

Bally

GAME 1154-E  
10-622

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GROUND

SHAKER

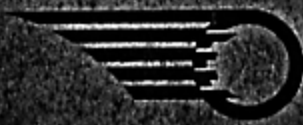


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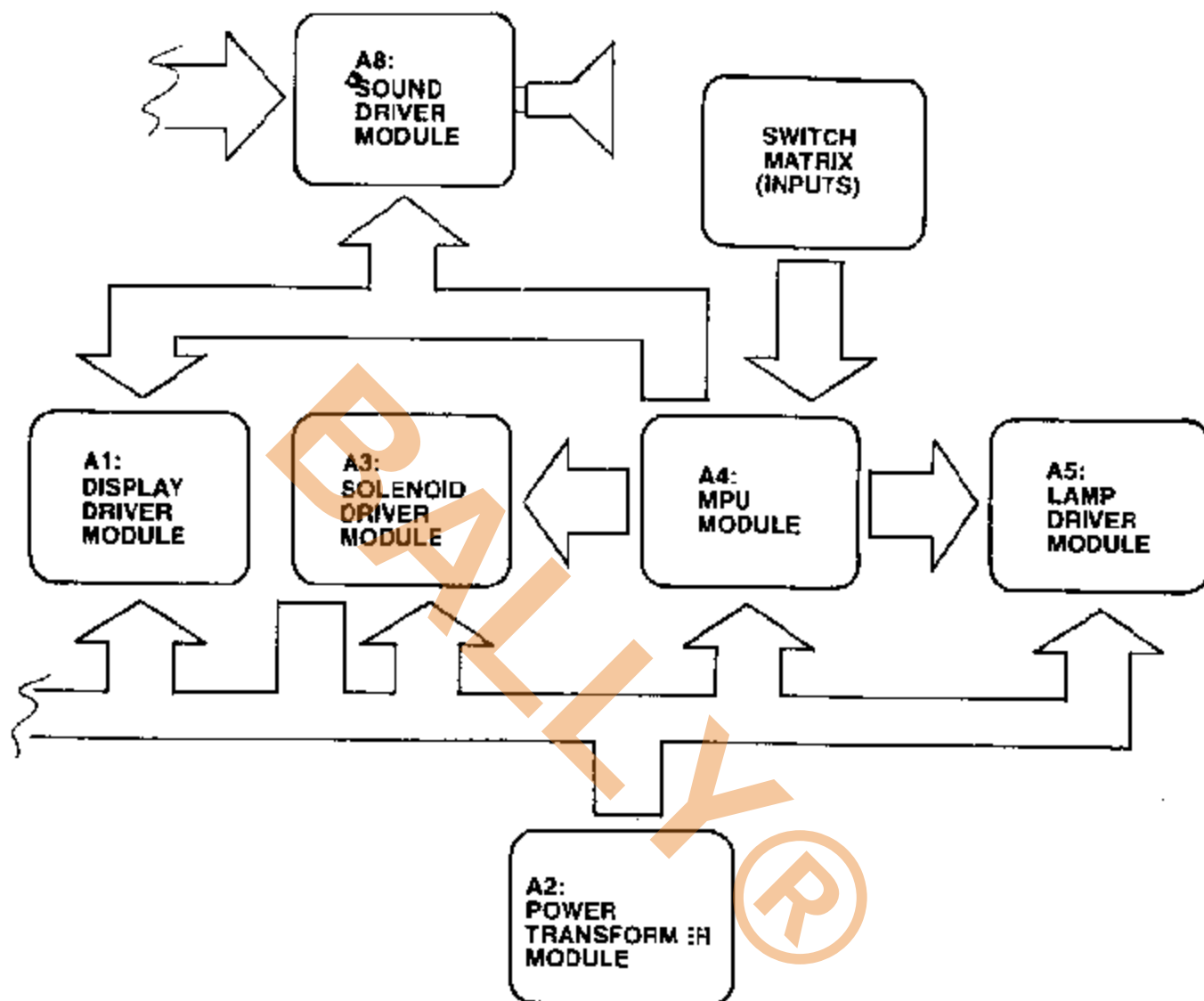
# GAME #1154-E GROUND SHAKER

## 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:

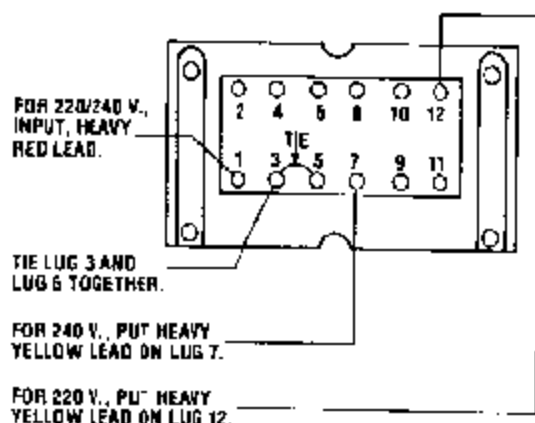
1. Check that all cable connectors are completely seated on printed circuit assemblies.
2. Check that cables are clear of all moving parts.
3. Check for any wires that may have become disconnected.
4. Check switches for loose solder or other foreign material that may have come loose in shipment and could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

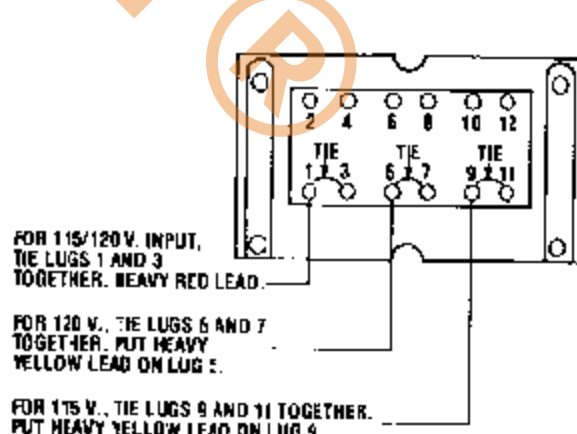
### TRANSFORMER CONNECTION INSTRUCTIONS

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 (Played & 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 ball 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)     | REPLAY   | X-BALL*   | 50,000    |
| Scoring thresholds       | X-BALL   | X-BALL**  | 25,000    |
|                          | 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<br>#1 (HNGE SIDE)<br>OR #3 | SWITCHES             | CREDITS/COIN |
|---------------------------------------|----------------------|--------------|
|                                       | 1 2 3 4 5 12 11 10 9 |              |
|                                       | 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 first and second 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      | SWITCH 7 | SWITCH 6 |
|------------|----------|----------|
| REPLAY     | ON       | ON       |
| EXTRA BALL | ON       | OFF      |
| NO AWARD   | 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. | Orfhole 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.

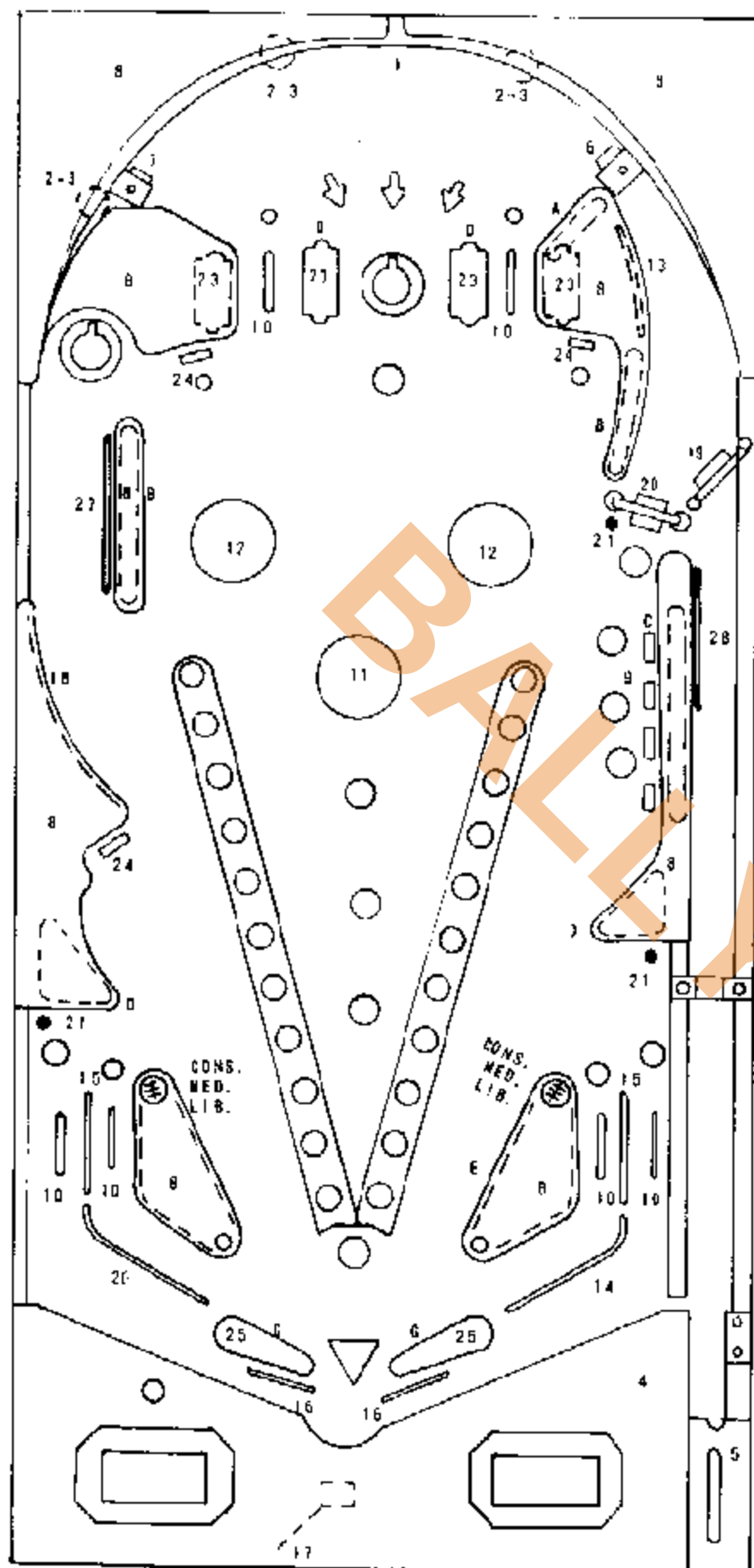


FIGURE 11

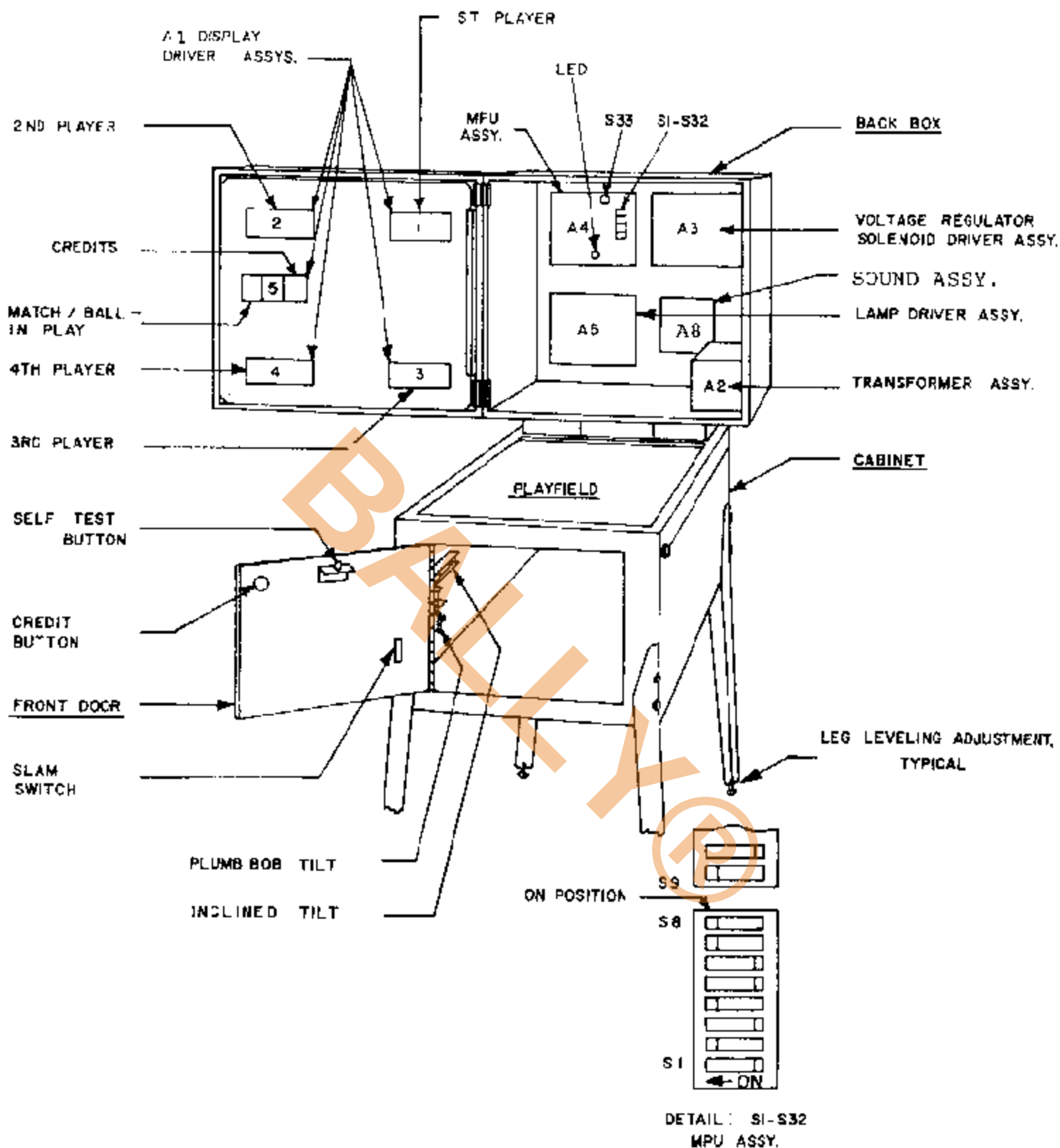


FIGURE III. ELECTRONIC PIN BALL MACHINE

## 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.

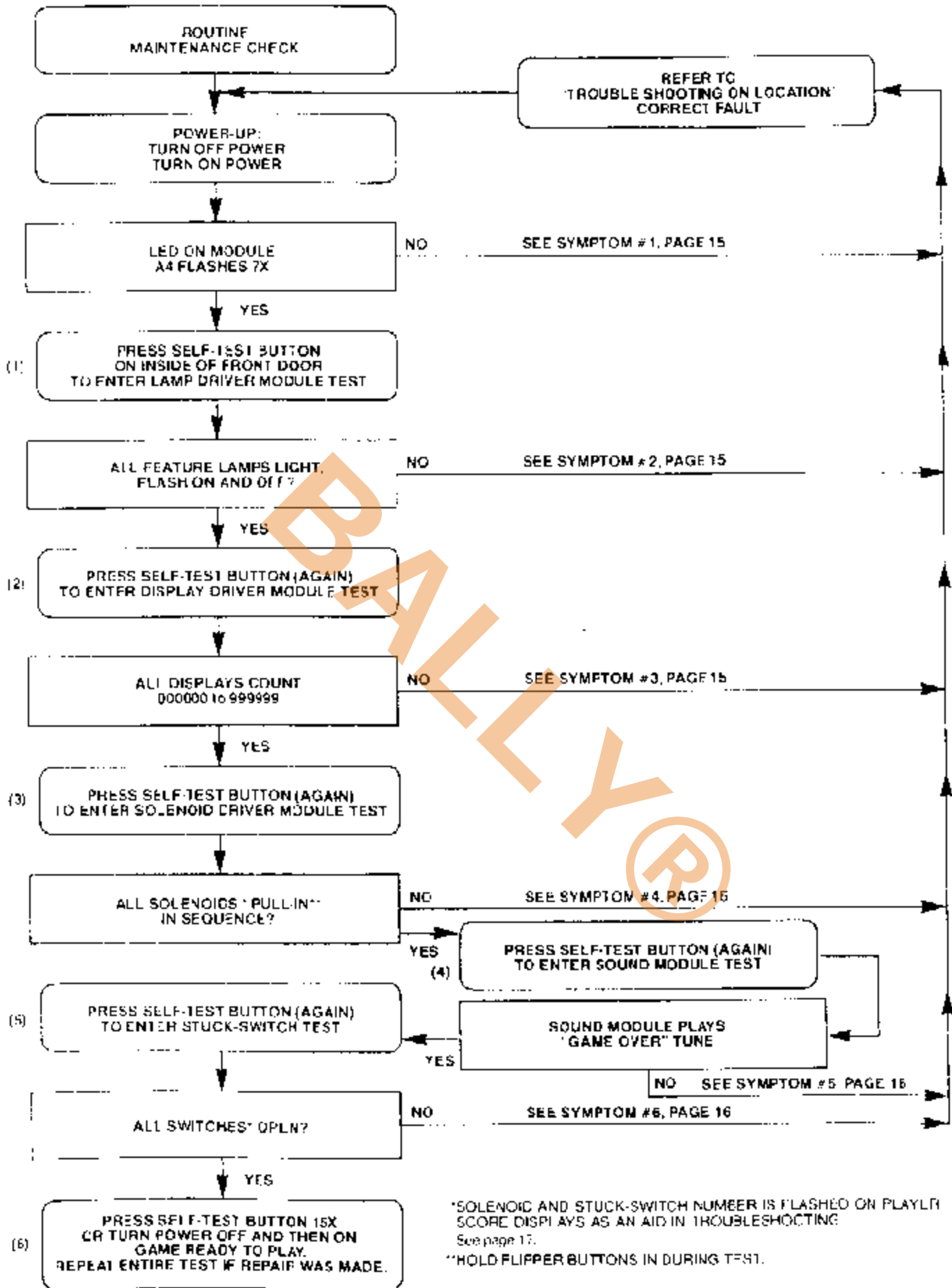
After successful completion of the Self Diagnostic Test procedure, set the game up for play. Exercise each rollover, thumper-bumper, slingshot, etc., by hand until each switch assembly on the playfield has been checked for proper operation. If actuating a switch assembly results in intermittent or no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



\*SOLENOID AND STUCK-SWITCH NUMBER IS FLASHED ON PLAYER'S 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, 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 & 3. 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

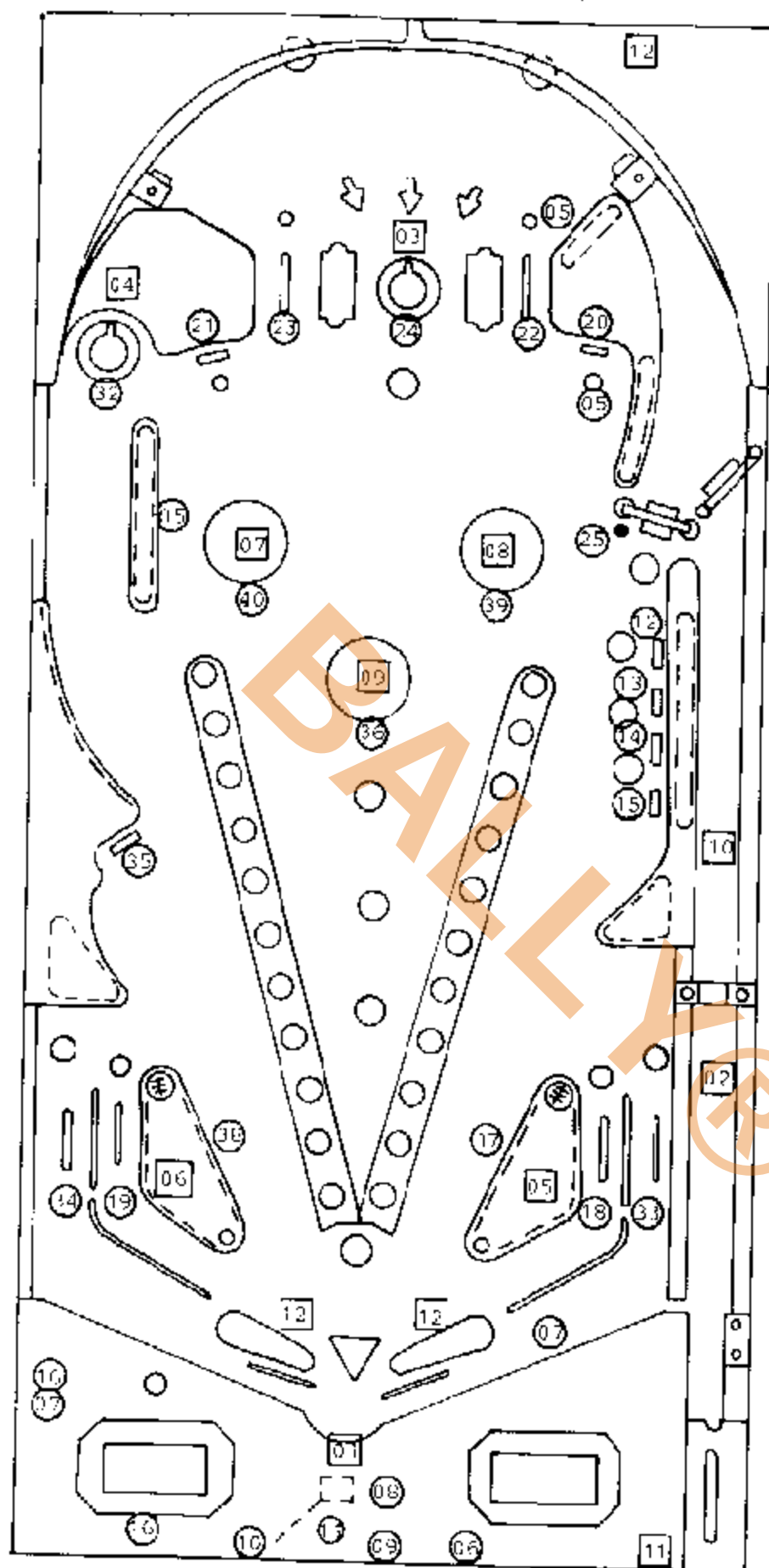
| Self   |                         | Self   |                           |
|--------|-------------------------|--------|---------------------------|
| Test # | SOLENOID IDENTIFICATION | Test # | SOLENOID IDENTIFICATION   |
| 01     | Outhole kicker          | 07     | Left thumper bumper       |
| 02     | 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 |                        | Switch |                        |
|--------|------------------------|--------|------------------------|
| Self   |                        | Self   |                        |
| Test # | DESCRIPTION            | 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**

|                                                                       | <b>PART NUMBER</b> |
|-----------------------------------------------------------------------|--------------------|
| 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/<br>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)

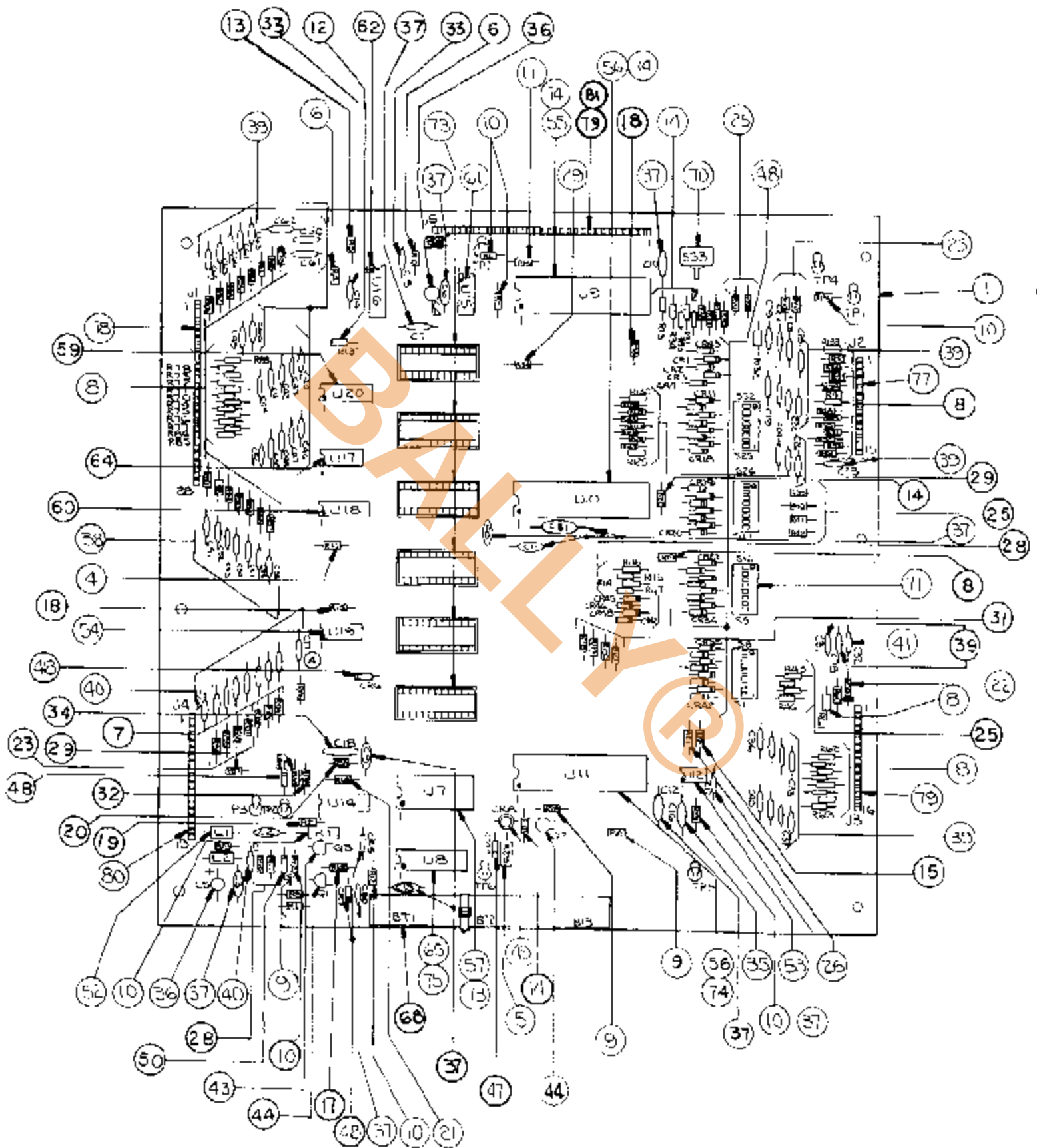
Kit #492—For Solenoid Driver/Voltage Regulator A3

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<br>DESIGNATION           | BALLY<br>PART # | DESCRIPTION                                   |
|------|------------------------------------|-----------------|-----------------------------------------------|
| 1    | A4 (see note 1)                    | AS-2962-9       | MPU Module Complete.<br>Ground Shaker         |
| 2    | A4 (see note 2)                    | AS-2518-35      | MPU Module less Program<br>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,<br>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,<br>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                        |

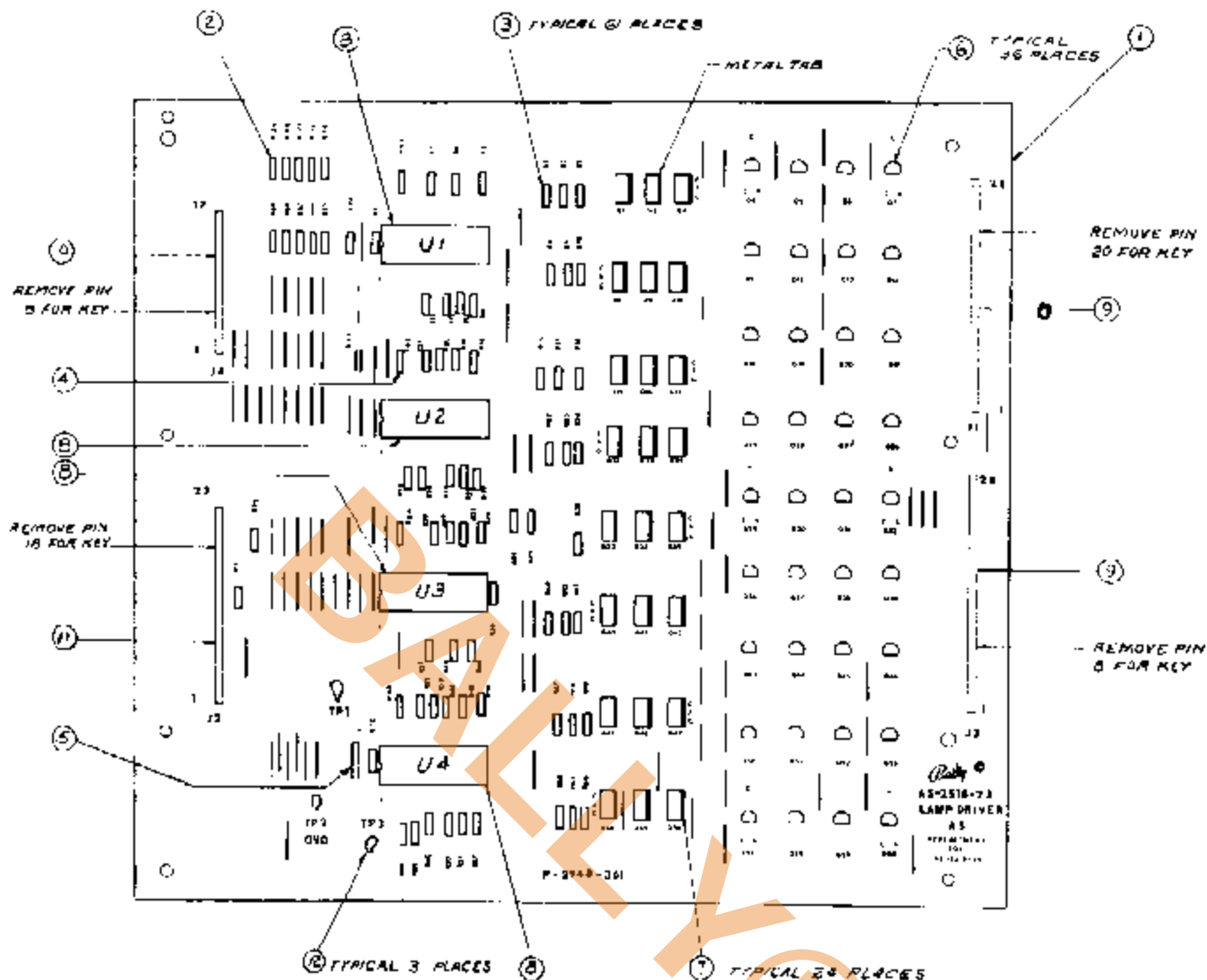
## NOTE 1:

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.

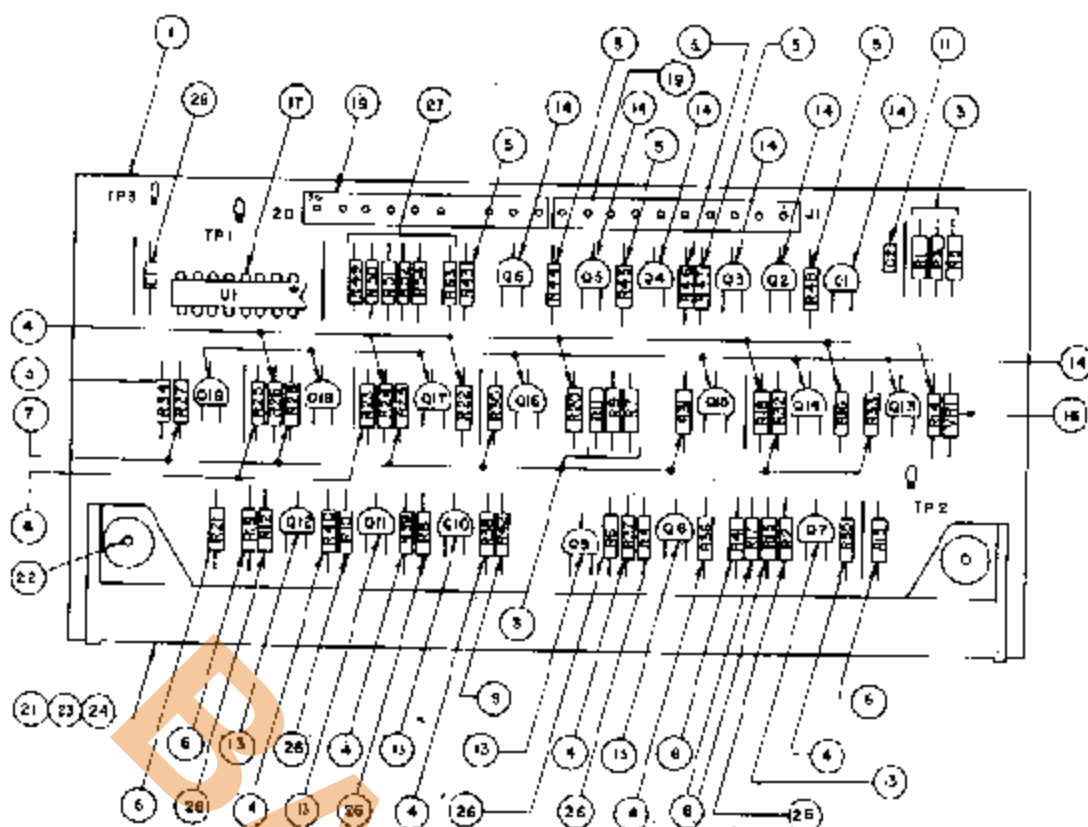
# AS-2518-23 LAMP DRIVER MODULE



## AS: 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 $\Omega$ , 5%, 1/4 W |
| 3    | R1-R60, R70                                                          | E-0C105-0237 | Resistor, 2k $\Omega$ , 5%, 1/4 W  |
| 4    | R61-R69                                                              | E-0C105-0256 | Resistor, 2.2M $\Omega$ , 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

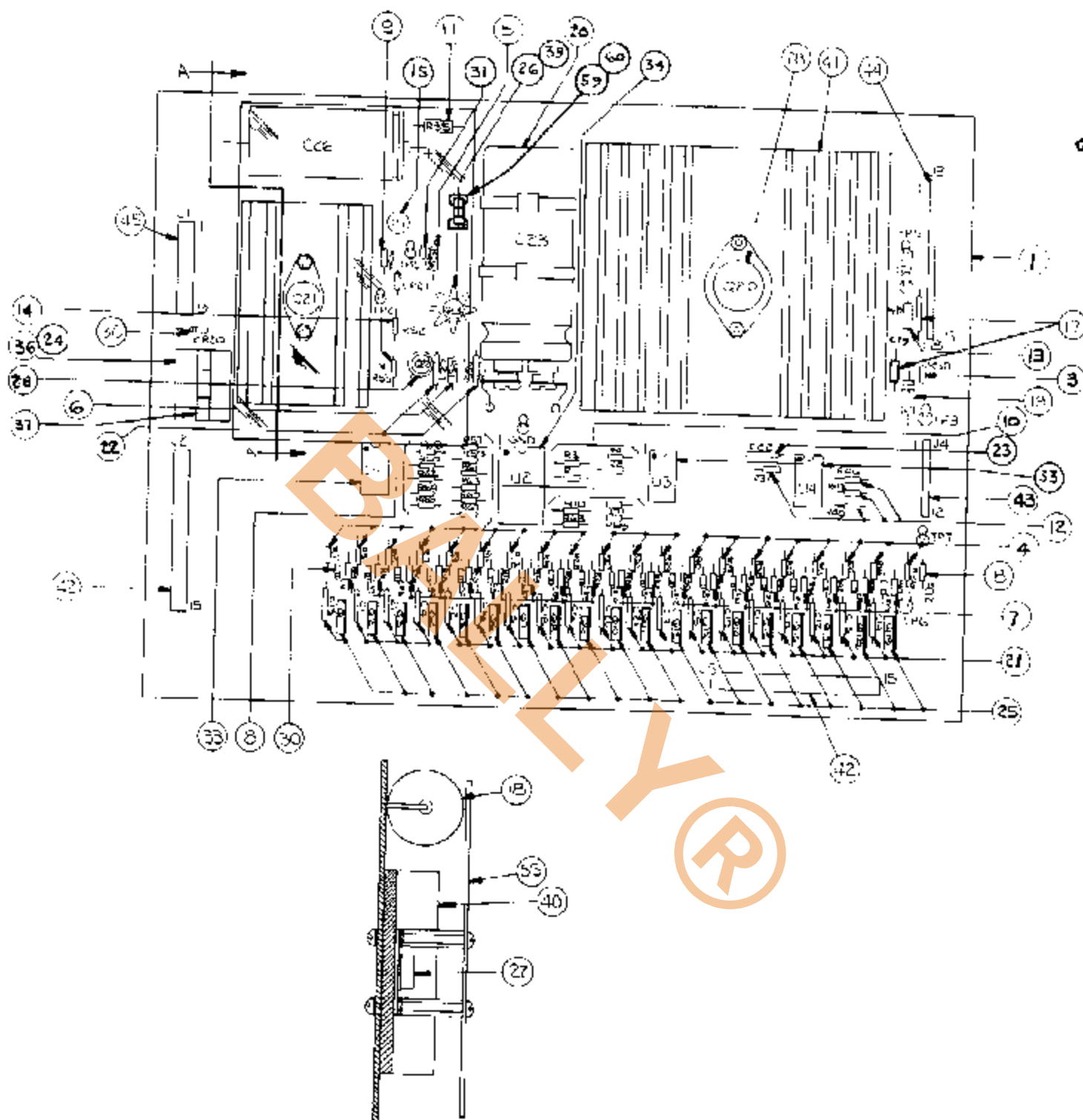


## A1: DISPLAY DRIVER MODULE COMPONENT PARTS LIST

| 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 $\Omega$   |
| 4    | 13       | R14, R16, R18, R20, R22, R24, R26, R35, R36, R37, R38, R39, R40 | E-105-227    | Resistor, 300K $\Omega$   |
| 5    | 6        | R43, R44, R45, R46, R47, R48                                    | E-105-228    | Resistor, 9.1K $\Omega$   |
| 6    | 7        | R13, R15, R17, R19, R21, R23, R25                               | E-105-229    | Resistor, 1.5K $\Omega$   |
| 7    | 7        | R27, R28, R29, R30, R31, R32, R33                               | E-105-230    | Resistor, 1K $\Omega$     |
| 8    | 1        | R41                                                             | F-105-231    | Resistor, 39K $\Omega$    |
| 9    | 1        | R42                                                             | E-105-271    | Resistor, 240K $\Omega$   |
| 10   |          |                                                                 |              |                           |
| 11   | 1        | C2                                                              | E-586-65     | Capacitor, .01 MFD, 500V  |
| 13   | 6        | Q7, Q8, Q9, Q10, Q11, Q12                                       | F-585-32     | Transistor (2N5401)       |
| 14   | 13       | Q1, Q2, Q3, Q4, Q5, Q6, Q13, Q14, Q15, Q16, Q17, Q18, Q19       | F-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 Header             |
| 21   | 1        | DS1                                                             | E-680        | Digital Display Panel     |
| 22   | 2        |                                                                 | 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 $\Omega$   |
| 27   | 6        | R49, R50, R51, R52, R53, R54                                    | E-105-242    | Resistor, 20K $\Omega$    |
| 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



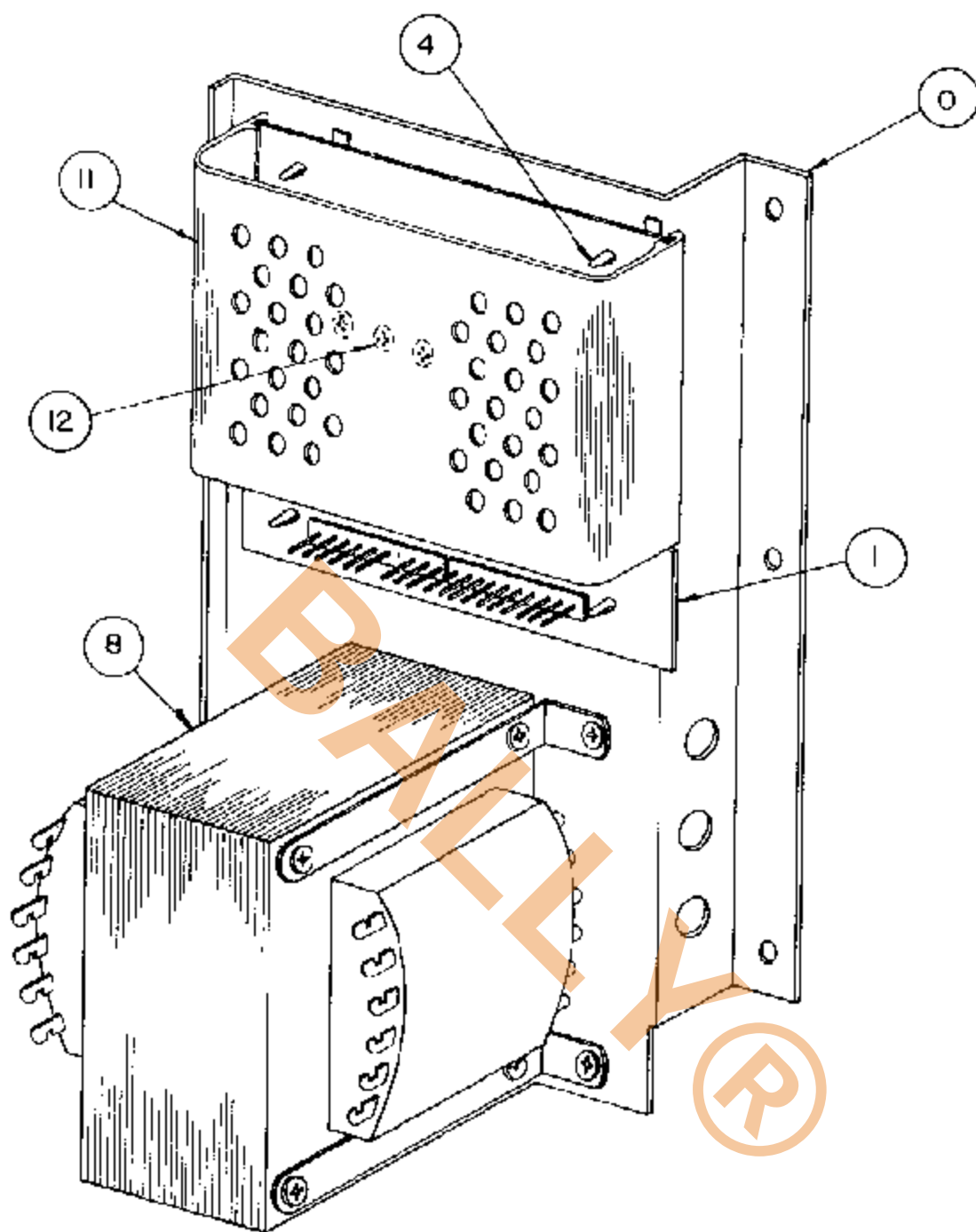
NOTE: INTERCHANGEABLE WITH AS-2518-16

# 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 78H05KG 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                            |

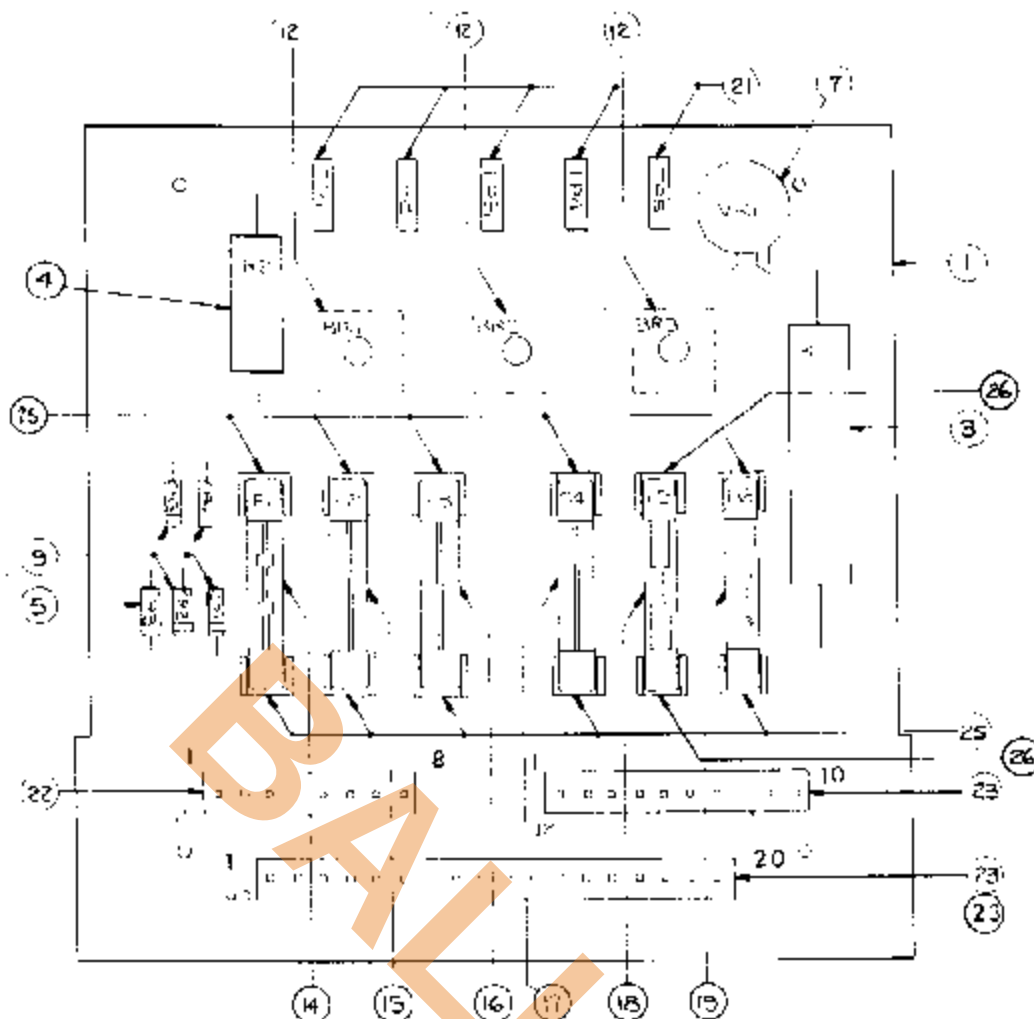
\*USED WITH ITEM 24 E-00146-0791, PLUG IN RELAY ONLY



## 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-00302-0003 | 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

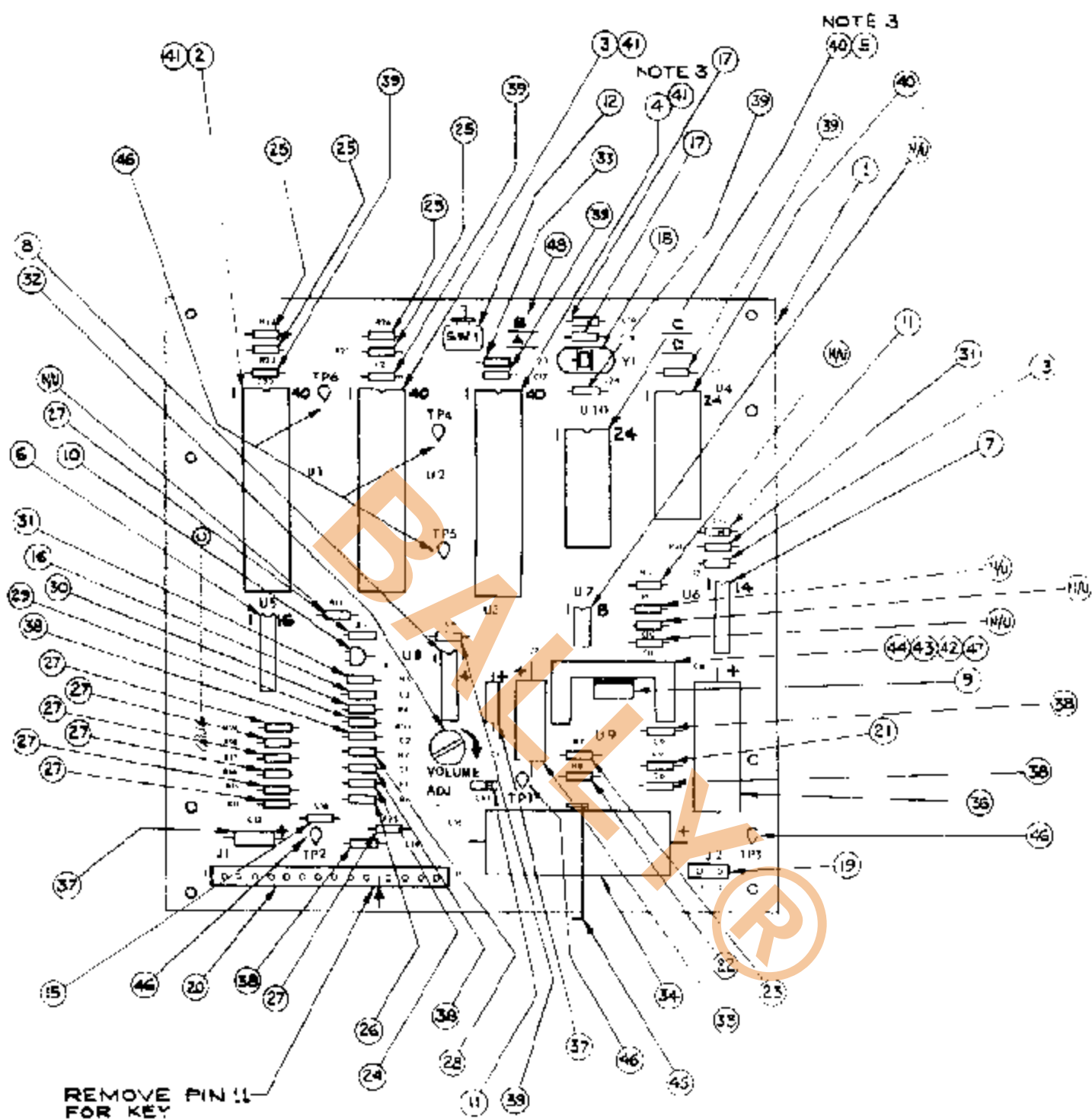
| ITEM | REFERENCE DESIGNATION             | BALLY PART NO.       | DESCRIPTION                               |
|------|-----------------------------------|----------------------|-------------------------------------------|
| 1    | A8 (see note 1)                   | AS-3022-2            | PWB Module 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,<br>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,<br>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<br>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.

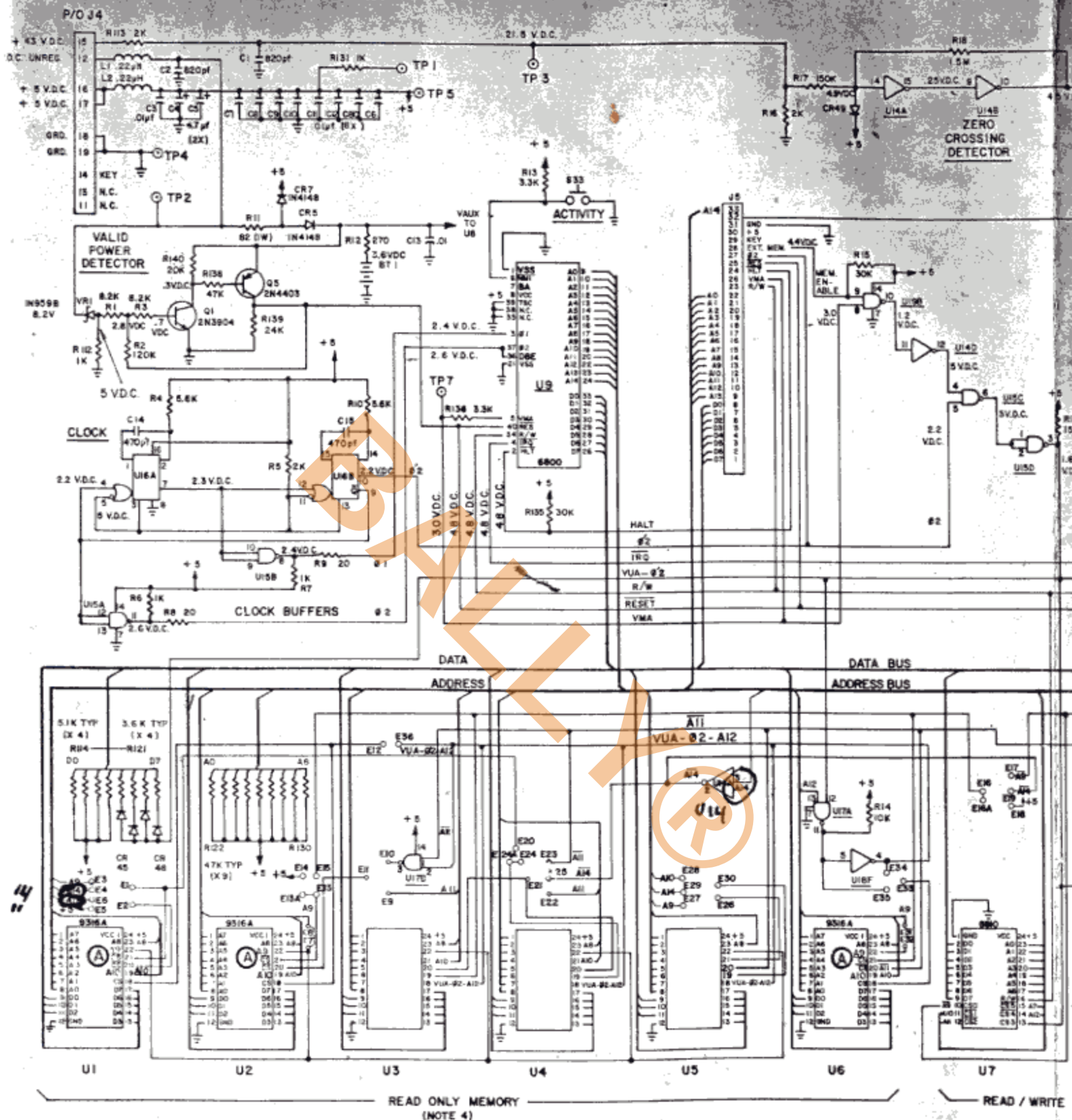
During servicing, when mating insulation displacement connectors on male connectors with a .640" pin length:

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:

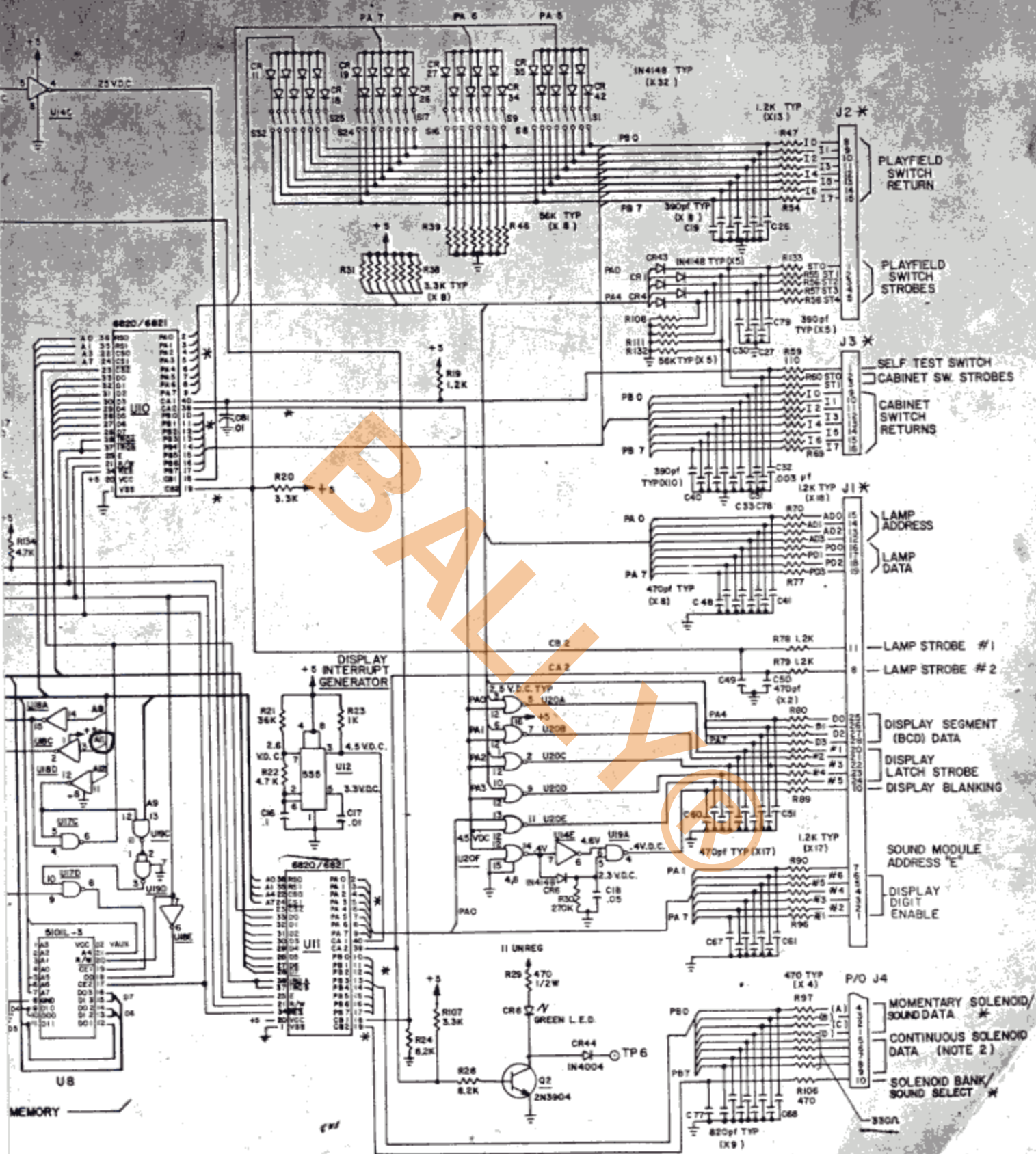
1. Follow steps 1-4 above, but—
2. Disregard the **CAUTION** note. Also, no air gap exists between the connector pair on total engagement.



# NOTES

- \* INDICATES "AID" TEST POINT.
- REMOVE A3J4 BEFORE USING AS AID TEST POINT
- PREFIX ALL REFERENCE DESIGNATIONS WITH "A4"

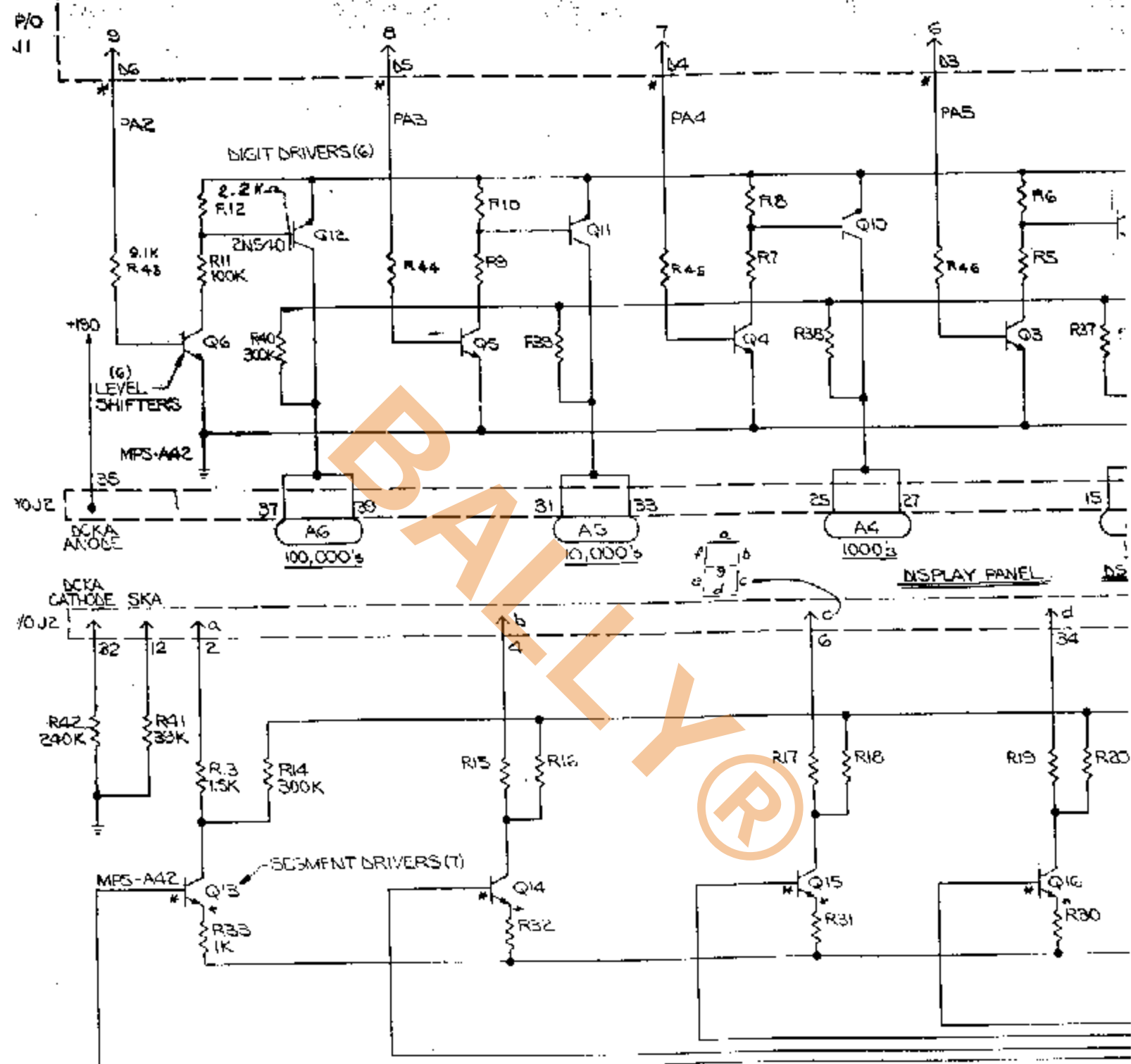
EXACT CHIP COMPLEMENT USED IN SOCKETS U1 THRU U6 CAN VARY FOR DIFFERENT GAMES AND PRODUCTION LOTS. TABLES OF MEMORY CHIPS AND CORRESPONDING JUMPERS FOR DIFFERENT GAMES AVAILABLE FROM BALLY FIELD SERVICE DEPARTMENT.

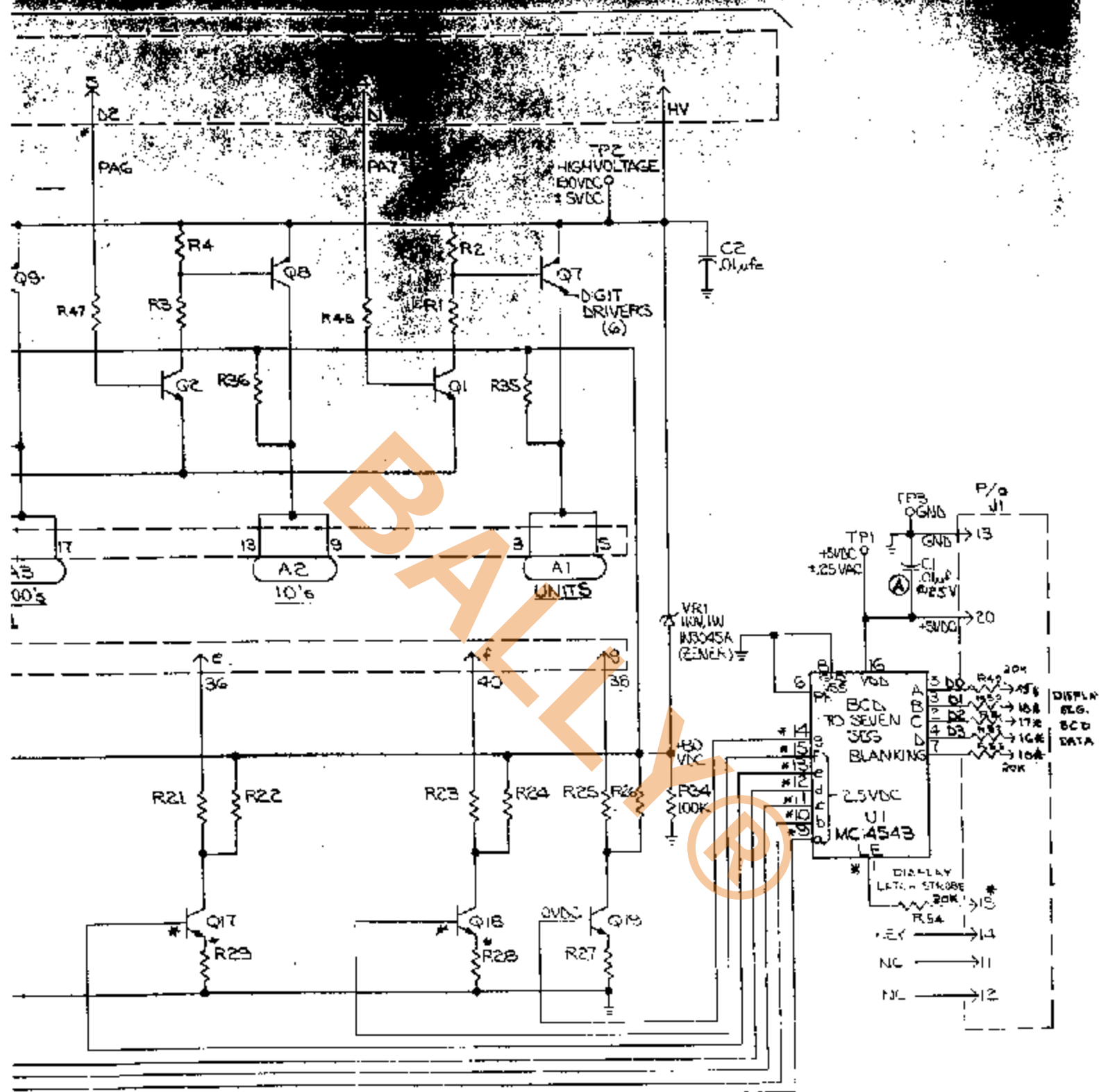


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|  |  | REMOVE ALL DIMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  | DR BY DATE<br>CK BY DATE<br>APP'D BY DATE<br>AUTH'D BY DATE |  | Bally MANUFACTURING CORP.<br>2640 BELMONT AVENUE<br>CHICAGO, ILLINOIS |  |             |  |                      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |       |  | 1115-E |  |
|                                                                                     |  | TOLERANCES ON DIMENSIONS UNLESS OTHERWISE SPECIFIED                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  | FRACTIONS - 3/16                                            |  | DECIMALS - .001                                                       |  | ANGLES - 1° |  | DO NOT SCALE DRAWING |  | TYP T1<br>TYP T2<br>TYP T3<br>TYP T4<br>TYP T5<br>TYP T6<br>TYP T7<br>TYP T8<br>TYP T9<br>TYP T10<br>TYP T11<br>TYP T12<br>TYP T13<br>TYP T14<br>TYP T15<br>TYP T16<br>TYP T17<br>TYP T18<br>TYP T19<br>TYP T20<br>TYP T21<br>TYP T22<br>TYP T23<br>TYP T24<br>TYP T25<br>TYP T26<br>TYP T27<br>TYP T28<br>TYP T29<br>TYP T30<br>TYP T31<br>TYP T32<br>TYP T33<br>TYP T34<br>TYP T35<br>TYP T36<br>TYP T37<br>TYP T38<br>TYP T39<br>TYP T40<br>TYP T41<br>TYP T42<br>TYP T43<br>TYP T44<br>TYP T45<br>TYP T46<br>TYP T47<br>TYP T48<br>TYP T49<br>TYP T50<br>TYP T51<br>TYP T52<br>TYP T53<br>TYP T54<br>TYP T55<br>TYP T56<br>TYP T57<br>TYP T58<br>TYP T59<br>TYP T60<br>TYP T61<br>TYP T62<br>TYP T63<br>TYP T64<br>TYP T65<br>TYP T66<br>TYP T67<br>TYP T68<br>TYP T69<br>TYP T70<br>TYP T71<br>TYP T72<br>TYP T73<br>TYP T74<br>TYP T75<br>TYP T76<br>TYP T77<br>TYP T78<br>TYP T79<br>TYP T80<br>TYP T81<br>TYP T82<br>TYP T83<br>TYP T84<br>TYP T85<br>TYP T86<br>TYP T87<br>TYP T88<br>TYP T89<br>TYP T90<br>TYP T91<br>TYP T92<br>TYP T93<br>TYP T94<br>TYP T95<br>TYP T96<br>TYP T97<br>TYP T98<br>TYP T99<br>TYP T100 |  | TOTAL |  | SCALE  |  |
|                                                                                     |  | 1. A<br>2. B<br>3. C<br>4. D<br>5. E<br>6. F<br>7. G<br>8. H<br>9. I<br>10. J<br>11. K<br>12. L<br>13. M<br>14. N<br>15. O<br>16. P<br>17. Q<br>18. R<br>19. S<br>20. T<br>21. U<br>22. V<br>23. W<br>24. X<br>25. Y<br>26. Z<br>27. AA<br>28. AB<br>29. AC<br>30. AD<br>31. AE<br>32. AF<br>33. AG<br>34. AH<br>35. AI<br>36. AJ<br>37. AK<br>38. AL<br>39. AM<br>40. AN<br>41. AO<br>42. AP<br>43. AQ<br>44. AR<br>45. AS<br>46. AT<br>47. AU<br>48. AV<br>49. AW<br>50. AX<br>51. AY<br>52. AZ<br>53. BA<br>54. BB<br>55. BC<br>56. BD<br>57. BE<br>58. BF<br>59. BG<br>60. BH<br>61. BI<br>62. BJ<br>63. BK<br>64. BL<br>65. BM<br>66. BN<br>67. BO<br>68. BP<br>69. BQ<br>70. BR<br>71. BS<br>72. BT<br>73. BU<br>74. BV<br>75. BW<br>76. BX<br>77. BY<br>78. BZ<br>79. CA<br>80. CB<br>81. CC<br>82. CD<br>83. CE<br>84. CF<br>85. CG<br>86. CH<br>87. CI<br>88. CJ<br>89. CK<br>90. CL<br>91. CM<br>92. CN<br>93. CO<br>94. CP<br>95. CQ<br>96. CR<br>97. CS<br>98. CT<br>99. CU<br>100. CV<br>101. CW<br>102. CX<br>103. CY<br>104. CZ<br>105. DA<br>106. DB<br>107. DC<br>108. DD<br>109. DE<br>110. DF<br>111. DG<br>112. DH<br>113. DI<br>114. DJ<br>115. DK<br>116. DL<br>117. DM<br>118. DN<br>119. DO<br>120. DP<br>121. DQ<br>122. DR<br>123. DS<br>124. DT<br>125. DU<br>126. DV<br>127. DW<br>128. DX<br>129. DY<br>130. DZ<br>131. EA<br>132. EB<br>133. EC<br>134. ED<br>135. EE<br>136. EF<br>137. EG<br>138. EH<br>139. EI<br>140. EJ<br>141. EK<br>142. EL<br>143. EM<br>144. EN<br>145. EO<br>146. EP<br>147. EQ<br>148. ER<br>149. ES<br>150. ET<br>151. EU<br>152. EV<br>153. EW<br>154. EX<br>155. EY<br>156. EZ<br>157. FA<br>158. FB<br>159. FC<br>160. FD<br>161. FE<br>162. FF<br>163. FG<br>164. FH<br>165. FI<br>166. FJ<br>167. FK<br>168. FL<br>169. FM<br>170. FN<br>171. FO<br>172. FP<br>173. FQ<br>174. FR<br>175. FS<br>176. FT<br>177. FU<br>178. FV<br>179. FW<br>180. FX<br>181. FY<br>182. FZ<br>183. GA<br>184. GB<br>185. GC<br>186. GD<br>187. GE<br>188. GF<br>189. GG<br>190. GH<br>191. GI<br>192. GJ<br>193. GK<br>194. GL<br>195. GM<br>196. GN<br>197. GO<br>198. GP<br>199. GQ<br>200. GR<br>201. GS<br>202. GT<br>203. GU<br>204. GV<br>205. GW<br>206. GX<br>207. GY<br>208. GZ<br>209. HA<br>210. HB<br>211. HC<br>212. HD<br>213. HE<br>214. HF<br>215. HG<br>216. HH<br>217. HI<br>218. HJ<br>219. HK<br>220. HL<br>221. HM<br>222. HN<br>223. HO<br>224. HP<br>225. HQ<br>226. HR<br>227. HS<br>228. HT<br>229. HU<br>230. HV<br>231. HW<br>232. HX<br>233. HY<br>234. HZ<br>235. IA<br>236. IB<br>237. IC<br>238. ID<br>239. IE<br>240. IF<br>241. IG<br>242. IH<br>243. II<br>244. IJ<br>245. IK<br>246. IL<br>247. IM<br>248. IN<br>249. IO<br>250. IP<br>251. IQ<br>252. IR<br>253. IS<br>254. IT<br>255. IU<br>256. IV<br>257. IW<br>258. IX<br>259. IY<br>260. IZ<br>261. JA<br>262. JB<br>263. JC<br>264. JD<br>265. JE<br>266. JF<br>267. JG<br>268. JH<br>269. JI<br>270. JJ<br>271. JK<br>272. JL<br>273. JM<br>274. JN<br>275. JO<br>276. JP<br>277. JQ<br>278. JR<br>279. JS<br>280. JT<br>281. JU<br>282. JV<br>283. JW<br>284. JX<br>285. JY<br>286. JZ<br>287. KA<br>288. KB<br>289. KC<br>290. KD<br>291. KE<br>292. KF<br>293. KG<br>294. KH<br>295. KI<br>296. KJ<br>297. KK<br>298. KL<br>299. KM<br>300. KN<br>301. KO<br>302. KP<br>303. KQ<br>304. KR<br>305. KS<br>306. KT<br>307. KU<br>308. KV<br>309. KW<br>310. KX<br>311. KY<br>312. KZ<br>313. LA<br>314. LB<br>315. LC<br>316. LD<br>317. LE<br>318. LF<br>319. LG<br>320. LH<br>321. LI<br>322. LJ<br>323. LK<br>324. LL<br>325. LM<br>326. LN<br>327. LO<br>328. LP<br>329. LQ<br>330. LR<br>331. LS<br>332. LT<br>333. LU<br>334. LV<br>335. LW<br>336. LX<br>337. LY<br>338. LZ<br>339. MA<br>340. MB<br>341. MC<br>342. MD<br>343. ME<br>344. MF<br>345. MG<br>346. MH<br>347. MI<br>348. MJ<br>349. MK<br>350. ML<br>351. MM<br>352. MN<br>353. MO<br>354. MP<br>355. MQ<br>356. MR<br>357. MS<br>358. MT<br>359. MU<br>360. MV<br>361. MW<br>362. MX<br>363. MY<br>364. MZ<br>365. NA<br>366. NB<br>367. NC<br>368. ND<br>369. NE<br>370. NF<br>371. NG<br>372. NH<br>373. NI<br>374. NJ<br>375. NK<br>376. NL<br>377. NM<br>378. NN<br>379. NO<br>380. NP<br>381. NQ<br>382. NR<br>383. NS<br>384. NT<br>385. NU<br>386. NV<br>387. NW<br>388. NX<br>389. NY<br>390. NZ<br>391. OA<br>392. OB<br>393. OC<br>394. OD<br>395. OE<br>396. OF<br>397. OG<br>398. OH<br>399. OI<br>400. OJ<br>401. OK<br>402. OL<br>403. OM<br>404. ON<br>405. OO<br>406. OP<br>407. OQ<br>408. OR<br>409. OS<br>410. OT<br>411. OU<br>412. OV<br>413. OW<br>414. OX<br>415. OY<br>416. OZ<br>417. PA<br>418. PB<br>419. PC<br>420. PD<br>421. PE<br>422. PF<br>423. PG<br>424. PH<br>425. PI<br>426. PJ<br>427. PK<br>428. PL<br>429. PM<br>430. PN<br>431. PO<br>432. PP<br>433. PQ<br>434. PR<br>435. PS<br>436. PT<br>437. PU<br>438. PV<br>439. PW<br>440. PX<br>441. PY<br>442. PZ<br>443. QA<br>444. QB<br>445. QC<br>446. QD<br>447. QE<br>448. QF<br>449. QG<br>450. QH<br>451. QI<br>452. QJ<br>453. QK<br>454. QL<br>455. QM<br>456. QN<br>457. QO<br>458. QP<br>459. QQ<br>460. QR<br>461. QS<br>462. QT<br>463. QU<br>464. QV<br>465. QW<br>466. QX<br>467. QY<br>468. QZ<br>469. RA<br>470. RB<br>471. RC<br>472. RD<br>473. RE<br>474. RF<br>475. RG<br>476. RH<br>477. RI<br>478. RJ<br>479. RK<br>480. RL<br>481. RM<br>482. RN<br>483. RO<br>484. RP<br>485. RQ<br>486. RR<br>487. RS<br>488. RT<br>489. RU<br>490. RV<br>491. RW<br>492. RX<br>493. RY<br>494. RZ<br>495. SA<br>496. SB<br>497. SC<br>498. SD<br>499. SE<br>500. SF<br>501. SG<br>502. SH<br>503. SI<br>504. SJ<br>505. SK<br>506. SL<br>507. SM<br>508. SN<br>509. SO<br>510. SP<br>511. SQ<br>512. SR<br>513. SS<br>514. ST<br>515. SU<br>516. SV<br>517. SW<br>518. SX<br>519. SY<br>520. SZ<br>521. TA<br>522. TB<br>523. TC<br>524. TD<br>525. TE<br>526. TF<br>527. TG<br>528. TH<br>529. TI<br>530. TJ<br>531. TK<br>532. TL<br>533. TM<br>534. TN<br>535. TO<br>536. TP<br>537. TQ<br>538. TR<br>539. TS<br>540. TT<br>541. TU<br>542. TV<br>543. TW<br>544. TX<br>545. TY<br>546. TZ<br>547. UA<br>548. UB<br>549. UC<br>550. UD<br>551. UE<br>552. UF<br>553. UG<br>554. UH<br>555. UI<br>556. UJ<br>557. UK<br>558. UL<br>559. UM<br>560. UN<br>561. UO<br>562. UP<br>563. UQ<br>564. UR<br>565. US<br>566. UT<br>567. UY<br>568. UZ<br>569. VA<br>570. VB<br>571. VC<br>572. VD<br>573. VE<br>574. VF<br>575. VG<br>576. VH<br>577. VI<br>578. VJ<br>579. VK<br>580. VL<br>581. VM<br>582. VN<br>583. VO<br>584. VP<br>585. VQ<br>586. VR<br>587. VS<br>588. VT<br>589. VY<br>590. VZ<br>591. WA<br>592. WB<br>593. WC<br>594. WD<br>595. WE<br>596. WF<br>597. WG<br>598. WH<br>599. WI<br>600. WJ<br>601. WK<br>602. WL<br>603. WM<br>604. WN<br>605. WO<br>606. WP<br>607. WQ<br>608. WR<br>609. WS<br>610. WT<br>611. WY<br>612. WZ<br>613. XA<br>614. XB<br>615. XC<br>616. XD<br>617. XE<br>618. XF<br>619. XG<br>620. XH<br>621. XI<br>622. XJ<br>623. XK<br>624. XL<br>625. XM<br>626. XN<br>627. XO<br>628. XP<br>629. XQ<br>630. XR<br>631. XS<br>632. XT<br>633. XU<br>634. XV<br>635. XW<br>636. XX<br>637. XY<br>638. XZ<br>639. YA<br>640. YB<br>641. YC<br>642. YD<br>643. YE<br>644. YF<br>645. YG<br>646. YH<br>647. YI<br>648. YJ<br>649. YK<br>650. YL<br>651. YM<br>652. YN<br>653. YO<br>654. YP<br>655. YQ<br>656. YR<br>657. YS<br>658. YT<br>659. YZ<br>660. ZA<br>661. ZB<br>662. ZC<br>663. ZD<br>664. ZE<br>665. ZF<br>666. ZG<br>667. ZH<br>668. ZI<br>669. ZJ<br>670. ZK<br>671. ZL<br>672. ZM<br>673. ZN<br>674. ZO<br>675. ZP<br>676. ZQ<br>677. ZR<br>678. ZS<br>679. ZT<br>680. ZY<br>681. ZZ |  |                                                             |  |                                                                       |  |             |  |                      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |       |  |        |  |

DISPLAY DIGIT ENABLE



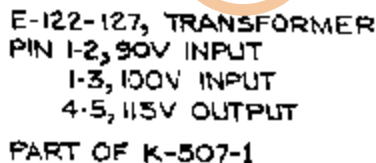


DIE SIZE — C.C. — FT. PER M — LBS PER M —

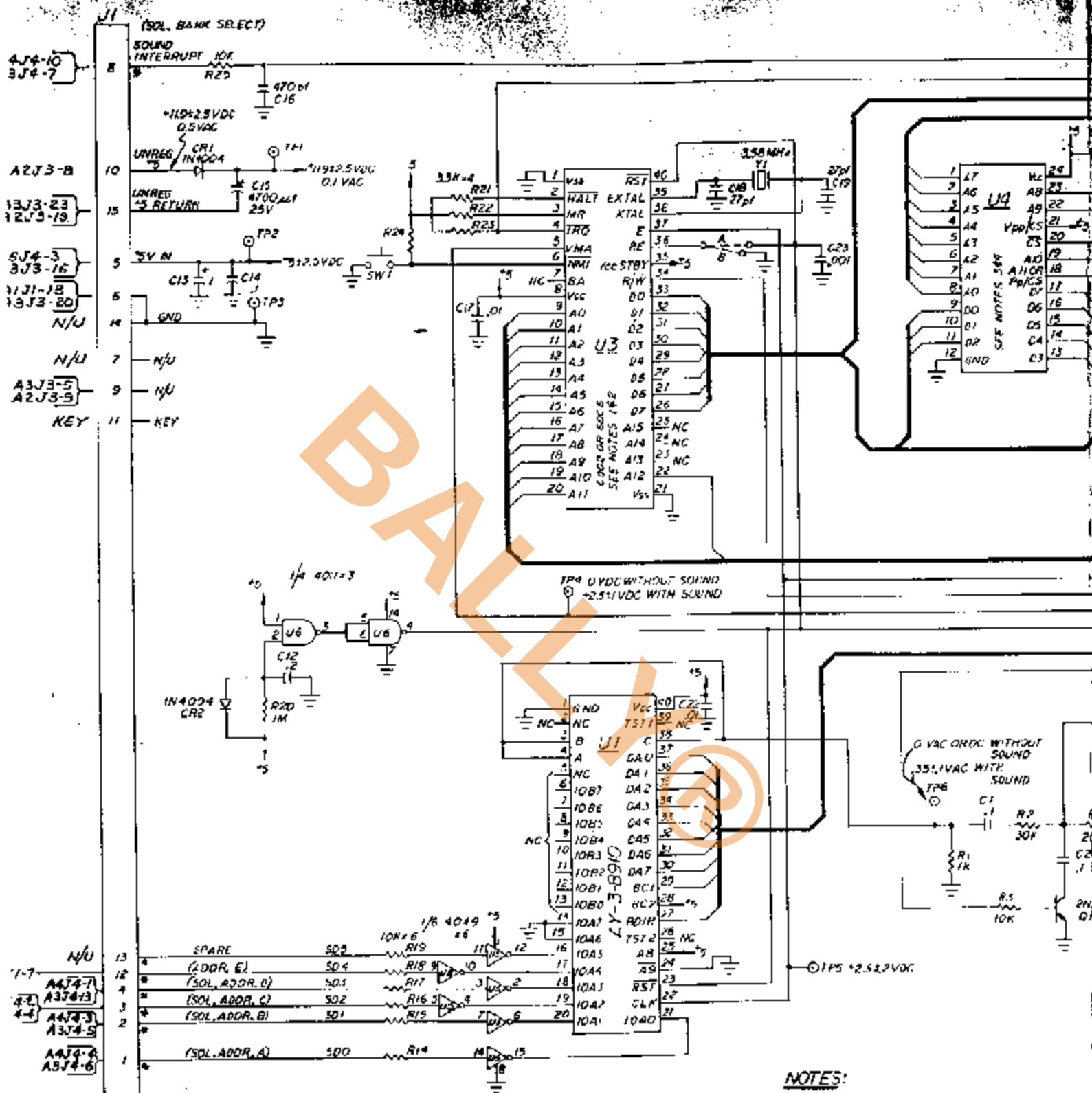
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED. DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY. DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY. DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY.

|                                                                                                                      |  |                                             |                                                                                                                |                                                                                        |
|----------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| <b>REVIEW ALL SHEETS</b><br>TOLERANCES OF DIMENSIONS UNLESS OTHERWISE SPECIFIED:<br>FRACTIONS & DECIMALS:<br>ANGLES: |  | DATE:<br>BY:<br>CHECKED BY:<br>APPROVED BY: | <b>Rally MANUFACTURING CORP #120-1</b><br>180 BELMONT AVENUE<br>CHICAGO, ILLINOIS 60601<br>ALL RIGHTS RESERVED | TITLE: <b>DISPLAY BOARD SCHEMATIC</b><br>PART: <b>AS-251B-2</b><br>REV: <b>W31341c</b> |
|----------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|





61-E



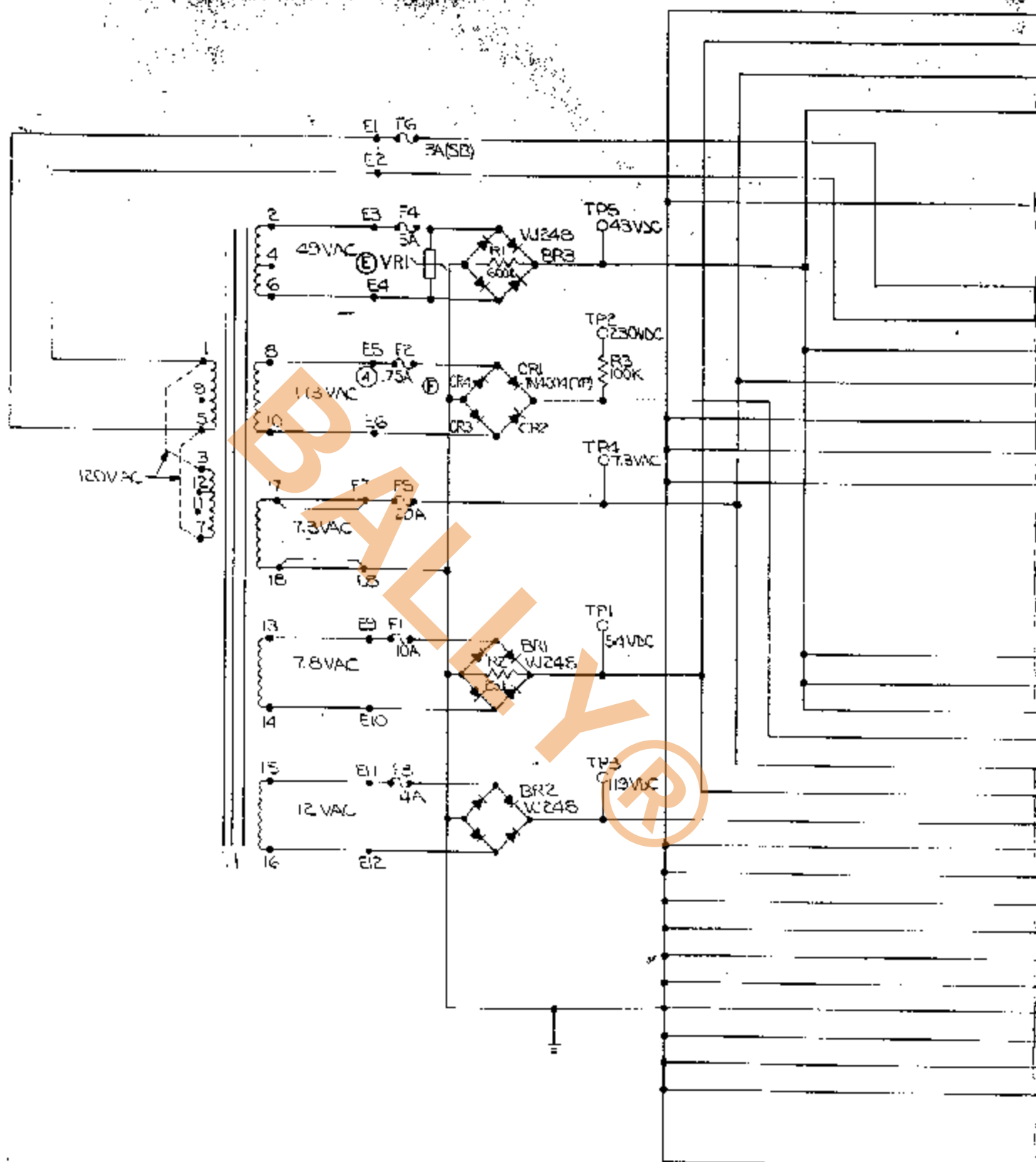
# NOTES:

1. USE JUMPER A IF INTERNAL RAM IS USED
2. " " B - EXTERNAL " " "
3. " " C - 2K ROW (EPROM) " " "
4. " " D - 4K " " "
5. U7, R12, R13, C10, C11 NOT USED ON THIS
6. UNLESS OTHERWISE INDICATED, ALL RESISTOR VALUES ARE IN OHMS
7. Z PREFIX ALL REFERENCE DESIGNATIONS
8. # INDICATES "AID" TEST POINT

| NO. | DATE     | DESCRIPTION   | TOOL NO. |
|-----|----------|---------------|----------|
| 1   | 11/11/78 | 110VDC 0.1VAC |          |



# TRANSFORMER ASSEMBLY A2



|   |                       |
|---|-----------------------|
| 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) |

|    |                 |
|----|-----------------|
| 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             |

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

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.

| LINE VOLTAGE<br>VRMS A.C. | STRAP<br>TERMINALS | APPLY POWER<br>TO<br>TERMINALS |
|---------------------------|--------------------|--------------------------------|
| 115                       | 1T03 AND<br>3T011  | 1 AND 9                        |
| 120                       | 1T03 AND<br>3T01   | 1 AND 5                        |
| 220                       | 3T05               | 1 AND 12                       |
| 240                       | 3T05               | 1 AND 7                        |
|                           |                    |                                |
|                           |                    |                                |

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

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED EXCEPT WHERE SHOWN OTHERWISE. DATE 08-01-2010 BY 60322 UCBAW/STP

|   |   |                             |              |
|---|---|-----------------------------|--------------|
| 6 | H | ADDED A8H-10, A3H-12        | NO-TEST E.V. |
| 5 | G | ADDED A8H-9                 | NO-TEST E.V. |
| 4 | F | BRAIED (16)                 | NO-TEST E.V. |
| 3 | G | VEI READ 43                 | NO-TEST E.V. |
| 2 | D | J1-2 READ "GND"             |              |
| 1 | C | J2-11 READ "GND"            |              |
| 1 | G | ADDED JUMPER J2-11 to J2-12 |              |
| 1 | A | FE WAS 5.0A                 |              |

**RESEARCH, PRACTICE, AND POLICY**

## THE FUTURE OF

## NEW! LOW-COST SPECIAL PRICES

**Abstract:**

**DE WET 1912**

|                           |                           |
|---------------------------|---------------------------|
| THE JOURNAL OF THE        |                           |
| ROYAL SOCIETY OF MEDICINE | ROYAL SOCIETY OF MEDICINE |

**C. 2nd 1st 4th**

|    |    |
|----|----|
| 10 | 11 |
|----|----|



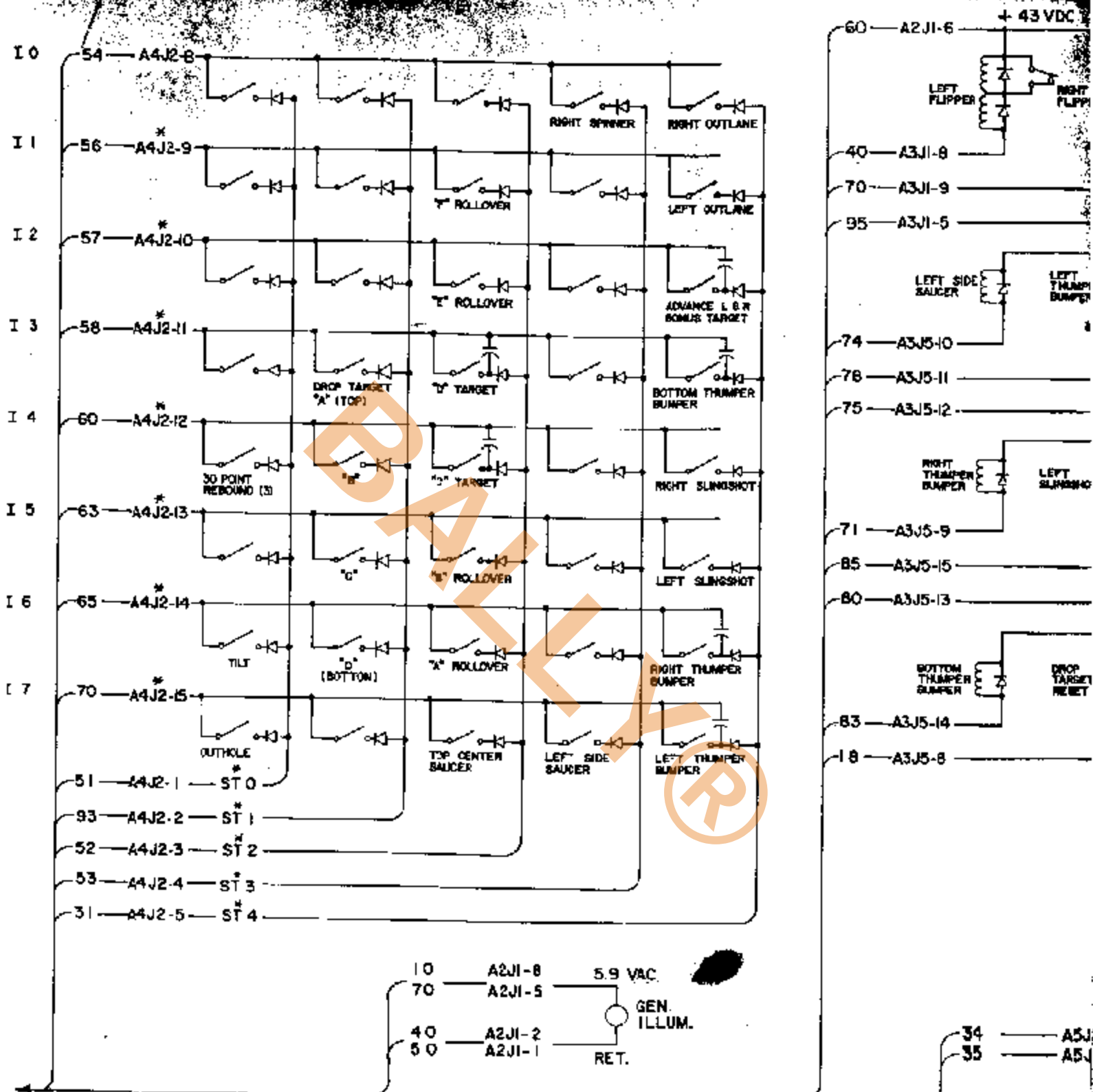
**【答案】** C

## MANUFACTURING CORP.

FILE 157-2000-CHICAGO, ILLINOIS - (U) (P)

姓名: 王 强 性别: 男 年龄: 35 职业: 教师  
 籍贯: 山东 民族: 汉族 婚姻: 已婚  
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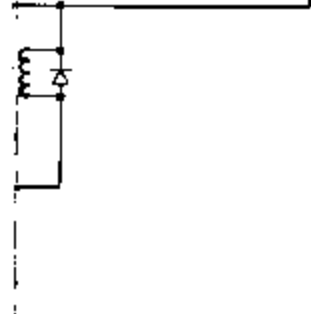
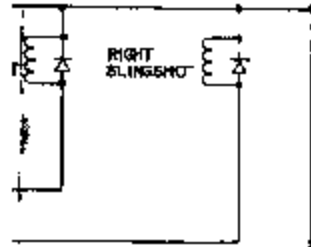
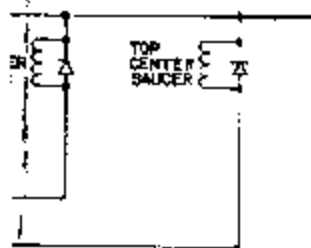
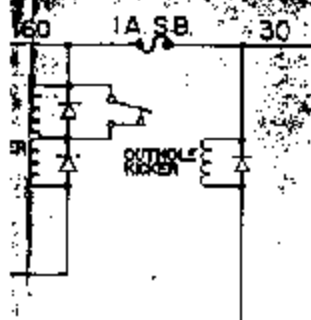
## CONCLUSION



PLAYFIELD A5

# NOTES

1. INDICATES NOT USED
2. N/U = NOT USED ON PLAYFIELD
3. \* INDICATES AID TEST POINT
4. ALL COIL DIODES ARE 1N4004 (E-587-6) SWITCH DIODES ARE 1N4001 (E-586-80)



| 58 | A5J1-18 1K RIGHT BONUS         |  |         |
|----|--------------------------------|--|---------|
| 60 | A5J1-19 5K RIGHT BONUS         |  |         |
| 57 | A5J1-17 5K RIGHT BONUS         |  | 5.4 VDC |
| 56 | A5J1-23 1K LEFT BONUS          |  |         |
| 54 | A5J1-14 5K LEFT BONUS          |  |         |
| 13 | A5J1-15 5K LEFT BONUS          |  |         |
| 12 | A5J1-16 "A" ROLLOVER           |  |         |
| 78 | A5J1-28 "E" ROLLOVER           |  |         |
| 50 | A5J1-24 DROP TARGET 5K         |  |         |
| 90 | A5J1-25 TOP SAUCER LEFT ARROW  |  |         |
| 91 | A5J1-26 SAME PLAYER 5. A.      |  |         |
| 53 | A5J1-27 20K SUPER BONUS        |  |         |
| 41 | A5J1-1 5K RIGHT BONUS          |  |         |
| 52 | A5J1-9 5K RIGHT BONUS          |  |         |
| 51 | A5J1-8 10K RIGHT BONUS         |  |         |
| 45 | A5J1-3 2K LEFT BONUS           |  |         |
| 43 | A5J1-2 5K 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 | 6" 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 & 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  | 5" 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        |

4148, (E-587-14)

|            |              |                         |           |                         |                                  |            |            |           |            |            |           |           |            |            |              |              |                  |  |
|------------|--------------|-------------------------|-----------|-------------------------|----------------------------------|------------|------------|-----------|------------|------------|-----------|-----------|------------|------------|--------------|--------------|------------------|--|
|            |              | <b>MIRAGE ALL BURE.</b> |           | <b>E.P. DATE</b>        | <b>Betty MANUFACTURING CORP.</b> |            |            |           |            |            |           |           |            |            |              |              |                  |  |
|            |              |                         |           | <b>EX BY DATE</b>       | <b>140 BELMONT AVENUE</b>        |            |            |           |            |            |           |           |            |            |              |              |                  |  |
|            |              |                         |           |                         | <b>CHICAGO, ILLINOIS</b>         |            |            |           |            |            |           |           |            |            |              |              |                  |  |
|            |              |                         |           | <b>APR BY DATE</b>      | <b>PROD CONTROL</b>              | <b>TOT</b> | <b>QRT</b> | <b>CV</b> | <b>DGR</b> | <b>HRC</b> | <b>ES</b> | <b>OP</b> | <b>WIP</b> | <b>JIT</b> | <b>TOTAL</b> | <b>SCALE</b> |                  |  |
|            |              |                         |           | <b>END OF DAY</b>       |                                  |            |            |           |            |            |           |           |            |            |              |              |                  |  |
|            |              |                         |           | <b>WORK IN PROGRESS</b> | <b>SWITCH MATRIX</b>             |            |            |           |            |            |           |           |            |            |              |              |                  |  |
|            |              |                         |           | <b>SCHEDULED</b>        |                                  |            |            |           |            |            |           |           |            |            |              |              |                  |  |
| <b>LET</b> | <b>CENSE</b> | <b>DATE</b>             | <b>BY</b> | <b>CL</b>               |                                  |            |            |           |            |            |           |           |            |            |              |              | <b>W-1192-12</b> |  |

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   |
| A5J2-2  | 21  | 6    |
| A5J2-4  | 22  | 72   |
| A5J2-3  | 23  | 84   |
|         | 24  |      |

INSERT TO BACK CAB.  
PLUG

A1 INSERT

|              | (PLAYER 1) | (PLAYER 2) | (PLAYER 3) | (PLAYER 4) | CREDIT | TO | SWITCH               |
|--------------|------------|------------|------------|------------|--------|----|----------------------|
|              | AI1        | AI2        | AI3        | AI4        | DA1    |    | ILL. (B)             |
| 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        |
| 60 - A4J1-1  | 4          | 4          | 4          | 4          | 4      | 60 | A5J2-1 R UP 4        |
| 20 - A4J1-2  | 5          | 5          | 5          | 5          | 5      | 47 | A5J2-2 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

AIJ2  
SEE  
TABLE A

LAMP DRIVER A5

| J4 | TO        | J2 | TO            | J1 | TO             | J3 | TO             |
|----|-----------|----|---------------|----|----------------|----|----------------|
| 51 | A2J3-4    | 60 | 4TH PLAYER UP | 41 | 2K RIGHT BONUS | 10 | 4K RIGHT BONUS |
| 13 | A2J3-3    | 20 | 3RD PLAYER UP | 43 | 2K LEFT BONUS  | 95 | 2K LEFT BONUS  |
| 84 | A3J3-16   | 84 | N/U           | 45 | 2K LEFT BONUS  | 81 | 2K LEFT BONUS  |
| 74 | A4J1-19   | 72 | N/U           | 25 | N/U            | 14 | 4K TARGET      |
| 71 | A4J1-18   | 5  | N/U           | 48 | N/U            | 5  | N/U            |
| 65 | A4J1-17   | 85 | N/U           | 25 | 6              | 6  | N/U            |
| 63 | A4J1-16   | 21 | N/U           | 34 | 7              | 7  | N/U            |
| 8  | KEY       | 93 | MATCH         | 11 | 8              | 8  | KEY            |
| 9  | N/U       | 9  | N/U           | 52 | 9              | 9  | 6K LEFT BONUS  |
| 10 | N/U       | 38 | TILT          | 10 | 10             | 10 | 6K LEFT BONUS  |
| 58 | A2J3-14   | 95 | GAME OVER     | 23 | 11             | 11 | 4K LEFT BONUS  |
| 12 | SPARE GND | 61 | N/U           | 61 | 12             | 12 | 4K RIGHT BONUS |
| 75 | A4J1-1    | 53 | N/U           | 96 | 13             | 13 | 6K RIGHT BONUS |
| 32 | A4J1-5    | 12 | 1ST PLAYER UP | 54 | 14             | 14 | 6K LEFT BONUS  |
| 13 | A4J1-14   | 23 | 2ND PLAYER UP | 13 | 15             | 15 | 6K LEFT BONUS  |
| 43 | A4J1-13   | 34 | 3RD PLAYER UP | 12 | 16             | 16 | 6K LEFT BONUS  |
| 48 | A4J1-12   | 17 | SPECIAL       | 57 | 17             | 17 | 6K LEFT BONUS  |
|    |           | 18 | N/U           | 58 | 18             | 18 | 6K LEFT BONUS  |
|    |           | 19 | KEY           | 60 | 19             | 19 | 6K LEFT BONUS  |
|    |           | 35 | N/U           | 20 | 20             | 20 | 6K LEFT BONUS  |
|    |           | 47 | SHOOT AGAIN   | 21 | 21             | 21 | 6K LEFT BONUS  |
|    |           | 62 | BALL IN PLAY  | 22 | 22             | 22 | 6K LEFT BONUS  |
|    |           | 97 | HIGH SCORE    | 23 | 23             | 23 | 6K LEFT BONUS  |
|    |           |    | TO DATE       | 24 | 24             | 24 | 6K LEFT BONUS  |
|    |           |    |               | 25 | 25             | 25 | 6K LEFT BONUS  |
|    |           |    |               | 26 | 26             | 26 | 6K LEFT BONUS  |
|    |           |    |               | 27 | 27             | 27 | 6K LEFT BONUS  |
|    |           |    |               | 28 | 28             | 28 | 6K LEFT BONUS  |

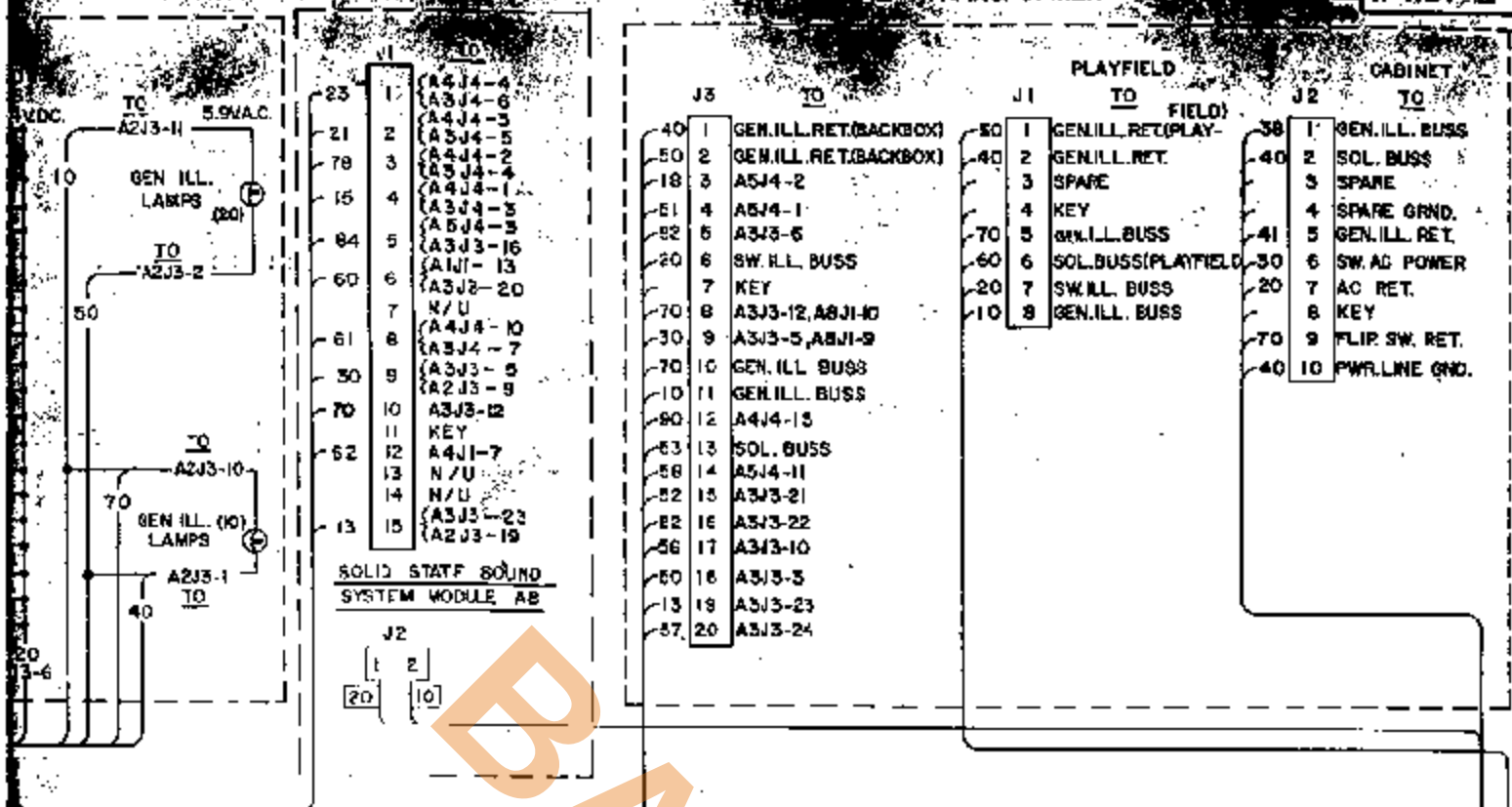
MPU A4

| J4 | TO      | J2 | TO |
|----|---------|----|----|
| 15 | A3J4-1  | 51 | 1  |
| 78 | A3J4-4  | 83 | 2  |
| 21 | A3J4-5  | 82 | 3  |
| 23 | A3J4-6  | 83 | 4  |
| 28 | A3J4-11 | 31 | 5  |
| 27 | A3J4-8  | 8  | 6  |
| 25 | A3J4-8  | 7  | 7  |
| 31 | A3J4-10 | 54 | 8  |
| 9  | N/U     | 56 | 9  |
| 10 | A3J4-7  | 57 | 10 |
| 11 | N/U     | 58 | 11 |
| 14 | A3J4-11 | 60 | 12 |
| 13 | N/U     | 63 | 13 |
| 14 | KEY     | 68 | 14 |
| 80 | A2J3-12 | 70 | 15 |
| 88 | A3J4-14 |    |    |
| 84 | A3J4-15 |    |    |
| 84 | A3J4-6  |    |    |
| 81 | A3J4-19 |    |    |

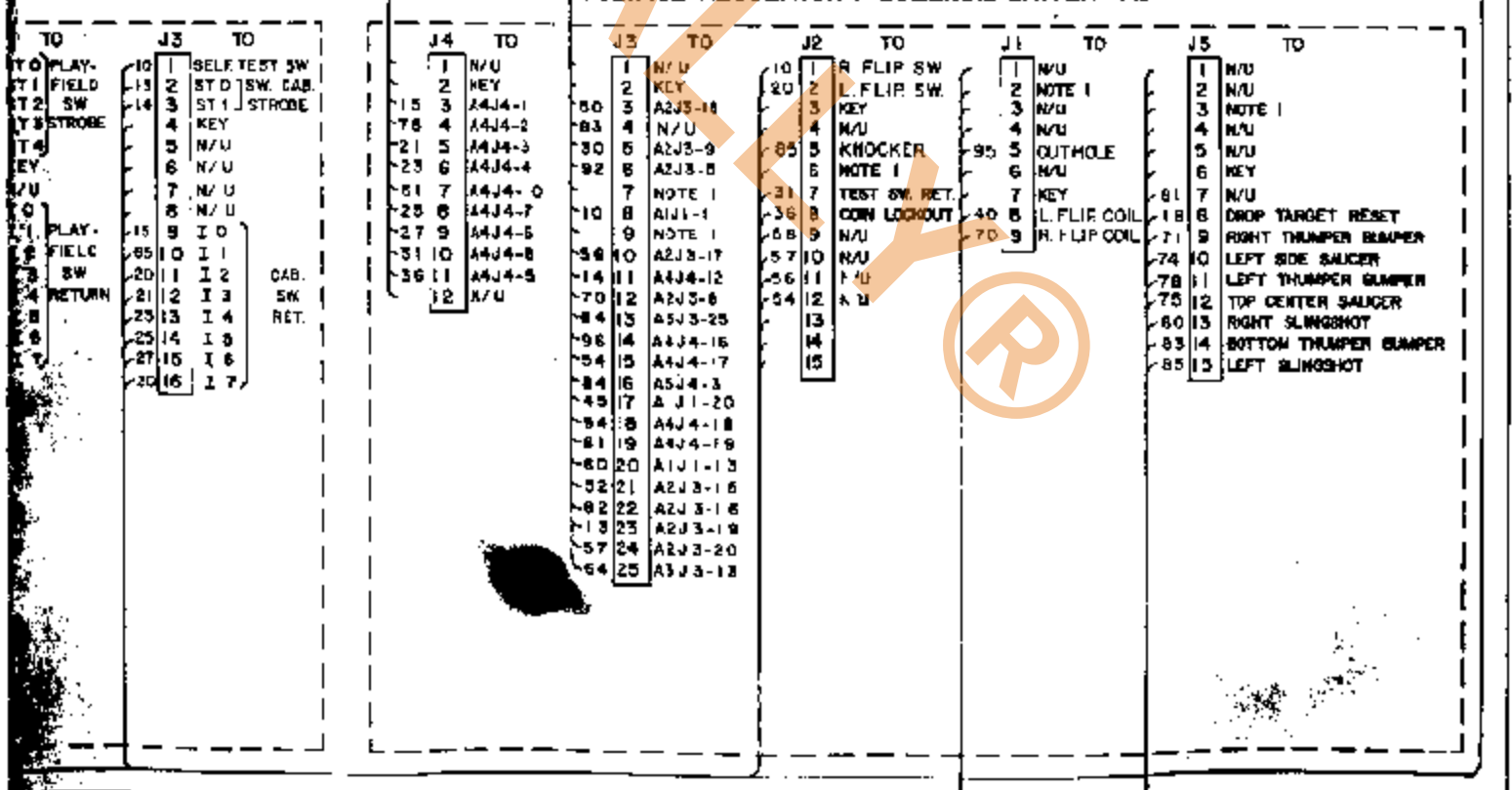
O CABINET

## 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. | DESCRIPTION | QTY | BY | CHK. |
|------|-------------|-----|----|------|
|      |             |     |    |      |
|      |             |     |    |      |
|      |             |     |    |      |
|      |             |     |    |      |
|      |             |     |    |      |
|      |             |     |    |      |
|      |             |     |    |      |
|      |             |     |    |      |
|      |             |     |    |      |

## REPAIR ALL SUBS

TOLERANCES ON DIMENSIONS UNLESS OTHERWISE SPECIFIED

FRACTIONS - 1/16

DECIMALS - .001

ANGLES - °

NO NOTABLE DIMENSIONS

| DATE | BY | DATE | BY |
|------|----|------|----|
|      |    |      |    |
|      |    |      |    |
|      |    |      |    |
|      |    |      |    |
|      |    |      |    |
|      |    |      |    |
|      |    |      |    |
|      |    |      |    |
|      |    |      |    |

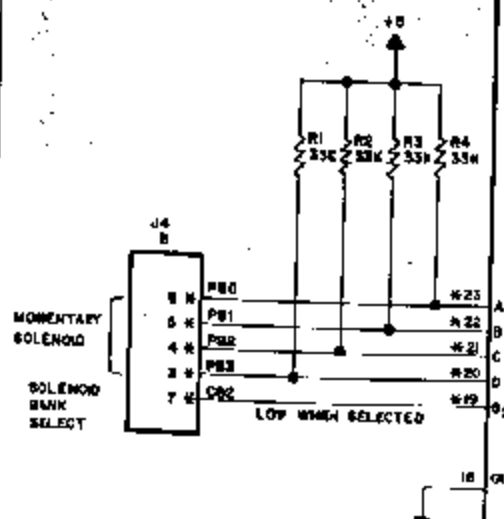
**W-1187-12 c**

**MANUFACTURING CORP.**

1187-12 c

**PLUS CONNECTORS**

**W-1187-12 c**



# NOTES:

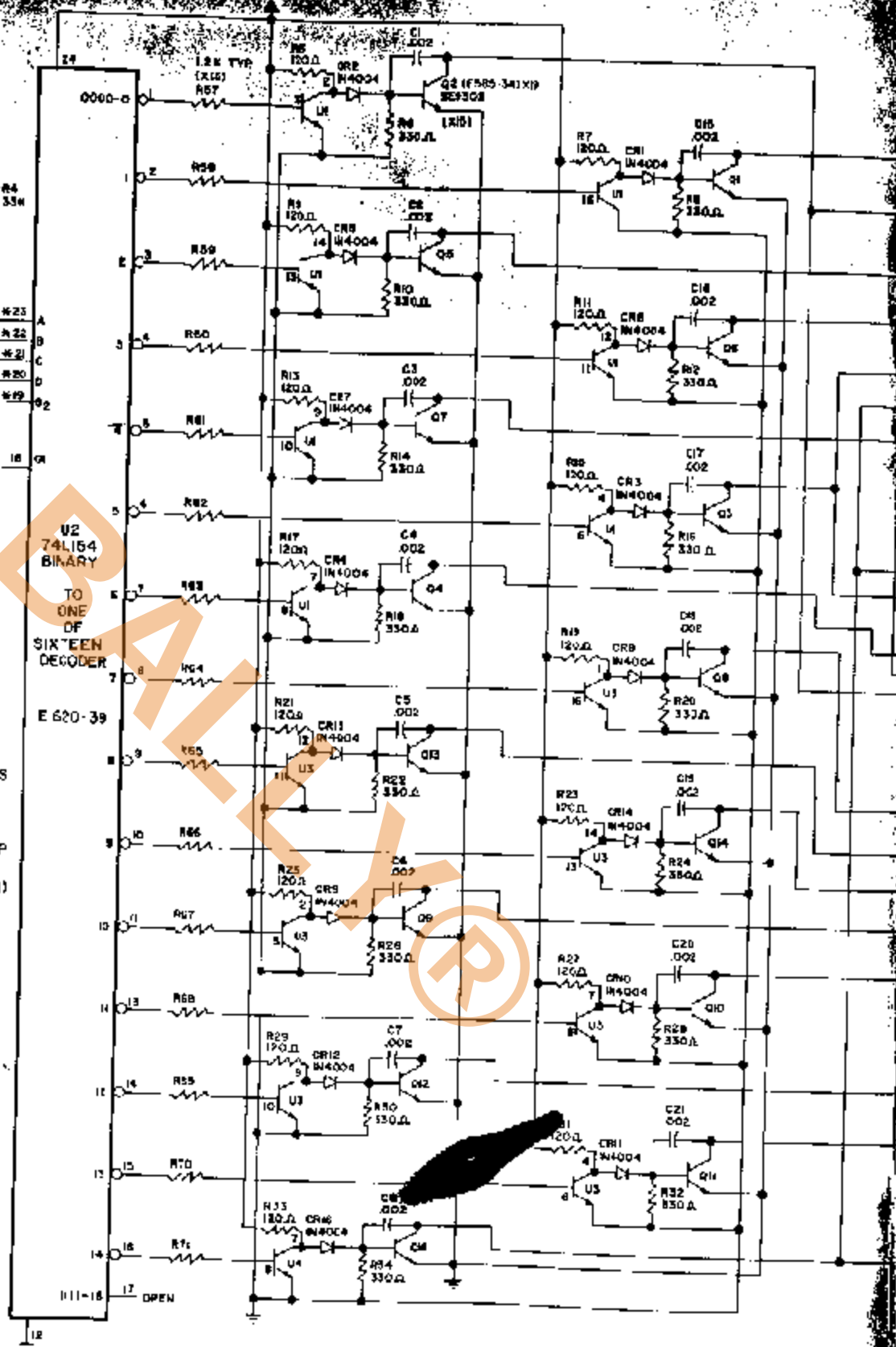
1. E-710, LAMBDA-LAS 1403 NATIONAL - LM323K FAIRCHILD 78H05KC
2. J1-KK156-9 PIN KEY PIN 7  
J2-KK156-15 PIN KEY PIN 3  
J3-KK100-25 PIN KEY PIN 2  
J4-KK100-12 PIN KEY PIN 2  
J5-KK156-15 PIN KEY PIN 6
3. PREFIX ALL REFERENCE DESIGNATIONS WITH "A3"
4. "U1", "U2", "U3" PINS 5 AND 5 ARE GROUNDED.
5. VOLTAGES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

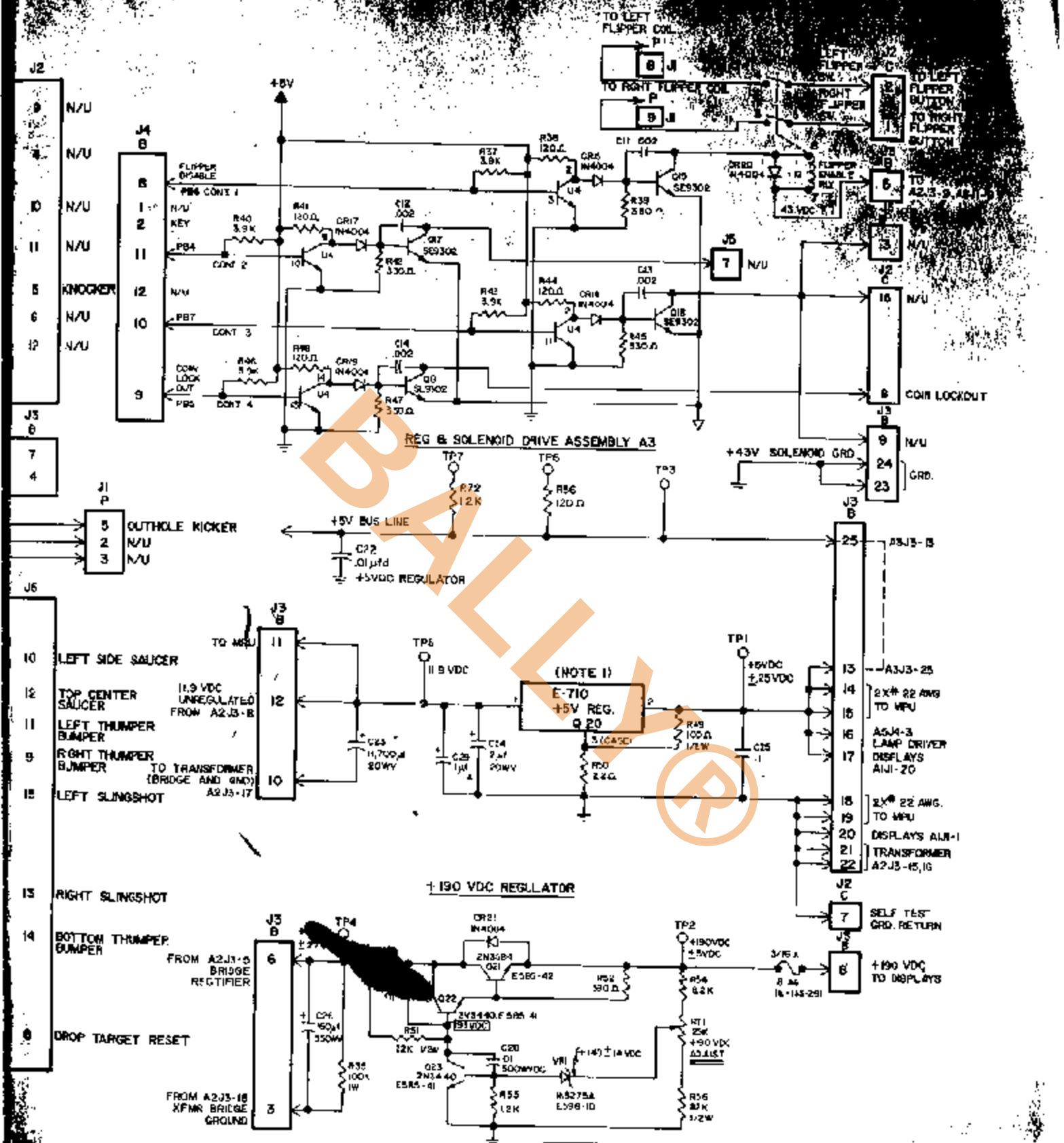
## CONNECTOR CODE

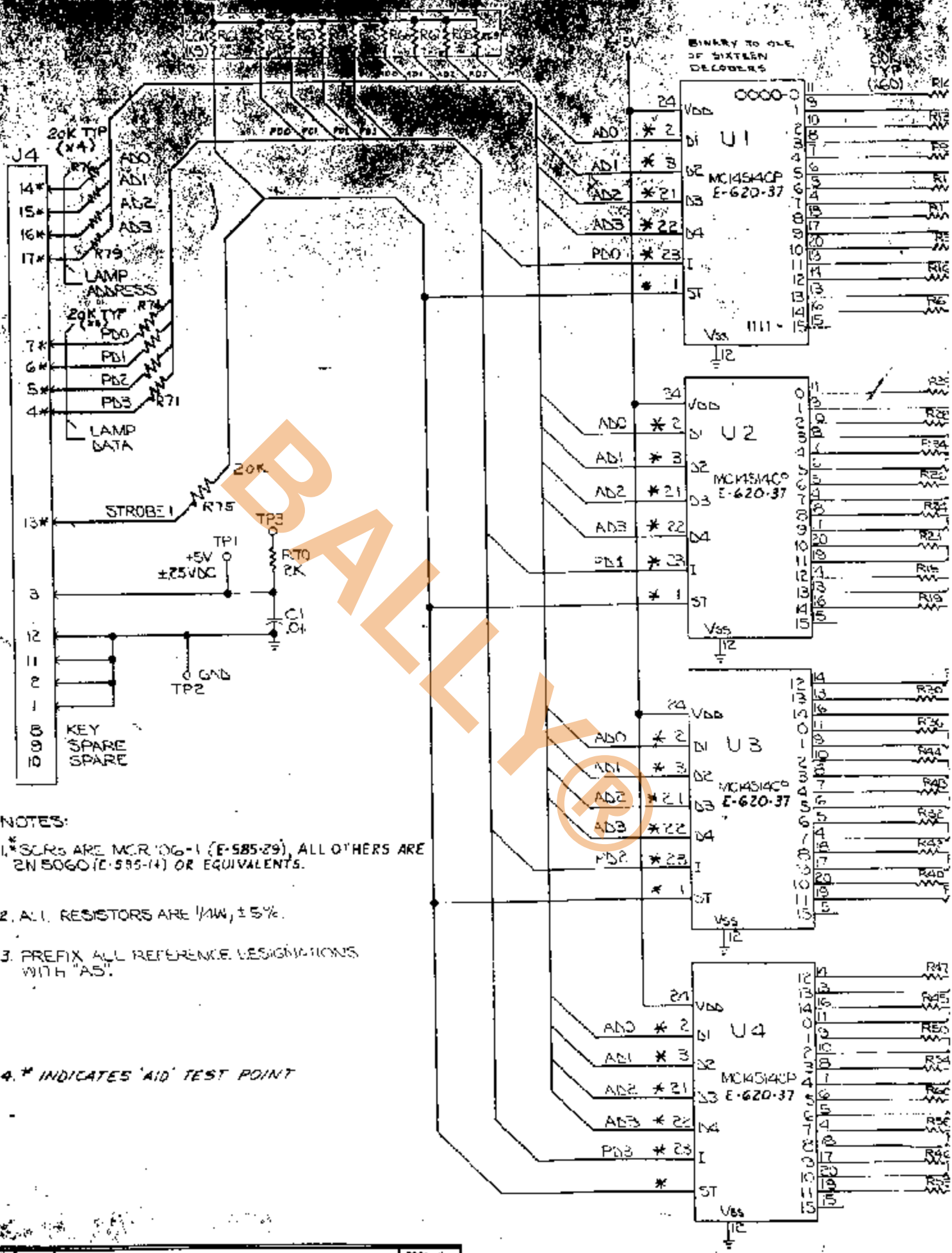
- G → ROUTE TO CABINET CONN
- B → ROUTE TO BLACK BOX CONN
- P → ROUTE TO PLAYFIELD CONN

## LAST NUMBER USED

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



[illegible]



NOTES:

1. \*SCRs ARE MCR 106-1 (E-585-29), ALL OTHERS ARE 2N5060 (E-585-14) OR EQUIVALENTS.
2. ALL RESISTORS ARE 1/4W,  $\pm 5\%$ .
3. PREFIX ALL REFERENCE DESIGNATIONS WITH "AS".
4. \* INDICATES 'AID' TEST POINT

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

