MIDWAY'S
ROTATION VIII

ELECTRICAL
OPERATING INSTRUCTIONS

ROTATION 8

Operating Instructions

INDEX

ELECTRICAL

TABLE OF CONTENTS (Cont'd)

NO. 627 – ROTATION VIII

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DO'S, DON'TS AND REMINDERS

DO . . . . . . Read the manual completely (cover to cover).

DO . . . . . . Call serviceman when needed.

DON'T . . . . . EVER turn table by hand with the ball in the shooter. It will fall into the bottom of the cabinet. At times it is difficult to remove the ball from the bottom of the cabinet.

DON'T . . . . . Turn the table if it is dragging or is jammed-up.

REMEMBER: The game will not turn if the ball is not in the outhole.

REMEMBER: Another player cannot "Punch In" when the table is turning.

REMEMBER: Once the game is beyond the first ball, the game in play must be finished before a new game can be started.

WHAT SHOULD HAPPEN WHEN THE GAME IS FIRST TURNED-ON

After the table has it's legs mounted, shipping bracket removed, table leveled, and the ball is on the table, plug it in, and turn it on. The "On-Off" switch is under the flipper between the west and south players. The game should do the following, all at once:

1. The lights around the edge of the playfield should turn on and remain on.

2. A musical note or series of notes should be heard.

3. The #1 ball in the "rack" should light.

   (The rack is a group of lamps arranged in the shape of a pool rack, see Fig. C).

4. The four-player displays (N,E,S,W) will light up with the "high score" value. If any of these conditions are not met, turn the game off IMMEDIATELY! Then see, "In Case Of Difficulty".

The next things to look for are:

1. The "Game Over" lamp will start flashing and remain flashing.

2. The #2 rack lamp should light along with the #1 rack lamp.

3. The four player displays will alternate between high score and last player score or "00" if just powered up.

The rack lamps should continue to light up the rack, in order, at an approximate 1 second rate. On the 15th rack lamp, the display will recycle (start at #1).
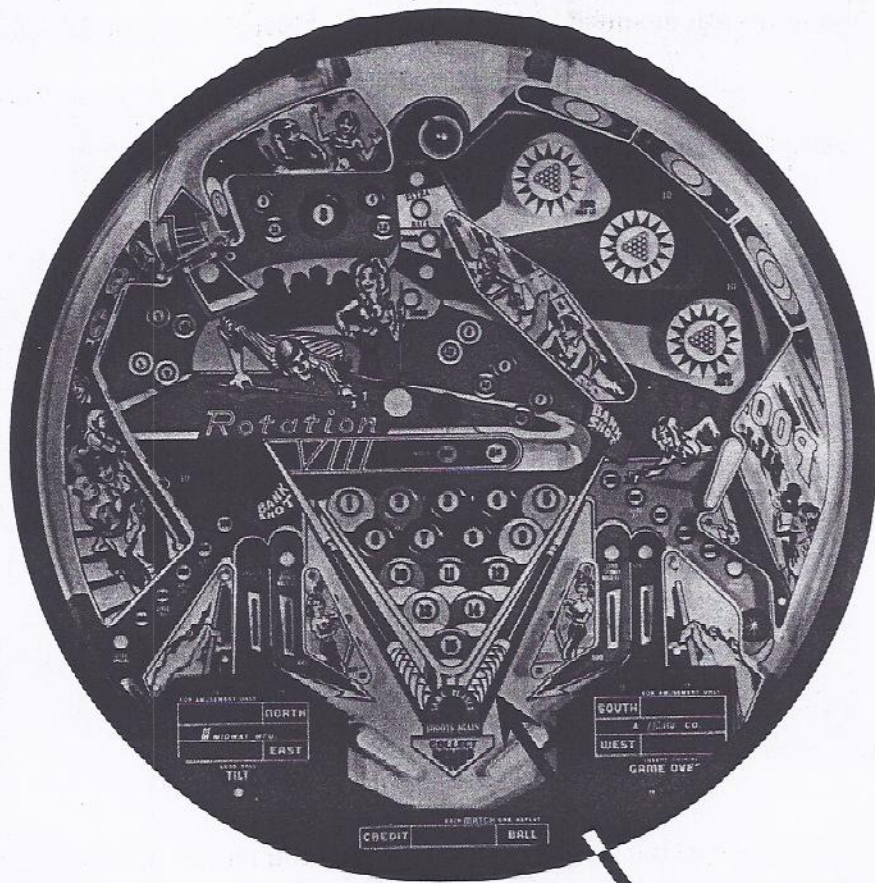
RACK

FIG. C

At this time read:

"How To Get To The Keypad", then

"How To Run A Test", then

if your game has lost it's preset program in shipping, then Run "Test #8".

If your game is OK, read

"How To Start Game".

If you have trouble, see

"In Case Of Difficulty".

- - - - - - - - - - -

HOW TO START GAME

To start the game <u>THE BALL MUST BE IN THE OUT HOLE.</u>

1. Open the coin door and flip the coin switch a few times. Make sure credits are adding up in the credit display. With each credit, a tone should be heard. Close the coin door.

2. Press a player call button. The credits will decrease and the number 1 will appear in the ball display. The playfield should turn to face you and then stop when it is exactly on target.

3. The ball will kick out of the out hole and land in the shooter.

4. The display of the location that you pressed should flash "00" in the 10's and 1's digits.

5. The shooter is located to the right of the call button and the flipper buttons are on each side.

6. PLAY THE GAME, Good Luck.

7. At the end of the game, the "Game Over" light should come on, your score and the high score are flashed alternately.

- - - - - - - - - - -

HOW TO GET TO THE KEYPAD (Coin Door Call Button)

On each coin door, there is a small red button mounted on the upper-right part of the coin door. With this button, the keypad can be called to the coin door of your choosing. This MUST be done with the game in "Game Over" and the BALL IN THE OUT HOLE.

- - - - - - - - - - -

HOW TO RUN A TEST

(see Fig. H)

All test MUST BE DONE IN "GAME OVER", WITH THE BALL IN THE "OUT HOLE".

Call the keypad to a coin door using the coin door call button. To use the test:

1. Press "Game".

2. Press "End".

3. Then press the desired test button, listed below.

4. When done testing, press "Game". If another test is to be run, repeat the above procedure.
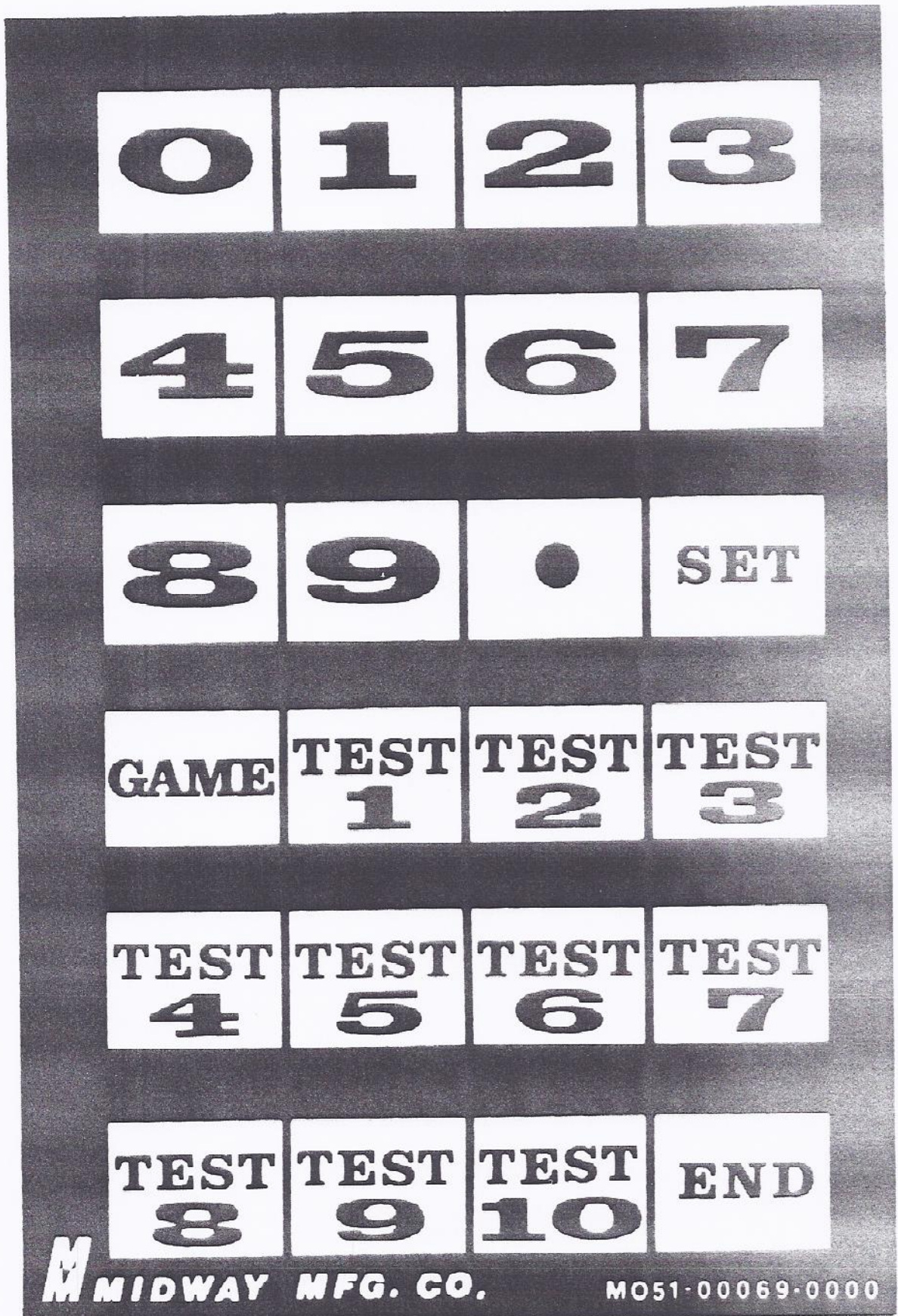
0	1	2	3
4	5	6	7
8	9	.	SET
GAME	TEST 1	TEST 2	TEST 3
TEST 4	TEST 5	TEST 6	TEST 7
TEST 8	TEST 9	TEST 10	END

MIDWAY MFG. CO.   MO51-00069-0000

TEST INDEX

TEST #1 (see Figs. 1 and 2)

To test all light bulbs or to show if a column or row is bad. When pressed, ALL playfield lamps should be on. The lamps that are out, should be replaced. If a bulb was replaced and still does not light, see "In Case Of Difficulty".

TEST #2 (see Figs. 1 and 3)

Shows any closed switches. Test #2 should be done without the ball being on the playfield. This test is used in finding stuck, intermittent or non-functioning switches. Each switch has a code number, and it will be displayed in all the player displays. It is a two-digit number. The 10's digit shows which column it is on and the 1's digit shows which switch row it is on. A listing of switches by code number is listed in Fig. 3.

> NOTE: The highest value switch will be displayed (Example: 30 will be displayed if 07 and 30 were on).

> NOTE: If 41 is displayed, the ball was left in the out hole.

> NOTE: If there are no stuck switches, then a number between 02 and 07 will be displayed. These numbers correspond to the angle encoder. To check out the encoder, use the encoder test and to check out the optical switch, use the table position test.

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FIG. 1

(TESTS 1 & 2)

LAMPS

SWITCHES

LOGIC BOARD

9
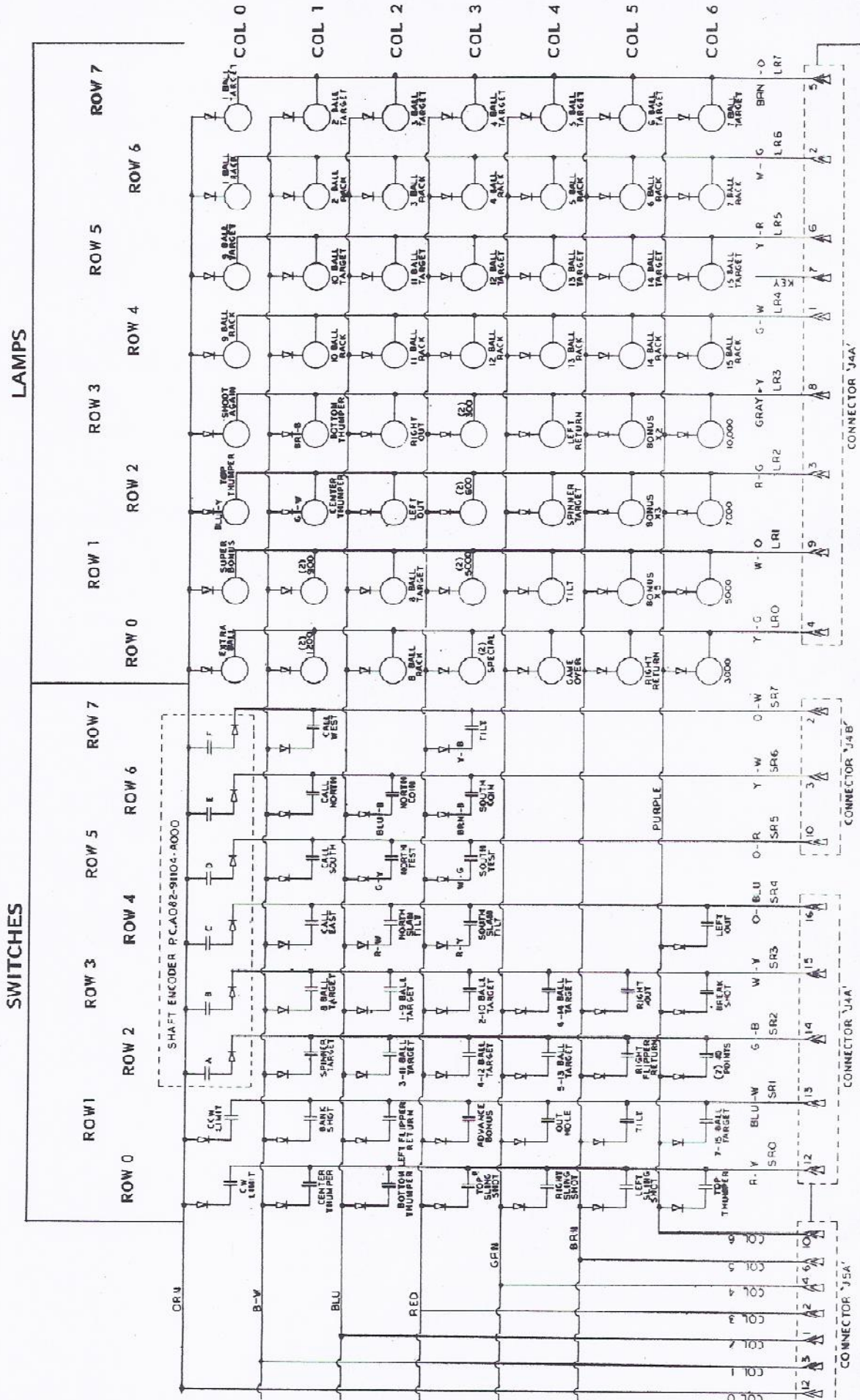
FIG 2

ROTATION 8

L A M P   M A T R I X

(TEST #1)

C O L U M N S

ROWS	0	1	2	3	4	5	6
7	TARGET 1	TARGET 2	TARGET 3	TARGET 4	TARGET 5	TARGET 6	TARGET 7
6	RACK 1	RACK 2	RACK 3	RACK 4	RACK 5	RACK 6	RACK 7
5	TARGET 9	TARGET 10	TARGET 11	TARGET 12	TARGET 13	TARGET 14	TARGET 15
4	RACK 9	RACK 10	RACK 11	RACK 12	RACK 13	RACK 14	RACK 15
3	S.P.S.A	BOTTOM T.B.	RIGHT OUT LANE	BANK SHOT 300 (2)	LEFT FLIPPER RETURN	2X	BREAK SHOT 10K
2	TOP T.B.	CENTER T.B.	LEFT OUT LANE	BANK SHOT 600 (2)	SPINNER	3X	BREAK SHOT 7K
1	SUPER BONUS	BANK SHOT 900 (2)	TARGET 8	BANK SHOT 5000 (2)	TILT	5X	BREAK SHOT 5K
0	BREAK SHOT EXTRA BALL	BANK SHOT 1200 (2)	RACK 8	BANK SHOT SPOL (2)	GAME OVER	RIGHT FLIPPER RETURN	BREAK SHOT 3K

FIG. 3

TEST #2 LISTING:

Switch #		Description
00		CW SW OPTICAL ASSY. NOT SEEN, USUALLY
01		CCW SW OPTICAL ASSY. NOT SEEN, USUALLY
	* * * * * *	
02	*	
	*	
	*	
03	*	GRAY CODE
	*	
04	*	SHAFT
	* *	
05	*	POSITION
	*	
06	*	ENCODER
	*	
07	*	
	* * * * * *	
10		CENTER T.B.
11		BANK SHOT OUTLANE
12		SPINNER
13		8 BALL TARGET
14		CALL EAST
15		CALL SOUTH
16		CALL NORTH
17		CALL WEST
20		BOTTOM T.B.
21		LEFT FLIPPER RETURN
22		3/11 TARGET
23		1/9 TARGET
24		NORTH SLAM (IF USED)
25		NORTH TEST BUTTON
26		NORTH COIN
27		NORTH TILT (IF USED)

Fig. 3 (cont.)

Switch #	Description
30	TOP SLING SHOT
31	BANK SHOT ADVANCE
32	4/12 TARGET
33	2/10 TARGET
34	SOUTH SLAM (IF USED)
35	SOUTH TEST
36	SOUTH COIN
37	SOUTH TILT
40	RIGHT SLING SHOT
41	OUTHOLE
42	5/13 TARGET
43	6/14 TARGET
44	. . . .
45	. . . .
46	. . . . .
47	. . . . .
50	LEFT SLING SHOT
51	. . . . .
52	RIGHT FLIPPER RETURN
53	RIGHT OUT LANE
54	. . . . .
55	. . . . .
56	. . . . .
57	. . . . .

Fig. 3 (cont.)

Switch #	Description
60	TOP T.B.
61	7/15 TARGET
62	10 POINTS
63	BREAK SHOT HOLE
64	LEFT OUT LANE
65	- - - - -
66	- - - - -
67	- - - - -

TEST #3 (see Fig. 4)

This test checks all solenoids. It energizes all solenoids automatically except the flippers, which are done manually. If the flippers need to be tested, press the flipper buttons on either side of the display, during the test. The flippers will then be energized automatically at the proper time. The test shows a code for what solenoid should be energized at that time. The code is shown in the ball display. A listing of solenoid code numbers and energization order is shown below.

NOTE: If the ball was in the out hole, it will be ejected to the shooter. Do not turn the table as the ball will fall off the table and into the cabinet. Also remember the game will not start or turn without the ball in the out hole.

FIG 4

Solenoid #	Name
40	OUTHOLE
41	BANK SHOT
42	CENTER T.B.
43	BOTTOM T.B.
44	TOP T.B.
45	TOP SLING SHOT
46	RIGHT SLING SHOT
47	LEFT SLING SHOT
50	BREAK SHOT
53	3 FLIPPERS

13

TEST #4 (see Fig. 5)

This test shows the code number for the encoder switches. This number is displayed in the ball display.

At the center of each player's location, the encoder should have a certain code number:

NORTH	00
EAST	20
SOUTH	40
WEST	60

As the table is rotated, the count should go up when turned clockwise, and should go down when turned counterclockwise. Since the game is using an electronic system, it will count in octal arithmetic. An 8 or a 9 will never be displayed in the 1's digit.

TEST #5

This test checks the display. It will run through the numbers 0 to 9 on each digit of all the displays except the middle two digits of the credit/ball display.

TEST #6 (see Fig. 6)

This tests the table position switch. This is not a mechanical switch, it uses the reflection of infrared light to sense it's location. The table should stop on location code 3. Area 3 is the exact place the table will stop. Areas 1 and 2 are indexes to find area 3. The area code will be displayed in the ball display.

Reading	Meaning
0	NEITHER SW ON
1	CW " "
2	CCW " "
3	BOTH " " (HOME POSITION)

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FIG. 5
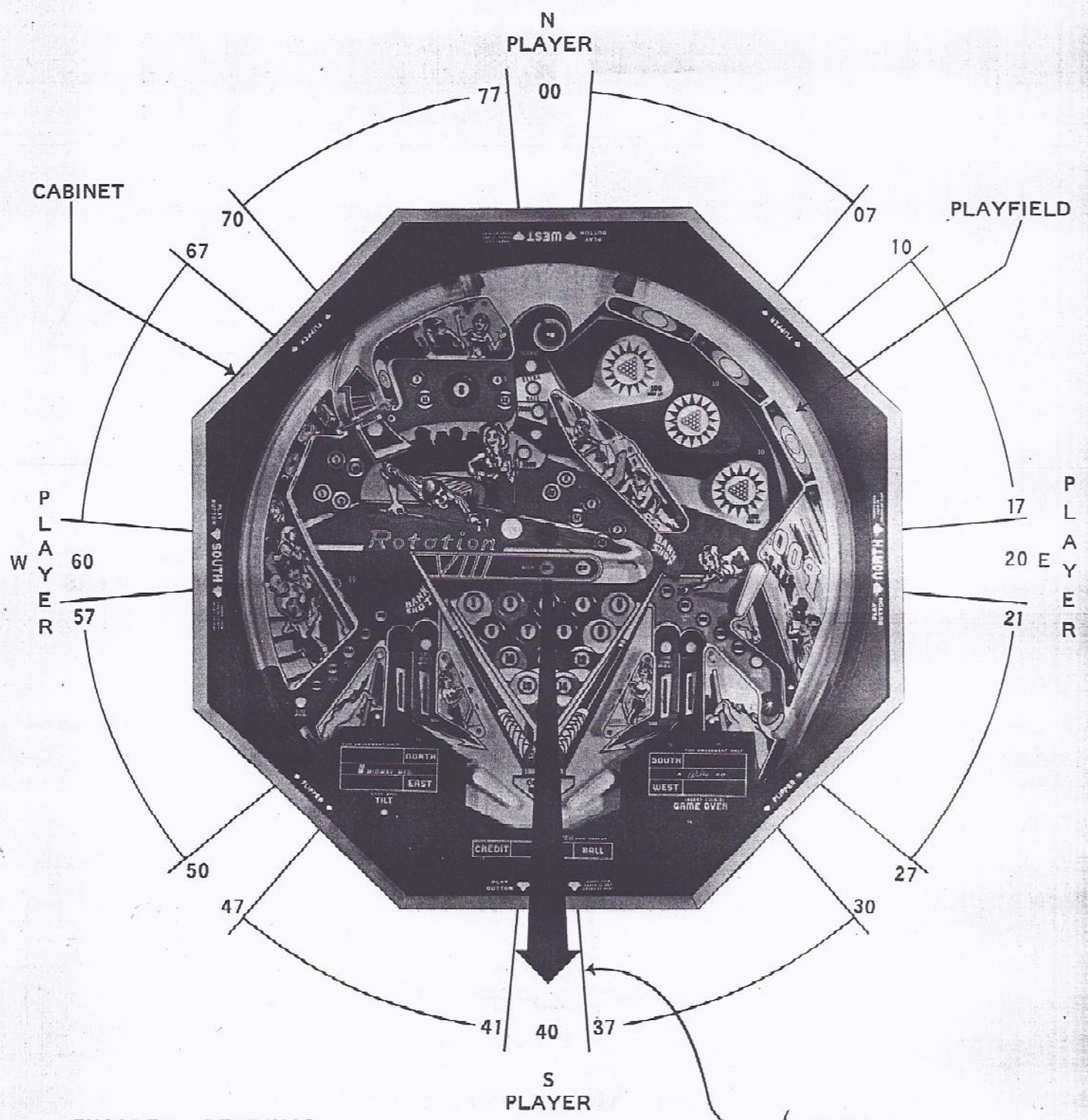
ENCODER — READINGS

(OVER HEAD VIEW
GAME IN CABINET)

(TEST 4)

EXAMPLE:
THE CODE DISPLAY
WOULD BE 40.

15

FIGURE 6
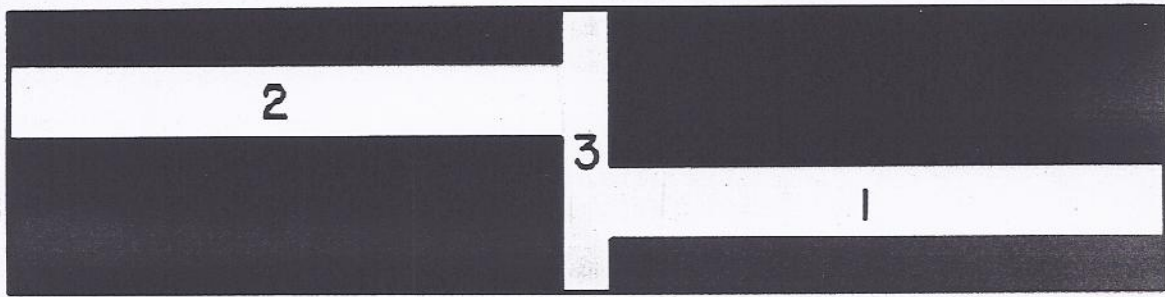
TABLE POSITION REFLECTOR

(WHITE SHOWS
REFLECTIVE
AREAS)
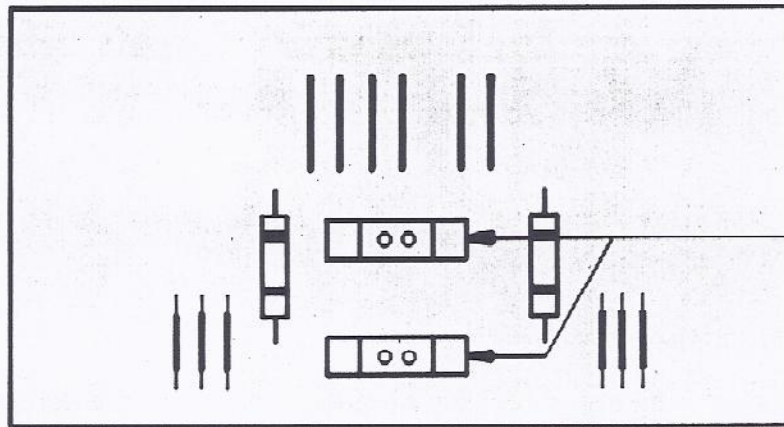
TABLE POSITION BOARD

OPTIC TRANSDUCERS

TO PLAYFIELD
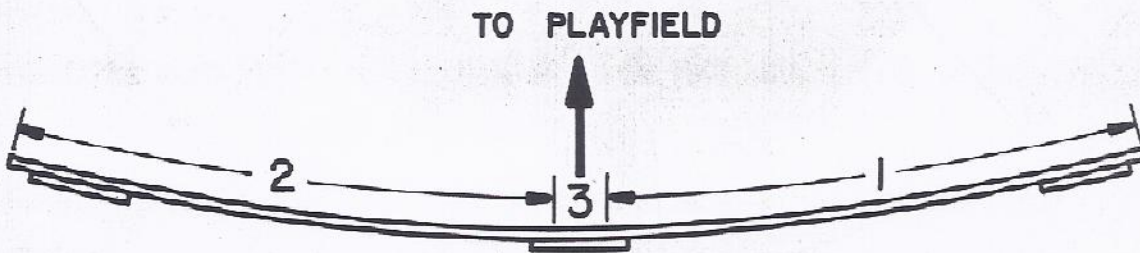
TABLE POSITION REFLECTIVE BRACKET

(TEST #6)

TEST #8

This is not really a test, it is a Factory/Operator Preset. It sets the game options to factory specifications.

A listing of the setup can be found in the "How To Use The Cocktail Pin Keypad".

HOW TO SET THE GAME YOU WANT (Programming)

See "How To Use The Cocktail Pin Keypad".

IN CASE OF DIFFICULTY

FEATURE LAMPS; TEST 1.

Burnt Out Lamps.

Replace lamps that are out. If the lamps still do not light up, follow the procedure given below.

— Check to see if all the lamps that are out are on the same column or row. If exactly 7 lamps are out, chances are that a row driver will have to be replaced. If 8 lamps are out, a column drive is probably the cause. One way to verify this is to check the wiring diagram. On the upper-right hand corner of the diagram is a matrix which shows which lamps are on what column or row. If the lamps that are out correspond to a particular row or column, then changing that particular driver transistor may solve the problem.

Another way to check for bad columns or rows is to look at the color of the wire going to all the lamps that are out. If the same colored wire goes to all of them, then a row or column driver may be at fault.

VERY BRIGHT LAMPS OR LAMPS ON ALL THE TIME

This problem may arise because of column or row driver problems. Follow the procedure mentioned for BURNT OUT LAMPS in order to determine the malfunctioning row or column.

NOTE: See Fig. 7 to determine the location of column and row transistors.

— — — — — — — — — — —

NO LAMPS

Check feature lamp fuse.

Check logic fuse.

Check wiring and lamp jacks.

— — — — — — — — — — —

SWITCHES;   TEST #2

Always Closed:

      Adjust switch manually.

Intermittent:

      Adjust switch.

Switch Does Not Work:

      Check wiring.

— — — — — — — — — — —

SOLENOIDS; TEST #3

Solenoid Stuck On:

    1. Check solenoid driver board and make sure that none of the transistors are shorting.

    2. Check the wiring.

    3. Check the UDN 2981 chips on the logic and driver board. (see Fig. 7)

If flippers are stuck on, check all of the above and then also check 7402 chip on logic board (see Fig. 7).

Solenoid Always off:

If all solenoids are always off, check the solenoid fuse.

If a single solenoid is always off, follow the test procedure for "SOLENOID STUCK ON".

Also, check the wiring and the pin-outs on the solenoid connectors.

_ _ _ _ _ _ _ _ _ _ _ _ _

ENCODER; TEST #4

Important: If the encoder is not properly adjusted and aligned, it may not be possible to
operate the game. The encoder must read the numbers shown if Fig. 8 for the North,
South, East and West positions.

If the number is off and the optical switch sees blank space instead of the reflector, the game will go

into a no-operation mode. In this mode, the game will not turn, nor will it eject the ball from the out hole.

To adjust the angle encoder, do the following:

1. There are set screws located below the angle encoder P.C., holding the shaft of

the encoder in place. Loosen these set screws so that the shaft can be moved easily

by hand.

2. Move the table to North, South, East or West position (see Note on next Page).

3. Put the game into the encoder test mode.

4. Adjust the encoder shaft by hand till you read the proper number in the display.

The numbers should be, depending upon your position, as shown in Fig. 8:

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FIG. 7

GAME LOGIC A084-91313-E627

ALL CAPS ARE 50V, AXIAL LEAD CERAMIC
UNLESS OTHERWISE SPECIFIED

270Ω 270Ω 270Ω 270Ω 270Ω 270Ω 270Ω 270Ω

47Ω 47Ω 47Ω 47Ω

SOUND2981A

47Ω 47Ω 47Ω 47Ω

9 PIN

11 PIN

J9

SOUND2981A

47Ω 47Ω 47Ω 47Ω

1.0MF. 25V. TANT.
1.0MF 25V. TANT.

68Ω   68Ω

1K 1K   7402

47Ω 47Ω 47Ω

CHAMPHER
6
200Ω 680Ω D42DI
200Ω 680Ω D42DI 4

1K 1K D45EI 2

1K 1K D45EI 3 METAL TAB 1K

3
200Ω 680Ω D42DI
200Ω 680Ω D42DI 0

1
6 PIN

1K 1K D45EI 1

1K 1K D45EI 4 1K

7
200Ω 680Ω D42DI
200Ω 680Ω D42DI 5

1K 1K D45EI 5 1K

1
7 PIN

J11 7 PIN

ROWS
RED

3 PIN 1

2
200Ω 680Ω D42DI
200Ω 680Ω D42DI 1

10 PIN

J4A

6
1K 1K D45EI 1K

4 PIN 1

4 PIN 1

J5B

J5A

0
1K 1K D45EI 1K

COLUMNS
GREEN

20

FIG. 8

NORTH	00
EAST	20
SOUTH	40
WEST	60

5. Carefully, retighten the set screws, using the encoder test. Make sure that you read the right number corresponding to the four positions. If you find you are still off, repeat the above procedure.

NOTE: To make sure that you are on NORTH, SOUTH, EAST or WEST position, use Test #6 (Table Positioning) which will indicate when you are exactly homed in.

— — — — — — — — — — —

DISPLAY; TEST #5

Bad Digit

If the same order digit on each of the five displays is malfunctioning, then run Test #1 and follow the procedure outlined to determine defective column driver. Check the TIP 140 transistors on the display board.

NOTE: Malfunction implies digit off or digit on very brightly. If a single digit is out or a segment from a digit, replace the L.E.D. block that the digit is on.

Missing Display

Check the display fuse on the power supply.

Check out the jacks corresponding to the displays.

TABLE POSITING; TEST #6

No Reading

1. Make sure that the jack going to the table positioning P.C. has not been yanked off.

    Also make sure that the encoder jack is on properly.

2. Check the reflector brackets which are mounted in the game cabinet near the bottom.

    There are four of these, one for each position. Make sure that these are placed

    perpendicular to the optical devices on the table positioning P.C.

FACTORY PRESET; TEST #8

This is not really a test but it sets all the game options and features to a predetermined value. The

exact values are shown in the "How To Use The Cocktail Pin Keypad".

_ _ _ _ _ _ _ _ _ _

GENERAL CONSIDERATIONS

SOUNDS ("E" VERSION LOGIC BOARDS)

Loud Hum:

1. Make sure that the sound amplifier chip (LM 383) is properly grounded (pin 3).

2. Check to see if the chip is making good contact with the heat sink.

3. Make sure grounds are isolated. You can do this by unplugging all the jacks that go

    to the logic board. Using a VOM with ohms setting RX1, measure from the case (or

    pin 5) of the LM 383 to logic ground. You should read 100 ohms or more. If you read

    100 ohms or less, check for shorts between power and logic grounds.

No Sound:

1. Make sure sound amplifier chip is getting power (Pin 5, 10V unregulated).

2. Check to see that the speaker jack is inserted properly.

3. Turn volume pot up.

SOUNDS ("G" VERSION LOGIC BOARDS.)

Loud Hum:

1. Make sure that the sound amplifier chip (LM 377) is properly grounded (Pin 3,4,5,10, 11, 12).

2. Check to see if the chip is making good contact with the heat sink.

3. Make sure grounds are isolated. You can do this by unplugging all the jacks that go to the logic board. Using a VOM with ohms setting RX1, measure from the case (Pin 3,4,5,) of the LM 377 to logic ground. You should read 100 ohms or more. If you read 100 ohms or less, check for shorts between power and logic grounds.

No Sound:

1. Make sure sound amplifier chip is getting power (Pin 14, 20V. unregulated).

2. Check to see that the speaker jack is inserted properly.

3. Turn volume pot up.

GENERAL LAMPS

No General Illumination:

Check fuse on power supply.

Check main line fuse.

MOTOR SPEED

Motor Will Not Turn

1. Check the fuse on motor speed board.

2. Check the solenoid fuse.

3. Make sure table is not jammed-up by loose cabling, etc.

4. Check wiring to motor speed board and to motor making sure that the female clips which are inserted on the motor, are making proper contact.

NOTE: Make sure that of the two clip on leads that go to the motor, the black one is on the outside and the red on the inside.

GAME DOES NOT POWER UP PROPERLY

1. Check line fuse.

2. Make sure that power supply is operational. Check the power supply voltage, especially those going to the logic board.

3. Remove the character board. Make sure that the ROMs are seated in their sockets properly and that no pins are bent.

4. Mount the characterization card back in the logic board connector, taking care to see that it is leveled firmly against the logic board.

5. Check the primary of the transformer to ensure that it is getting A.C. voltage from outside.

CAUTION:

In trouble shooting the game, if you find that solenoids energize and stay on, then it is advisable advisable to disconnect the solenoid jack from the logic board.

FUSE LOCATIONS
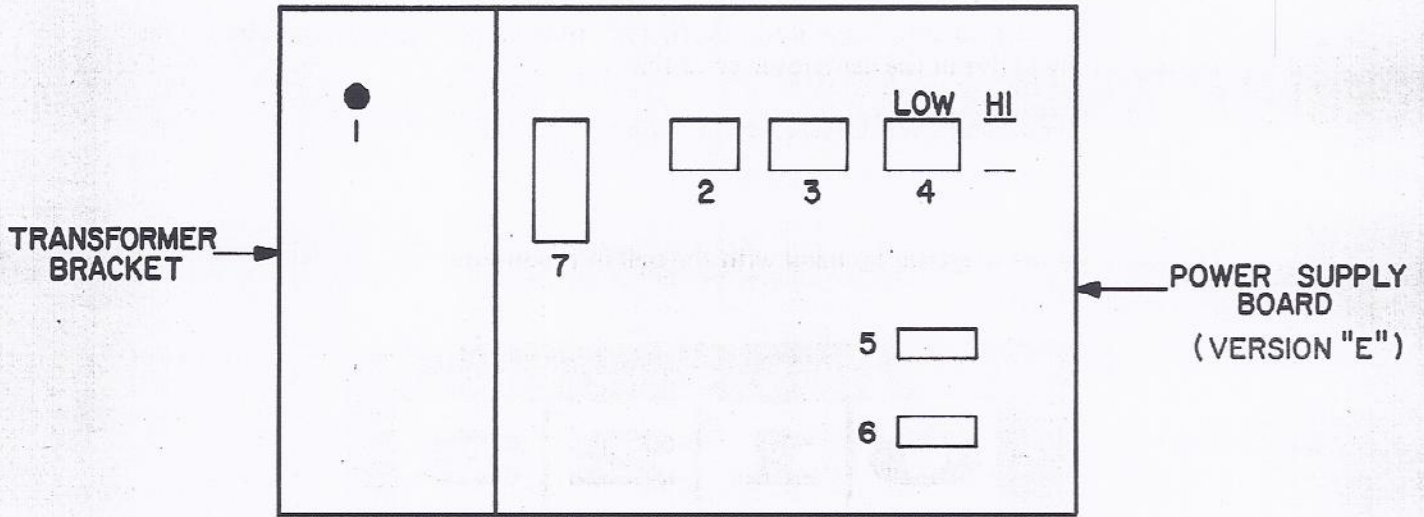
1	Power Line Fuse	120/220 Primary	2 A Slo Blo
2	Display Fuse	+8 Vled.	4 A
3	Feature Lamp Fuse	+22, +12	6 A
4	Solenoid Fuse	+48 Sol. & Mot. (22)	4 A Slo-Blo
5	Logic Fuse	+5, -5, Unreg. +5 +10	2 A Slo-Blo
6	General Lighting Fuse	5.5 Vac.	8 A
7	Motor Speed Fuse	+48 V.	½ A Slo-Blo

NOTE: ½ A Slo-Blo, mounted on motor speed. (Version "D" only).

* 4 A Slo-Blo, can be mounted low or high voltage for solenoids.

HOW TO USE COCKTAIL PIN KEYPAD

1. To bring keyboard to either coin door, push "red" button mounted on coin door. This button is only active in the game/over condition.

2. THE "game computer" WILL NOT rotate the playfield if the ball is not in the outhole.

3. **W A R N I N G :**

   Do not move the playfield by hand with the ball in the shooter.

0	1	2	3
4	5	6	7
8	9	•	SET
GAME	TEST 1	TEST 2	TEST 3
TEST 4	TEST 5	TEST 6	TEST 7
TEST 8	TEST 9	TEST 10	END

MIDWAY MFG. CO.   M051-00069-0000
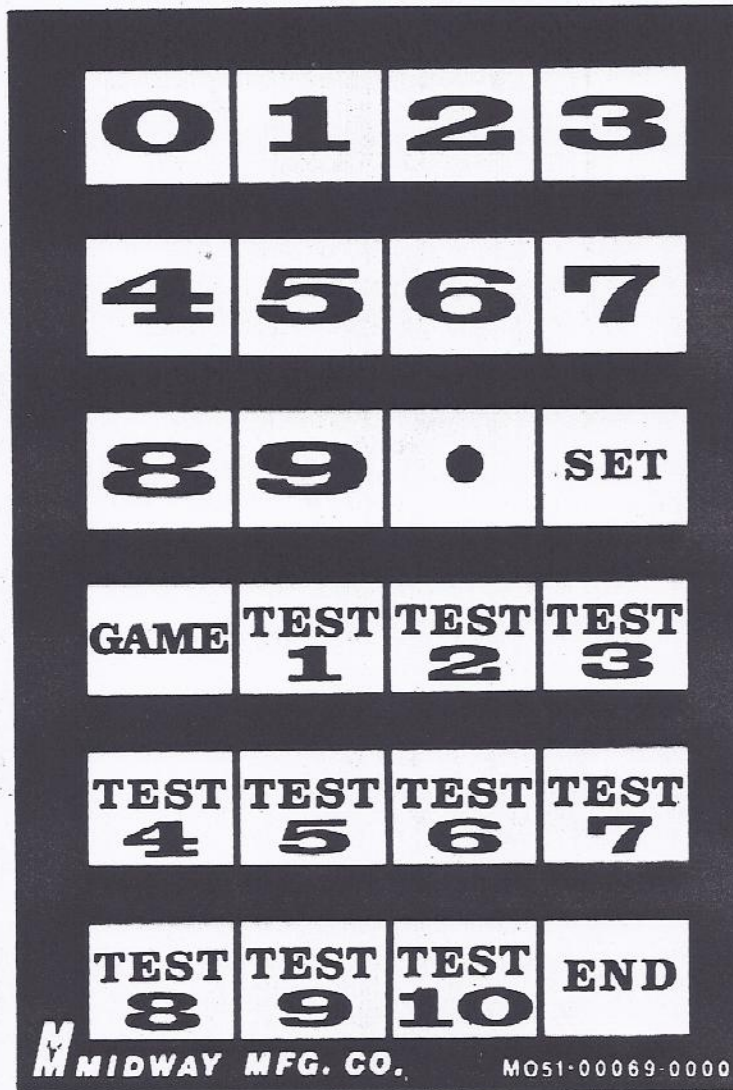
FIG. 1

The keyboard can only be used when the game is in "game over".

The keyboard is used to display and modify operator setable features.

See Figure 1.

TO DISPLAY a feature:

1. Press "end" key.
2. Press "set". key; player displays 1 to 4 should go blank.
3. Press "dot" key.
4. Press numbered keys (0 to 9) until desired feature number, see page 28, is displayed in "match/ball in play" window.
5. Press "dot"; current value of desired feature will appear in players 1 to 4 displays.

> NOTE: If a feature number larger than the last number listed on page 29 is entered, game will return to the "game over" shill state.

> Example:
>
> To display feature number "10":
>
> Press: "end", "set", "dot", "1", "0", "dot"
>
> If you do not wish to change value:
> Press "game" key, if you are done.
> Press "end" key, if you want to check another feature.

6. *TO MODIFY* feature value, press number keys until desired number appears in displays 1 to 4.

7. When number is correct:
   Press "game" key, if you are done with keypad.
   Press "end" key, if you want to go to another feature or do a test.

8. To do a test, press "end" and then press:

   "Test 1":   Lamp Test (all lamps will lite)
   "Test 2":   Stuck switch test (page 29)
   "Test 3":   Solenoid test (page 32)
   "Test 4":   Encoder readout (page 32)
   "Test 5":   Digit test (0 to 9)
   "Test 6":   Optical switch check (page 33)
   "Test 8":   Nonvolatile Ram setup (page 33)

   NOTE: To do another test, do step 8.

9. You can return to the "game over" shill state at any time by pressing the "game" key.

LIST OF GAME FEATURES

00	Total coins thru chute 1 (north door)
01	Total coins thru chute 2 (south door)
02	Total plays (payed and free)
03	High score to date

NOTE: Features 04, 05 & 06 can be disabled by setting value to 000000.

04	First level score award
05	Second level score award
06	Third level score award
07	Total replays (free)
08	Current credits
09	Credits per coin:

	Credits	Coins	
Enter 11 =	1	1	
Enter 21 =	2	1	
Enter 31 =	3	1	
Enter 41 =	4	1	
Enter 51 =	5	1	
Enter 61 =	6	1	
Enter 71 =	7	1	
Enter 81 =	8	1	
Enter 91 =	9	1	
Enter 52 =	5	2	(2 + 3)
Enter 12 =	1	2	(0 + 1)
Enter 13 =	1	3	
Enter 32 =	3	2	(1 + 2)

Enter any other number = 1 per 1 coin.

10	1 = Replay
	0 = Extra ball; for beating each score level (04, 05, 06)

11	1 = Match feature on
	0 = Match feature off

| 12 | 1 = Credits are displayed |
| | 0 - Credits are not displayed |

| 13 | 1 = Game over table mover enabled |
| | 0 = Game over table mover disabled |

| 14 | 1 = Plays tunes |
| | 0 = Plays single notes only |

| 15 | 1 = Each target is spotted individually |
| | 0 = Targets 1/9 spotted with 4/12; Targets 2/10 spotted with 3/11 |

| 16 | 1 = 20,000 points for beating a score level and disables featuers "10" |
| | 0 = No points and enables feature "10" |

| 17 | 1 = Bank shot starts at 600 |
| | 0 = Bank shot starts at 300 |

| 18 | 1 = free play |
| | 0 = No free play |

| 22 | Number of balls per game: 01 to 05, any other number will give 5 balls. |

| 23 | Maximum credits that can be accumulated. Set by operator. |

| 24 | Number of replays awarded for beating "Hi-Score". Enter : 00 or 01 or 02 or 03. |

TEST 2 — STUCK SWITCH

NOTE: The switch number will appear in player displays 1 to 4.

The ball cannot be in the outhole for this test to be able to check all the switches. Do "Test 3" first to put the ball in the shooter.

Switch #	Description
00	CW. Sw. Optical Assy. (Not Seen)
01	CWW. SW. Optical Assy.

Switch #	Description
***** *	
02 *	
*	
03 *	Gray Code
*	
04 *	Shaft
*	
* * * * * * * * * * * * * * * * *	Position
05 *	
*	
06 *	Encoder
*	
07 *	
*	
***** *	
10	Center T. B.
11	Bank Shot Outlane
12	Spinner
13	8 Ball Target
14	Call East
15	Call South
16	Call North
17	Call West
20	Bottom T. B.
21	Left Flipper Return
22	3/11 Target
23	1/9 Target
24	North Slam
25	North Test Button
26	North Coin
27	North Tilt (If Used)
30	Top Sling Shot
31	Bank Shot Advance
32	4/12 Target
33	2/10 Target

Switch #	Description
34	South Slam
35	South Test
36	South Coin
37	South Tilt
40	Right Sling Shot
41	Outhole
42	5/13 Target
43	6/14 Target
44	- - - - -
45	- - - - -
46	- - - - -
47	- - - - -
50	- - - - -
51	Left Sling Shot
52	- - - - -
53	Right Flipper Return
54	Right Outlane
55	- - - - -
56	- - - - -
57	- - - - -
60	Top T.B.
61	7/15 Target
62	10 Points
63	Break Shot Hole
64	Left Outlane
65	- - - - -
66	- - - - -
67	- - - - -

TEST 3 — SOLENOID TEST

NOTE: Number appears in "Match" window

Solenoid #	Name
40	Outhole
41	Bank Shot
42	Center T.B.
43	Bottom T.B.
44	Top T.B.
45	Top Sling Shot
46	Right Sling Shot
47	Left Sling Shot
50	Break Shot
53	Flippers

TEST 4 — ENCODER READOUT

NOTE: Used to check encoder number for any playfield position. Number is displayed in "Match" window.

Playfield Postion (Outhole)	Number
North	00
East	20
South	40
West	60

TEST 6 — OPTICAL SWITCH READOUT

NOTE: Used to check optical switch operation. Number is displayed in "Match" window.

Reading	Meaning
0	Neither Sw. on
1	CW Sw. on
2	CCW Sw. on
3	Both Sw. on (home position)

TEST 8 — NONVOLATILE RAM (NVR) SETUP

The NVR can be set to certain fixed settings by using this test button.

The purpose is to allow an operator to set certain game settings without doing each one separately.

The values are as follows:

North coin chute total:	010000
South coin chute total:	010000
Total plays:	010000
High score:	400000
First score level:	200000
Second score level:	300000
Third score level:	400000
Total replays:	010000
Credits:	00
Credits per coins:	11 (One credit per coin)
Balls per game:	3
Max. credits allowed:	10

1 replay for beating each score level. 3 replays for beating high score to date.

"Free play" is off.

NOTES

This space is provided for personal notes

"ROTATION 8"
MIDWAY MFG. CO.
10750 W. GRAND AVE.
FRANKLIN PARK, IL. 60131

DISPLAY P.C. A084-91306-8627

BLANK

TABLE POSITION
R.C. A082-91317-B000

4 NORTH SCORE DISPLAY   4 EAST SCORE DISPLAY   4 CREDIT DISPLAY   4 SOUTH SCORE DISPLAY

+5V   +10V

LEFT DISPLAY CONNECTOR

RIGHT DISPLAY CONNECTOR

TO V. LAMP   B-W
TO V. LAMP RETURN   BLU

GRAY-A
GRAY-G
PURPLE
G-W

W-O
TO L1

R-W   Y-B   O-B   R-B   Y-BRN   W-G   O-BLU   BRN-O   R-G

BLU-Y   W-R   O-W   G-Y   BLU-R   GRAY-W   GRAY-Y   -Y-W

KEY   ORN   R-Y   BLU-W   BLANK

CONNECTOR 'J5B'   CONNECTOR 'J4B'   CONNECTOR 'J3'   CONNECTOR

CHARACTERIZATION
P.C. A082-91320-A00X

GAME L

CONNECTOR 'J1'   CONNECTOR 'J1'   CONNECTOR 'J2'   CONNECTOR 'J5B'   CONNECTOR 'J4B'

G-B   Y-G   GRAY-Y   O-B   R-W   Y-W   GRY-G   BLU   GRAY-G   G-Y   KEY

O-R   W-BLU   G-R   Y-R   BRN-O   B-W   Y-O   BRN   R-Y   BRN   BLU COL 2   O-BLU SR4

KEY   LOGIC GROUND   B-W COL1   RED COL 3   O-R SR5

+10V   +K.LAMP   +5V.REG   LAMP RETURN   COMMON   +5V REG   +5V.REG   +12V.REG

KEY BOARD R.C. A082-91316-A000

CONNECTOR 'C'

2 AMP SLO-BLO FUSE

CONNECTOR 'A'

GRA   9V.
BLU-W   C.TAP
GRAY   9V.
WMT   5.5V.
KEY
WHT
GRN   34V.
RED   32V.
BRN
BLK   16V.
BLK
O-W   7.5V.
O-W

ORN   PURPLE   BRN

POWER SUPPLY
P.C. A082-90400-E000

MOTOR DRIVER
R.C. A082-90312-B627

BLU-W
O-R
GRAY-G   +5V. REG
BRN   COMMON
RED   4V. MOTOR
GRAY   MOTOR RET.
BLK   KEY
KEY
ORN

DRIVE MOTOR
0040-0061C
32V. D.C.

220V   115V

ON OFF SW.

WMT   YEL   BRN

COIN DOOR LITES

FILTER

MT 67B '60CY.
MT 68B 50CY.   115V

CONNECTOR 'B'

BR-W
B-W
YEL
BLU

20.000MF. 35%
10.000MF. 75%

SOUTH SLAM TILT   SOUTH TEST   SOUTH COIN

RED   O-BLU

NORTH SLAM TILT   NORTH TEST   NORTH COIN

BLU   O-R

CALL EAST   CALL SOUTH

+10V   6.3V AC   +52V

CONNECTOR 'D'

G-W   V.LED

PURPLE   V.LED RET.

GRAY-G   +5V. REG.

GRAY-A   COMMON

WHT   YEL   KEY

DISPLAY LITES

SOLENOID RETURN   GRAY

SOLENOID POWER   BLACK

TO COIN DOORS

NOTE: ALL DIODES AR
UNLESS OTHE

35

Pinball machine wiring schematic. LOGIC P.C. A084-91313-G627 and SOLENOID DRIVER P.C. A084-90501-C627.

+52V

14 PIN

N   M   K   H   F   E   D

74LS367   74LS04   74LS32   74LS02

0.1MF.   0.1MF.   0.1MF.   0.1MF.

Z80

20 PIN
J13

8156   0066-117XX

8ILS95   8304   74LS174   74LS112

0.1MF.   0.1MF.   0.1MF.   0.1MF.

7445   74LS259   74LS259   74LS259

74LS259   74LS259   74LS259

| 2.2K |
| 10K |
| 10K |
470Ω	470Ω
.001MF.	.001MF.
3.3K	3.3K
470Ω	470Ω
.001MF.	.001MF.
3.3K	3.3K
470Ω	470Ω
.001MF.	.001MF.
3.3K	3.3K
470Ω	470Ω
.001MF.	.001MF.
3.3K	3.3K
470Ω	470Ω
.001MF.	.001MF.
3.3K	3.3K

LM 3900

560K	390K
2.4M	220K
330K	150K
2.4M	680K
390K	300K
75K	560K
110K	2.4M
	160K

0.1MF.   0.1MF.   0.1MF.

0.1MF.   0.1MF.   0.1MF.

6 PIN   4 PIN
J4B

J11   7 PIN   3 PIN

LR2
200Ω	200Ω	200Ω	200Ω
680Ω	680Ω	680Ω	680Ω
D42DI	D42DI	D42DI	D42DI

LR6
CHAMPHER

LR3   LR7

200Ω	200Ω	200Ω	200Ω
680Ω	680Ω	680Ω	680Ω
D42DI	D42DI	D42DI	D42DI

LR1   LR4
LR5   LRO

J4A   10 PIN   6 PIN

| 68Ω |
| 1K |
| 1K |
| 68Ω |

1.0MF. 25V. TANT.
1.0MF. 25V. TANT.

1K	1K
1K	1K
D45EI	D45EI

COL1   COL 2

1K   1K

7402   UND2981A   UND2981A

| 270Ω |
| 270Ω |
| 270Ω |
| 270Ω |
| 270Ω |

1K	1K	1K	1K	1K
1K	1K	1K	1K	1K
D45EI	D45EI	D45EI	D45EI	D45EI
1K				1K

COL 0   COL 6   COL 5   COL 4   COL 3
METAL TAB

47Ω	47Ω	47Ω	47Ω	270Ω
47Ω	47Ω	47Ω	47Ω	270Ω
47Ω	47Ω	47Ω	47Ω	270Ω
47Ω	47Ω	47Ω	47Ω	270Ω

J5B   4 PIN   7 PIN

J5A   4 PIN   7 PIN

11 PIN   9 PIN
J9

GAME LOGIC A084-91313-E627

ALL CAPS ARE 50V. AXIAL LEAD CERAMIC
UNLESS OTHERWISE SPECIFIED

5 PIN

J0

A

100K
100K

C

B

22K
2.2K
2.2K
100 Pf.
330 Pf.

14.318MHz
XTAL

11K

1

D74LS00   D74LS293   CD4020

0.1MF.   0.1MF.   0.1MF.

TIS137   B
        C E

2

100K
200K
560Ω
1N5222

LM339

2K
510Ω
510Ω

D74LS02   D74LS10   D74LS74

0.1MF.   0.1MF.   0.1MF.

3

5K POT

D74LS259

0.1MF

4

15K   220Ω   LM383

1000MF. 15V.   470MF. 15V.
ELECTROLYTIC   ELECTROLYTIC

80ME.
16V.
AXIAL

10MF.
25V.
RADIAL

D74LS259

5

2.2Ω   12K

.022MF.
100V.
MYLAR

.047MF.
100V.
MYLAR

0.1MF.

6

500MF
16V
RADIAL

2 PIN

J7

J3

5 PIN   9 PIN   1

J2

8 PIN   6 PIN   1

7

270 Ω
270 Ω
270 Ω
270 Ω
270 Ω
270 Ω
270 Ω
270 Ω

J1

4 PIN   6 PIN   1

13 PIN   4 PIN   1

J10

ROTATION VIII
GAME LOGIC P.C.A084-91313
LOGIC SECTION

8156 M3-4

Z-80 N2

CHARACTERIZATION BOARD
P.C.A082-91320-A000

J13
20 PIN CONNECTOR

J12
14 PIN CONNECTOR

I.C.E. CONNECTOR
TEST ONLY

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ROTATION
GAME LOGIC P.C.A084-91313-E627
DRIVER SECTION

CONNECTOR 'J3'

CONNECTOR 'J2'

CONNECTOR 'J4A'

CONNECTOR 'J4B'

CONNECTOR 'J1'

CONNECTOR 'J5B'

CONNECTOR 'J6A'

J3

J2

4A

4A

J4B

BLNK
P1A
P1B
P1C
P1D
P2A
P2B
P2C
P2D
MA
MB
MC
MD

P3A
P3B
P3C
P3D
P4A
P4B
P4C
P4D
ME
MF
MG
MH

SR0
SR1
SR2
SR3
SR4
SR5
SR6
SR7

LR0
LR1
LR2
LR3
LR4
LR5
LR6
LR7

SR0
SR1
SR2
SR3
SR4
SR5
SR6
SR7
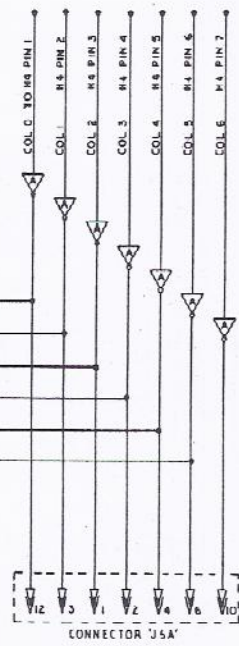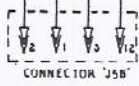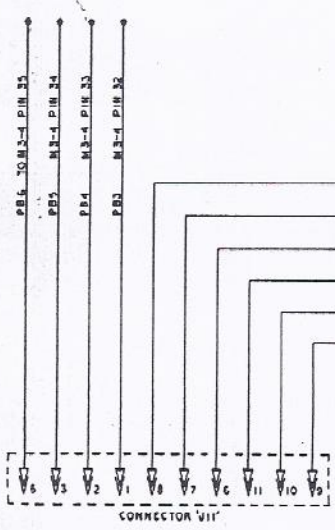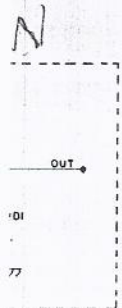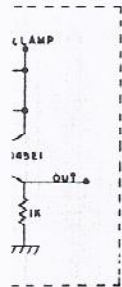
ROTATION VIII
GAME LOGIC P.C. A084-91313-G627
DRIVER SECTION

CONNECTOR 'J3'
BLNK
P1A
P1B
P1C
P1D
P2A
P2B
P2C
P2D
MA
MB
MC
MD

CONNECTOR 'J2'
P3A
P3B
P3C
P3D
P4A
P4B
P4C
P4D
ME
MF
MG
MH

CONNECTOR 'J4A'
SR0
SR1
SR2
SR3
SR4
SR5
SR6
SR7
LR0
LR1
LR2
LR3
LR4
LR5
LR6
LR7

CONNECTOR 'J4B'
SR0
SR1
SR2
SR3
SR4
SR5
SR6
SR7

270Ω   270Ω
270Ω   270Ω

D4201

COL 0 TO H4 PIN 1
COL 1   H4 PIN 2
COL 2   H4 PIN 3
COL 3   H4 PIN 4
COL 4   H4 PIN 5
COL 5   H4 PIN 6
COL 6   H4 PIN 6

LR0 TO F4 PIN 7
LR1   E4 PIN 7
LR2   D4 PIN 7
LR3   C4 PIN 7
LR4   F5 PIN 7
LR5   E5 PIN 7
LR6   D5 PIN 7
LR7   C5 PIN 7

SR0 TO M5-4 PIN 21
SR1   M5-4 PIN 22
SR2   M5-4 PIN 23
SR3   M5-4 PIN 24
SR4   M5-4 PIN 25
SR5   M5-4 PIN 26
SR6   M5-4 PIN 27
SR7   M5-4 PIN 28

P3A TO F3 PIN 5
P3B   E3 PIN 5
P3C   D4 PIN 5
P3D   C4 PIN 5
P4A   F5 PIN 5
P4B   E5 PIN 5
P4C   C5 PIN 5
P4D   D5 PIN 5
ME   F5 PIN 6
MF   E5 PIN 6
MG   D5 PIN 6
MH   C5 PIN 6

P1A TO F4 PIN 1
P1B   E4 PIN 4
P1C   D4 PIN 4
P1D   C4 PIN 4
P2A   F5 PIN 4
P2B   E5 PIN 4
P2C   D5 PIN 4
P2D   C5 PIN 4
MA   F4 PIN 6
MB   E4 PIN 6
MC   D4 PIN 6
MD   C4 PIN 6

PB4   M5-4 PIN 33
PB3   M5-4 PIN 32

CONNECTOR 'J1'
CONNECTOR 'J3B'
CONNECTOR 'J3A'

39

14 PIN
J12

N   M   L   K   H   F   E   D

74LS367   74LS04   74LS32   74LS02

0.1MF.   0.1MF.   0.1MF.   0.1MF.

Z80

0.1MF.

20 PIN
J13

43Ω
1N4740

8ILS95   8304   74LS174   74LSII2

0.1MF.   0.1MF.   0.1MF.   0.1MF.

| 2.2K |
| 10K |
| 10K |
470Ω	470Ω
.001MF.	.001MF.
3.3K	3.3K
470Ω	470Ω
.001MF.	.001MF.
3.3K	3.3K
470Ω	470Ω
.001MF.	.001MF.
3.3K	3.3K
470Ω	470Ω
.001MF.	.001MF.
3.3K	3.3K
470Ω	470Ω
.001MF.	.001MF.
3.3K	3.3K
470Ω	470Ω
.001MF.	.001MF.
3.3K	3.3K

8156   0066-117XX   7445   74LS259   74LS259   74LS259

0.1MF.   0.1MF.
160K

560K	390K
2.4M	220K
330K	150K
2.4M	680K
390K	300K
75K	560K
110K	2.4M

LM3900

680Ω SIP

74LS259   74LS259   74LS259

0.1MF.   0.1MF.   0.1MF.

J4B
6 PIN   4 PIN

7 PIN   3 PIN
J11

| 200Ω |
| 200Ω |
| 200Ω |
| 200Ω |
| 200Ω |
| 200Ω |
| 200Ω |
| 200Ω |

C B E

0.27Ω	0.27Ω	0.27Ω	0.27Ω
.022MF.	.022MF.	.022MF.	.022MF.
D42DI	D42DI	D42DI	D42DI

C B E

| 0.27Ω | 0.27Ω | 0.27Ω | 0.27Ω |
| .022MF. | .022MF. | .022MF. | .022MF. |
| D42DI | D42DI | D42DI | D42DI | ← CHAMPHER

1.0MF. 25V. TANT.
68Ω
1K
1K
1.0MF. 25V. TANT.
68Ω

J4A   10 PIN   6 PIN

1K	1K
1K	1K
D45EI	D45EI
1K	1K

7402   UND2981A   UND2981A

| 1K | 1K | 1K | 1K | 1K |
| 1K | 1K | 1K | 1K | 1K |
| D45EI | D45EI | D45EI | D45EI | D45EI | ← METAL TAB
| 1K | 1K | 1K | 1K | 1K |

| 47Ω |
| 47Ω |

| 270Ω |
| 270Ω |
| 270Ω |
| 270Ω |
| 270Ω |
| 270Ω |
| 270Ω |
| 270Ω |

47Ω	47Ω	47Ω	47Ω
47Ω	47Ω	47Ω	47Ω
47Ω	47Ω	47Ω	47Ω

J5B   4 PIN   7 PIN

J5A   4 PIN   7 PIN

11 PIN   9 PIN
J9

GAME LOGIC A084-91313-C627

ALL CAPS ARE 50V, AXIAL LEAD CERAMIC
UNLESS OTHERWISE SPECIFIED

Component Layout Diagram

```
                    5 PIN  I
                     J0

  C        B        A
                   100K
                   100K
                          22K
                          2.2K
                          2.2K
                          100 Pf.
  74LS00  74LS293  CD4020  330 Pf.      I
                          14.318MH
                          XTAL
                          11K
  0.1MF.   0.1MF.         TIS137  B     2
                  0.1MF.          C E
                          100K
                  LM339   200K
                          560Ω
                          1N5222

                          2K
                          510Ω
                          510Ω
  74LS02   74LS10   74LS74                3
                          1.0MF.   50K POT
                          25V.
  0.1MF.   0.1MF.  0.1MF.  TANT.

                          0.1MF.
                          25V.
                          MYLAR
  74LS259          1.0MF.  100K 10K 1N4148 1N4148 10K   4
                          25V.
                          TANT.
                     LM3900
  74LS259   75K 200K 1N4148 1K 1K   100K 100K 220K 220K 2K
                                     10MF.
                                     25V.
                                     RAD.
  74LS259          0.1MF.        0.1MF.          5
                   100V.         100V.
  0.1MF.           MYLAR         MYLAR
                     100K          100K

                   0.1MF.        0.1MF.
                   100V.         100V.
                   MYLAR  LM377  MYLAR          6
                    10K          10MF 25V.
                    200K
                                  10K
                   10MF.          200K
                   35V.           100K
                   TANT.

                          2 PIN
                           J7
```

```
                        J3
500MF.    5 PIN      9 PIN        I
16V.
RADIAL

                        J2
      8 PIN         6 PIN          I

  270Ω            10MF.            7
  270Ω            25V.
  270Ω            TANT.
  270Ω
  270Ω                  J1
  270Ω    4 PIN      6 PIN         I
  270Ω
  270Ω

      13 PIN          4 PIN        I
                 J10
```

ROTATION VIII
GAME LOGIC P.C.A084-91313-G627
LOGIC SECTION

41

IN5251 10K
10K 10K
56K 10K

IOMF.
25V.
TANT.

LM3900

IOMF.
25V.
TANT.

56K 10K
10K 10K
10K IN5251

MOTOR DRIVER
A082-90502-

CHARACTER
R.C. A082

TIP
110

HEAT SINK
THERMALLOY
6070

SCREW-NUT
& WASHER

TIP
110

10K
10K

20K
20K

E
C
B
TIP 115

O.IMF. IOOV.
CERAMIC

2.7K
2.7K

E
C
B
TIP 115

4 PIN

5 PIN

O.IMF.
50V.
2.7K

E   B
MPSA20

10K
10K

O.IMF.
50V.
2.7K

E   B
MPSA20

10K
10K

O.IMF.
50V.

1K
1K

5-24-78

42

3.3 Ω
2 OR 5W

```
E
C   TIP 115
B
```

0.1MF. 100V.
CERAMIC

2.7K

2.7K

```
E
C   TIP 115
B
```

IN5251

10K

10K   10K

56K   10K

0.1MF.
50V.

2.7K

4 PIN

LM3900

IOMF.
25V.
TANT.

IOMF.
25V.
TANT.

TIP
110

HEAT SINK
THERMALLOY
6070

SCREW-NUT
& WASHER

E B
MPSA20

5 PIN

10K

10K

56K   10K

10K   10K

10K   IN5251

TIP
110

0.1MF.
50V.

2.7K

1K

1K

E B
MPSA20

10K

10K

10K

10K

20K

20K

0.1MF.
50V.

MOTOR DRIVER
A082-90502-C627

MOTOR DRIVER P.C. A082-90502-C627
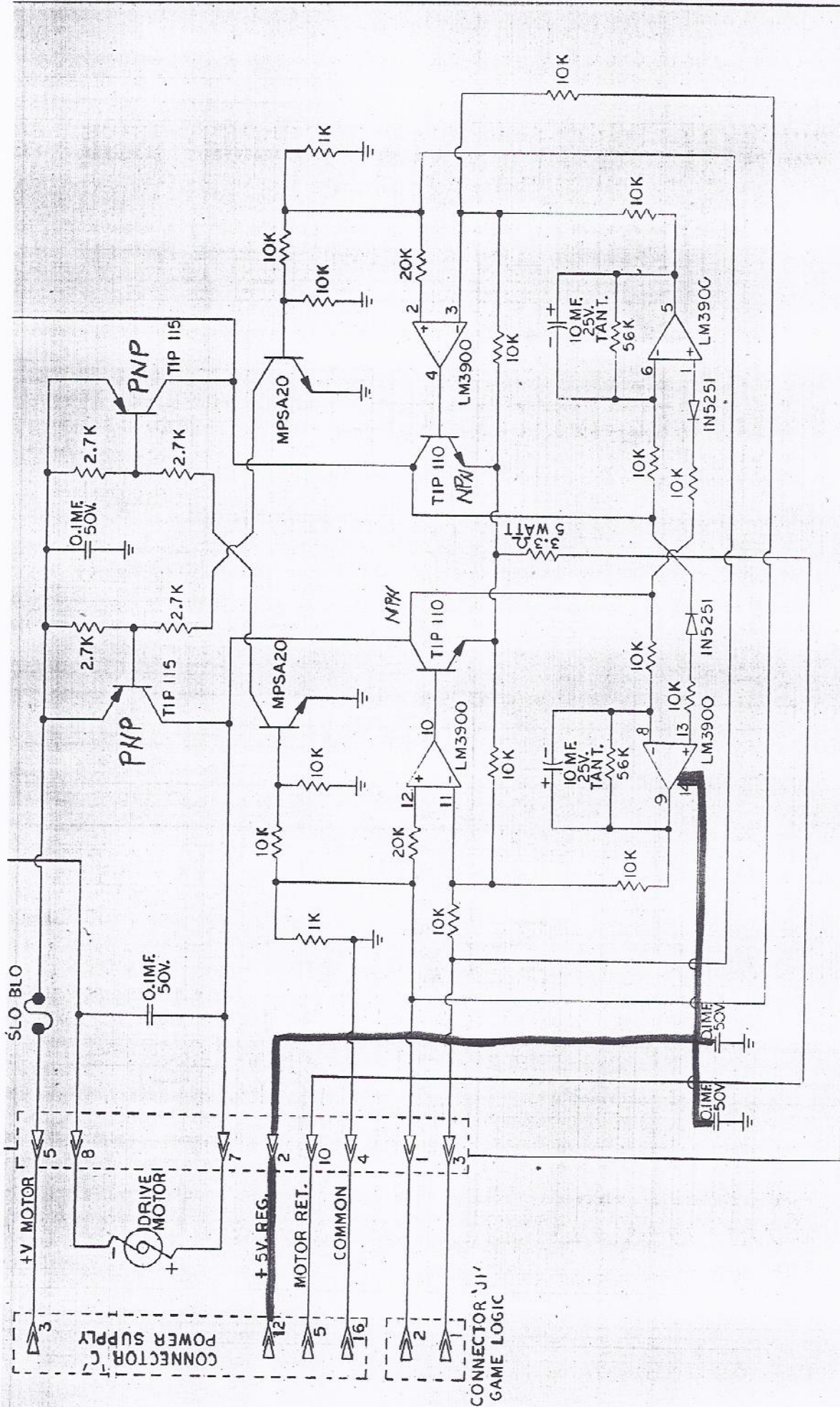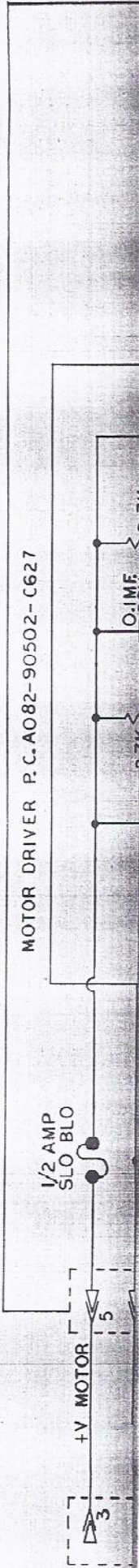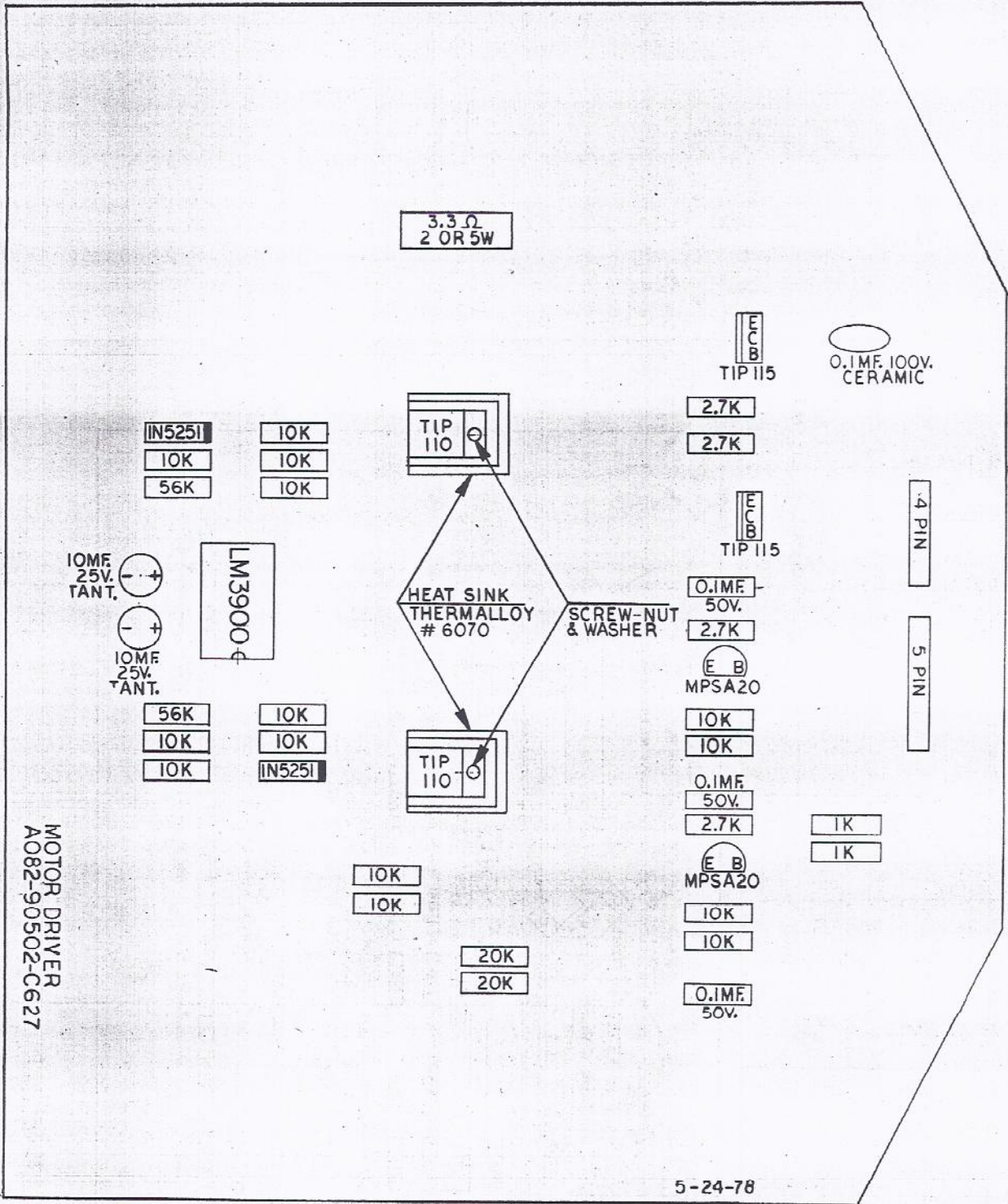
0.1MF.

0.1MF.

1/2 AMP
SLO BLO

+V MOTOR

5

3

5-24-78

43

CONNECTOR 'D' — 10 — + V. SOLENOIDS
— 2 — SOLENOID RETURN

MOTOR RETURN
— 5 —
+ V. MOTOR
— 3-4 —

+ V. FEATURE LAMPS
— 1-2 —
+ 12V. LOGIC
— 9 —

FEATURE LAMP RET.
— 6 —

CONNECTOR 'C'

+ 10V.
— 13 —
+ 10V.
— 14 —
+ 5V. LOGIC
— 11 —
+ 5V. MOTOR
— 12 —

COMMON LOGIC
— 15 —
COMMON MOTOR
— 16 —
— 5V. LOGIC
— 10 —

COMMON DISPLAY
— 1 —
+ 5V. DISPLAY
— 3 —
+ 5V. DISPLAY
— 4 —
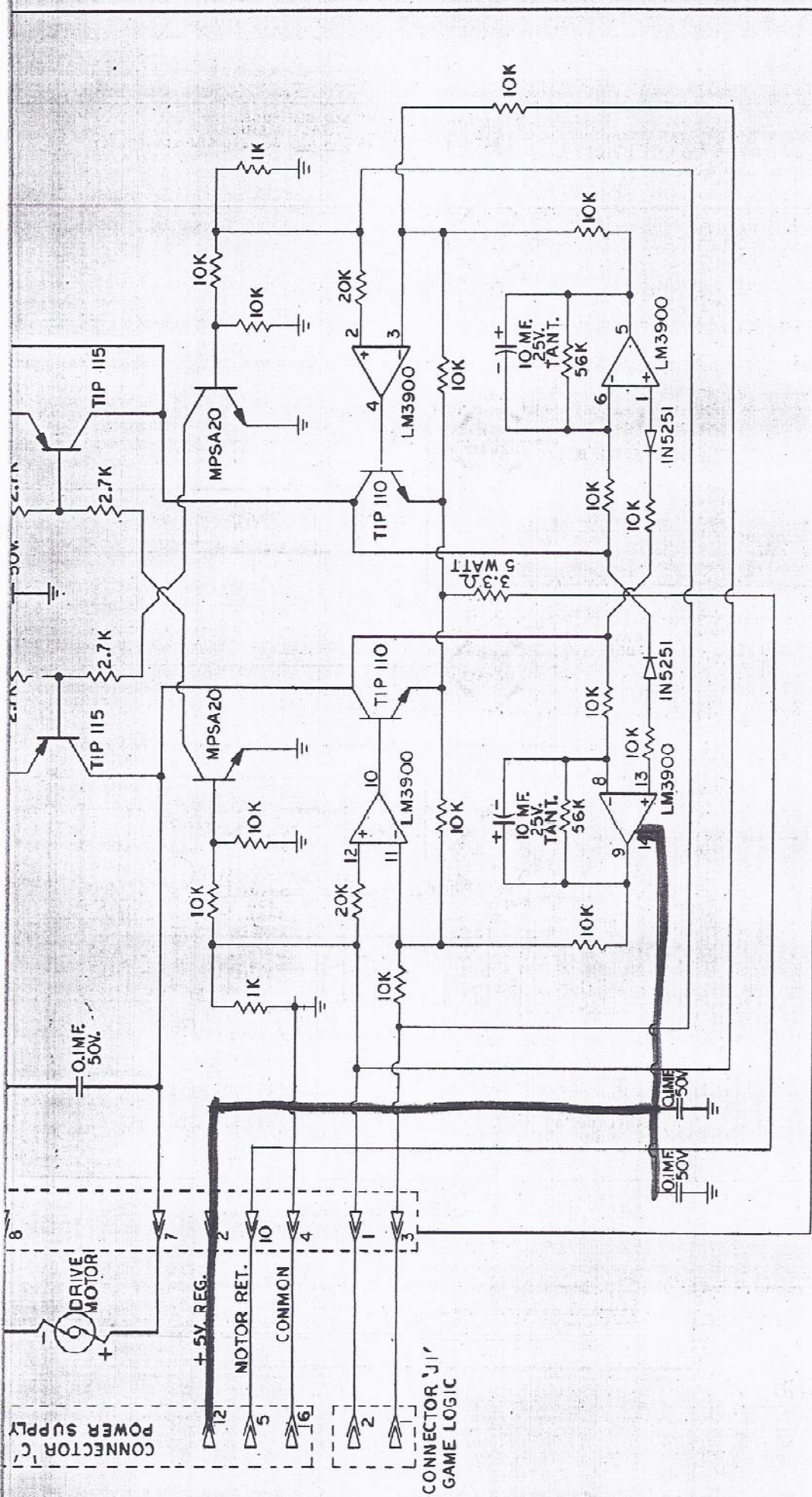
CONNECTOR 'D'
LED RETURN
— 7 —
LED RETURN
— 8 —
+ V. LED
— 5 —
+ V. LED
— 6 —
5.5VAC
— 13-14 —
0
— 11-12 —

FASTEN THESE CAPS WITH CABLE TIE

+ 11,000 MF. 20V. AXIAL

20,000 MF. 16V. AXIAL

HEAT SINK 690-220-B

FT2955

78M12

1ME. 25V. TANT.

3.6K

10MF. 25V. TANT.

36Ω 1W

3.6K 1/2W

A15F   A15F
A15F   A15F
A15F   A15F
A15F   A15F
A15F   A15F

SCORE DISPLAY
A   A
4 AMP

FEATUR LAMP VOLTS
A   A
6 AMP

A082-90400-D000
POWER SUPPLY

5 PIN   D
8 PIN
8 PIN   C
6 PIN
12 PIN   B
9 PIN
4 PIN   A
6 PIN

JUMPER

GEN. ILLUM.   A   A
8 AMP
A14F

LOGIC VOLTAGE   A   A
2 AMP SLO-BLO
A14F

JUMPER

10MF. 25V. TANT.
5.6 1/2W
78M05
0.33 MF. TANT.
1ME. 25V. TANT.

10MF. 25V. TANT.
79M05
0.47 MF. 25V. TANT.
1N4001
1000 MF. 25V. AXIAL

1N4001
7.5K 1W

A15A   A15A
A15A   A15A
A15A   A15A

SOLENOID AND MOTOR VOLTAGE
A   C
B   A
4 AMP SLO BLO } LO
4 AMP SLO BLO } HI

JUMPER

A DENOTES BEL FUSE CLIP TYPE 1
B DENOTES BEL FUSE CLIP TYPE 2

* I PIECE ONLY, 4AMP SLO-BLO FUSE.
INSERT IN DESIRED VOLTAGE POSITION.
BOTH * POSITIONS CAN NOT BE USED SIMULTANEOUSLY

A082-90502-C627

POWER SUPPLY
A082-90400-D000

MT-67B XFORMER 60 CYC.
MT-68B XFORMER 50 CYC.

44

TOR 'D' 10 + V. SOLENOIDS +52.3V
2 SOLENOID RETURN .05V

5 MOTOR RETURN .005V
3-4 + V. MOTOR +52.2V

+22.3V
1-2 + V. FEATURE LAMPS
9 + 12V. LOGIC +12.0
6 FEATURE LAMP RET. .003-.015
(# of lamps on)

TOR 'C'

(UNREGULATED +5V)
13 + 10V. +12.3
14 + 10V. +12.3
11 + 5V. LOGIC +4.9
12 + 5V. MOTOR +4.9

15 COMMON LOGIC +.05V
16 COMMON MOTOR +.05V
10 -5V. LOGIC -5.1

COMMON DISPLAY .05V
3 + 5V. DISPLAY +4.93V
4 + 5V. DISPLAY +4.93V
TOR 'D'
7 LED RETURN .001V
8 LED RETURN
5 + V. LED 9.9→10.1V
6 + V. LED
13-14 5.5VAC 6.2VAC
11-12 0

at refer to (A)

FASTEN WITH CABLE TIES

+11,000 ME 20V. AXIAL
20,000ME. 16V. AXIAL

HEAT SINK 690-220-B
FT2955   78M12

JUMPER

10MF. 25V. TANT.   5.6 1/2W   78MO5
79MO5   0.33MF. 25V. TANT.   1MF. 25V. TANT.
0.047MF. 25V. TANT.   1000 ME. 25V. AXIAL
IN4001   IN4001
7.5K 1W

GEN. ILLUM.   8AMP
LOGIC VOLTAGE   2AMP SLO-BLO
A14F
A14F

JUMPER

3.6K
1MF. 25V. TANT.
10MF. 25V. TANT.
36Ω 1W
3.5K 1/2W

A15F   A15F
A15F   A15F
A15F   A15F
A15F   A15F

CORE DISPLAY   4AMP
FEATUR LAMP VOLTS   6AMP
A

SOLENOID AND MOTOR VOLTAGE   4AMP SLO BLO   LO
4 AMP SLO BLO   HI
A15A   A15A
A15A   A15A

JUMPER

A082-90400-E000
POWER SUPPLY

0.5 AMP SLO-BLO   JUMPER
5 PIN   D
8 PIN
8 PIN   C
5 PIN   JUMPER
12 PIN   B
9 PIN
4 PIN   A
6 PIN

A DENOTES BEL FUSE CLIP TYPE 1
B DENOTES BEL FUSE CLIP TYPE 2

Hz
7/30
.25V
.045V   .8V
0
30Hz   oscillator

36V.
34V.
32V.
0
2-3
8-9
6-7

* 1 PIECE ONLY, 4AMP SLO-BLO FUSE.
INSERT IN DESIRED VOLTAGE POSITION.
BOTH * POSITIONS CAN NOT BE USED SIMULTANEOUSLY

×
*

AI5A   AI5A
1WATT
7.5K
AI5A   AI5A

CONNE

10,000MF.
75V.
1

4-5

0.5A
SLO-B
FUSE

115V
105V

16V
13-14

6AMP.
FUSE

CONNECTOR 'B'

AI5F   AI5F
3.6K
1/2WATT
AI5F   AI5F

36Ω
1WATT

M7812
I   O
C

10MF.
25V.
TANT.

10MF.
25V.
TANT.

2AMP
SLO-BLO
FUSE

15-16

20,000MF
35V.
17-18

11-12

7.5V.
19-20

4AMP
FUSE

AI5F   AI5F
3.6K
1/2WATT

21-22

20 000
16V.

0
9V.
8-9

C.TAP
5-6

9V.
10-11

COMMUTATOR

ON-OFF
SW.

AI4F   AI4F

AI4F   AI4F

2AMP
SLO-BLO
FUSE

11,000MF
20V.

A

1000MF.
25V.

5.6Ω
1/2WATT

FT2955

78M05
I   O
C

0.33MF
25V.
TANT.

1.0MF.
25V.
TANT.

0.47MF.
25V.
TANT.

10MF.
25V.
TANT.

79M05
I   O
C

CONNE

LINE
FILTER

CONNECTOR 'A'

POWER SUPPLY
A082-90400-

CONNE

MT-67B XFORMER 60 CYC.
MT-68B XFORMER 50 CYC.

5.5V.
1-2
0
3-4

8AMP
FUSE

all Voltages

45

ULN 2003A

74LS48

ULN 2003A

74LS48

14 PIN DISPLAY SOCKET

14 PIN DISPLAY SOCKET

TIP 140

TIP 140

TIP 140

1.5K

1.5K

1.5K

IN4004

IN4004

IN4004

18 Ω

18 Ω

18 Ω

18 Ω

18 Ω

18 Ω

18 Ω

18 Ω

18 Ω

18 Ω

18 Ω

18 Ω

18 Ω

0.1M55N

IN4004

TILT

YELLOW FILTER

+ IOMF. 16V. ELECT. −

IN4733

0.1MF5CN

5 PIN

13 PIN

CONNECTORS MOUNT ON SOLDER SIDE

COMM

ON

DISPLA
A084-913

14 PIN

46

ULN
2003A

18 Ω 18 Ω 18 Ω

74LS48

18 Ω 18 Ω 18 Ω

14 PIN DISPLAY SOCKET

IN4004

1.5K

TIP 140

IN4004

1.5K

TIP 140

18 Ω 18 Ω 18 Ω

ULN
2003A

74LS48

18 Ω 18 Ω 18 Ω

14 PIN DISPLAY SOCKET

IN4004

1.5K

TIP 140

RED FILTER

ULN
2003A

18 Ω 18 Ω 18 Ω 18 Ω

GAME OVER

IN4004

74LS48

18 Ω 18 Ω 18 Ω

10 PIN

8 PIN

5-B627

PLAY SOCKET

GAME LOGIC

CONNECTOR 'J3'

LEFT DISPLAY CONNECTOR

P1A P1B P1C P1D

74LS48

ULN2003B

+5V +10V VLED

DL6530
NORTH SCORE DISPLAY

(7) 18 Ω

P2A P2B P2C P2D

BLNK

74LS48

ULN2003B

+5V +10V VLED

DL6530
EAST SCORE DISPLAY

(7) 18 Ω

MA MB MC MD

74LS48

ULN2003B

+5V +10V VLED

DL6530
CREDIT DISPLAY
COL INPUT #
0 1 2 3 4 5

COL 2

CONNECTOR 'J2'

RIGHT DISPLAY CONNECTOR

P3A P3B P3C P3D

74LS48

ULN2003B

+5V +10V VLED

DL6530
SOUTH SCORE DISPLAY

(7) 18 Ω

COL 1
COL 0

P4A P4B P4C P4D

74LS48

ULN2003B

+5V +10V VLED

DL6530
WEST SCORE DISPLAY

(7) 18 Ω

GAME LOGIC

CHARACTERIZATION P.C. A082-91320-C000

OPTIONAL

D7 D6 D5 D4 D3 D2 D1 D0

OPTIONAL

+5V
1N4001

16 CPDI824CD 18
15   VDD
MWR 17   Vss 9

OPTIONAL
1N4001 82Ω +9V
0.1MF   IOMF
50V. 270Ω   25V.
             TANT.
        3cv
        V. BATTERY

V. BATTERY

CONNECTOR
'J 13'

SA4 SA3 SA2 SA1 SA0

+9V.
5.6V
1N5232
27Ω
+5.4
270Ω

MCI4584B

A4 A3 A2 A1 A0

GRND

MWR   WR Z80 #22
           6

+12V. 13
-5V.   14

IOMF   + + IOMF
25V. TANT.   25V.
TANT.   TANT.

+5V. CONNECTOR
2   'J 12'
(7) 0.1MF
    50V.

2.2K

6 4 3   2
   74LS00   74LS00   MREQ Z80 #19
       5   3
              MEMEN   NC
                       4
TG   RD   Z80 #21
1B A15   21
1A A14   RAMSEL 8156 #7
2B A12   L5
2A A11

74LS139
2G

74LS532 6

1B A15
1A A14
2B A12
2A A11

A082-91320-C000   CHARACTERIZATION

BATTERY G.E.418901CD05GI

270Ω 1N4001 1N4001 82Ω 0.1MF. 74LS139 74LS32 1N5232

22MF. 0.1MF. CDP1824CD CD4001 27Ω
25V.   74LS00
TANT.   270Ω
0.1MF.   1V5K120

ROM   14584

6 PIN CONNECTOR   0.1MF.

ROM   100X

15 PIN CONNECTOR   22MF.
                       25V.
                       TANT.
0.1MF.
22MF. ROM   15 PIN CONNECTOR
25V.
TANT.
15 PIN CONNECTOR
0.1MF.
ROM
22MF.
25V.
TANT.

10K 10K 10K 10K 10K 2.2K

A082-91316-A000

(6) IN4148

6 PIN

4 PIN

KEY BOARD

KEYBOARD P.C.A082-91316-A000

CONNECTOR 'J11'
GAME LOGIC

A084-90501-C627
SOLENOID DRIVER

(6) IN4148

| 4 PIN | 8 PIN |

METAL TAB

10K	TIP 140		TIP 140	10K
10K	TIP 140		TIP 140	10K
10K	TIP 140		TIP 140	10K
10K	TIP 140		33Ω	TIP 140	10K
10K	TIP 140		33Ω	TIP 140	10K
10K	TIP 140		TIP 140	10K

| 6 PIN | 7 PIN |

SOLENOID DRIVER 'A'

OUTPUT — 150Ω — TIP 140 — TO SOL.REL.

50

SOLENOID DRIVER
P.C. A084-90501-C627

GAME LOGIC P.C. A084-91313-E627

J9

Label	W-R
SOLENOID RETURN	14
TOM LEFT FLIP	W-R
T HOLE	W-BLU
IK SHOT	Y-BRN
T SLINGSHOT	BLU-BRN
SLINGSHOT	BLU-R
EAK SHOT	G-BRN
TOM THUMPER	G-Y
TER THUMPER	R-B
THUMPER	GRAY-R
HT SLINGSHOT	O-B
TOM RIGHT FLIP	
RIGHT FLIP	BLU-Y

+52V

SOL. COIL

TIP NPN
140   INPUT
C   B
E

-52V SOL. RET.

SOLENOID DRIVER "B"

OUTPUT

150Ω   10K

TIP
140

INPUT

33Ω

TO SOL. RET.   10K

INPUT
OUTPUT

TABLE POSITION P.C.A082-91317-B000
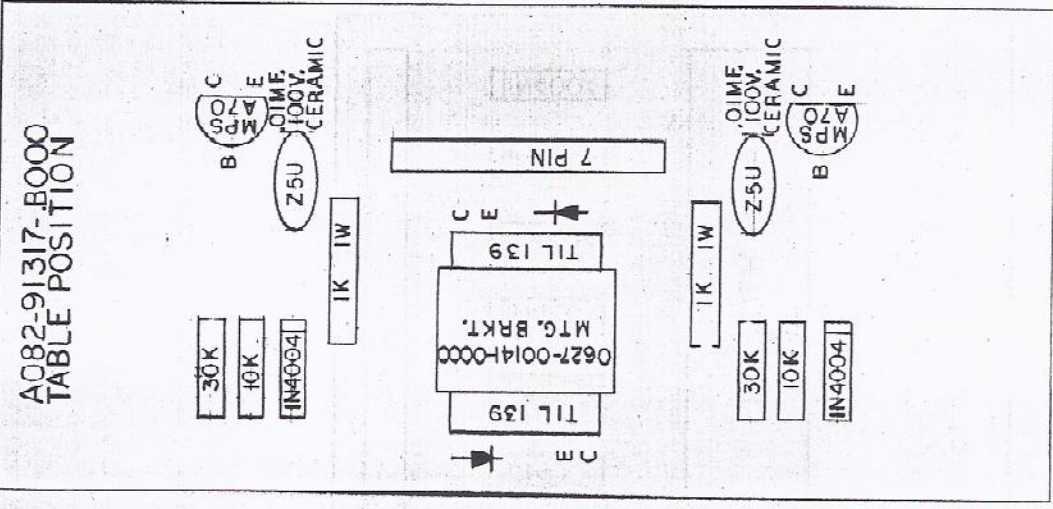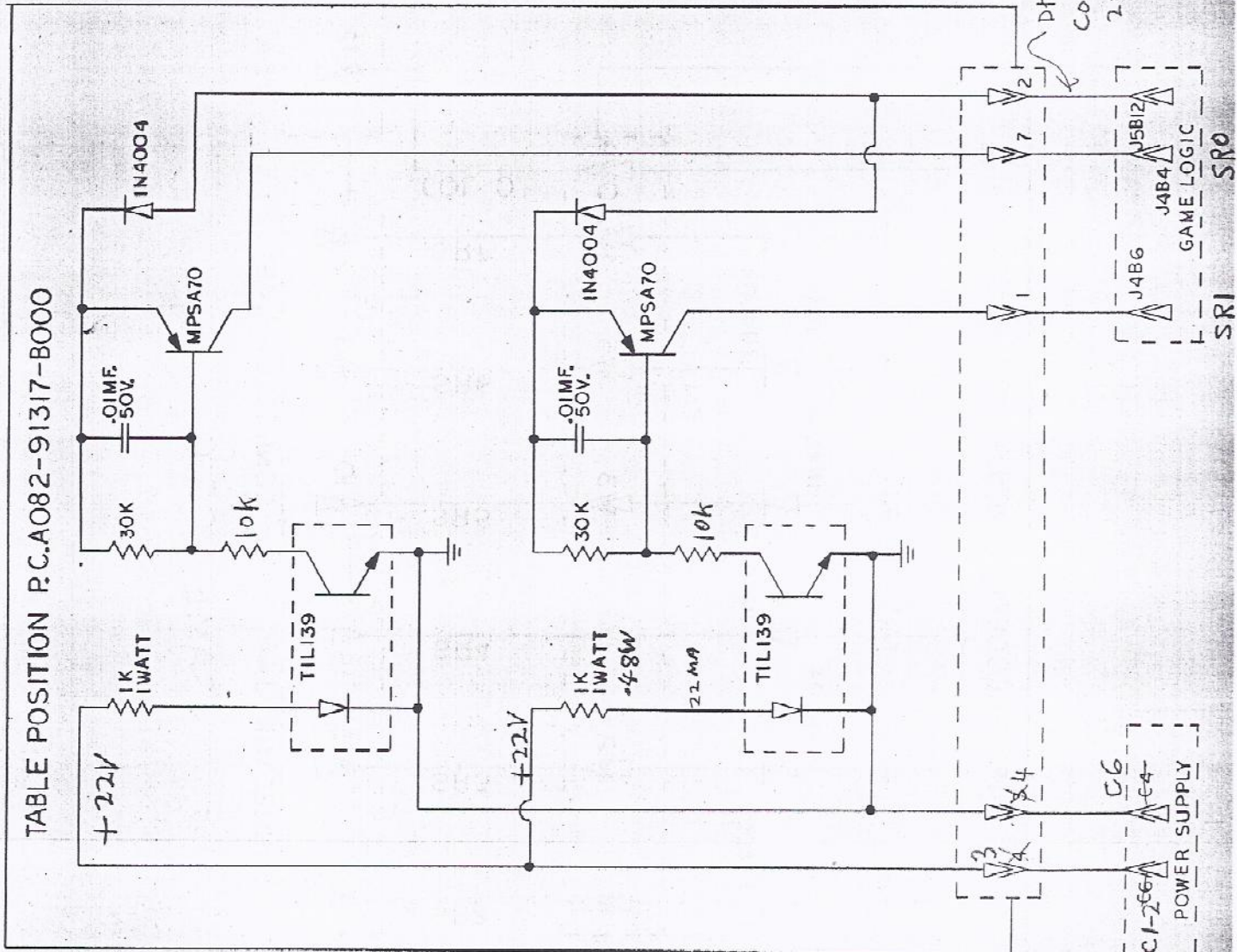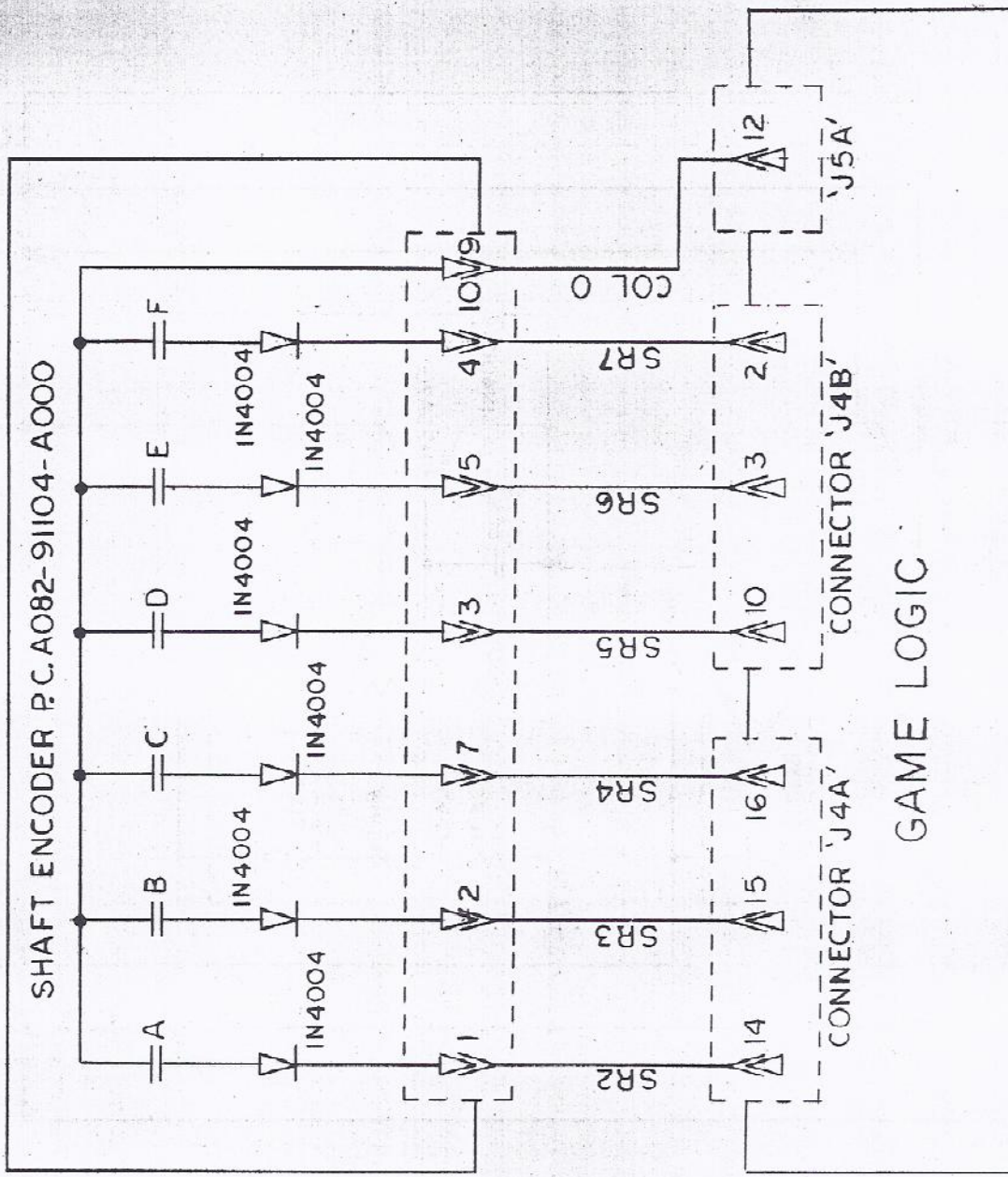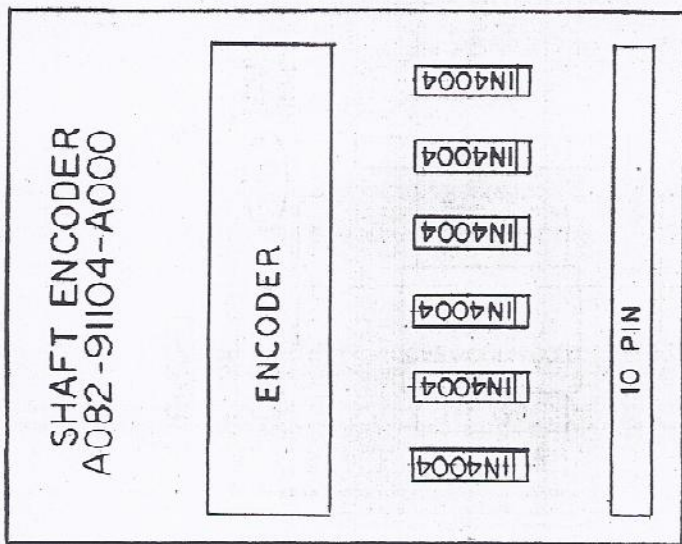
A082-91317-B000
TABLE POSITION

DRIVER A
COL "0" OUT
22V WHEN ON

SHAFT ENCODER P.C. A082-9II04-A000

SHAFT ENCODER
A082-9II04-A000

ENCODER

IN4004 IN4004 IN4004 IN4004 IN4004 IN4004

IO PIN

GAME LOGIC

CONNECTOR 'J4A'

CONNECTOR 'J4B'

'J5A'

COL 0

SR2 SR3 SR4 SR5 SR6 SR7

we're loaded with BULLETINS

MIDWAY MFG. CO.

A BALLY COMPANY

10750 W. GRAND AVENUE • FRANKLIN PARK, ILL. 60131

PHONE: AREA CODE 312 451-1360

CHICAGO PHONE: 992-2250

October 9, 1978

S E R V I C E   B U L L E T I N

GAME: Rotation VIII

SUBJECT: Characterization P.C. A082-91320 Battery

* *

1. The battery life during power down is about two
    weeks.

2. To prevent memory loss when programming game,
    leave game on for at least eight hours (recharge
    battery).

Andy Ducay
Service Manager

AD:jk

/1

MIDWAY MFG. CO.

A BALLY COMPANY

10750 W. GRAND AVENUE • FRANKLIN PARK, ILL. 60131

October 11, 1978

S E R V I C E   B U L L E T I N

GAME: Rotation VIII

SUBJECT: Prom Test (Program #115)

* * * * * * * * * * * * * * * * * * *

1. The Prom test is done when power is turned on.

2. The normal power up sequence is for the displays
    to read all zeros for about one second and then
    go into the game over shill.

3. If a bad Prom is found, the following error code
    is displayed:

    1. All 1's displayed, bad A Prom.

    2. All 2's displayed, bad B Prom.

    3. All 3's displayed, bad C Prom.

Andy Ducay
Service Department

AD:jk

/0