



*Gottlieb's*  
**CIRCUS**

**INSTRUCTION MANUAL**

*D. Gottlieb & Co.*



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**CIRCUS PROMS  
GAME #654**

**ARE MARKED AS FOLLOWS:**

**GAME PROM 1 IS 654/1**

**GAME PROM 2 IS 654/2**

**SOUND PROM IS 654**

**INSERT PROMS WITH  
INDENT NOTCH UP**

# **CIRCUS**

## **INSTRUCTION MANUAL**

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# CIRCUS

(SEE PAGE 6 FOR SWITCH LOCATION)

SWITCH NUMBER	SWITCH ASSIGNMENT	SCORING	FEATURE
00	#1 DROP TARGET	500 OR 5000 WHEN LIT	ADD BONUS; ADVANCE MULTIPLIER WHEN LIT
01	#1 ROLLOVER	500 OR 5000 WHEN LIT	ADD BONUS; SPIN ROTO WHEN LIT
02	"A" TARGET	500 OR 5000 WHEN LIT	ADD BONUS
03	LEFT SIDE ROLLOVER	500 OR 5000 WHEN LIT	ADD BONUS; SPIN ROTO WHEN LIT
04	RIGHT SIDE ROLLOVER	500 OR 5000 WHEN LIT	ADD BONUS; SPIN ROTO WHEN LIT
05	CENTER ROLLOVER	500 OR 5000 WHEN LIT	ADD BONUS; SPIN ROTO WHEN LIT
06	10 POINT CONTACTS (7)	10 POINTS	ALTERNATES SPECIAL AND EXTRA BALL ON 5 BALL
10	#2 DROP TARGET	500 OR 5000 WHEN LIT	ADD BONUS; ADVANCE MULTIPLIER WHEN LIT
11	#2 ROLLOVER	500 OR 5000 WHEN LIT	ADD BONUS; ADVANCE MULTIPLIER WHEN LIT
12	"B" TARGET	500 OR 5000 WHEN LIT	ADD BONUS; SPIN ROTO WHEN LIT
13	LEFT RETURN ROLLOVER	500 OR 5000 WHEN LIT	ADD BONUS; SPIN ROTO WHEN LIT
14	RIGHT RETURN ROLLOVER	500 OR 5000 WHEN LIT	ADD BONUS; SPIN ROTO WHEN LIT
15	LEFT & RIGHT OUTSIDE ROLLOVERS	500 OR 5000 WHEN LIT	ADD BONUS
16	50 POINT CONTACTS (3)	50 POINTS	
20	#3 DROP TARGET	500 OR 5000 WHEN LIT	ADD BONUS; ADVANCE MULTIPLIER WHEN LIT
21	#3 ROLLOVER	500 OR 5000 WHEN LIT	ADD BONUS; ADVANCE MULTIPLIER WHEN LIT
22	"C" TARGET	500 OR 5000 WHEN LIT	ADD BONUS; SPIN ROTO WHEN LIT
23	HOLE	5000	ADD BONUS; SPIN ROTO, SCORE BONUS WHEN LIT
24	BALL BACK ROLLOVER	500	
25	SPIN TARGET	100 OR 1000 WHEN LIT	ADD BONUS
26	POP BUMPERS (2)	1000 3 BALL, 100 5 BALL	
40	#4 DROP TARGET	500 OR 5000 WHEN LIT	ADD BONUS; ADVANCE MULTIPLIER WHEN LIT
41	#4 ROLLOVER	500 OR 5000 WHEN LIT	ADD BONUS; SPIN ROTO WHEN LIT
42-46	LEFT ROTO TARGET	100 X INDICATED VALUE (STAR VALUE = 5)	
52-56	CENTER ROTO TARGET	1000 X INDICATED VALUE (STAR VALUE = 5)	SPOTS 1-4 ROLLOVERS, SCORES EXTRA BALL AND/OR SPECIAL WHEN LIT
57	TILT		TILT
62-66	RIGHT ROTO TARGET	100 X INDICATED VALUE (STAR VALUE = 5)	
67	OUTHOLE		SCORES BONUS

**I. INSTALLATION**

To assemble the game, first bolt the legs to the cabinet. Feed the line cord through the slot provided in the pedestal. Place the lightbox atop the pedestal and engage the holding brackets.

To remove glass, insert key and unlock. Lift glass up and swing bottom out. Loosen and lower the shipping bracket at top center of lightbox insert panel. Lift panel up and then swing out. Secure lightbox to cabinet with the four bolts and washers provided.

Connect all cables and secure with cable clamps provided. Inspect the following **before** plugging in line cord:

1. Check that cables are clear of moving parts.
2. Look for any disconnected wires.
3. Check switches for loose solder or other foreign matter.
4. Be certain all fuses are firmly seated.
5. Check the transformers for foreign matter across the terminals.
6. Be sure that the transformer wiring corresponds to the supply voltage.
7. Check the setting of the tilt switch on the underside of the playfield. One blade of this switch is free-floating with a weight on the end.

After levelling the machine, adjust the plumb-bob tilt (on left side of cabinet near front door) to the sensitivity desired.

**II. GAME ADJUSTMENTS**

**A. PLAYFIELD ADJUSTMENTS**

The game is shipped with adjustable posts in the position found to be suitable for the greatest number of players. Therefore the posts should not be changed unless the need is clearly evident.

The “conservative” (easier entry) position decreases playing time and scoring while the “liberal” position has the opposite effect.

**B. LIGHTBOX ADJUSTMENTS**

There are 32 switches on the control board which permit adjustment of the game parameters. These switches are contained in four packages of eight switches each, as shown below:

S1 – S8	S9 – S16	S17 – S24	S25 – S32
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**SWITCHES**

S1	S2	S3	S4		
S5	S6	S7	S8		Left Chute
S9	S10	S11	S12		Right Chute
					Center Chute

NOTE: FOR GERMAN GAMES ONLY, switches S5-S8 adjust the center chute and switches S9-S12 adjust the right chute.

**COIN CHUTE ADJUSTMENTS**

	OFF	ON	OFF	ON		
	OFF	OFF	OFF	OFF	.....	1/1
	OFF	OFF	OFF	ON	.....	1/2
	OFF	OFF	ON	OFF	.....	1/3
	OFF	OFF	ON	ON	.....	1/4
	OFF	ON	OFF	OFF	.....	1/5
	OFF	ON	OFF	ON	.....	1/6
	OFF	ON	ON	OFF	.....	1/7
	OFF	ON	ON	ON	.....	1/8
	ON	OFF	OFF	OFF	.....	1/9
	ON	OFF	OFF	ON	.....	2/1*
	ON	OFF	ON	OFF	.....	2/2*
	ON	OFF	ON	ON	.....	2/3*
	ON	ON	OFF	OFF	.....	2/4*
	ON	ON	OFF	ON	.....	2/5*
	ON	ON	ON	OFF	.....	1/1 and 2/3
	ON	ON	ON	ON	.....	3/1*

\*NO CREDITS UNTIL LAST COIN IS INSERTED

**SWITCH 13** ..... **EXTRA CREDITS**  
 ON ..... Adds 9 credits to center coin chute setting  
 OFF ..... No effect

NOTE: FOR GERMAN GAMES ONLY, Switch 13 adds 9 credits to the **right** coin chute setting, when ON.

**SWITCH 14** ..... **COIN CHUTE CONTROL**  
 ON ..... Left and Right Chutes Same  
 OFF ..... Left and Right Chutes Separate

NOTE: FOR GERMAN GAMES ONLY, Switch 14 controls the **left** and **center** coin chutes.

**SWITCHES**

**15 16** ..... **MAXIMUM CREDITS**  
 OFF OFF ..... 8  
 OFF ON ..... 10  
 ON OFF ..... 15  
 ON ON ..... 25

**SWITCH 17** ..... **BALLS PER GAME**  
 ON ..... 3  
 OFF ..... 5

**SWITCH 18** ..... **MATCH FEATURE**  
 ON ..... ON  
 OFF ..... OFF

**SWITCH 19** ..... **REPLAY LIMIT**  
 ON ..... Limits each player to one replay per game  
 OFF ..... No replay limit

**SWITCH 20** ..... **NOVELTY MODE**  
 ON ..... Playfield SPECIAL and EXTRA BALL features award 50,000 points and 5 knocks. High score, high game to date, and match features disabled.  
 OFF ..... Normal game mode.

NOTE: SWITCH 20 overrides SWITCH 21

**SWITCH 21** ..... **GAME MODE**  
 ON ..... Extra Ball  
 OFF ..... Replay

NOTE: IF SWITCH 21 is ON, the high game to date and match awards are disabled.

**SWITCH 22** ..... **PLAYFIELD SPECIAL**  
 ON ..... Awards Extra Ball  
 OFF ..... Awards Special

**SWITCHES**

**23 24** ..... **HIGH GAME TO DATE**  
 OFF OFF ..... Not displayed — no award  
 OFF ON ..... Displayed — No award  
 ON OFF ..... Displayed — awards 2 replays  
 ON ON ..... Displayed — awards 3 replays

**SWITCH 25** ..... **SOUND WHEN SCORING?**  
 ON ..... Yes  
 OFF ..... No

**SWITCH 26** ..... **REPLAY BUTTON TUNE?**  
 ON ..... Yes  
 OFF ..... No

**SWITCH 27** ..... **COIN SWITCH TUNE?**  
 ON ..... Yes  
 OFF ..... No

**SWITCH 28** ..... **CREDITS DISPLAYED?**  
 ON ..... Yes  
 OFF ..... No

**SWITCH 29** ..... **TILT PENALTY**  
 ON ..... Ball in play only  
 OFF ..... Game over

**SWITCH 30** ..... **ATTRACT FEATURES**  
 ON ..... ON  
 OFF ..... OFF

**SWITCH 31**  
 ON ..... LIBERAL  
 OFF ..... CONSERVATIVE

**SWITCH 32**  
 ON ..... LIBERAL  
 OFF ..... CONSERVATIVE

## LIBERAL-CONSERVATIVE ADJUSTMENTS

The two rightmost switches (31 & 32) on the control board allow liberal-conservative adjustments.

SWITCH 31 in the LIBERAL position adds ball-to-ball memory to the following:

- 1-2-3-4 rollover sequence.
- 'SPECIAL' light.
- Advance Multiplier When Lit hats.
- Center rollover when lit (between upper flippers).

SWITCH 32 in the LIBERAL position adds ball-to-ball memory to the two outside rollovers, completion of both lighting the spinning target. (rollovers with blue hats)

Recommended settings are Switch 31—LIBERAL, Switch 32—LIBERAL.

## C. ELECTRONIC SOUND ADJUSTMENTS

There are two switches on the SOUND BOARD which allow variation:

### SWITCH S1

OFF ..... SOUND MODE  
ON ..... TONE MODE

### SWITCH S2

OFF ..... NO ATTRACT TUNE  
ON ..... ATTRACT TUNE PLAYED EVERY 6 MINUTES

The volume control is on the bottom panel in the cabinet and is accessible from the front door opening.

## III. GAME OPERATION

With the line cord unplugged drop a coin into one of the chutes. It should be rejected. Plug the line cord ONLY into a properly grounded 3-wire receptacle of the correct voltage. Turn on the game by pressing the main switch located on the cabinet bottom near the front right corner.

After a five second delay the relays will pulse and the score displays will light and show all zeros. The credit display will show the number of credits remaining and the ball in play display will be blank. If the credits fail to light, turn off the game and inspect the ball roll assembly switch and the front door slam switch. They are both normally closed.

Five seconds after the score displays light, they will flash the High Game to Date score for one second. This cycle continues until the game is started. A number of playfield lights controlled by the MPU will be flashed to create an attract mode.

Insert coins into each chute and note that the correct number of credits are added on the credit display according to the information on the coin entrance plate. Press the replay button to reset the game; the ball should now be at the shooter. The first player score reads zero and flashes, indicating that that player is now scoring. The other player displays are blank and a one appears on the ball in play display. Additional players are indicated by a zero showing in each corresponding player display. After the maximum number of players has been added, or when the credit display reads zero, the replay button has no effect.

When the ball enters the outhole the bonus is scored, the ball is kicked to the shooter, and the display of the player now scoring begins to flash and continues to flash until a score is made. When the Shoot Again light is lit neither the player designation (flashing display) nor the ball in play display changes when the ball enters the outhole. Only one extra ball per ball in play can be given.

The number of balls per game is adjustable. When the last ball enters the outhole, the Game Over and Number to Match lights come on. A random number appears in the ball in play display and if this number matches the last two digits in any player's score a replay is awarded. At this time a High Game to Date score is periodically flashed in all player displays. When a score higher than this is achieved, an award dependent on switches 23 and 24 is given.

Tilting the game results in a penalty depending on the setting of switch 29. There is a normally closed switch on the front door and one on the ball roll assembly. If either of these switches opens from raising the front of the game or pounding the front door, the entire game is ended. The Game Over light comes on and for three seconds the entire switch matrix is inactive.

Additional players can be added at any time the first ball is still in play.

#### IV. BOOKKEEPING AND SELF-TEST

The circuitry in this game helps the operator perform many bookkeeping functions. The information is shown one step at a time on the first player score display while the step number is shown in the credit display. Pressing the play/test button on the front door begins the bookkeeping and advances it to the next step each time the button is pressed. If the button is not pressed within sixty seconds of each step, the game returns to the attract mode.

STEP NUMBER	INFORMATION SHOWN
00	NONE
01	TOTAL COINS THROUGH LEFT COIN CHUTE
02	TOTAL COINS THROUGH RIGHT COIN CHUTE
NOTE: IF CONTROL BOARD SWITCH 14 IS ON, STEPS 01 AND 02 ARE ADDED TOGETHER AND DISPLAYED IN STEP 01.	
03	TOTAL COINS THROUGH CENTER COIN CHUTE
NOTE: FOR GERMAN GAMES ONLY, STEP 02 DISPLAYS TOTAL COINS THROUGH CENTER COIN CHUTE AND STEP 03 DISPLAYS TOTAL COINS THROUGH RIGHT COIN CHUTE.	
04	TOTAL PLAYS
05	TOTAL REPLAYS
06	GAME PERCENTAGE (Replays ÷ total plays)
NOTE: IF STEP 06 IS RESET, STEPS 04 AND 05 MUST ALSO BE RESET.	
07	EXTRA BALLS
08	TILTS
09	SLAMS
10	Number of times High Game to Date has been incremented to reach its present value.
11	First High Score level
12	Second High Score level
13	Third High Score level
14	High Game to Date score
15	Average playing time per game PLAYER 1 shows minutes PLAYER 2 shows seconds
NOTE: IF STEP 15 IS RESET, STEP 04 MUST ALSO BE RESET.	

All bookkeeping information is checked against itself to insure that it is correct. If the data changes for any reason, such as a dead battery, that information will be flashing while it is displayed.

The data in any bookkeeping step may be reset to zero while it is displayed by pressing the replay button on the front door. The play/test button must then be pressed to enter the zero into memory.

#### TO CHANGE HIGH SCORE LEVELS OR HIGH GAME TO DATE SCORE:

1. Press the play/test button on the front door to advance to step 11. (1st high score level).
2. Reset the score by pressing the replay button on the front door.
3. Release the replay button then hold it in again. This causes the score to advance by 10,000's. Hold in the replay button until the desired score is shown.

Enter the new score into memory by pressing the play/test button and advancing to the next step.

To return to the attract mode at any time, actuate the slam switches, tilt switches, on-off power switch, or wait sixty seconds.



## SELF-TEST FEATURES:

The self-test routine begins with STEP 16. To bypass the bookkeeping functions and advance directly to self-test, press the Replay button in STEP 00.

### STEP NUMBER

16

#### LAMP TEST

Replays and coin lockout coil are pulsed, then all controlled lamps are turned on in sequence.

17

#### SOLENOID TEST

Each controlled solenoid is pulsed while its number appears on the status display.

#### SOLENOID ASSIGNMENTS

### NUMBER

### FUNCTION

1	Hole kicker
2	Roto Unit
3	Left Coin Chute counter*
4	Right Coin Chute counter*
5	Target Bank Reset
6	Not Used
7	Center Coin Chute counter*
8	Knocker
9	Outhole

\*Coin counters are optional and are **NOT** pulsed during SOLENOID TEST.

NOTE: FOR GERMAN GAMES ONLY, SOLENOID #4 is assigned to the **center** coin chute counter and SOLENOID #7 is assigned to the **right** coin chute counter.

18

#### SWITCH TEST

All switches on the switch matrix are inspected. If all switches are open, 99 is displayed on the status display. If one or more switches are closed, their numbers will appear on the status displays.

#### CAUTION: TURN POWER OFF BEFORE MAKING ANY SWITCH ADJUSTMENTS!

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#### DISPLAY TEST

Each digit of each display is turned on individually and all numbers 0-9 are sequenced.

20

#### MEMORY TEST

Each control board memory device is inspected. Any defective devices are indicated by part number on the PLAYER 1 score display. If all memory devices are okay, 99 is displayed on the status display.

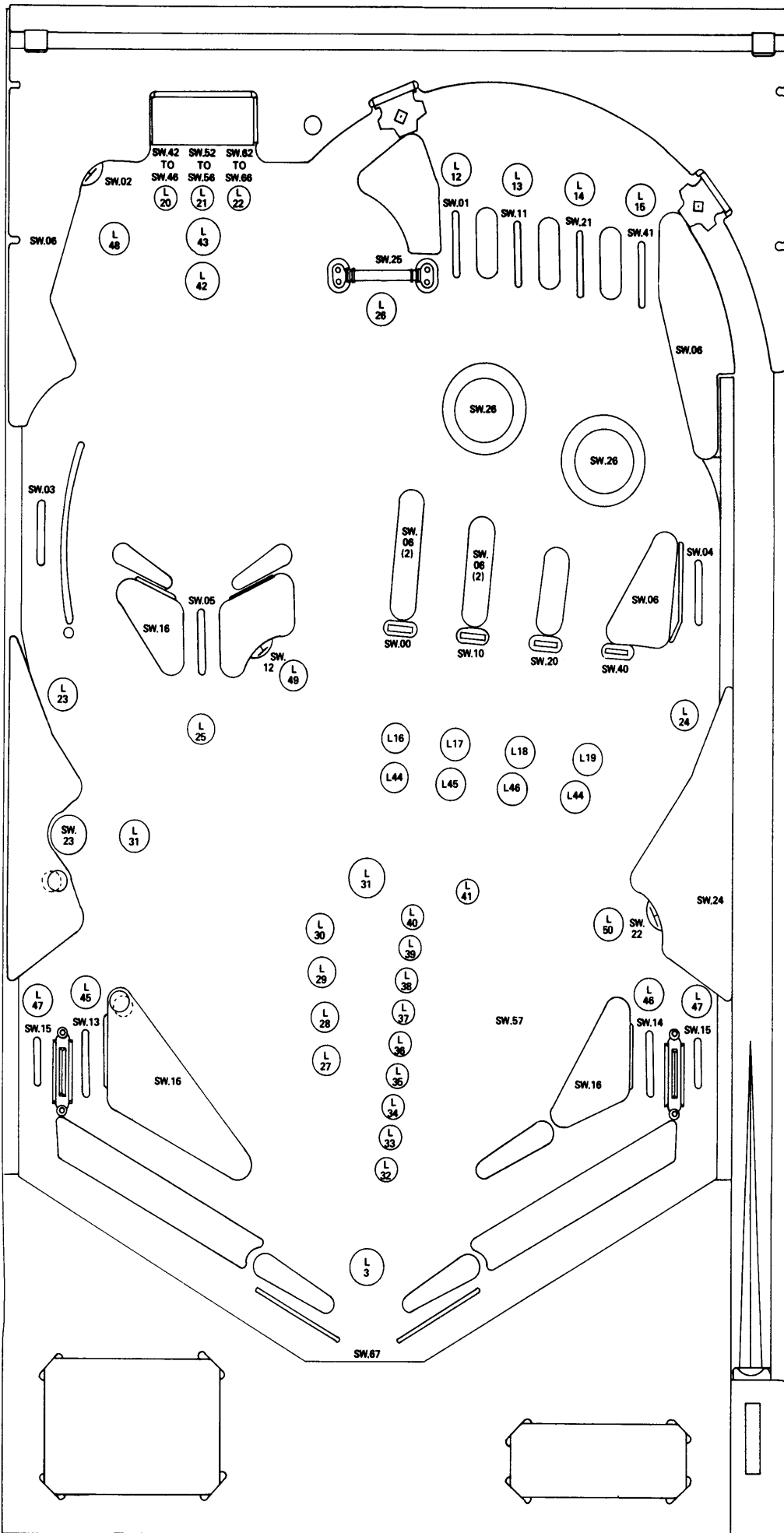
Any of the tests in steps 16 through 20 may be repeated any number of times by pressing the replay button immediately after the test is completed.

## V. OPTIONAL ELECTRO-MECHANICAL COIN COUNTERS

Electro-mechanical coin counters may be installed on the bottom board, if desired. Directly behind the seven position fuse block, solder lugs are provided which will connect the counters to the electronic circuitry.

1. Position the counter and secure it to the bottom board. Mounting holes are spotted in the bottom board for most standard 24 volt counters.
2. **CAUTION:** A 1N4004 diode must be connected across each counter with the cathode end connected to the solder lug with the RED-BLACK-BLACK wire.
3. Connect one counter lead to each of the two solder lugs provided for each counter.
4. The counter should increment once when the respective coin chute switch is closed.

# VI. SWITCH MATRIX AND LAMP LOCATION ASSIGNMENT



## SWITCH MATRIX AND LAMP LOCATION

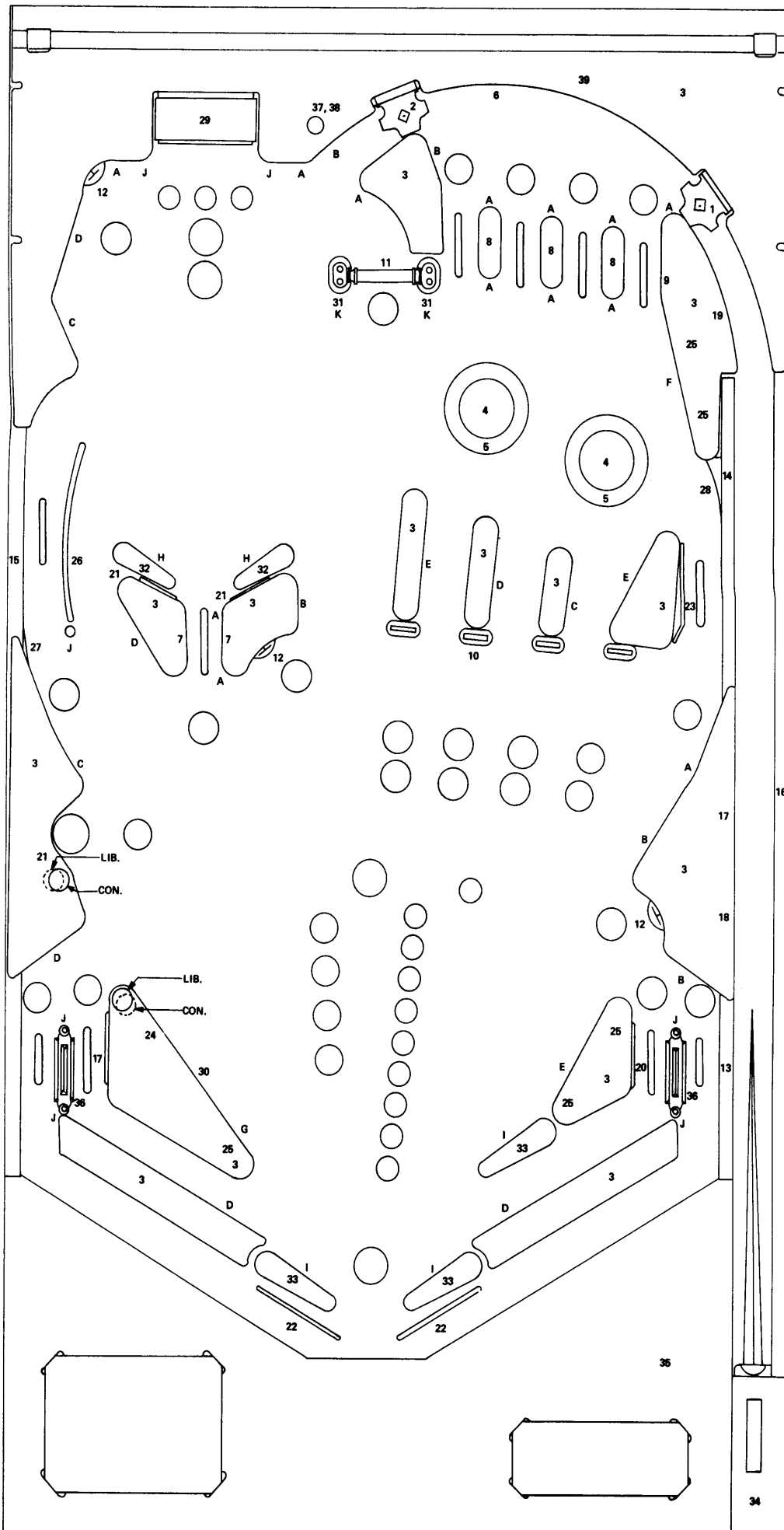
### SWITCHES ON MATRIX

SW. MATRIX NUMBER	SWITCH FUNCTION
00	#1 Drop Target.
01	#1 Rollover.
02	"A" Target.
03	Left Side Rollover.
04	Right Side Rollover.
05	Center Rollover.
06	10 Point Contacts. (7)
10	#2 Drop Target.
11	#2 Rollover.
12	"B" Target
13	Left Return Rollover
14	Right Return Rollover.
15	Left and Right Outside Rollovers.
16	50 Point Contacts. (3)
20	#3 Drop Target.
21	#3 Rollover.
22	"C" Target
23	Hole.
24	Ball Back Rollover.
25	Spin Target.
26	Pop Bumpers. (2)
40	#4 Drop Target.
41	#4 Rollover.
42-46	Left Roto Target.
52-56	Center Roto Target.
57	Tilt.
62-66	Right Roto Target.
67	Outhole.

### CPU CONTROLLED LAMPS

LAMP NUMBER	LAMP FUNCTION
0	Game Over Relay.
1	Tilt Relay.
2	Coin Lockout Coil.
3	Same Player Shoots Again. (Lightbox and Playfield)
4	1st Player.
5	2nd Player.
6	3rd Player.
7	4th Player.
10	High Game To Date.
11	Game Over.
12	#1 Top Rollover.
13	#2 Top Rollover.
14	#3 Top Rollover.
15	#4 Top Rollover.
16	#1 Advance Multiplier.
17	#2 Advance Multiplier.
18	#3 Advance Multiplier.
19	#4 Advance Multiplier.
20	Left Hit.
21	Center Hit.
22	Right Hit.
23	Left Side Rollover.
24	Right Side Rollover.
25	Center Rollover.
26	Spin Target.
27	2X
28	3X
29	4X
30	5X
31	20,000 and Scores Bonus.
32	1000 Bonus.
33	2000 Bonus.
34	3000 Bonus.
35	4000 Bonus.
36	5000 Bonus.
37	6000 Bonus.
38	7000 Bonus.
39	8000 Bonus.
40	9000 Bonus.
41	10,000 Bonus.
42	Special.
43	Extra Ball.
44	#1 and #4 Drop Targets.
45	#2 Drop Target and Left Return Rollover.
46	#3 Drop Target and Right Return Rollover.
47	Left and Right Outside Rollovers.
48	"A" Target.
49	"B" Target.
50	"C" Target.

## VII. PLAYBOARD INFORMATION



## PLAYBOARD INFORMATION

### RUBBER RINGS

A—A-10217	(13)
B—A-10218	(5)
C—A-10219	(3)
D—A-10220	(6)
E—A-10221	(3)
F—A-10222	(1)
G—A-10224	(1)
H—A-13149	(2)
I—A-13151	(3)
J—A-15705	(7)
K—A-17493	(2)

### PARTS LIST

1. A-19645 Ball Gate Right.
2. A-19646 Ball Gate Left.
3. D-19982 Plastic Shield Set.
4. Yellow Pop Bumpers A-10436 and A-15915 Cap Stamped in Red.
5. C-10433 Yellow Pop Bumper Skirt. (2)
6. D-19872 Arch Rail.
7. A-9393 Red Plastic Guide Rail. (2)
8. A-9394 Green Plastic Guide Rail. (3)
9. A-9395 Green Plastic Guide Rail. (1)
10. White Drop Target A-14485 in Blue.
11. A-20004 Spinning Target.
12. A-9383 Target.
13. B-19926 Bottom Center Wood Rail.
14. B-19927 Top Center Wood Rail.
15. B-19981 Left Outside Wood Rail.
16. C-19982 Right Outside Wood Rail.
17. A-4831 Ball Guide Rail. (2)
18. A-4832 Ball Guide Rail. (1)
19. A-4833 Ball Guide Rail. (1)
20. A-6612 Ball Guide Rail. (1)
21. A-6931 Ball Guide Rail. (3)
22. A-13798 Ball Snubber Rail. (2)
23. A-14687 Ball Guide Rail. (1)
24. A-17650 Ball Guide Rail. (1)
25. A-18070 Ball Guide Rail. (5)
26. A-18764 Ball Guide Rail. (1)
27. B-15629 Metal Flat Rail. (1)
28. B-19890 Metal Flat Rail. (1)
29. A-16962 Roto Unit Light Shield.
30. A-15836 Left Kicking Rubber.
31. C-17492 White Siamese Post. (2)
32. C-11241 White Flippers. (2)
33. C-13150 White Jumbo Flipper. (3)
34. C-9767 Ball Shooter Gage.
35. E-18940 Card Holder.
36. C-15648 Orange Rollover Guide. (2)
37. B-19873 End Post.
38. B-19874 End Post Cap.
39. B-19875 Support Post.

C-11561 Clear 1" High Post. (54)  
A-14487 Split Post Base. (6)  
A-14488 Split Post Cap. (6)

CON. = CONSERVATIVE.  
LIB. = LIBERAL.

## VIII. CABLE PLUG WIRE ASSIGNMENTS

The following lists provide wire color and function information for each wire of each connector in the game.

Wire colors are shown as numbers. Use the chart below to convert to colors.

0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Slate
9	White

For example, 688 is a BLUE-SLATE-SLATE striped wire.

Printed Circuit Board connectors are shown as AX-JX.

Use the following chart to determine which printed circuit board applies:

A1	Control Board
A2	Power Supply
A3	Driver Board
A4	Score Displays (4)
A5	Status Display
A6	Sound Board
A8	Pop Bumper Driver Board

For example, A3-J3 is connector J3 on the driver board.

There are eight male/female cable connectors in the game. These are shown as A7-JX/PX.

A1-J1			A1-J4		
PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	*688	+5VDC	1	*54	GROUND
2	*688	+5VDC	2	*688	+5VDC
3	—	SPARE	3	9	DS2
4	*54	GROUND	4	9	LD3
5	*54	GROUND	5	9	LD4
			6	9	LD2
			7	9	LD1
			8	—	SPARE
			9	—	SPARE
			10	—	SPARE
			11	—	SPARE
			12	—	SPARE
			13	—	SPARE
			14	—	SPARE
			15	—	SPARE
			16	—	SPARE
			17	—	SPARE
			18	—	KEY
			19	—	SPARE
			20	—	SPARE
			21	9	KNOCKER
			22	9	3RD COUNTER
			23	9	2ND COUNTER
			24	9	1ST COUNTER
			A	*54	GROUND (SPARE)
			B	*688	+5VDC (SPARE)
			C	9	DS1
			D	9	DS4
			E	9	DS3
			F	9	DS6
			H	9	DS5
			J	9	DS8
			K	9	DS7
			L	9	DS10
			M	9	DS9
			N	9	DS11
			P	9	DS12
			R	9	SOLENOID 5
			S	9	SOLENOID 1
			T	9	OUTHOLE
			U	9	SOLENOID 6
			V	—	(KEY)
			W	—	SPARE
			X	9	SOLENOID 2
			Y	9	SOUND 8
			Z	9	SOUND 4
			Ā	9	SOUND 2
			Ḃ	9	SOUND 1

A1-J2		
PIN	WIRE COLOR	FUNCTION
1	300	aA
2	311	bA
3	322	cA
4	333	dA
5	344	eA
6	355	fA
7	366	gA
8	377	hA
9	600	aB
10	611	bB
11	622	cB
12	633	dB
13	644	eB
14	655	fB
15	666	gB
16	677	hB
17	800	aC
18	811	bC
19	822	cC
20	833	dC
21	844	eC
22	855	fC
23	866	gC
24	877	hC

A1-J3		
PIN	WIRE COLOR	FUNCTION
1	400	D1
2	411	D2
3	422	D3
4	433	D4
5	444	D5
6	455	D6
7	466	D7
8	477	D8
9	700	D9
10	711	D10
11	722	D11
12	733	D12
13	744	D13
14	755	D14
15	766	D15
16	777	D16
17	—	SPARE

ALL WIRES #22 GAUGE UNLESS SPECIFIED\* (18 GA.)

A1-J5			A2-J3		
PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	677	RETURN 7	1	044	+60VDC
2	400	STROBE 0	2	—	(KEY)
3	411	STROBE 1	3	055	+42VDC
4	422	STROBE 2	4	54	GROUND
5	433	STROBE 3	5	54	GROUND
6	*444	STROBE 4	6	688	+5VDC (SPARE)
7	455	STROBE 5	7	688	+5VDC
8	666	RETURN 6			
9	477	STROBE 7			
10	700	SLAM SW.			
A1-J6			A3-J1		
PIN	WIRE COLOR	FUNCTION	PIN	WIRE COLOR	FUNCTION
1	400	STROBE 0	1	*54	GROUND
2	411	STROBE 1	2	*688	+5VDC
3	422	STROBE 2	3	9	DS2
4	433	STROBE 3	4	9	LD3
5	444	STROBE 4	5	9	LD4
6	455	STROBE 5	6	9	LD2
7	466	STROBE 6	7	9	LD1
8	477	STROBE 7	8	—	SPARE
9	9	GROUND	9	—	SPARE
10	600	RETURN 0	10	—	SPARE
11	611	RETURN 1	11	—	SPARE
12	622	RETURN 2	12	—	SPARE
13	633	RETURN 3	13	—	SPARE
14	644	RETURN 4	14	—	SPARE
15	655	RETURN 5	15	—	SPARE
16	666	RETURN 6	16	—	SPARE
17	677	RETURN 7	17	—	SPARE
18	688	+5VDC	18	—	SPARE
19	—	SPARE	19	—	(KEY)
A2-J1			20	—	SPARE
PIN	WIRE COLOR	FUNCTION	21	9	KNOCKER
1	(#16GA)	12VDC	22	9	3RD COUNTER
	200		23	9	2ND COUNTER
2	(#16GA)		24	9	1ST COUNTER
	54	GROUND	A	*54	GROUND (SPARE)
3	—	SPARE	B	*688	+5VDC (SPARE)
4	—	(KEY)	C	9	DS1
5	688	+5VDC	D	9	DS4
6	166	+5VDC offset	E	9	DS3
7	100	60V	F	9	DS6
8	111	60V RETURN	H	9	DS5
9	133	+8VDC offset	J	9	DS8
A2-J2			K	9	DS7
PIN	WIRE COLOR	FUNCTION	L	9	DS10
1	*688	+5VDC	M	9	DS9
2	*688	+5VDC	N	9	DS11
3	*54	GROUND	P	9	DS12
4	*54	GROUND	R	9	SOLENOID 5
5	—	(KEY)	S	9	SOLENOID 1
6	—	SPARE	T	9	OUTHOLE
			U	9	SOLENOID 6
			V	—	SPARE
			W	—	(KEY)
			X	9	SOLENOID 2
			Y	9	SOUND 8
			Z	9	SOUND 4
			A	9	SOUND 2
			B	9	SOUND 1

ALL WIRES #22 GAUGE UNLESS SPECIFIED\* (18 GA.)

A3-J2		
PIN	WIRE COLOR	FUNCTION
1	588	SHOOT AGAIN LAMP
2	500	PLAYER 1 LAMP
3	511	PLAYER 2 LAMP
4	533	PLAYER 4 LAMP
5	522	PLAYER 3 LAMP
6	*54	GROUND
7	577	HIGH GAME TO DATE LAMP
8	566	GAME OVER LAMP
9	—	SPARE
10	—	SPARE

A3-J3		
PIN	WIRE COLOR	FUNCTION
1	*54	SPARE GROUND
2	777	L43
3	755	L41
4	744	L40
5	544	L32
6	555	L33
7	577	L35
8	—	KEY
9	344	L24
10	355	L25
11	377	L27
12	366	L26
13	144	L16
14	155	L17
15	177	L19
16	166	L18
17	(16GA) 54	GROUND (L20-L27)
18	322	L22
19	333	L23
20	311	L21
21	300	L20
22	122	L14
23	133	L15
24	111	L13
25	100	L12
A	*54	SPARE GROUND
B	*688	+5VDC (SPARE)
C	*54	GROUND (L44-L51)
D	800	L44
E	844	L48
F	811	L45
H	855	L49
J	—	KEY
K	566	L34
L	—	SPARE
M	833	L47
N	877	L51
P	822	L46
R	866	L50

A3-J3 continued		
PIN	WIRE COLOR	FUNCTION
S	*54	GROUND (L40-L43)
T	766	L42
U	(16GA) 54	GROUND (L28-L35)
V	522	L30
W	533	L31
X	511	L29
Y	500	L28
Z	(16GA) 54	GROUND (L12-L19)
Ā	288	GAME OVER RELAY
B̄	277	TILT RELAY
C̄	588	SHOOT AGAIN LAMP

A3-J4		
PIN	WIRE COLOR	FUNCTION
1	700	L36
2	711	L37
3	733	L39
4	722	L38
5	*54	GROUND (L36-L39)
6	*211	SOLENOID 5
7	*266	SOLENOID 1
8	*244	OUTHOLE (SOL. 9)
9	*54	GROUND (SOL. 1, 9)
10	*54	GROUND (SOL. 2)
11	*54	GROUND (SOL. 6)
12	*233	SOLENOID 6
13	*200	SOLENOID 2
14	*54	GROUND (SOL. 5)
15	*54	SPARE GROUND

A3-J5		
PIN	WIRE COLOR	FUNCTION
1	733	SOUND 4
2	877	COIN LOCKOUT COIL
3	54	GROUND (KNOCKER)
4	688	+5VDC (SPARE)
5	722	SOUND 2
6	711	SOUND 1
7	744	SOUND 8
8	888	KNOCKER

A3-J6		
PIN	WIRE COLOR	FUNCTION
1	633	2ND COUNTER
2	644	3RD COUNTER
3	655	1ST COUNTER
4	54	GROUND

continued

ALL WIRES #22 GAUGE UNLESS SPECIFIED\* (18 GA.)

<b>1A4-J1</b>		
<b>PIN</b>	<b>WIRE COLOR</b>	<b>FUNCTION</b>
1	455	D6
2	444	D5
3	433	D4
4	422	D3
5	411	D2
6	400	D1
7	377	hA
8	366	gA
9	355	fA
10	344	eA
11	333	dA
12	322	cA
13	311	bA
14	300	aA
15	122	5VAC
16	144	5VAC RETURN
17	044	+60VDC
18	—	SPARE
19	54	GROUND

<b>3A4-J1</b>		
<b>PIN</b>	<b>WIRE COLOR</b>	<b>FUNCTION</b>
1	455	D6
2	444	D5
3	433	D4
4	422	D3
5	411	D2
6	400	D1
7	677	hB
8	666	gB
9	655	fB
10	644	eB
11	633	dB
12	622	cB
13	611	bB
14	600	aB
15	122	5VAC
16	144	5VAC RETURN
17	044	+60VDC
18	—	SPARE
19	54	GROUND

<b>2A4-J1</b>		
<b>PIN</b>	<b>WIRE COLOR</b>	<b>FUNCTION</b>
1	733	D12
2	722	D11
3	711	D10
4	700	D9
5	477	D8
6	466	D7
7	377	hA
8	366	gA
9	355	fA
10	344	eA
11	333	dA
12	322	cA
13	311	bA
14	300	aA
15	122	5VAC
16	144	5VAC RETURN
17	044	+60VDC
18	—	SPARE
19	54	GROUND

<b>4A4-J1</b>		
<b>PIN</b>	<b>WIRE COLOR</b>	<b>FUNCTION</b>
1	733	D12
2	722	D11
3	711	D10
4	700	D9
5	477	D8
6	466	D7
7	677	hB
8	666	gB
9	655	fB
10	644	eB
11	633	dB
12	622	cB
13	611	bB
14	600	aB
15	122	5VAC
16	144	5VAC RETURN
17	044	+60VDC
18	—	SPARE
19	54	GROUND

ALL WIRES #22 GAUGE UNLESS SPECIFIED\* (18 GA.)



A5-J1		
PIN	WIRE COLOR	FUNCTION
1	—	SPARE
2	777	D16
3	766	D15
4	—	SPARE
5	755	D14
6	744	D13
7	822	cC
8	811	bC
9	877	hC
10	866	gC
11	855	fC
12	844	eC
13	833	dC
14	800	aC
15	155	3vAC
16	177	3vAC RETURN
17	055	+42vDC
18	688	+5vDC
19	54	GROUND

A6-J1		
PIN	WIRE COLOR	FUNCTION
1	200	+12vDC
2	—	SPARE
3	333	AC
4	344	AC RETURN
5	688	+5vDC
6	54	GROUND
7	011	SPEAKER OUTPUT
8	711	SOUND 1
9	722	SOUND 2
10	—	SPARE
11	733	SOUND 4
12	744	SOUND 8

A7-J1/P1		
PIN	WIRE COLOR	FUNCTION
1	677	RETURN 7
2	500	STROBE 0
3	511	STROBE 1
4	533	STROBE 3
5	522	STROBE 2
6	544	STROBE 4
7	555	STROBE 5
8	—	SPARE
9	—	SPARE
10	700	ANTI-CHEAT SW.
11	9	ANTI-CHEAT SW. (GND)
12	*54	EARTH GROUND

A7-J2/P2		
PIN	WIRE COLOR	FUNCTION
1	*066	COIN CHUTE LIGHTS
2	*000	COIN CHUTE LIGHTS RETURN
3	*055	LEFT FLIPPER SWITCH
4	*388	FLIPPER SWITCH RETURN
5	222	+24vDC
6	877	COIN LOCKOUT

A7-J3/P3		
PIN	WIRE COLOR	FUNCTION
1	*122	5VAC
2	*144	5VAC RETURN
3	155	3VAC
4	177	3VAC RETURN
5	*54	LAMP GROUND
6	—	SPARE
7	(16GA) 077	6.3 VAC
8	(16GA) 000	6.3 VAC RETURN
9	*255	+6vDC

A7-J4/P4		
PIN	WIRE COLOR	FUNCTION
1	*54	GROUND
2	*54	GROUND
3	*54	GROUND
4	*54	GROUND
5	*54	GROUND
6	*54	GROUND
7	*54	GROUND
8	*54	GROUND
9	*54	GROUND
10	*54	GROUND
11	*54	GROUND
12	—	SPARE

A7-J5/P5		
PIN	WIRE COLOR	FUNCTION
1	(16GA) 255	+6 VDC
2	(16GA) 54	GROUND
3	(16GA) 54	GROUND
4	(16GA) 54	GROUND
5	(16GA) 54	GROUND
6	(16GA) 222	+24VDC
7	*388	FLIPPER SW. RETURN
8	*388	FLIPPER SW. RETURN
9	*055	LEFT FLIPPER SWITCH
10	*044	RIGHT FLIPPER SWITCH
11	(16GA) 066	6.3VAC
12	(16GA) 000	6.3VAC RETURN
13	*277	25VAC
14	*288	25VAC RETURN
15	—	SPARE

ALL WIRES #22 GAUGE UNLESS SPECIFIED\* (18 GA.)

**A7-J6/P6**

PIN	WIRE COLOR	FUNCTION
1	011	MATCH LIGHT
2	022	TILT LIGHT
3	033	BALL IN PLAY LIGHT
4	—	SPARE

**A7-J7/P7**

PIN	WIRE COLOR	FUNCTION
1	400	STROBE 0
2	433	STROBE 3
3	477	STROBE 7
4	666	RETURN 6
5	677	RETURN 7
6	(#16GA) 54	GROUND
7	—	SPARE
8	777	AC INPUT
9	788	AC INPUT

**A7-J8/P8**

PIN	WIRE COLOR	FUNCTION
1	022	SPEAKER
2	*54	GROUND
3	*54	EARTH GROUND
4	—	SPARE

**1A8-J1**

PIN	WIRE COLOR	FUNCTION
1	*188	COIL #1
2	*54	GROUND
3	—	KEY
4	077	SWITCH #1
5	688	+5VDC
6	9	DC GROUND

**2 A8-J1**

PIN	WIRE COLOR	FUNCTION
1	*488	COIL #2
2	*54	GROUND
3	—	KEY
4	011	SWITCH #2
5	688	+5VDC
6	9	DC GROUND

ALL WIRES #22 GAUGE UNLESS SPECIFIED\* (18 GA.)

## IX. PARTS LIST

### CONTROL BOARD

PART NUMBER	DESCRIPTION
R6502-13	CPU—(U1)
R6532-18	RIOT—(U4, U5, U6)
R3273-12	ROM—(U2)
R3272-12	ROM—(U3)
P5101L-1	RAM/CMOS—(Z5)
640361-3	SOCKET—DIP, 24 PIN
SN7402N	IC—2 INPUT—"NOR"—(Z8)
SN7400N	IC—2 INPUT—"NAND"—(Z9, Z13, Z14)
SN7432N	IC—2 INPUT—"OR"—(Z15)
SN7404N	IC—HEX INVERTER—(*)
SN7416N	IC—HEX INVERTER—OC/HV—(Z29, Z30)
SN7417N	IC—HEX BUFFER—OC—(Z32)
SN74LS139N	IC—2 TO 4 DECODER—(Z28)
SN74175N	IC—"D" FLIP FLOP—(Z18, Z20, Z22)
SN7448N	IC—4 TO 7 DECODER—(Z19, Z21, Z23)
SN74154N	IC—4 TO 16 DECODER—(Z25, Z33)
SN7474N	IC—DUAL FLIP FLOP—(Z2)
SCL4528B	CMOS IC—DUAL 1 SHOT—(Z1)
SCL4081B	CMOS IC—QUAD 2 INPUT "AND"—(Z4)
1N4148	DIODE—GP—(CR1-CR35)
1N5225B or 1N5987B	ZENER DIODE—3.0V, 5%—(VR1)
326R10-002	BATTERY—3.6V—(BAT. 1)
333R08-001	CRYSTAL—3.579545 MHZ—(Y1)
131R06-001	SPACER, CORK
MPS A70	TRANSISTOR—PNP—(Q1, Q4)
341R31-005	DIP SWITCH PACK—8 POS.—(SW1-SW4)
	RESISTOR—62 $\Omega$ , 1/4W, 5%—(R7)
	CAPACITOR—.01 MICROFARAD, 50V—(C2, C4-C13, C15-C24, C26-C29, C31-C35)
	CAPACITOR—.1 MICROFARAD, 50V—(C3, C14, C25, C30)
	CAPACITOR—100 MICROFARAD, 10V—(C1)
	RESISTOR—3.0K $\Omega$ , 1/4W, 5%—(R1, R6, R11-24, R42, R45, R46, R48, R51-R57)
	RESISTOR—2.0K $\Omega$ , 1/4W, 5%—(R4, R5, R44)
	RESISTOR—180 $\Omega$ , 1/4W, 5%—(R8, R50)
	RESISTOR—1K $\Omega$ , 1/4W, 5%—(R9)
	RESISTOR—2.7M $\Omega$ , 1/4W, 5%—(R10)
	RESISTOR—620 $\Omega$ , 1/4W, 5%—(R25-R33)
	RESISTOR—4.7K $\Omega$ , 1/4W, 5%—(R2, R34-R41)
	RESISTOR—5.6K $\Omega$ , 1/4W, 5%—(R3, R43, R49)
	RESISTOR—24K $\Omega$ , 1/4W, 5%—(R47)
	CAPACITOR—10 MICROFARAD, 10V—(C36)
2N4400	TRANSISTOR—MOTOROLA—(Q2, Q3)
SN74LS05N	IC—OPEN COLLECTOR INVERTER—(Z10)
SN74LS04N	IC—HEX INVERTER—(Z7)
MM74C04 or SCL 4069B	IC—CMOS—(Z36)
640379-3	SOCKET—40 PIN—(TC1)
*(Z3, Z11, Z12, Z16, Z17, Z24, Z26, Z27, Z34, Z35)	

## MASTER DRIVER BOARD

PART NUMBER	DESCRIPTION
43-03-4	INSULATOR—THERMALLOY
2N6043	TRANSISTOR—NPN—(Q53, Q59, Q60)
2N3055	TRANSISTOR—NPN—(Q58, Q62, Q64)
MPS-U45	TRANSISTOR—NPN—(Q1-Q4, Q13-Q32, Q45-Q52, Q54-Q57, Q61, Q63)
MPS-A13	TRANSISTOR—NPN—(Q5-Q12, Q33-Q44)
SN74175N	IC—QUAD "D" FLIP-FLOP—(Z1-Z12)
SN7404N	IC—HEX INVERTER—(Z13)
1N4148	DIODE—SILICON—(CR1-CR6)
	CAPACITOR—.01 MICROFARAD, 50V—(C2-C19)
	CAPACITOR—10 MICROFARAD, 10V—TANTALUM—(C1)
	RESISTOR—1000 $\Omega$ , 1/4W, 5%—(R1-R53, R61, R55, R56, R58, R59)
	RESISTOR—9.1 $\Omega$ , 1W, 5%—(R54, R57, R60)

### POWER SUPPLY

PART NUMBER	DESCRIPTION
	HEATSINK MOUNTING PLATE
	SPACER—6—32 THREAD X 5/32
	SPACER—6—32 THREAD X 1/8
1N4004	DIODE—(CR1-CR4)
1N4759A	ZENER DIODE—62V, 1W, 5%—(CR5)
1N4746A	ZENER DIODE—18V, 1W, 5%—(CR6)
1N3445	ZENER DIODE—8.2V, 2W, 10%—(CR7)
1N4734A	ZENER DIODE—5.6V, 1W, 5%—(CR8)
SW4F013	TRANSISTOR—NPN—NATIONAL—(Q1)
2N5550	TRANSISTOR—NPN—(Q2)
PMD10K40	TRANSISTOR—LAMBDA—(Q3)
S107Y1	SILICON CONTROLLED RECTIFIER—(SCR1)
UA723CN	IC—14 PIN DIP—(IC1)
CM4-22	DIODE—LIGHT EMITTING—(LED1, LED2)
115R501A	POTENTIOMETER—500 $\Omega$ —CTS—(POT1)
	RESISTOR—1.3K $\Omega$ , 5W, 10%—(R1)
	RESISTOR—1K $\Omega$ , 1/4W, 5%—(R2, R9)
	RESISTOR—12K $\Omega$ , 1/2W, 5%—(R3)
	RESISTOR—33 $\Omega$ , 1W, 5%—(R4)
	RESISTOR—510 $\Omega$ , 1/4W, 5%—(R6, R13)
	RESISTOR—3.9K $\Omega$ , 1/4W, 5%—(R7)
	RESISTOR—10K $\Omega$ , 1/4W, 5%—(R8)
	RESISTOR—30 $\Omega$ , 2W, 5%—(R10)
	RESISTOR—2.2K $\Omega$ , 1/4W, 5%—(R11)
	RESISTOR—.33 $\Omega$ , 5W, 10%—(WIRE WOUND)—(R12)
	RESISTOR—10K $\Omega$ , 1/2W, 5%—(R5)
	RESISTOR—2K $\Omega$ , 1/4W, 5%—(R14)
	RESISTOR—100 $\Omega$ , 1/4W, 5%—(R15)
	RESISTOR—20 $\Omega$ , 1/4W, 5%—(R16)
	RESISTOR—620 $\Omega$ , 1/2W, 5%—(R17)
	RESISTOR—180 $\Omega$ , 1/4W, 5%—(R18)
	CAPACITOR—470 MICROFARAD, 100V—(C1)
	CAPACITOR—47 MICROFARAD, 100V—(C2)
	CAPACITOR—1000 PICOFARAD, 50V—(C3)
	CAPACITOR—470 MICROFARAD, 10V—(C4)
	CAPACITOR—.2 MICROFARAD, 16V, $\begin{matrix} +80\% \\ -20\% \end{matrix}$ —(C5)
	TURRET TERMINAL—(E1-E6)
	TURRET TERMINAL—(TP1-TP5, CR5)
1NS-3	INSULATOR
DM111	INSULATOR
GS2-3	EYELET
	CONNECTOR—6 PIN—MOLEX—(J2)
	CONNECTOR—7 PIN—MOLEX—(J3)
	CONNECTOR—9 PIN—MOLEX—(J1)
	HEAT SINK—THERMALLOY

**SOUND BOARD**

<b>PART NUMBER</b>	<b>DESCRIPTION</b>
	RESISTOR—2.7K $\Omega$ , 1/4W, 5%—(R1, R2, R7)
	RESISTOR—2.7 $\Omega$ , 1/4W, 5%—(R9)
	RESISTOR—6.8K $\Omega$ , 1/4W, 5%—(R10)
	RESISTOR—430 $\Omega$ , 1/2W, 5%—(R11)
	RESISTOR—2.7M $\Omega$ , 1/4W, 5%—(R3)
	RESISTOR—1.8M $\Omega$ , 1/4W, 5%—(R4)
	RESISTOR—22.1K $\Omega$ , 1/4W, 1%—(R12)
	RESISTOR—10K $\Omega$ , 1/4W, 5%—(R6)
	RESISTOR—5.6K $\Omega$ , 1/4W, 5%—(R8)
	RESISTOR—270K $\Omega$ , 1/4W, 5%—(R5)
	RESISTOR—47K $\Omega$ , 1/4W, 5%—(R13)
	CAPACITOR—0.01 MICROFARAD, 100V, 20%—KEMET—(C1-C5)
	CAPACITOR—47 MICROFARAD, 25V—(C7, C9)
	CAPACITOR—470 MICROFARAD, 25V—(C8)
	CAPACITOR—0.1 MICROFARAD, 100V, 20%—KEMET—(C6, C10, C13, C17)
	CAPACITOR—10 PICO FARAD, 1000V, 5%—(C11)
	CAPACITOR—100 PICO FARAD, 250V, 20%—(C12)
	CAPACITOR—0.047 MICROFARAD, 25V, 20%—(C15)
	CAPACITOR—0.0033 MICROFARAD, 50V, 20%—(C16)
	CAPACITOR—10 MICROFARAD, 25V—(C14)
R6503	IC—CPU—(U1)
R6530C:R3016-11	IC—ROM/RAM/I/O—(U2)
SSS1408-6P	IC—DAC—(U3)
HM7643-5	IC—PROM—(U4)
NE555P	IC—TIMER—(U8)
SN7404N	IC—INVERTER—(U6, U7)
LM380N	IC—AMPLIFIER—(U5)
1N4004	DIODE—(CR1-CR4)
1N4742A	ZENER DIODE—12V, 1W, 5%—(CR5)
1N270	DIODE—(CR6)
76SB02	2 POSITION DIP SWITCH—(S1, S2)
EVQ-PAR-11K	PUSH BUTTON SWITCH—(S3)
640359-1	SOCKET, 18 PIN (PROM SOCKET)

**POP BUMPER DRIVER BOARD**

<b>PART NUMBER</b>	<b>DESCRIPTION</b>
	CAPACITOR—47 MICROFARAD, 10V—(C4)
	CAPACITOR—0.01 MICROFARAD, 100V, 20%—(C1, C2)
	CAPACITOR—4.7 MICROFARAD, 10V, 10%—(C3)
	RESISTOR—1.5K $\Omega$ , 1/4W, 5%—(R1)
	RESISTOR—12K $\Omega$ , 1/4W, 5%—(R2)
	RESISTOR—220 $\Omega$ , 1/4W, 5%—(R3)
	DIODE—(CR1, CR2)
1N4148	IC—(Z1)
SN74121N	IC—(Z2)
SN7416N	IC—(Z2)
PMD10K60	TRANSISTOR—LAMBDA—(Q1)
09-65-1061	CONNECTOR—(J1)

**6-DIGIT DISPLAY  
(SPRAGUE DRIVERS)**

QUANTITY	NUMBER	DESCRIPTION
1	RC20GF103	Resistor—10K $\Omega$ , 1/2W, 5% (R1)
1	TE1400	Capacitor—1 Microfarad, 100V (C3)
2	C320C103MIR5CA	Capacitor—0.01 Microfarad, 100V—Kemet (C1, C2)
2	UDN6118A	IC—Fluorescent Display Driver—Sprague (Z1, Z2)
1	6-JS-01	6-digit Display Tube—Futaba (DS1)

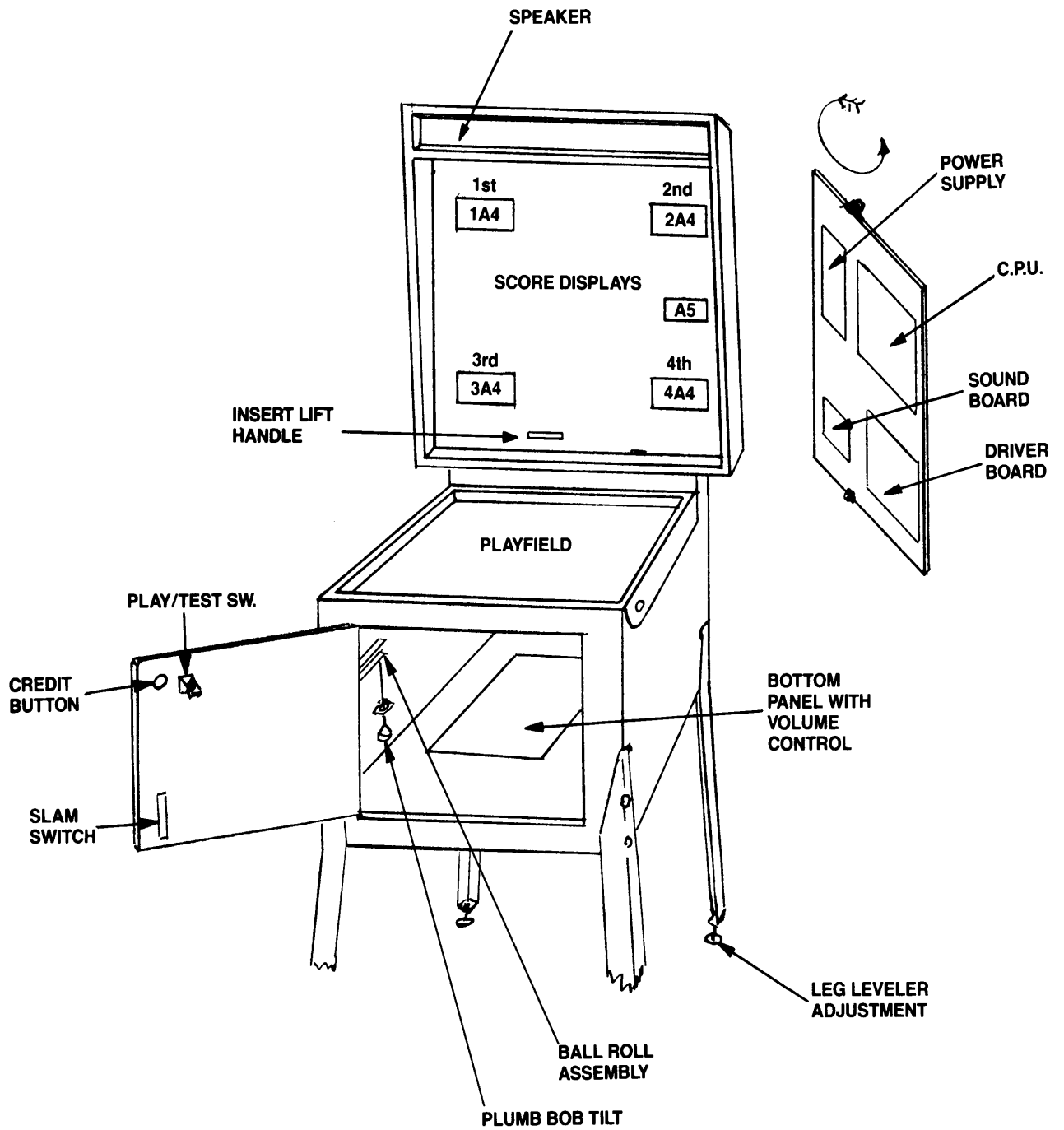
**4-DIGIT DISPLAY**

QUANTITY	NUMBER	DESCRIPTION
1	TE1400	Capacitor—1 Microfarad, 100V—Sprague (C-1)
2	C320C103MIR5CA	Capacitor—0.01 Microfarad, 100V—Kemet (C2, C3)
2	UDN6118A	IC—Fluorescent Display Driver—Sprague (Z2, Z3)
1	SN7432N	IC—Quad OR Gate—T.I. (Z1)
1	4-LT-11	4-digit Display Tube—Futaba (DS1)
2	721R01-113	Resistor—4.7K $\Omega$ , 1/4W, 5% (R1, R2)

**X. WIRING AND SCHEMATIC DIAGRAMS**

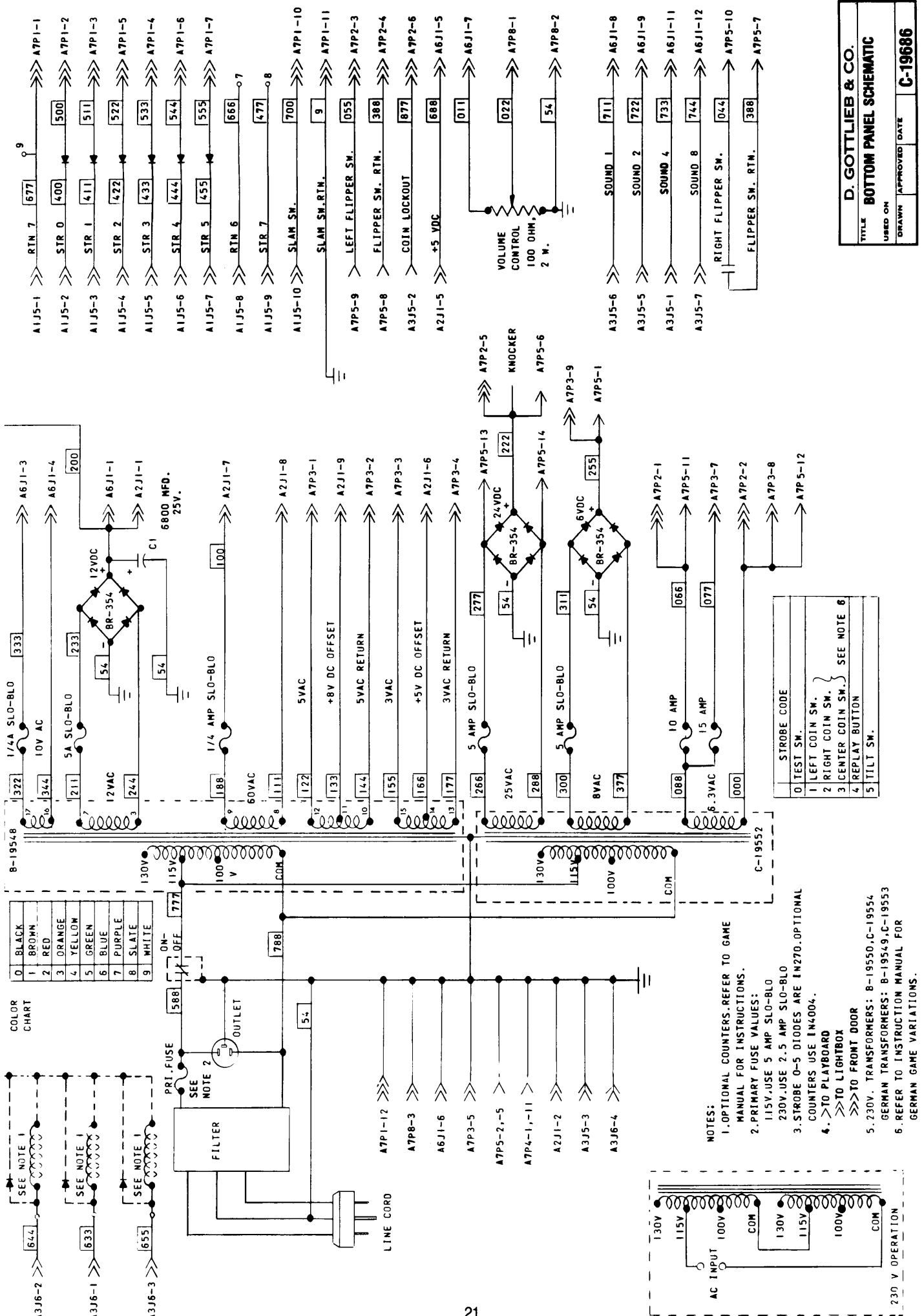
- A. COMPONENT LOCATION DIAGRAM
- B. BOTTOM BOARD SCHEMATIC
- C. BOTTOM BOARD AND LIGHTBOX SCHEMATIC
- D. SWITCH MATRIX ASSIGNMENT DIAGRAM
- E. PLAYBOARD SOLENOID SCHEMATIC DIAGRAM
- F. PLAYBOARD ILLUMINATION SCHEMATIC DIAGRAM
- G. LIGHTBOX CABLE SCHEMATIC DIAGRAM
- H. CONTROL BOARD COMPONENT LOCATION DIAGRAM
- I. CONTROL BOARD SCHEMATIC DIAGRAM 1 OF 2
- J. CONTROL BOARD SCHEMATIC DIAGRAM 2 OF 2
- K. DRIVER BOARD COMPONENT LOCATION DIAGRAM
- L. DRIVER BOARD SCHEMATIC DIAGRAM
- M. 6 DIGIT DISPLAY SCHEMATIC AND COMPONENT LOCATION DIAGRAM
- N. 4 DIGIT DISPLAY SCHEMATIC AND COMPONENT LOCATION DIAGRAM
- O. POWER SUPPLY SCHEMATIC DIAGRAM
- P. SOUND BOARD SCHEMATIC DIAGRAM
- Q. SOUND BOARD COMPONENT LOCATION DIAGRAM
- R. POP BUMPER DRIVER BOARD SCHEMATIC DIAGRAM

**X. A. COMPONENT LOCATION DIAGRAM**



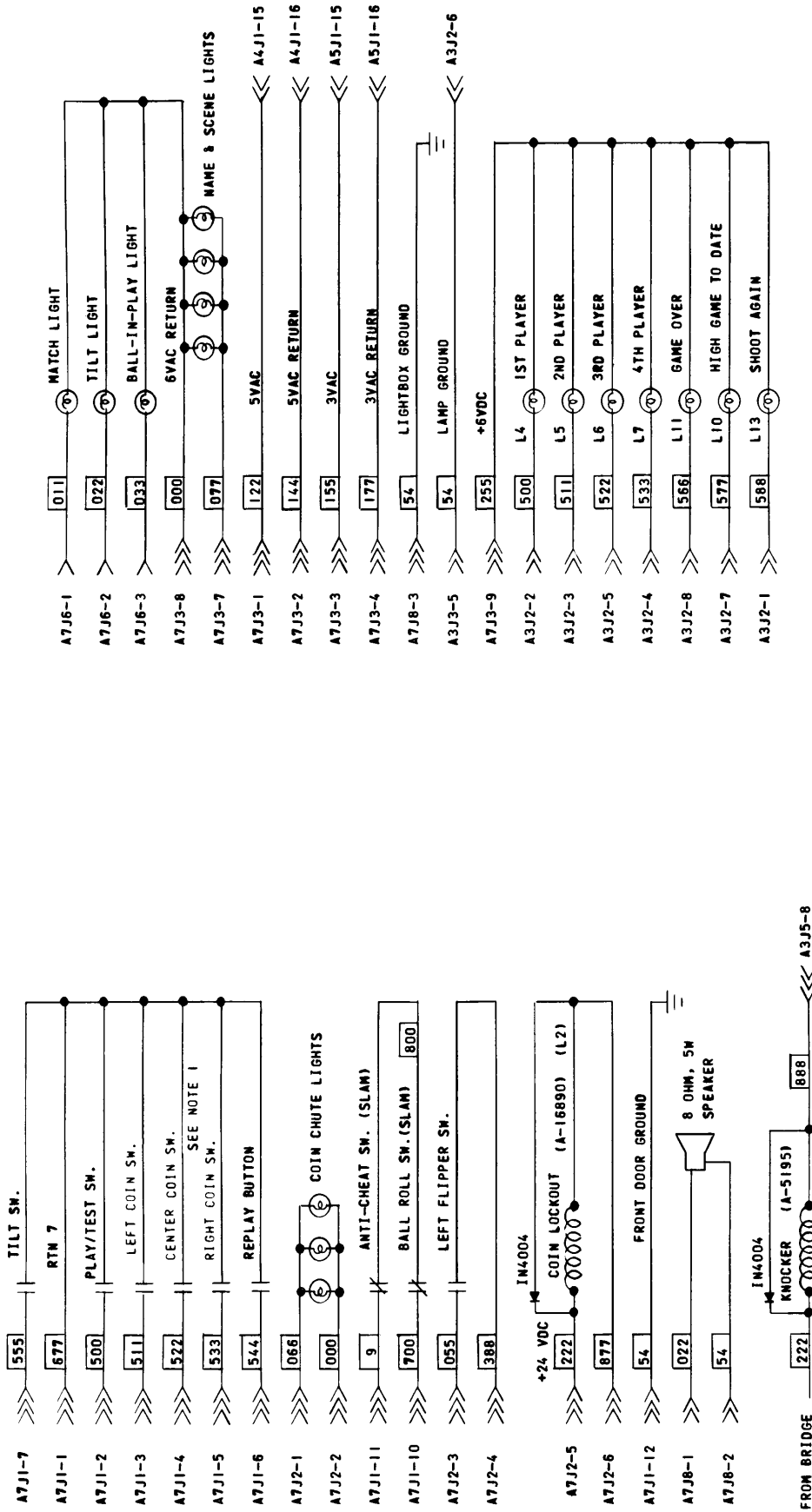


# X. B. BOTTOM BOARD PANEL SCHEMATIC



<b>D. GOTTLIEB &amp; CO.</b>	
<b>TITLE BOTTOM PANEL SCHEMATIC</b>	
USED ON	DRAWN
APPROVED	DATE
<b>C-19686</b>	

X. C. BOTTOM BOARD & LIGHTBOX SCHEMATIC

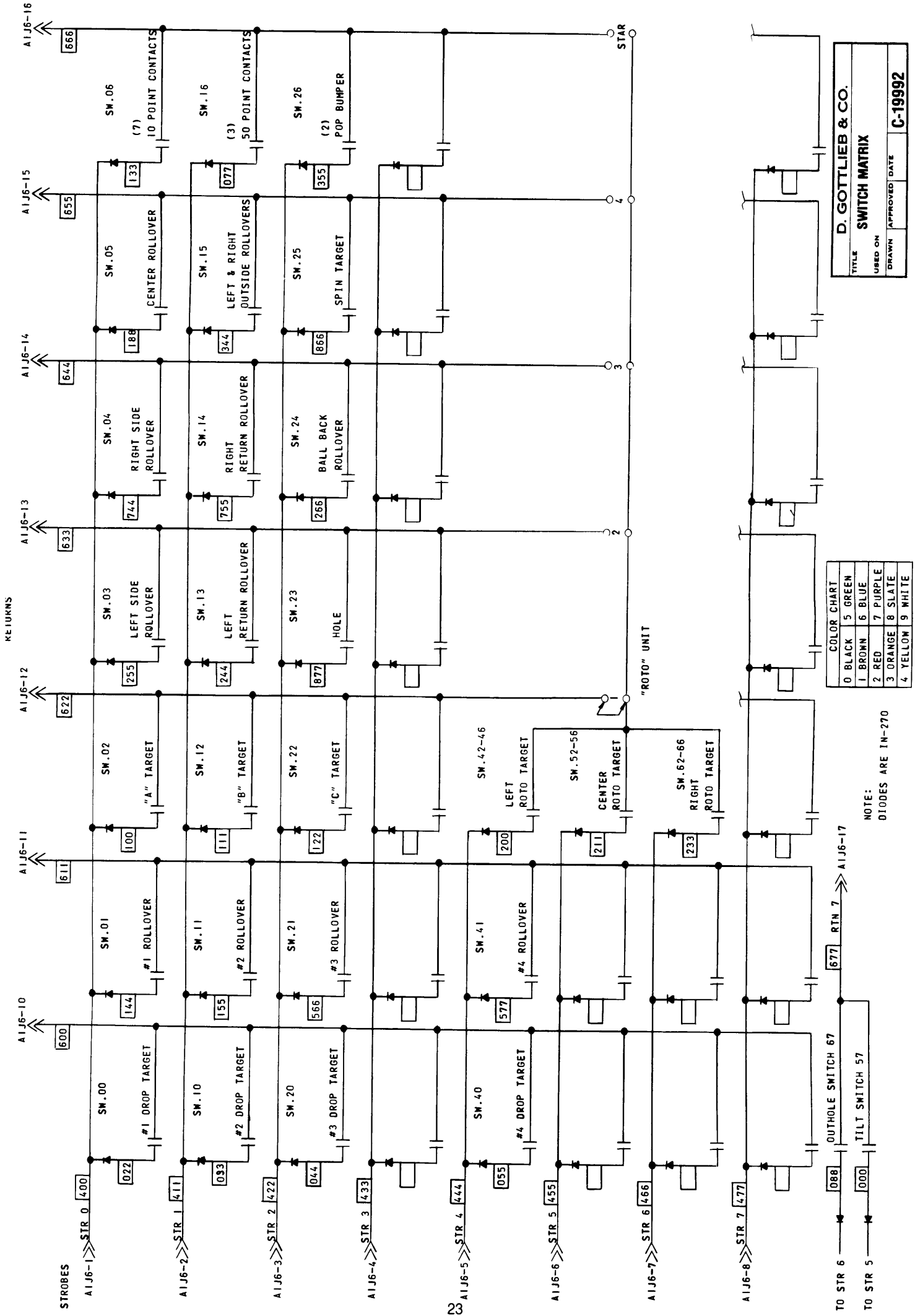


NOTE 1: REFER TO INSTRUCTION MANUAL FOR GERMAN GAME VARIATIONS.

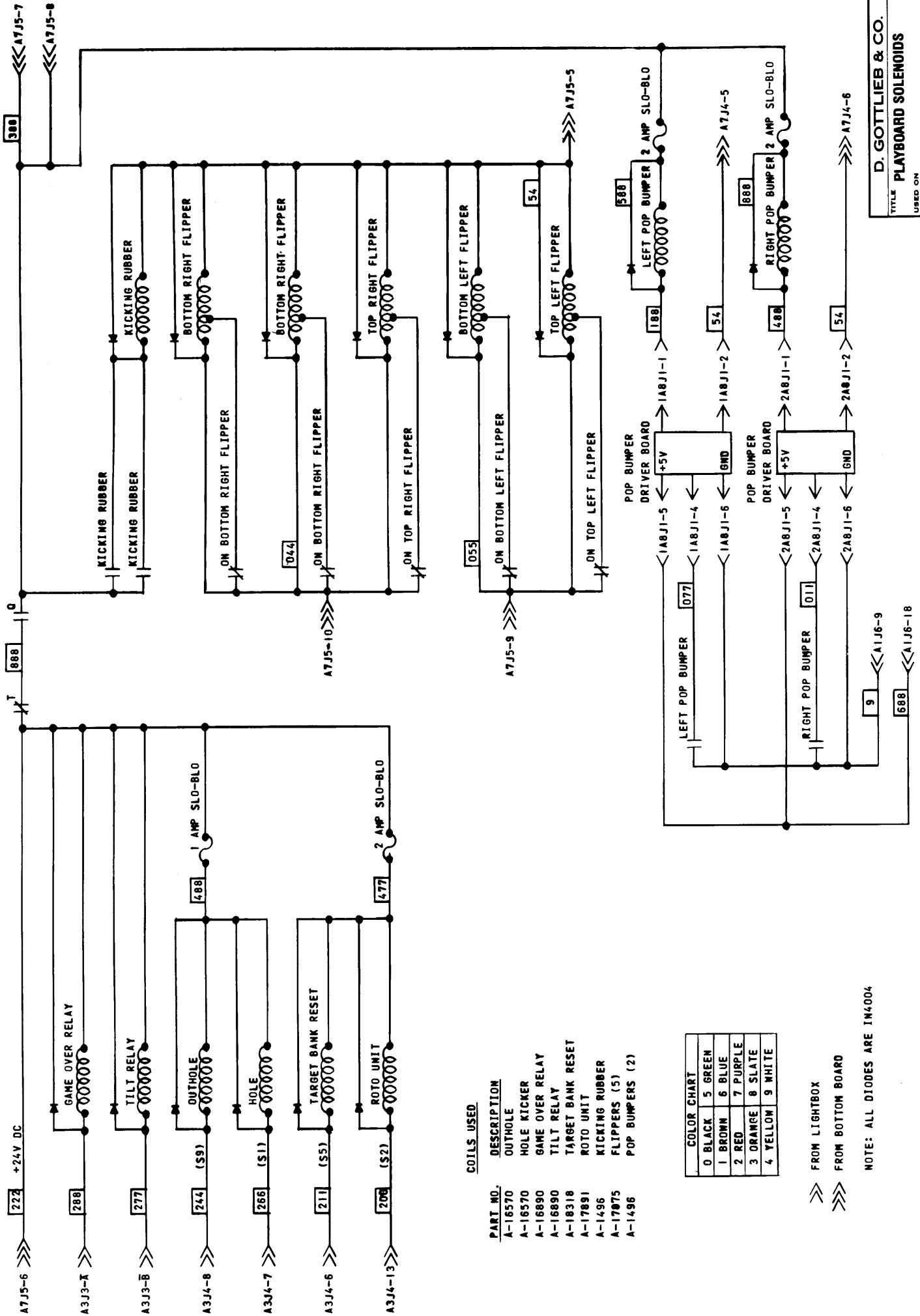
- > FROM PLAYBOARD
- >> FROM LIGHTBOX
- >>> FROM BOTTOM BOARD

D. GOTTLIEB & CO.	
TITLE BOTTOM BOARD & LIGHTBOX	
USED ON SCHEMATIC	
DRAWN	APPROVED DATE
	C-19690

# X. D. SWITCH MATRIX



X. E. PLAYBOARD SOLENOIDS



COILS USED

PART NO.	DESCRIPTION
A-16570	OUTHOLE
A-16570	HOLE KICKER
A-16890	GAME OVER RELAY
A-16890	TILT RELAY
A-18318	TARGET BANK RESET
A-17891	ROTO UNIT
A-1496	KICKING RUBBER
A-17875	FLIPPERS (5)
A-1496	POP BUMBERS (2)

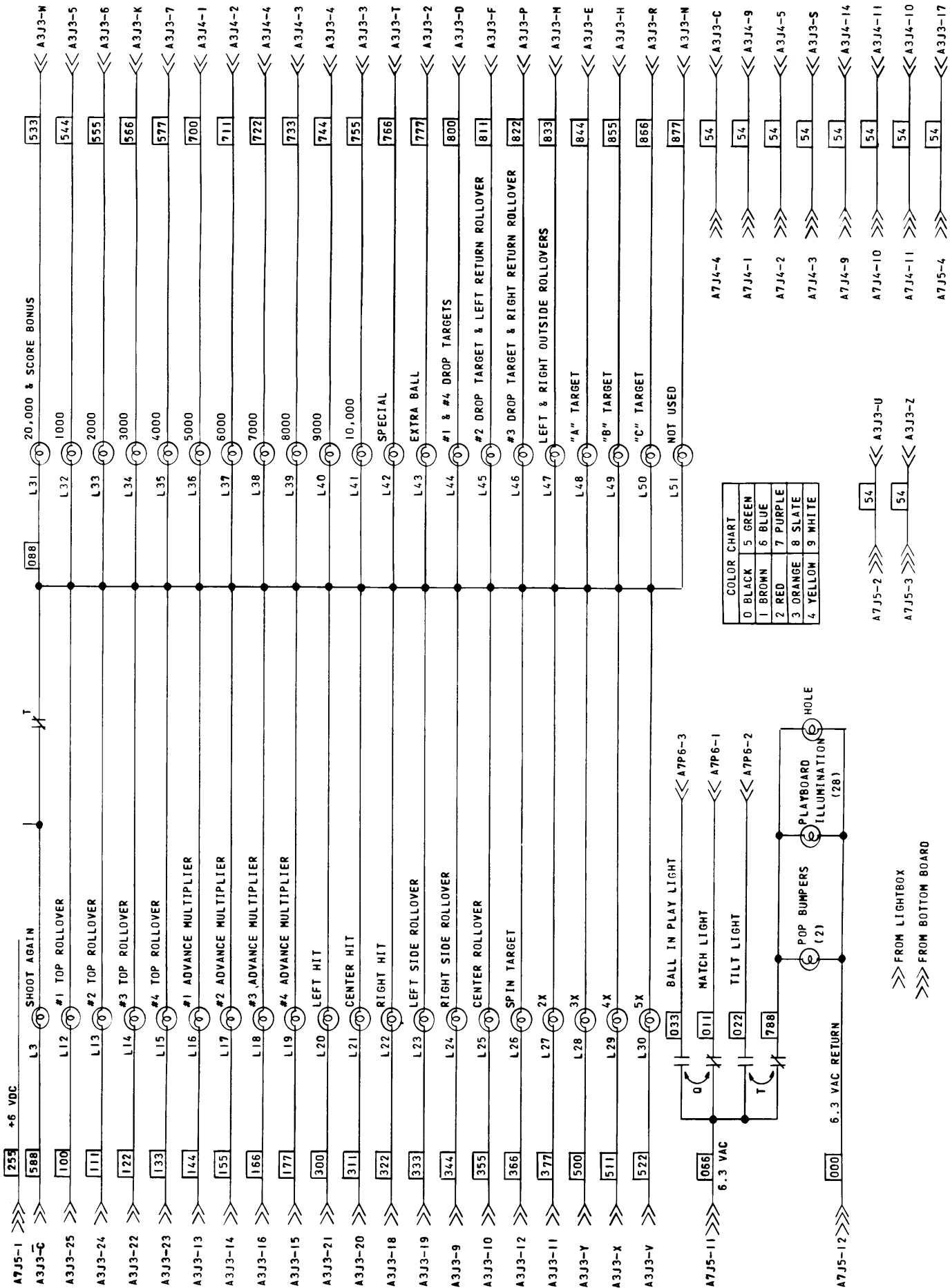
COLOR	CHART
0	BLACK
1	BROWN
2	RED
3	ORANGE
4	YELLOW
5	GREEN
6	BLUE
7	PURPLE
8	SLATE
9	WHITE

>>> FROM LIGHTBOX  
 >>> FROM BOTTOM BOARD

NOTE: ALL DIODES ARE IN4004

D. GOTTLIEB & CO.	
TITLE PLAYBOARD SOLENOIDS	
USED ON	DATE
DRAWN	APPROVED
C-19990	

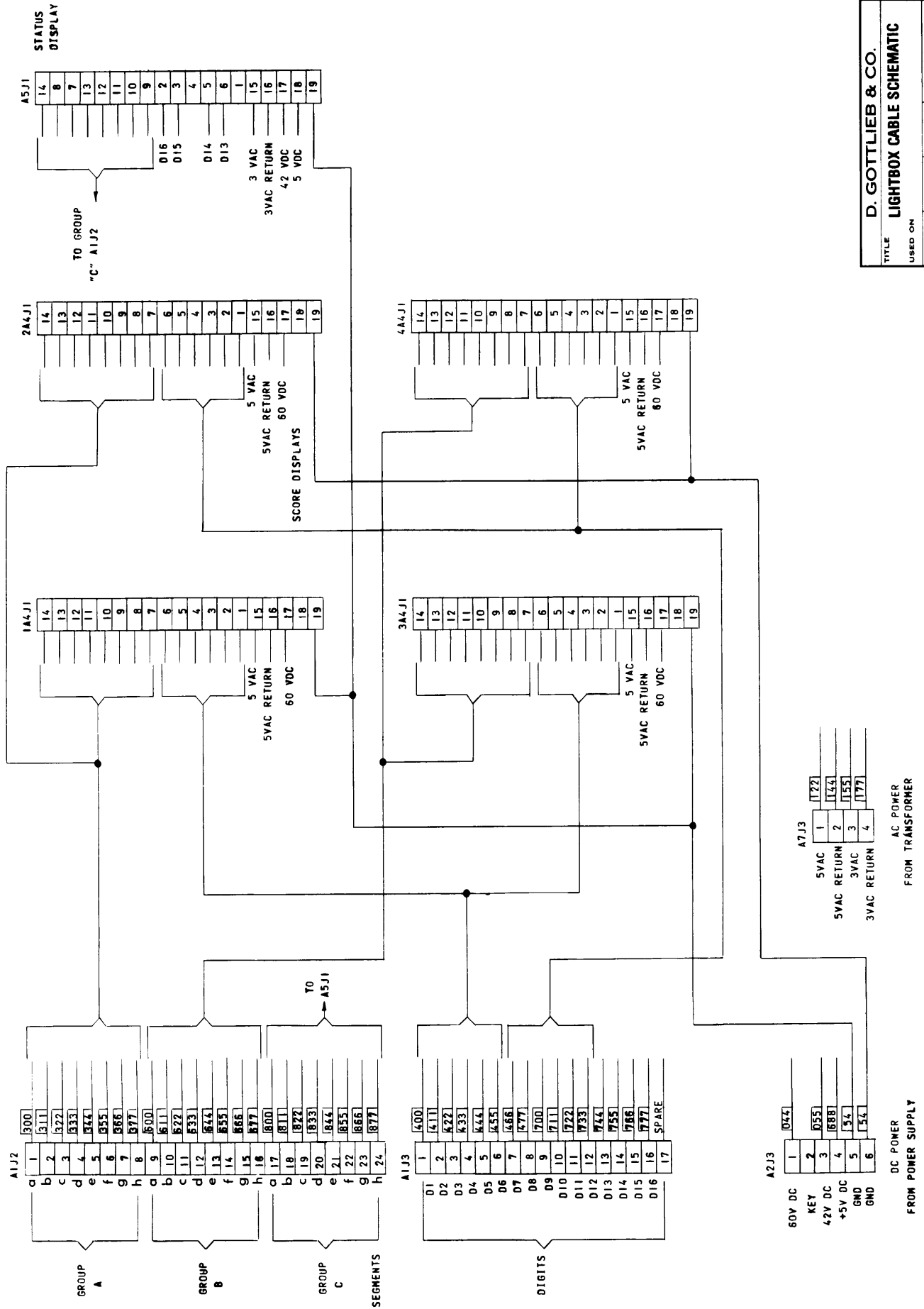
**X. F. PLAYBOARD ILLUMINATION**



LAMPS L32-L43 ARE DRIVEN BY MPS-A13'S.  
ALL OTHER LAMP DRIVERS ARE MPS-U45'S.

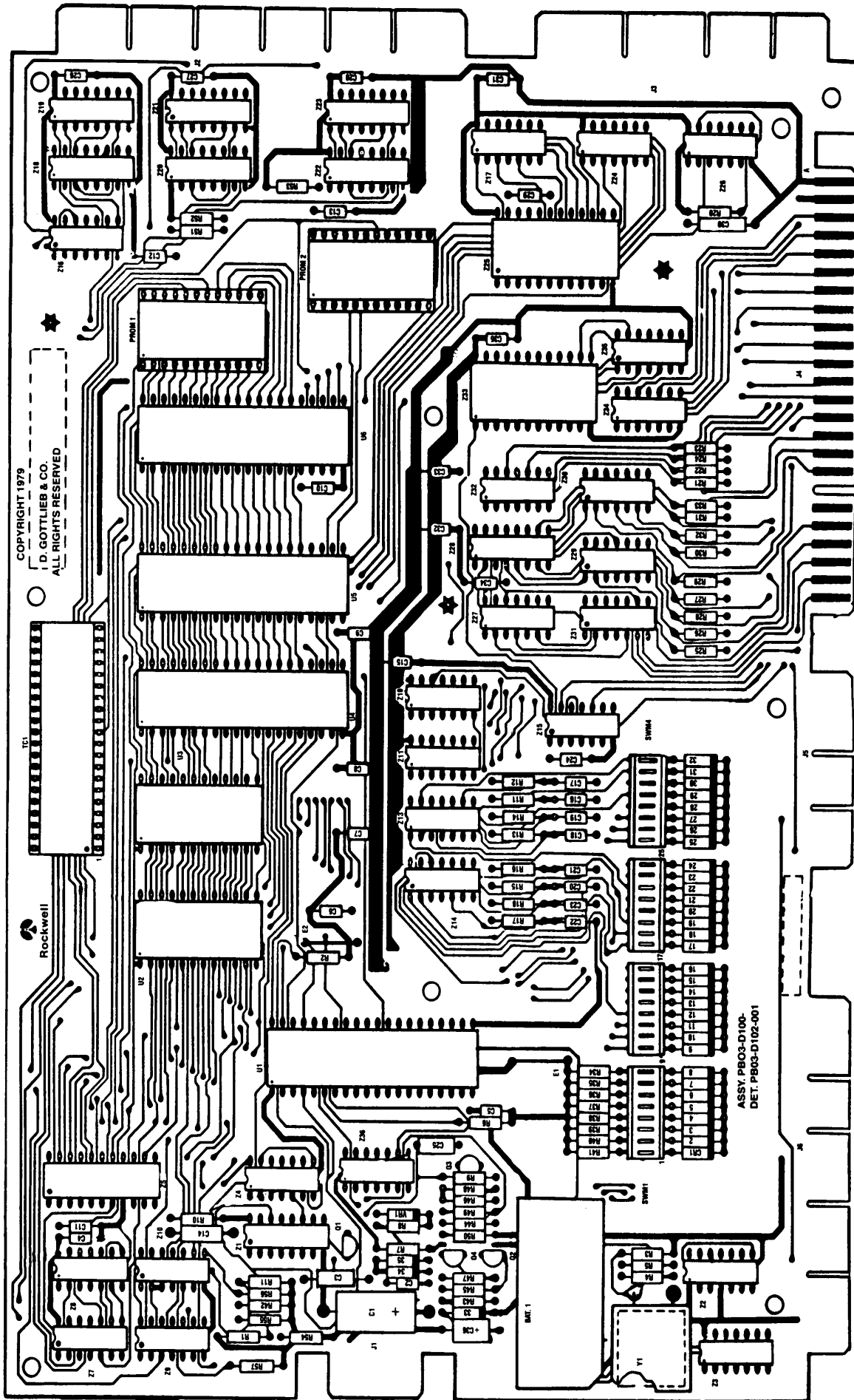
D. GOTTLIEB & CO.	
TITLE PLAYBOARD ILLUMINATION	
USED ON	DRAWN
APPROVED	DATE
	C-19991

# X. G. LIGHTBOX CABLE SCHEMATIC



D. GOTTLIEB & CO.  
**LIGHTBOX CABLE SCHEMATIC**  
 TITLE  
 USED ON  
 DRAWN APPROVED DATE  
**C-19692**

X. H. CONTROL BOARD COMPONENT LOCATION



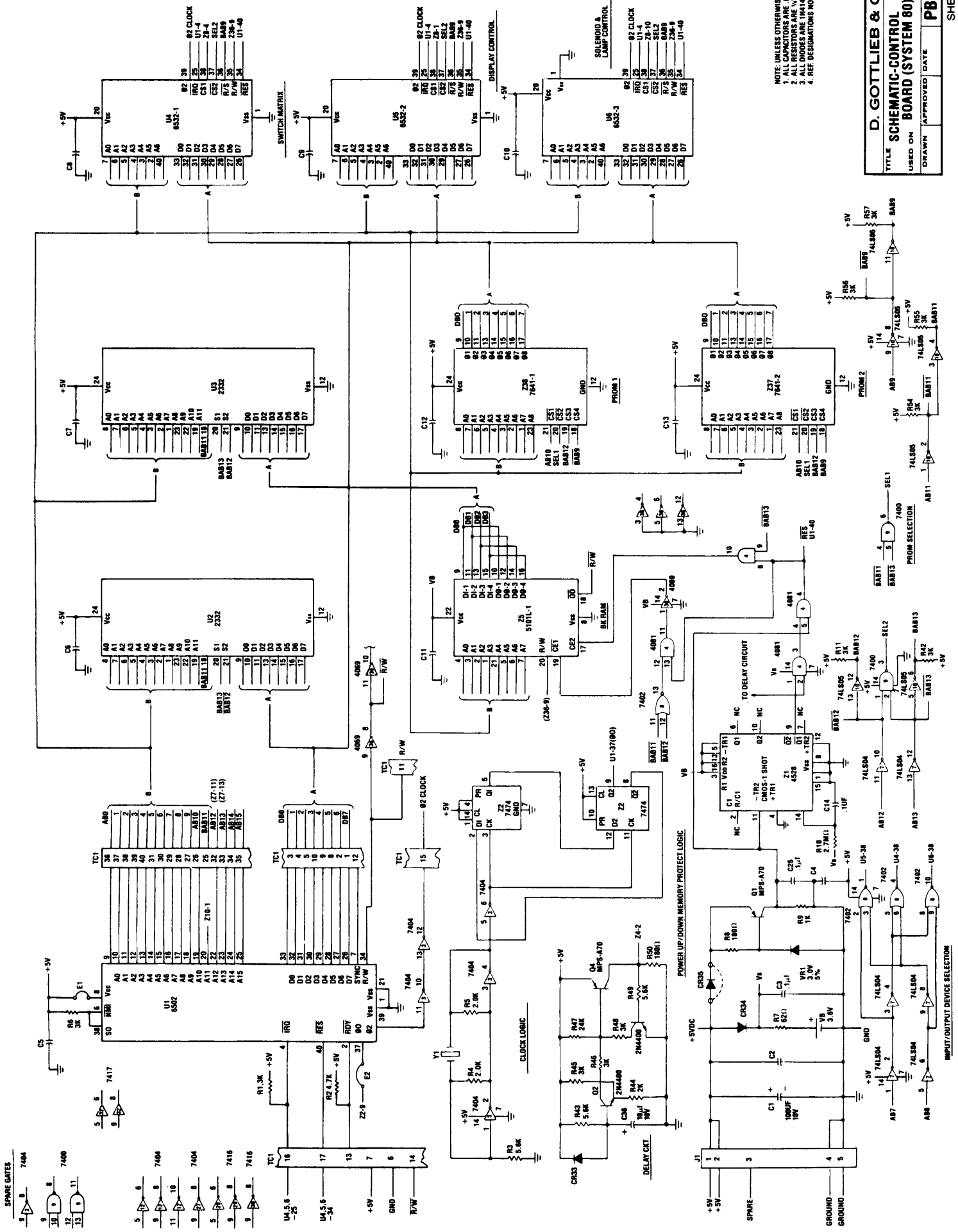
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Rockwell

ASSY. PB03-D100-  
DET. PB03-D102-001

D. GOTTLIEB & CO.	
TITLE CONTROL BOARD	
USED ON SYSTEM 80	
DRAWN	APPROVED DATE
PB03-D100	

# X. I. CONTROL BOARD SCHEMATIC

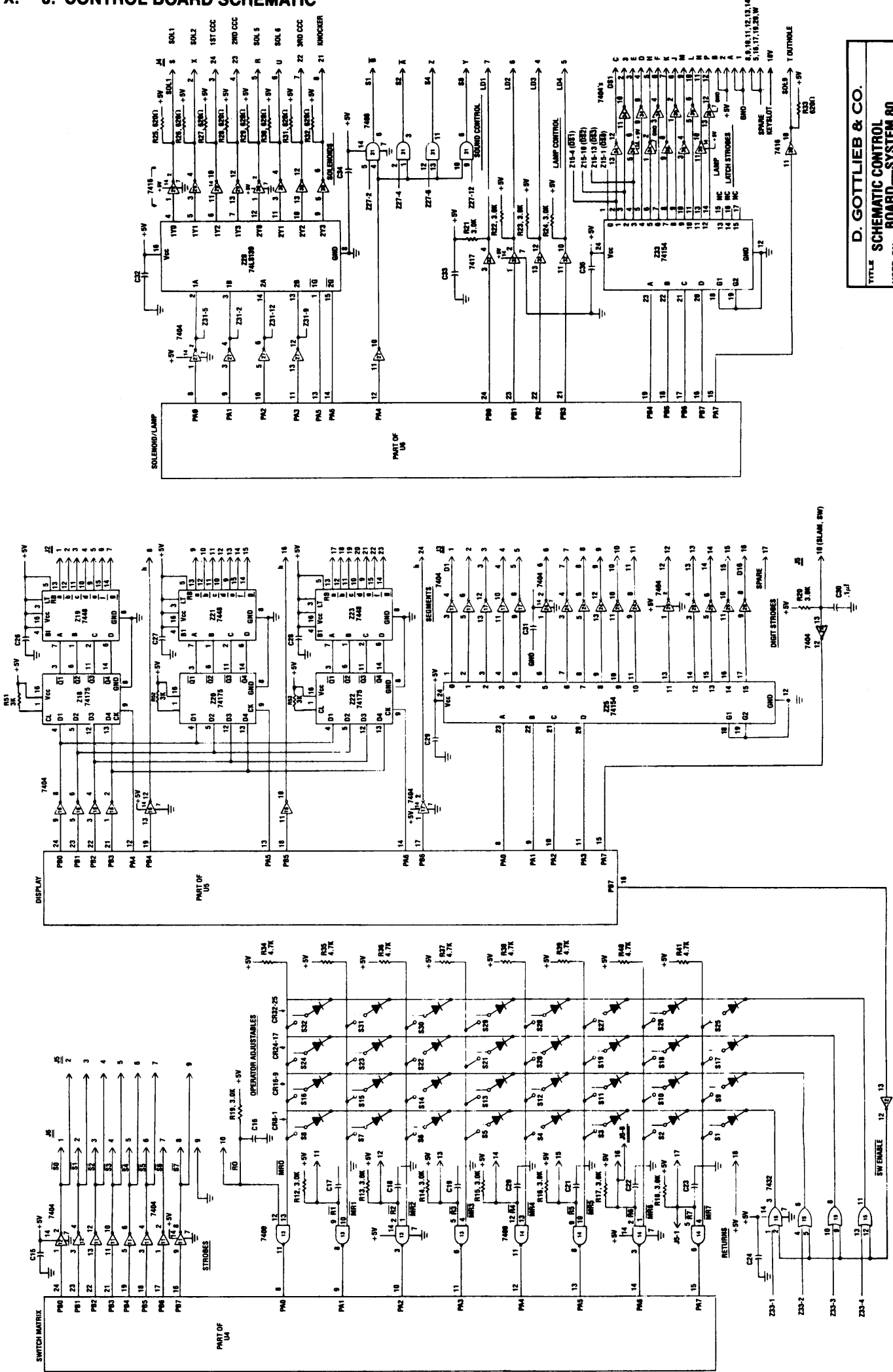


NOTE: UNLESS OTHERWISE SPECIFIED  
 1. ALL CAPACITORS ARE 0.1µF, 50V  
 2. ALL RESISTORS ARE 1/4W, 5%  
 3. ALL DIODES ARE 1N4148  
 4. REF. DESIGNATIONS NOT USED 26

<b>D. GOTTLIEB &amp; CO.</b>	
TITLE <b>SCHEMATIC CONTROL BOARD (SYSTEM 80)</b>	
USED ON	DATE
DRAWN <b>PB03-X101</b>	
SHEET 1 OF 2	

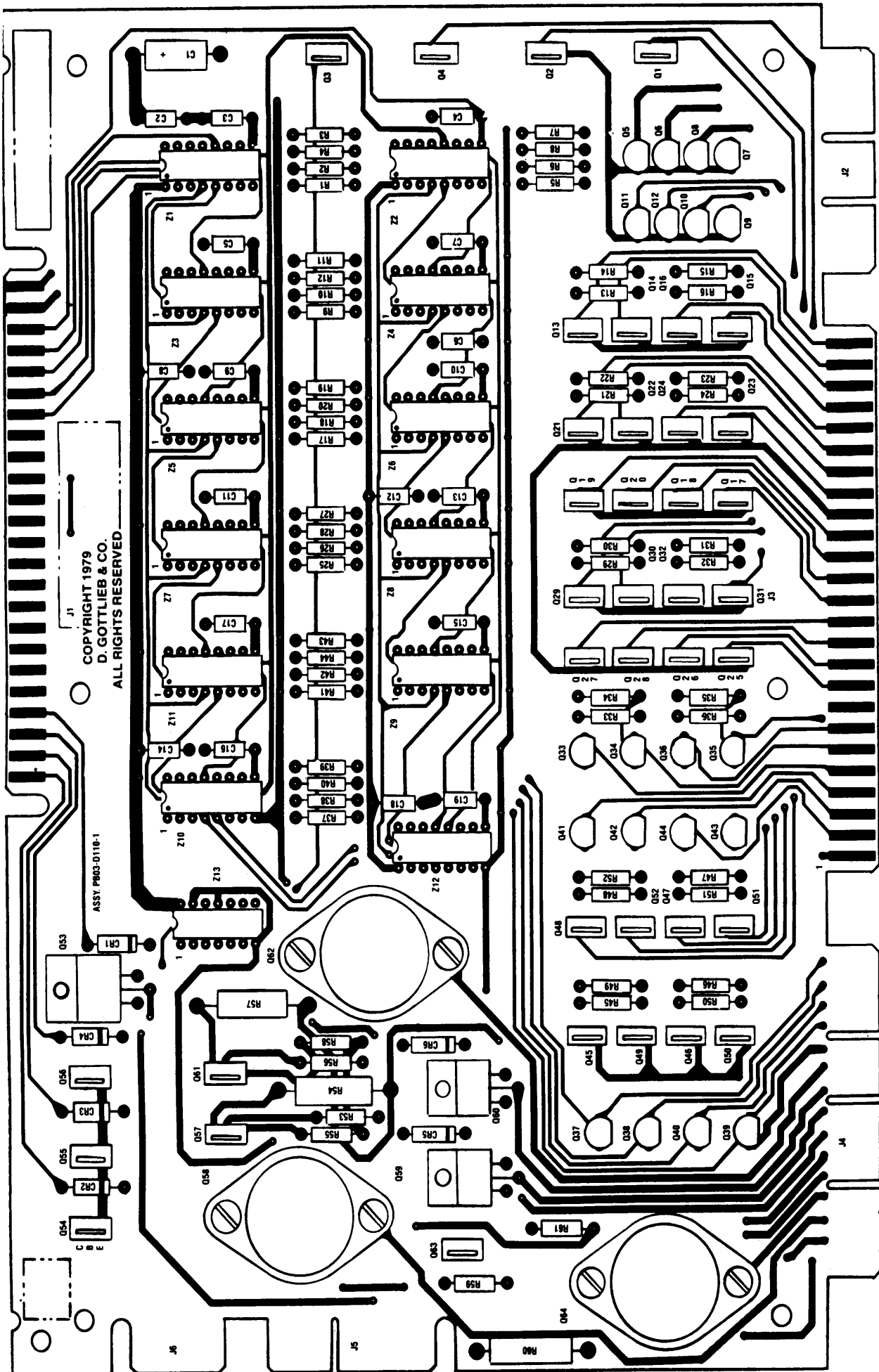


X. J. CONTROL BOARD SCHEMATIC



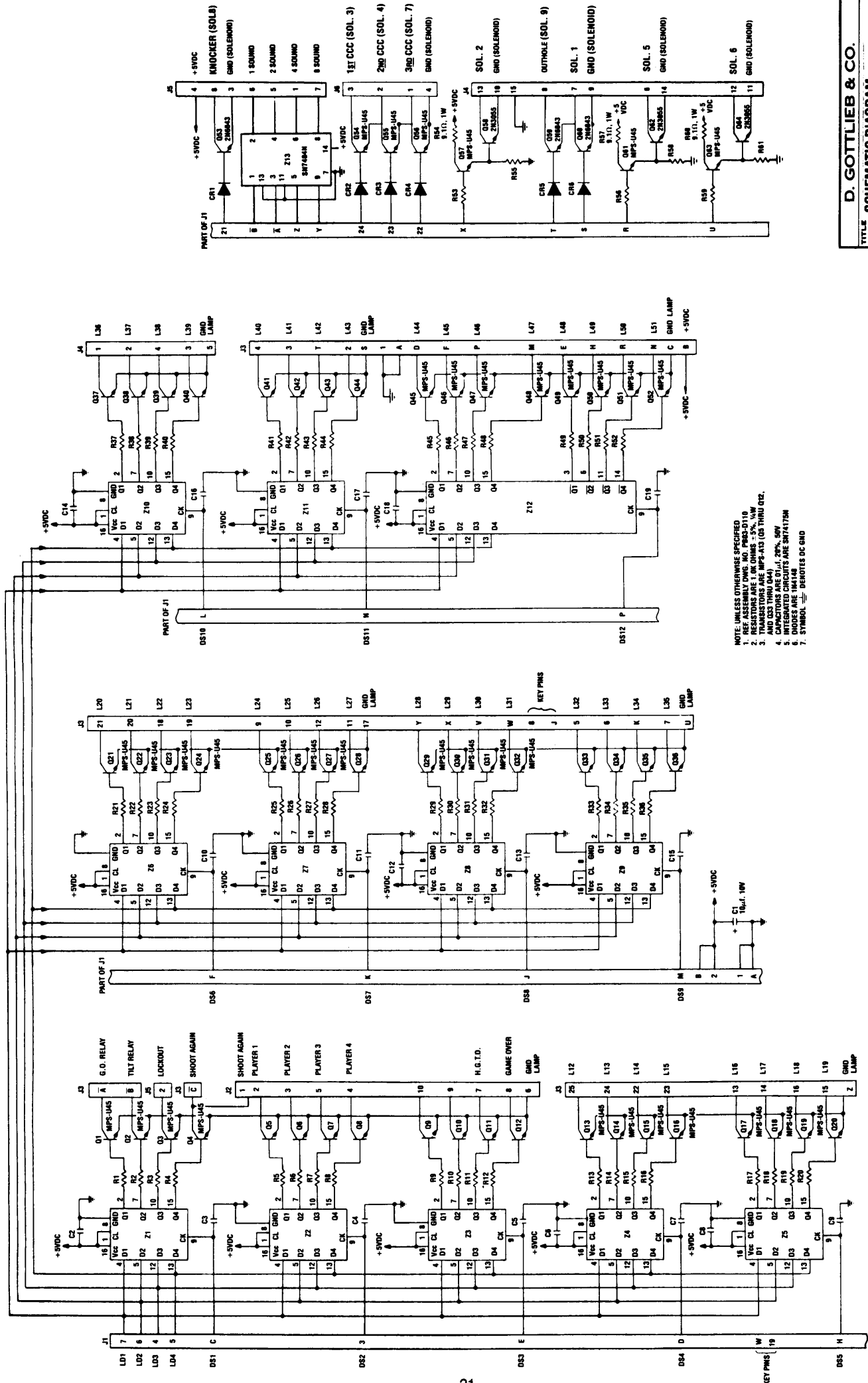
D. GOTTLIEB & CO.  
 TITLE SCHEMATIC CONTROL BOARD—SYSTEM 80  
 USED ON BOARD—SYSTEM 80  
 DRAWN APPROVED DATE PB03-X101  
 SHEET 2 OF 2

X. K. DRIVER BOARD COMPONENT LOCATION



D. GOTTLIEB & CO.	
TITLE	MASTER DRIVER
USED ON	SYSTEM 80
DRAWN	APPROVED
DATE	PB03-D110

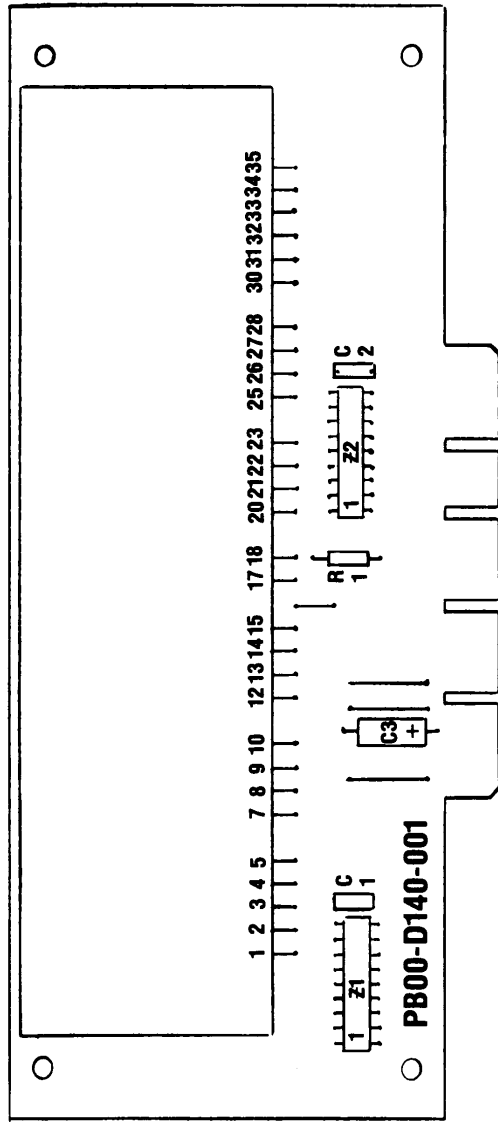
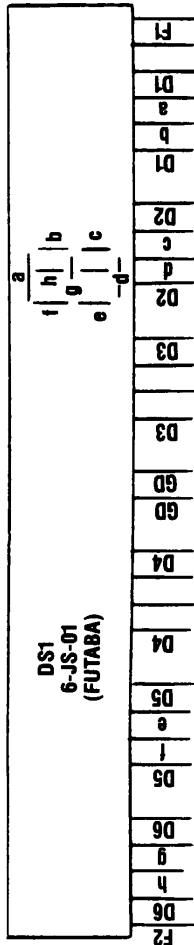
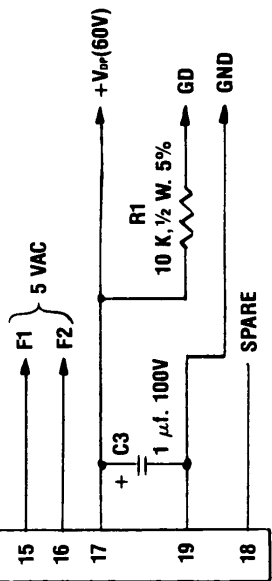
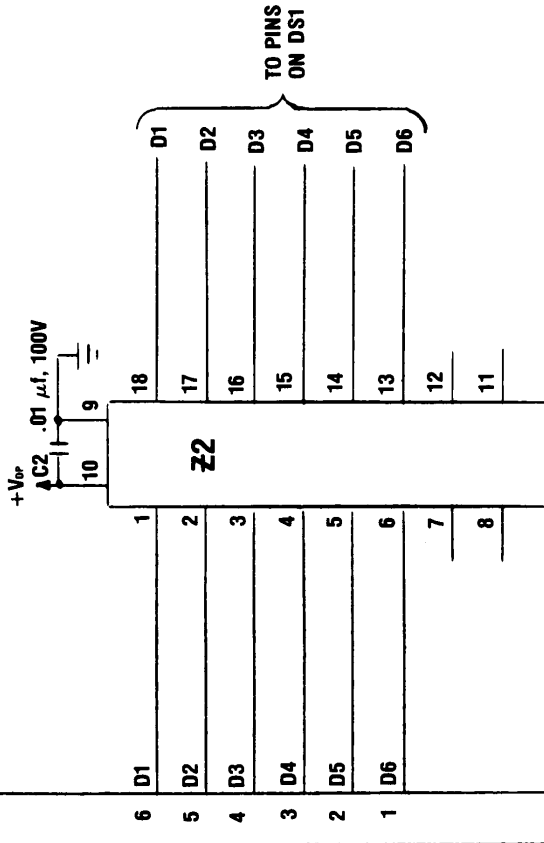
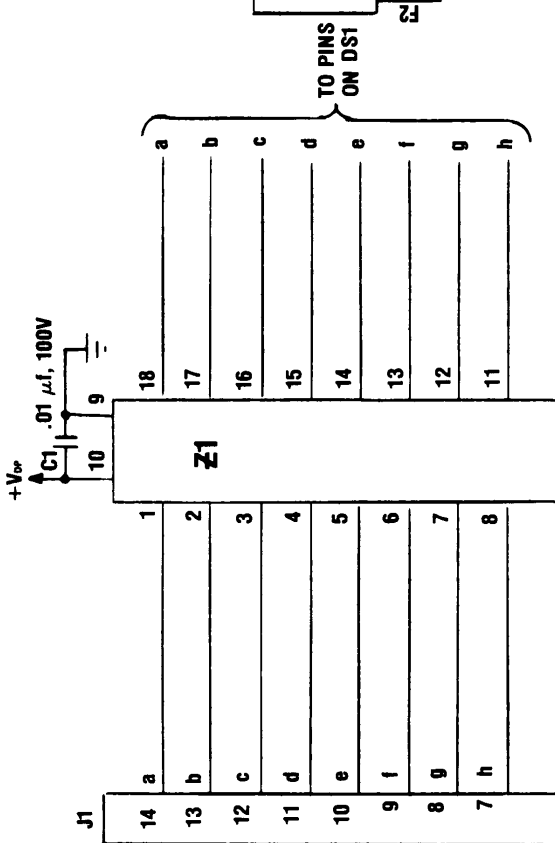
# X. L. DRIVER BOARD SCHEMATIC



NOTE: UNLESS OTHERWISE SPECIFIED  
 1. REF ASSEMBLY DWG. NO. PMS-0110  
 2. TRANSISTORS ARE MPS-145 (Q3 THRU Q12)  
 AND Q33 THRU Q44  
 3. CAPACITORS ARE 0.1μF, 20%, 50V  
 UNLESS OTHERWISE SPECIFIED  
 4. INTEGRATED CIRCUITS ARE SN74175M  
 UNLESS OTHERWISE SPECIFIED  
 5. SYMBOL  $\equiv$  DENOTES DC GND

D. GOTTLIEB & CO.	
TITLE SCHEMATIC DIAGRAM—	
USED ON MASTER DRIVER SYSTEM 80	
DRAWN	APPROVED DATE
PB03-X111	

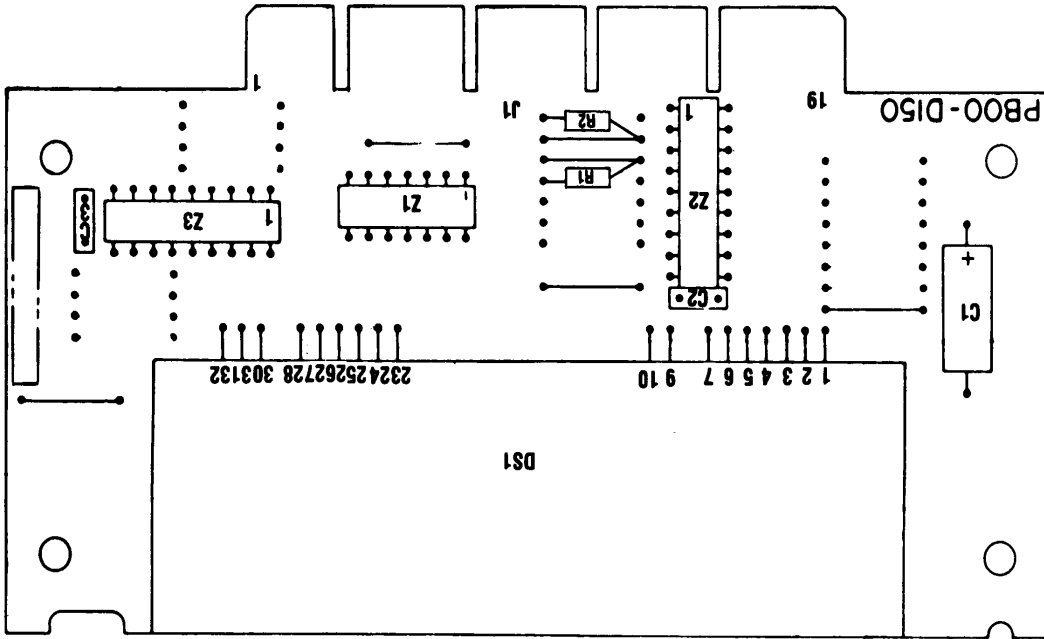
X. M. 6 DIGIT DISPLAY



NOTE: Z1 & Z2 ARE UDN6118A (SPRAGUE)

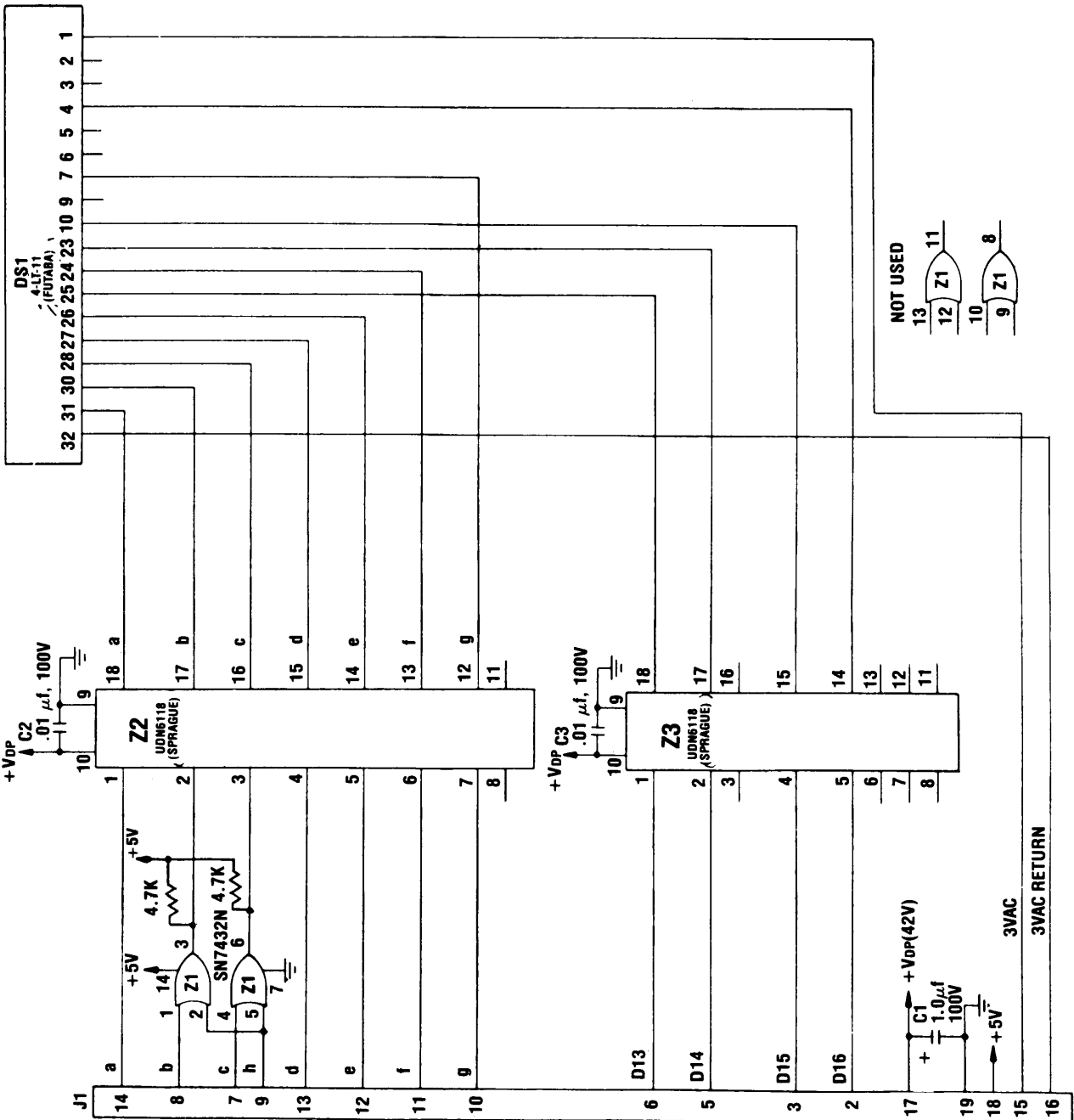
D. GOTTLIEB & CO.			
TITLE SCHEMATIC DIAGRAM —			
USED ON 6 DIGIT DISPLAY			
DRAWN	APPROVED	DATE	PB00-D140

X. N. 4 DIGIT DISPLAY

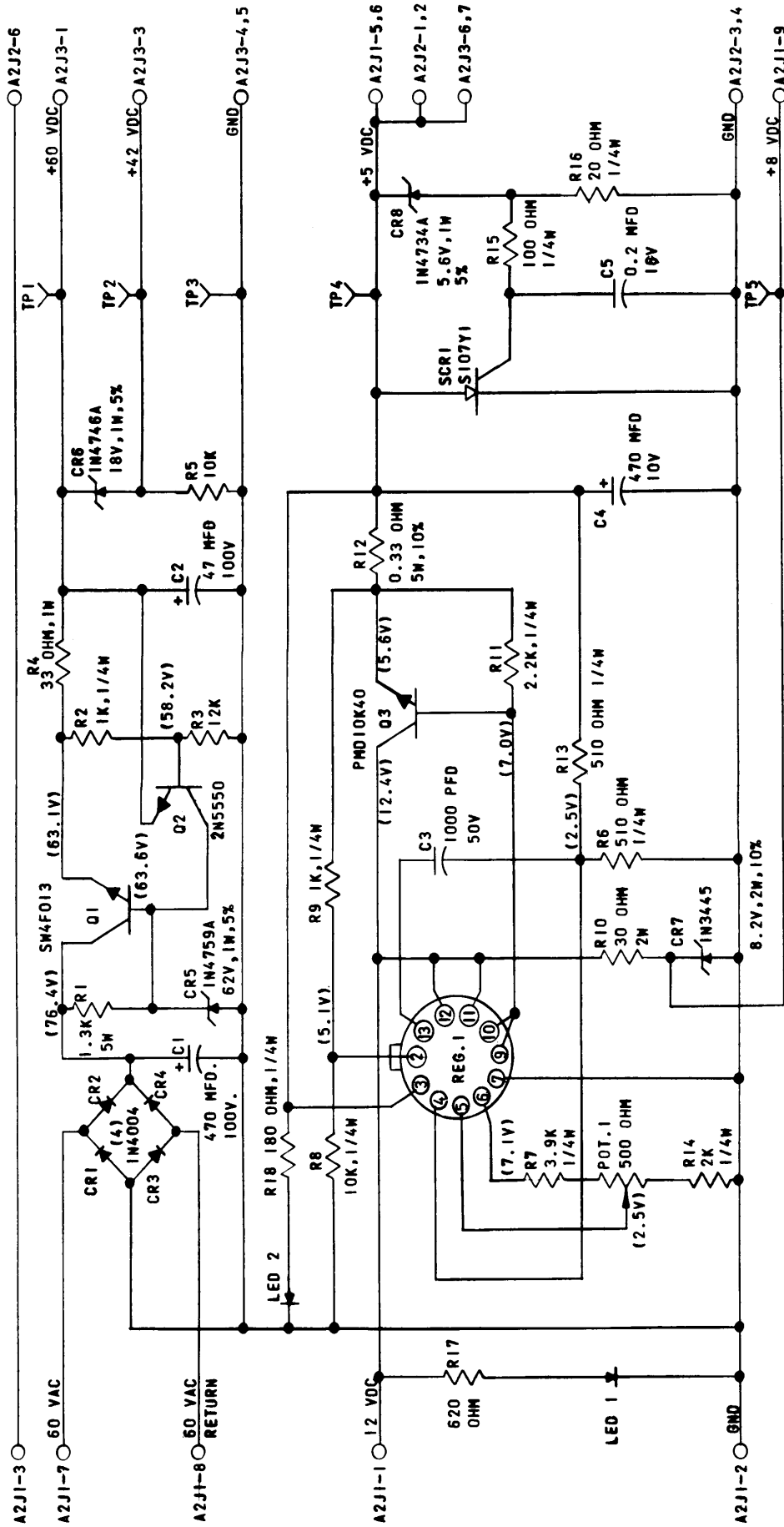


NOTE: RESISTOR VALUES ARE IN OHMS  $\pm$  5% 1/4W

D. GOTTLIEB & CO.	
TITLE SCHEMATIC DIAGRAM-	
USED ON 4 DIGIT DISPLAY	
DRAWN	APPROVED DATE
PB00-D150	



# X. O. POWER SUPPLY SCHEMATIC

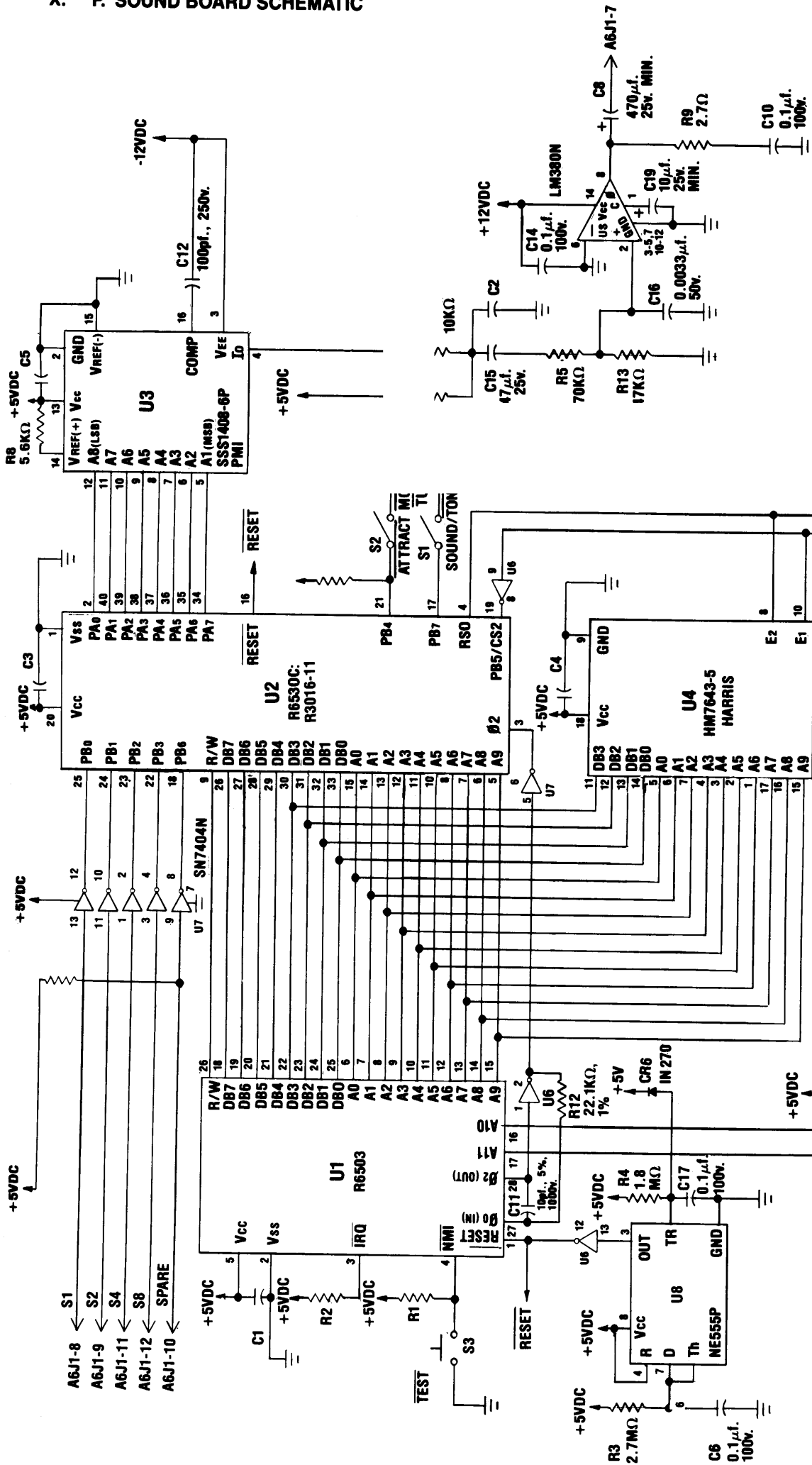


NOTE: UNLESS OTHERWISE SPECIFIED,

1. RESISTORS ARE 1/2W, 5%
2. VOLTAGES ARE DC WITH RESPECT TO CIRCUIT GROUND
3. ALL VOLTAGES ARE AT NOMINAL LINE VOLTAGE (115VAC)
4. REG. 1 IS TYPE 723 14 PIN DIP
5. LEDs ARE RL4850

D. GOTTLIEB & CO.	
TITLE POWER SUPPLY SCHEMATIC	
USED ON SYSTEM 80	
DRAWN	APPROVED DATE
	B-19694

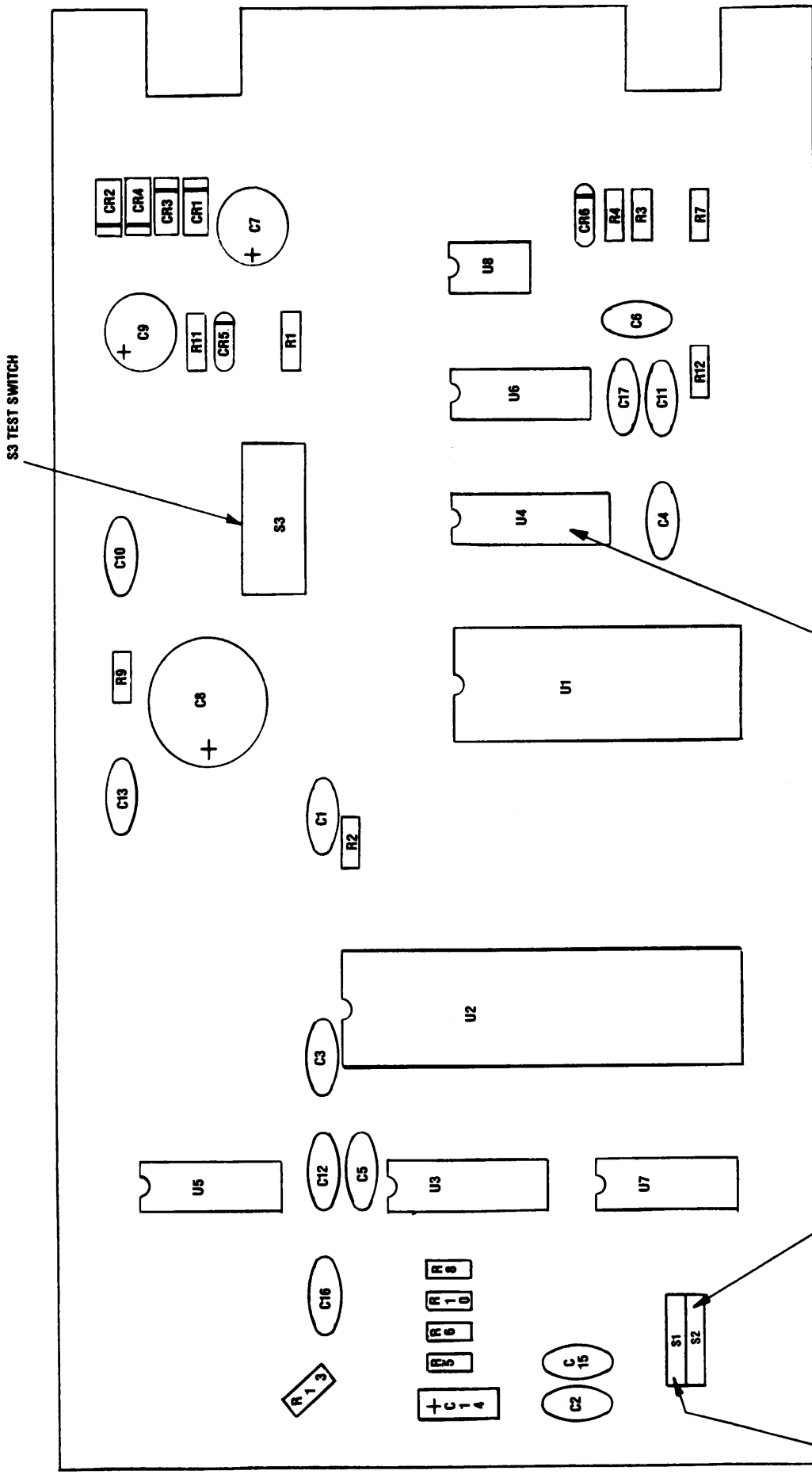
# X. P. SOUND BOARD SCHEMATIC



NOTES: UNLESS OTHERWISE SPECIFIED:  
 1. ALL RESISTORS ARE 2.7KΩ, ± 5%, ¼W.  
 2. ALL CAPACITORS ARE 0.01μf., 20%, 100V.  
 3. ALL DIODES ARE 1N4004

D. GOTTLIEB & CO.	
TITLE	SOUND BOARD SCHEMATIC
USED ON	
DRAWN	APPROVED DATE
	C-19691

X. Q. SOUND BOARD COMPONENT LOCATION



NOTE: SOUND BOARD PROM IS INSERTED WITH INDENT NOTCH UP. PROM IS MARKED WITH GAME NUMBER.

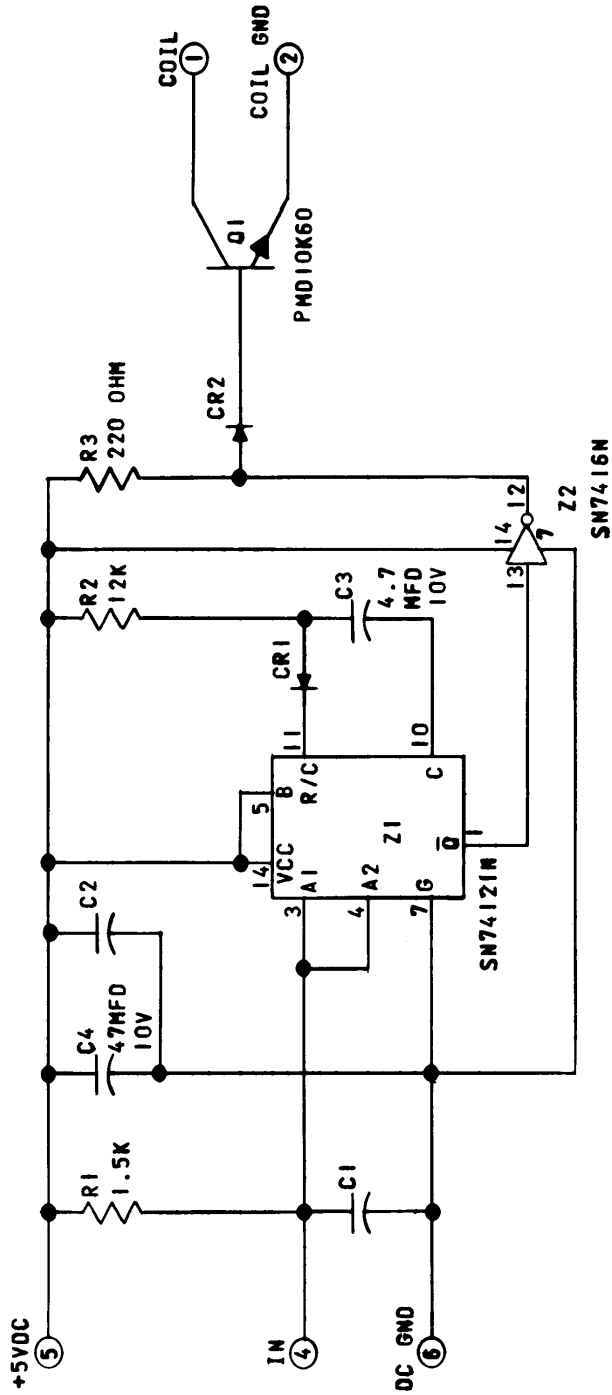
S2  
OFF = NO ATTRACT TUNE  
ON = ATTRACT TUNE EVERY 6 MINUTES

S1  
OFF = SOUNDS  
ON = TONES

D. GOTTLIEB & CO.	
TITLE	SOUND BOARD COMPONENT LOCATION—SYSTEM 80
USED ON	
DRAWN	APPROVED DATE
	A-19998



X. R. POP BUMPER DRIVER BOARD SCHEMATIC



NOTE: UNLESS OTHERWISE SPECIFIED,  
 1. RESISTORS ARE 1/4W,5%  
 2. CAPACITORS ARE 0.01,MFD,100V,20%  
 3. DIODES ARE 1N4148

D. GOTTLIEB & CO.	
TITLE	POP BUMPER DRIVER BOARD
USED ON	SYSTEM 80
DRAWN	APPROVED DATE
	A-19602

