



International Concepts Inc.

Instruction Manual



(2 BALL GAME)

INSTRUCTION MANUAL

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GAME PROM:

SOUND PROMS:

(TYPE 27C512)

(TYPE 27C256)

(TYPE 27C020-25)

C102/GPROM

C102/DROM1
C102/YROM1

C102/AROM1
C102/AROM2

NOTE: ANY PROM CHANGES DURING PRODUCTION WILL BE INDICATED BY A REVISION NUMBER FOLLOWING THE GAME NUMBER. CONSULT YOUR DISTRIBUTOR FOR ANY PROM CHANGE UPDATE.

For more information
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SYSTEM 3 OVERVIEW

System 3 contains many new features which improve game play and reliability. Some of these features are as follows:

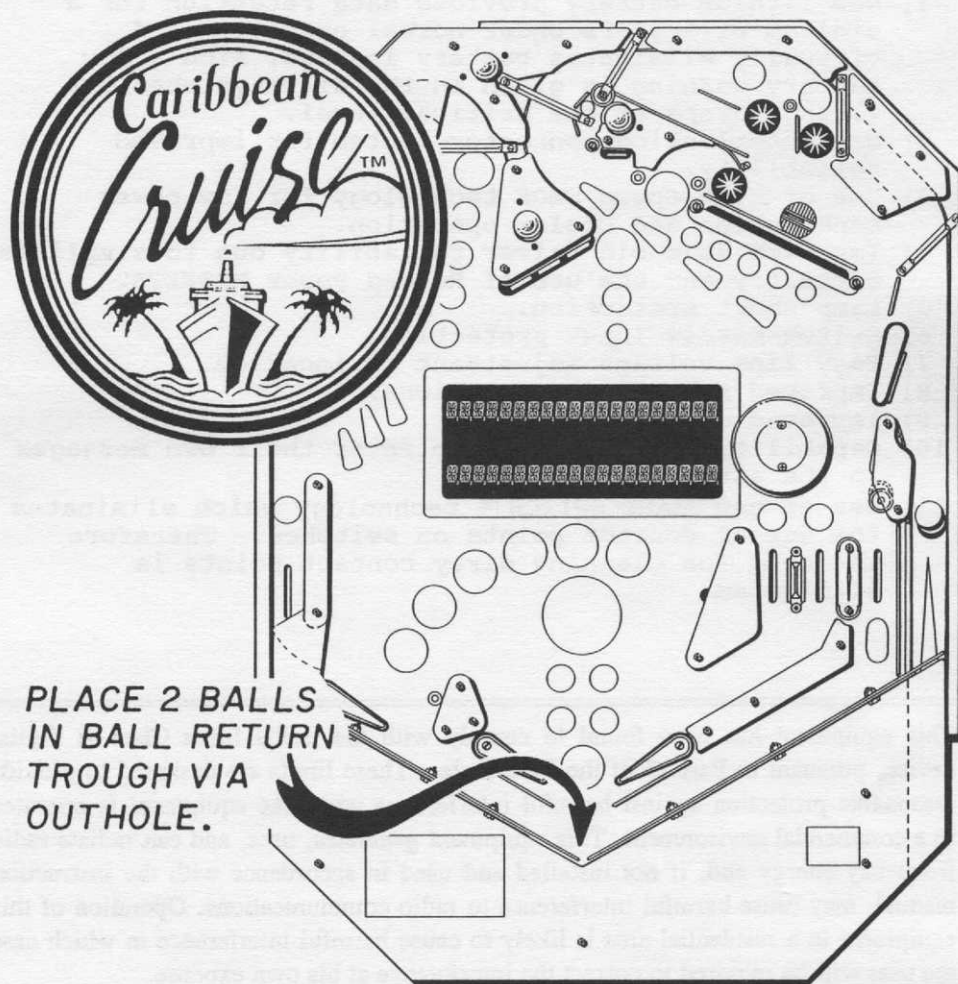
- 1) New lithium battery provides data retention for a minimum of 5 years under normal operation and virtually eliminates battery leakage. Also a low battery warning is given in the displays when the voltage drops to the critical level.
- 2) New interlocking connector system for improved reliability.
- 3) Use of High Speed CMOS technology for low power consumption and cooler operation.
- 4) Improved solenoid driver reliability due to simplified circuitry and the use of Rugged Power MOSFETS.
- 5) Lamp short protection.
- 6) Switch matrix input protection.
- 7) Easy line voltage adjustment on location.
- 8) Improved bookkeeping functions.
- 9) Improved display control.
- 10) Capability for operators to enter their own messages in the attract mode.
- 11) Use of new SMART SWITCH™ technology which eliminates the use of contact points on switches. Therefore the need for cleaning dirty contact points is eliminated.

This equipment has been found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

I. INSTALLATION

ATTENTION

BEFORE STARTING GAME:



I. INSTALLATION

A. SET-UP

1. Carefully remove the game from the carton.
2. Unlock glass top from rear of cabinet, lift from rear of cabinet and slide toward you slightly ($1/2"$ to $1"$), remove top glass assembly.
3. Using the leg adjusters, level the playfield and set the pitch. Recommended pitch is 6° .

B. CHECK-OUT

1. To access cabinet parts and playfield underside, lift up the front of the playboard and swing away from you to an opened position, maintain this position with the prop stick.

To prevent the playboard from tipping over backwards when opened, secure the plastic chain mounted on the left side of the cabinet platform to the coiled hook mounted on the bottom of the playboard at the extreme left as viewed when the playboard is in the opened position.

2. Check that all cables are clear of moving parts.

3. Check for any loose wires.
4. Check switches for loose solder or other foreign matter.
5. Be certain all fuses are firmly seated.
6. Check transformer for any foreign matter across terminals.
7. Be sure that Transformer Panel power input connector A12J7, corresponds to the supply voltage.
8. Check the setting of the normally open tilt switch on the underside of the playfield. One blade should be free-floating with a weight on the end.
9. The plumb-bob tilt can be adjusted by loosening the clip and raising the plumb-bob to increase its sensitivity, or lowering it to decrease its sensitivity.
10. Reinstall the top glass assembly.
11. Plug the line-cords into a properly grounded 3-wire receptacle ONLY!
12. Refer to Section III to make all necessary game adjustments.
13. CAUTION! If this game has been subjected to extreme cold, allow to warm up to room temperature.

II. GAME PLAY AND SCORING



HOW TO PLAY

GENERAL GAME FEATURES

A AND B STAR ROLLOVERS:

- * SCORE 50,000 LIT.
- * SCORE 5,000 UNLIT.
- * BOTH COMPLETE ADVANCES MULTIPLIER.

RIGHT SPINNER:

- * SCORE 3,000.
- * AWARD EXTRA BALL IF FLASHING.

CENTER SPOT TARGET:

- * SCORE 10,000.
- * SPOT AN A OR B STAR ROLLOVER IF LIT. ADVANCE MULTIPLIER IF BOTH STAR ROLLOVERS COMPLETE.
- * COLLECT JACKPOT IF FLASHING.
- * COLLECT "SEA BONUS" IF FLASHING.

CAPTURE HOLE:

- * SCORE 50,000.
- * AWARD MYSTERY IF FLASHING.

HOLE STAR ROLLOVER:

- * SCORE 5,000.

LEFT SPINNER:

- * SCORE LIT VALUE DURING NORMAL PLAY.
- * SCORE 3,000 DURING MULTIBALL.

2 SPOT TARGETS (NEAR LEFT SPINNER):

- * SCORE 3,000.
- * IF COLLECT FLASHING, LIGHT A SPECIAL LAMP.

SKEET SPOT TARGETS:

- * IN NORMAL PLAY, SCORE 10,000 LIT OR 1,000 UNLIT. ALL TARGETS COMPLETE ENTERS THE SKEET ROUND.
- * IN SKEET ROUND, SCORE 1,000,000 LIT OR 1,000 UNLIT.
- * IN MULTIBALL, SCORE 1,000.

DROP TARGETS:

- * SCORE 5,000.
- * IN NORMAL PLAY, ALL TARGETS DOWN ADVANCES "CRUISE". CRUISE COMPLETE STARTS THE RIGHT SPINNER "COLLECT EXTRA BALL" FLASHING.

POP BUMPERS:

- * SCORE 300.
- * ROTATE TOP STAR LAMPS, 100,000 LANE LAMPS, AND ANY LIT SPECIAL LAMPS.

SEA SPOT TARGETS:

- * SCORE 1,000.
- * ALL 3 TARGETS COMPLETE, ADVANCE "SEA BONUS" 100,000 AND FLASH "COLLECT SEA BONUS" FOR A TIME PERIOD.

100,000 ROLLOVERS:

- * SCORE 100,000 LIT.
- * SCORE 10,000 UNLIT.

LEFT RETURN ROLLOVER:

- * SCORE 10,000.
- * AWARD SPECIAL IF LIT.

II. GAME PLAY AND SCORING



- * IF BALL RETURNING FROM A SHOT THROUGH THE LEFT SPINNER, ADVANCE THE LEFT SPINNER VALUE LAMP.

RIGHT RETURN ROLLOVERS:

- * SCORE 10,000.
- * AWARD SPECIAL IF LIT.

KICKING RUBBERS:

- * SCORE 30.

OUTHOLE:

- * SCORE 100,000 POINTS TIMES MULTIPLIER FOR EACH LIT LETTER OF "CRUISE".
- * ADD 50,000 TO JACKPOT VALUE.

FLIPPERS:

- * DURING NORMAL PLAY, ROTATE ANY LIT SPECIAL LAMPS AND A OR B STAR ROLLOVER LAMPS.

ADDITIONAL FEATURES

MULTIBALL:

- * ENTERED IF AWARDED FROM MYSTERY.
- * OBJECTIVE IS TO COLLECT JACKPOTS.

SKEET ROUND:

- * ENTERED BY COMPLETING SKEET SPOT TARGETS.
- * OBJECTIVE IS TO HIT THE MOVING SPOT TARGET LAMP WITHIN A TIME PERIOD.

III. TEST MODE

There are several functions accessible to the operator while in the test mode. These functions are Self-Test, Bookkeeping, Game Adjustments, and Burn-In. Each of these functions will be explained in detail later in this section. To enter the test mode, the game must be in the attract mode (game over). Then depress the Test button located just inside the front door of the game. The operator will be given a choice as to which function he wants to access. Pressing the appropriate button will select that function.

NOTE: The Test button may be held in to fast forward through the steps of a particular function.

To exit the test mode or change functions the Slam switch (front door) must be activated or the power must be turned off.

I. SELF-TEST

This function will allow the operator to test all the hardware related devices in the game. Each test is described below.

A. MEMORY TEST

This function tests all memory devices on the Control Board (A1). If all the devices pass the test an "OK" will be displayed. If a failure occurs, a description of the faulty component will be displayed. Then after a short period of time the Game Prom check sum will be displayed. The Credit button can be used to restart this test.

B. LAMP CHECK

This function will flash all the controlled lamps and flasher lamps continuously. This will allow the operator to easily check for and replace any burned out light bulbs.

C. LAMP MATRIX TEST

This test will allow the operator to single step through and check the operation of each lamp in the game. The left flipper button will decrement the active lamp number by one while the right flipper button

will increment the active lamp number by one. The strobe number and the return number are combined to form the lamp number (strobe,return) which is shown in the lower display along with a description of the lamp. The Credit button can be used to restart this test. Only one lamp at a time should flash during this test.

D. RELAY AND SOLENOID TEST

This test will allow the operator to single step through and check the operation of each relay and solenoid driver in the game. The left and right flipper buttons are used to change the active driver number. The selected driver description and number will appear in the lower display. The Credit button is then used to activate the driver for a short time period. Solenoid #31 ("Q" relay) is always on during this test so as to provide power to devices such as the pop bumpers and kicking rubbers (see Playboard Schematic Diagram).

E. SWITCH MATRIX TEST

This test will allow the operator to test the operation of all the switches used in the game. If no switches are closed when this test is started, the message "ALL SWITCHES OPEN" will be displayed. If any switches are closed either before or after this test is started, the closed switch(s) name and number will be displayed. The strobe number and the return number are combined to form the switch number (strobe,return). The Credit button can be used to restart this test.

F. DISPLAY TEST

This test will allow the operator to check the operation of the individual digits and segments of the displays. Pressing the right flipper button will advance to the next step of the test. The displays will first step through all the individual segments followed by all the individual digits. The Credit button can be used to restart this test.

G. SOUND TEST

This test allows the operator to test the interface lines from the Control

III. TEST MODE

Board (A1) to the Sound Board (A6). Every time the right flipper button is pressed, a different tone should be heard from the Sound Board. During each tone, the sound line connection which is being tested will be shown in the lower display. After the tone stops the sound line which is being tested will still be kept at a low level (<.8v) until the right flipper button is pressed again or the Credit button is used to restart the test.

H. FRONT DOOR TEST

This test allows the operator to check the operation of the coin chutes used in the game. Utilizing this function will not affect any bookkeeping values. Each coin chute closure is categorized and shown in the display. The Credit button can be used to restart this test.

II. BOOKKEEPING

The Test button is used to step through bookkeeping. The upper display will contain a description of each step while the lower display will contain the step number and two different bookkeeping values. The value in the leftmost column represents long term bookkeeping. The value in the rightmost column (in brackets) represents short term bookkeeping. These two values are provided so that the operator may compare recent performance with long term performance and then make any necessary game adjustments.

NOTE: The first four left steps (coin chute counts) will not be displayed unless the credit button is pressed during that active step number.

The left flipper button will allow the operator to reset all of the left (long term) and right (short term) bookkeeping values. The right flipper button will allow the operator to reset all of the right (short term)

bookkeeping values only. If the R.BOOK AUTO-RESET adjustment is on, the right (short term) bookkeeping will automatically be reset after every 2000 plays (see Game Adjustments). Therefore, the operator does not need to reset the short term bookkeeping himself unless he prefers to follow his own procedure. Also, this feature will aid in adjusting the game payout percentage to the caliber of players in different locations. If there happens to be a major error in a long term bookkeeping value the letters ERR will appear to the right of that bookkeeping value. To correct this error the long term bookkeeping must be reset. A description of each bookkeeping step is given in the test mode flowchart.

III. GAME ADJUSTMENTS

This function allows the operator to make any adjustments to his game as necessary.

A. FACTORY SETTINGS

Upon entering the game adjustment section of bookkeeping, the operator is given a choice to load all factory settings or to single step through the game adjustments and adjust each section individually. If he chooses to enter the factory settings by depressing the Credit button, he will also be given a choice of what language to load. By using the right flipper button he may choose the appropriate language and then depress the Credit button again to enter the settings. After the settings are loaded the display should show the message "FACTORY SETTINGS LOADED" for a short time and then proceed to game adjustment step 1. At any time during the previous steps the operator may either exit the test mode or depress the Test button to proceed immediately to game adjustment step 1.

III. TEST MODE

WARNING

Loading the factory settings will affect all previous game adjustment settings. Therefore be careful when selecting this feature.

B. GAME ADJUSTMENT STEPS

Each time the Test button is pressed a description of the next step appears in the upper display while the lower display contains the step number and the current status of that step. Unless otherwise specified, the left and right flipper buttons are used to change the possible selections in each step.

- 1) SCORE REPLAY LEVEL 1
- 2) SCORE REPLAY LEVEL 2
- 3) SCORE REPLAY LEVEL 3

Each Score Replay Level may be set by using the left flipper button to decrement the score and the right flipper button to increment the score. The Credit button can be used to load the factory setting for each individual level if desired. If the Auto-Percentaging adjustment is on, Replay Levels 2 & 3 can only be set to on or off. If Replay Level 2 is on, the score level will be set to two times Replay Level 1. If Replay Level 3 is on, the score level will be set to three times Replay Level 1. This allows the operator several combinations of levels in the Auto-Percentaging mode (i.e. 1, 1 & 2, 1 & 3, or 1 & 2 & 3).

- 4) HIGH GAME TO DATE 1
- 5) HIGH GAME TO DATE 2
- 6) HIGH GAME TO DATE 3
- 7) HIGH GAME TO DATE 4
- 8) HIGH GAME TO DATE 5

Each High Game To Date may be set by using the left flipper button to decrement the score and the right flipper button to increment the score. The Credit button can be used to load the factory setting for the displayed level and all those below it.

9) GAME PRICING

This step provides a choice of loading a standard setting for a particular country or a custom setting. When a standard setting is selected, the following steps (10-17) are skipped.

- 10) CHUTE 1 UNITS (L)
- 11) CHUTE 2 UNITS (R)
- 12) CHUTE 3 UNITS (C)
- 13) CHUTE 4 UNITS
- 14) UNITS REQUIRED FOR CREDIT
- 15) UNITS REQUIRED FOR BONUS
- 16) BONUS CREDITS
- 17) MINIMUM UNITS REQUIRED FOR CREDIT

Steps 10-17 are used if a custom setting is selected in step 9 (GAME PRICING). Steps 10-13 select the number of units that each chute is worth when a coin is dropped into that particular chute. The value entered for step 14 determines how many units must be accumulated for a credit to be issued on the game. Steps 15 and 16 determine how many units must be accumulated for any bonus credits to be issued. A value of zero entered for step 15 will disable the bonus feature. Step 17 indicates the number of units required before any credits are issued (see Coin Chute Setting Table for examples).

18) COIN METER

If set to ON, the pulses to be given for each of the four coin chutes can be defined so that the number of pulses for a given chute are in relation to the currency denomination. If set to OFF, steps 19-22 will be skipped.

- 19) CHUTE 1 PULSES
- 20) CHUTE 2 PULSES
- 21) CHUTE 3 PULSES
- 22) CHUTE 4 PULSES

The four steps above are used to set the number of pulses to be issued for each of the four coin chutes.

23) 1 COIN BUY-IN BONUS

At the end of a game a 10-second timer is initialized allowing each player that participated in the previous game a chance to purchase 1 credit for each coin inserted.

24) GAME PERCENT PAYOUT

This step is used to set the game payout percentage used when the Auto-Percentaging adjustment is on. The value entered for this step is compared to the value calculated by dividing total replays by total plays (see Bookkeeping section). Total

III. TEST MODE

COIN CHUTE SETTING TABLE																
Country	Coin Chutes				Plays/Coin(s)	Chute Adjustment Steps										
	Left 1	Right 2	Center 3	4		10	11	12	13	14	15	16	17			
USA	.25	.25	\$1		1/.50, 2/.75, 3/\$1	03	03	12	00	04	00	00	00			
USA (Custom)					1/.50, 3/\$1	01	01	04	00	02	04	01	00			
					1/.25, 4/\$1	01	01	04	00	01	00	00	00			
					1/.25, 5/\$1	01	01	04	00	01	04	01	00			
Australia	1	.20	\$1	\$2	-	1/3x.20, 2/\$1, 5/\$2	02	10	20	00	05	20	01	00		
	2	.20	\$1	\$2	-	1/5x.20, 1/\$1, 3/\$2	01	05	10	00	05	10	01	00		
Belgium		5Fr	20Fr	50Fr	-	1/20Fr, 3/50 Francs	03	12	30	00	10	00	00	00		
Canada		.25	\$1	-	-	1/.50, 2/.75, 3/\$1	03	12	00	00	04	00	00	00		
Canary Islands		25P	100P	-	-	1/25P, 4/100 Pesetas	01	04	00	00	01	00	00	00		
Denmark		1Kr	10Kr	-	-	1/3x1Kr, 4/10 Kroner	01	10	00	00	03	10	01	00		
Finland		5Mka	1Mka	-	-	1/3x1 Markka, 2/5 Markkaa	10	02	00	00	05	00	00	00		
France	1	1Fr	5Fr	10Fr	-	1/3x1Fr, 2/5Fr, 5/10Fr	02	10	20	00	05	20	01	00		
	2	1Fr	5Fr	10Fr	-	2/5Fr, 4/10Fr, 9/2x10Fr	02	10	20	00	05	40	01	10		
	3	1Fr	5Fr	10Fr	-	1/5Fr, 3/10Fr, 7/2x10Fr	03	15	30	00	10	60	01	15		
Germany		5DM	2DM	1DM	-	1/1DM, 2/2DM, 6/5 D-Mark	05	02	01	00	01	05	01	00		
Italy		500L	500L	-	-	1/500 Lire	01	01	00	00	01	00	00	00		
Japan		100Y	100Y	-	-	1/100 Yen, 3/2x100 Yen	01	01	00	00	01	02	01	00		
New Zealand		.20	.20	-	-	1/20 Cents	01	01	00	00	01	00	00	00		
Norway		5Kr	10Kr	-	-	1/5Kr, 2/10 Kroner	01	02	00	00	01	00	00	00		
Spain		500P	100P	-	-	1/100P, 6/500 Pesetas	05	01	00	00	01	05	01	00		
Sweden		10Kr	5Kr	-	1Kr	1/5x1Kr, 1/5Kr, 2/10Kr	10	05	00	01	05	00	00	00		
Switzerland		1Fr	5Fr	2Fr	-	1/1Fr, 3/2Fr, 7/5 Francs	01	07	03	00	01	00	00	00		
United Kingdom	1	1£	50P	20P	10P	1/3x10P, 2/50P, 4/1 Pound	20	10	04	02	05	00	00	00		
	2	1£	50P	20P	10P	1/50P, 3/1 Pound	10	05	02	01	05	10	01	00		
Universal		-	-	-	-	1/1 Coin	01	01	00	00	01	00	00	00		

III. TEST MODE

replays include all replays won from beating the score replay level, achieving a new high game to date, winning a playfield special, and all match replays.

When the GAME MODE adjustment is set to Add a Ball this setting refers to extra ball percentage rather than replay percentage. The value entered in this case will be compared to the value calculated by dividing total extra balls won by total plays (see Bookkeeping section).

25) MATCH PERCENT PAYOUT

This step is used to set the match payout percentage. If this step is set to zero, the match will be disabled.

NOTE: The resulting value from subtracting the value entered for this step from the value entered for the GAME PERCENT PAYOUT adjustment indicates what percentage is left for any other means of winning a replay during a game.

26) HIGH GAME REPLAYS

This step is used to set the number of replays to award when the highest game to date has been beaten.

27) MAXIMUM CREDITS

This step sets the maximum number of credits allowed on the game.

28) TILT WARNINGS

This step sets the number of tilts allowed before the current player's ball in play is terminated.

29) BALLS PER GAME

This step sets the game to 3-ball play or 5-ball play.

30) GAME MODE

This step allows the game to be played in Replay, Replay + Tickets, Tickets Only, Add a Ball, or Novelty mode. In Replay mode all Specials and replays are allowed. Replay + Tickets mode is the same as Replay mode with the addition of one or more tickets to be issued (TICKETS TO AWARD) along with each replay. In Tickets Only mode one or more tickets will be issued in place of each replay won.

In Add a Ball mode all Score Level Replays and Playfield Specials award an extra ball in place of a replay. Also the Match and High Game To Date awards are disabled. However, after the Add a Ball mode is selected, the PLAYFIELD SPECIAL, MATCH PERCENT PAYOUT, and HIGH GAME REPLAYS adjustments may be individually set to whatever setting may be desired. In Novelty mode all Specials award 10,000,000 points and the Score Replay Levels, Match, and High Game to Date awards are disabled.

NOTE: If either the Replay + Tickets or Tickets Only setting is selected do not set the COIN METER setting to on.

31) TICKETS TO AWARD

This step allows the operator to set the number of tickets to award when a replay has been won. This setting will only apply when the GAME MODE is set to either Replay + Tickets, or Tickets Only.

32) LANGUAGE

This step allows the Test Mode steps to be displayed in English, German, or French.

33) AUTO-PERCENTAGING

If this step is set to on, the Score Replay Levels will be adjusted periodically so that the Game Percent Payout setting will match the actual Replay Percentage displayed in Bookkeeping.

NOTE: If the GAME MODE is set to Add a Ball, the Extra Ball Percentage in bookkeeping is used in place of the Replay Percentage.

34) REPLAY LIMIT

This step may be set to no limit or one per player per game.

35) HIGH GAMES 2-5

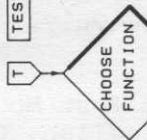
This step will determine if High Games to Date (2-5) will be saved or erased when power is turned off.

36) ATTRACT SOUND

This step determines whether or not sounds are enabled during the attract mode (game over).

NOTE:
THE TEST MODE CAN ONLY BE ACCESSED DURING THE ATTRACT MODE (GAME OVER).
THE TEST MODE MAY BE EXITED BY EITHER ACTUATING THE SLAM SWITCH ON THE FRONT DOOR OR TURNING THE POWER OFF.

TEST MODE



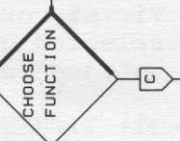
SELF-TEST



BOOKKEEPING

- STEP**
- 1) CHUTE 1 COINS (LEFT)
 - 2) CHUTE 2 COINS (RIGHT)
 - 3) CHUTE 3 COINS (CENTER)
 - 4) CHUTE 4 COINS
- Left values for steps 1-4 can be displayed by pressing the credit button.
- 5) PERCENT REPLAYS
 - 6) BALL TIME (MIN-SEC)
 - 7) GAME TIME (MIN-SEC)
 - 8) TOTAL PLAYS PAID
 - 9) TOTAL PLAYS
 - 10) TOTAL REPLAYS
 - 11) PLAYFIELD SPECIALS
 - 12) SCORE LEVEL REPLAYS
 - 13) HIGH GAME REPLAYS
 - 14) MATCH REPLAYS
 - 15) TOTAL EXTRA BALLS
 - 16) PERCENT EXTRA BALLS
 - 17) TOTAL TILTS
 - 18) TILT WARNINGS
 - 19) 0-1.9M SCORES
 - 20) 2-4.9M SCORES
 - 21) 5-8.9M SCORES
 - 22) 9-13.9M SCORES
 - 23) 14-19.9M SCORES
- NEXT STEP**
- T NEXT STEP
 - L RESET LEFT AND <RIGHT> VALUES.
 - R RESET <RIGHT> VALUES ONLY

GAME ADJUSTMENTS



- STEP**
- 1) FIRST REPLAY LEVEL *
 - 2) SECOND REPLAY LEVEL *
 - 3) THIRD REPLAY LEVEL *
 - 4) HIGHEST GAME TO DATE *
 - 5) HIGH GAME TO DATE 2 *
 - 6) HIGH GAME TO DATE 3 *
 - 7) HIGH GAME TO DATE 4 *
 - 8) HIGH GAME TO DATE 5 *
 - 9) GAME PRICING
- Steps 10-17 are skipped if GAME PRICING is not set to CUSTOM.
- 10) <L> CHUTE 1 UNITS
 - 11) <R> CHUTE 2 UNITS
 - 12) <C> CHUTE 3 UNITS
 - 13) CHUTE 4 UNITS
 - 14) UNITS/CREDIT
 - 15) UNITS/BONUS CREDIT
 - 16) BONUS CREDITS
 - 17) MINIMUM UNITS
 - 18) COIN METER
- Steps 19-22 are skipped if step 18 is off

- NEXT STEP**
- T NEXT STEP
 - L CHANGE ADJUSTMENT
 - R CHANGE ADJUSTMENT
 - C SET TO FACTORY DEFAULT (Applies only to steps below that are followed by an asterisk *)

MODE FLOWCHART

- 24) 20-26.9M SCORES
- 25) 27-34.9M SCORES
- 26) 35-43.9M SCORES
- 27) 44-53.9M SCORES
- 28) 54M+ SCORES

LEGEND

- ☐ T PRESS TEST BUTTON
- ☐ C PRESS CREDIT BUTTON
- ☐ L PRESS LEFT FLIPPER BUTTON
- ☐ R PRESS RIGHT FLIPPER BUTTON

☐ R NEXT DRIVER

SWITCH MATRIX TEST

☐ C RESTART TEST

DISPLAY TEST

☐ C RESTART TEST

☐ R NEXT STEP

SOUND TEST

☐ C RESTART TEST

☐ R NEXT STEP

FRONT DOOR TEST

☐ C RESTART TEST

- 19) CHUTE 1 PULSES
- 20) CHUTE 2 PULSES
- 21) CHUTE 3 PULSES
- 22) CHUTE 4 PULSES
- 23) 1 COIN BUY-IN BONUS
- 24) GAME PERCENT PAYOUT
- 25) MATCH PERCENT PAYOUT
- 26) HIGH GAME REPLAYS
- 27) MAXIMUM CREDITS
- 28) TILT WARNINGS
- 29) BALLS PER GAME
- 30) GAME MODE
- 31) TICKETS TO AWARD
- 32) LANGUAGE
- 33) AUTO PERCENTAGING
- 34) REPLAY LIMIT
- 35) HIGH GAMES 2-S
- 36) ATTRACT SOUND
- 37) ATTRACT MESSAGE
- 38) FREE PLAY
- 39) RIGHT BOOK AUTO-RESET
- 40) PLAYFIELD SPECIAL
- 41) CRUISE BONUS EXTRA BALL
- 42) BONUS MULTIPLIER
- 43) SPINNER SPECIAL

Use the credit button to enter a message

III. TEST MODE

37) ATTRACT MESSAGE

This step is used to enable or disable an operator message during the attract mode (game over). This step is also used to enter a user message into memory. To enter a message press the Credit button. The current message will be displayed and the cursor position will be indicated by the flashing character. If the current position is blank, a flashing directional arrow will appear. This type of arrow will indicate which direction the cursor will move if the Credit button is pressed. The Credit button is also used to select characters after they have been chosen using the left and right flipper buttons.

38) FREE PLAY

If this step is set to on, a game may be started without any credits posted on the machine.

39) RIGHT BOOKKEEPING AUTO-RESET

If this step is set to on, all the short term bookkeeping steps (in brackets) will reset after 2000 plays. Otherwise they will not reset until 10,000 games have been played on the machine.

40) PLAYFIELD SPECIAL

When a playfield special is won, either a replay or an extra ball is awarded to the player based on the setting of this step.



ADJUSTMENTS

OPERATOR ADJUSTMENT SETTINGS
(*** = FACTORY DEFAULT SETTING)

41) CRUISE BONUS EXTRA BALL

Chooses the difficulty of lighting the right spinner extra ball lamps from completing CRUISE.

*** EASY = Previously lit CRUISE letters are remembered from ball to ball.

HARD = Each ball starts with only C lit in CRUISE.

42) BONUS MULTIPLIER

Adjusts game score levels by controlling the outhole bonus multiplier.

*** EASY = Multiplier value is carried over from ball to ball.

HARD = Multiplier resets to 1X at the start of each ball.

43) SPINNER SPECIAL

Sets the difficulty of lighting return lane special lamps from repeated shots to the left spinner.

*** EASY = Restores previously lit left spinner score lamp at the start of each ball.

HARD = Left spinner point value starts at 3,000 for each ball.

SOUND ADJUSTMENTS

The speaker(s) output is controlled by the potentiometer mounted on a bracket located inside the cabinet next to the front door hinge.

Turning the potentiometer counter-clockwise will decrease the volume. Turning it clockwise will increase the volume.

POST ADJUSTMENTS

The post at the mouth of the right outlane can be positioned for liberal/conservative play. The smaller opening produces a more liberal game.

IV. BURN-IN

This function can be used to continuously exercise all the lamps and solenoids in the game.

IV. THEORY OF OPERATION

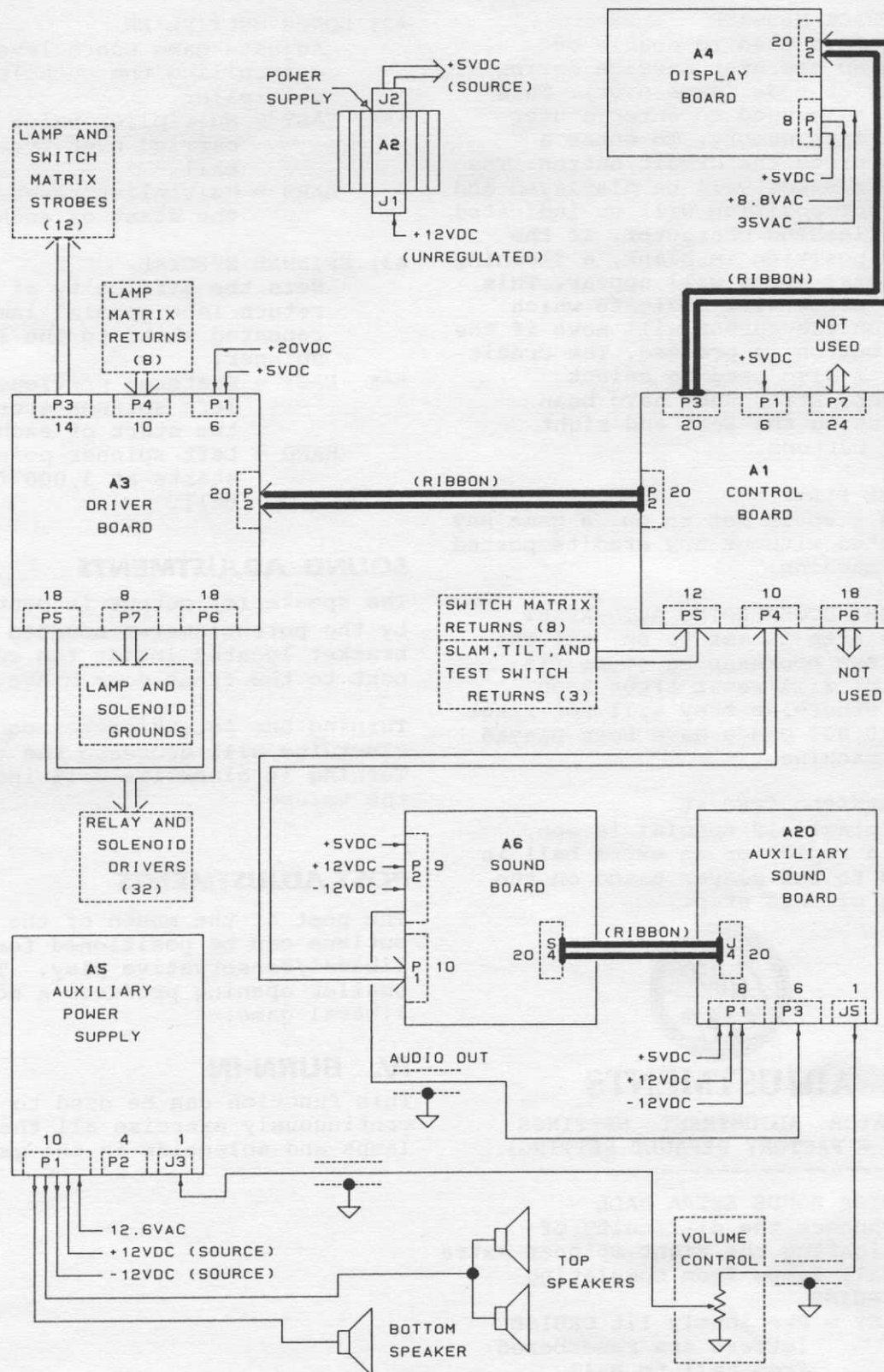


FIGURE 1, SYSTEM 3 BLOCK DIAGRAM

IV. THEORY OF OPERATION

A. CONTROL BOARD (A1)

The Control Board is supplied with 5vdc (A1P1) from the Power Supply (A2P2). The data contained in ram (U3) is kept valid when power is turned off by the lithium battery (BAT1) and controller (U6).

NOTE: When replacing either the battery, ram, or the controller there may be a message that appears in the display on power up the first time that indicates a low battery condition. If this occurs, turn the power off and back on again. The board should power up normally this time. If not, there is another problem on the board.

The Control Board can accommodate either a 27512 or a 27256 Eprom. JP1 must be installed for a 27512 or JP2 for a 27256 Game Prom. A 4 Mhz oscillator is configured using U17, R1, R2, C22, C23, and XTAL1. The oscillator output is then divided by 2 to a 2Mhz clock by U18 which is used as the input clock to the 65C02 (U1) microprocessor. The clock output of U1 (pin 39) is used as a sync signal for reading from or writing to the peripheral devices.

Two versatile interface adapters (U4, U5) are used to develop the necessary control signals for the system. The waveform generated on the CB2 output of U4 triggers the NMI input of the microprocessor. This signal controls the display refresh rate. The display connector (A1P3) is comprised of several signals. The display blanking (DBLNK), digit strobe (DSTB), and digit data (DDATA) are generated by U4-17, U4-16, and U4-15 respectively. The display segment data is output by U7 and latched into the appropriate device on the Display Board by the display segment strobes (DS0-DS3).

The Driver Board connector (A1P2) contains all the signals necessary to operate the lamp and switch matrix strobes, the lamp matrix returns, and the solenoids. The

lamp clear (LCLR), lamp strobe (LSTB), and lamp strobe data (LDATA) are generated by U4-12, U4-11, and U4-10 respectively. The appropriate lamp return data during each active lamp strobe is output by U7 and latched into U5 on the Driver Board by the lamp return data strobe (LDS). The solenoid data is output by U7 and latched into the appropriate Driver Board device (U1-U4) by the solenoid strobes (SS0-SS3).

The switch matrix returns are input at A1P5, buffered by U19 and U20 and then input to U4. Discrete inputs are provided at A1P5 for the slam, tilt, and test switches.

The connection to the Sound Board (A1P4) is made up of eight sound data lines (SD0-SD7), a return line (SRET), and a reset line (MR).

A reset circuit is configured using U13, U14, R3, and C24. When power is applied to the system, the microprocessor reset pin (U1-40) is held low for approximately 10 milliseconds. The system can also be reset by pressing the switch (SW1) on the board. Whenever a reset occurs the master reset signal (MR) (U18-9) is held low until the display strobe (DSTB) becomes active. At this point the master reset goes high which enables the peripheral IC's on the Display Board and Driver Board to accept data.

A watchdog circuit is employed to monitor both the display digit strobe and the lamp strobe. This circuit is made up of U11, U12, U13, U16, R5, R6, R29, R32, R33, C20, C21, C28, and C29. If either the display strobe or the lamp strobe is missing for 330 milliseconds the system will be reset. The system will also be reset if the supply voltage drops below 4vdc. This voltage monitor is configured using U21, VR1, D1, D2, R34, and R35.

IV. THEORY OF OPERATION

B. POWER SUPPLY (A2)

The transformer panel delivers 12vdc to the input of the power supply. The regulated output voltage should be set to 5vdc by using potentiometer R3. This voltage is then supplied to the Control Board (A1), Driver Board (A3), Display Board (A4), Sound Board (A6), and any other auxillary board which may require it. (A1P3) to the Display Board (A4P2).

C. DRIVER BOARD (A3)

Two voltages are supplied to this board at A3P1. The 5vdc is supplied from the Power Supply (A2) and the 20vdc is supplied from the transformer panel. The 20vdc is used to source the controlled lamps and the switch matrix. The Driver Board receives its data at A3P2 from the Control Board (A1P2). Solenoid data is latched into U1-U4. Lamp return data is latched into U5. Lamp and switch strobe data is shifted through U6 and U7. The comparators (U10,U11) are used to protect the MOSFETS (Q33-Q49). If a sensed input voltage exceeds the reference voltage (V_{ref}), the corresponding MOSFET is turned off immediately following the lamp clear pulse (LCLR) supplied by U12 thus limiting the duty cycle. If the master reset signal (MR) is held low all lamps and solenoids will be disabled.

D. DISPLAY BOARD (A4)

Several voltages are input to this board at A4P1. The power supply (A2) supplies 5vdc (V_{cc}). The board develops V_{gg} from the 35vac supplied from the transformer panel. The transformer panel also sources 8.8vac to the display filaments. The display filaments are biased 9.1vdc above ground by the zener diode VR1.

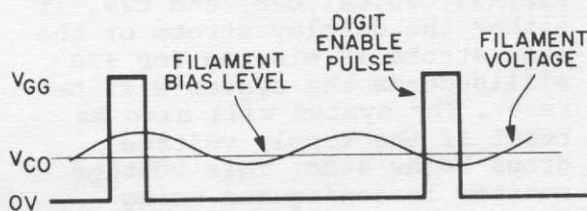


Figure 2. Display Waveform

The Display Board incorporates two vacuum fluorescent display tubes (DSP1,DSP2). The tube's digits are driven by U9. The segments (a-n) of the upper display are driven by U3,U4,U7, and U8. The segments of the lower display are driven by U1,U2,U5, and U6. Figure 1 shows the basic display waveform. Data is sent from the Control Board (A1P3) to the Display Board (A4P2).

E. SOUND BOARD (A6)

The Sound Board consists of two 6502 microprocessor systems, a dual DAC, an input port to receive commands from the system Control Board, and a low level audio output at A6P2-9 which is sent to the summing amplifier located on the Auxiliary Sound Board (A20) for amplification.

The Sound Board requires three supply voltages +5vdc, +12vdc, and -12vdc. In addition, a power-up reset signal is required from the Control Board. If a manual reset is desired, pressing SW2 will reset both processors.

A 4MHz oscillator is configured with R11, R12, C14, C15, C22, XTAL1, and T1. This clock is then divided down by S1 into either a 2MHz or 1MHz clock signal for the processors N1 and T3. A 250 KHz clock signal from S1-11 is used by the programmable timer section consisting of N5, H5, T5, and K5.

Eight lines from the Control Board are input at A6P1 on the Sound Board and sent to the two input code latches A3 and B2. When any of these inputs goes low (except for A6P1-9 when JP7 is not installed) A2-8 goes high which causes the input code data to be latched into A3 and B2. Also at the same time the flip-flops contained in A4 are clocked which cause the IRQ input of each microprocessor to go low. The outputs of A4 will remain in the low state until each flip-flop is cleared by a signal from its associated microprocessor after each IRQ is processed.

The Sound Board is designed to accomodate different types of Eproms. Jumpers JP1, JP2, JP3, and JP4 should be set to their proper positions based on the density of the Eproms being used.

IV. THEORY OF OPERATION

F. AUXILIARY SOUND BOARD (A20)

The Auxiliary Sound Board contains a sound generator YM2151 (U9) and a speech generator MSM6295 (U1). Both of these IC's operate under the control of the T3 microprocessor on the master Sound Board (A6). The sound generator YM2151 responds to its commands by sending serial data to the YM3014 DAC (U10). The DAC then converts this data into an analog signal which is filtered through a series of op-amps and then sent to the main summing amplifier (U11).

When the speech generator MSM6295 receives a command, it then retrieves its data from the Eproms (U4, U5). The analog output at pin 36 (DAO) is then sent through an active filter network and then to the main summing amplifier (U11). A 1MHz crystal resonator (XTAL1) is used to generate the proper clock signal for U1.

The output of the main summing amplifier is sent off the board to a potentiometer (volume control) located just inside the front door of the game. A portion of this output signal is then sent to the power amplifier inputs on the Auxiliary Power Supply Board (A5).

G. SENSOR BOARD (A15)

This board is used to detect if any flipper is energized and then inputs the data to the Control Board to be processed. This board therefore eliminates the need for a second switch to be used on the flipper assembly itself. U1 is an optocoupler device which converts the input signal from the flipper circuit when energized to a signal which can be recognized by the Control Board as a valid switch closure.

H. OPTICAL INTERFACE (A25)

The optical interface assembly generates and receives the infrared light pulses needed to optically detect the ball breaking an infrared light beam. It also provides a visual indication that the interface assembly is functioning properly.

This method of detection transmits

infrared light pulses from an opto LED to an opto phototransistor receiver. The LED light pulses are generated from a switch strobe that is buffered and current amplified by 2 sections of the LM-339 voltage comparator (output pins 1 & 2) and transistor Q2.

When no ball is present, the light pulses reach the opto receiver which passes the pulses 180 degrees out of phase with the switch strobe on to 2 additional sections of the comparator (pins 9 & 10). Because the strobe pulses and receive pulses are out of phase, they cancel at resistors R1 & R3 and keep comparator output pin 13 high preventing Q1 from passing strobes on to the switch return line.

As a ball passes between the opto transmitter and receiver, the light beam is broken. Now, with no out of phase pulses coming from the receiver, the strobe appears at comparator inputs 9 & 10. Comparator output pin 13 begins pulsing low and passes the strobes through Q1 to the return line to signal a closed switch. Also, positive strobe pulses at output pin 14 of the comparator turn Q3 on and light LED D2. D2 lit indicates a broken light beam and a closed optical switch.

J. SMART SWITCH™ (Piezo Film Sensor)

This device takes the place of the momentary rollover type switches. The main advantage of this device is that the need for switch contact points is eliminated. Therefore this eliminates the possibility of contamination by such elements as moisture, dust or smoke. A direct contact force on the wide cantilever beam induces a strain on the laminated piezo film sensor element. As the beam is returning to its rest position it generates an output voltage which triggers the on board circuit. This circuit then generates a momentary output which resembles that of contact points. This switch does not require any adjustment. DO NOT ATTEMPT TO ADJUST THE WIDE CANTILEVER BEAM. This could cause permanent damage to the device. The lifetime of this switch has been determined to be over 10 million cycles.

V. GENERAL INFORMATION

A. PRINTED CIRCUIT BOARDS ARE DESIGNATED AS FOLLOWS:

A1 - Control Board
A2 - Power Supply
A3 - Driver Board
A4 - Display Board
A5 - Auxiliary Power Supply
A6 - Sound Board
A13 - Resistor Board
A15 - Sensor Board
A17 - Diode Board
A20 - Auxiliary Sound Board
A25 - Optical Interface Board

Printed circuit board connectors will be labeled AX-JX. For example, A3-J4 is the connector J4 to the driver board (A3).

B. WIRE COLORS ARE SHOWN AS NUMBERS:

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

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

C. FUSE AND COIL INFORMATION

TRANSFORMER PANEL

F1	Line Input.....	110V AC....	8 Amp	SLO-BLO
		220V AC....	4 Amp	SLO-BLO
F2	Primary Power.....	110V AC....	5 Amp	SLO-BLO
		220V AC....	2.5 Amp	SLO-BLO
F3	Display Filament.....		1/2 Amp	
F4	Display Filament.....		1/2 Amp	
F5	Displays.....		1/4 Amp	SLO-BLO
F6	Power Supply.....		2-1/2 Amp	SLO-BLO
F7	Controlled Lamps.....		10 Amp	SLO-BLO
F8	Solenoids.....		8 Amp	SLO-BLO
F9	Playfield Illumination.....		4 Amp	SLO-BLO
F10	Auxiliary Power Supply.....		1 Amp	SLO-BLO

NOTE:

FUSE DESIGNATIONS F11 THRU F14 NOT USED

V. GENERAL INFORMATION

PLAYBOARD FUSES, COILS/COLORS/SLEEVES

FUSE	RATING	PART NO.	USAGE	COIL/COLOR	SLEEVE
F15	1-1/2 AMP SLO-BLO	EL-24	LEFT POP BUMPER	16570 (GREEN)	5064
F16	1-1/2 AMP SLO-BLO	EL-24	RIGHT POP BUMPER	16570 (GREEN)	5064
F17	1-1/2 AMP SLO-BLO	EL-24	LEFT KICKING RUBBER	5195 (WHITE)	5064
F18	1-1/2 AMP SLO-BLO	EL-24	RIGHT KICKING RUBBER	5195 (WHITE)	5064
F19	1 AMP SLO-BLO	EL-6	3-BANK RESET	26926 (BLUE)	5172
F20	1/2 AMP SLO-BLO	EL-20	BALL KICKER	26451 (YELLOW)	5065
			OUTHOLE RELEASE	27926 (BLUE)	5065
			HOLE KICKER	26451 (YELLOW)	5065
F21	1-1/2 AMP SLO-BLO	EL-24	BOTTOM LEFT FLIPPER	28740 (TAN)	5065
F22	1-1/2 AMP SLO-BLO	EL-24	BOTTOM RIGHT FLIPPER	28740 (TAN)	5065
F23	2 AMP SLO-BLO	EL-7	LEFT SIDE FLIPPER	26646 (BLUE)	5065
F24	1 AMP SLO-BLO	EL-6	TOP RIGHT FLIPPER	27643 (GREEN)	5064

V. GENERAL INFORMATION

D. COIL CHART

SOLENOID COILS					
PART NUMBER	WHERE USED	RESISTANCE (OHMS)	NUMBER OF TURNS	WIRE GAUGE	WRAPPER COLOR
A-19300	GENERAL PURPOSE	7.8	1075	#25	ORANGE
A-5195	GENERAL PURPOSE	12.3	1305	#26	WHITE
A-16570	GENERAL PURPOSE	15.5	1450	#27	GREEN
A-17876	GENERAL PURPOSE	24	1750	#28	TAN
A-26450	GENERAL PURPOSE	42	2400	#29	PINK
A-26451	GENERAL PURPOSE	65.8	3000	#30	YELLOW
A-26926	3-BANK RESET	32.8	2650	#27	BLUE
A-25959	FLIPPER (NEW UNIT)	3.85/202	445/1225	#22/#30	RED
A-26646	FLIPPER (NEW UNIT)	4.57/201	725/3470	#25/#33	BLUE
A-28740	FLIPPER (NEW UNIT)	6.02/207	790/3600	#26/#33	TAN
A-27642	FLIPPER (NEW UNIT)	9.1/203	950/3700	#27/#33	YELLOW
A-27643	FLIPPER (OLD UNIT)	11.4/202	960/3670	#28/#33	GREEN
A-27926	GENERAL PURPOSE	64.7	3475	#29	BLUE
RELAY COILS					
PART NUMBER	WHERE USED	RESISTANCE (OHMS)	NUMBER OF TURNS	WIRE GAUGE	WRAPPER COLOR
A-26452	DROP TAR. TRIP	137	2450	#35	PINK
A-16890	GENERAL PURPOSE	231	4000	#35	ORANGE

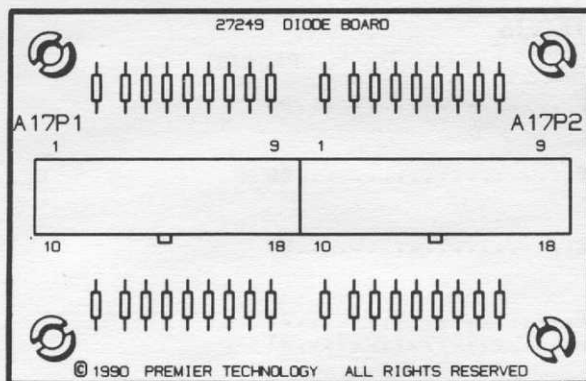
VI. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

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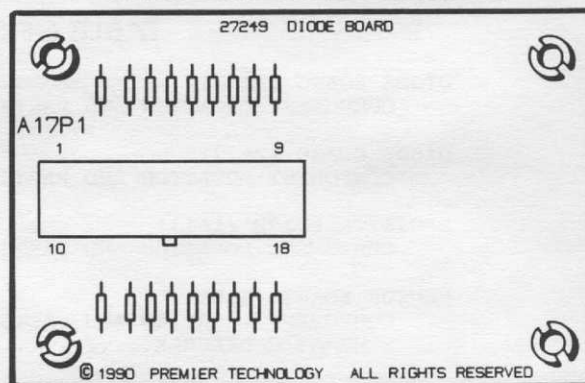
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VI. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

DIODE BOARD (A17) COMPONENT LOCATION



DIODE BOARD (A17) COMPONENT LOCATION



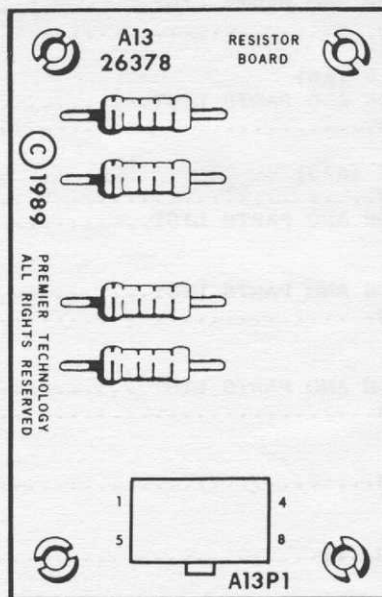
DIODE BOARD (A17) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
1A17	Diode Matrix Assembly	MA-1448
D1-D32	Diode, 1N4148	XO-261
P1,P2	Header, 18 Position	XO-916
R1-R4	Resistor, 220 OHM, 5%, 1/4W	XO-21
	Circuit Board Support (4)	23984

DIODE BOARD (A17) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
2A17	Diode Matrix Assembly	MA-1449
D1-D16	Diode 1N4148	XO-261
P1	Header, 18 Position	XO-916
R1,R2	Resistor, 220 OHM, 5%, 1/4W	XO-21
	Circuit Board Support (4)	23984

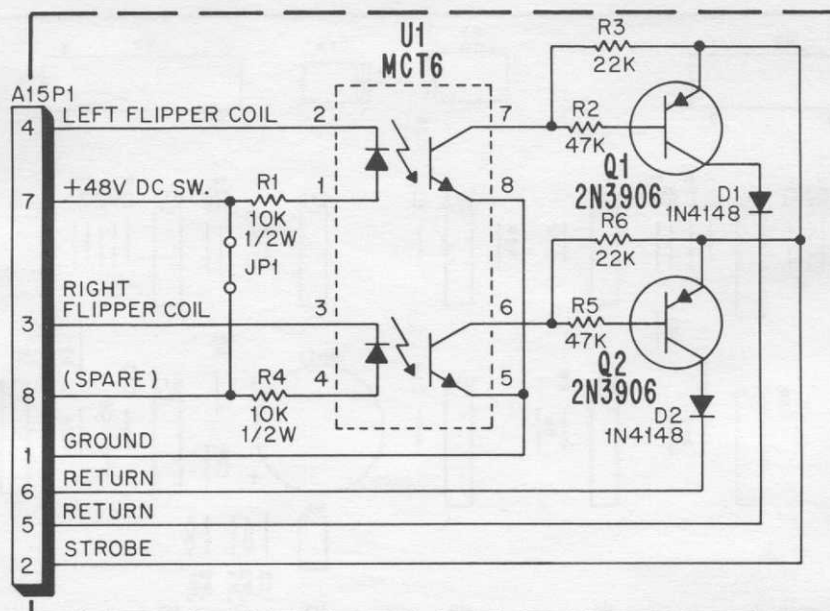
RESISTOR BOARD (A13) COMPONENT LOCATION



RESISTOR BOARD (A13) PARTS LIST

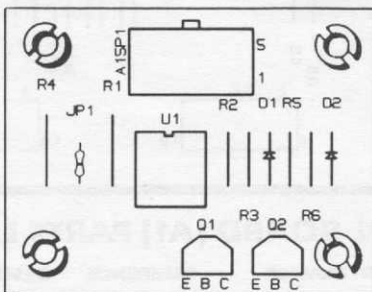
REFERENCE	DESCRIPTION	PART NUMBER
1A13	Resistor Board Assembly	MA-1435
R1,R2, R4,R5	Resistor 33 OHM, 5%, 5W	XO-1009
P1	Header, 8 Position	XO-911
	Circuit Board Support (4)	23984

VI. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS



SENSOR BOARD (A15), SCHEMATIC DIAGRAM

SENSOR BOARD (A15) COMPONENT LOCATION

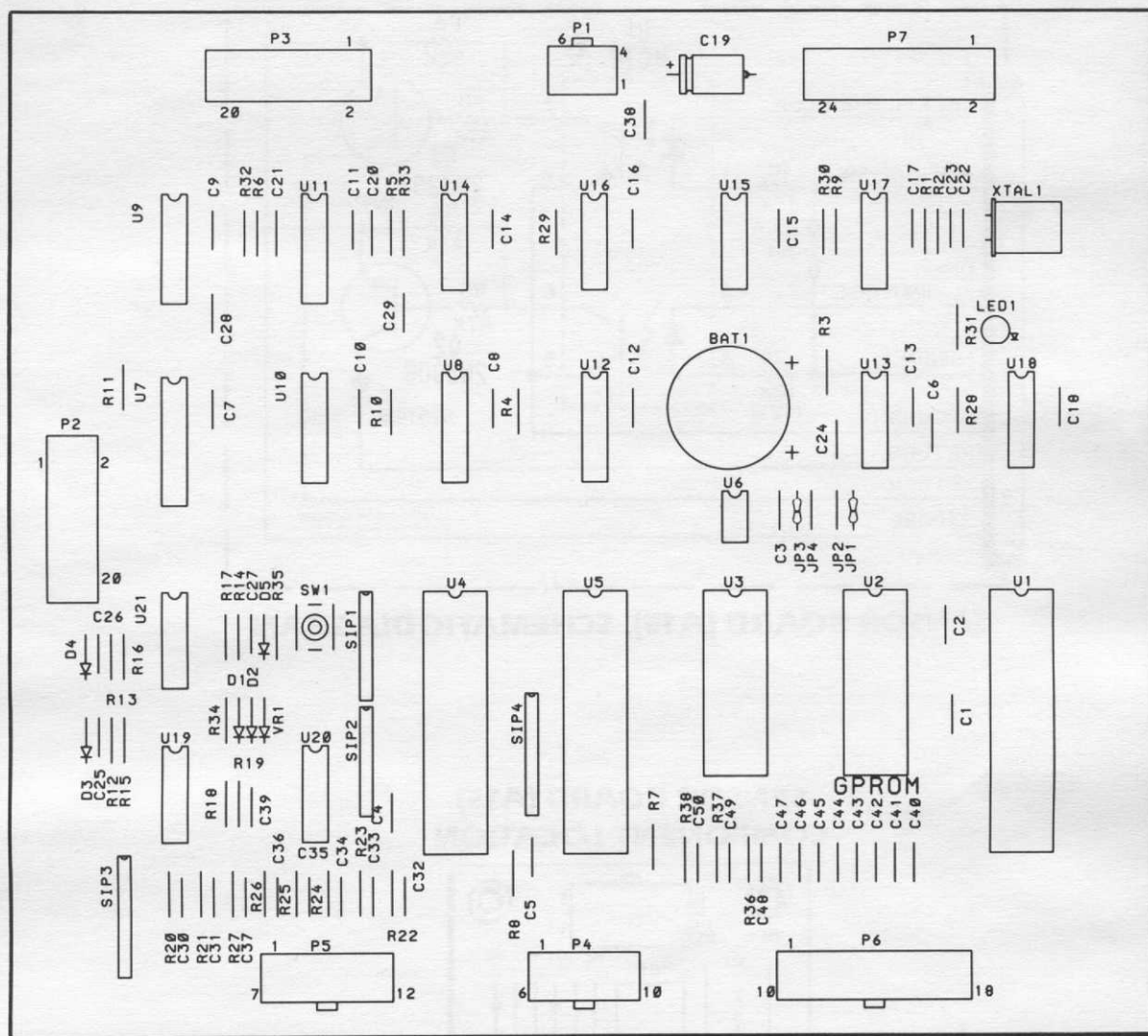


SENSOR BOARD (A15) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
	Sensor Board Assembly (A15)	MA-1334
D1,D2	Diode, 1N4148	XO-261
JP1	Jumper, Resistor, 0 OHM	XO-469
Q1,Q2	Transistor, 2N3906 (PNP)	XO-588
R1,R4	Resistor, 10K Ohm, 5%, 1/2W	XO-62
R2,R5	Resistor, 47K Ohm, 5%, 1/4W	XO-30
R3,R6	Resistor, 22K Ohm, 5%, 1/4W	XO-42
U1	IC, Optocoupler, MCT6	XO-1000
A15P1	Header, 8 Position	XO-911
	Spacer (4)	23984

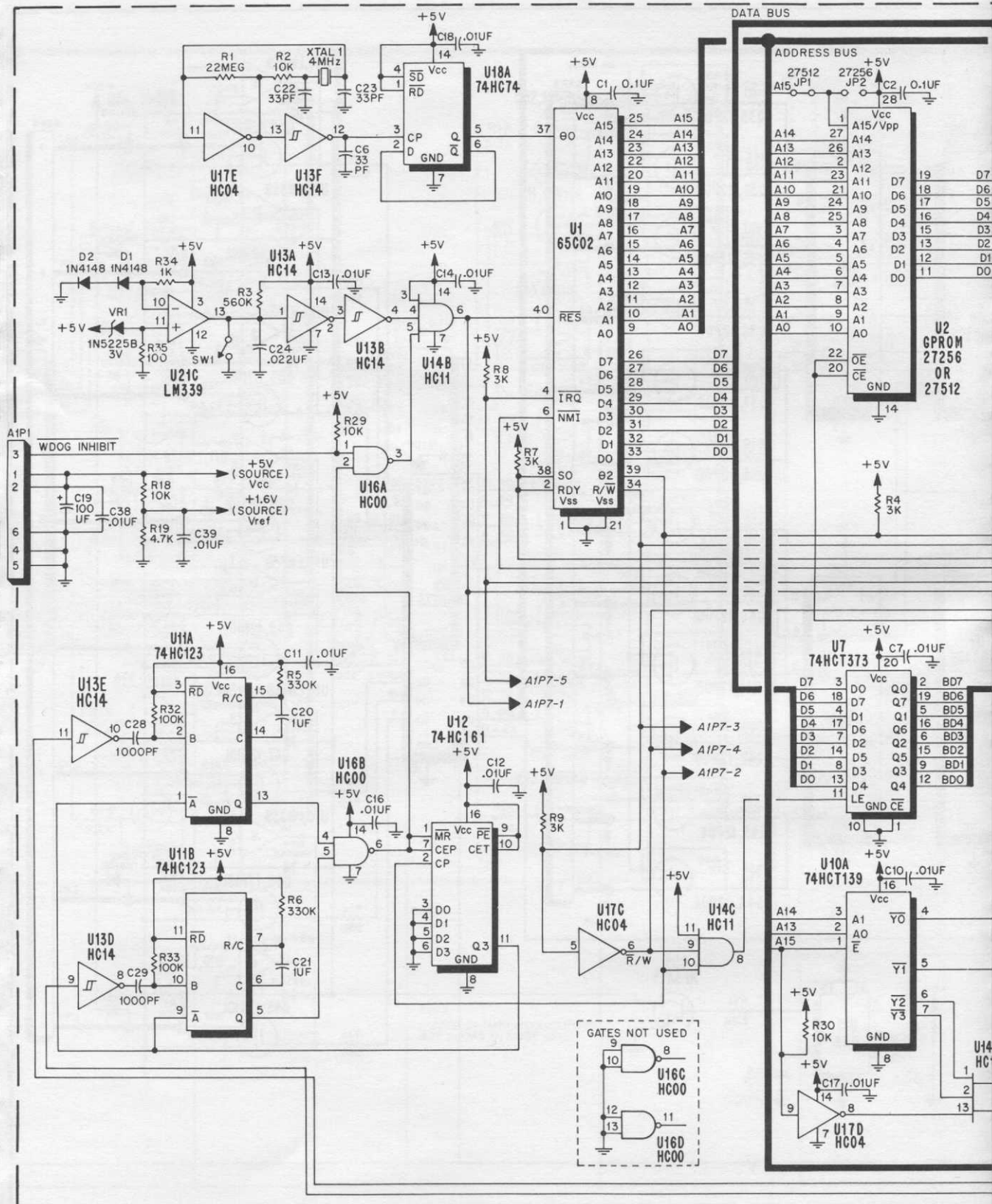
VI. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

CONTROL BOARD (A1) COMPONENT LOCATION

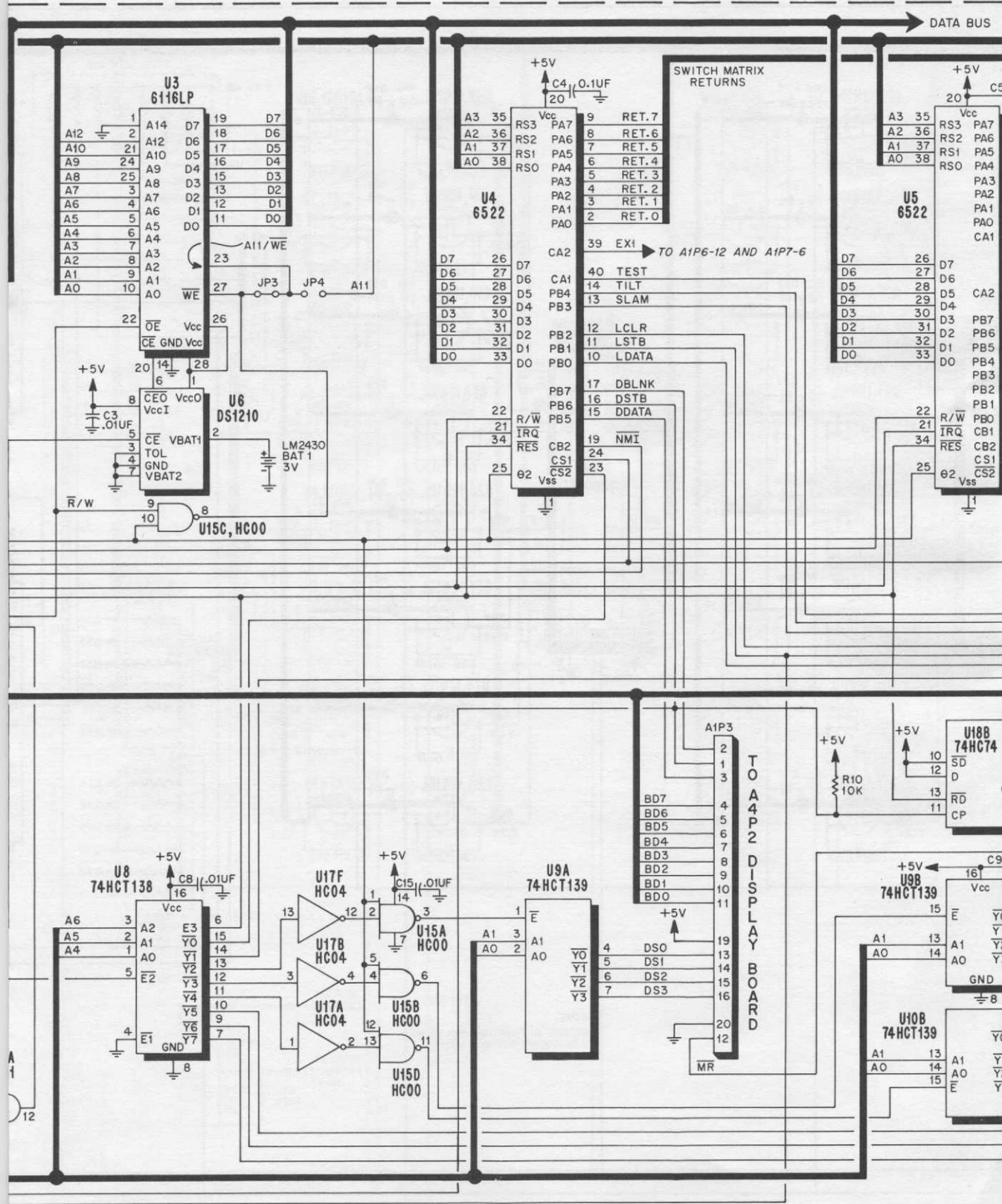


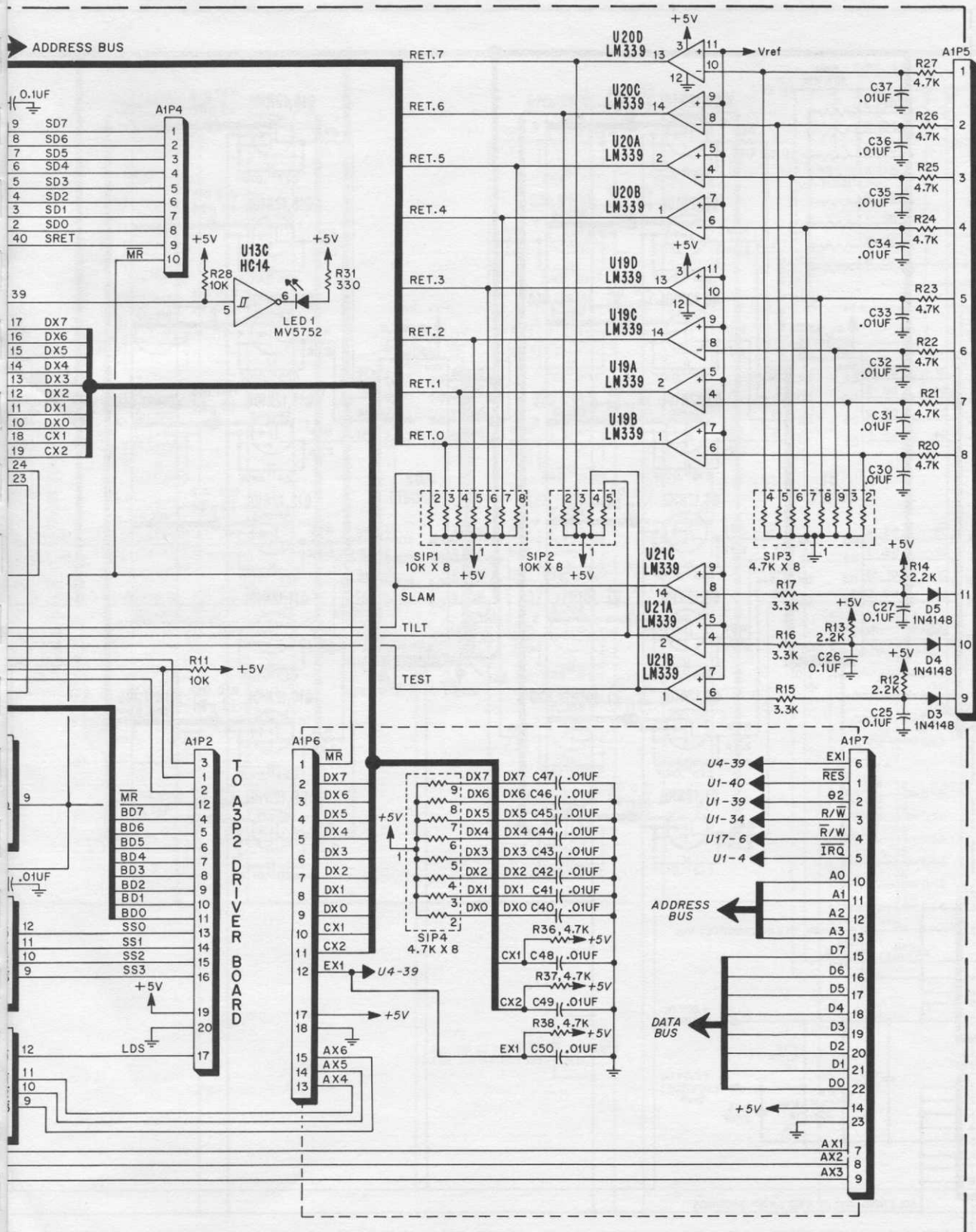
CONTROL BOARD (A1) PARTS LIST

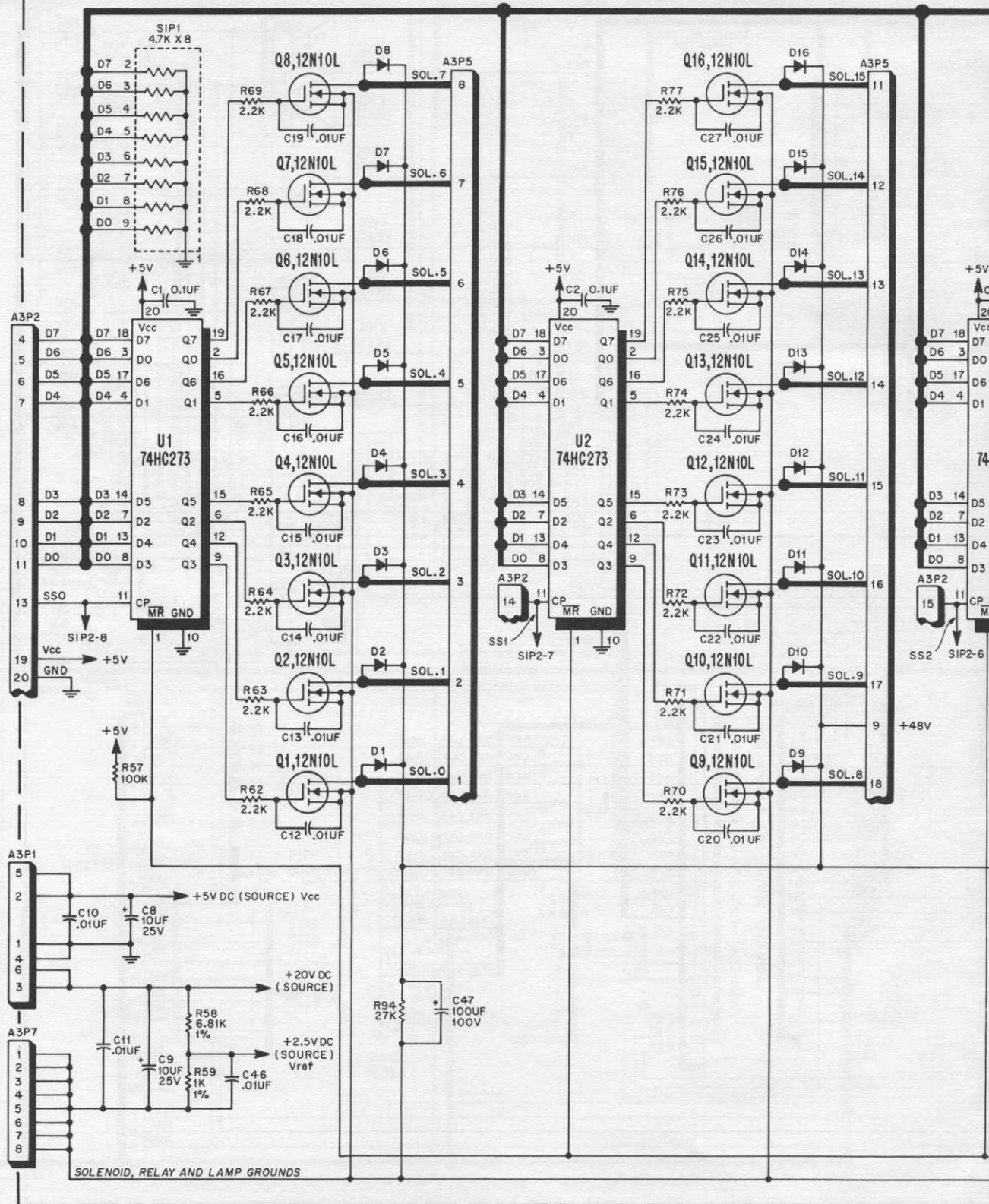
REFERENCE	DESCRIPTION	PART NUMBER	REFERENCE	DESCRIPTION	PART NUMBER
	Control Board Assembly (A1)	MA-1423	SIP3, SIP4	Resistor Pack, 4.7K OHM X 8	X0-161
BAT 1	Lithium Battery, LM2430, 3V	X0-925	SW1	Switch, N.O.	X0-897
C3, C7-C18,	Capacitor, .01UF, +80% -20%, 50V	X0-229	U1	IC, 65C02P2, CPU, 2MHZ	X0-927
C30-C50			U3	IC, 6116LP, 2K X 8, Static Ram	X0-928
C1, C2, C4	Capacitor, 0.1UF, +80% -20%, 50V	X0-230	U4, U5	IC, 6522AP, Versatile Interface Adaptor (VIA)	X0-929
C5, C25, C27			U6	IC, DS1210, Non-Volatile Controller	X0-930
C6, C22, C23	Capacitor, 33PF, 10%, 50V	X0-896	U7	IC, 74HCT373, Octal Latch	X0-931
C19	Capacitor, 100UF, +80% -20%, 10V	X0-211	U8	IC, 74HCT138, Decoder	X0-932
C20, C21	Capacitor, 1UF, 20%, 50V	X0-746	U9, U10	IC, 74HCT139, Dual Decoder	X0-933
C24	Capacitor, .022UF, 10%, 50V	X0-873	U11	IC, 74HC123, Dual Multivibrator	X0-934
C28, C29	Capacitor, 1000PF, 10%, 100V	X0-296	U12	IC, 74HC161, Binary Counter	X0-935
D1-D5	Diode, 1N4148	X0-261	U13	IC, 74HC14, Schmitt Hex Inverters	X0-936
LED 1	LED, MV5752 (Red)	X0-270	U14	IC, 74HC11, Triple "And" Gates	X0-937
R1	Resistor, 22 MEGOHM, 5%, 1/4W	X0-74	U15, U16	IC, 74HC00, Quad "Nand" Gates	X0-782
R2, R10, R11	Resistor, 10K OHM, 5%, 1/4W	X0-18	U17	IC, 74HC04, Hex Inverters	X0-888
R18, R28, R30			U18	IC, 74HC74, Dual "D" Flip-Flop	X0-939
R3	Resistor, 560K OHM, 5%, 1/4W	X0-169	U19, U20, U21	IC, LM339, Quad Comparators	X0-583
R5, R6	Resistor, 330K OHM, 5%, 1/4W	X0-47	VR1	Zener Diode, 1N5225B, 3V, 5%	X0-269
R4, R7-R9	Resistor, 3K OHM, 5%, 1/4W	X0-23	XTAL1	Crystal, 4MHZ	X0-366
R12-R14	Resistor, 2.2K OHM, 5%, 1/4W	X0-27	A1P1	Header, 6 Position	X0-910
R15-R17	Resistor, 3.3K OHM, 5%, 1/4W	X0-38	A1P2, A1P3	Header, 20 Position (Ribbon)	X0-940
R19-R27,	Resistor, 4.7K OHM, 5%, 1/4W	X0-7	A1P4	Header, 10 Position	X0-912
R36-R38			A1P5	Header, 12 Position	X0-913
R31	Resistor 330 OHM, 5%, 1/4W	X0-34	A1P6	Header, 18 Position	X0-916
R32-R33	Resistor, 100K OHM, 5%, 1/4W	X0-45		Jumper, Resistor, 0 OHM (2)	X0-469
R34	Resistor, 1K OHM, 5%, 1/4W	X0-5		Socket, 28 Pin Dip	X0-536
R35	Resistor, 100 OHM, 5%, 1/4W	X0-28			
SIP1, SIP2	Resistor Pack, 10K OHM X 7, 5%, 1/4W	X0-926			



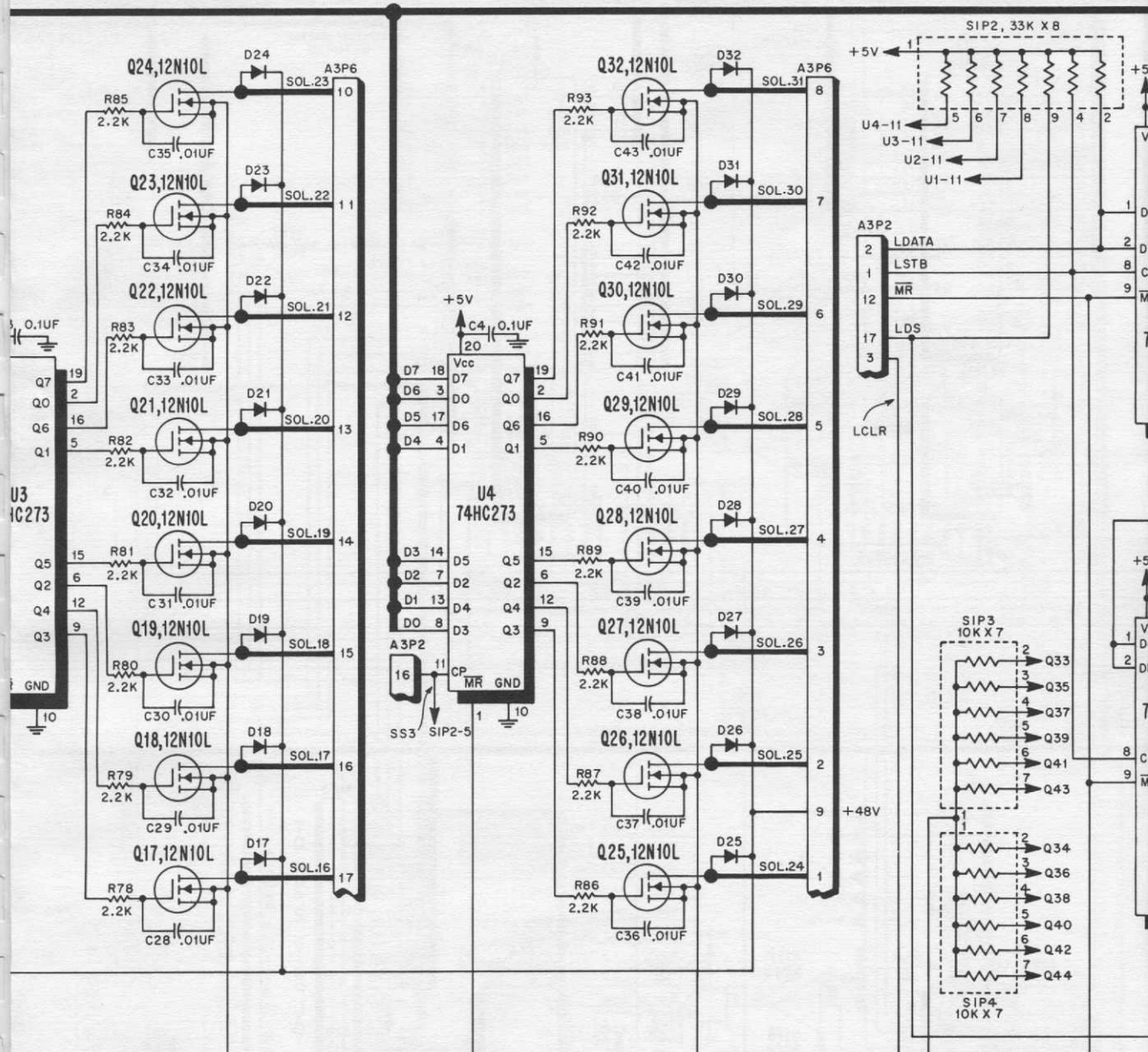
VI. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

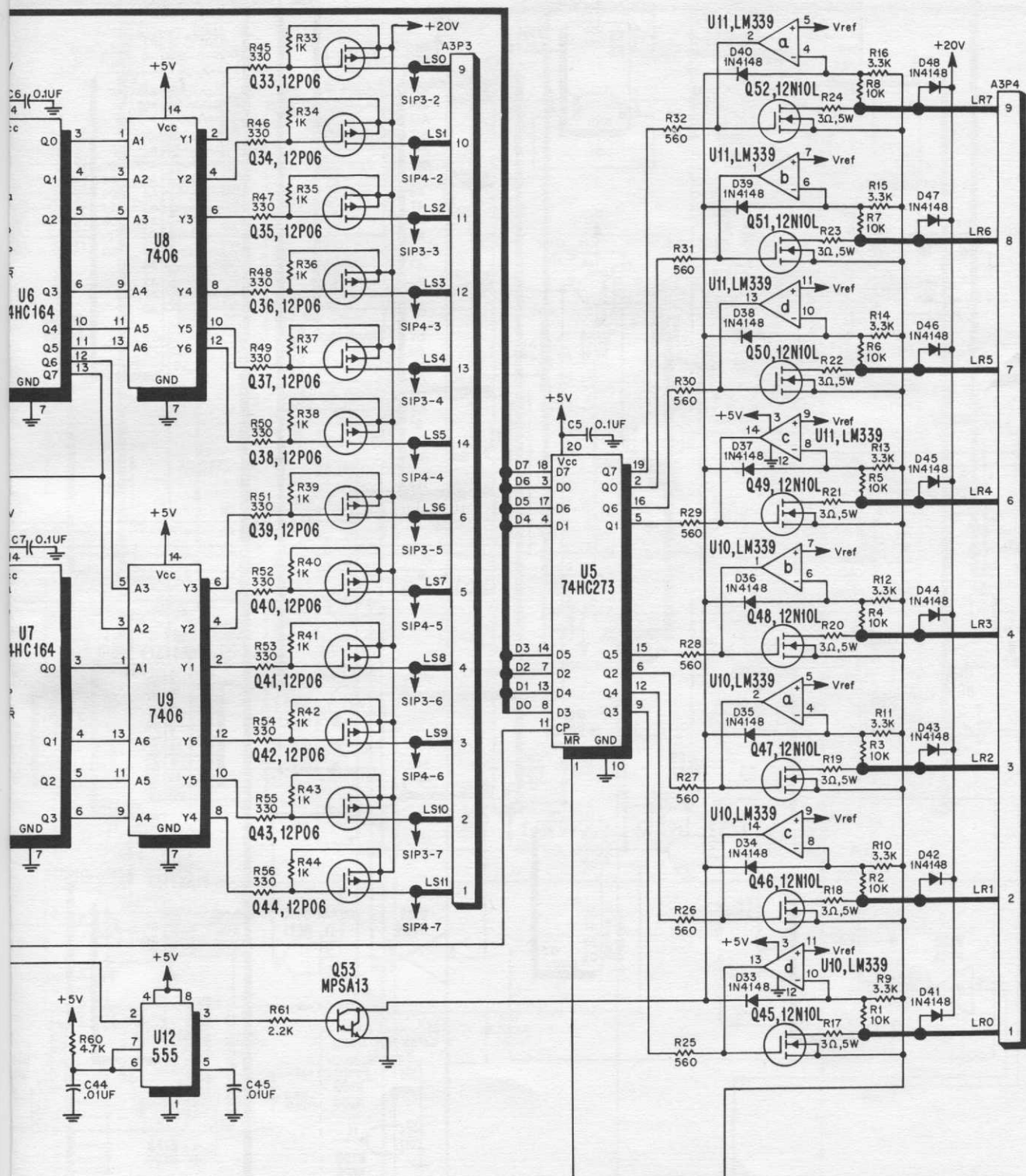






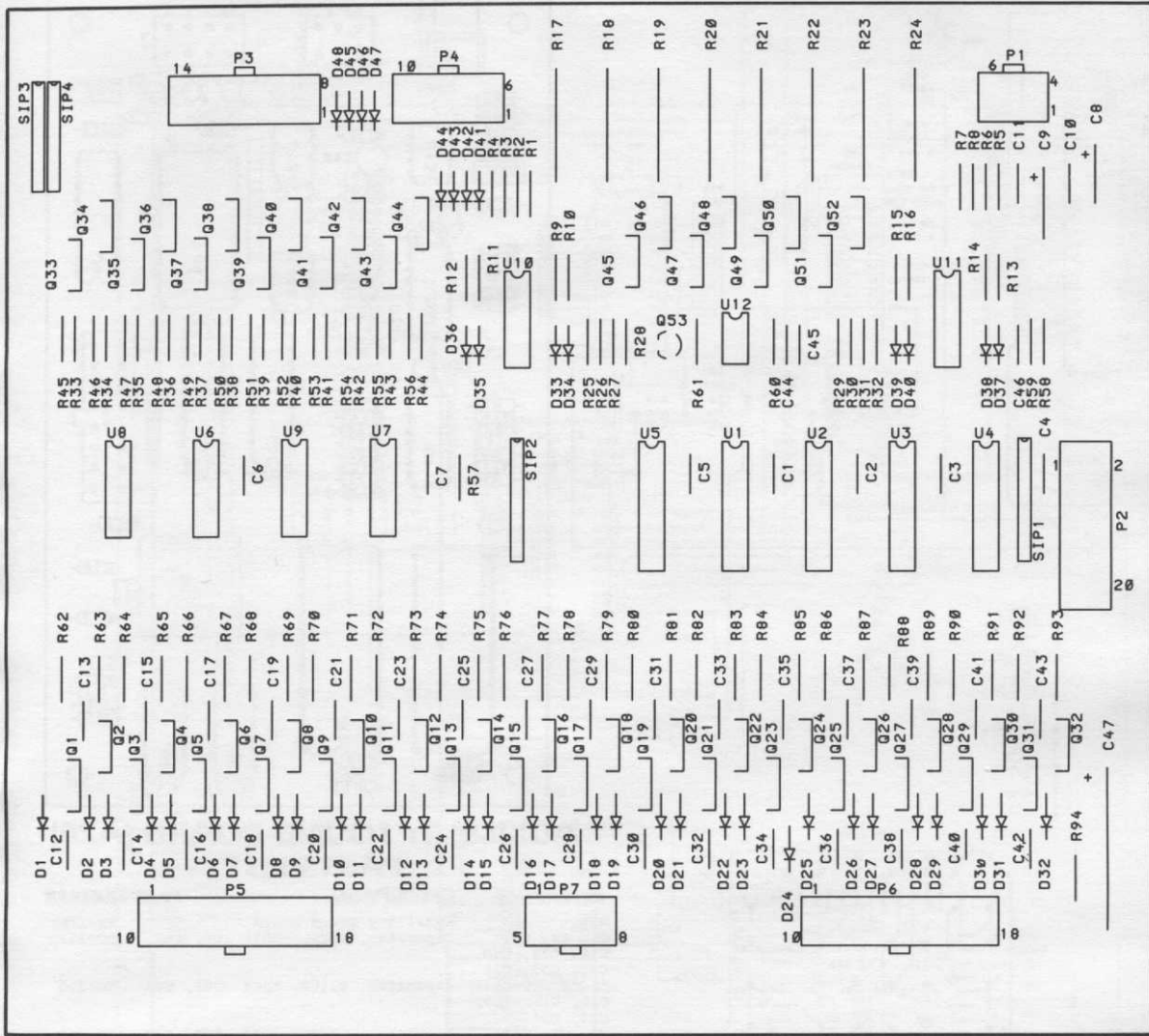
VI. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS





DRIVER BOARD (A3), SCHEMATIC DIAGRAM

DRIVER BOARD (A3) COMPONENT LOCATION

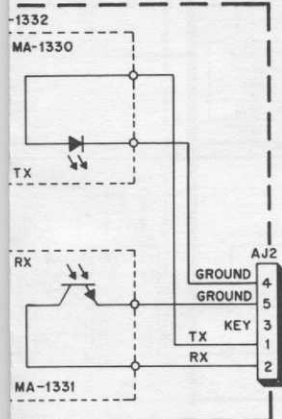


DRIVER BOARD (A3) PARTS LIST

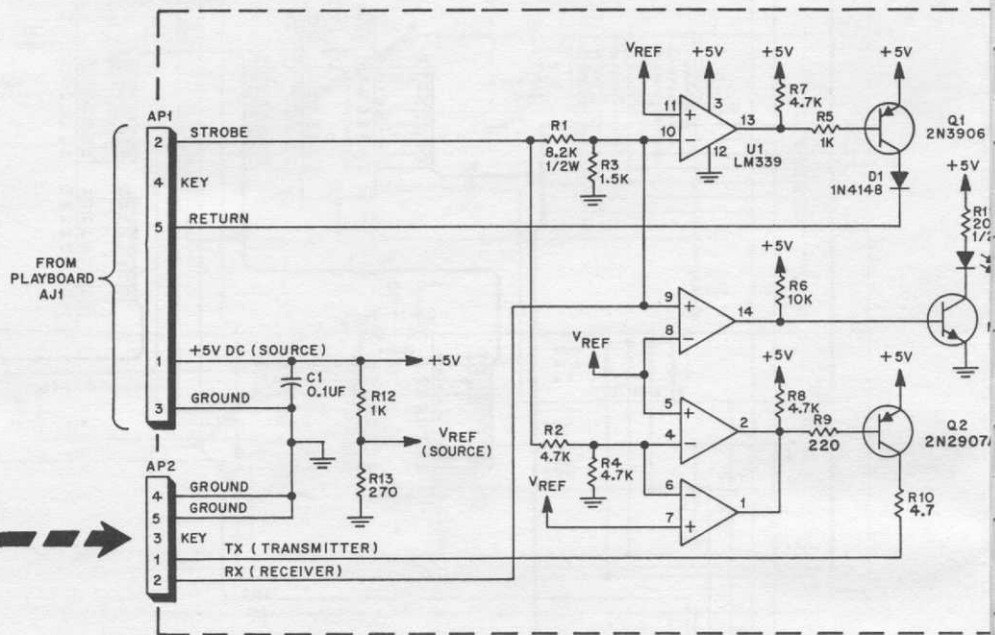
REFERENCE	DESCRIPTION	PART NUMBER	REFERENCE	DESCRIPTION	PART NUMBER
C1-C7	Driver Board Assembly (A3)	MA-1358	R58	Resistor, 6.81K Ohm, 1%, 1/4W	XO-943
C8	Capacitor, 0.1 UF, +80% -20%, 50V	XO-230	R59	Resistor, 1K Ohm, 1%, 1/4W	XO-944
C9	Capacitor, 10UF, 20%, 25V	XO-127	R60	Resistor, 4.7K Ohm, 5%, 1/4W	XO-7
C10, C11	Capacitor, 10UF, +80% -20%, 25V	XO-225	R61-R93	Resistor, 2.2K Ohm, 5%, 1/4W	XO-27
C45, C46	Capacitor, .01UF, +80% -20%, 50V	XO-229	R94	Resistor, 27K Ohm, 5%, 1/4W	XO-11
C12-C44	Capacitor, .01UF, 10%, 50V	XO-696	SIP1	Resistor Pack, 4.7K Ohm X 8.5%, 1/4W	XO-161
C47	Capacitor, 100UF, 20%, 100V	XO-958	SIP2	Resistor Pack, 33K Ohm X 8.5%, 1/4W	XO-945
D33-D48	Diode, 1N4148	XO-261	SIP3	Resistor Pack, 10K Ohm X 7.5%, 1/4W	XO-926
Q1-Q32, Q45-Q52, Q54	Transistor, RFP12N10L, OR IRL530, N-Channel MOSFET	XO-947	SIP4		
Q33-Q44	Transistor, RFP12P06, OR IRF9531, P-Channel MOSFET	XO-948	U1-U5	IC, Octal "D" Flip-Flops, 74HC273	XO-949
Q53	Transistor, MPSA13, Darlington	XO-304	U6-U7	IC, Shift Register, 74HC164	XO-950
R1-R8	Resistor, 10K Ohm, 5%, 1/4W	XO-18	U8-U9	IC, Buffer, 7406	XO-85
R9-R16	Resistor, 3.3K Ohm, 5%, 1/4W	XO-38	U10-U11	IC, Quad Comparator, LM339	XO-583
R17-R24	Resistor, 3 Ohm, 5%, 5W	XO-942	U12	IC, Timer, NE555	XO-631
R25-R32	Resistor, 560 Ohm, 5%, 1/4W	XO-36	A3P1	Header, 6 Position	XO-910
R33-R44	Resistor, 1K Ohm, 5%, 1/4W	XO-5	A3P2	Header, 20 Position (Ribbon)	XO-940
R45-R56	Resistor, 330 Ohm, 5%, 1/4W	XO-34	A3P3	Header, 14 Position	XO-914
R57	Resistor, 100K Ohm, 5%, 1/4W	XO-45	A3P4	Header, 10 Position	XO-912
			A3P5	Header, 18 Position	XO-916
			A3P6		
			A3P7	Header, 8 Position	XO-911

VI. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

LED TRANSMITTER BOARD SCHEMATIC DIAGRAM

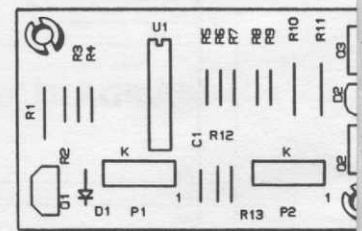


OPTO PHOTOTRANSISTOR RECEIVER BOARD SCHEMATIC DIAGRAM



OPTICAL INTERFACE BOARD, SCHEMATIC DIAGRAM

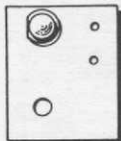
OPTICAL INTERFACE BOARD COMPONENT LOCATION



OPTICAL INTERFACE BOARD PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
AP1, AP2	5 PIN HEADER	
C1	CAPACITOR, 0.1UF, +80% -20%, 50V	
D1	DIODE, 1N4148	
D2	DIODE, MV5752 (LED, RED)	
Q1	TRANSISTOR, PNP, 2N3906	
Q2	TRANSISTOR, PNP, 2N2907A	
Q3	TRANSISTOR, NPN, MPSA13	
R1	RESISTOR, 8.2K OHM, 5%, 1/2W	
R2, R4, R7, R8	RESISTOR, 4.7K OHM, 5%, 1/4W	
R3	RESISTOR, 1.5K OHM, 5%, 1/4W	
R5, R12	RESISTOR, 1K OHM, 5%, 1/4W	
R6	RESISTOR, 10K OHM, 5%, 1/4W	
R9	RESISTOR, 220 OHM, 5%, 1/4W	
R10	RESISTOR, 4.7 OHM, 5%, 1/4W	
R11	RESISTOR, 20 OHM, 5%, 1/2W	
R13	RESISTOR, 270 OHM, 5%, 1/4W	
U1	IC, QUAD COMPARATORS, LM339	
	SUPPORT, SRS-8-6N, (2)	

LED TRANSMITTER BOARD COMPONENT LOCATION



LED TRANSMITTER BOARD PARTS LIST

DESCRIPTION	PART NUMBER
Opto LED Transmitter Assembly	MA-1330
Plastic Transmitter LED	XO-994

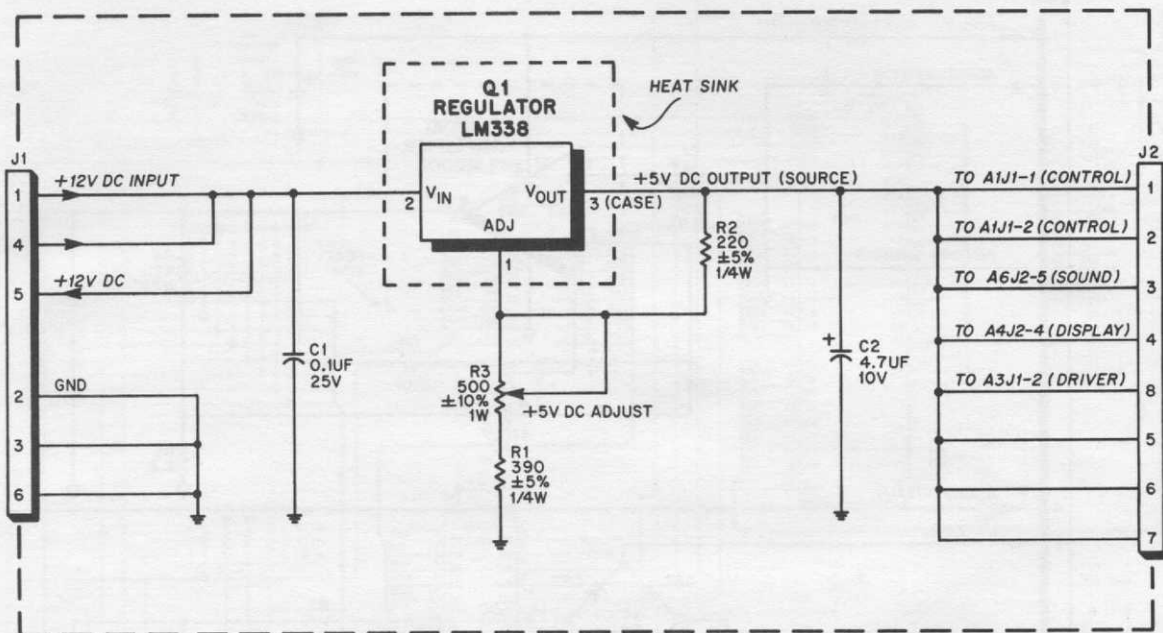
DESCRIPTION	PART NUMBER
Bracket And Optic Boards Assembly	MA-1667
Optical Switch Bracket	28038

OPTO PHOTOTRANSISTOR RECEIVER BOARD COMPONENT LOCATION

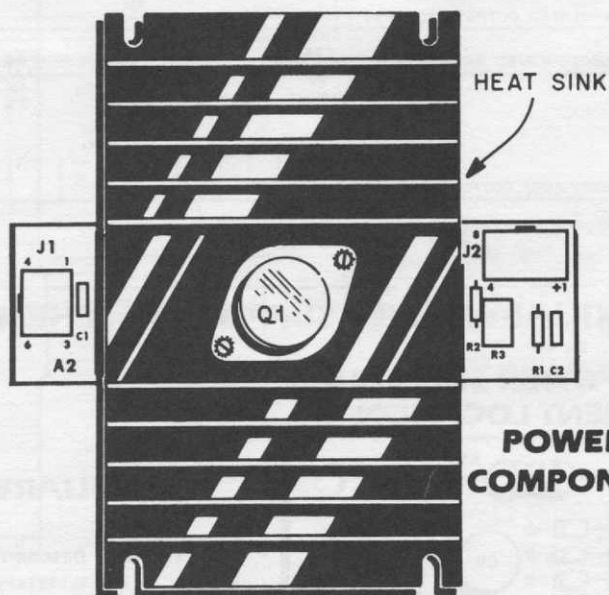


OPTO PHOTOTRANSISTOR RECEIVER BOARD PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
AP1	5 PIN HEADER	
AP2	5 PIN HEADER	
C1	CAPACITOR, 0.1UF, +80% -20%, 50V	
D1	DIODE, 1N4148	
D2	DIODE, MV5752 (LED, RED)	
Q1	TRANSISTOR, PNP, 2N3906	
Q2	TRANSISTOR, PNP, 2N2907A	
Q3	TRANSISTOR, NPN, MPSA13	
R1	RESISTOR, 8.2K OHM, 5%, 1/2W	
R2, R4, R7, R8	RESISTOR, 4.7K OHM, 5%, 1/4W	
R3	RESISTOR, 1.5K OHM, 5%, 1/4W	
R5, R12	RESISTOR, 1K OHM, 5%, 1/4W	
R6	RESISTOR, 10K OHM, 5%, 1/4W	
R9	RESISTOR, 220 OHM, 5%, 1/4W	
R10	RESISTOR, 4.7 OHM, 5%, 1/4W	
R11	RESISTOR, 20 OHM, 5%, 1/2W	
R13	RESISTOR, 270 OHM, 5%, 1/4W	
U1	IC, QUAD COMPARATORS, LM339	
	SUPPORT, SRS-8-6N, (2)	



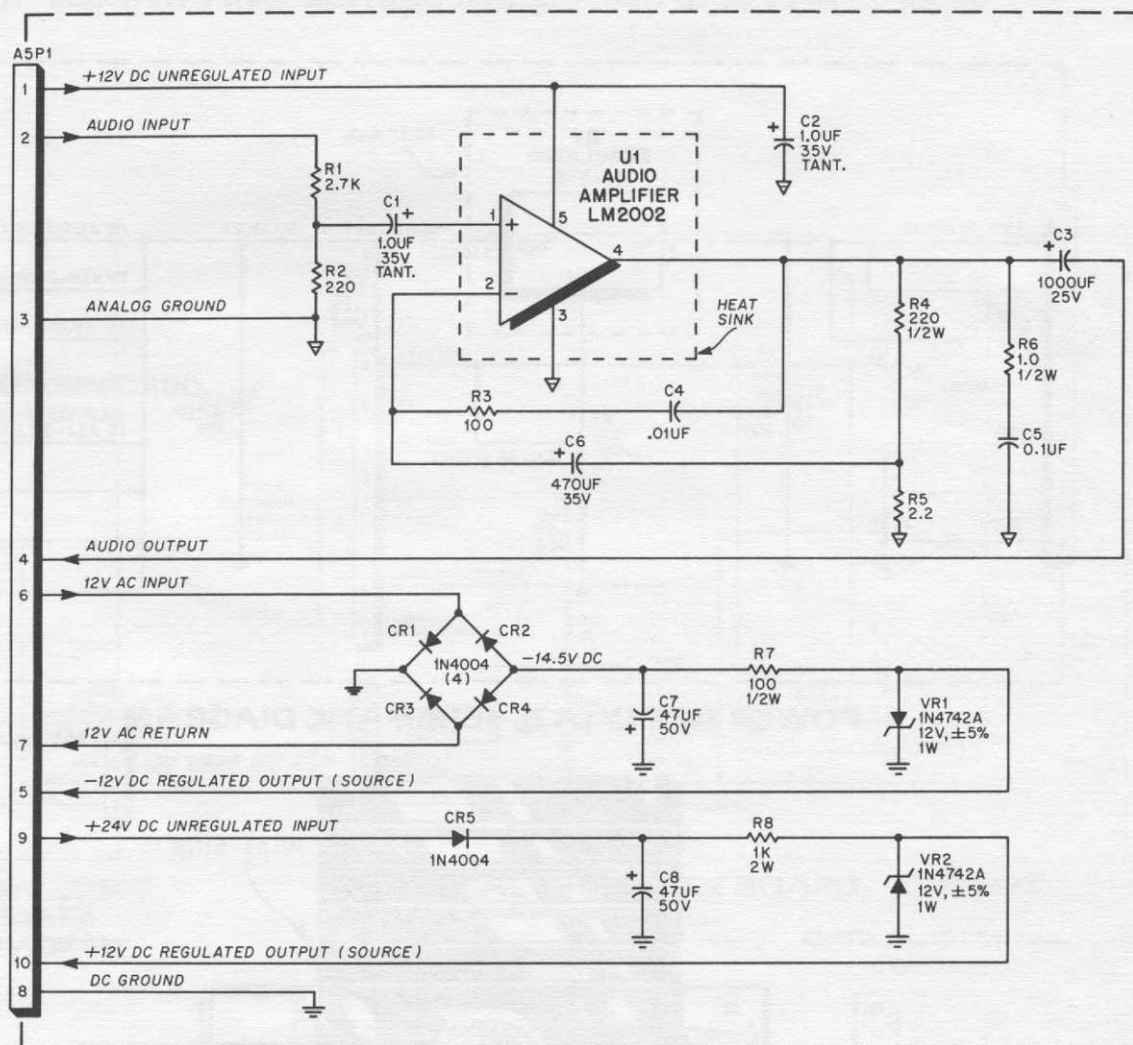
POWER SUPPLY (A2), SCHEMATIC DIAGRAM



**POWER SUPPLY (A2)
COMPONENT LOCATION**

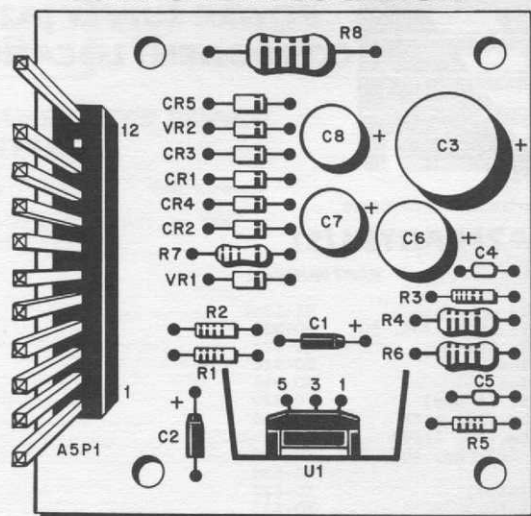
POWER SUPPLY (A2) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
	Power Supply (A2)	MA-1359
C1	Capacitor, 0.1uF, +80% -20%, 50V	XO-230
C2	Capacitor, 4.7uF, 10% 10V	XO-226
J1	Header, 6 Position	XO-910
J2	Header, 8 Position	XO-911
Q1	Regulator, LM338, (5 Amp)	XO-839
R1	Resistor, 390 Ohm, 5%, 1/4W	XO-845
R2	Resistor, 220 Ohm, 5%, 1/4W	XO-21
R3	Resistor, (Pot) 500 Ohm, 10%, 1W	XO-112
	Heat Sink	XO-534
	Insulator (Regulator)	XO-522
	Insulator (Regulator)	XO-523



AUXILIARY POWER SUPPLY (A5), SCHEMATIC DIAGRAM

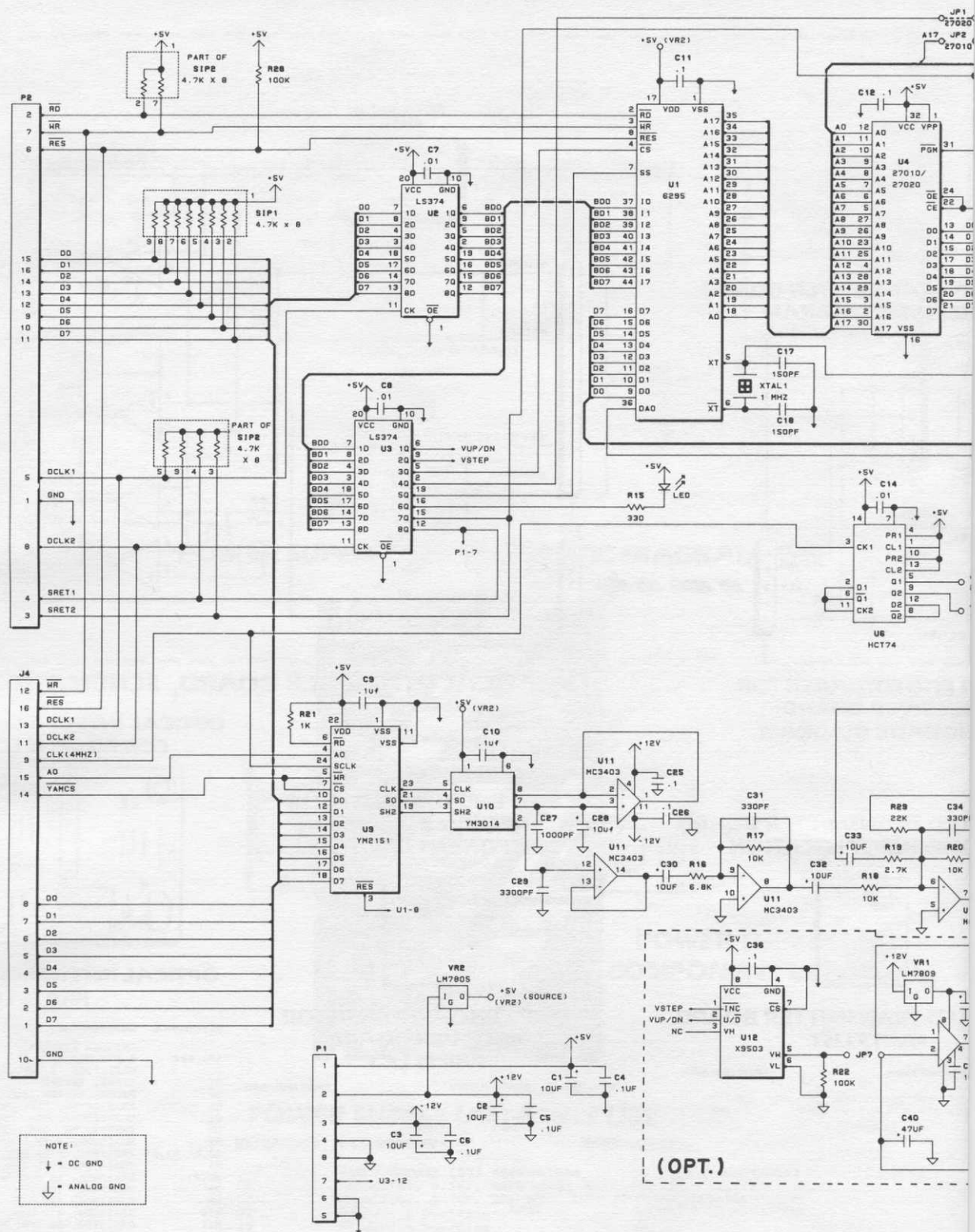
**AUXILIARY POWER SUPPLY (A5)
COMPONENT LOCATION**



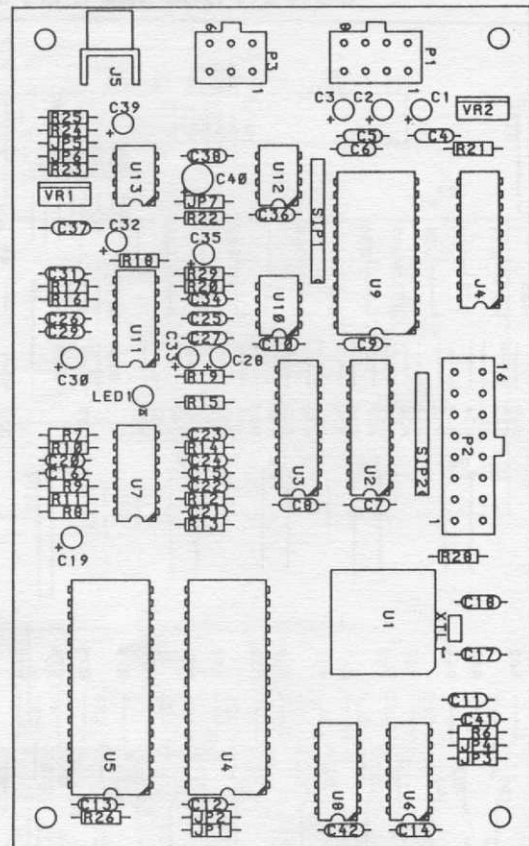
**AUXILIARY POWER SUPPLY (A5)
PARTS LIST**

REFERENCE	DESCRIPTION	PART NUMBER
	Auxiliary Power Supply	MA-1744
C1, C2	Capacitor, 1UF, 10%, 35V, TANT	XO-715
C3	Capacitor, 1000UF, 25V	XO-874
C4	Capacitor, .01UF, +80% -20%, 50V	XO-229
C5	Capacitor, 0.1UF, +80% -20%, 50V	XO-230
C6	Capacitor, 470UF, 35V	XO-284
C7, C8	Capacitor, 47UF, 50V	XO-210
CR1-CR5	Diode, 1N4004	XO-254
R1	Resistor, 2.7K Ohm, 5%, 1/4W	XO-6
R2	Resistor, 220 Ohm, 5%, 1/4W	XO-185
R3	Resistor, 100 Ohm, 5%, 1/4W	XO-28
R4	Resistor, 220 Ohm, 5%, 1/4W	XO-185
R5	Resistor, 2.2 Ohm, 5%, 1/4W	XO-595
R6	Resistor, 1 Ohm, 5%, 1/2W	XO-593
R7	Resistor, 100 Ohm, 5%, 1/2W	XO-52
R8	Resistor, 1K Ohm, 5%, 2W	XO-627
U1	Audio Amplifier, LM2002	XO-550
VR1, VR2	Diode, Zener, 1N4742A, 12V, +5%, 1W	XO-257
	Heat Sink	XO-472
	12 Position Connector	XO-879

VI. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

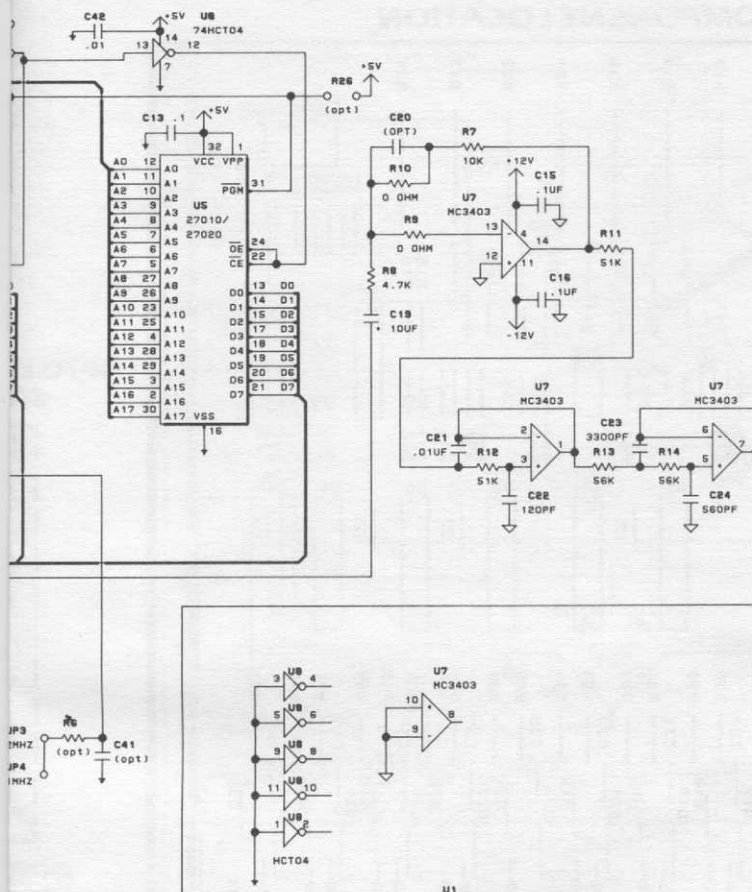


AUXILIARY SOUND BOARD (A20) COMPONENT LOCATION



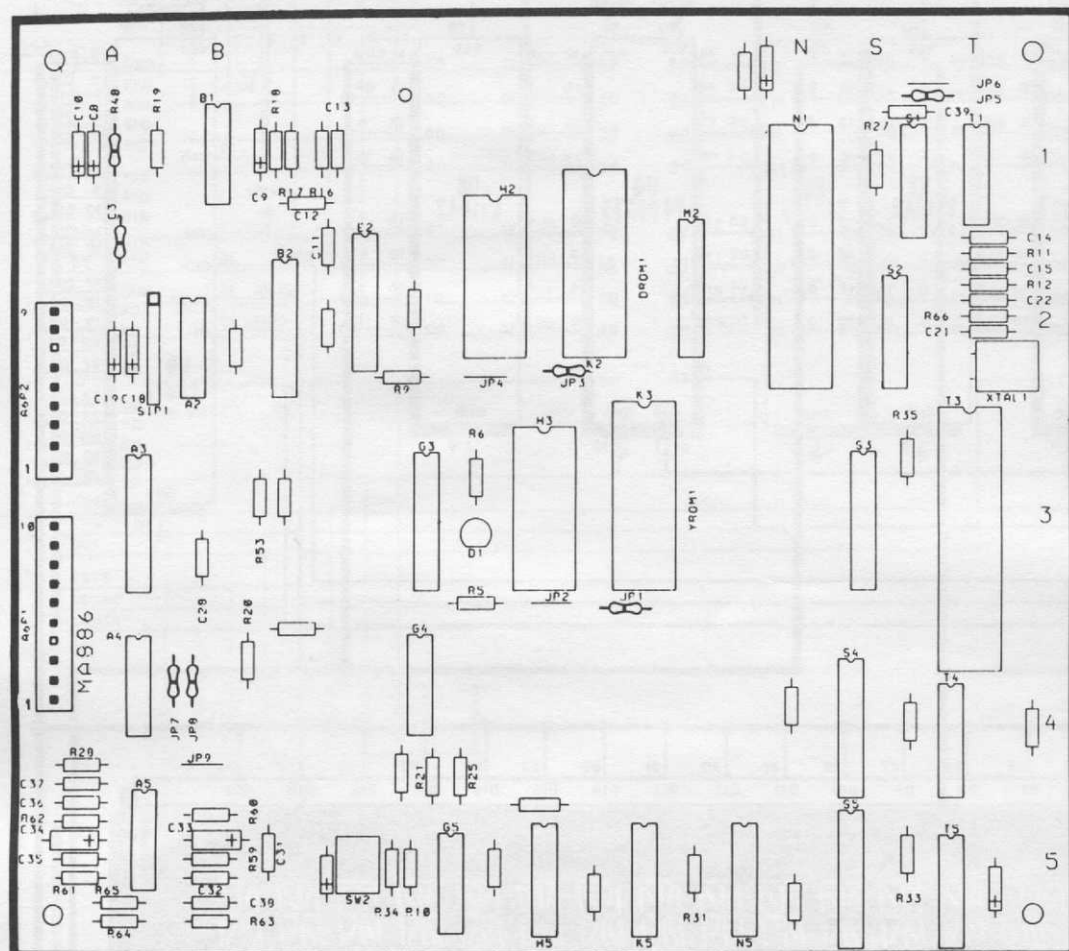
AUXILIARY SOUND BOARD (A20) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
A20	Auxiliary Sound Board	MA-1712
C1, C2, C3, C19, C28, C30, C32, C33, C35	Capacitor, 10UF, +80% -20%, 16V	XO-1030
C4-C6, C9-C13, C15, C16, C25, C26, C36	Capacitor, 0.1UF, +80% -20%, 50V	XO-230
C7, C8, C42	Capacitor, .01UF, +80% -20%, 50V	XO-229
C17, C18	Capacitor, 150PF, 5%, 100V	XO-803
C21	Capacitor, .01UF, 10%, 50V	XO-696
C22	Capacitor, 120PF, 10%, 50V	XO-1032
C23, C29	Capacitor, 3300PF, 10%, 100V	XO-600
C24	Capacitor, 560PF, 10%, 50V	XO-681
C31, C34	Capacitor, 330PF, 10%, 50V	XO-133
LED1	Diode, MV5752, Red	XO-270
R7, R17, R18, R20	Resistor, 10K OHM, 5%, 1/4W	XO-18
R8, R26	Resistor, 4.7K, 5%, 1/4W	XO-7
R9, R10, JP1, JP6	Resistor, 0 OHM, Jumper	XO-469
R11, R12	Resistor, 51K OHM, 5%, 1/4W	XO-44
R13, R14	Resistor, 56K OHM, 5%, 1/4W	XO-771
R15	Resistor, 330 OHM, 5%, 1/4W	XO-34
R16	Resistor, 6.8K OHM, 5%, 1/4W	XO-8
R19	Resistor, 2.7K OHM, 5%, 1/4W	XO-6
R21, R25	Resistor, 1K OHM, 5%, 1/4W	XO-5
R28	Resistor, 100K OHM, 5%, 1/4W	XO-45
R29	Resistor, 22K OHM, 5%, 1/4W	XO-42
U1	IC, MSM6295, Speech Chip	*XO-1023
U2, U3	IC, 74LS374, Octal "D" Flip Flop	XO-96
U4, U5	IC, 27C010 (Specified Per Game)	
U7, U11	IC, MC3403P, Quad Amp	XO-953
U8	IC, 74HCT04, Hex Inverter	XO-1026
U9	IC, YM2151, Sound Chip	XO-882
U10	IC, YM3014, Serial DAC	XO-883
XTAL1	Resonator, 1MHz	XO-1034
J4	Socket, 20 Pin	XO-491
J5	Jack, RCA	XO-1035
P1	Header, 8 Position	XO-911
P3	Header, 6 Position	XO-910
U4, U5	Socket, 32 Pin	XO-1036
U9	Socket, 24 Pin	XO-529
VR2	PCB Assembly, P/O *XO-1023	27922
	IC, 5V Regulator	XO-663

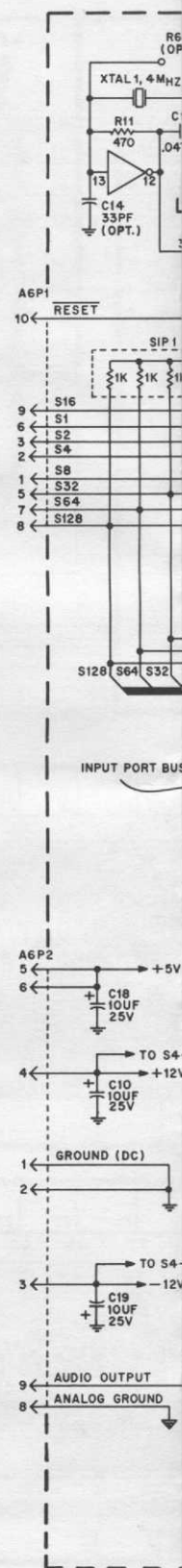


IC DIAGRAM

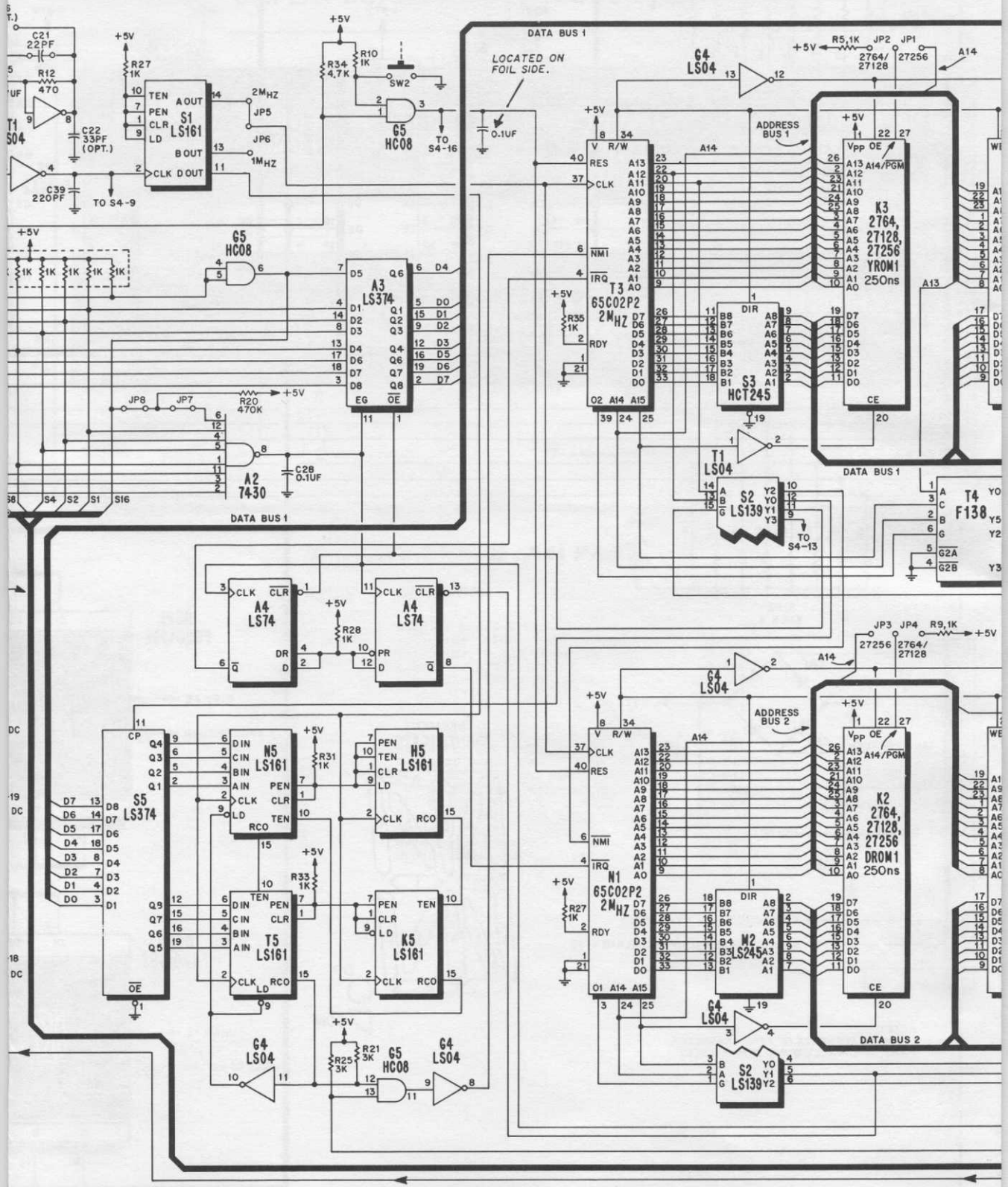
SOUND BOARD (A6) COMPONENT LOCATION



REFERENCE	DESCRIPTION	PART NUMBER	REFERENCE	DESCRIPTION	PART NUMBER
C13,C37	Sound Board Assembly (1A6)	MA-1629	R20,R34	Resistor, 4.7K Ohm, 5%, 1/4W	XO-7
C8,C9,C10,	Capacitor, 1UF, 20%, 50V (Non-polar)	XO-746	R61-R64	Resistor, 33K Ohm, 5%, 1/4W	XO-43
C18,C19,	Capacitor, 100UF, 20%, 25V (Tantalum)	XO-127	R59,R60	Resistor, 100K Ohm, 5%, 1/4W	XO-45
C33,C34			R65	Resistor, 27K Ohm, 5%, 1/4W	XO-11
AND THREE			A2	IC, 7430, 8 Input NAND Gate	XO-643
UNMARKED			A3,B2,S5	IC, 74LS374, Octal "D" Flip Flop	XO-066
CAPACITORS			A4	IC, 74LS74, Dual "D" Flip Flop	XO-434
C11,C12	Capacitor, 10PF, +80%-20%, 50V	XO-635	B5	IC, MC3403P, Quad Op-Amp	XO-953
C14,C22	Capacitor, 33PF, 10%, 100V	XO-896	E1	IC, MC3403P, Quad Op-Amp	XO-953
C15	Capacitor, .047UF, 20%, 50V	XO-638	E2	IC, AD7528J, Multiplier DAC	XO-647
C21	Capacitor, 22PF, 10%, 50V	XO-633	G4,T1	IC, 74LS377, Octal "D" Flip Flop	XO-97
C28 AND	Capacitor, 0.1UF, +80%-20%, 50V	XO-230	G4,T1	IC, 74LS804, Hex Inverter	XO-418
FIFTEEN			H2,H3	IC, 74HC08, Dual 1 of 2 Input "AND" Gate	XO-872
UNMARKED			H5,K5,M5	IC, 6116LP-15, 2K X 8 RAM	XO-929
CAPACITORS			S1,T5	IC, 74LS161, Synchronous Presettable Binary Counter	XO-440
C31,C32	Capacitor, 0.1UF, 10%, 100V	XO-784	K2,K3	IC, Specified Per Game	
C35	Capacitor, 1000PF, 10%, 100V	XO-296	M2	IC, 74LS245, Octal Bus Transceiver	XO-79
C36	Capacitor, 2200PF, 10%, 100V	XO-289	N1,T3	IC, 65C02P2 or 6502A, CPU	XO-927 or XO-893
C37	Capacitor, 4003UF, 10%, 100V	XO-600	S2	IC, 74LS139, Dual 1 of 8 Decoder	XO-435
C39	Capacitor, 220PF, 10%, 100V	XO-694	S3	IC, 74HC245, Octal Bus Transceiver	XO-929
D1	Diode, MV5575, (LED, Red)	XO-270	T4	IC, 74P138 1 of 8 Decoder	XO-104
R5,R9,R10,	Resistor, 1K Ohm, 5%, 1/4W	XO-5	TP1	Resistor Pack 1K Ohm X 8	XO-493
R27,R28,R31,			SW2	Switch, Pushbutton	XO-897
R33,R35			XTAL1	Crystal, 4 MHz	XO-366
R6	Resistor, 240 Ohm, 5%, 1/4W	XO-173	A6P1,A6P2	Connector (2)	XO-879
R11,R12	Resistor, 470 Ohm, 5%, 1/4W	XO-35			
R21, R25	Resistor, 3K Ohm, 5%, 1/4W	XO-23		28 Pin Dip Socket (2)	XO-536
R16,R17	Resistor, 10K Ohm, 5%, 1/4W	XO-18		Jumper, Resistor, 0 OHM (7)	XO-469
R18	Resistor, 6.8K Ohm, 5%, 1/4W	XO-8		20 Pin Dip Socket	XO-491



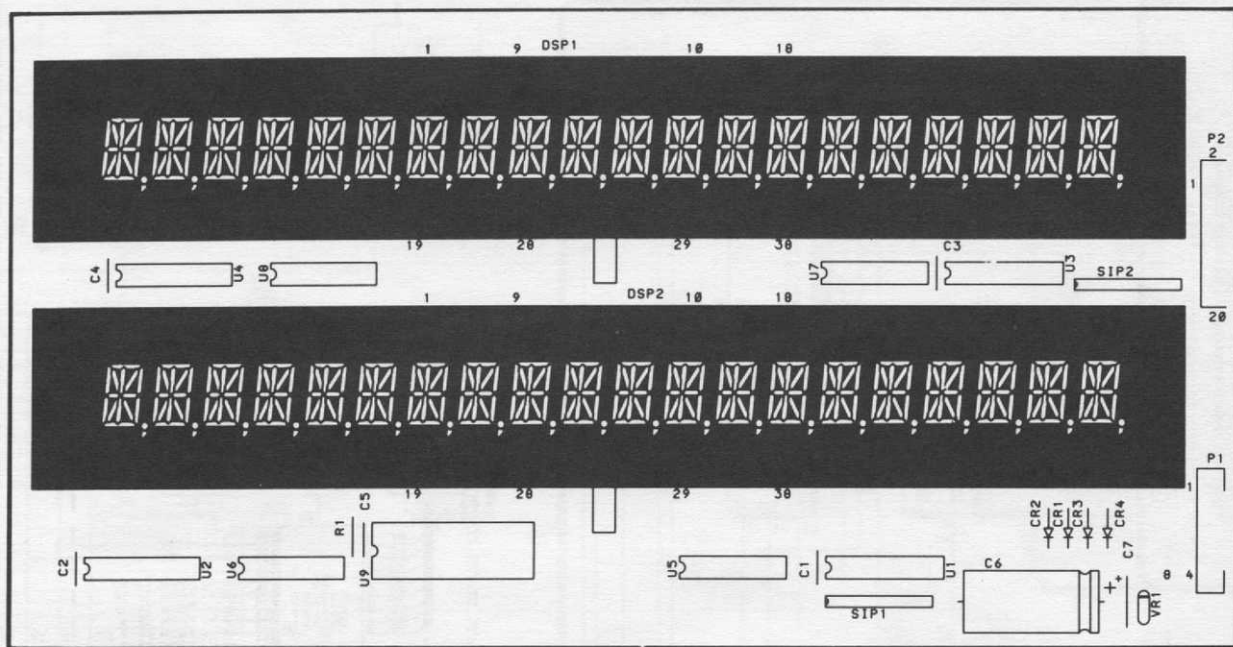
VI. WIRING AND SCHEMATIC





VI. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

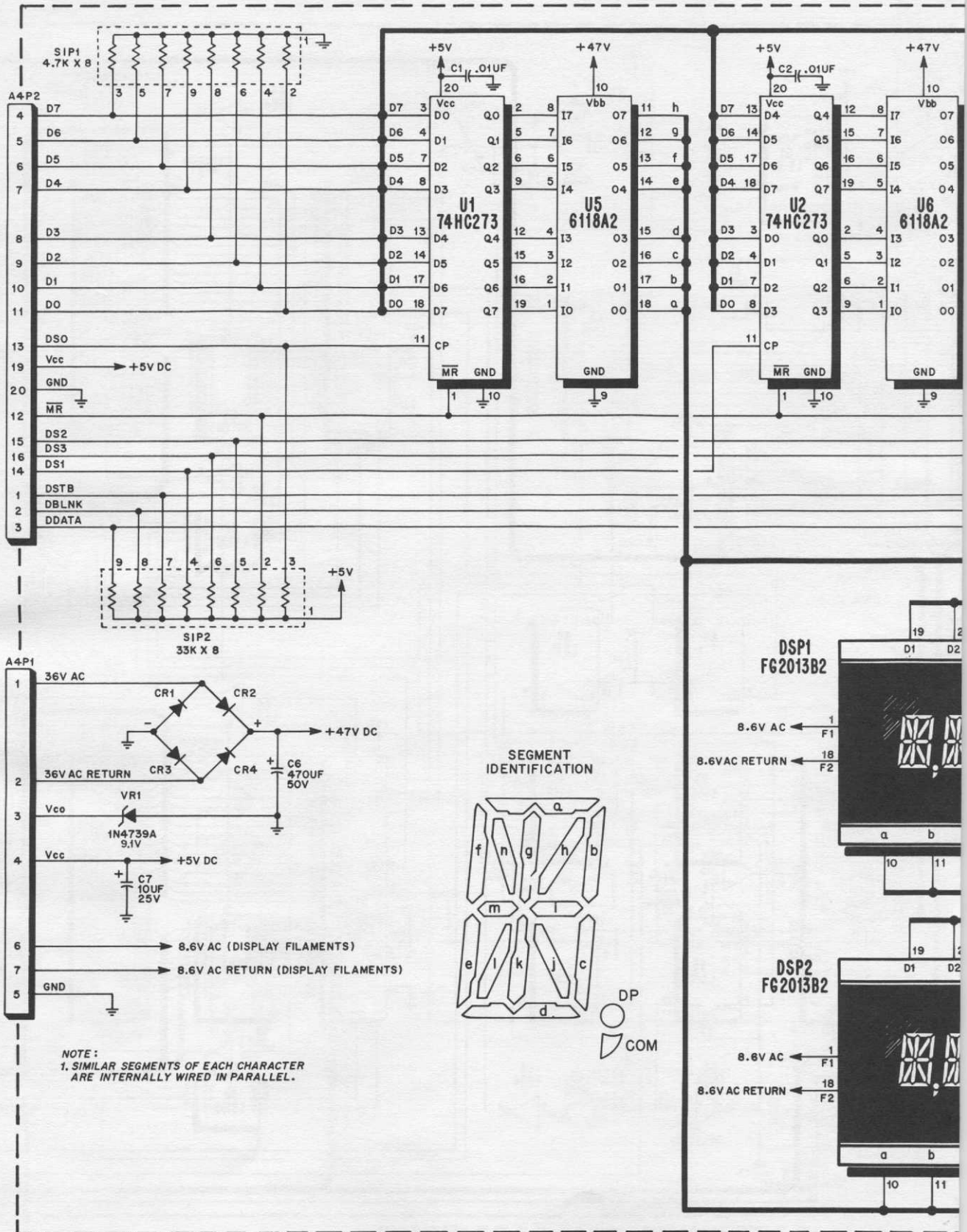
DISPLAY BOARD (A4) COMPONENT LOCATION



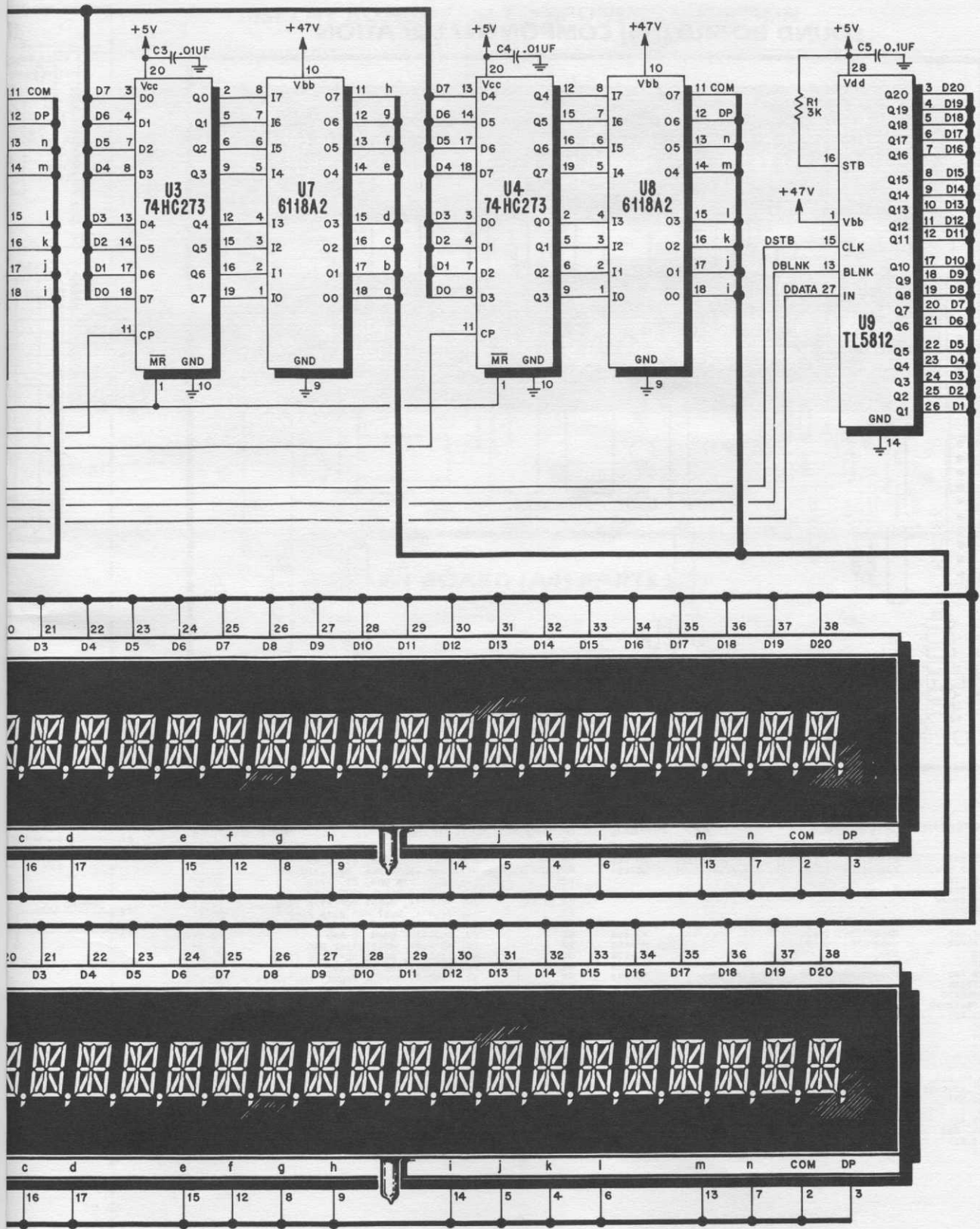
DISPLAY BOARD (A4) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
	Display Board Assembly (A4)	MA-1431
C1-C4	Capacitor, .01UF, +80%-20%, 50V	XO-229
C5	Capacitor, 0.1UF, +80%-20%, 50V	XO-230
C6	Capacitor 470UF, 50V	XO-847
C7	Capacitor, 10UF, 20%, 25V	XO-127
CR1-CR4	Diode, 1N4004	XO-254
DSP1, DSP2	Alphanumeric Display, FG2013B2	XO-901
R1	Resistor, 3K Ohm, 5%, 1/4W	XO-23
SIP1	Resistor Pack 4.7K Ohm X 8, 5%, 1/4W	XO-161
SIP2	Resistor Pack, 33K Ohm X 8, 5%, 1/4W	XO-945
U1-U4	IC, Octal "D" Flip-Flop, 74HC273	XO-949
U5-U8	IC, Display Drivers, 6118A2	XO-951
U9	IC, Latched Drivers, TL5812	XO-952
VR1	Diode 1N4739A, 9.1V Zener	XO-881
A4P1	Header, 8 Position	XO-901
A4P2	Header, 20 Position	XO-940
	Sponge Rubber, 1-1/4" (4)	24290A

VI. WIRING AND SCHEMATIC



C DIAGRAMS, PARTS LISTS

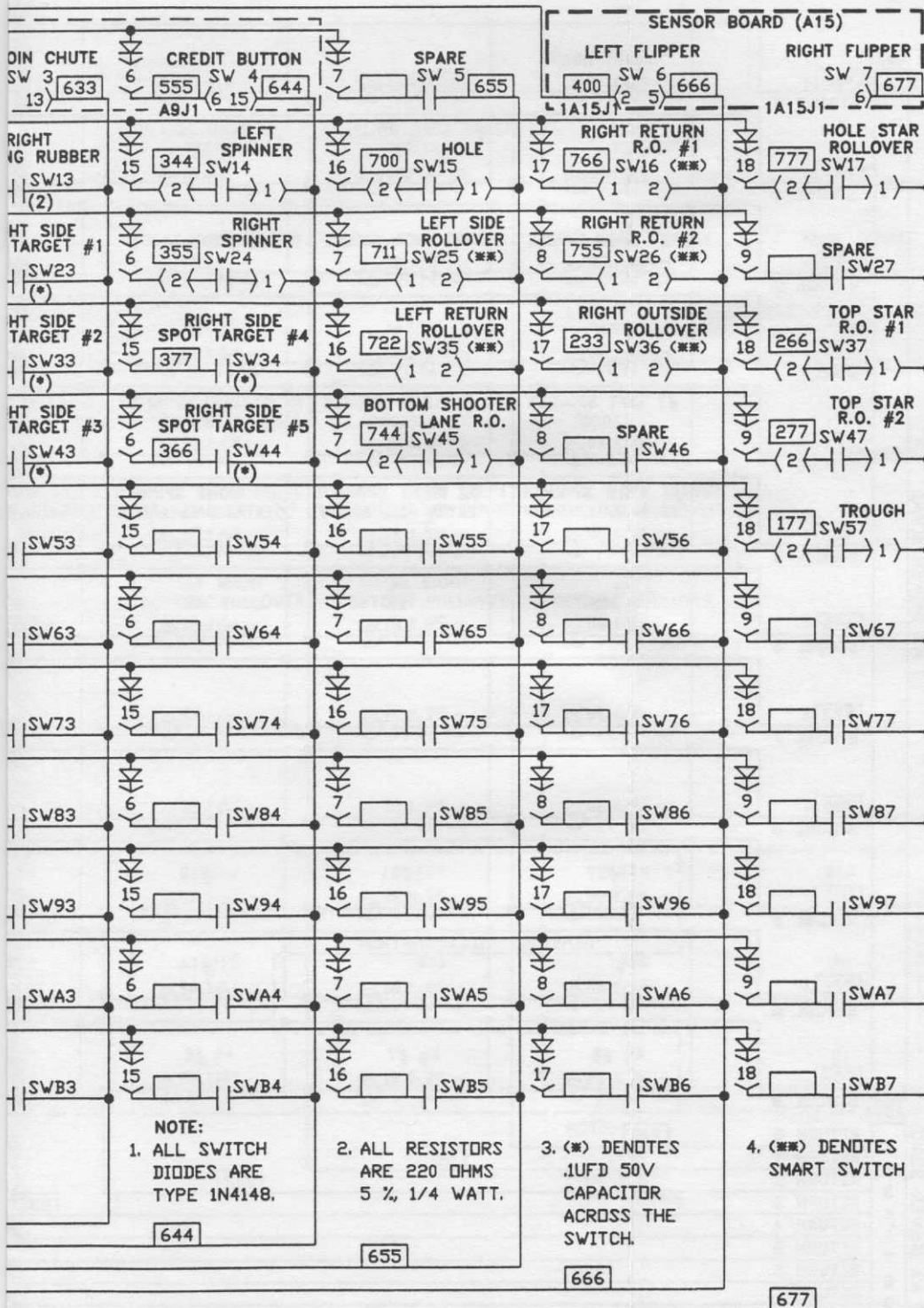


DISPLAY BOARD (A4), SCHEMATIC DIAGRAM
40

VI. WIRING AND SCHEMAT

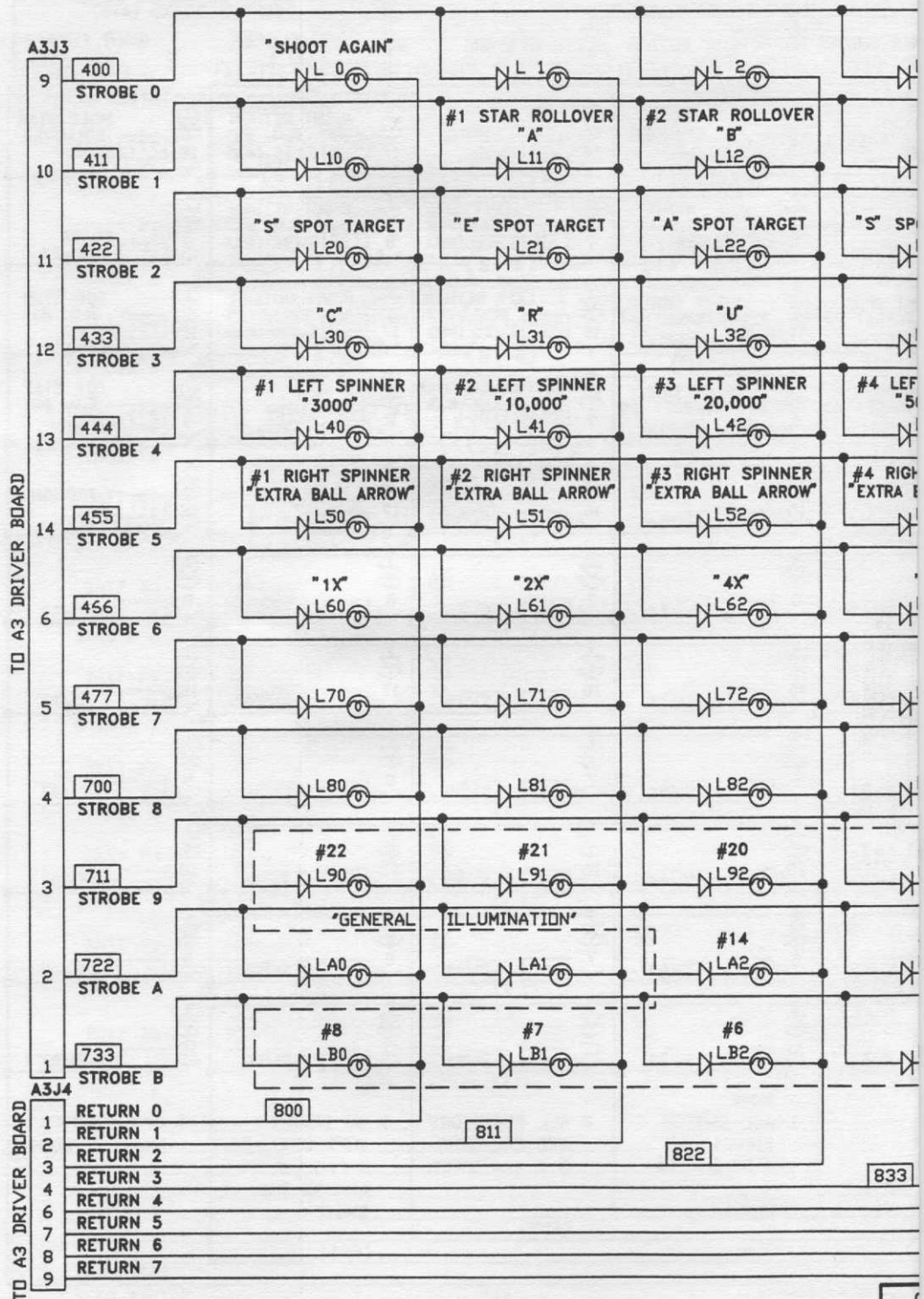


IC DIAGRAMS, PARTS LISTS

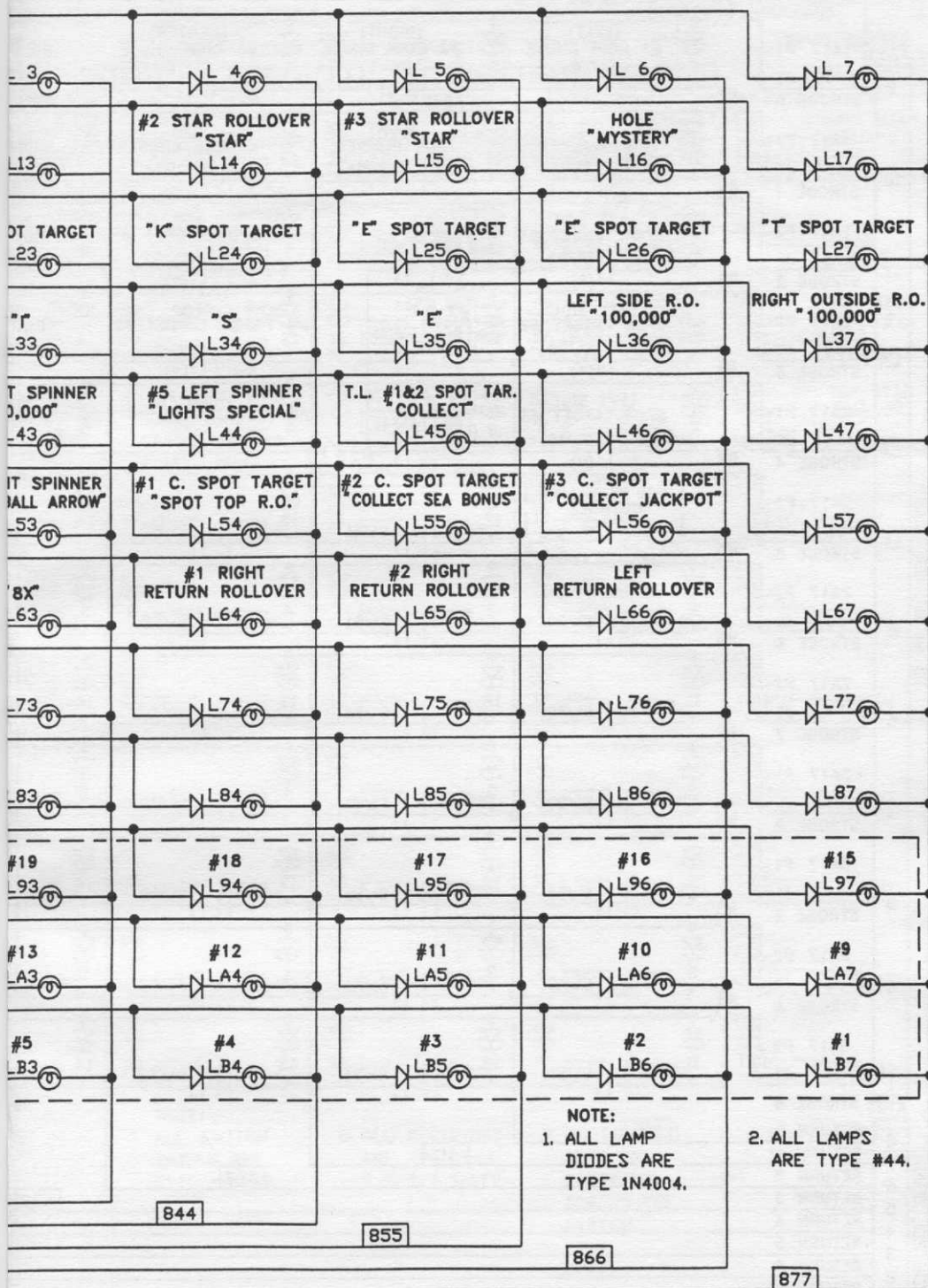


SWITCH MATRIX, SCHEMATIC DIAGRAM

VI. WIRING AND SCHEMATIC



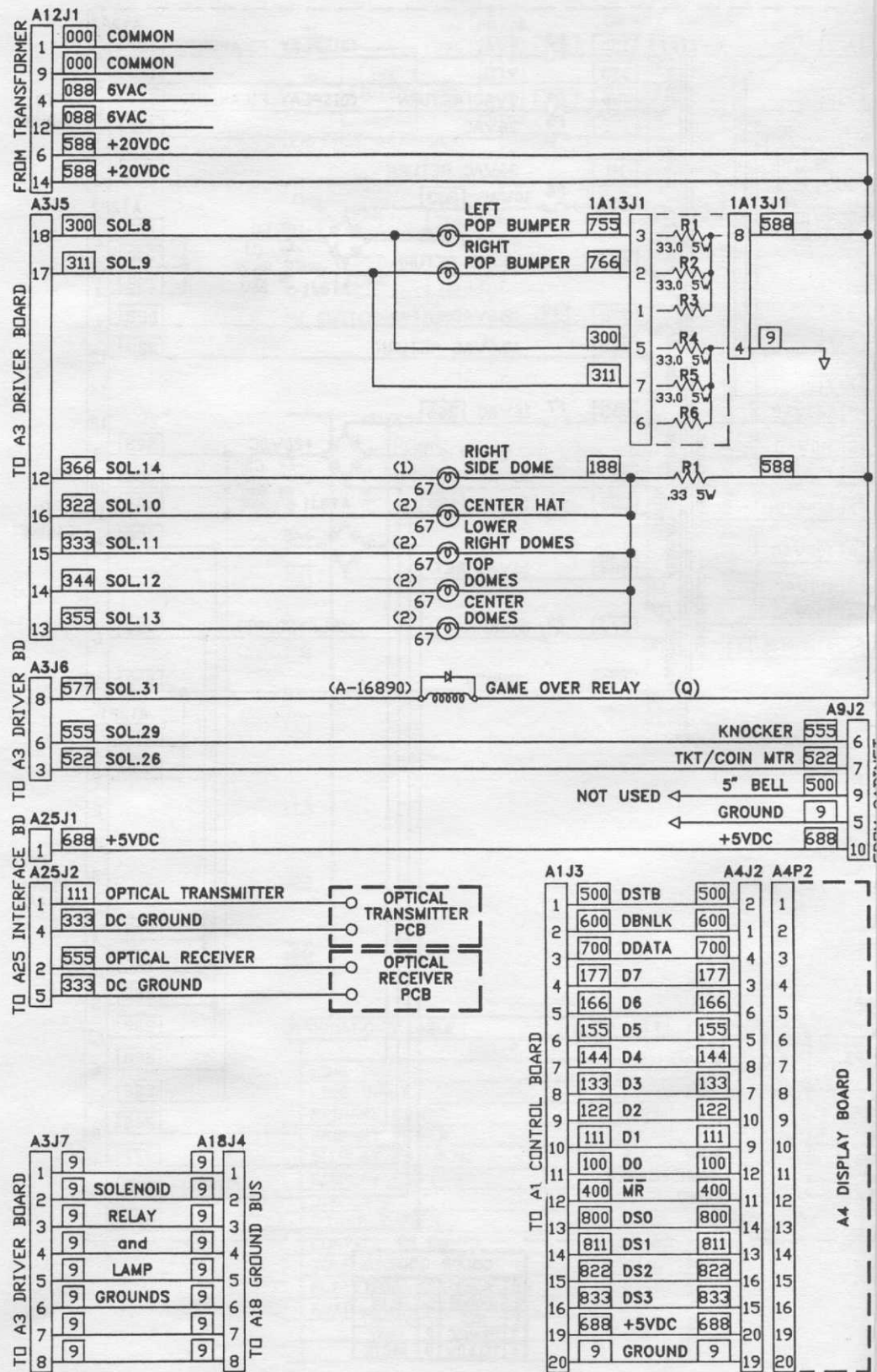
IC DIAGRAMS, PARTS LISTS



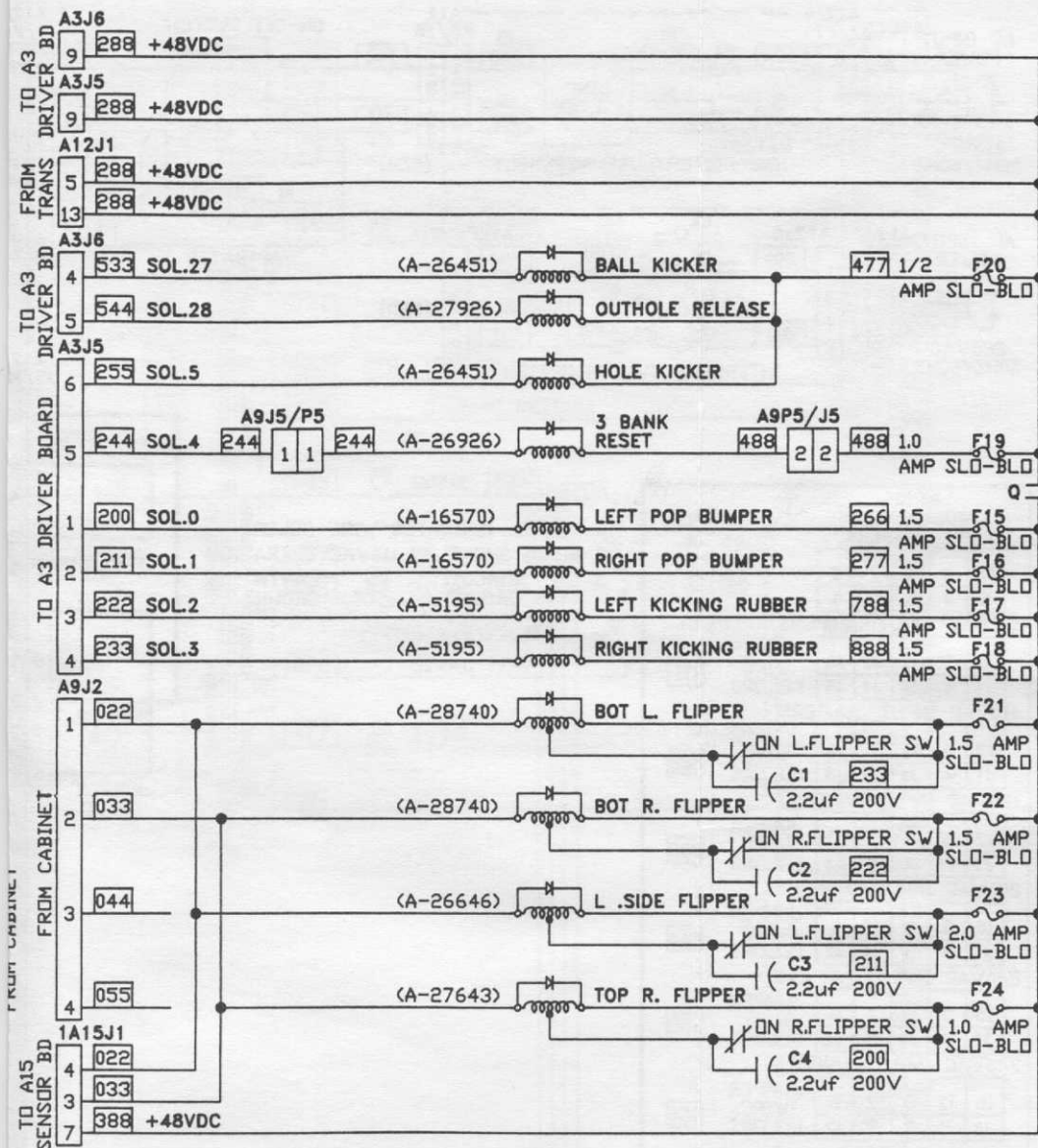
COLOR CODE		
BLACK	5	GREEN
BROWN	6	BLUE
RED	7	VIOLET
ORANGE	8	GRAY
YELLOW	9	WHITE

LAMP MATRIX, SCHEMATIC DIAGRAM

VI. WIRING AND SCHEMATIC



IC DIAGRAMS, PARTS LISTS



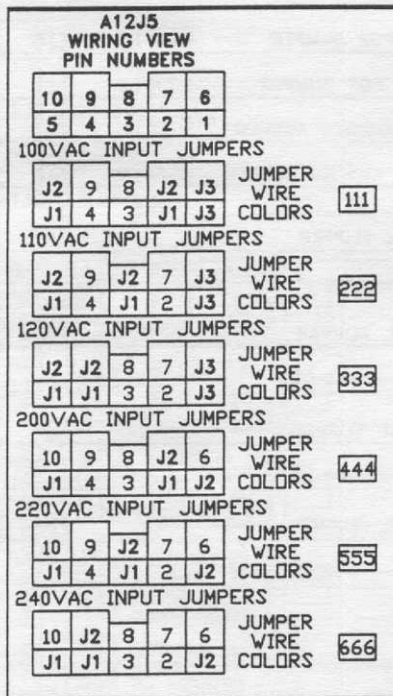
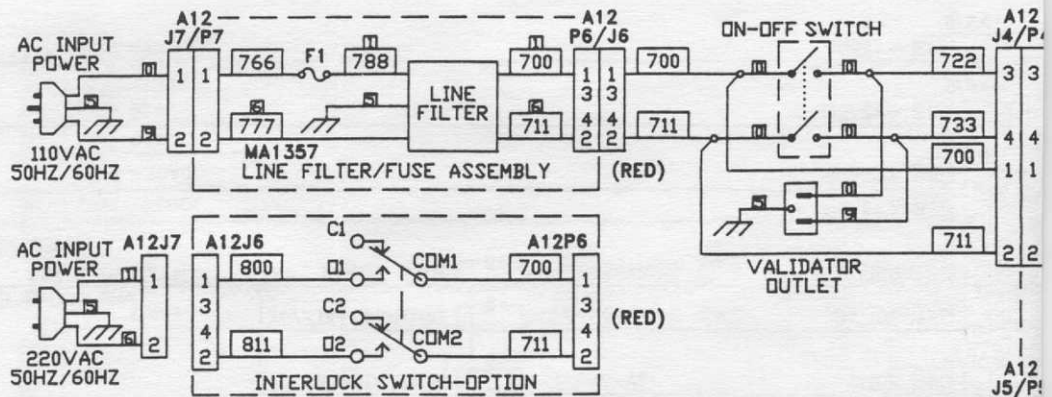
NOTE:

- ALL DIODES ARE TYPE 1N4004.
- UNLESS OTHERWISE SPECIFIED ALL LAMPS ARE TYPE #44.

COLOR CODE					
0	BLACK	5	GREEN		
1	BROWN	6	BLUE		
2	RED	7	VIOLET		
3	ORANGE	8	GRAY		
4	YELLOW	9	WHITE		

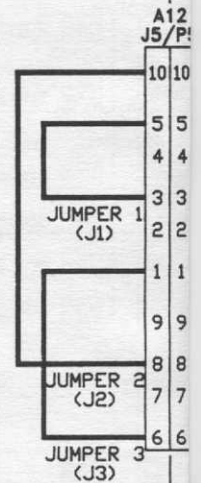
PLAYBOARD, SCHEMATIC DIAGRAM

VI. WIRING AND SCHEMATIC



NOTES:

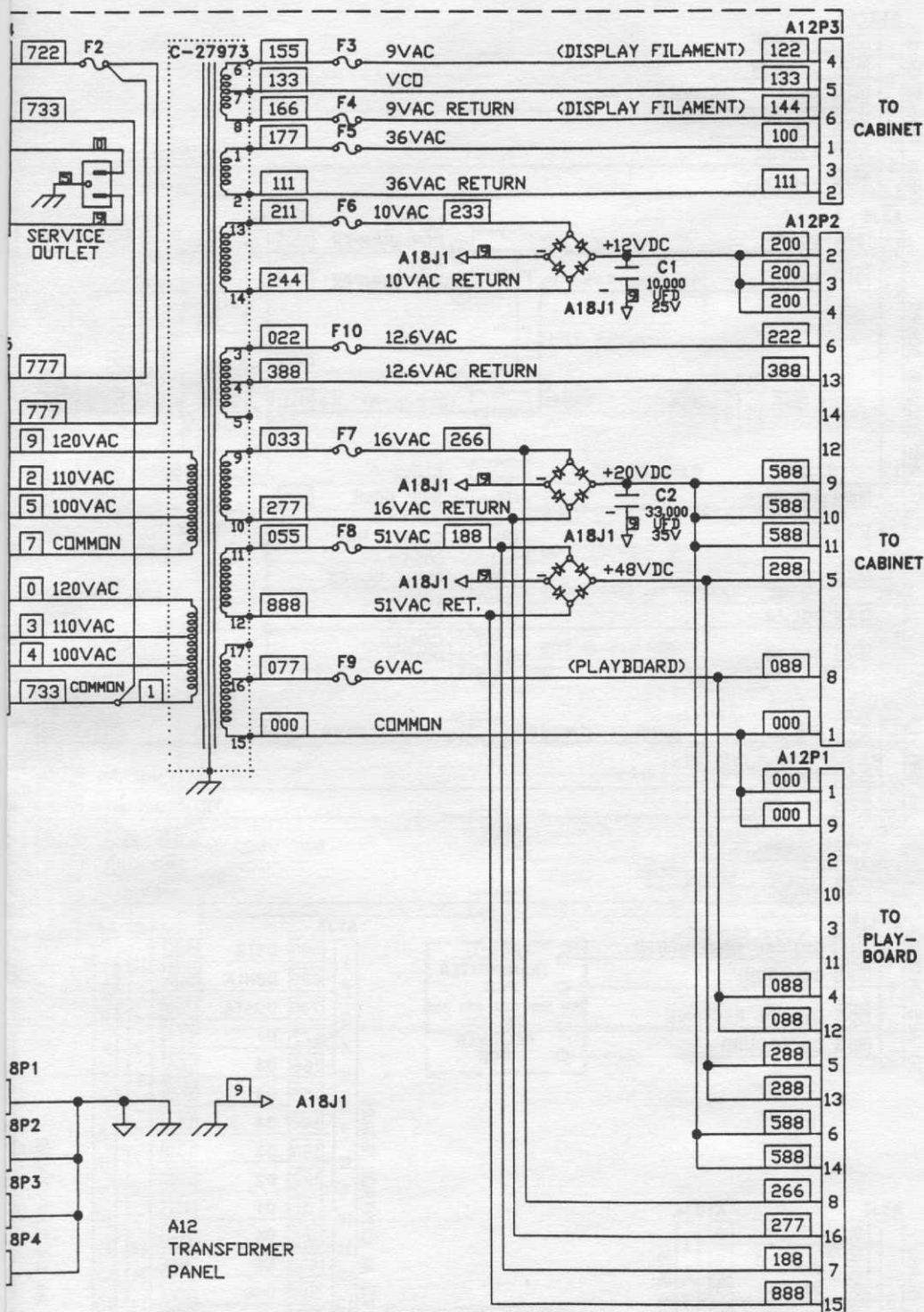
1. XXXX INDICATES WIRE COLOR.
2. A12J5 SHOWN IN 110VAC OPERATION.
3. CIRCUIT GROUND EARTH GROUND



FUSE DESIGNATIONS TABLE					
FUSE	RATING	PART NO.	USAGE		
F1	8.0A SLO-BLO	EL26	LINE INPUT	110VAC	
	4.0A SLO-BLO	EL33	LINE INPUT	220VAC	
F2	5.0A SLO-BLO	EL8	PRIMARY POWER	110VAC	
	2.5A SLO-BLO	EL21	PRIMARY POWER	220VAC	
F3	1/2A	EL28	DISPLAY FILAMENT	9VAC	
F4	1/2A	EL28	DISPLAY FILAMENT	9VAC	
F5	1/4A SLO-BLO	EL5	DISPLAYS	36VAC	
F6	2.5A SLO-BLO	EL21	POWER SUPPLY	10VAC	
F7	10.0A SLO-BLO	EL36	CONTROLLED LAMPS	16VAC	
F8	8.0A SLO-BLO	EL26	SOLENOIDS	51VAC	
F9	1.0A SLO-BLO	EL6	PLAYFIELD ILLUMINATION	6VAC	
F10	1/2A	EL28	AUXILLIARY POWER SUPPLY	12.6VAC	
F11					
F12					

A1
 GROUNDS TO TRANSFORMER
 A1
 GROUNDS TO CABINET
 A1
 GROUNDS TO A3 DRIVER BOARD
 A1

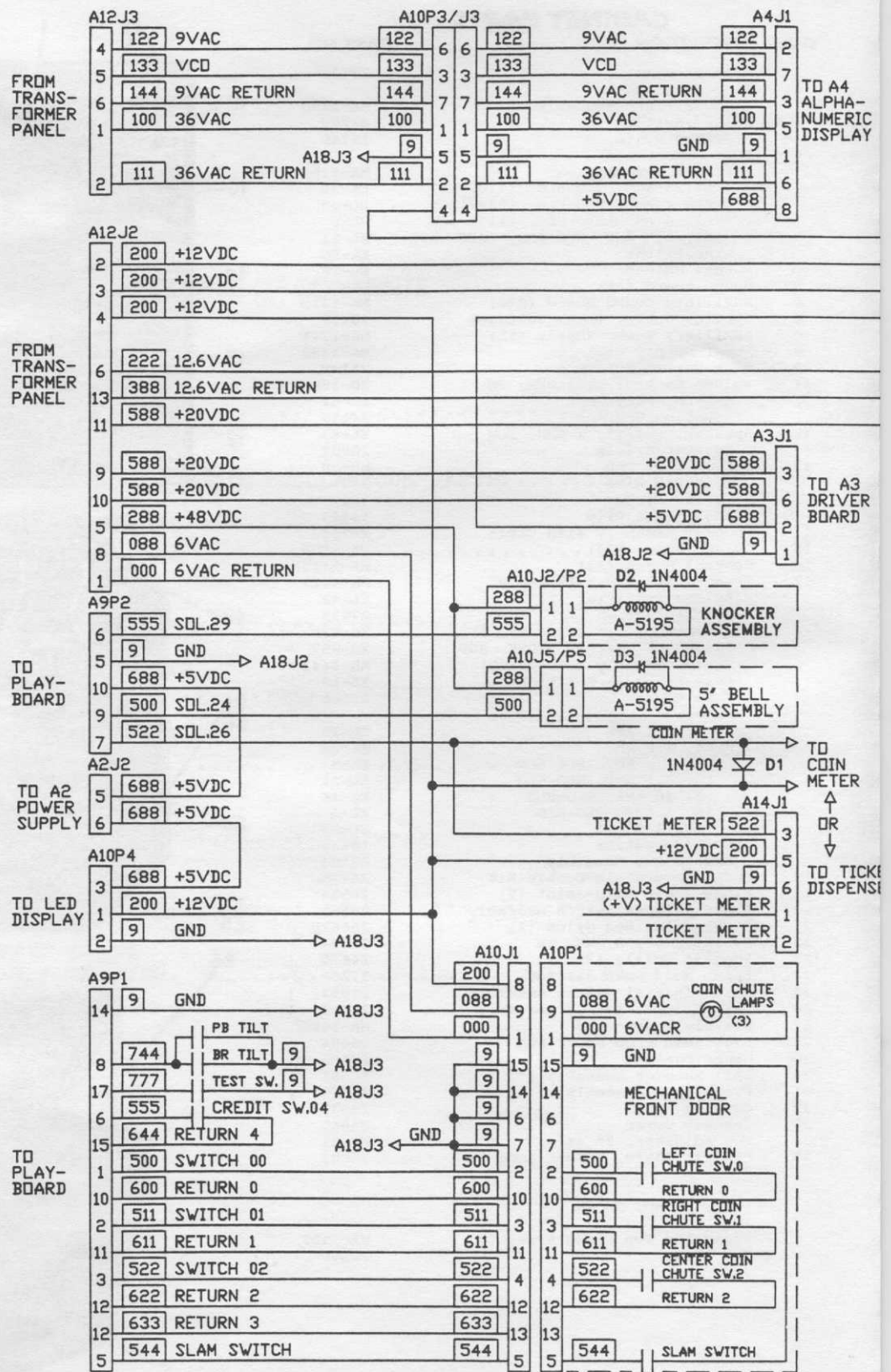
IC DIAGRAMS, PARTS LISTS



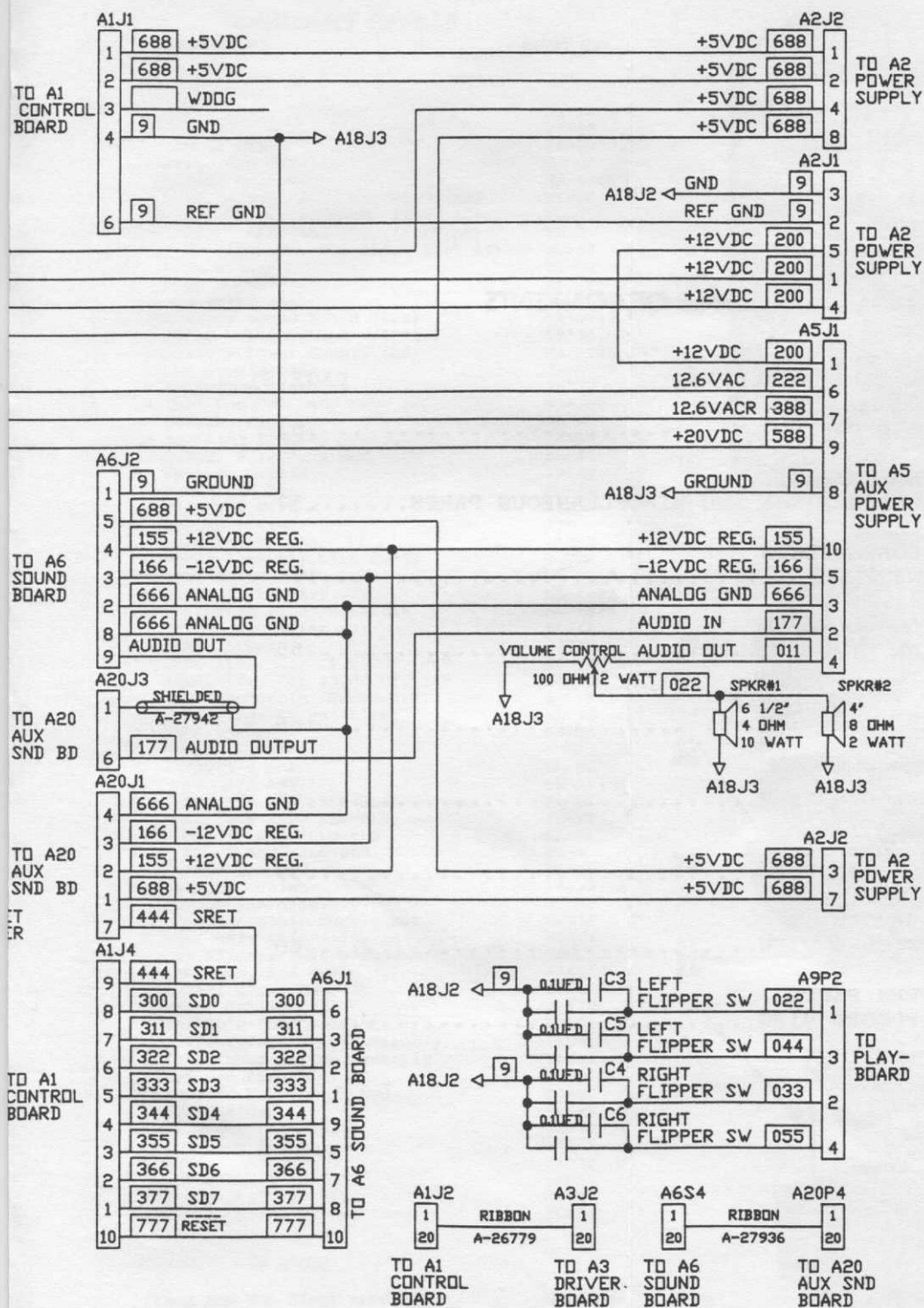
COLOR CODE			
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1	BROWN	6	BLUE
2	RED	7	VIOLET
3	ORANGE	8	GRAY
4	YELLOW	9	WHITE

TRANSFORMER PANEL, SCHEMATIC DIAGRAM

VI. WIRING AND SCHEMAT



IC DIAGRAMS, PARTS LISTS



NOTE:
AMOUNT OF
PARTS VARIES
PER GAME.

COLOR CODE			
0	BLACK	5	GREEN
1	BROWN	6	BLUE
2	RED	7	VIOLET
3	ORANGE	8	GRAY
4	YELLOW	9	WHITE

CABINET, SCHEMATIC DIAGRAM

VII. PARTS INFORMATION

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VII. PARTS INFORMATION

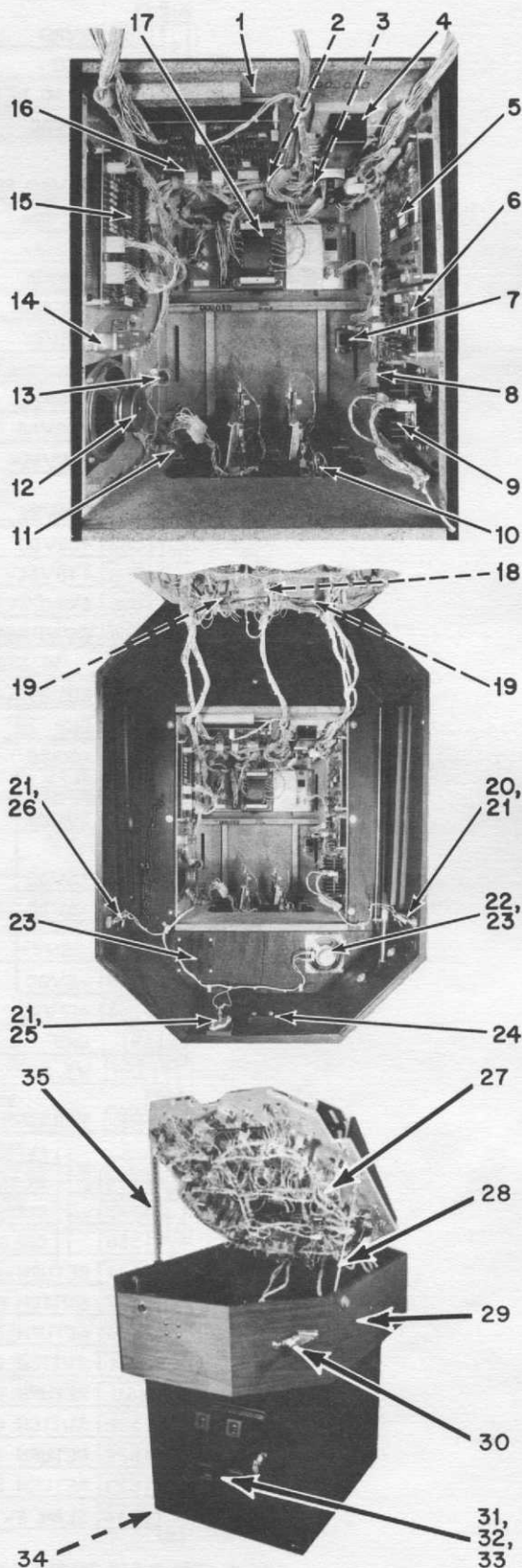
CABINET PARTS

ITEM	DESCRIPTION	PART NO.
1	Cabinet Base	27723
2	Line Cord And	
	Cover Plate Assembly	MA-1356
3	On/Off Switch	23799
	Switch Plate	18769
4	Fuse Holder And	
	Filter Assembly	MA-1386
	F1, 8 AMP, SLO-BLO, (110V AC)	EL-26
	F1, 4 AMP, SLO-BLO, (220V AC)	EL-33
	F2, 5 AMP, SLO-BLO, (110V AC)	EL-8
	F2, 2.5 AMP, SLO-BLO, (220V AC)	EL-21
	Line Filter	EL-50
	Fuse Holder	EL-78
5	Sound Board (A6)	MA-1629
6	Auxiliary Sound Board (A20)	MA-1712
7	Service Outlet (Line Voltage)	18133
8	Auxiliary Power Supply (A5)	MA-1744
9	Power Supply (A2)	MA-1359
10	Slam Switch Assembly	26130
11	Volume Control, 100 OHM, 2W	XO-199
	Switch, Play Test	EL-57
	Mounting Bracket	24149
12	Speaker, 6-1/2", 4 OHM, 10W	EL-83
	Speaker Grille	20931
13	Carbon Tilt Bob	MH-30
	Tilt Bob Wire	357
	Strike Plate	358
	Adjustment Clip	14653
14	Knocker Assembly With Cable	26782
15	Driver Board (A3)	MA-1358
16	Control Board (A1)	MA-1423
17	Transformer Panel Assembly	MA-1427
	Bridge Rectifier (3)	EL-42
	Transformer	27973
	Capacitor, C1; 10,000UF, 25V	XO-830
	Capacitor, C2; 33,000UF, 35V	XO-957
	Cable Assembly (Secondary)	MA-1441
	Fuse Block (8 Position)	EL-10
	Fuse Cover	23805
	Fuses	
	F3, 1/2 AMP	EL-28
	F4, 1/2 AMP	EL-28
	F5, 1/4 AMP, SLO-BLO	EL-5
	F6, 2.5 AMP, SLO-BLO	EL-21
	F7, 10 AMP, SLO-BLO	EL-36
	F9, 1 AMP, SLO-BLO	EL-6
	F10, 1/2 AMP	EL-29
	Service Outlet	18133
	Ground Bus Assembly	27153
18	Lock, Reversible-Double Bit	26126
19	Hinge, Male Slip-Joint (2)	26533
20	Right Flipper Switch Assembly	26665
21	Pushbutton, Red Nylon (2)	26662U
22	Speaker, 4", 8 OHM, 2W	24644
23	Speaker Grille (2)	24670
24	Frame Hold-Down Bracket	27257
25	Start/Initial Switch Assembly	18092
26	Left Flipper Switch Assembly	26664
27	Playfield Assembly	MA-1426
28	Playfield Prop Stick Rod	26654
29	Upper Cabinet	27695
30	Ball Shooter Assembly	26652
31	Front Door Assembly	24159
32	Cashbox	28032
33	Cashbox Cover	28062
34	Leg Adjuster, 3" (4)	MA-21
35	Plastic Chain, 2 Feet Long	26681

NOT SHOWN

Frame And Top Glass Assembly
Top Glass

MA-1452
26650



VII. PARTS INFORMATION

PLAYBOARD PARTS INFORMATION

PARTS LIST

ITEM	DESCRIPTION	PART NO.
1	METAL SHIELD (3)	17300
2	WIREFORM GATE (3)	22112
3	PLASTIC SHIELD SET	27197
4	PLASTIC DOME, YEL (3)	26293T
5	TARGET SHIELD (2)	14043
6	SPINNER SPACER (4)	27244
7	SWITCH ROD (2)	27196
8	SWINGING TARGET ASSEMBLY (2)	24494
9	NYLON WASHER (4)	20407
10	BALL GUIDE RAIL	18070
11	BALL GUIDE RAIL	13833
12	BALL GUIDE RAIL	21961
13	BALL GUIDE RAIL	17650
14	BALL GUIDE RAIL	11703
15	FLAT RAIL	27149
16	BALL GUIDE RAIL	6931
17	FLAT RAIL	27148
18	FLAT RAIL	27150
19	PLASTIC TRIM PLATTER (3)	25732
20	SPOT TARGET ASSEMBLIES (SEE SWITCH LOCATION ILLUSTRATION)	-----
21	METAL SHIELD	27207
22	HEX POST WITH GRIP (6)	25531
23	3 POSITION TARGET BANK ASSEMBLY (SEE EXPLODED VIEW ILLUSTRATION)	MA-1481
24	3 POSITION TARGET BANK RESET COIL	26926
25	TARGET ARM, NYLON, BLUE (3)	11905W
26	POP BUMPER ASSEMBLY (SEE EXPLODED VIEW ILLUSTRATION)	-----
27	POP BUMPER CAP, CLEAR YELLOW (2)	26635T
28	POP BUMPER COIL (2)	MA-1529
29	POP BUMPER BODY, SOCKET, YELLOW (2)	MA-1437
30	BALL HOLE KICKER ASSEMBLY (SEE EXPLODED VIEW ILLUSTRATION)	-----
31	BALL HOLE KICKER COIL	26451
32	BALL GUIDE RAIL	6612
33	ROLLOVER BUTTON (3), WHITE	11968
34	PLAYBOARD WINDOW	26620
35	SPONGE RUBBER MOUNTING (8)	21219B
36	ALPHANUMERIC DISPLAY ASSEMBLY	MA-1431
37	BALL GUIDE RAIL	5977
38	BALL GUIDE RAIL	27161
39	STEEL BALL, 1-1/16" DIAMETER (2)	28164
40	ROLLOVER GUIDE, YELLOW	15647T
41	BALL GUIDE RAIL, YELLOW	9396T
42	KICKER ASSEMBLY	MA-1373
43	KICKER ASSEMBLY COIL	5915
44	KICKER ASSEMBLY	MA-1081
45	KICKER ASSEMBLY COIL	5195
46	FLIPPER ASSEMBLY FLIPPER SWITCH FLIPPER COIL (SEE EXPLODED VIEW ILLUSTRATION)	MA-1140H 27657 27643
47	FLIPPER ASSEMBLY FLIPPER SWITCH FLIPPER COIL (SEE EXPLODED VIEW ILLUSTRATION)	MA-1250A 26439 26646
47A	FLIPPER ASSEMBLY FLIPPER SWITCH ASSEMBLY FLIPPER COIL (SEE EXPLODED VIEW ILLUSTRATION)	MA-1250D 26439 28740
48	FLIPPER ASSEMBLY FLIPPER SWITCH ASSEMBLY FLIPPER COIL (SEE EXPLODED VIEW ILLUSTRATION)	MA-1251D 26439 28740
49	BALL GUIDE RAIL	17650
50	BALL SNUBBER RAIL (2)	13798
51	PLASTIC SHIELD	27214
52	PLASTIC SHIELD	27220
53	FENCE (2)	26612
54	CARDHOLDER	27230
55	OUTHOLE RELEASE ASSEMBLY	1658
56	OUTHOLE RELEASE COIL	27926
57	WIREFORM TROUGH GATE	20601
58	BALL KICKER UNIT	MA-1689
59	BALL KICKER COIL	26451

RUBBER RINGS

ITEM	DESCRIPTION	PART NO.
A	MINI-POST, LARGE (6)	15705
B	BUMPER RUBBER, YEL (6)	26648
C	1" (3)	10219
D	3" (3)	10223
E	2-1/2" (2)	10222
F	1-1/2" (2)	10220
G	5/16" (4)	10217
H	FLIPPER (4)	13151

MISCELLANEOUS PARTS

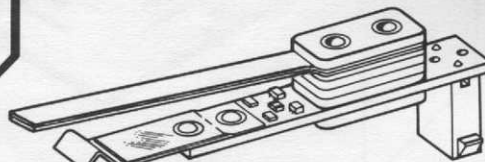
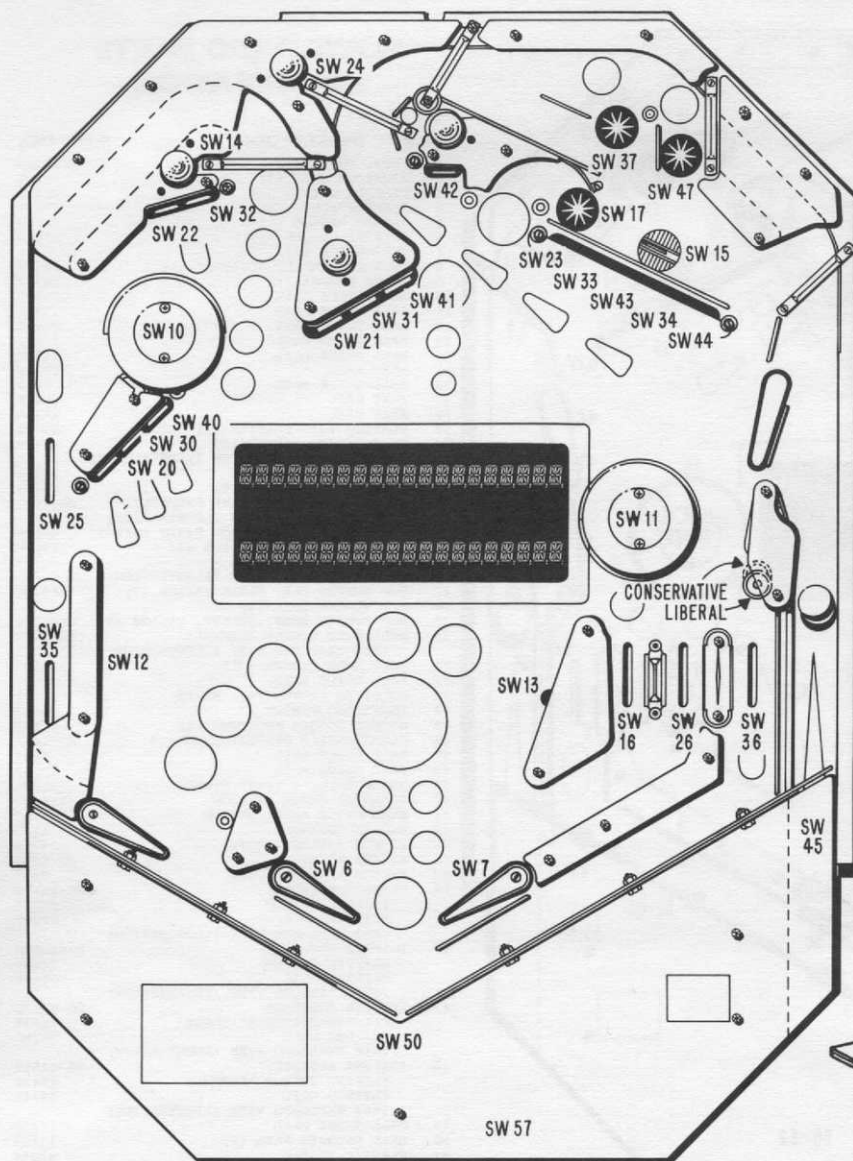
DESCRIPTION	PART NO.
MINI-POST SCREW	14792
SIAMESE POST	17492
PLASTIC POST, YEL, 1"	15561T
PLASTIC POST, YEL	20635T
PLASTIC POST, YEL	11562T
"Q" RELAY ASSY.	MA-23

VII. PARTS INFORMATION

PLAYBOARD SWITCH ASSIGNMENTS

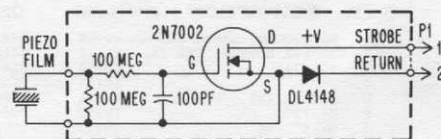
SWITCH MATRIX NUMBER	SWITCH ASSIGNMENT	PART NO.
SW 0	LEFT COIN CHUTE (#1)	P/O FRONT DOOR
SW 1	RIGHT COIN CHUTE (#2)	P/O FRONT DOOR
SW 2	CENTER COIN CHUTE (#3)	P/O FRONT DOOR
SW 3	#4 COIN CHUTE	P/O ELECTRONIC DOOR
SW 4	START (CREDIT) BUTTON	P/O CABINET 18092
SW 5	(NOT USED)	
SW 6	LEFT FLIPPER (SENSOR BOARD A15)	P/O MA-1334
SW 7	RIGHT FLIPPER (SENSOR BOARD A15)	P/O MA-1334
SW 10	LEFT POP BUMPER	22704
SW 11	RIGHT POP BUMPER	22704
SW 12	LEFT KICKING RUBBER	27702
SW 13	RIGHT KICKING RUBBER	27702
SW 14	LEFT SPINNER	27217
SW 15	HOLE	28080
*SW 16	RIGHT RETURN ROLLOVER #1	28625
SW 17	HOLE STAR ROLLOVER	28081
SW 20	LEFT SIDE SPOT TARGET #1, ORANGE	28730V
SW 21	#1 DROP TARGET	18094
SW 22	TOP SPOT TARGET #1, GREEN	28730S
SW 23	RIGHT SIDE SPOT TARGET #1, YELLOW	28730T
SW 24	RIGHT SPINNER	27217
*SW 25	LEFT SIDE ROLLOVER	28625
*SW 26	RIGHT RETURN ROLLOVER #2	28625
SW 27	(NOT USED)	
SW 30	LEFT SIDE SPOT TARGET #2, ORANGE	28730V
SW 31	#2 DROP TARGET	18095
SW 32	TOP SPOT TARGET #2, GREEN	28730S
SW 33	RIGHT SIDE SPOT TARGET #2, YELLOW	28730T
SW 34	RIGHT SIDE SPOT TARGET #4, YELLOW	28730T
*SW 35	LEFT RETURN ROLLOVER	28625
*SW 36	RIGHT OUTSIDE ROLLOVER	28625
SW 37	TOP STAR ROLLOVER #1	28081
SW 40	LEFT SIDE SPOT TARGET #3, ORANGE	28730V
SW 41	#3 DROP TARGET	18093
SW 42	CENTER SPOT TARGET, RED	28730U
SW 43	RIGHT SIDE SPOT TARGET #3, YELLOW	28730T
SW 44	RIGHT SIDE SPOT TARGET #5, YELLOW	28730T
SW 45	BOTTOM SHOOTER LANE ROLLOVER	27763
SW 46	(NOT USED)	
SW 47	TOP STAR ROLLOVER #2	28081
SW 50	OUTHOLE	
	TRANSMITTER	MA-1330
	RECEIVER	MA-1331
	OPTICAL INTERFACE BOARD	MA-1558
SW 57	TROUGH	27763

*SMART SWITCH™



SMART SWITCH™
DO NOT ADJUST WIDE BEAM

SEE PAGE 15



SCHEMATIC REPRESENTATION

VII. PARTS INFORMATION

PLAYBOARD LAMP ASSIGNMENTS

LAMP NUMBER LAMP ASSIGNMENT

L0	Shoot Again
L11	#1 Star Rollover "A"
L12	#2 Star Rollover "B"
L14	#2 Star Rollover "STAR"
L15	#3 Star Rollover "STAR"
L16	Hole "MYSTERY"
L20	"S" Spot Target
L21	"E" Spot Target
L22	"A" Spot Target
L23	"S" Spot Target
L24	"K" Spot Target
L25	"E" Spot Target
L26	"E" Spot Target
L27	"T" Spot Target
L30	"C"
L31	"R"
L32	"U"
L33	"I"
L34	"S"
L35	"E"
L36	Left Side Rollover "100,000"
L37	Right Outside Rollover "100,000"
L40	#1 Left Spinner "3000"
L41	#2 Left Spinner "10,000"
L42	#3 Left Spinner "20,000"
L43	#4 Left Spinner "50,000"
L44	#5 Left Spinner "LIGHTS SPECIAL"
L45	Top Left #1 and #2 Spot Target "COLLECT"
L50	#1 Right Spinner "EXTRA BALL ARROW"
L51	#2 Right Spinner "EXTRA BALL ARROW"
L52	#3 Right Spinner "EXTRA BALL ARROW"
L53	#4 Right Spinner "EXTRA BALL ARROW"
L54	#1 Center Spot Target "SPOT TOP R.O."
L55	#2 Center Spot Target "COLLECT SEA BONUS"
L56	#3 Center Spot Target "COLLECT JACKPOT"
L60	"1X"
L61	"2X"
L62	"4X"
L63	"8X"
L64	#1 Right Return Rollover
L65	#2 Right Return Rollover
L66	Left Return Rollover

THE FOLLOWING LAMP ASSIGNMENTS
ARE ALL GENERAL ILLUMINATION.

L90	#22
L91	#21
L92	#20
L93	#19
L94	#18
L95	#17
L96	#16
L97	#15
LA2	#14
LA3	#13
LA4	#12
LA5	#11
LA6	#10
LA7	#9
LB0	#8
LB1	#7
LB2	#6
LB3	#5
LB4	#4
LB5	#3
LB6	#2
LB7	#1

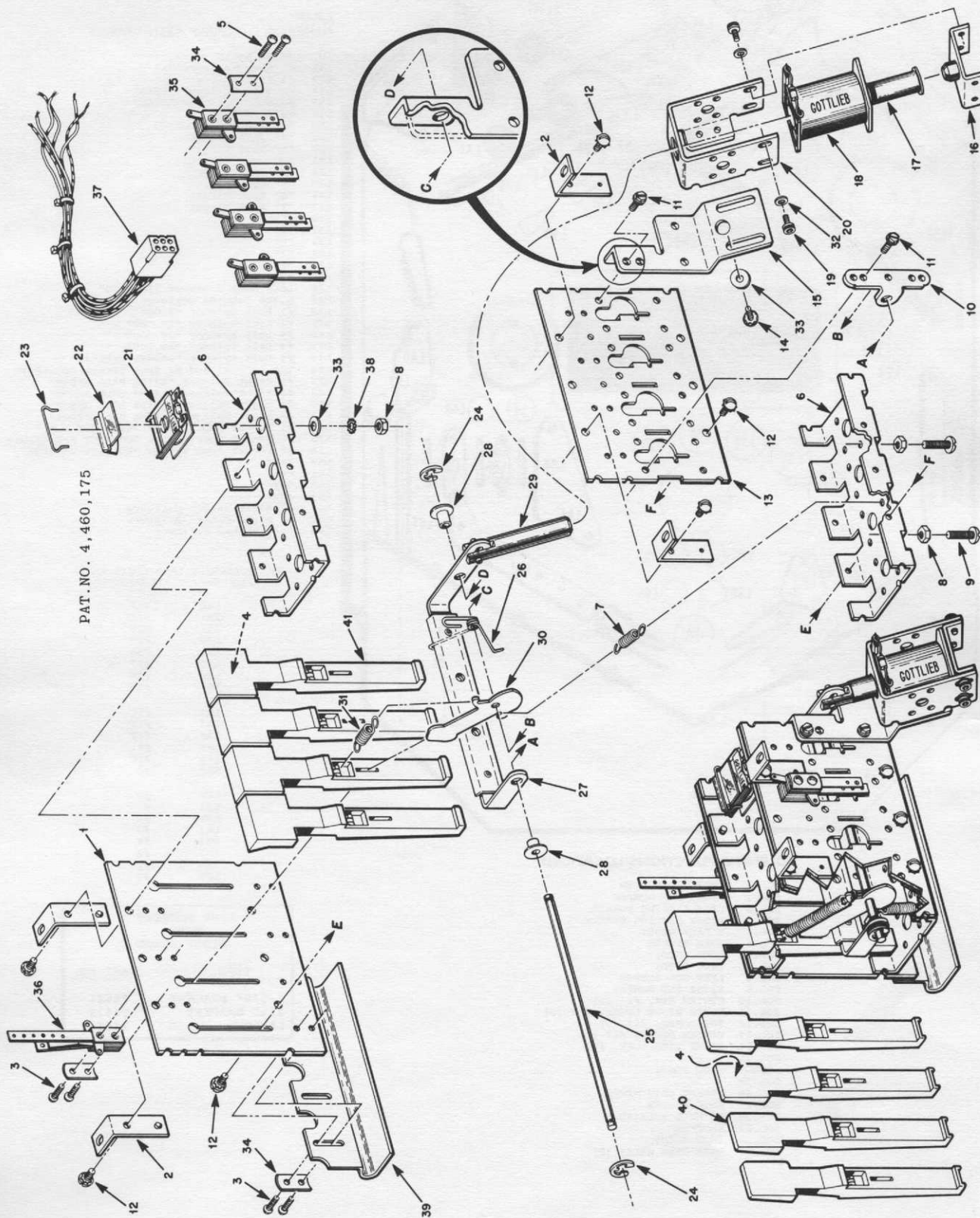
SOLENOID FUNCTIONS/LOCATIONS

SOL.0	LEFT POP BUMPER
SOL.1	RIGHT POP BUMPER
SOL.2	LEFT KICKING RUBBER
SOL.3	RIGHT KICKING RUBBER
SOL.4	3 BANK RESET
SOL.5	HOLE KICKER
SOL.6	(NOT USED)
SOL.7	(NOT USED)
SOL.8	LEFT POP BUMPER
SOL.9	RIGHT POP BUMPER
SOL.10	CENTER HAT, #67 (2)
SOL.11	LOWER RIGHT DOMES, #67 (2)
SOL.12	TOP DOMES, #67 (2)
SOL.13	CENTER DOMES, #67 (2)
SOL.14	RIGHT SIDE DOME, #67
SOL.15	THRU
SOL.25	(NOT USED)
SOL.26	TICKET COIN METER
SOL.27	BALL KICKER
SOL.28	OUTHOLE RELEASE
SOL.29	KNOCKER
SOL.30	(NOT USED)
SOL.31	GAME OVER RELAY (Q)

LAMP SOCKETS WITH DIODE BOARD

TYPE	PART NO.
1-1/8" BRACKET	26621
1/2" BRACKET	26622
LAYDOWN	26623

VII. PARTS INFORMATION DROP TARGET PARTS



VII. PARTS INFORMATION

DROP TARGET PARTS

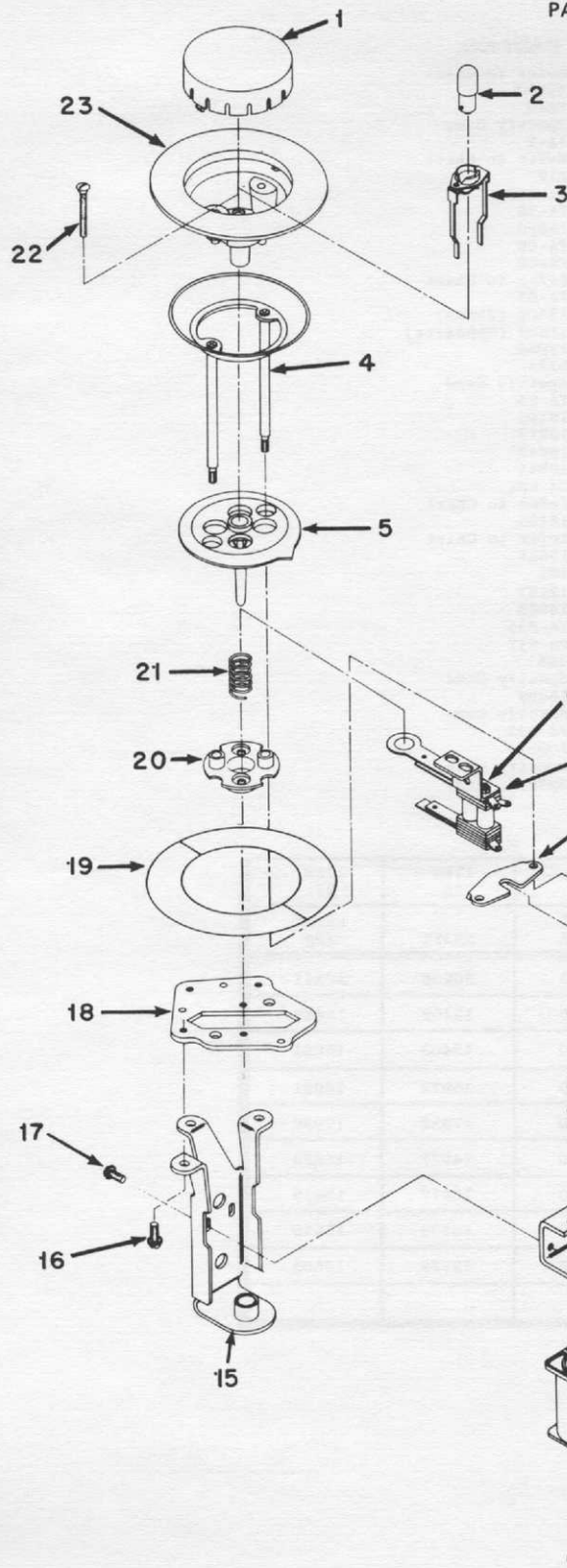
ITEM	DESCRIPTION	PART NO.
1	Switch Plate	Refer to Chart
2	Mounting Plate	12180
3	RHMS, #5-40 x 3/4	FA-3
4	Decals	Specify Game
5	RHMS, #5-40 x 5/8	FA-2
6	Guide Plate	Refer to Chart
7	Spring	517
8	Hex Nut, #8-32	FA-652
9	RHMS, #8-32 x 5/8	FA-75
10	Outboard Bearing Bracket	15696
11	HWHMS, #8-32 x 3/8	FA-69
12	RHMS, #8-32 x 1/4	FA-62
13	Pivot Plate	Refer to Chart
14	HWHMS, #8-32 x 5/16	FA-67
15	Coil Setup Bracket	15505 (Shown) 15504 (Opposite)
16	Coil Mount Bracket	17958
17	Plastic Slip in Core 2 1/2"	5172
18	Coil	Specify Game
19	Socket Head, #8-32 x 1/4	FA-65
20	Coil Housing	16194
21	Coil	19217
22	Armature	18643
23	Clip	18644
24	Retaining Ring	FA-681
25	Shaft	Refer to Chart
26	Reset Arm Return Spring	13455
27	Reset Arm	Refer to Chart
28	Reset Arm Bearing	15687
29	Drive Coil Plunger	262
30	Trigger	12181
31	Spring	18995
32	Internal Lockwasher, #8	FA-635
33	Washer, #8	FA-617
34	Switch Cover	465
35	Switch(s)	Specify Game
36	Switch(s), (10 Point)	18096
37	Cable Assembly	Specify Game
38	External Lockwasher, #8	FA-632
39	Stop Bracket	20937
40	Drop Target	Specify Game
41	Rollover Target	Specify Game

DROP TARGETS	ITEM 1 SWITCH PLATE	ITEM 6 GUIDE PLATE	ITEM 13 PIVOT PLATE	ITEM 25 SHAFT	ITEM 27 RESET ARM
3	20936	20934	20935	20938	20941
4	13411	13413	13409	13402	15689
5	13412	13414	13410	13403	15691
5 (TRIP ARM)	13412	13414	13410	15878	15691
6	17938	17937	17939	17932	17936
7	14531	14532	14530	14527	15693
9	15621	15622	15620	15617	15619
9 (TRIP ARM)	15621	15622	15620	16406	15619
10	12187	12188	12186	12179	15503

VII. PARTS INFORMATION

POP BUMPER PARTS

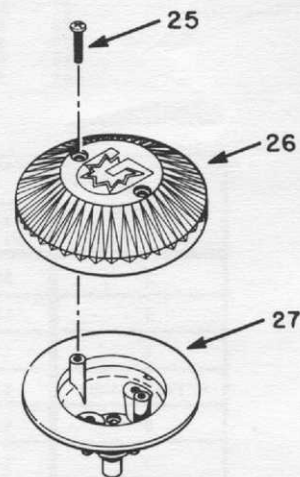
PAT. NO. 213,981



ITEM	DESCRIPTION	PART NO.
1	Pop Bumper Assembly	Specify Game
2	Pop Bumper Cap (Specify Color)	10434
3	Lamp, #44	LA-0
4	Socket	PS-0
5	Tie Rods and Ring	16634
6	Pop Bumper Skirt (Specify Color)	10433
7	Switch Assembly	Specify Game
8	Slotted Yoke	12149
9	Plunger	2663
10	Insulating Yoke	2662
11	Elastic Stop Nut, 6-32	FA-660
12	Kicker Return Spring	21643
13	Stop Bracket	8571
14	Coil	Specify Game
15	Coil Sleeve	5064
16	Coil Mounting Bracket and Stop	17906
17	8-32 x 1/4 HHMS SEMS	FA-64
18	6-32 x 1/4 HHMS SEMS	FA-53
19	Pop Bumper Pad	16632
20	Pop Bumper Trim Platter	25732
21	Pop Bumper Base	10432
22	Pop Bumper Spring	10430
23	6-32 x 1-1/8 Oval HMS	FA-43
24	Pop Bumper Body (Specify Color)	10435
25	Bracket	16647
26	4-40 x 1/2 Pan Head Phillips	FA-108
27	Pop Bumper Cap, Clear, (Specify Color)	26635
	Pop Bumper Body (Specify Color)	26860

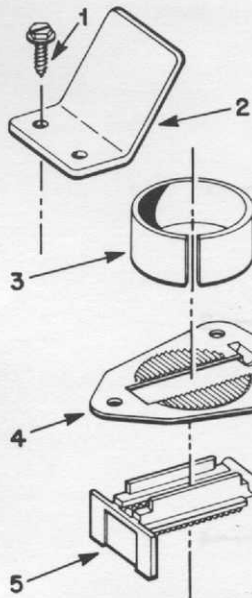
NOTE:

ITEMS 23 AND 27 ARE INTERCHANGEABLE.

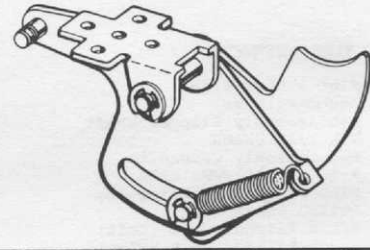


VII. PARTS INFORMATION

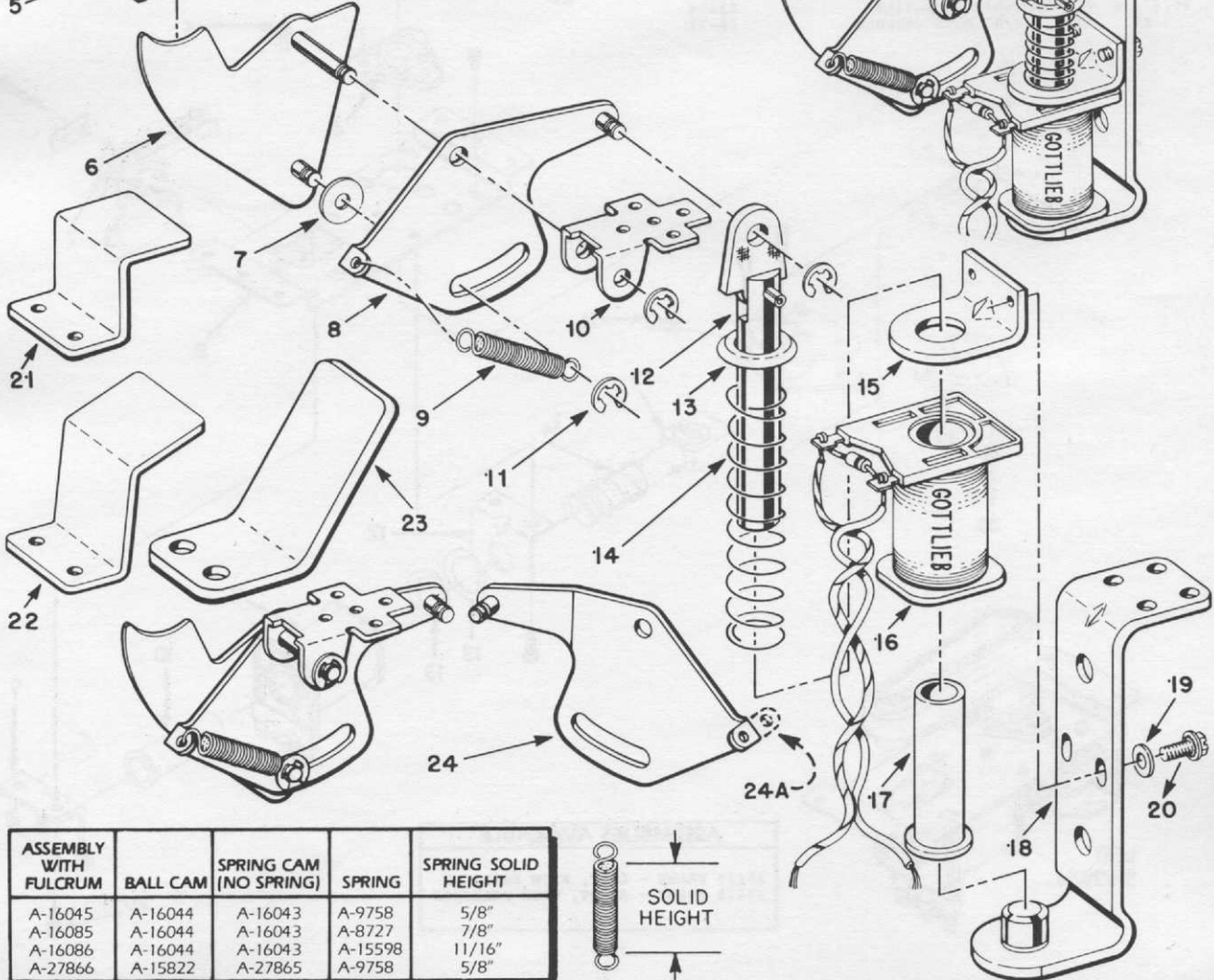
BALL HOLE KICKER PARTS



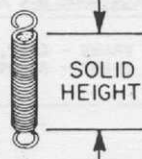
ITEM	DESCRIPTION	PART NO.
1	6 x 1/2" HHWSMS (2)	FA-270
2	Ball Snubber	16038
3	Metal Hole Liner	11151
4	Hole Base Plate	15707
5	Hole Switch Arm	15708
6	Ball Cam (See Tables)	
7	Nylon Washer	6443
8	Spring Cam (See Tables)	
9	Spring (See Tables)	
10	Fulcrum	15819
11	E-Ring (3)	FA-682
12	Link and Plunger Assy.	22234
13	Spring Retaining Washer	22233
14	Spring	1636
15	Mounting Bracket	15409
16	Coil with Diode	
	(Specify Game)	
17	Coil Sleeve	5064
18	Coil Stop and Mounting Bracket	20597
19	#8 Washer (2)	FA-617
20	8-32 x 5/16" HHWS SEMS (2)	FA-67
21	Ball Snubber	21532
22	Ball Snubber	21159
23	Ball Snubber	27128
24	Spring Cam (15° Offset)	18993
	(See Tables)	
24A	Spring Cam (Dotted Lines)	27865
	(Opposite Tab)	
	(See Tables)	



ASSEMBLY WITH FULCRUM	BALL CAM	SPRING CAM (NO SPRING)	SPRING	SPRING SOLID HEIGHT
A-15827	A-15822	A-15826	A-9758	5/8"
A-15828	A-15822	A-15826	A-15598	11/16"
A-16083	A-15822	A-15826	A-8727	7/8"
A-25842	A-15822	A-18993	A-15598	11/16"



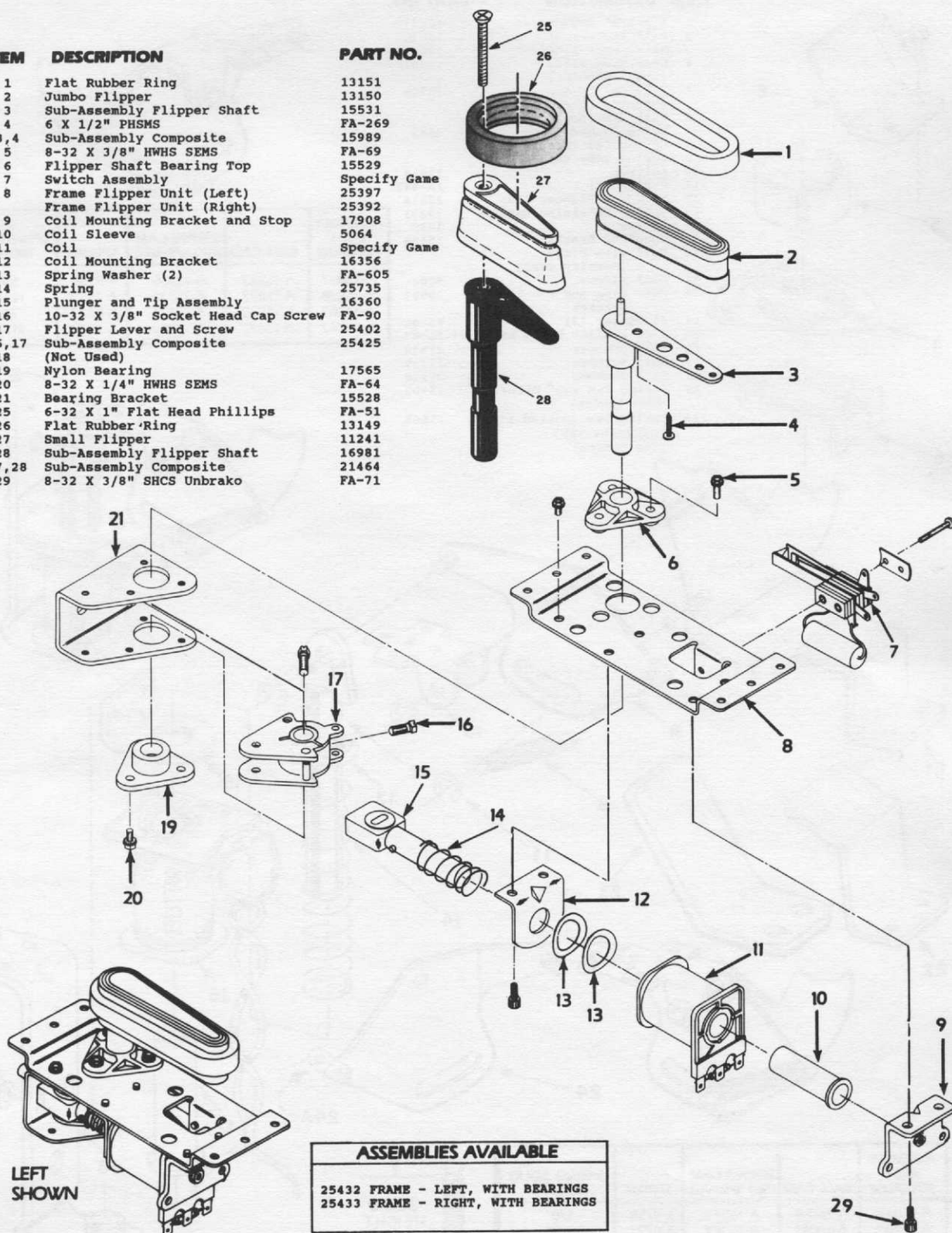
ASSEMBLY WITH FULCRUM	BALL CAM	SPRING CAM (NO SPRING)	SPRING	SPRING SOLID HEIGHT
A-16045	A-16044	A-16043	A-9758	5/8"
A-16085	A-16044	A-16043	A-8727	7/8"
A-16086	A-16044	A-16043	A-15598	11/16"
A-27866	A-15822	A-27865	A-9758	5/8"



VII. PARTS INFORMATION

FLIPPER PARTS

ITEM	DESCRIPTION	PART NO.
1	Flat Rubber Ring	13151
2	Jumbo Flipper	13150
3	Sub-Assembly Flipper Shaft	15531
4	6 X 1/2" PHSMS	FA-269
2,3,4	Sub-Assembly Composite	15989
5	8-32 X 3/8" HWHS SEMS	FA-69
6	Flipper Shaft Bearing Top	15529
7	Switch Assembly	Specify Game
8	Frame Flipper Unit (Left)	25397
	Frame Flipper Unit (Right)	25392
9	Coil Mounting Bracket and Stop	17908
10	Coil Sleeve	5064
11	Coil	Specify Game
12	Coil Mounting Bracket	16356
13	Spring Washer (2)	FA-605
14	Spring	25735
15	Plunger and Tip Assembly	16360
16	10-32 X 3/8" Socket Head Cap Screw	FA-90
17	Flipper Lever and Screw	25402
15,16,17	Sub-Assembly Composite	25425
18	(Not Used)	
19	Nylon Bearing	17565
20	8-32 X 1/4" HWHS SEMS	FA-64
21	Bearing Bracket	15528
25	6-32 X 1" Flat Head Phillips	FA-51
26	Flat Rubber Ring	13149
27	Small Flipper	11241
28	Sub-Assembly Flipper Shaft	16981
25,27,28	Sub-Assembly Composite	21464
29	8-32 X 3/8" SHCS Unbrako	FA-71



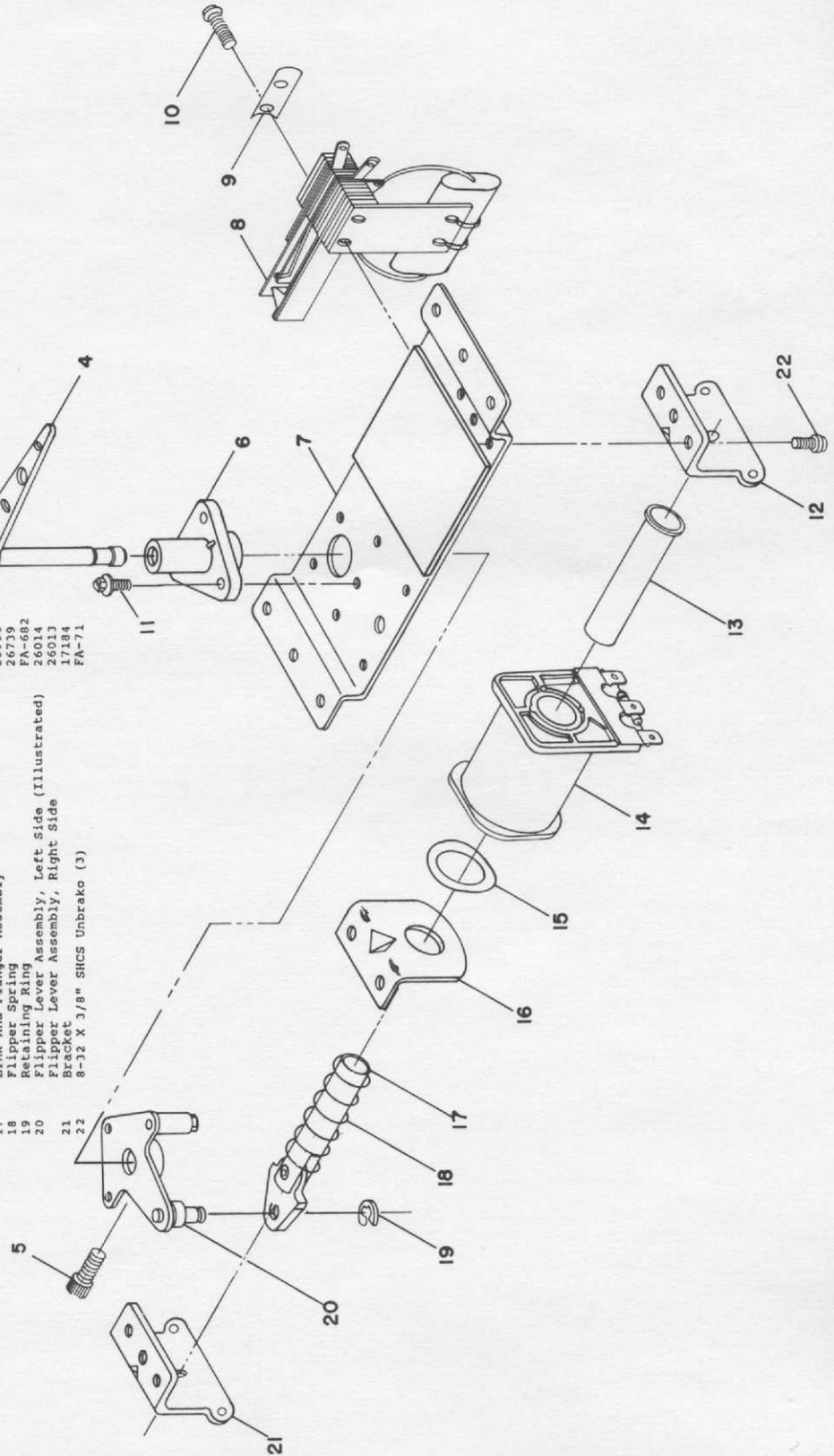
VII. PARTS INFORMATION

FLIPPER PARTS

ITEM	DESCRIPTION	PART NO.
1	Flipper Assembly, Left Side (Illustrated)	MA-1250A
2	Flipper Assembly, Right Side	MA-1251A
3	8-32 X 1/2" Oval Head MS	FA-77
4	Flat Rubber Ring, Red	13151
5	Flipper	25972Y
6	Flipper Shaft Assembly	26497
7	10-32 X 3/8" Unbrako (2)	FA-90
8	Flipper Shaft Bearing	25961
9	Frame, Left Side (Illustrated)	27330
10	Frame, Right Side	27329
11	Switch Assembly, Left Side (Illustrated)	26439
12	Switch Assembly, Right Side	26438
13	Capacitor, 2.2UF, 200V	XO-995
14	Switch Cover	465
15	5-40 X 7/8" RHMS SEMS (2)	FA-7
16	8-32 X 3/8" RHMS SEMS (6)	FA-49
17	Stop Stud and Bracket Assembly	25958
18	Coil Mounting Bracket	5065
19	Coil With Diode (See Schematic Diagram)	FA-605
20	Spring Washer	16356
21	Link And Plunger Bracket	25956
22	Coil Mounting Bracket	26739
	Flipper Spring	FA-682
	Retaining Ring	26014
	Flipper Lever Assembly, Left Side (Illustrated)	26013
	Flipper Lever Assembly, Right Side	17184
	Bracket	FA-71
	8-32 X 3/8" SHCS Unbrako (3)	

REPAIR NOTE:
BEFORE INSERTING ITEM 1,
PLACE ONE DROP OF SAF-T-LOK
T70 THREAD LOCKING COMPOUND
INTO THE THREADED HOLE OF ITEM 4.

NOTE:
ITEMS 1 THRU 4 ARE NOT PART
OF THE FLIPPER ASSEMBLY.



NOTES

BASIC TROUBLESHOOTING GUIDE

CONDITION	POSSIBLE CAUSE
Game does not power up	* Line fuse (F1) blown * Primary fuse (F2) blown * Power Supply fuse (F6) blown
SWITCH SHORT message appears in display on power up	* Check for a voltage >0v shorted to switch return number shown in display * Bad Control Board (A1) * Bad Driver Board (A3)
Playfield illumination lamps do not light	* Fuse (F9) blown
All controlled lamps, flash lamps, relays, and switches not working	* Fuse (F7) blown * Bad Driver Board (A3)
All controlled lamps work but some switches do not work	* Bad diode associated with the switch (contact point type switch only)
Some controlled lamps and some switches do not work	* Short circuit on associated strobe line on playfield * Bad Driver Board (A3)
Display not working (blank)	* Display fuse (F3, F4, or F5) blown * Bad Display Board (A4) * Bad Control Board (A1)
Display segments or digits stay lit all the time or do not light at all	* Bad Display Board (A4) * Bad Control Board (A1)
A solenoid operated device does not work. (Pop Bumper, Kicker, etc.)	* Associated fuse on playfield is blown * Bad Driver Board (A3)
All flippers and solenoids do not work	* Solenoid fuse (F8) blown
A flipper coil overheats and burns	* End of stroke switch on flipper unit not opening when the flipper button is held in. * Shorted capacitor on flipper unit
Flipper chatters when flipper button is held in	* Open hold winding (small diameter wire) on flipper coil
No sound or speech	* Bad Auxiliary Power Supply fuse (F10) * Bad Auxiliary Power Supply Board (A5) * Bad Auxiliary Sound Board (A20) * Bad Sound Board (A6)
Some sounds or speech missing	* Bad Auxiliary Sound Board (A20) * Bad Sound Board (A6)
An optical switch does not work or works intermittently	* Misalignment of LED transmitter to receiver * Bad LED transmitter and/or receiver * Bad Optical Interface Board (A25)

IMPORTANT NOTICE

THIS SHIPMENT HAS BEEN CAREFULLY INSPECTED AND PROPERLY PACKED BEFORE LEAVING THE FACTORY.

WE CANNOT ASSUME RESPONSIBILITY FOR BREAKAGE THAT MAY OCCUR IN TRANSPORTATION. IF THIS SHIPMENT IS DAMAGED IN ANY WAY, IMMEDIATELY NOTIFY THE CARRIER AND FILE DAMAGE REPORT SO THAT A SATISFACTORY ADJUSTMENT CAN BE MADE BY THEM.



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