Bally MIDWAY T.M.

GAME No. 0391
Form No. 0391-00300-0000



Bally MIDWAY MFG. CO. T.M.

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THIS GAME MUST BE GROUNDED. FAILURE TO DO SO MAY RESULT IN DESTRUCTION TO ELECTRONIC COMPONENTS.

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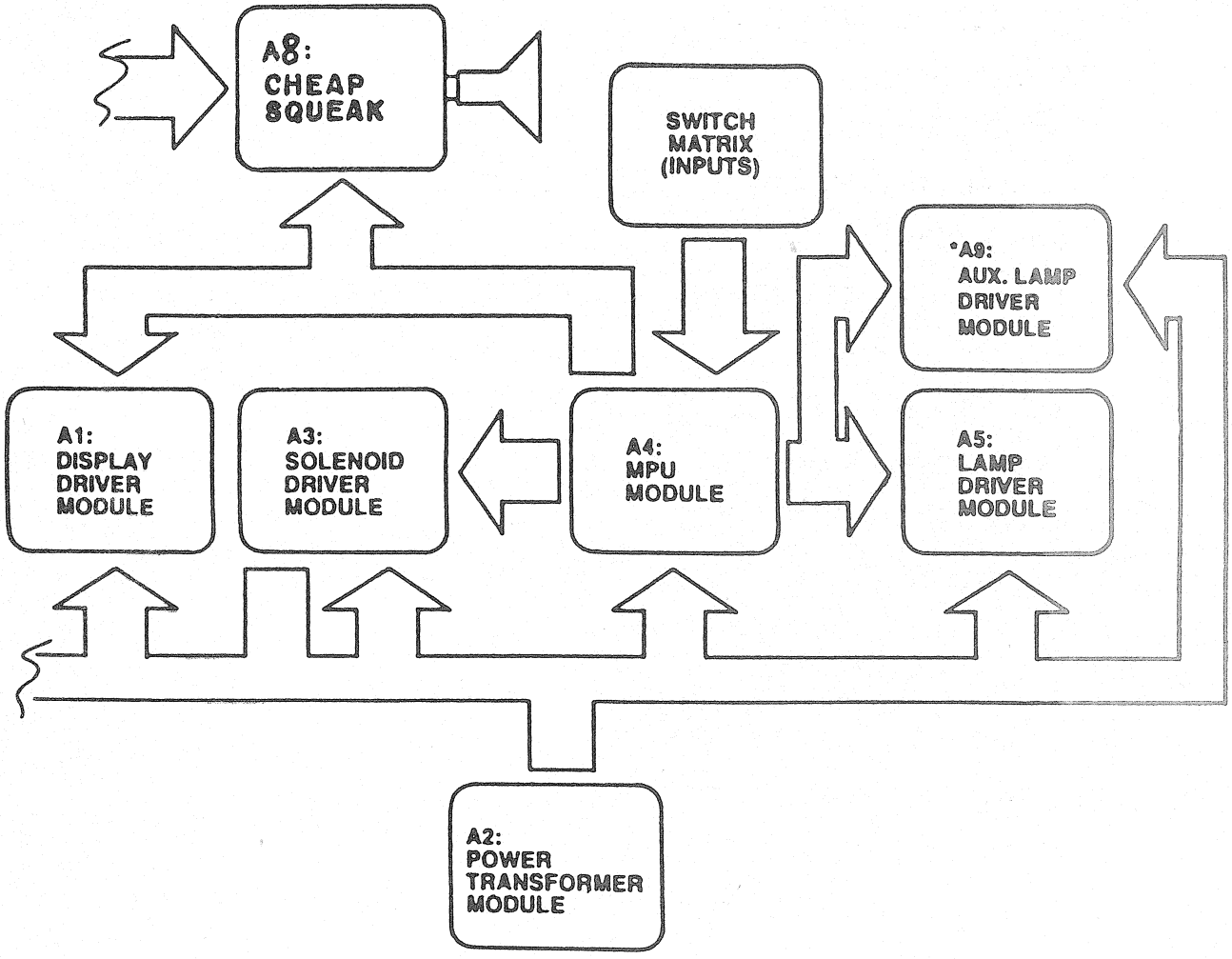
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Installation and General Game Operation Instructions

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BLOCK DIAGRAM—ELECTRONIC PINBALL GAME



I. INSTALLATION

Assemble the game as follows:

Bolt legs to cabinet. Bolt back box to cabinet. Use flat washers under bolt heads. Gently feed cable connectors and ground braid through cable port in back box. Screw ground braid to braid in back box. Carefully and fully insert connectors on printed circuit assemblies.

On all games there are certain items that should be checked after shipment. These are visual inspections which may avoid time consuming service work later. Minor troubles caused by abusive handling in shipment are unavoidable. Cable connectors may be loosened, switches (especially tilt switches) may go out of adjustment. Plumb bob tilt switch should always be adjusted after game is set on location and leg levelers are adjusted.

Visual inspections before plugging in line cord:

1. Check that all cable connectors are completely seated on printed circuit assemblies.
2. Check that cables are clear of all moving parts.
3. Check for any wires that may have become disconnected.
4. Check switches for loose solder or other foreign material that may have come loose in shipment and could cause shorting of contacts.
5. Check wires on coils for proper soldering. Cold solder connections may not show up in factory inspection, but vibration in shipment may break contact.
6. Check that fuses are firmly seated and making good contact.
7. Check the transformer for any foreign material shorting across wiring lugs.
8. Check wiring of transformer to correspond to location voltage. See figure 1.

Check adjustment of the three (normally open) tilt switches:

1. Panel tilt on bottom of playfield panel.
2. Plumb bob tilt on left side of cabinet near front door.
3. Ball tilt above plumb bob tilt. Insert the smaller ball (15/16" dia.) into the ball tilt assembly, and adjust the bracket so the ball will roll free to contact the switch blade, if front of cabinet is raised.

TRANSFORMER CONNECTION INSTRUCTIONS

REFER TO POWER SUPPLY SCHEMATIC IN GAME MANUAL FOR TABLE "A"

115 VAC, 2-8, 3-6, 7-10
120 VAC, 2-8, 4-6, 7-11
220 VAC, 4-8, 7-9
240 VAC, 4-8, 7-11

PART OF POWER–TRANSFORMER MODULE A2, LOCATED IN LOWER CABINET

II. GENERAL GAME OPERATION

Place ball into playfield by outhole.

Coin game. Coin should be rejected. Plug in line cord. Move power ON-OFF master switch at bottom right front corner of cabinet to 'ON' position. The game will play a power-up tune to announce game-readiness. Drop targets are reset, scores are set to zero, alternating with the 'High Score to Date,' and the game is ready for play. Coin game. The game should accept the coin and post credits* for coins accepted (adjustable). Pressing the credit button on the door will cause the outhole kicker to serve the ball to the shooter alley. The 1st player-up lite is lit. A game-up tune* is played to announce play-readiness.

One player is posted each additional time the credit button is pressed (one to four can play). The credits are reduced by one each time the credit button is pressed until the credits are reduced to zero.

Shooting the ball initiates play.

The game awards all points earned by the player. If spinner is turning and scoring when the ball hits a target, the spinner and the target scores are awarded.

When the ball enters the outhole, the bonus score is added to the total score. The player-up and/or ball in play on the back box is advanced one position. The outhole kicker serves the ball to the shooter alley and play is resumed. This continues until each player has played the allowable number of balls per game (adjustable). At this time the 'Game Over' light is lit. A random Match* number appears and the 'Match' light is lit. If the number is the same as the last two digits in a player's score, a free game is awarded.

Extra balls won during the course of the game are played immediately after the player's regular ball enters the outhole. The player-up and/or ball in play on the back box are not advanced for extra ball play. Bonus score is added to the player's score before the game serves the extra ball for play.

Scoring over 10,000,000 gives "High Score to Date" award.
At the end of the game, a 'High Score to Date' is alternately flashed with all 4 player scores. If the 'High Score to Date' is beat, this feature* awards free games.

Tilting the game results in loss of a ball. The flippers, thumper-bumpers, etc., go 'dead.' Bonus points are not scored. The purpose of the tilt penalty is to discourage the player from jostling the machine in an attempt to prolong play. Game action becomes normal after the ball kicker assembly serves the ball to the shooter alley.

Slamming the machine results in loss of the game. All feature lights go out, the game goes 'dead,' and a time delay occurs. The purpose of the time delay is to discourage unnecessary abuse of the machine. After the delay, the 'Game Over' light lites and the power-up tune is played. The time delay occurs anytime one of the slam switches is made to contact. There are two factory installed slam switches, on the front door, and one on left side of cabinet. (Any number of slam switches could be installed by the operator, to meet his individual requirement.) The switch should be adjusted to have approximately 1/16" gap between the contacts. The weighted blade should be adjusted to attain the desired sensitivity. Decreasing the gap between contacts will make the switch more sensitive. Opening the gap will reduce sensitivity.

*Some tunes and features can be disabled by operator if so desired. See Back Box Adjustments.

NOTE: Scoring and feature units will differ from game to game.

III. BOOKKEEPING FUNCTIONS

The game is designed to help the operator perform certain accounting functions. The game can display the number of total plays and replays (free games). It can display the number of coins dropped down each coin chute. The bookkeeping functions are displayed on all player score displays simultaneously. An identification number, 05 to 15, appears on the Match/Ball in Play window as follows:

05—	00 to—	40	= Current Credits
*06—	10000 to—	99999	= Total Plays (Payed & Free Games)
*07—	10000 to—	99999	= Total Replays (Free Games)
08—	00 to—	99999	= Game Percentage
09—	00 to—	99999	= Total times 'High Score to Date' is beat
*10—	10000 to—	99999	= Coins Dropped thru Coin Chute #1
*11—	10000 to—	99999	= Coins Dropped thru Coin Chute #2**
*12—	10000 to—	99999	= Coins Dropped thru Coin Chute #3**
*13—	00 to—	99999	= Number of Specials awarded from Panel Specials Only
*14—	00 to—	99999	= Number of minutes of Game Play
*15—	00 to—	99999	= Number of Service Credits

The game displays the first bookkeeping entry if the Self-Test button (See Fig. III) on the inside of the front door is pressed ten times. Alternately push and release the Self-Test button at one second intervals. The number 05 appears in the 'Match/Ball in Play' window. Current credits appear on the player score displays. Each additional press of the button causes the next entry to be displayed.

After the data in each bookkeeping register is recorded, it can be set to zero simply by pressing switch button S33, located on A4, the MPU module in the back box (See Fig. III), or by pressing the Coin Chute #3 switch. Any or all registers can be cleared by alternating between the Self-Test button and the switch button S33 on the MPU module or Coin Chute #3 switch. The operator is given this option as a possible convenience and can elect to use or not use it as his needs direct.

Pressing the button 5 more times causes the game to play the power-up tune and light the Game Over light.

Service credits are designed to allow the serviceman to test the game under actual play conditions without disturbing the bookkeeping records that reside at identification numbers 06, 07, 10, 11 and 12.

To obtain Service Credits, push and release the Self-Test switch until identification number 05 appears in the 'Match/Ball in Play' window. Hold in the Credit button until the desired number of Service Credits (up to five) appears on the player score displays.

NOTE: If, upon accessing identification number 05, a number of credits greater than five is displayed, pressing the credit button has no effect.

Identification number 15 is reserved as a record of the number of Service Credits used.

*The 10,000 level is pre-set at the factory; can be set to zero, initially, if desired.

**If Coin Chute is not used in game, number displayed (if other than 00) on Player Score displays has no significance.

NOTE: If "Total Play" register is reset to zeroes then "Total Replays" register should also be reset to zeroes to maintain the game percentage value.

X'S AND O'S SCORING, FEATURES AND OPERATION

SCORING

1st skill shot made 100,000 pts, 2nd skill shot made 200,000 pts, 3rd skill shot made (1) replay will be awarded. (skill shot switch will score 5,000 points when none of the 3 lites are lit.)

3 drop targets: 5,000 pts each + lit value. Award (1) replay when red lite by the targets is on.

Left arrows lane score 5,000 pts or lit value which is 20,000-40,000-60,000 & Special.

Top X-ball potential lane, scores 5,000 pts every time until 50,000 pts lite is on.

Top Special lane, scores 10,000 pts every time until 100,000 pts lite is on.

3 Bumpers score 1,000 pts each at all times.

3 Left, 3 Right & 3 Center Targets score 1,000 pts 1st time hit & 2,000 pts any time thereafter until the 5,000 pt lite by any sets of 3 targets is lit.

Left & Right outlanes score 500 pts each.

Left return lane scores 5,000 pts all the time. Right return lane scores 1000 pts all the time

All rebound switches will score 30 pts, outhole scores 3 individual bonuses (1) 3 in line bonus 20K, 40K, 60, . . . etc.

(2) completed X's and O's card bonus 90K, 180K, 270K.

(3) 5,000 pts for each lit symbol in card.

Saucer Scores 500 pts or 5000 pts for each lit symbol in card.

SKILL SHOT

Features: when starting the game the skill shot 100,000 pts will be flashing to make the skill shot, ball must travel past the gate but not to go over the runway switch.

Skill shot is on a pre-determined timer which consists of 2 different settings for LIB or CONV (SW #8)

3 top drop targets knocked down any time lites and advances targets and the left top lane values. When the value is at max, the lane and targets Special would lite simultaneously. Knocking down the 3 target or rolling over the left arrows switch when Special is on will award 1 replay and the values will reset and start all over again.

TIC-TAC-TOE Feature:

At the start of the game computer will select either 3X's or O's by the targets and turn one set of them on. Hitting any of the targets will spot the corresponding lite in proper position on the X's and O's Card. The X's and O's lites are alternated by the 2 bottom return lanes and 2 sling shots switches. However, completing any 3 in line of the same vertically in card with X's and O's will turn off the X and O lites by the corresponding target and the 5,000 pt by those targets will illuminate. However, if any 3 of the same kind were made horizontally or diagonally that section or row in card will be locked and cannot be changed by the X's and O's, but the targets will still be alternating and hitting a target with already locked symbol will not change the X or O in the card.

For every 3 of the kind in line made, 20,000 pts would be lit and could increase the 3 in line bonus value up to 380,000 pts (SW option—Recall or reset bonus)

For completion of the card with combination of X's and O's 90,000 1st time, 180,000 2nd, 270,000 3rd (and SPL on 4th will be awarded).

The lite on left of the card comes on, indicating the next 3 in line will turn on the X ball potential. The lite on right of the card comes on indicating the next 3 in line will turn on the SPL lite on top left lane.

However, no recall is required on top X-ball pot or SPL if were not made on previous ball. For the lites on left and right of the card a switch would be necessary to have the X-ball pot to come on with 1 (3) in line or 2 three in line.

Liting the card with all X's or O's will award (1) Replay, if SW #6 is in on position.

BACK BOX TIC-TAC-TOE FEATURE

Whenever all 9 Tic-Tac-Toe lites on backbox are made game will award 2 replays. Backbox Tic-Tac-Toe lites will not reset until all are made.

BACKBOX TIC-TAC-TOE FEATURE

SELF TEST POSITION 20

Tic-Tac-Toe can be set up to start game from no lites to 8 lites.

SPECIAL REPLAY/X-BALL/NOVELTY MODES

Self test positions 16 and 17 give the operator flexibility to award a replay ball or score (Novelty) when a special is scored. A combination of X-Ball, Novelty can be obtained through the following chart.

Self test position 16	Set to "03"	Set to "02"	Set to "01"
Playfield X-Balls and Specials	AWARD	AWARD	AWARD
Skill shot special	REPLAY	X-BALL	50,000
Card special	REPLAY	X-BALL*	50,000
100,000/Special lane special	REPLAY	X-BALL*	50,000
3 drop target special	REPLAY	X-BALL*	50,000
Left lane arrow special	REPLAY	X-BALL*	50,000
50,000/extra ball lane x-ball	X-BALL	X-BALL**	25,000
Self Test Position 17	Set to "03"	Set to "02"	Set to "01"
	AWARD	AWARD	AWARD
Scoring Thresholds	REPLAY	X-BALL	25,000

*50,000 if same player shoot again is lit.
**25,000 if same player shoot again is lit.

V. GAME ADJUSTMENTS

A. Playfield Panel Post Adjustments:

Posts that control left and right outlane opening on panel can be removed to make access to outlanes easier or harder for ball to enter. See Figure II.

Easier entry will decrease playing time and scoring (conservative).
Harder entry will increase playing time and scoring (liberal).

B. Back Box Game Adjustments:

Each game has thirty-two switches located on A4, the MPU module, located in the back box, that allow play to be customized to the location. See Figure III. Credits per coin, maximum credits, credit display, balls per game, match feature, high game feature, special award and melody are selectable by means of the switches. The switches are contained in four-sixteen lead packages numbered S1-8, S9-16, S17-24, and S25-32 for easy identification. The "ON" toggle position is marked on the assembly. **Turn off power before making adjustments.**

Credits/Coin Adjustments:

The credits per coin are selectable by means of S17-S20 for coin chute #2 (Center). The switch settings and resultant credits/coin are as follows:

S20	S19	S18	S17	Credits/Coin
OFF	OFF	OFF	OFF	Same as Coin Chute #1 Settings
OFF	OFF	OFF	ON	1/1 Coin
OFF	OFF	ON	OFF	2/1 Coin
OFF	OFF	ON	ON	3/1 Coin
OFF	ON	OFF	OFF	4/1 Coin
OFF	ON	OFF	ON	5/1 Coin
OFF	ON	ON	OFF	6/1 Coin
OFF	ON	ON	ON	7/1 Coin
ON	OFF	OFF	OFF	8/1 Coin
ON	OFF	OFF	ON	9/1 Coin
ON	OFF	ON	OFF	10/1 Coin
ON	OFF	ON	ON	11/1 Coin
ON	ON	OFF	OFF	12/1 Coin
ON	ON	OFF	ON	13/1 Coin
ON	ON	ON	OFF	14/1 Coin
ON	ON	ON	ON	15/1 Coin

The credits given are selectable by means of switches 1-5 incl., for coin chute #1 and switches 9-13 incl., for coin chute #3. Thirty-one different credit ratios are available for each coin chute. The switch settings and resultant credits/coin are listed below.

CREDITS/COIN ADJUSTMENTS

COIN CHUTE	SWITCHES					CREDITS	CREDITS	CREDITS	CREDITS	CREDITS	TOTAL CREDITS/COINS
#1 (HINGE SIDE)	5	4	3	2	1						
OR #3	13	12	11	10	9						
(RIGHT SIDE)	OFF	OFF	OFF	OFF	OFF	1/1 Coin					
	OFF	OFF	OFF	OFF	ON	2/1 Coin					
	OFF	OFF	OFF	ON	OFF	3/1 Coin					
	OFF	OFF	OFF	ON	ON	4/1 Coin					
	OFF	OFF	ON	OFF	OFF	5/1 Coin					
	OFF	OFF	ON	OFF	ON	6/1 Coin					
	OFF	OFF	ON	ON	OFF	7/1 Coin					
	OFF	OFF	ON	ON	ON	8/1 Coin					
	OFF	ON	OFF	OFF	OFF	9/1 Coin					
	OFF	ON	OFF	OFF	ON	12/1 Coin					
	OFF	ON	OFF	ON	OFF	14/1 Coin					
	OFF	ON	OFF	ON	ON	1/2 Coins*					
	OFF	ON	ON	OFF	OFF	2/2 Coins*					
	OFF	ON	ON	OFF	ON	3/2 Coins*					
	OFF	ON	ON	ON	OFF	4/2 Coins*					
	OFF	ON	ON	ON	ON	5/2 Coins*					
	ON	OFF	OFF	OFF	OFF	6/2 Coins*					
	ON	OFF	OFF	OFF	ON	7/2 Coins*					
	ON	OFF	OFF	ON	OFF	8/2 Coins*					
	ON	OFF	OFF	ON	ON	9/2 Coins*					
	ON	OFF	ON	OFF	OFF	12/2 Coins*					
	ON	OFF	ON	OFF	ON	14/2 Coins*					
	ON	OFF	ON	ON	OFF	1/1st Coin	2/2nd Coin				3/2
	ON	OFF	ON	ON	ON	0/1st Coin*	1/2nd Coin	1/3rd Coin	1/4th Coin		3/4
	ON	ON	OFF	OFF	OFF	0/1st Coin*	1/2nd Coin	0/3rd Coin**	2/4th Coin		3/4
	ON	ON	OFF	OFF	ON	1/1st Coin	1/2nd Coin	1/3rd Coin	2/4th Coin		5/4
	ON	ON	OFF	ON	OFF	1/1st Coin	2/2nd Coin	1/3rd Coin	3/4th Coin		7/4
	ON	ON	OFF	ON	ON	1/1st Coin	2/2nd Coin	2/3rd Coin	2/4th Coin		7/4
	ON	ON	ON	OFF	OFF	0/1st Coin***	0/2nd Coin***	1/3rd Coin			1/3
	ON	ON	ON	OFF	ON	0/1st Coin**	0/2nd Coin**	0/3rd Coin**	1/4th Coin		1/4
	ON	ON	ON	ON	OFF	0/1st Coin****	0/2nd Coin****	0/3rd Coin****	0/4th Coin****	1/5th Coin	1/5
	ON	ON	ON	ON	ON	0/1st Coin***	0/2nd Coin***	1/3rd Coin	0/4th Coin****	1/5th Coin	2/5

*No Credits until 2nd coin is dropped.
**No Credits until 4th coin is dropped.
***No Credits until 3rd coin is dropped.
****No Credits until 5th coin is dropped.

MAXIMUM CREDITS:

The maximum credits accepted by the machine limits the number of games that can be accumulated by coining, by winning replays or both. The maximum number of credits is selectable by means of switches 25 and 26. Four credit limits are available. Switch settings are listed below.

MAXIMUM CREDITS	SWITCHES 26	25
10	OFF	OFF
15	OFF	ON
25	ON	OFF
40	ON	ON

BALLS PER GAME:

# BALLS /GAME	SWITCHES 32	31
5	OFF	ON
4	ON	OFF
3	OFF	OFF
2	ON	ON

MATCH FEATURE:

When the Match Feature is ON, a random number appears on the Match/Ball in Play window and the word Match is illuminated. If the number matches the tens digit in a player's score, a free game is awarded. The Match Feature creates an incentive to play.

MATCH	SWITCH 28
ON	ON
OFF	OFF

CREDIT DISPLAY:

CREDITS DISPLAYED	SWITCH 27
YES	ON
NO	OFF

HIGH SCORE FEATURE:

The game is designed to award an Extra Ball or Free Game at each of the two or three score levels. See Front Door Game Adjustments.

AWARD	SELF TEST POSITION 16	SELF TEST POSITION 17
REPLAY	SET TO "03"	SET TO "03"
EXTRA BALL	SET TO "02"	SET TO "02"
NOVELTY	SET TO "01"	SET TO "01"
NO AWARD	SET TO "00"	SET TO "00"

For combinations of replay/X-ball/Novelty Modes see page 4A "K. Special Replay/X-ball/Novelty Modes"

HIGH SCORE TO DATE OR OVER 10,000,000 SCORE FEATURE:

The game is designed to award free games as an option if high score to date is beat or player exceeds 10,000,000 points. Each time this happens, the winning score becomes the new high score to beat. This score is displayed on all 4 player score displays at the end of each game as an incentive to play. Recommended setting is underlined.

HIGH SCORE TO DATE FEATURE	SELF TEST POSITION 19
No Award	SET TO "00"
One Credit	SET TO "01"
Two Credits	SET TO "02"
Three Credits	SET TO "03"

State and local laws may regulate the use of the above features, and they have been designed to allow for appropriate adjustment in order to conform to such requirements.

#0391 X's & O's

SOUND OPTION

The game is designed to make several tones and noises to announce power-up, game-up, etc. The tones are intended to attract attention to the game and increase game usage. The tones are controlled by pressing Self-Test button until the #18 shows on the match/ball in display. Now pulse replay button to desired sound setting.

Setting "00"
Most switches associated chimes without feature background.

Setting "01"
Playfield switches associated chimes with background.

Setting "02"
Most scoring will have a noise effect without background.

Setting "03"
Most all scoring will have a noise effect with background.

GAME FEATURE OPTIONS:

All X's and O's Replay Adjustment:

Liberal	SW	6	ON	Making all X's or O's on card gives 1 replay.
Conservative	SW	6	OFF	Making all X's or O's on card does not give replay.

Skill Shot Flashing Lite Beep Time Adjustment:

Liberal	SW	7	ON	SW	8	ON	30 beeps on 100,000, 20 beeps on 200,000, 10 beeps on special.
Medium	SW	7	OFF	SW	8	ON	20 beeps on 100,000, 15 beeps on 200,000 10 beeps on special.
Semi-Medium	SW	7	ON	SW	8	OFF	15 beeps on 100,000, 200,000 and special.
Conservative	SW	7	OFF	SW	8	OFF	10 beeps on 100,000, 200,000 and special.

Card Special Lite Adjustment:

Liberal	SW	14	ON	Special will come on with 180K.
Conservative	SW	14	OFF	Special will come on with 270K.

Skill Shot Feature Lite Advance Adjustment:

Liberal	SW	15	ON	16	ON	100,000, 200,000, Special, Special, Special.
Medium	SW	15	OFF	16	ON	100,000, 200,000, Special, 200,000, Special, 200,000.
Semi-Medium	SW	15	ON	16	OFF	100,000, 200,000, Special, 100,000, 200,000, Special.
Conservative	SW	15	OFF	16	OFF	100,000, 200,000, Special, 200,000, 200,000.

Next Extra-Ball Lite Adjustment:

Liberal	SW	21	ON	Making 3 X's or O's in line 2 times lites next extra ball lite.
Conservative	SW	21	OFF	Making 3 X's or O's in line 3 times lites next extra ball lite.

Left Lane Arrow And 3 Drop Target Lite Advance Adjustment:

Liberal	SW	22	ON	23	ON	20, 40, 60, Special. (Arrow Lane) 30, 60, 90, Special. (Drop Targets)
Medium	SW	22	OFF	23	OFF	20, 40, 60, 80, Special 30, 60, 90, 120, Special.
Semi-Medium	SW	22	ON	23	OFF	20, 40, 60, 80, 100, Special. 30, 60, 90, 120, 150, Special.
Conservative	SW	22	OFF	23	OFF	20, 40, 60, 80, 100, 120, Special. 30, 60, 90, 120, 150, 180, Special.

Skill Shot Lane Advancing Left Lane Arrow And 3 Drop Target Lite Adjustment:

Liberal	SW	24	ON	Making skill shot lane advances left lane arrow and 3 drop target lite.
Conservative	SW	24	OFF	Making skill shot lane does not advance left lane arrow and 3 drop target lite.

Number Of Games Replays Per Game Adjustment:

Liberal	SW	29	ON	All replays earned will be collected.
Conservative	SW	29	OFF	Only 1 replay per player per game.

Game Over Attract Adjustment:

	SW	30	ON	Makes sounds when X's and O's card lites are scanning.
	SW	30	OFF	No sounds.

C. FRONT DOOR GAME ADJUSTMENTS

High Score Feature Adjustments:

The game is designed to award an extra ball (option) or a free game at each of three score levels. The recommended levels are on the score card in the game.

Any level from 10,000 to 990,000 can be set, as desired. It is also possible to reset or turn off (00) any or all of the levels, if desired.

1. Push and release Self-Test button (See Figure III) at one second intervals approximately six times or until identification number 01 appears on the 'Match/Ball in Play' display.

2. The number on the Player Score Displays is the score level.* It can be increased, if desired, by holding the credit button in. To decrease the score level, hold the credit button in and depress and release the Self-Test button. Release the credit button when the desired number appears. Note that the level changes 10,000 points at a time. If the number '00' is left on the displays, the high score feature is eliminated for that level.

3. Repeat steps 1 and 2 for the second and third score levels. The identification numbers '02' and '03' on the Match/Ball in Play display are for the second and third levels, respectively.

High Score to Date and 10,000,000 Feature:

The game is designed to award free games when 'High Score to Date' is beat, or if the player exceeds 10,000,000 points.

It is recommended that the level, which will build with play, be periodically reset to the factory recommended level to encourage game play. The adjustment procedure is the same as for the High Score Feature Adjustment, Steps 1 and 2. Continue pushing the Self-Test button until the identification number '04' appears on the 'Match/Ball in Play' display and then do Step 2.

Any level from '00' to 9,990,000 can be set as described. It is to be noted that '00' does NOT turn off the feature, as it does on High Score feature. The feature is turned off by self test position 19 as discussed under Back Box Game Adjustments.'

SELF TEST SETUP FOR 16-20:

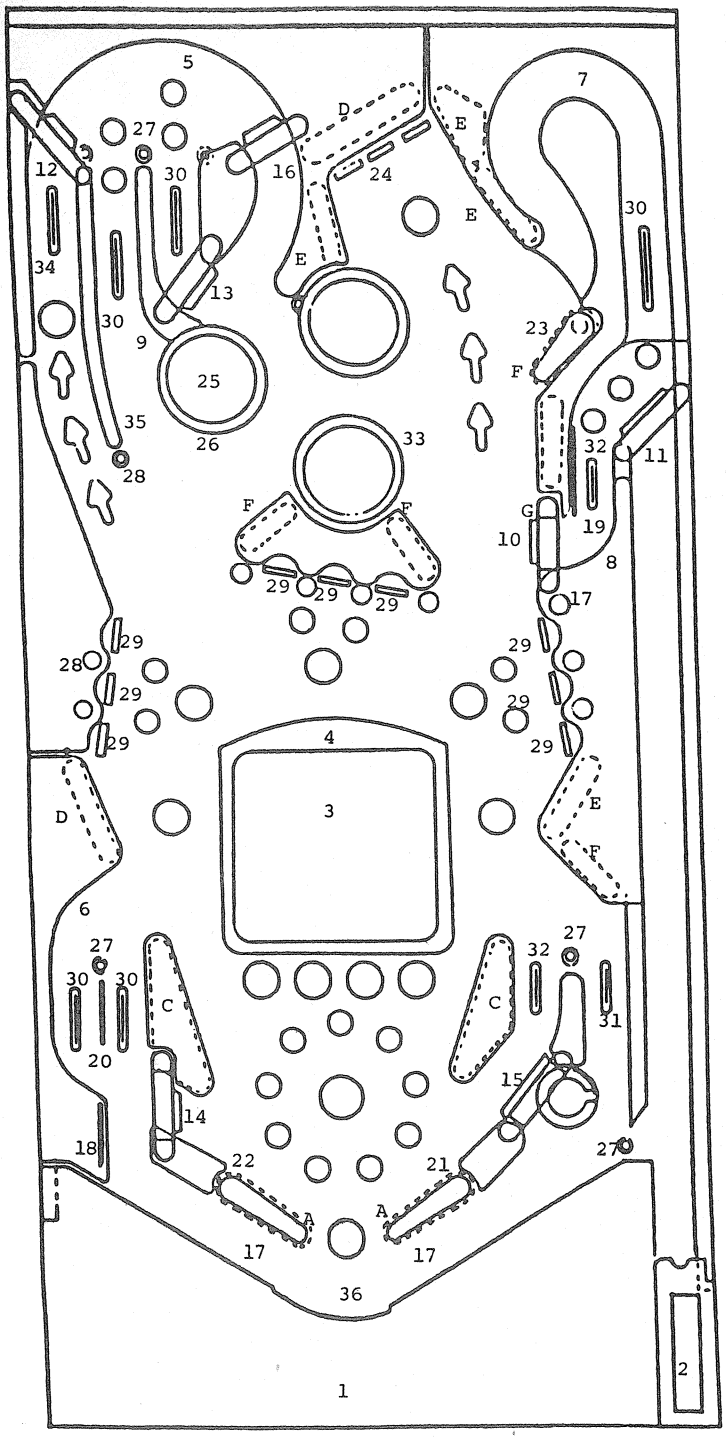
To set up positions 16-20 push and release self test button till 16 shows on match/ball in play. Now pulse replay button for recommended setup from "00" thru "03." Repeat for positions 17, 18, 19, or 20. Position 20 setups go from "00" thru 15."

SOUND

In addition to game sounds, there is also a Master Volume Control located on the front door. (refer to page 10)

Please note that these module volume controls should be adjusted prior to setting the control on the front door.

*Can be quickly set to '00' by pressing S33 on the MPU assembly in the back box or Coin Chute switch #3. (See Figure III.)



X'S AND O'S (0391)
RUBBER PARTS

A. 0017-00041-0653 Flipper (2)
B. 0017-00041-0633 Mini Post (17)
C. 0017-00041-0645 2'' Dia (2)
D. 0017-00041-0644 1½'' Dia (2)
E. 0017-00041-0643 1'' Dia (5)
F. 0017-00041-0642 3/4'' Dia (5)
G. 0017-00041 0637 5/16'' Dia (4)

PANEL PARTS

1. Bottom Arch 0391-00105-0000
2. Shooter Gauge 0391-00106-0000
3. Feature Lens 0391-00902-0000
4. Feature Lens Spacer 0391-00901-0000
5. Ball Guide Assy. A391-00014-0000
6. Ball Guide Assy. A371-00010-0000
7. Ball Guide Assy. A391-00013-0000
8. Ball Guide Assy. A391-00012-0000
9. Ball Guide Assy. A391-00019-0000
10. Wire and Bracket A391-00030-0000
11. Wire and Bracket A391-00027-0000
12. Wire and Bracket A391-00027-0000
13. Wire and Bracket A391-00029-0000
14. Wire and Bracket A371-00040-0000
15. Wire and Bracket A391-00023-0000
16. Wire and Bracket A391-00022-0000
17. Guide Wire 0627-00172-0000
18. Guide Wire 0360-00957-0084
19. Guide Wire 0360-00957-0065
20. Guide Wire 0360-00175-5600
21. Flipper Assy. A360-00268-0000
22. Flipper Assy. A360-00267-0000
23. Flipper Assy. A331-00027-0000
24. Drop Target Assy. A391-00035-0000
25. Thumper Bumper Cap A391-00038-0000
26. Thumper Bumper Collar 0017-00042-0403
27. Mini-Post A967-00063-0000
28. Mini-Post A360-00218-0000
29. Target Assy. A391-00043-0000
30. Wire Actuator Assy. A967-00062-0000 (5)
31. Wire Actuator Assy. A360-00216-0000 (1)
32. Wire Actuator Assy. A331-00042-0000 (2)
33. Thumper Bumper Assy. A967-00053-0000 (3)
34. Wire Actuator Assy. A360-00215-0000 (1)
35. Ball Guide Assy. A391-00018-0000
36. Wire Actuator Assy. A360-00217-0000

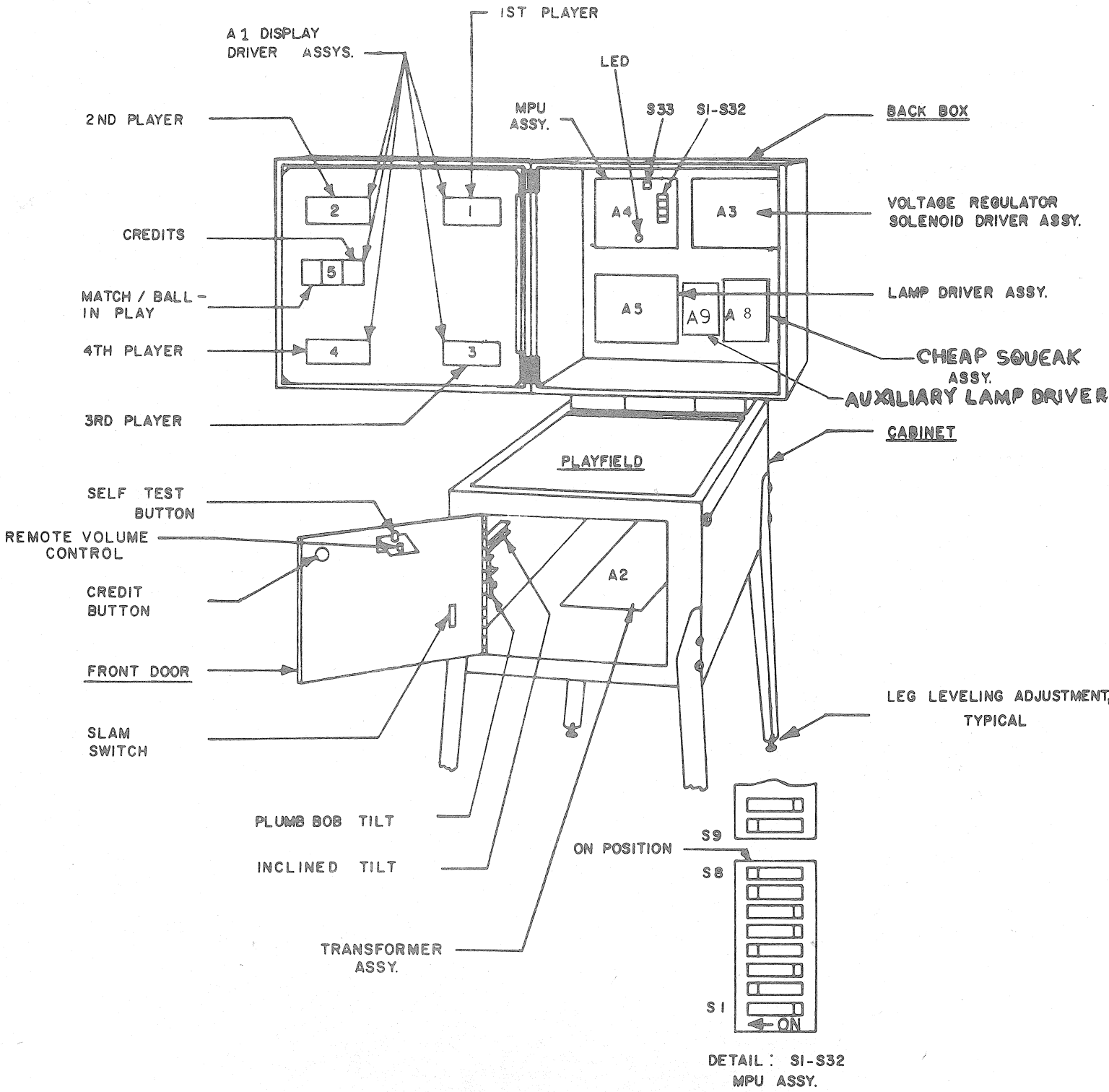


FIGURE III. ELECTRONIC PIN BALL MACHINE

RECOMMENDED

Instructions, Score Cards and High Score Feature Settings
to be used on **X's and O's 0391**

3-BALL

REPLAYS

Instructions Card	M-051-00391-A030
Score Card	M-051-00391-A038

1 Replay at 1,100,000
1 Replay at 2,300,000

5-BALL

REPLAYS

Instruction Card	M-051-00391-A031
Score Card	M-051-00391-A039

1 Replay at 2,000,000
1 Replay at 3,000,000

EXTRA BALL

Instruction Card	M-051-00391-A033
Score Card	M-051-00391-A039 W/M-051-00391-A073

1 Extra Ball at 2,200,000
1 Extra Ball at 3,500,000

ADDITIONAL CARDS

REPLAYS

M-051-00391-A040	700,000	1,600,000
M-051-00391-A041	800,000	1,700,000
M-051-00391-A042	900,000	1,800,000
M-051-00391-A043	1,000,000	2,000,000
M-051-00391-A044	1,000,000	2,100,000
M-051-00391-A045	1,100,000	2,400,000
M-051-00391-A046	1,200,000	2,500,000
M-051-00391-A047	1,300,000	2,500,000
M-051-00391-A048	1,400,000	2,600,000
M-051-00391-A049	1,500,000	2,700,000
M-051-00391-A050	1,600,000	2,800,000
M-051-00391-A051	1,700,000	2,800,000
M-051-00391-A052	1,800,000	2,900,000
M-051-00391-A053	1,900,000	2,900,000
M-051-00391-A054	2,000,000	3,200,000
M-051-00391-A055	2,100,000	3,300,000
M-051-00391-A056	2,200,000	3,500,000
M-051-00391-A057	2,300,000	3,600,000
M-051-00391-A064	2,400,000	3,800,000
M-051-00391-A065	2,500,000	4,000,000

EXTRA BALL

M-051-00391-A072	2,100,000	3,300,000
M-051-00391-A073	2,200,000	3,500,000
M-051-00391-A074	2,400,000	3,800,000
M-051-00391-A075	2,600,000	4,100,000

Instruction Card Novelty
M-051-00391-A034

M-051-00391-A036
M-051-00391-A037

BLANKS (3)
High Game to date recommended levels;
(reset periodically)
3 BALL 2,500,000
5 BALL 3,200,000

X's And O's 0391
RECOMMENDED SETTINGS

RECOMMENDED REPLAY GAME SETTING FOR:		3-BALL	5-BALL
ALL X'S AND O'S REPLAY	SW.6	ON	OFF
SKILL SHOT FLASHING LITE BEEP TIME	SW.7	OFF	ON
	SW.8	ON	OFF
CARD SPECIAL LITE	SW.14	ON	OFF
SKILL SHOT FEATURE LITE ADVANCE	SW.15	OFF	ON
	SW.16	ON	OFF
NEXT EXTRA BALL LITE	SW.21	OFF	OFF
LEFT LANE ARROW AND 3 DROP TARGET LITE	SW.22	OFF	ON
	SW.23	ON	OFF
SKILL SHOT LANE ADVANCE LEFT LANE ARROW AND 3 DROP TARGET LITE	SW.24	ON	OFF
NUMBER OF GAMES REPLAYS PER GAME	SW.29	ON	ON
GAME OVER ATTRACT	SW.30	ON	ON
BALLS PER GAME	SW.31	OFF	ON
BALLS PER GAME	SW.32	OFF	OFF

REPLAYS	3-BALL	5-BALL
Instruction Card	M-051-00391-A030	M-051-0391-A031
Score Cards	M-051-00391-A038	M-051-00391-A039
Major Mode	Self Test Position 16, 17 Set to "03"	Self Test Position 16, 17 Set to "03"
Match	SW.28 ON	SW.28 ON
High Score to Date	Self Test Position 19 Set to "03"	Self Test Position 19 Set to "03"

X-BALL	
Instruction Card	M-051-00391-A033
Score Card	M-051-00391-A039 W/M-051-00391-A073
Major Mode	Self Test Position 16, 17 Set to "02"
Match	SW.28 OFF
High Score to Date	Self Test Position 19 Set to "00"

NOVELTY		
Instruction Card	M-051-00391-A034	M-051-00391-A035
Score Card	M-051-00391-A036	M-051-00391-0037
Major Mode	Self Test Position 16, 17 Set to "01"	Self Test Position 16, 17 Set to "01"
Match	SW.28 OFF	SW.28 OFF
High Score to Date	Self Test Position 19 Set to "00"	Self Test Position 19 Set to "00"

VIII. ROUTINE MAINTENANCE ON LOCATION:

Self-Test routines are written into the game design. They are particularly useful for routine maintenance. The tests are described below. The first test is automatic and occurs on power-up. This test causes the MPU module A4 to examine itself for failures. Seven flashes of an LED indicates proper operation. The second series of self-diagnostic tests causes the MPU to 'exercise' each of the other modules in such a way as to make their faults, if any, obvious. See Figure III and Page ii.

It is recommended that these tests be used several times a week to check out the games before play. If faults are discovered, they may be corrected on location if the operator has a stock of replacement modules. See "Trouble Shooting on Location."

MPU Module Self-Test:

At power on, the LED on the MPU module flashes once. (Flicker-Flash.) After a pause, it flashes six more times and goes out. A power-up tune is played to announce game readiness. This indicates proper MPU operating condition and successful completion of the power-up test.

Game Self-Diagnostic Tests:

1. Pressing the Self-Test button inside the door initiates the Self-Test routine. See Figures III and IV. All switched lamps flash off and on continuously.

2. Pressing the Self-Test button again causes each digit on each display to cycle from 0 thru 9, and repeat continuously.

3. Pressing the Self-Test button again causes each solenoid to be energized, one at a time, in a continuous sequence. Hold both flipper buttons 'in' during this test. The number appearing on the Player Score displays is the same as the number assigned to the solenoid. The sound of a solenoid pulling-in as a number appears indicates proper operation. The absence of sound is improper. If sound is absent, see Page 17 for help in Solenoid identification.

4. Pressing Self-Test button again causes the sound module to play same tune repeatedly.

5. Pressing the Self-Test button again causes the MPU to search each switch assembly for stuck contacts. If any are found, the number of the first set encountered is flashed on the Player Score displays. The number remains until the fault is cleared. See Page 17 for help in Stuck Switch identification. Other numbers may follow if more stuck contacts are present. If there are no stuck switches, the Match/Ball in Play display flashes '0'.

6. Pressing the Self-Test button 20 more times causes the MPU to step thru the threshold and bookkeeping functions described previously and finally to repeat the power-up test. For more rapid exit to power-up, turn the game off, then on. The game is now ready to play.

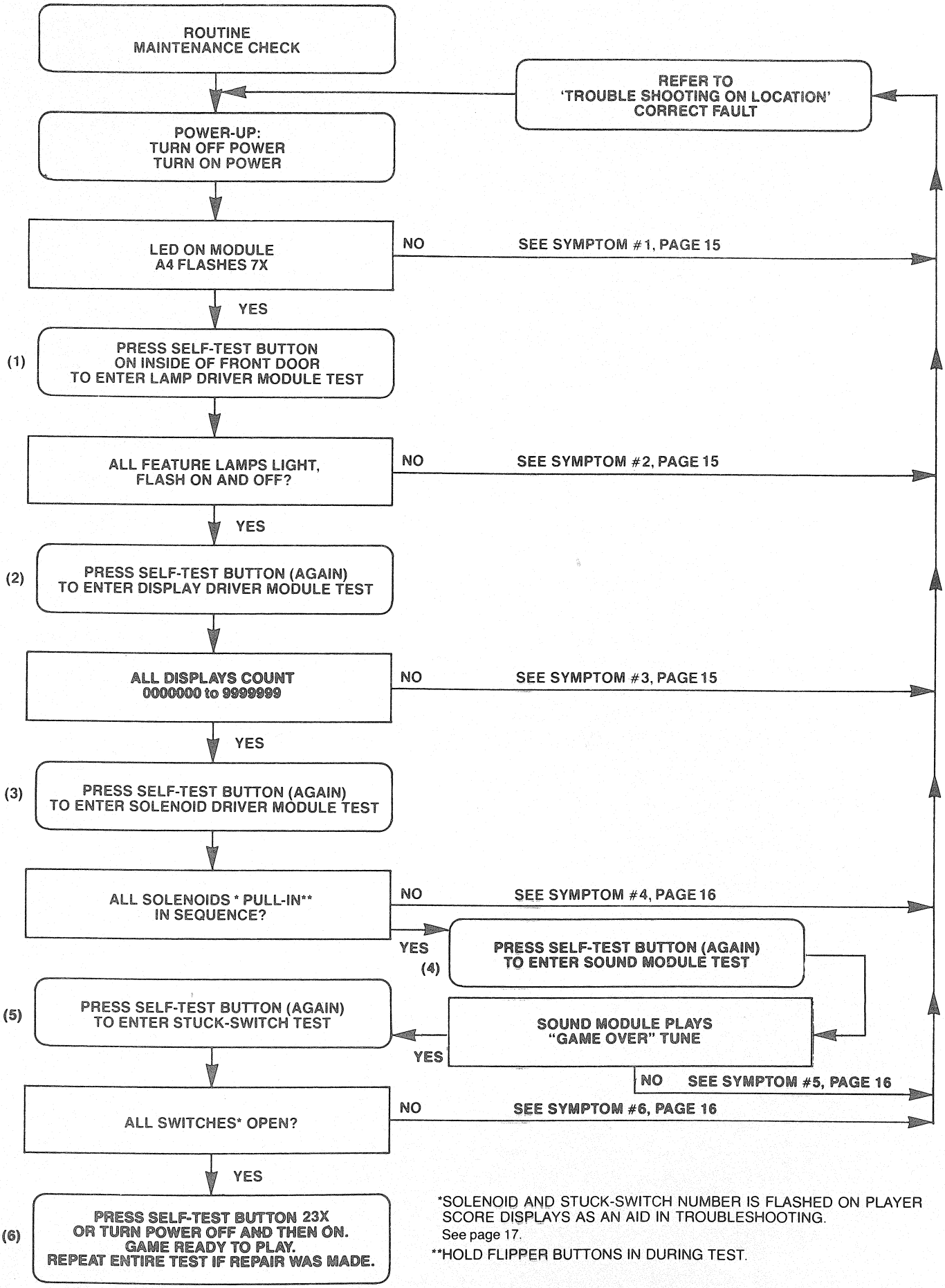
After successful completion of the Self Diagnostic Test procedure, set the game up for play. Exercise each rollover, thumper-bumper, slingshot, etc., by hand until each switch assembly on the playfield has been checked for proper operation. If actuating a switch assembly results in intermittent or no response, clean contacts by gently closing them on a clean business card or piece of paper and wiping until they wipe clean. Regap, if necessary, to 1/16". **Do not burnish or file Gold Plated Switch Contacts.**

IX. TROUBLESHOOTING ON LOCATION

The game is designed to make troubleshooting easy. Several simple procedures are given herein that cover the greatest percentage of game failures. They are written for an operator on location and require module replacement. (See Figure III) Symptoms and the action to be taken are given for each type of problem.

If the problem is more complicated and is not solved by following this procedure, more detailed procedures are available from Bally. See the Parts List for ordering information.

FIGURE IV SELF DIAGNOSTIC TEST



*SOLENOID AND STUCK-SWITCH NUMBER IS FLASHED ON PLAYER SCORE DISPLAYS AS AN AID IN TROUBLESHOOTING.
See page 17.

**HOLD FLIPPER BUTTONS IN DURING TEST.

1A) **SYMPTOM:** Game does not play power-up tune when power is turned on. General Illumination is present.

ACTION: **A)** Turn power OFF. Open back box. Locate light emitting diode (LED) on MPU module A4.

B) Turn Power ON. LED must flash 7X to indicate that module A4 is good. Correct flash sequence is flicker/flash-pause-and then six more flashes and LED goes out.

C. If LED does not come on, or does not flash, or flashes, but less than 7X, turn off power. Replace MPU module A4.

CAUTION: **Replacement MPU Module must have same Part Number or incorrect operation will result! See Parts List for MPU Module Part Number.**

Turn power ON.

D) If game is correct, it is now ready for play. If game is not correct, refer to Module Replacement procedure. (See Parts List.)

2A) **SYMPTOM:** Not all feature lamps light during game play.

ACTION: **A)** With power ON, open front door. Press button (Self-Test switch) once. If the game is correct, **all** feature lamps flash ON and OFF.

B) Carefully raise playfield or open back box to gain access to lamps.

C) Replace bulbs that do not flash.

D) If game is correct, it is now ready for play.

E) If game is not correct, turn power OFF. Replace Lamp Driver Module A5. Turn power ON and repeat A.

F) If game is correct, if is now ready for play.*

G) If game is not correct, turn power OFF. Replace MPU module A4. See CAUTION, 1C. Turn power ON and repeat A.

H) If game is correct, it is now ready for play.* If game is not correct, refer to Module Replacement procedure. (See Parts List.)

2B) **SYMPTOM:** One or some switched lamps always ON.

ACTION: Repeat 2AA, AB, AE, and AF and, if necessary AG & AH.

3A) **SYMPTOM:** Display digits improper on **one** or **several,** but less than all Display Driver module(s), A1. Improper: One or several segments always OFF, digits mottled or several segments or digit(s) always ON.

ACTION: **A)** With power ON, open front door. Press button (Self-Test switch) twice. If the game is correct, each digit on each Display Driver Module A1 (5 used/game) displays the count 1-9 and 0 continuously in all 6 digit positions. Note defective Display Driver modules.

B) Turn power OFF.

CAUTION: High Voltage is supplied to the Display Driver Modules, A1, from the Solenoid Driver/Voltage Regulator Module A3. Wait 30 seconds for High Voltage to Bleed Off.

C) Replace Display Driver module(s) A1. Turn power ON. Repeat A.

D) If game is correct, it is now ready to play.* If game is not correct, refer to Module Replacement procedure. (See Parts List.)

3B) **SYMPTOM:** **All** displays improper (all five display Driver modules). Improper: Digit(s) always on or off/segment(s) always on or off, all displays.

ACTION: **A)** Repeat 3AA, and AB.

B) Replace MPU module A4. See CAUTION NOTE, 1C. Turn power ON. Repeat A.

C) If game is correct, it is now ready to play.* If game is not correct, refer to Module Replacement procedure. (See Parts List.)

3C) **SYMPTON:** One or several displays always off.

ACTION: A) Do 3AA, AB, AC, and AD.

B) Repeat 3BB and BC, if necessary.

4A) **SYMPTOM:** Solenoid(s) do(es) not pull-in during course of game.

ACTION: A) With power ON, open front door. Press button (Self-Test switch) three times.

B) If game was correct, each solenoid would be energized. A number is flashed on the Player Score displays as each solenoid is pulsed. Note any numbers that do not have the sound of a solenoid associated. See Solenoid Identification Table, Page 17 and Figure V.

C) Carefully lift the playfield (or open the back box) to gain access to the solenoid. Turn power OFF. Inspect the solenoid.

D) If a lead is broken off, repair. Repeat A & B. If game is correct, it is now ready for play.* If solenoid wiring was correct, turn power OFF.

E) Replace Solenoid Driver/Voltage Regulator module A3. See CAUTION NOTE 3AB.

F) Repeat AA & AB. If game is correct, it is now ready to play.* If game is not correct, turn power OFF.

G) Replace Sound Module A8.

H) Repeat AA and AB if game is correct. It is now ready to play. If game is not correct, turn power OFF."

I) Replace MPU module A4. See CAUTION NOTE, 1C.

J) Repeat A & B. If game is correct, it is now ready to play.* If game is not correct, refer to Module Replacement Procedure. (See Parts List.)

4B) **SYMPTOM:** Solenoid(s) always energized—Note: if impulse solenoids (ball ejects, slingshots, thumper-bumpers, etc.) are energized continuously, they are subject to damage. Limit troubleshooting to one minute with power ON, followed by **five minutes with power OFF.** Repeat as necessary. Replace damaged solenoids.

ACTION: Do 4AA, AB, AE, AF, AG, AH and if necessary, AI and AJ.

5) **SYMPTOM:** No Sound.

ACTION: A) With Power ON, open front door, press Self-Test switch four times.

B) Turn volume control clockwise to Max.

C) If correct, sound will be heard. If incorrect, try seating speaker lead connector (J2) and input connector (J1).

D) If correct, sound will be heard. If incorrect, refer to Module Replacement procedure."

6) **SYMPTOM:** Feature (Drop Targets, etc.) does not score.

ACTION: A) With power ON, open front door. Press button (Self-Test switch) five times.

B) If the game is correct, Match/Ball in Play display would flash '0.' If a number appears on the Player Score displays, see Switch Assembly Identification Table, Page 17 and Figure V.

C) Carefully lift the playfield. Locate the switch assembly identified from the number. Visually inspect the switch assembly. If the contacts are 'stuck,' regap them to 1/16". See section under ADJUSTMENTS. Repeat A & B. If the game is correct, it is now ready to play.* If game is not correct, turn the power OFF.

D) Replace MPU module A4. See CAUTION NOTE 1, C.

E) Repeat A & B. If the game is correct, it is now ready to play.* If the game is not correct, refer to Module Replacement Procedure. (See Parts List).

7) **SYMPTOM:** Game blows fuse(s) repeatedly.

ACTION: See Module Replacement Procedure. F.O. 560

*Turn power On-Off switch OFF and then ON.

GAME #0391 X'S AND O'S
SOLENOID IDENTIFICATION TABLE

Self Test #	SOLENOID IDENTIFICATION
01	3 DROP TARGET RESET
02	SAUCER
03	OUTHOLE
04	TOP THUMPER BUMPER
05	LEFT THUMPER BUMPER
06	BOTTOM THUMPER BUMPER
07	KNOCKER
08	COIN LOCKOUT DOOR
09	K1 RELAY (FLIPPER ENABLE)

SWITCH ASSEMBLY SELF-TEST DISPLAY NUMBERS

Switch Self Test #	DESCRIPTION
01	3 DROP TARGET (LEFT)
02	3 DROP TARGET (MIDDLE)
03	3 DROP TARGET (RIGHT)
04	SAUCER
05	EXTRA BALL/50,000 LANE
06	CREDIT BUTTON
07	30 POINT REBOUND (4)
08	OUTHOLE KICKER
09	COIN III (RIGHT)
10	COIN I (LEFT)
11	COIN II (MIDDLE)
12	LEFT AND RIGHT OUTLANE
13	RIGHT RETURN LANE
14	SPECIAL/100,000 LANE
15	TILT (3)
16	SLAM (2)
17	LEFT RETURN LANE

Switch Self Test #	DESCRIPTION
18	BOTTOM THUMPER BUMPER
19	LEFT THUMPER BUMPER
20	TOP THUMPER BUMPER
21	TARGET RIGHT (TOP)
22	TARGET RIGHT (CENTER)
23	TARGET RIGHT (BOTTOM)
24	"KILL" SKILL SHOT LANE
25	TARGET LEFT (TOP)
26	TARGET LEFT (CENTER)
27	TARGET LEFT (BOTTOM)
28	SKILL SHOT LANE
29	TARGET CENTER (TOP)
30	TARGET CENTER (CENTER)
31	TARGET CENTER (BOTTOM)
32	LEFT SIDE ARROW LANE
40	BOTTOM LEFT AND RIGHT REBOUND

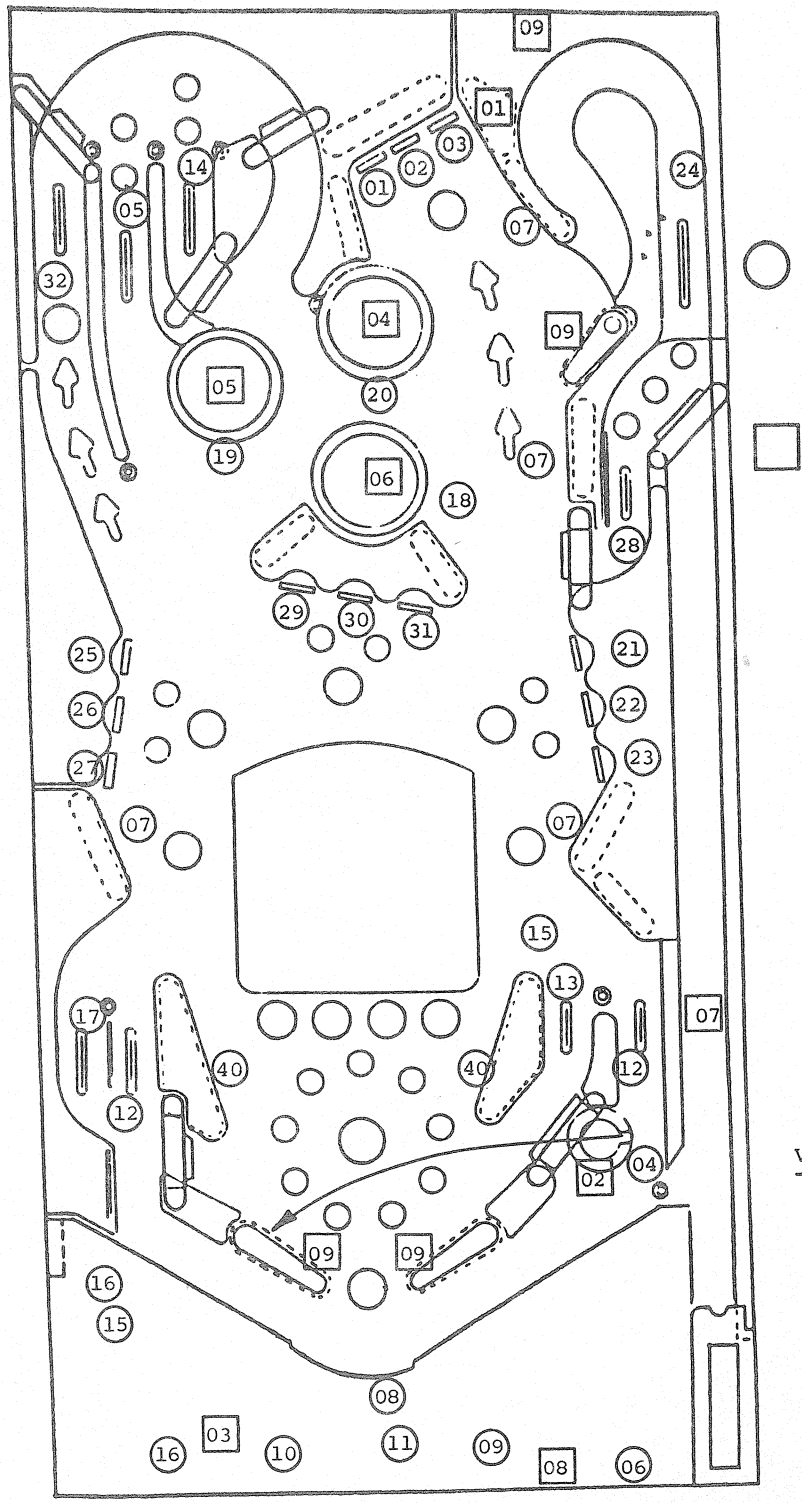


FIGURE V

#0391 X's and O's

INQICATES SWITCH ASSEMBLY
IDENTIFICATION NUMBERS
NOTE: CABINET: 15, 16
DOOR: 06, 09
10, 11, 16

INDICATES SOLENOID
IDENTIFICATION NUMBERS
NOTE: DOOR 08
BACKBOX: 09
CABINET: 07

VECTOR SHOWING FOR EJECT SAUCER

TO BE KICKED ABOUT AS SHOWN BY ARROW

ASSEMBLY ADJUSTMENTS:

GENERAL:

All switch assemblies consist of leaf springs, contacts, separators, plastic tubing and screws to hold them to the mounting surface. Before attempting to adjust a switch assembly, make sure that these screws are tight. If not, tighten screw closest to the contact end of the leaf spring first. This will prevent the assembly from being secured in such a manner that the leaf springs tend to fan out. In general, all leaf springs are adjusted for a 1/16" gap in the open position and .010" over-travel or wipe in the closed position. All contacts should be in good condition. Unless otherwise instructed, they should be dry or non-lubricated. All contacts should be free of dust and dirt. Contacts, with the exception of the flipper button switch assemblies, are plated to resist corrosion. Filing or burnishing breaks the finish and encourages corrosion. Clean by closing the contacts over a clean piece of paper (e.g., a business card) and wiping gently until the contacts are clean. For the flipper button switch assemblies **ONLY**: Tarnish can be removed with a contact file followed by burnishing tool. Severely pitted contacts must be replaced as an assembly. In general, contacts need be cleaned or replaced and adjusted only when they are found to be a source of game malfunction.

X. SERVICE PARTS:

A parts catalogue is available upon request. The catalogue is illustrated and lists all replacement parts for each game manufactured by Bally. Requests should be addressed to:

BALLY MIDWAY MFG. CO.
10601 WEST BELMONT AVENUE
FRANKLIN PARK, ILLINOIS 60131
ATTN: PARTS DEPARTMENT

SERVICE HINTS:

The Bally playfield has an improved tuff-coat finish with excellent wearing properties. Its life expectance, as well as play appeal, can be extended by periodic cleaning of the playfield.

DO: Bally recommends you clean your playfield with Wildcat #125 (Wildcat Chemical Co., 1333 W. Seminary Drive, Ft. Worth, Texas 76115). Wildcat #125 is a combination cleaner and polish. Bally has tried and tested this product and found it to be very effective. If Wildcat #125 is not available, Bally suggests you ask your Distributor to order it. Inspect and hand polish the ball in a clean cloth. A chipped ball must be replaced. It can ruin the finish on the playfield in a short period of time.

DON'T: Use water in large quantities, highly caustic cleaners, abrasive cleaners or cleaning pads on the playfield. Do not allow a wax or polish build up. Waxes yellow with age and spoil play appeal.

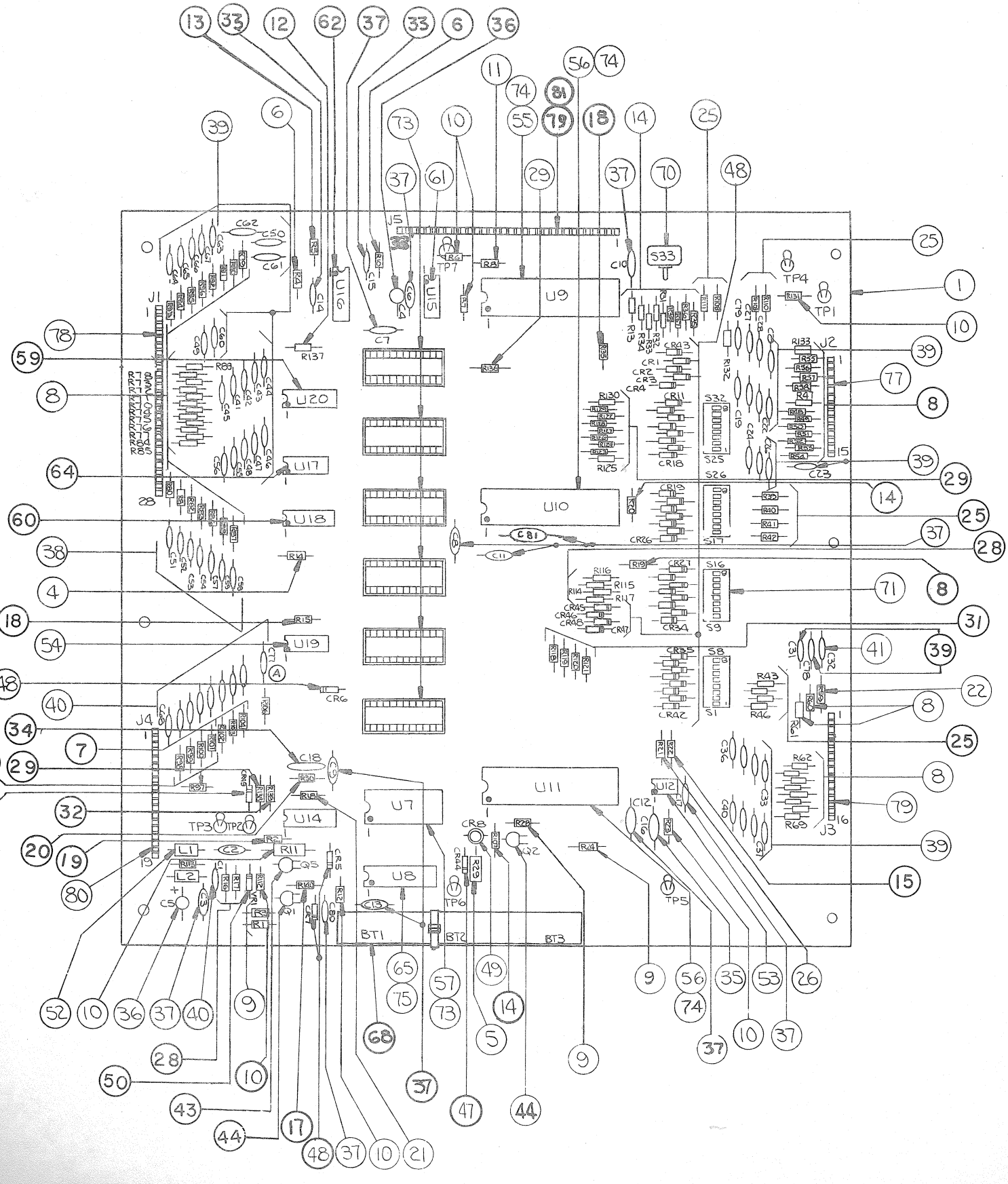
XI. PARTS LIST
XIs and O's #0391

MISCELLANEOUS	MIDWAY PART NUMBER	BALLY PART NUMBER
Transformer (Domestic or Export)	MT00-00110-A000	E-122-142
Bulbs, #555	0017-00003-0484	E-125-73
Fuse, 1 Amp. 3 AG Slow Blow (Playfield Solenoid Protection)	0017-00003-0103	E-133-44
ASSEMBLY COILS		
Coin Lockout	A360-00208-0000	FO-366-7000
Flipper (3)	A360-00045-0000	AQ-25-500/ 34-4500
Drop Target Reset	A360-00209-0000	NO-26-1900
Knocker	A360-00046-0000	AR-26-1200
Outhole Kicker	A360-00211-0000	AO-27-1300
Thumper Bumper (3)	A360-00044-0000	AN-26-1200
Saucer	A360-00211-0000	AO-27-1300
PLAYFIELD PARTS		See Figure II
MODULES		
Lamp Driver A5	A084-91613-A000	AS-2518-23
Display Driver A1 (4 used)	A084-91617-A000	AS-2518-58
Display Driver A1 (1 Used)	A084-91491-A000	AS-2518-21
MPU A4	A084-91624-A391	
Transformer & Rectifier A2	A370-00064-0000	AS-2877-6
Rectifier Board (Part of A2)	A084-91616-A000	AS-2518-54
Cheap Squeak	A084-91603-B391	
Auxiliary Lamp Driver A9	A084-91614-A000	AS-2518-43
REPAIRS PROCEDURES/AIDS		
Module & Component Replacement		F.O. 560-1
AID (Assistance in Diagnostics) Kit, used with F.O. 560-1		KIT #485-1

MODULE COMPONENTS
SEE MODULE PARTS LIST

MODULE COMPONENT STARTER KITS
(Each kit contains an assortment of the most needed electronic parts for use in Module repair.)
KIT #558—For Rectifier Board (Part of A2)
KIT #503—For MPU Board A4 (less Memory U1-U6)
KIT #492—For Solenoid Drive/Voltage Regulator A3
KIT #493—For Display Drive A1
KIT #494—For Lamp Drive A3

A082-91624-A000 MPU MODULE

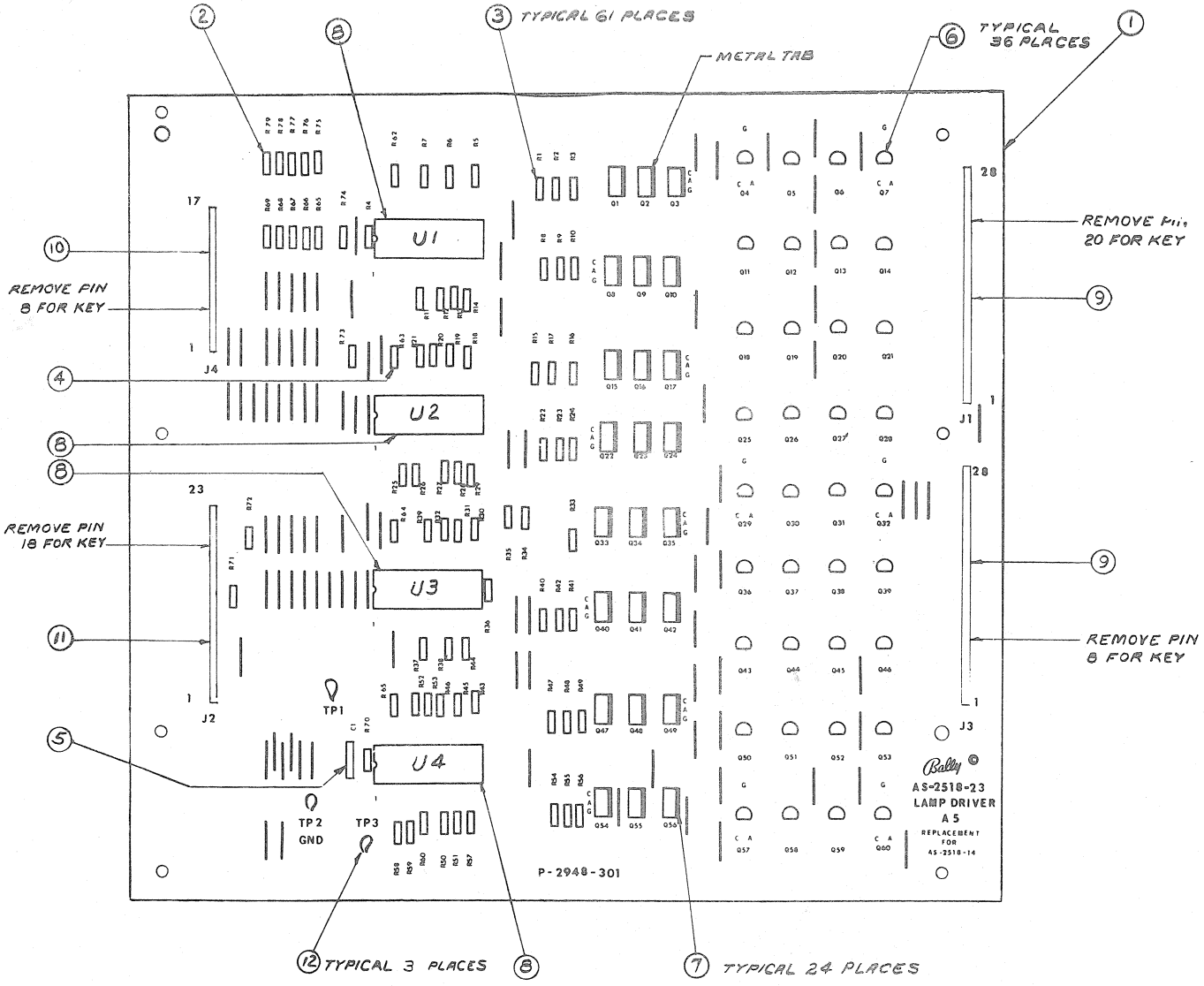


A4: MPU MODULE
COMPONENT PARTS LIST

ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
1	A4 (see note 1)	A084-91624-A391	MPU Module Complete.
2	A4 (see note 2)	A082-91624-A000	MPU Module less Program Memory, U1-6 incl.
3-32	See Schematic		Resistors, See schematic for value
33	C14, C15	E-00586-0067	Capacitor, 470 PFD, 1kv
34	C18	E-00586-0088	Capacitor, .05 MFD, 16V
35	C16	E-00586-0081	Capacitor, .1 MFD, 100V
36	C4, C5	E-00586-0073	Capacitor, 4.5 MFD, 25V
37	C3, C6-C13, C17, C81	E-00586-0085	Capacitor, .01 MFD, 25V
38	C79, C41-C67	E-00586-0083	Capacitor, 470 PFD, 50V
39	C19-C31, C78, C33-C40	E-00586-0082	Capacitor, 390 PFD, 50V
40	C1, C2, C68-C77	E-00586-0084	Capacitor, 820 PFD, 50V
41	C32	E-00586-0077	Capacitor, 3000 PF, 1 kv
43	Q5	E-00585-0023	Transistor PNP (MPS-3702)
44	Q1, Q2	E-00585-0031	Transistor (2N3904)
47	CR44	E-00587-0006	Diode (IN4004)
48	CR1-CR7, CR11-CR43, CR45-CR49, CR52	E-00587-0014	Diode (IN4148)
49	CR8	E-00679	LED (Green)
50	VR1	E-00598-0008	Diode Zener (8.2V, IN9598)
52	L1, L2	E-00604-0003	Inductor, 22 Micro Hy.
53	U12	E-00620-0004	Timer (555)
54	U19	E-00620-0005	Quad 2 Input (4011)
55	U9	E-00620-0028	MPU I.C. (6800)
56	U10, U11	E-00620-0029	PIA I.C. (6820)
57	U7	E-00620-0030	RAM I.C. (6810)
59	U20	E-00620-0032	HEX Buffer I.C. (14502B)
60	U14, U18	E-00620-0033	HEX Inverter (4049B)
61	U15	E-00620-0034	Quad Memory Drive (MC3459L)
62	U16	E-00620-0035	Dual Monostable (9602)
64	U17	E-00620-0041	Quad 2 Inputs (74L00N)
65	U8	E-00620-0042	RAM (C MOS, P5101L-3)
68	BT1, BT2, BT3	E-00628-0003	Battery
70	S33	E-00658-0001	Push Button Switch
71	S1-S8, S9-S16, S17-S24, S25-S32	E-00677	DIP Switch
73		E-00712	24 Pin Socket
74		E-00712-0001	40 Pin Socket
75		E-00712-0003	22 Pin Socket
77	J2	E-00715	15 Pin Wafer Connector
78	J1	E-00715-0004	28 Pin Wafer Connector
79	J3, J5	E-00715-0017	16 Pin Wafer Connector
80	J4	E-00715-0018	19 Pin Wafer Connector
81	J5	E-00715-0024	17 Pin Wafer Connector

NOTE: Order replacement memory chips U1-U6, specifying game, socket and part number stamped on chip.

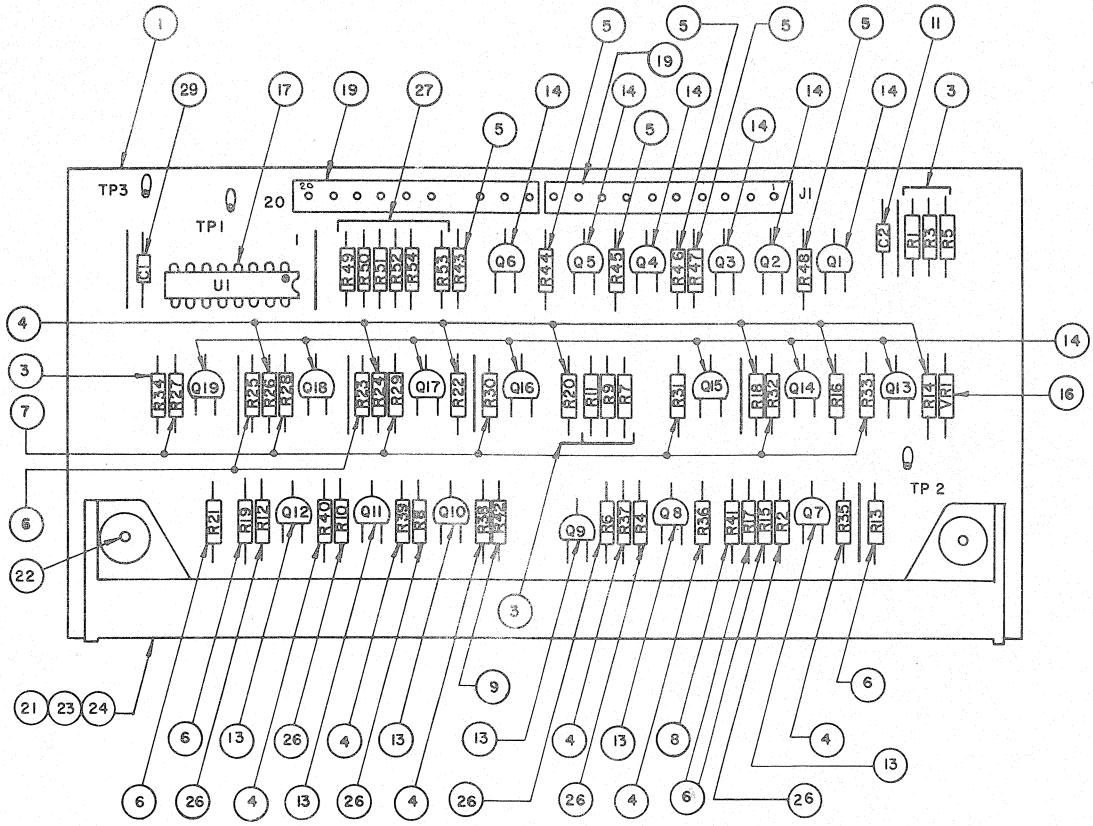
AS-2518-23 LAMP DRIVER MODULE



A5: LAMP DRIVER MODULE
COMPONENT PARTS LIST

ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
1	A5	AS-2518-23	Lamp Driver Module, Complete
2	R71-R79	E-00105-242	Resistor, 20kΩ, 5%, ¼ W
3	R1-R60, R70	E-00105-0237	Resistor, 2kΩ, 5%, ¼ W
4	R61-R69	E-00105-0256	Resistor, 2.2MΩ, ¼ W
5	C1	E-00586-0065	Capacitor, .01 MFD, 500V
6	Q4-Q7, Q11-Q14, Q18-Q21, Q25-Q32, Q36-Q39, Q43-Q46, Q50-Q53, Q57-Q60	E-00585-0014	SCR, 2N5060
7	Q1-Q3, Q8-Q10, Q15-Q17, Q22-Q24, Q33-Q35, Q40-Q42, Q47-Q49, Q54-Q56	E-00585-0029	SCR, MCR106-1
8	U1-U4	E-00620-0037	I.C., Decoder, 14514B
9	J1, J3	E-00715-0004	28 Pin Wafer Connector
10	J4	E-00715-0024	17 Pin Wafer Connector
11	J2	E-00715-0014	23 Pin Wafer Connector
12	TP1, TP2, TP3	P-05399	Test Clip

AS-2518-21 CREDIT DISPLAY DRIVER MODULE

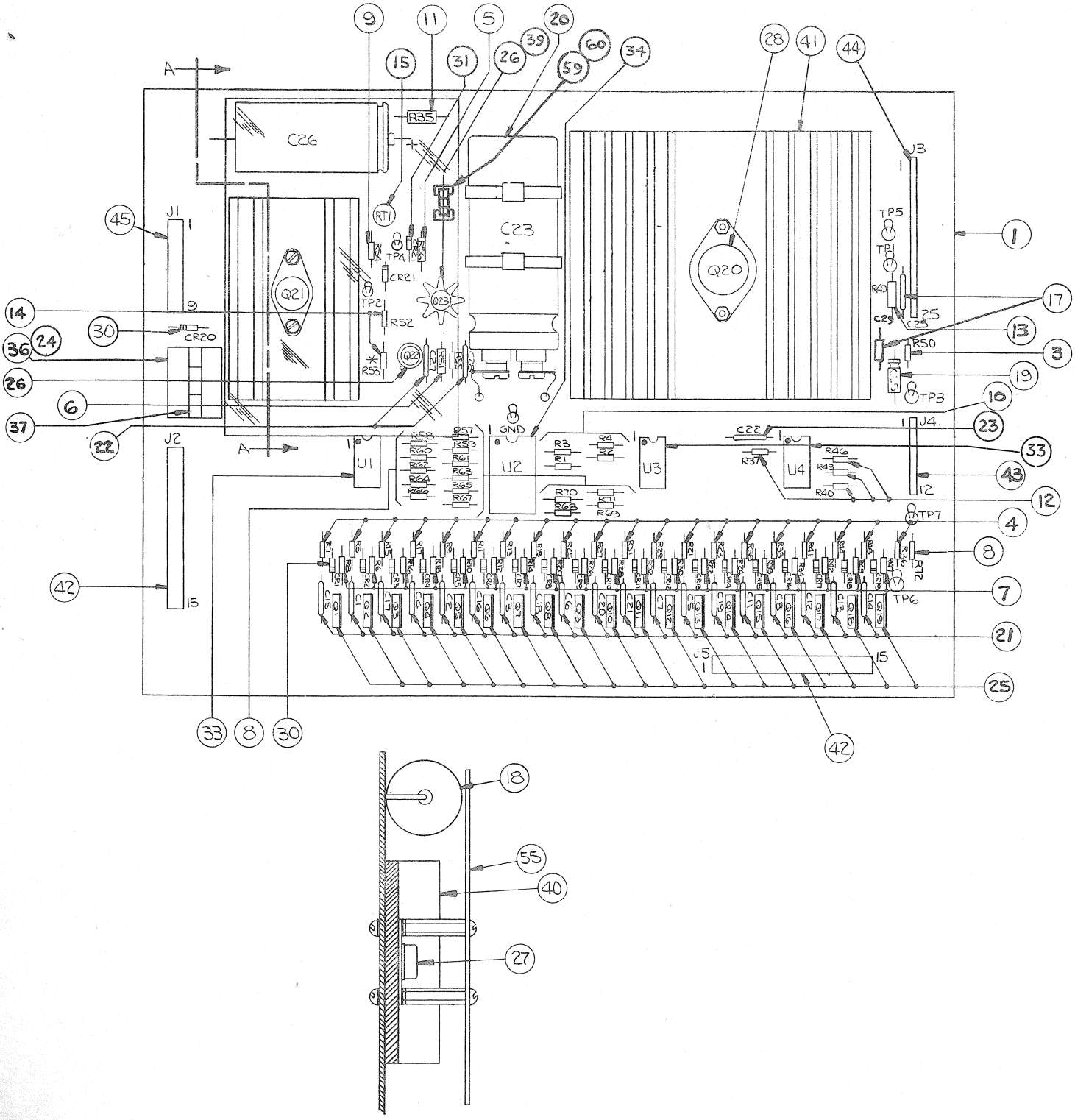


A1: 6 DIGIT DISPLAY DRIVER MODULE
COMPONENT PARTS LIST

ITEM	QTY.	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
1	1	A1	AS-2518-21	6 Digit Display Driver, Complete
3	7	R1, R3, R5, R7, R9, R11, R34	E-105-331	Resistor, 100K Ω
4	13	R14, R16, R18, R20, R22, R24, R26, R35, R36, R37, R38, R39, R40	E-105-227	Resistor, 300K Ω
5	6	R43, R44, R45, R46, R47, R48	E-105-228	Resistor, 9.1K Ω
6	7	R13, R15, R17, R19, R21, R23, R25	E-105-229	Resistor, 1.5K Ω
7	7	R27, R28, R29, R30, R31, R32, R33	E-105-222	Resistor, 1.2K Ω
8	1	R41	E-105-231	Resistor, 39K Ω
9	1	R42	E-105-271	Resistor, 240K Ω
10				
11	1	C2	E-586-65	Capacitor, .01 MFD, 500V
13	6	Q7, Q8, Q9, Q10, Q11, Q12	E-585-32	Transistor (2N5401)
14	13	Q1, Q2, Q3, Q4, Q5, Q6, Q13, Q14, Q15, Q16, Q17, Q18, Q19	E-585-33	Transistor (MPS-A42)
16	1	VR1	E-598-7	Zener Diode, 110V
17	1	U1	E-620-38	I.C. Decoder
18				
19	2	J1	E-715-34	10 Pin Wafer Pin Connector
21	1	DS1	E-680	Digital Display Panel
22	2		M-1836	Hi-Lo Screw, W/H
23	1		P-2399	Display Mounting (Top)
24	1		P-2399-1	Display Mounting (Bottom)
26	6	R2, R4, R6, R8, R10, R12	E-105-287	Resistor, 2.2K Ω
27	6	R49, R50, R51, R52, R53, R54	E-105-242	Resistor, 20K Ω
28	As Req'd			Wire Jumper
29	1	C1	E-586-85	Capacitor, .01 MFD, 25V

NOTE: INTERCHANGEABLE WITH AS-2518-15

AS-2518-22 SOLENOID DRIVER/VOLTAGE REGULATOR MODULE



NOTE: INTERCHANGEABLE WITH AS-2518-16

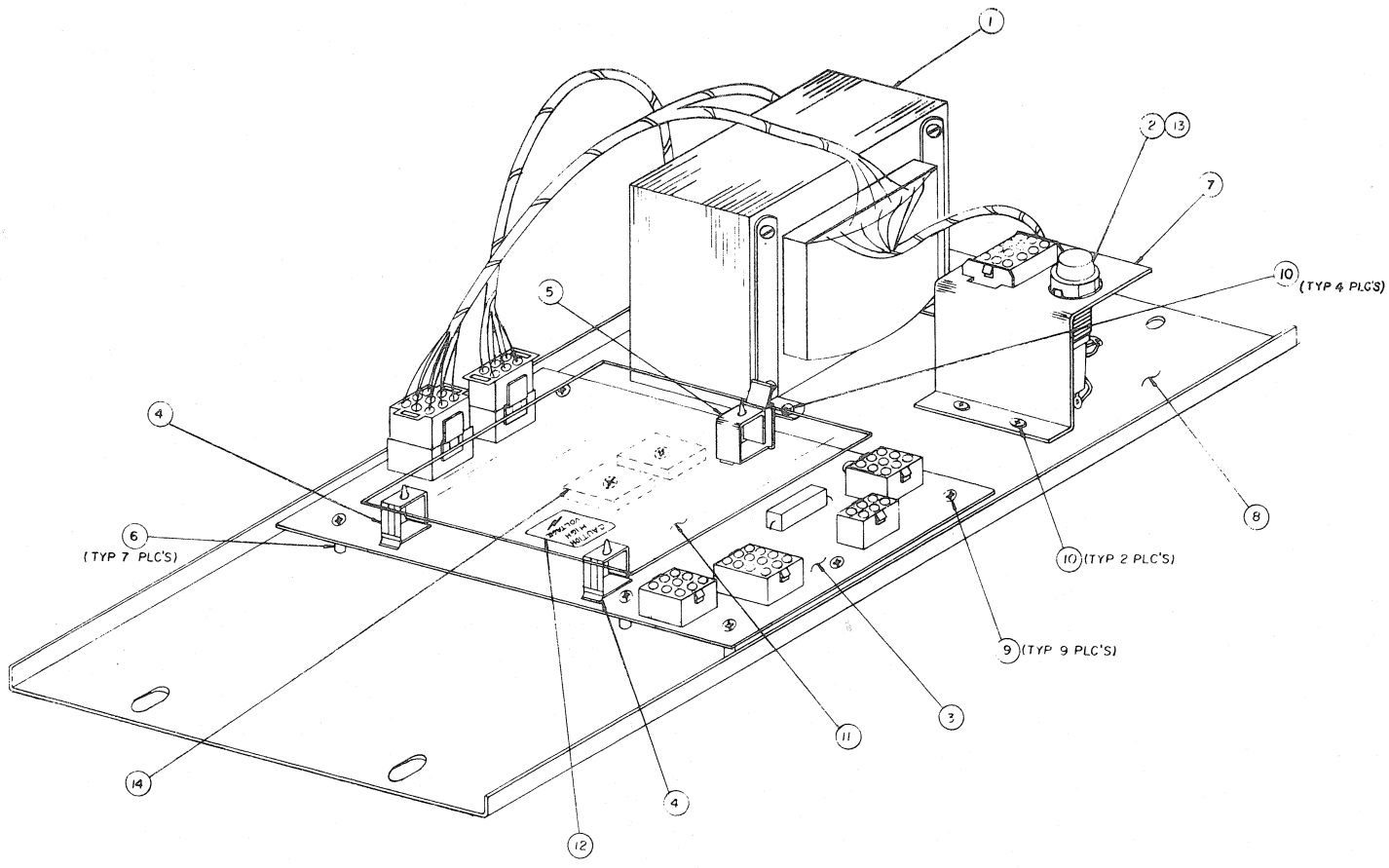
A3: SOLENOID DRIVER/VOLTAGE REGULATOR MODULE

COMPONENT PARTS LIST

ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
1	A3	AS-2518-22	Solenoid Driver/Voltage Regulator Module, Complete
3-14	Resistors		Resistor, See Schematic for value.
15	RT1	E-00599-0014	Pot. (Linear) 25K
17	C25, 29	E-00586-0014	Capacitor, .1 MFD, 20V
18	C26	E-00586-0059	Capacitor, 160 MFD, 350V
19	C24	E-00586-0063	Capacitor, 2 MFD @ 25V
20	C23	E-00586-0062	Capacitor, 11700 MFD, 20V
21	C1-C8, C11-C21	E-00586-0064	Capacitor, .002 MFD, 1kv
22	C27, C28	E-00586-0065	Capacitor, .01 MFD, 500V
24	K1	E-00146-0795	Relay, Printed Circuit
25	Q1-Q19	E-00585-0034	Transistor, SE9302
26	Q22, Q23	E-00585-0041	Transistor, 2N3440
27	Q21	E-00585-0042	Transistor, 2N3584
28	Q20	E-00710	+5V Regulator, LAS1405 or 78H05KC or LM323K
30	CR1-CR21	E-00587-0015	Diode (IN4004)
31	VR1	E-00598-0010	Diode, Zener 140V, IN5275A
33	U1, U3, U4	E-00681	I.C. Transistor Array, CA3081
34	U2	E-00620-0039	I.C. Binary to 1/16 Decoder, 74L154
36		E-00592-0002*	Relay Socket
37		M-1839*	Relay Holder
39		E-00682	Heat Sink, TO5
40		E-00682-0001	Heat Sink, TO66
41		E-00682-0002	Heat Sink, TO3 Case
42		E-00715-0039	15 Pin Wafer Connector
43		E-00715-0016	12 Pin Wafer Connector
44		E-00715-0020	25 Pin Wafer Connector
45		E-00715-0033	9 Pin Wafer Connctor
55		M-1838	Shield-Plexiglass
59		E-00148-0021	Fuse Clips
60	F1	E-00133-0029	Fuse 8 AG-3/16 Amp.
23	C22	E-00586-0085	Capacitor, .01 MFD, 25V

*USED WITH ITEM 24, E-00146-0791, PLUG IN RELAY ONLY

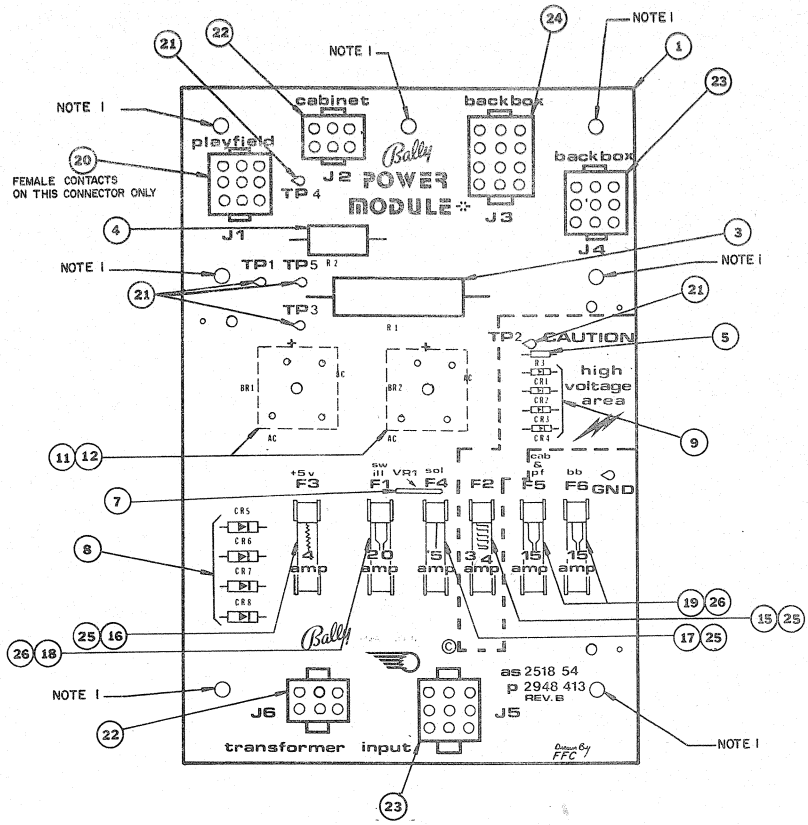
A2: POWER TRANSFORMER MODULE



COMPONENT PARTS LIST

ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
0	A2	AS-2877-6	Power Transformer Module, Complete
1		AS-3071-2	Transformer
2		E-148-25	Fuse Holder
3	A2	AS-2518-54	Power Module Assy.
4		M-1829-4	Hinged Support
5		M-1829-3	Edge Holder
6		M-1829-5	Spacer
7		P-6442-244b	Fuse & Connect Brkt.
8		P-6442-246	Chassis
9		RLPP-832-1812	Screw
10		RLPP-1032-1806	Screw
11		P-2692-2	Shield
12		M-469-936a	High Voltage Sticker
13		E-133-24	3A S.B. Fuse
14		M-1834	H. S. Compound

AS-2518-54 RECTIFIER BOARD ASSEMBLY

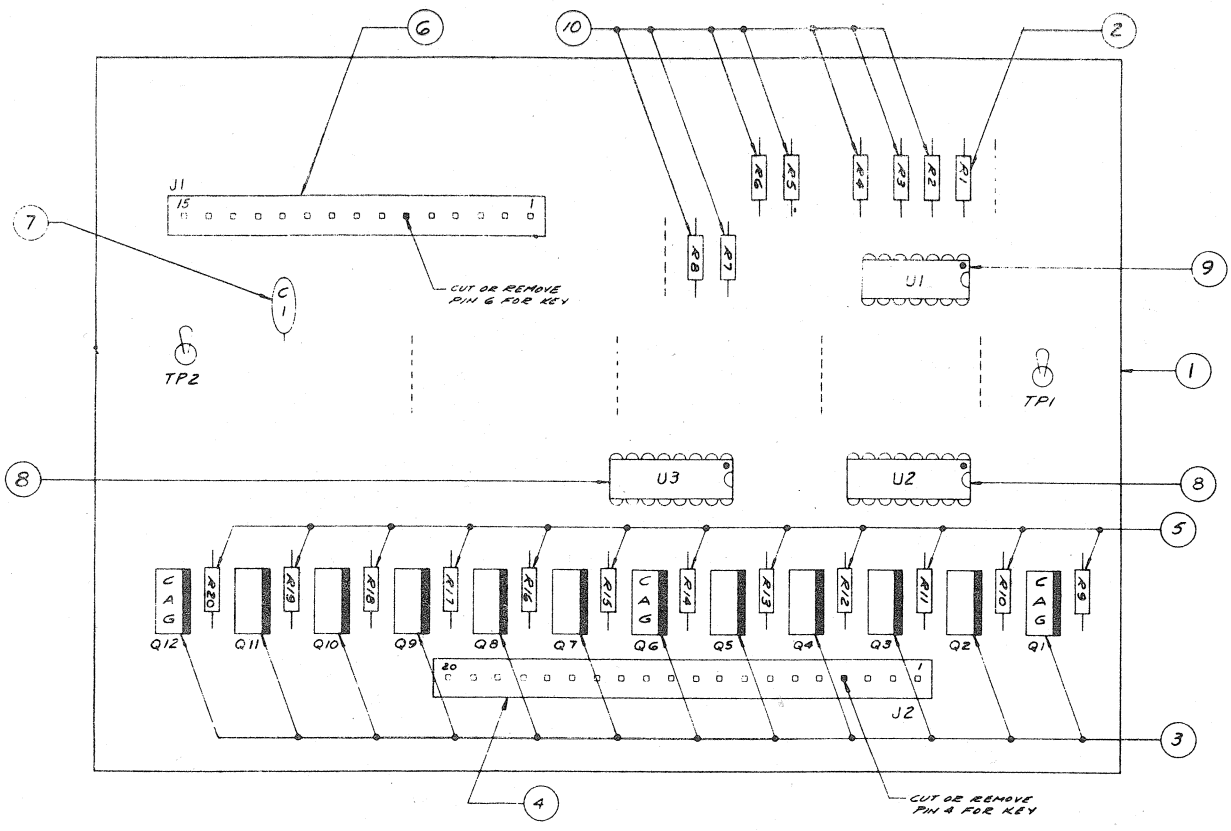


(Part of) A2: POWER TRANSFORMER MODULE
COMPONENT PARTS LIST

ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
0	A2	AS-2877-6	Power Transformer Module, Complete
1	P/O A2	AS-2518-54	Rectifier Board Assembly, Complete
3	R1	E-00104-0092	Resistor, 10%, 600 Ohm, 10W
4	R2	E-00104-0091	Resistor, 25 Ohm, 5W
5	R3	E-00105-0226	Resistor, 5%, 100K Ohm, ¼W
7	VR1	E-00623	Varistor
8	CR5, CR6, CR7, CR8	E-00587-22 or 24	3A Diode
9	CR1, CR2, CR3, CR4	E-00587-0015	Diode (IN4004)
10			
11	Used with BR1-2	P-1973-480	Spacer
12	BR1, BR2	E-00602-0007	Bridge Rectifier
15	F2	E-00133-0028	Fuse, ¾A, 250V, 3AG
16	F3	E-00133-0004	Fuse, 4A, 32V, 3AG
17	F4 NOTE 1	E-00133-0005	Fuse 5A, 32V, 3AG
18	F1	E-00133-0027	Fuse, 20A, 32V, 3AG
19	F5, F6	E-00133-0015	Fuse, 15A, 32V, 3AG
20	J1	E-806-9	9 CKT Socket Header
21	TP1, 2, 3, 4, 5	P-05399	Test Clip
22	J2, J6	E-805-6	6 CKT Pin Header
23	J4, J5	E-805-9	9 CKT Pin Header
24	J3	E-805-12	12 CKT Pin Header
25	F2, 3, 4	E-00148-0021	Fuse Clips
26	F1, 5, 6	E-00148-0022	Fuse Clips (Low Resistance)

NOTE 1—All games with 4 or more flippers use 7A

AS-2518-43 AUXILIARY LAMP DRIVER



A9: AUXILIARY LAMP DRIVER
COMPONENT PARTS LIST

ITEM	QTY.	REFERENCE DESIGNATION	BALLY PART NO.	DESCRIPTION
1	1	A9	AS-2518-43	Auxiliary Lamp Driver, Complete
2	1	R1	E-105-173	Resistor 2.2 Meg. Ω
3	12	Q1 Thru Q12	E-585-29	SCR MCR 106-1
4	2	J2	E-715-34	10 Pin Wafer Pin Connector
5	12	R9 Thru R20	E-105-237	Resistor 2K Ω
6	1	J1	E-715-39	15 Pin Wafer Pin Connector
7	1	C1	E-00586-0065	Capacitor .01 MFD
8	2	U3, U2	E-620-84	MC14555B Binary 1 to 4
9	1	U1	E-620-85	MC14013B Dual D Flip Flop
10	7	R2 Thru R8	E-105-242	Resistor 20K Ω