamp in the rollover lanes (located at the back of the playfield) is flashing. You must shoot that lane. The lane can be rotated with the flipper buttons. A "Nudge Shot" can be made by not rotating the lanes and hitting the lit lane.	• 2 mil score for hitting the flashing lane. • 1 mil score for "Nudge Shot". • Each skill shot made increases score by 1 mil. • Missing the skill shot awards 100k score.
SECRET SKILL SHOT	2	Shoot 1-bank drop target without hitting anything else.	6 mil
BATHROOM SHOT	1	Shoot ramp and exit right wireform.	Note: The setting for the number of return trips to the bathroom is software adjustable. The default is set at 3 in normal mode. Awards are given after a series of "Bathroom" trips are made. (Example: If the setting is 3 then the awards would be collected after 3, 6, 9,12,15,18,21,24 trips). Once you have completed the entire series (all 8 awards have been given), the number of return trips is increased by 1 (28, 32, 36, etc.).

Series of Awards:	
1) Spot "BRAWL" letter	5) Spot "BRAWL" letter
2) Start "Tube Dancer"	6) Award "BALL BUSTERS"
3) Spot "BRAWL" letter	7) Spot "BRAWL" letter
4) Light "Extra Ball"	8) Light "Special"

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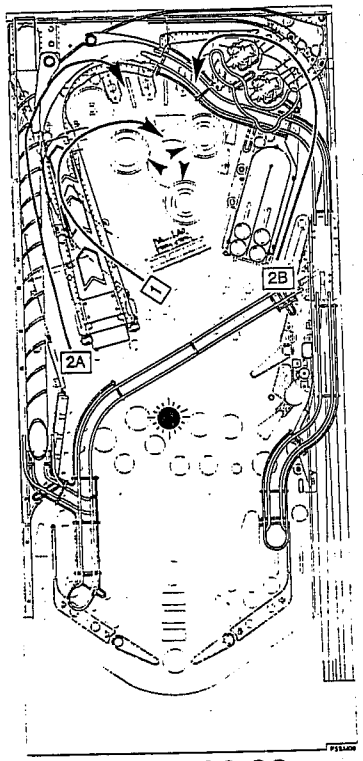
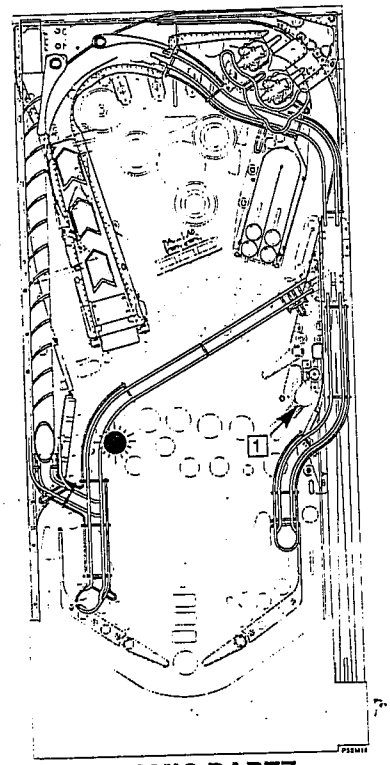
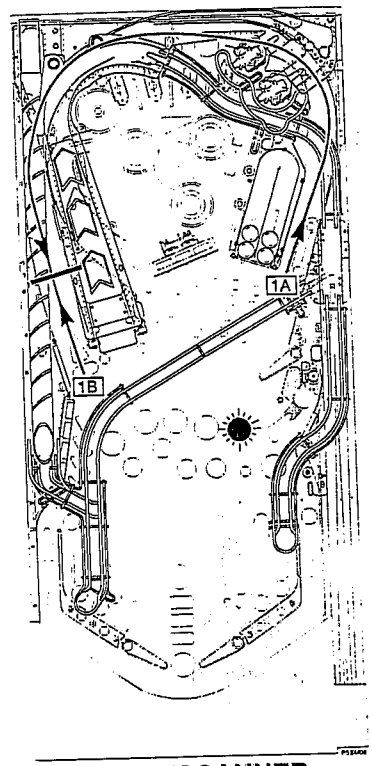
SHOTMAPS (CONT.)



MOSH A GO-GO



COSMIC DARTZ



BABESCANNER

DESCRIPTION	SHOT #	CONDITION / ACTION	SCORING
MOSH A GO-GO	1, 2A, 2B	This is a timed mode. Mode lamp will flash in center of playfield until mode is completed. Shoot inner orbit (1), or shoot either side of outer orbit (2A, 2B) into star bumpers.	100k, add 100k after every 3rd hit (100k, 200k, 300k etc.) up to 800k.
COSMIC DARTZ	1	This is a timed mode. Mode lamp will flash in center of playfield until mode is completed. Shoot eject hole on right (1).	1.5 mil eject hole, and 500k bonus, 500k each additional hit.
BABESCANNER	1A, 1B	This is a timed mode. Mode lamp will flash in center of playfield until mode is completed. Shoot spinner through left or right orbit (1A, 1B).	1 mil, and 250k bonus for each left orbit completed.

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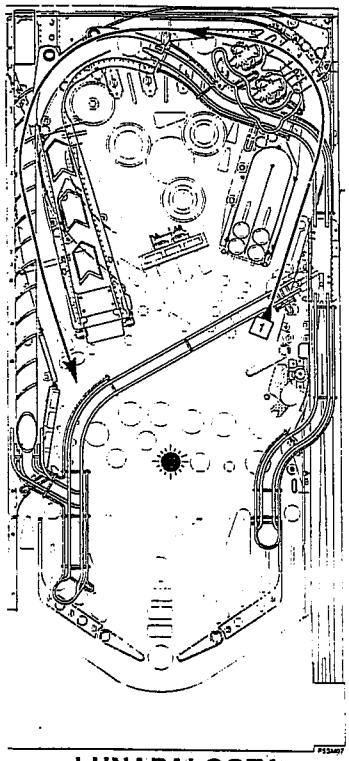
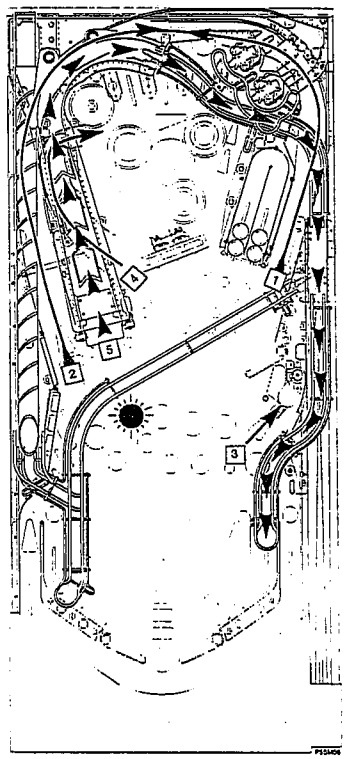
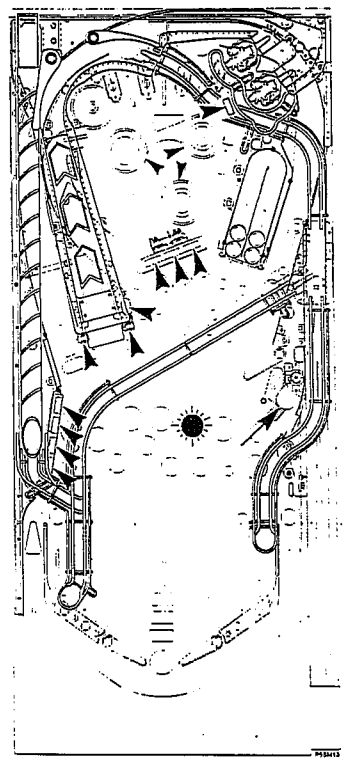
SHOTMAPS (CONT.)



LUNAPALOOZA



TOUR THE BAR



HAPPY HOUR

DESCRIPTION	SHOT #	CONDITION / ACTION	SCORING
LUNAPALOOZA	1	This is a timed mode. Mode lamp will flash in center of playfield until mode is completed. Shoot the right orbit. Each right orbit will change the tune.	2 mil, and 250k bonus for each right orbit completed.
TOUR THE BAR	1	**Note:** Shots DO NOT have to be completed in the order specified. This is a timed mode. Mode lamp will flash in center of playfield until mode is completed. Shoot right orbit.	1.5 mil, and 100,000 bonus.
	2	This is a timed mode. Mode lamp will flash in center of playfield until mode is completed. Shoot left orbit.	
	3	This is a timed mode. Mode lamp will flash in center of playfield until mode is completed. Shoot eject hole.	
	4	This is a timed mode. Mode lamp will flash in center of playfield until mode is completed. Shoot inner orbit.	
	5	This is a timed mode. Mode lamp will flash in center of playfield until mode is completed. Shoot ramp to right inlane	
HAPPY HOUR	ALL TARGETS	This is a timed mode. Mode lamp will flash in center of playfield until mode is completed. Shoot any target (drops, stand-ups, star bumper, eject hole).	All targets worth 500,000, and 5,000 bonus.

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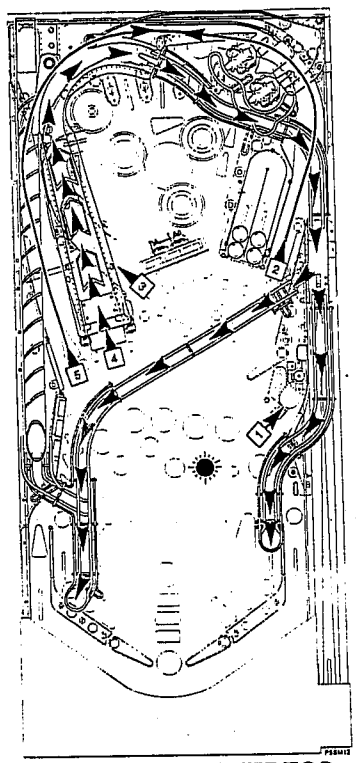
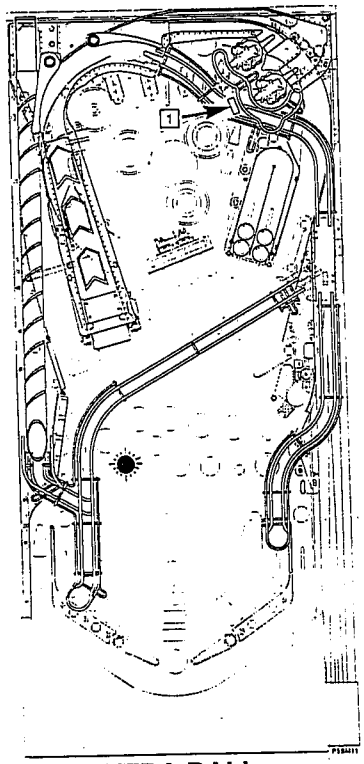
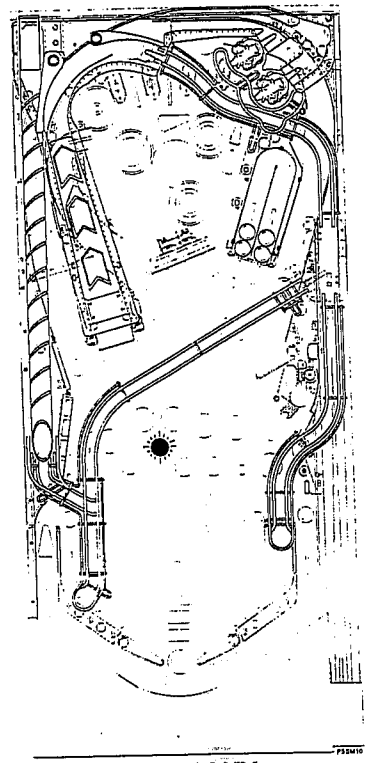
SHOTMAPS (CONT.)



CHASE THE WAITRESS



EXTRA BALL



GET LUCKY

DESCRIPTION	SHOT #	ACTION	SCORING
CHASE THE WAITRESS		This is a timed mode. Mode lamp will flash in center of playfield until mode is completed. Follow the waitress around the playfield until you catch her. Lamps will travel around the playfield and lamp up the shot that must be made. **Note:** Mode is finished when the waitress is caught or time runs out, whichever comes first.	Hurry-up score counts down 20,000,000. Shooting the lit target awards hurry-up score, 50,000 bonus. Score decreases as time runs down.
	1	Shoot eject hole.	
	2	Shoot right orbit.	
	3	Shoot inner orbit.	
	4	Shoot ramp to right inlane.	
	5	Shoot left orbit.	
EXTRA BALL	1	Extra ball lamp will flash until extra ball is collected or time runs out. Shoot single drop target.	No point value. Extra ball given.
GET LUCKY	1	Mode lamp will flash in center of playfield. To "Get Lucky", only the *Qualify Mode* and *Collect Mode* shots are required. Random award is then given.	Random awards: • 8,000,000 points • Collect bonus now. • Hold bonus (doesn't reset after this ball; this award not given on last ball of game). • Bonus multiplier (10X) • Super Dance: star bumpers worth 5X rest of ball. • Super Spinner: Spinner worth 5X for rest of ball. • Super Shots: Kickback always enabled for rest of ball. • Super Save: Restart ball saver (for its normal time).

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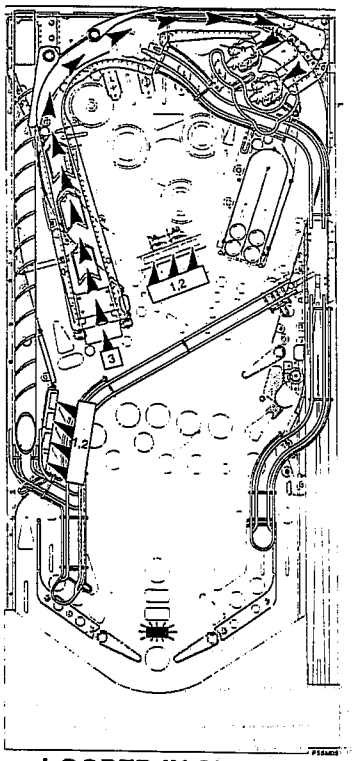
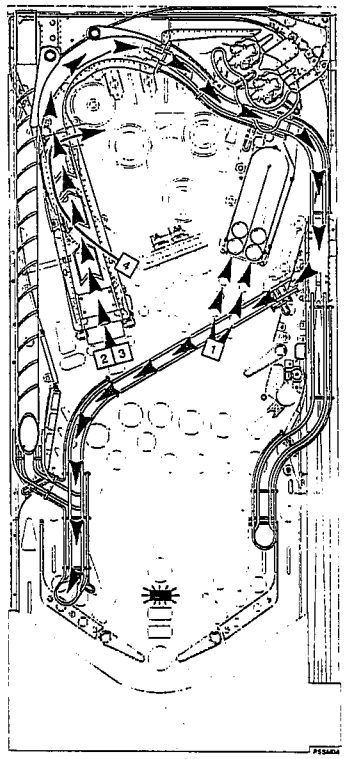
SHOTMAPS (CONT.)

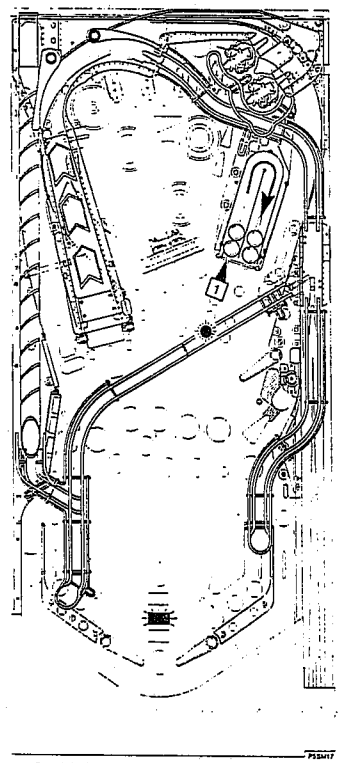
Note: The following shots are available at all times and can be completed any number of times. They do not have to be "Qualified" nor "Collected" as in previous Modes.



LOOPED IN SPACE



MULTI-BRAWL



RAY'S BALL BUSTERS

DESCRIPTION	SHOT #	ACTION	SCORING
LOOPED IN SPACE (2-Ball Mayhem)	1	Lamp will flash at bottom of playfield until shot(s) is completed. Knock down 3-bank drop targets to qualify right alien. Knock down 4-bank drop targets to qualify left alien.	*Not released at time of publications.*
	2	Lamp will flash at bottom of playfield until shot(s) is completed. Knock down 3-bank and 4-bank repeatedly to increase jackpot value.	
	3	Lamp will flash at bottom of playfield until shot(s) is completed. Shoot ramp and lock both balls in aliens mouths to start.	
MULTI-BRAWL (3-Ball Mayhem)	1	Lock qualified by hitting captive balls to spell "BRAWL".	No balls or 1 ball up ramp sets base value to 1X, 2 balls sets base value to 2X, and 3 balls sets base value to 3X. All must be done within time allotted.
	2	After 3 balls are locked, they're released one at a time. Shoot the ramp to build jackpot value..	
	3	"Jackpot" lamp in front of ramp will flash. Shoot ramp to collect "Jackpot". "Double Jackpot" lamp will flash in front of inner orbit. Shoot inner orbit to collect "Double Jackpot".	
	4	Shoot inner orbit to collect "Double Jackpot".	Gives double amount of base jackpot.
RAY'S BALL BUSTERS (Captive Ball)	1	Lamp will light steady on bottom of playfield. then, separate drink lamp columns (located at upper right of playfield) will strobe, indicating which captive ball side to shoot. Moving both captive balls to the other side will spell "BRAWL" and qualify "Multi-Brawl".	• Hitting a ball to wrong side: 0 score, 0 points • Hitting a ball to correct side: 500k score, 2,500 bonus. • Hitting all balls to correct side: 5 mil score, 75k bonus.

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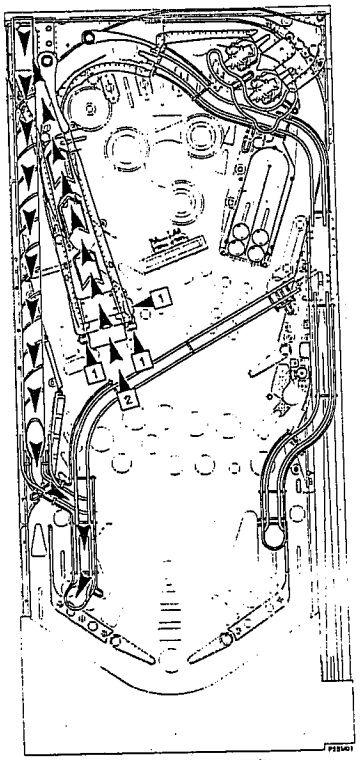
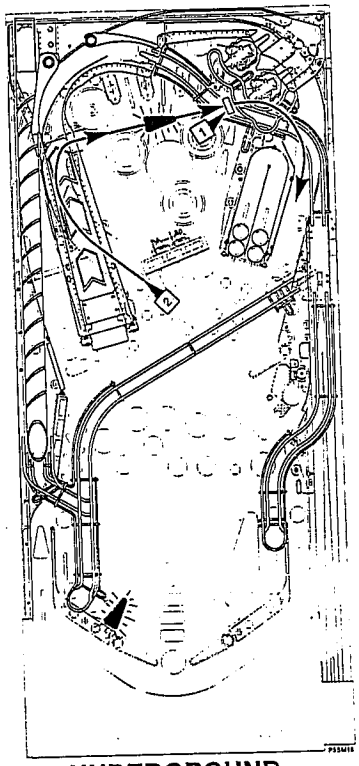
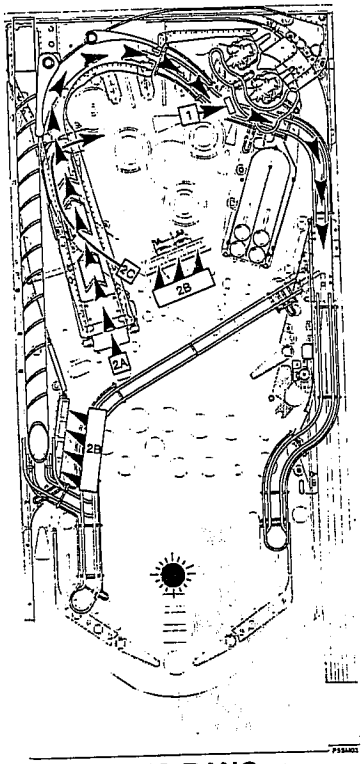
SHOTMAPS (CONT.)



TUBE DANCER



UNDERGROUND



BIG BANG

DESCRIPTION	SHOT #	ACTION	SCORING
TUBE DANCER	1	The three lamps (stand-up targets) around the bottom of the ramp will flash. Hit all three ramp stand-up targets to qualify (first time, the side stand-up is spotted free). Once target has been hit, it will turn to a solid lit lamp. After all three stand-ups have been hit, the black light at the back of the playfield will be lit steady, the tube will begin to flash and the "Tube Dancer" starts to dance. until shot is completed.	• Hurry-up Jackpot (repeat the ramp shot within time allotted for big points). • 10 million • Hurry-up Extra ball (hit 1-bank within time allotted for extra ball).
	2	Shoot ramp (tube to stop the lady dancing and get current award).	
UNDERGROUND	1	Hit 1-bank drop target. After 4 hits (software adjustable) the "Underground Mode" is started.	• Hitting the 1-bank awards 500k score, 5k bonus.
	2	Mode lamp will light steady at bottom of the playfield. The 1-bank is held down for 10 seconds to allow inner orbit shots. Shoot inner orbit.	• Each orbit awards 1 mil score,10k bonus (10 sec timer is reset when orbit is made). • 2mil, 3mil, 4mil, etc., 250k bonus for each inner orbit made.

*BIG BANG	1	Hit the 1-bank target to start.	• All targets worth 543,210k score times the numbers of balls in play.
			• The following shots are each worth 5 mil score times the number of balls in play.
			  • Ramp
			  • Completing either drop target
			  • Inner orbit

	2A, 2B, 2C	Shoot ramp (2A) or complete either drop targets (2B) or shoot the inner orbit (2C).	

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THEORY OF OPERATION

POWER SUPPLY CIRCUIT AND RELATED COMPONENTS

AC POWER CIRCUITS

The AC line cord may be any one of several domestic or international grounding type cordsets. Power enters the machine through a shielded I.E.C. (International Electrotechnical Commission) connector and passes through an electromagnetic interference filter. This filter reduces both common mode and differential conducted noise on the AC power wires. Power then travels through the main fuse to the unswitched convenience outlet and the OFF/ON switch. Both sides of the line are switched to prevent shock hazard during machine maintenance. The power transformer has dual tapped primary windings which must be connected in parallel for AC voltages less than 200 and in series for voltages more than 200. Multiple secondary windings provide low, medium, and high voltage power to the power supply circuit board for rectification, filtering, regulation, and protection. The high voltage power goes through a standard interlock switch to protect against shock or accidental equipment damage during routine maintenance or service. Note that the main fuse must be changed when switching between series and parallel configuration.

DC POWER CIRCUITS

All power sources are fused at their point of entry onto this board. Each power source is rectified by a full wave diode bridge and filtered by an electrolytic capacitor and a bleeder resistor to discharge the voltages during equipment service. Immediately following the capacitor is a light emitting diode with a current limiting resistor which indicates the presence of voltage. Additional fuses and LED indicators are used for branch circuits, and the low and medium voltage sources have series diodes to protect against power cross with higher voltages. All power supply voltages are positive with respect to ground to reduce noise sensitivity.

The lowest voltage source is the most critical since it runs the system microprocessors, the digital logic circuits, memory, and the interface circuits, so it gets its own three-terminal voltage regulator and filter capacitors. A voltage divider is used to provide the minimum load for regulator operation and at the same time set the output to five volts. This regulator has thermal shutdown to avoid damage due to overheating. Short-circuit protection is automatic, so there is no separate fuse required for the regulated low voltage.

DC SIGNAL CIRCUITS

Four voltage comparators are used to monitor the critical power supply characteristics. Two of the devices act as detectors for Alternating Current. One triggers on positive voltages, the other on negative voltages. The output of the circuit is a series of narrow pulses at twice the frequency of the AC Line Voltage. These pulses are used by the processor to determine the AC frequency and zero cross points.

The remaining two voltage comparators are used to check analog voltages against a processor generated reference signal. One circuit monitors regulated low voltage; the other an unregulated high voltage source. Since the high voltage power supply is not regulated, it will rise or fall with changes in the AC Line Voltage. The microprocessor varies the reference signal to determine the value of these DC voltage sources.

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AUDIO CIRCUITS AND RELATED COMPONENTS

All audio information is compressed using the MPEG digital signal processing standard and stored in Read Only Memory.

Once the digital signals have been expanded and converted to analog audio signals, the remainder of the circuitry is used to amplify the sound and provide volume and tone control functions.

PROCESSOR BOARD AND RELATED COMPONENTS

A MC68306 Microprocessor is used to control the game functions, the diagnostics, the adjustable features, and the system communications. In addition, this processor has indirect control of display functions through a Programmable Logic Device and sound (the Sound Board has its own dedicated microprocessor). This 16-bit device was selected because it has common elements with the well known MC68000 family of integrated processors. The MC68306 is optimized for use with memory and communications.

INPUT / OUTPUT CIRCUITS

Each time power is applied to the game, a timer circuit generates a reset signal to start the microprocessor. The DC signals from the Power Supply circuit generate interrupt messages, allowing the processor to identify the AC power line characteristics. Cabinet switches create input signals used to control game play, system operating mode, menu item selection, etc. The remainder of the input signals are collected from other boards through a mixture of serial and parallel communications channels.

One output from the microprocessor is used for the display. The characters and images are stored in Read Only Memory. The Field Programmable Gate Array temporarily saves this data to Random Access Memory and converts this information to row and column signals for the display dot matrix. The Sound Board receives data commands from the processor and then generates the voices, music, and sound effects to go along with the display images and messages. Lamp, motor, and solenoid drive circuits receive control signals from the processor through a parallel communication port.

In system diagnostic mode, more circuits become active. The microprocessor sends test signals through the drive and switch circuits to determine the state (normal operation, fault conditions, etc.) of the switches, lamps, motors, and solenoids. The processor is also able to recognize cable disconnections, communication errors, switch related problems, etc., and issues messages or reports as necessary.

MEMORY CIRCUITS

Game parameters, custom messages, adjustable features, intermittent conditions, etc., are saved in Static Random Access Memory. This circuit has a built-in back up battery to prevent data corruption or loss.

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INDICATOR CIRCUITS

There are two Light Emitting Diodes located on the Processor Board. One LED indicates the presence of regulated low voltage DC power. The other LED serves as a low level status indicator for the microprocessor. Internal fault conditions generate an error code which can be useful when the display circuits malfunction or system diagnostics are not available.

POWER CIRCUITS

Two types of filter circuits are used on the Processor Board. Small bypass capacitors are used on the data lines to reduce the effects of noise. The regulated low voltage DC power source uses a more complex filter network (two capacitors and an inductor) to eliminate interference present on the power supply wiring.

SWITCH BOARD AND RELATED COMPONENTS

The Switch Board has two main functions.. Switches close and open very rapidly in the course of a pinball game, and there are instances where several switches may operate simultaneously. During game play, momentary switch connections are tracked and turned into signals which the microprocessor uses to determine the location of the balls. These input signals allow interaction with the players by increasing point score, illuminating indicator lamps, activating solenoids or motors, and by triggering images or sounds at the appropriate times. When the diagnostics routines are in use, the Switch Board circuits test the continuity of each switch device and its associated wiring. This permits the system to locate faults and provide service information on demand.

SWITCH SENSE CIRCUITS

Each switch has its own dedicated line to the Switch Board. The inputs have series diodes to protect against power cross with higher voltages. Each comparator has one switch input signal and one from a fixed DC voltage obtained from a voltage divider on the low voltage regulated power source. Any switch closure causes one comparator to change its output state; this signal is then buffered before being sent off board. Independent output lines prevent a single fault from disabling more than one switch signal.

One contact of each switch is connected to system ground. This is done to reduce the effects of noise on the switch and processor circuits when a switch is activated.

The addition of a resistor directly to each set of switch contacts allows the switch circuits to detect the difference between a normal circuit path and a faulty condition. This resistor forms a voltage divider with others located on the circuit board. This resistor has no effect on the normal operation of the switch.

When the system is operating in its Diagnostic or Troubleshooting modes, the microprocessor sends a digital message to the Switch Board to activate the test circuits. This message is decoded and turned into two signals, one for each switch group. These test signals go through flip-flop circuits wired as latches and then on to individual driver circuits. The outputs of the drivers effectively bypass one of the resistors in the voltage divider, changing the value of the reference voltage to a higher threshold during switch tests. Under this condition, the processor can detect whether a switch is normally open or the circuit is defective.

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POWER CIRCUITS

Two types of filter circuits are used on the Switch Board. Small bypass capacitors are used on the integrated circuits to reduce the effects of noise caused by solenoids and motors operating. The regulated low voltage DC power source uses a more complex filter network consisting of two capacitors and an inductor to eliminate any interference which might be present on the power supply wiring.

DRIVER BOARD AND RELATED COMPONENTS

Two types of drive circuits are used on this board. Low power loads (indicator and illuminator lamps) are connected in a typical row and column matrix configuration to reduce the number of components and wires needed. High power loads (flashing lamps, motors, or solenoids) have individual independent control circuitry. Both circuit types feature protection from electrical noise, thermal overload, and short circuits.

The majority of the lamps used in the game are connected in two identical matrices. Each matrix has eight rows and eight columns for a total of sixty four controlled positions; however, some of the positions have two lamps wired in parallel. The maximum number of lamps supported by one matrix is eighty.

Motors, solenoids, and flashing lamps have their own dedicated drive devices. By maintaining separate circuit paths many loads can operate simultaneously, but interaction with other game functions is eliminated.

INPUT / OUTPUT CIRCUITS

The Processor must send an enable signal to the Driver Board before any of the circuits will respond. This signal allows control data to pass through flip-flop circuits and into the driver devices. Lamp data from the microprocessor is decoded and turned into signals for rows and columns. In addition to lamp location, the program changes lamp brightness independently by varying how long each selected position is active. A lamp warming routine in the program keeps each location continuously powered at a very low level to reduce filament inrush current, turn on time, and voltage fluctuations on the power supply circuits.

Power for each matrix is delivered by eight row drivers and eight column drivers. The lamp row drives use conventional devices with comparator circuits to sense excessive current and provide circuit protection. So called Smart Power Solid State Relays are used for the lamp columns and the independent drive circuits. These devices have built-in overtemperature protection circuitry and a status output signal. Diodes are connected in series with these output circuits to prevent damage from power cross with higher voltages.

At the end of each complete pass through all of the lamps in a matrix, the microprocessor sends a digital message to the Driver Board to activate the test circuits. This message is decoded and turned into two signals, one for each lamp group. These test signals go through flip-flop circuits wired as latches and then on to individual driver circuits. The outputs of the drivers effectively bypass one of the resistors in the voltage divider, changing the value of the reference voltage to a lower threshold during lamp tests. Under this condition, the processor can detect whether a lamp is shorted or the circuit is defective.

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POWER CIRCUITS

Two types of filter circuits are used on the Switch Board. Small bypass capacitors are used on the integrated circuits to reduce the effects of noise caused by solenoids and motors operating. The regulated low voltage DC power source uses a more complex filter network consisting of two capacitors and an inductor to eliminate any interference which might be present on the power supply wiring.

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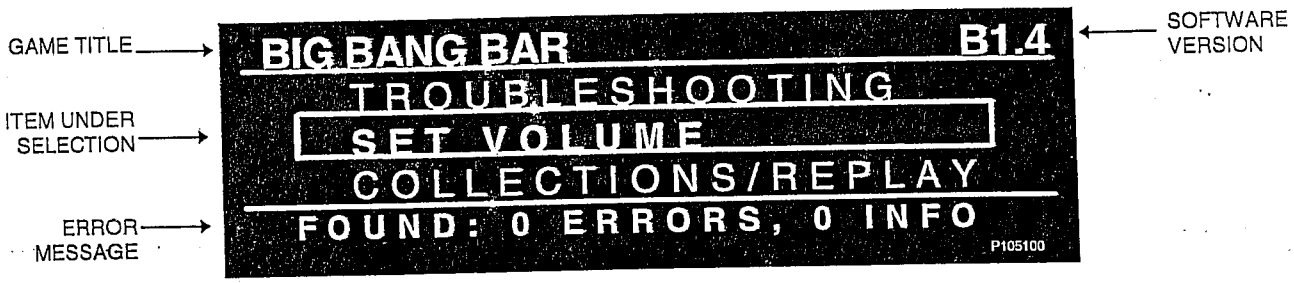
MENU SYSTEM

The menu system is started when the coin door is opened. When the coin door is closed, the game will return to the Attract mode. If a game is in progress when the coin door is opened, the game will be restored when the coin door is closed again unless an adjustment (except volume or service credit adjustment) is made or a diagnostic function is performed.

When the coin door is opened, the dot matrix display typically shows the following Main Menu:



The Main Menu displays the number of ERRORS or problems that were found during game play or while in the Attract Mode. ERRORS are major problems, such as non-operative switches, that should be repaired/replaced before game play is resumed. INFO items are minor problems, such as burned-out lamps, that need repair/replacement during the next regular maintenance cycle.

The menu system is controlled by the use of the left & right flipper buttons and the Start button. Pressing these button(s) will result in the following menu actions:

1) Right Flipper button	increment, or move to the next field
2) Left Flipper button	decrement, or move to the previous field
3) Left & Right Flipper buttons together	cancel, back-up, or restore the original setting
4) Start button	accept, enter, or keep new setting

If the game has been in operation for some period of time, the operator may notice that the following Reset Replay Menu appears *before* the Main Menu:

The operator can elect to accept the suggested replay score, by pushing the start button, or ignore the change in score by pushing both flipper buttons simultaneously. This action will return the system to the Main Menu. Additional information regarding Replay credits and scores can be found in the *B1 : Standard Adjustments* section of this manual.

MENU SYSTEM LAYOUT:

The Menu System consists of the following menus and sub-menus:

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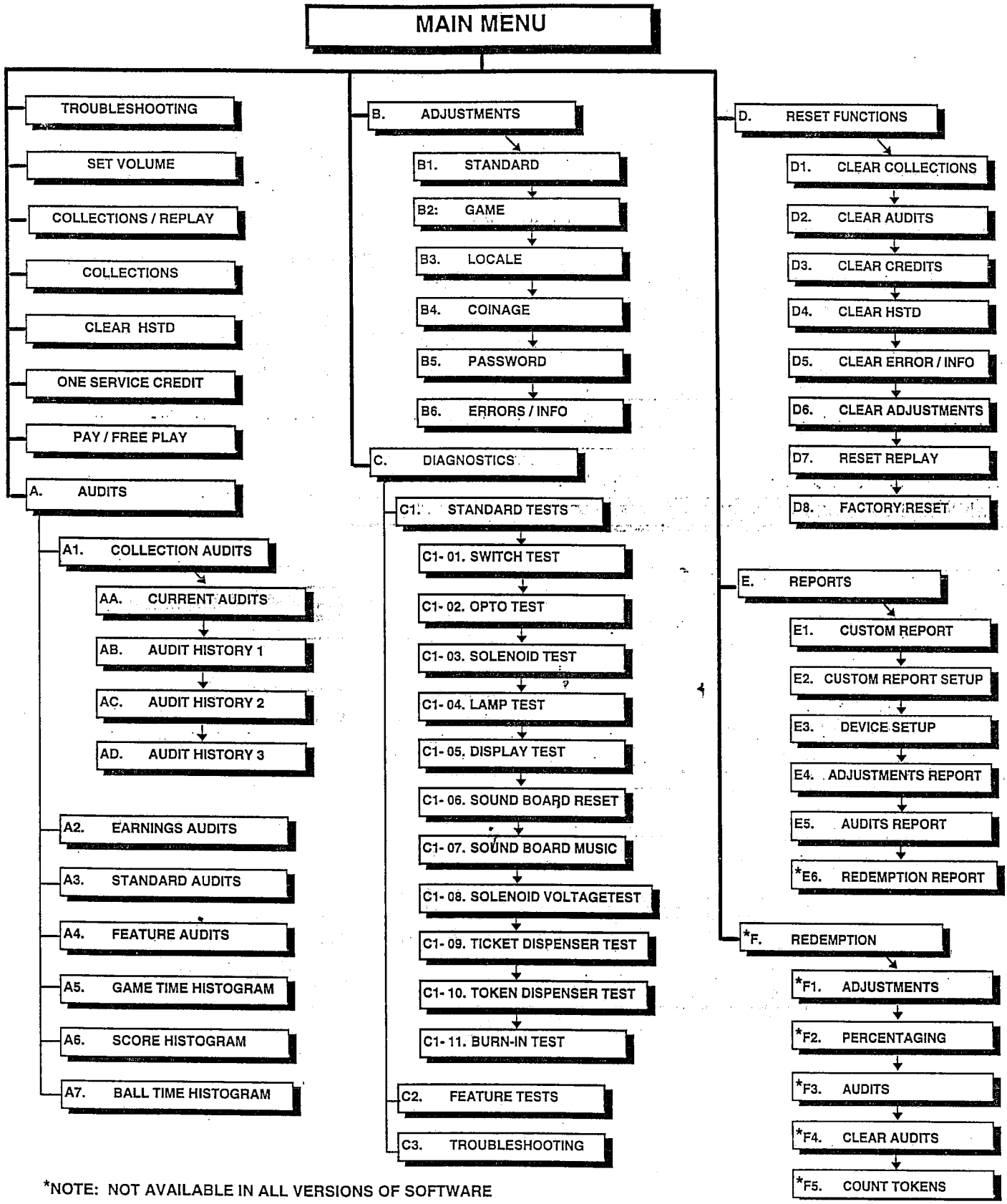

*NOTE: NOT AVAILABLE IN ALL VERSIONS OF SOFTWARE

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MAIN MENU FUNCTIONS

TROUBLESHOOTING:	Use this menu to start troubleshooting the game's electrical components. NOTE: Troubleshooting can also be accessed through the *DIAGNOSTICS* Menu.
SET VOLUME:	Plays a test tune so that the game volume can be adjusted.
COLLECTIONS/REPLAY:	Allows the operator to scroll through recent collections audits. The operator may optionally clear the audits and adjust the replay score to meet the target replay percentage (see Adjustment B1:04A, "Replay Percentage").
COLLECTIONS:	Same as COLLECTIONS/REPLAY, except the replay score is **not** adjusted when the collections audits are cleared.
ONE SERVICE CREDIT:	Issues one service credit to the game.
PAY / FREE PLAY:	Set the game mode to Pay-to-Play (disables Adjustment B1:10, *Free Play*) or to continuous Free Play (enables Adjustment B1:10, *Free Play*).
A. AUDITS:	Allows the operator to retrieve the games' earnings and performance information.
B. ADJUSTMENTS:	Operator adjustables are available for *STANDARD, GAME, LOCALE, COINAGE, PASSWORD,* and *ERRORS/INFO.*
C. DIAGNOSTICS:	Use *STANDARD TESTS, FEATURE TESTS, and TROUBLESHOOTING* to perform in-depth, automated testing of electrical and mechanical components.
D. RESET FUNCTIONS:	Allows the operator to individually clear certain *AUDITS* and *ADJUSTMENTS* data or elect to re-configure the game to the original factory settings.
E. REPORTS:	Allows the operator to output *AUDIT* and *ADJUSTMENTS* data to a serial communications device, such as a printer or laptop computer.
F. REDEMPTION	Allows the pinball game to be configured as a Redemption game (not available in all versions of software). Tickets or tokens are dispensed when a preset score is achieved by the player.

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AUDITS DATA TABLE

REF	AUDIT #	DESCRIPTION	TOTALS	PERCENTAGES	AVERAGE PER GAME
		A1 : COLLECTION AUDITS			
1	A1:AA:01	CURRENT : RECENT EARNINGS			
2	A1:AA:02	CURRENT : RECENT 1ST COIN CHUTE		% OF RECENT COINS	
3	A1:AA:03	CURRENT : RECENT 2ND COIN CHUTE		% OF RECENT COINS	
4	A1:AA:04	CURRENT : RECENT 3RD COIN CHUTE		% OF RECENT COINS	
5	A1:AA:05	CURRENT : RECENT 4TH COIN CHUTE		% OF RECENT COINS	
6	A1:AA:06	CURRENT : RECENT CREDITS			
7	A1:AA:07	CURRENT : RECENT COIN CREDITS		% OF RECENT CREDITS	
8	A1:AA:08	CURRENT : RECENT SERVICE CREDITS		% OF RECENT CREDITS	
9	A1:AA:09	CURRENT : RECENT FREE CREDITS		% OF RECENT CREDITS	
10	A1:AA:10	CURRENT : RECENT TOURNT CREDITS		% OF RECENT CREDITS	
11	A1:AB:01	HISTORY 1 : RECENT EARNINGS			
12	A1:AB:02	HISTORY 1 : RECENT 1ST COIN CHUTE			
13	A1:AB:03	HISTORY 1 : RECENT 2ND COIN CHUTE			
14	A1:AB:04	HISTORY 1 : RECENT 3RD COIN CHUTE			
15	A1:AB:05	HISTORY 1 : RECENT 4TH COIN CHUTE			
16	A1:AB:06	HISTORY 1 : RECENT EARNINGS			
17	A1:AB:07	HISTORY 1 : RECENT COIN CREDITS			
18	A1:AB:08	HISTORY 1 : RECENT SERVICE CREDITS			
19	A1:AB:09	HISTORY 1 : RECENT FREE CREDITS			
20	A1:AB:10	HISTORY 1 : RECENT TOURNT CREDITS			
21	A1:AC:01	HISTORY 2 : RECENT EARNINGS			
22	A1:AC:02	HISTORY 2 : RECENT 1ST COIN CHUTE			
23	A1:AC:03	HISTORY 2 : RECENT 2ND COIN CHUTE			
24	A1:AC:04	HISTORY 2 : RECENT 3RD COIN CHUTE			
25	A1:AC:05	HISTORY 2 : RECENT 4TH COIN CHUTE			
26	A1:AC:06	HISTORY 2 : RECENT EARNINGS			
27	A1:AC:07	HISTORY 2 : RECENT COIN CREDITS			
28	A1:AC:08	HISTORY 2 : RECENT SERVICE CREDITS			
29	A1:AC:09	HISTORY 2 : RECENT FREE CREDITS			
30	A1:AC:10	HISTORY 2 : RECENT TOURNMT CREDITS			
31	A1:AD:01	HISTORY 3 : RECENT EARNINGS			
32	A1:AD:02	HISTORY 3 : RECENT 1ST COIN CHUTE			
33	A1:AD:03	HISTORY 3 : RECENT 2ND COIN CHUTE			
34	A1:AD:04	HISTORY 3 : RECENT 3RD COIN CHUTE			
35	A1:AD:05	HISTORY 3 : RECENT 4TH COIN CHUTE			
36	A1:AD:06	HISTORY 3 : RECENT EARNINGS			
37	A1:AD:07	HISTORY 3 : RECENT COIN CREDITS			
38	A1:AD:08	HISTORY 3 : RECENT SERVICE CREDITS			
39	A1:AD:09	HISTORY 3 : RECENT FREE CREDITS			
40	A1:AD:10	HISTORY 3 : RECENT TOURNT CREDITS			
		A2 : EARNINGS AUDITS			
41	A2:01	TOTAL EARNINGS			
42	A2:02	TOTAL 1ST COIN CHUTE		% OF TOTAL COINS	
43	A2:03	TOTAL 2ND COIN CHUTE		% OF TOTAL COINS	
44	A2:04	TOTAL 3RD COIN CHUTE		% OF TOTAL COINS	
45	A2:05	TOTAL 4TH COIN CHUTE		% OF TOTAL COINS	
46	A2:06	TOTAL CREDITS			
47	A2:07	TOTAL COIN CREDITS		% OF TOTAL CREDITS	
48	A2:08	TOTAL SERVICE CREDITS		% OF TOTAL CREDITS	
49	A2:09	TOTAL FREE CREDITS		% OF TOTAL CREDITS	
50	A2:10	TOTAL TOURNAMENT CREDITS		% OF TOTAL CREDITS	
		A3 : STANDARD AUDITS			
51	A3:01	AVERAGE BALL TIME	HRS MIN SEC		
52	A3:02	1 PLAYER GAMES		% OF ALL GAMES	
53	A3:03	2 PLAYER GAMES		% OF ALL GAMES	
54	A3:04	3 PLAYER GAMES		% OF ALL GAMES	
55	A3:05	4 PLAYER GAMES		% OF ALL GAMES	
56	A3:06	TOTAL STARTED CREDITS			
57	A3:07	TOTAL FINISHED CREDITS			
58	A3:08	REPLAY AWARDS		% OF GAMES	
59	A3:09	TOTAL STARTED BALLS			

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AUDITS DATA TABLE

REF	AUDIT #	DESCRIPTION	TOTALS	PERCENTAGES	AVERAGE PER GAME
		A3 : STANDARD AUDITS (CONTINUED)			
60	A3:10	TOTAL FINISHED BALLS			
61	A3:11	MATCH AWARDS		% OF GAMES	
62	A3:12	EXTRA BALLS			
63	A3:13	LEFT DRAINS		% OF ALL DRAINS	
64	A3:14	RIGHT DRAINS		% OF ALL DRAINS	
65	A3:15	CENTER DRAINS		% OF ALL DRAINS	
66	A3:16	TILTS			
67	A3:17	SLAM TILTS			
68	A3:18	HSTD CREDITS		% OF GAMES	
69	A3:19	BUY-IN 1			
70	A3:20	BUY-IN 2			
71	A3:21	BUY-IN 3 +			
72	A3:22	HSTD RESET COUNT			
73	A3:23	TOTAL TIME ON	DAYS HRS MIN SEC		
74	A3:24	TOTAL GAME TIME	HRS MIN SEC	% OF TOTAL TIME ON	
75	A3:25	AVERAGE GAME TIME	HRS MIN SEC		
76	A3:26	TOTAL BURN-IN TIME	HRS MIN SEC		
77	A3:27	TOTAL TICKETS			
78	A3:28	TOTAL TOKENS			
		A4 : FEATURE AUDITS			
79	A4:01	NORMAL SKILL SHOT			
80	A4:02	SECRET SKILL SHOT			
81	A4:03	MODE START			
82	A4:04	BRAWL START			
83	A4:05	LOOPEP START			
84	A4:06	LOWER LOCK 1			
85	A4:07	LOWER LOCK 3			
86	A4:08	LOWER LOCK 3			
87	A4:09	BRAWL JACKPOT 1			
88	A4:10	BRAWL JACKPOT 2			
89	A4:11	BRAWL JACKPOT 3			
90	A4:12	BRAWL JACKPOT 2 X 1			
91	A4:13	BRAWL JACKPOT 2 X 2			
92	A4:14	BRAWL JACKPOT 2 X 3			
93	A4:15	L. ALIEN LOCK			
94	A4:16	R. ALIEN LOCK			
95	A4:17	LOOPED JACKPOT			
96	A4:18	UNDERGND START			
97	A4:19	UNDERGND ORBITS			
98	A4:20	TUBE START			
99	A4:21	TUBE POINTS COLL			
100	A4:22	TUBE JACKPOT QUAL			
101	A4:23	TUBE JACKPOT COLL			
102	A4:24	TUBE XBALL QUAL			
103	A4:25	TUBE XBALL COLL			
104	A4:26	RAY'S BALL BUSTERS			
105	A4:27	BIG BANG QUALIFY			
106	A4:28	BIG BANG COLLECT			

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AUDITS DATA TABLE

REF	AUDIT #	DESCRIPTION	TOTALS	PERCENTAGES	AVERAGE PER GAME
		A5: GAME TIME HISTOGRAM			
115	A5	GAME TIME HISTOGRAM 0.0 - 0.9 MINS			
116	A5	GAME TIME HISTOGRAM 1.0 - 1.9 MINS			
117	A5	GAME TIME HISTOGRAM 2.0 - 2.9 MINS			
118	A5	GAME TIME HISTOGRAM 3.0 - 3.9 MINS			
119	A5	GAME TIME HISTOGRAM 4.0 - 4.9 MINS			
120	A5	GAME TIME HISTOGRAM 5.0 - 5.9 MINS			
121	A5	GAME TIME HISTOGRAM 6.0 - 6.9 MINS			
122	A5	GAME TIME HISTOGRAM 7.0 - 7.9 MINS			
123	A5	GAME TIME HISTOGRAM 8.0 - 8.9 MINS			
124	A5	GAME TIME HISTOGRAM 9.0 - 9.9 MINS			
125	A5	GAME TIME HISTOGRAM 10 - 11 MINS			
126	A5	GAME TIME HISTOGRAM 11 - 12 MINS			
127	A5	GAME TIME HISTOGRAM 12+ MINS			
		A6: SCORE HISTOGRAM			
128	A6	SCORE HISTOGRAM 0 - 19 MILLION			
129	A6	SCORE HISTOGRAM 20 - 39 MILLION			
130	A6	SCORE HISTOGRAM 40 - 59 MILLION			
131	A6	SCORE HISTOGRAM 60 - 79 MILLION			
132	A6	SCORE HISTOGRAM 80 - 99 MILLION			
133	A6	SCORE HISTOGRAM 100 - 120 MILLION			
134	A6	SCORE HISTOGRAM 120 - 139 MILLION			
135	A6	SCORE HISTOGRAM 140 - 159 MILLION			
136	A6	SCORE HISTOGRAM 160 - 179 MILLION			
137	A6	SCORE HISTOGRAM 180 - 199 MILLION			
138	A6	SCORE HISTOGRAM 200 - 219 MILLION			
139	A6	SCORE HISTOGRAM 220 - 239 MILLION			
140	A6	SCORE HISTOGRAM 240 - 259 MILLION			
141	A6	SCORE HISTOGRAM 260 - 279 MILLION			
142	A6	SCORE HISTOGRAM 280 - 299 MILLION			
143	A6	SCORE HISTOGRAM 300 - 319 MILLION			
144	A6	SCORE HISTOGRAM 320 - 339 MILLION			
145	A6	SCORE HISTOGRAM 340 - 359 MILLION			
146	A6	SCORE HISTOGRAM 360 - 379 MILLION			
147	A6	SCORE HISTOGRAM 380 - 399 MILLION			
148	A6	SCORE HISTOGRAM 400 - 419 MILLION			
149	A6	SCORE HISTOGRAM 420 - 439 MILLION			
150	A6	SCORE HISTOGRAM 440 - 459 MILLION			
151	A6	SCORE HISTOGRAM 460 - 479 MILLION			
152	A6	SCORE HISTOGRAM 480 - 499 MILLION			
153	A6	SCORE HISTOGRAM 50.0 - MILLION			
		A7: BALL TIME HISTOGRAM			
154	A7	BALL TIME HISTOGRAM 0 - 9 SECS			
155	A7	BALL TIME HISTOGRAM 10 - 19 SECS			
156	A7	BALL TIME HISTOGRAM 20 - 29 SECS			
157	A7	BALL TIME HISTOGRAM 30 - 39 SECS			
158	A7	BALL TIME HISTOGRAM 40 - 49 SECS			
159	A7	BALL TIME HISTOGRAM 50 - 59 SECS			
160	A7	BALL TIME HISTOGRAM 60 - 69 SECS			
161	A7	BALL TIME HISTOGRAM 70 - 79 SECS			
162	A7	BALL TIME HISTOGRAM 80 - 89 SECS			
163	A7	BALL TIME HISTOGRAM 90 - 99 SECS			
164	A7	BALL TIME HISTOGRAM 100 - 109 SECS			
165	A7	BALL TIME HISTOGRAM 110 - 119 SECS			
166	A7	BALL TIME HISTOGRAM 120 - 129 SECS			
167	A7	BALL TIME HISTOGRAM 130 - 139 SECS			
168	A7	BALL TIME HISTOGRAM 140 - 149 SECS			
169	A7	BALL TIME HISTOGRAM 150 - 159 SECS			
170	A7	BALL TIME HISTOGRAM 160 - 169 SECS			
171	A7	BALL TIME HISTOGRAM 170 - 179 SECS			
172	A7	BALL TIME HISTOGRAM 180 - 189 SECS			
173	A7	BALL TIME HISTOGRAM 190 - 199 SECS			
174	A7	BALL TIME HISTOGRAM 200 - 209 SECS			
175	A7	BALL TIME HISTOGRAM 210+ SECS			

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B. ADJUSTMENTS

B1: STANDARD ADJUSTMENTS

AUDIT REF.	AUDIT NAME	RANGE	FACTORY SETTING	DESCRIPTION
B1-01	BALLS PER GAME	1 - 10 BALLS	3 BALLS	THE NUMBER OF BALLS GIVEN IN A GAME.
B1-02	TILT WARNINGS	0 - 10	2	THE NUMBER OF TIMES THE GAME CAN "TILT" BEFORE ENDING THE CURRENT BALL IN PLAY.
B1-03	ATTRACT MODE SOUNDS	YES, NO	YES	SELECT WHETHER SOUNDS & MUSIC ARE PLAYED DURING ATTRACT MODE.
B1-04+	ALLOW REPLAY	YES, NO	YES	SELECT WHETHER REPLAY CREDITS ARE AWARDED. IF *YES* IS SELECTED, ADDITIONAL REPLAY ADJUSTMENTS CAN BE SET (SEE B1-04A,B,C,D).
B1-04A	REPLAY PERCENT	5 - 50 %	20%	THE "IDEAL" PERCENTAGE OF GAMES THAT RECEIVE A REPLAY. THIS VALUE IS THEN USED TO SUGGEST ACTUAL REPLAY SCORE VALUES ONCE A HISTORY OF GAME SCORES IS ACCUMULATED.
B1-04B	REPLAY START SCORE	0 - 42,000,000,000	130,000,000	THE INITIAL SCORE AT WHICH A REPLAY CREDIT IS AWARDED.
B1-04C	NOT USED	----------	----------	----------
B1-04D	ALLOW REPLAY BUMP	YES, NO	YES	SELECT WHETHER THE REPLAY START SCORE IS TEMPORARILY INCREMENTED WHEN REPLAY IS AWARDED. THE REPLAY START SCORE IS RETURNED TO ITS' NORMAL VALUE *AFTER* ALL FREE CREDITS HAVE BEEN EXHAUSTED
B1-04E	REPLAY INDICATOR	ON, OFF	OFF	WHEN SET TO *ON*, AN INDICATOR (▲) APPEARS IN EACH CORNER OF THE DISPLAY DURING ATTRACT MODE (REPLAY AT...) TO SHOW A NEW REPLAY VALUE HAS BEEN REACHED (SEE B1-04A).
B1-04F	REPLAY AWARD	CREDIT, EXTRA BALL, POINTS	CREDIT	THE TYPE OF AWARD ISSUED WHEN A *REPLAY* IS EARNED BY THE PLAYER.
B1-04G	COIN DOOR REPLAY	ON, OFF	ON	WHEN SET TO *ON*, THE OPERATOR WILL BE PROMPTED (WHEN OPENING THE COIN DOOR) TO CHANGE THE REPLAY SCORE IN ORDER TO SATISFY THE REPLAY PERCENT (B1-04A). NOTE: THE MENU SYSTEM IS INTERRUPTED UNTIL THIS PROMPT IS ANSWERED
B1-05+	ALLOW HSTD	YES, NO	YES	SELECT WHETHER THE HIGH SCORE TO DATE FEATURE IS ENABLED. IF ***YES*** IS SELECTED, ADDITIONAL HSTD ADJUSTMENTS CAN BE SET (SEE B1-05A,B,C,D).
B1-05A	HSTD FIRST SCORE	0 - 42,000,000,000	500,000,000	THE HIGHEST SCORE WRITTEN TO THE HSTD TABLE **AFTER** THE TABLE IS CLEARED BY THE RESET FUNCTION (D4). THE GAME WILL AUTOMATICALLY GENERATE SCORES BETWEEN THE *HSTD FIRST SCORE* AND THE *HSTD LAST SCORE* TO FILL-IN MIDDLE ENTRIES IN THE TABLE.
B1-05B	HSTD LAST SCORE	0 - 42,000,000,000	250,000,000	THE LOWEST SCORE WRITTEN TO THE HSTD TABLE **AFTER** THE TABLE IS CLEARED BY THE RESET FUNCTION (D4). THE GAME WILL AUTOMATICALLY GENERATE SCORES BETWEEN THE *HSTD FIRST SCORE* AND THE *HSTD LAST SCORE* TO FILL-IN MIDDLE ENTRIES IN THE TABLE.
B1-05C	CREDITS FOR GRAND CHAMP	0 - 99 CREDITS	3 CREDITS	THE NUMBER OF CREDITS AWARDED FOR EXCEEDING THE *GRAND CHAMP*.
B1-05D	CREDITS FOR #1-4 SCORES	0 - 99 CREDITS	1 CREDIT	THE NUMBER OF CREDITS AWARDED FOR EXCEEDING THE #1 -#4 HIGH SCORES.
B1-06	MATCH PERCENT	0 - 95%	8%	THE PERCENTAGE OF GAMES THAT AWARD A MATCH CREDIT AT THE END OF THE GAME.
B1-07	SPECIAL AWARD	CREDIT, EXTRA BALL, POINTS	CREDIT	SELECT THE TYPE OF AWARD ISSUED WHEN A *SPECIAL* IS EARNED BY THE PLAYER.
B1-08	EXTRA BALL AWARD	EXTRA BALL, POINTS	EXTRA BALL	THE TYPE OF AWARD ISSUED WHEN AN *EXTRA BALL* IS EARNED BY THE PLAYER.

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B1: STANDARD ADJUSTMENTS (CONTINUED)

AUDIT REF.	AUDIT NAME	RANGE	FACTORY SETTING	DESCRIPTION
B1-9	SET GAME LOCATION	0 - 99,999	0	A TRACKING NUMBER USED TO INDICATE THE PHYSICAL LOCATION OF A GAME.
B1-10	SET MACHINE ID	0 - 99,999	0	ASSIGN A SECONDARY ID TO A GAME WHERE MULTIPLE GAMES MAY EXIST IN THE SAME LOCATION.
B1-11	FREE PLAY	YES, NO	NO	ENABLES / DISABLES *FREE PLAY* MODE. ALSO CONTROLS THE MAIN MENU SETTINGS FOR *PAY-TO- PLAY* AND *FREE PLAY*.
B1-12	PLAY MODE	NORMAL, TOURNAMENT XBALL ON, TOURNAMENT XBALL OFF,	NORMAL	SELECT *NORMAL* OR *TOURNAMENT* MODE. *TOURNAMENT* MODE EQUALIZES THE SCORING OF CERTAIN FEATURES AMONGST PLAYERS IN MULTI-PLAYER GAMES.
B1-13	SOL.(ENOID) VOLTAGE PERCENT	0 - 90%	10%	SELECT THE PERCENTAGE OF SOLENOID VOLTAGE REGULATION (FOR DISPLAY PURPOSES ONLY). **DOES NOT** ACTIVELY REGULATE THE GAMES' SOLENOIDS.
B1-14	SHOW MESSAGE OF THE DAY	YES, NO, VIEW/EDIT	NO	SELECT A MESSAGE FOR DISPLAY DURING ATTRACT MODE. THIS MESSAGE MAY BE CUSTOMIZED BY CHOOSING *VIEW/EDIT*.
B1-15	FLIPPER STRENGTH	1 - 16	14	SELECT RELATIVE STRENGTH OF FLIPPER COILS. FOR EXAMPLE, A SETTING OF *12* REPRESENTS 3/4 STRENGTH (12/16). MAY BE USED TO ADJUST THE AMOUNT OF BALL TRAVEL WHEN PLAYFIELD PITCH IS CHANGED.
B1-16+	TICKET DISPENSER	NONE STANDARD TICKET	NONE	SELECT THE TYPE OF TICKET DISPENSER (IF INSTALLED ON THE GAME). AFTER *TICKET DISPENSER* IS ENTERED, AUDIT A3:27, *TOTAL TICKETS*, IS INCREMENTED AND THE TICKET MOTOR-DRIVE IS PULSED TICKET DISPENSERS CURRENTLY SUPPORTED: 1) DELTRONICS, MODEL 1275; 2) COIN CONTROLS, MODEL CTD10. **NOTE:** AFTER SERVICING AN "OUT OF TICKETS" CONDITION OR A DISPENSER JAM, YOU CAN EITHER: A) *CONTINUE* DISPENSING TICKETS FROM THE GAME-IN-PROGRESS BY CLOSING THE COIN DOOR, OR B) *CLEAR* DISPENSER MEMORY BY INTERRUPTING POWER TO THE GAME (OFF, THEN ON).
B1-16A	TICKETS / CREDIT	0, 1 - 99	0	SELECT THE NUMBER OF TICKETS TO BE DISPENSED FOR EACH *FREE CREDIT* AWARDED (REPLAYS, SPECIALS, MATCH, AND HSTD). NO CREDITS WILL THEN BE ISSUED TO THE PLAYER, ONLY DISPENSED TICKETS. IF YOUR GAME IS **NOT** EQUIPPED WITH A TICKET DISPENSER, SELECT "0", OTHERWISE, SELECT FROM 1 TO 99 TICKET(S) TO BE DISPENSED PER FREE CREDIT AWARDED (EXAMPLE: IF THIS OPTION IS SET TO "6" AND "3" FREE CREDITS ARE EARNED, "18" TOTAL TICKETS WILL BE DISPENSED)

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B1: STANDARD ADJUSTMENTS (CONTINUED)

AUDIT REF.	AUDIT NAME	RANGE	FACTORY SETTING	DESCRIPTION
B1-17+	TOKEN DISPENSER	NONE *BALLYWULFF* DISPENSER *COIN CONTROLS* DISPENSER *COIN CONTROLS* COMPACT HOPPER (RED DISC) *COIN CONTROLS* COMPACT HOPPER (PURPLE OR GREEN DISCS) *COIN CONTROLS* COMPACT HOPPER (GRAY, BLACK, BROWN, OR BLUE DISCS) *COIN CONTROLS* COMPACT HOPPER (5 AWP DISC USED IN ITALY)	NONE	SELECT THE TYPE OF TOKEN DISPENSER (IF INSTALLED ON THE GAME). AFTER *TOKEN DISPENSER* IS ENTERED, AUDIT A3:28, *TOTAL TOKENS*, IS INCREMENTED AND THE TOKEN METER DRIVE IS PULSED NOTE: AFTER SERVICING AN "OUT OF TOKENS" CONDITION OR A DISPENSER JAM, YOU CAN EITHER: A) *CONTINUE* DISPENSING TOKENS FROM THE GAME-IN-PROGRESS BY CLOSING THE COIN DOOR, OR B) *CLEAR* DISPENSER MEMORY BY INTERRUPTING POWER TO THE GAME (OFF, THEN ON).
B1-17A	TOKENS / CREDIT	0, 1 - 99	0	SELECT THE NUMBER OF TOKENS TO BE DISPENSED FOR EACH *FREE CREDIT* AWARDED (REPLAYS, SPECIALS, MATCH, AND HSTD). NO CREDITS WILL THEN BE ISSUED TO THE PLAYER, ONLY DISPENSED TOKENS. IF YOUR GAME IS **NOT** EQUIPPED WITH A TOKEN DISPENSER, SELECT "0", OTHERWISE, SELECT FROM 1 TO 99 TOKEN(S) TO BE DISPENSED PER FREE CREDIT AWARDED (EXAMPLE: IF THIS OPTION IS SET TO "6" AND "3" FREE CREDITS ARE EARNED, "18" TOTAL TOKENS WILL BE DISPENSED)

B2: GAME ADJUSTMENTS

AUDIT REF.	AUDIT NAME	RANGE	FACTORY SETTING	DESCRIPTION
B2-01	GAME DIFFICULTY	EXTRA EASY, EASY, NORMAL, HARD, EXTRA HARD	NORMAL	SETS THE OVERALL DIFFICULTY OF THE GAME. THIS OPTION WILL AUTOMATICALLY CONFIGURE THE SETTINGS FOR B2-02 THROUGH B2-24.
B2-02	BALL SAVER TIME	0 - 60 SECONDS	7 SECONDS	SETS A GRACE FOR "QUICK DRAIN" BALLS. ANY BALL "LOST" BEFORE THE TIMER EXPIRES WILL BE RETURNED TO THE PLAYER.
B2-03	GET LUCKY BALLSAVER	5 - 25 SECONDS	15 SECONDS	SETS DURATION FOR BALLSAVER WHEN *GET LUCKY* MODE IS ACTIVE (LIT).
B2-04	RAMP BALLSAVER	YES, NO	NO	SELECT WHETHER THE BALL IS RETURNED TO THE PLAYER AFTER A RAMP SHOT RESULTS IN AN IMMEDIATE CENTER-DRAIN.
B2-05	EJECT BALLSAVER	YES, NO	YES	SELECT WHETHER THE BALL IS RETURNED TO THE PLAYER AFTER A BALL IS EJECTED FROM *COSMIC DARTZ* AND RESULTS IN AN IMMEDIATE DRAIN.
B2-06	KICKER BALLSAVER	YES, NO	YES	SELECT WHETHER THE BALL IS RETURNED TO THE PLAYER AFTER A BALL IS EJECTED FROM THE *FREE SHOT* KICKER AND RESULTS IN AN IMMEDIATE DRAIN.
B2-07	DROP TIMEOUT	20 - 200 SECONDS	60 SECONDS	SETS THE INITIAL TIMING FOR THE DROP TARGETS TO RESET AFTER THE FIRST TIME *LOOPED IN SPACE* IS COLLECTED.
B2-08	KICKER MEMORY	LIBERAL, CONSERVATIVE	LIBERAL	"LIBERAL" ALLOWS THE *FREE SHOT* KICKER TO BE LIT AT THE BEGINNING OF EACH BALL; "CONSERVATIVE" SAVES ITS' STATE FROM BALL-TO-BALL.

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B2: GAME ADJUSTMENTS (CONTINUED)

AUDIT REF.	AUDIT NAME	RANGE	FACTORY SETTING	DESCRIPTION
B2-09	KICKER GRACE TIME	0 -15 SECONDS	5 SECONDS	SETS THE TIME ALLOWED FOR THE *FREE SHOT* KICKER TO BE RE-FIRED (WITHOUT BEING RELIT).
B2-10	BATHROOM DELTA	1 - 10 SHOTS	3	SETS THE NUMBER OF *BATHROOM* SHOTS REQUIRED FOR EACH ADDITIONAL *BATHROOM* AWARD.
B2-11	"BRAWL" SPOTTED	NONE, B, BR, BRA, BRAW	BRA	SETS THE INITIAL LETTERS SPOTTED FOR MULTI-BRAWL.
B2-12	HITS FOR UNDERGROUND	0 - 4 LETTERS	4	SETS THE NUMBER OF LETTERS SPOTTED EACH TIME MULTI-BRAWL IS COLLECTED.
B2-13	TUBE DIFFICULTY	EASY, NORMAL, HARD	NORMAL	"EASY" SETS THE SIDE RAMP STANDUP TARGET TO BE SPOTTED CONTINUOUSLY, "NORMAL" SPOTS FIRST TIME ONLY, "HARD" NEVER SPOTS.
B2-14	MODE TIMEOUT	10 - 120 SECONDS	35 SECONDS	SETS THE TIME PERIOD FOR WHEN A FEATURE MODE IS ACTIVE.
B2-15	BUMBER TILT DISABLE	YES, NO	NO	SELECT "YES" TO DISABLE GAME TILTS WHILE THE BALL IS CONTACTING THE STAR BUMPERS
B2-16	DARTZ KICKER STRENGTH	6 - 16	12	SETS THE RELATIVE STRENGTH OF THE *COSMIC DARTZ* EJECT HOLE MECHANISM. THE HIGHER THE NUMBER, THE STRONGER THE "KICK".
B2-17	FAMILY MODE	YES, NO	NO	SELECT "YES" TO REDUCE THE SEXUAL CONTENT OF THE *TUBE LADY* SOUND EFFECTS; "NO" ALLOWS THE *TUBE LADY* TO SPEAK & MOAN SEDUCTIVELY

B3: LOCALE ADJUSTMENTS

AUDIT REF.	AUDIT NAME	RANGE	FACTORY SETTING	DESCRIPTION
B3-01	COUNTRY	UNITED STATES, FRANCE, GERMANY 1,2,3, SPAIN, MEXICO CANADA (ENGLISH), CANADA (FRENCH), SWITZERLAND 1,2,3; ITALY 1,2, UNITED KINGDOM, NETHERLANDS, GREECE 1,2,3 HONG KONG, MALAYASIA, BRAZIL 1,2 SWEDEN 1,2 AUSTRALIA	UNITED STATES	SETS THE COUNTRY LOCATION OF THE GAME. THIS SETTING CONTROLS NUMBERS, TIMES, DATES, AND MONETARY VALUES SHOWN ON THE DOT MATRIX DISPLAY. THIS OPTION WILL ALSO CHANGE THE SETTINGS FOR B3-02 AND B3-03.
B3-02	TEXT LANGUAGE	ENGLISH, FRENCH, GERMAN, SPANISH, **ITALIAN**, DUTCH, PORTUGUESE	ENGLISH	SETS THE LANGUAGE USED FOR TEXT SHOWN ON THE DOT MATRIX DISPLAY.
B3-03	SPEECH LANGUAGE	ENGLISH, FRENCH, GERMAN, SPANISH, **ITALIAN**, DUTCH, PORTUGUESE	ENGLISH	SETS THE LANGUAGE USED IN SOUND EFFECTS.
		NOTE: TEXT AND SPEECH LANGUAGES IN **BOLD** ARE NOT CURRENTLY IMPLEMENTED.		

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B4: COINAGE ADJUSTMENTS

AUDIT REF.	AUDIT NAME	RANGE	FACTORY SETTING	DESCRIPTION
B4-01	CONFIGURE COINAGE TO	1 GAME / 1 COIN 1 GAME / 2 COINS 1 GAME / 3 COINS 2 GAMES / 1 COIN 1/1 3/2 GAMES/COINS 1/2 3/4 GAMES/COINS 1/2 2/3 3/4 1/2 2/4 3/6 5/8 USA, 50c, 5/$2.00 USA, 50c, 2/75c 3/$1.00 FR 3/1 5/2 10/5 20/11 FR 5/1 10/3 20/7 FR 3/1 5/2 10/4 20/9 GERMAN 1/2 2/3 3/4 5/5 GERMAN 1/2 2/3 3/4 4/5 GERMAN 1/1 6/5 SPAIN, 1/100 6/500 U. K., 3/L1 U. K., 1/50p SWISS, 1/1 2/2 6/5 SWISS, 1/1 3/2 8/5 SWISS, 1/1 ITALY 1/2X500L 3/4X500L ITALY 1/500L ITALY 1/2X500L HOLL. 1/1G 3/2.5G 6/5G GREECE 1/100Dr. GREECE 1/200Dr. 2/300 GREECE 1/100Dr. 2/150 SWEDEN 1/10Kr. 2/15 3/20 SWEDEN 1/ 5Kr. 2/10 5/20 AUSTRALIA 1/$1 3/2 CUSTOM PRICING	SET ACCORDING TO COUNTRY DEFAULT	SETS THE RATIO OF NUMBER OF CREDITS (GAMES) TO THE NUMBER OF COINS. SELECT THE ***CUSTOM PRICING*** FEATURE AND CHOOSE UP TO FOUR SEPARATE COIN/CREDIT CONFIGURATIONS.
B4-02+	COIN DOOR TYPE	CUSTOM ALL CHUTE UNITS 1 COIN USA 25-25 USA 25 W/MULTIPULSE DBV FRANCE ELEC1-5-10-20 FRANCE MECH 5-10 GERMANY ELEC 1-2-5 GERMANY MECH 1-2-5 UK ELEC L1-50-20-10 ITALY MECH 500-500 N.Z. MECH 1-2 SPAIN MECH 100-500 JAPAN MECH 100-100 JAPAN MECH 100 PORT MECH 100-200 GREECE MECH 50-100 HUNGARY MECH 20-20 AUSTRIA MECH 5-10-10 AUSTRIA MECH 5-10 KOREA MECH 100-100 HONG KONG MECH 1-2 SWISS MECH 1-2-5 SWISS MECH 1-5 SWISS MECH 1-1-1 HOLLAND MECH 1-1 HOLLAND MECH 1-2.5-5 CANADA MECH .25-1 CANADA MECH .25-.25-1 NORWAY MECH 5-10 NORWAY MECH 10-5-20 NORWAY ELEC 5-10-20 DENMARK ELEC 1-5-10-20 AUSTRALIA MECH .20-1 AUSTRALIA MECH 1-2 AUSTRALIA ELEC .20-1-2-M1 FINLAND ELEC 1-5 FINLAND ELEC 5-1	SET ACCORDING TO COUNTRY DEFAULT	SETS THE COIN DOOR TYPE AND THE COIN UNITS FOR EACH CHUTE. SELECT ***CUSTOM*** FOR INDIVIDUAL DOOR TYPE CONFIGURATIONS AND CHUTE UNITS (SEE B4-02A THRU B4-02I).

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B4: COINAGE ADJUSTMENTS (CONTINUED)

AUDIT REF.	AUDIT NAME	RANGE	FACTORY SETTING	DESCRIPTION
		BELGIUM MECH 20-20 BELGIUM ELEC 5-20-50 SWEDEN ELEC 1-5-10 SINGAPORE MECH 1-1 ITALY ELEC 500		
B4-02A	1ST COIN CHUTE UNITS	0 - 65,535	0	THE NUMBER OF COIN UNITS USED FOR THE IST CHUTE.
B4-02B	2ND COIN CHUTE UNITS	0 - 65,535	0	THE NUMBER OF COIN UNITS USED FOR THE 2ND CHUTE.
B4-02C	3RD COIN CHUTE UNITS	0 - 65,535	0	THE NUMBER OF COIN UNITS USED FOR THE 3RD CHUTE.
B4-02D	4TH COIN CHUTE UNITS	0 - 65,535	0	THE NUMBER OF COIN UNITS USED FOR THE 4TH CHUTE.
B4-02E	CHUTE 1 TYPE	MECHANICAL, ELECTRICAL	MECHANICAL	SELECT THE CHUTE TYPE.
B4-02F	CHUTE 2 TYPE	MECHANICAL, ELECTRICAL	MECHANICAL	SELECT THE CHUTE TYPE
B4-02G	CHUTE 3 TYPE	MECHANICAL, ELECTRICAL	MECHANICAL	SELECT THE CHUTE TYPE
B4-02H	CHUTE 4 TYPE	MECHANICAL, ELECTRICAL	MECHANICAL	SELECT THE CHUTE TYPE
B4-02I	COIN METER UNITS	0 - 65,535	1	SELECT THE NUMBER OF COIN CHUTE UNITS THAT ARE **EQUIVALENT TO** ONE PULSE OF THE "SOFTWARE-" CONTROLLED COIN METER #5 (NOT CURRENTLY IMPLEMENTED IN HARDWARE).
B4-03	COIN VALUE	NOT APPLICABLE	0.25	SETS THE MULTIPLIER (COIN VALUE) FOR DETERMINING COIN CHUTE TOTALS IN *A1: COLLECTION AUDITS*. DEFAULTS TO BASE VALUE AS SET IN *B4-01 : COINAGE ADJUSTMENT*
B4-04	SHOW CREDIT FRACTIONS	YES, NO	YES	DISPLAY FRACTIONAL CREDITS AS COINS ARE INSERTED (TYPICALLY USED IN COUNTRIES WHERE ONE COIN RESULTS IN LESS THAN ONE CREDIT).
B4-05+	ALLOW BUY-IN	YES, NO	YES	SELECT WHETHER BUY-INS ARE ALLOWED DURING THE GAME (UNLIMITED).
B4-05A	BUY-IN CREDITS	1/255 TO 255 CREDITS	1 CREDIT	DETERMINES THE NUMBER OF BUY-IN CREDITS REQUIRED TO CONTINUE THE GAME. EX. A GAME REQUIRES 50¢, OR ONE CREDIT, TO START. BUY-INS CAN NOW BE SET AT *LESS* OR *MORE* THAN THE ONE CREDIT REQUIREMENT, PERHAPS A 1/2 CREDIT (25¢).
B4-05B	MAXIMUM BUY-INS	0 - 99	10	SETS THE MAXIMUM NUMBER OF BUY-INS ALLOWED DURING A GAME.
B4-06	MAXIMUM CREDITS	1 - 99	20	SETS THE MAXIMUM NUMBER OF CREDITS ALLOWED DURING A GAME.
B4-07	ENABLE CREDIT BONUSES	YES, NO	YES	ALLOW MULTIPLE COINS (YES) OR SINGLE COINS (NO) TO BE USED IN CALCULATING CREDIT BONUSES. EX. GAME PRICING IS ONE TOKEN PER PLAY, 2 TOKENS FOR 3 PLAYS. IF *YES* IS SELECTED, THE SECOND TOKEN WILL GIVE 3 CREDITS; IF *NO*, THE SECOND TOKEN WILL YIELD 2 CREDITS.

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B5 : PASSWORD

AUDIT REF.	AUDIT NAME	RANGE	FACTORY SETTING	DESCRIPTION
B5-01+	PASSWORD	OFF, ON, CHANGE	OFF	SETS THE PASSWORD USED BY THE OPERATOR. SELECT *CHANGE* FOR A NEW OR REVISED PASSWORD; SELECT *ON* TO SET ADDITIONAL PASSWORD PROTECTION (SEE B5-01A,B). **CAUTION:** IF THE PASSWORD HAS BEEN SET ON AND CAN'T BE REMEMBERED BY THE OPERATOR, THE GAME MUST BE FACTORY RESET (SEE D7: FACTORY RESET). THIS ACTION DESTROYS ANY PREVIOUS AUDIT INFORMATION AND OPERATOR ADJUSTMENTS TO THE GAME.
B5-01A	HIDE EARNINGS	YES, NO	NO	ALLOW EARNINGS INFO (AUDITS MENU) TO APPEAR/NOT APPEAR ON THE DOT MATRIX DISPLAY.
B5-01B	PROTECT ADJUSTMENTS	YES, NO	NO	SELECT *YES* TO PROTECT OPERATOR-SET ADJUSTMENTS FROM RESET (D8: FACTORY RESET).
B5-01C	PROTECT AUDITS	YES, NO	NO	SELECT *YES* TO PROTECT OPERATOR-SET AUDITS FROM RESET (SEE D8: FACTORY RESET).

B6 : ERRORS/INFO

AUDIT REF.	AUDIT NAME	RANGE	FACTORY SETTING	DESCRIPTION
B6-01	SWITCH ERRORS	REPORT ALL, DISABLE MOMENTARIES, DISABLE ALL	REPORT ALL	SETS THE OPTION TO DISPLAY OR HIDE ERROR MESSAGES ON-THE SCREEN DISPLAY.
B6-02	SWITCH INFO MSG	REPORT ALL, DISABLE MOMENTARIES, DISABLE ALL	REPORT ALL	SETS THE OPTION TO DISPLAY OR HIDE *INFO* MESSAGES ON-THE SCREEN DISPLAY.
B6-03	SOLENOID ERRORS	REPORT ALL, DISABLE MOMENTARIES, DISABLE ALL	REPORT ALL	SETS THE OPTION TO DISPLAY OR HIDE *ERROR* MESSAGES ON-THE SCREEN DISPLAY.
B6-04	SOLENOID INFO MSG	REPORT ALL, DISABLE MOMENTARIES, DISABLE ALL	REPORT ALL	SETS THE OPTION TO DISPLAY OR HIDE *INFO* MESSAGES ON-THE SCREEN DISPLAY.
B6-05	LAMP ERRORS	REPORT ALL, DISABLE MOMENTARIES, DISABLE ALL	REPORT ALL	SETS THE OPTION TO DISPLAY OR HIDE *ERROR* MESSAGES ON-THE SCREEN DISPLAY.
B6-06	LAMP INFO MSG	REPORT ALL, DISABLE MOMENTARIES, DISABLE ALL	REPORT ALL	SETS THE OPTION TO DISPLAY OR HIDE *INFO* MESSAGES ON THE SCREEN DISPLAY.

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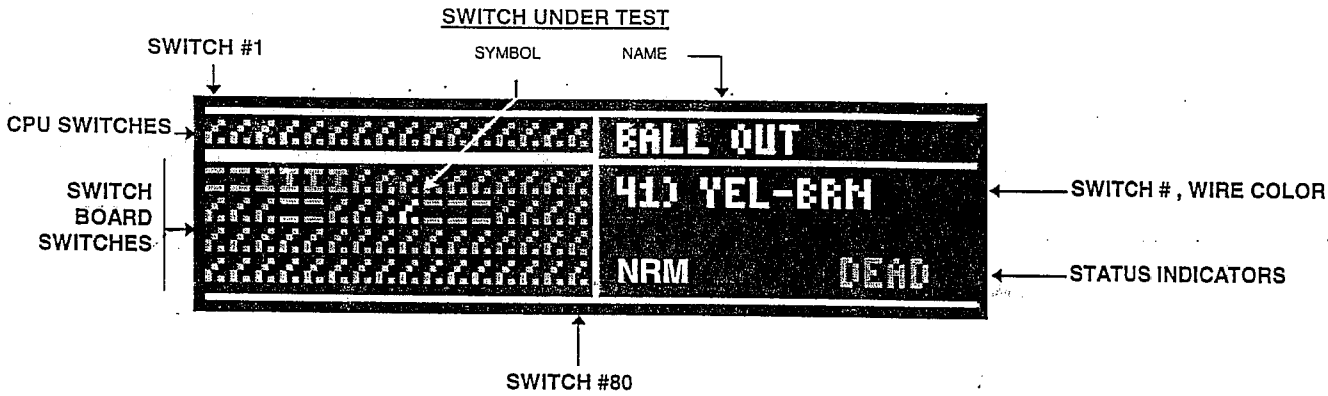
C. DIAGNOSTICS

C1: STANDARD TESTS

C1- 01 : SWITCH TEST -

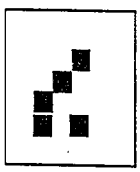


The Switch Test displays a graphical representation of the switch , indicating which switches are seen as open and which are seen as closed. Also shown is information about the switch under test (name, number, wire color, and status indicators). The status indicators, when highlighted, show:

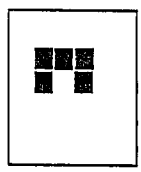
NRM - Normal operation; no problems are detected;

DEAD Indicates when a switch has not been activated in past games.

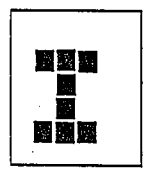
The Switch icons are:



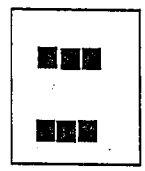
OPEN SWITCH



CLOSED SWITCH



OPTO WITH VERTICAL BEAM OF LIGHT



OPTO WITHOUT BEAM OF LIGHT (BLOCKED OPTO)

NOTE: If a status indicator is blinking, it is indicative of a problem area.

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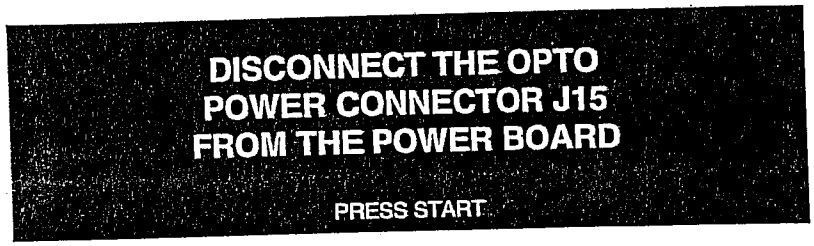
C1- 02 : OPTO TEST

The Opto Test is used to verify opto operation by blinking the controlled lamps and flashers. The dot matrix display screen is similar to the Switch Test (C1-01) above, however, when selected, the following screen appears:



Open the backbox and remove connector J15 from the Power Board. Then, when verifying each opto, check that the opto icon does NOT have a vertical line (representing a "triggered" receiver condition). In this case, make sure that all balls are secure in a ball holding device (since infrared light can be reflected off the game ball) and re-test. If the opto continues to fail this test, repair/replace as required.

NOTE: Reconnect J15 at the Power Board after completing this test.

C1- 03 : SOLENOID TEST

CAUTION

THE FOLLOWING TEST SHOULD BE PERFORMED ONLY BY QUALIFIED SERVICE PERSONNEL.
TO START THE TEST, THE COIN DOOR MUST BE OPEN AND THE STEM OF THE 50V INTERLOCK SWITCH MUST BE PULLED-OUT (ENABLED).

The Solenoid Test will test solenoids, motors, and flashers on the game. The screen displays information on the name of the device, a representative icon for the device, wire colors, driver board connector & pin number, power board wire color, and status indicators (NRM, OFF). For each test, the device will be energized and the icon will pulse.

The status indicators, when highlighted, represent the following conditions:

NRM	Normal operation; no problems are detected;
OFF	A short circuit is detected. The device may be in a cooling-down period and will automatically enable itself after reaching the proper operating temperature;
OFF?	Momentary short circuit (e.g. at some point the device had been detected as shorted, although it may be fine now). This is a good way to detect intermittent problems.

Use the flipper buttons to cycle from solenoid-to-solenoid. Press both flipper buttons to exit the Solenoid Test.

NOTE: If an indicator is blinking, there is a software-detected problem with this device.

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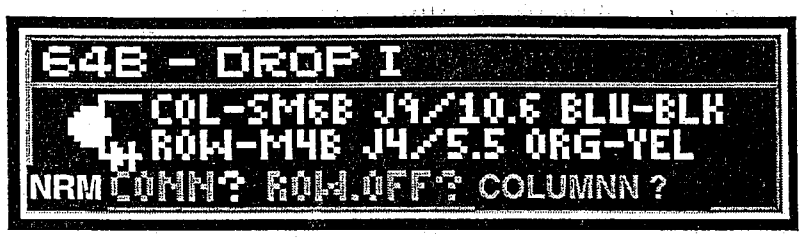
C1- 04 : LAMP TEST



The Lamp Test will start all game lamps flashing. The flippers can then be used to get detailed information about any individual lamp.. This information includes the lamp name and number, row and column information from the lamp matrix, its' wire colors, and an icon indicating whether the lamp is active.

The lamp's indicators report:

NRM = If BRIGHT, no electrical problems have been detected.

***CONN =** If this indicator is BRIGHT, an electrical connection is detected. If this indictor is dim; there is a break in the wiring to the lamp.

*CONN? = At some point the device had been detected as not connected, although it may be fine now. This is a good way to find intermittent problems.

ROW.OFF = A row driver is disabled from a ROW or BULB short circuit - The device was shorted and is now inactive (may be in a 15 second cool-down period).

ROW.OFF? = Indicates a momentary row short. At some point the device had been detected as shorted, although it may be fine now. This is a good way to find intermittent problems.

***COLUMN =** A column driver can be overheated and thermally shutdown, most likely from a column short-to-ground or an entire column without lamps (i.e. loose or disconnected column wire at the driver board or burned-out lamps).

*COLUMN? = Indicates a momentary column problem. At some point the device had a column problem, although it may be fine now. This is a good way to find intermittent problems.

*NOTE: Lamp connector (CONN?) and column driver (COLUMN?) indicators are not active for Column 8, Matrix A (cabinet fluorescent lamp and playfield "black light" lamp).

ADDITIONAL NOTE: If an indicator is blinking, this is the problem area. Use the flippers to cycle from lamp to lamp. Press both flipper buttons to exit the Lamp Test.

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ADDITIONAL NOTES ON LAMP INDICATORS:

CONN: A bright indicator shows that at least 1 bulb is connected and is lit. For 2 bulbs at a single location, both bulbs must be burned-out (or disconnected) before this indicator is made bright.

SERVICE TIP : Fix column problems *BEFORE* using this indicator to troubleshoot bulb problems.

ROW.OFF: A bright indicator reflects the drive is cooling from an unknown voltage short on the row side of a column/row matrix OR a short across the bulb. The "?"after this indicator helps to isolate either a bulb short or a row short. If all or multiple "?" are on the same row of the same matrix, then this would tend to indicate a row-short-to-power supply. **Row-shorts-to-ground are not detectable** (the only symptom is that all the bulbs in a particular row are extremely bright). If there is only one "?" in a row, then most likely a short exists at the bulb, socket, or terminals.

COLUMN: A bright indicator usually reflects a thermally-shutdown column driver caused by a short-to-ground condition, or all lamps in the column are burned-out, or a loose/broken column wire. A column shorted to a power source (i.e. any 50 volt supply) usually just burns-out all the bulbs in the column or blows a fuse.

WARNING: TO AVOID RISK OF PERSONAL INJURY, DO NOT TOUCH A COLUMN DRIVER DURING A THERMAL SHUTDOWN.

C1- 05 : DISPLAY TEST

The Display Test can assist the operator in checking the dot matrix display for proper illumination of individual pixel elements. It has six continuos test modes that move across the display:

1) A light diagonal bar illuminated against a dark background;
2) A light vertical bar illuminated against a dark background;
3) A light horizontal bar illuminated against a dark background;
4) A dark vertical bar illuminated against a light background;
5) A dark horizontal bar illuminated against a light background;
6) An intensity checker.

In the first five modes, use the flipper buttons to move the bar across the display. If you hold either flipper button "in" continuously, you will notice that the bar will run off the screen and the display will show the next (or previous) mode. The start button can be used at any time to change the intensity of the bar from normal to medium, dim, and off.

The sixth mode will light every pixel to full intensity. Pressing the flipper button will change the intensity to medium, dim, and off. After the sixth mode, the test cycles back to the first mode.

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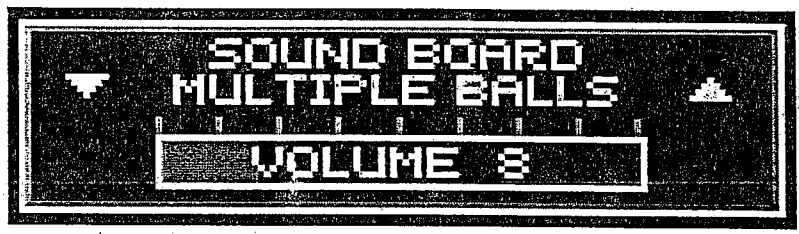
Press both flippers to exit the Display Test.

C1- 06 : SOUND BOARD RESET

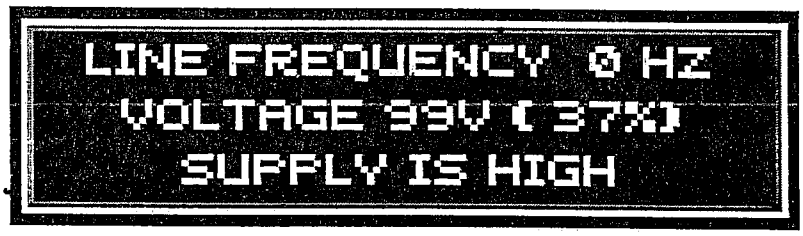
The Sound Board Test resets the sound board and causes it to report its powerup status. Press the start button to restart the test.

C1- 07 : SOUND BOARD MUSIC TEST



The Sound Board Music Test plays several samples of music which fully tests the capabilities of the sound board hardware. The selection of the tune and its' volume level can be changed by the use of the flippers and start button.

C1- 08 : SOL(ENOID) VOLTAGE



This test will measure and display signal strength from the power board (connector J3) to the CPU board (connector J2). The zero cross detection circuit should report the correct non-zero line frequency (top line of display) for this location . The second line of the display reports the flipper's 50 Volt A/D converter voltage to within ±2 volts along with the current percent tolerance.

CAUTION: If any of the following conditions exist, the message **"CHECK 50V INTERLOCK SW."** will be displayed:

1) the 50V coin door interlock switch is "off" (the stem is pushed-in instead of "out");
2) the 50V fuse (F6) on the Power Board is blown;
3) the connection from the Power Board to the CPU is disconnected;
4) a power circuit or cabling is not operating properly.

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Since the solenoid voltage is unregulated and unloaded at the time of this particular test, this measurement is an excellent indicator of the actual line voltage. The bottom line can display:

"SUPPLY WITHIN 10%" (10% is user-selected in Adjustment B1-13)
"SUPPLY IS HIGH"
"SUPPLY IS LOW"

The normal range of tolerance for the line voltage (not solenoid voltage) is -15% to +10%, for example, 120VAC can measure between 102VAC to 132VAC. The solenoid voltage is dependent upon the line voltage, and the transformer "taps" convert certain line voltages to a nominal non-loaded solenoid voltage of about 76 Volts. If your game is not within the 10% range, you might consider re-tapping the transformer to a high-line or low-line tap (depending if your solenoid voltage is high or low). The extra "cushion" of 5% (for the -15% tolerance) is highly recommended for temporary low- line conditions.

C1- 09 : TICKET DISPENSER TEST

NOTE: Before performing this test, return to the Menu System, Standard Adjustment B1-16, *TICKET DISPENSER*, and verify that the installed dispenser is configured properly. Ticket audit totals are not affected by this test.

Tickets should be loaded and ready to dispense. This test will check the operation of the ticket dispenser motor, notch switch, and meter.

When the test starts, the motor will try to dispense a ticket and increment the ticket meter. If successful, the message "DISPENSED" will appear on the display; if unsuccessful, an "ERROR" is reported to the display. Possible "ERROR" conditions are discussed in the Troubleshooting section of this manual. This test can be repeated at any time by pressing the "START" button.

NOTE: After servicing an "Out of Tickets" condition or a dispenser jam, you can either:
a) *Continue* dispensing tickets from the game-in-progress by closing the coin door, or
b) *Clear* dispenser memory by interrupting power to the game (off, then on).

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C1- 10 : TOKEN DISPENSER TEST

NOTE: Before performing this test, return to the Menu System, Standard Adjustment B1-17, *TOKEN DISPENSER*, and verify that the installed dispenser is configured properly. Token audit totals are not affected by this test.

Tokens should be loaded and ready to dispense. This test will activate the dispenser solenoid and pulse the ticket meter. The operator must confirm that the actual number of tokens dispensed agrees with the number of test(s) performed (one token per test). This test will typically display a successful "DISPENSED" (no "ERROR" will be reported) since most dispenser solenoids lack provisions for feedback circuitry (switches).

NOTE 1: For dispensers that are equipped with switch feedback, the test message "ERROR" will be reported to the display. Possible "ERROR" conditions are discussed in the Troubleshooting section of this manual. This test can be repeated at any time by pressing the "START" button.

NOTE 2: After servicing an "Out of Tokens" condition or a dispenser jam, you can either:
a) *Continue* dispensing tokens from the game-in-progress by closing the coin door, or
b) *Clear* dispenser memory by interrupting power to the game (off, then on).

C1- 11 : BURN-IN TEST

The Burn-In Test energizes all of the machine hardware in a sequenced pattern. All the solenoids are fired, motors run, and lamps flashed. The dot matrix display and sound system are also activated as well. This test is primarily intended for factory use to assure that all electronic and mechanical features are operating when the game leaves the factory.

To end the Burn-In test, press both flipper buttons at any time. Also, see the *Audit* section for the total cumulative time that Burn-In Tests have been run on the game.

C2: FEATURE TESTS

CAUTION

THE FOLLOWING TEST SHOULD BE PERFORMED ONLY BY QUALIFIED SERVICE PERSONNEL.
TO START THE TEST, THE COIN DOOR MUST BE OPEN AND THE STEM OF THE 50V INTERLOCK SWITCH MUST BE PULLED-OUT (ENABLED).

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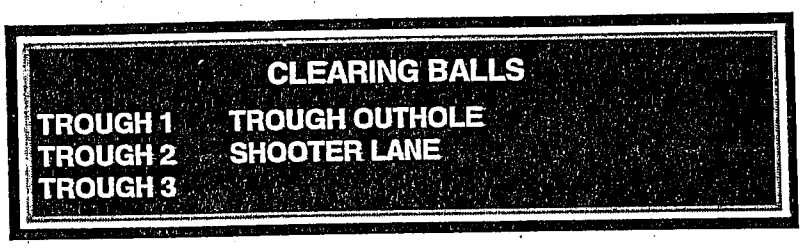
C2- 01 : CLEAR OUT BALLS

This test will eject all balls present in the game trough. It cycles through all ball trough switches and highlights (on the display) the current switch being activated.

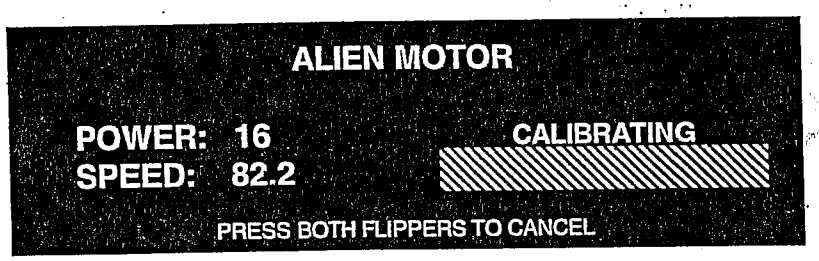


If this test is started with no balls present in the troughs or re-tested after a previous attempt, the message *"BALL TROUGH IS NOW EMPTY"* will be displayed. Also, if the game is unable to eject a ball from any trough, the message *"BALL TROUGH PROBLEM SUSPECTED"* will be displayed.

C2-02: ALIEN MOTOR

This test calibrates the motor used in the alien lock mechanism. The game software needs a fairly accurate idea of the speed of the motor when the *ALIEN LOCK* feature is activated. Dirt and wear can affect the motors' performance and occasional recalibration is necessary.

This test is automatic and will calibrate the motor at two running speeds. It takes a few minutes to cycle and the display will show the following status:



"Power" shows the power level at which the motor is being driven. This test calibrates the motor at power levels 15 and 16, which are used during game play. "Speed" shows the actual measured speed in revolutions per second. The bar graph underneath the word "Calibrating" shows how complete the calibration is at the current power level.

When the test is over, any of the following messages will appear:

C2-02: ALIEN MOTOR (continued)

When the test is over, one of the following messages will be displayed:

- Calibration Finished : The test finished successfully, and the software has been updated with new motor speed readings.

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- Can't Find Home Position : The encoder wheel has two notches very close together. This is the motor's "home" position. This error message indicates that the motor driver couldn't find the double notch beacause the opto (which reads the encoder wheel) is dirty, inoperative, or that the encoder wheel is misaligned.

- Speed Won't Stabilize : The motor must run at a fairly constant speed, for a number of revolutions, during this test. This message indicates that the motors' gears may be binding or that the mechanism's rotation is impaired by an obstruction.

- Calibration Cancelled : The test was interrupted by the operator pressing both flipper buttons.

- Calibration Error : An unknown software error occurred during calibration. Contact your local distributor or report the failure to Capcom Field Service at the number indicated at the front of this manual..

C2-02: ANIMATO (ANIMATION)

This test simply allows you to view some of the animations used in the game. It's the visual equivalent of standard test C1-07, Sound Board Music. In the title screen, the left and right flippers allow you to step from one animation display to the next. The title of the animation is displayed, as are the number of frames and the frame rate in frames per second (FPS). Press the start button to view the animation under selection.

While the animation is running, the following commands are available:

START BUTTON: Pause the animation, or resume playback at normal speed if the animation is already paused.

LEFT FLIPPER: Toggle the frame number on and off. When on, the frame number appears in the lower right-hand corner of the display.

RIGHT FLIPPER: Pause the animation, and step through each frame individually.

BOTH FLIPPERS: Quit to the title screen.

From the title screen, press both flippers again to return to the diagnostic menu.

C3: TROUBLESHOOTING

The Troubleshooting diagnostic is a shortcut tool to get to the games' troublespots as quickly and conveniently as possible. This diagnostic scans all the switches, solenoids, and lamps for problems and presents a summary of what was found. Use the flipper buttons to automatically step to the appropriate test for each error condition. The tests used (switch, lamp and solenoid) are described in Section C1, Standard Tests.

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NOTE: The troubleshooting diagnostic continuously gathers and updates information, in real time, about switches, lamps and solenoids. A sound is made when any of this information changes. This allows the operator to make repairs or find loose connections in the game and check his/her results by viewing the display.

There are two categories of troubleshooting, Errors and Information. *Errors* are considered important to game play and should be fixed at the earliest opportunity. *Information* messages (for example, a lamp behind the backglass is burned-out) are considered less critical and can be serviced as part of a routine maintenance schedule. Errors and Information messages can also be selectively disabled from viewing by Adjustment B6, Errors/Info. Additionally, all Errors and Information messages can be cleared by the reset function D5, Clear Errors/Info.

NOTE: Refer to the previous individual tests (C1-01 to C1-04) for information on indicator status and troubleshooting tips.

ADDITIONAL NOTE: Individual momentaries for a lamp, switch, or solenoid are always "forgotten" when you leave this test.

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D. RESET FUNCTIONS

*D1: CLEAR COLLECTIONS

This function clears all Collection Audits (A1) and moves all Histories down one level in the collections history log (Example: Current audits become History 1 audits, History 1 audits become History 2 audits, etc.).

*D2: CLEAR AUDITS

This action clears all other audits, from A2: Earnings Audits to A7: Ball Time Histogram.

D3: CLEAR CREDITS

Reset the Credits counter to zero.

D4: CLEAR HIGH SCORE TO DATE (HSTD)

Used to reset the game's HSTD table based on the settings in Adjustments B1-05A: HSTD High Score and B1-05B: HSTD Last Score.

D5: CLEAR ERRORS/INFO

Clears all troubleshooting errors and info. Always use this after repair or replacement of PC boards.

*D6: CLEAR ADJUSTMENTS

Returns all B: Adjustments(6) to their factory-set defaults (A: Audits are not affected by this function).

D7: RESET REPLAY

Resets the replay score to meet the target replay percentage (see Adjustment B1-04A: Replay Percent).

D8: FACTORY RESET

Clears ALL audits and adjustments information and returns the game to the original factory default settings. The operator is prompted to select a country for which the locale, language, and coin door adjustments are set (default country is the *United States*, Adjustment B3-01).

***NOTE:** WHEN PASSWORD-PROTECTED, THESE FUNCTIONS **WILL NOT CLEAR** (SEE SECTION B5 , *PASSWORD*)

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E. REPORTS

THEORY OF OPERATION

The Reports utility permits the operator the ability to "dump" all *Audits* and *Adjustments* data to a serial communications device, such as a printer or a laptop computer. A Report can be generated using one of the following methods:

1) Automatically, via the "Hot Plug" ("energized" serial port). When the "Hot Plug" method is used, the system software will automatically detect the presence of the printer when the coin door is opened and the printer cable is connected to the serial port of the Interface PCB. The Report will then start printing. The progress of the print job will be shown on the dot matrix display, along with any error messages. When a "Hot Plug" print job is successfully completed, all current audits data will be cleared, replay award levels reset, and the printout counter will be incremented. The operator must close the coin door and re-open it again to generate another "Hot Plug" Report.

2) Manually, through the Menu System using *E1: Custom Report* The operator can also elect to disable the "Hot Plug" method of reporting (see *E3-01B*: *Hotplug Custom Report*), and configure the printer/computer for mode of operation, communications protocol, and customization features of the report. When a "Custom" print job is successfully completed, the printout counter will be incremented and audits data and replay award levels will also be cleared/reset unless the operator elects otherwise (see *E2-01,02: Clear Collections, Reset Replay.*

CAUTION: The "Hot Plug" (serial port) is active when the coin door is opened. For a *Custom Report*, the printer plug must NOT be inserted in the serial port until *E1: Custom Report* is selected and the START button is pushed. Any attempt to generate a *Report* prior to this sequence will always result in a "Hot Plug" *Report.*

PRINTERS and COMPUTERS CURRENTLY SUPPORTED:

- O'Neil microFlash Receipt Printer;
- NSM Datapoint 3000 Printer/Recorder;
- Citizen Dot-Matrix Printer, Models IDP 560 or 562;
- Any serial printer supporting an ASCII format;
- Any desktop/laptop computer capable of supporting an ASCII format.

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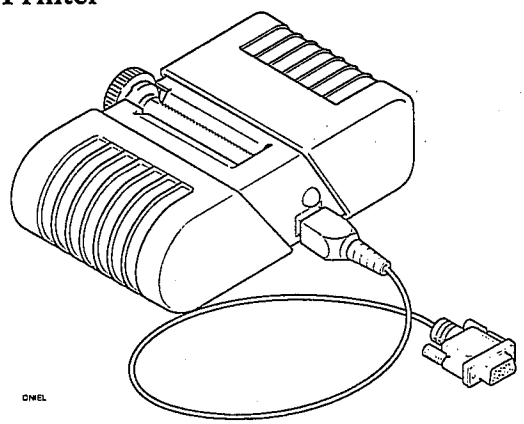
PRINTER/COMPUTER CONFIGURATION AND INSTALLATION

I. O'Neil microFlash Receipt Printer



NOTE: If your game is not equipped with a printer interface PCB, contact your local CAPCOM® distributor for Field Kit K-008-2. Install all necessary hardware and cables using the enclosed instructions.

1) Using the O'Neil Configuration Utility, open to the following sub-menus and configure the printer for the following settings:

a. *Communication Parameters-*
PORT = COM1;
BAUD RATE = 19200;
DATA BITS = 8;
PARITY = NONE;
HANDSHAKING = XON/XOFF.

b. *Printer Options* -
BEEPER = ON;
TIME-OUT = 10 SECONDS;
INFRARED CRC = OFF.

c. *Paper, Fonts, and Graphics Options* -
SET PER USER REQUIREMENTS.

2) Configure the games' *Reports* software as follows;
E3 - 01+: Select O'NEIL MICROFLASH;
E2 -01 thru 17: Select per user requirements for a *Custom Report* (optional).

3) Determine the method of generating the Report. For a "Hot Plug" Report, connect the DB9 female connector (supplied with the printer) to the DB9 male connector now located on the switch bracket inside the coin door. The *Report* will start printing after this connection is made. The *Report* can be repeated, if necessary, by removing the cable, closing and re-opening the coin door, and re-installing the printer cable to the serial port.

4) For a *Custom Report*, scroll through the Menu System to *E1 : Custom Report*. Press the START button and install the printer cable to the serial port . The Custom Report will now begin printing. Remove the printer cable when the print job is finished and close the coin door.

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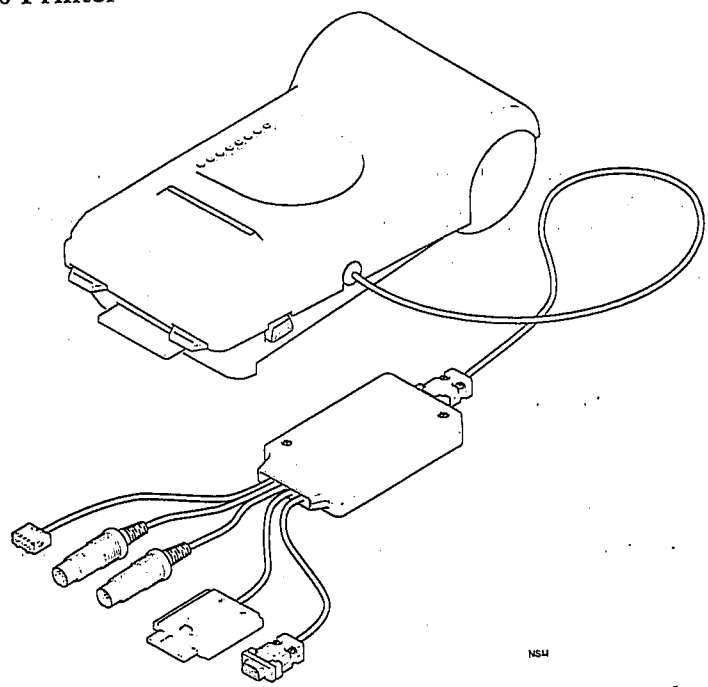
II. NSM Datapoint 3000 Printer



NOTE: If your game is not equipped with a printer interface PCB, contact your local CAPCOM® distributor for Field Kit K-008-5. Install all necessary hardware and cables using the enclosed instructions.

1) Configure the games' *Reports* software as follows:
E3 - 01+: Select NSM DATAPRINTER, PRINT;
E2 -01 thru 17: Select per user requirements for a *Custom Report* (optional).

2) Check that the NSM Memory Card is fully inserted into its' slot.

3) Determine the method of generating the Report. For a "Hot Plug" Report, connect the DB9 female connector (supplied with the printer) to the DB9 male connector now located on the switch bracket inside the coin door. The Report should start printing automatically. The *Report* will start printing after this connection is made. The *Report* can be repeated, if necessary, by removing the cable, closing and re-opening the coin door, and re-installing the printer cable to the serial port.

4) For a *Custom Report*, scroll through the Menu System to *E1 : Custom Report*. Press the START button and install the printer cable to the serial port . The Custom Report will now begin printing. Remove the printer cable when the print job is finished and close the coin door.

III. NSM Datapoint 3000 Recorder

Same as the NSM Datapoint 3000 Printer above except that the printer is configured through *Reports* software as a memory storage device. The *Reports* data is saved to the NSM memory card and downloaded to a computer through the use of NSM-compatible software, such as DATACONTACT 3000©.

You must configure the games' *REPORTS* software, in section E3 - 01+, for **NSM DATAPRINTER, SAVE.** Follow the above NSM Printer steps 2 through 4 to capture a *Report* to the memory card.

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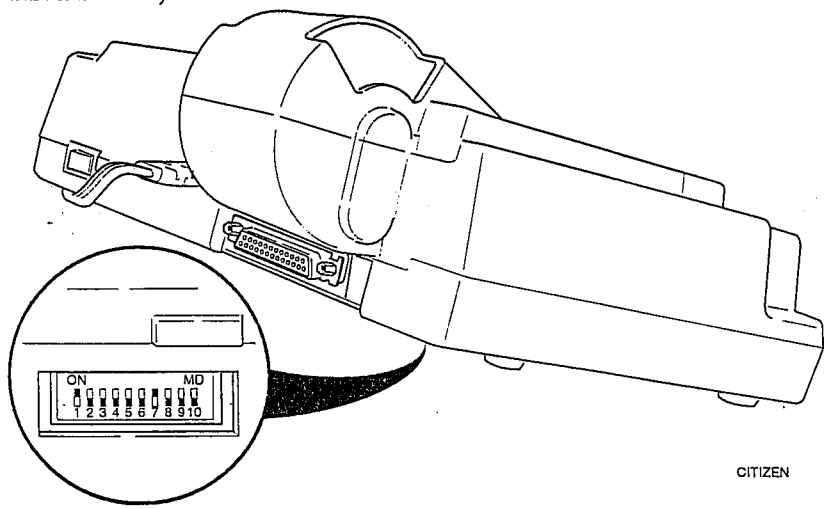
IV. Citizen Dot-Matrix Printer, Models IDP 560 or 562



NOTE: If your game is not equipped with a printer interface PCB, contact your local CAPCOM® distributor for Field Kit K-008-2. Install all necessary hardware and cables using the enclosed instructions.

1) Set the printer's DIP switches as follows:

DIP SWITCH #									
1	2	3	4	5	6	7	8	9	10
ON	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF

2) Configure the games' *Reports* software as follows:
E3 - 01+: Select CITIZEN 560/562;
E2 -01 thru 17: Select per user requirements for a *Custom Report* (optional).

3) Determine the method of generating the Report. For a "Hot Plug" Report, obtain a standard serial printer cable (purchase locally) with DB25 male/ DB9 female connector leads. Connect the DB25 male connector to the printer I/O port and attach the DB9 female connector to the male connector now located on the switch bracket inside the coin door. The Report should start printing automatically. The *Report* will start printing after this connection is made. The *Report* can be repeated, if necessary, by removing the cable, closing and re-opening the coin door, and re-installing the printer cable to the serial port.

4) For a *Custom Report*, scroll through the Menu System to *E1 : Custom Report.* Press the START button and install the printer cable (as described above) to the serial port. The Custom Report will now begin printing. Remove the printer cable when the print job is finished and close the coin door.

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V. Generic ASCII

NOTE: If your game is not equipped with a printer interface PCB, contact your local CAPCOM® distributor for Field Kit K-008-2. Install all necessary hardware and cables using the enclosed instructions.

1) Set the printer/computer serial port to receive data in the following format:

BAUD RATE = 19200;
DATA BITS = 8;
PARITY = NONE;
STOP BIT(S) = 1;
FLOW CONTROL (HANDSHAKING) = CTS and/or XON/XOFF

2) Configure the games' REPORTS software as follows:

E3 - 01+: Select GENERIC ASCII;
E3 - 02+: Select DELIMITED if data is used for importation into a spreadsheet program, such as Microsoft® Excel.
E2 - 01 thru 17: Select per user requirements for a *Custom Report* (optional).

3a) For a printer, determine the method of generating the Report. For a "Hot Plug" Report, obtain a standard serial printer cable (purchase locally) with DB25 male/ DB9 female connector leads. Connect the DB25 male connector to the printer I/O port and attach the DB9 female connector to the male connector now located on the switch bracket inside the coin door. The Report should start printing after this connection is made. The *Report* can be repeated, if necessary, by removing the cable, closing and re-opening the coin door, and re-installing the printer cable to the serial port.

For a *Custom Report*, scroll through the Menu System to *E1 : Custom Report*. Press the START button and install the printer cable to the serial port . The Custom Report will now begin printing. Remove the printer cable when print job is finished and close the coin door.

3b) For computers, the pinball game is configured as a data terminal device (DTE) and the receiver is assumed to be a communications device (DCE). This configuration normally requires the use of a null modem cable with DB9 female and DB9/DB25 female terminations. Connect the DB9/DB25 female connector to the computer serial port (COM1 or COM2).

Prepare the computer to receive the ASCII text by opening to a serial port (modem) capture program, such as PROCOMM PLUS® or Microsoft® Windows TERMINAL (look under Program Manager, Accessories Group). Scroll through the Menu System to *E1 : Custom Report*. and press the START button. Connect the DB9 female connector to the male connector now located on the switch bracket inside the coin door. The Report should begin downloading to the computer terminal. Remove the printer/computer cable when the job is finished and close the coin door.

E1: Custom Report

The *Custom Report* is an operator-defined report which will be generated according to the settings defined in *E2: Custom Report Setup*. For printing a *Custom Report*, the operator must scroll through the Menu System to *E1 : Custom Report* and press the START button. The printer cable should now be connected to the serial port. The *Custom Report* will begin printing. Remove the printer cable when the print the job is finished and close the coin door.

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E2 Custom Report Setup

This menu is used to configure the *Custom Report.* Each device, as described in *Printer/Computer Configuration and Installation,* is pre-configured according to the settings in *E3-01: Install Device.* The user can also customize the Report according to the following table:

REF.	NAME	RANGE	*INSTALLED DEVICE* SETTINGS O'NEIL	NSM-PRINT	NSM-SAVE	CITIZEN	GENERIC	DESCRIPTION
E2-01	CLEAR COLLECTIONS	NO, LEAVE COLLECTIONS YES, WHILE PRINTING	YES	YES	YES	YES	YES	SELECT WHETHER *CURRENT AUDITS* SHOULD BE CLEARED AFTER THE PRINT JOB IS COMPLETE.
E2-02	RESET REPLAY	NO, LEAVE REPLAY YES, WHILE PRINTING	YES	YES	YES	YES	YES	SELECT WHETHER *REPLAY AWARDS* SHOULD BE CLEARED AFTER THE PRINT JOB IS COMPLETE.
E2-03+	COLLECTION AUDITS	YES, NO	YES	NO	NO	YES	YES	SELECT WHETHER *COLLECTION AUDITS* SHOULD APPEAR ON THE REPORT. IF YES, EACH *COLLECTION AUDIT* IS SELECTED INDIVIDUALLY (E3-03A THROUGH E3-03D) FOR THE REPORT.
E2-03A	CURRENT AUDITS	YES, NO	YES	NO	NO	YES	YES	SHOULD *CURRENT AUDITS* APPEAR ON THE REPORT?
E2-03B	AUDIT HISTORY 1	YES, NO	NO	NO	NO	NO	NO	SHOULD *AUDIT HISTORY 1* APPEAR ON THE REPORT?
E2-03C	AUDIT HISTORY 2	YES, NO	NO	NO	NO	NO	NO	SHOULD *AUDIT HISTORY 2* APPEAR ON THE REPORT?
E2-03D	AUDIT HISTORY 3	YES, NO	NO	NO	NO	NO	NO	SHOULD *AUDIT HISTORY 3* APPEAR ON THE REPORT?
E2-04	EARNINGS AUDITS	YES, NO	YES	NO	NO	YES	YES	SHOULD *EARNINGS AUDITS* APPEAR ON THE REPORT?
E2-05	STANDARD AUDITS	YES, NO	YES	NO	NO	YES	YES	SHOULD *STANDARD AUDITS* APPEAR ON THE REPORT?
E2-06	FEATURE AUDITS	YES, NO	YES	NO	NO	YES	YES	SHOULD *FEATURE AUDITS* APPEAR ON THE REPORT?
E2-07	STANDARD ADJUSTMENTS	YES, NO	NO	NO	NO	NO	NO	SHOULD *STANDARD ADJUSTMENTS* APPEAR ON THE REPORT?
E2-08	GAME ADJUSTMENTS	YES, NO	NO	NO	NO	NO	NO	SHOULD *GAME ADJUSTMENTS* APPEAR ON THE REPORT?
E2-09	LOCALE ADJUSTMENTS	YES, NO	NO	NO	NO	NO	NO	SHOULD *LOCALE ADJUSTMENTS* APPEAR ON THE REPORT?
E2-10	PASSWORD ADJUSTMENTS	YES, NO	NO	NO	NO	NO	NO	SHOULD *PASSWORD ADJUSTMENTS* APPEAR ON THE REPORT?
E2-11	ERROR/INFO ADJUSTMENTS	YES, NO	NO	NO	NO	NO	NO	SHOULD *ERROR/INFO ADJUSTMENTS* APPEAR ON THE REPORT?
E2-12	COINAGE ADJUSTMENTS	YES, NO	NO	NO	NO	NO	NO	SHOULD *COINAGE ADJUSTMENTS* APPEAR ON THE REPORT?
E2-13	REPORT SETTINGS	YES, NO	NO	NO	NO	NO	NO	SHOULD *REPORT SETTINGS* APPEAR ON THE REPORT?
E2-14	DEVICE SETTINGS	YES, NO	NO	NO	NO	NO	NO	SHOULD *DEVICE SETTINGS* APPEAR ON THE REPORT?
E2-15	GAME TIME HISTOGRAMS	YES, NO	NO	NO	NO	NO	NO	SHOULD *GAME TIME HISTOGRAMS* APPEAR ON THE REPORT?
E2-16	SCORE HISTOGRAMS	YES, NO	NO	NO	NO	NO	NO	SHOULD *SCORE HISTOGRAMS* APPEAR ON THE REPORT?
E2-17	BALL TIME HISTOGRAMS	YES, NO	NO	NO	NO	NO	NO	SHOULD *BALL TIME HISTOGRAMS* APPEAR ON THE REPORT?
*E2-18	REDEMPTION ADJUSTMENTS	NO, YES	NO	NO	NO	NO	NO	SELECT WHETHER *REDEMPTION ADJUSTMENTS* (F1) SHOULD APPEAR ON THE REPORT.
*E2-19	REDEMPTION PERCENTAGING	NO, YES	NO	NO	NO	NO	NO	SELECT WHETHER *REDEMPTION PERCENTAGING* (F2) SHOULD APPEAR ON THE REPORT.
*E2-20	REDEMPTION AUDITS	NO, YES	NO	NO	NO	NO	NO	SELECT WHETHER *REDEMPTION AUDITS* (F3) SHOULD APPEAR ON THE REPORT.

* NOTE: NOT AVAILABLE IN ALL VERSIONS OF SOFTWARE

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E3: Device Setup

This menu is used to configure the serial communications between the game and the output device. Each device, as described in *Printer/Computer Configuration and Installation,* is pre-configured at the factory according to the country setting of the game (see *B3 : Locale Adjustments).* In the chart below, the County Settings are described as follows:

I - used as the factory default for the U.S. and all other countries other than France and Germany;
II - used as the factory default for Germany;
III - optional configuration (not used as the factory default for any specific country);
IV - used as the factory default for France;
V - optional configuration (not used as the factory default for any specific country).

The user can also customize a device according to the following table:

REF.	NAME	RANGE	COUNTRY SETTING I.	II.	III.	IV.	V.	DESCRIPTION
E3-01+	INSTALL DEVICE	CUSTOM GENERIC ASCII O'NEIL MICROFLASH NSM DATAPRINTER, PRINT NSM DATAPRINTER, SAVE CITIZEN 560/562	O'NEIL	NSM-PRINT	NSM-SAVE	CITIZEN	GENERIC	SELECT THE TYPE OF DEVICE CONNECTED TO THE SERIAL PORT. IF *CUSTOM* IS SELECTED, ADDITIONAL PRINTER SETTINGS (E3-01A THROUGH E3-01K) MUST BE SELECTED.
E3-01A	DEVICE TYPE	GENERIC ASCII O'NEIL MICROFLASH NSM DATAPRINTER CITIZEN 560/562	O'NEIL	NSM-	NSM-	CITIZEN	GENERIC	SELECT THE TYPE OF DEVICE CONNECTED TO THE SERIAL PORT.
E3-01B	HOTPLUG CUSTOM REPORT	YES, NO	YES	YES	YES	YES	YES	SELECT WHETHER TO ENABLE (YES) O DISABLE (NO) *CUSTOM REPORTS* FRO THE MAIN MENU.
E3-01C	HOTPLUG QUERY	NONE 3 ASCII NULLS ASCII DC1	3 ASCII NULLS	NONE	NONE	ASCII DC1	NONE	SELECT THE INITIALIZATION STRING FOR YOUR PRINTER AFTER THE CONNECTION IS MADE ACTIVE.
E3-01D	HOT PLUG RESPONSE	NONE CTS ACTIVE DSR ACTIVE	CTS	CTS	CTS	CTS	CTS	SELECT WHETHER A HARDWARE HANDSHAKE IS REQUIRED.
E3-01E	SAVE REPORT	YES, NO	NO	NO	YES	NO	NO	SELECT WHETHER TO SAVE THE REPORT TO PRINTER MEMORY (IF SO EQUIPPED).
E3-01F	BAUD RATE	300, 600, 1200, 2400, 4800, 9600,19200	19200	9600	9600	9600	19200	SELECT THE BAUD RATE OF THE SERIA PORT. NOTE: ONLY 8N1 (8-BIT, NO PARITY, 1 STOP BIT) IS SUPPORTED.
E3-01G	END OF LINE	CR, LF, CR & LF	CR & LF	CR & LF	CR & LF	CR & LF	CR & LF	SELECT THE END OF LINE (EOL) ASCII CHARACTERS TO BE USED: CR- CARRIAGE RETURN LF-LINE FEED
E3-01H	CHARACTERS PER LINE	24 TO 80	42	24	24	40	80	SELECT THE MAXIMUM NUMBER OF CHARACTERS PER LINE OF PRINT.
E3-01I	RS232 CTS HANDSHAKE	YES, NO	NO	NO	YES	YES	YES	SELECT WHETHER A RS232 CTS HANDSHAKE IS REQUIRED BY THE PRINTER DEVICE.
E3-01J	XON/XOFF HANDSHAKE	YES, NO	YES	NO	NO	NO	YES	SELECT WHETHER AN ASCII HANDSHAKE (XON/XOFF) IS REQUIRED BY THE PRINTER DEVICE.
E3-01K	RS232 DSR HANDSHAKE	YES, NO	NO	NO	NO	NO	NO	SELECT WHETHER A RS232 DSR HANDSHAKE IS REQUIRED BY THE PRINTER DEVICE.
E3-01L	EOL/CTS HANDSHAKE	YES, NO	NO	YES	NO	NO	NO	SELECT WHETHER A COMBINATION OF EOL & CTS SIGNALS ARE REQUIRED BY THE PRINTER DEVICE.

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AUDIT REF.	AUDIT NAME	RANGE	FACTORY SETTING					DESCRIPTION
E3-02+	OUTPUT FORMAT	FORMATTED, DELIMITED	FORM.	FORM.	FORM.	FORM.	FORM.	SELECT THE FORMAT FOR DATA OUTPUT. *DELIMITED* (TEXT) OUTPUT WILL GENERALLY BE CAPTURED BY A TERMINAL SOFTWARE PACKAGE AND IMPORTED INTO A SPREADSHEET APPLICATION. IF *DELIMITED* IS CHOSEN ADDITIONAL CRITERIA (E3-02 A,B) MUST BE SELECTED. *FORMATTED* DATA IS IN A PRINTER-READY, READABLE USER FORMAT, SUCH AS SEEN ON A RECEIPT
E3-02A	DELIMITER	TAB SPACE COMMA SEMI-COLON	TAB	TAB	TAB	TAB	TAB	SELECT THE DELIMITER TO BE INSERTED BETWEEN THE 3 FIELDS (TITLE, VALUE, PERCENTAGE) OF THE REPORT.
E3-02B	TEXT QUALIFIER	DOUBLE QUOTE SINGLE QUOTE	DOUBL	DOUBL	DOUBL	DOUBL	DOUBL	SPECIFY THE BEGINNING AND ENDING CHARACTER OF A FIELD.

E4: Adjustments Report

Generates a complete listing of ALL of the games' adjustments information. Any sensitive adjustments which are password-protected will not be shown on the report (only the title of the adjustment will appear with the message "PASSWORD PROTECTED"). This report can only be generated through the Menu System (see *E2-01: Custom Report*).

E5: Audits Report

Generates a complete listing of ALL of the games' audit information. Any sensitive audits which are password protected will not be shown on the report (only the title of the audit will appear with the message "PASSWORD PROTECTED"). This report can only be generated through the Menu System (see *E2-01: Custom Report*).

STATUS MESSAGES

NOTE: All of the following Status Messages are shown on the dot matrix display and do not appear on the printed report:

1) **PLEASE DISCONNECT PRINTER** - This message appears after an automatic report has been completed using the "Hot Plug" method.

2) **SEARCHING FOR PRINTER... -** This message appears at the beginning of each print job.

3) **ONE MOMENT, PRINTING <type> -** This message appears during a print job where <type> is the title or the section currently being printed.

4) **ONE MOMENT, PRINTING ALL ADJUSTMENTS, <type> -** This message appears during the Adjustments Report where <type> is the title of the section currently being printed.

5) **ONE MOMENT, PRINTING ALL AUDITS, <type> -** This message appears during the Audits Report where <type> is the title of the section currently being printed.

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6) **ONE MOMENT, PRINTING CUSTOM REPORT, <type>** - This message appears during the Custom Report where <type> is the title of the section currently being printed.

7) **PRINT JOB COMPLETE** - This message appears after the completion of the current print job.

8) **PRINT JOB CANCELED** - This message appears when the operator cancels a print job in progress by pressing both flippers simultaneously.

9) **RESET COLLECTION AUDITS COMPLETE** - This message appears after the *COLLECTIONS* Audits have been cleared.

10) **RESET REPLAY PERCENTAGE COMPLETE** - This message appears after the replay setting has been changed to the recommended settings.

ERROR MESSAGES

NOTE: All of the following Error Messages are shown on the dot matrix display and do not appear on the printed report:

1) **ERROR: PRINTER NOT RESPONDING, CHECK CONNECTION AND TRY AGAIN** - This message appears after a print job is activated and the system is not able to detect the presence of a printer device. Check the printer cable for a loose connection and verify that it is the correct type of serial cable.

2) **ERROR: PRINT JOB INTERRUPTED, CHECK PRINTER AND TRY AGAIN** - This message will appear during a print job if the printer cable becomes disconnected, the printer goes off-line or runs out of paper, or an undetermined error occurs.

3) **PLEASE DISCONNECT PRINTER** - This message will appear after one of the above error messages was previously displayed and the re-connection attempt was unsuccessful. You must unplug the printer cable to remove the message from the display and return to the System Menu.

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F. REDEMPTION

(NOT AVAILABLE IN ALL VERSIONS OF SOFTWARE)

DESCRIPTION

The Redemption Menu is used in configuring the game for a redemption mode of operation when the game is equipped with an optional ticket or token dispenser . The redemption mode has five levels of scoring, payout, mechanism selection (ticket and/or token dispenser), and percentaging. The number and type of prizes (tickets, tokens, free credits, extra balls) that are awarded are operator adjustable and can be set for increasing levels of scoring difficulty. Prizes are awarded incrementally during the game after each scoring level is reached by the player. The player must also score within a preset time limit. After the timer expires, the current game will continue but the dispenser is disabled and prizes are no longer awarded.

F1 : ADJUSTMENTS

AUDIT REF.	AUDIT NAME	RANGE	FACTORY SETTING	DESCRIPTION
F1-01+	REDEMPTION MODE	ON, OFF	OFF	SELECT WHETHER GAME OPERATES IN REDEMPTION MODE (ON).
F1-01A	SCORE 1	0 - 42,000,000	50,000,000	SET THE FIRST LEVEL OF SCORING THAT WILL DISPENSE A PRIZE(S).
F1-01B	PAYOUT 1	0 - 100	1	SET THE AMOUNT OF PRIZE(S) TO BE AWARDED WHEN REACHING A LEVEL 1 SCORE.
F1-01C	MECHANISM 1	TOKEN, TICKET, CREDIT, XBALL	TOKEN	SELECT THE TYPE OF AWARD TO BE ISSUED WHEN REACHING A LEVEL 1 SCORE.
F1-01D	PERCENTAGE 1	1 - 99	40	SET THE "IDEAL" PERCENTAGE OF GAMES THAT SHOULD REACH A LEVEL 1 SCORE. WHEN A HISTORY OF GAME SCORES HAS BEEN ACCUMULATED, THIS PERCENTAGE WILL THEN BE USED IN DETERMINING A "SUGGESTED" LEVEL 1 SCORE (SEE F2, *PERCENTAGING*).
F1-01E	SCORE 2	0 - 42,000,000	100,000,000	SET THE SECOND LEVEL OF SCORING THAT WILL DISPENSE A PRIZE(S).
F1-01F	PAYOUT 2	0 - 100	3	SET THE AMOUNT OF PRIZE(S) TO BE AWARDED WHEN REACHING A LEVEL 3 SCORE.
F1-01G	MECHANISM 2	TOKEN, TICKET, CREDIT, XBALL	TOKEN	SELECT THE TYPE OF AWARD TO BE ISSUED WHEN REACHING A LEVEL 2 SCORE.
F1-01H	PERCENTAGE 2	1 - 99	20	SET THE "IDEAL" PERCENTAGE OF GAMES THAT SHOULD REACH A LEVEL 2 SCORE WHEN A HISTORY OF GAME SCORES HAS BEEN ACCUMULATED, THIS PERCENTAGE WILL THEN BE USED IN DETERMINING A "SUGGESTED" LEVEL 2 SCORE (SEE F2, *PERCENTAGING*).
F1-01I	SCORE 3	0 - 42,000,000	200,000,000	SET THE THIRD LEVEL OF SCORING THAT WILL DISPENSE A PRIZE(S).
F1-01J	PAYOUT 3	0 - 100	6	SET THE AMOUNT OF PRIZE(S) TO BE AWARDED WHEN REACHING A LEVEL 3 SCORE.
F1-01K	MECHANISM 3	TOKEN, TICKET, CREDIT, XBALL	TOKEN	SELECT THE TYPE OF AWARD TO BE ISSUED WHEN REACHING A LEVEL 3 SCORE.
F1-01L	PERCENTAGE 3	1 - 99	10	SET THE "IDEAL" PERCENTAGE OF GAMES THAT SHOULD REACH A LEVEL 3 SCORE. WHEN A HISTORY OF GAME SCORES HAS BEEN ACCUMULATED, THIS PERCENTAGE WILL THEN BE USED IN DETERMINING A "SUGGESTED" LEVEL 3 SCORE (SEE F2, *PERCENTAGING*).

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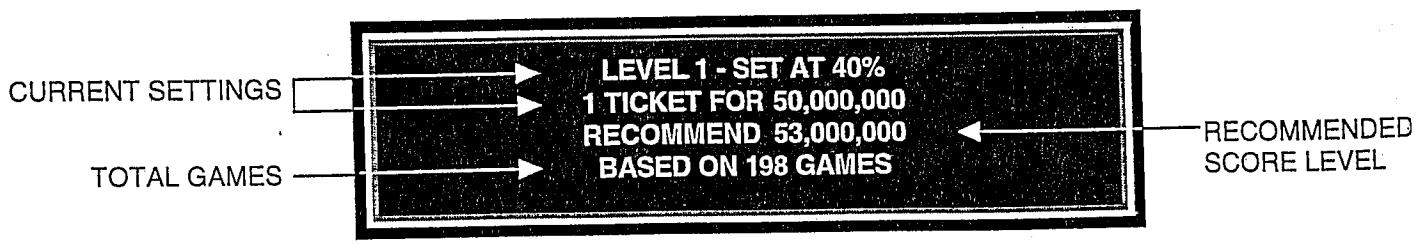
F1 : ADJUSTMENTS (CONTINUED)

AUDIT REF.	AUDIT NAME	RANGE	FACTORY SETTING	DESCRIPTION
F1-01M	SCORE 4	0 - 42,000,000	300,000,000	SET THE FOURTH LEVEL OF SCORING THAT WILL DISPENSE A PRIZE(S).
F1-01N	PAYOUT 4	0 - 100	10	SET THE AMOUNT OF PRIZE(S) TO BE AWARDED WHEN REACHING A LEVEL 4 SCORE.
F1-01O	MECHANISM 4	TOKEN, TICKET, CREDIT, XBALL	TOKEN	SELECT THE TYPE OF AWARD TO BE ISSUED WHEN REACHING A LEVEL 4 SCORE.
F1-01P	PERCENTAGE 4	1 - 99	5	SET THE "IDEAL" PERCENTAGE OF GAMES THAT SHOULD REACH A LEVEL 4 SCORE. WHEN A HISTORY OF GAME SCORES HAS BEEN ACCUMULATED, THIS PERCENTAGE WILL THEN BE USED IN DETERMINING A "SUGGESTED" LEVEL 4 SCORE (SEE F2, *PERCENTAGING*).
F1-01Q	SCORE 5	0 - 42,000,000	400,000,000	SET THE FIFTH LEVEL OF SCORING THAT WILL DISPENSE A PRIZE(S).
F1-01R	PAYOUT 5	0 - 100	1	SET THE AMOUNT OF PRIZE(S) TO BE AWARDED WHEN REACHING A LEVEL 5 SCORE.
F1-01S	MECHANISM 5	TOKEN, TICKET, CREDIT, XBALL	TICKET	SELECT THE TYPE OF AWARD TO BE ISSUED WHEN REACHING A LEVEL 5 SCORE.
F1-01T	PERCENTAGE 5	1 - 99	1	SET THE "IDEAL" PERCENTAGE OF GAMES TO REACH LEVEL 5 SCORING. WHEN A HISTORY OF GAME SCORES HAS BEEN ACCUMULATED, THIS PERCENTAGE WILL THEN BE USED IN DETERMINING A "SUGGESTED" LEVEL 5 SCORE (SEE F2, *PERCENTAGING*).
F1-01U	TIMER	10 - 300	200	SET THE AMOUNT OF "TICKS" ALLOWED FOR REACHING SCORING LEVELS 1 -5. WHEN THE TIMER EXPIRES, THE GAME CONTINUES BUT THE REDEMPTION FEATURE IS DISABLED FOR EXAMPLE, 200 "TICKS" ARE EQUIVALENT TO 200 MILLISECONDS, OR ABOUT 1/5 OF A SECOND.
F1-01V	TIMER MILLISEC	500 - 2,000 ms	1000 ms	SET THE AMOUNT OF TIME PER "TICK" AT WHICH THE TIMER COUNTS DOWN.

F2 : PERCENTAGING

The Percentaging menu suggests to the operator a recommended scoring level that will better approximate the "target replay" percentage as set forth in F1, *Adjustments*. When selected, the following screen appears:



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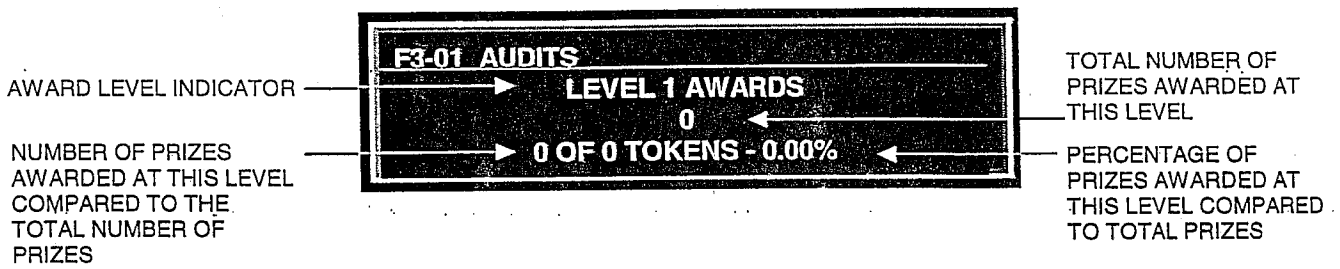
To accept the recommended new score level, press the START button. To cycle through the remaining score levels, press either FLIPPER button. To cancel, back-up, or restore the original setting, press both FLIPPER buttons simultaneously.

F3 : AUDITS

The Audits menu will display awards information accumulated from previous games. A sample Audits screen is shown:



To cycle through the remaining award levels, press either FLIPPER button. To cancel or back-up to a previous menu, press both FLIPPER buttons simultaneously.

F4 : CLEAR AUDITS

Clears Totals and Percentaging values from the above F3, *AUDITS*.

F5 : COUNT TOKENS

NOTE: This test is intended only for token dispensers equipped with a token switch. **Prior to starting this test, remove all existing tokens from the collection drawer (bin) in order to prevent a backup of tokens into the dispenser mechanism.**

This utility will start emptying the token dispenser of its' remaining tokens while counting each token as it exits. The token count will be continually displayed to the screen.

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NOTES

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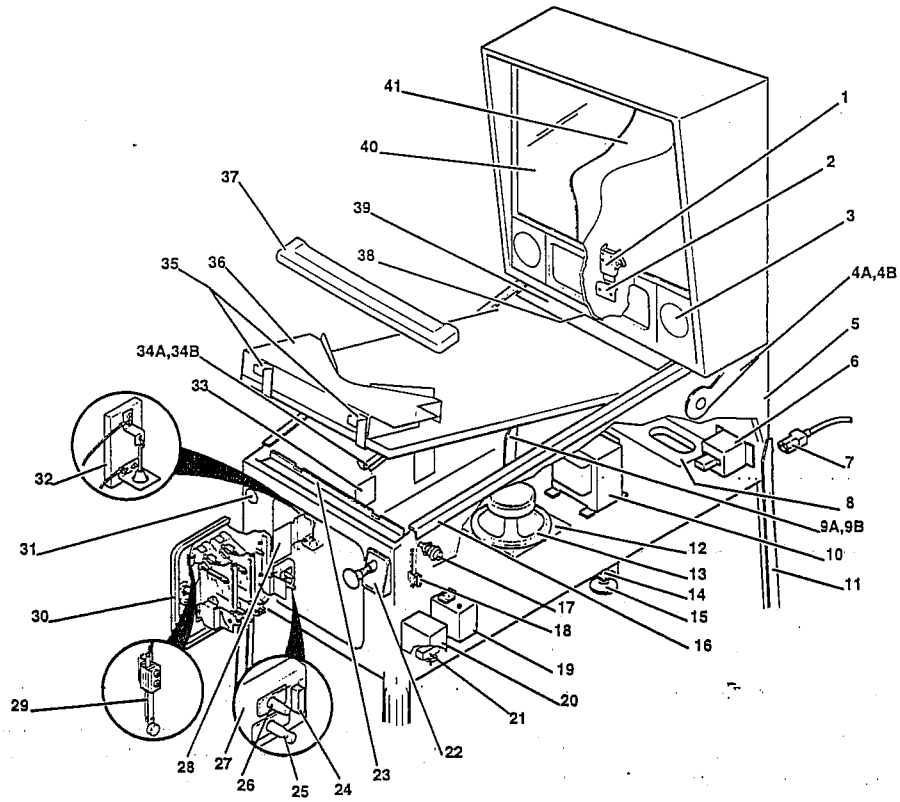
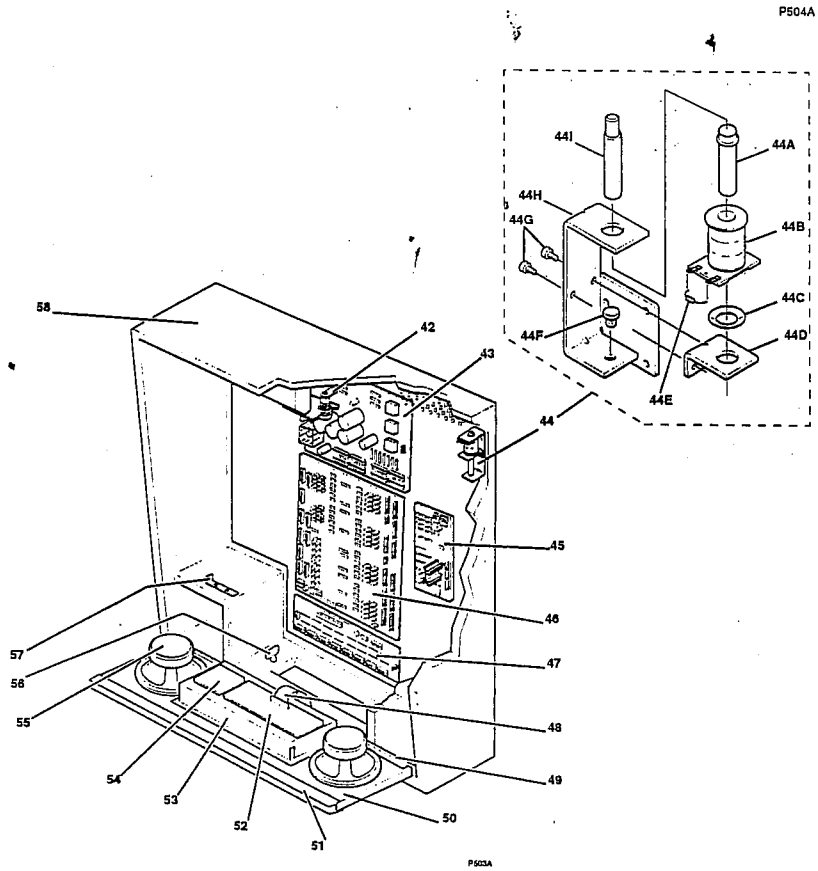
CABINET AND BACKBOX PARTS IDENTIFICATION



P504A



P503A

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CABINET AND BACKBOX PARTS LIST

Ref.	Description	Part Number
1	LATCH, LINK LOCK, HEX, CAM (CONNECTED TO CABINET)	MT00428
2	PLATE, KEEPER, LATCH (CONNECTED TO BACKBOX)	MT00428-1
3	GRILLE, SPEAKER	AW00188
4A	HINGE-LEFT, BACKBOX	MT00173-L
4B	HINGE-RIGHT, BACKBOX	MT00173-R
5	CABINET, WITH ARTWORK	WD00163-PB5
6	FILTER, LINE	LF00100
7	CORD, LINE (POWER)	LC0010*
8	GRILLE, VENT, 10 X 16	PL00310
9A	ASSEMBLY, LEFT, ARM, PLAYFIELD LIFT	A-00351-L
9B	ASSEMBLY, RIGHT , ARM, PLAYFIELD LIFT	A-00351-R
10	TRANSFORMER, POWER	XF00106
11	LEG, PINBALL, 28-1/2"L	MT00231
12	GRILLE, SPEAKER, 7-1/2"	PL00173
13	SPEAKER, 8.0", 4 OHM, 20 WATT	SP00101
14	NUT, 10-24 KEPS HEX	NT00101-10
15	LEVELER, LEG, 3/8-16 X 3.0 WITH NUT	MS00101-1
16	ARMOR, SIDE PANEL, PINBALL, BLACK	MT00163-BK
17	PUSHBUTTON, 1 9/16, RED	PL00178-R
18	ASSEMBLY, SWITCH & CABLE, FLIPPER BURRON SINGLE	A-00455
19	OUTLET, SERVICE, UL / CSA	MT00316-2
20	COVER, SWITCH, ON / OFF, UL / CSA	MT00579
21	SWITCH, & PLATE, ON / OFF	A-00413
22	ASSEMBLY, BALL SHOOTER	A-00192-03
23	ASSEMBLY, LOCK, HANDRAIL	A-00125-1
24	CABLE, PRINTER, TICKET DISPENSER, METER PCB WITH CONNECTOR	C-00198
25	SWITCH, INTERLOCK, PANEL MOUNTING	SW00119
26	SWITCH, MOMENTARY, 0.1 AMPS 125 VAC	SW00132
27	BRACKET, SWITCH, INTERRUPT, 3-POSITION WITH PRINTER CONNECTOR	MT00321-2
28	ASSEMBLY, PCB, PRINTER/METER/T.D. *(OPTIONAL)*	A0019501
29	SWITCH, LEAF, ANTI-SLAM	SW00121
30	DOOR, COIN	A-00492-*
31	SWITCH, START BUTTON	SW00130
32	ASSEMBLY, TILT, PLUMB BOB, WITH CABLE	A-00065-1
33	ASSEMBLY, PCB, DIODE	A0016900
34A	RAIL-LEFT, CABINET	MT00357-L
34B	RAIL-RIGHT, CABINET	MT00357-R

Ref.	Description	Part Number
35	BRACKET, HANGER, PLAYFIELD	MT00162-2
36	ASSEMBLY, BOTTOM ARCH	A-00211-PB5
37	ASSEMBLY, HANDRAIL, BLACK	A-00124
38	ASSEMBLY, "BLACK" LIGHT	A-00535
39	BRACKET, GLASS, PLAYFIELD, REAR, BLACK	MT00177-BK
40	GLASS, TEMPERED 26-1/8 X 19-3/4 X 1/8 *(BACKBOX)*	GL00106
	GLASS, TEMPERED21.0 X 43.0 X 3/16 *(PLAYFIELD) (NOT SHOWN)*	GL00102
41	FILM, BACKGLASS	AW00183
42	CYLINDER, LOCK	LK00101
43	ASSEMBLY, PCB, POWER	A0015205
44	ASSEMBLY, KNOCKER	A-00150
44A	SLEEVE, COIL, 1.810"L WITH .250 EXTENSION	PL00154-01
44B	COIL, 800T #23	CL00109
44C	WASHER, SPRING, .531ID .795OD .129H	WS00107-02
44D	BRACKET, RETAINING, .625 8-32 X .375 13GA C.R.S.	MT00136
44E	DIODE, 1N4004 , 1.0A 400VR	DI00100
44F	BUTTON, BUMPER, 5/8"D 1/8"H 14GA .078"T	RB00110
44G	SCREW, MACHINE, 8-32 X 1/4 PPH SEMS ZC	SC00101-02
44H	BRACKET, COIL MOUNTING, .625 SLTD X .375	MT00203
44I	ASSEMBLY, SUB, PLUNGER & TIP	A-00149
45	ASSEMBLY, PCB, SOUND	A0015004-PB5
46	ASSEMBLY, PCB, DRIVER	A0015106
47	ASSEMBLY, PCB, SWITCH	A0015302
48	RIBBON CABLE 50-PIN I/C PB WITH FERRITE BEAD	RC00103
49	ASSEMBLY, HINGE, SPEAKER PANEL	A-00163
50	ASSEMBLY, PANEL, SPEAKER	A-00301-PB5
51	CHANNEL, GLASS	PL00179
52	ASSEMBLY, PCB, CPU SYSTEM	A0015405-PB5
53	DISPLAY, DOT MATRIX 128 X 32	DP00102
54	ASSEMBLY, PCB, DISPLAY SWITCHING POWER SUPPLY	A0015505
55	SPEAKER, 4.0" D, 4.0 OHM	SP00100
56	THUMBSCREW, 3/8-16 X 2.5 WITH SHOULDER	SC00154-20
57	BRACKET, SLIDE, PANEL LATCH	MT00221
58	BACKBOX WITH ARTWORK	WD00132-PB5

*NOTE: When ordering for service, please indicate model number of your game.

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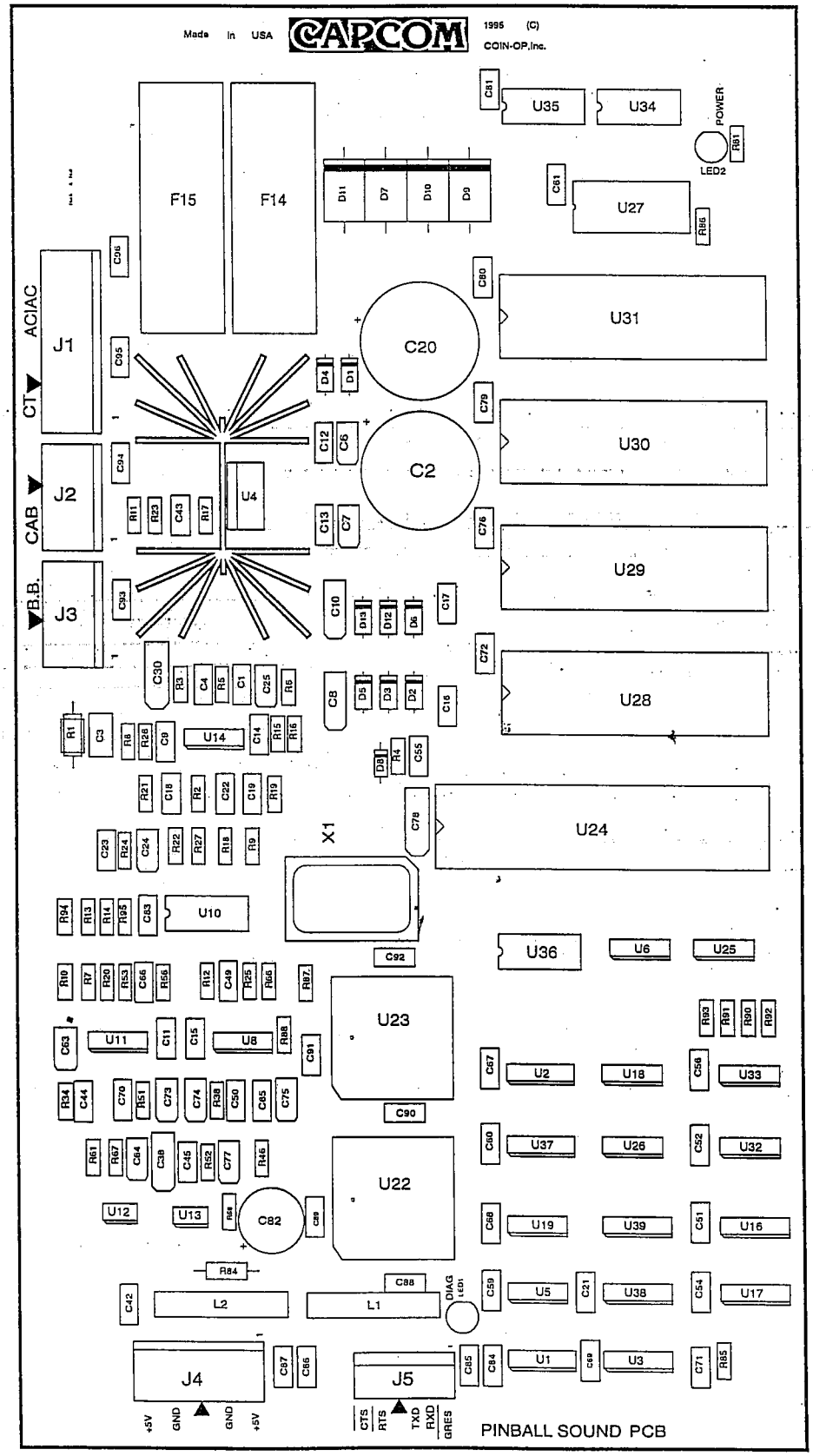
SOUND BOARD



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SOUND BOARD ASSEMBLY A0015004
PARTS LIST

Des.	Description	Part Number
C1,C4	CAPACITOR , CERAMIC 100V .001UF 10% SMT 1206	CP00055-SMT
C2,C20	CAPACITOR , ELECTROLYTIC 25V 4700UF 20% RAD	CP00020
C3	CAPACITOR , CERAMIC 50V .22UF 20% SMT 1210	CP00051-SMT
C6-7,C24, C63-64, C73-75, C77	CAPACITOR , TANTALUM 35V 1.0UF 10% SMT	CP00012-SMT
C8,C10,C38	CAPACITOR , TANTALUM 25V 4.7UF 20% SMT	CP00050-SMT
C9,C11-17 C21,C42, C45,C51-52, C54-56,C59-61,C67-C69, C71-72,C76, C79-81, C83, C88-C96	CAPACITOR, CERAMIC 50V .1UF 10% SMT 1206	CP00056-SMT
C18	CAPACITOR , CERAMIC 100V .022UF 20% SMT 1206	CP00063-SMT
C19,C22, C44,C50, C65,C70	CAPACITOR , CERAMIC 50V .033UF 5% SMT 1206	CP00061-SMT
C23,C49, C66	CAPACITOR , CERAMIC 100V 3300PF 20% SMT 1206	CP00064-SMT
C25	CAPACITOR, TANTALUM 50V .05UF 10% SMT	CP00073-SMT
C30,C78	CAPACITOR , TANTALUM 16V 22UF 20% SMT	CP00045-SMT
C43	CAPACITOR , CERAMIC 100V 470PF 5% SMT 1206	CP00060-SMT
C82	CAPACITOR , ELECTROLYTIC 16V 470UF 20% RAD	CP00054
C84-87	CAPACITOR , CERAMIC 100V 100PF 10% SMT 1206	CP00058-SMT
D1-6,D12-13	DIODE 1N4004 RECTIFIER 1.0A 400VR	DI00100
D7,D9-11	DIODE 1N5402 RECTIFIER 3.0A 200VR	DI00106
D8	DIODE 1N4148 SW 200MA 75VR	DI00104
J1	CONNECTOR HEADER .156 STR 7-PIN LOCK	CN00100-07
J2,J3	CONNECTOR HEADER .156 STR 4-PIN LOCK	CN00100-04
J4	CONNECTOR HEADER .156 STR 5-PIN LOCK	CN00100-05
J5	CONNECTOR HEADER .100 STR 6-PIN LOCK	CN00104-06
L1-2	IND CHOKE 4.7UH 3A AXIAL	IN00100
LED1-2	LED LTL4201 RED 20MA T-1 70 °	DI00105
F14-F15	FUSE HOLDER 3AG PC MTG	FS00101
F14.F15	FUSE SLO BLO 3.0A 250V 3AG	FS00100-02
R1	RESISTOR CARBON FILM 1/4W 5% 1 OHM	RS00100-23
R2	RESISTOR CARBON FILM 1/8W 5% 100 OHM SMT 1206	RS00102-02S
R3,R5	RESISTOR CARBON FILM 1/8W 5% 12K OHM SMT 1206	RS00102-18S
R4,R85	RESISTOR CARBON FILM 1/8W 5% 1K OHM SMT 1206	RS00102-05S
R6,R17	RESISTOR CARBON FILM 1/8W 5% 22K OHM SMT 1206	RS00102-21S

Des.	Description	Part Number
R7,R20,R88	RESISTOR CARBON FILM 1/8W 5% 3.3K OHM SMT 1206	RS00102-27S
R8-9,R11	RESISTOR CARBON FILM 1/8W 5% 680 OHM SMT 1206	RS00102-13S
R10,R12, R25,R53, R56,R66, R86,R90-R93	RESISTOR CARBON FILM 1/8W 5% 10K OHM SMT 1206	RS00102-07S
R13-14	RESISTOR CARBON FILM 1/8W 5% 27K OHM SMT 1206	RS00102-40S
R15	RESISTOR CARBON FILM 1/8W 5% 47K OHM SMT 1206	RS00102-20S
R16	RESISTOR CARBON FILM 1/8W 5% 39K OHM SMT 1206	RS00102-19S
R18-19, R21-22	NOT USED	----------
R23	RESISTOR CARBON FILM 1/8W 5% 2.0K OHM SMT 1206	RS00102-22S
R24,R26-27	RESISTOR CARBON FILM 1/8W 5% 4.7K OHM SMT 1206	RS00102-26S
R34,R38, R46,R51	RESISTOR CARBON FILM 1/8W 5% 1.2K OHM SMT 1206	RS00102-08S
R52,R61, R67-68	RESISTOR CARBON FILM 1/8W 5% 11K OHM SMT 1206	RS00102-38S
R81	RESISTOR CARBON FILM 1/8W 5% 270 OHM SMT 1206	RS00102-03S
R84	RESISTOR CARBON FILM 1/4W 5% 0 OHM	RS00100-10
R87	RESISTOR CARBON FILM 1/8W 5% 33 OHM SMT 1206	RS00102-41S
R94,R95	RESISTOR CARBON FILM 1/8W 5% 2.2K OHM SMT 1206	RS00102-23S
U1,U3	IC 74LS112 DUAL J-K F/F SMT	IC00093-SMT
U2,U37	IC 74LS165 8-BIT SHIFT REGISTER SMT	IC00089-SMT
U4	IC TDA2030A 18W HI-FI AMP	IC00056
U4	HEATSINK TO-220 W/KOOL CLIP	HS00102
U5,U32	IC 74HC74 DUAL D-TYPE F/F SMT	IC00087-SMT
U6	IC 74LS74 DUAL D-TYPE FF SMT	IC00042-SMT
U8,U11,U14	IC TLO84 OPERATIONAL AMP SMT	IC00037-SMT
U10	IC X9241U QUAD E2POT 50K SMT	IC00061-SMT
U12-13	IC TDA1545 16-BIT DAC SMT	IC00091-SMT
U16-17, U38-39	IC 74LS161 4-BIT SYN BIN CTR SMT	IC00083-SMT
U18-19	IC 74LS04 HEX INVERTER SMT	IC00048-SMT
U22-23	IC TMS320AV120 MPEG AUDIO DECODER SMT	IC00086-SMT
U24	IC87C52 PROGRAMMED MICOCONTROLLER	A-00566-U24
U24	SOCKET 40-PIN DIP	SK00112-40
U25-26	IC 74LS08 QUAD 2-IN AND GATE	IC00088-SMT
U27	IC SRAM32KX8 SMT	IC00090-SMT
U28-31	ROM SOCKET 32PIN600	SK00112-32
*U28	ROM, MASKED	A-00632-U28
*U29	ROM, MASKED	A-00632-U29
*U30	EPROM, PROGRAMMED	A-00632-U30
U33	IC 74LS00 QUAD 2-IN NAND GATE SMT	IC00084-SMT
U34-36	IC 74LS373 OCT D-TYPE LATCH SMT	IC00092-SMT
X1	CLOCK OSCILLATOR 24MHZ	OS00101

NOTE: C57 & 58 are replaced with jumper wires.

* NOTE: Game ROMs are not included with Sound Board Assembly: must be purchased separately.

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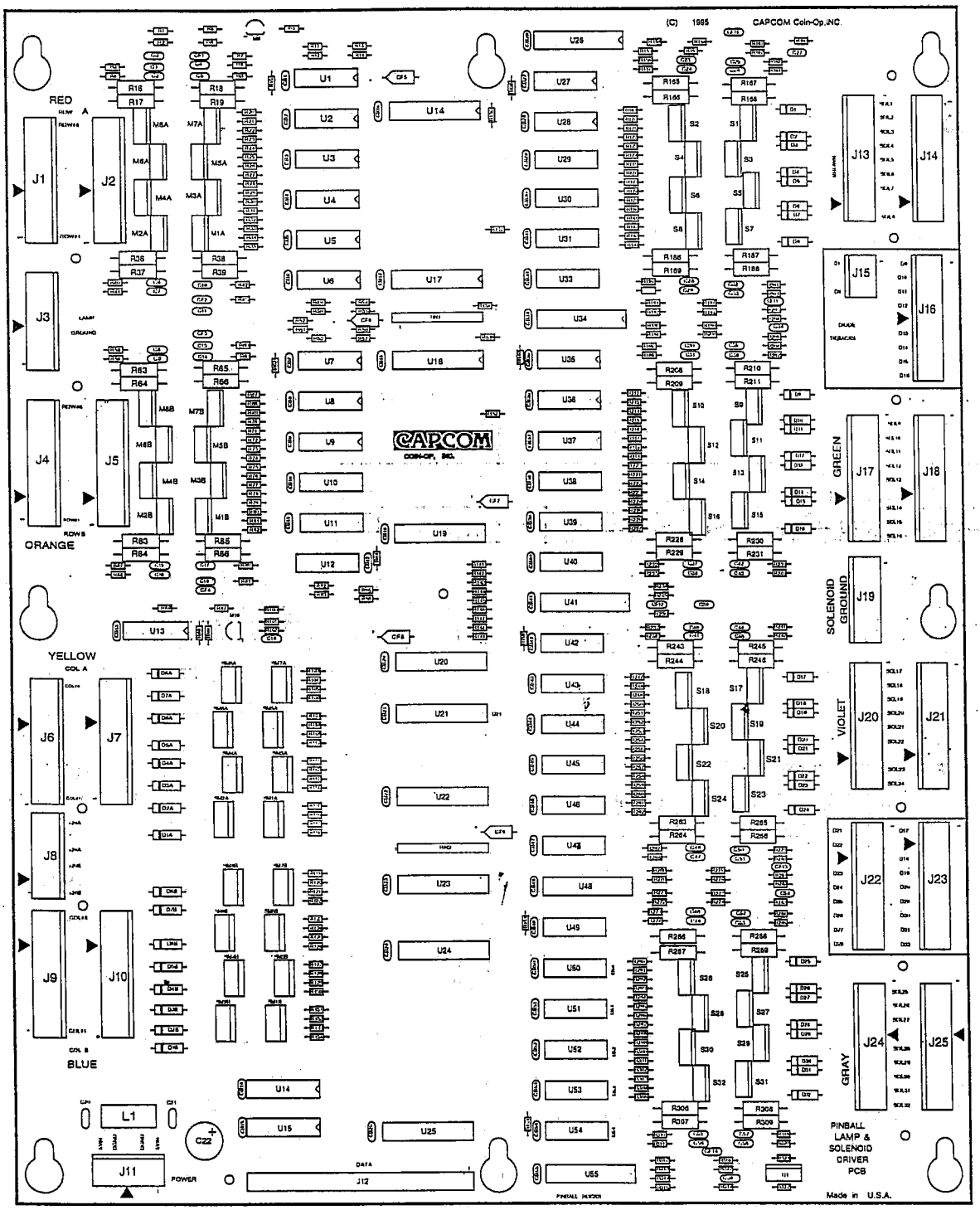
DRIVER BOARD



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DRIVER BOARD ASSEMBLY A0015106
PARTS LIST

Des.	Description	Part Number
C1-11,C13-19, C23-59	CAPACITOR CERAMIC 50V .22UF 20% AX	CP00024
C20-21	CAPACITOR CERAMIC 50V 100P 10% AX	CP00068
C22	CAPACITOR ELECT 16V 470UF 20% RAD	CP00054
CB14-26,CB34, CB41,CB48,CB55	CAPACITOR CERAMIC 50V .01UF 10% AX	CP00048
CB42-47,CB49-54	CAPACITOR CERAMIC 50V .001UF 10% AX	CP00049
CF1-4,CF10-14	CAPACITOR CERAMIC 50V .01UF 10% AX	CP00048
CF5-9	CAPACITOR TANTALUM 35V 1.0UF 5% AX	CP00012
D1-32,D1A,D1B, D2A,D2B,D3A, D3B,D4A,D4B, D5A,D5B,D6A, D6B,D7A,D7B, D8A,D8B-1	DIODE 1N4004 RECTIFIED 1.0A 400VR	DI00100
J15	CONNECTOR HEADER .156 STR 3 PIN LOCK	CN00100-03
J11	CONNECTOR HEADER .156 STR 5-PIN LOCK	CN00100-05
J8,J19	CONNECTOR HEADER .156 STR 6-PIN LOCK	CN00100-06
J3	CONNECTOR HEADER .156 STR 7-PIN LOCK	CN00100-07
J1-2,J4-7,J9-10, J13-14,J16-18, J20-25	CONNECTOR HEADER .156 STR 9 PIN LOCK	CN00100-09
J12	CONNECTOR HEADER .100 STR 50-PIN 2X25	CN00101-50
L1	IND 4.7UH 3.4A 15%AX	IN00100
M1A,M1B, M2A, M2B,M3A, M3B, M4A,M4B, M5A, M5B, M6A,M6B, M7A,M7B, M8A, M8B,S1-32	TRANSISTOR STP20N10L MOSFET N-CH	TR00101
M9-10	TRANSISTOR 2N7000 MOSFET N-CH	TR00109
Q1	TRANSISTOR TIP102 NPN	TR00102
R1,R100	RESISTOR METAL FILM 1/4W 1% 200 OHM	RS00113-11
R2,R101,R162, R204,R235, R282,R317	RESISTOR METAL FILM 1/4W 1% 7.50K OHM	RS00113-08
R3-4,R8-9, R40-43,R58-61, R87-88,R90-91	RESISTOR CARBON FILM 1/4W 5% 680 OHM	RS00100-13
R5,R97	RESISTOR METAL FILM 1/4W 1% 270 OHM	RS00113-12
R6,R15,R62,R94, R102,R135,R140, R150-151,R153, R160,R205,R236, R283,R318	RESISTOR CARBON FILM 1/4W 5% 100 OHM	RS00100-02

Des.	Description	Part Number
R7,R21,R23,R25, R27,R29,R31,R33, R35,R51,R68,R70, R72,R74,R76, R78,R80,R82,R89, R98,R136-139, R141,R152,R169, R172-173,R176-177, R180-181,R184, R212,R215-216, R219-220, R223-224,R227, R247,R250-251, R254-255,R258-259, R262,R290, R293-294, R297-298, R301-302, R305, RR321-322	RESISTOR CARBON FILM 1/4W 5% 4.7K OHM	RS00100-26
R10,R99	RESISTOR CARBON FILM 1/4W 5% 330 OHM	RS00100-12
R11-14,R49-50, R52-57,R92-93, R95-96,R104, R106,R108,R110, R112,R114,R116, R118,R120,R122, R124,R126,R128, R130,R132,R134, R142-149,R154-155, R158-159,R191-194, R197-200,R269-272, R275-278,R312-315	RESISTOR CARBON FILM 1/4W 5% 10K OHM	RS00100-07
R16-19,R36-39, R63-66,R83-86, R165-168,R185-188, R208-211,R228-231, R243-246,R263-266, R286-289, R306-309	RESISTOR CARBON FILM 1W 5% .020 OHM	RS00112-01
R20,R22,R24,R26, R28,R30,R32,R34, R67,R69,R71,R73, R75,R77,R79,R81, R170-171,R174-175, R178-179,R182-183, R213-214,R217-218, R221-222,R225-226, R248-249,R252-253, R256-257,R260-261, R291-292,R295-296, R299-300, R303-304	RESISTOR CARBON FILM 1/4W 5% 750 OHM	RS00100-42
R103,R105,R107 R109,R111,R113 R115,R117,R119 R121,R123,R125 R127,R131,R133	RESISTOR CARBON FILM 1/4W 5% 1K OHM	RS00100-05

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DRIVER BOARD ASSEMBLY A0015106
PARTS LIST (CONT.)

Des.	Description	Part Number
R156-157,R163-164, R189-190,R195-196, R201-202,R206-207, R232-233,R237-242, R267-268,R273-274, R279-280,R284-285, R310-311,R319-320	RESISTOR CARBON FILM 1/4W 5% 56 OHM	RS00100-41
R161,R203,R234, R281,R316	RESISTOR METAL FILM 1/4W 1% 470 OHM	RS00113-06
RN1-2	RESISTOR SIP 10K X 9R 2% BUSSED	RS00104
SM1A,SM1B,SM2A, SM2B,SM3A,SM3B, SM4A,SM4B,SM5A, SM5B,SM6A,SM6B, SM7A,SM7B,SM8A, SM8B-1	TRANSISTOR VN02N MOSFET RELAY	TR00105
U1,U6-7,U12, U27, U33,U35,U40 U42, U47,U49,U54	IC LM339 VOLTAGE COMPARATOR	IC00036
U2-5,U8-11, U13, U28-31,U36-39, U43-46,	IC 74LS74 DUAL D-TYPE FF	IC00042
U14-15	IC 74LS138 3 OF 8 LINE DECODER	IC00047
U16-20,U22,U24-26, U34,U41,U48,U55	IC 74LS244 OCT BFFR/LINE DR	IC00057
U21,U23	IC 74LS273 OCTAL D-TYPE FF	IC00041

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NOTES

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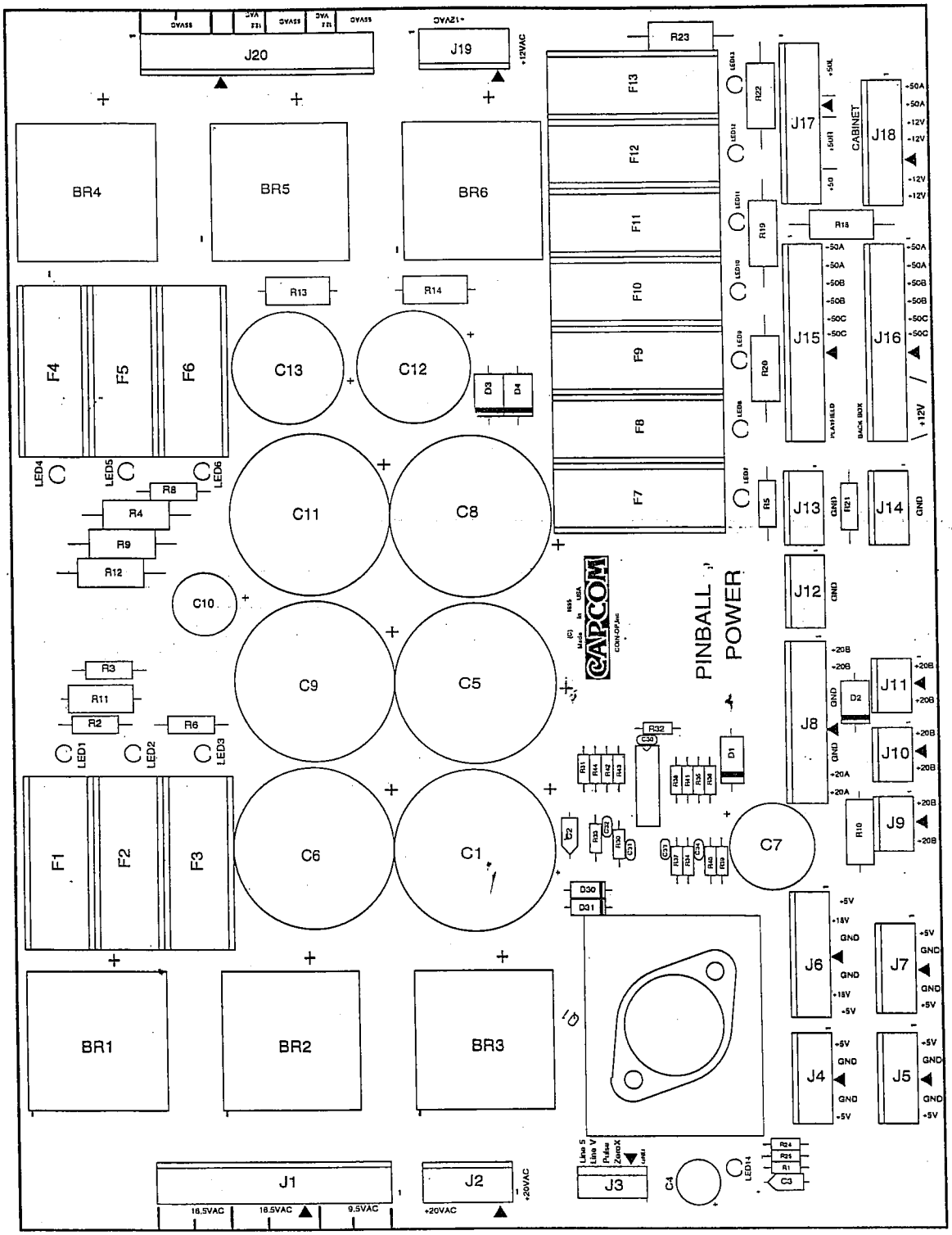
POWER BOARD



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POWER BOARD ASSEMBLY A0015205
PARTS LIST

Des.	Description	Part Number
BR1-6	RECTIFIER MB352W BRIDGE 35A 200V	+ *DI00101
C1,C5-6, C8-9,C11	CAPACITOR ELECTROLYTIC 35V 15000UF 20% RAD	CP00065
C2-3	CAPACITOR TANTALUM 35V 1.0UF 5% AX	CP00012
C4	CAPACITOR ELECTROLYTIC 10V 470UF 20% RAD	CP00016
C10	CAPACITOR ELECTROLYTIC 100V 100UF 20% RAD	CP00011-01
C12-13	CAPACITOR ELECTROLYTIC 100V 2200UF 20% RAD	CP00046
C30	CAPACITOR CERAMIC 50V .1UF 10% AX	CP00019
C31	CAPACITOR CERAMIC 50V .033UF 5% AX	CP00047
C32	CAPACITOR CERAMIC 50V .01UF 10% AX	CP00048
C33-34	CAPACITOR CERAMIC 100V .001UF 10% AX	CP00066
D1	RESISTOR, METAL FILM JUMPER	RS00117-01
D2-4	DIODE IN5402 RECTIFIER 20MA T-1 70 °	DI00106
D30-31	DIODE 1N4004 RECTIFIER 1.0A 400VR	DI00100
F1-2,6	FUSE SLO-BLO 10.0A 250V 3AG	FS00100-10
F3	FUSE SLO-BLO 7.0A 250V 3AG	FS00100-07
F4	FUSE SLO-BLO 8.0A 250V 3AG	FS00100-08
F5,F7-8	FUSE SLO-BLO 3.0A 250V 3AG	FS00100-03
F9-13	FUSE SLO-BLO 4.0A 250V 3AG	FS00100-04
FH1-13	FUSE HLDR 3AG PC MTG	FS00101
HS1	HEAT SINK TO-3 HEAVY DUTY 2"	*HS00106
J1,J20	CONNECTOR HEADER .156 STR 13-PIN LOCK	CN00100-13
J2,J4-5, J7,J19	CONNECTOR HEADER .156 STR 5-PIN LOCK	CN00100-05
J3	CONNECTOR HEADER .100 STR 6-PIN LOCK	CN00104-06
J6,J18	CONNECTOR HEADER .156 STR 7-PIN LOCK	CN00100-07
J8,J17	CONNECTOR HEADER .156 STR 9 PIN LOCK	CN00100-09
J9-11	CONNECTOR HEADER .156 STR 3 PIN LOCK	CN00100-03
J12-14	CONNECTOR HEADER .156 STR 4-PIN LOCK	CN00100-04
J15-16	CONNECTOR HEADER .156 STR 11-PIN LOCK	CN00100-11

Des.	Description	Part Number
LED1-14	LED LTL4501 RED 20MA T-1 70°	DI00105
Q1	VOLTAGE REGULATOR 5A LOW DROP ADJ	*VR00100
R1	RESISTOR CARBON FILM1/4W 5% 330 OHM	RS00100-12
R2-3	RESISTOR CARBON FILM 1/2W 5% 1.5K OHM	RS00101-09
R4,R9,R18-20,R22-23	RESISTOR MOF 2W 5% 5.6K OHM	RS00114
R6	RESISTOR CARBON FILM 1/4W 5% 820 OHM	RS00100-30
R8,R21,R5	RESISTOR CARBON FILM 1/2W 5% 1.2K OHM	RS00102-11
R10-11	RESISTOR MOF 2W 5% 620 OHM	RS00114-01
R12,R14	RESISTOR MOF 2W 5% 6.2K OHM	RS00114-02
R13	RESISTOR MOF 2W 5% 270 OHM	RS00114-03
R24	RESISTOR METAL FILM 1/4W 1% 121 OHM	RS00113-01
R25	RESISTOR METAL FILM 1/4W 1% 374 OHM	RS00113
R30,R42-43	RESISTOR METAL FILM 1/4W 1% 11K OHM	RS00113-02
R31	RESISTOR METAL FILM 1/4W 1% 56.2K OHM	RS00113-10
R33	RESISTOR METAL FILM 1/4W 1% 2K OHM	RS00113-03
R36,R32, R44	RESISTOR CARBON FILM 1/4W 5% 3.3K OHM	RS00100-27
R38	RESISTOR CARBON FILM 1/4W 5% 27K OHM	RS00100-40
R41	RESISTOR CARBON FILM 1/4W 5% 1K OHM	RS00100-05
U30	IC LM339 VOLTAGE COMPARATOR	IC00036
----	MACHINE SCREW 6-32 X 1/2 PPH SEMS ZC	SC00100-04
---	NUT 6-32 HEX KEPS	NT00101-06
----	HEAT SINK 1.5 X 4.5 EXTRUSION	*HS00105
----	MACHINE SCREW 6-32 X 3/4 PPH SEMS ZC	SC00100-06
----	CIRCUIT BOARD SUPPORT	PL00287-05

* NOTE: Heat sink compound should be applied to ALL heat sink/semi-conductor surfaces

+NOTE: Spacing between the bottom of the bridge and the PCB shall be 1/4".

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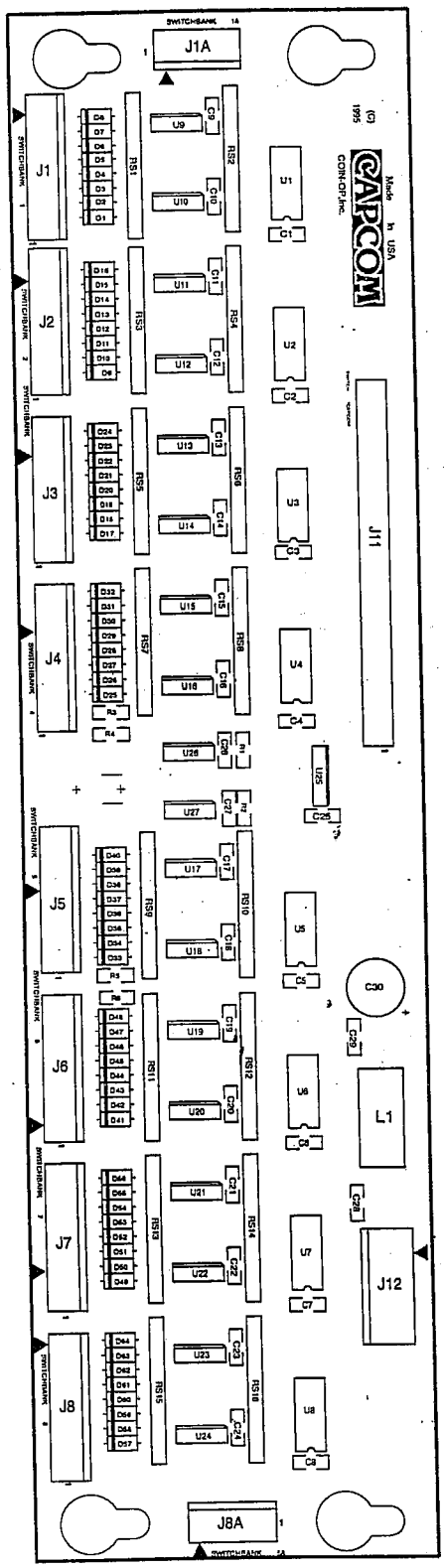
SWITCH BOARD



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SWITCH BOARD ASSEMBLY A0015302
PARTS LIST

Des.	Description	Part Number
C1-29	CAPACITOR CERAMIC 50V 0.1UF 10% SMT	CP00019-SMT
C30	CAPACITOR ELECTROLYTIC 16V 470UF 20% RAD	CP00054
D1-64	DIODE 1N4148 SW 200MA 75VR	DI00104
J1-8	CONNECTOR HEADER .100 STR 10-PIN LOCK	CN00104-10
J11	CONNECTOR HEADER .100 STR 50-PIN 2X25	CN00101-50
J12	CONNECTOR HEADER .156 STR 5-PIN LOCK	CN00100-05
J1A,J8A-1	CONNECTOR HEADER .100 STR 6-PIN LOCK	CN00104-06
L1	IND 4.7UH 3.4A 15%AX	IN00100
R1-2,R4, R6	RESISTOR CARBON FILM 1/8W 5% 3.3K OHM SMT 1206	RS00102-12-SMT
R3,R5	RESISTOR CARBON FILM 1/8W 5% 620 OHM SMT 1206	RS00102-24-SMT
RS1,RS3, RS5,RS7, RS9, RS11, RS13,RS15	RESISTOR SIP 2.2K X 9R 2% BUSSED	RS00103
RS2,RS4, RS6,RS8, RS10,RS12 RS14,RS16	RESISTOR SIP 10K X 9R 2% BUSSED	RS00104
U1-8	IC 74LS245 OCT BUS TRANSCEIVER SMT	IC00044-SMT
U9-24	IC LM339 VOLTAGE COMPARATOR SMT	IC00036-SMT
U25	IC 74LS138 3 OF 8 LINE DECODER SMT	IC00047-SMT
U26	IC 74LS74 DUAL D-TYPE FF SMT	IC00042-SMT
U27	IC 74LS126 QUAD 3-STATE BUFFER SMT	IC00099-SMT

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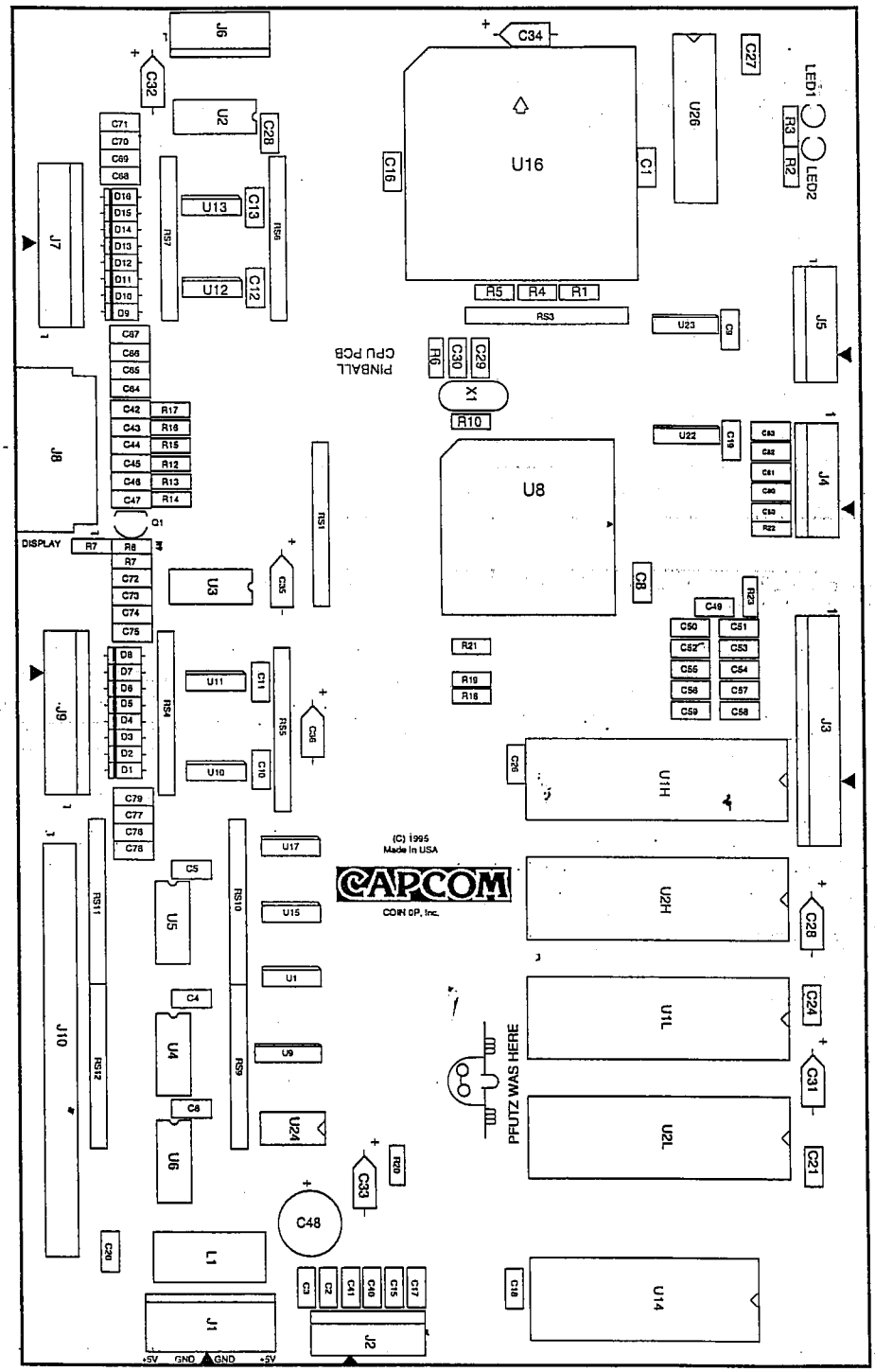
CPU BOARD



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CPU BOARD ASSEMBLY A0015405
PARTS LIST

Des.	Description	Part Number
C1,C8,C16, C18,C20-21, C24,C26-27	CAPACITOR CERAMIC 50V .1UF 10% SMT 1206	CP00056-SMT
C2-6, C9, C19,C23, C24,C64-79	CAPACITOR CERAMIC 50V .01UF 10% SMT 1206	CP00048-SMT
C10-13	CAPACITOR CERAMIC 50V .001UF 10% SMT 1206	CP00055-SMT
C15,C17, C40-41, C49-63,C80	CAPACITOR CERAMIC 100V 100PF 10% SMT 1206	CP00058-SMT
C28,C31-36	CAPACITOR TANTALUM 35V 1.0UF 5% AX	CP00012
C29-30, C42-47	CAPACITOR CERAMIC 100V 10PF 10% SMT 1206	CP00017-SMT
C48	CAPACITOR ELECT 16V 470UF 20% RAD	CP00054
D1-16	DIODE 1N4148 SW 200MA 75VR	DI00104
J1	CONNECTOR HEADER .156 STR 5-PIN LOCK	CN00100-05
J2,J4	CONNECTOR HEADER .100 STR 7-PIN LOCK	CN00104-07
J3	CONNECTOR HEADER .100 STR 14-PIN LOCK	CN00104-14
J6	CONNECTOR HEADER .100 STR 6-PIN LOCK	CN00104-06
J7,J9	CONNECTOR HEADER .100 STR 10-PIN LOCK	CN00104-10
J8	CONNECTOR HEADER .100 RT 14-PIN 2X7 4W	CN00137-14
J10	CONNECTOR HEADER .100 STR 50-PIN 2X25	CN00101-50
L1	IND 4.7UH 3.4A 15% AX	IN00100
LED1-2	LED LTL4201 RED 20MA T-1 70°	DI00105
Q1	TRANSISTOR 2N3904 NPN G.P. AMP	TR00106
R1,R10	RESISTOR CARBON FILM 1/8W 5% 33 OHM SMT 1206	RS00102-41S
R2-3	RESISTOR CARBON FILM 1/8W 5% 270 OHM SMT 1206	RS00102-03S
R4-7	RESISTOR CARBON FILM 1/8W 5% 4.7K OHM SMT 1206	RS00102-26S
R8	RESISTOR CARBON FILM 1/8W 5% 1K OHM SMT 1206	RS00102-05S
R9	RESISTOR CARBON FILM 1/8W 5% 1.2K OHM SMT 1206	RS00102-08S
R12-17	RESISTOR CARBON FILM 1/8W 5% 100 OHM SMT 1206	RS00102-02S
R18-21	RESISTOR CARBON FILM 1/8W 5% 3.3K OHM SMT 1206	RS00102-27S
R22-23	RESISTOR CARBON FILM 1/8W 5% 10K OHM SMT 1206	RS00102-07S
RS1,RS3	RESISTOR SIP 4.7K X 9R 2% BUSSED	RS00111
RS4,RS7	RESISTOR SIP 1.2K X 9R 2% BUSSED	RS00103
RS5-6, RS9-12	RESISTOR SIP 10K X 9R 2% BUSSED	RS00104
*U1H	EPROM	A-00632-U1H
*U1L	EPROM	A-00632-U1L
*U2H	ROM, GAME	A-00632-U2H
*U2L	ROM, GAME	A-00632-U2L
U1H,U1L, U2H,U2L-1	SOCKET 32 PIN .600 DUAL WIPE	SK00112-32
U1	IC 74LS02 QUAD NOR SMT	IC00098-SMT
U2-6	IC 74LS245 OCT BUS TRANSCEIVER SMT	IC00044-SMT
U8	IC XC68306 MPU 16-BIT	IC00046
U9	IC 74LF139 DUAL 2-4 DECODER SMT	IC00117-SMT
U10-13	IC LM339 VOLTAGE COMPARATOR SMT	IC00036-SMT
U14	IC SRAM 8K X 8 100NS BAT	IC00035
U15	IC 74LS14 HEX SCHMITT TRIG SMT	IC00063-SMT
U16	SOCKET IC 84-PIN PLCC	SK00101-84
U16	ACTEL 1020 PROGRAMMED	IC00106
U17	IC 74LS74 DUAL D-TYPE FF SMT	IC00042-SMT
U22-23	IC 74LS257 QUAD 2-IN MUX SMT	IC00045-SMT
U24	IC MAX699 RESET CHIP	IC00097
U25	IC DRAM 256K X 16 100NS	IC00074-SMT
X1	CRYSTAL 16.67 MHZ	CR00103

*NOTE: Game ROMs are not included with A0015405: Must be purchased separately.

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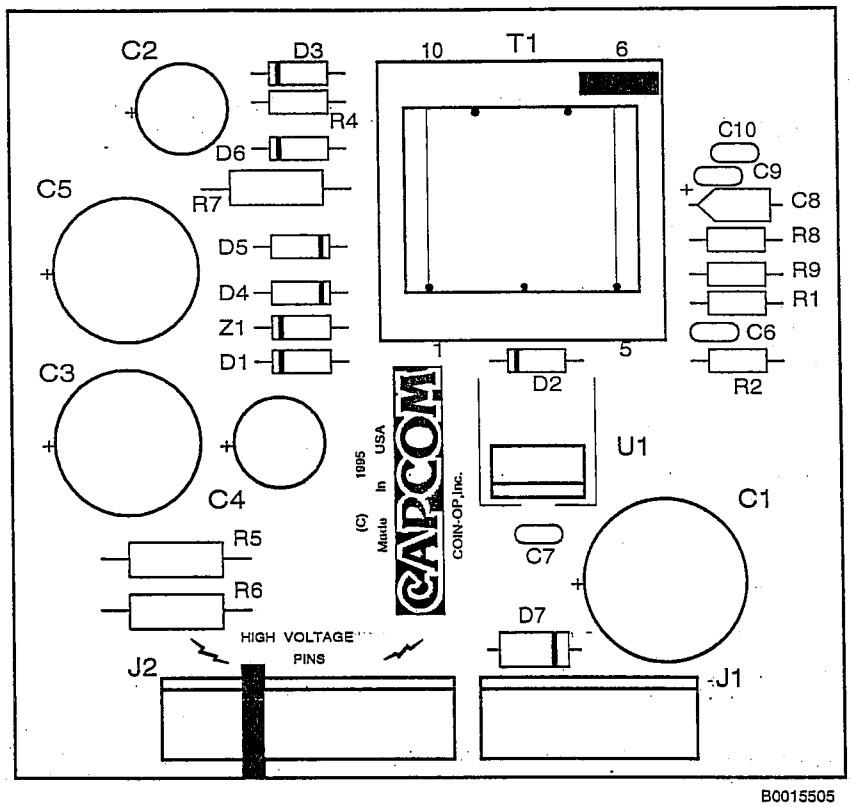
DISPLAY POWER BOARD ASSEMBLY A0015505



Des.	Description	Part Number
*C1	CAPACITOR ELECTROLYTIC 25V 4700UF 20% RAD	CP00020
*C2	CAPACITOR ELECTROLYTIC 25V 220UF 20% RAD	CP00041
*C3,C5	CAPACITOR ELECTROLYTIC 160V 47UF 20% RAD	CP00034
*C4	CAPACITOR ELECTROLYTIC 200V 6.8UF 20% RAD	CP00042
C7	CAPACITOR CERAMIC 50V .1UF 10% AX	CP00019
C8	CAPACITOR TANTALUM 35V 1.0UF 5% AX	CP00012
D1-3	DIODE 1N5819 1A 40V SCHOTTKEY	DI00108
D4-6	DIODE MUR160 1A 600V ULTRA FAST RECOVERY	DI00113
D7	DIODE, IN5402 RECTIFIER 3.0A 200vR	DI00106
HS1	HEAT SINK TO220 0.5 X 0.75W	HS00103
J1	CONNECTOR HEADER .156 STRAIGHT 6-PIN LOCK	CN00100-06
J2	CONNECTOR HEADER .156 STRAIGHT 8 PIN LOCK	CN00100-08

Des.	Description	Part Number
R1	RESISTOR METAL FILM 1/4W 1% 64.9K OHM	RS00113-04
R2	RESISTOR METAL FILM 1/4W 1% 1.24K OHM	RS00113-05
R4	RESISTOR CARBON FILM 1/4W 5% 1.5K OHM	RS00100-09
R5	RESISTOR CARBON FILM 1/2W 5% 47K OHM	RS00100-20
R6	RESISTOR CARBON FILM 1.0W 5% 15K OHM	RS00112-03
R7	RESISTOR CARBON FILM 1/2W 5% 12K OHM	RS00100-18
R8	RESISTOR CARBON FILM 1/4W 5% 330 OHM	RS00100-12
T1	TRANSFORMER FLYBACK 47UH 30VA 13-23VDC	XF00103
U1	SWITCHING REGULATOR LT1271CT HI EFF	IC00082
Z1	DIODE 1N4748 ZENER 1W 22V	DI00110

* CAPS: C1-C5 are special capacitors for switching power supplies, they are low impedance, high ripple current capacitors.

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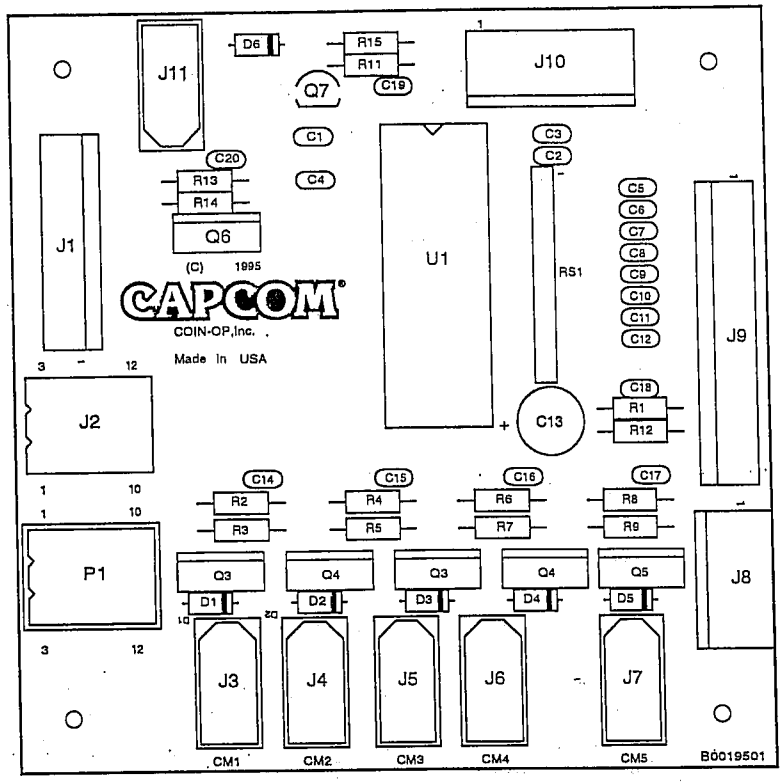
INTERFACE BOARD ASSEMBLY A0019501



Des.	Description	Part Number
C1-4	CAPACITOR CERAMIC 50V .22UF 10% AX	CP00024
C5-12	CAPACITOR CERAMIC 100V 100PF 10% AX	CP00058
C13	CAPACITOR ELECTROLYTIC 100UF 25V 20% RAD	CP00067
C14-20	CAPACITOR CERAMIC 50V .1UF 10% AX	CP00019
D1-6	DIODE 1N4004 RECTIFIER 1.0A 400VR	DI00100
J1	CONNECTOR HEADER .100 STRAIGHT 10-PIN LOCK	CN00104-10
J2	CONNECTOR .062, 12-PIN FEMALE, RECEPTACLE	CN00111-12
J3-7,J11	CONNECTOR, .062, 3-PIN FEMALE, RECEPTACLE	CN00112-03
J8	CONNECTOR HEADER .156 STRAIGHT 4-PIN LOCK	CN00100-04
J9	CONNECTOR HEADER .100 STRAIGHT 14-PIN LOCK	CN00104-14

Des.	Description	Part Number
J10	CONNECTOR HEADER .156 STRAIGHT 5-PIN LOCK	CN00100-05
P1	CONNECTOR .062, 12-PIN MALE, PLUG	CN00112-12
P1	TERMINAL MALE PC TAIL .062	CN00139-M
R1,R11-14	RESISTOR CARBON FILM 1/4W 5% 10K OHM	RS00100-07
R2,R4,R6, R8,R15	RESISTOR CARBON FILM 1/4W 5% 4.7K OHM	RS00100-26
R3,R5, R7,R9	RESISTOR CARBON FILM 1/4W 5% 12K OHM	RS00100-18
RS1	RESISTOR SIP 10K X 9R 5% BUSSED	RS00103
Q1-4	TRANSISTOR TIP-107 PNP	TR00103
Q5-6	TRANSISTOR TIP-102 NPN	TR00102
Q7	TRANSISTOR 2N3906 PNP	TR00108
U1	IC LT1337ACN 5V RS232 DRIVER	IC00114

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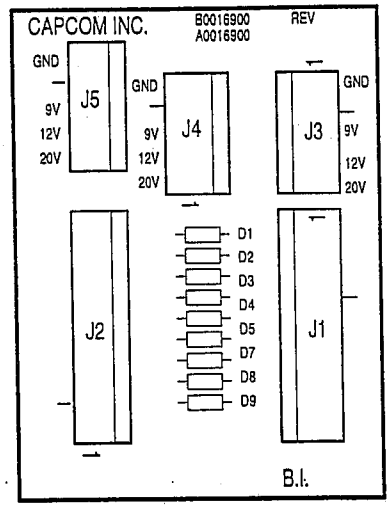
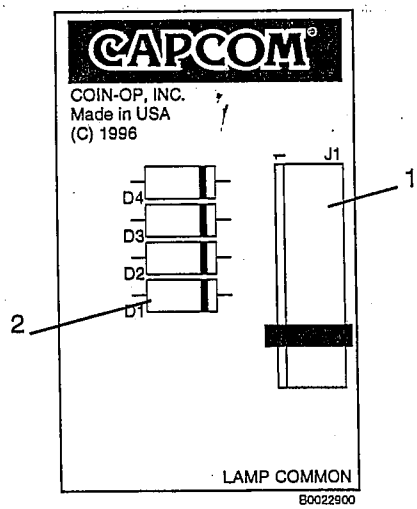
DIODE BOARD A0016900



Des.	Description	Part Number
D1-9	DIODE 1N4004 RECTIFIER 1.0A 400VR	DI00100
J1-2	CONNECTOR HEADER .156 STRAIGHT 9-PIN LOCK	CN00100-09
J3-5	CONNECTOR HEADER .156 STRAIGHT 5-PIN LOCK	CN00100-05

STAR BUMPER DIODE BOARD A0022900



No.	Description	Part Number
---------	ASSEMBLY, PCB, STAR BUMPER	A0022900
1	CONNECTOR HEADER .156 STR	CN00100-06
2	DIODE, 1N4004, RECTIFIER	DI00100

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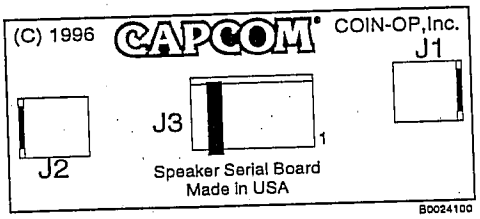
SERIAL SPEAKER BOARD A0024100



No.	Description	Part Number
---	ASSEMBLY, PCB, SPEAKER, SERIAL	A0024100
1	LUG, TERMINAL, .187 FASTON, PCB, .020" THICK, PRE-TIN BRASS	CN00148
2	CONNECTOR HEADER .156 STRAIGHT 4-PIN LOCK	CN00100-04

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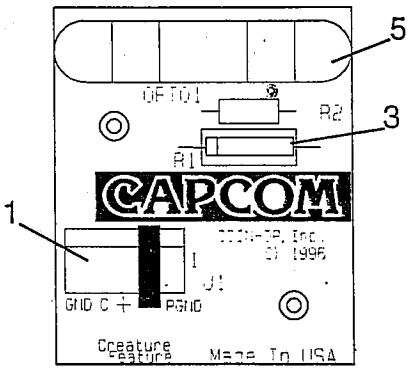
OPTO BOARDS

A0020000



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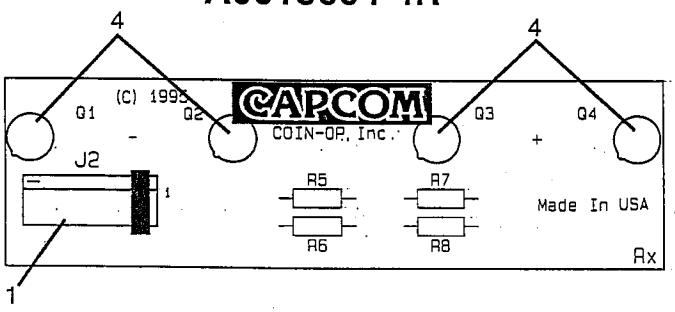

RECEIVER

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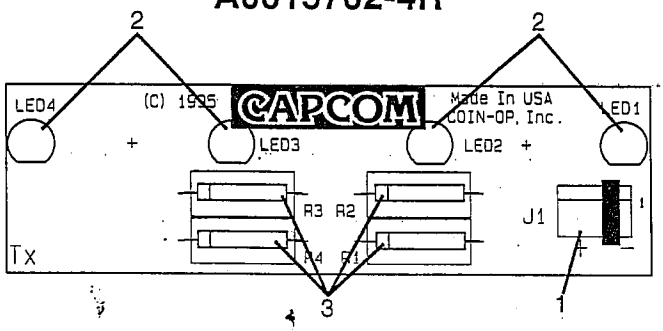

TRANSMITTER

No.	Description	Component Part Number	Opto Board Assembly Part Number & Component Quantity		
			A0020000	A0015604-4R	A0015702-4R
1	CONNECTOR HEADER .100 R/A 4-PIN	CN00137-04			1
1	CONNECTOR HEADER .100 R/A 7-PIN	CN00137-07		1	
1	CONNECTOR HEADER .100 STR 5-PIN	CN00104-05	1		
2	IRED 21E187 100MA T-1 3/4	DI00103			4
3	RESISTOR MOF 1W 5% 330 OHM	RS00112-04			4
3	RESISTOR MOF 1W 5% 510 OHM	RS00119-01	1		
4	TRANSISTOR 21T313 NPN PHOTO	TR00104		4	
5	SWITCH, OPTO, SLOTTED, .375, PIN-IN	SW00148	1		

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NOTES

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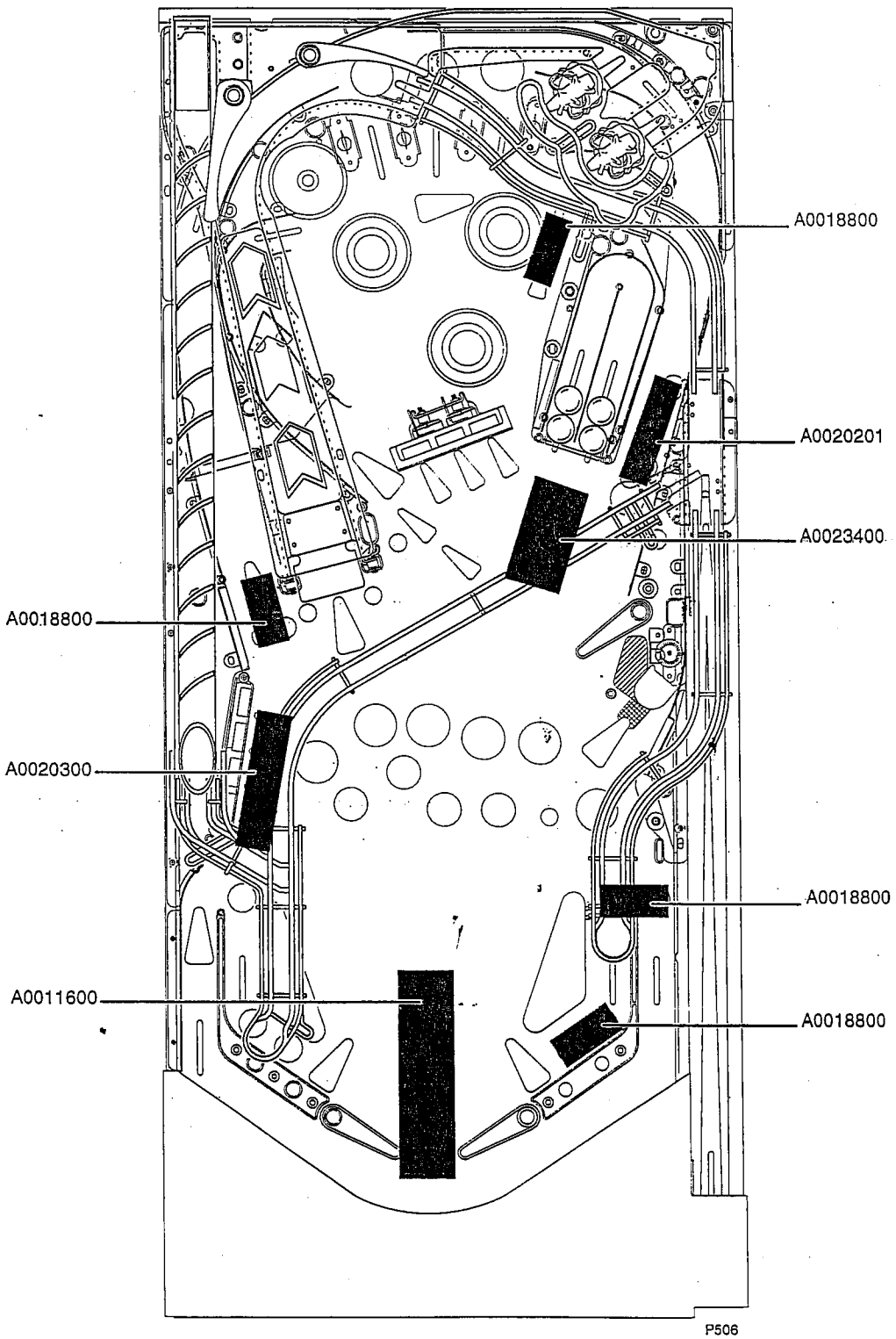
LAMP BOARD IDENTIFICATION



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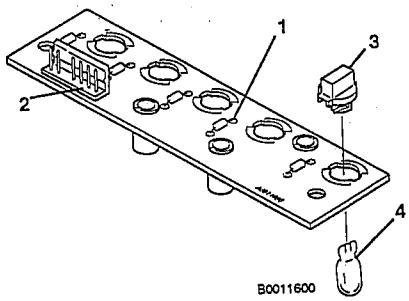
LAMP BOARD ASSEMBLIES

A0011600



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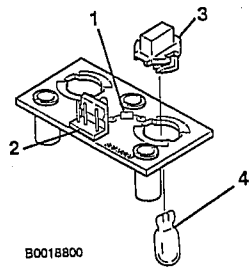
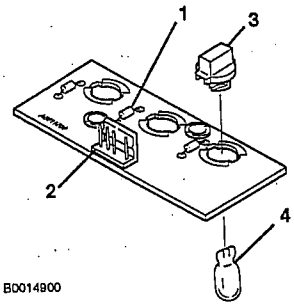


A0020201



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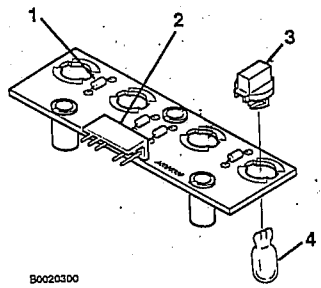

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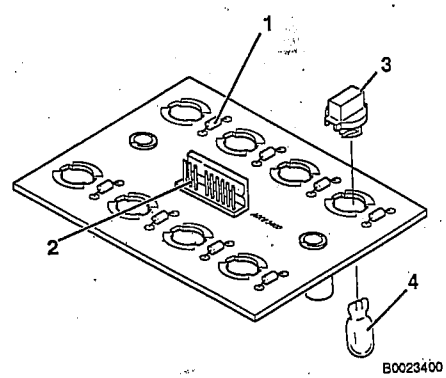

No.	Description	Part Number	Lamp Board Assembly Part Number and Component Part Quantity Requirements				
			A0011600	A0018800	A0020201	A0020300	A0023400
1	DIODE, IN4004 RECTIFIER	DI00100	5	2	3	4	8
2	CONN HDR, .156 STR 4-PIN LOCK	CN00100-04		1			
2	CONN HDR, .156 STR 5-PIN LOCK	CN00100-05			1		
2	CONN HDR, .156 STR 6-PIN LOCK	CN00100-06				1	
2	CONN HDR, .156 STR 7-PIN LOCK	CN00100-07	1				
2	CONN HDR, .156 STR 10-PIN LOCK	CN00100-10					1
3	SOCKET, LAMP	SK00102	5	2	3	4	8
4	LAMP, #555, 6.3V WEDGE	LP00100	5	2	3	4	8

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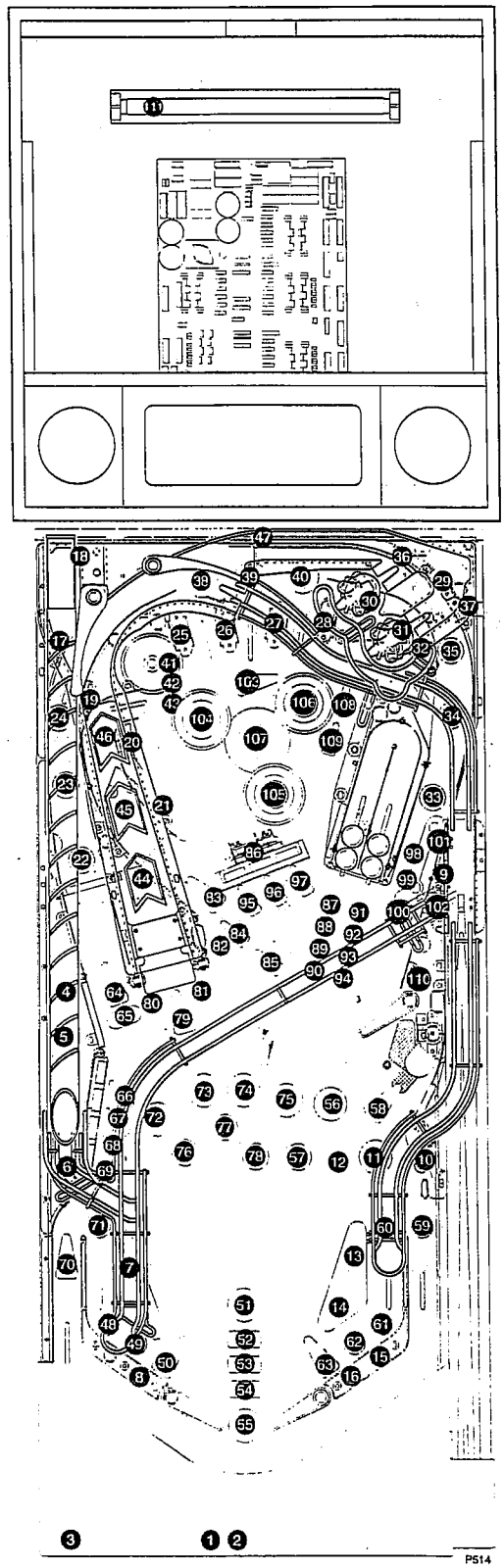
CABINET, PLAYFIELD, & BACKBOX LAMPS



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CABINET, PLAYFIELD, & BACKBOX LAMPS

NO	SOFTWARE TEST REFERENCE C1-04	WIRE COLOR		BULB	PART NUMBER
		COLUMN	ROW		
1	11A COIN DOOR 1&2	RED/BRN	YEL/BRN	259	LP00113
2	12A COIN DOOR 3&4	RED/BLK	YEL/BRN	259	LP00113
3	13A START	RED/ORG	YEL/BRN	555	LP00100
----	14A UNUSED	RED/YEL	YEL/BRN	----	----
----	15A UNUSED	RED/GRN	YEL/BRN	----	----
----	16A UNUSED	RED/BLU	YEL/BRN	----	----
----	17A UNUSED	RED/VIO	YEL/BRN	----	----
----	18A UNUSED	RED/GRY	YEL/BRN	----	----
4	21A 4-BANK G.I. 1	RED/BRN	YEL/RED	44	LP00104
5	22A 4-BANK G.I. 2	RED/BLK	YEL/RED	44	LP00104
6	23A 4-BANK G.I. 3	RED/ORG	YEL/RED	44	LP00104
7	24A L. SLINGSHOT G.I. 1	RED/YEL	YEL/RED	44	LP00104
----	25A UNUSED	RED/GRN	YEL/RED	----	----
8	26A L. FLIPPER G.I. 1	RED/BLU	YEL/RED	44	LP00104
----	27A UNUSED	RED/VIO	YEL/RED	----	----
----	28A UNUSED	RED/GRY	YEL/RED	----	----
9	31A U.R. FLIPPER G.I. 1	RED/BRN	YEL/ORG	44	LP00104
10	32A EJECT HOLE G.I. 1	RED/BLK	YEL/ORG	44	LP00104
11	33A SPACESHIP G.I. 1	RED/ORG	YEL/ORG	44	LP00104
12	34A SPACESHIP G.I. 2	RED/YEL	YEL/ORG	44	LP00104
13	35A R. SLINGSHOT G.I. 1	RED/GRN	YEL/ORG	44	LP00104
14	36A R. SLINGSHOT G.I. 2	RED/BLU	YEL/ORG	44	LP00104
15	37A R. FLIPPER G.I. 1	RED/VIO	YEL/ORG	44	LP00104
16	38A R. FLIPPER G.I. 2	RED/GRY	YEL/ORG	44	LP00104
17	41A TUBE G.I. 1	RED/BRN	YEL/BLK	44	LP00104
18	42A TUBE G.I. 2	RED/BLK	YEL/BLK	44	LP00104
19	43A TUBE G.I. 3	RED/ORG	YEL/BLK	44	LP00104
20	44A TUBE G.I. 4	RED/YEL	YEL/BLK	44	LP00104
21	45A TUBE G.I. 5	RED/GRN	YEL/BLK	44	LP00104
22	46A L. ORBIT CHASE 1	RED/BLU	YEL/BLK	44	LP00104
23	47A L. ORBIT CHASE 2	RED/VIO	YEL/BLK	44	LP00104
24	48A L. ORBIT CHASE 3	RED/GRY	YEL/BLK	44	LP00104
25	51A HOOT G.I. 1	RED/BRN	YEL/GRN	44	LP00104
26	52A HOOT G.I. 2	RED/BLK	YEL/GRN	44	LP00104
27	53A HOOT G.I. 3	RED/ORG	YEL/GRN	44	LP00104
28	54A HOOT G.I. 4	RED/YEL	YEL/GRN	44	LP00104
29	55A ALIEN G.I. 1	RED/GRN	YEL/GRN	44	LP00104
30	56A ALIEN G.I. 2	RED/BLU	YEL/GRN	44	LP00104
31	57A ALIEN G.I. 3	RED/VIO	YEL/GRN	44	LP00104
32	58A CAPTIVE G.I. 1	RED/GRY	YEL/GRN	44	LP00104
33	61A R. ORBIT CHASE 1	RED/BRN	YEL/BLU	44	LP00104
34	62A R. ORBIT CHASE 2	RED/BLK	YEL/BLU	44	LP00104
35	63A R. ORBIT CHASE 3	RED/ORG	YEL/BLU	44	LP00104
36	64A ALIEN LOCK LEFT	RED/YEL	YEL/BLU	44	LP00104
37	65A ALIEN LOCK RIGHT	RED/GRN	YEL/BLU	44	LP00104
----	66A UNUSED	RED/BLU	YEL/BLU	----	----
----	67A UNUSED	RED/VIO	YEL/BLU	----	----
----	68A UNUSED	RED/GRY	YEL/BLU	----	----
38	71A ROLLOVER "B"	RED/BRN	YEL/VIO	44	LP00104
39	72A ROLLOVER "A"	RED/BLK	YEL/VIO	44	LP00104
40	73A ROLLOVER "R"	RED/ORG	YEL/VIO	44	LP00104
41	74A TUBE SIGN X-BALL	RED/YEL	YEL/VIO	44	LP00104
42	75A TUBE SIGN 10 MILL	RED/GRN	YEL/VIO	44	LP00104
43	76A TUBE SIGN JACKPOT	RED/BLU	YEL/VIO	44	LP00104
----	77A UNUSED	RED/VIO	YEL/VIO	----	----
----	78A UNUSED	RED/GRY	YEL/VIO	----	----
44	81A (ELECTRO) RAMP 1	RED/BRN	YEL/GRY	44	LP00104
45	82A (ELECTRO) RAMP 2	RED/BLK	YEL/GRY	44	LP00104
46	83A (ELECTRO) RAMP 3	RED/ORG	YEL/GRY	44	LP00104
----	84A (ELECTRO) UNUSED	RED/YEL	YEL/GRY	----	----
----	85A (ELECTRO) UNUSED	RED/GRN	YEL/GRY	----	----
47	86A (ELECTRO) BLACK LIGHT	RED/BLU	YEL/GRY	44	LP00109
----	87A (ELECTRO) UNUSED	RED/VIO	YEL/GRY	----	----
----	88A (ELECTRO) UNUSED	RED/GRY	YEL/GRY	----	----

NO	SOFTWARE TEST REFERENCE C1-04	WIRE COLOR		BULB	PART NUMBER
		COLUMN	ROW		
48	11B BONUS 2X	ORG/BRN	BLU/BRN	44	LP00104
49	12B BONUS 3X	ORG/RED	BLU/BRN	44	LP00104
50	13B MODE: UNDERGROUND	ORG/BLK	BLU/BRN	44	LP00104
51	14B MODE: BIG BANG	ORG/YEL	BLU/BRN	555	LP00100
52	15B MODE: BAR ROOM BRAWL	ORG/GRN	BLU/BRN	555	LP00100
53	16B MODE: RAY'S BALL BUSTERS	ORG/BLU	BLU/BRN	555	LP00100
54	17B MODE: LOOPED IN SPACE	ORG/VIO	BLU/BRN	555	LP00100
55	18B SHOOT AGAIN	ORG/GRY	BLU/BRN	555	LP00100
56	21B MODE: BABE SCANNER	ORG/BRN	BLU/RED	44	LP00104
57	22B MODE: CHASE WAITRESS	ORG/RED	BLU/RED	44	LP00104
58	23B SHOOT: COSMIC DARTZ	ORG/BLK	BLU/RED	44	LP00104
59	24B SPECIAL (OUTLANE R.)	ORG/YEL	BLU/RED	555	LP00100
60	25B INLANE RIGHT	ORG/GRN	BLU/RED	555	LP00100
61	26B BONUS 5X	ORG/BLU	BLU/RED	44	LP00104
62	27B BONUS 4X	ORG/VIO	BLU/RED	555	LP00100
63	28B MODE: TUBE DANCER	ORG/GRY	BLU/RED	555	LP00100
64	31B SHOOT: LEFT ORBIT	ORG/BRN	BLU/ORG	555	LP00100
65	32B SHOOT: BABE SCANNER	ORG/RED	BLU/ORG	555	LP00100
66	33B 4-BANK MARS	ORG/BLK	BLU/ORG	555	LP00100
67	34B 4-BANK PYTHOS	ORG/YEL	BLU/ORG	555	LP00100
68	35B 4-BANK VENUS	ORG/GRN	BLU/ORG	555	LP00100
69	36B 4-BANK MERCURY	ORG/BLU	BLU/ORG	555	LP00100
70	37B FREE SHOT (OUTLANE L.)	ORG/VIO	BLU/ORG	44	LP00104
71	38B INLANE LEFT	ORG/GRY	BLU/ORG	44	LP00104
72	41B MODE: COSMIC DARTZ	ORG/BRN	BLU/YEL	44	LP00104
73	42B MODE: TOUR DE BAR	ORG/RED	BLU/YEL	44	LP00104
74	43B MODE: MOSH A GO-GO	ORG/BLK	BLU/YEL	44	LP00104
75	44B MODE: HAPPY HOUR	ORG/YEL	BLU/YEL	44	LP00104
76	45B MODE: EXTRA BALL	ORG/GRN	BLU/YEL	44	LP00104
77	46B MODE: GET LUCKY	ORG/BLU	BLU/YEL	44	LP00104
78	47B MODE: LUNA PALOOZA	ORG/VIO	BLU/YEL	44	LP00104
----	48B UNUSED	ORG/GRY	BLU/YEL	----	----
79	51B RAMP JACKPOT	ORG/BRN	BLU/GRN	44	LP00104
80	52B RAMP STANDUP LEFT	ORG/RED	BLU/GRN	44	LP00104
81	53B RAM STANDUP RIGHT	ORG/BLK	BLU/GRN	44	LP00104
82	54B RAMP STANDUP SIDE	ORG/YEL	BLU/GRN	44	LP00104
83	55B DOUBLE JACKPOT	ORG/GRN	BLU/GRN	44	LP00104
84	56B SHOOT: TOUR DE BAR	ORG/BLU	BLU/GRN	555	LP00100
85	57B SHOOT: UNDERGROUND 1	ORG/VIO	BLU/GRN	555	LP00100
86	58B QUALIFY MODE	ORG/GRY	BLU/GRN	44	LP00104
87	61B CAPTIVE: LEFT 4	ORG/BRN	BLU/BLK	555	LP00100
88	62B CAPTIVE: LEFT 3	ORG/RED	BLU/BLK	555	LP00100
89	63B CAPTIVE: LEFT 2	ORG/BLK	BLU/BLK	555	LP00100
90	64B CAPTIVE: LEFT 1	ORG/YEL	BLU/BLK	555	LP00100
91	65B CAPTIVE: RIGHT 4	ORG/GRN	BLU/BLK	555	LP00100
92	66B CAPTIVE: RIGHT 3	ORG/BLU	BLU/BLK	555	LP00100
93	67B CAPTIVE: RIGHT 2	ORG/VIO	BLU/BLK	555	LP00100
94	68B CAPTIVE: RIGHT 1	ORG/GRY	BLU/BLK	555	LP00100
95	71B 3-BANK URANUS	ORG/BRN	BLU/VIO	44	LP00104
96	72B 3-BANK NEPTUNE	ORG/RED	BLU/VIO	44	LP00104
97	73B 3-BANK PLUTO	ORG/BLK	BLU/VIO	44	LP00104
98	74B SHOOT: RIGHT ORBIT	ORG/YEL	BLU/VIO	555	LP00100
99	75B D.J. EYES G.I.	ORG/GRN	BLU/VIO	555	LP00100
100	76B SHOOT: LUNA PALOOZA	ORG/BLU	BLU/VIO	44	LP00104
101	77B ISLAND: LOCK READY	ORG/VIO	BLU/VIO	44	LP00104
102	78B ISLAND: MODE READY	ORG/GRY	BLU/VIO	44	LP00104
103	81B SHOOT: UNDERGROUND 2	ORG/BRN	BLU/GRY	44	LP00104
104	82B STAR BUMPER LEFT	ORG/RED	BLU/GRY	555	LP00100
105	83B STAR BUMPER MIDDLE	ORG/BLK	BLU/GRY	555	LP00100
106	84B STAR BUMPER RIGHT	ORG/YEL	BLU/GRY	555	LP00100
107	85B DANCE FLOOR	ORG/GRN	BLU/GRY	44	LP00104
108	86B SHOOT: EXTRA BALL	ORG/BLU	BLU/GRY	555	LP00100
109	87B SHOOT: BIG BANG	ORG/VIO	BLU/GRY	555	LP00100
110	88B U.R. FLIPPER G.I.2	ORG/GRY	BLU/GRY	44	LP00104
111	FLUORESCENT IN BACKBOX	WHT	WHT/BLK	T8	LP00105

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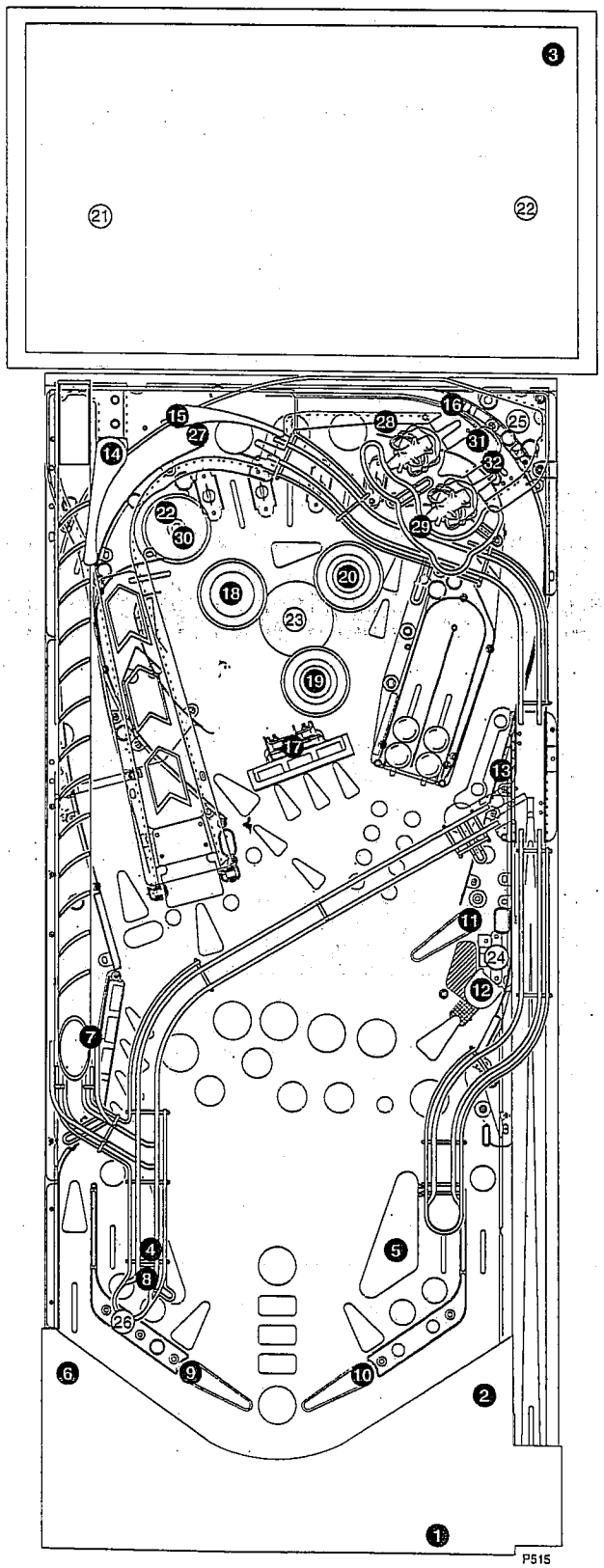
SOLENOIDS, MOTORS, & FLASHERS

Ref.	Description	Part Number
1	OUTHOLE	CL00109
2	TROUGH	CL00109
3	KNOCKER	CL00109
4	LEFT SLINGSHOT	CL00109
5	RIGHT SLINGSHOT	CL00109
6	KICKBACK	CL00109
7	4-BANK RESET	CL00109
8	LOWER LOCK POST	CL00109
9	LEFT FLIPPER	CL00109
10	RIGHT FLIPPER	CL00109
11	UPPER RIGHT FLIPPER	CL00109
12	EJECT HOLE	CL00109
13	ISLAND DIVERTER 1	CL00112
14	RAMP DIVERTER 1	CL00109
15	RAMP DIVERTER 2	CL00109
16	ALIEN LOCK POST	CL00109
17	3-BANK RESET	CL00109
18	STAR BUMPER LEFT	CL00109
19	STAR BUMPER MIDDLE	CL00109
20	STAR BUMPER RIGHT	CL00109
21	BACKBOX LEFT (FLASHER)	LP00101
22	TUBE DANCER	CL00109
	BACKBOX RIGHT (FLASHER)	LP00101
23	DANCE FLOOR (FLASHER)	LP00101
24	EJECT HOLE (FLASHER)	LP00101
25	ALIENS (FLASHER)	LP00101
26	LOWER LOCK (FLASHER)	LP00101
27	ORBIT GATE LEFT	CL00112
28	ORBIT GATE RIGHT	CL00112
29	1-BANK RESET	CL00109
30	TUBE DANCER (MOTOR)	MR00108
31	ALIENS FORWARD (MOTOR)	MR00108
32	ALIENS REVERSE (MOTOR)	MR00108



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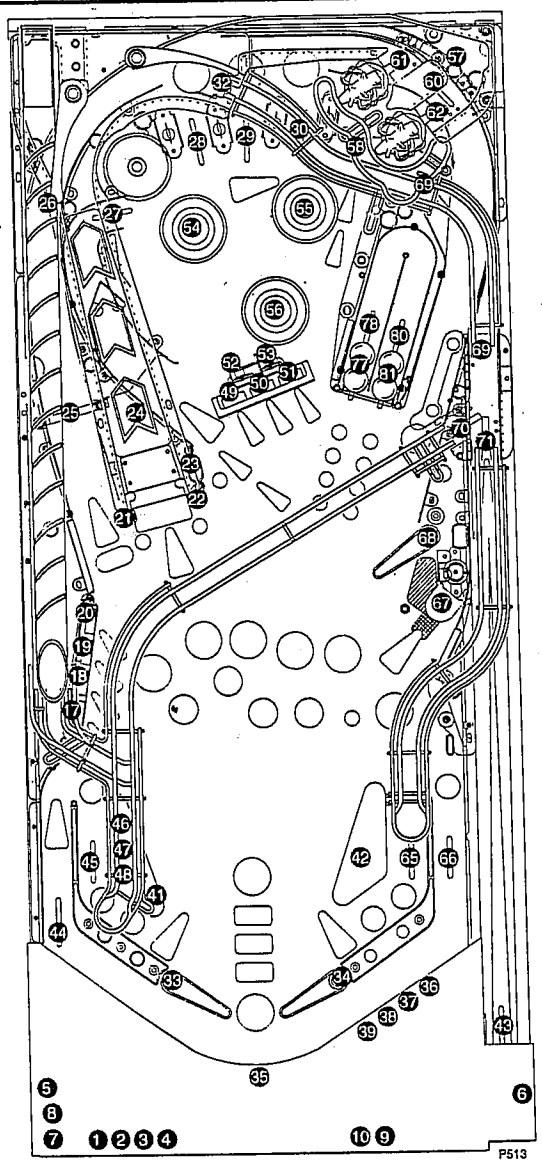
LOCATION OF SWITCHES & OPTO DETECTORS

REF. NO.	DESCRIPTION	SWITCH PART NUMBER
*1	COIN DOOR-CHUTE 1	**
*2	COIN DOOR-CHUTE 2	**
*3	COIN DOOR-CHUTE 3	**
*4	COIN DOOR-CHUTE 4	**
*5	LEFT FLIPPER BUTTON	SW00127
*6	RIGHT FLIPPER BUTTON	SW00127
*7	"START" BUTTON	SW00130
*8	COIN DOOR OPEN (MODE)	SW00132
*9	COIN DOOR - SLAM TILT	SW00121
*10	TILT BOB	A-00065-1
11-14	UNUSED	
15	TOKEN DISPENSE	
16	TICKET DISPENSE	
17	4-BANK MERCURY	SW00106
18	4-BANK VENUS	SW00106



REF. NO.	DESCRIPTION	SWITCH PART NUMBER	OPTO RECEIVER P/N	OPTO XMTR. P/N
19	4-BANK PYTHOS	SW00106		
20	4-BANK MARS	SW00106		
21	RAMP STAND-UP LEFT	A-00583-FGT		
22	RAMP STAND-UP RIGHT	A-00583-FGT		
23	RAMP STAND-UP SIDE	A-00585-FGT		
24	RAMP ENTRANCE	SW00117		
25	SPINNER	SW00107		
26	OUTER ORBIT LEFT	SW00111		
27	INNER ORBIT LEFT	SW00111		
28	ROLLOVER "B"	SW00111		
29	ROLLOVER "A"	SW00111		
30	ROLLOVER "R"	SW00111		
31	TUBE ENTRANCE	SW00142		
32	RAMP EXIT	SW00117		
33	LEFT FLIPPER E.O.S.	SW00127		
34	RIGHT FLIPPER E.O.S.	SW00127		
35	OUTHOLE	SW00113		
36	TROUGH 1 BALL		A0015604-4R	A0015702-4R
37	TROUGH 2 BALLS		A0015604-4R	A0015702-4R
38	TROUGH 3 BALLS		A0015604-4R	A0015702-4R
39	TROUGH 4 BALLS		A0015604-4R	A0015702-4R
40	UNUSED			
41	LEFT SLINGSHOT	SW00138		
42	RIGHT SLINGSHOT	SW00138		
43	SHOOTER LANE	SW00112		
44	OUTLINED LEFT	SW00111		
45	INLANE LEFT	SW00111		
46	LOWER LOCK 1 BALL	SW00142		
47	LOWER LOCK 2 BALLS	SW00142		
48	LOWER LOCK 3 BALLS	SW00142		
49	3-BANK URANUS	SW00106		
50	3-BANK NEPTUNE	SW00106		
51	3-BANK PLUTO	SW00106		
52	3-BANK STAND-UP LEFT	SW00141		
53	3-BANK STAND-UP RIGHT	SW00141		
54	STAR BUMPER LEFT	SW00126		
55	STAR BUMPER RIGHT	SW00126		
56	STAR BUMPER MIDDLE	SW00126		
57	ALIEN MOTOR			
58	1-BANK	SW00106		
59	INNER ORBIT RIGHT	SW00111		
60	OUTER ORBIT RIGHT	SW00111		
61	ALIEN LOCK LEFT	SW00146		
62	ALIEN LOCK RIGHT	SW00146		
63-64	UNUSED			
65	INLANE RIGHT	SW00111		
66	OUTLANE RIGHT	SW00111		
67	EJECT HOLE	SW00139		
68	U.R. FLIPPER E.O.S.	SW00127		
69	ISLAND ENTRANCE	SW00142		
70	ISLAND EXIT LEFT	A-00578-L		
71	ISLAND EXIT RIGHT	A-00578-R		
72-76	UNUSED			
77	CAPTIVE BOTTOM LEFT	SW00111		
78	CAPTIVE TOP LEFT	SW00111		
79	CAPTIVE BOTTOM RIGHT	SW00111		
80	CAPTIVE TOP RIGHT	SW00111		

* NOTE: SWITCH IS LOCATED IN CABINET.
** NOTE: NOT SERVICED SEPARATELY.

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NOTES

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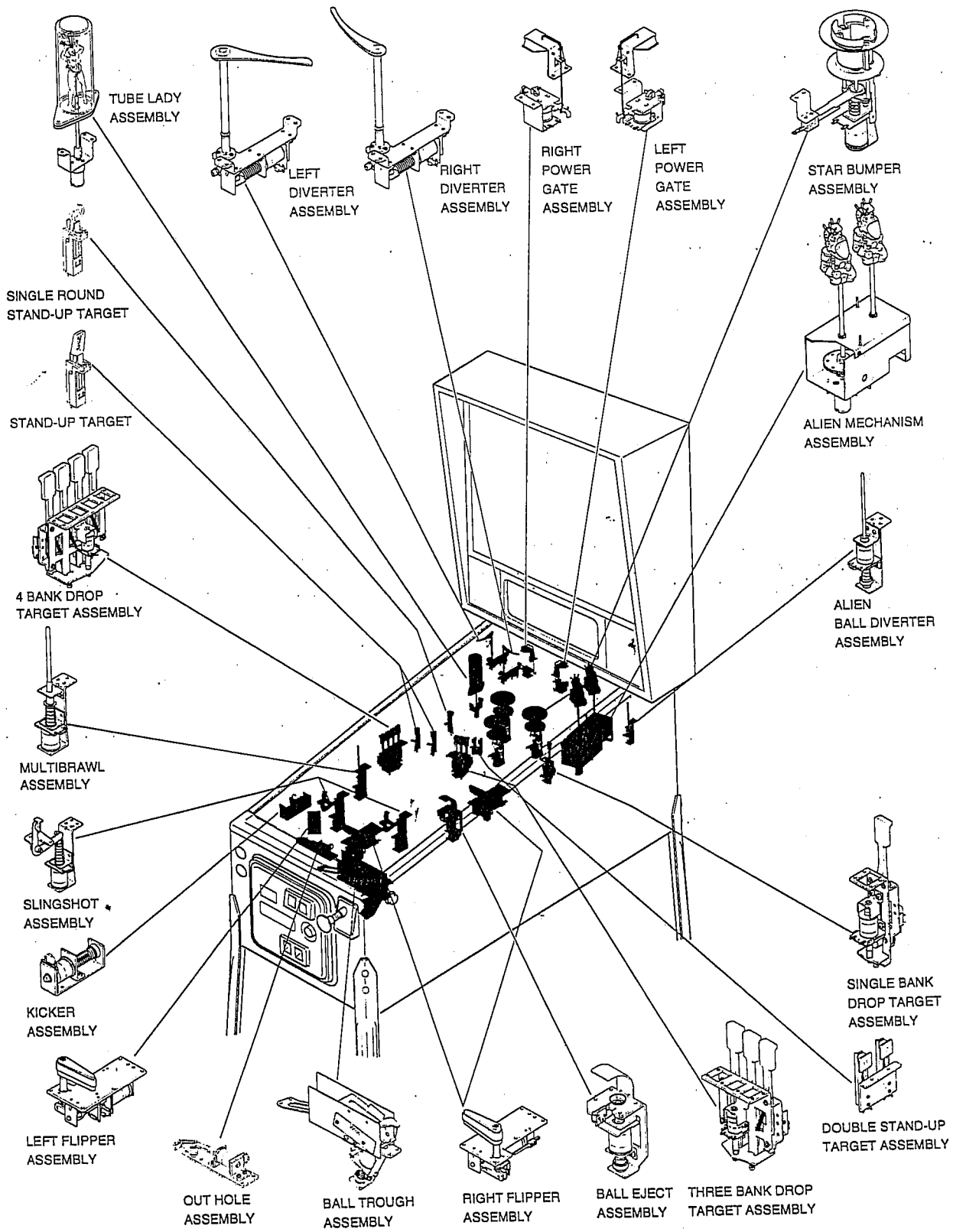
COMPONENT IDENTIFICATION - PLAYFIELD MECHANISMS



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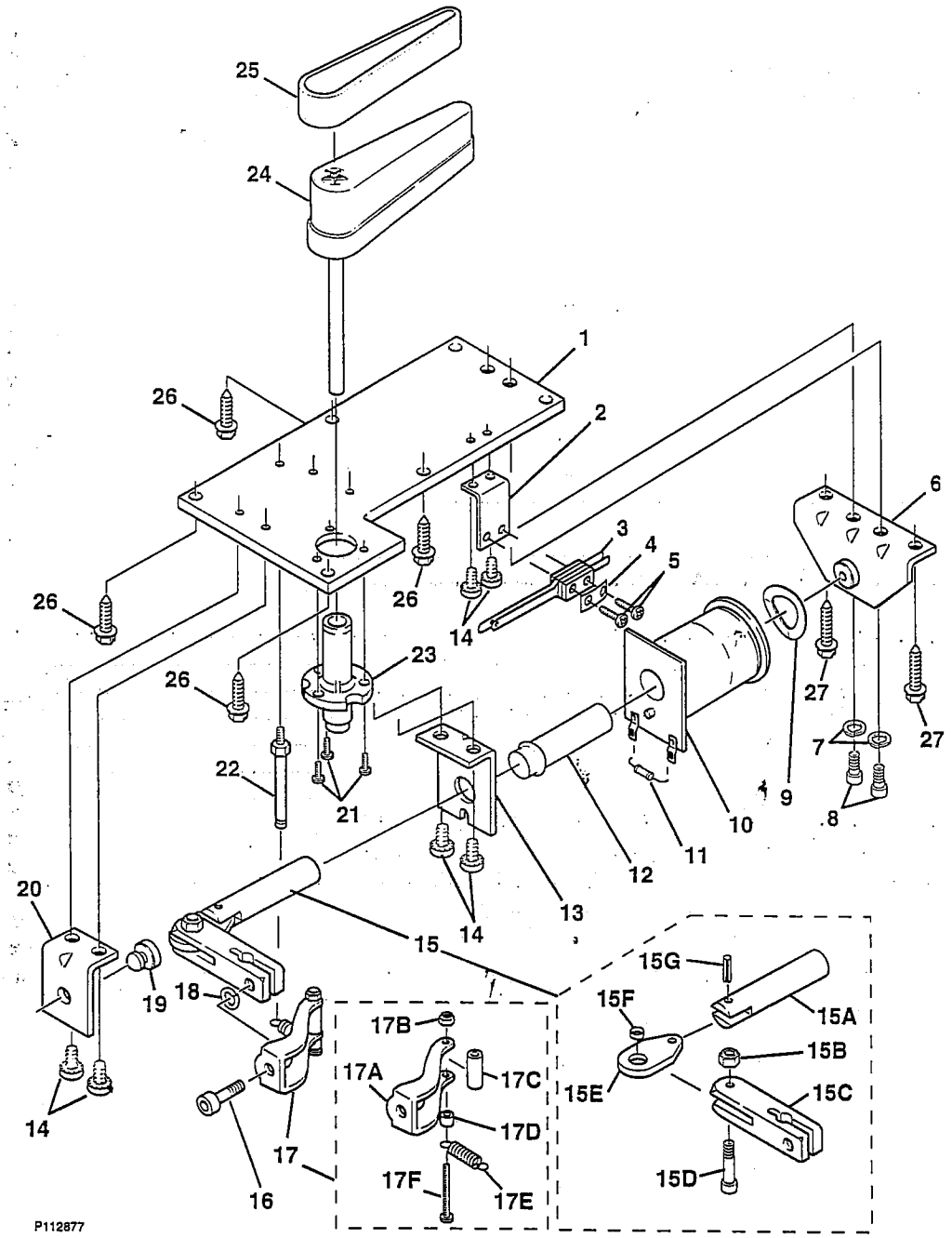
FLIPPER ASSEMBLIES



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FLIPPER ASSEMBLIES

Ref.	Part Number	Description	Quantity Required	
			Upper & Lower Left Flipper	Upper & Lower Right Flipper
	A-00155-L	ASSEMBLY, UPPER & LOWER LEFT FLIPPER		
	A-00155-R	ASSEMBLY, UPPER & LOWER RIGHT FLIPPER		
		left and right assemblies consist of the following parts:		
1	MT00388	BASE PLATE	1	1
2	MT00392	BRACKET, SWITCH MOUNTING	1	1
3	SW00127	SWITCH, LEAF	1	1
4	MT00461-1	PLATE, SWITCH	1	1
5	SC00100-05	SCREW, MACHINE, 6-32 X 5/8 PPH SEMS ZC	2	2
6	A-00378-1	ASSEMBLY, BRACKET, COIL STOP	1	1
7	WS00102-17	WASHER, LOCK 1/4 SPLIT	2	2
8	SC00169-03	SCREW, CAP, 1/4-20 X 3/8 SH ALLOY, BLACK	2	2
9	WS00107-02	WASHER, SPRING	1	1
10	CL00111	COIL 1100T #22	1	1
11	DI00100	DIODE, 1N4004 1.0A 400 VR	1	1
12	PL00132-05	SLEEVE, COIL 2.218 L	1	1
13	MT00390	BRACKET, COIL RETAINING	1	1
14	SC00101-02	SCREW, MACHINE, 8-32 X 1/4 PPH SEMS ZC	6	6
15	A-00429-1L	ASSEMBLY, PLUNGER/LINK/CLAMP- LEFT	1	
15	A-00429-1R	ASSEMBLY, PLUNGER/LINK/CLAMP- RIGHT		1
		left and right assemblies consist of the following parts:		
15A	SM00183	PLUNGER	1	1
15B	NT00104-11	NUT, 10-32 STOP, NYLON ZC	1	1
15C	MT00394	CLAMP, SHAFT	1	1
15D	SC00135-06	SCREW, CAP, 10-32 X 3/4 SH ALLOY ZC	1	1
15E	PL00202-1	LINK, PLUNGER	1	1
15F	SM00184	BUSHING, PLUNGER LINK	1	1
15G	RP00102-01	PIN, ROLL 5/32 X 3/8	1	1
16	SC00135-05	SCREW, CAP, 10-32 X 5/8 SH ALLOY ZC	1	1
17	A-00425-2L	ASSEMBLY, ACTUATOR- LEFT	1	
17	A-00425-2R	ASSEMBLY, ACTUATOR- RIGHT		1
		left and right assemblies consist of the following parts:		
17A	MT00393-2	BRACKET, SPRING MOUNTING	1	1
17B	NT00109-04	NUT, 4-40 STOP, NYLON ZC, THIN	1	1
17C	PL00288-1	BUSHING, ROLLER	1	1
17D	SM00225	BUSHING, SPRING, EOS	1	1
17E	SG00111	SPRING, EXT., .240 X .834" L	1	1
17F	SC00171-27	SCREW, MACHINE, 4-40 X 1 1/16 PPH ZC	1	1
18	WS00102-10	WASHER, LOCK #10 SPLIT	1	1
19	RB00103	BUMPER, BUTTON 5/8 D X 1/8 H	1	1
20	MT00389	BRACKET, PLUNGER SUPPORT	1	1
21	SC00100-26	SCREW, MACHINE, 6-32X 5/16 PPH SEMS ZC	3	3
22	SM00191	POST, SPRING MOUNTING	1	1
23	PL00264-1	BUSHING, FLIPPER	1	1
*24	A-00217-BK	ASSEMBLY, FLIPPER BAT, 3.0" BLACK	1	1
*25	RB00114-BK	RUBBER RING, 1-1/2" ID 1/2"W, BLACK	1	1
*26	SC00119-05	SCREW, SELF TAPPING #8 X 5/8 SHWH "AB" ZC	4	4
*27	SC00119-06	SCREW, SELF TAPPING #8 X 3/4 SHWH "AB" ZC	2	2

*NOTE: REFERENCE ONLY- NOT INCLUDED IN ASSEMBLIES SHOWN. MUST BE ORDERED SEPARATELY.

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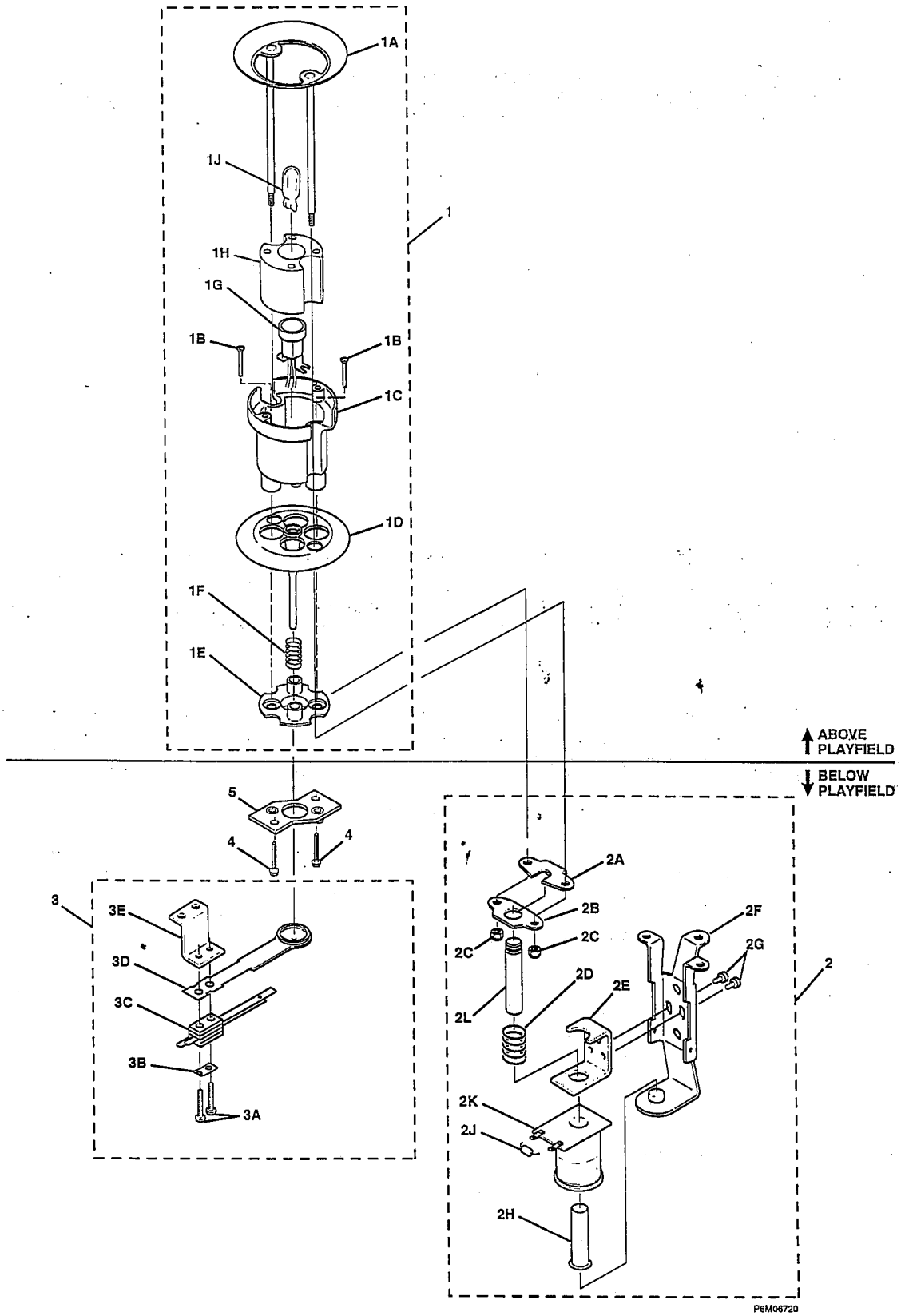
STAR BUMPER ASSEMBLY



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STAR BUMPER ASSEMBLY

No.	Part Number	Description	Req.
1	A-00376-PT	ASSEMBLY, STAR BUMPER, PURPLE	1
		consists of the following parts:	
1A	A-00374	ASSEMBLY, RING	1
*1B	SC00130-06	SCREW, MACHINE, 4-40 X 3/4 PFH ZC	2
1C	PL00265	BODY	1
1D	PL00229-P	SKIRT, PURPLE	1
1E	PL00261	WAFER	1
1F	SG00115	SPRING, 6 TURNS	1
*1G	SK00113	SOCKET, LAMP, WEDGE, WITH 12.0" LEADS	1
*1H	MS00172	MOUNT, SHOCK, LAMP	1
*1J	LP00100	LAMP, #555 6.3V WEDGE T-3 1/4	1
2	A-00375	ASSEMBLY, COIL & BRACKET, STAR BUMPER	1
		consists of the following parts:	
2A	MT00379	PLUNGER, LINK, METAL	1
2B	FB00104	PLUNGER, LINK, FIBER	1
*2C	NT00104-06	NUT, 6-32 STOP NYLON INS ZC	2
2D	SG00114	SPRING, 5 TURNS	1
2E	MT00380	BRACKET, COIL RETAINING	1
2F	A-00373	ASSEMBLY, SUB, COIL BRACKET	1
2G	SC00131-02	SCREW, MACHINE, 6-32 X 1/4 SLHWH ZC	2
2H	PL00132-01	SLEEVE, COIL, 1.745L	1
2J	DI00100	DIODE, 1N4004 RECT 1.0A 400VR	1
2K	CL00109	COIL, 800T #23	1
2L	SM00179	PLUNGER	1
3	A-00381	ASSEMBLY, SWITCH, STAR BUMPER	1
		consists of the following parts:	
3A	SC00100-05	SCREW, MACHINE, 6-32 X 5/8 PPH SEMS ZC	2
3B	MT00461-1	PLATE, SWITCH	1
3C	SW00126	SWITCH, LEAF	1
3D	PL00263	ACTUATOR, LEAF SWITCH	1
3E	MT00384	BRACKET, SWITCH MOUNTING	1
4	SC00121-04	SCREW, WOOD #6 X 1/2	2
5	A-00648	PLATE, SUPPORT	1

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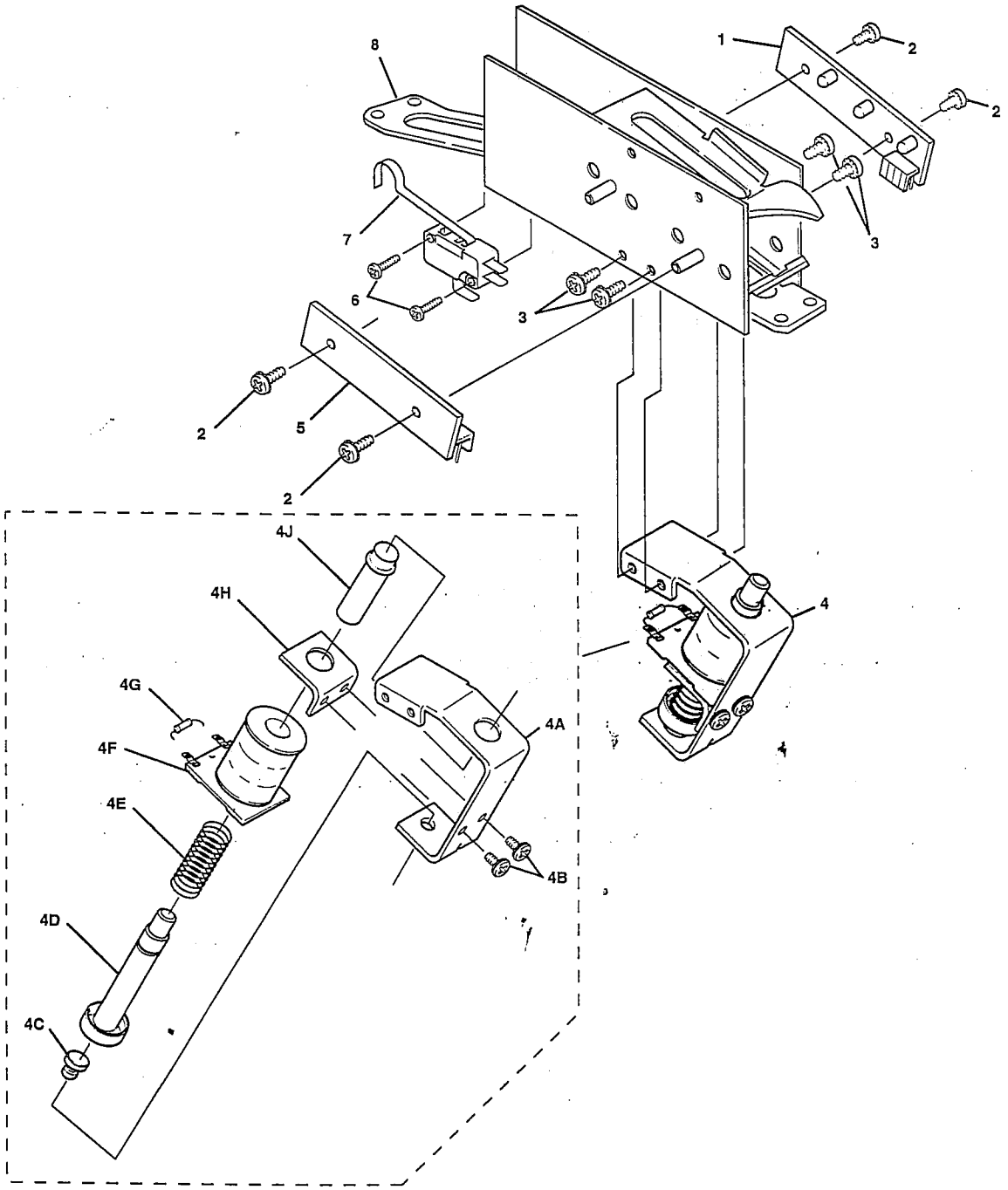
BALL TROUGH ASSEMBLY



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BALL TROUGH ASSEMBLY, 4 BALLS

No.	Part Number	Description	Req.
	A-00411-4R	ASSEMBLY, BALL TROUGH, 4 BALLS	
		consists of the following parts:	1
1	A0015702-4R	ASSEMBLY, OPTO, TRANSMITTER	4
2	SC00100-04	SCREW, MACHINE, 6-32 X 1/4 PPH SEMS ZC	4
3	SC00101-03	SCREW, MACHINE, 8-32 X 3/8 PPH SEMS ZC	
4	A-00371	ASSEMBLY, KICKER, BALL TROUGH	1
		consists of the following parts:	1
4A	MT00378	BRACKET	2
4B	SC00101-02	SCREW, MACHINE, 8-32 X 3/8 PPH SEMS ZC	1
4C	RB00103	BUTTON, RUBBER	1
4D	A-00369	ASSEMBLY, PLUNGER/TIP	1
4E	SG00103	SPRING, COMP.	1
4F	CL00109	COIL, 800T #23	1
4G	DI00100	DIODE, 1N4004 RECT 1.0A 400VR	1
4H	MT00191	BRACKET, COIL RETAINING	1
4J	PL00133-05	SLEEVE, COIL 1.880L WITH .188 EXT	
5	A0015604-4R	ASSEMBLY, OPTO, RECEIVER	1
6	SC00120-06	SCREW, MACHINE, 4-40 X 3/4 PPH SEMS ZC	2
7	SW00113	SWITCH, MICRO, WITH ACTUATOR	1
8	A-00370	ASSEMBLY, SUB, TROUGH WELDMENT	1

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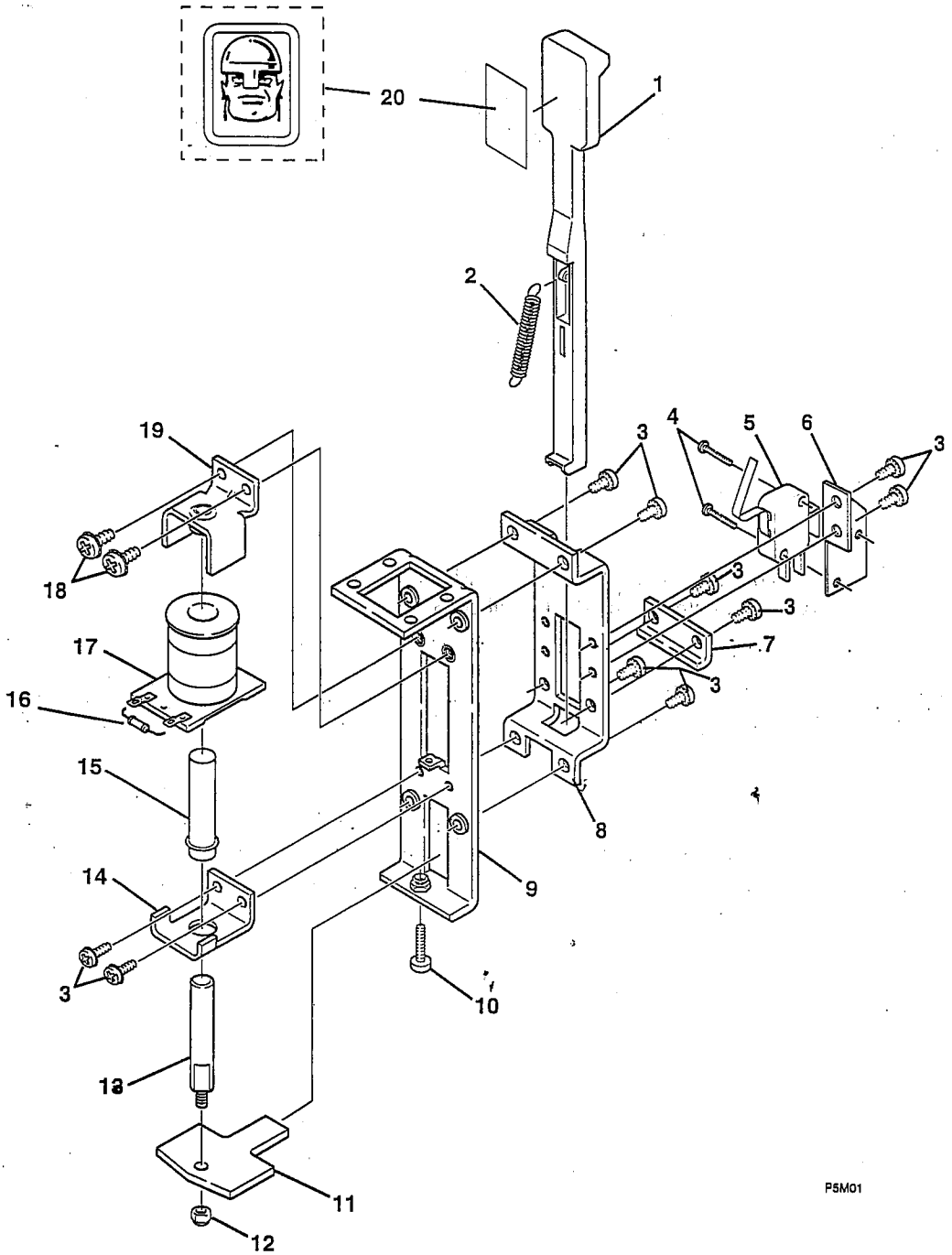
1 BANK DROP TARGET ASSEMBLY



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1 BANK DROP TARGET ASSEMBLY

Ref.	Part Number	Description	Req.
	A-00634	ASSEMBLY, DROP TARGET, 1 BANK	
		consists of the following parts:	
1	PL00325-W	TARGET, DROP, WHITE	1
2	SG00117	SPRING, EXT., 0.250 X .440	1
3	SC00101-02	SCREW, MACHINE, 8-32 X 1/4 PPH SEMS ZC	10
4	SC00120-05	SCREW, MACHINE, 4-40 X 5/8 PPH SEMS ZC	2
5	SW00106	SWITCH, MICRO, WITH ACTUATOR	1
6	MT00212	BRACKET, SWITCH	1
7	MT00527	BRACKET, RETAINER	1
8	MT00525	BRACKET, GUIDE	1
9	A-00633	ASSEMBLY, SUB, BRACKET, MAIN	1
10	SC00146-05	SCREW, MACHINE, 8-32 X 5/8 PPH ZC	1
11	MT00526	PLATE, LIFTER	1
12	NT00104-11	NUT, 10-32 STOP NYLON INS ZC	1
13	SM00118-01	PLUNGER, WITH STUD 2.47L	1
14	MT00208	BRACKET, COIL MOUNTING	1
15	PL00133-03	SLEEVE, COIL, 2.094L WITH .188 EXT	1
16	DI00100	DIODE, IN4004 RECT 1.0A 400VR	1
17	CL00109	COIL, 800T #23	2
18	SC00102-03	SCREW, MACHINE, 10-32 X 3/8 PPH SEMS ZC	1
19	A-00159	ASSEMBLY, SUB, BRACKET, PLUNGER STOP	1
*20	AW00187-8	DECAL, DROP TARGET, UNDERGROUND	

*NOTE: REFERENCE ONLY- NOT INCLUDED IN ASSEMBLIES SHOWN. MUST BE ORDERED SEPARATELY.

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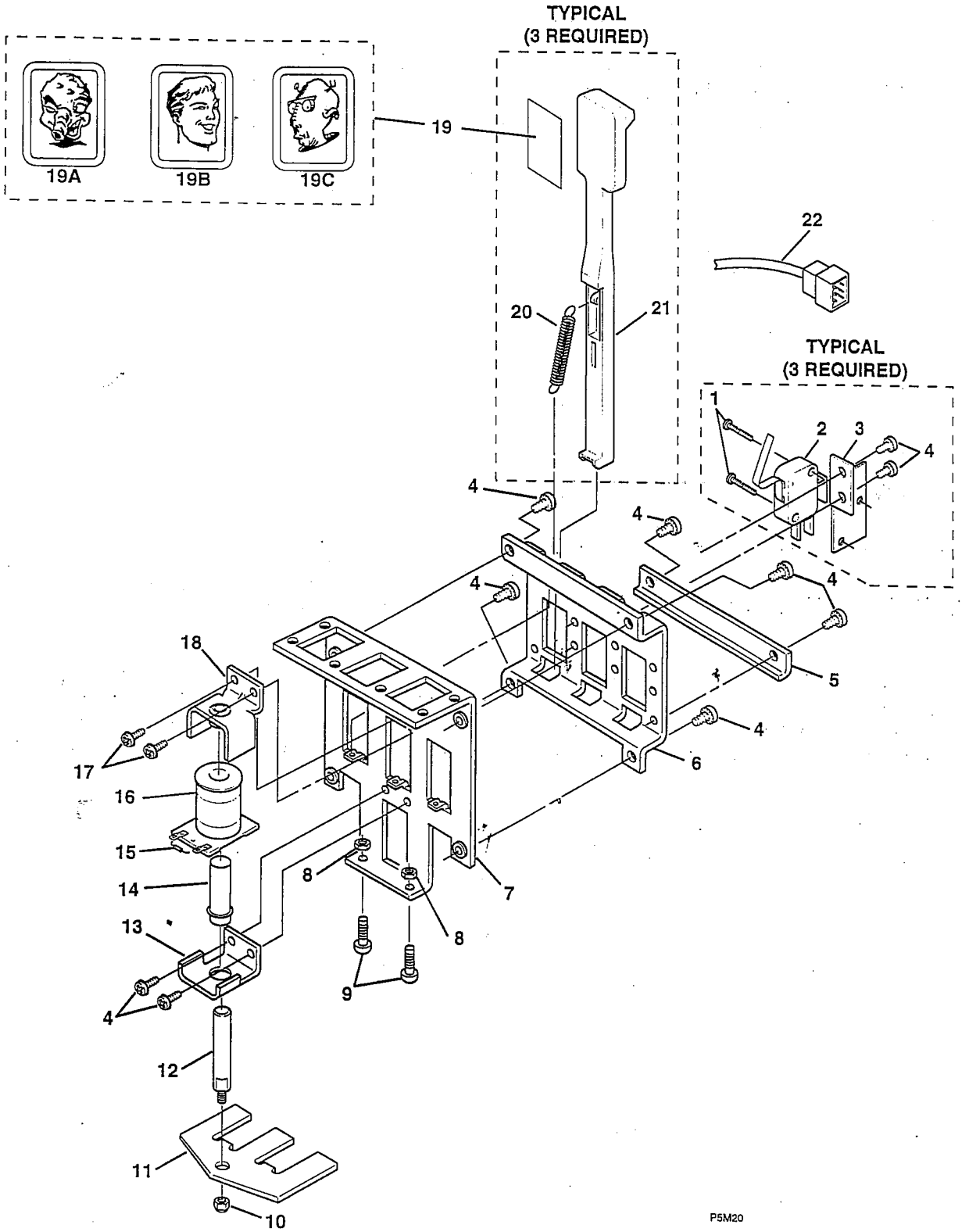
THREE BANK DROP TARGET ASSEMBLY



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THREE BANK DROP TARGET ASSEMBLY

No.	Part Number	Description	Req.
	A-00153	ASSEMBLY, 3 BANK DROP TARGET	
		consists of the following parts:	
1	SC00120-05	SCREW, MACHINE, 4-40 X 5/8 PPH SEMS ZC	6
2	SW00106	SWITCH, MICRO, WITH ACTUATOR	3
3	MT00212	BRACKET, MICRO SWITCH MOUNTING	3
4	SC00101-02	SCREW, MACHINE, 8-32 X 1/4 PPH SEMS ZC	14
5	MT00210	BRACKET, RETAINING	1
6	MT00213	BRACKET, GUIDE	1
7	A-00158	ASSEMBLY, SUB, MAIN BRACKET	1
8	NT00104-08	NUT, 8-32 KEPS HEX	2
9	SC00146-05	SCREW, MACHINE, 8-32 X 5/8 PPH ZC	2
10	NT00104-11	NUT, 10-32 STOP NYLON INS ZC	1
11	MT00209	PLATE, LIFTER	1
12	SM00118-01	PLUNGER, WITH STUD 2.47L	1
13	MT00208	BRACKET, COIL MOUNTING	1
14	PL00133-03	SLEEVE, COIL, 2.094L WITH .188 EXT	1
15	DI00100	DIODE, 1N4004 RECT 1.0A 400VR	1
16	CL00109	COIL, 800T #23	1
17	SC00102-03	SCREW, MACHINE, 10-32 X 3/8 PPH SEMS ZC	2
18	A-00159	ASSEMBLY, BRACKET, PLUNGER STOP	1
*19A	AW00187-5	DECAL, DROP TARGET, URANUS	1
*19B	AW00187-6	DECAL, DROP TARGET, NEPTUNE	1
*19C	AW00187-7	DECAL, DROP TARGET, PLUTO	1
20	SG00117	SPRING, EXT., .250 X .440, .16D WIRE	3
21	PL00325-W	TARGET, DROP, WHITE	3
22	C-00239	CABLE	1

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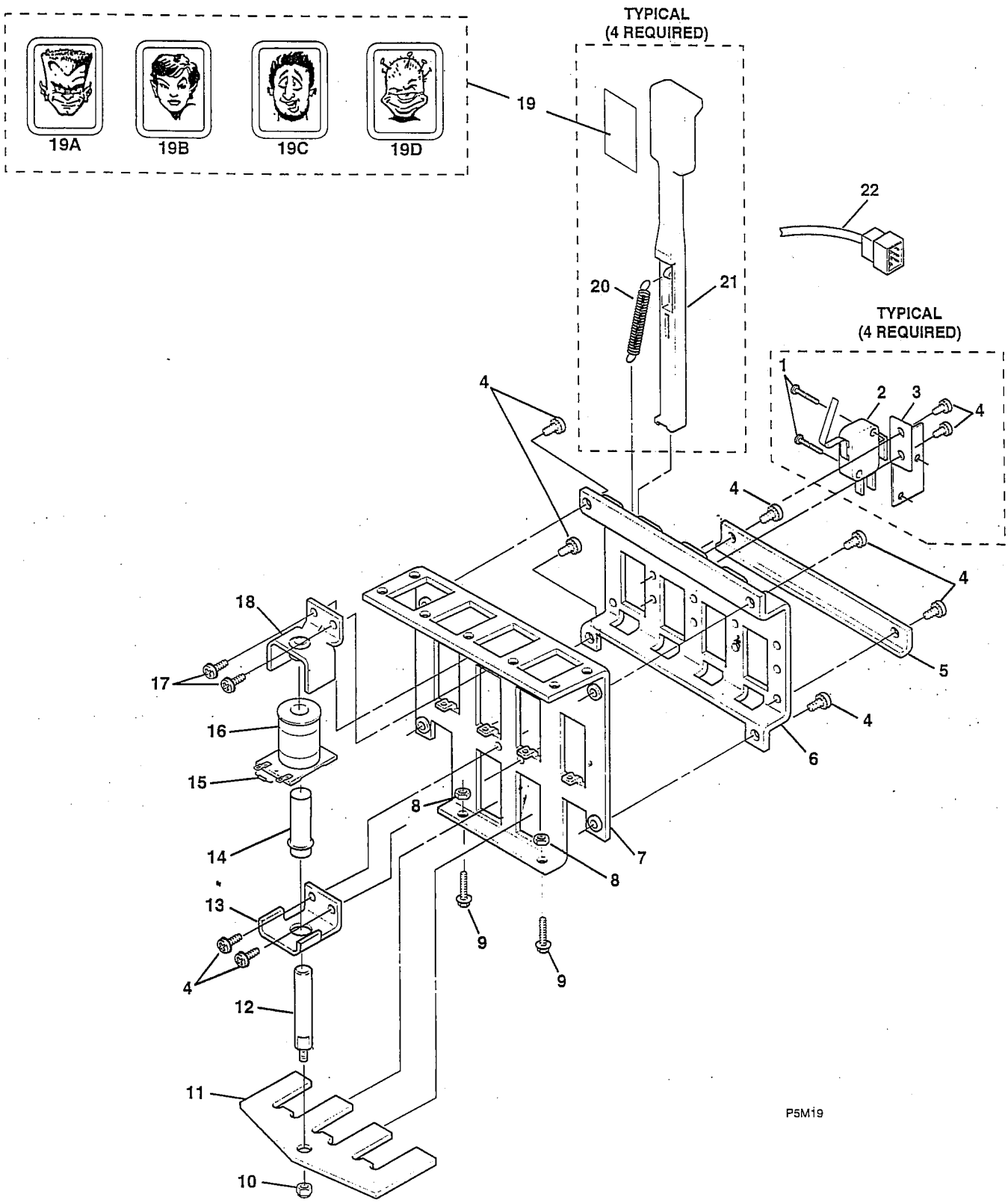
FOUR BANK DROP TARGET ASSEMBLY



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FOUR BANK DROP TARGET ASSEMBLY

No.	Part Number	Description	Req.
	A-00457	ASSEMBLY, 4 BANK DROP TARGET	
		consists of the following parts:	
1	SC00120-05	SCREW, MACHINE, 4-40 X 5/8 PPH SEMS ZC	8
2	SW00106	SWITCH, MICRO, WITH ACTUATOR	4
3	MT00212	BRACKET, MICRO SWITCH MOUNTING	4
4	SC00101-02	SCREW, MACHINE, 8-32 X 1/4 PPH SEMS ZC	16
5	MT00443	BRACKET, RETAINING	1
6	MT00441	BRACKET, GUIDE	1
7	A-00456	ASSEMBLY, SUB, MAIN BRACKET	1
8	NT00104-08	NUT, 8-32 KEPS HEX	2
9	SC00146-05	SCREW, MACHINE, 8-32 X 5/8 PPH ZC	2
10	NT00104-11	NUT, 10-32 STOP NYLON INS ZC	1
11	MT00442	PLATE, LIFTER	1
12	SM00118-01	PLUNGER, WITH STUD 2.47L	1
13	MT00208	BRACKET, COIL MOUNTING	1
14	PL00133-03	SLEEVE, COIL, 2.094L WITH .188 EXT	1
15	DI00100	DIODE, 1N4004 RECT 1.0A 400VR	1
16	CL00109	COIL, 800T #23	1
17	SC00102-03	SCREW, MACHINE, 10-32 X 3/8 PPH SEMS ZC	2
18	A-00159	ASSEMBLY, BRACKET, PLUNGER STOP	1
*19A	AW00187-1	DECAL, DROP TARGET, MERCURY	1
*19B	AW00187-2	DECAL, DROP TARGET, VENUS	1
*19C	AW00187-3	DECAL, DROP TARGET, PYTHOS	1
*19D	AW00187-4	DECAL, DROP TARGET, MARS	1
20	SG00117	SPRING, EXT., .250 X .440 .16D WIRE	4
21	PL00325-W	TARGET, DROP, WHITE	4
22	C-00240	CABLE	1

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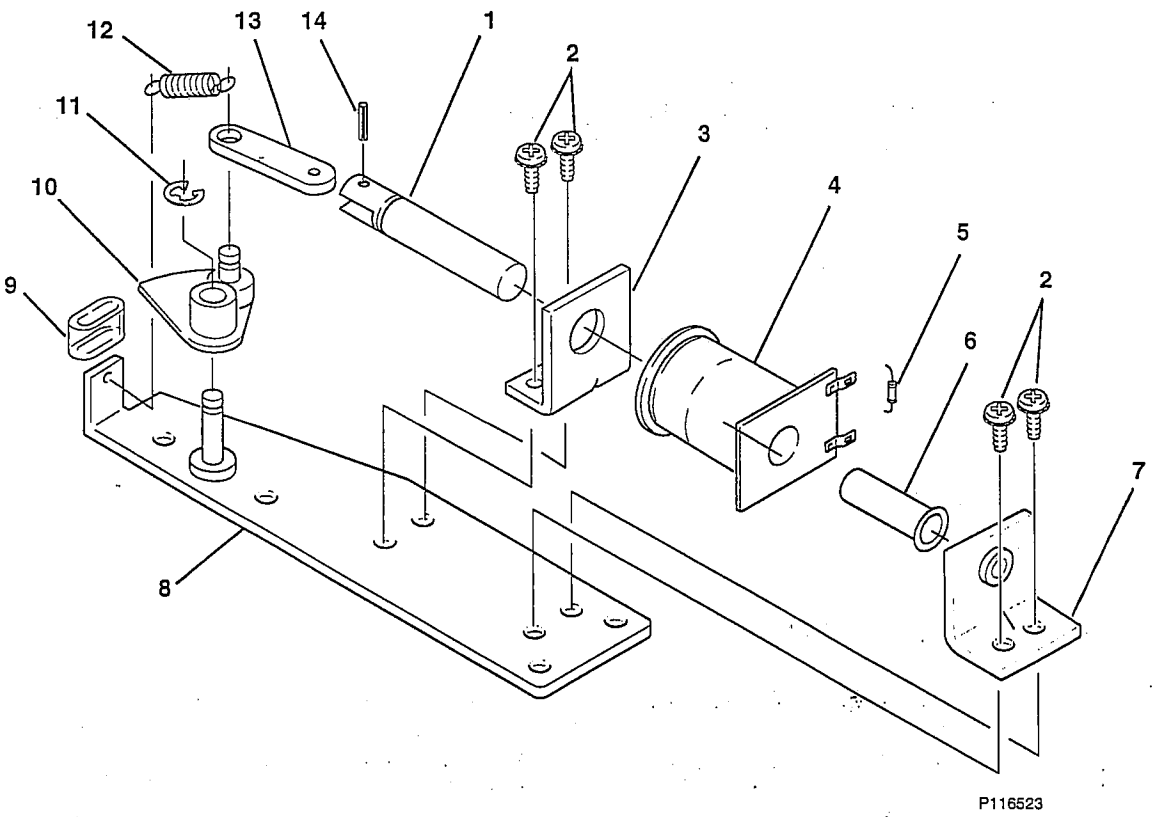
OUTHOLE KICKER ASSEMBLY



OUTHOLE KICKER ASSEMBLY			
No.	Part Number	Description	Req.
	A-00372	ASSEMBLY, BALL RETURN, OUTHOLE	
		consists of the following parts:	
1	SM00216	PLUNGER, BALL RETURN, OUTHOLE	1
2	SC00100-02	SCREW, MACHINE, 6-32 X 1/4 PPHS EXT/SEMS	4
3	MT00494	BRACKET, COIL RETURN, .625 #6 X .375	1
4	CL00109	COIL, 800T #23	1
5	DI00100	DIODE, 1N4004 RECT 1.0A 400VR	1
6	PL00132-03	SLEEVE, COIL 1.686L	1
7	A-00523	ASSEMBLY, BRACKET, PLUNGER STOP #6 X .375	1
8	A-00522	ASSEMBLY, PLATE, MOUNTING	1
9	MS00164	BUMPER, CAM ARM	1
10	A-00524	ASSEMBLY, CAM ARM	1
11	RR00100-25	E-RING, .25D SHAFT	1
12	SG00125	SPRING, EXT.	1
13	PL00285	LINK, PLUNGER	1
14	RP00100-06	PIN, ROLL 1/8 X 5/8L	1

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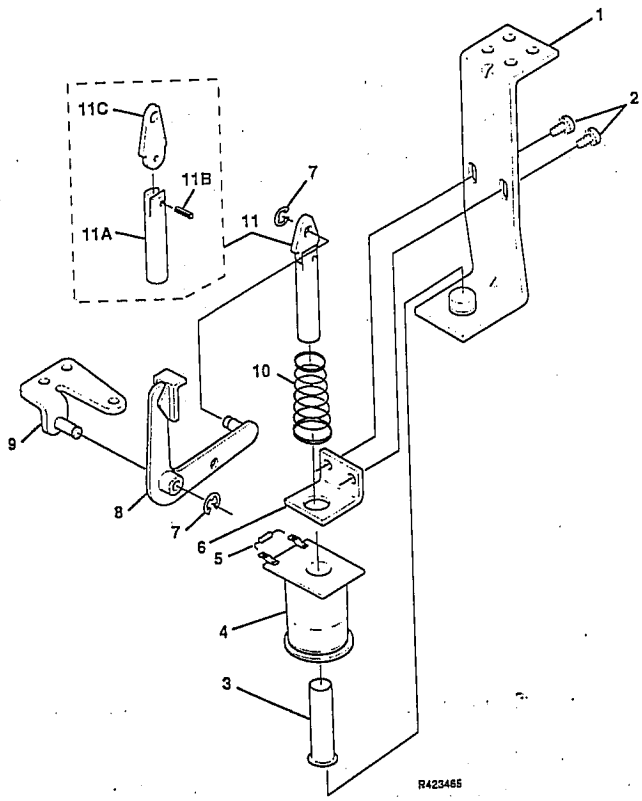
SLINGSHOT ASSEMBLY



SLINGSHOT ASSEMBLY			
No.	Part Number	Description	Req.
	A-00540-1	ASSEMBLY, SLINGSHOT, STANDARD	
		consists of the following parts: ,	1
1	A-00537	ASSEMBLY, BRACKET, COIL MOUNTING, SLINGSHOT	2
2	SC00101-02	SCREW, MACHINE, 8-32 X 1/4 PPH SEMS ZC	1
3	PL00132-01	SLEEVE, COIL	1
4	CL00109	COIL, 800T #23	1
5	DI00100	DIODE, 1N4004 RECT 1.0A 400 VR	1
6	MT00136-01	BRACKET, COIL RETAINING	1
7	RR00100-25	E-RING, EXT., .250D SHAFT	1
8	A-00328	ASSEMBLY, ARM, SLINGSHOT	1
9	A-00538	ASSEMBLY, BRACKET, PIVOT, SLINGSHOT ARM	1
10	SG00105	SPRING, COMP, .700 X 1.625 CONICAL	1
11	A-00329	ASSEMBLY, PLUNGER/LINK	
		consists of the following parts:	1
11A	SM00113-06	PLUNGER, CLEVIS 2.000L	1
11B	RP00100-06	PIN, ROLL 1/8 X 5/8	1
11C	PL00246	LINK, PLUNGER	

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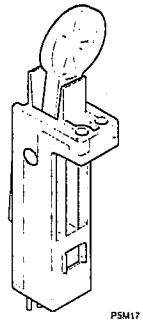
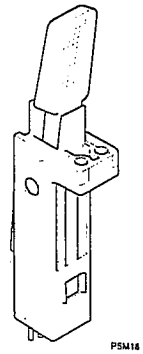
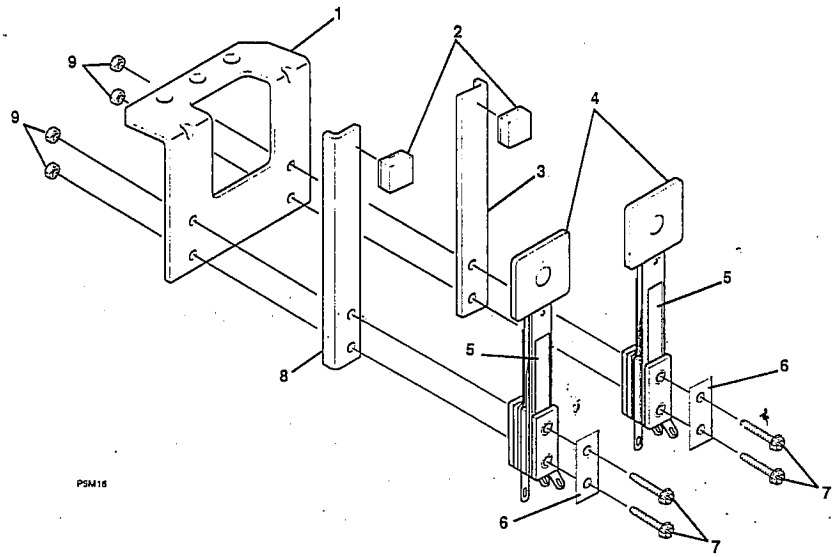
STAND UP TARGET ASSEMBLIES



A-00585-FGT



A-00583-FGT



A-00577-O

Ref.	Description	Component Part Number	Stand-Up Target Assembly Part Number & Component Part Quantity		
			*A-00585-FGT	*A-00583-FGT	A-00577-O
1	BRACKET, MOUNTING, REAR, 2-BANK	MT00561	-----	-----	1
2	FOAM PAD 3/8 X 3/8 X 1/4 WITH ADHESIVE	MS00134	-----	-----	2
3	PLATE, BACK-UP, STAND-UP TARGET, RIGHT	MT00275-R	-----	-----	1
4	TARGET, STAND-UP, 1.0 X .875	PL00230-O	-----	-----	2
5	SWITCH, LEAF	SW00141			2
6	PLATE, BACK-UP	MT00461			2
7	SCREW, MACHINE, 6-32 X 3/4 SLHWH, ZC	SC00131-06	-----	-----	4
8	PLATE, BACK-UP, STAND-UP TARGET, LEFT	MT00275-L	-----	-----	1
9	NUT, 6-32, KEPS, HEX	NT00101-06	-----	-----	4

*NOTE: No user serviceable components; must be purchased as an assembly.

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NOTES

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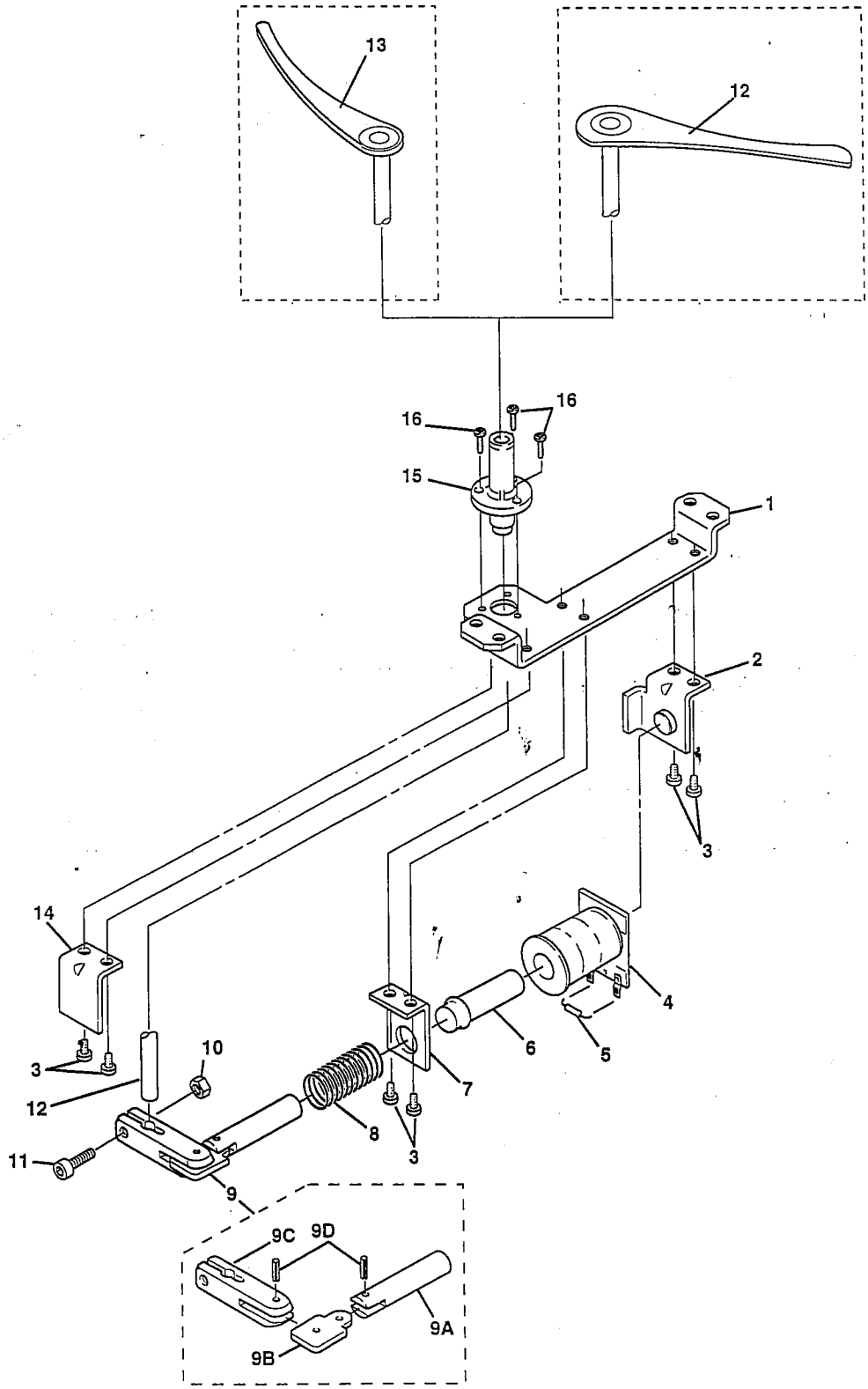
LEFT AND RIGHT DIVERTER ASSEMBLIES



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LEFT AND RIGHT DIVERTER ASSEMBLIES

Ref.	Part Number	Description	Quantity Required	
			Left Diverter	Right Diverter
	A-00136-05	ASSEMBLY, DIVERTER, CCW, 28°	1	1
		consists of the following parts:		
1	MT00181-R	BRACKET, DIVERTER	1	1
2	A-00134-2	ASSEMBLY, BRACKET, COIL STOP	1	1
3	SC00101-02	SCREW, MACHINE, 8-32 X 1 4 PPH SEMS ZC	6	6
4	CL00109	COIL, 800T #23	1	1
5	DI00100	DIODE, 1N4004 RECT 1.0A 400VR	1	1
6	PL00132-03	SLEEVE, COIL	1	1
7	MT00185-1	BRACKET, COIL RETAINING	1	1
8	SG00105-2	SPRING, COMP., 0.70 X 1.62, 0.29 CONICAL	1	1
9	A-00135-1	ASSEMBLY, PLUNGER/LINK & CLAMP	1	1
		consists of the following parts:		
9A	SM00113	PLUNGER, CLEVIS, 2.000L	1	1
9B	PL00150	LINK, PLUNGER	1	1
9C	MT00183-1	CLAMP, SHAFT	1	1
9D	RP00100-04	PIN, ROLL 1/8 X 1/2	2	2
10	NT00104-11	NUT, 10-32 STOP NYLON INS ZC	1	1
11	SC00135-07	SCREW, CAP, 10-32 X 7/8 SH ALLOY	1	1
*12	A-00554	ASSEMBLY, BLADE & SHAFT	1	
*13	A-00555	ASSEMBLY, BLADE & SHAFT		1
14	MT00323	BRACKET, LINK STOP	1	1
15	PL00149	BUSHING, FLIPPER	1	1
16	SC00100-03	SCREW, MACHINE, 6-32 X 3/8 PPH SEMS ZC	3	3

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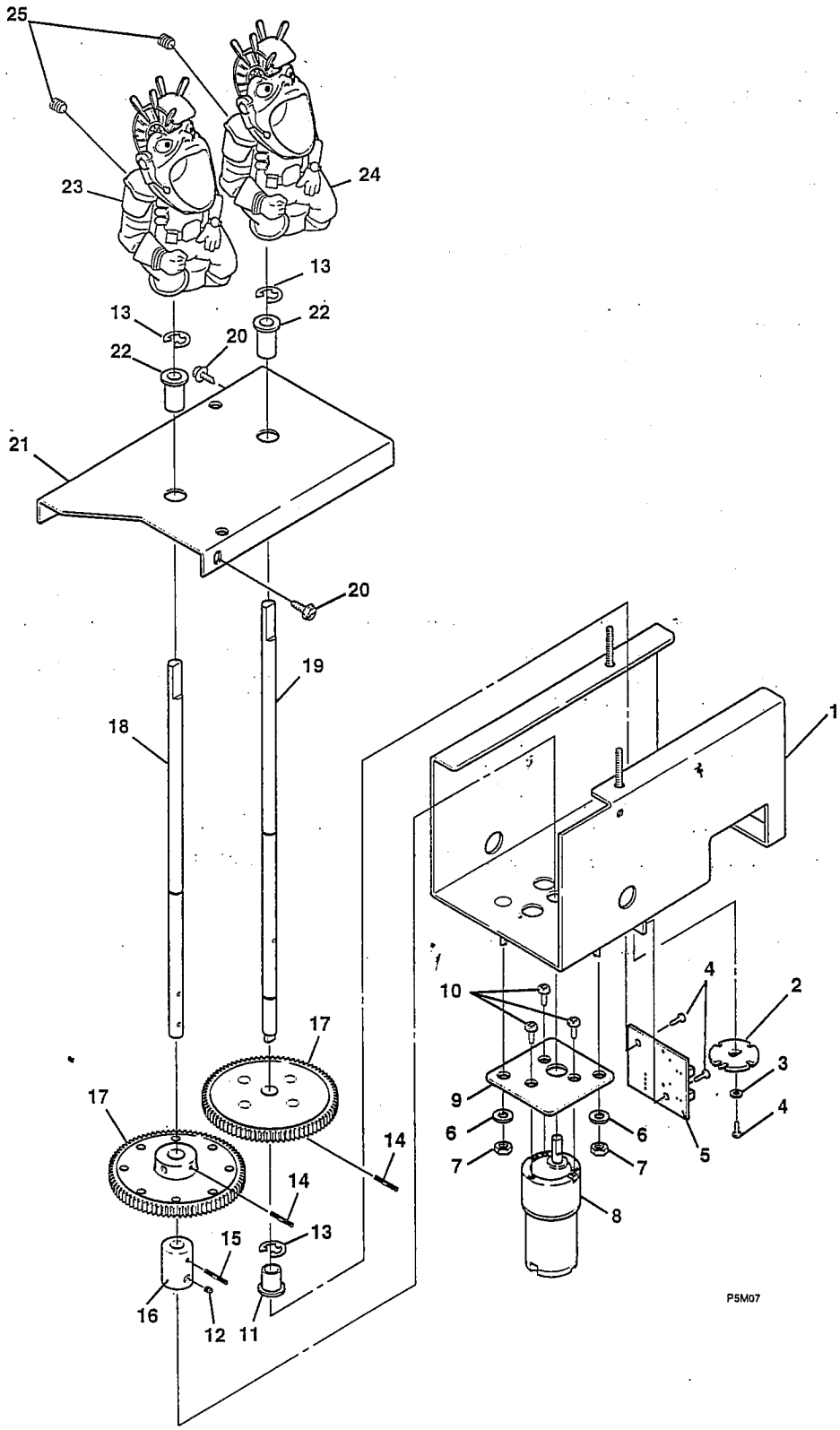
ALIEN MECH ASSEMBLY



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ALIEN MECH ASSEMBLY

No.	Part Number	Description	Req.
	A-00536	ASSEMBLY, ALIEN MECH	
		consists of the following parts:	
1	A-00609	ASSEMBLY, BRACKET, MOTOR	1
2	MT00501	DISC, ENCODER	1
3	WS00100-02	WASHER, FLAT #4 .208" OD .026"T	1
4	SC00120-02	SCREW, MACHINE, 4-40 X 5/16 PPH SEMS ZC	3
5	A0020000	ASSEMBLY, PCB, OPTO	1
6	WS00100-05	WASHER, FLAT #8 .375OD .032T	2
7	NT00104-08	NUT, 8-32 STOP NYLON INS ZC	2
8	MR00108	MOTOR, 12 VDC, 65 RPM	1
9	MT00615	PLATE, ADAPTER	1
10	SC00100-25	SCREW, MACHINE, 6-32 X 3/16 PPH SEMS ZC	3
11	BG00101-03	BEARING, FLANGED, 0.250ID X .375OD X 0.375L, BRONZE	1
12	SC00133-25	SCREW, SET, 8-32 X 3-16 SH FLAT PT	1
13	RR000100-25	E-RING, EXT .250D SHAFT	3
14	RP00103-07	PIN, ROLL, 1/16 X 9/16	2
15	RP00103-06	PIN, ROLL, 1/16 X 1/2	1
16	SM00221	COUPLING, SHAFT, 0.256 / .201ID	1
17	PL00332	GEAR	2
18	SM00220	SHAFT, DRIVER	1
19	SM00219	SHAFT, DRIVEN	1
20	SC00103-02	SCREW, SELF TAPPING, #6 X 1/4 PPH "AB" ZC	2
21	MT00560	COVER, MOTOR	1
22	BG00101-05	BEARING, FLANGED, 0.250ID X 0.375OD X 0.75L, BRONZE	2
*23	PL00330-P	ALIEN, PURPLE	1
*24	PL00330-G	ALIEN, GREEN	1
*25	SC00133-04	SCREW, SET, 8-32 X 1/2 SH FLAT PT	2

*NOTE: REFERENCE ONLY- NOT INCLUDED IN ASSEMBLIES SHOWN. MUST BE ORDERED SEPARATELY.

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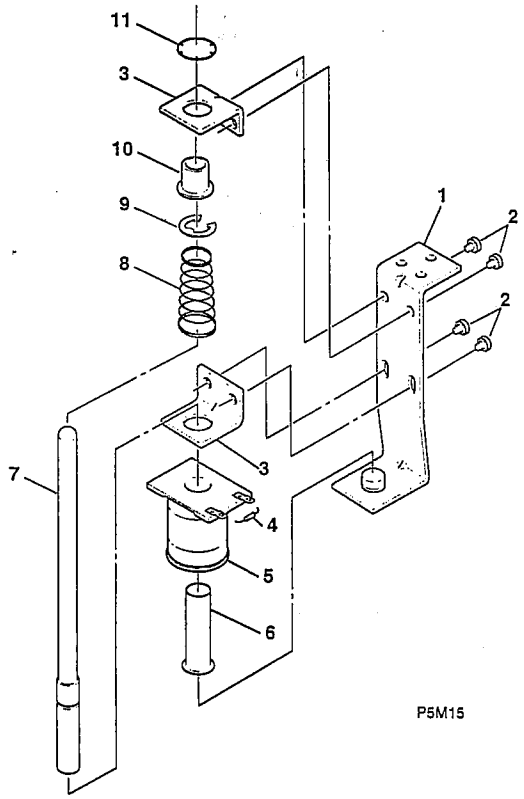
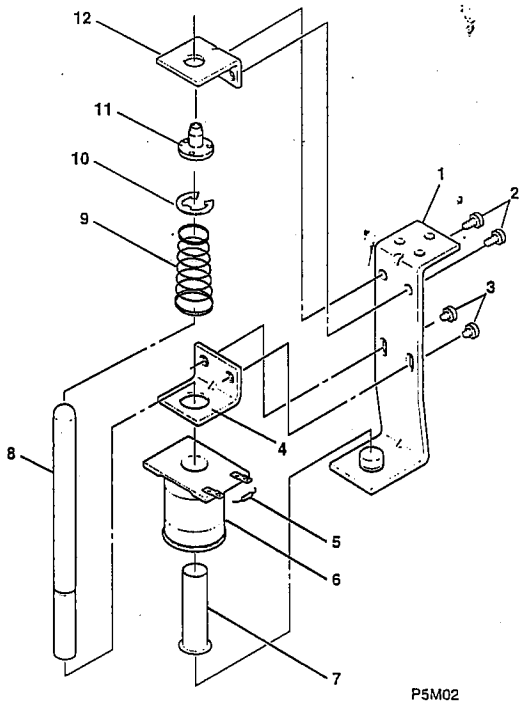


ALIEN BALL DIVERTER



MULTI-BRAWL ASSEMBLY

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ALIEN BALL DIVERTER ASSEMBLY

No.	Part Number	Description	Req.
	A-00610	ASSEMBLY, BALL DIVERTER, ALIEN	
		consists of the following parts:	
1	A-00446-1	ASSEMBLY, SUB, BRACKET, COIL MOUNTING .218H PLUNGER STOP	1
2	SC00101-02	SCREW, MACHINE, 8-32 X 1/4 PPH SEMS ZC	4
3	MT00198	BRACKET, COIL RETAINING .625 8-32 X .500	2
4	DI00100	DIODE, 1N4004 RECT 1.0A 400 VR	1
5	CL00109	COIL, 800T #23	1
6	PL00132-01	SLEEVE, COIL, 1.745L	1
7	SM00238	SHAFT	1
8	SG00105-2	SPRING, COMP., 0.70 X 1.62, 0.029	1
9	RR00100-43	E-RING, EXT .437D SHAFT	1
10	PL00269	BUSHING, FLGS, .375ID X .500L	1
11	RR00101-50	RING, RETAINING, .500D SHAFT PUSH-ON	1

MULTI-BRAWL ASSEMBLY

No.	Part Number	Description	Req.
	A-00612	ASSEMBLY, MULTI-BRAWL	
		consists of the following parts:	
1	A-00446-1	ASSEMBLY, SUB, BRACKET, COIL MOUNTING .218 H PLUNGER STOP	1
2	SC00101-04	SCREW, MACHINE, 8-32 X 1/2 PPH SEMS ZC	2
3	SC00101-02	SCREW, MACHINE, 8-32 X 1/4 PPH SEMS ZC	2
4	MT00198	COIL, RETAINING BRACKET, .625, 8-32 X .500	1
5	DI00100	DIODE, 1N4004 RECT 1.0A 400 VR	1
6	CL00109	COIL, 800T #23	1
7	PL00132-01	SLEEVE, COIL 1.745	1
8	SM00240	SHAFT	1
9	SG00105-2	SPRING, COMP., 0.70 X 1.62, 0.029	1
10	RR00100-43	E-RING EXT .437D SHAFT	1
11	PL00318	BUSHING, ROD	1
12	MT00583	BRACKET, BUSHING	

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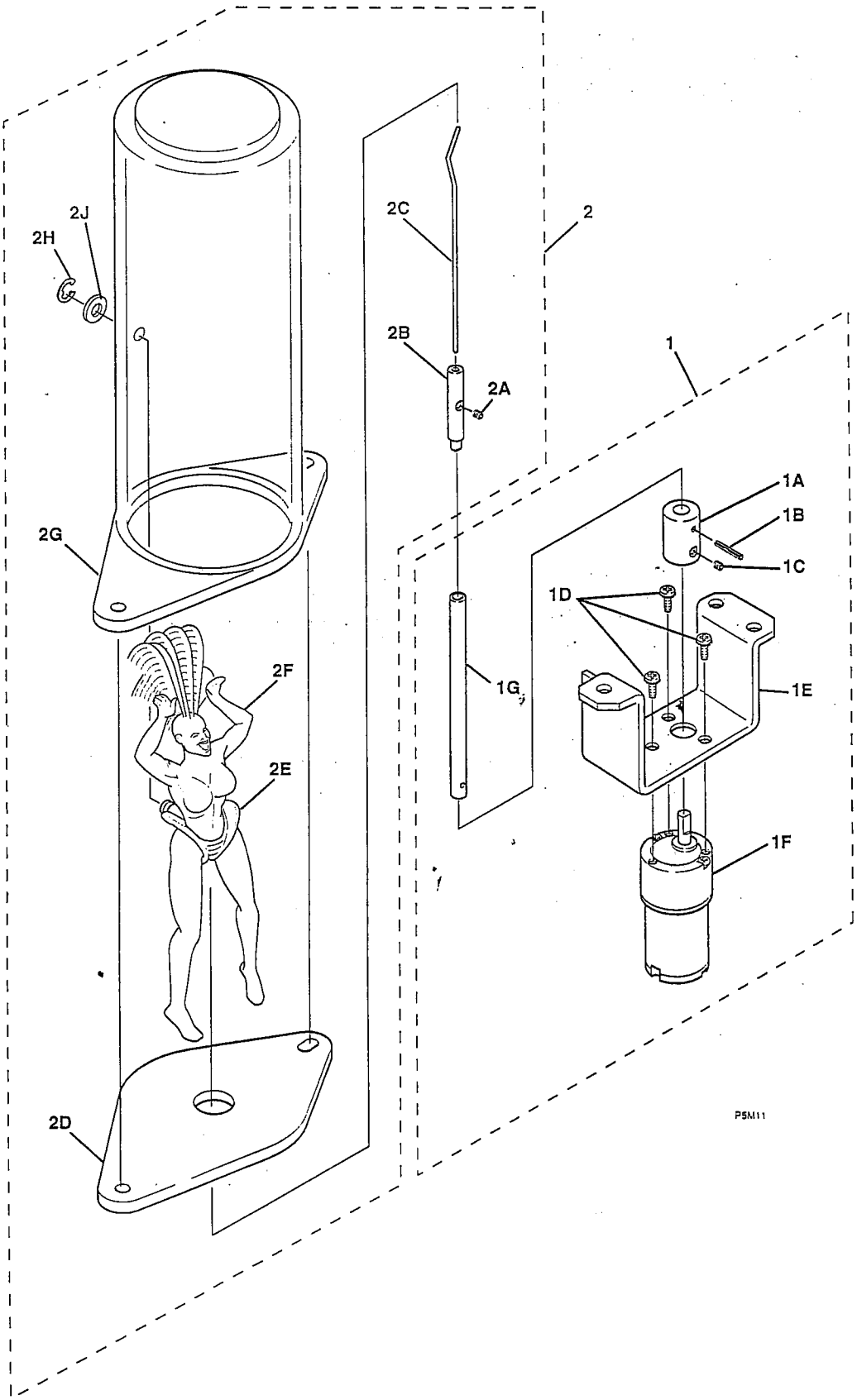
TUBE LADY ASSEMBLY



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TUBE LADY ASSEMBLY

No.	Part Number	Description	Req.
1	A-00649	ASSEMBLY, MOTOR, TUBE LADY	
		consists of the following parts:	1
1A	SM00221	COUPLING, SHAFT, 0.256 / .201ID	1
1B	RP00103-06	PIN, ROLL 1/16 X 1/2	1
1C	SC00133-25	SCREW, SET, 8-32 X 3/16 SH FLAT PT	3
1D	SC00100-25	SCREW, MACHINE, 6-32 X 3/16 PPH SEMS ZC	1
1E	MT00598	BRACKET, MOUNTING, MOTOR	1
1F	MR00108	MOTOR, 12 VDC, 65 RPM	1
1G	SM00248	SHAFT, MOTOR	
2	A-00650	ASSEMBLY, TUBE LADY	
		consists of the following parts:	1
2A	SC00179-25	SCREW, SET, 6-32 X 3/16 SH FLAT PT	1
2B	SM00249	SHAFT, INSERT	1
2C	WF00144	WIREFORM	1
2D	PL00344	BASE	1
2E	A-00652	ASSEMBLY, BELT	1
2F	RB00126	FIGURE	1
2G	A-00651	ASSEMBLY, TUBE	1
2H	RR00100-18	E-RING, EXT .188D SHAFT	1
2J	WS00106	WASHER, FLAT #6 .375OD .060T RUBBER	

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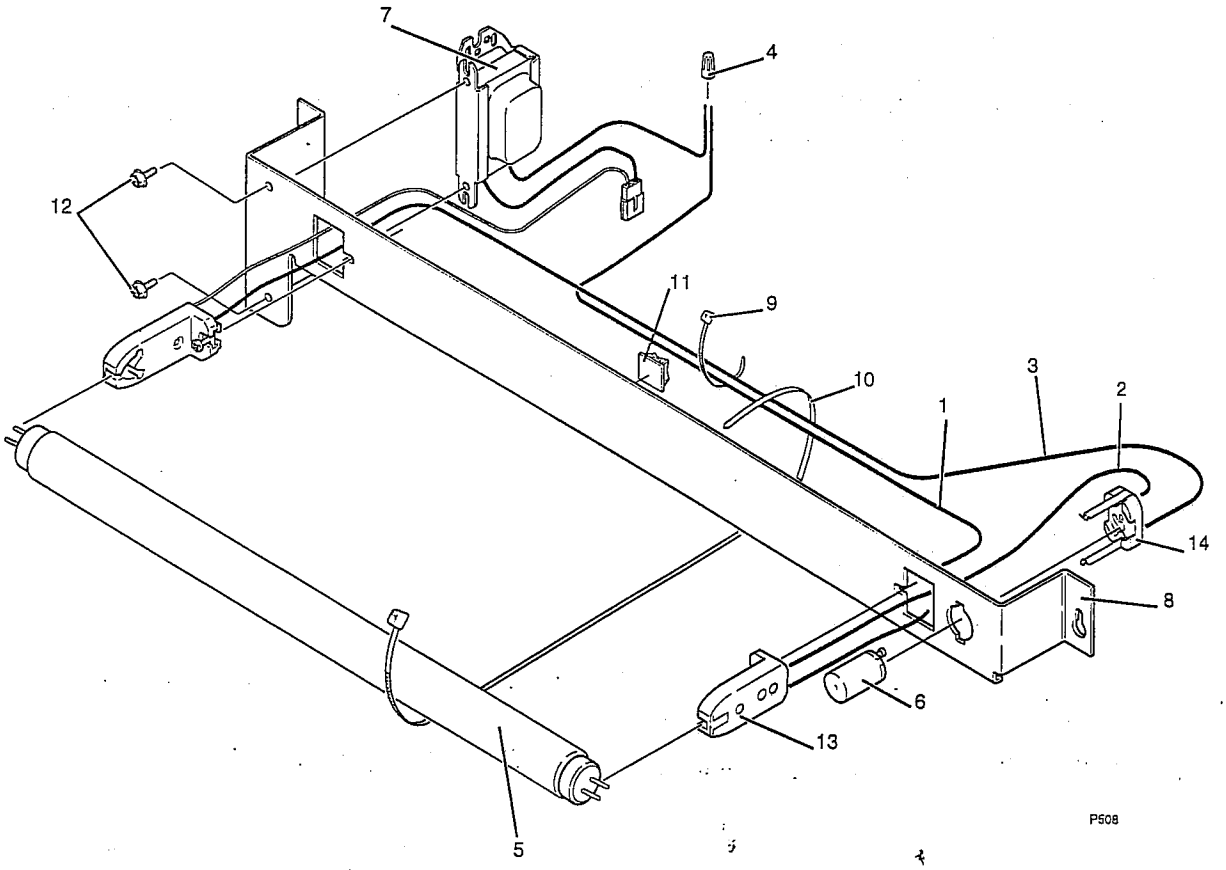
FLUORESCENT LAMP ASSEMBLY



FLUORESCENT LAMP ASSEMBLY			
No.	Part Number	Description	Req.
	A-00692	ASSEMBLY, LAMP, FLUORESCENT, 18"	
		consists of the following parts:	
1	C-00282	CABLE, STARTER, FLUORESCENT, 18.0"L, T8	1
2	C-00283	CABLE, STARTER, FLUORESCENT, 6.0"L, T8	1
3	C-00284	CABLE, BALLAST, FLUORESCENT, T815W	1
4	CN00106-01	WIRE NUT 22-14 AWG BLU	1
5	LP00105	LAMP, FLUORESCENT LAMP, FS-2	1
6	MS00162	STARTER, FLUORESCENT LAMP, 18.0"	1
7	MS00180	BALLAST, FLUORESCENT, #F15T8	1
8	MT00261	CHASSIS, LAMP, FLUORESCENT, 18.0"	1
9	PL00131-01	CABLE TIE, 3-7/8"L, MINI, NYLON	1
10	PL00131-03	CABLE TIE, 11.4"L, INNER, NYLON	1
11	PL00329	BASE, CABLE TIE, #6 MOUNTING, WITH ADHESIVE	
12	SC00170-03	TRS 6-32 X 3/8 SLHWH ZC	2
13	SK00126	SOCKET LP FL MED BI-PIN #F15T8	2
14	SK00127	SOCKET LP FL STARTER #F15T8	1

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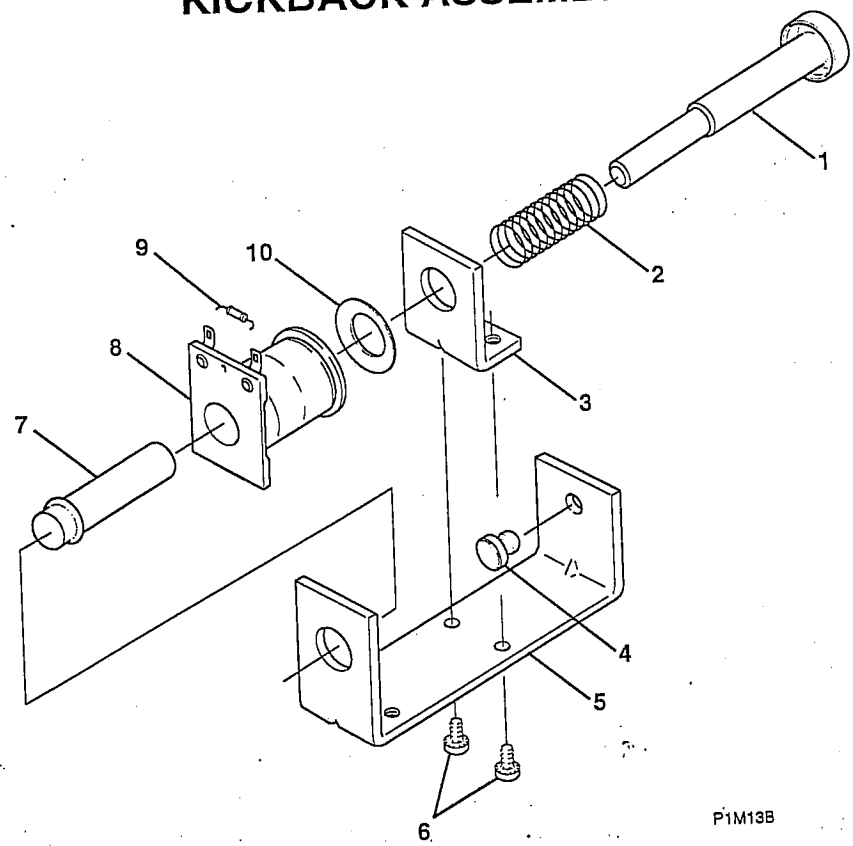
KICKBACK ASSEMBLY



KICKBACK ASSEMBLY			
No.	Part Number	Description	Req.
	A-00148	ASSEMBLY, KICKBACK	
		consists of the following parts:	1
1	A-00147	ASSEMBLY, SUB, PLUNGER & TIP	1
2	SG00105	SPRING, COMP. 0.70 X 1.62, .024 CONICAL	1
3	MT00136	BRACKET, COIL RETAINING	1
4	RB00110	BUTTON, BUMPER, 5/8D X 1/8H	1
5	MT00203	BRACKET, COIL MOUNTING	
			2
6	SC00101-02	SCREW, MACHINE, 8-32 X 1/4 PPH SEMS ZC	1
7	PL00154-01	SLEEVE, COIL, 1.81L WITH .25 EXT.	1
8	CL00109	COIL, 800T #23	1
9	DI00100	DIODE, 1N4004 RECTIFIER 1.0A 400VR	1
10	WS00107-02	WASHER, SPRING	

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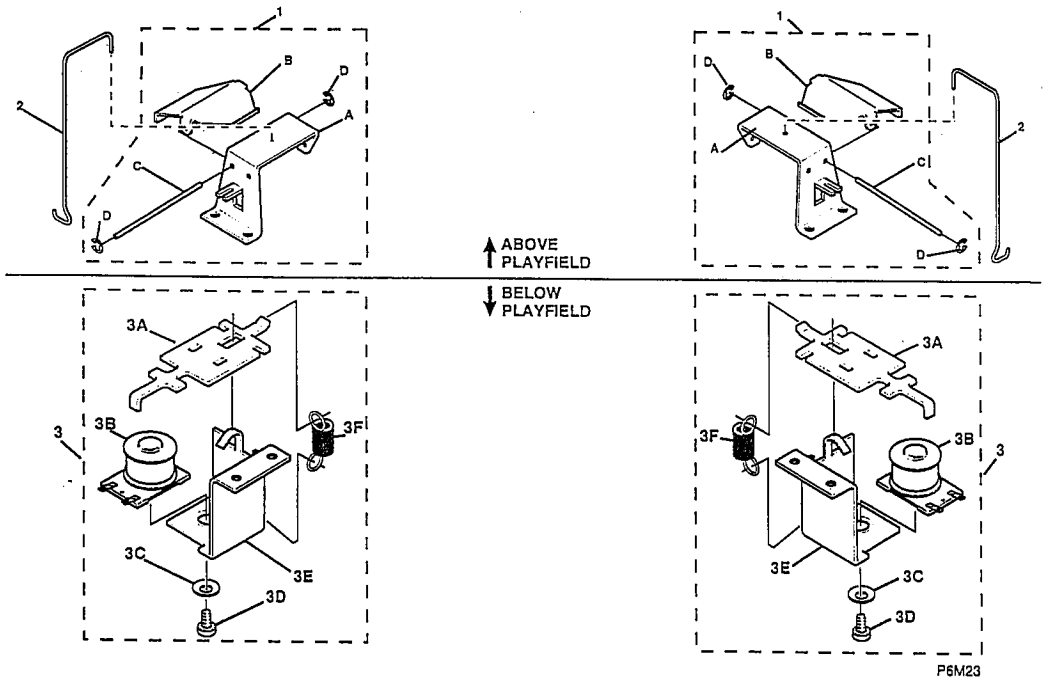
LEFT POWER GATE ASSEMBLY

RIGHT POWER GATE ASSEMBLY



POWER GATE ASSEMBLIES				
Ref.	Part Number	Description	Quantity Required	
			Left Power Gate A-00526-1L	Right Power Gate A-00526-1R
1	A-00526-1L	ASSEMBLY, GATE, 1 WAY, LEFT	1	
1	A-00526-1R	ASSEMBLY, GATE, 1 WAY, RIGHT		1
		left and right assemblies consist of the following parts:		
1A	MT00498-1	BRACKET	1	1
1B	MT00477-1	GATE	1	1
1C	SM00217-1	SHAFT	1	1
1D	RR00100-06	E-RING, EXT., .062D SHAFT	2	2
2	WF00135	WIREFORM	1	1
3	A-00575-L	ASSEMBLY, COIL & BRACKET, LEFT	1	
3	A-00575-R	ASSEMBLY, COIL & BRACKET, RIGHT		1
		left and right assemblies consist of the following parts:		
3A	A-00574	ACTUATOR	1	1
3B	A-00573	ASSEMBLY, COIL	1	1
3C	WS00109-15	WASHER, FLAT #8 .438OD .064T BRASS	1	1
3D	SC00141-03	SCREW, MACHINE, 8-32 X 3/8 SLPH BRASS	1	1
3E	A-00572-L	BRACKET, LEFT	1	
3E	A-00572-R	BRACKET, RIGHT		1
3F	SG00126	SPRING, EXT, 0.200D X 21 ACTIVE COILS	1	1

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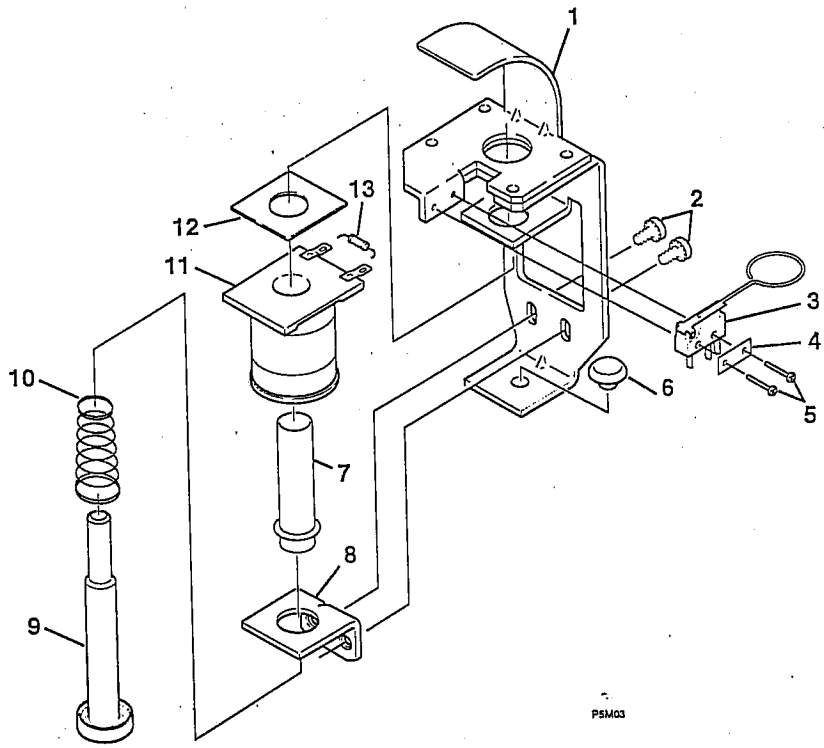
SINGLE BALL EJECTOR ASSEMBLY



SINGLE BALL EJECTOR ASSEMBLY			
No.	Part Number	Description	Req.
	A-00547	ASSEMBLY, BALL EJECTOR	
		consists of the following parts:	
1	A-00546	ASSEMBLY, SCOOP	1
2	SC00101-02	SCREW, MACHINE, 8-32 X .25L PHP SEMS	2
3	SW00139	SWITCH, MICRO, WITH ACTUATOR	1
4	MT00491	PLATE, SWITCH, #4 X .375	1
5	SC00157-04	SCREW, MACHINE, 2-56 X .50L PHP SEMS ZC	2
6	RB00110	GROMMET, RUBBER 5/8D X 1/8H	1
7	PL00133-02	SLEEVE, COIL	1
8	MT00136	BRACKET, COIL RETAINING	1
9	A-00147	ASSEMBLY, PLUNGER & TIP	1
10	SG00105	SPRING, COMP., .700 X 1.625 CONICAL	1
11	CL00109	COIL, 800T #23	1
12	FB00103	INSULATOR, COIL, 1.16 X 1.31 X .010	1
13	DI00100	DIODE, 1N4004 RECT 1.0A 400VR	1

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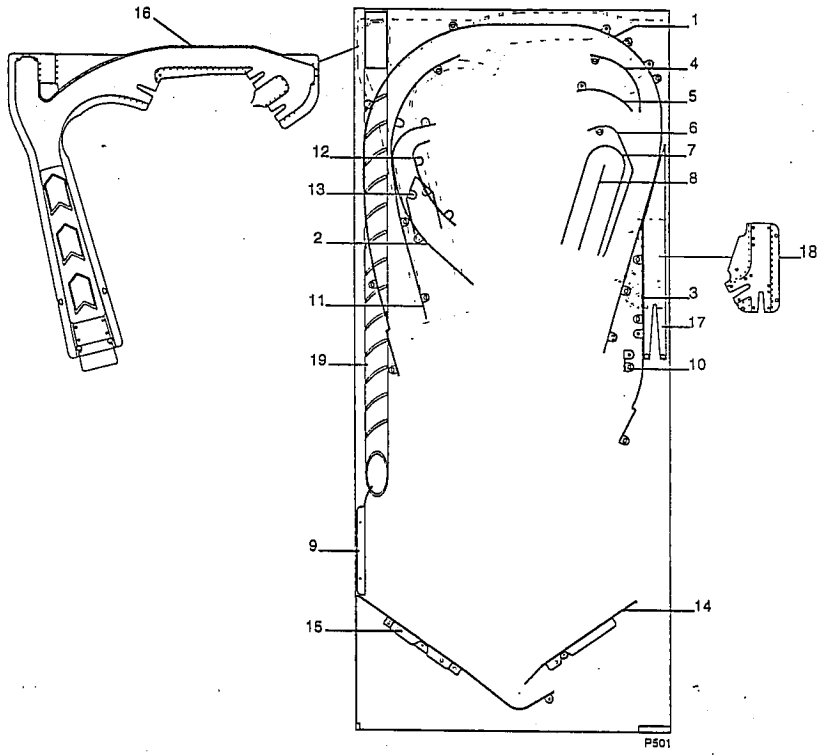
PLAYFIELD RAMPS AND BALL GUIDES



Ref.	Part Number	Description
1	A-00556	ASSEMBLY, BALL GUIDE, UPPER OUTER
2	A-00557	ASSEMBLY, BALL GUIDE, LOWER OUTER
3	A-00558	ASSEMBLY, BALL GUIDE, EJECT
4	A-00559	ASSEMBLY, BALL GUIDE, UPPER INNER
5	A-00560	ASSEMBLY, BALL GUIDE, LOWER OUTER
6	A-00561	ASSEMBLY, BALL GUIDE, LOWER INNER
7	A-00562	ASSEMBLY, BALL GUIDE, CAPTIVE BALL , OUTER
8	A-00563	ASSEMBLY, BALL GUIDE, CAPTIVE BALL, INNER
9	A-00564	ASSEMBLY, BALL GUIDE, KICKBACK
10	A-00565	ASSEMBLY, BALL GUIDE, FLIPPER, UPPER
11	MT00514	BALL GUIDE, UPPER INNER, LEFT
12	MT00516	BALL GUIDE, LOWER INNER, LEFT
13	MT00594	BALL GUIDE, ANTI-BALL TRAP
14	A-00422-R	ASSEMBLY, BALL GUIDE, RIGHT, BOTTOM ARCH
15	A-00422-L	ASSEMBLY, BALL GUIDE, LEFT, BOTTOM ARCH
16	A-00513	ASSEMBLY, RAMP, MAIN
17	A-00608	ASSEMBLY, RAMP, SHOOTER LANE
18	A-00519	ASSEMBLY, RAMP, INTERSECTION
19	A-00582	ASSEMBLY, TUBE, RAMP

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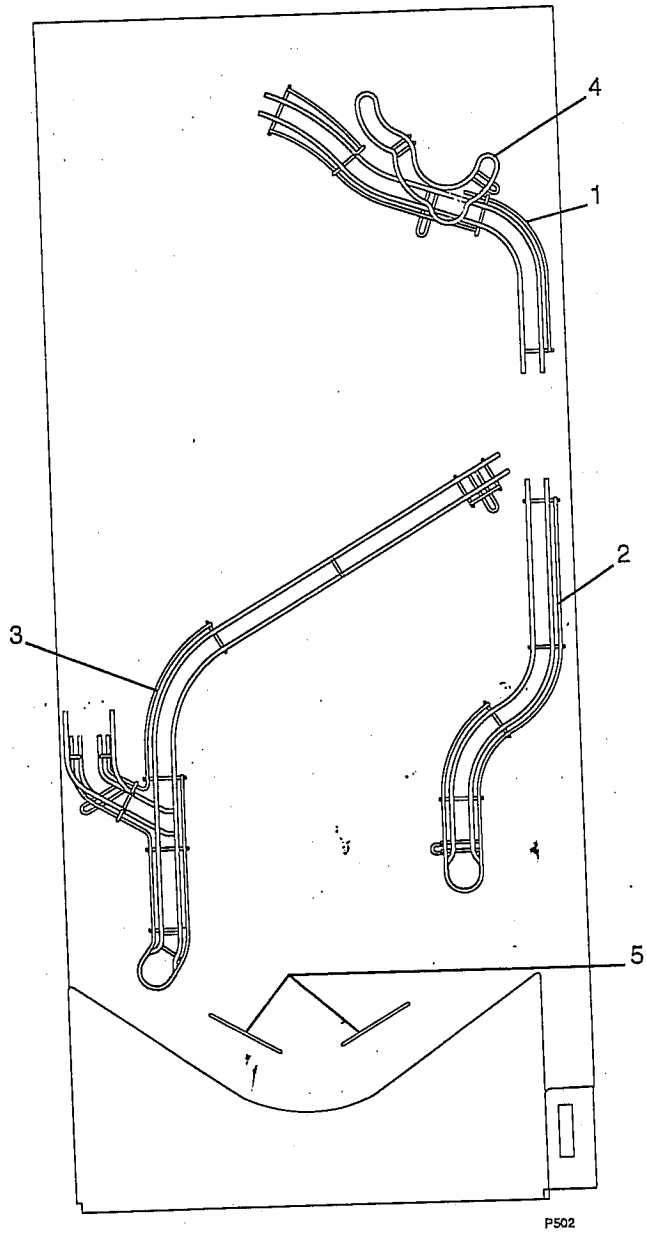
PLAYFIELD WIREFORMS



No.	Part Number	Description
1	WF00136	WIREFORM, RAMP, MAIN
2	WF00140	WIREFORM, RAMP, RIGHT
3	A-00581	ASSEMBLY, WIREFORM, RAMP, LEFT
4	WF00137	WIREFORM, RAMP, CREATURE
5	WF00121	WIREFORM, FLIPPER BAT

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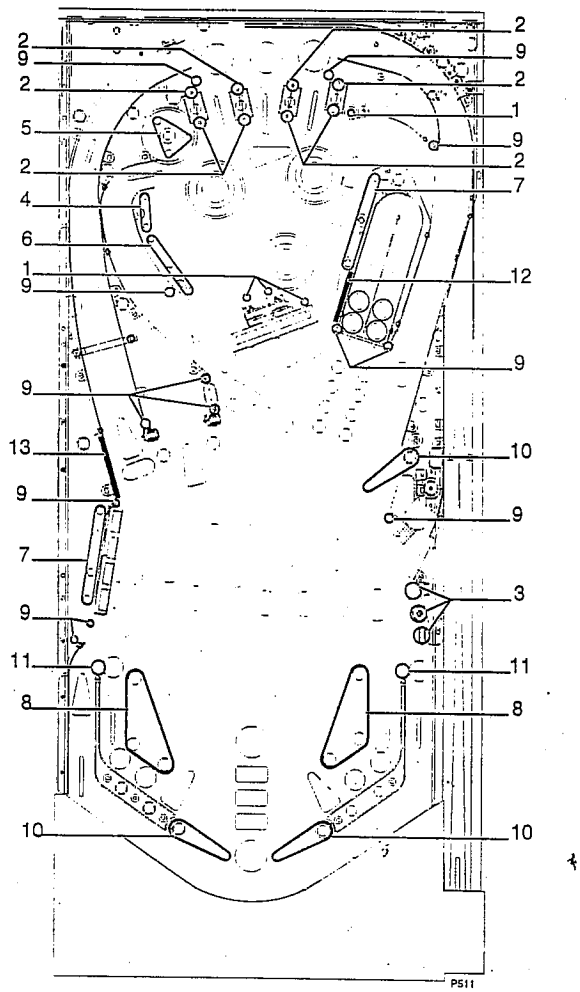
PLAYFIELD RUBBERS



No.	Part Number	Description
1	RB00108-01	RING, RUBBER, 3/16"ID, BLACK
2	RB00108-02	RING, RUBBER, 5/16"ID, BLACK
3	RB00108-04	RING, RUBBER, 7/16"ID, BLACK
4	RB00108-05	RING, RUBBER, 3/4"ID, BLACK
5	RB00108-08	RING, RUBBER, 1-1/2"ID, BLACK
6	RB00108-09	RING, RUBBER, 2.000"ID, BLACK
7	RB00108-10	RING, RUBBER, 2-1/2"ID, BLACK
8	RB00108-11	RING, RUBBER, 2-3/4"ID, BLACK
9	RB00113	BUMPER, 1/4"ID 7/16"ID 1.000"L, BLACK
10	RB00114-BK	RING, RUBBER, 1-1/2"ID 1/2"W, BLACK
11	RB00117-01	BUMPER, MINI POST, 3/8"OD, BLACK
12	RB00124-01	PAD, RUBBER, 2.125 X .750 X .250
13	RB00124-02	PAD, RUBBER, 3.000 X .750 X .250

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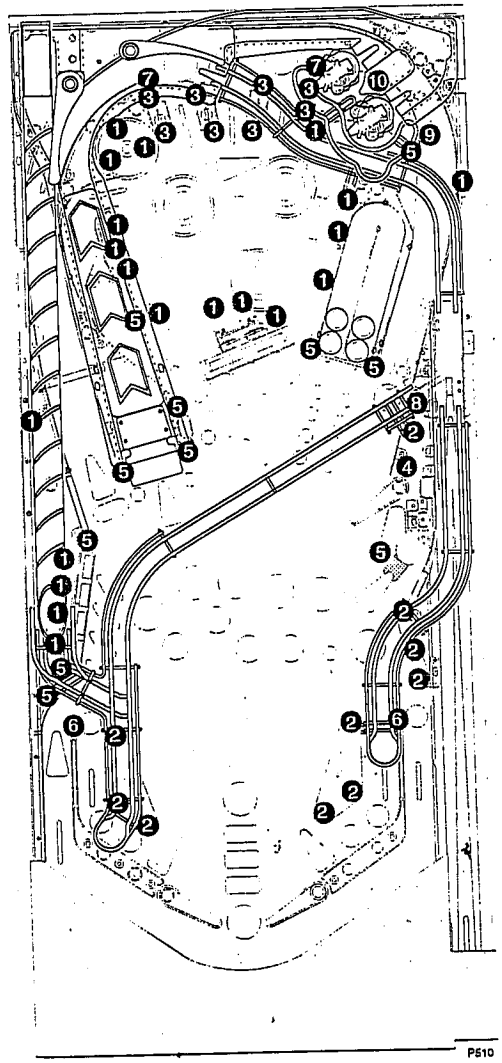
PLAYFIELD POSTS



1

No.	Part Number	Description
1	PL00164-N	POST, SINGLE, 1.000, #8 HOLE, CLEAR
2	PL00197-N	POST, BUMPER, 1.000, FACETED, CLEAR
3	PL00197-PT	POST, BUMPER, 1.000, FACETED, TRANSPARENT PURPLE
4	SM00145-01	POST, BUMPER, 1.000, M-F 1/2 x 1/2
5	SM00145-04	POST, BUMPER, 1.000, M-F, 7/8 X 1/2
6	SM00150-02	POST, BUMPER, MINI, 8/32 x 3/4
7	SM00154-13	STANDOFF, HEX, M-F, 1.125, 1/2 X 1/2
8	SM00236-01	STANDOFF, HEX, M-F, 3.85, 1/2 X 1/2 X 3/8"
9	SM00236-02	STANDOFF, HEX, M-F, 2.66, 1/2 X 1/2 X 3/8"
10	SM00236-03	STANDOFF, HEX, M-F, 5.10, 1/2 X 1/2 X 3/8"

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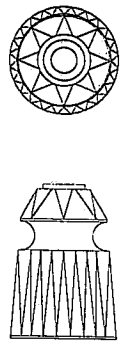
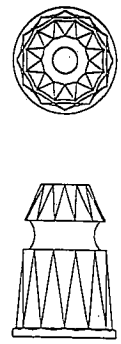
PLAYFIELD POST IDENTIFICATION

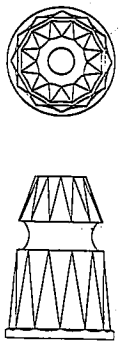
PL00164-COLOR (1.000" H)



PL00172-COLOR (1.000" H)

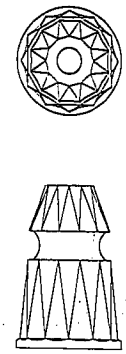


PL00197-COLOR (1.000" H)

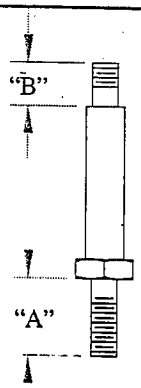


PL00198-COLOR (1.188" H)

PL00200-COLOR (1.000" H)



PL00304-COLOR (1.063" H)



SM00144-		
DASH #	"A"	"B"
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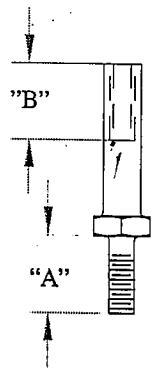
-02	.50	.50



SM00145-		
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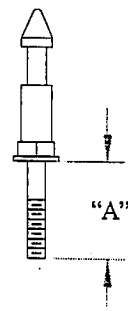
-05	.875	0



SM00150-	
DASH #	"A"
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-02	.75

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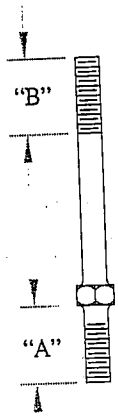
SM00151



SM00152-		
DASH #	"A"	"B"
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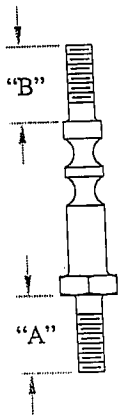
-02	.50	.50
-03	.375	.50
-04	.875	.50
-05	.750	.50



SM00153-		
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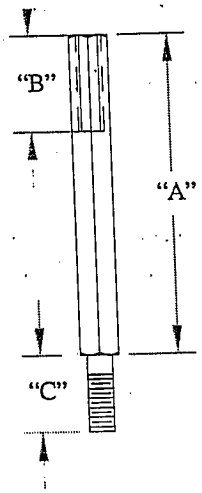
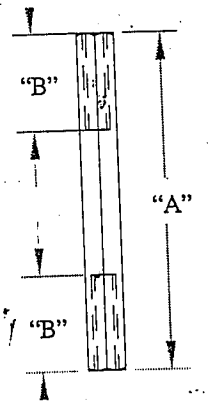


SM00154-			
DASH #	"A"	"B"	"C"
-01	1.36	.50	.50
-02	1.65	.50	.50
-03	5.19	.50	.50
-04	1.82	.50	.50
-05	1.58	.50	.50
-06	1.46	.50	.50
-07	1.36	.50	.625
-08	1.245	.50	.50
-09	3.607	.50	.50
-10	3.93	.50	.50
-11	3.264	.50	.50
-12	1.36	.50	.75



SM00155- (1/4" HEX)		
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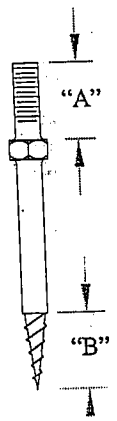
-04	1.06	.38



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-04	.75	.50

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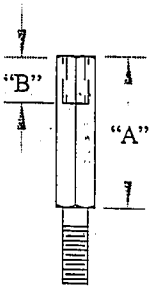

SM00229- (1/4" HEX) (6-32)		
DASH #	"A"	"B"
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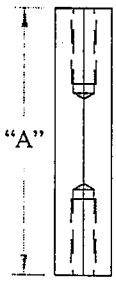
-02	.375	.250
-03	.500	.375
-04	.625	.375
-05	.750	.375
-06	.875	.375
-07	1.00	.375



SM00235- (3/8" HEX)	
DASH #	"A"
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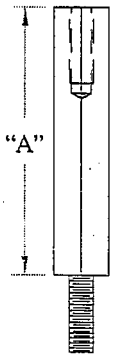
-02	4.94 +.00/-.01
-03	2.68 +.01/-.00
-04	2.62 +.00/-.01
-05	2.50 +.00/-.01



SM00236- (3/8" HEX)	
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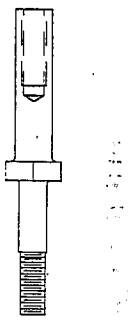
-02	2.66 +.01/-.00



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TROUBLESHOOTING GUIDE

POWER-UP PROBLEMS

SYMPTOM	POSSIBLE CAUSE	PROBABLE SOLUTION
Game Is Completely Dead -No Lights, No Sound, No Pushbuttons, No Display	Main Power Switch not set to ON position.	1. Set Main Power Switch to the ON position. (Switch located under cabinet near right front leg.)
	Broken Plug or Power Cord.	1. Inspect Cord and Plug for defects and repair or replace the entire cord set. 2. Check Plug for loose wires and tighten as required.
	No AC Power.	1. Connect Plug to AC power outlet. 2. Check building circuit breakers or fuses. 3. Check Power Transformer, Line Filter assemblies.
	Main Power Fuse defective.	1. Replace fuse with another of the exact same type. 2. Che .. Power Transformer, Line Filter assemblies. (Fuse located inside cabinet near right front leg.)
	Low Voltage AC Fuse defective.	1. Replace fuse with another of the exact same type. 2. Check Low Voltage DC Power rectifiers. (Fuse located inside backbox on top circuit board.)
	Low Voltage DC Fuse defective.	1. Replace fuse with another of the exact same type. 2. Check Low Voltage DC Voltage Regulator.
	Low Voltage DC Wiring Harness unplugged or damaged.	1. Check Low Voltage DC Wiring Harness Connectors. 2. Test Low Voltage DC Wiring Harness for continuity.
	Game set up for incorrect AC Line Voltage.	1. Check Power Transformer Line Voltage Wiring (Connector located near transformer in cabinet.)
Game Accepts Currency Or Tokens, But Does Not Start.	Acceptor Mechanism not seated fully on its own mounting bracket.	1. Open Coin Door and check each Acceptor by hand to ensure proper mounting. Ensure that each of the release latches is in the closed and locked position. 2. Check for switch activation when known good token or currency is inserted into Acceptor. Adjust switch or carefully bend lever to improve alignment if necessary.
	Faulty or intermittent Coin Door Wiring Harness connections.	1. Open coin door to enter System Menu, then select *Standard Tests* and go to the *Switches* routine. Check each device independently to locate trouble. 2. Look for pinched or cut wires where harness touches moving parts. Repair and reroute wires away from area.
Game Accepts Currency Or Tokens And Gives Players Instructions, But Does Not Produce A Ball To Begin Play.	High Voltage DC Power disabled.	1. Open coin door to enter System Menu, then select *Standard Tests* and go to *Voltage* to look for Check Interlock report. Pull out on switch actuator to reset. (Interlock Switch is located at left side of Coin Door.) 2. Switch damaged or broken. Replace Interlock Switch. (NOTE: The Switch routine will not test this switch!)
	High Voltage AC Fuse defective.	1. Replace fuse with another of the exact same type. 2. Check High Voltage DC Power rectifiers.
	High Voltage DC Fuse defective.	1. Replace fuse with another of the exact same type. 2. Check High Voltage DC Power filter capacitor.
	High Voltage DC Wiring Harness unplugged or damaged.	1. Check all High Voltage DC Power Wiring Connectors. 2. Check High Voltage DC Wiring Harness for continuity.

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COIN DOOR PROBLEMS

SYMPTOM	POSSIBLE CAUSE	PROBABLE SOLUTION
Game Will Not Start When Coins, Bills, Tokens, Etc. Are Inserted Into Acceptors.	Coin Door Wiring Harness unplugged or damaged.	1. Check Coin Door Wiring Harness Connectors. 2. Test Coin Door Wiring Harness for continuity.
	Acceptor Mechanism is jammed.	1. Open Coin Door, unlatch and remove Acceptor Mechanism, inspect and clear currency path as needed. 2. Object in cabinet blocking currency at Cash Box.
	Acceptor not level.	1. Repair or replace Coin Door if bent or damaged. 2. Adjust Game using internal Bubble Level.
	Cash Box filled to maximum capacity.	1. Check Cash Box for presence of counterfeit currency. 2. Remove currency from game more frequently.
	Acceptor Switch defective.	1. Open Coin Door to enter System Menu, then select Standard Tests and go to Switches to look for Dead reports. If manual switch activation does not change the Dead report then there is an electrical problem.
	Acceptor Assembly defective.	1. Clean and lubricate Acceptor Mechanism following specific manufacturer's detailed instructions. 2. Substitute known good Acceptor to verify that problem is not external to Acceptor.
Acceptor Mechanism Rejects Known Good Currency, Tokens, Etc.	Dirt or Debris in Acceptor Mechanism.	1. Open Coin Door, unlatch and remove Acceptor Mechanism, inspect and clear currency path as needed 2. Clean and lubricate Acceptor Mechanism following specific manufacturer's detailed instructions.
	Acceptor Mechanism out of adjustment.	1. Ensure that all removable parts are installed correctly and fully seated against the chassis of the Acceptor. 2. Clean and adjust Acceptor Mechanism following specific manufacturer's detailed instructions.
	Acceptor Mechanism defective.	1. Substitute known good unit to verify that problem is not external to Acceptor. 2. Repair or replace Acceptor assembly.
External Acceptor Indicators (Pricing, Flashing Arrows, Etc.) Not Illuminated.	No DC Power to indicator circuits.	1. Check Coin Door Wiring Connectors. 2. Test Coin Door Wiring Harness for continuity.
	Defective indicator lamp.	1. Go to System Menu and perform Lamp Test. 2. Substitute known good lamp to verify that problem is not external to Acceptor.
Acceptor Takes Known Good Currency But Game Will Not Start Or Continue.	Acceptor Switch out of adjustment.	1. Go to System Menu and perform Switch Test. 2. Clean and adjust Acceptor Switch following specific manufacturer's detailed instructions.
	Acceptor Switch defective.	1. Open Coin Door to enter System Menu, then select Standard Tests and go to Switches to look for Dead reports. If manual switch activation does not change the Dead report then there is an electrical problem. 2. Substitute known good switch to verify that problem is not external to Acceptor.

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DOT MATRIX DISPLAY PROBLEMS

SYMPTOM	POSSIBLE CAUSE	PROBABLE SOLUTION
Game Plays But Message Center (Dot Matrix Display) Is Completely Blank.	System Communication failure.	1. Check Communication Wiring Harness Connectors. 2. Test Communication Wiring Harness for continuity.
	Display Power Harness unplugged or damaged.	1 Check Display Power Wiring Harness Connectors. 2. Test Display Power Wiring Harness for continuity.
	Display Power AC Fuse defective.	1. Replace fuse with another of exact same type. 2. Check Display Power DC rectifiers, decoupling diode. (Fuse located inside backbox on top circuit board.)
	Display Board Assembly defective.	1. Check if any dot matrix display pixels are illuminated. 2. Inspect display glass for cracks, chips, darkened areas.
	Display Power Supply Board Assembly defective.	1. Test Display Power Supply diodes, transformer, caps. 2. Check Display Power Supply Switching Regulator IC.
Game Plays But Part Of Message Center Is Blank Or Illuminated All The Time.	System Communication failure.	1. Check Communication Wiring Harness Connectors. 2. Test Communication Wiring Harness for continuity.
	Display Board Assembly defective.	1. Inspect display glass for cracks, chips, darkened areas. 2. Check soldered connections between glass panel and printed circuit board, and resolder using minimum heat.
Random Patterns On Message Center (Some Images May Be Correct While Others Are Corrupted).	Incorrect Display Program.	1. Game or Image Memory IC installed in wrong order. 2. Music or Voice Memory IC installed on Processor Board Assembly (i.e., right chip, wrong socket). 3. Display or Game Memory IC defective. 4. Custom Control (FPGA) IC defective. 5. Microprocessor (MPU) IC defective.
	Display Board Assembly defective.	1. Open Coin Door to enter System Menu, then select Standard Tests and go to the Display routine. Check each pixel independently to locate trouble.
Checkerboard Pattern On Message Center (Display Never Changes).	No Display Program.	1. Game or Image Memory IC removed from socket. 2. Game or Image Memory IC defective.
Messages Appear Normal, Then Display Locks Up In The Same Place Every Time.	Corrupt Display Program.	1. Bent, broken, shorted pins on Memory IC. 2. Game or Image Memory IC defective.
Message Center Always In Game Menu And Troubleshooting Mode; Will Not Return To Game Play.	Coin Door open.	1. Close and lock Coin Door to go to normal game play.
	Mode Switch defective.	1. Switch Mounting Bracket bent, loose, or missing. 2. Mode Switch Wiring Harness may be faulty.
	Dirty or intermittent Mode circuit connection.	1. Check Mode Switch Wiring Harness Connectors. 2. Check Mode Switch Wiring Harness for continuity.
Game Will Not Retain Audit Information Or Custom Settings When Turned OFF. (An Error Message May Be Displayed).	Memory Back Up Battery or Memory IC defective.	1. Set Main Power Switch to the OFF position for one minute, then restore power to game. If RAM ERROR message appears, replace Processor Board Assembly. NOTE: The battery is integrated onto the Memory IC; it cannot be repaired or replaced separately.

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SOUND PROBLEMS

SYMPTOM	POSSIBLE CAUSE	PROBABLE SOLUTION
Game Plays But No Sound Is Heard At Any Time.	Volume set to zero loudness.	1. Open Coin Door to enter System Menu, then select SET VOLUME from the menu and use Flipper Buttons to adjust the sound to a comfortable loudness.
	Loudspeaker Wiring Harness unplugged or damaged.	1. Check Loudspeaker Wiring Connectors. 2. Test Loudspeaker Wiring Harnesses for continuity.
	Audio Power AC Fuse defective.	1. Replace fuse with another of exact same type. 2. Check Audio Power DC rectifiers. (Fuse located inside backbox on right side circuit board.)
	Faulty Loudspeaker.	1. Test each Loudspeaker for continuity. 2. Check each Loudspeaker for voice coil binding.
	System Communication failure.	1. Check Communication Wiring Harness Connectors. 2. Test Communication Wiring Harness for continuity.
	Sound Board Assembly defective.	1. Verify that the Light Emitting Diodes are functional. 2. Check Spike Protection Diodes, Audio Amplifier IC.
Game Plays But Sound Is Limited To Hum (Low Frequency Buzzing Noise) From All Loudspeakers.	Audio Power AC Fuse defective.	1. Replace fuse with another of exact same type. 2. Check Audio Power DC rectifiers, Filter Capacitors. (Fuse located inside backbox on right side circuit board.)
	Sound Board Assembly defective.	1. Check Audio Amplifier IC.
Weak Or Distorted Sound From One Or Two Loudspeakers.	Faulty Loudspeaker.	1. Check Loudspeakers for torn paper, liquid spills, etc. 2. Inspect speaker boxes for loose screws, dirt or debris
	Dirty or intermittent audio connections.	1. Carefully unplug and reseat each loudspeaker wire. 2. Check Loudspeaker Wiring Harnesses for continuity.
Little Or No High Frequency (Treble), Muffled Or Distant Sound Quality.	Loudspeakers disconnected.	1. Check small Loudspeakers in backbox for operation. 2. Test each small Loudspeaker for continuity. 3. Check Loudspeaker Wiring Harnesses for continuity.
Little Or No Low Frequency (Bass), Weak Or Hollow Sound Quality.	Loudspeakers disconnected or wired out of phase.	1. Check large Loudspeaker in cabinet for operation. 2. Connectors on small Loudspeakers installed in reverse. 3. Check Loudspeaker Wiring Harnesses for continuity.
Unintelligible Voice Messages, Strange Noises, Unrecognizable Music.	Incorrect Sound Program.	1. Music or Voice Memory ICs installed in wrong order. 2. Display or Game Memory ICs installed on audio board. 3. Defective Voice or Music Memory IC.
Continuous Medium Pitch Tone (Middle Frequency).	No Sound Program (1khz Self Test Tone is active).	1. Music or Voice Memory ICs removed from sockets. 2. Defective Music or Voice Memory IC.

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PLAYFIELD PROBLEMS - MECHANICAL

SYMPTOM	PROBABLE CAUSE	PROBABLE SOLUTION
Game Plays But One Or More Balls Continually Stick In One Area Of The Playfield.	Build up of dirt or debris.	1. Clean the playfield to remove any spills or sticky substances. Check for depressions on playfield surface. 2. Replace cracked cabinet glass or other sources of leaks.
	Loose screws cause parts to shift out of alignment.	1. Reposition parts and retighten screws firmly. 2. Apply removable threadlocking adhesive to fasteners.
	Damaged or broken guides, troughs, forms, etc.	1. Cracked or deformed items should be replaced. 2. Broken joints may be brazed or welded as a repair.
	Binding trip lever on position detection switch.	1. Move wiring harness out of lever path. 2. Loosen mounting screws and adjust switch position. 3. Carefully bend trip lever to improve alignment. 4. Repair or replace detection switch.
	Insufficient solenoid force to eject ball from assembly.	1. Clean and lubricate assembly linkages, bearings, etc. 2. Ensure that correct solenoid return spring is installed. 3. Open Coin Door to enter System Menu, then select Standard Tests and go to Sol. Volts to look for Low Voltage report. Check Power Transformer Line Voltage Wiring. (Connector located near transformer in cabinet.) 4. Check playfield angle using a protractor or level.
Game Plays OK But Balls Hit Hard And Bounce Too Much.	Excessive solenoid force.	1. Rubber bumper button damaged or missing from one or more solenoid assemblies. 2. Ensure that correct solenoid return spring is installed. 3. Open Coin Door to enter System Menu, then select Standard Tests and go to Sol. Volts to look for Hi Voltage report. Check Power Transformer Line Voltage Wiring. (Connector located near transformer in cabinet.) 4. Check playfield angle using a protractor or level.
Premature Breakage Of Posts, Targets, Buttons, Or Other Plastic Parts.	Aftermarket replacement parts installed during previous game repair.	1. Use only new *factory* parts and assemblies for repairs. Other parts may fit and function but they will not last. 2. Fasteners tightened excessively, cracking parts during installation. Do not use too much force when tightening.
One Or More Balls Are Missing When The Game Is Started Or In Play	Mechanical part failure or poor alignment (ball dropped in cabinet, stuck somewhere on the playfield, etc.)	1. Game will automatically initiate its own "ball search" by cycling through each solenoid and motor assembly a few times to dislodge a ball stuck on the playfield. 2. After an unsuccessful attempt at freeing a missing ball, the game will resume operation with fewer balls. A game will continue with only one ball.
	Ball removed from game or placed in cabinet during service.	1. Locate missing ball in cabinet and return to playfield. Game will accept ball and return to normal operation. 2. Check your pockets!
Ball Trough Is Inoperative (Jams, Not Able To Eject A Ball For The Shooter, Etc.)	Binding trip lever on position detection switch.	1. Check harness for wires caught in lever path. Relocate wires so they can not get into switch lever path again. 2. Loosen mounting screws and adjust switch position. Carefully bend lever to improve alignment if necessary. 3. Repair or replace detection switch.
	Loose part caught in Ball Trough Assembly.	1. Remove Bottom Arch from playfield to expose the interior of the Ball Trough Assembly. Extract loose part and realign as necessary to restore proper operation. 2. Reinstall Bottom Arch and loose part onto playfield.

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PLAYFIELD PROBLEMS - MECHANICAL (CONT.)

SYMPTOM	PROBABLE CAUSE	POSSIBLE SOLUTION
Tilt Or Slam Switches Are Stuck, Causing Constant Game Tilt	An item in the cabinet is pressing against the switch, causing a false Tilt or Slam indication.	1. Open Coin Door to enter System Menu, then select Standard Tests and go to the Switches routine. Check each device independently to locate trouble. 2. Look for objects that can touch either switch when the Coin Door would be in its closed and locked position.
	Loose part caught in mechanism.	1. Check Tilt Switch Assembly for loose thumbscrew on weight or hookwire separated from hanger bracket. 2. Make sure that playfield bottom assemblies do not contact either switch. Realign and tighten fasteners.

PLAYFIELD PROBLEMS - SOLENOIDS & MOTORS

SYMPTOM	PROBABLE CAUSE	POSSIBLE SOLUTION
Solenoids Firing Randomly, Sometimes Two At One Time.	Faulty or intermittent solenoid connections.	1. Open coin door to enter System Menu, then select Standard Tests and go to the Solenoids routine. Check each device independently to locate trouble. 2. Look for pinched or cut wires where harness touches moving parts. Repair and reroute wires away from area. 3. Damaged or missing diodes on solenoid coils. 4. Test Communication Wiring Harness for continuity.
	Driver Board Assembly defective.	1. Damaged or missing diodes on Driver Board Assembly. Repair or replace Driver Board Assembly.
Motors Running Too Long Or Not Long Enough When Game Assembly Is Active.	Limit Switches not activated at the correct time.	1. Check motorized assembly for dirt and debris blocking motion. Clean and lubricate linkages, bearings, etc. 2. Open coin door to enter System Menu, then select Feature Tests and go to the Wand or Stage routine. Check each device independently to locate trouble. 3. Carefully bend trip lever to improve alignment.
	Gearmotor Assembly defective.	1. Gears worn or teeth broken. Replace entire assembly.
Flippers Respond Too Slowly Or Do Not Reset Quickly.	Flipper Assembly binding or defective.	1. Clean and lubricate assembly linkages, bearings, etc. 2. Ensure that correct solenoid return spring is installed. 3. Open coin door to enter System Menu, then select Standard Tests and go to the Solenoids routine. Check each device independently to locate trouble.
None Of The Solenoids Work.	High Voltage DC Power disabled.	1. Open coin door to enter System Menu, then select Standard Tests and go to Voltage to look for Check Interlock report. Pull out on switch actuator to reset. (Interlock Switch is located at left side of Coin Door.) 2. Switch damaged or broken. Replace Interlock Switch. (NOTE: The Switch routine will not test this switch!)
	High Voltage AC Fuse defective.	1. Replace fuse with another of the exact same type. 2. Check High Voltage DC Power rectifiers.
	High Voltage DC Fuse defective.	1. Replace fuse with another of the exact same type. 2. Check High Voltage DC Power filter capacitor.
	High Voltage DC Wiring Harness unplugged or damaged.	1. Check all High Voltage DC Power Wiring Connectors. 2. Check High Voltage DC Wiring Harness for continuity.

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PLAYFIELD PROBLEMS - SOLENOIDS & MOTORS (CONT.)

SYMPTOM	PROBABLE CAUSE	POSSIBLE SOLUTION
None Of The Solenoids Work.	System Communication failure.	1. Check Communication Wiring Harness Connectors. 2. Test Communication Wiring Harness for continuity.
	Driver Board Assembly defective.	1. Check Low Voltage DC Power filter capacitor and coil.
Game Plays But A Small Group Of Solenoids Do Not Operate.	Solenoid Assembly Wiring Harness unplugged or damaged.	1. Check Solenoid Assembly Wiring Harness Connectors. 2. Test Solenoid Assembly Wiring Harnesses for continuity.
	System Communication failure.	1. Check Communication Wiring Harness Connectors. 2. Test Communication Wiring Harness for continuity.
One Or More Solenoids, Lamps, Or Motors Is Always On When Main Power Is ON.	Cross connection between two DC Voltage sources.	1. Look for pinched or cut wires where harness touches moving parts. Repair and reroute wires away from area.
	Driver Board Assembly defective.	1. Check Smart Solid State Relays (Power IC devices).
Solenoids Or Motors Repeatedly Burn Out.	System Communication failure.	1. Check Communication Wiring Harness Connectors. 2. Test Communication Wiring Harness for continuity.

PLAYFIELD PROBLEMS - SWITCHES

SYMPTOM	PROBABLE CAUSE	POSSIBLE SOLUTION
Premature Failure Of A Few Switches, Causing Irregular Scoring Or Inability To Complete All Steps In Game.	Excessive solenoid force.	1. Use only new factory parts and assemblies for repairs. Other parts may fit and function but they will not last. 2. Fasteners tightened excessively, cracking parts during installation. Do not use too much force when tightening. 3. Open Coin Door to enter System Menu, then select Standard Tests and go to Sol. Volts to look for Hi Voltage report. Check Power Transformer Line Voltage Wiring. (Connector located near transformer in cabinet.) 4. Check playfield angle using built-in bubble level.
Switches Firing Randomly, Sometimes Two At One Time.	Faulty or intermittent switch connections.	1. Open coin door to enter System Menu, then select Standard Tests and go to the Switches routine. Check each device independently to locate trouble. 2. Look for pinched or cut wires where harness touches moving parts. Repair and reroute wires away from area. 3. Test Communication Wiring Harness for continuity.
Too Many Or Not Enough Tilt Or Slam Detections.	Incorrect switch adjustment.	1. Slam Switch caught on clothing or cash box and bent. Refer to Slam Switch Sensitivity Adjustment instructions. 2. Tilt Switch caught on wiring or aligned incorrectly. Refer to Tilt Switch Sensitivity Adjustment instructions.
A Standard Switch Has Not Been Activated In Several Games.	Players are concentrating on other shots or not skilled enough to activate switch.	1. Open Coin Door to enter System Menu, then select Standard Tests and go to Switches to look for Dead reports. If manual switch activation changes the report to OK then players are the cause of this condition.
	Switch defective.	1. Open Coin Door to enter System Menu, then select Standard Tests and go to Switches to look for Dead reports. If manual switch activation does not change the Dead report then there is an electrical problem.

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PLAYFIELD PROBLEMS - SWITCHES (CONT.)

SYMPTOM	PROBABLE CAUSE	POSSIBLE SOLUTION
An Optical Switch Has Not Been Activated In Several Games.	External light leakage is enough to prevent normal activation of switch.	1. Open Coin Door to enter System Menu, then select Standard Tests and go to Switches to look for Dead reports. If manual switch path blockage changes the report to OK then leakage is the cause of this condition. 2. Check for missing light shields or misalignment.
	Switch defective.	1. Open Coin Door to enter System Menu, then select Standard Tests and go to Switches to look for Dead reports. If manual switch activation does not change the Dead report then there is an electrical problem. 2. Ensure that Optodetector Board Assembly is oriented properly
	Faulty or intermittent switch connections.	1. Open Coin Door to enter System Menu, then select Standard Tests and go to the Switches routine. Check each device independently to locate trouble. 2. Look for pinched or cut wires where harness touches moving parts. Repair or reroute wires away from area.
None Of The Switches Work.	Low Voltage DC Wiring Harness unplugged or damaged.	1. Check Low Voltage DC Power Wiring Connectors. 2. Test Low Voltage DC Wiring Harness for continuity.
	System Communication failure.	1. Check Communication Wiring Harness Connectors. 2. Test Communication Wiring Harness for continuity.
	Switch Board Assembly defective.	1. Check Low Voltage DC Power filter capacitor and coil. 2. Repair or replace Switch Board Assembly.
System Menu Is Not Displayed When Opening Coin Door.	Cabinet Switch Wiring Harness unplugged or damaged.	1. Check Cabinet Switch Wiring Harness Connectors. 2. Test Cabinet Switch Wiring Harness for continuity.
	Switch defective.	1. Temporarily jumper switch to get into System Menu. 2. Test System Menu Switch for continuity.
	Processor Board Assembly defective.	1. Check signal diodes for rectification and leakage.

PLAYFIELD & BACKBOX PROBLEMS - ILLUMINATION

SYMPTOM	PROBABLE CAUSE	POSSIBLE SOLUTION
Premature Burn Out Of Many Lamps (Bulbs May Or May Not Appear Excessively Bright).	Higher than normal line voltage or excessive temperature stresses bulbs.	1. Open coin door to enter System Menu, then select Standard Tests and go to Sol. Volts to look for Hi Line report. Check Power Transformer Line Voltage Wiring. (Connector located near transformer in cabinet.) 2. Move game away from sources of heat such as heat registers and high intensity lighting. Ensure that air flows freely around cabinet and backbox ventilation holes.
	Incorrect bulbs used as a replacement during a previous game repair.	1. Use only new factory parts and assemblies for repairs. Other parts may fit and function but they will not last.

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PLAYFIELD & BACKBOX PROBLEMS - ILLUMINATION (CONT.)

SYMPTOM	PROBABLE CAUSE	POSSIBLE SOLUTION
Lamps Firing Randomly, Sometimes Two At One Time.	Faulty or intermittent lamp connections.	1. Open coin door to enter System Menu, then select Standard Tests and go to the Lamps routine. Check each device independently to locate trouble. NOTE: Some lamps are wired in pairs; refer to Lamp Matrix charts. 2. Look for pinched or cut wires where harness touches moving parts. Repair and reroute wires away from area. 3. Damaged or missing diodes on lamp sockets. 4. Test Communication Wiring Harness for continuity.
	Driver Board Assembly defective.	1. Damaged or missing diodes on Driver Board Assembly. Repair or replace Driver Board Assembly.
	Medium Voltage DC Wiring Harness unplugged or damaged.	1. Check Medium Voltage DC Wiring Harness Connectors. 2. Test Medium Voltage DC Wiring Harness for continuity.
Game Plays But About Half Of The Lamps Are Not Illuminated.	Medium Voltage AC Fuse defective.	1. Replace fuse with another of the exact same type. 2. Check Medium Voltage DC Power rectifiers.
	Medium Voltage DC Fuse defective.	1. Replace fuse with another of the exact same type. 2. Check Medium Voltage DC Power filter capacitor.
Game Plays But A Small Group Of Lamps Are Not Illuminated.	Lamp Matrix Row or Column Wiring Harness unplugged or damaged.	1. Check Lamp Matrix Wiring Harness Connectors. 2. Test Lamp Matrix Wiring Harnesses for continuity.
	System Communication failure.	1. Check Communication Wiring Harness Connectors. 2. Test Communication Wiring Harness for continuity.
Game Plays But A Small Group Of Lamps Are Constantly Illuminated.	One Lamp Matrix Row or Column stuck ON (continuously powered).	1. Look for pinched or cut wires where harness touches moving parts. Repair and reroute wires away from area.
	Driver Board Assembly defective.	1. Check Smart Solid State Relays (Power IC devices). 2. Check Field Effect Transistors (Power Transistors).
One Or More Lamps Very Dim But Still Illuminated.	Incorrect bulbs used as a replacement during a previous game repair.	1. Use only new factory parts and assemblies for repairs. Other parts may fit and function but they will not last.
	Blackened glass, weak or old bulb filament, etc.	1. Replace bulb with another of the exact same type. 2. Test lamp diode for rectification and leakage.
Several Lamps Illuminate When Only One Or Two Should Be On ("Phantom" Effect).	Lamp Matrix defective.	1. Open coin door to enter System Menu, then select Standard Tests and go to Lamps routine. Check each device independently to locate trouble. 2. Test lamp diode for rectification and leakage.
	Lamp Wiring Harness damaged.	1. Look for pinched or cut wires where harness touches moving parts. Repair and reroute wires away from area.
One Or More Large Lamps ("Flashers") Are Constantly Illuminated.	Lamp Wiring Harness damaged.	1. Look for pinched or cut wires where harness touches moving parts. Repair and reroute wires away from area.
	Driver Board Assembly defective.	1. Check Field Effect Transistors (Power Transistors). 2. Test lamp diode for rectification and leakage.

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NOTES

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LAMP MATRIX "A"

	Column 1 J6/7.1 YEL/BRN	Column 2 J6/7.2 YEL/RED	Column 3 J6/7.3 YEL/ORG	Column 4 J6/7.4 YEL/BLK	Column 5 J6/7.5 YEL/GRN	Column 6 J6/7.7 YEL/BLU	Column 7 J6/7.8 YEL/VIO	Column 8 J6/7.9 YEL/GRY
Row 1 J1/2.1 RED/BRN	(0) Coin 1 Coin 3	(8) 4-Bank GI 1	(16) U.R. Flipper GI 1	(24) Tube GI 1	(32) Hoot GI 1	(40) Right Orbit Chase 1	(48) Rollover "B"	(56) (electro) Ramp 1 Electro
Row 2 J1/2.2 RED/BLK	(1) Coin 2 Coin 4	(9) 4-Bank GI 2	(17) Eject Hole GI 1	(25) Tube GI 2	(33) Hoot GI 2	(41) Right Orbit Chase 2	(49) Rollover "A"	(57) (electro) Ramp 2 Electro
Row 3 J1/2.3 RED/ORG	(2) Start Button	(10) 4-Bank GI 3	(18) Spaceship GI 1	(26) Tube GI 3	(34) Hoot GI 3	(42) Right Orbit Chase 3	(50) Rollover "R"	(58) (electro) Ramp 3 Electro
Row 4 J1/2.5 RED/YEL	(3)	(11) L. Slingshot GI 1	(19) Spaceship GI 2	(27) Tube GI 4	(35) Hoot GI 4	(43) Alien Lock Left	(51) Tube Sign X-Ball	(59) (electro)
Row 5 J1/2.6 RED/GRN	(4)	(12) L. Flipper GI 1	(20) R. Slingshot GI 1	(28) Tube GI 5	(36) Alien GI 1	(44) Alien Lock Right	(52) Tube Sign 10 Million	(60) (electro)
Row 6 J1/2.7 RED/BLU	(5)	(13) L. Flipper GI 2	(21) R. Slingshot GI 2	(29) Left Orbit Chase 1	(37) Alien GI 2	(45)	(53) Tube Sign Jackpot	(61) (electro)
Row 7 J1/2.8 RED/VIO	(6)	(14)	(22) R. Flipper GI 1	(30) Left Orbit Chase 2	(38) Alien GI 3	(46)	(54)	(62) (electro)
Row 8 J1/2.9 RED/GRY	(7)	(15)	(23) R. Flipper GI 2	(31) Left Orbit Chase 3	(39) Captive GI 1	(47)	(55)	(63) (electro)

LAMP MATRIX "B"

	Column 1 J9/10.1 BLU/BRN	Column 2 J9/10.2 BLU/RED	Column 3 J9/10.3 BLU/ORG	Column 4 J9/10.4 BLU/BLK	Column 5 J9/10.5 BLU/GRN	Column 6 J9/10.6 BLU/BLK	Column 7 J9/10.8 BLU/VIO	Column 8 J9/10.9 BLU/GRY
Row 1 J4/5.1 ORG/BRN	(64) Bonus 2x	(72) Mode: Babescanner	(80) Shoot: Left Orbit	(88) Mode: Cosmic Dartz	(96) Ramp Jackpot	(104) Captive: Left 4	(112) 3-Bank Uranus	(120) Shoot: Undergnd 2
Row 2 J4/5.2 ORG/RED	(65) Bonus 3x	(73) Mode: Waitress	(81) Shoot: Babescanner	(89) Mode: Tour de Bar	(97) Ramp Standup Left	(105) Captive: Left 3	(113) 3-Bank Neptune	(121) Star Bumper Left
Row 3 J4/5.4 ORG/BLK	(66) Mode: Underground	(74) Shoot: Cosmic Dartz	(82) 4-Bank Mars	(90) Mode: Mosh	(98) Ramp Standup R.	(106) Captive: Left 2	(114) 3-Bank Pluto	(122) Star Bumper Middle
Row 4 J4/5.5 ORG/YEL	(67) Mode: Big Bang	(75) Special (Outlane R.)	(83) 4-Bank Pythos	(91) Mode: Happy Hour	(99) Ramp Standup Side	(107) Captive: Left 1	(115) Shoot: Right Orbit	(123) Star Bumper Right
Row 5 J4/5.6 ORG/GRN	(68) Mode: Bar Brawl	(76) Inlane Right	(84) 4-Bank Venus	(92) Mode: Extra Ball	(100) Double Jackpot	(108) Captive: Right 4	(116) DJ Eyes GI	(124) Dance Floor
Row 6 J4/5.7 ORG/BLU	(69) Mode: Ball Busters	(77) Bonus 5x	(85) 4-Bank Mercury	(93) Mode: Get Lucky	(101) Shoot: Tour de Bar	(109) Captive: Right 3	(117) Shoot: Lunapalooza	(125) Shoot: Extra Ball
Row 7 J4/5.8 ORG/VIO	(70) Mode: Looped	(78) Bonus 4x	(86) Free Shot (Outlane L.)	(94) Mode: Lunapalooza	(102) Shoot: Undergnd 1	(110) Captive: Right 2	(118) Island: Lock Ready	(126) Shoot: Big Bang
Row 8 J4/5.9 ORG/GRY	(71) Shoot Again	(79) Mode: Tube Dancer	(87) Inlane Left	(95)	(103) Qualify Mode	(111) Captive: Right 1	(119) Island: Mode Ready	(127) Captive: Sign

Cabinet | Playfield

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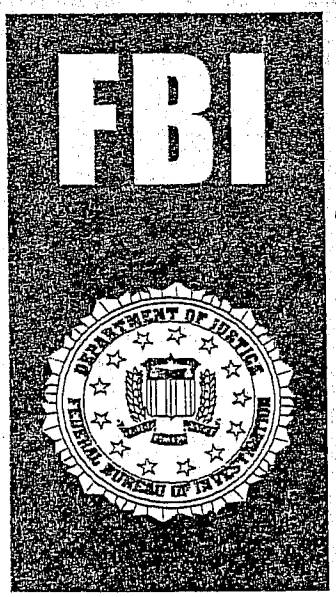

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CAPCOM® COIN-OP, INC.
3311 N. Kennicott Avenue
Arlington Heights, Illinois 60004
Phone: (847) 797-6100
Fax: (847) 797-6306

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