

Bally

GAME 1154-1
NO. 622

0485-312-242

1900-1200

GROUND

SHAKER



Bally

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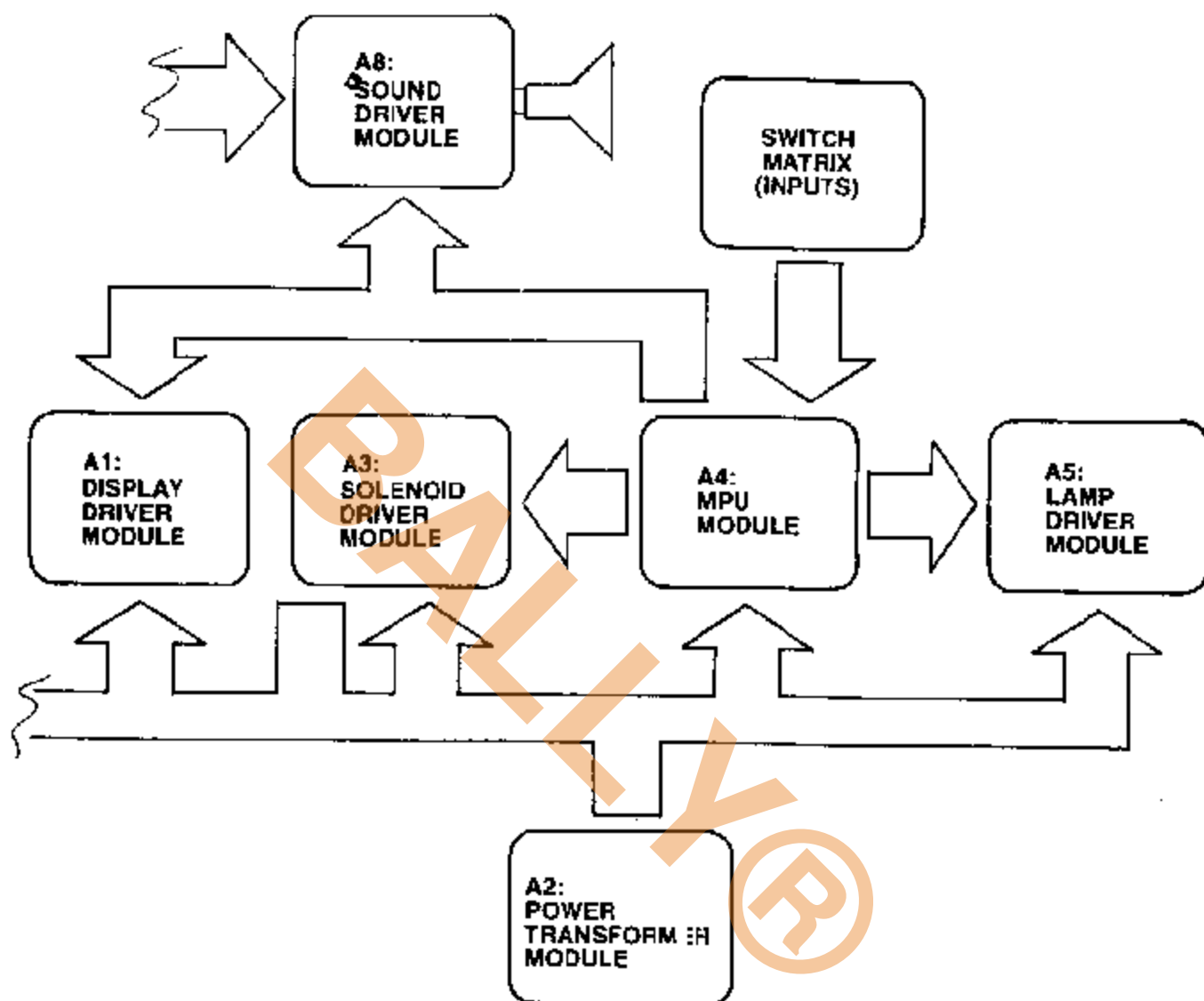
GAME #1154-E GROUND SHAKER

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:

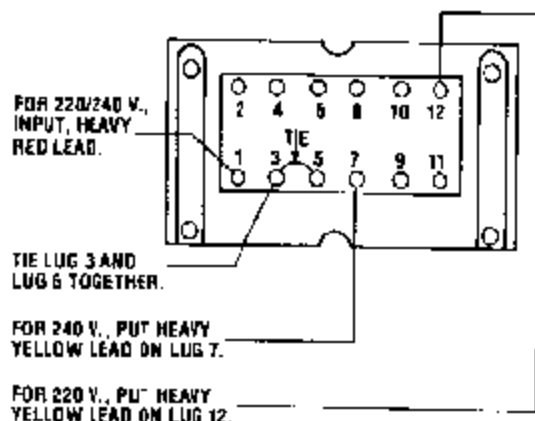
1. Check that all cable connectors are completely seated on printed circuit assemblies.
2. Check that cables are clear of all moving parts.
3. Check for any wires that may have become disconnected.
4. Check switches for loose solder or other foreign material that may have come loose in shipment and could 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.

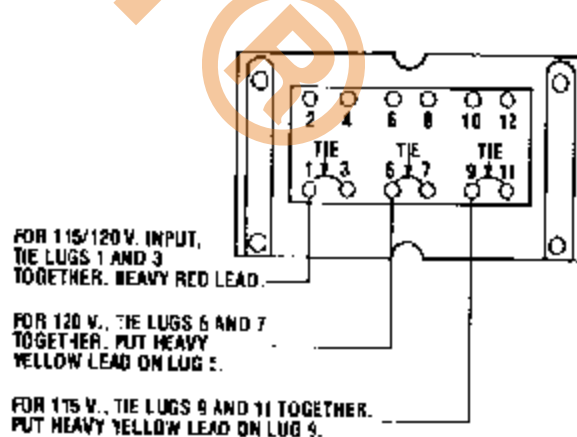
TRANSFORMER CONNECTION INSTRUCTIONS

E-122-125 TRANSFORMER WIRING FOR 220/240 V.,
50/60 CYCLE INPUT.



VARISTOR, BALLY PART NO. E-713-1,
LOCATED IN CABINET, MUST BE USED
FOR OPERATION AT 220 V. OR 240 V. A.C.

E-122-125 TRANSFORMER WIRING FOR 115/120 V.,
50/60 CYCLE INPUT.



VARISTOR, BALLY PART NO. E-713,
LOCATED IN CABINET, MUST BE USED
FOR OPERATION AT 115 OR 120 V. A.C.

FIGURE 1. TRANSFORMER
(PART OF POWER—TRANSFORMER MODULE A2, LOCATED IN BACK BOX).

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. The bonus score is advanced to 1000 points.

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. Rebound switches score 10 points. Thumper-bumpers, when not lit, score 10 points.

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 bonus score is advanced to 1000 points. 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 and the bonus is set to 1000 points before the game serves the extra ball for play.

Scoring over 1,000,000 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 is one factory installed slam switch on the front door. (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.

III. BOOKKEEPING FUNCTIONS

The game is designed to help the operator perform 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 14, appears on the Match/Ball in Play window as follows:

- 05— 00 to— 40=Current Credits
- *06—10000 to—99999= Total Plays (Paid & Free Games)
- *07—10000 to—99999= Total Replays (Free Games)
- 08— 00 to—99999= Total times 'High Score to Date' is beat
- *09—10000 to—99999= Coins Dropped thru Coin Chute #1
- *10—10000 to—99999= Coins Dropped thru Coin Chute #2**
- *11—10000 to—99999= Coins Dropped thru Coin Chute #3**
- *12— 00 to—99999= Number of Specials awarded from Panel Specials Only
- *13— 00 to—99999= Number of minutes of Game Play
- *14— 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 once more with the 14th entry displayed 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, 09, 10 and 11.

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 14 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.

#1154-E GROUND SHAKER FEATURE OPERATION & SCORING

A. BONUS SCORE FEATURE

A bonus score of 29,000 may be scored on left or right bonus. Going into top saucer advances left & right bonus and left side saucer advances left & right bonus depending on the arrow that is lit. Going over A-E lane or hitting C target advances left bonus. Going over B-F lane or hitting D target advances right bonus.

B. BONUS COLLECT AND BONUS DOUBLE

When the ball goes into side saucer & either left or right bonus or both are lit, the lit bonus scores are added to the players score. Going into the outhole, left, right, 20,000 super or 30,000 nitro bonus lites are lit, scores are collected. If the double bonus lite is on, bonus scores double. A tilt nullifies the bonus score.

C. OUTLANE SPECIAL LITE

On 3 & 5 bal. game when left & right bonus reach 15,000 the left special will lite.

SW. 8 controls the special lite.

SW. 8 OFF —outlanes alternate.

SW. 8 ON —both outlanes stay ON.

D. DROP TARGET FEATURE (on 3 & 5 ball)

1st time targets down scores 5,000 points and lites extra ball lite. 2nd time 4 targets down award extra ball and lites special lite 3rd and each additional time awards replay.

There is a recall on extra ball lite if lit from ball to ball. No recall on special lite.

E. A-B-C-D-E-F FEATURE

1st time A-B-C-D-E-F lites are put out 20,000 super bonus lites. 2nd time A-B-C-D-E-F lites are put out 30,000 nitro bonus and A thru F special lites. 3rd and each additional time A thru F is made one replay is awarded.

20,000 or 30,000 bonus are collected in outhole only. They also can score double when bonus is lit by the setting of SW. 23.

F. TOP SAUCER HOLE FEATURE

When ball goes into saucer with left arrow lit, it lites side bonus left arrow. When ball goes into saucer with right arrow lit, it lites side bonus right arrow. Making both left & right saucer arrows, lites to 5,000 saucer arrow. This arrow remains lit until the ball goes into the outhole.

When ball goes into saucer with the double bonus lit, it lites lower double bonus.

Saucer double bonus lites every other time or every 3 times.

SW 16 controls the double bonus lite.

SW 16 ON lites every other time.

SW 16 OFF lites every 3 times.

On 3 & 5 ball double bonus saucer lite comes on every other time.

G. LEFT SAUCER SCORE AND ADVANCED FEATURES

3 BALL when ball goes into saucer it scores 3,000 points, advances left & right bonuses 3 steps each and collects the lit collect bonus lite (advance left & right bonus arrow stays ON at all times).

5 BALL it scores 3,000 points and advances left & right bonus one step each if no bonus collect lites are lit (advances left & right bonus arrow lit goes out as soon as one of the bonus collect lites are lit).

H.

On 3 ball C & D, E & F are tied together (C & D is controlled by 3 & 5 ball switch).

On 5 ball E & F are tied together.

I. SPECIAL REPLAY/X-BALL/NOVELTY MODES

Switch #6 and #7 give the operator flexibility to award a replay, extra ball or score (Novelty) when a special is scored (outlanes, drop target, A thru F feature). The following chart explains the settings.

SWITCH	SW. 6-ON	SW. 6-OFF	SW. 6-OFF
Positions	SW. 7-ON	SW. 7-ON	SW. 7-OFF
Outlane special	REPLAY	X-BALL	NOVELTY
Drop target special	REPLAY	X-BALL*	50,000
A thru F feature special	REPLAY	X-BALL*	50,000
Drop target (x-ball)	X-BALL	X-BALL**	25,000
Scoring thresholds	REPLAY	X-BALL**	NO AWARD

*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 moved 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. 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 per coin 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 #1 (HNGE SIDE) OR #3	SWITCHES	CREDITS/COIN
	1 2 3 4 5 9 10 11 12 13	
	OFF OFF OFF OFF OFF	3/2 COINS*
	OFF OFF OFF OFF ON	3/2 COINS**
	OFF OFF OFF ON OFF	1/COIN
	OFF OFF OFF ON ON	1/2 COINS*
	OFF OFF ON OFF OFF	2/COIN
	OFF OFF ON OFF ON	2/2 COINS*
	OFF OFF ON ON OFF	3/COIN
	OFF OFF ON ON ON	3/2 COINS*
	OFF ON OFF OFF OFF	4/COIN
	OFF ON OFF OFF ON	4/2 COINS*
	OFF ON OFF ON OFF	5/COIN
	OFF ON OFF ON ON	5/2 COINS*
	OFF ON ON OFF OFF	6/COIN
	OFF ON ON OFF ON	6/2 COINS*
	OFF ON ON ON OFF	7/COIN
	OFF ON ON ON ON	7/2 COINS*
	ON OFF OFF OFF OFF	8/COIN
	ON OFF OFF OFF ON	8/2 COINS*
	ON OFF OFF ON OFF	9/COIN
	ON OFF OFF ON ON	9/2 COINS*
	ON OFF ON OFF OFF	10/COIN
	ON OFF ON OFF ON	10/2 COINS*
	ON OFF ON ON OFF	11/COIN
	ON OFF ON ON ON	11/2 COINS*
	ON ON OFF OFF OFF	12/COIN
	ON ON OFF OFF ON	12/2 COINS*
	ON ON OFF ON OFF	13/COIN
	ON ON OFF ON ON	13/2 COINS*
	ON ON ON OFF OFF	14/COIN
	ON ON ON OFF ON	14/2 COINS*
	ON ON ON ON OFF	15/COIN
	ON ON ON ON ON	15/2 COINS*

*No Credits until second coin is dropped

**One Credit for first coin. Two Credits for second coin provided that no scoring occurred between 1st and 2nd coin drops. If scoring occurred, second coin gives one credit

MAXIMUM CREDITS:

The maximum credits accepted by the machine limits the number of games that can be accumulated by coining, by winning repays 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****SWITCH 31**

5	ON
3	OFF

MATCH FEATURE:

When the Match Feature is ON, a random number appears in 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 three score levels. See Front Door Game Adjustments.

AWARD
REPLAY
EXTRA BALL
NO AWARD

SWITCH 7**SWITCH 6**

ON	ON
ON	OFF
OFF	OFF

HIGH SCORE TO DATE OR OVER 1,000,000 SCORE FEATURE:

The game is designed to award free games as an option if high score to date is beat or player exceeds 1,000,000 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	SWITCH 22	SWITCH 21
No Award	OFF	OFF
One Credit	OFF	ON
Two Credits	ON	OFF
<u>Three Credits</u>	<u>ON</u>	<u>ON</u>

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.

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 switch settings as shown.

SW. 29, 30 ON.

Playfield switches associated noises with background.

SW. 29 ON, SW. 30 OFF.

Playfield switches associated noises without background.

SW. 29, 30 OFF.

All scoring will have a chime effect.

SW. 29 OFF, SW. 30 ON.

Most all scoring will have a laughing noise effect.

GAME FEATURE OPTIONS:

Outlane Special Adjustment:

Liberal	SW. 8 ON	Both lanes lite for Special.
Conservative	SW. 8 OFF	Alternates Special from side to side.

Top Saucer Double Bonus Lite Adjustment:

Liberal	SW. 16 ON	Double bonus lites every 2nd time.
Conservative	SW. 16 OFF	Double bonus lites every 3rd time.

"E" and "F" Rollover Adjustment:

Liberal	SW. 32 ON	"E" and "F" are tied together.
Conservative	SW. 32 OFF	"E" and "F" are not tied.

20,000, 30,000 Bonus 2X adjustment:

Liberal	SW. 23 ON	Making 20,000 or 30,000 bonus, scores double when double bonus is lit.
Conservative	SW. 23 OFF	Making 20,000 or 30,000 bonus, scores single when double bonus is lit.

Outlane Bonus Special Adjustment:

SW. 14, 15 OFF — Making left & right bonus at 10,000 lites outlane special.

SW. 14 ON, 15 OFF — Making left & right bonus at 15,000 lites outlane special.

SW. 14, 15 ON — Making left & right bonus at 20,000 lites outlane special.

NOTE: SW. 24 game over attraction sound. Games having ROM-E776-10, SW. 24 is not used. Games having ROM-E776-17, SW. 24 is used, to turn game over attraction sound off if the location desires so.

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 1,000,000 Feature:

The game is designed to award free games when 'High Score to Date' is beat, or if the player exceeds 1,000,000 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 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 positioning switches as discussed under 'Back Box Game Adjustments.'

*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)

#1154-E GROUND SHAKER

RUBBER PARTS

A.	R-521-1	1" DIA.	(1)
B.	R-521-3	2" DIA.	(2)
C.	R-521-5	3" DIA.	(2)
D.	R-521-2	1½" DIA.	(4)
E.	R-521-4	2½" DIA.	(2)
F.	R-243	5/16" DIA.	(1)
G.	R-408-3	FLIPPER	(2)

PANEL TOP PARTS

1.	Arch Rail	M-1774-1
2.	Rail Post	C-907 (3)
3.	Rail Post Cap	C-908 (3)
4.	Bottom Arch	P-5971-64
5.	Shooter Gauge	P-6359-23
6.	Ball Gate (R)	A-1475-13
7.	Ball Gate (L)	A-1475-12
8.	Screened Plastics (Set)	M-1330-158
9.	Drop Target Assembly	AS-2795-40
10.	Roller Wire	AS-2806 (6)
11.	Thumper Cap	A-3713-45
12.	Thumper Cap	A-3713-51 (2)
13.	Ball Guide Wire	M-121-59
14.	Ball Guide Wire	M-121-44
15.	Ball Guide Wire	M-121-18 (2)
16.	Ball Guide Wire	M-121-53 (2)
17.	Orthole Wire	AS-2806-21
18.	Guide Rail Assy.	A-3032-35
19.	Ball Gate Assy.	AS-2250-24 (R)
20.	Spinner Gate Assy.	AS-2250-58
21.	Mini-Post Assy.	AS-2836-1 (3)
22.		
23.	Guide Rail	C-938-5 (4)
24.	Target assy.	AS-2911-3 (3)
25.	Flipper & Shaft Assy.	AS-2214-24 (2)
26.	Ball Wire Guide	M-121-43
27.	Ball Guide Wire	M-121-30
28.	Ball Guide Wire	M-121-33

CONS.—Conservative
MED.—Medium
LIB.—Liberal

Indicates movable posts for scoring adjustments.

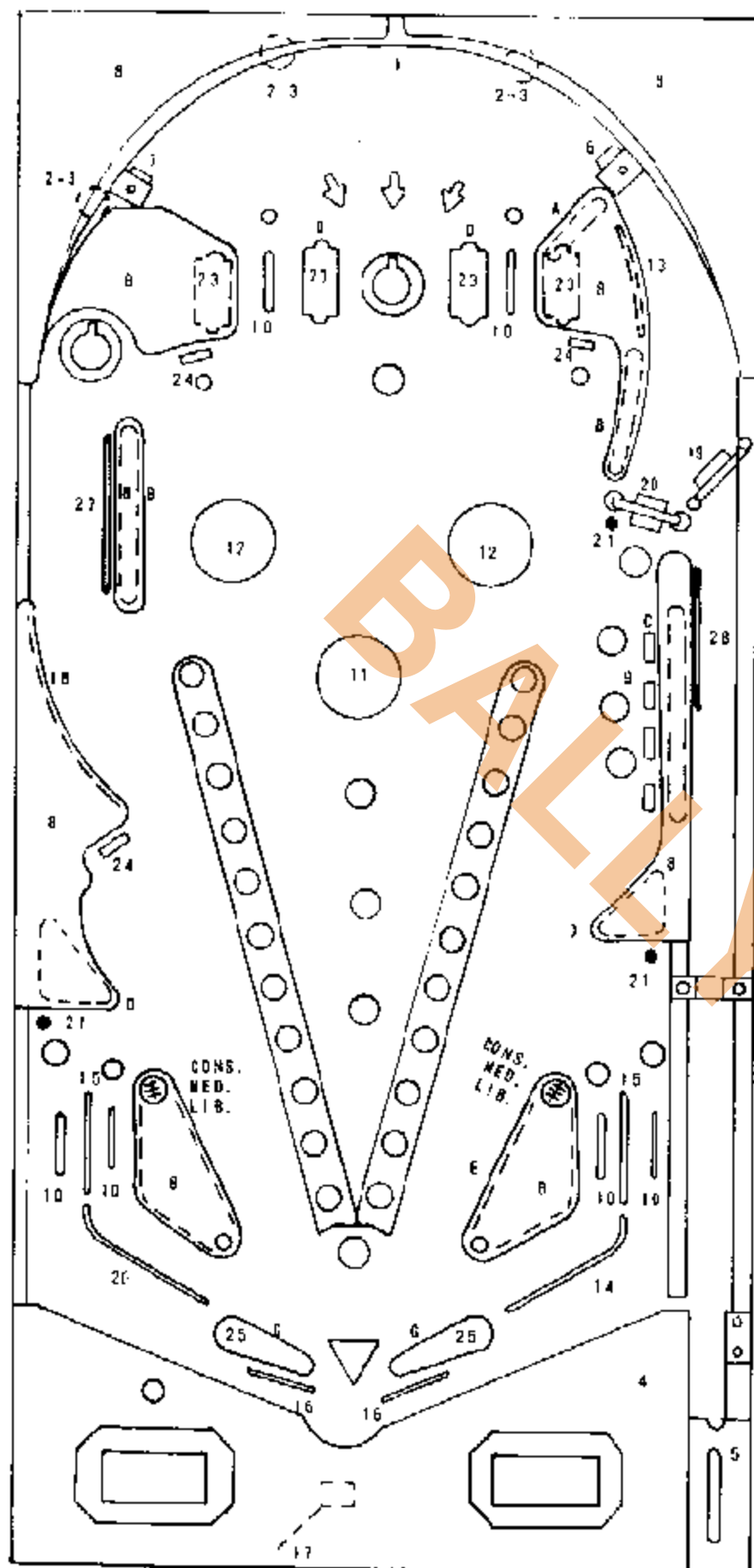


FIGURE 11

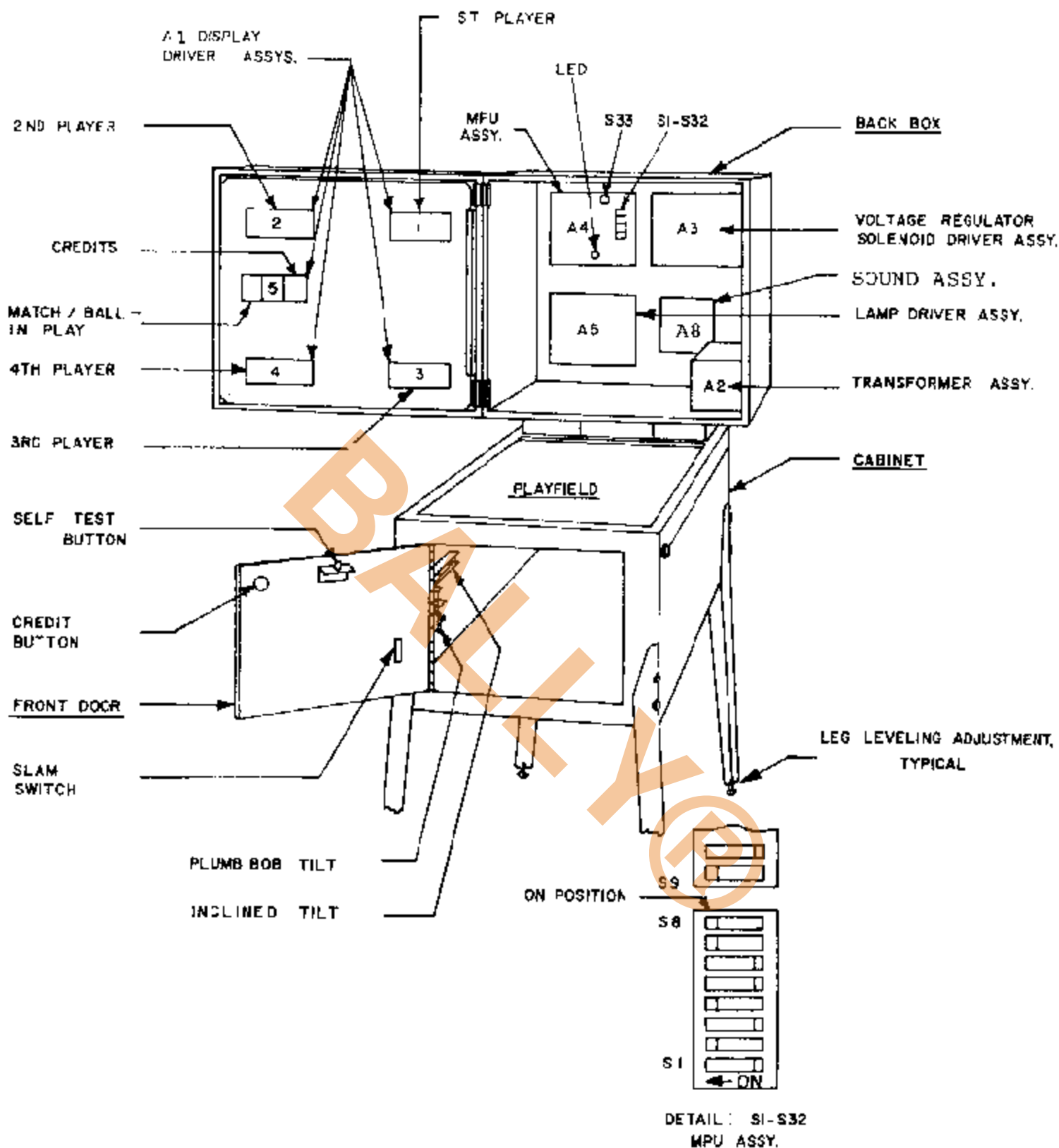


FIGURE III. ELECTRONIC PIN BALL MACHINE

RECOMMENDED

Instruction, Score Cards and High Score feature settings to be used on GROUND SHAKER ELECTRONIC #1154-E

3 BALL

REPLAYS

Instruction Card M-1508-82-E
Score Card M-1508-82-B w/o
1 Replay at 220,000
1 Replay at 460,000

EXTRA BALL

Instruction Card M-1508-82-F
Score Card M-1508-82-MM
1 Extra Ball at 240,000
1 Extra Ball at 480,000
1 Extra Ball at 700,000

5 BALL

REPLAYS

Instruction Card M-1508-82-TT
Score Card M-1508-82-A w/Y
1 Replay at 360,000
1 Replay at 600,000

EXTRA BALL

Instruction Card M-1508-82-F
Score Card M-1508-82-RR
1 Extra Ball at 390,000
1 Extra Ball at 630,000
1 Extra Ball at 850,000

(all playfield posts in medium position).

ADDITIONAL CARDS

REPLAYS

M-1508-H	120,000	360,000	
M-1508-I	140,000	380,000	
M-1508-J	160,000	400,000	
M-1508-K	180,000	420,000	
M-1508-L	200,000	440,000	
M-1508-M	220,000	460,000	
M-1508-N	240,000	480,000	
M-1508-O	260,000	500,000	
M-1508-P	280,000	520,000	
M-1508-Q	300,000	540,000	
M-1508-R	320,000	560,000	
M-1508-S	340,000	580,000	
M-1508-T	360,000	600,000	
M-1508-U	380,000	620,000	
M-1508-V	400,000	640,000	
M-1508-W	420,000	660,000	
M-1508-X	440,000	680,000	
M-1508-Y	460,000	700,000	
M-1508-AA	140,000	430,000	580,000
M-1508-BB	160,000	450,000	600,000
M-1508-CC	180,000	470,000	620,000
M-1508-DD	200,000	490,000	640,000
M-1508-EE	220,000	510,000	660,000
M-1508-FF	240,000	530,000	680,000
M-1508-GG	260,000	550,000	700,000

EXTRA BALL

M-1508-MM	240,000	480,000	700,000
M-1508-NN	270,000	510,000	730,000
M-1508-OO	300,000	540,000	760,000
M-1508-PP	330,000	570,000	790,000
M-1508-QQ	360,000	600,000	820,000
M-1508-RR	390,000	630,000	850,000
M-1508-SS	420,000	660,000	880,000

Instruction Card, Novelty
M-1508-82-G

Blanks (3)

High game to date recommended levels
(reset periodically)

3 BALL 540,000
5 BALL 680,000

M-1508-HH	280,000	570,000	720,000
M-1508-II	300,000	590,000	740,000
M-1508-JJ	320,000	610,000	760,000
M-1508-KK	340,000	630,000	780,000
M-1508-LL	360,000	650,000	800,000

#1154-E GROUND SHAKER

RECOMMENDED SETTINGS

		3 BALL	5 BALL
SPECIAL: REPLAY	SW. 6	ON	ON
	SW. 7	ON	ON
Outlane special	SW. 8	OFF	OFF
Top saucer double bonus lite	SW. 16	ON	ON
E and F rollover lane lite	SW. 32	ON	ON
20,000, 30,000 Bonus 2X	SW. 23	ON	ON
Outlane bonus special	SW. 14	ON	ON
	SW. 15	OFF	OFF

The following chart gives recommendations for three typical types of operation

REPLAY	3-BALL	5-BALL
Instruction Card	M-1508-82-E	M-1508-82-TT
Score Card	M-1508-82-B	M-1508-82-A
Major Mode	SW. 6, 7, ON	SW. 6, 7, ON
Match	SW. 28 ON	SW. 28 ON
High Score to Date	SW. 21, 22, ON	SW. 21, 22, ON
X-BALL		
Instruction Card	M-1508-82-F	M-1508-82-F
Score Card	M-1508-82-b w/MM	M-1508-82-a w/RR
Major Mode	SW. 6 OFF	SW. 6 OFF
	SW. 7 ON	SW. 7 ON
Match	SW. 28 OFF	SW. 28 OFF
High Score to Date	SW. 21, 22, OFF	SW. 21, 22, OFF
NOVELTY		
Instruction Card	M-1508-82-G	M-1508-82-G
Major Mode	SW. 6, 7, OFF	SW. 6, 7, OFF
Match	SW. 28 OFF	SW. 28 OFF
High Score to Date	SW. 21, 22, OFF	SW. 21, 22, OFF

ADDITIONAL CARDS FOR PAGE 11

REPLAYS

M-1508-UJ	480,000	720,000	M-1508-EEE	380,000	670,000	820,000
M-1508-VV	500,000	740,000	M-1508-FFF	400,000	690,000	840,000
M-1508-WW	520,000	760,000	M-1508-GGG	420,000	710,000	860,000
M-1508-XX	540,000	780,000	M-1508-HHH	440,000	730,000	880,000
M-1508-YY	560,000	800,000	M-1508-III	460,000	750,000	900,000
M-1508-ZZ	580,000	820,000	M-1508-JJJ	480,000	770,000	920,000
M-1508-AAA	600,000	840,000	M-1508-KKK	500,000	790,000	940,000
M-1508-BBB	620,000	860,000	M-1508-LLL	520,000	810,000	960,000
M-1508-CCC	640,000	880,000	M-1508-MMM	540,000	830,000	980,000
M-1508-DDD	660,000	900,000	M-1508-NNN	560,000	850,000	990,000

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 the "Game Over" 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 4 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.

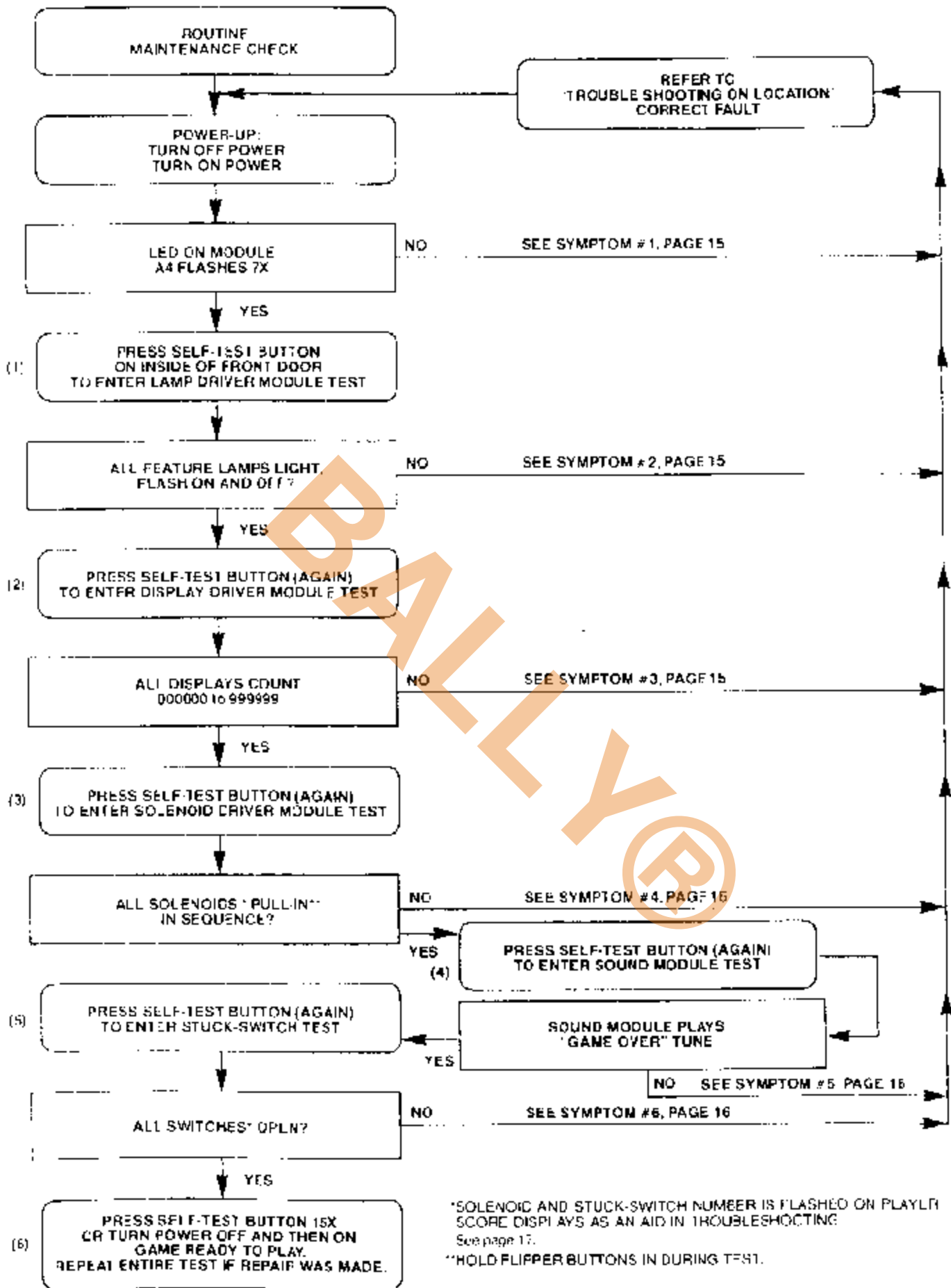
After successful completion of the Self Diagnostic Test procedure, set the game up for play. Exercise each rollover, thumper-bumper, slingshot, etc., by hand until each switch assembly on the playfield has been checked for proper operation. If actuating a switch assembly results in intermittent or no 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



- 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, it 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 live 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) **SYMPTOM:** 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, bumper-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. 56D

*Turn power On-Off switch OFF and then ON

GAME #1154-E GROUND SHAKER (FIGURE V)

SOLENOID IDENTIFICATION TABLE

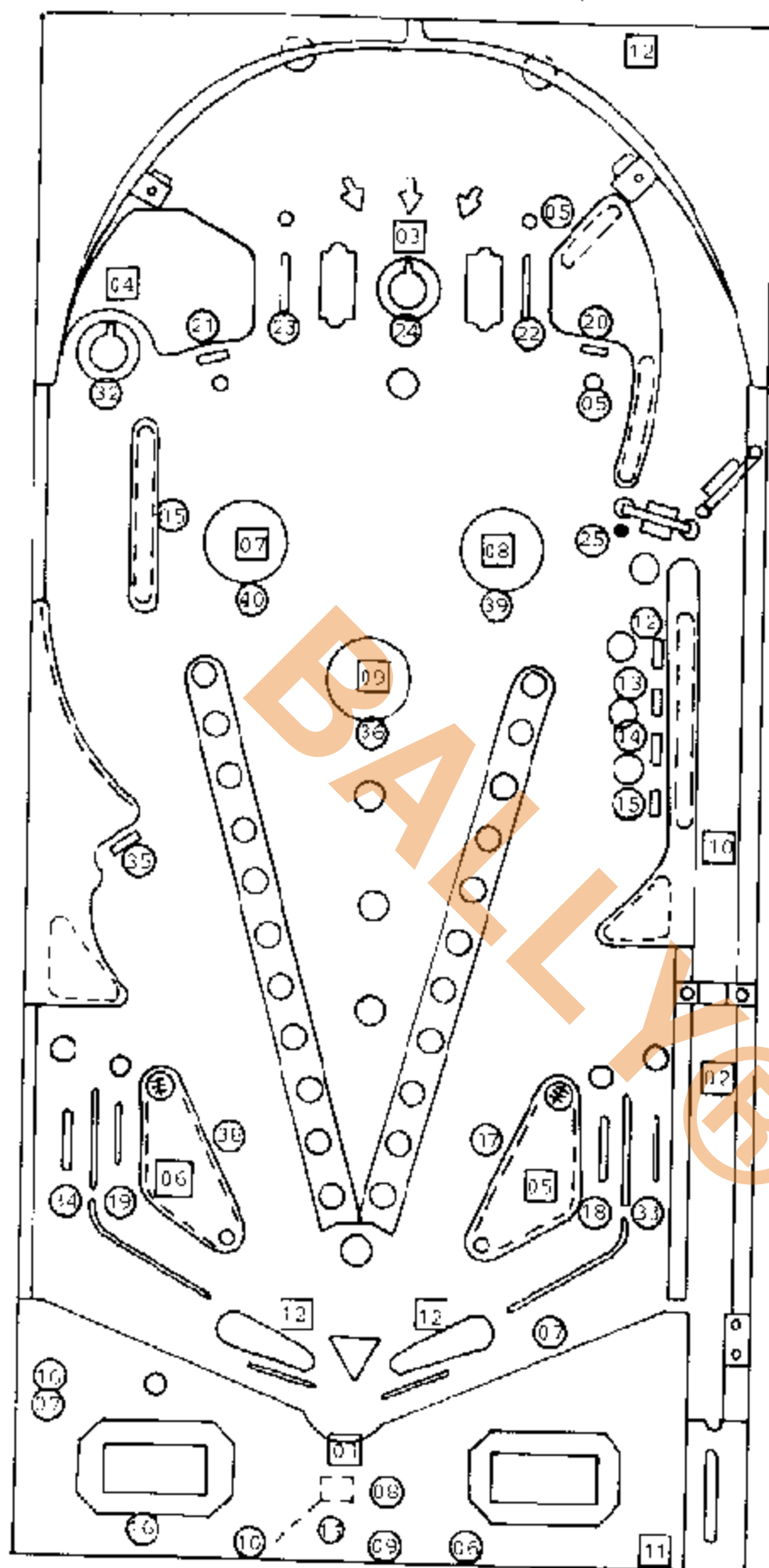
Self Test #	SOLENOID IDENTIFICATION	Self Test #	SOLENOID IDENTIFICATION
01	Outhole kicker	07	Left thumper bumper
02	Knocker	08	Right thumper bumper
03	Top center saucer	09	Bottom thumper bumper
04	Left side saucer	10	Drop target reset
05	Right slingshot	11	Coin lockout door
06	Left slingshot	12	K1 relay (flipper enable)

SWITCH ASSEMBLY SELF-TEST DISPLAY NUMBERS

Switch Self Test #	DESCRIPTION	Switch Self Test #	DESCRIPTION
01		21	C Target
02		22	B Follower lane
03		23	A Follower lane
04		24	Top center saucer
05	30 point reb. (30)	25	Spinner
06	Credit button	26	
07	Tilt (3)	27	
08	Outhole	28	
09	Coin III (rt)	29	
10	Coin I (left)	30	
11	Coin II (middle)	31	
12	Drop target A (top)	32	Saucer left side
13	Drop target B	33	Right outlane
14	Drop target C	34	Left outlane
15	Drop target D (bottom)	35	Adv L & R bonus target
16	Slam (2)	36	Bottom thumper bumper
17		37	Right slingshot
18	F rollover lane	38	Left slingshot
19	E rol over lane	39	Right thumper bumper
20	D target	40	Left thumper bumper

NOTE: SLINGSHOT & THUMPER BUMPER COILS
WILL BE ENERGIZED WHEN SWITCH IS MADE.

#1154
GROUND SHAKER



○ INDICATES SWITCH ASSEMBLY
IDENTIFICATION NUMBERS.
NOTE: CABINET: 07, 15
DOOR: 06, 09, 10
11, 16

□ INDICATES SOLENOID
IDENTIFICATION NUMBERS.
NOTE: DOOR: 11
BACKBOX: 12
CABINET: 02

FIGURE V

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" overtravel 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 a 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 MANUFACTURING CORPORATION
2640 WEST BELMONT AVENUE
CHICAGO, ILLINOIS 60618
ATTN: PARTS DEPARTMENT

SERVICE HINTS:

The Bally playfield has an improved tuff-coat finish with excellent wearing properties. Its life expectancy, 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 **#1154-E GROUND SHAKER**

MISCELLANEOUS

	PART NUMBER
Transformer (Domestic or Export)	E-122-125
Bulbs, #44	E-125-22
Fuse, 1 Amp. 3 AG Slow Blow (Playfield Solenoid Protection)	E-133-44

ASSEMBLY COILS

Coin Lockout	FO-36-7000
Flipper (2)	AQ-25-500/ 34-4500
Knocker	AR-26-1200
Outhole Kicker	AN-26-1200
Thumper-Bumper (3)	AN-26-1200
Sling-Shot (2)	AN-26-1200
Drop Target Reset	NO-26-1500
Saucer (2)	AO-27-1300

PLAYFIELD PARTS

See Figure II

MODULES

Lamp Driver A5	AS-2518-23
Display Driver A1 (5 used)	AS-2518-21
Solenoid Driver/Voltage Regulator A3	AS-2518-22
MPU A4	AS-2962-9
Transformer & Rectifier A2	AS-2877-1
Rectifier Board (Part of A2)	AS-2518-18
Sound	AS-3022-2

REPAIRS PROCEDURES/AIDS

Module & Component Replacement	EC-560-1
AID (Assistance in Diagnostics)	KIT #485-1
Kit, used with EC-560-1	

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 #490—For Rectifier Board (Part of A2)

Kit #503—MPU Board A4 (Less Memory U1-U6)

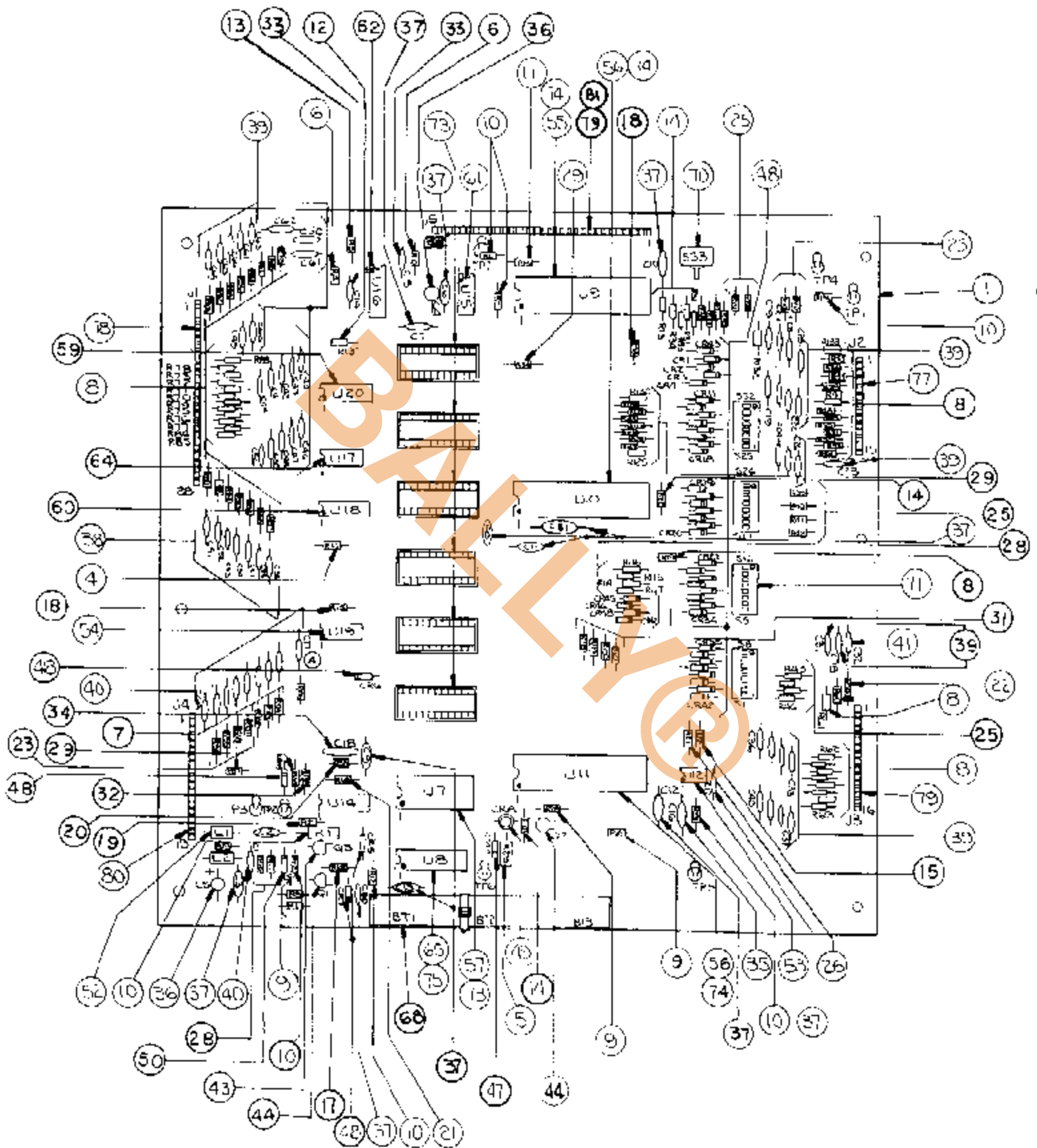
Kit #492—For Solenoid Driver/Voltage Regulator A3

Kit #493—For Display Driver A1

Kit #494—For Lamp Driver A5

Kit #559—For Sound A8

AS-2518-35 MPU MODULE



A4: MPU MODULE COMPONENT PARTS LIST

ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
1	A4 (see note 1)	AS-2962-9	MPU Module Complete. Ground Shaker
2	A4 (see note 2)	AS-2518-35	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-00586-0083	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, C31	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, 1kv
43	Q5	E-00585-0023	Transistor PNP (MPS-3702)
44	G1, Q2	E-00585-0031	Transistor (2N3904)
47	CR44	E-00587-0006	Diode (IN4004)
48	CR1-CR7, CR11-CR43, CR45-CR49	E-00587-0014	Diode (IN4148)
49	CR8	E-00679	LED (Green)
50	VR1	E-00598-0003	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-00620-0023	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	Dua. Monostable (9602)
64	U17	E-00620-0041	Quad 2 Inputs (74L00N)
65	U8	E-00620-0042	RAM (CMOS, P5101L-3)
68	BT1, BT2, BT3	E-00628-0003	Battery
70	S33	E-00658-0001	Push Button Switch
71	S1-S3, 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	J6	E-00715-0024	17 Pin Wafer Connector

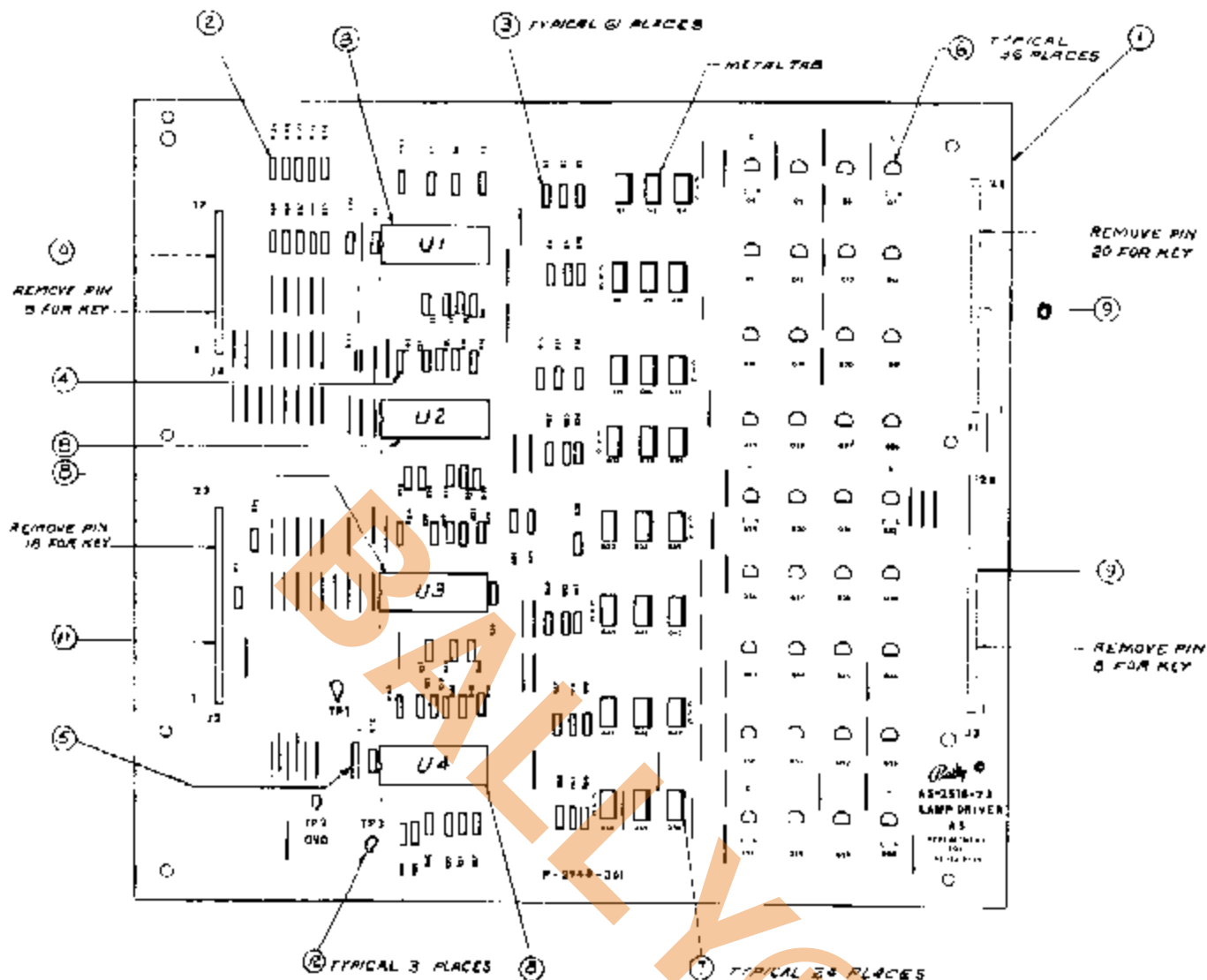
NOTE 1:

When ordering, fill in dash number. For example, AS-2962-0: LOST WORLD, AS-2962-2: SIX MILLION DOLLAR MAN, AS-2962-3: PLAYBOY, AS-2962-4: VOLTAN, AS-2962-5: SUPERSONIC, AS-2962-6: STAR TREK, AS-2962-7: KISS, AS-2962-8: PARAGON, AS-2962-9: GROUND SHAKER, AS-2962-10: HARLEM GLOBE-TROTTERS, AS-2962-12: DOLLY PARTON, AS-2962-14: FUTURE SPA.

NOTE 2:

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

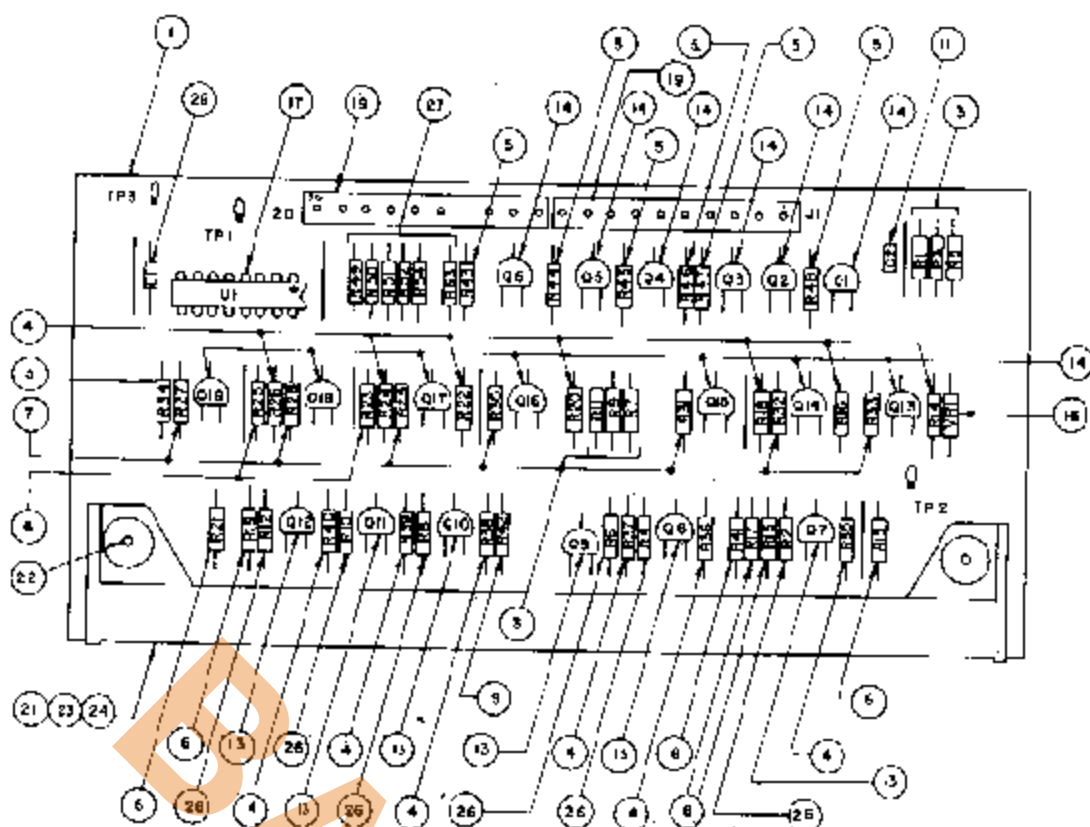
AS-2518-23 LAMP DRIVER MODULE



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-0C105-242	Resistor, 20k Ω , 5%, 1/4 W
3	R1-R60, R70	E-0C105-0237	Resistor, 2k Ω , 5%, 1/4 W
4	R61-R69	E-0C105-0256	Resistor, 2.2M Ω , 1/4 W
5	C1	E-0C586-0065	Capacitor, .01 MFD, 500V
6	Q4-Q7, Q11-Q14, Q18-Q21, Q25-Q32, Q36-Q39, Q43-Q46, Q50-Q53, Q57-Q60	E-0C585-0014	SCR, 2N5080
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, 145143
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 DISPLAY DRIVER MODULE

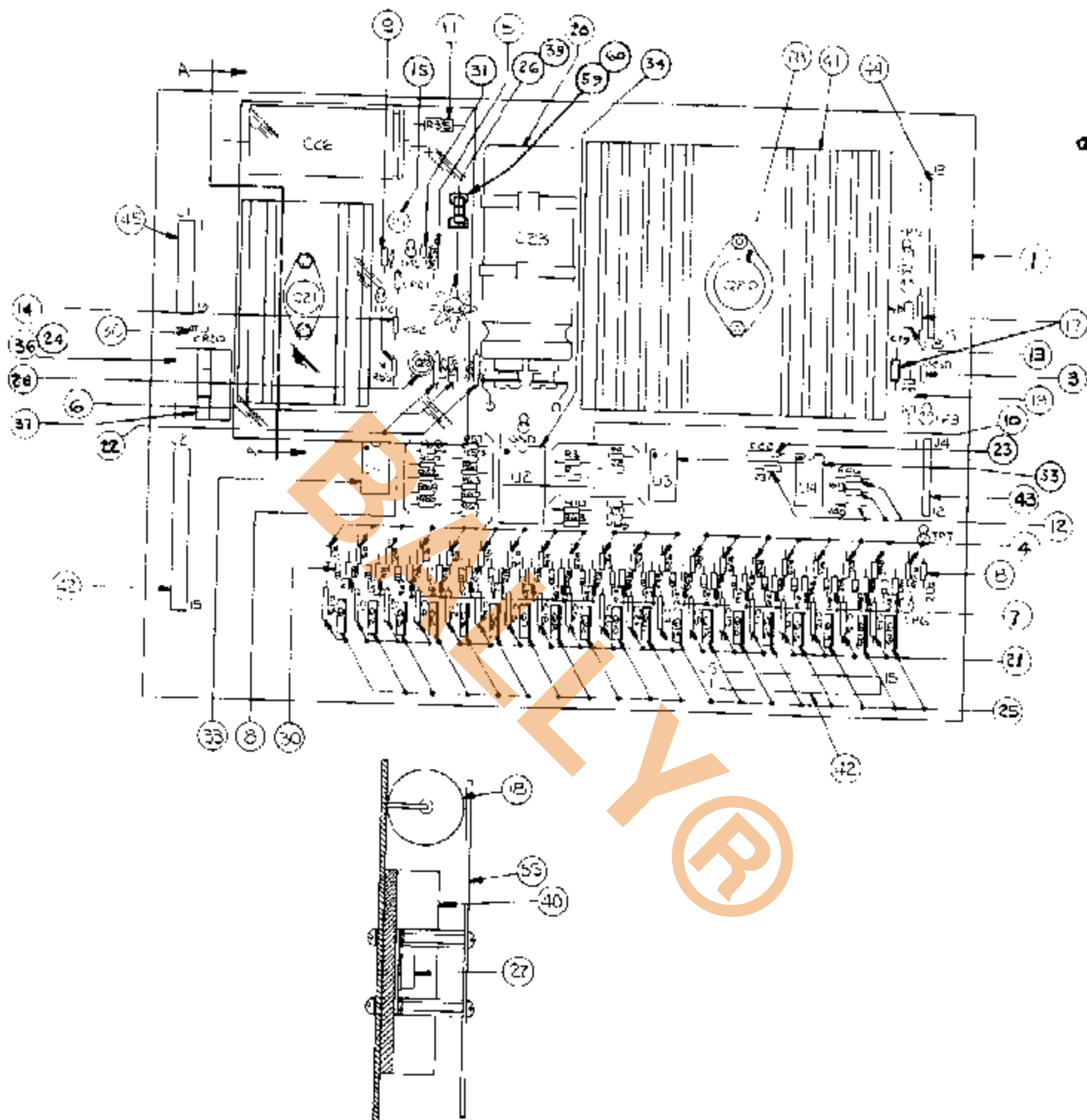


A1: DISPLAY DRIVER MODULE COMPONENT PARTS LIST

ITEM	QTY.	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
1	1		P-2948-296	P.C. Board, M-645-392
3	7	R1, R3, R5, R7, R9, R11, R34	E-105-226	Resistor, 100K Ω
4	13	H14, 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-105-230	Resistor, 1K Ω
8	1	R41	E-105-231	Resistor, 39K Ω
9	1	R42	E-105-271	Resistor, 240K Ω
10				
11	1	C2	E-585-65	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	VH1	E-588-7	Zener Diode, 110V
17	1	U1	E-620-38	I.C. Decoder
18				
19	2	J1	E-715-34	10 Pin Water Pin Connector
21	1	DS1	E-680	Digital Display Panel
22	7		M-1836	Hi-Lc Screw, W/H
23	1		P-2389	Display Mounting (Top)
24	1		P-2389-1	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



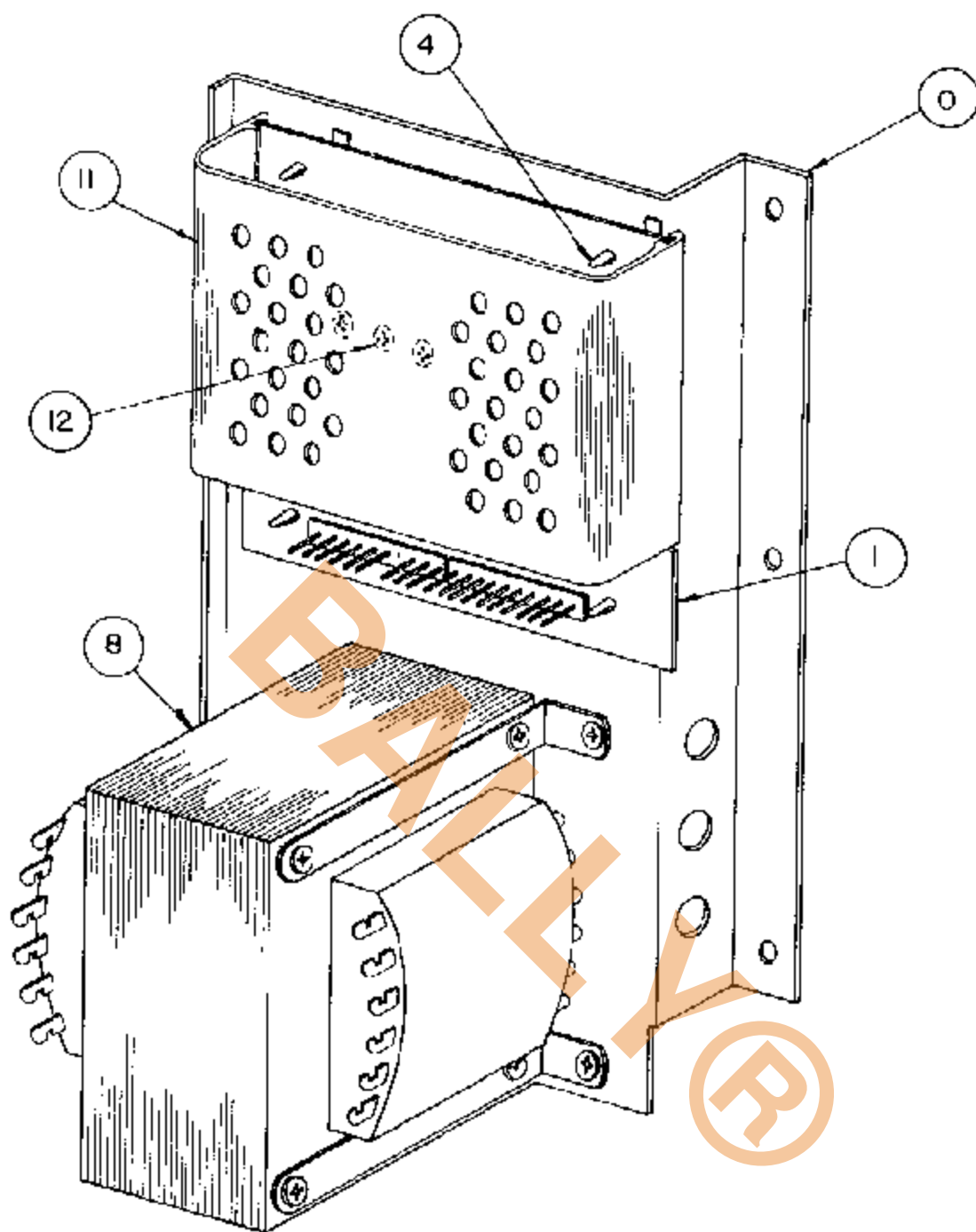
NOTE: INTERCHANGEABLE WITH AS-2518-16

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
19	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 (1N4004)
31	VR1	E-00598-0010	Diode, Zener 140V, 1N5275A
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 Connector
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

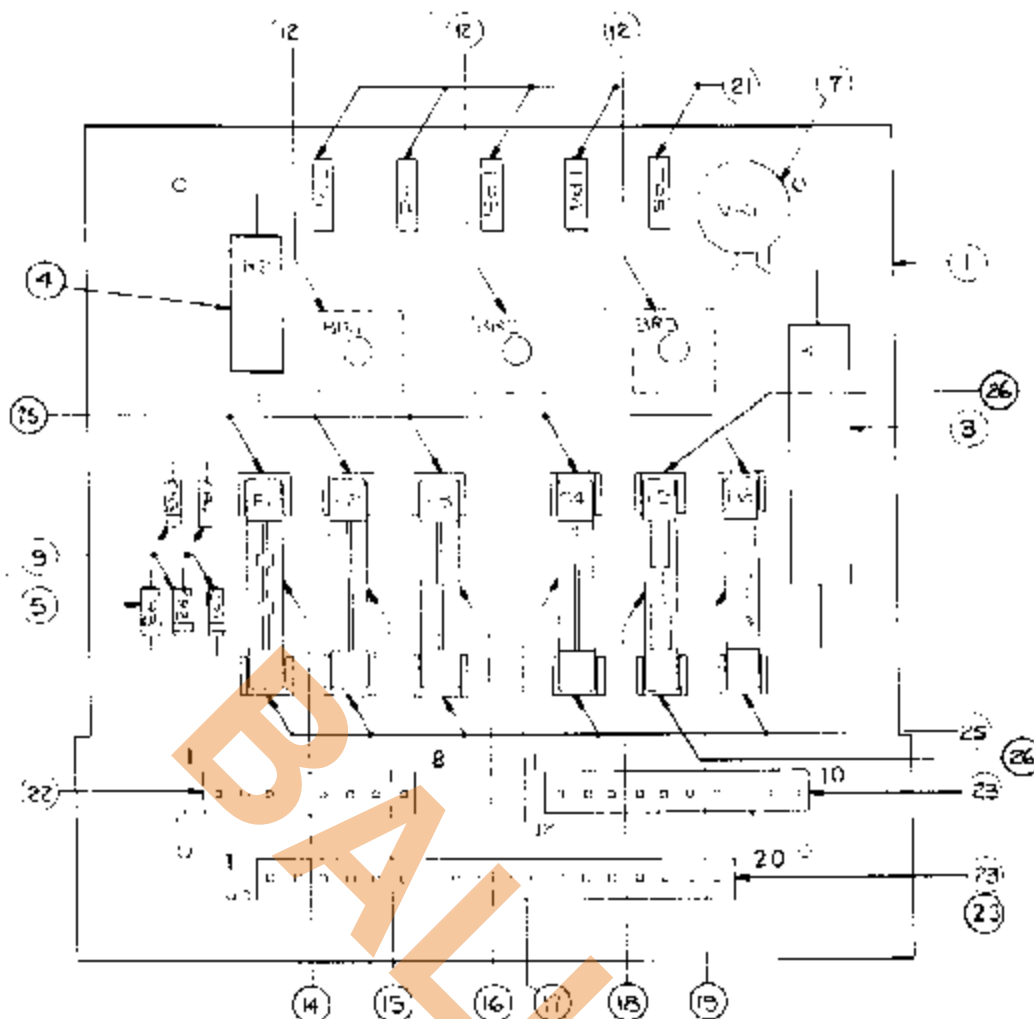
*USED WITH ITEM 24 E-00146-0791, PLUG IN RELAY ONLY



A2: POWER TRANSFORMER MODULE COMPONENT PARTS LIST

ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
0	A2	AS-2877-1	Power Transformer Module, Complete
1		AS-2518-18	Rectifier Board Assembly
4		M-1829-2a	Circuit Board Support (4 Req'd.)
8		E-00122-0125c	Transformer 120/240V, 50/60 Hz
11		P-2692b	P.C.B. Cover
12		M-1834	Heat Sink Compound

AS-2518-18 RECTIFIER BOARD ASSEMBLY



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

ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
1	P/O A2	AS-2518-18	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-00105-0223	Resistor, 5%, 100K Ohm, 1/4W
7	VR1	E-00523	Varistor
9	CR1, CR2, CR3, CR4	E-00587-0005	Diode (1N4004)
12	BR1, BR2, BR3	E-00602-0003	Bridge Rectifier (VJ248 VARO)
14	F1	E-00133-0010	Fuse, 10A, 32V, 3AG
15	F2	E-00133-0028	Fuse, 3/4A, 250V, 3AG
16	F3	E-00133-0004	Fuse, 4A, 32V, 3AG
17	F4	E-00133-0005	Fuse, 5A, 32V, 3AG
18	F5	E-00133-0027	Fuse, 20A, 32V, 3AG
19	F6	E-00133-0024	Fuse, 3A, 3AG, S.B.
21		E-00584	Test Point
22	J1	E-00715-0032	8 Pin Wafer Connector
23	J2, J3	E-00715-0034	10 Pin Wafer Connector
25		E-00148-0021	Fuse Clips
26		E-00148-0022	Fuse Clips

A8: SOUND MODULE COMPONENT PARTS LIST

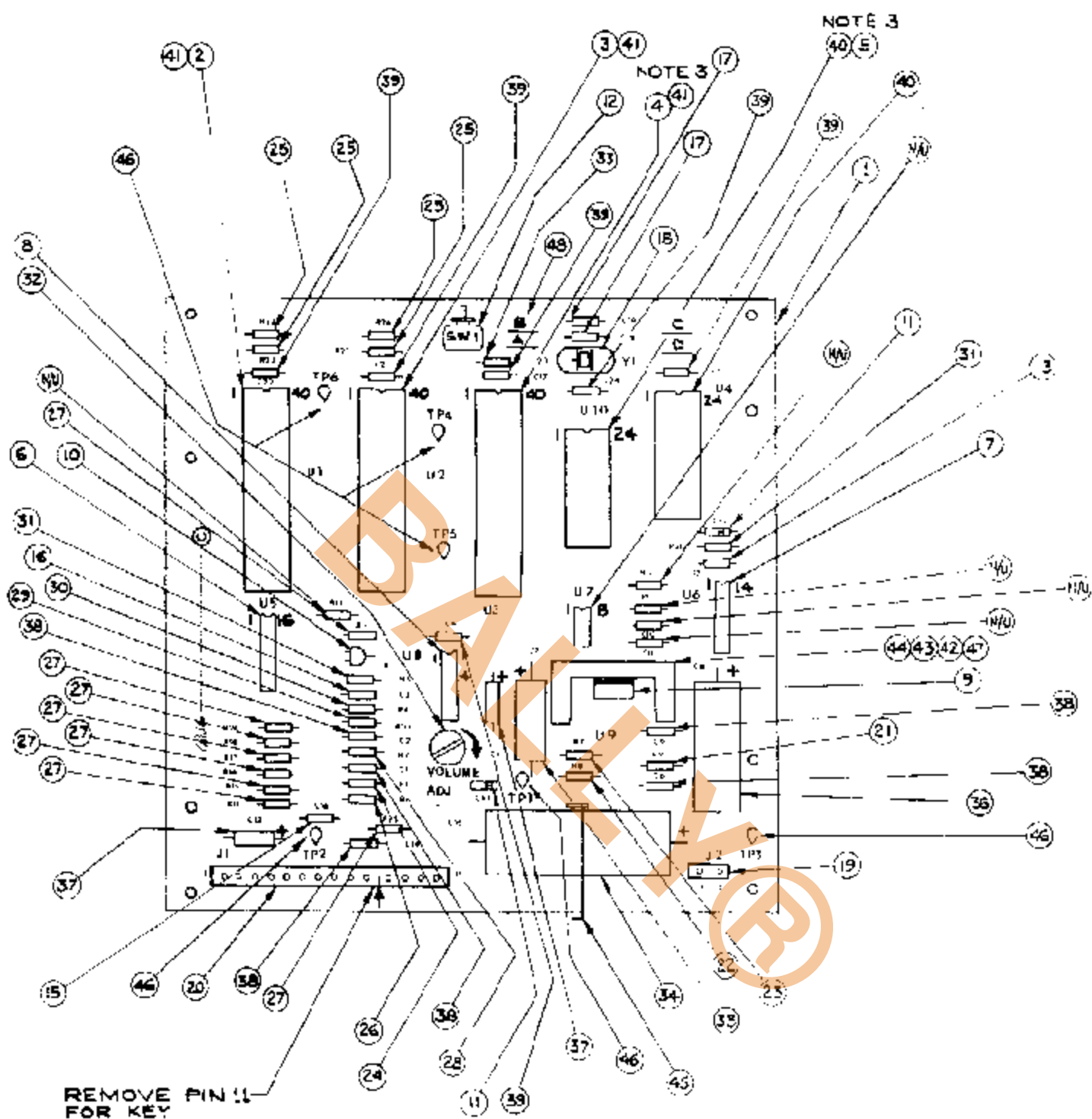
ITEM	REFERENCE DESIGNATION	BALLY PART NO.	DESCRIPTION
1	A8 (see note 1)	AS-3022-2	PWB Module Complete
2	U1	E-620-124	Sound Chip AY-3-8910
3	U2	E-620-29	PIA, 6820/21
4	U3	E-620-125 (E620-128)	CPU, 6808 (6802 Note 3)
5	U10	E-620-30	Ram, 6810 (Note 3)
6	U5	E-620-33	Hex Inverter 4049B
7	U6	E-620-5	Quad 2 Input 4011B
8	U8	E-620-126	Amp, LM3900
9	U9	E-620-127	Power Amp TDA 2002
10	Q1	E-585-31	Transistor, 2N3904
11	CR1, 2	E-587-6	Diode, 1N4004
12	SW1	E-658-1	Switch
13	C12	E-586-118	Cap. .2MF $\pm 20\%$ Y5P, 16 V.
15	C16	E-586-83	Cap. 470 PF 50 V.
16	C3	E-586-120	Cap. 68 PF, $\pm 20\%$ 1K
17	C18, 19	E-586-121	Cap. 27 PF, $\pm 20\%$ 1K
18	Y1	E-744-5	Crystal, 3.579545 MHZ
19	J2	E-736-2	Connector, Wafer, 2 Pin KK156
20	J1	E-736-15	Connector, Wafer, 15 Pin KK156
21	R9	E-105-196	Resistor, 1 Ohm, $\frac{1}{4}$ W., 5%
22	R8	E-105-211	Resistor, 2.2 Ohm, $\frac{1}{4}$ W., 5%
23	R7	E-105-303	Resistor, 220 Ohm, $\frac{1}{4}$ W., 5%
24	R1	E-105-230	Resistor, 1 K, $\frac{1}{4}$ W., 5%
25	R21, 22, 23, 24	E-105-238	Resistor, 3.3K, Ohm, $\frac{1}{4}$ W., 5%
26	R6	E-105-239	Resistor, 4.7K, $\frac{1}{4}$ W., 5%
27	R3, 14, 15, 16, 17, 18, 19, 25	E-105-185	Resistor, 10K, $\frac{1}{4}$ W., 5%
28	R2	E-105-245	Resistor, 30K, $\frac{1}{4}$ W., 5%
29	R10	E-105-252	Resistor, 180K, $\frac{1}{4}$ W., 5%
30	R4	E-105-225	Resistor, 200K, $\frac{1}{4}$ W., 5%
31	R5, 20	E-105-285	Resistor, 1M, $\frac{1}{4}$ W., 5%
32	RT1	E-599-16	Potentiometer 1K
33	C23	E-586-122	Cap. .001 $\pm 20\%$ 25F
34	C15	E-586-123	Cap. 4700 MF @ 25 V.
35	C7	E-586-124	Cap. 470 MF @ 6.3 V
36	C8	E-586-125	Cap. 220 MF @ 25 V
37	C5, 13	E-586-90	Cap. 1 MF @ 50 V.
38	C9, 1, 14, 6, 2	E-586-89	Cap. .1 MF
39	C4, 22, 17, 21, 20, 24	E-586-85	Cap. .01 MF
40	XU10, XU4	E-712	Socket, 24 Pin
41	XU1, XU2, XU3	E-712-1	Socket, 40 Pin
42	Used with 43	LSPR-00632-1103	Bolt, 6 x 32 x $\frac{3}{8}$
43	Used with 42	N-00632-2112	Nut, 6 x 32
44	H.S for U9	E-682-8	Heat Sink, 6030BTT
45	Used with C15	E-647-5	Ty Rap
46	TP1, 2, 3, 4, 5, 6	P-5399	Test Point
47	Use with 44, 9	M-1834	Thermal Grease
48	Jumper, B	W-1211c	22 AWG Wire, Solid Tinned Schematic

NOTE 1: When ordering specify name of game.

NOTE 2: Order replacement memory chip U4 specifying name of game and part no. stamped on chip

NOTE 3: When using item 4, 6808 you must use item 5, 6810 and the "B" jumper. When item, 6802 is available delete item 5 and use "A" jumper.

AS-2518-51 SOUND MODULE



ATTACHMENT II: INSTRUCTION MANUAL

Female insulation displacement connectors are used in the backbox cable harnesses. These connectors can be identified by the side entry of the leads and by their black, plastic covers.

The mating, white, male connectors on the Sound, Solenoid Driver and Transformer modules have .156" center to center spacing. Two pin lengths are in use. This, and all current games have a .450" length. Older games have a .640" length.

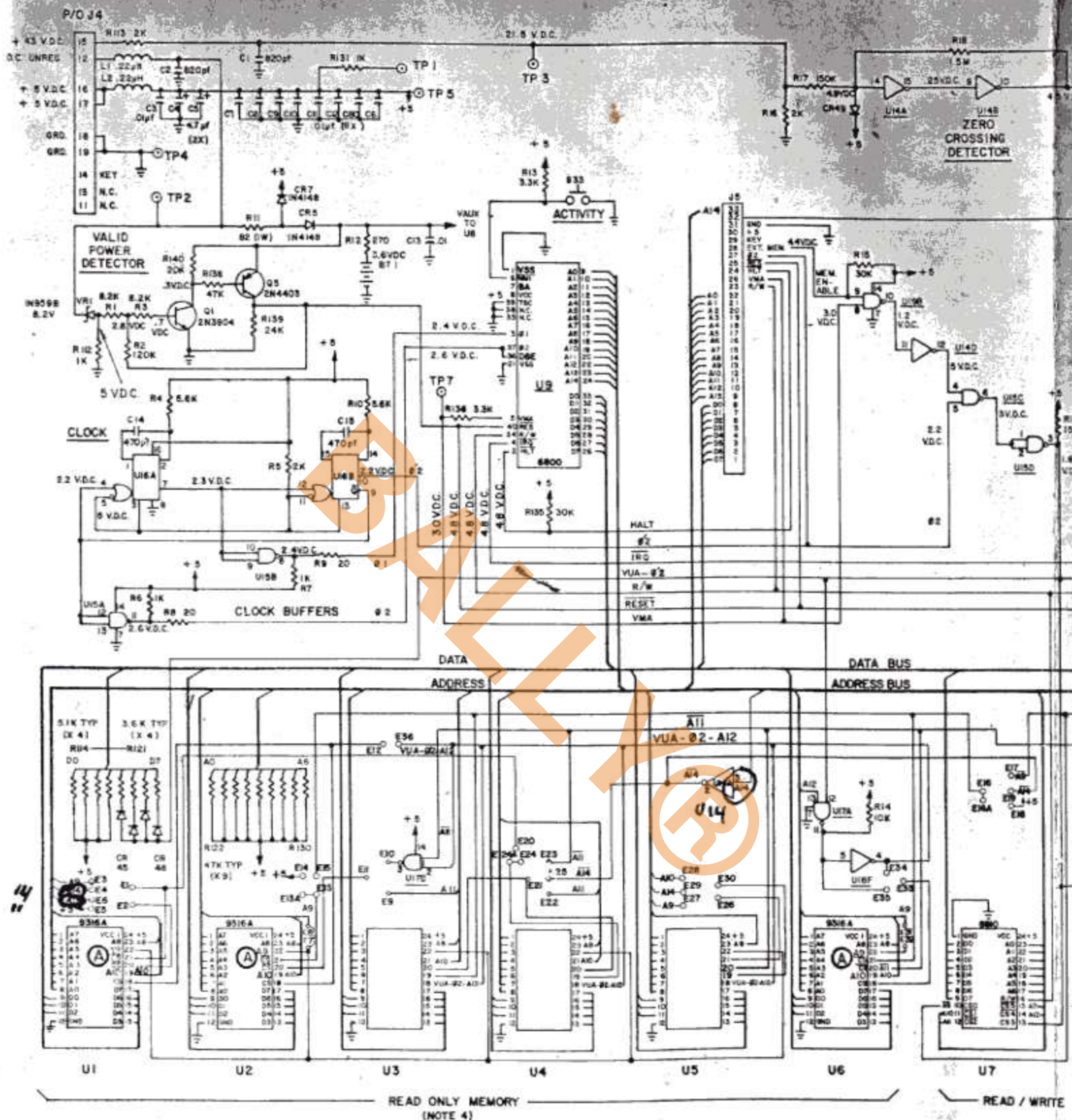
During servicing, when mating insulation displacement connectors on male connectors with a .640" pin length:

1. Hold the female connector parallel to the module surface.
2. Carefully align the openings in the female with the male pins.
3. Mate the connector set firmly but gently while maintaining the parallel relationship.
4. As resistance is encountered, stop applying force. An air gap of about .150" between the male and female connector bodies is normal at complete engagement.

CAUTION: it is not necessary or advisable to force the female connector further onto the male pins. Doing so may cause an intermittent connection.

When mating insulation displacement connectors on male connectors with a .450" pin length:

1. Follow steps 1-4 above, but—
2. Disregard the **CAUTION** note. Also, no air gap exists between the connector pair on total engagement.

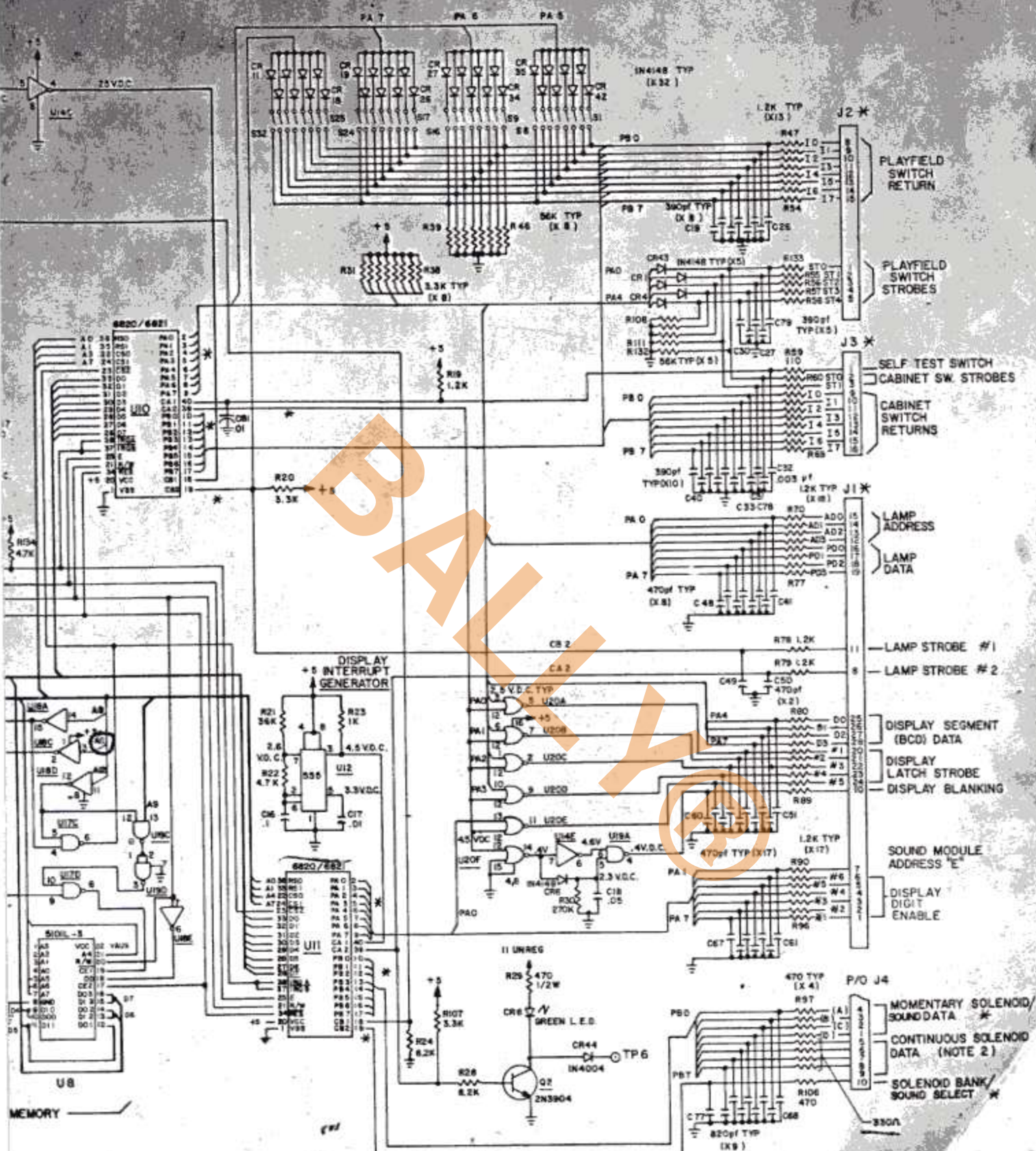


NOTES

* INDICATES "AID" TEST POINT.
REMOVE A3J4 BEFORE USING
AS AID TEST POINT

PREFIX ALL REFERENCE
DESIGNATIONS WITH "A4"

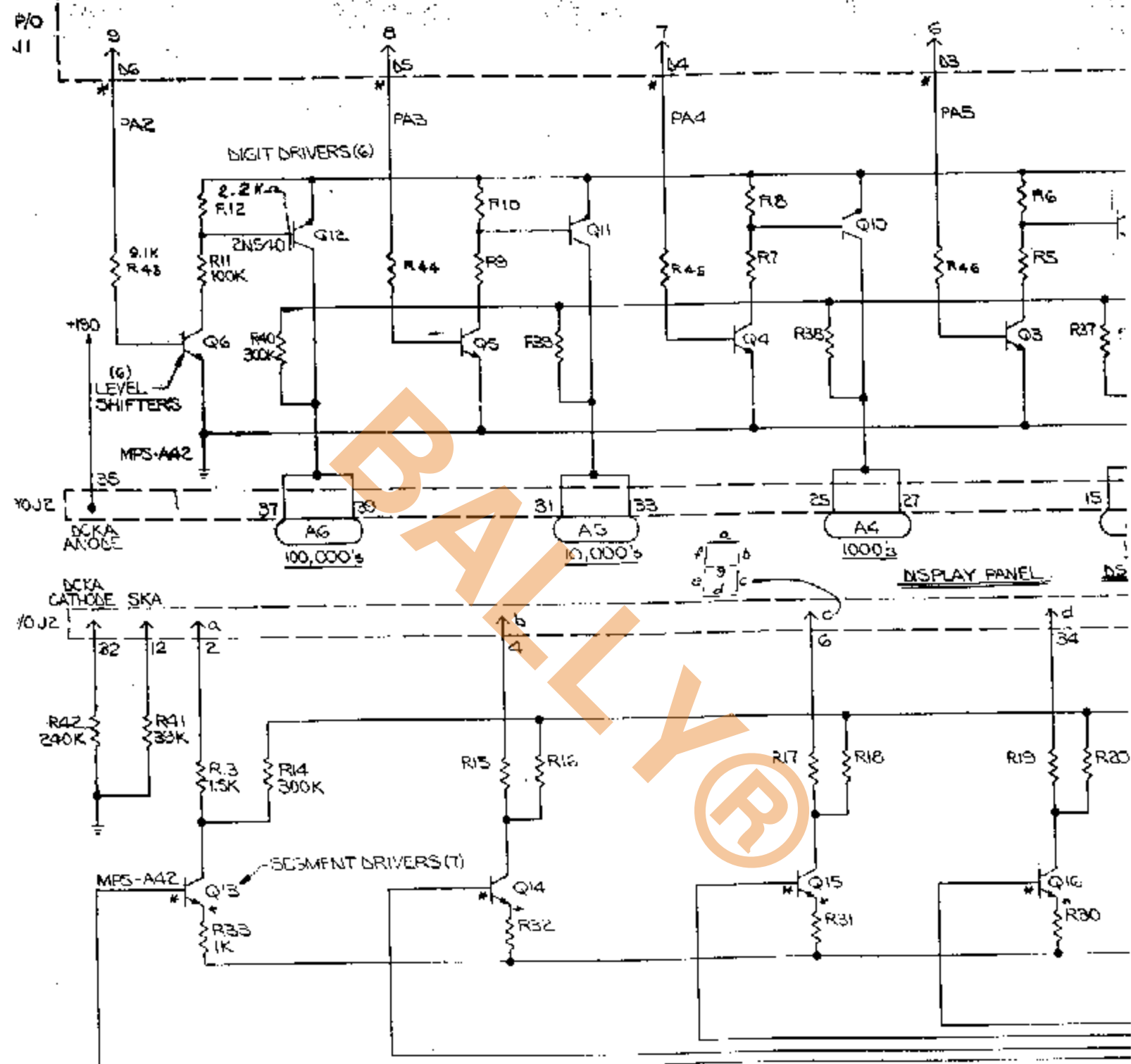
EXACT CHIP COMPLEMENT USED IN SOCKETS U1 THRU U6
CAN VARY FOR DIFFERENT GAMES AND PRODUCTION LOTS.
TABLES OF MEMORY CHIPS AND CORRESPONDING
JUMPERS FOR DIFFERENT GAMES AVAILABLE FROM
BALLY FIELD SERVICE DEPARTMENT.



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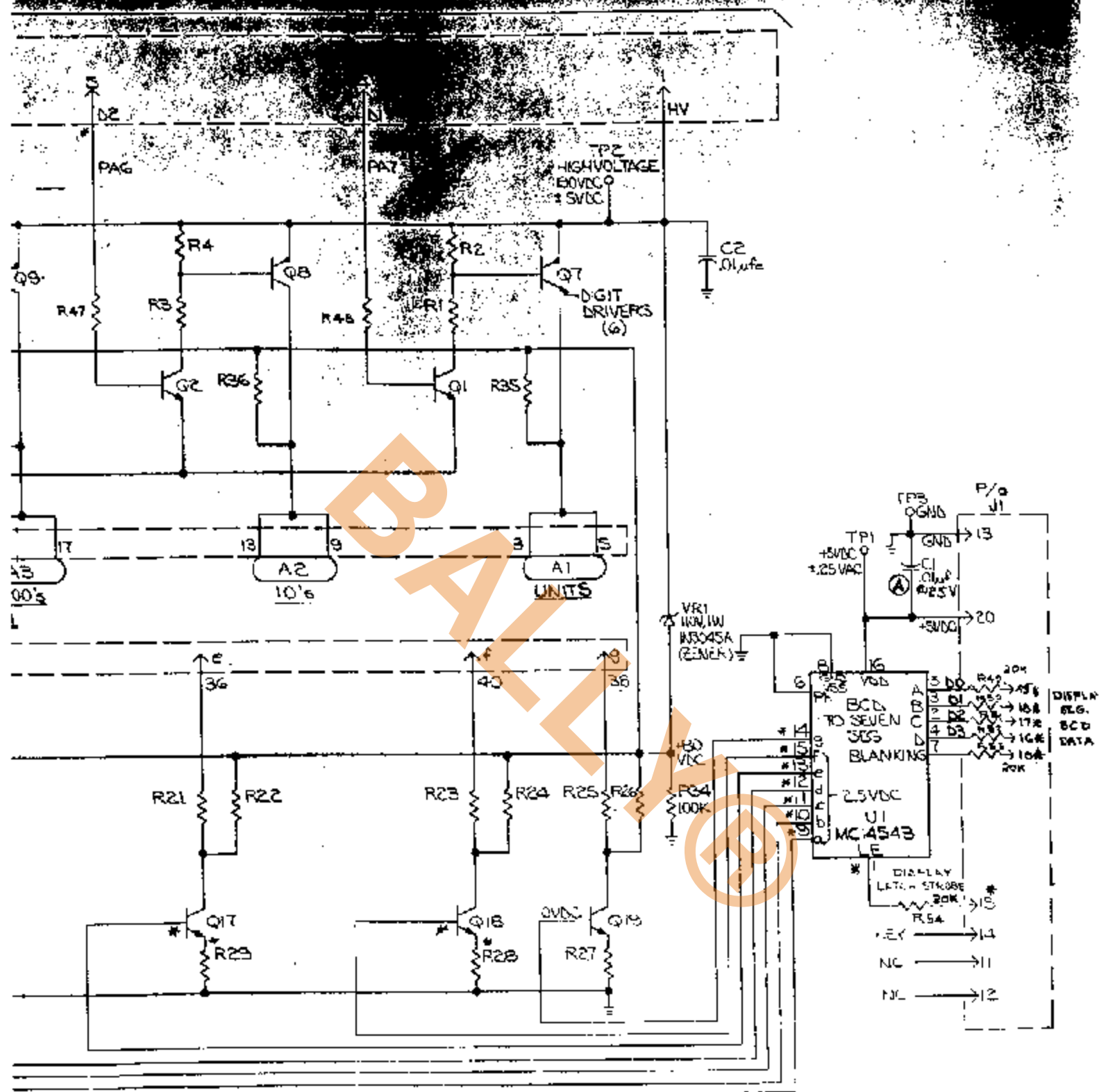
		REMOVE ALL BURNS TOLERANCES ON DIMENSIONS UNLESS OTHERWISE SPECIFIED FRACTIONS - 3/16 DECIMALS - .001 ANGLES - °		Bally MANUFACTURING CORP. 2640 BELMONT AVENUE CHICAGO, ILLINOIS												1115-E	
		NO HOT SCALE DRAWING		TOP VIEW FRONT VIEW SIDE VIEW DETAIL VIEW SECTION VIEW ISOMETRIC VIEW PERSPECTIVE VIEW OTHER VIEW												TOTAL SCALE	
AS WBS VCQ2 ON U1, U2, U3 A10 W0 C8		11-75 27		M.P.U. CONTROL BOARD SCHEMATIC												PART NO. W-1181-3	

DISPLAY DIGIT ENABLE



NOTES:

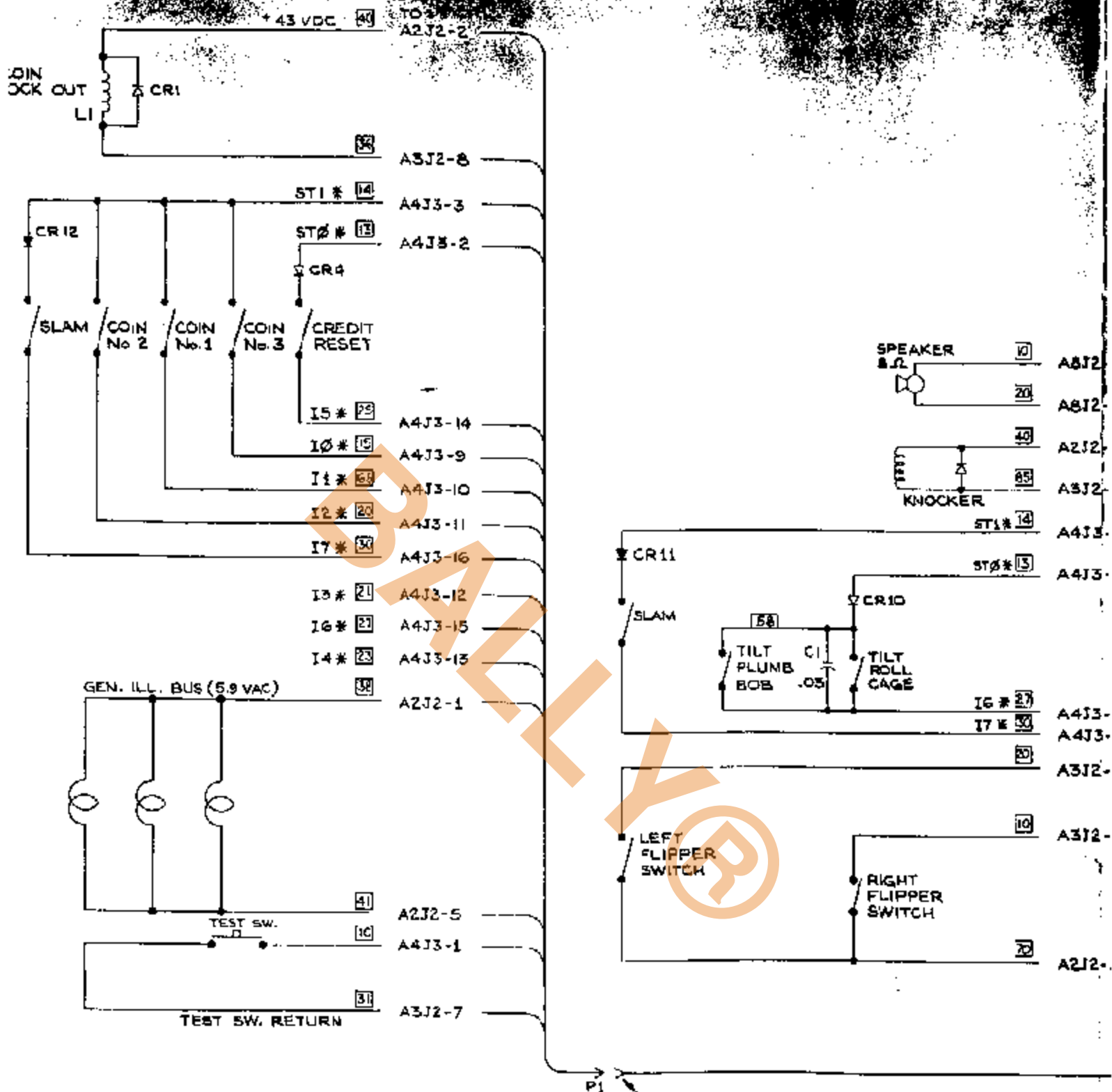
1. UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE $\pm 5\%$, $\frac{1}{4}W$.
2. PREFIX ALL REFERENCE DESIG. WITH ASSEMBLY REFERENCE DESIG. "A"
3. * INDICATES 'A10' TEST POINT.



DIE SIZE — C.C. — FT. PER M — LBS PER M —

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE TO BE TAKEN FROM THE CENTER OF THE HOLE UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE TO BE TAKEN FROM THE CENTER OF THE HOLE UNLESS OTHERWISE SPECIFIED.

REVIEW ALL SHEETS TOLERANCES OF DIMENSIONS UNLESS OTHERWISE SPECIFIED: FRACTIONS & DECIMALS ANGLES		DATE: BY: CHECKED BY: APPROVED BY:	Rally MANUFACTURING CORP #1120-1 1400 BELMONT AVENUE CHICAGO, ILLINOIS 60606 ALL MATERIALS NAME: DISPLAY BOARD SCHEMATIC PART NO: AS-251B-2 REV: 1 DATE: 10/14/64
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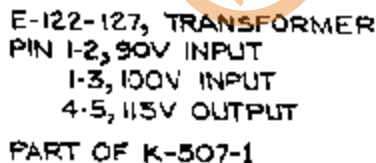
TO	J1 PIN	TO	J1 PIN
A4J3-9	1	A4J3-3	11
A4J3-10	2	A2J2-2	15
A4J3-11	3	A3J2-8	16
A4J3-12	4	A2J2-1	17
A4J3-13	5	A2J2-5	18
A4J3-14	6	A4J3-1	19
A4J3-15	7	A3J2-7	20
A4J3-16	8		
A4J3-2	10		

DOOR PLUG

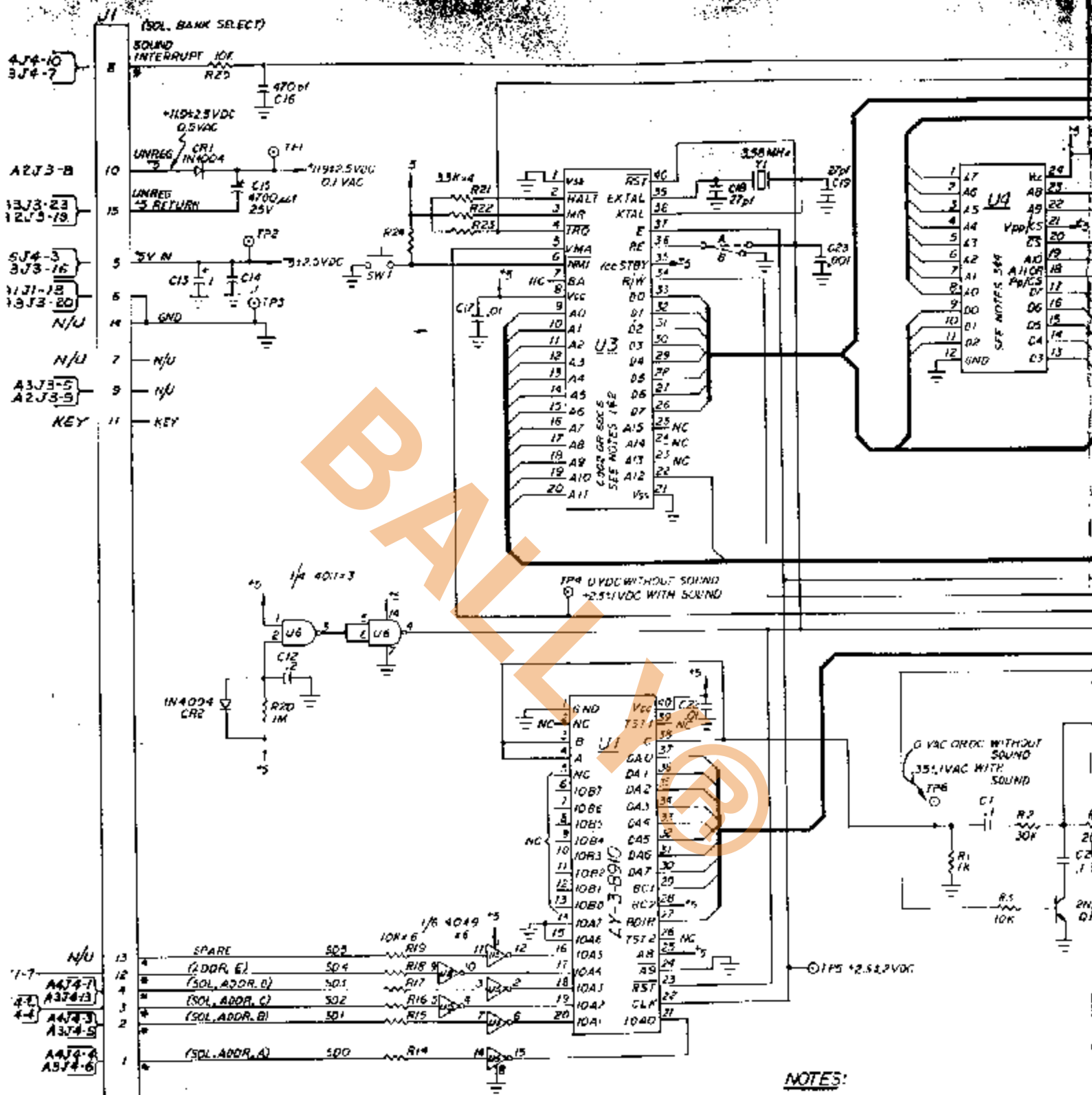
A7 CABINET A

NOTE: -DIODES AF

DESCRIPTION	TOOL No.



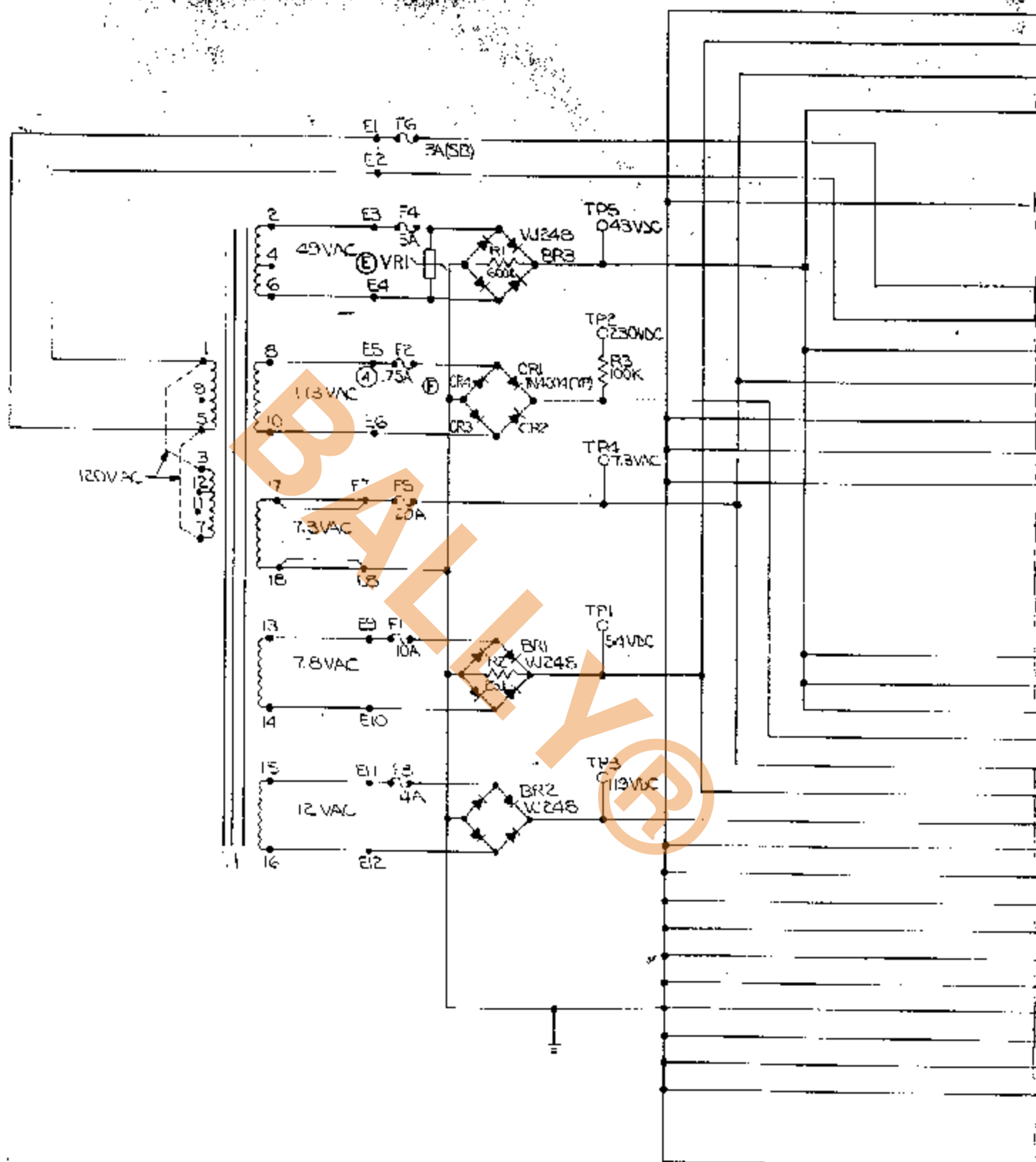
6-E



Q	REF	DESCRIPTION	TOOL NO.
OR	NAME		

[illegible]

TRANSFORMER ASSEMBLY A2



PLAYFIELDS

1	GEN. ILL. RET.
7	SW. ILL. BUS.
8	GEN. ILL. BUS.
6	SOLENOID BUS.
4	KEY
3	SPARE
5	GENERAL ILL. BUS. (B)
2	GENERAL ILL. RET. (D)

JZ
CABINET

6	A.C. POWER
7	A.C. RET.
2	SOLENOID PWS
1	GEN. ILL. BUS.
5	GEN. ILL. RET.
9	FLIP SW. RET.
10	POWER LINE GRD
3	SPARE
4	SPARE
8	KEY

JB
BACKBOX

9	RELAY ,A8J1-9	⑥
12	Z.C. INPUT ,A4-4-15	⑦
13	SOLENOID BUS.	
5	TO REG.(190) INPUT	
11	GEN. ILL BUS	
6	SW. ILL BUS	
8	TO REG.(+S) INPUT	{ A8J1-10 A3J3-12
2	GEN. ILL. RET.	
3	SW. LAMP RET	
4	SW. LAMP RET	
14	SW. LAMP RET.	
15	TO REG.(+S) RET.	
16	TO REG. 190 RET.	
17	TO REG.+S FILT RET.	
18	TO REG.(190) FILT RET.	
19	SOLENOID RET. BUS.	
20	SOLENOID RET. BUS.	
10	GEN. ILL BUS.	
7	KEY	
1	GEN. ILL. RET.	

NOTES:

1. WIRE A.C. POWER AND TERMINALS PER TABLE 1.
2. VOLTAGES SHOWN ARE FOR GAME IN POWER-UP CONDITION.
3. PREFIX ALL REFERENCE DESIGNATIONS WITH A2.

TABLE 1
POWER LINE CONNECTIONS

LINE VOLTAGE VRMS A.C.	STRAP TERMINALS	APPLY POWER TO TERMINALS
115	1T03 AND ST011	1 AND 9
120	1T03 AND ST07	1 AND 5
220	3T03	1 AND 12
240	3T05	1 AND 7

ONE SIZE — C.L. — FT. PER M. — LB. PER M. —

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6	H	ADDER A&T-10, A30-12	10-179 E.V.
5	G	ADDED A&T-9	10-179 E.V.
4	F	WRASSED (L&B)	10-179 E.V.
3	G	VEILED AS	10-179 E.V.
2	D	J1-2 SEND "GND"	10-179 E.V.
1	C	J1-11 SEND "E.C. INPUT"	10-179 E.V.
1	B	ADDED JUMPER J1-2&J1-3	10-179 E.V.
1	A	FE WAS 5.0A	10-179 E.V.
NO.	LET.	CO. NAME	DATE

RECEIVED JUL 2 1964

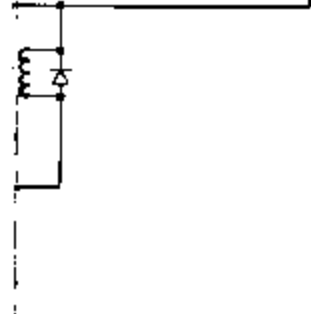
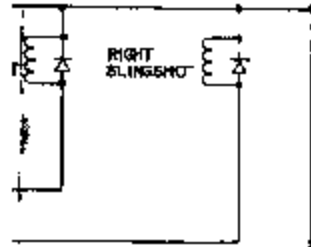
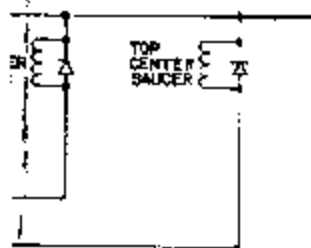
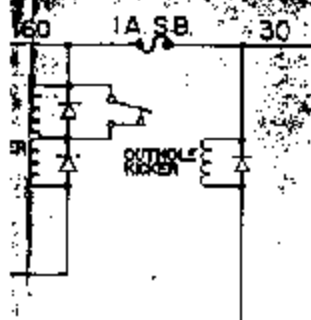
TELEPHONE NO.
ADDRESS | CITY, STATE
CITY, STATE, ZIP CODE
FACSIMILE NO. |

EXTRAORDINARY
AMERICAN
DRUGS

NAME	DATE
CLASS	GRADE
TEACHER	SCHOOL
ADDRESS	CITY
STATE	ZIP
PHONE	
EMAIL	
HOME	
WORK	
MOBILE	
FAX	
INTERNET	
OTHER	

Bally MANUFACTURING CORP.

FEB 21 1977



Pin	Function	Signal
58	A5J1-18 1K RIGHT BONUS	
60	A5J1-19 8K RIGHT BONUS	
57	A5J1-17 8K RIGHT BONUS	
56	A5J1-23 1K LEFT BONUS	
54	A5J1-14 8K LEFT BONUS	
13	A5J1-15 8K LEFT BONUS	
12	A5J1-16 "A" ROLLOVER	
78	A5J1-28 "E" ROLLOVER	
50	A5J1-24 DROP TARGET 8K	
90	A5J1-25 TOP SAUCER LEFT ARROW	
91	A5J1-26 SAME PLAYER 8. A.	
53	A5J1-27 20K SUPER BONUS	
41	A5J1-1 8K RIGHT BONUS	
52	A5J1-9 8K RIGHT BONUS	
51	A5J1-8 10K RIGHT BONUS	
45	A5J1-3 8K LEFT BONUS	
43	A5J1-2 8K LEFT BONUS	
23	A5J1-10 10K LEFT BONUS	
34	A5J1-7 "B" ROLLOVER	
25	A5J1-6 "F" ROLLOVER	
48	A5J1-5 N/U	
65	A5J1-11 TOP SAUCER 5,000 ARROW	
35	A5J1-4 N/U	
61	A5J1-12 30K HITRO BONUS	
96	A5J1-13 DROP TARGET EXTRA BALL	
38	A5J3-26 3K RIGHT BONUS	
36	A5J3-25 7K RIGHT BONUS	
67	A5J3-19 20K RIGHT BONUS	
27	A5J3-17 3K LEFT BONUS	
25	A5J3-16 7K LEFT BONUS	
98	A5J3-23 20K LEFT BONUS	
40	A5J3-27 "C" TARGET	
30	A5J3-21 COLLECT LEFT BONUS	
64	A5J3-20 TOP SAUCER RIGHT ARROW	
23	A5J3-22 BOTTOM DOUBLE BONUS	
72	A5J3-24 ADVANCE L.B.R. BONUS	
10	A5J3-1 4K RIGHT BONUS	
21	A5J3-12 8K RIGHT BONUS	
53	A5J3-15 SPINNER 1K	
20	A5J3-11 4K LEFT BONUS	
15	A5J3-9 8K LEFT BONUS	
13	A5J3-13 CREDIT INDICATOR	
14	A5J3-4 "D" TARGET	
95	A5J3-2 DROP TARGET SPECIAL	
91	A5J3-10 COLLECT RIGHT BONUS	
56	A5J3-18 TOP SAUCER DOUBLE BONUS	
81	A5J3-3 A THRU F SPECIAL	
84	A5J3-14 BOTTOM BUMPER	
20	A2J1-7 FEATURE LAMP BUS	

TABLE A. AIJ2

FROM	PLN	WIRE
A5J2-6	1	20
A5J2-14	2	12
A5J2-2	3	50
A5J2-11	4	10
A5J2-23	5	97
A5J2-18	6	23
A5J2-22	7	62
A5J2-8	8	93
A5J2-1	9	60
A5J2-2	10	20
A5J2-11	11	95
A5J2-21	12	47
A5J2-10	13	98
A5J2-7	14	8
A5J2-6	15	83
A5J2-20	16	35
A5J2-16	17	34
A5J2-1	18	40
A5J2-10	19	70
A5J2-12	20	53
A5J2-13	21	6
A5J2-4	22	72
A5J2-3	23	84
	24	

INSERT TO BACK CAB.
PLUG

A1 INSERT

	(PLAYER 1) 1A1	(PLAYER 2) 2A1	(PLAYER 3) 3A1	(PLAYER 4) 4A1	CREDIT DISPLAY 5A1		TO	SWITCH ILL. (B)
	J1	J1	J1	J1	J1			
10 - A3J3-8	1	1	1	1	1	12	A5J2-14 R UP 1	☐
N/U	2	2	2	2	2	23	A5J2-15 R UP 2	☐
N/U	3	3	3	3	3	20	A5J2-2 R UP 3	☐
80 - A4J1-1	4	4	4	4	4	60	A5J2-1 R UP 4	☐
20 - A4J1-2	5	5	5	5	5	47	A5J2-21 SHOOT AGAIN	☐
50 - A4J1-3	6	6	6	6	6	95	A5J2-11 GAME OVER	☐
40 - A4J1-4	7	7	7	7	7	98	A5J2-10 TILT	☐
50 - A4J1-5	8	8	8	8	8	34	A5J2-16	☐
58 - A4J1-6	9	9	9	9	9	35	A5J2-20	☐
70 - A4J1-10	10	10	10	10	10	85	A5J2-6	☐
N/U	11	11	11	11	11	91	A5J2-7	☐
N/U	12	12	12	12	12	97	A5J2-23 HIGH SCORE	☐
50 - A3J3-20	13	13	13	13	13	83	A5J2-8 MATCH	☐
KEY	14	14	14	14	14	62	A5J2-22 BALL IN PLAY	☐
65 - A4J1-20	15	15	15	15	15	84	A5J2-3	☐
54 - A4J1-28	16	16	16	16	16	72	A5J2-4	☐
38 - A4J1-27	17	17	17	17	17		A5J2-8 NOTE 1	☐
25 - A4J1-26	18	18	18	18	18		A5J2-9 NOTE 1	☐
51 - A4J1-25	19	19	19	19	19	61	A5J2-12	☐
45 - A3J3-17	20	20	20	20	20	53	A5J2-13	☐

A4J1-21

A4J1-22

A4J1-23

A4J1-24

A4J1-21

A4J1-22

A4J1-23

A4J1-24

AIJ2
SEE
TABLE A

LAMP DRIVER A5

J4	TO	J2	TO	J1	TO	J3	TO
51	1 A2J3-4	60	1 4TH PLAYER UP	41	1 2K RIGHT BONUS	10	1 4K RIGHT BONUS
13	2 A2J3-3	20	2 3RD PLAYER UP	43	2 8K LEFT BONUS	95	2 DROP TMR. SPECIAL
84	3 A3J3-16	84	3 N/U	45	3 2K LEFT BONUS	81	3 ATRUL F SPECIAL
74	4 A4J1-19	72	4 N/U	25	4 N/U	14	4 "T" TARGET
71	5 A4J1-18	5	5 N/U	48	5 N/U	5	5 N/U
65	6 A4J1-17	85	6 N/U	25	6 "Y" FOLLOWER	6	6 N/U
63	7 A4J1-16	21	7 N/U	34	7 "B" FOLLOWER	7	7 N/U
8	8 KEY	93	8 MATCH	11	8 8K RIGHT BONUS	8	8 KEY
9	9 N/U	9	9 N/U	52	9 6K RIGHT BONUS	15	9 8K LEFT BONUS
10	10 N/U	38	10 TILT	10	10 8K LEFT BONUS	51	10 COLLECT RT BONUS
58	11 A2J3-14	95	11 GAME OVER	23	11 TOP SAUCER BLOOD	20	11 4K LEFT BONUS
12	12 SPARE GND	61	12 N/U	61	12 20K RTHO BONUS	21	12 8K RIGHT BONUS
75	13 A4J1-1	53	13 N/U	96	13 DROP TARGET	13	13 CREDIT INDICATOR
32	14 A4J1-5	12	14 1ST PLAYER UP	54	14 5K LEFT BONUS	84	14 BOTTOM BUMPER
13	15 A4J1-14	23	15 2ND PLAYER UP	13	15 8K LEFT BONUS	53	15 SPINNER IN
43	16 A4J1-13	34	16 3RD PLAYER UP	12	16 "A" FOLLOWER	25	16 7K LEFT BONUS
48	17 A4J1-12	17	17 N/U	57	17 9K RIGHT BONUS	27	17 2K LEFT BONUS
		18	18 KEY	58	18 1K RIGHT BONUS	56	18 TOP SAUCER
		19	19 N/U	60	19 5K RIGHT BONUS	67	19 20K RIGHT BONUS
		35	20 LEFT OUTLINE	20	20 KEY	64	20 TOP SAUCER RIGHT
		47	21 SHOOT AGAIN	21	21 N/U	30	21 COLLECT LT. BONUS
		62	22 BALL IN PLAY	22	22 N/U	23	22 BOTTOM DOUBLE
		97	23 HIGH SCORE	58	23 1K LEFT BONUS	98	23 20K LEFT BONUS
				50	24 DROP TARGET 5K	72	24 ADVANCE L & R
				90	25 TOP SAUCER LEFT	36	25 7K RIGHT BONUS
				31	26 SAME PLAYER 5 K	38	26 5K RIGHT BONUS
				35	27 20K SUPPER BONUS	40	27 "T" TARGET
				78	28 "E" FOLLOWER	28	28 N/U

TEST CONNECTOR

MPU A4

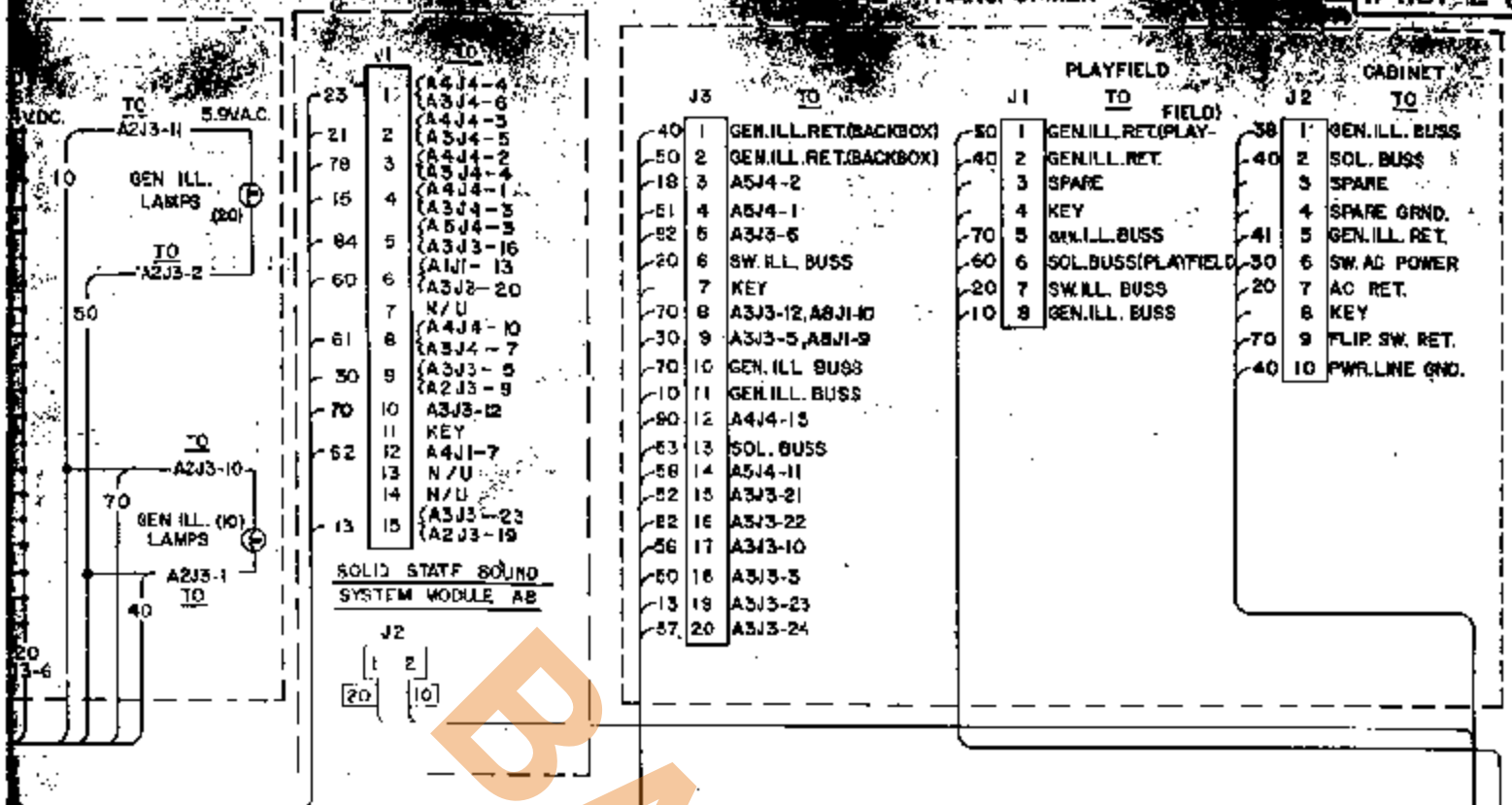
J4	TO	J2	TO
15	1 A3J4-1	51	1
78	2 A3J4-4	83	2
21	3 A3J4-5	82	3
23	4 A3J4-6	83	4
28	5 A3J4-11	31	5
27	6 A3J4-8	8	6
25	7 A3J4-8	7	7
31	8 A3J4-10	54	8
9	9 N/U	56	9
8	10 A3J4-7	57	10
11	11 N/U	58	11
14	12 A3J4-11	60	12
13	13 N/U	63	13
14	14 KEY	68	14
80	15 A2J3-12	70	15
88	16 A3J4-14		
84	17 A3J4-15		
84	18 A3J4-6		
81	19 A3J4-13		
60	1 A3J1-4		
20	2 A3J1-5		
30	3 A3J1-6		
40	4 A3J1-7		
50	5 A3J1-8		
58	6 A3J1-9		
62	7 A3J1-2		
8	8 NOTE 1		
9	9 KEY		
70	10 A3J1-10		
75	11 A3J4-13		
48	12 A3J4-17		
45	13 A3J4-16		
32	14 A3J4-15		
32	15 A3J4-14		
63	16 A3J4-7		
65	17 A3J4-6		
71	18 A3J4-5		
74	19 A3J4-4		
65	20 A3J1-15		
31	21 A3J1-10		
72	22 A3J1-16		
67	23 A3J1-18		
18	24 A3J1-15		
51	25 A3J1-10		
25	26 A3J1-10		
38	27 A3J1-17		
64	28 A3J1-18		
1	01		
2	06		
3	05		
4	04		
5	03		
6	02		
7	01		
8	00		
9	01		
10	02		
11	03		
12	04		
13	05		
14	06		
15	07		
16	08		
17	09		
18	10		
19	11		
20	12		
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29	21		
30	22		
31	23		
32	24		

O CABINET

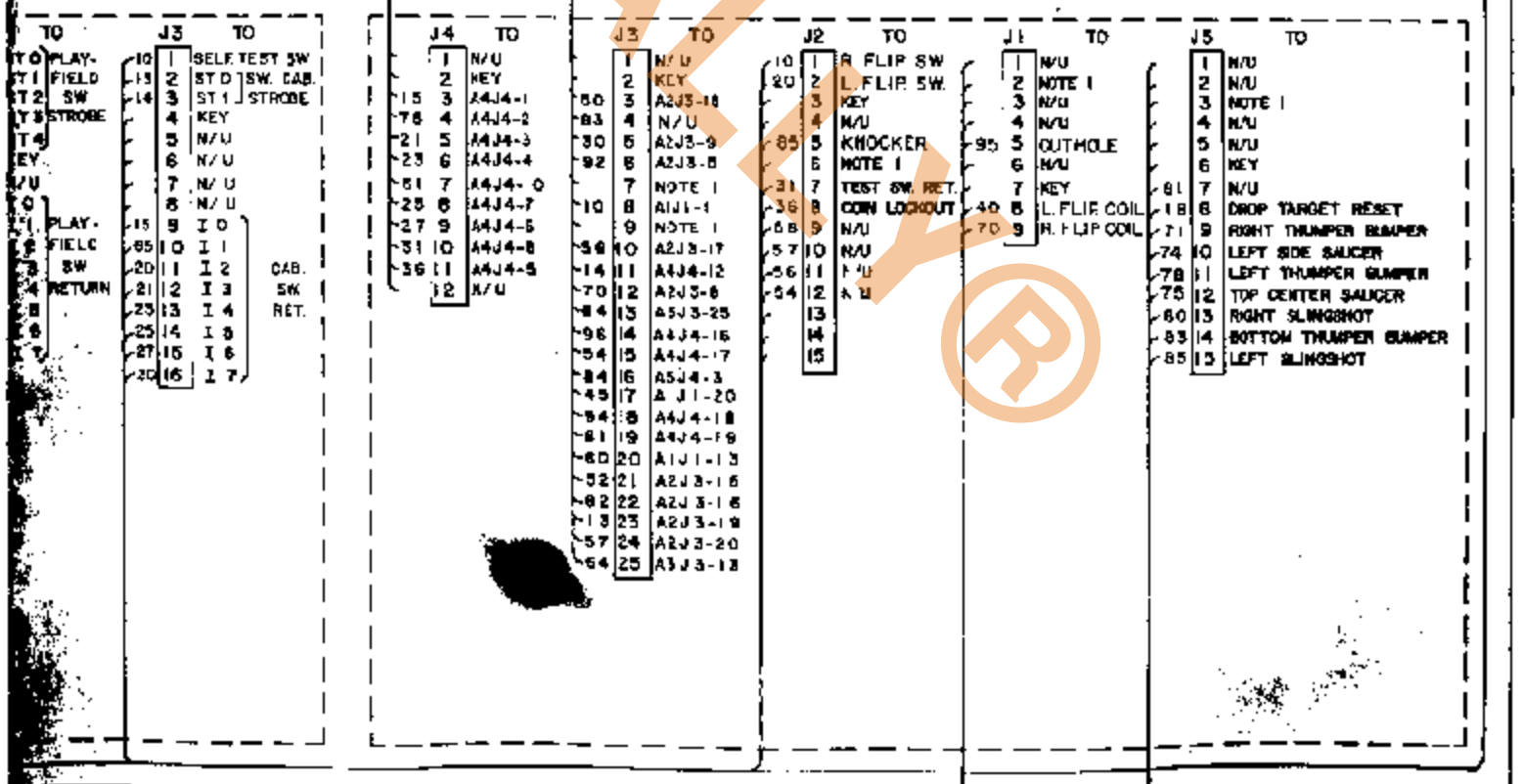
PLAYFIELD

NOTES

1. THESE PINS ARE RESERVED FOR FUTURE USE.
2. WIRE COLORS ARE SHOWN FOR ALL CONNECTOR PINS, SOME WIRES MAY NOT BE USED IN ALL GAMES.
3. * INDICATES AID TEST POINT.



VOLTAGE REGULATOR / SOLENOID DRIVER A3



WIRE-COLOR CODE

- 1-BROWN
- 2-ORANGE
- 3-BLACK
- 4-BLACK
- 5-GRAY
- 6-NO TRACE

LIT.	DATE	BY	CHK.

REPAIR ALL SUBS

TOLERANCES ON DIMENSIONS UNLESS OTHERWISE SPECIFIED
FRACTIONS - 1/32
DECIMALS - .000
ANGLES - °

DATE	BY	CHK.

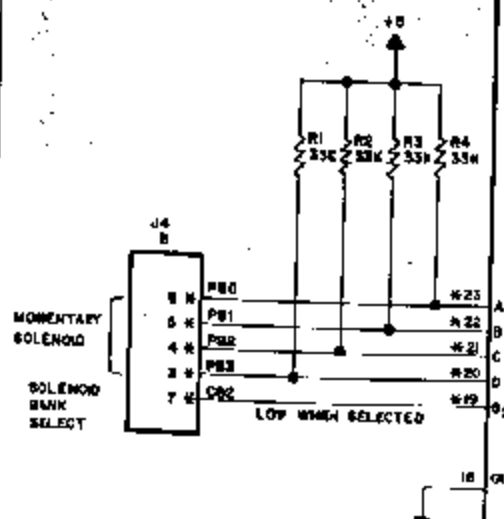
W-1187-12 c

MANUFACTURING CORP.

1187-12 c

PLUS CONNECTORS

W-1187-12 c



NOTES:

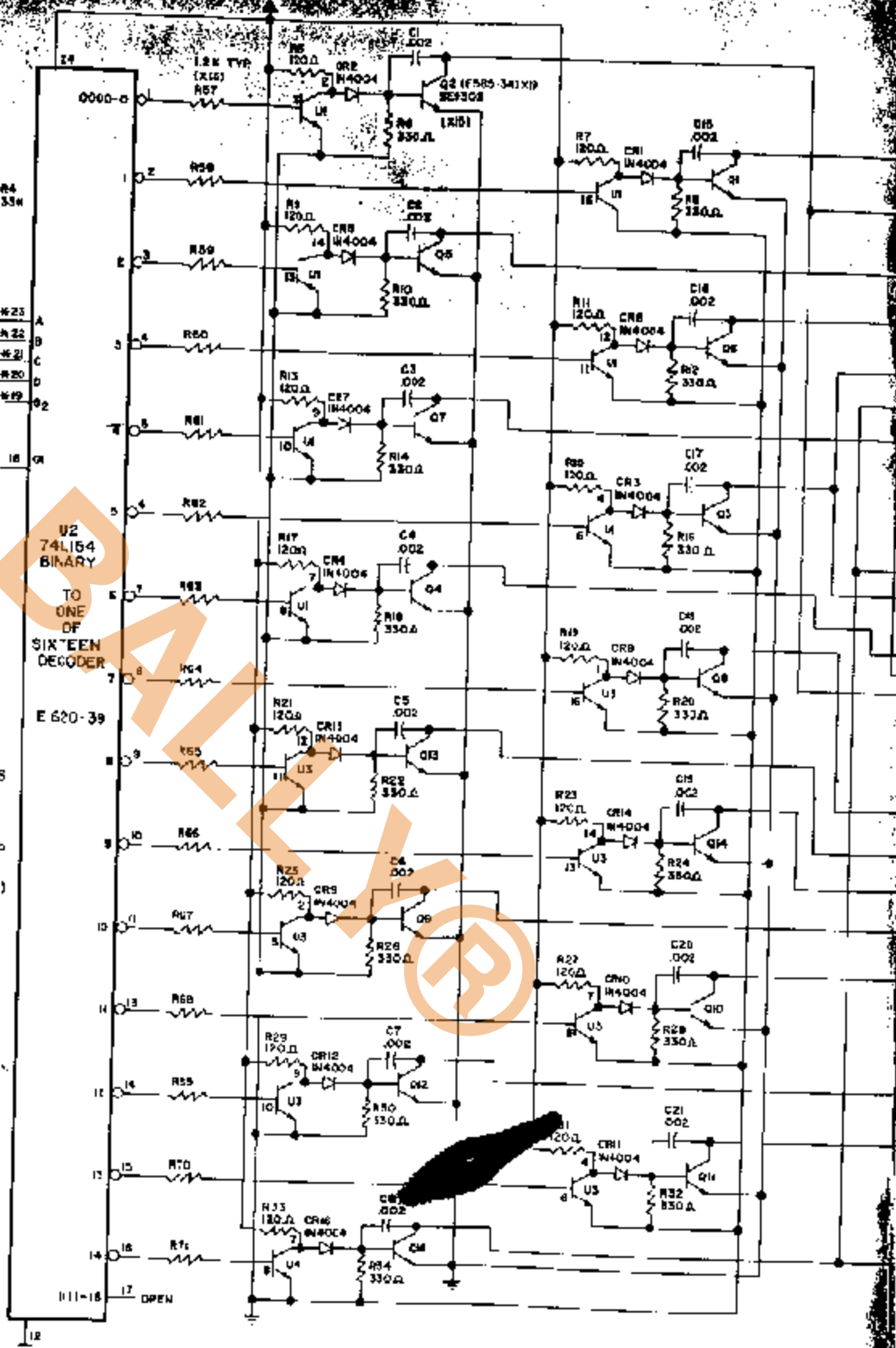
1. E-710, LAMBDA-LAS 1403 NATIONAL - LM323K FAIRCHILD 78H05KC
2. J1-KK156-9 PIN KEY PIN 7
J2-KK156-15 PIN KEY PIN 3
J3-KK100-25 PIN KEY PIN 2
J4-KK100-12 PIN KEY PIN 2
J5-KK156-15 PIN KEY PIN 6
3. PREFIX ALL REFERENCE DESIGNATIONS WITH "A3"
4. "U1", "U2", "U3" PINS 5 AND 5 ARE GROUNDED.
5. VOLTAGES SHOWN ARE FOR A GAME-UP CONDITION.
6. "U1", "U3" AND "U4" ARE CA-3081 (E681)
7. * INDICATES 'AID' TEST POINT.

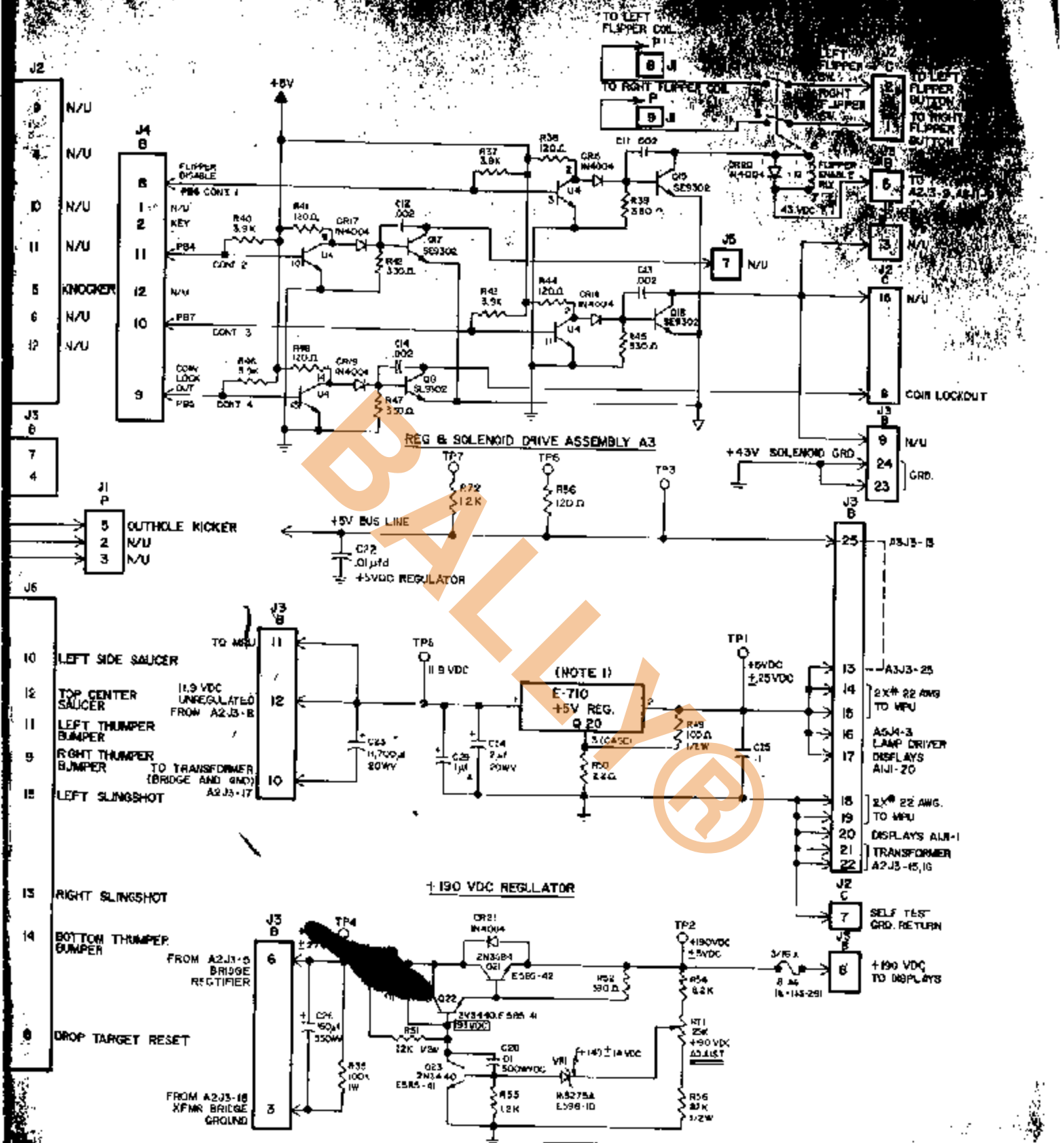
CONNECTOR CODE

- G → ROUTE TO CABINET CONN
- B → ROUTE TO BLACK BOX CONN
- P → ROUTE TO PLAYFIELD CONN

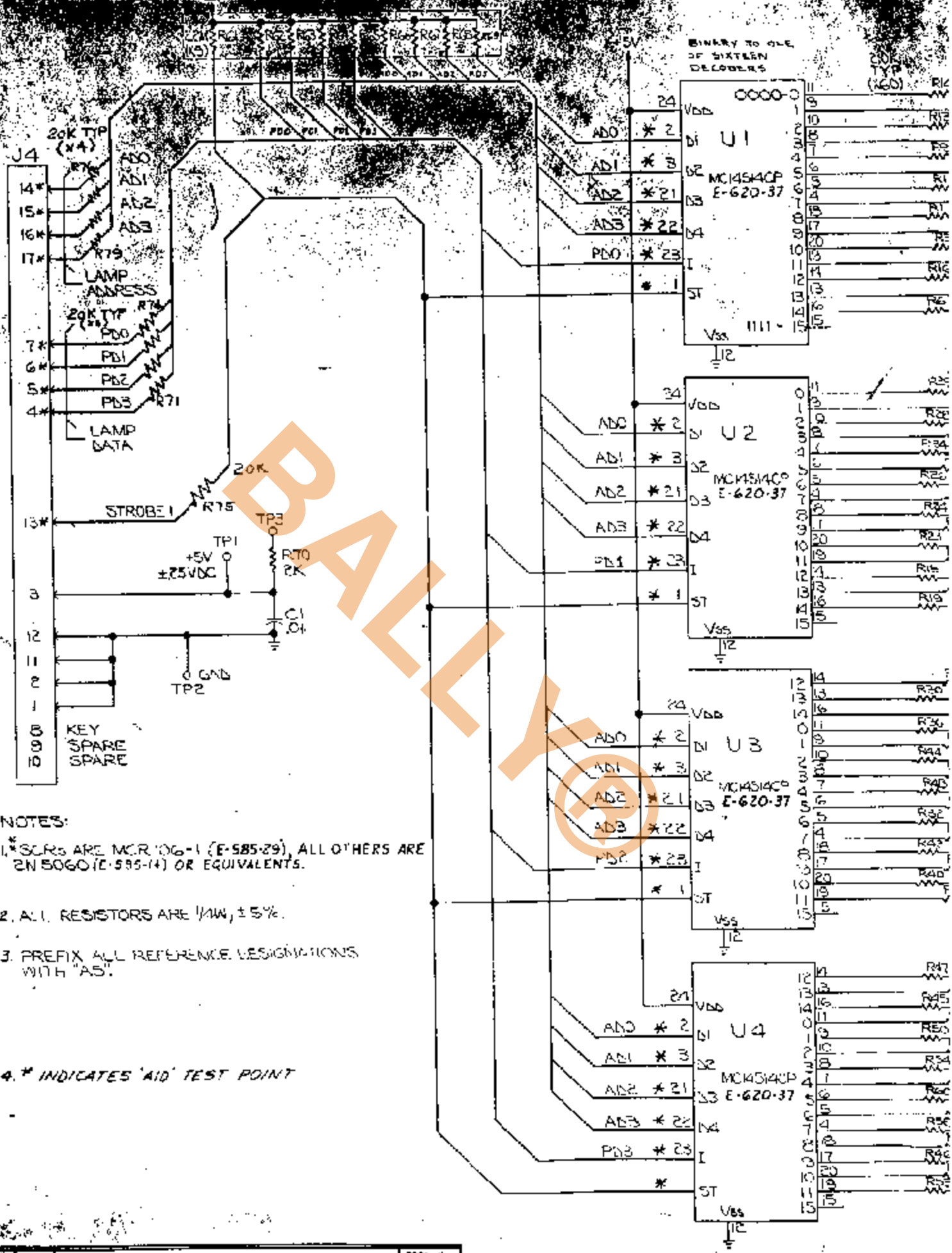
LAST NUMBER USED

R72
C29 N/U C9, C10
Q23 N/U Q20
CR21
VRI





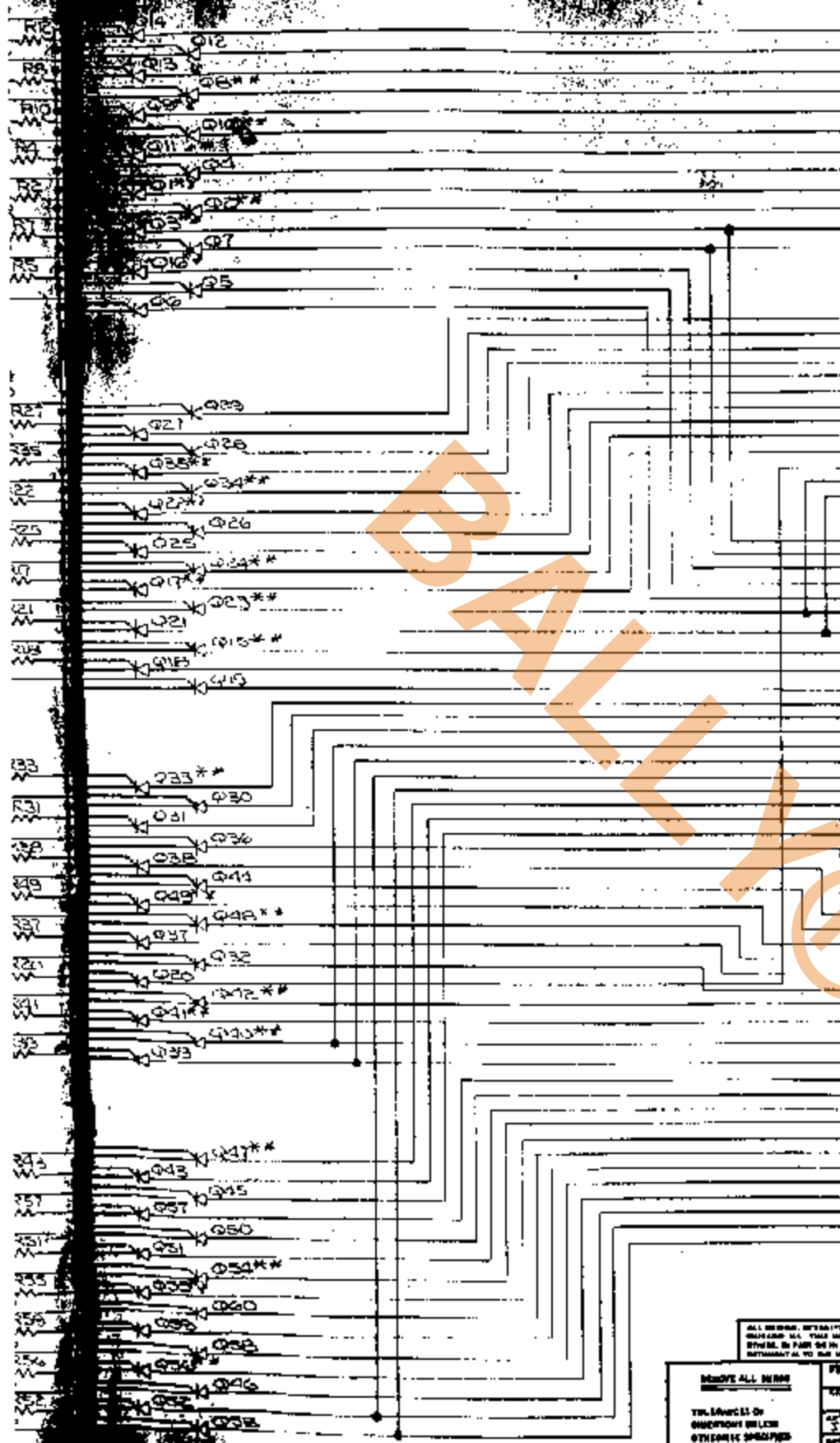
INQ. LST.		CHARGES		DATE		TO GET NEW NUMBER	
10-1-79		10-1-79		10-1-79		10-1-79	



NOTES:

1. *SCRs ARE MCR 106-1 (E-585-29), ALL OTHERS ARE 2N 5060 (E-585-14) OR EQUIVALENTS.
2. ALL RESISTORS ARE 1/4W, ±5%.
3. PREFIX ALL REFERENCE DESIGNATIONS WITH "AS".
4. * INDICATES 'AID' TEST POINT

DC	DESCRIPTION	TOOL No.
----	-------------	----------



- J1**
- 22 N/U
 - 21 N/U
 - 20 KEY
 - 18 1K RIGHT BONUS
 - 19 5K RIGHT BONUS
 - 17 9K RIGHT BONUS
 - 23 1K LEFT BONUS
 - 14 5K LEFT BONUS
 - 13 9K LEFT BONUS
 - 16 'A' ROLLOVER
 - 28 'E' ROLLOVER
 - 24 DROP TARGET 5K
 - 25 TOP SAUCER LEFT ARROW
 - 26 SAME PLAYER 9 A
 - 27 20K SUPER BONUS
- J2**
- 2K RIGHT BONUS
 - 6K RIGHT BONUS
 - 10K RIGHT BONUS
 - 2K LEFT BONUS
 - 6K LEFT BONUS
 - 10K LEFT BONUS
 - 'B' ROLLOVER
 - 'F' ROLLOVER
 - N/U
 - TOP SAUCER 5,000 ARROW
 - DROP TARGET EXTRA BALL
 - N/U
 - 30K NITRO BONUS
- J3**
- 21 SHOOT AGAIN
 - 13 N/U
 - 22 BALL IN PLAY
 - 18 RIGHT OUTLINE SPECIAL
 - 14 1ST PLAYER UP
 - 8 MATCH
 - 12 N/U
 - 23 HIGH SCORE TO DATE
 - 20 LEFT OUTLINE SPECIAL
 - 15 2ND PLAYER UP
 - 11 GAME OVER
 - 6 N/U
 - 2 3RD PLAYER UP
 - 9 N/U
 - 4 N/U
 - 5 N/U
 - 3 N/U
 - 10 TILT
 - 7 N/U
 - 17 4TH PLAYER UP
 - 19 N/U
 - KEY
 - N/U
- J5**
- 26 3K RIGHT BONUS
 - 25 7K RIGHT BONUS
 - 19 20K RIGHT BONUS
 - 17 3K LEFT BONUS
 - 16 7K LEFT BONUS
 - 23 20K LEFT BONUS
 - 21 'C' TARGET
 - 21 COLLECT LEFT BONUS
 - 20 TOP SAUCER RIGHT ARROW
 - 22 BOTTOM DOUBLE BONUS
 - 24 ADVANCE L/R BONUS
 - 1 4K RIGHT BONUS
 - 12 5K RIGHT BONUS
 - 13 SPINNER 1K
 - 11 4K LEFT BONUS
 - 8 5K LEFT BONUS
 - 4 'A' THRU 'F' SPECIAL
 - 2 'D' TARGET
 - 2 DROP TARGET SPECIAL
 - 10 COLLECT RIGHT BONUS
 - 15 TOP SAUCER DOUBLE BONUS
 - 13 CREDIT INDICATOR
 - 16 BOTTOM BUMPER
 - N/U
 - N/U
 - N/U
 - N/U
 - N/U
 - N/U

PLAYFIELD

TO BACK BOARD

TO PLAYFIELD

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REMOVE ALL NIBS		P&P		KEY	
TILTS/LOCKS ON		1K		2K	
OTHERWISE UNLESS		3K		4K	
SPECIFICALLY		5K		6K	
INDICATED		7K		8K	
BY THE		9K		10K	
BALLY		11K		12K	
MANUFACTURING CORP.		13K		14K	
CHICAGO, ILLINOIS		15K		16K	
1154-E		17K		18K	
AS		19K		20K	
LAMP DRIVER SCHEMATIC		21K		22K	
W-1162-16		23K		24K	
		25K		26K	
		27K		28K	
		29K		30K	
		31K		32K	
		33K		34K	
		35K		36K	
		37K		38K	
		39K		40K	
		41K		42K	
		43K		44K	
		45K		46K	
		47K		48K	
		49K		50K	
		51K		52K	
		53K		54K	
		55K		56K	
		57K		58K	
		59K		60K	
		61K		62K	
		63K		64K	
		65K		66K	
		67K		68K	
		69K		70K	
		71K		72K	
		73K		74K	
		75K		76K	
		77K		78K	
		79K		80K	
		81K		82K	
		83K		84K	
		85K		86K	
		87K		88K	
		89K		90K	
		91K		92K	
		93K		94K	
		95K		96K	
		97K		98K	
		99K		100K	