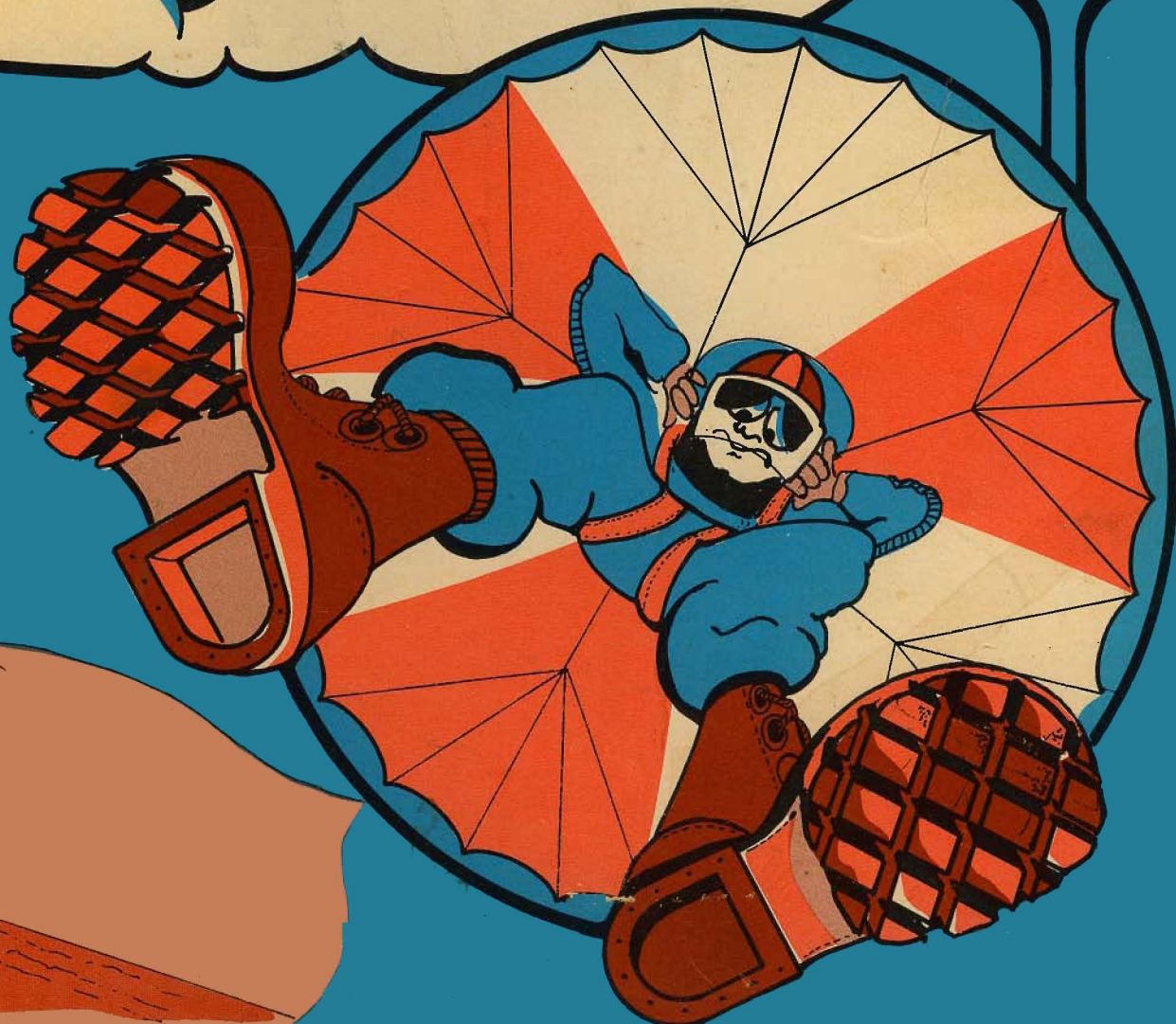


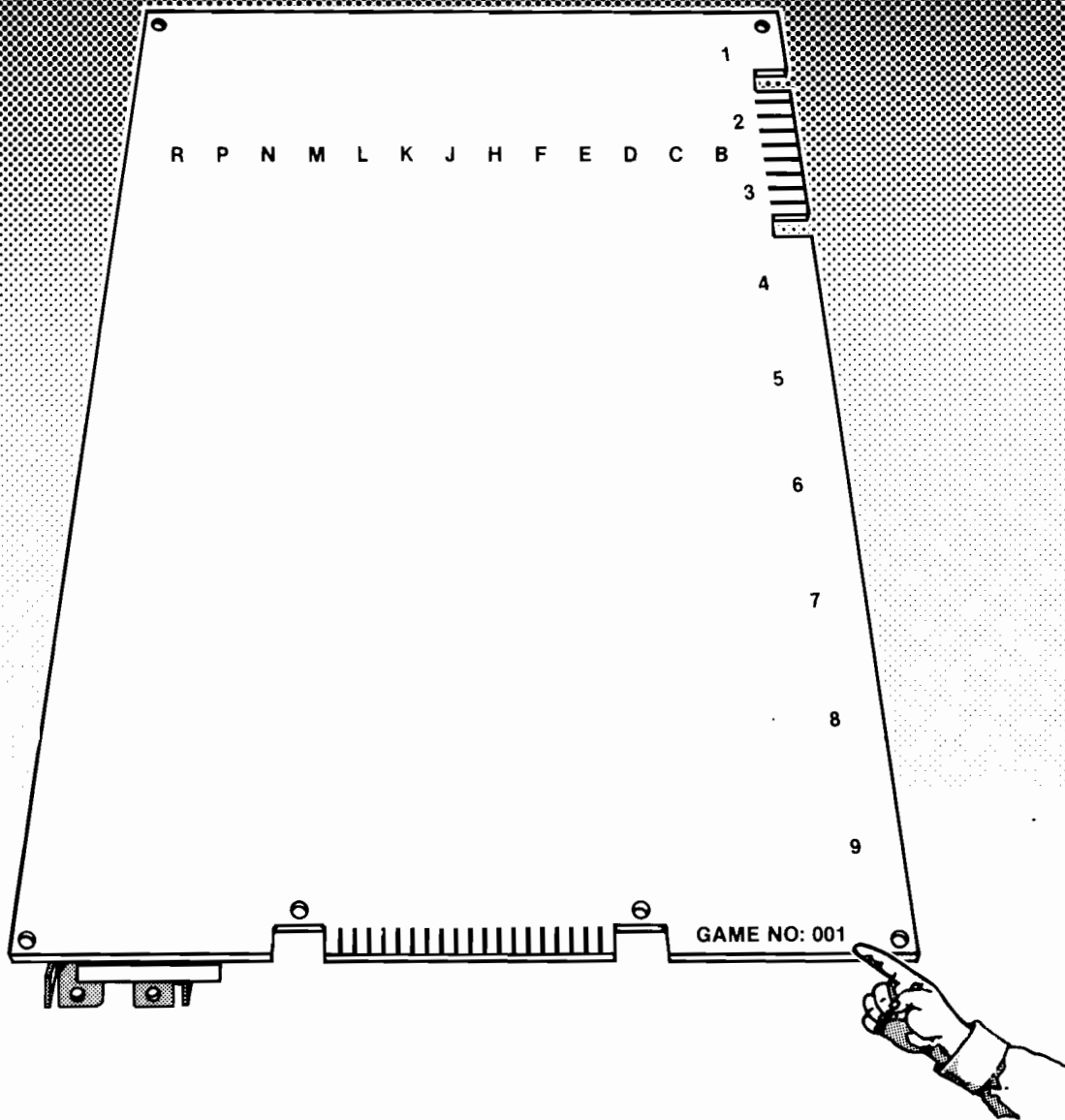
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Operation, Maintenance and Service Manual

# SKYDIVER™



Complete with Illustrated Parts Catalog



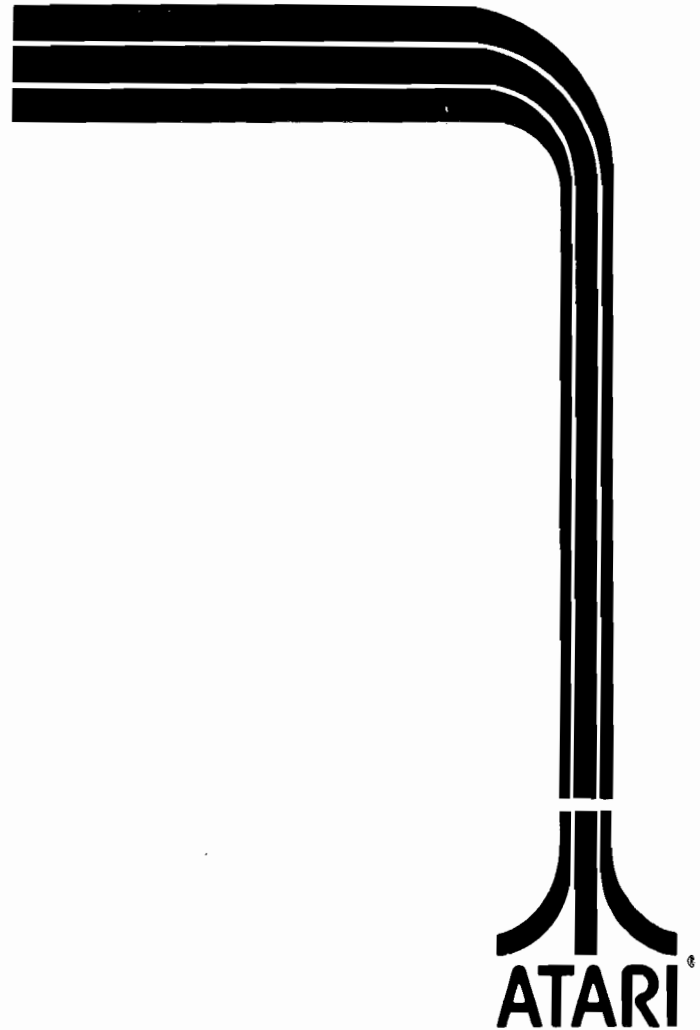
## GAME SERIAL NUMBER LOCATION

Your game's serial number is stamped on the circuit (back) side, bottom right corner, of the printed circuit board—see the illustration below. The same number is also stamped on the label located on the rear of the game cabinet. Please mention this number whenever calling your distributor for service.

# SKYDIVER™

## Operation, Maintenance and Service Manual

ATARI INC  
1265 BORREGAS AVENUE  
P.O. BOX 9027  
SUNNYVALE, CALIFORNIA 94086  
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**6G**

Lithographed in the U.S.A.

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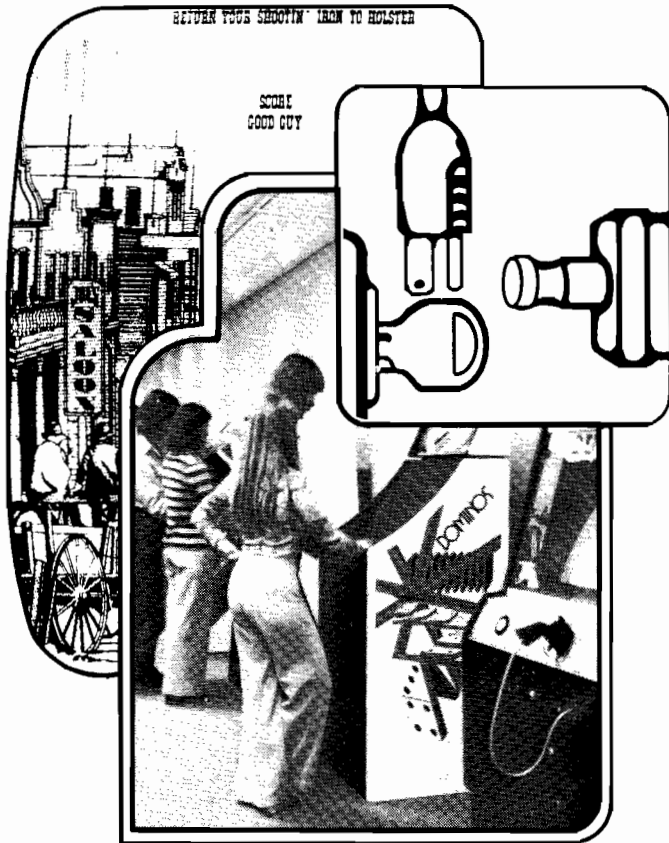
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## LOCATION SETUP

### A. INTRODUCTION

Skydiver™ is a one- or two-player action game developed by Atari, Inc. The game is contained in an upright cabinet illustrated with brightly colored graphics to further enhance player appeal. A 23-inch TV monitor is mounted in the top front of the cabinet. The TV monitor viewing screen is shielded by a Plexiglas® panel that also displays graphics.

Player-operated controls are mounted directly below the TV monitor viewing screen on the front of the game cabinet. The controls consist of a rip cord control, a jump button and two LED switches labeled *Black Player Start* and *Blue Player Start*. A speaker mounted below the control panel provides the game sound.

The coin mechanism mounted on the front part of the cabinet below the control panel initiates the play. The cash box is located behind a locked access door to the coin mechanism.

The object of the Skydiver game is to successfully skydive from a traveling plane to a ground target that appears in a different position after each successful jump.

The player watches wind speed and direction using the blue or black wind socks. He or she must also judge target position, plane speed, duration of freefall before pulling the rip cord (to increase target score). Finally, the player must guide the man into the target using the rip cord control (left or right).

One or two players can simulate the action of skydiving using the authentic rip cord control. For a detailed description of game play refer to Chapter 2.

## **B. GAME INSPECTION**

Your new Skydiver game is manufactured by Atari,

Inc. and is ready to play immediately on removal from the shipping carton. Your cooperation is desired to supply the final touch of quality control to your game. Please follow the procedures below to ensure that your game is in perfect condition:

1. Examine all external parts of the game cabinet for dents, chips, or broken parts.
2. After determining that the game has been received in good condition, unlock and open the rear access door. Carefully inspect the interior and verify that:
  - All plug-in connectors are firmly seated.
  - All integrated circuits in sockets on the game printed circuit board are firmly seated.
  - The fuses are all seated in their holders.
  - No harness wires are disconnected.
  - No loose foreign objects are present, especially metal objects that could cause electrical problems.

Be sure all major assemblies are checked. Check the game printed circuit board (PCB), the transformer, the two coin mechanisms, the speaker, the fluorescent light, and the player controls. Also, be sure the TV monitor is secure in its mounting.

Plexiglas® is a registered trademark of Rohm & Haas Company.

## C. INSTALLATION REQUIREMENTS

### Power Requirements and Line Voltage Selection

Skydiver is shipped for operation at 110 VAC, 60 Hz. Power consumption is approximately 200 watts. However, if your local voltage is not 110 volts, follow this procedure. You must select one of four connectors at the power supply and plug it into the voltage selection socket. Figure 1-1 shows the four connectors with one of them plugged in. The plugs are identified by wire color as listed in this figure.

Note that there are two basic operating voltages — 110 VAC, 60 Hz, and 220 VAC, 50 Hz, with provisions for low line voltage in each case. To insure proper operation, measure line voltage. If voltage is consistently below 100 V (for 110 VAC lines) or consistently below 210 V (for 220 VAC lines), use the low-voltage connections.

### Temperature Range

Location and storage should not be below 0 degrees Celsius (32 degrees Fahrenheit), and no higher than 49 degrees Celsius (120 degrees Fahrenheit).

### Humidity Range

Relative humidity for location or storage should be no more than 95%.

### Location Space Requirements

The Skydiver game requires a minimum of:

- 169 centimeters (66 inches) of vertical clearance
- 62 centimeters (25.5 inches) of width clearance
- 69 centimeters (27 inches) of depth space

See Figure 1-2 for details.

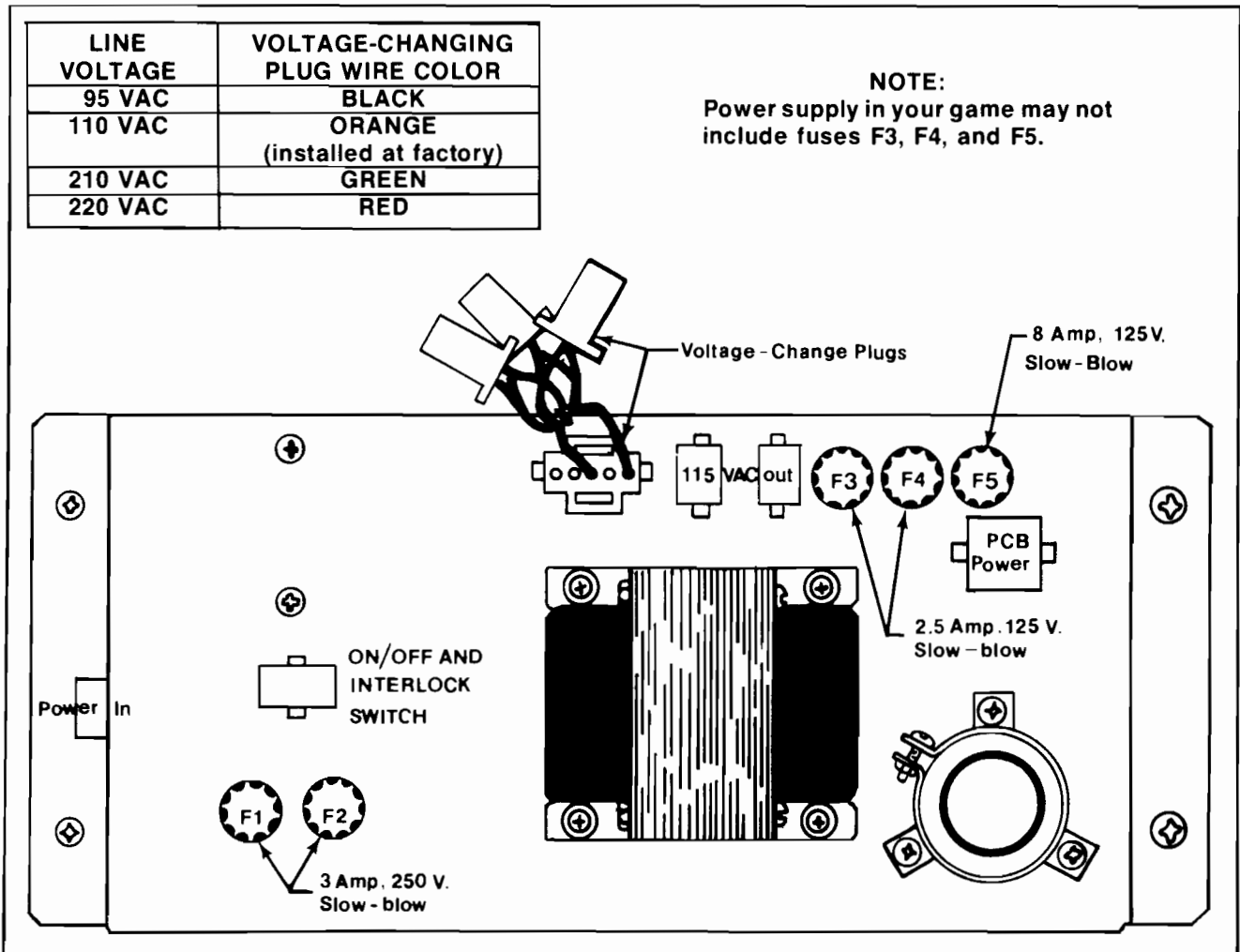


Figure 1-1 Location of Voltage-Changing Plugs on the Power Supply

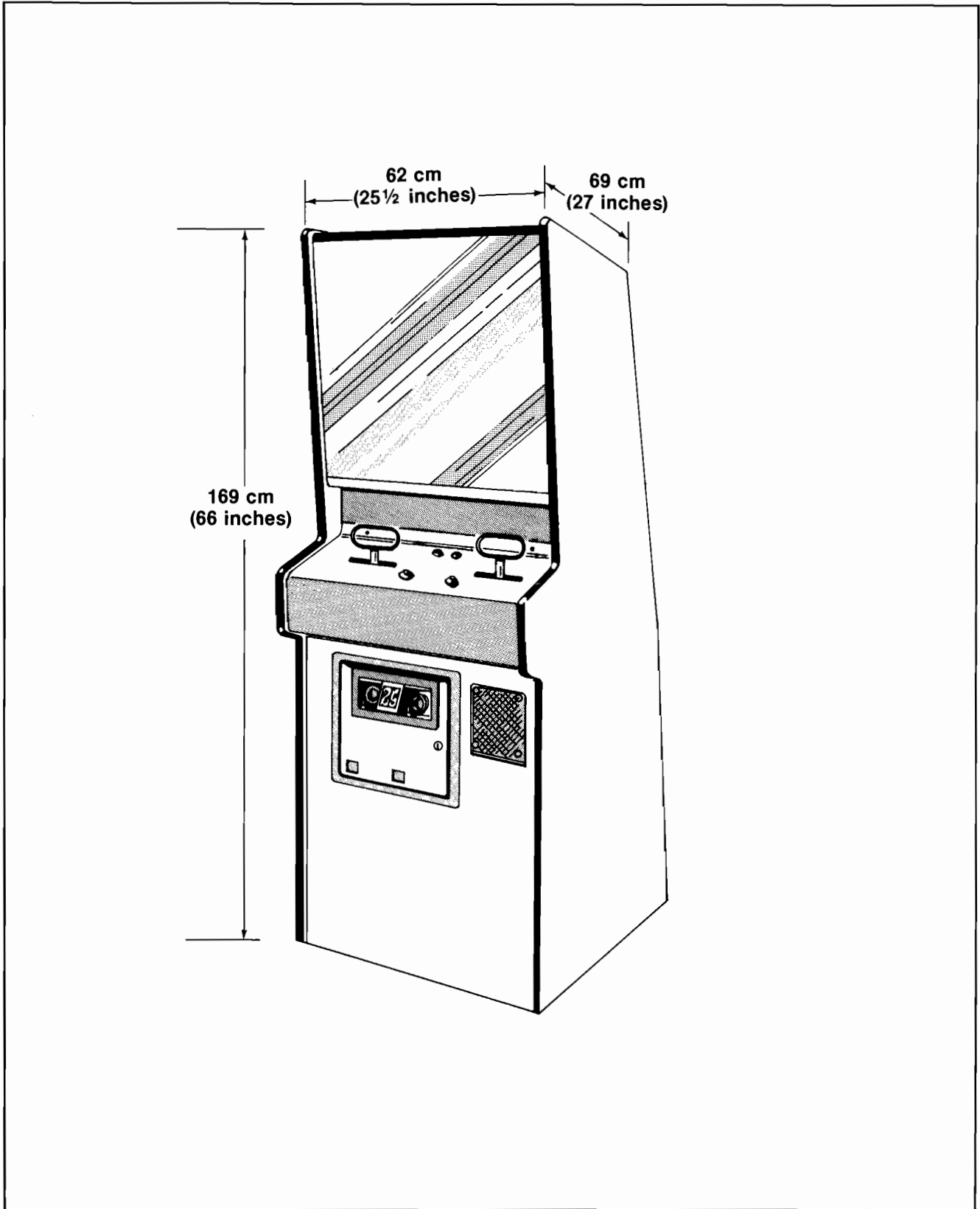


Figure 1-2 Location Setup Requirements

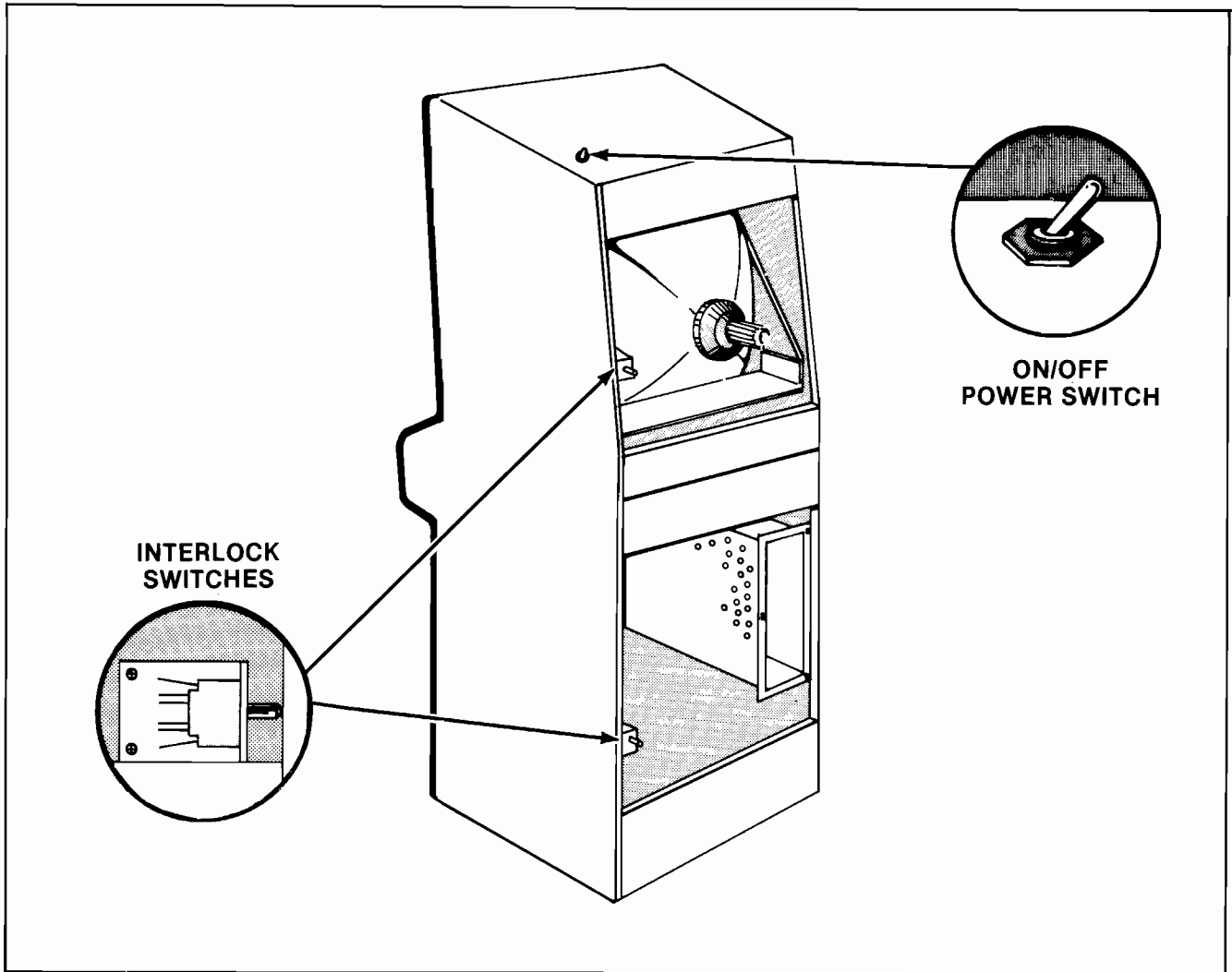


Figure 1-3 Location of Power On/Off and Interlock Switches

### Type of Power Cord

Atari has added a strain relief power cord to Skydiver. The advantage of this type of power cord is that, if pulled accidentally, the strain relief will hold the cord in place at the cabinet wall. The plastic strain relief "cushions" the impact of the shock and prevents the cord from pulling the wires out of the harness connector.

### D. INTERLOCK AND POWER ON/OFF SWITCHES

To minimize the hazard of electrical shock while you are working inside the game cabinet, an interlock switch has been installed at the rear access door. This switch removes all power from the game while the ac-

cess door is open. To help you conserve energy, a power on/off switch has been installed on Skydiver so that the game can be turned off during closed periods. This switch is located at the top of the cabinet in a recess, as shown in Figure 1-3.

Check for proper operation of the rear access door interlock switch by performing the following steps:

1. Unlock and open the rear access door.
2. Plug the AC power cord into an AC power source outlet (wall plug).
3. Set the power on/off switch to the *on* position.
4. Close the rear access door. Within thirty seconds the TV monitor should display a picture.

5. Slowly open the rear access door until the picture on the TV monitor disappears. The picture should disappear when the rear door is opened less than one inch from the top.
6. If the results of Step 5 are satisfactory, the interlock switches are operating properly. If the picture does not disappear as described, check to see if the appropriate switch is broken from its mounting or stuck in the *on* position.
7. Close and lock the rear access door.

## E. OPERATOR OPTIONS

Skydiver game options offer maximum player appeal for each game location. These options are listed in Table 1-1. They are preset for a certain game setup during production. To determine how the switches have been set for your game, compare the TV monitor viewing screen during the attract mode with the information in Table 1-1.

An additional method for determining these switch settings involves the self-test procedure. The self-test switch is located inside the cabinet, to the left of the coin door hinge, on the audio amplifier PCB. Set this switch to the *on* position. Compare the information on the TV monitor viewing screen during the self-test with the information in Table 1-1.

To change the toggle positions of the switch assembly and set the desired options, the printed circuit board (PCB) must be removed according to the following procedure:

### NOTE

Skydiver has a new style of easy-access PCB. The radio frequency shield has been redesigned to use only three quarter-turn fasteners—as a direct result of field input.

1. Unplug the game. Unlock and open the lower rear access door.
2. Locate the radio frequency (RF) shield assembly immediately inside the cabinet on the right. See Figure 1-4. On one end of the box is a printed circuit board (PCB) with an edge connector coming from the edge of the board.
3. Turn the three quarter-turn fasteners on the RF Shield assembly by turning the wing nuts  $\frac{1}{4}$  turn.
4. Carefully pull out the PCB and the RF shield board as one unit. These would *not* normally need to be separated when making option switch changes.
5. Set the switches for the desired options, as shown in Table 1-1.
6. Reinstall the PCB following steps 1 through 4 in reverse order. Do not force or bend the printed circuit board. Before reinstalling, always inspect the PCB for damage. Close and lock the rear access door.
7. Plug in the game and verify option functions by playing it.

## F. SELF-TEST PROCEDURE

Skydiver will test itself and provide data to demonstrate that the game's circuitry and controls are working properly. This procedure uses the TV monitor and the speakers; no additional equipment is required. See Figure 1-5 for location of the self-test switch.

To start the procedure over from the beginning, turn the switch off, then on again. This will return the test to Step 1 and can be done at any time during the procedure. See Table 1-1 for further details and instructions on the self-test. We suggest that you run the self-test procedure each time the coin box is emptied.

## G. VOLUME CONTROL

If volume is incorrect for your location, open the coin door and adjust the volume control. See Figure 1-5 for location of volume control.

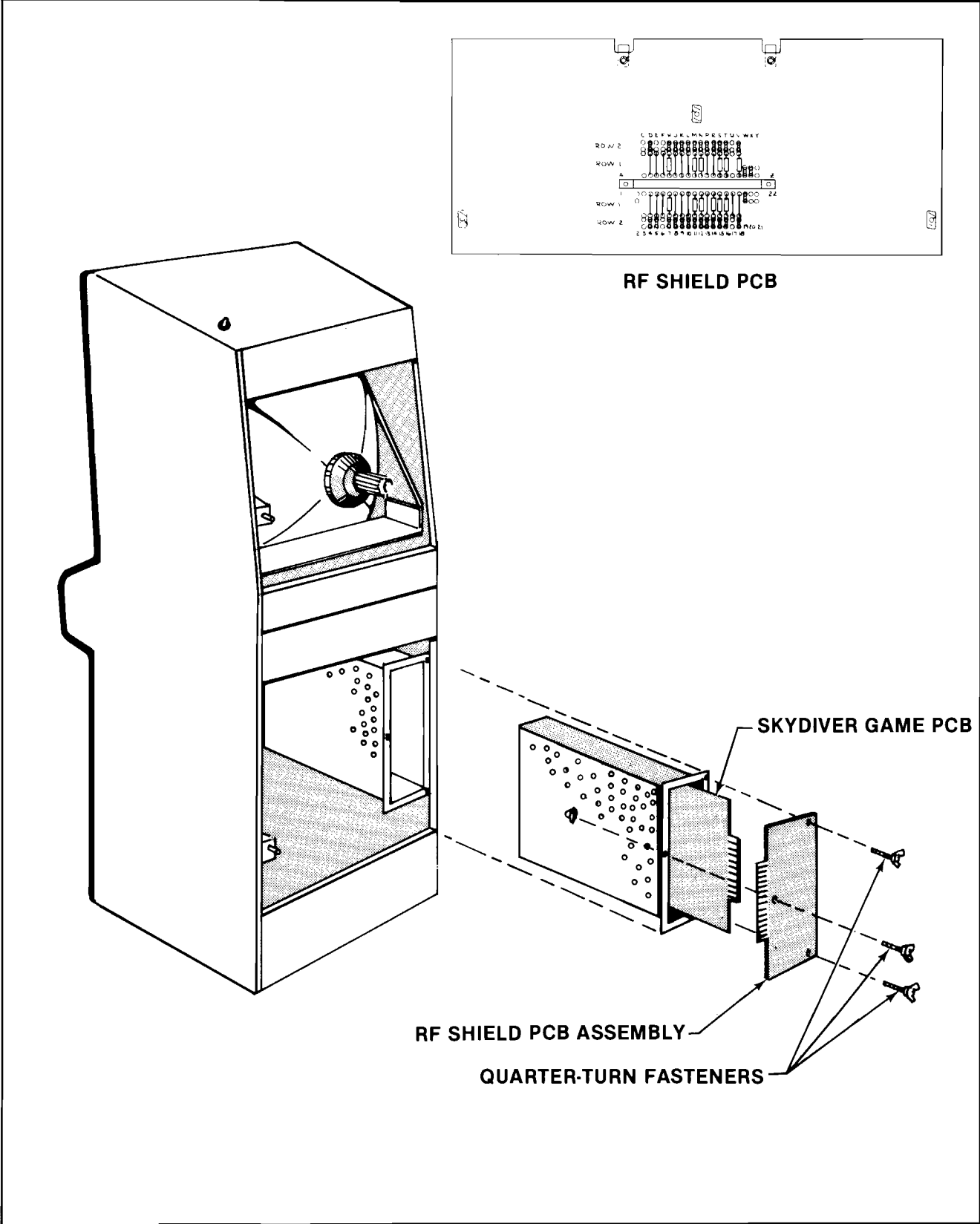


Figure 1-4 Location of RF Shield PCB Assembly

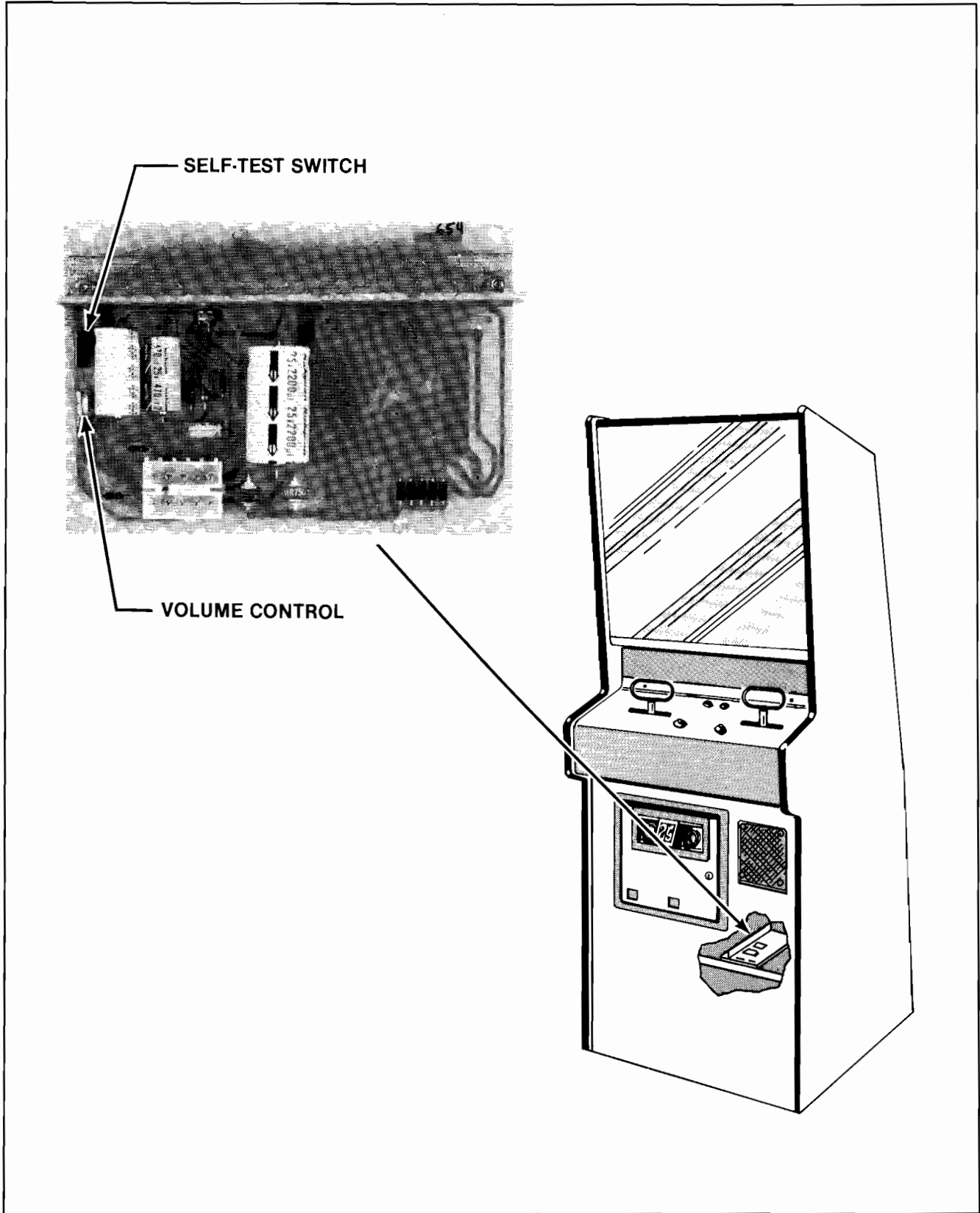


Figure 1-5 Location of Self-Test Switch and Volume Control



**Table 1-1 Operator Options**

OPTION	SWITCH SETTINGS ON 8-TOGGLE DIP SWITCH (Located at Position F10 on PCB)								RESULT
	1	2	3	4	5	6	7	8	
Game Instruction Language (as displayed on TV screen)	ON ON OFF OFF				ON OFF ON OFF				English French Spanish German
Coin Mode			ON ON OFF OFF				ON OFF ON OFF		Free Play 1 Coin 2 Plays 1 Coin 1 Play 2 Coins 1 Play
Game Length				ON ON OFF OFF				ON OFF ON OFF	3 Misses 4 Misses 5 Misses 6 Misses
Extended Play		ON ON OFF OFF				ON OFF ON OFF			Extended Play Hard* Extended Play Easy* No Extended Play No Extended Play

\*See Table 1-2 for details on extended play levels and the double score bonus.

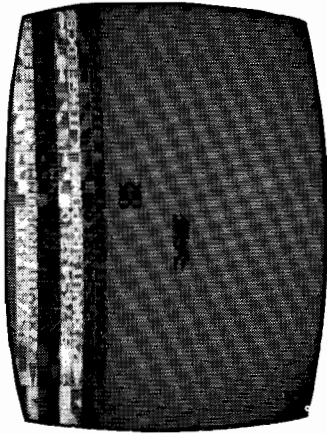
**Table 1-2 Extended Play and Bonuses**

PLAY	DESCRIPTION
Extended Play Easy	The player must achieve point score described below. The extended play points are displayed during the attract mode. When the 3000 points are reached, a short changing tone will alert the player. 3 Misses— 3000 pts.                                  5 Misses— 4400 pts. 4 Misses— 3700 pts.                                   6 Misses— 5100 pts.
Extended Play Hard	The player must achieve point score described below. The extended play points are displayed during the attract mode. When the 4000 points are reached, a short changing tone will alert the player. 3 Misses— 4000 pts.                                   5 Misses— 5400 pts. 4 Misses— 4700 pts.                                   6 Misses— 6100 pts.
Double Score Bonus	Double score bonus (2X SCORE) occurs when the word SKYDIVER is spelled out at the corner of the TV monitor screen nearest the player. If the JUMP button is pressed when an individual letter in the word SKYDIVER is flashing on the attraction panel, the same letter appears on the monitor and flashes. If the jump is successful, the letter stays lit. When all letters are lit, the player receives double score from that point onward and a musical fanfare plays.

**Table 1-3 Self-Test Procedure**

INSTRUCTIONS	RESULT IF TEST PASSES	RESULT IF TEST FAILS																											
<p>1 RAM TEST</p> <p>Remove Skydiver PCB from the RF cage as illustrated in Figure 1-4.</p> <p>Set all DIP switches in the small group (4 switches) to off.</p> <p>Set volume level potentiometer (located on the audio amplifier PCB next to the Self-Test Switch) to 1/2 full volume.</p> <p>Set Self-Test slide switch (located inside and to the right on the single audio amplifier PCB) to the on position.</p>	<p>Screen should be clear.</p> <p>A series of eight high tones are heard. If all sounds are audibly identical in pitch, the RAM is good.</p>	<p>A drop in pitch of one or more of the sounds indicates a bad RAM. The RAM location is determined from the following:</p> <table border="1" data-bbox="440 263 797 768"> <thead> <tr> <th>Low Sound in the Series</th> <th>Data Bit</th> <th>RAM Location on the PCB</th> </tr> </thead> <tbody> <tr><td>1st</td><td>0</td><td>K1</td></tr> <tr><td>2nd</td><td>1</td><td>M1</td></tr> <tr><td>3rd</td><td>2</td><td>P1</td></tr> <tr><td>4th</td><td>3</td><td>J1</td></tr> <tr><td>5th</td><td>4</td><td>N1</td></tr> <tr><td>6th</td><td>5</td><td>K/L1</td></tr> <tr><td>7th</td><td>6</td><td>L1</td></tr> <tr><td>8th</td><td>7</td><td>H/J1</td></tr> </tbody> </table>	Low Sound in the Series	Data Bit	RAM Location on the PCB	1st	0	K1	2nd	1	M1	3rd	2	P1	4th	3	J1	5th	4	N1	6th	5	K/L1	7th	6	L1	8th	7	H/J1
Low Sound in the Series	Data Bit	RAM Location on the PCB																											
1st	0	K1																											
2nd	1	M1																											
3rd	2	P1																											
4th	3	J1																											
5th	4	N1																											
6th	5	K/L1																											
7th	6	L1																											
8th	7	H/J1																											
<p>2 ROM TEST</p> <p>No operator action required. Wait for the last tone from Step 1.</p>	<p>Graphics cover the upper portion of the TV screen. These graphics display the contents of the graphics ROM.</p>	<p>If RAM 6810 (at B1) is bad, the letters F1 will appear in place of the top "OK" just below the Graphics Display as illustrated below.</p>																											

Below the graphics display, the word OK appears twice as illustrated.



The upper OK indicates that the 6810 chip (B1) is good.  
 The lower OK indicates that the ROM check sums are alright.  
 Two stretched\*\* black Skydiver men appear below and slightly to the left of the OKs.

If the bad sum check occurs, a number will appear in place of the bottom "OK" that indicates the bad ROM location — as listed in the following table:

Fault Number	PROM Location*	ROM Location
0	J0 or J/K0	F1
1	E2 or K/L0	E1
2	H0 or B0	E1
3	D/E2 or H2	D1
4	D/E0 or D0	D1
5	C/D2 or F2	C1
6	E/F0 or C0	C1

### 3 SWITCH AND LAMP TEST

- 3 Be sure that switch toggle
- 4 of DIP switch at F10 remains in the off state.
- Slowly press and hold down any LED push button or toggle any DIP switch to its opposite state; listen for a test tone each time a switch is pressed or toggled.
- Slowly release the LED push button or return the DIP switch settings, and listen for the same test tone.

All LEDs and the Skydiver attraction panel at the top of the cabinets should be lighted, as follows:  
 16 SKYDIVER lamps  
 2 Jump LEDs  
 2 Start LEDs

\*No MSB or LSB determination  
 \*\*True when Self-Test is entered from the play mode. The image is not stretched when Self-Test is entered from a reset.





## GAME PLAY

The Skydiver game has three different modes of operation:

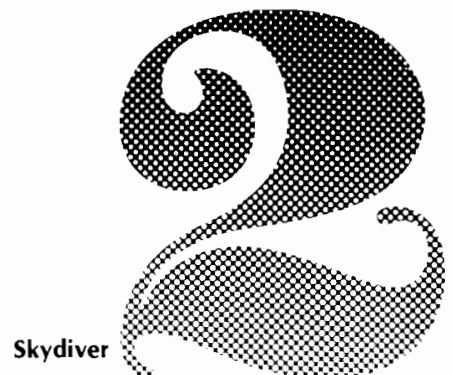
ATTRACT — Power accepted or as a result of the end of a game

READY-TO-PLAY — Coin accepted

PLAY — 4 to 5 seconds after start button is pressed

### **A. ATTRACT MODE (See Figure 2-1)**

The attract mode begins when power is applied to the game and the power switch is turned on (the power switch is located at the top rear of the cabinet as shown in Figure 1-2). This mode also occurs at the end of every game.



During the attract mode, the TV monitor screen displays the planes and little men jumping out to their targets. Note that Figure 2-1 has the black chute, but no little man, a blue man, but no chute. This occurs as a result of photograph and TV frame synchronization...it is not an actual visual display. The TV screen also displays the previous game scores, the standing high score, the point total required for extended play, the credits, and the cost per play. The player controls and sounds are inactive during this mode.

## **B. READY-TO-PLAY MODE (See Figure 2-2)**

When the correct amount of coins clear the coin acceptor, the ready-to-play mode is initiated. The TV monitor display does not change or vary from the attract mode display, although the PRESS START command does flash on the screen, along with the amount of accumulated credit.

The *START* LED pushbuttons light up and flash, alerting the player(s). Only the start buttons on the control panel will be activated during this mode.

## **C. PLAY MODE (See Figure 2-3)**

The play mode is initiated from the ready-to-play mode previously discussed, by pressing either the black or blue player start button for a single player or two players. At this point the screen display freezes and the PRESS START command continues to flash, but at a more rapid rate. The pressed start button (either one or both) stops flashing and goes out; it remains so until the next game credit. Approximately four seconds after the start button(s) is pressed, the game goes into the play mode unless both are initially pressed.

When only one player presses either start button, the opponent start button continues to flash for about ten seconds. This gives the opponent player the opportunity to enter the game, even after the first player has already started. If no one presses the opponent start button within those ten seconds, the LED start button goes off and remains off until the next game. The computer will take control of the opponent position during this one-player game mode.

Assume a one-player game is in progress. The player must successfully land his skydiver onto the target of matching color. As the player improves his or

her target landing skills for the highest score, the bi-planes will drop down a level closer to the target, and while flying a faster speed.

The skydiver jumps whenever the player presses the jump LED pushbutton switch. The chute opens at the pull of the rip cord, and the skydiver glides down to the target. His flight is determined by the wind speed and direction, as indicated by the video wind socks. Each player has his own color wind sock to indicate wind speed and direction. The player, however, does have some control over these forces by shifting the rip cord control either to the left or right. This action guides the skydiver in the desired direction.

The player scores by allowing the skydiver to freefall for as long as possible. This safe distance must be determined by a player while judging the wind speed, direction, speed and direction of his bi-plane, distance from the target, and state of the SKYDIVER attraction panel. (The latter is discussed in the following paragraphs.) The closer the target before pulling up the rip cord, the higher the target point score will be. The skydiver (or even his foot) must touch the target in order to score any points. When the skydiver hits the ground before the chute opens fully, he appears with his head in the ground and feet waving in mid-air. A video ambulance (see Figure 2-4) then appears on the screen, sounds its siren, and stops at the skydiver. Appearing to have loaded the skydiver, it then proceeds in the same direction off the screen.

Depending on the option switch settings, the player has 3, 4, 5, or 6 target misses allotted to him, and an extended play score to achieve. The most difficult part of the game is to attain the double bonus score. This double bonus is awarded when the player spells out the word SKYDIVER. In the play mode, each letter from SKYDIVER (located at the top of the Plexiglas shield) repeatedly lights up sequentially from left to right.

Immediately below the corresponding player score is a video band (black or blue) that actually covers the word SKYDIVER. When the game starts, the letters do not show. Each time the jump button is pressed while a letter is lighted on the attraction panel, that particular letter is revealed from behind the band on the TV monitor and begins to flash. If the player hits the target and scores, the letter remains uncovered. If the player misses the letter, it is once again hidden behind the band.

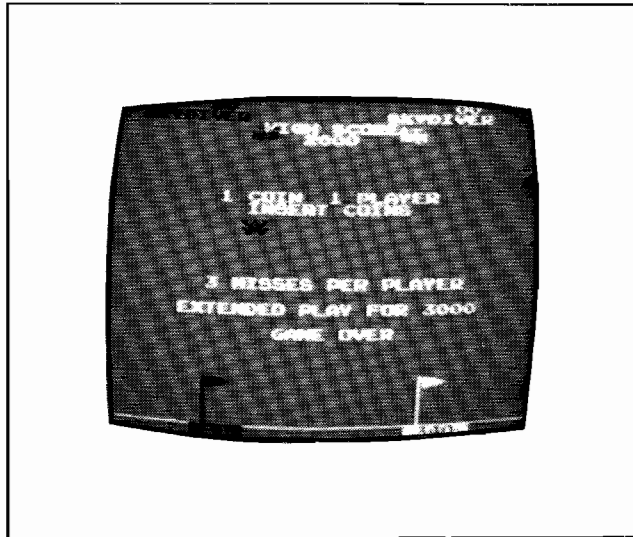


Figure 2-1 Attract Mode

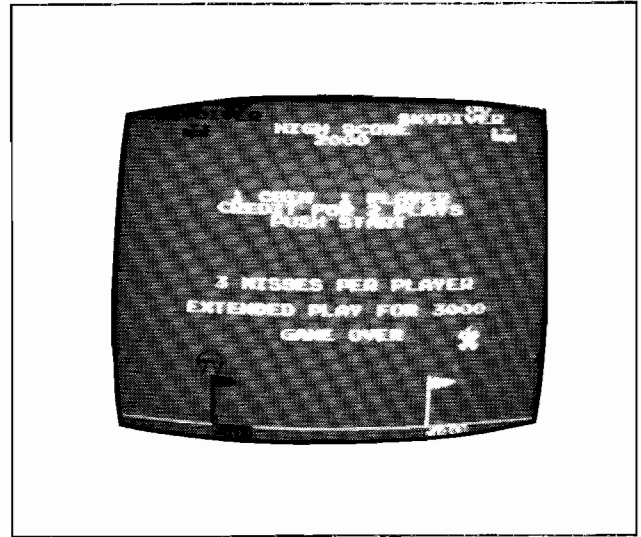


Figure 2-2 Ready-To-Play Mode

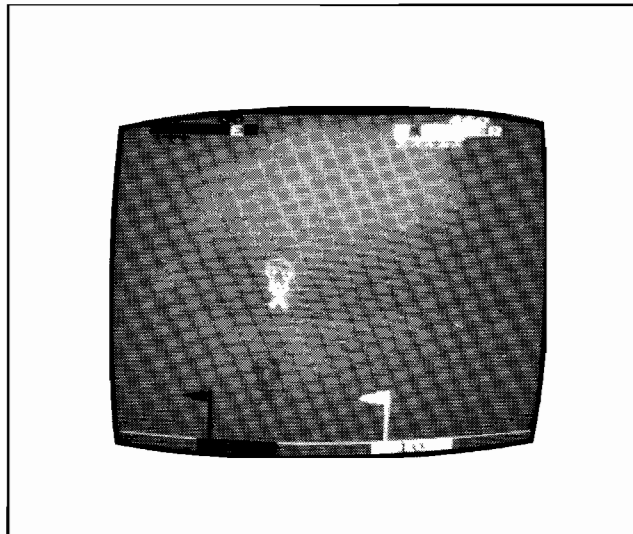


Figure 2-3 Play Mode

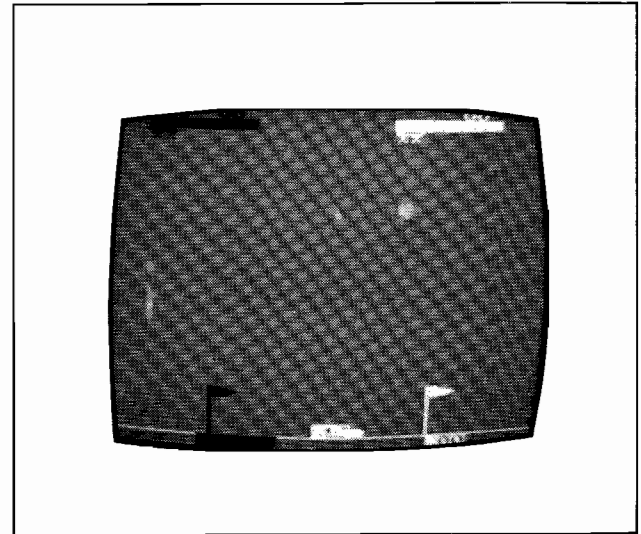


Figure 2-4 Ambulance Display

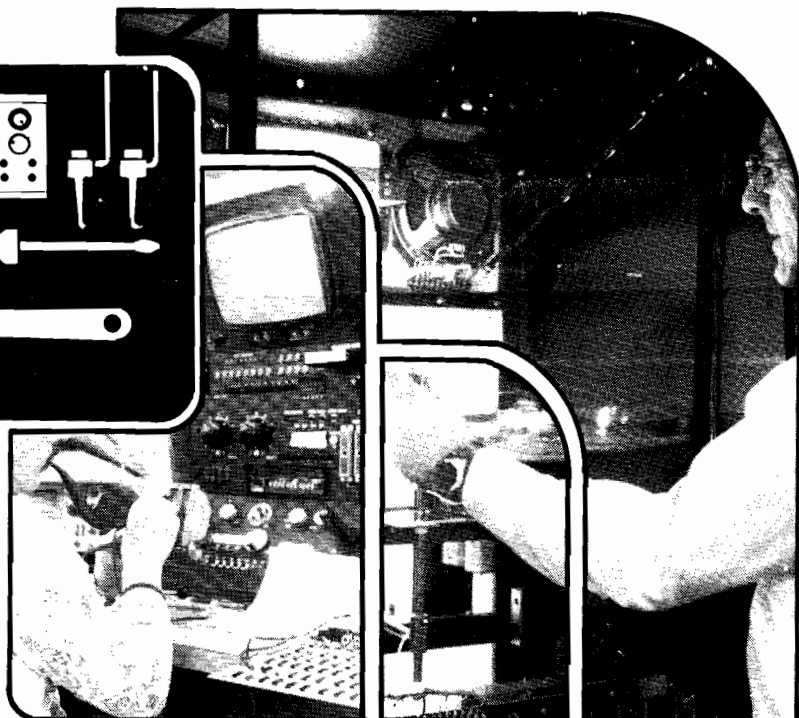
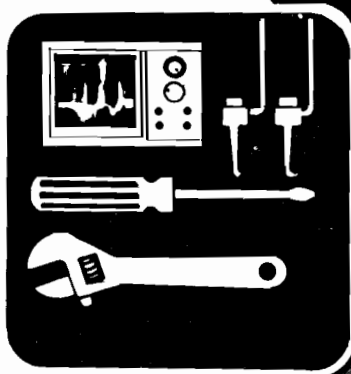
Eventually the player has several letters of *SKYDIVER* displayed and occasionally will score a hit for the same letter he already has showing. This provides no advantage. The player must be more observant to the letters displayed on the attraction panel. He must synchronize with a desired (and still uncovered) letter and press the jump pushbutton

without missing the target.

When the player has completely spelled out *SKYDIVER* and the music plays, a *2X SCORE* is displayed below the player's score. This informs the player that all displayed target points are doubled.







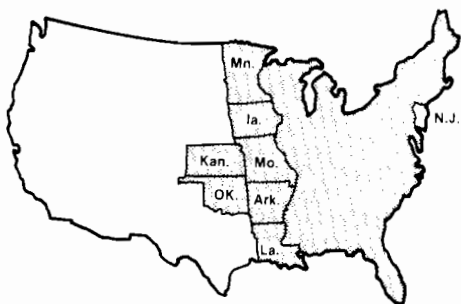
Due to its solid-state electronic circuitry, this Atari unit should require very little maintenance and only occasional adjustment. Information given in this chapter and elsewhere in this manual is intended to cover most servicing situations that may be encountered at a game site. The procedures given are in sufficient detail to be understood by a person with moderate technical background.

**NOTE**

If reading through this manual does not lead to solving a specific maintenance problem, you can get help from the following two Atari Customer Service offices.

Atari/New Jersey Customer Service Office  
46 Colonial Drive, Piscataway, NJ 08854  
Telex 37-9347  
(Monday-Friday, 8:30-5 pm Eastern time)

Dial toll-free from anywhere in the shaded area on map below (800) 631-5374.

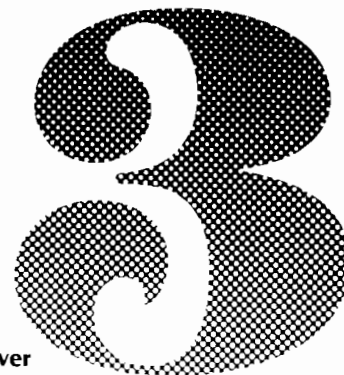


From New Jersey and elsewhere in the U.S. dial (201) 981-0490.

Atari/California Customer Service Office  
1344 Bordeaux Drive, Sunnyvale, CA 94086  
Telex 17-1103  
(Monday-Friday, 7:30-4 pm Pacific time)

From California, Alaska and Hawaii dial (408) 745-2900.  
From the remaining 47 states, dial toll-free (800) 538-1611.

# MAINTENANCE AND ADJUSTMENTS



Skydiver

## A. CLEANING

The exteriors of game cabinets and Plexiglas® panels may be cleaned with any non-abrasive household cleaner. If desired, special coin machine cleaners that leave no residue can be obtained from your distributor. Do not dry-wipe the acrylic plastic panels, because any dust can scratch the surface and result in fogging the plastic.

## B. COIN MECHANISM

### Components On Coin Door

Figure 3-1 shows the back side of the coin door assembly where the game's two coin mechanisms are mounted. Included is the lock-out coil assembly; the lock-out wires are connected to this assembly but are hidden behind the coin mechanisms. Powering the game causes the lock-out wires to retract far enough to allow genuine coins to reach the coin box. When AC power to the game has already been turned off, the lock-out coil is de-energized, causing the lock-out wires to move out far enough to divert coins to the return chute.

Directly below each coin mechanism is a secondary coin chute and a coin switch with a trip wire exten-

ding out to the front edge of the chute. When the trip wire is positioned correctly, a coin passing down the secondary chute and into the coin box will momentarily push the trip wire down and cause the switch contacts to close.

Also shown in the photograph is a slam switch assembly. It has been included to defeat any players who might try to obtain free game plays by violently pounding on the coin door to momentarily close the contacts on a coin switch. The slam switch contacts connect to the microcomputer system, which will ignore coin switch signals whenever the slam switch contacts are closed.

### Access to Coin Mechanisms

To remove jammed coins, and for maintenance cleaning, each magnet gate assembly can be hinged open without removing it from the door, as shown in Figure 3-2. Or, if necessary, each coin mechanism can be entirely removed from the door merely by pushing down on a release lever and simultaneously tilting the mechanism back, then lifting it up and out. This is shown in Figure 3-3.

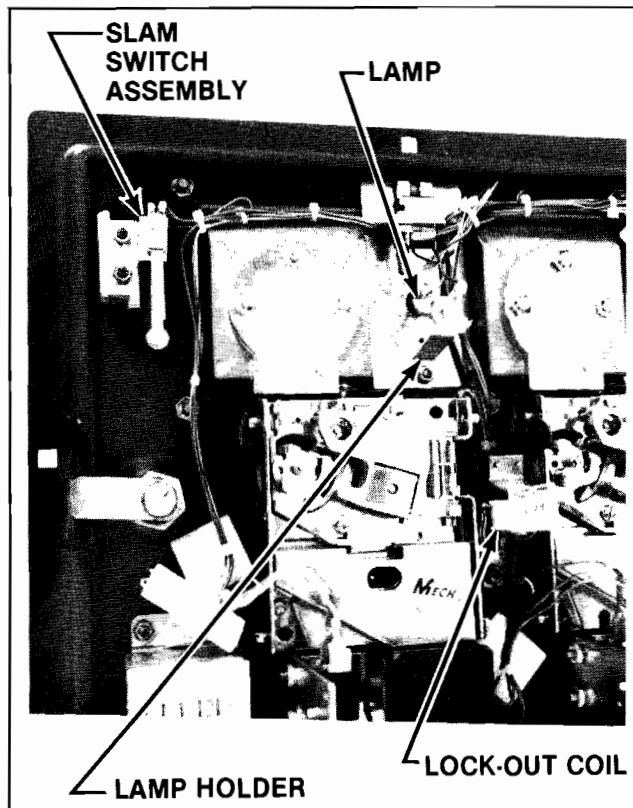


Figure 3-1 Coin Door Assembly

Plexiglas® is a registered trademark of Rohm & Haas Company.

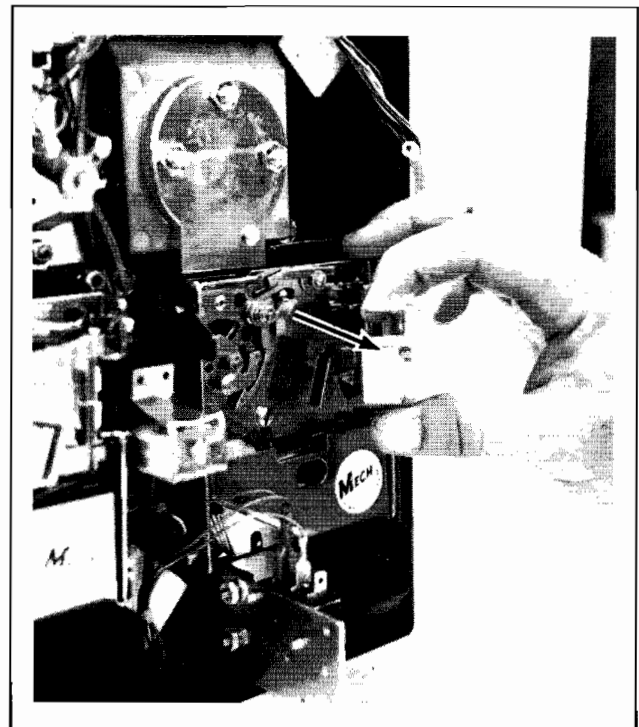
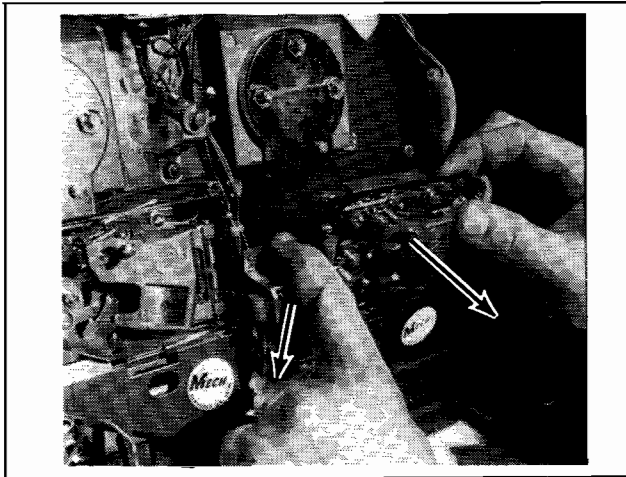


Figure 3-2 Hinging Open the Magnet Gate Assembly



**Figure 3-3 Removal of Coin Mechanism**

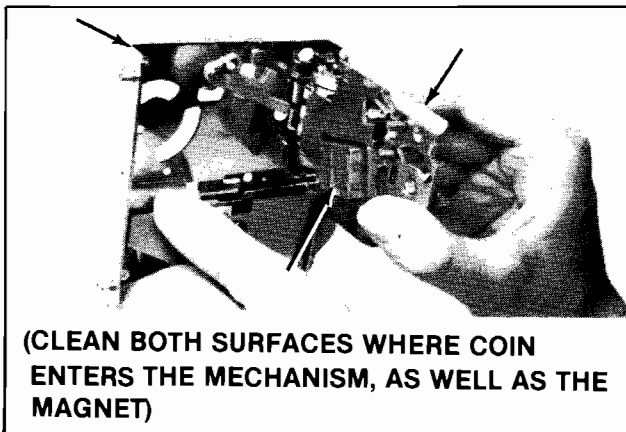
### **Cleaning of Coin Paths**

**CAUTION**

The use of an abrasive (such as steel wool or a wire brush) or a lubrication on a coin mechanism will result in a rapid buildup of residue.

By talking to many operators, we have found that the best method of cleaning a coin mechanism is by using hot or boiling water and a mild detergent. A toothbrush may be used for those stubborn buildups of residue. After cleaning, flush thoroughly with hot or boiling water, then blow out all water with compressed air.

Figure 3-4 shows the surfaces to clean inside the coin mechanism. These include the inside surface of the

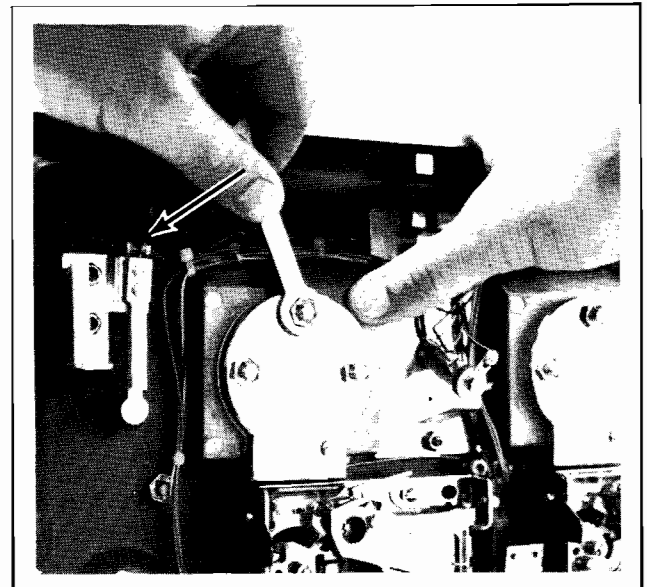


**Figure 3-4 Surfaces to Clean Inside the Coin Mechanism**

mainplate, and the corresponding surface of the gate assembly. There may also be metal particles clinging to the magnet itself. To remove these you can guide the point of a screwdriver or similar tool along the edge of the magnet.

If coins are not traveling as far as the coin mechanisms, you will need to clean the channel beneath the coin slot. To gain access to this channel, use a 3/8-inch wrench and remove all three nuts that secure the cover plate (refer to Figure 3-5). Removing the plate will provide access to the entire channel.

Also clean the inside surfaces of the secondary coin chutes, but when doing this be careful not to damage or bend the trip wires on the coin switches.



**Figure 3-5 Removal of Plate Covering Rear of Coin Slot**

### **Lubrication**

Do *not* apply lubrication to the coin mechanisms. The only points that may need lubrication (and only rarely) are the shafts of the scavenger buttons (coin rejection buttons) where they pass through the coin door. Apply only one drop of light machine oil, and be positive that no oil drops down onto a coin mechanism. Figure 3-6 shows this lubrication point.

### **Adjustment of Coin Switch Trip Wire**

In order for a coin switch to operate reliably when a coin travels down the secondary coin chute, the rest position of its trip wire should be as shown in Figure 3-7. Use extreme care when handling or touching these wires.



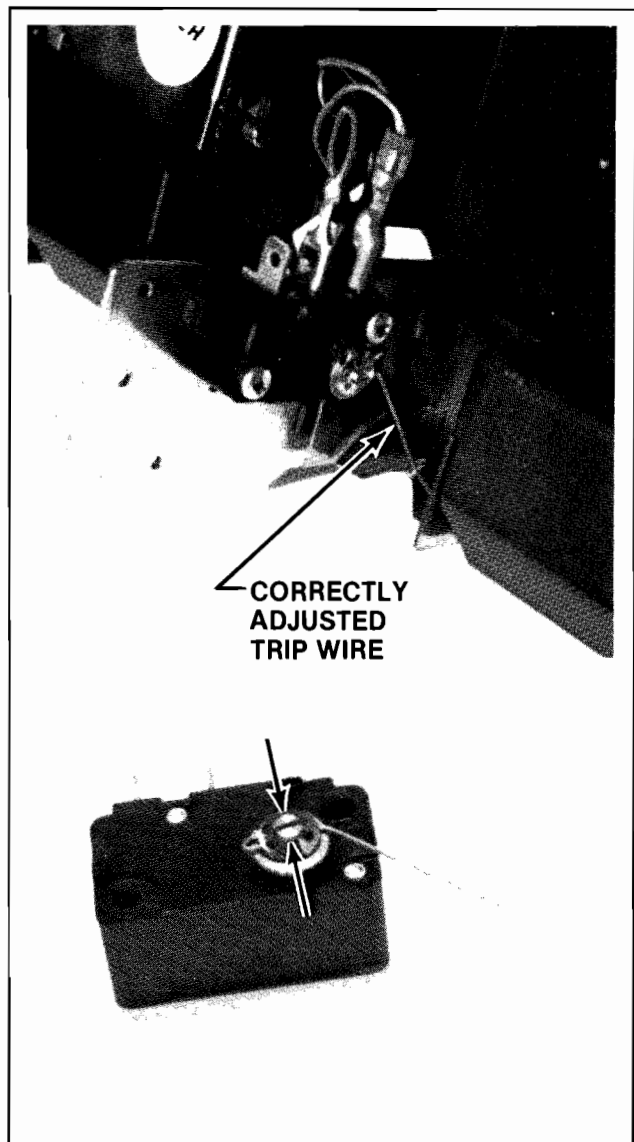
**Figure 3-6 Close-Up View of Lubrication Point**

In Figure 3-7 you will note that the coin switch trip wire is oriented into the "V" of the secondary coin chute. The wire should extend to only about 1/8" beyond the chute.

A retaining clip holds the wire onto the switch actuating stud. If you should loose a retaining clip, all is not lost. Just crimp the switch actuating stud over the trip wire with a pair of pliers.

### **Mechanical Adjustments on Coin Mechanism**

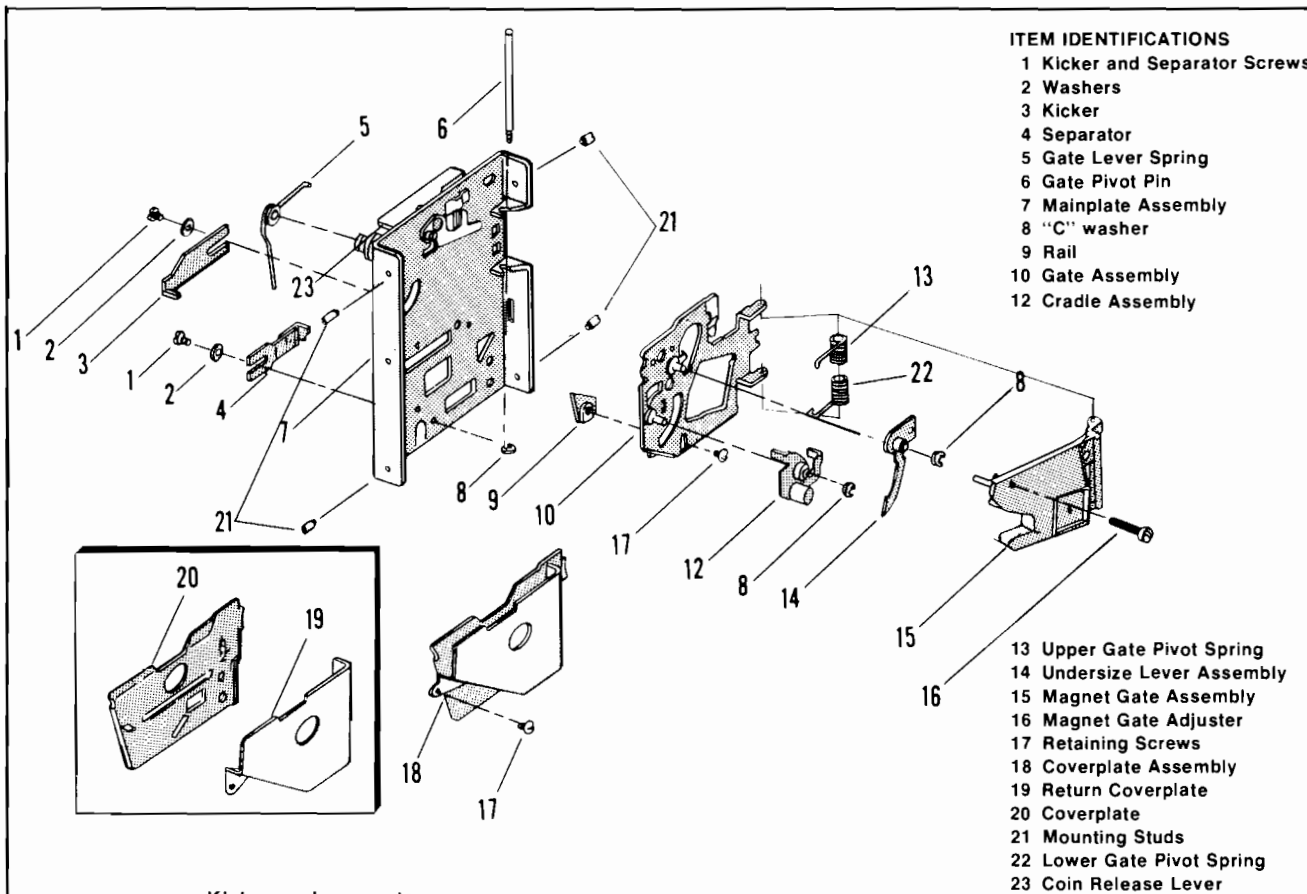
Coin mechanisms are adjusted prior to shipment from the factory and normally will retain these adjustments for many months. If, due to wear or other causes, it becomes necessary to make new adjustments, remove the coin mechanism from the coin door. Then take it to a clean well-lighted area where it can be placed in a vertical position on a level surface (such as a bench top). Besides a screwdriver, you will need a set of several coins, including both new and old, worn ones. Figure 3-8 shows an exploded view of the mechanism and gives procedures for adjusting the kicker, separator, and the magnet gate. These adjustments should only be done by someone who has experienced in servicing coin mechanisms and who understands their operation.



**Figure 3-7 Detail View of Coin Switch and Trip Wire**

### **General Troubleshooting Hints**

The first action is to look for jammed coins. After these have been removed, examine the coin path for presence of foreign material or loose objects (such as chewing gum, small metallic objects, paper wads, etc.). In cases where game usage is heavy, it may be necessary to clean the entire coin path periodically, in order to prevent build-up of contaminants that can hinder the movement of coins through the mechanisms. Also confirm that the trip wire on each coin switch is intact, and is properly adjusted. If troubles still persist, check the conditions and positions of the lock-out wires, and the mechanical adjustments on the coin mechanisms, before suspecting the electronics. If a coin mechanism



**Kicker and separator**

1. Set the acceptor with the back of the unit facing you in the test position.
2. Loosen the kicker and separator screws (1) and move the kicker (3) and the separator (4) as far to the right as they will go. Lightly tighten the screws.
3. Insert several test coins (both old and new) and note that some are returned by striking the separator.
4. Loosen the separator screw and move the separator a slight amount to the left. Lightly retighten the screw.
5. Insert the test coins again and, if some are still returned, repeat Step 4 until all the coins are accepted.
6. Loosen the kicker screw and move the kicker as far to the left as it will go. Lightly retighten the screw.
7. Insert the test coins and note that some are returned.
8. Loosen the kicker screw and move the kicker a slight amount to the right. Lightly retighten the screw.
9. Insert the test coins again and, if some are still returned, repeat Step 8 until all the coins are accepted.
10. Be sure that both screws are tight after the adjustments have been made.

**Magnet gate**

1. Set the acceptor with the front of the unit facing you in the test position.
2. Turn the magnet gate adjusting screw (16) out or counterclockwise until none of the coins will fit through.
3. With a coin resting in the acceptor entrance, turn the adjuster in or clockwise until the coin barely passes through the magnet gate.
4. Test this adjustment using several other coins (both old and new) and, if any fail to pass through the magnet gate, repeat Step 3 until all the coins are accepted.
5. Fix the magnet gate adjusting screw in this position with a drop of glue.

**Additional Cleaning**

- 1) Remove the transfer cradle (12) and the undersize lever (14).
- 2) Use a pipe cleaner or similar effective cleaning tool to clean the bushings and pivot pins.
- 3) Replace the transfer cradle and the undersize lever.
- 4) To be certain the coin mechanism is completely free of any residue, place the mechanism in boiling water for several minutes. Carefully remove it and let it air-dry completely before reinstalling in the door.

Figure 3-8 Coin Mechanism, Exploded View

rejects genuine coins, try to readjust it. If this is not successful, then replace it with a working mechanism.

Correct operation of the slam switch can be verified by putting the game into the test mode and performing the switch test (described in Table 1). Correct operation of the other switches and of the lock-out coil can also be checked by the switch test, or else merely by manually operating them and watching game responses as it changes from the attract mode to play mode, and then back to attract mode again.

### C. FUSE REPLACEMENT

Skydiver contains seven fuses, five on the power supply assembly in the lower part of the cabinet and two on the TV monitor assembly. Power supply fuses are accessible through the lower rear door assembly. TV fuses are accessible through the upper service panel door. Replace fuses only with the same type as follows:

*TEC TM-600/623 Monitors:*

3AG 2-amp and 0.5-amp quick-blow, 250 volts

*Motorola M5000/M7000 Monitors:*

3AG 0.8-amp quick-blow, 250 volts

*Power Supply:*

Fuses F1 and F2—3AG 3-amp slow-blow, 250 volts

Fuses F3 and F4—3AG 2.5-amp slow-blow, 125 volts

Fuse F5—3AG 8-amp fast-blow, 125 volts

### D. TV MONITOR ADJUSTMENTS

#### CAUTION

For best results be sure the game has been turned on for a while before making any TV monitor adjustments.

#### NOTE

The TV monitor adjustments are accessible through the rear door panel of the game cabinet. These adjustments have to be done while the game is energized. Therefore, only persons familiar with safety measures and repair procedures on electrical equipment should perform them.

The TV monitor should be adjusted only when the picture is distorted or if the contrast or brightness seem out of adjustment.

The monitor's adjustments function like those of a conventional, home television set, except that the volume adjustment has no effect. Instead, the game produces its sound in circuits separate from the TV monitor. Figure 3-9 shows the location of the adjustments on both TV monitors used by Atari. Your game contains a TV monitor manufactured to Atari specifications by either Motorola or TEC.

When making adjustments, follow these general guidelines:

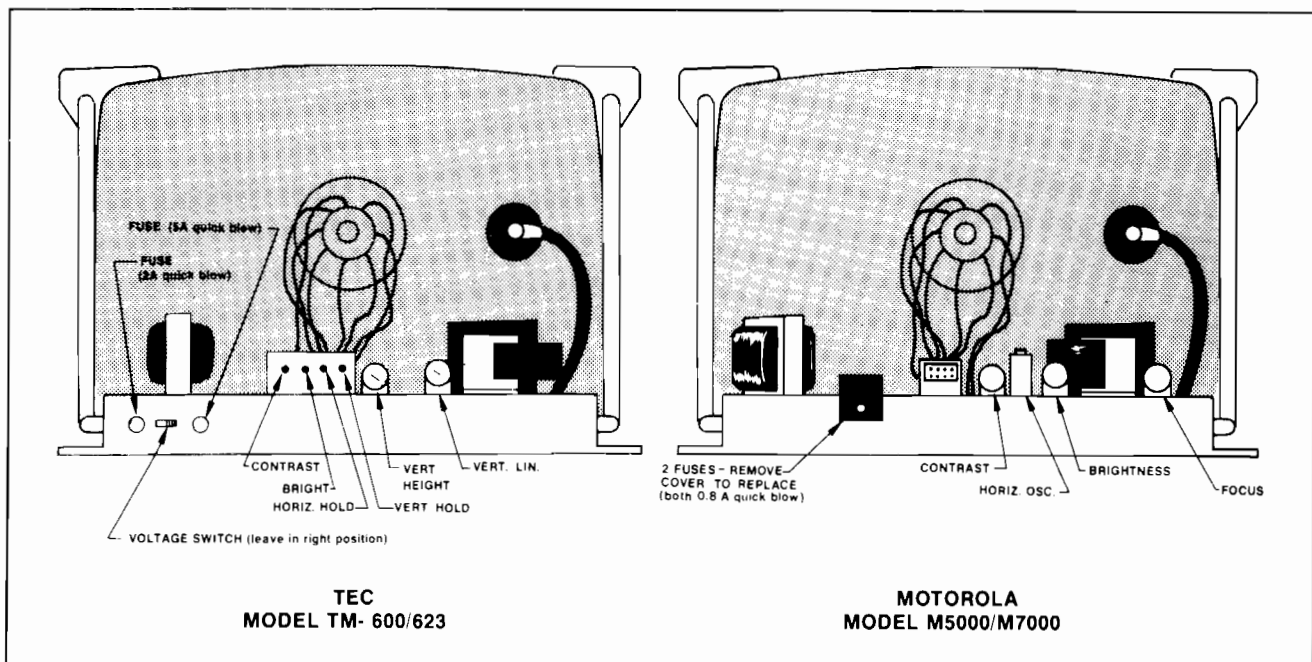


Figure 3-9 Locations of Adjustments on TV Chassis

**BRITE (Brightness)**—Perform this adjustment before the contrast. Adjust so that the white lines covering the screen just barely disappear, when the brightness is turned up.

**CONT (Contrast)**—Adjust so that the images are as bright as possible against the dark background without being blurred.

**HORIZ HOLD (Horizontal Hold) or HORIZ OSC (Horizontal Oscillator)**—Adjust if the picture is slightly off-center horizontally, if the images appear warped, or if the picture is broken up into a series of diagonal lines. Adjust for a stable, centered picture.

**VERT HOLD (Vertical Hold)**—This needs adjustment only if the picture appears to be rolling up or down the screen. Adjust for a stable, centered picture.

### **E. TV MONITOR REMOVAL (See Figure 3-10)**

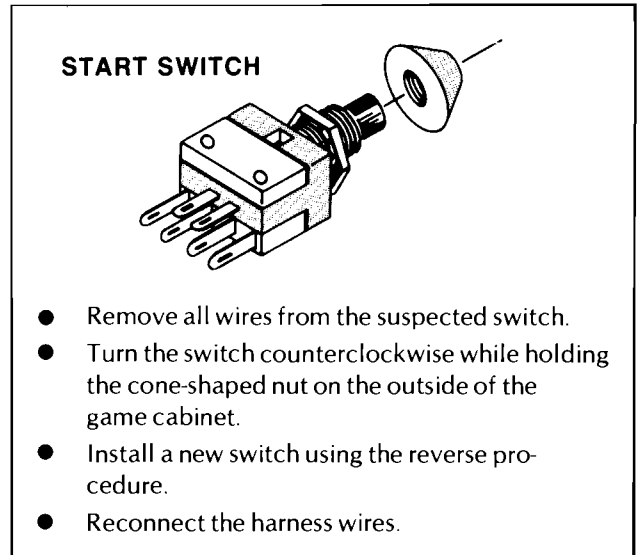
Remove three screws (button-head socket cap #10-32) at the top edge of the cabinet and remove the Plexiglas® retainer. Slide the shield out through the top of the cabinet and remove the smoked Plexiglas screen which is immediately behind. Next remove the cardboard bezel. At the back of the cabinet unlock the upper service panel and remove it. Now remove the six carriage bolts (10-24 x 2.00" long) that secure the monitor to the TV shelf assembly. Disconnect the TV monitor harness and slide the monitor out through the front of the cabinet.

### **F. ATTRACTION BOARD AND LAMP REMOVAL (See Figure 3-10)**

The Skydiver cabinet has an attraction board with lamps mounted on the inside behind the Plexiglas shield, at the top of the cabinet assembly. To replace either the attraction board or individual lamps, refer

### **G. LED START SWITCH REPLACEMENT**

The start switch on the front panel has a very low failure rate. To test a switch, unlock and open the coin door. Remove the wires from the suspected switch. With a multimeter set on the Rx1 ohmmeter scale, test the contact opening and closing. If the contacts do not operate sharply, replace the switch. To change a switch follow the procedures listed in Figure 3-11.



**Figure 3-11 LED Start Switch Replacement**

### **H. RIP CORD CONTROL REPLACEMENT (See Figure 3-12)**

The black and blue rip cord controls, located on the main control panel assembly may need to be replaced if faulty or damaged. To replace this control, proceed with the instructions outlined in Figure 3-12.

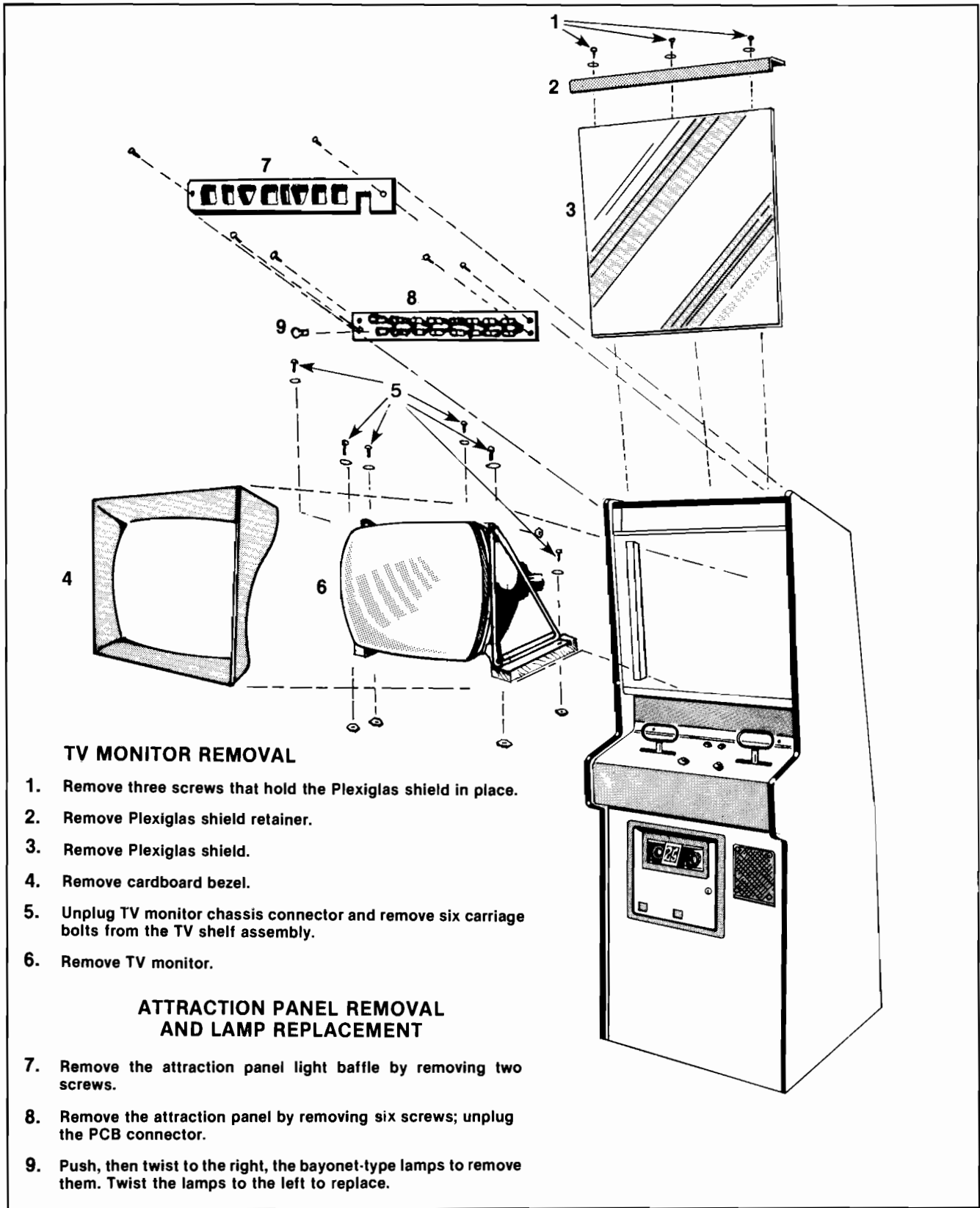
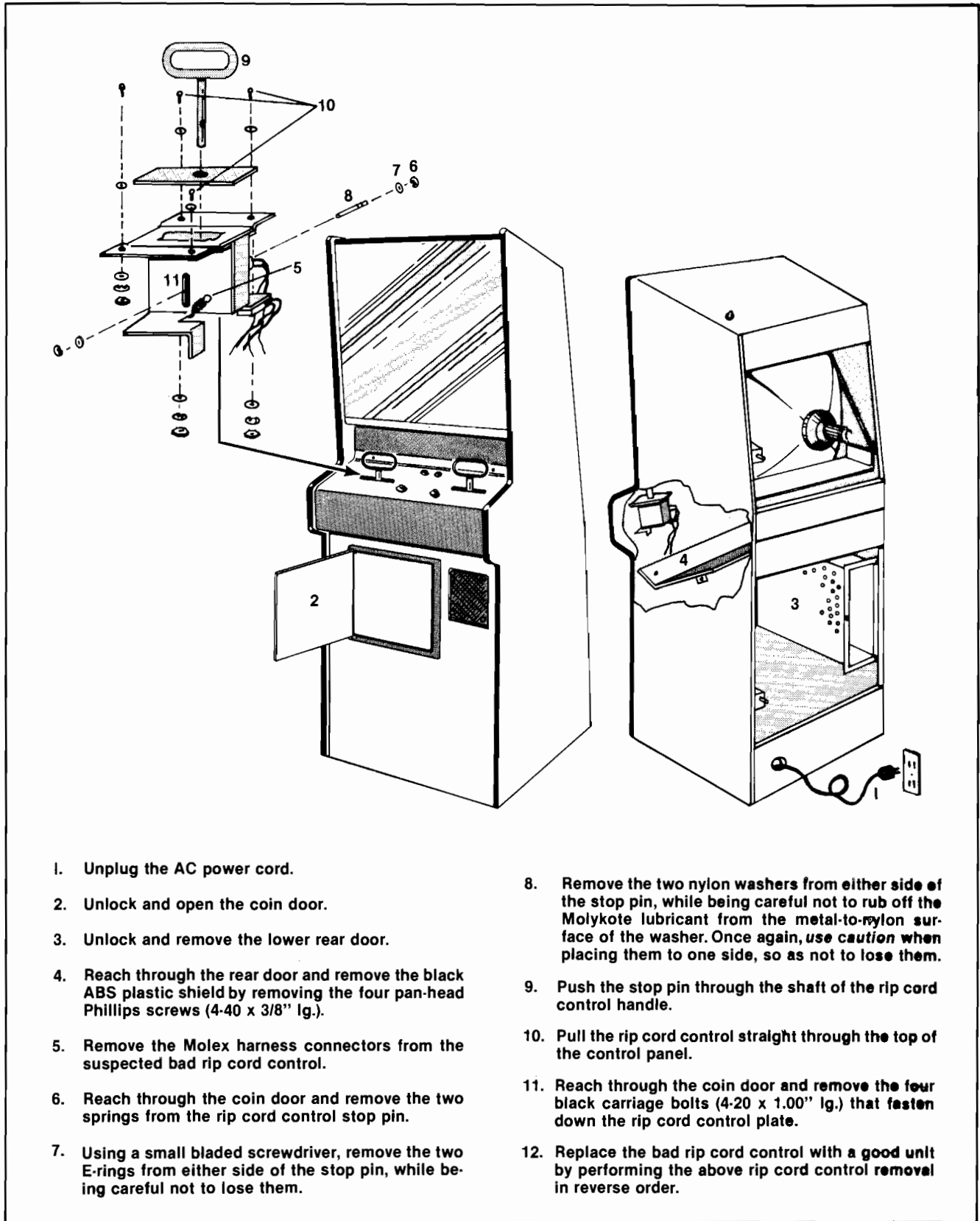


Figure 3-10 TV Monitor and Attraction Panel Removal





1. Unplug the AC power cord.
2. Unlock and open the coin door.
3. Unlock and remove the lower rear door.
4. Reach through the rear door and remove the black ABS plastic shield by removing the four pan-head Phillips screws (4-40 x 3/8" lg.).
5. Remove the Molex harness connectors from the suspected bad rip cord control.
6. Reach through the coin door and remove the two springs from the rip cord control stop pin.
7. Using a small bladed screwdriver, remove the two E-rings from either side of the stop pin, while being careful not to lose them.
8. Remove the two nylon washers from either side of the stop pin, while being careful not to rub off the Molykote lubricant from the metal-to-nylon surface of the washer. Once again, use caution when placing them to one side, so as not to lose them.
9. Push the stop pin through the shaft of the rip cord control handle.
10. Pull the rip cord control straight through the top of the control panel.
11. Reach through the coin door and remove the four black carriage bolts (4-20 x 1.00" lg.) that fasten down the rip cord control plate.
12. Replace the bad rip cord control with a good unit by performing the above rip cord control removal in reverse order.

Figure 3-12 Rip Cord Control Replacement



# THEORY OF OPERATION

## A. GENERAL INFORMATION

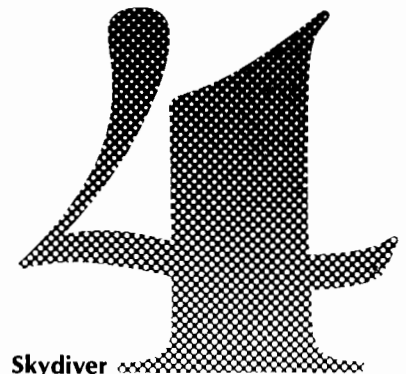
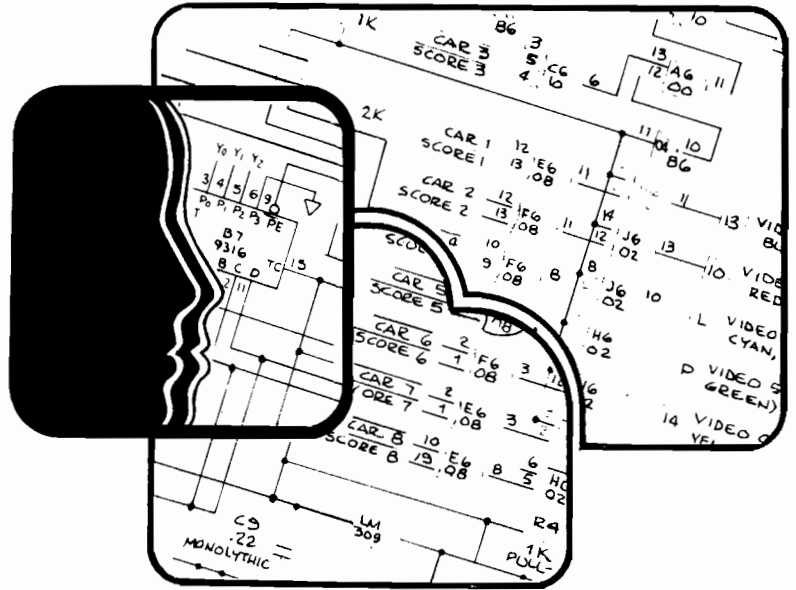
The block diagram in Figure 4-1 shows the major parts of the Skydiver game.

The game's television monitor is a self-contained solid-state unit. The composite video sent to the monitor differs in many respects from the signal derived from commercial TV broadcasts. The picture appearing on the screen, therefore, is unlike that of a home TV set, and the monitor does not produce any sound. See Chapter 6 for a schematic diagram of the TV monitor.

The game's composite video signal produces four video levels, instead of the continuous shades of grey seen on a home TV screen.

On the game PCB schematic diagram, Figure 4-2, the symbol "P" (appearing at various inputs of integrated circuit devices) indicates a connection of +5 volts DC through a pull-up resistor. For easy reference, the game PCB is divided into grid sections. Along the short side of the board these sections are identified by letters A through P (skipping letters G, I, O and Q because they may be easily confused with the numbers 6, 10, and 0 respectively). Along the long side of the board the numbers 1 through 13 are used.

Figure 4-3 is a harness schematic of the entire Skydiver game. This figure illustrates how all electrical and electronic assemblies are electrically connected together.



Skydiver

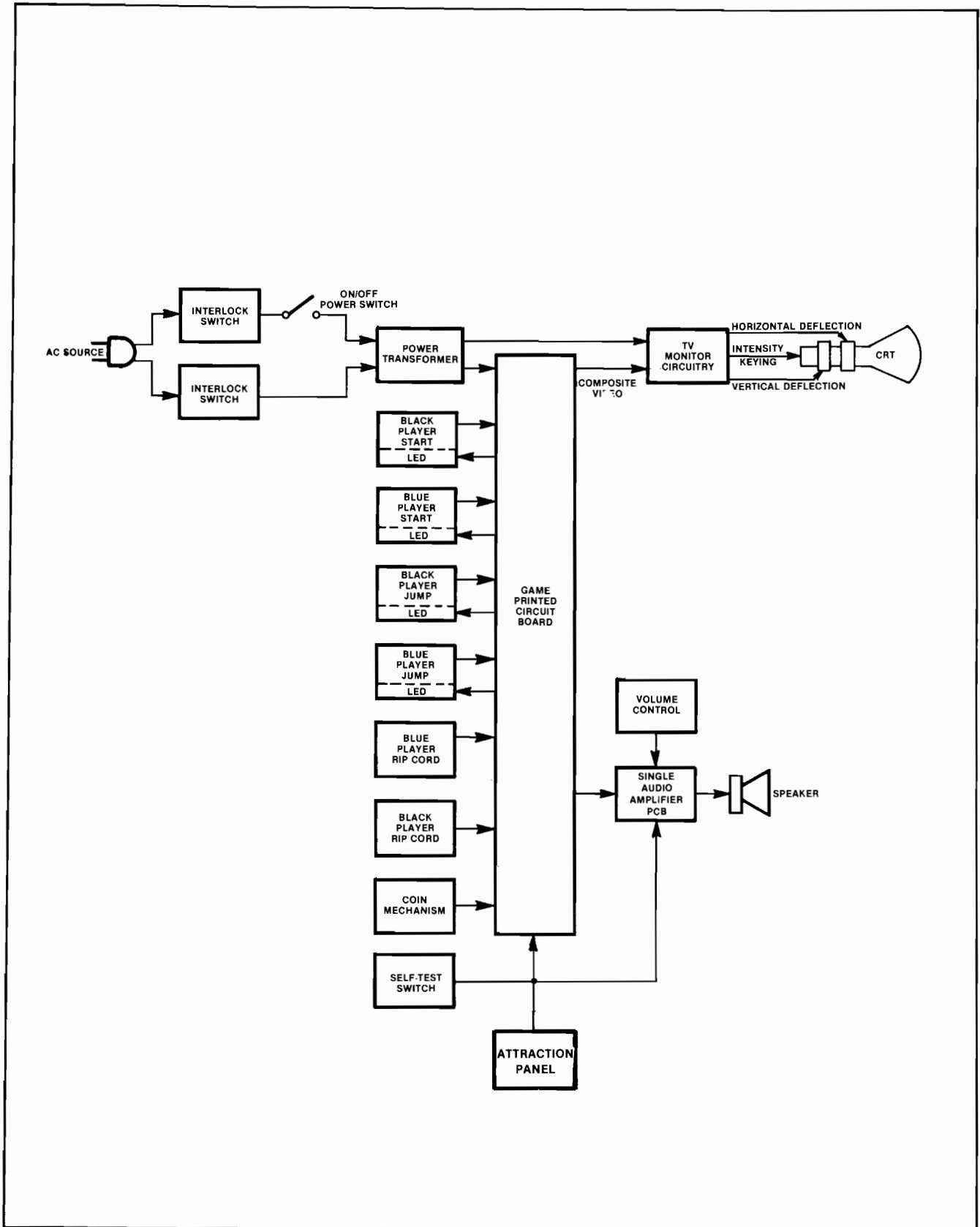
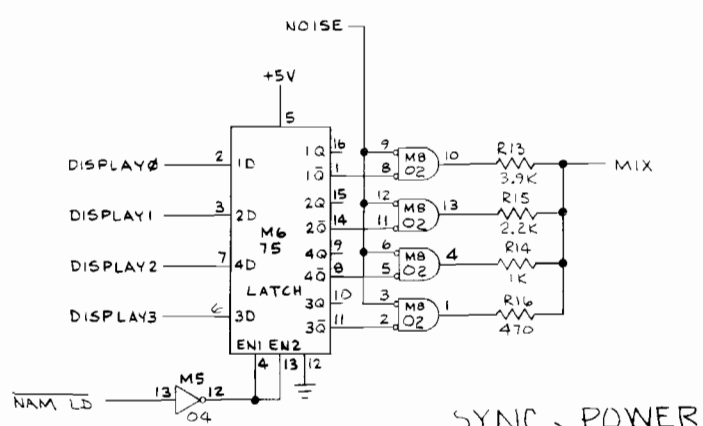
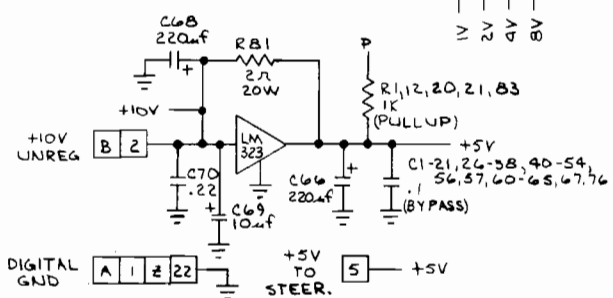
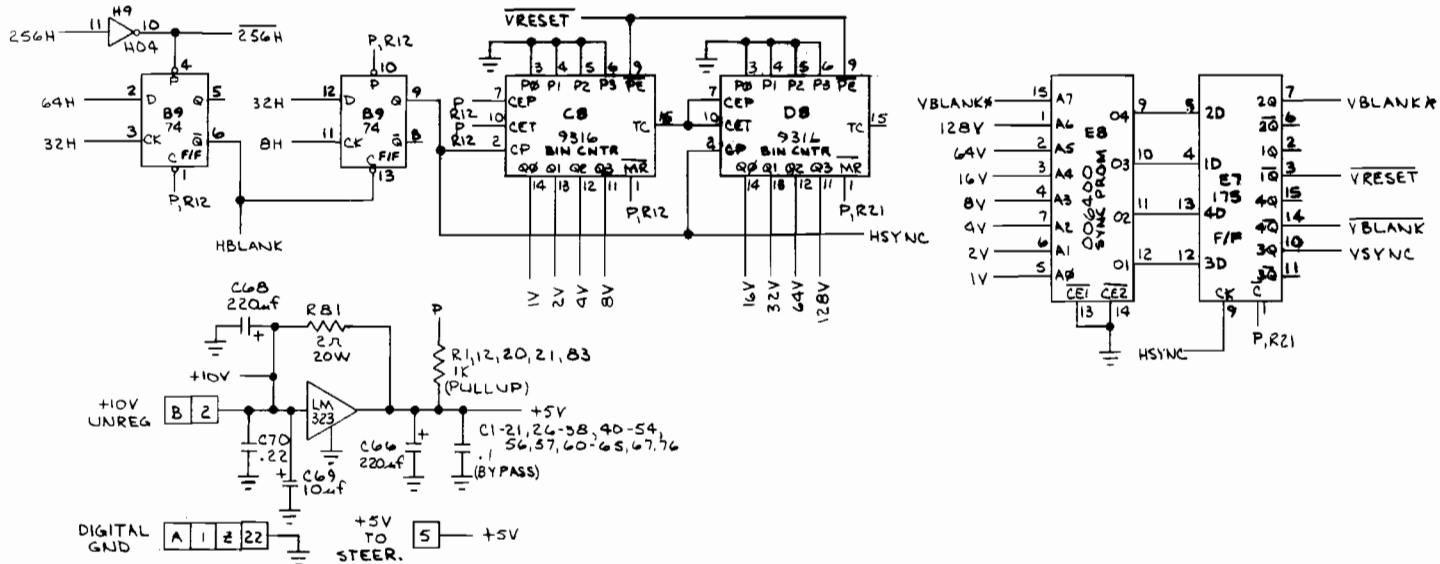
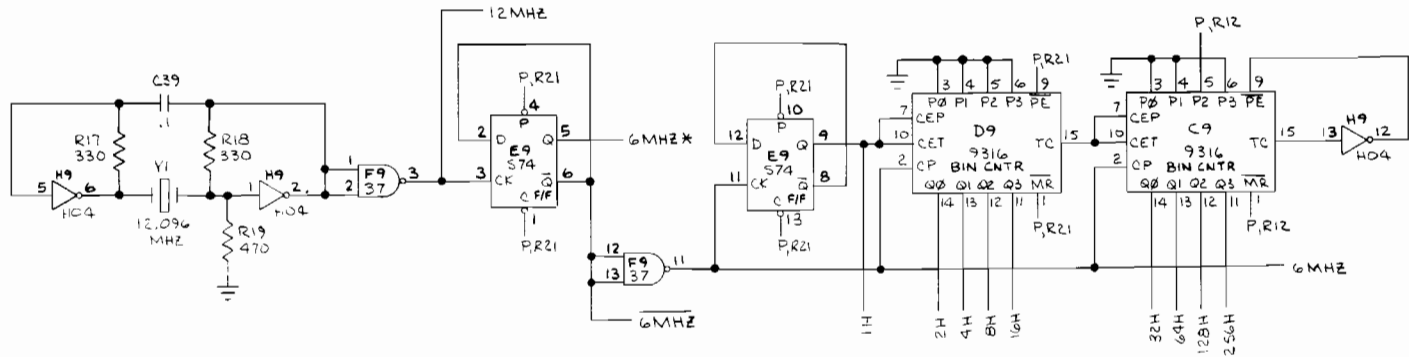


Figure 4-1 Skydiver Game Block Diagram

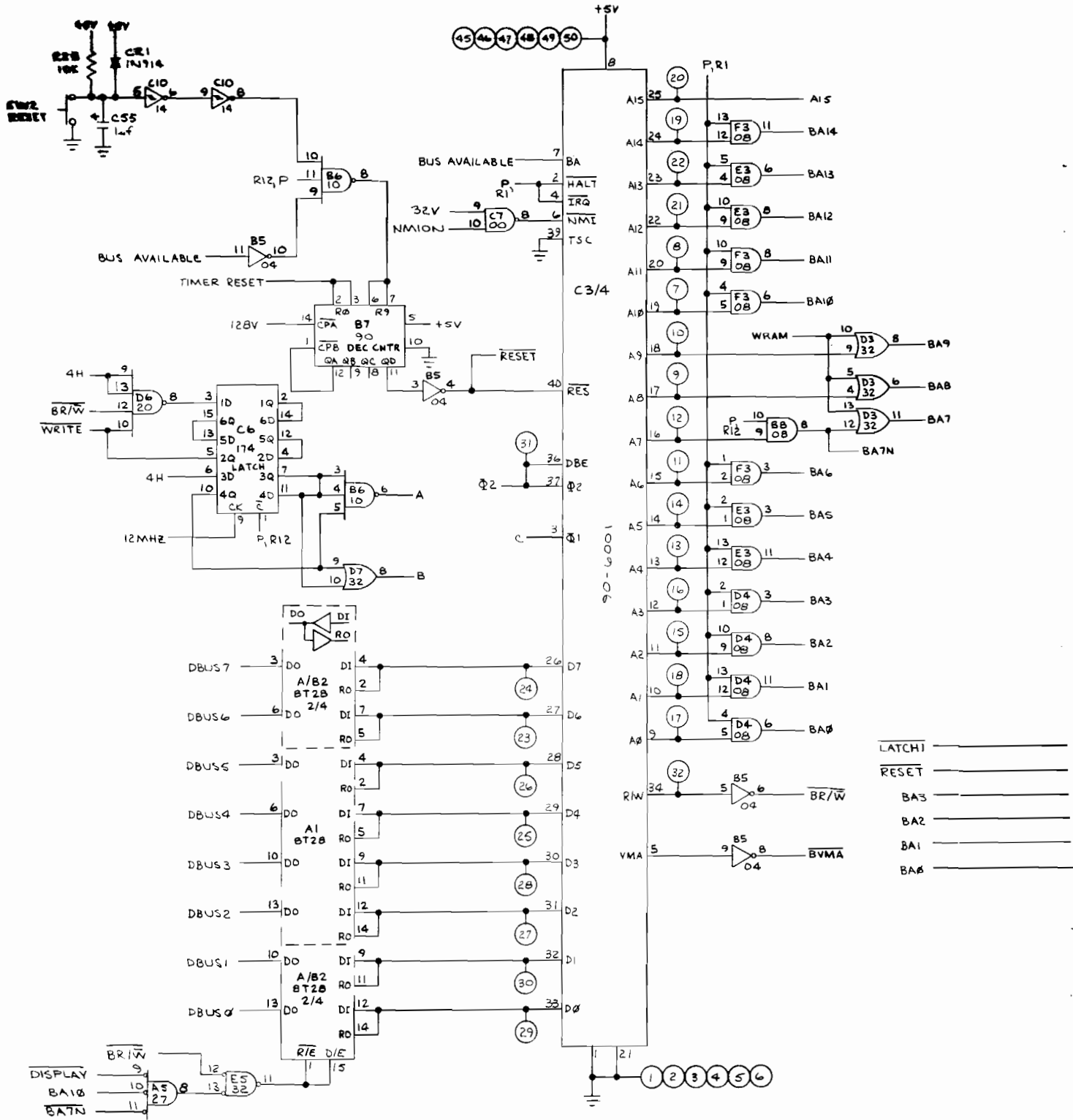


SYNC, POWER

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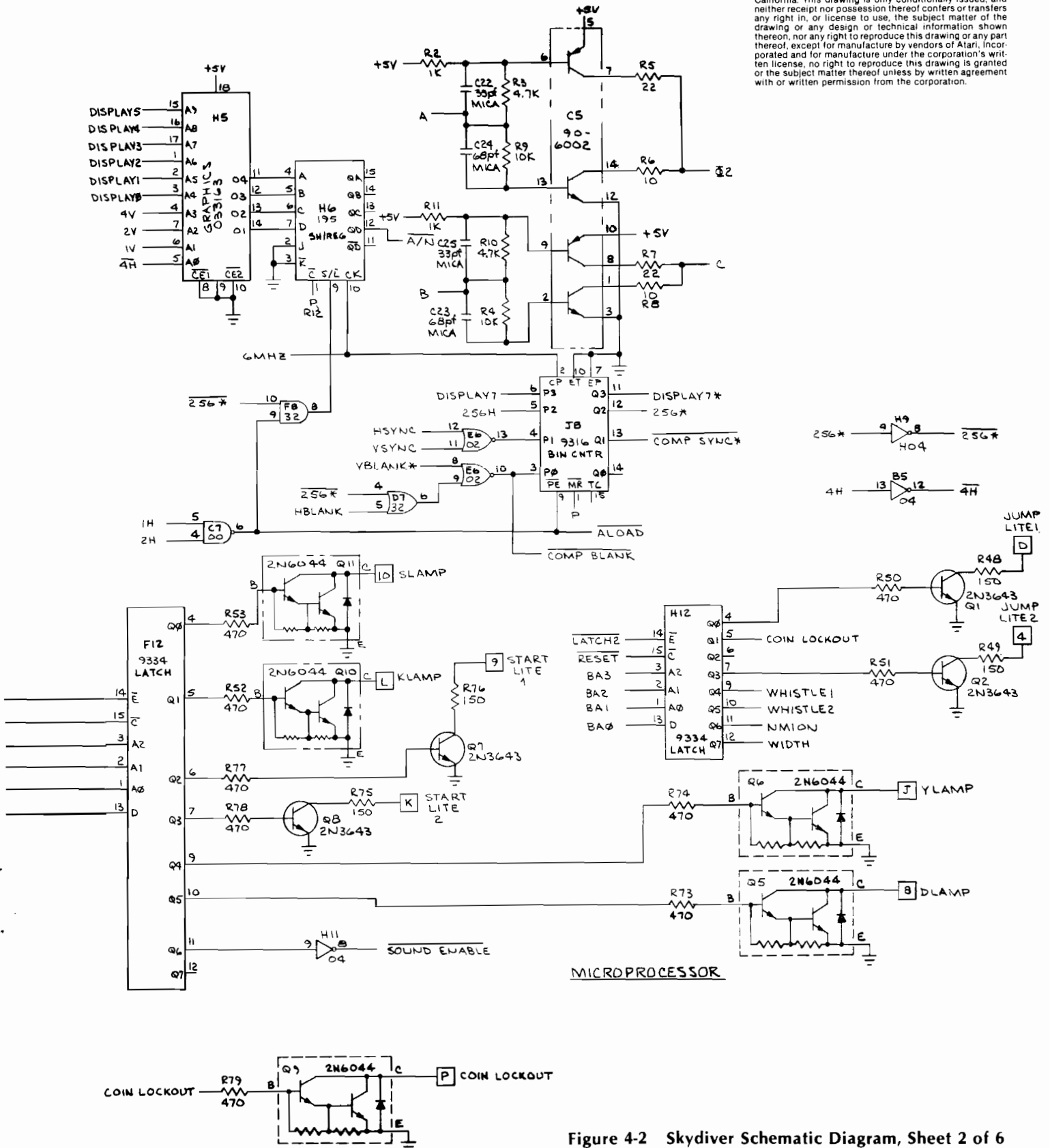
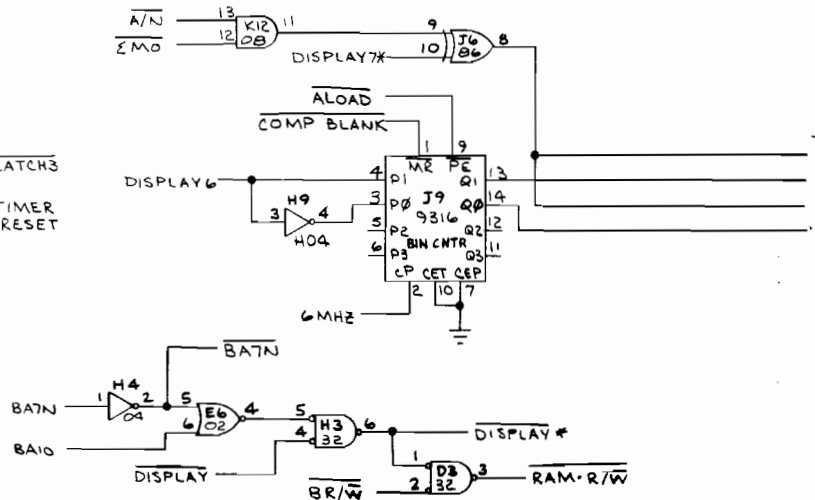
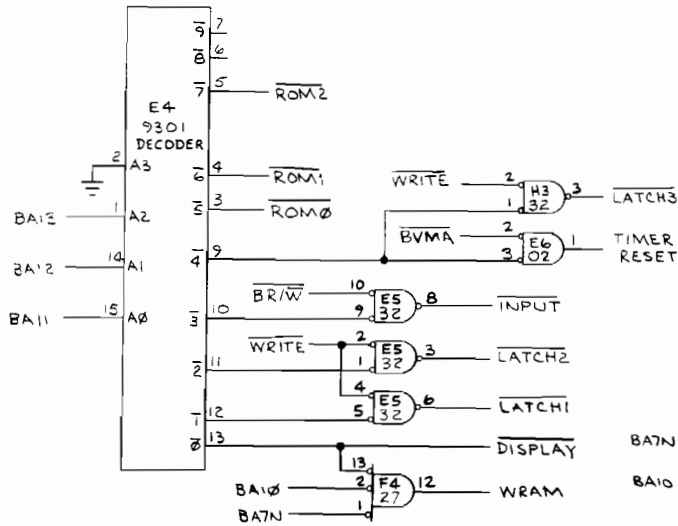
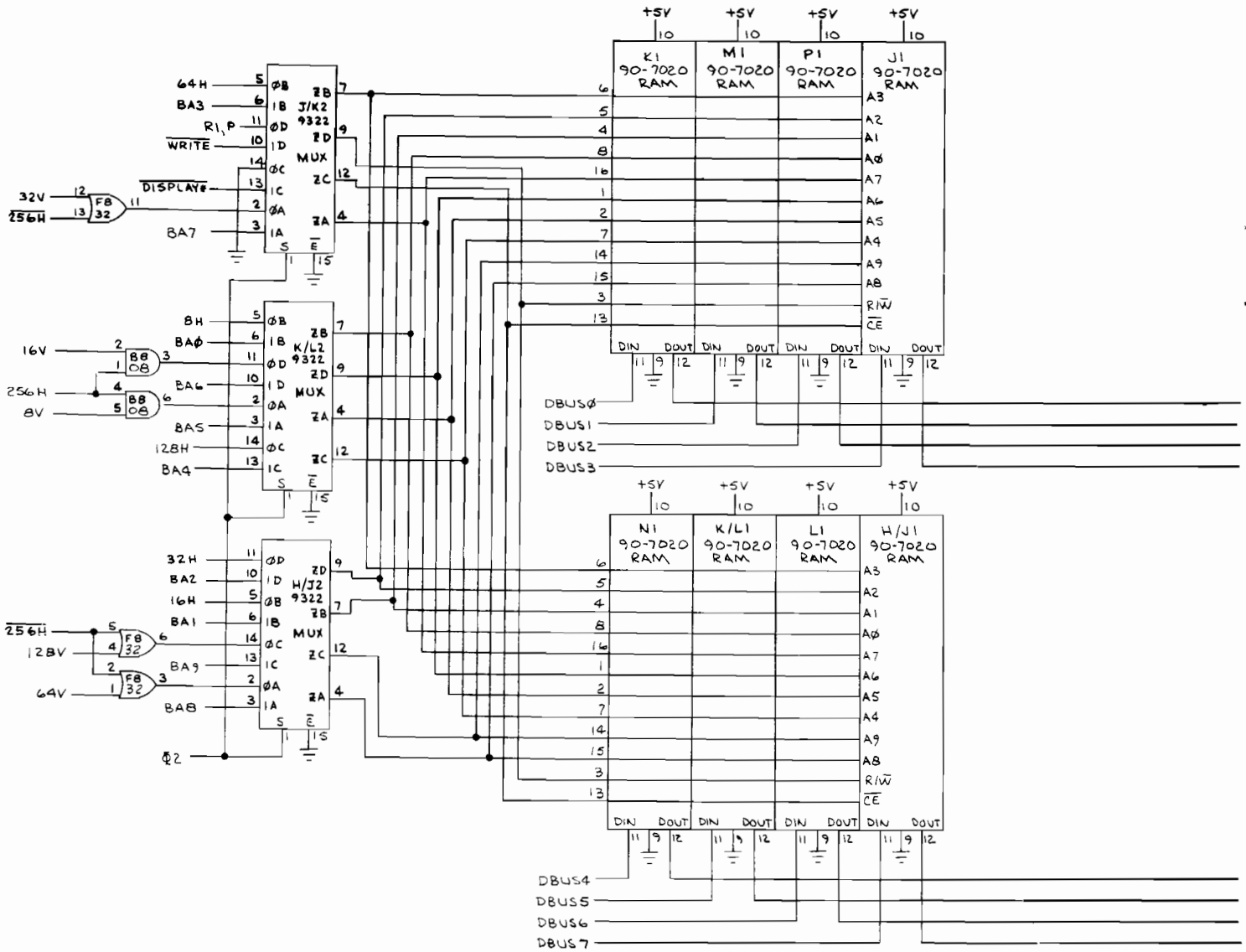
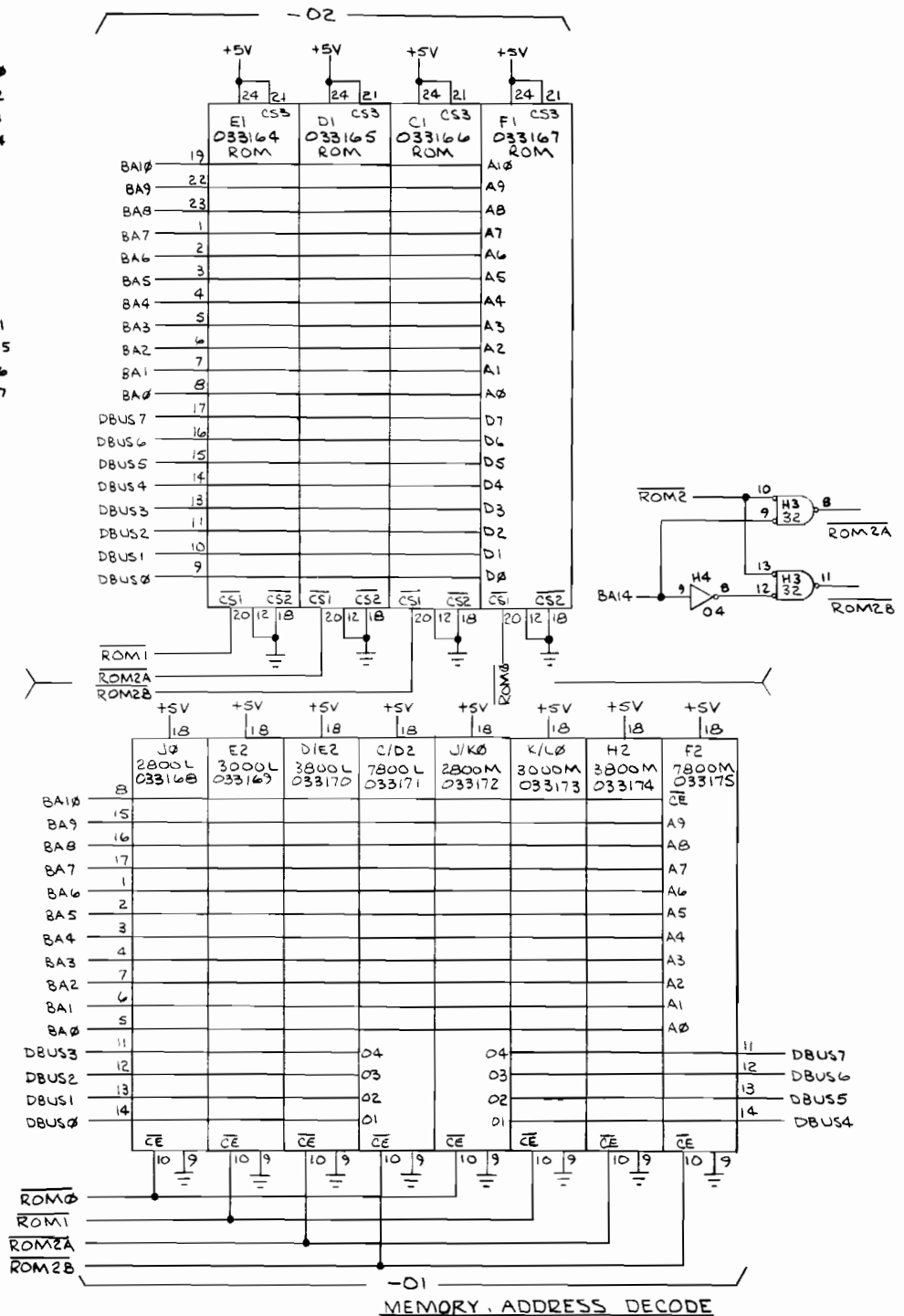
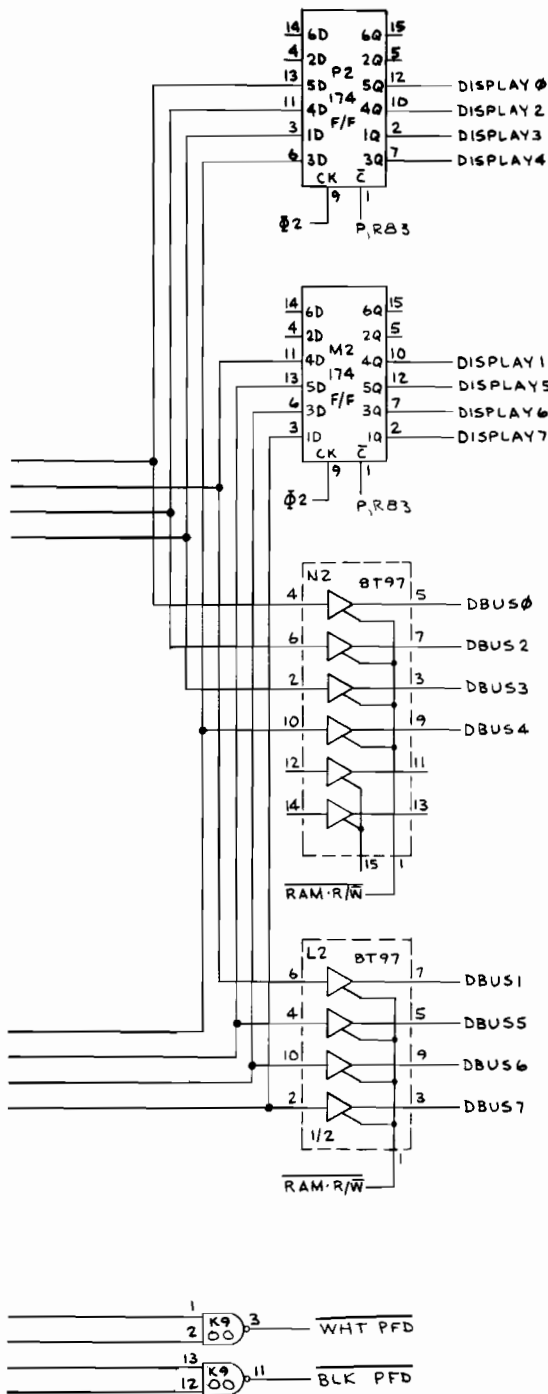


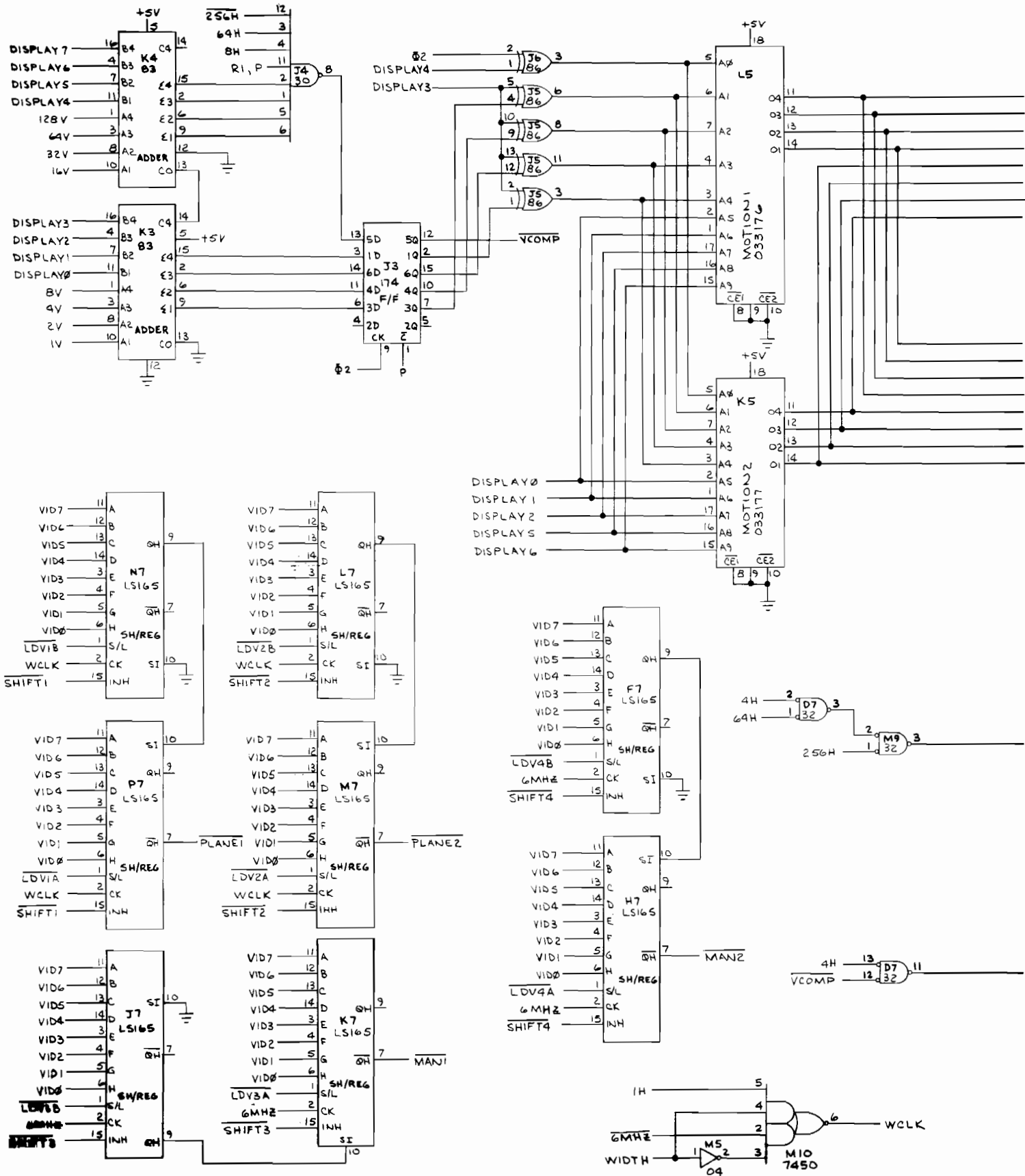
Figure 4-2 Skydiver Schematic Diagram, Sheet 2 of 6





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Figure 4-2 Skydiver Schematic Diagram, Sheet 3 of 6



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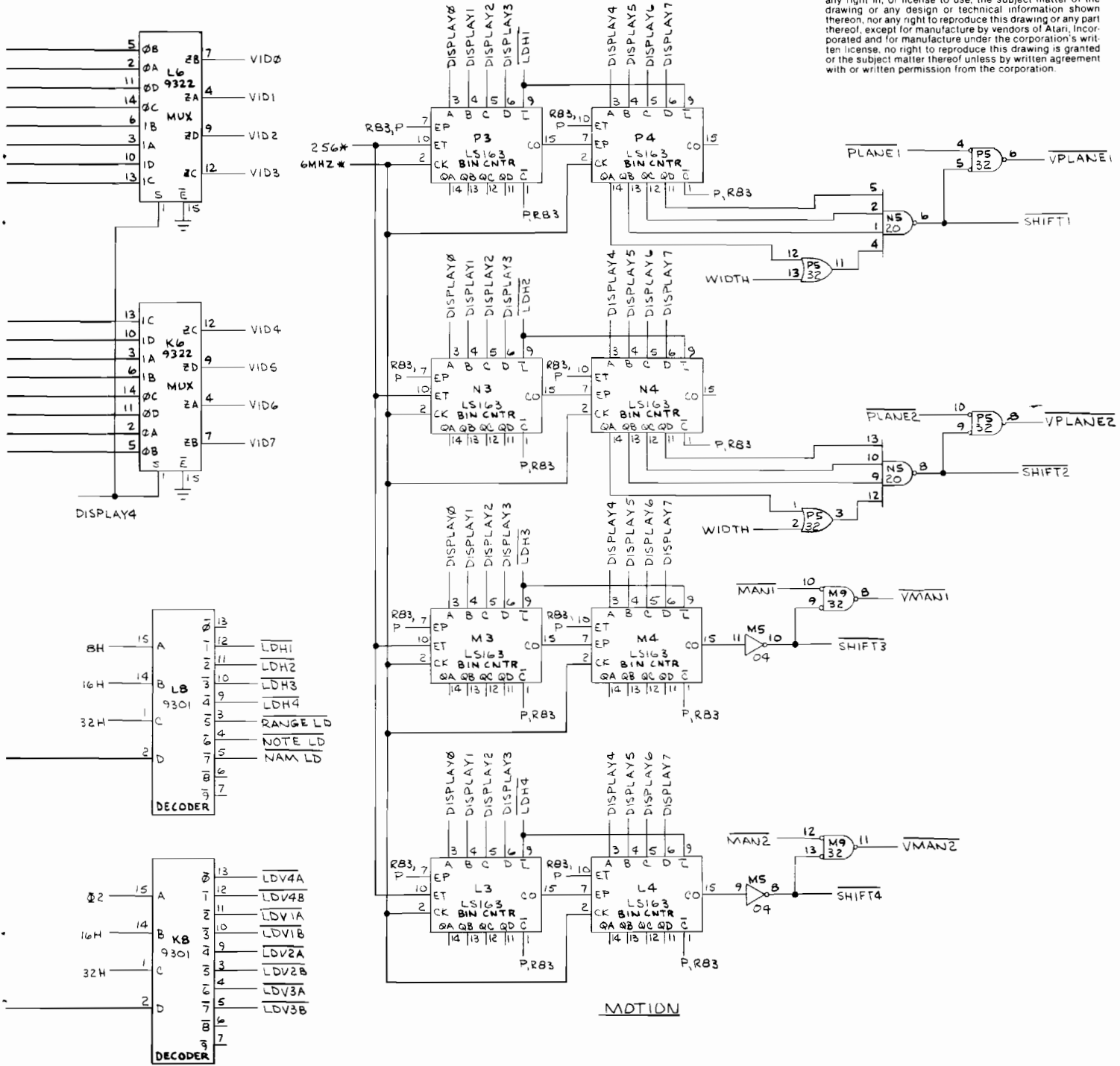
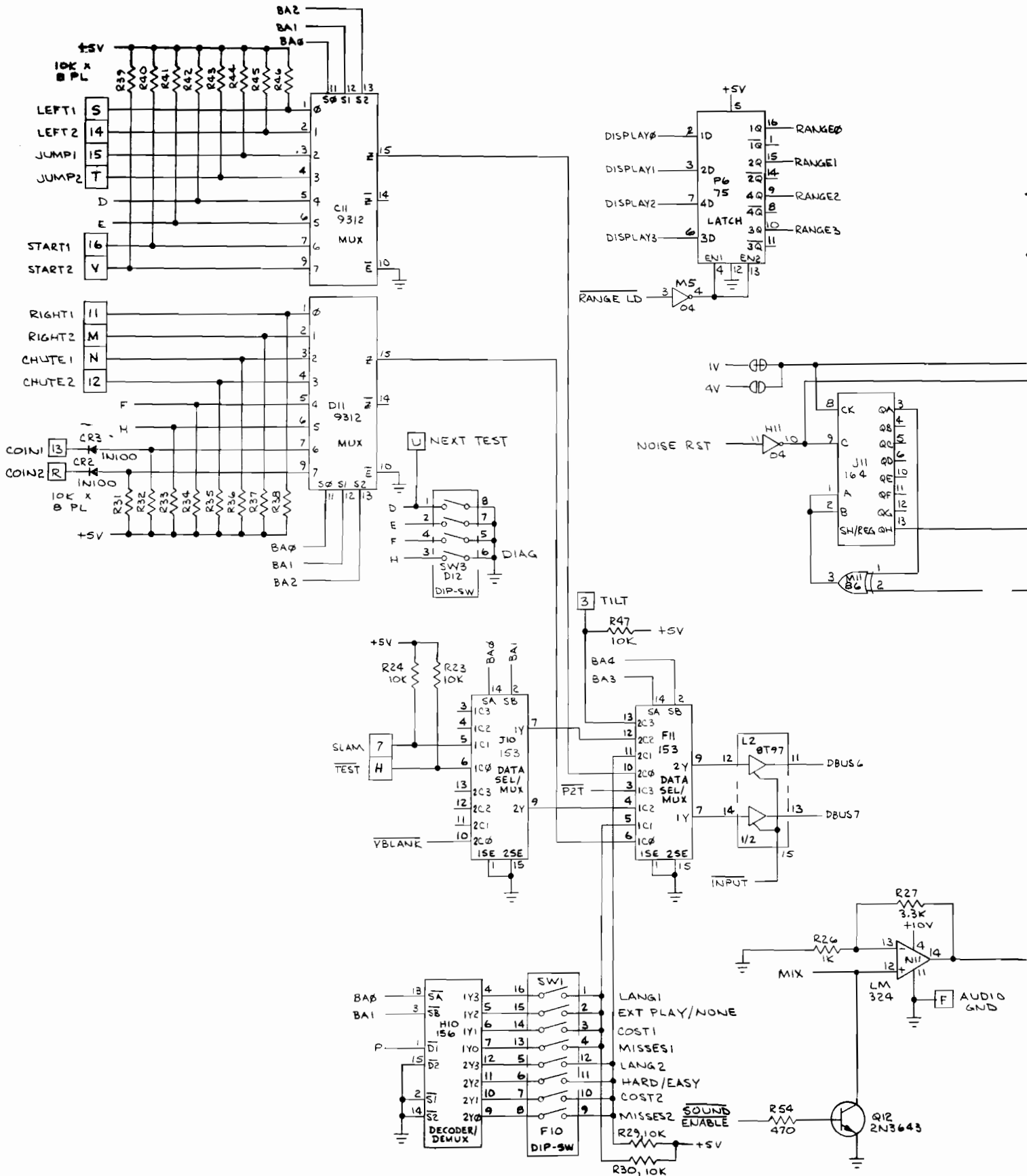


Figure 4-2 Skydiver Schematic Diagram, Sheet 4 of 6



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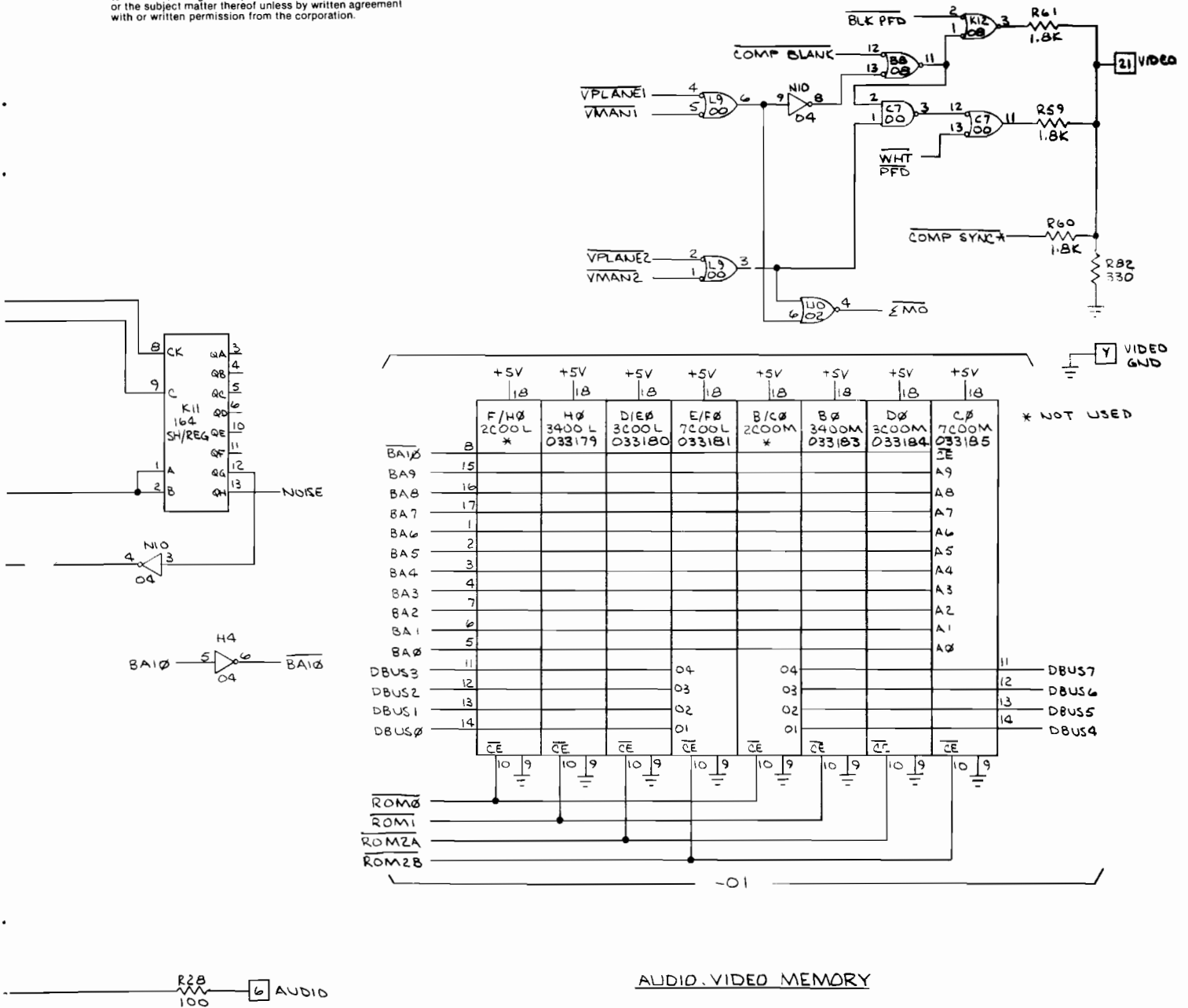
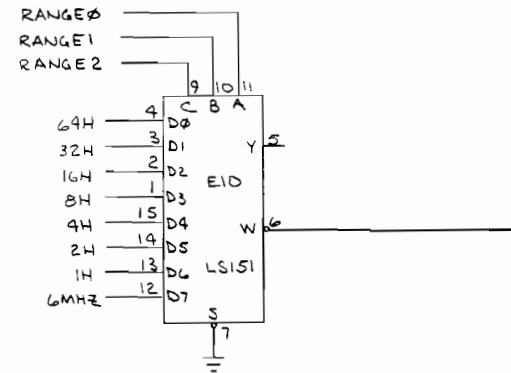
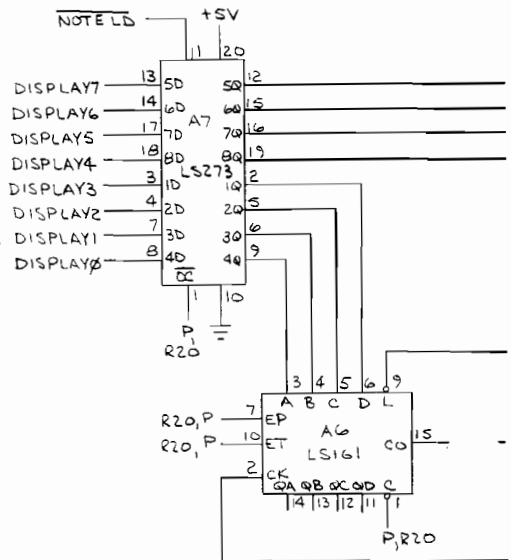
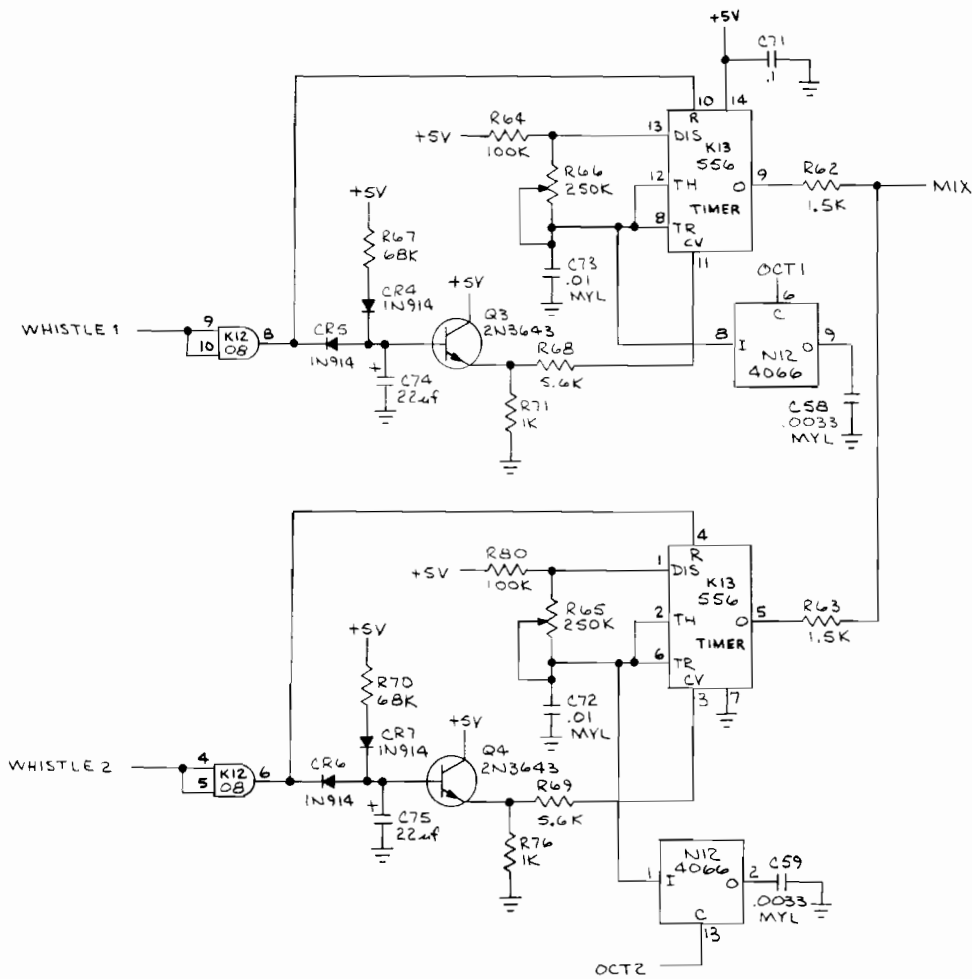
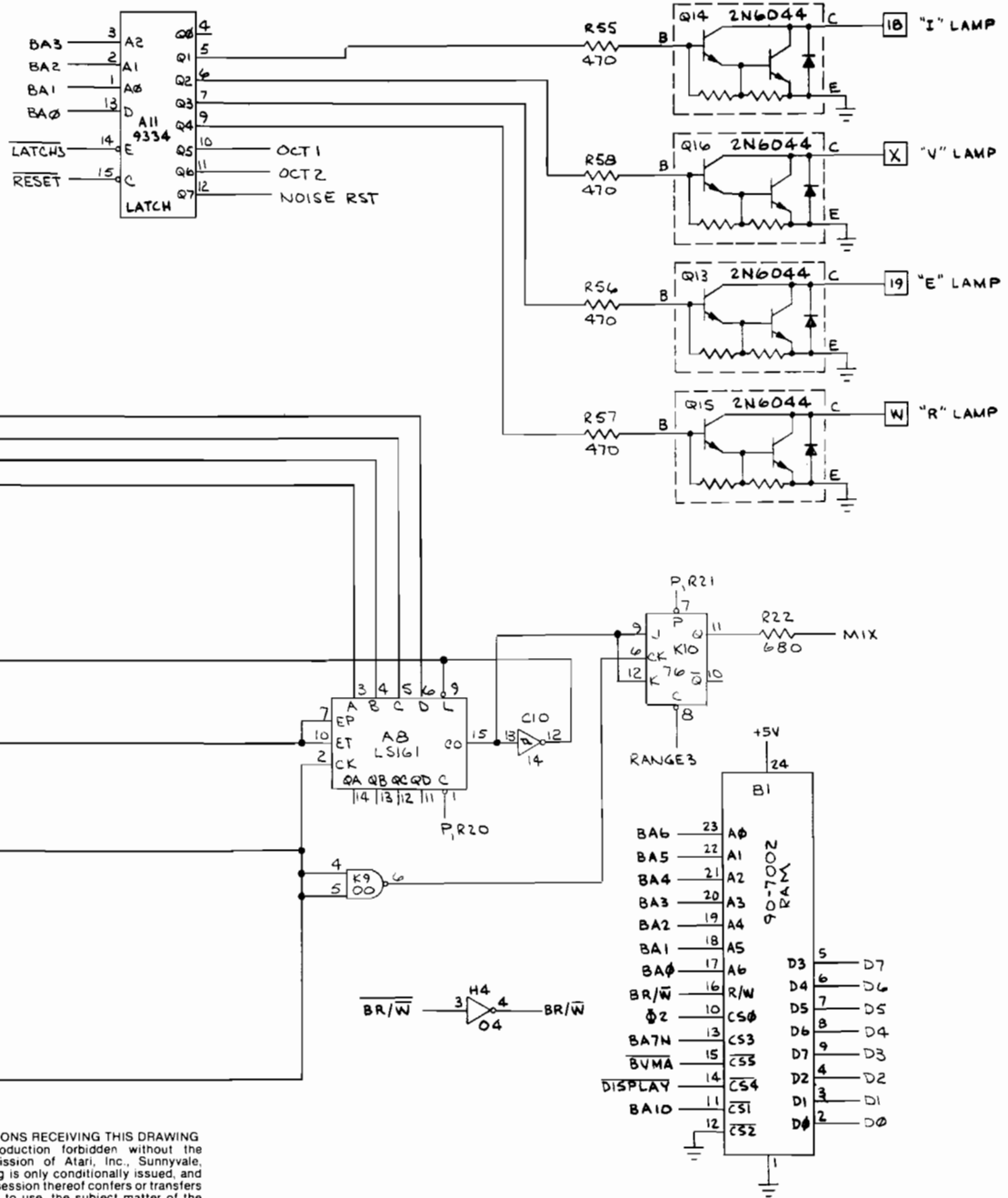


Figure 4-2 Skydiver Schematic Diagram, Sheet 5 of 6





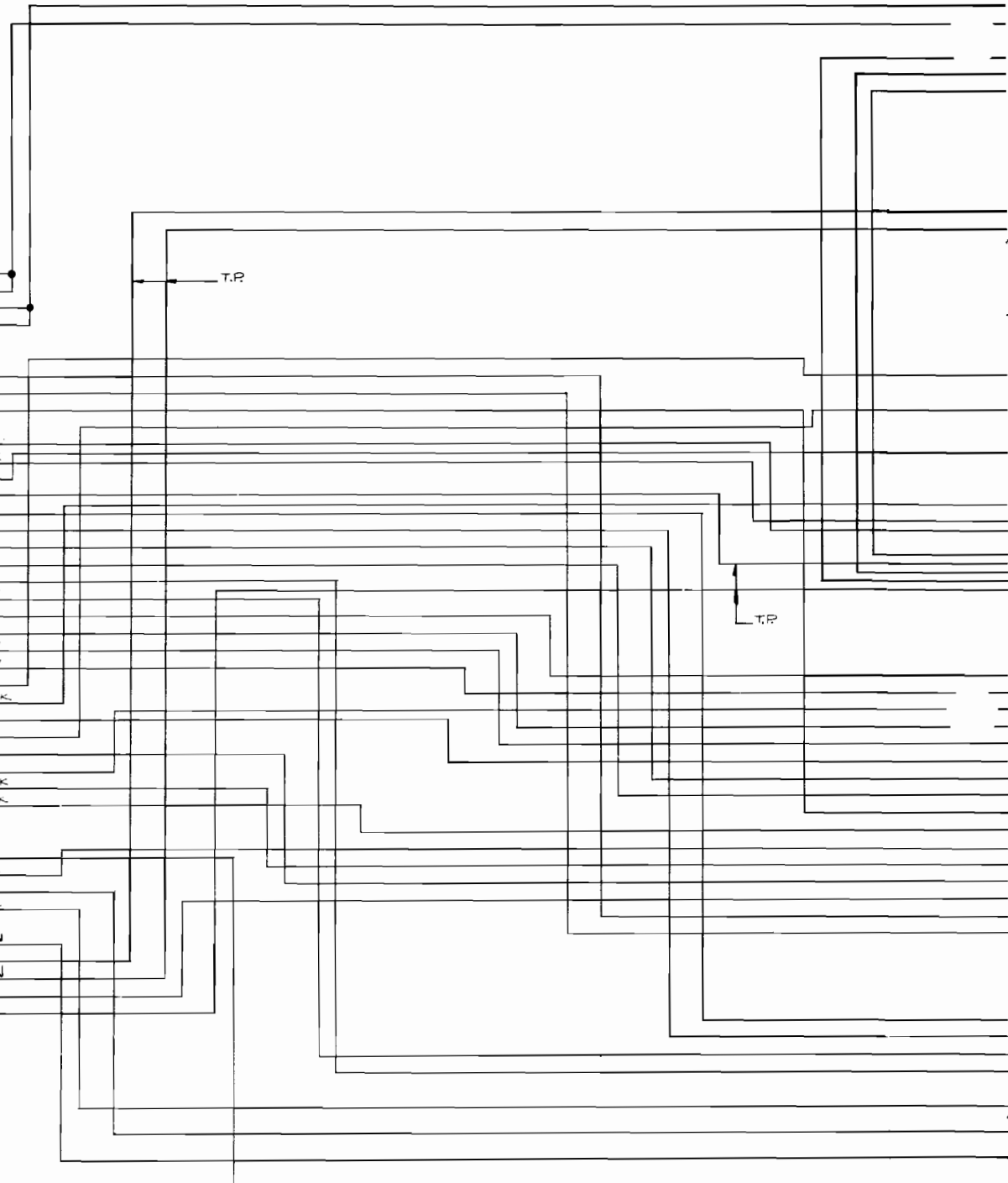


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Figure 4-2 Skydiver Schematic Diagram, Sheet 6 of 6

44 POSITION EDGE CONNECTOR

+10V GRD	1	R/GN
+10V GRD	A	R/BK
+10V UNREG	2	
+10V UNREG	B	
	3	
	C	Y/R
BLUE JUMP LP	4	V/R
BLACK JUMP LP	D	R
+5V	E	
	F	N/BK
AUDIO	G	W/BK
AUDIO GRD	H	GY
SLAM	7	Y
TEST	H	
D LAMP	8	N/BU
Y LAMP	J	W/Y
START BLACK LP	9	GY/R
START BLUE LP	K	BU/R
S LAMP	10	W/GY
K LAMP	L	BU/W
BLACK RIGHT N.O.	I	R/W
BLUE RIGHT N.O.	M	V/W
BLUE CHUTE N.O.	12	OR/W
BLACK CHUTE N.O.	N	BN/W
COIN 1 (RIGHT) N.O.	13	OR
LOCKOUT	P	BN/BK
BLUE LEFT N.O.	14	GY/W
COIN 2 (LEFT) N.O.	R	Y
BLACK JUMP N.O.	15	V/BK
BLACK LEFT N.O.	S	Y/W
BLACK START N.O.	16	BU/BK
BLUE JUMP N.O.	T	OR/BK
	17	
I LAMP	18	W/R
BLUE START N.O.	V	V/BK
E LAMP	19	W/Y
R LAMP	W	W/OR
	20	
V LAMP	X	W/BN
VIDEO	Z1	V
VIDEO GRD	Y	W/GN
GRD	Z2	BK
GRD	Z	BK



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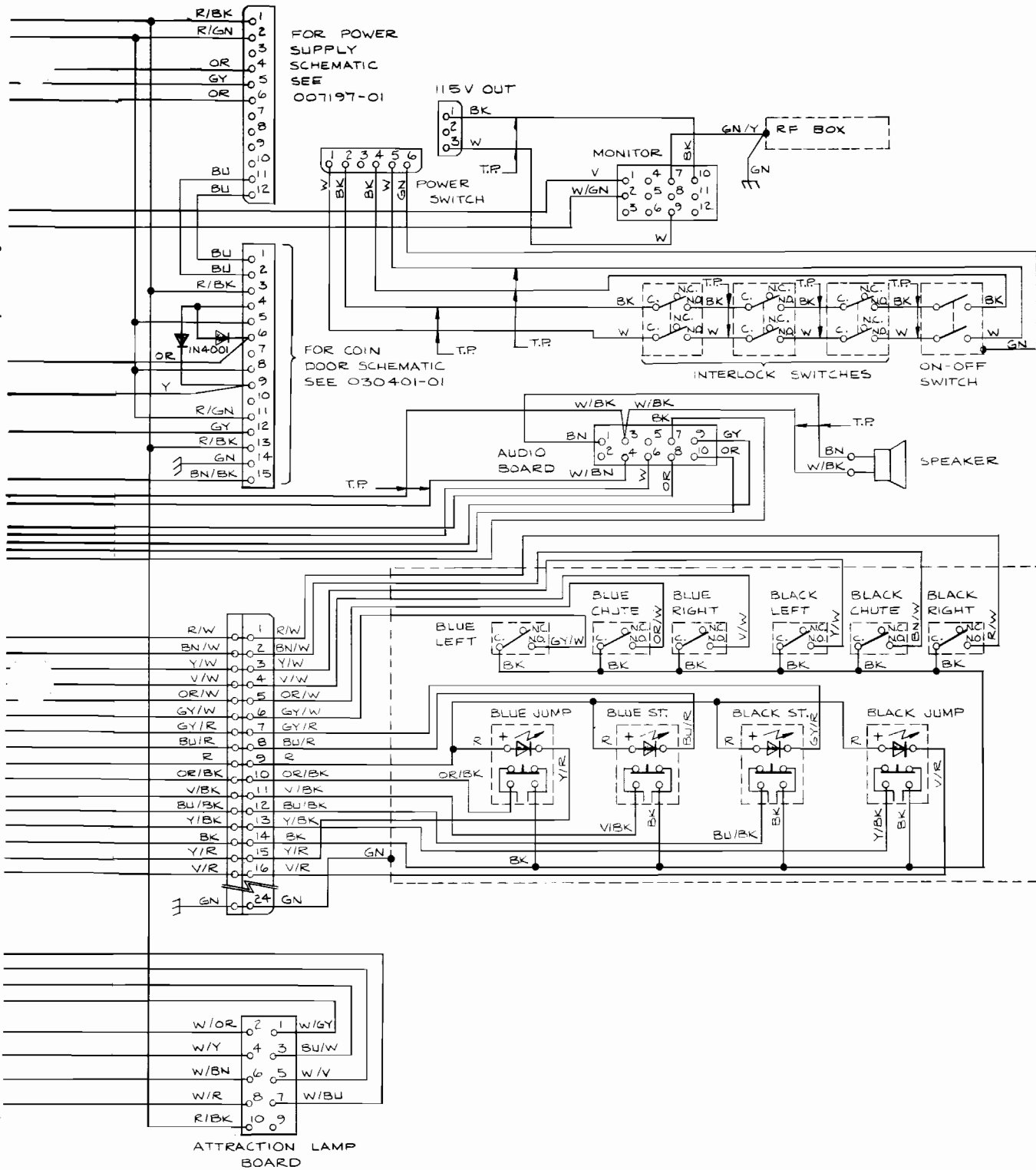
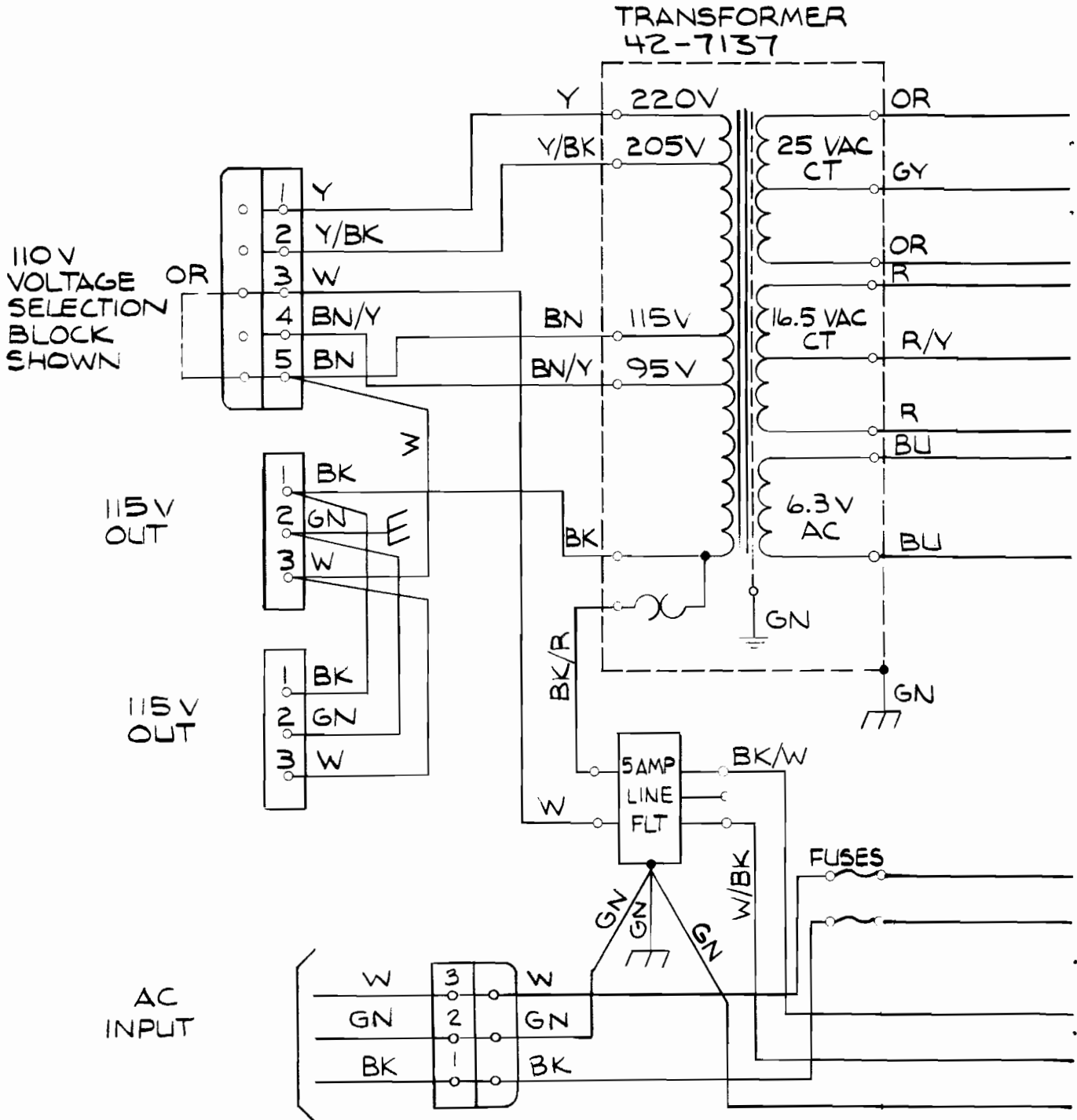


Figure 4-2 Skydiver Harness Schematic Diagram



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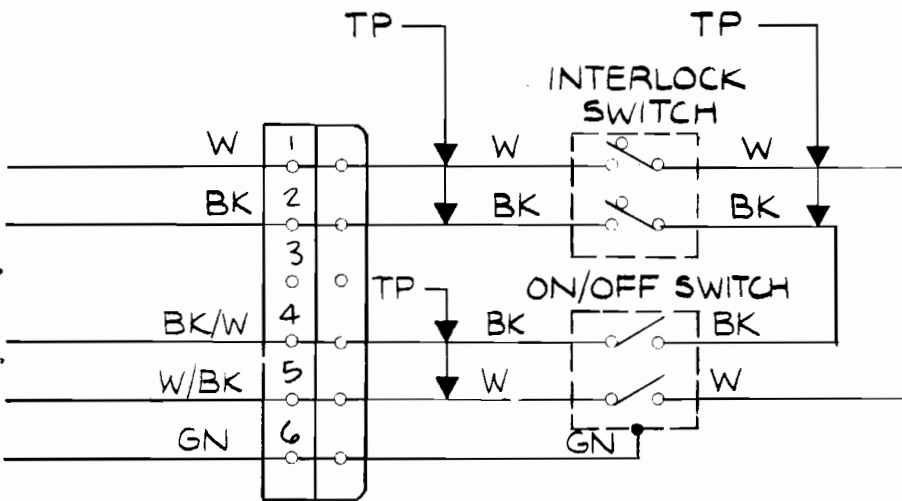
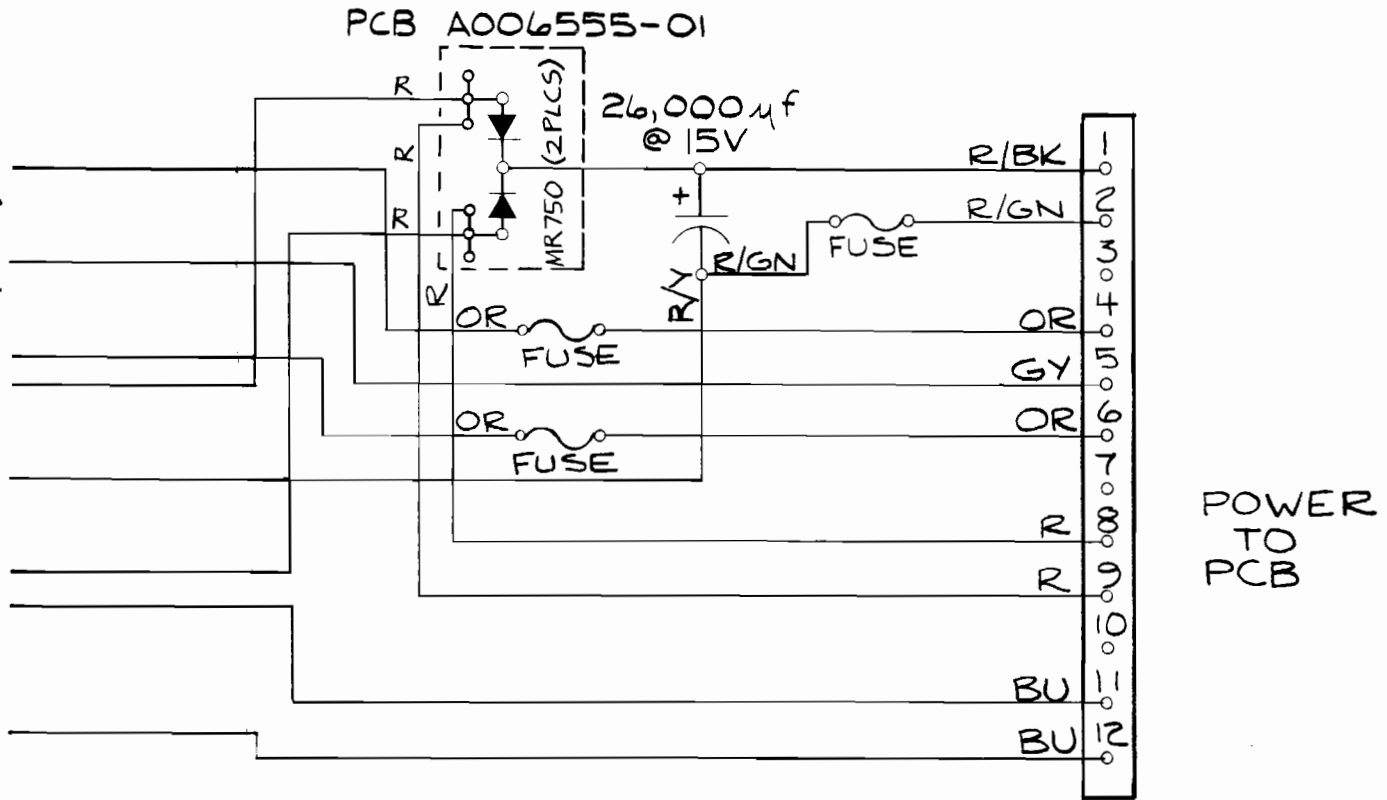
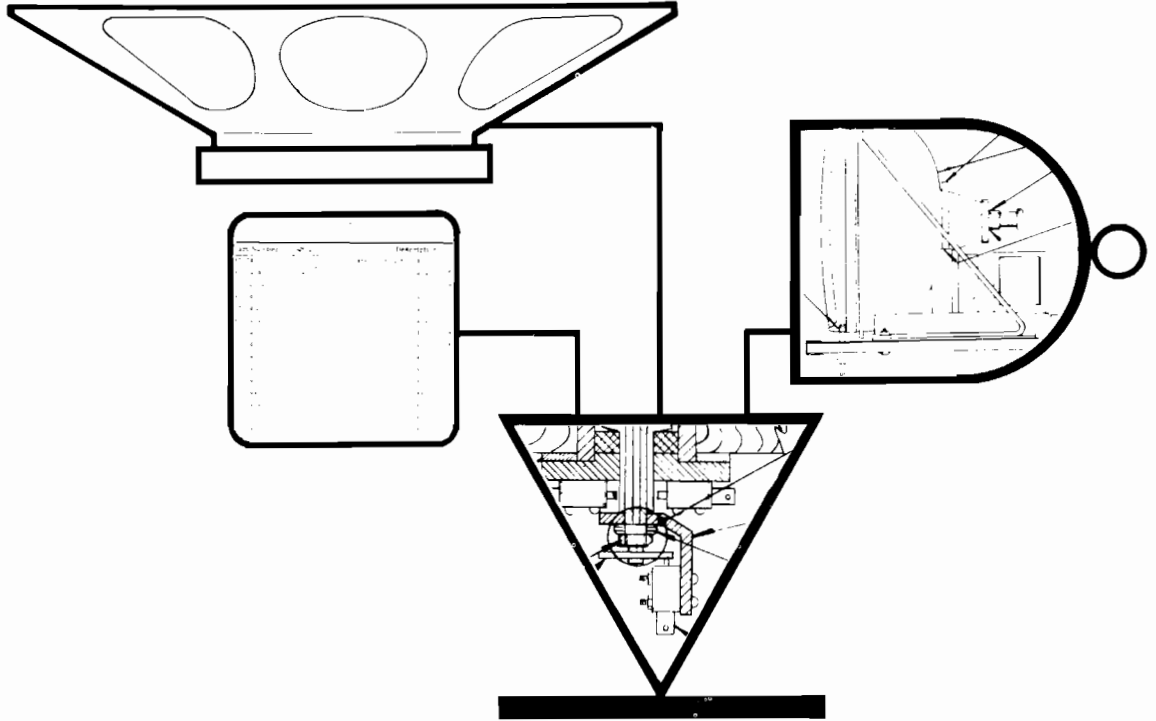


Figure 4-4 Skydiver Type B Power Supply Schematic Diagram

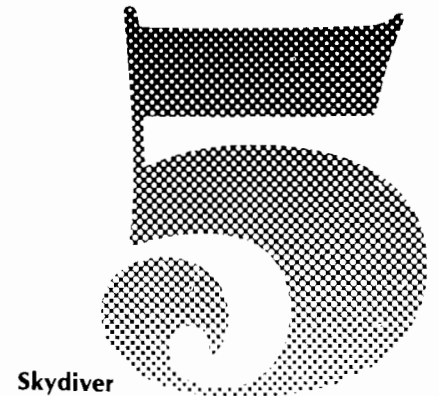




# ILLUSTRATED PARTS CATALOG

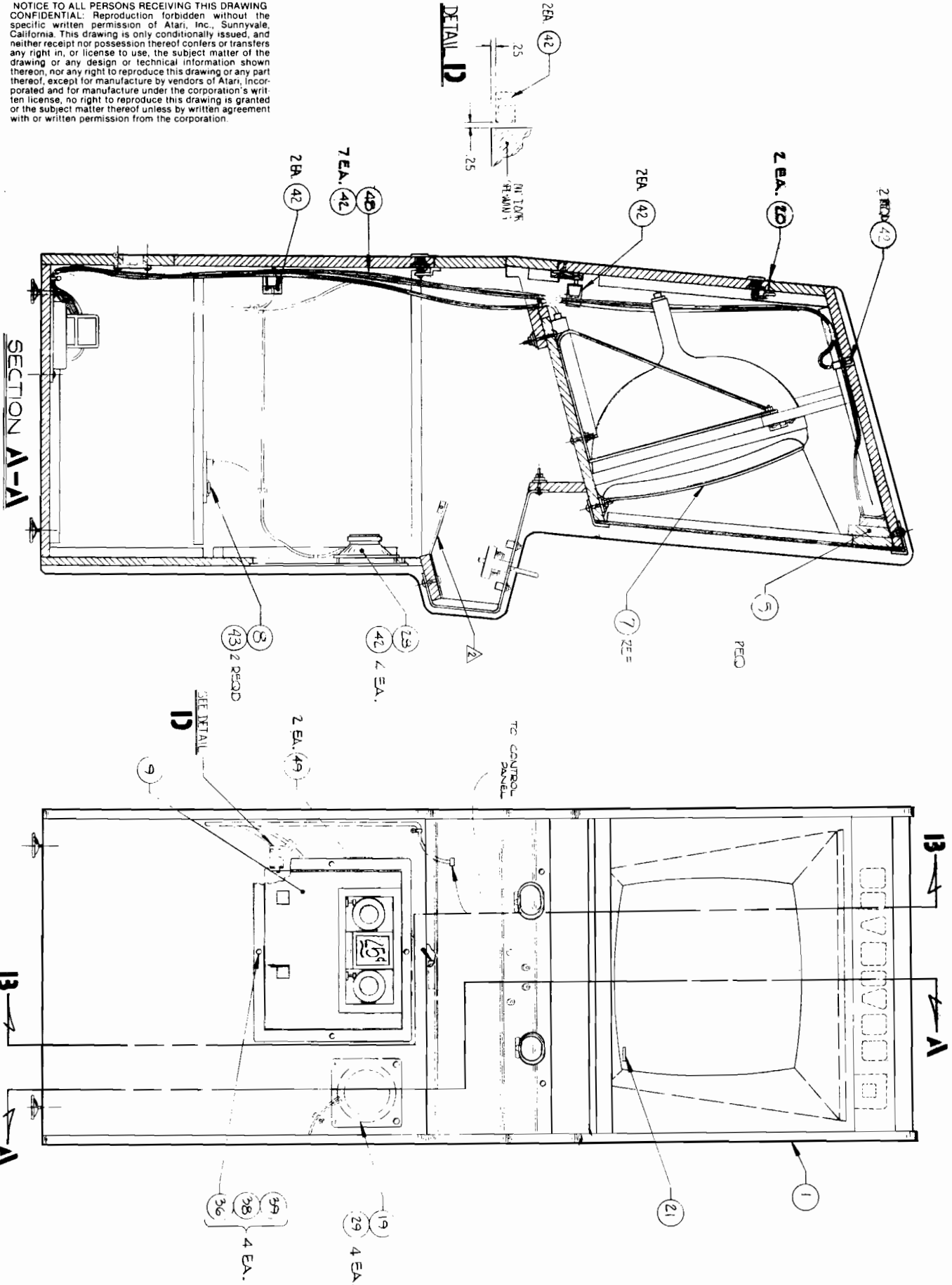
The purpose of this chapter is to provide you with the necessary information for ordering replacement parts for your Skydiver game.

When ordering parts from your distributor, give the part number, part name, applicable figure number of this catalog, and the serial number of your Skydiver game. This will help to avoid confusion and mistakes in your order. We hope the results will be less downtime and more profit from your game.



Skydiver

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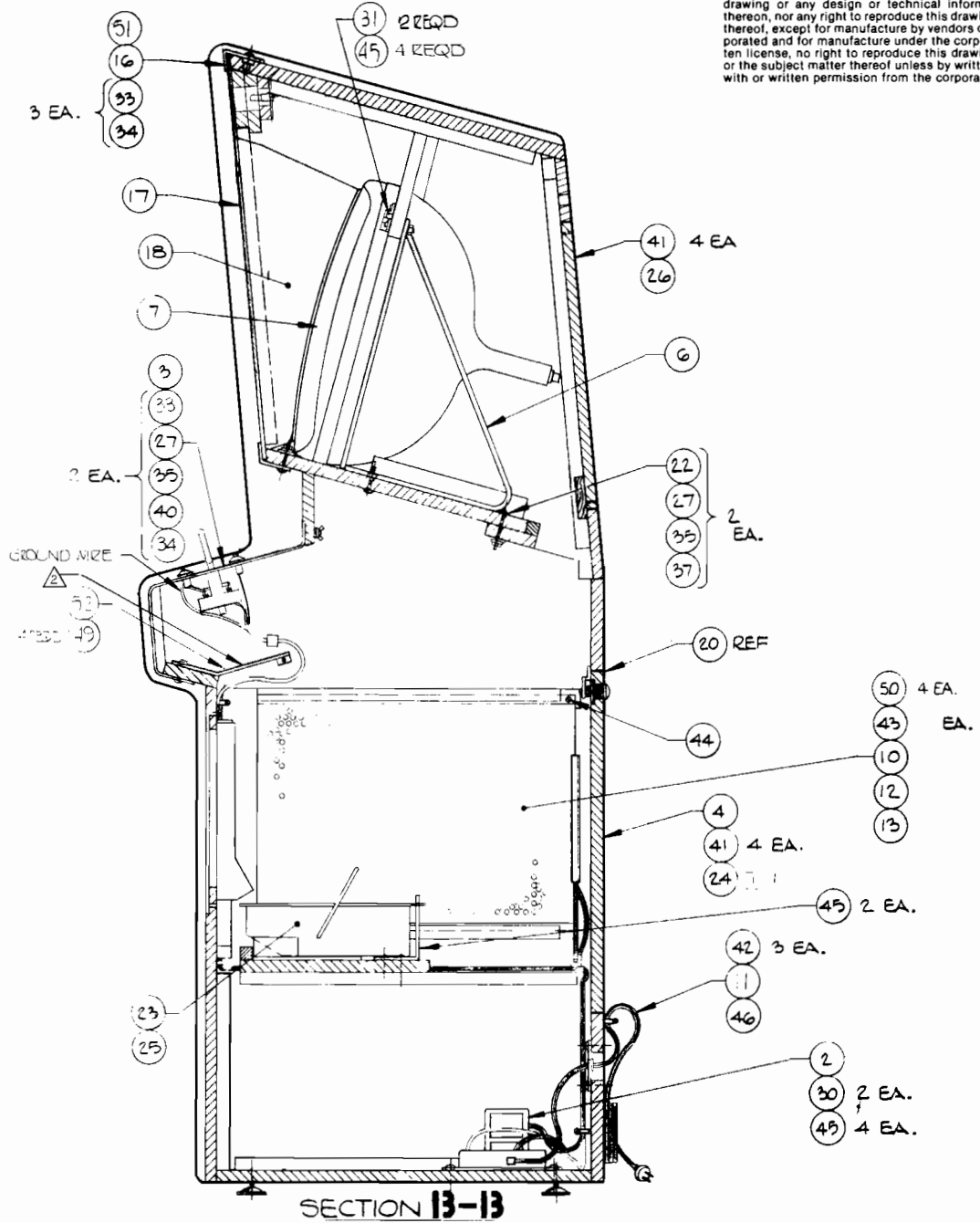


Figure 5-1 Final Assembly  
 A033037-01 B



Figure 5-1 Final Assembly Parts List

Item	Part Number	Qty.	Description
1	A033043-01	1	Cabinet Assembly with Graphics
2	A007197-03	1	Power Supply Assembly Type B
3	A033042-01	1	Control Panel Assembly
4	A030838-01	1	Lower Rear Door Assembly
5	A03048-01	1	Assembly, Light Panel
6	A030836-01	1	T.V. Shelf Assembly
7	033045-01	1	Vacuum Formed Overlay W/Graphics
8	A009574-01	1	Assy Audio Board
9	A009083-01	1	Coin Door Assembly
10	A030867-01	1	Assy, R.F. Shield Enclosure
11	A033016-01	1	Power Cord Assy, Strain Relief
12	A033046-01	1	R.F. Shield PC Bd Assembly
*13	A009787-01	1	P.C. Board Assy, SKYDIVER (Prom Version)
14	006305-01	1	Printed Poly Bag
15	TN-117	1	Operation, Maintenance and Service Manual, Complete with Illustrated Parts Catalog
16	006873-01	1	Retainer, Plexiglas
17	032849-01	1	Plexiglas, Shield W/Graphics
18	009010-02	1	Bezel, Cardboard
19	000869-01	1	Speaker, Grill Cover
20	005233-01	2	Rear Door Seal
21	006319-03	1	Copyright Decal
22	75-5132N	2	Carriage Bolts, #10-24 x 2.00" Lg
23	A007902-01	1	Cash Box Assembly
24	ST-117	1	Self Test Chart
25	006870-01	1	Coin Box Bracket
26	A030453-01	1	Assy, Rear Door, Upper Service Panel
27	75-040	4	Washers, Split Lock, #10
28	48-001	2	Speakers, 8 inch
29	73-77015	6	Rivets, 3/16" O.D. x .68 Lg (.250 x .500 Grip) Black
30	46-201302	2	Fuses, 3 AMP
31	005594-01	2	Corner, Mounting Brkt.
32	033095-01	2	Label, Shipping
33	82-8016	5	Screws, Button Head, Socket Cap. #10-32 x 1.00 Lg
34	75-990900006	5	Washers, Blind Hole Fastener #10-32
35	75-0105	4	Washers, Flat, #10
36	75-5516B	4	Carriage Bolts, #4-20 x 1.00 Lg (Black)
37	75-9115	2	Hex Nuts, #10-24
38	75-0155	4	Washers, Flat #4
39	75-9905055	4	Hex Nuts, #4-20, Nylon Locking

A Warner Communications Company

Item	Part Number	Qty.	Description
40	75-931S	2	Wing Nuts, #10-24
41	82-1824	10	Wood Screws, #8 x 1 1/2" Lg. Ft. Hd. Phil.
42	72-6610	26	Screws, S.M. Pan Hd. Phil. #6 x 5/8 Lg.
43	72-6608	7	Screws, S.M. Pan Hd. Phil. #6 x 1/2 Lg.
44	72-6808	1	Screws, S.M. Pan Hd. Phil. #8 x 1/2 Lg.
45	72-6812	16	Screws, S.M. Pan Hd. Phil. #8 x 3/4 Lg.
46	78-25001	1	Screw Down Tie Wraps
47	70-11-1816	5	Lamp, Incandescent, Miniature, Bayonet Base 12V
48	A033081-02	1	Harness and Switch Assy.
49	72-6810	6	Screw, SM Pan Hd Phil. #8 x 5/8" Lg.
50	72-1406S	4	Screws, Mach. Pan. HD. Phil. #4-40x 3/8" Lg.
51	75-07021	3	#10 Nylon Black Washers
52	033049-01	1	Shield, ABS liquid

\* A Substitute for item 13 is A009787-02 Qty of 1, PCB Assy, SKYDIVER (Rom Version)

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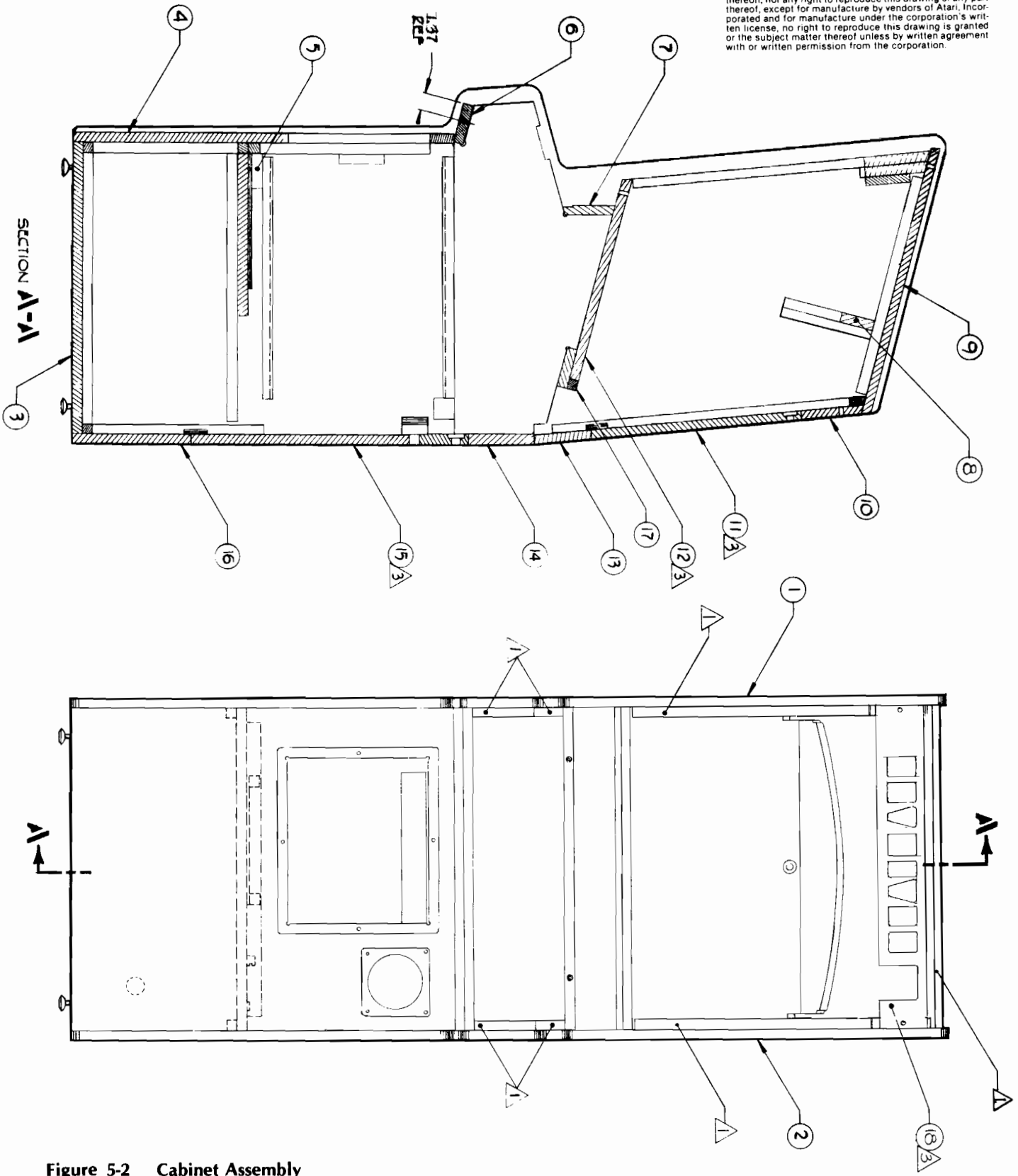


Figure 5-2 Cabinet Assembly  
 A033038-01 A



Figure 5-2 Cabinet Assembly  
Parts List

Item	Part Number	Qty.	Description
1	A033033-01	1	Assy, Side Panel Cleat, Left Side
2	A033036-01	1	Assy, Side Panel Cleat, Right Side
3	006846-01	1	Base Panel
4	033035-01	1	Panel, Front
5	A033039-01	1	Assy, Coin Box Shelf
6	006849-01	1	Cross Panel, Front
7	030831-01	1	Panel, Middle Front
8	033034-01	1	Support, Monitor
9	006854-01	1	Top Panel
10	006853-01	1	Upper Rear Panel
11	006852-01	1 REF	Upper Service Panel
12	030834-01	1 REF	Shelf, Sliding, T.V.
13	030833-01	1	Panel, Rear Cross
14	030832	1	Panel, Center Back
15	A006877-01	1 REF	Lower Rear Door Assy
16	006847-01	1	Lower Rear Panel
17	030830-01	1	Shelf, T.V. Support
18	033041-01	1 REF	Light Baffle

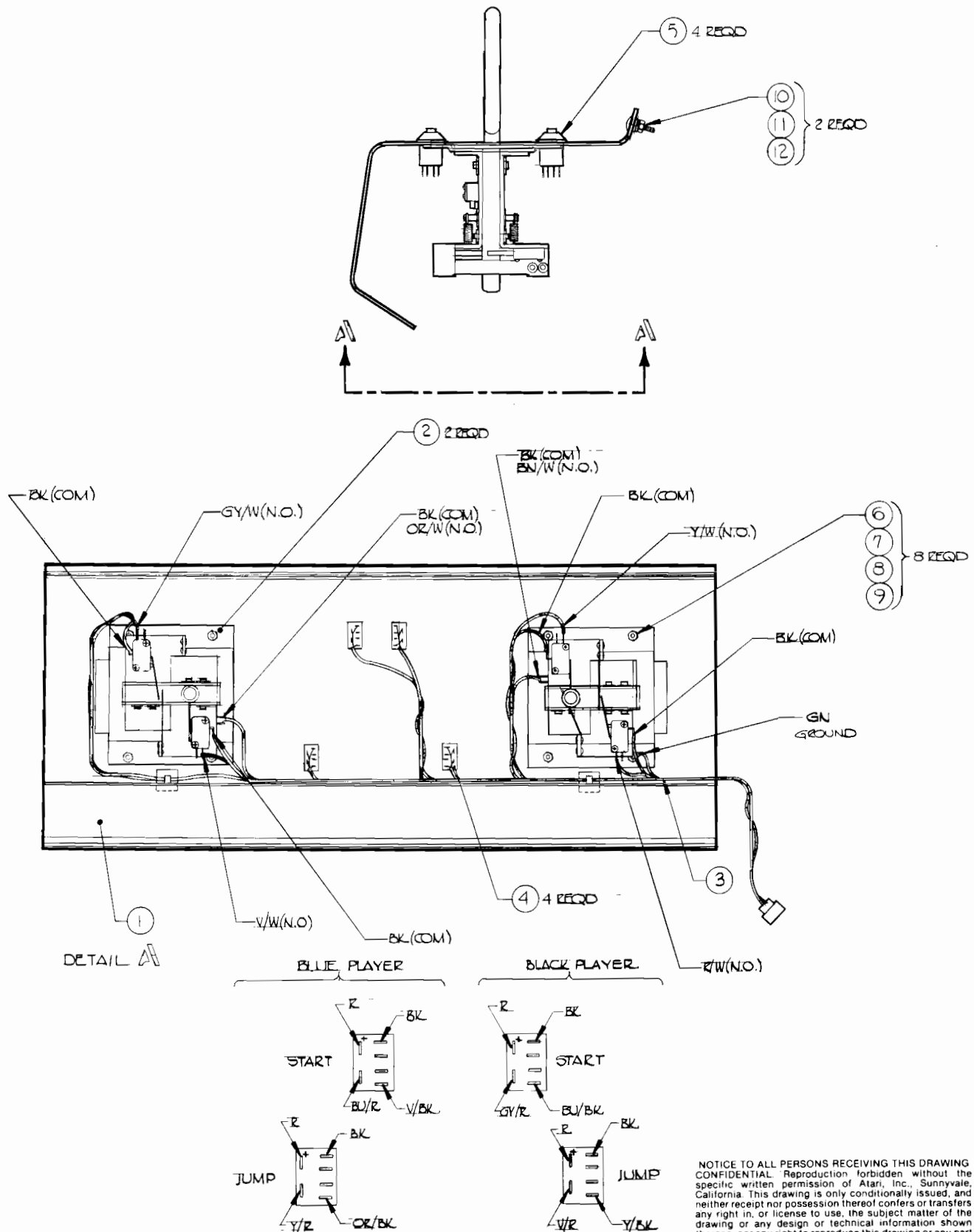


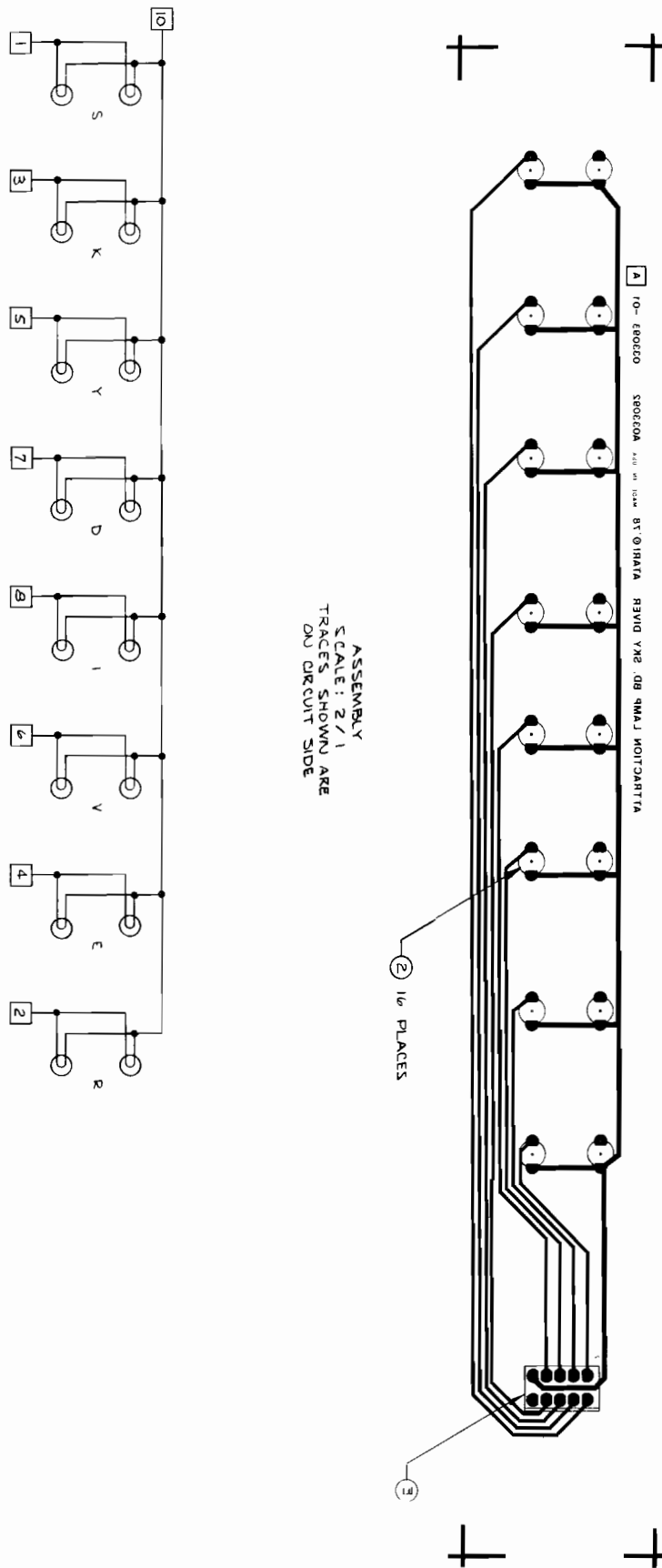
Figure 5-3 Control Panel Assembly  
A033042-01 A

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Figure 5-3 Control Panel Assembly  
Parts List

Item	Part Number	Qty.	Description
1	033040-01	1	Control Panel W/Graphics
2	A033084-01	2	Assy, Ripcord Control
3	A033082-01	1	Control Harness
4	62-002	4	Led Switch
5	001856-01	4	Bushing, Switch
6	75-5516	8	Bolt, Carriage $\frac{1}{4}$ -20 x 5/8" Lg
7	75-015S	8	Washer, Flat $\frac{1}{4}$ "
8	75-045	8	Washer, Split $\frac{1}{4}$ "
9	75-915C	8	Nut, Hex $\frac{1}{4}$ -20
10	75-5120	2	Bolt, Carriage 10-24 x 1.25" Lg
11	75-040	2	Washer Split #10
12	75-911S	2	Nut, Hex 10-24



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Figure 5-4 Attraction Lamp Board Schematic and Assembly  
 A033092-01 A





Figure 5-4 Attraction Lamp Board Schematic and Assembly Parts List

Item	Part Number	Qty.	Description
1	033093-01	1	P.C. Board
2	79-4313	16	Socket, Lamp
3	79-58005	1	Connection, 10-Pin

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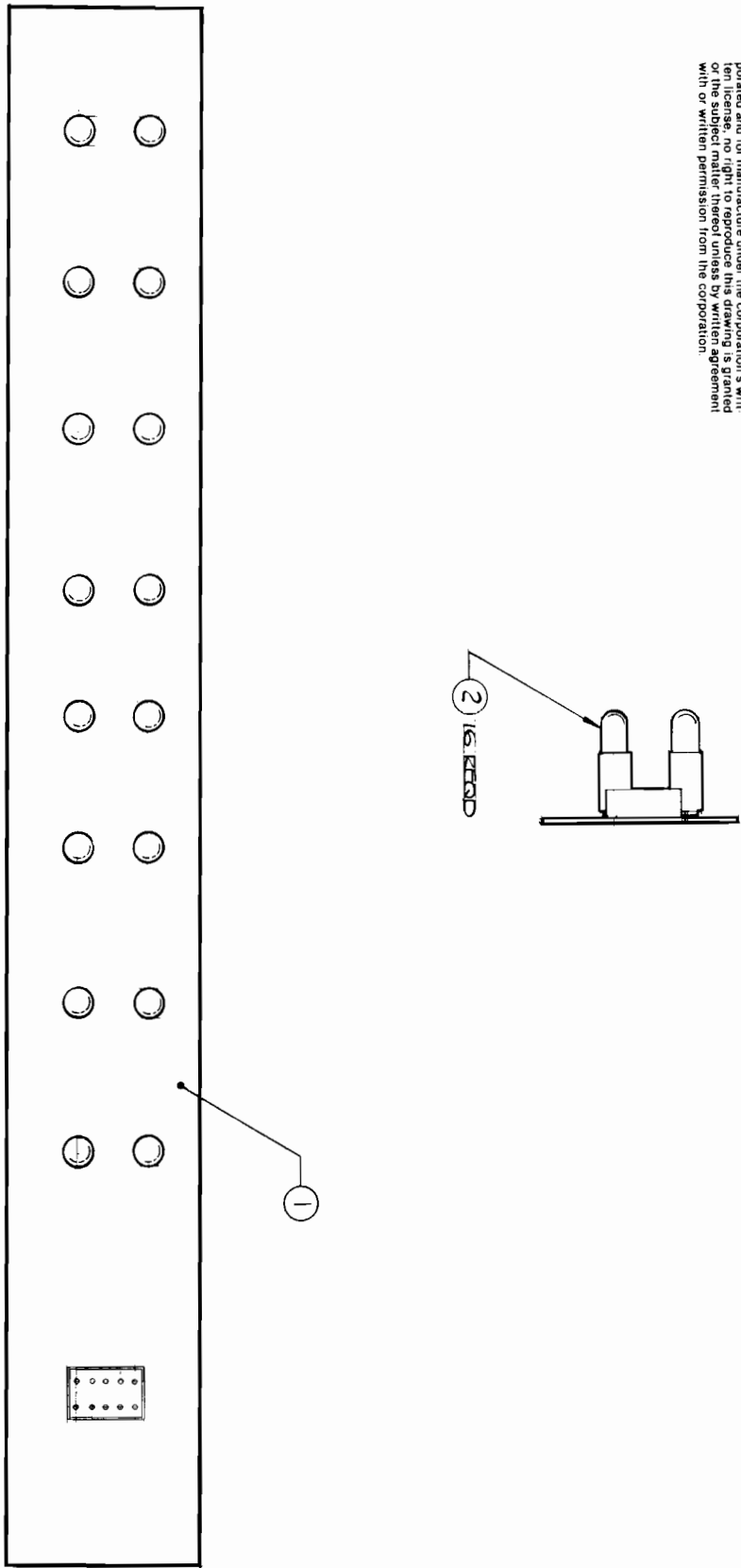


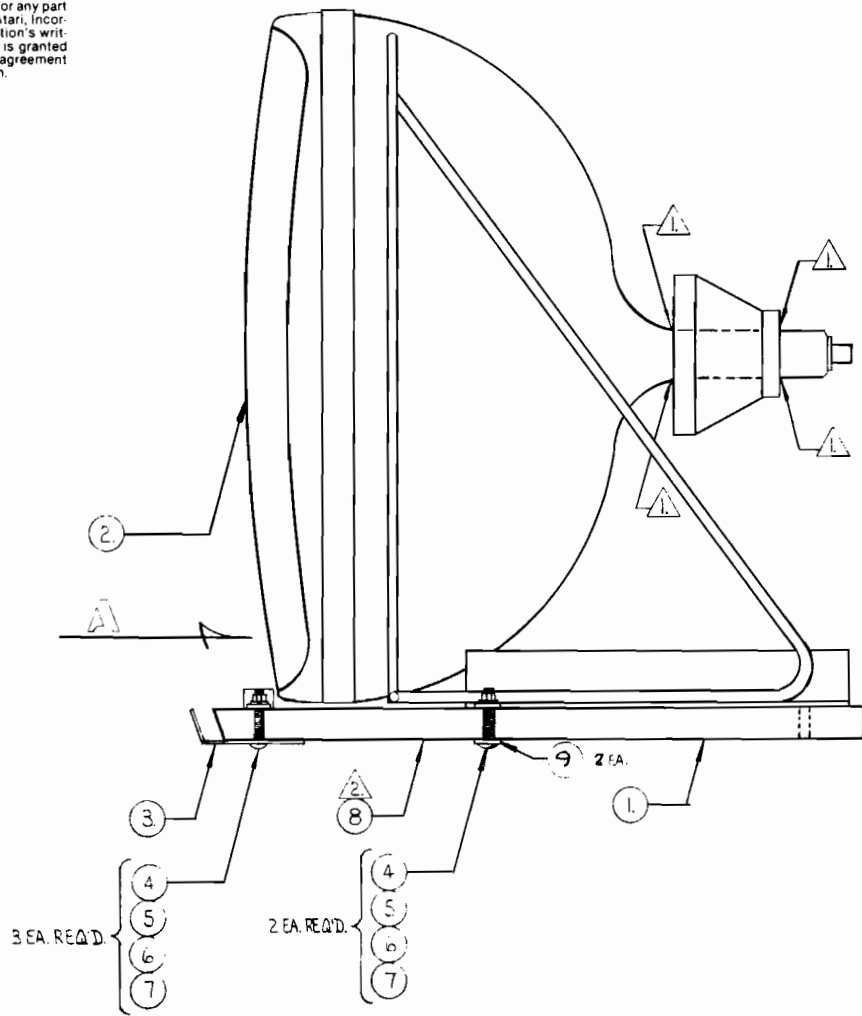
Figure 5-5 Attraction Lamp Board with Lamps Assembly  
 A033047-01 A



Figure 5-5 Attraction Lamp Board With Lamps Assembly  
Parts List

Item	Part Number	Qty.	Description
1	A033092-01	1	Assy, Attraction Lamp Board
2	70-11-1816	16	Lamp, Incandescent, Minature, Bayonet Base 12V

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NOTES:

- ▲ STAPLE AS REQUIRED
- ▲ APPLY ITEM 8 OVER HOLES IN T.V. SHELF, AS SHOWN, ON ONE SIDE.
- ▲ APPLY R.T.V. SILICONE RUBBER (SEE 108 OR EQUIV.) WHERE SHOWN.

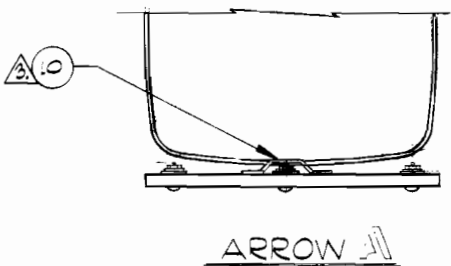
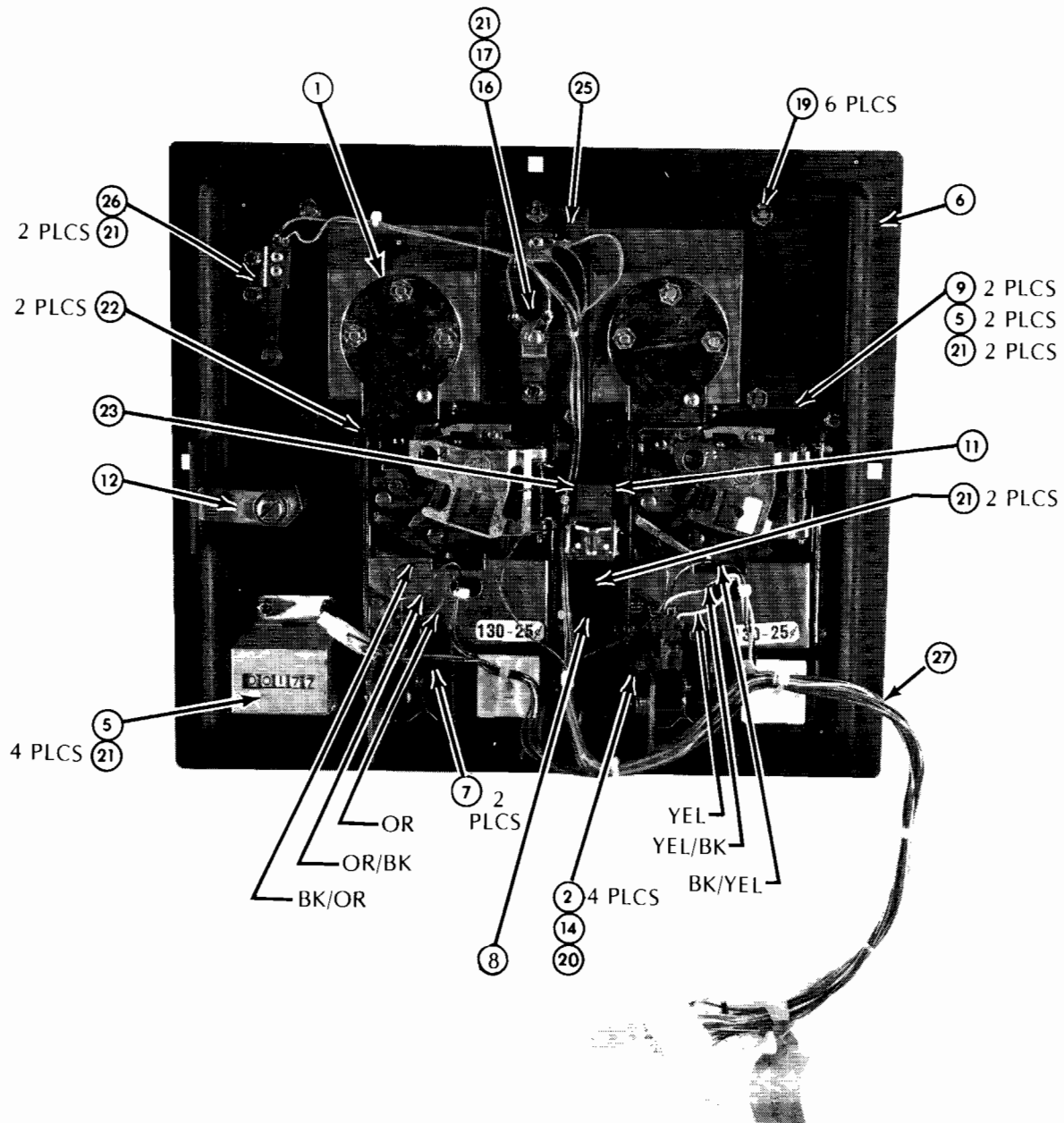


Figure 5-6 TV Shelf Assembly  
 A030836-01 C



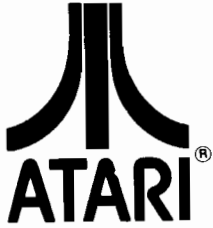
Figure 5-6 TV Shelf Assembly  
Parts List

Item	Part Number	Qty.	Description
1	030834-01	1	T.V. Mounting Board
2	92-032	1	T.V. Monitor, 23"
3	006874-01	1	Plexiglas Retainer
4	75-5120B	5	Carriage Bolts, #10-24 X 1½ Lg.
5	75-040	5	Washers, Split-Lock, #10
6	75-010S	5	Washers, Flat, #10
7	75-911S	5	Hex Nuts, #10-24
8	78-6601216	1	Alum. Foil, 1" Wide X 10" Lg. (Approx.)
9	75-015S	2	Flat Washer, #¼
10	033050-01	1	Strip, Cardboard



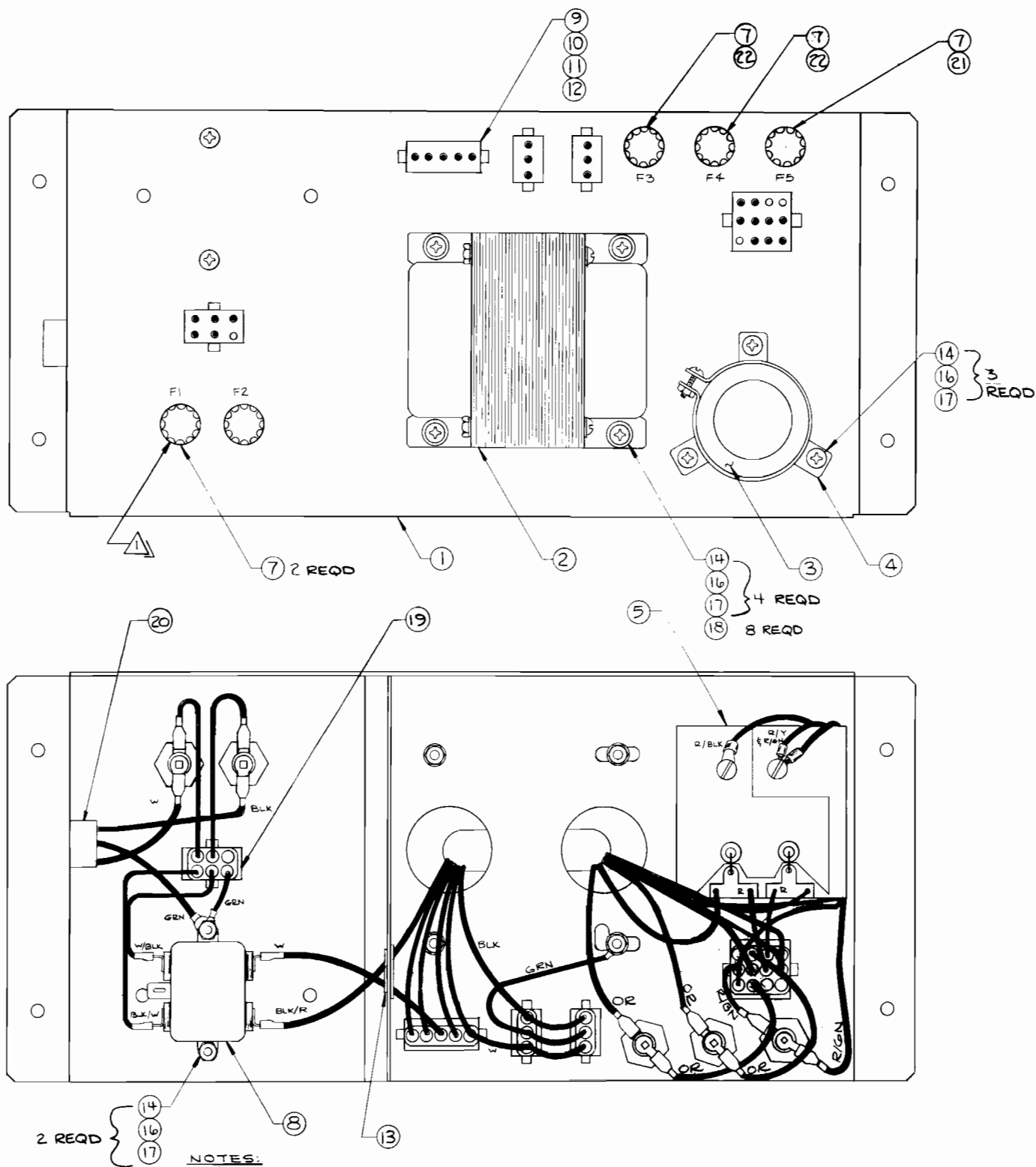
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Figure 5-7 Coin Door Assembly  
 A009083-01 C



**Figure 5-7 Coin Door Assembly  
Parts List**

Item	Part Number	Qty.	Description
1	A007637-01	1	Front Bezel Assy. - Used only on -01 Coin Door Assy.
	A007637-02	Ref.	Front Bezel Assy. - Used only on -02 Coin Door Assy.
	A007637-03	Ref.	Front Bezel Assy. - Used only on -03 Coin Door Assy.
	A007637-04	Ref.	Front Bezel Assy. - Used only on -04 Coin Door Assy.
	A007637-05	Ref.	Front Bezel Assy. - Used only on -05 Coin Door Assy.
	A007637-06	Ref.	Front Bezel Assy. - Used only on -06 Coin Door Assy.
	A007637-07	Ref.	Front Bezel Assy. - Used only on -07 Coin Door Assy.
			<b>See Figure 5-14</b>
2	75-9165	4	Nut 6-32
3	<b>A030362</b> -01	1	Coin Lock-Out Assembly <b>See Figure 5-15</b>
4	A007640-01	2	Coin Switch Assembly <b>See Figure 5-16</b>
5	A002465-01	1	Coin Counter Assembly
6	004320-01	1	Coin Door Weldment
7	004341-01	2	Secondary Coin Chute
8	004344-01	1	Key Loop
9	004340-01	2	Spring-Return
10	004337-01	2	Bracket, Wire Form
11	004338-01	1	Lock-Out, Wire Form, R.H.
12	004336-01	1	Lock-Out, Wire Form, L.H.
13	004326-01	2	Button, Scavenger
14	75-046	4	Lock Washer, #6
15	006904-01	2	Spacer
16	007359-01	1	Lamp Socket
17	70-11-47	1	Lamp
18	73-3008	2	Retaining "C" Ring, Truarc #5103-25
19	75-9914001	6	Self-Threading Nut, Timmerman #SR188006
20	75-026S	4	Washer #6
21	75-00516	13	Kepnut, Style 842, Stl., 6-32
22	008629-01	2	Spring
23	71-2118	1	Lock Assembly, Hudson Lock
24	71-1225CU	2	Coin Mechanism for American Quarter only
	71-125FB	Ref.	Coin Mechanism for Belgian 5 Francs Only
	71-1205FF	Ref.	Coin Mechanism for German Mark only
	71-1201MG	Ref.	Coin Mechanism for Swedish Krona Only
	71-1201KS	Ref.	Coin Mechanism for Japanese 100 Yen Only
	71-1210PE	Ref.	Coin Mechanism for English 10 Pence Only
	71-1220CA	Ref.	Coin Mechanism for Australian 20-Cent Piece only
25	007753-01	1	Plate, Anti-Probe
26	A007638-01	1	Switch Assembly - Slam
27	A006921-01	1	Harness Assembly



- NOTES:**
1. FUSES WILL BE LISTED ON THE FINAL ASSEMBLY PARTS LIST OF EACH INDIVIDUAL GAME.
  2. SEE 007197-01 FOR POWER SUPPLY SCHEMATIC (TYPE B)

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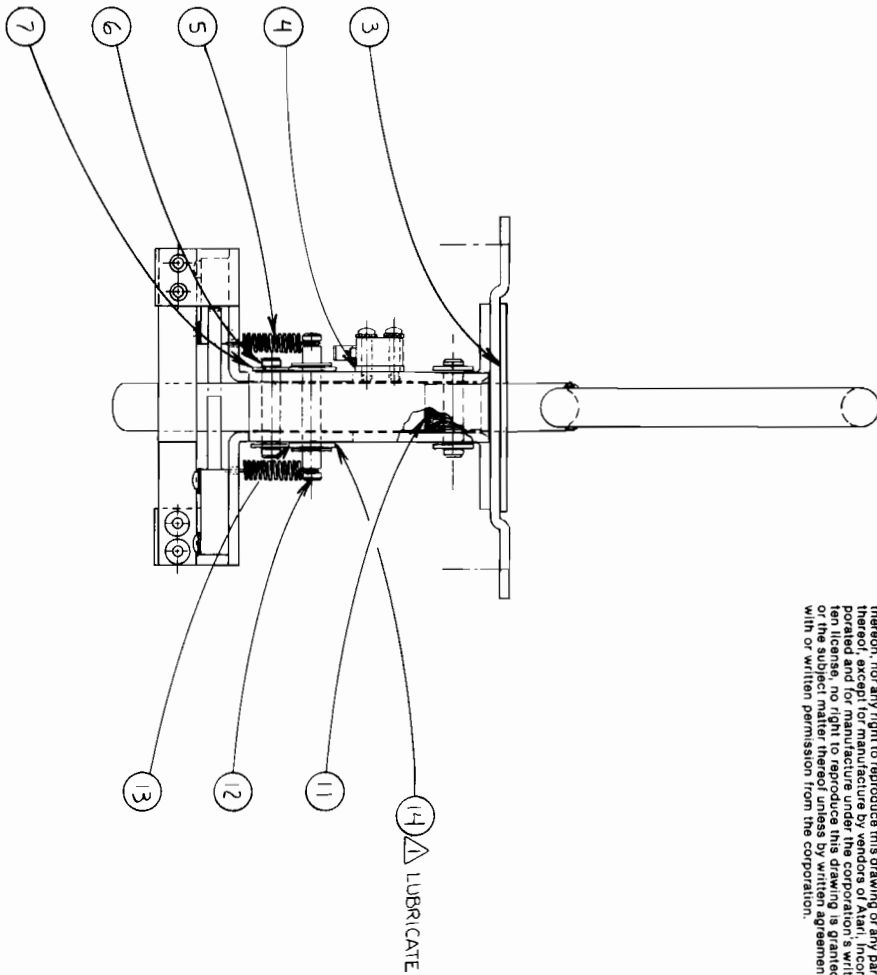
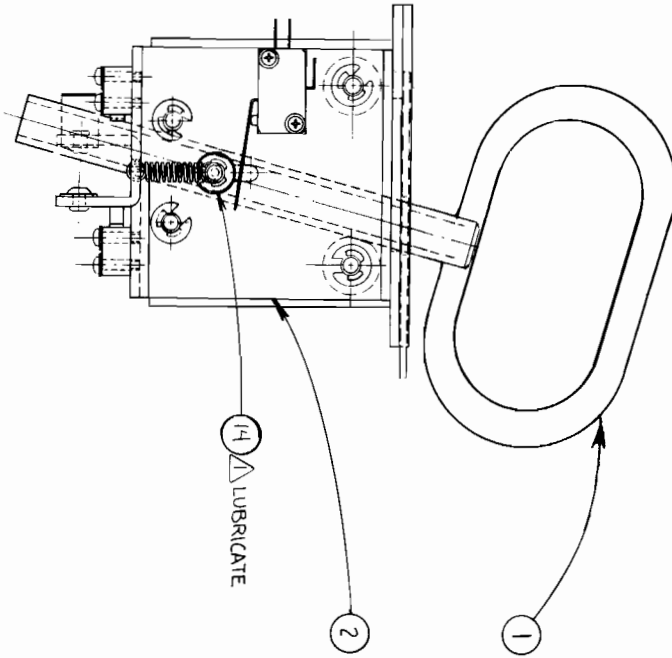
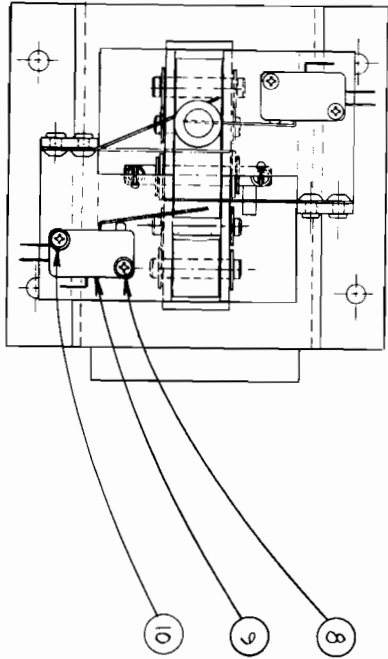
**Figure 5-8 Power Supply Assembly**  
**A007197-02 D**





Figure 5-8 Power Supply Assembly  
Parts List

Item	Part Number	Qty.	Description
1	A009266-01	1	Power Supply Base Weldment Assembly
2	A006886-01	1	Transformer Termination Assembly "Type B"
3	29-053	1	Cap., Sprague Electrolytic 26,000uf @ 15V
4	78-70501SC	1	Brkt., Cap. Mtg. Sprague #4586-48
5	A006555-01	1	P.C. Board Rectifier
6			
7	79-4411004	5	Fuse Holder, Panel Mounting
8	41-2003	1	Filter, Power Line, 5 AMP
9	A006958-01	A/R	Volt Sel Block 95V
10	A006958-02	"	Volt Sel Block 110V
11	A006958-03	"	Volt Sel Block 205V
12	A006958-04	"	Volt Sel Block 220V
13	78-2708	1	Grommet, Plastic
14	72-1810S	9	Screw Pan Hd., #8-32 x 5/8"Lg.
15			
16	75-048	9	Washer, Split-Lock #8
17	75-918S	9	Nut Hex #8
18	75-018S	8	Washer Flat #8
19	A007192-01	1	Power Switch Termination
20	A007444-01	1	Power In Harness
21	46-2028002	1	Fuse, 8 AMP, 230V, 3 AG Slow Acting
22	46-201251	2	Fuse, 2½ AMP, 125V, Slow Acting



△ LUBRICATE ALL PIVOT AND SLIDE POINTS WITH  
 MOLYKOTE G-n PASTE LUBRICANT. ATARI P/N 78-1709  
 NOTE:

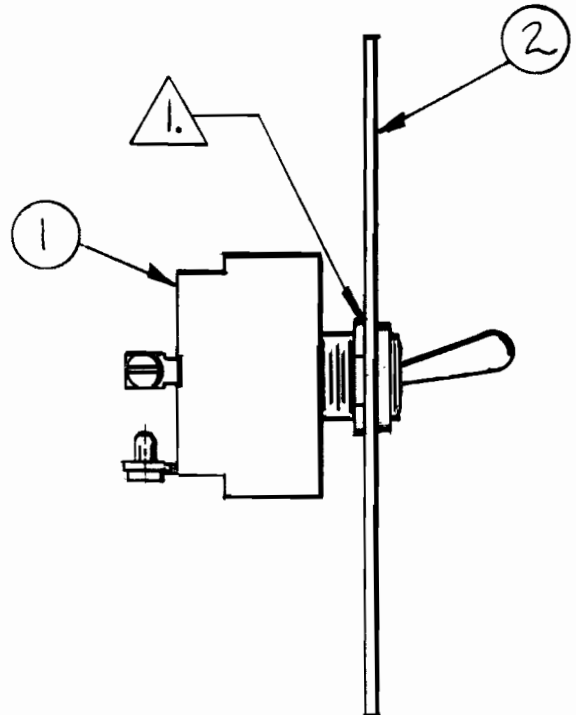
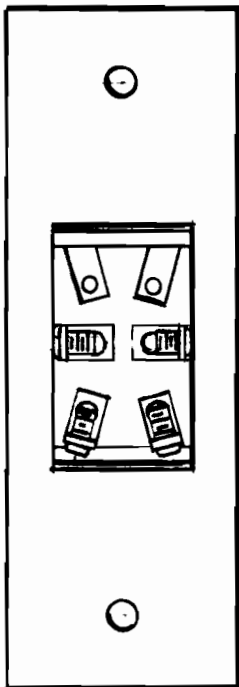
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Figure 5-9 Rip Cord Assembly  
 A0330084 A



Figure 5-9 Rip Cord Assembly  
Parts List

Item	Part Number	Qty.	Description
1	033115-01	1	Handle, Control
2	A033123-01	1	Bracket, Control Assy
3	033109-01	1	Plate, Slide
4	007371-01	1	Spacer, Switch
5	78-3001035	2	Spring, Extension
6	033112-01	4	Pin, Stop
7	73-3008	10	'E' Ring, $\frac{1}{4}$ Shaft
8	72-1410S	6	Screw, Mach, Phillips Pan Hd., #4-40UNC-2A x 5/8 LG
9	007859-01	3	Switch
10	75-054	6	Washer, Lock, #4 (Star)
11	033113-01	2	Stop, Neoprene
12	033110-01	1	Pin, Spring
13	75-07050	2	Washer, Nylon
14	78-1709	A/R	Lubricant, Paste, Molykote G



### NOTES

1. POSITION HEX NUT APPROX. AS SHOWN.
2. HARDWARE FOR MOUNTING SWITCH IS INCLUDED WITH SWITCH.

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Figure 5-10 On-Off Switch Assembly  
 A006449-01



Figure 5-10 On-Off Switch Assembly  
Parts List

Item	Part Number	Qty.	DESCRIPTION
1	61-062A	1	Toggle Switch, DPST Carling Switch #2GK54
2	006450-01	1	MTG Plate, On - Off Switch

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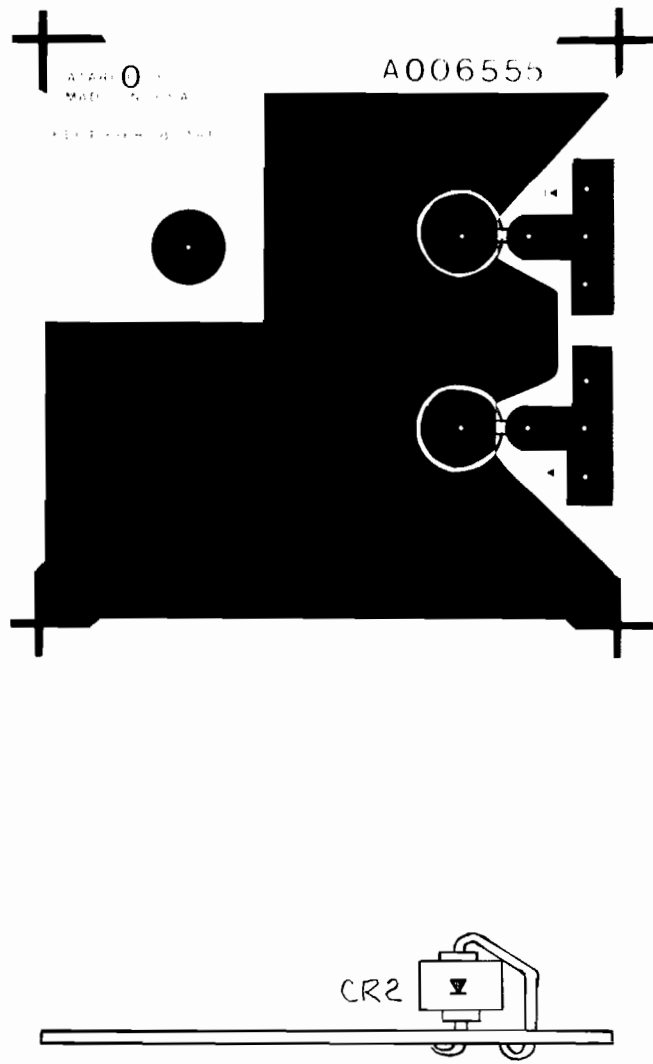


Figure 5-11 Rectifier Board Assembly  
A006555-01

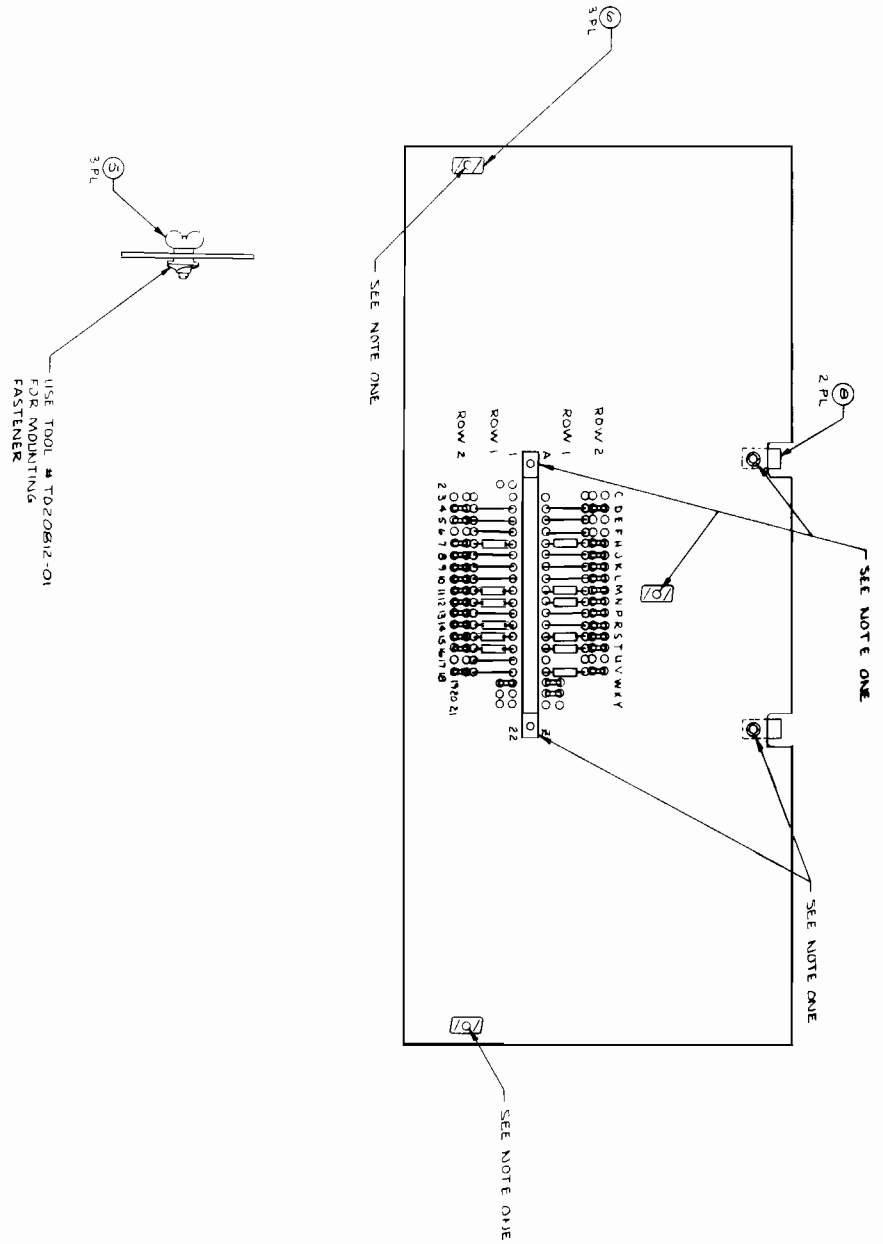


Figure 5-11 Rectifier Board Assembly  
Parts List

Item	Part Number	Qty.	Description
1	006556-01	1	P.C. Board
2	31-MR750	2	Diode, MR750 CR1,CR2

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(CONT.)	ROW 1	ROW 2		
PIN NO	INDUCTOR	JUMPER	CAPACITOR	CAPACITOR
A	X	X	X	X
B	X	X	X	X
C	X	X	X	X
D	X	X	X	X
E	X	X	X	X
F	X	X	X	X
G	X	X	X	X
H	X	X	X	X
I	X	X	X	X
J	X	X	X	X
K	X	X	X	X
L	X	X	X	X
M	X	X	X	X
N	X	X	X	X
O	X	X	X	X
P	X	X	X	X
Q	X	X	X	X
R	X	X	X	X
S	X	X	X	X
T	X	X	X	X
U	X	X	X	X
V	X	X	X	X
W	X	X	X	X
X	X	X	X	X
Y	X	X	X	X
Z	X	X	X	X
1	X	X	X	X
2	X	X	X	X
3	X	X	X	X
4	X	X	X	X
5	X	X	X	X
6	X	X	X	X
7	X	X	X	X
8	X	X	X	X
9	X	X	X	X
10	X	X	X	X
11	X	X	X	X
12	X	X	X	X
13	X	X	X	X
14	X	X	X	X
15	X	X	X	X
16	X	X	X	X
17	X	X	X	X
18	X	X	X	X
19	X	X	X	X
20	X	X	X	X
21	X	X	X	X
22	X	X	X	X



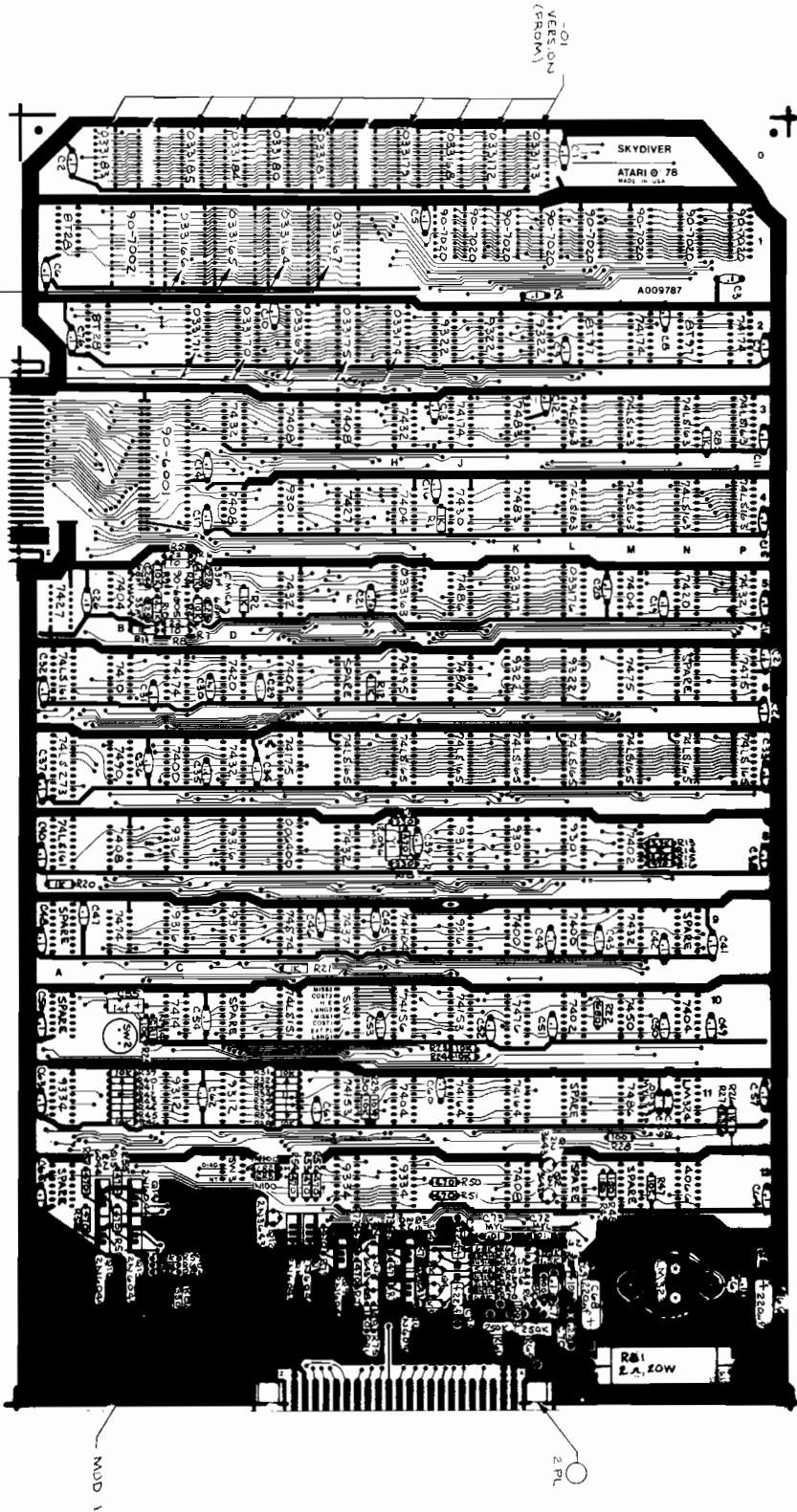
**Figure 5-12 RF Shield PCB Assembly**  
**A033046-01 D**





Figure 5-12 RF Shield PCB Assembly  
Parts List

Item	Part Number	Qty.	Description
1	030835-01	1	P.C. Board
2	2D-1016	28	Capacitor, Mono, 0.1uf, 50V
3	41-3003	12	Inductor, 100uH
4	52-003	17	Jumper, .600 Centers
5	75-E6106082	3	Wingscrew, #6-32 x 1/2 Lg
6	75-992501	3	Fastener, 1/4 Turn, #6-32, Stainless Steel
7	79-517222	1	Connector, 44 Pin P.C. Mount
8	030868-01	2	Mount, Connector



MODIFICATIONS: TO 009788-01 REV 'A' P.C. B.DS.  
 I. ADP 330 OHM RES (CR82) TO VIDEO SUMMING  
 CIRCUIT AS SHOWN

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Figure 5-13 Skydiver PCB Assembly  
 A009787-01



Figure 5-13 Skydiver PCB Assembly  
Parts List  
Version -01

Item	Part Number	Qty.	Description
1	009788-01	1	P.C. Board
2	10-5100	2	Res., Car. Comp., 1/4W, 5%, 10 Ohm
3	10-5220	2	" " " " " 22 "
4	10-5101	1	" " " " " 100 "
5	10-5151	4	" " " " " 150 "
6	10-5331	3	" " " " " 330 "
7	10-5471	16	" " " " " 470 "
8	10-5681	1	" " " " " 680 "
9	10-5102	11	" " " " " 1K "
10	10-5152	2	" " " " " 1.5K "
11	10-5182	3	" " " " " 1.8K "
12	10-5222	1	" " " " " 2.2K "
13	10-5332	1	" " " " " 3.3K "
14	10-5392	1	" " " " " 3.9K "
15	10-5472	2	" " " " " 4.7K "
16	10-5562	2	" " " " " 5.6K "
17	10-5103	26	" " " " " 10K "
18	10-5683	2	" " " " " 68K "
19	10-5104	2	Res., Car. Comp., 1/4W, 5%, 100K Ohm
20			R67, 70
21	19-8D9W2P0	1	Res., Wirewound, 20W, 2 Ohm
22			R64, 80
23			R81
24	19-315254	2	Trimpot, 250K Ohm
25			R65, 66
26			
27			
28			

Item	Part Number	Qty.	Description
29	21-101332	2	Cap., Mylar, 100V, .0033uf
30	21-101103	2	" " " " .01uf
31	21-101224	1	Cap., Mylar, 100V, .22uf
32			
33			
34	24-250105	1	Cap., Electrolytic, 25V, 1uf
35	24-250106	1	" " " " 10uf
36	24-250226	2	" " " " 22uf
37	24-250227	2	Cap., Electrolytic, 25V, 220uf
38			
39			
40	27-250104	61	Cap., Ceramic Disc, 25V, 1uf
41			C1-21, 26-54, 56, 57, 60-65, 67, 71, 76
42	28-101330	2	Cap., Dipped Mica, 100V, 33pf
43			C22, 25
44	28-101680	2	Cap., Dipped Mica, 100V, 68pf
45			C23, 24
46			
47	31-1N914	5	Diode, 1N914
48			CH1, 4-7
49	31-1N100	2	Diode, 1N100
50			CR2, 3
51			
52			
53	34-2N3643	7	Transistor, 2N3643
54	34-2N6044	9	Transistor, 2N6044
55			Q1-4, 7, 8, 12
56			Q5, 6, 9-11, 13-16
57			
58	37-7400	3	Integrated Circuit, 7400
59	37-7402	3	" " " " 7432
60	37-7404	5	" " " " 7404
61	37-74H04	1	" " " " 74H04
62	37-7408	5	" " " " 7408
63	37-7410	1	" " " " 7410
64	37-7414	1	" " " " 7414
65	37-7420	2	" " " " 7420
66	37-7427	2	" " " " 7427
67	37-7430	1	" " " " 7430
68	37-7432	7	" " " " 7432
69	37-7437	1	" " " " 7437
70	37-7450	1	" " " " 7450
71	37-7474	1	" " " " 7474
72	37-74S74	1	" " " " 74S74
73	37-7475	2	" " " " 7475
74	37-7476	1	" " " " 7476
			C7, K9, L9
			E6, M8, L10
			H4, B5, M5, N10, H11
			H9
			E5, F3, D4, B8, K12
			B6
			C10
			N5, D6
			F4, A5
			J4
			D8, H8, E5, P8, D7, F8,
			M9
			F9
			M10
			B9
			E9
			M6, P6
			K10



Figure 5-13 Skydiver PCB Assembly  
Parts List  
Version -01

Item	Part Number	Qty.	Description
75	37-7483	2	Integrated Circuit, 7483
76	37-7486	3	" " " " 7486
77	37-7490	1	" " " " 7490
78	37-741S151	1	" " " " 741S151
79	37-74153	2	" " " " 74153
80	37-74156	1	" " " " 74156
81	37-741S161	2	" " " " 741S161
82	37-741S163	8	" " " " 741S163
83	37-74164	2	" " " " 74164
84	37-741S165	8	" " " " 741S165
85	37-74174	4	" " " " 74174
86	37-74175	1	" " " " 74175
87	37-74195	1	" " " " 74195
88	37-741S273	1	" " " " 741S273
89	37-8T28	2	" " " " 8T28
90	37-8T97	2	" " " " 8T97
91	37-9301	3	" " " " 9301
92	37-9312	2	" " " " 9312
93	37-9316	6	" " " " 9316
94	37-9322	5	" " " " 9322
95	37-9334	3	" " " " 9334
96	37-LM324	1	" " " " LM324
97	37-4066	1	" " " " 4066
98	37-556	1	Integrated Circuit, 556
99			
100			
101	62-001	1	Switch, SPST, Momentary, SW2
102	66-114PT	1	" " " " x 4, Dip, SW3
103	66-118PT	1	" " " " x 8, Dip, SW1
104			
105			
106			
107			
108	72-1608C	2	Screws, Pan Hd, Phil, 6-32 x 1/2 LG, Cress.
109	75-016	2	Washer, Flat, #6
110	75-056	2	Washer, Lock, Int. Star, #6
111	75-916C	2	Nut, Hex, #6-32, Cress.
112			
113			
114			
115	78-06001	1	Heatsink (LM323)
116	78-16005	1	Slipad (LM323)
117			
118			
119			

Item	Part Number	Qty.	Description
120	79-42040	1	Socket, 40 Pin, Med. Insert
121			
122			
123			
124	90-102	1	Crystal, 12.096 MHz
125			
126			
127			
128	90-6001	1	Microprocessor, 6800
129	90-6002	1	Trans., MPQ6842
130	90-7020	8	Ram, 21102A
131	90-7002	1	Ram, 6810
132			
133			
134			
135	006400-01	1	Sync Prom
136			
137			
138			
139	030868-01	2	Mount Connector
140			
141			
142			
143	033163-01	1	Skydiver Graphics
144	033176-01	1	" " Motion 1
145	033177-01	1	Skydiver Motion 2
146			
147			
148			
149	033168-02	1	Skydiver Prom 2800L
150	033165-02	1	" " " " 3000L
151	033170-02	1	" " " " 3800L
152	033171-02	1	" " " " 7800L
153	033172-02	1	" " " " 2800M
154	033173-02	1	" " " " 3000M
155	033174-02	1	" " " " 3800M
156	033175-02	1	" " " " 7800M
157			
158	033179-02	1	" " " " 3400L
159	033180-02	1	" " " " 3C00L
160	033181-02	1	" " " " 7C00L
161			
162	033183-02	1	" " " " 3400M
163	033184-02	1	" " " " 3C00M
164	033185-02	1	" " " " 7C00M

Figure 5-13 Skydiver PCB Assembly  
Parts List  
Version -02



Item	Part Number	Qty.	Description
1	009788-01	1	P.C. Board
2	10-5100	2	Res., Car. Comp., 1/4W, 5%, 10 Ohm
3	10-5220	2	" " " " 22 Ohm
4	10-5101	1	" " " " 100 "
5	10-5151	4	" " " " 150 "
6	10-5331	3	" " " " 330 "
7	10-5471	16	" " " " 470 "
8	10-5681	1	" " " " 680 "
9	10-5102	11	" " " " 1K "
10	10-5152	2	" " " " 1.5K "
11	10-5182	3	" " " " 1.8K "
12	10-5222	1	" " " " 2.2K "
13	10-5332	1	" " " " 3.3K "
14	10-5392	1	" " " " 3.9K "
15	10-5472	2	" " " " 4.7K "
16	10-5562	2	" " " " 5.6K "
17	10-5103	26	" " " " 10K "
18	10-5683	2	" " " " 68K "
19	10-5104	2	Res., Car. Comp., 1/4W, 5%, 100K Ohm
20			R64, 80
21			
22	19-8D9W2P0	1	Res., Wirewound, 20W, 2 Ohm
23			R81
24			
25	19-315254	2	Tempot., 250K Ohm
26			R65, 66
27			
28			

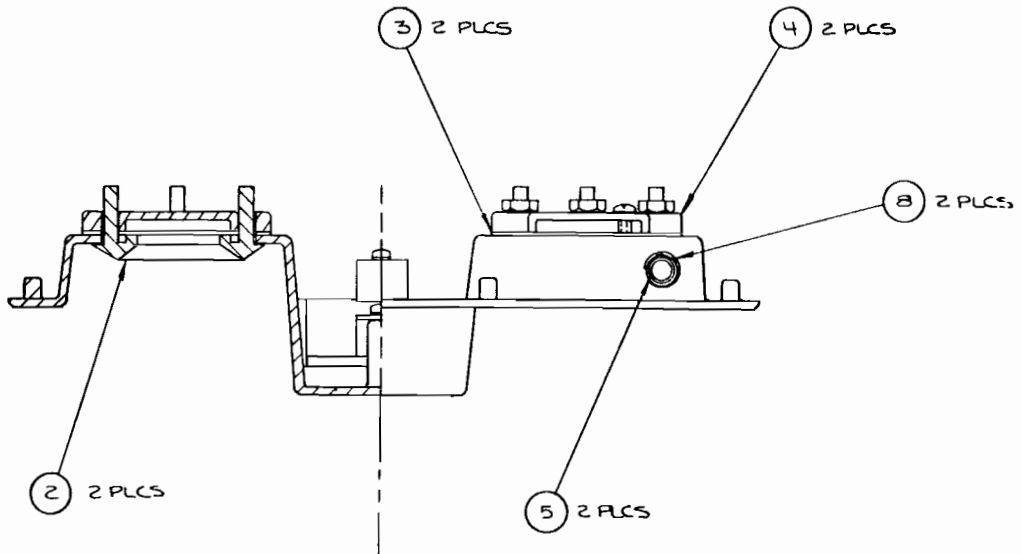
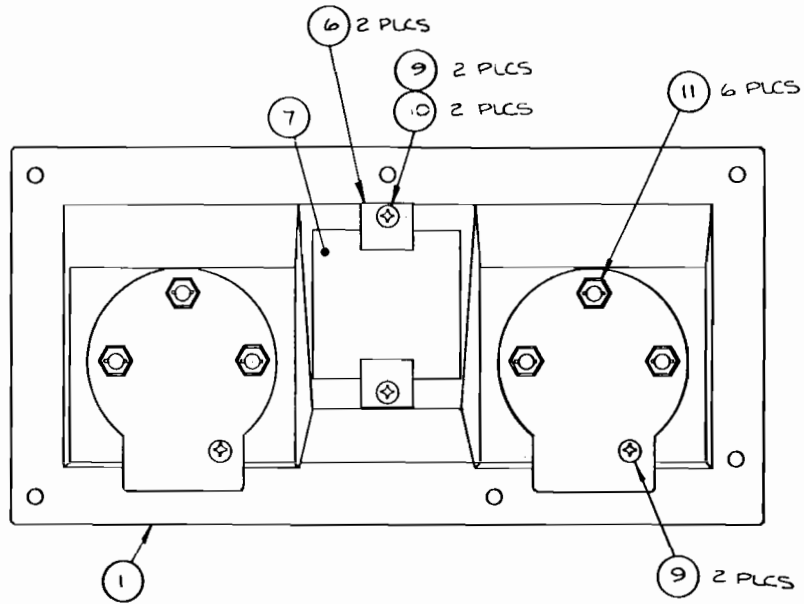
Item	Part Number	Qty.	Description
29	21-101332	2	Cap., Mylar, 100V, .0033uF
30	21-101103	2	" " " " .01uF
31	21-101224	1	Cap., Mylar, 100V, .22uF
32			C58, 59
33			C72, 73
34	24-250105	1	Cap., Electrolytic, 25V, 1uF
35	24-250106	1	" " " " 10uF
36	24-250226	2	" " " " 22uF
37	24-250227	2	Cap., Electrolytic, 25V, 220uF
38			C66, 68
39			
40	27-250104	61	Cap., Ceramic Disc, 25V, .1uF
41			C1-21, 26-54, 56, 57, 60-65, 67, 71, 76
42			
43	28-101330	2	Cap., Dipped Mica, 100V, 33pF
44	28-101680	2	Cap., Dipped Mica, 100V, 68pF
45			C22, 25
46			C23, 24
47			
48	31-1N914	5	Diode, 1N914
49	31-1N100	2	Diode, 1N100
50			CRL, 4-7
51			CR2, 3
52			
53	34-2N3643	7	Transistor, 2N3643
54	34-2N6044	9	Transistor, 2N6044
55			Q1-4, 7, 8, 12
56			Q5, 6, 9-11, 13-16
57			
58	37-7400	3	Integrated Circuit, 7400
59	37-7402	3	" " " " 7402
60	37-7404	5	" " " " 7404
61	37-74H04	1	" " " " 74H04
62	37-7408	5	" " " " 7408
63	37-7410	1	" " " " 7410
64	37-7414	1	" " " " 7414
65	37-7420	2	" " " " 7420
66	37-7427	2	" " " " 7427
67	37-7430	1	" " " " 7430
68	37-7432	7	" " " " 7432
69	37-7437	1	" " " " 7437
70	37-7450	1	" " " " 7450
71	37-7474	1	" " " " 7474
72	37-74S74	1	" " " " 74S74
73	37-7475	2	" " " " 7475
74	37-7476	1	" " " " 7476
			C7, K9, L9
			E6, M8, L10
			H4, B5, M5, N10, H11
			H9
			E3, F3, D4, B8, K12
			B6
			C10
			N5, D6
			F4, A5
			J4
			D3, H3, E5, P5, D7, F8, M9
			F9
			M10
			B9
			E9
			M6, P6
			K10



Figure 5-13 Skydiver PCB Assembly  
Parts List  
Version -02

Item	Part Number	Qty.	Description
75	37-7483	2	Integrated Circuit, 7483
76	37-7486	3	" " 7486 K3, K4
77	37-7490	1	" " 7490 J5, J6, M11
78	37-74LS151	1	" " 74LS151 B7
79	37-74LS153	2	" " 74LS153 E10
80	37-74LS156	1	" " 74LS156 J10, F11
81	37-74LS161	2	" " 74LS161 H10
82	37-74LS163	8	" " 74LS163 A6, A8
83	37-74164	2	" " 74164 L3, M3, N3, P3, L4, M4, N4, P4
84	37-74LS165	8	" " 74LS165 F7, H7, J7, K7, L7, M7, N7, P7
85	37-74174	4	" " 74174 M2, P2, J3, C6
86	37-74175	1	" " 74175 E7
87	37-74195	1	" " 74195 H6
88	37-74LS273	1	" " 74LS273 A7
89	37-8T28	2	" " 8T28 A1, A/B2
90	37-8T97	2	" " 8T97 L2, N2
91	37-9301	3	" " 9301 E4, K8, L8
92	37-9312	2	" " 9312 C11, D11
93	37-9316	6	" " 9316 C8, D8, J8, C9, D9, J9
94	37-9322	5	" " 9322 H/J2, J/K2, K/L2, K6, L6
95	37-9334	3	" " 9334 A11, F12, H12
96	37-1M324	1	" " 1M324 N11
97	37-4066	1	" " 4066 N12
98	37-556	1	Integrated Circuit, 556 K13
99			
100			
101	62-001	1	Switch, SPST, Momentary, SW2
102	66-114P1T	1	" " x 4, Dhp, SW3 D12
103	66-118P1T	1	" " x 8, Dhp, SW1 F10
104			
105			
106			
107	72-1608C	2	Screws, Pan Hd, Phil, 6-32 x 1/2 IG, Cres.
108	75-016	2	Washer, Flat, #6
109	75-056	2	Washer, Lock, Int. Star, #6
110	75-056	2	Washer, Lock, Int. Star, #6
111	75-916C	2	Nut, Hex, #6-32, Cres.
112			
113			
114			
115	78-06001	1	Heatsink (1M323)
116	78-16005	1	Shield (1M323)
117			
118			
119			

Item	Part Number	Qty.	Description
120	79-42040	1	Socket, 40 Pin, Med. Insert C3/4
121			
122			
123			
124	90-102	1	Crystal, 12.096 MHz Y1
125			
126			
127			
128	90-6001	1	Microprocessor, 6800 C3/4
129	90-6002	1	Trans., MPQ6842 C5
130	90-7020	8	Ram, 21102A H/J1, J1, K1, K/L1, L1
131	90-7002	1	Ram, 6810 M1, N1, P1
132			
133			
134			
135	006400-01	1	Sync Prom E8
136			
137			
138			
139	030868-01	2	Mount Connector
140			
141			
142			
143	033163-01	1	Skydiver Graphics H5
144	033176-01	1	" Motion 1 L5
145	033177-01	1	Skydiver Motion 2 K5
146			
147			
148			
149	033164 -02	1	Skydiver Rom 1 E1
150	033165 -02	1	" " 2 D1
151	033166 -02	1	" " 3 C1
152	033167 -02	1	Skydiver Rom 4 F1



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Figure 5-14 Front Bezel Assembly  
 A007637-01 thru -07 D



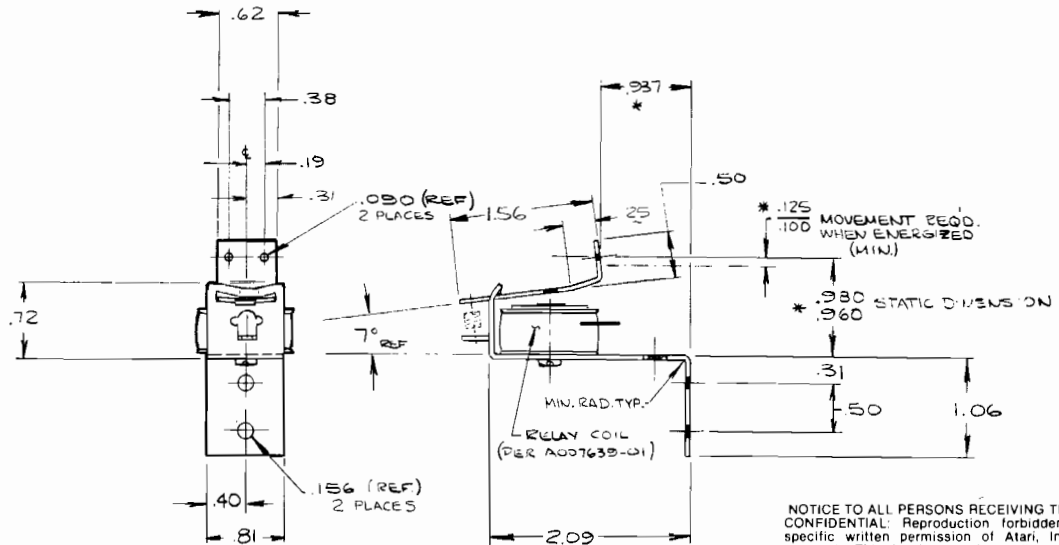
Figure 5-14 Front Bezel Assembly  
Parts List

Item	Part Number	Qty.	Description
1	004328-01	1	Bezel
2	See Below	2	Ring
3	004331-01	2	Coin Shield
4	004332-01	2	Primary Coin Chute
5	004327-01	2	Bearing, Scavenger Button
6	004329-01	2	Clamp, Price Plate
7	See Below	1	Price Plate
8	73-3009	2	Retaining "C" Ring, Truarc #5103-37
9	72-1604S	4	Mach. Scr., 6-32 x 1/4 Lg. Pan Hd., Phil
10	75-046	2	Washer, #6, Split-Lock .
11	75-9914001	6	Self-Threading Nut, Tinnerman #SR188006

DASH NO	ITEM 2	ITEM 7	DENOMINATION
-01	004330-01	004343-01	25¢
-02	004330-01	004343-06	5 FR
-03	009153-01	004343-04	1 DM
-04	004330-01	004343-03	1 KR
-05	009520-01	004343-05	100 Y
-06	007752-01	004343-02	10 P
-07	007752-01	004343-07	20¢ AUST.



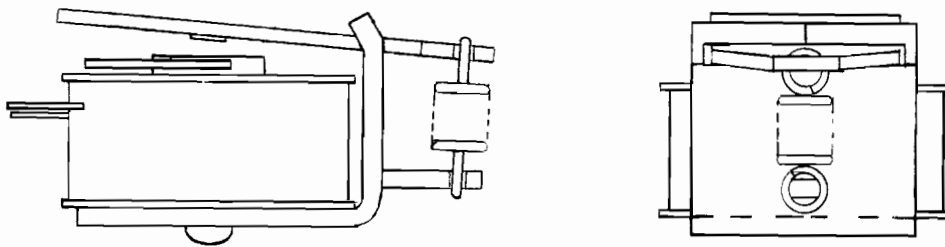


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NOTES

1. DIMENSIONS SHOWN ARE DIM'S REQD. TO INTERCHANGE & REPLACE RELAY WITH EXISTING EQUIPMENT IN FIELD AND PRODUCTION.
2. BREAK & DEBURR ALL SHARP CORNERS
3. DIMENSIONS TAKEN FROM TOOLED PART. DIMENSIONS WITH ASTRIC (\*) ARE SPECIFIED DIMS REQUIRED IN TOOLING BY ENGINEERING TO HAVE PART INTERCHANGE WITH/OK B/YOUT PART.
4. COIL DATA 10VDC  $\pm 2$ , 50 $\Omega$  RES, CURRENT 200 mA MAX. (PER ATARI DWG A007639-01)
5. MFR COIL MECH INC (VENDOR)

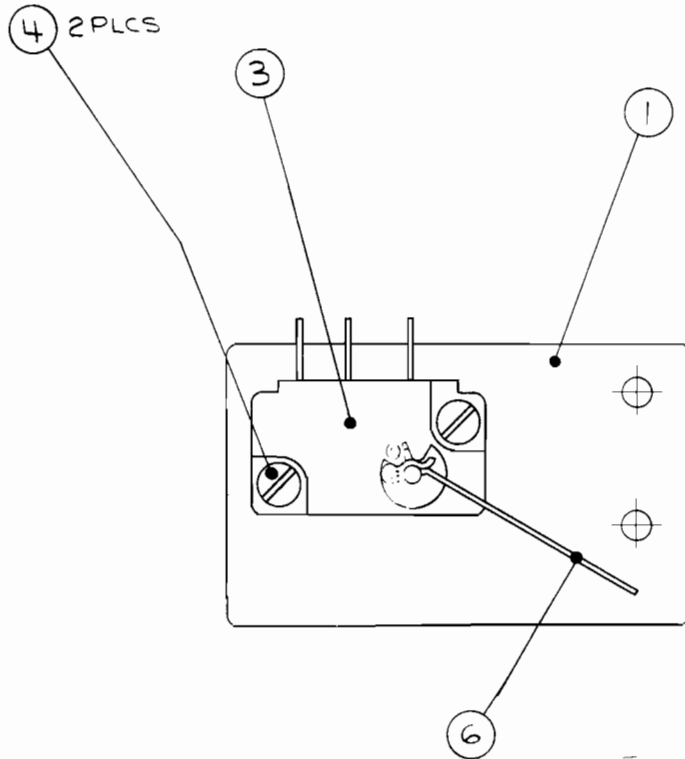
Detail of Relay Coil (A007639-01)



COIL DATA	
VOLTAGE	10 VDC $\pm 2$
RES	50 $\Omega$
CURRENT	200 ma MAX

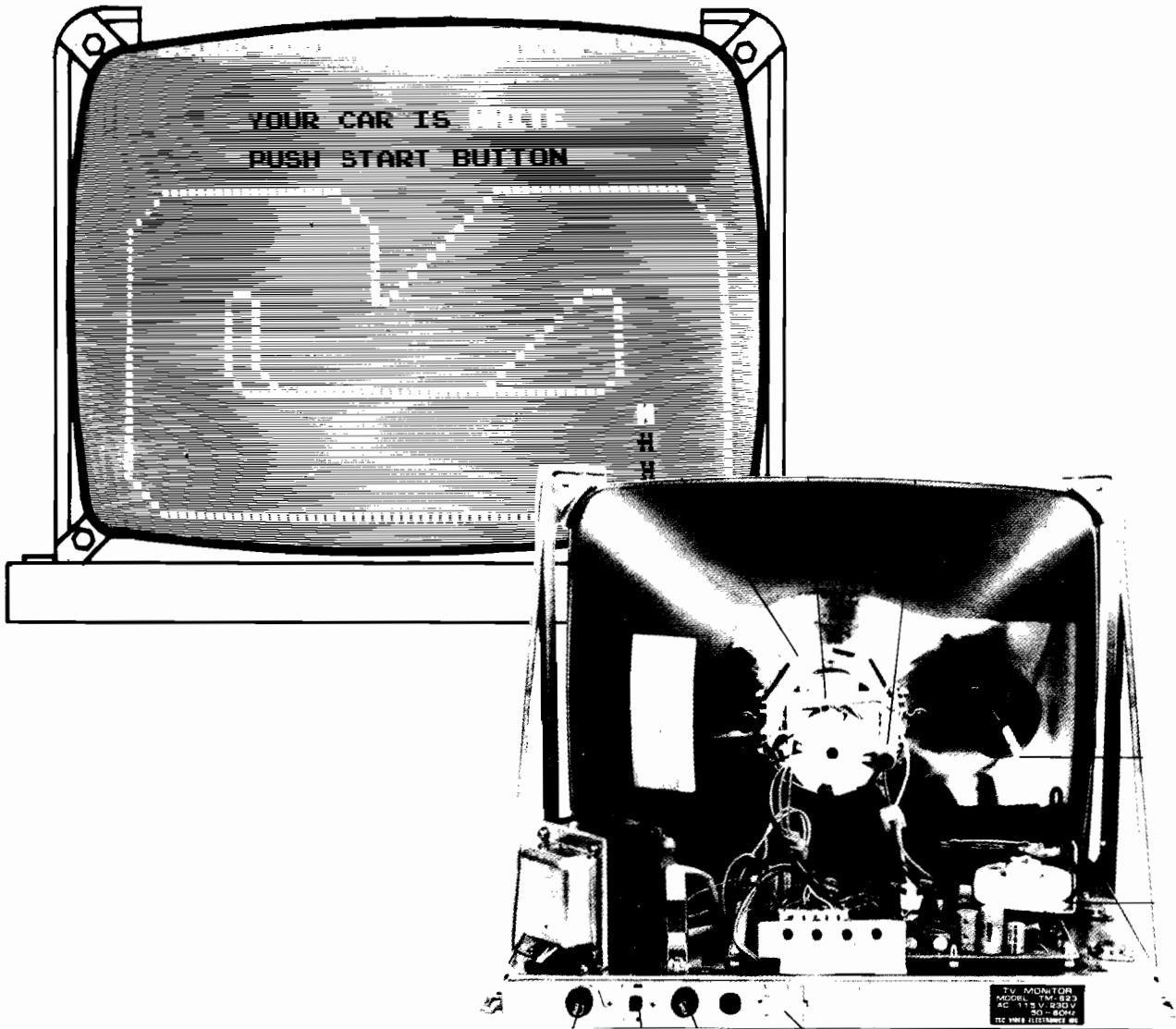
Figure 5-15 Coin Lockout Assembly  
 A030362-01 A

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ITEM	PART NO.	DESCRIPTION	QTY
1	004542-01	SWITCH MTG PLATE	1
2			
3	65-441C	SWITCH, OMRON C-5G3-3	1
4	72-HA 4412	SCR, MS, #4-40 x 3/4, <sup>ROLL TIGHT</sup> SELF TAPPING	2
5			
6	008824-01	WIREFORM, CHERRY	1

Figure 5-16 Coin Switch Assembly  
 A007640-01 D

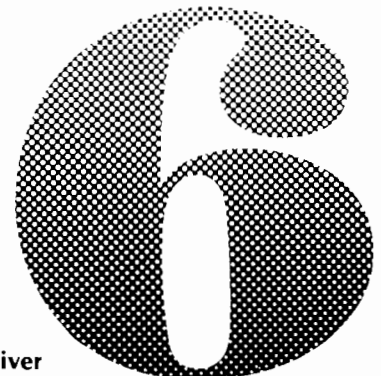


## TV MONITOR SERVICING INFORMATION

This chapter provides servicing information taken from the Motorola and TEC service manuals. Each manual has been reprinted by permission of the respective monitor manufacturer.

Your game will include either the Motorola or TEC monitor, depending on their availability during production.

Skydiver





# MOTOROLA

## Service Manual

**CAUTION**

No work should be attempted on any exposed monitor chassis by anyone not familiar with servicing procedures and precautions.

### A. GENERAL INFORMATION

This manual contains information on the M5000/M7000 monitor series and the +5 volt logic power supply. The M5000 uses a 19-inch CRT and the M7000 uses a 23-inch CRT. All CRTs are of the magnetic deflection type with integral implosion protection.

All monitor power supplies are capable of producing both +73 and +12 volts regulated from either 115-volt or 230-volt AC input to the transformer primary. All monitor variations described herein require a composite video input signal.

**Note**

This service manual refers to the Sky Raider Monitor only

Input and output connections for the monitors are made through a 12-pin connector plug located at the rear of the chassis. Inputs consist of composite video, audio, and 115/220 volt AC three-wire.

All monitors employ: four stages of video amplification, a two-stage sync separator, a two-stage vertical integrator, a four-stage horizontal sweep circuit, a three-stage vertical sweep circuit, a one-stage spot kill, a one stage blanking amplifier; and a regulated, full-wave bridge power supply.

**Model Breakdown Chart**

Model	Video Input	19" CRT	23" CRT
M5000-155	Composite	X	
M7000-155	Composite		X

**SAFETY WARNING**

**CAUTION**

No work should be attempted on an exposed monitor chassis by anyone not familiar with servicing procedures and precautions.

1. Safety procedures should be developed by habit so that technicians rushed with repair work automatically take precautions.
2. A good practice, when working on any unit, is to first ground the chassis and to use only one hand when testing circuitry. This will avoid the possibility of carelessly putting one hand on chassis or ground and the other on an electrical connection which could cause a severe electrical shock.
3. Extreme care should be used in *handling the picture tube* as rough handling may cause it to implode due to atmospheric pressure (14.7 lbs. per sq. in.). Do not nick or scratch glass or subject it to any undue pressure in removal or installation.

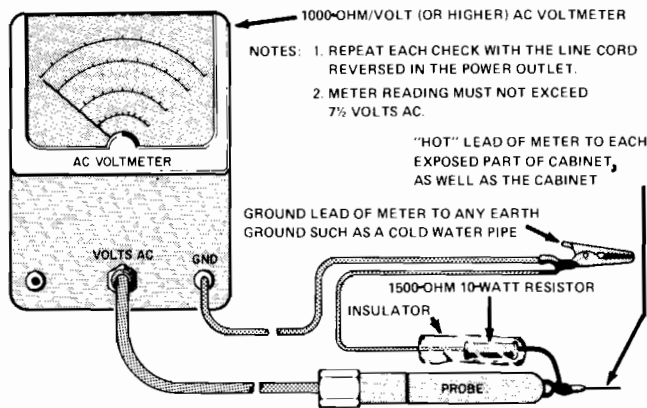
When handling, safety goggles and heavy gloves should be worn for protection. Discharge picture tube by shorting the anode connection to chassis ground (not cabinet or other mounting parts). When discharging, go from ground to anode or use a well-insulated piece of wire. When servicing or repairing the monitor, if the cathode ray tube is replaced by a type of tube other than that specified under the Motorola Part Number as original equipment in this Service Manual, then avoid prolonged exposure at close range to unshielded areas of the cathode ray tube. Possible danger of personal injury from unnecessary exposure to X-ray radiation may result.

4. An *isolation transformer* should always be used during the servicing of a unit whose chassis is connected to one side of the power line. Use a transformer of adequate power rating as this protects the serviceman from accidents resulting in personal injury from electrical shocks. It will also protect the chassis and its components from being



damaged by accidental shorts of the circuitry that may be inadvertently introduced during the service operation.

5. Always *replace protective devices*, such as fishpaper, isolation resistors and capacitors and shields after working on the unit.
6. *Before returning a serviced unit*, the service technician must thoroughly test the unit to be certain that it is completely safe to operate without danger of electrical shock. *Do not use a line isolation transformer when making this test.*



**Voltmeter Hook-up for Safety Check**

In addition to practicing the basic and fundamental electrical safety rules, the following test, which is related to the minimum safety requirements of the Underwriters Laboratories, should be performed by the service technician before any unit which has been serviced is installed in a game again.

A 1000-ohm-per-volt AC voltmeter is prepared by shunting it with a 1500-ohm, 10-watt resistor. The safety test is made by contacting one meter probe to any portion of the unit exposed to the operator such as the cabinet trim, hardware, controls, knobs, etc., while the other probe is held in contact with a good "earth" ground such as a cold water pipe.

The AC voltage indicated by the meter must not exceed 7½ volts. A reading exceeding 7½ volts indicates that a potentially dangerous leakage path exists between the exposed portion of the unit and earth ground. Such a unit represents a potentially serious shock hazard to the operator.

The above test should be repeated with the power plug reversed, when applicable.

*Never reinstall a monitor which does not pass the safety test until the fault has been located and corrected.*

**Table 6-1 Motorola Monitor Electrical Specifications**

	MODEL M5000-155	MODEL M7000-155
PICTURE TUBE	19" measured diagonally (48.2 cm); 184 sq. inch viewing area (1188 sq. cm); 114° deflection angle; integral implosion protection; P4 phosphor standard	23" measured diagonally (58.4 cm); 282 sq. inch viewing area (1820 sq. cm); 110° deflection angle; integral implosion protection; P4 phosphor standard
POWER INPUT	115/230 VAC, 110 Watts (nominal); 60 Hz provision for 230 VAC, 50 Hz	
FUSES	M5000-155, M7000-155—0.8A	
+73 VOLT SUPPLY	Electronically regulated over AC inputs from 103 VAC to 130 VAC, or 260 VAC to 260 VAC	
VIDEO INPUT	0.5 Volts to 2.5 Volts P/P maximum, composite for 50V at CRT	
RESOLUTION	500 lines at picture center	
LINEARITY	Within 3%, measured with standard EIA ball chart and dot pattern	

**Table 6-1 Motorola Monitor Electrical Specifications**

HIGH VOLTAGE	17KV (nominal)	
HORIZONTAL BLANKING INTERVAL	11 microseconds typical (includes retrace and delay)	
SCANNING FREQUENCY	Horizontal: 15,750 Hz±500 Hz; Vertical: 50/60 Hz	
ENVIRONMENT	Operating temperature: 10°C to 55°C (ambient) Storage Temperature: -40°C to +65°C Operating Altitude: 10,000 ft. maximum (3048 meters) Designed to comply with applicable DHEW rules on X-Radiation CSA certified for use in coin-operated amusements in a combustible enclosure UL listed under specification 1410 (electronic components)	
TYPICAL DIMENSIONS	14.11" H, 18.18" W, 14.83" D (35.8 x 46 x 37.6 cm)	16.72" H, 21.56" W, 16.18" D (42.4 x 54.7 x 41 cm)

*Specifications subject to change without notice.*

**B. SERVICE NOTES**

**Circuit Tracing**

Component reference numbers are printed on the top and bottom of the three circuit cards to facilitate circuit tracing. In addition, control names are also shown and referenced on the schematic diagram in this manual.

Transistor elements are identified as follows:  
 E—Emitter, B—Base, C—Collector.

**Component Removal**

Removing components from an etched circuit card is facilitated by the fact that the circuitry (copper foil) appears on one side of the circuit card only and the component leads are inserted straight through the holes and are not bent or crimped.

It is recommended that a solder extracting gun be used to aid in component removal. An iron with a temperature-controlled heating element would be desirable since it would reduce the possibility of damaging the circuit card foil due to over-heating.

The nozzle of the solder extracting gun is inserted directly over the component lead and when sufficiently heated, the solder is drawn away, leaving the lead free from the copper foil. This method is particularly suitable in removing multi-terminal components.

**CRT Replacement**

Use extreme care in handling the CRT, as rough handling may cause it to implode due to high vacuum pressure. Do not nick or scratch glass or subject it to any undue pressure in removal or installation. Use goggles and heavy gloves for protection. In addition, be sure to disconnect the monitor from all external voltage sources.

1. Discharge CRT by shorting 2nd anode to ground; then remove the CRT socket, deflection yoke and 2nd anode lead.
2. Remove CRT from the front of the chassis by loosening and removing four screws, one in each corner of the CRT.

**Adjustments**

A non-metallic tool is recommended when performing the following adjustments.

**Regulator Adjustment**

**NOTE**

Misadjustment of the +73 volt regulator or the horizontal oscillator may result in damage to the horizontal output transistor or pulse-limiter diode. The following procedure is recommended to insure reliable operation.

1. Connect the monitor to an AC line supply; then adjust supply to 120 volts (240 volts in some applications).
  2. Apply test signal to proper input. Signal should be of same amplitude and sync rate as when monitor is in service.
  3. Adjust HOR. SET coil L1 until display is stable.
  4. Connect a DC digital voltmeter or equivalent precision voltmeter to the emitter of the regulator output transistor, Q17, or any +73 volt test point.
  5. Adjust the 73V ADJUST. control, R93, for an output of +73 volts. *Do not* rotate the control through its entire range; damage to the monitor may result.
  6. When adjustment is complete, the AC line supply can be varied between 103 and 130 volts AC to check for proper regulator operation. With the regulator operating properly, changes in display size should be negligible.
2. Rotate the vertical size control, R60, until the smallest display is obtained.
  3. Adjust the vertical linearity control, R64, until the top and bottom of the test pattern is equally spaced.
  4. Readjust R60 until the desired display height is obtained.
  5. Readjust R64, if necessary, as in Step 2 above.

#### Focus Adjustment

The best overall focus of the display is obtained by adjusting the focus control, R42, for best focus at a point which is near the center and approximately 1/3 down from the top of the display.

#### Monitor Servicing

The monitor circuit board may be installed in a service position to provide easier access to the circuit foil when servicing the monitor (see Figure 6-1).

### C. THEORY OF OPERATION

#### Power Supply

The power supplies are transformer-operated, full-wave, regulated supplies which maintain constant output voltages for input line variations of 103 volts AC to 130 volts AC, or 206 volts AC to 260 volts AC. Regulation of the output voltages is accomplished by using positive feedback through the integrated circuit reference amplifier.

#### +73 Volt Supply (See Figures 6-3, 6-4)

When the +73 volt supply attempts to increase, the voltage at pin 3 of IC1 will increase, while the voltage at pin 2 remains constant due to D20. The increasing voltage at pin 3 will cause the output voltage of the reference amplifier (pin 6) to increase the forward bias of Q19. The collector voltage of Q19, forward bias of Q18, and the base current of Q17 will all decrease. The resultant proportional increase of Q17 collector-to-emitter voltage will cancel the attempted output voltage increase.

When the +73 volt supply bus attempts to decrease; the voltage at pin 3 of IC1 will decrease while the voltage at pin 2 remains constant. The decreasing voltage at pin 3 will cause the reference amplifier output voltage at pin 6 to decrease the forward bias of Q19. The collector voltage of Q19, the forward bias of Q18 and the base current of Q17 will increase. The collector-to-emitter voltage of Q17, which is in series

#### Horizontal Hold/Oscillator Adjustment

Adjust the core of HOR. SET coil L1 until the horizontal blanking lines are vertical or the CRT display is stable (synced).

#### Vertical Height/Linearity Adjustment

1. Connect a test generator whose output is similar to the display signal normally used.

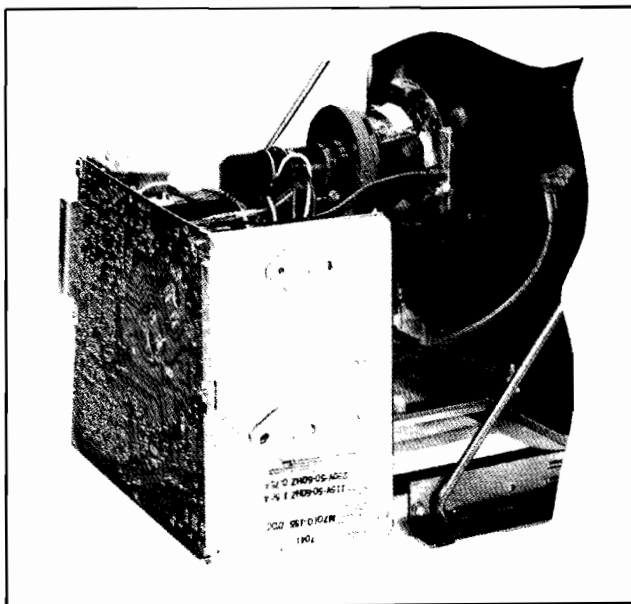


Figure 6-1 Motorola Monitor Circuit Board in Service Position

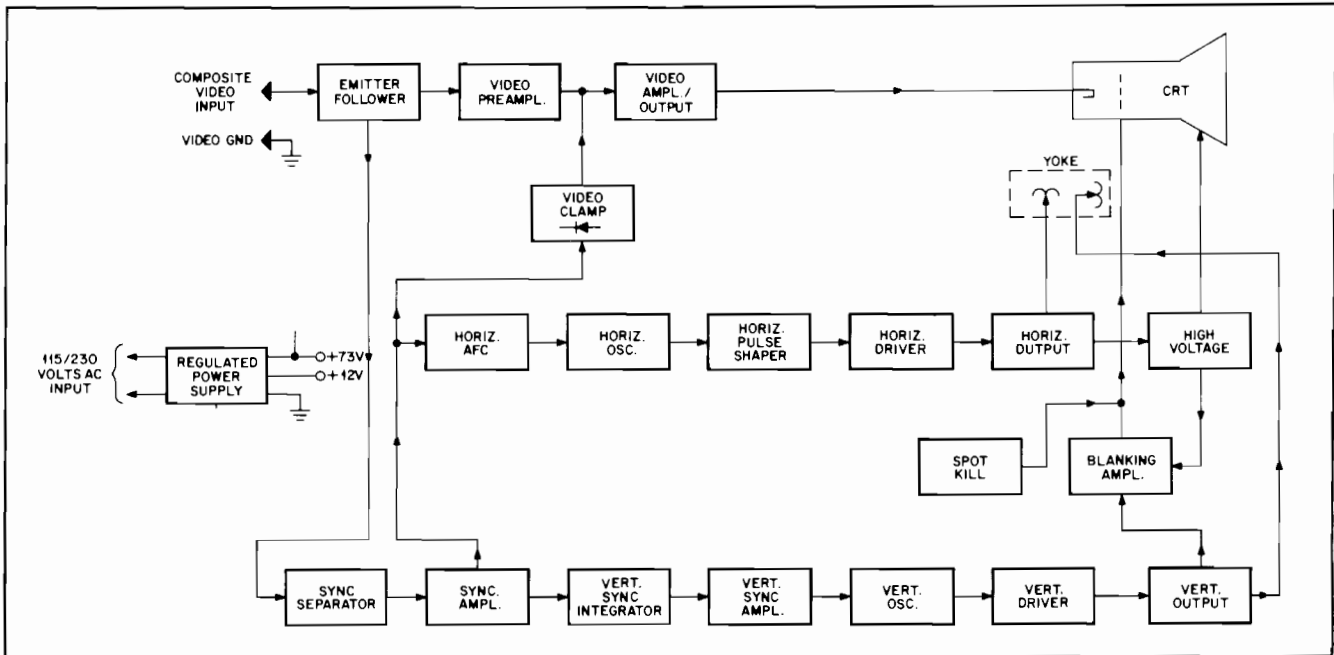


Figure 6-2 Motorola Monitor Block Diagram

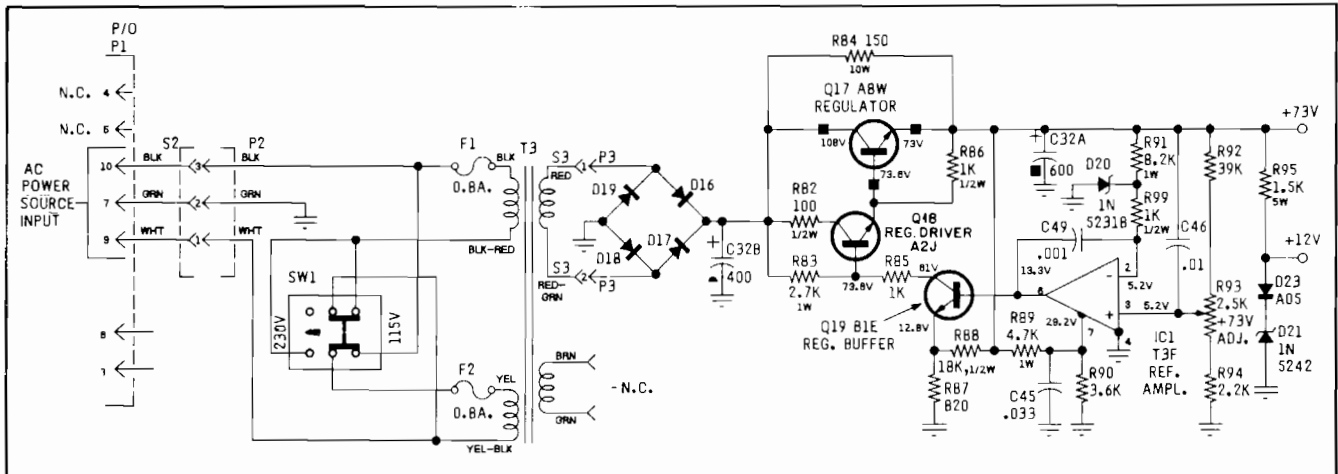


Figure 6-3 +73 Volt Supply Circuit

with the output, will decrease proportionally to the attempted decrease in the output bus.

Resistor R84 shunts a portion of the output current around Q17 so less power is dissipated within the device. Resistor R82 is the current-limiting resistor for Q18, and R86 controls the leakage current of Q17. Resistors R83 and R85 are the collector load for Q19, and R88 and R87 provide an emitter voltage for Q19 within the range of IC1's output voltage variations. Capacitor C45 filters high frequency variations from the voltage at pin 7 of IC1, and C49 is a Miller-effect capacitor which eliminates instability.

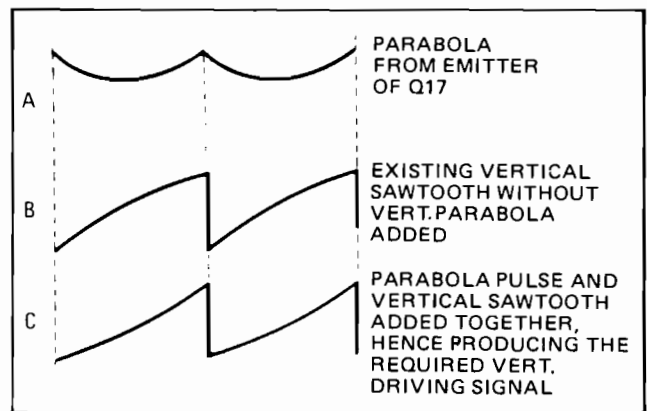
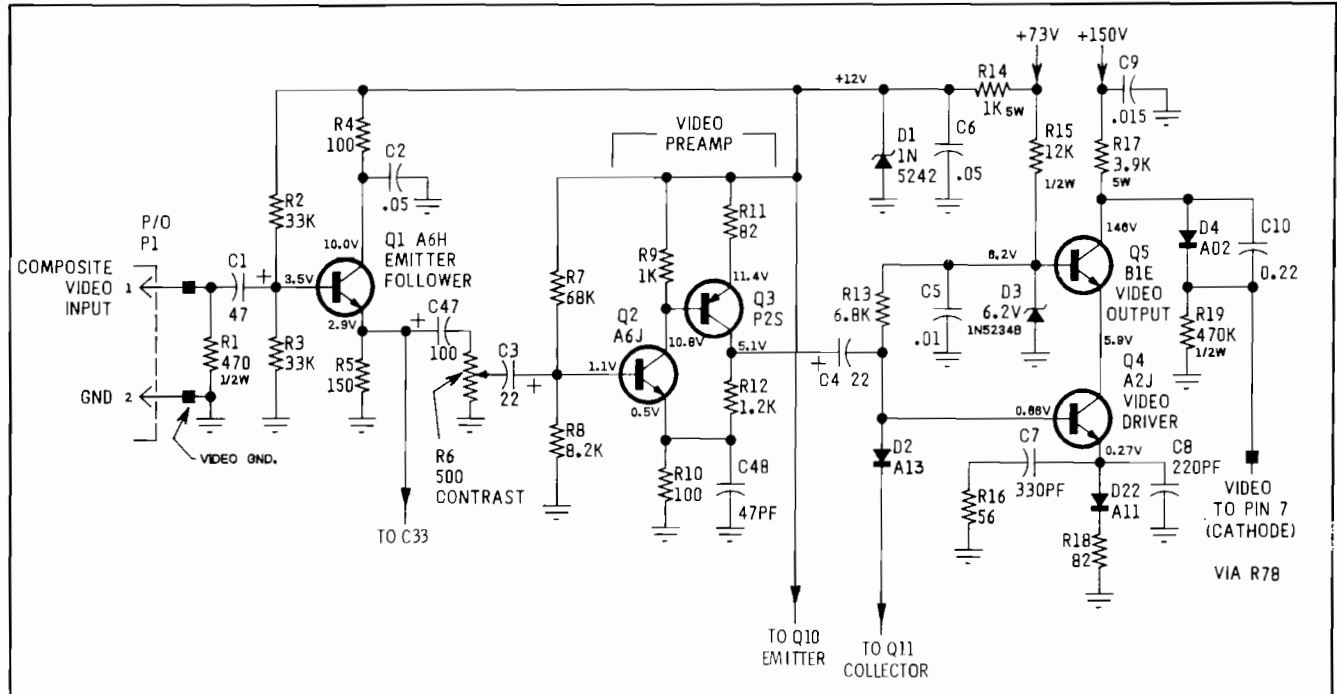


Figure 6-4 Motorola Monitor Vertical Drive Waveform





**Figure 6-5 Motorola Monitor Video Amplifiers and Output Circuit**

Capacitor C32A filters horizontal frequency variations from the output bus.

Resistor R91 provides bias current for D20, and the value of R99 presents an impedance from pin 2 of IC1 to AC ground (through D20). Capacitor C46 couples high frequency voltage variations, which occur at the output bus, back to pin 3—preventing oscillations for proper operation of the reference amplifier. Resistors R92, R93, and R94 provide voltage division such that the adjustment of R93 can be set equal to the voltage of pin 2 of IC1. Resistor R95 provides bias current for D21 and also provides the +12 volt output. Diode D23 is necessary to temperature-compensate for variations within D21. Capacitor C32B filters AC variations from the output of the full-wave bridge.

### Video Amplifiers and Output (See Figure 6-5)

The composite video signal is coupled to the emitter-follower Q1 through the input connector P1 and capacitor C1. Transistor Q1 is a buffer stage which matches the impedance of the signal source to the video preamplifier and the sync separator stages. Resistor R1 is a terminating resistor for the video signal source, and resistors R2, R3, R4, and R5 form the biasing network for the stage. Capacitor C2 bypasses higher video frequencies to ground. The

composite video signal is coupled from the emitter of Q1 to the sync separator Q10 through C33 and to the contrast control R6 through C47.

The contrast control varies the amplitude and couples the composite video signal to the base of Q2 through capacitor C3. Transistors Q2 and Q3 are complimentary, direct-coupled, common emitter amplifiers. The voltage gain (approximately 12) of the preamplifier stage is controlled by the feedback arrangement of R9, R10, R11, and R12. Resistors R7 and R8 provide the base bias voltage for Q2. Capacitor C48 is used for high-frequency peaking.

The output of the video preamplifier stage is coupled to the video output stage through capacitor C4. Diode D2 clamps the video signal to approximately +0.7 volts (DC restoration) when a sync pulse turns on the sync amplifier Q11. The video output stage is connected in a cascade configuration. Transistor Q4 is a common emitter amplifier and Q5 is connected in a common base arrangement. Capacitors C7, C8, and resistor R16 are used for high-frequency compensation, and resistor R18 controls the gain of the stage to approximately 47. Diode D3 maintains the base of Q5 at +6.2 volts, while capacitor C5 filters the video signal variations from the base voltage. Resistor R13 provides a DC bias path for D2, and R19 and D4 are used to limit the current through the CRT.

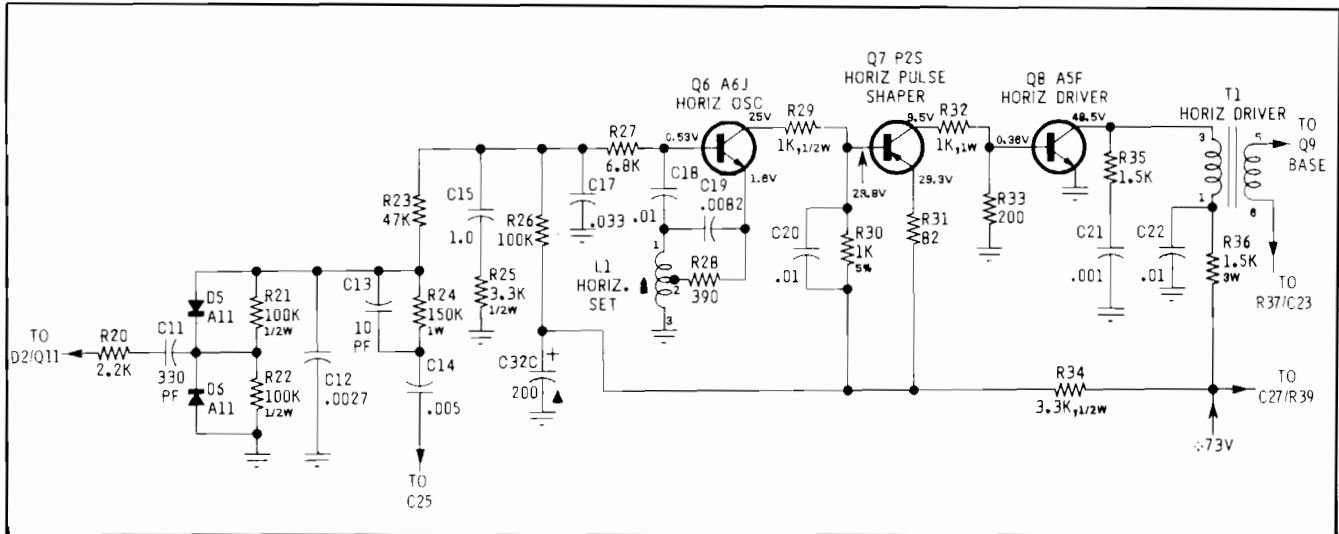


Figure 6-6 Motorola Monitor Horizontal Deflection Circuit

Capacitor C10 AC-couples the video from the collector of Q5 to the cathode of the CRT if D4 turns off due to high beam currents. Resistor R17 is the collector load for Q5, and R15 provides the bias current for the zener diode D3. Capacitors C9 and C6 filter video frequencies from the +150 volt and +12 volt supplies. Resistor R14 and zener diode D1 are used to supply +12 volts for Q1, Q2, and Q3.

## D. HORIZONTAL DEFLECTION CIRCUITS (See Figure 6-6)

### Phase Detector (See Figure 6-7)

The phase detector consists of two diodes (D5 and D6) in a keyed clamp circuit. Two inputs are required to generate the required output, one from the horizontal sync amplifier, Q11, and one from the horizontal output circuit, Q9. The required output must be of the proper polarity and amplitude to correct phase differences between the input horizontal sync pulses and the horizontal time base.

The horizontal output (Q9) collector pulse is integrated into a sawtooth by R24 and C12. During horizontal sync time, diodes D5 and D6 conduct, which shorts C12 to ground. This effectively clamps the sawtooth on C12 to ground at sync time. If the horizontal time base is in phase with the sync (waveform A), the sync pulse will occur when the sawtooth is passing through its AC axis, and the net charge on C12 will be zero (waveform B). If the horizontal time base is lagging the sync, the sawtooth on C12 will be clamped to ground at a point negative from the AC axis. This will result in a positive DC charge on C12 (waveform C). The positive polarity

causes the horizontal oscillator to speed up and correct the phase lag. Likewise, if the horizontal time base is leading the sync, the sawtooth on C12 will be clamped at a point positive from its AC axis. This results in a net negative charge on C12 which is the required polarity to slow the horizontal oscillator (waveform D).

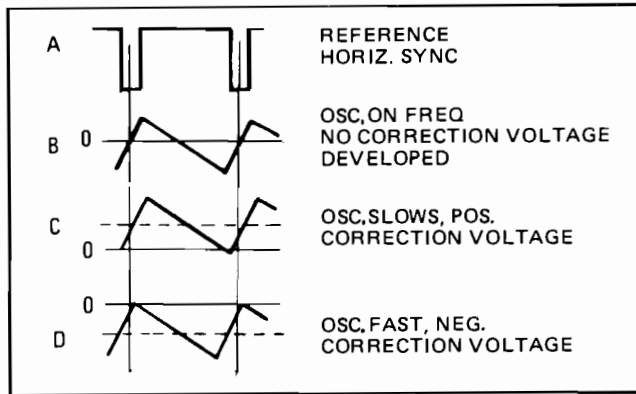
Components R23, C15, R25 and C17 comprise the phase detector filter. The bandpass of this filter is chosen to provide correction of horizontal oscillator phase without ringing or hunting. Capacitor C13 times the phase detector for correct centering of the picture on the raster.

### Horizontal Oscillator

The horizontal oscillator employs the principles of the Hartley-type oscillator. Its operating frequency is sensitive to its DC base input voltage, thus permitting the frequency of the oscillator to be varied by the output voltage of the phase detector. The main frequency-determining components are L1, C19, and R28. The oscillator operates as a switch being biased alternately into saturation and cut-off. The initial forward starting bias is supplied via R26.

### Horizontal Pulse Shaper and Driver

The horizontal pulse shaper Q7 serves as a buffer stage between the horizontal oscillator and driver. Capacitor C20 and resistor R30 combine to shape the input waveform to the required duty cycle of 50%, which is necessary to drive the horizontal output stage.



**Figure 6-7 Motorola Monitor Horizontal Deflection Waveforms**

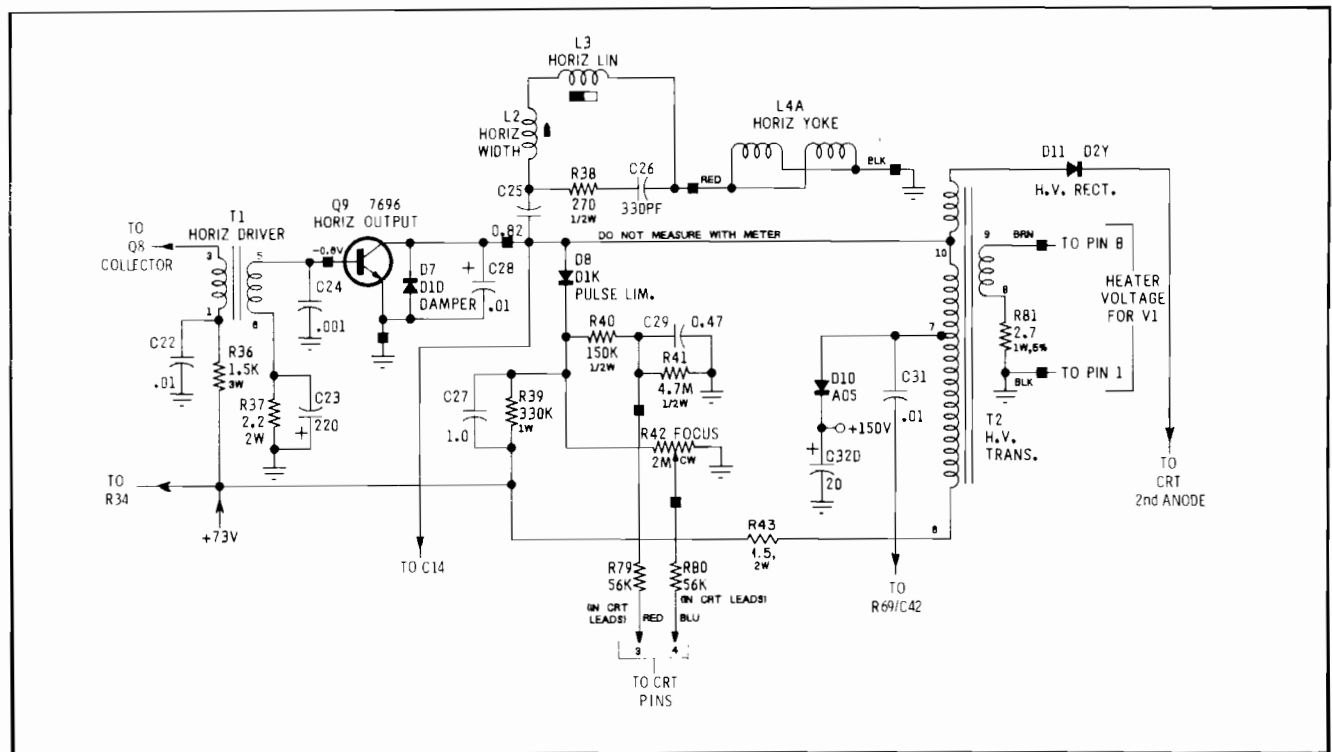
The horizontal driver Q8 operates as a switch to driving horizontal output transistor Q9 through T1. Because of the low impedance drive and fast switching times, very little power is dissipated in Q8.

Resistor R35 and capacitor C21 provide damping to suppress ringing in the primary of T1 when Q8 goes into cut-off. Resistor R36 is used for limiting current in the collector of Q8, and C22 filters the horizontal frequency variations from the DC side of the transformer primary.

### Horizontal Output (See Figure 6-8)

The secondary of T1 provides the required low drive impedance for Q9. Resistor R37 limits current in the base of Q9, while capacitor C23 provides additional reverse bias to keep Q9 turned off during the horizontal retrace pulse. Transistor Q9 operates as a switch which once each horizontal time period connects the supply voltage across the parallel combination of the horizontal deflection yoke and the primary of T2. The required sawtooth deflection current through the horizontal yoke is formed by the L-R time constant of the yoke and output transformer primary. The horizontal retrace pulse charges C27 through D8 to provide operating voltage for G2 of the CRT. Momentary transients at the collector of Q9, should they occur, are limited to the voltage on C27, since D8 will conduct if the collector voltage exceeds this value.

The damper diode D7 conducts during the period between retrace and turn-on of Q9 to reduce retrace overshoot; capacitor C28 is the retrace tuning capacitor. Capacitor C25 blocks DC from deflection yoke. Components R38 and C26 are damping components for the width and linearity coils. Capacitor C32D is charged through D10, developing the video output supply voltage.



**Figure 6-8 Motorola Monitor Horizontal Output Circuit**

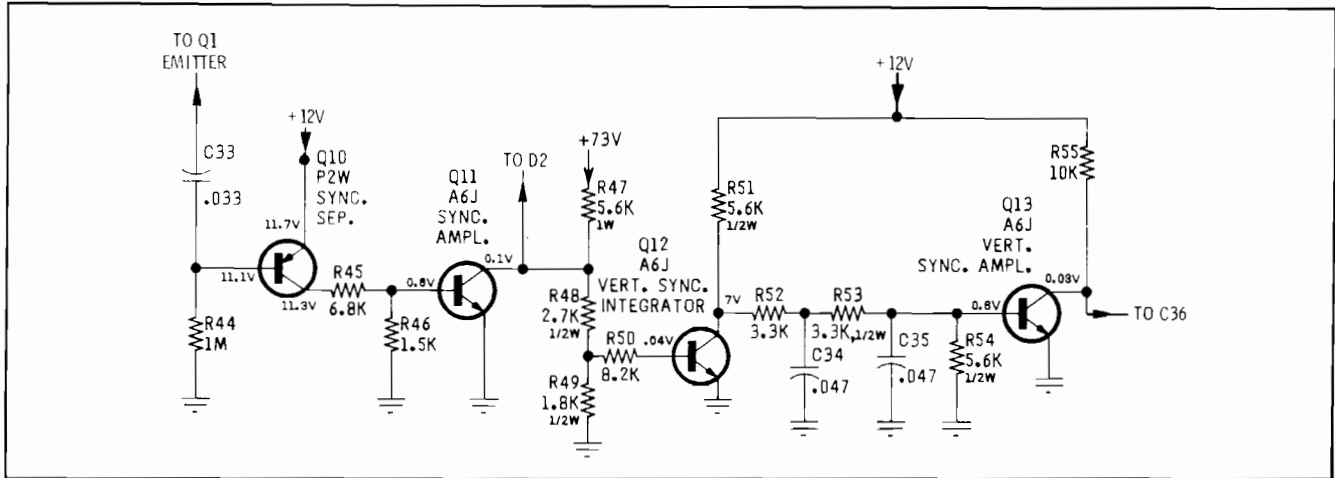


Figure 6-9 Motorola Monitor Sync Circuit

### Sync Circuits (See Figure 6-9)

The video signal is coupled from the emitter of Q1 to the base of Q10 through C33. The negative-going sync tips turn on Q10 and are clamped to the value of the base voltage due to the base-emitter diode junction. The video information within the composite video signal, however, is less negative and Q10 remains off between each sync tip. Therefore, the waveform at the collector of Q10 will contain only the composite sync pulse information.

Resistors R45 and R46 provide base bias for Q11. The composite sync pulses are amplified and inverted by Q11 where they are coupled to the vertical sync

integrator Q12, the horizontal phase detector, and the video clamp diode D2. Resistors R47, R48, and R49, are the collector load for Q11, and also provide base bias for Q12. Resistor R50 limits current through the base-emitter junction of Q12, and R51 is its collector load. Components R52, C34, R53, C35, and R54 form a double integrator which removes the horizontal pulses from the composite sync signal, leaving the vertical pulses to be amplified by Q13 and coupled to the vertical oscillator.

### Vertical Oscillator and Output (See Figure 6-10)

The vertical oscillator is a relaxation oscillator and operates at a free-running frequency that is set by

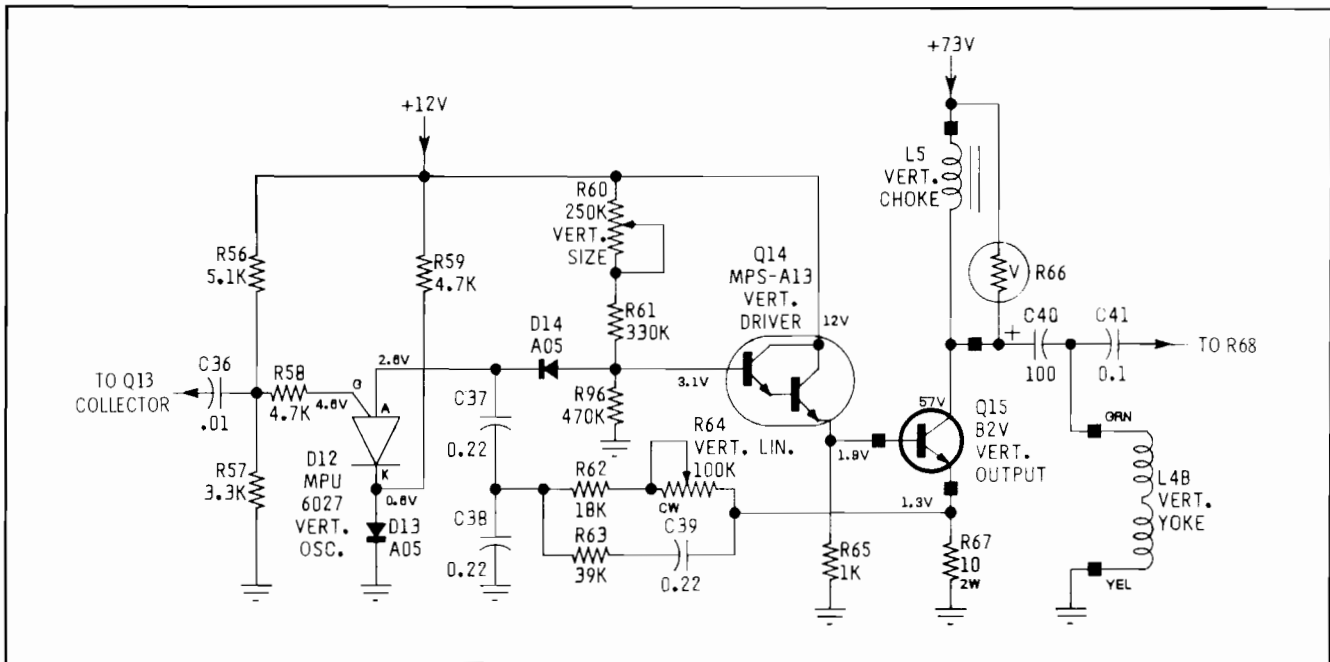


Figure 6-10 Motorola Monitor Vertical Oscillator Circuit

the value of resistors R56 and R57. The series combination of C37 and C38 charges through D14, R61, and R60, until D12 turns on. This occurs when the anode voltage of D12 exceeds the gate voltage by approximately 1.0 volt. When D12 conducts, C37 and C38 are discharged to nearly zero volts; then D12 turns off and the cycle repeats. The value of R61 and the setting of R60 determines the amplitude of the waveform.

Diode D14 provides a small incremental voltage above ground to overcome the forward base-emitter drop of Q14; D13 provides temperature compensation for the output stage. Resistor R96 provides a constant oscillator load for variations in input impedance of Q14. Transistor Q14 is an emitter-follower used to transform the high impedance drive sawtooth to a low impedance drive for Q15.

The vertical choke L5 acts as a current source during linear scan time and provides a high-voltage pulse to aid retrace when Q15 shuts off. To limit this pulse to a safe value, a varistor, R66, is connected across the choke.

Since the impedance of the choke decreases when the collector current of Q15 increases, severe vertical non-linearity will result unless some compensation is employed.

Resistors R64 and R62 couple the emitter voltage of Q15 to the junction of C37 and C38. This path is resistive, and the waveform coupled back will be integrated by C38. This results in a pre-distortion of the drive sawtooth. This is done to compensate for the non-linear charging of C37, C38 and the changing impedance of C5. An additional feedback path through R63 and C39 serves to optimize the drive waveshape for best linearity. Capacitor C40 couples the signal to the vertical yoke winding and blocks DC.

### Spot Kill (See Figure 6-11)

The spot kill circuitry is used to reduce the effect of the electron beam concentrating on one area of the CRT after the monitor is turned off. The circuitry is accomplished by raising the arm of potentiometer R73 to the +150 volt level and, therefore, increasing the brightness to maximum to dissipate the high-voltage charge that normally remains in the CRT.

When the monitor is operating, transistor Q20 is on and its collector is near zero volts. Capacitor C44 charges through the base-emitter junction of Q20 and R97. Resistor R72 provides the base bias voltage required to keep Q20 on. When the monitor is turned

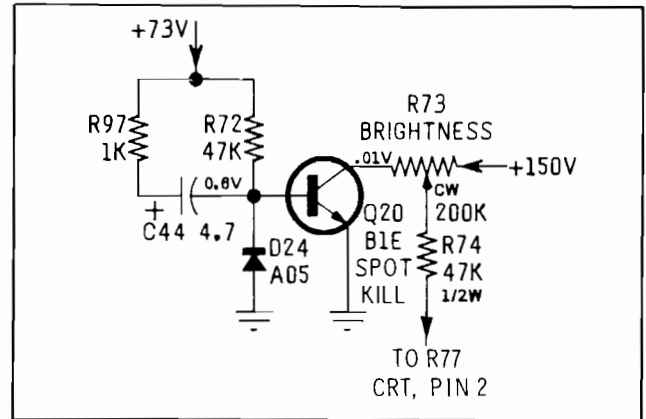


Figure 6-11 Motorola Monitor Spot Killer Circuit

off, the falling +73 volts is coupled to the base of Q20 to turn off the transistor causing its collector voltage to rise to approximately +150 volts. Diode D24 prevents the negative voltage swing at the base of Q20 from exceeding the reverse voltage rating of the transistor.

### Blanking Amplifier (see Figure 6-12)

The blanking amplifier combines both the vertical and horizontal retrace pulses to turn off the electron beam in the CRT once every horizontal line and once every vertical field.

Capacitor C41 couples the vertical retrace pulses and capacitor C31 couples the horizontal retrace pulses to the blanking amplifier. Resistor R68 determines the amplitude of the vertical pulses, while R69 determines the amplitude of the horizontal pulses. Capacitor C42 bypasses R69 to couple the leading and trailing edges of the horizontal retrace pulses to the amplifier. Resistor R70 allows C41 to discharge when the retrace pulses swing below zero volts. Diode D15 prevents the retrace overshoot from exceeding the reverse voltage rating of Q20. Resistor R71 permits Q20 to turn off between retrace pulses, while R75 and R76 provide the collector voltage for Q20. Capacitor C43 couples the blanking pulses to the control grid of the CRT.

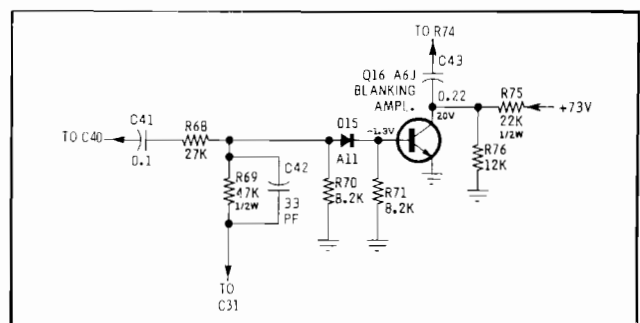


Figure 6-12 Motorola Monitor Blanking Amplifier Circuit

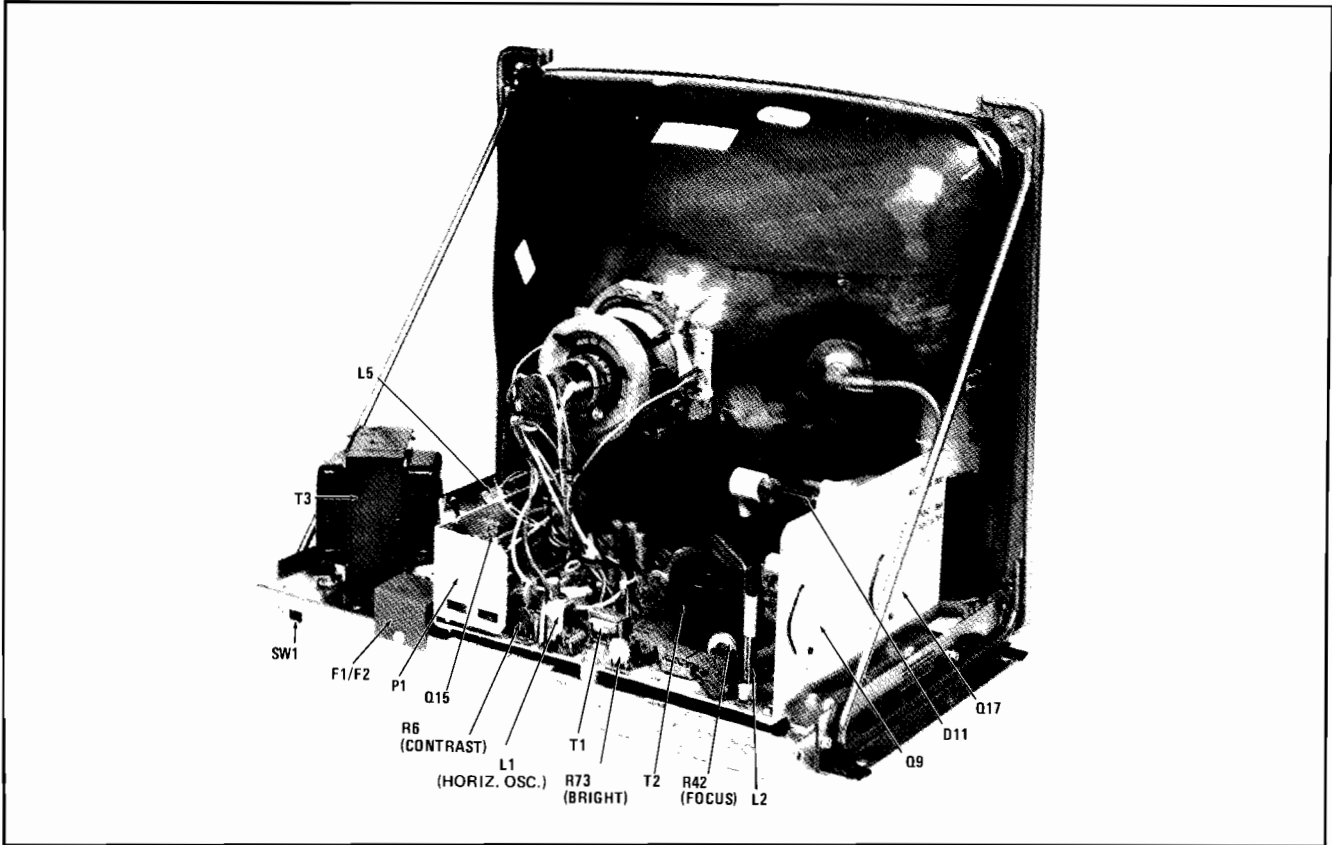


Figure 6-13 Motorola Monitor Chassis Rear View —Component Location

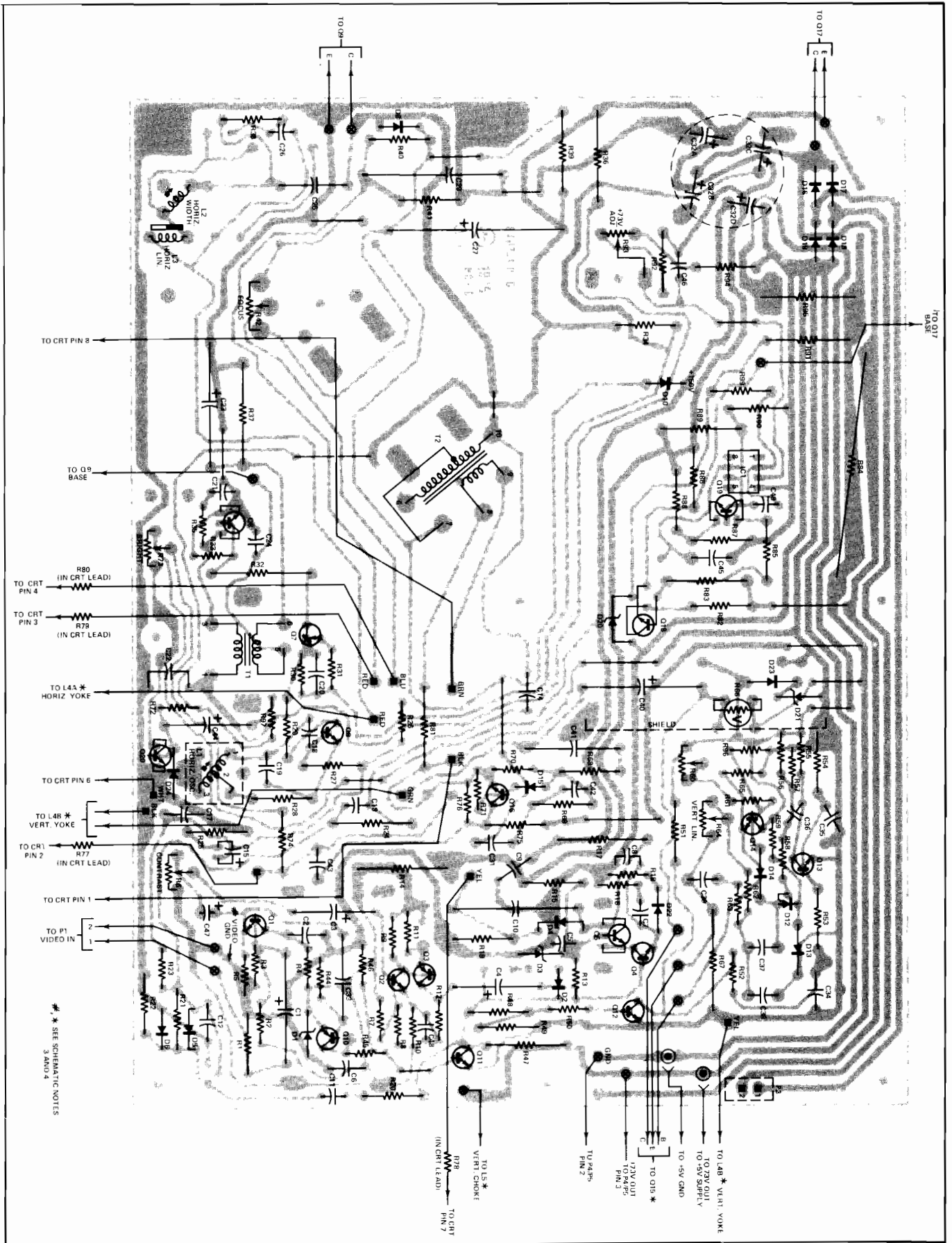


Figure 6-14 Motorola Monitor Circuit Board Detail—Solder View

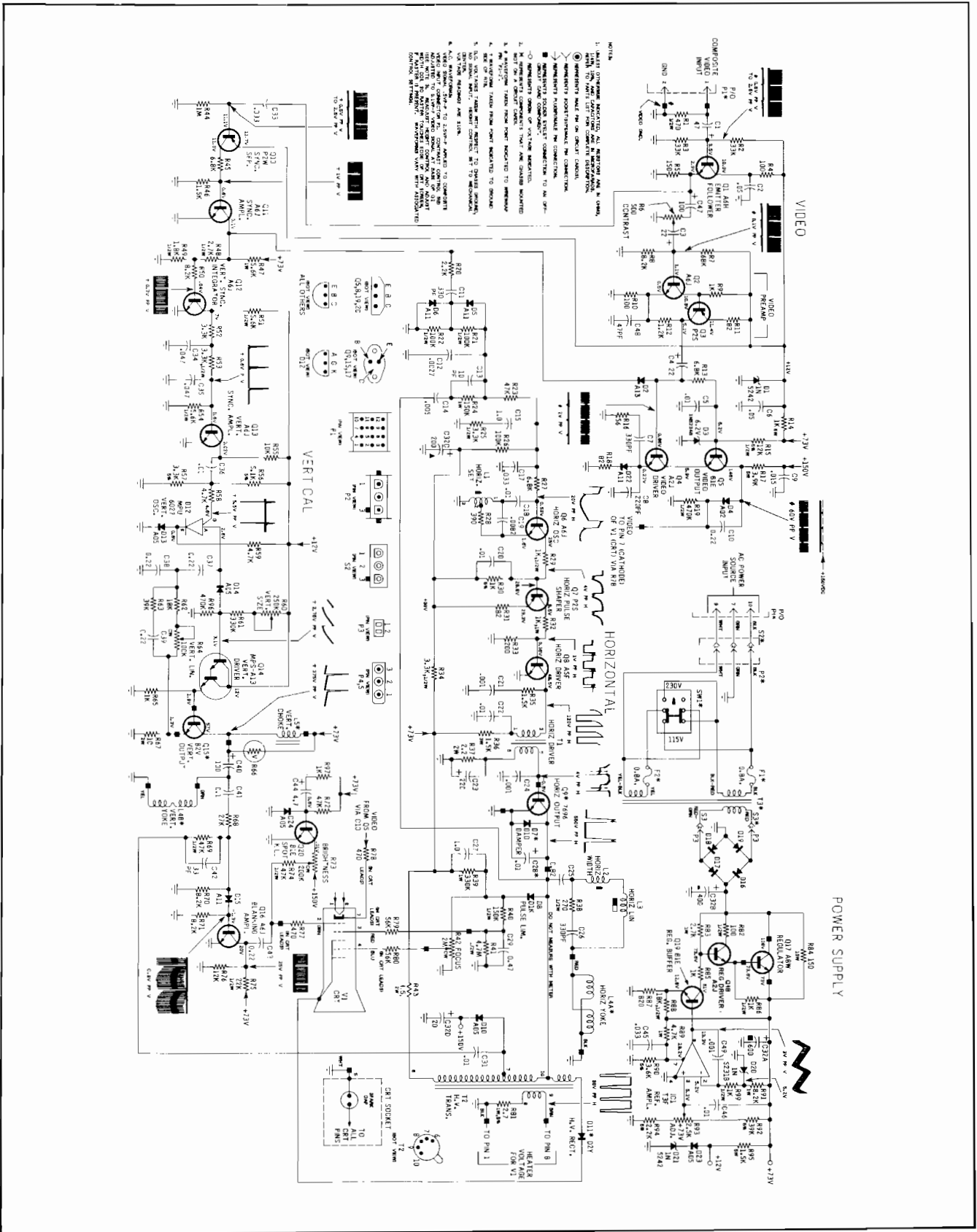


Figure 6-15 Motorola Monitor Schematic Diagram





**Table 6-2 Motorola Replacement Part Numbers**

REF. NO.	PART NUMBER	DESCRIPTION	REF. NO.	PART NUMBER	DESCRIPTION
<b>Capacitors:</b>			C31	8S10191B98	.01, 10%, 250V; Poly.
All values are in Microfarads unless otherwise noted.			C32	23S10255B73	20/200, 400/125, 600/100, 200/50; Lytic
C1	23S10255A27	47, 50V; Lytic	C33	8S10191A51	.033, 10%, 160V; Poly.
C2	21S135660	.05, +80-20, Z5V, 50V; Cer. Disc.	C34, C35	8S10191A32	.047, 10%, 250V; Poly.
C3, C4	23S187A26	22, 25V; Lytic	C36	21S180E60	.01, +80-20, Z5V, 50V; Cer. Disc.
C5	21S180E60	.01, +80-20; Z5V, 50V; Cer. Disc.	C37, 38, 39	8S10191B67	0.22, 10%, 250V; Poly.
C6	21S135660	.05, +80-20, Z5V, 50V; Cer. Disc.	C40	23S10255A60	100, 63V; Lytic
C7	21S131625	330pf, 10%, X5F, 500V; Cer. Disc.	C41	8S10212B16	0.1, 20%, 400V; Mtlz. Poly.
C8	21S180B87	220pf, 10%, X5F, 500V; Cer. Disc.	C42	21S180C82	0.33, 10%, N150, 500V; Cer. Disc.
C9	8S10191B99	.015, 10%, 250V; Poly.	C43	8S10191B67	0.22, 10%, 250V; Poly.
C10	8S10212B18	0.22, 10%, 400V; Mtlz. Poly.	C44	23S10255B28	4.7, 100V; Lytic
C11	21S131625	330pf, 10%, X5F, 500V; Cer. Disc.	C45	8S10191B90	.033, 10%, 250V; Poly.
C12	21S180C41	.0027, 10%, Z5F, 500V; Cer. Disc.	C46	21S132492	.01, +80-20, Z5V, 100V; Cer. Disc.
C13	21S180C02	10pf, 10%, N150, 500V; Cer. Disc.	C47	23S10255B63	100, 10V; Lytic
C14	21S180D34	.005, 20%, Z5F, 1KV; Cer. Disc.	C48	21S180D56	47pf, 10%, N750, 100V; Cer. Disc.
C15	23S10229A32	1.0, 16V; Lytic	C49	21S180B51	.001, 10%, X5F, 500V; Cer. Disc.
C17	8S10191B90	.033, 10%, 250V; Poly.	<b>Diodes:</b>		
C18	8S10299B28	.01, 10%, 100V; Polycarb.	D1	48S10813A03	Diode, Silicon, Zener; IN5242
C19	8S10299B29	.0082, 10%, 100V; Polycarb.	D2	48D67120A13	Diode; A13
C20	8S10191B98	.01, 10%, 250V; Poly.	D3	48S10813A01	Diode, Silicon, Zener; IN5234B
C21	21S180B51	.001, 10%, X5F, 500V; Cer. Disc.	D4	48S191A02	Rectifier, Silicon; 91A02
C22	8S10191B98	.01, 10%, 250V; Poly.	D5, D6	48D67120A11	Diode; A11
C23	23S10255B50	150, 10V; Lytic	D7	48S134921	Diode, Damper; D1D
C24	21S180B51	.001, 10%, X5F, 500V; Cer. Disc.	D8	48S134978	Diode, Pulse Lim; D1K
C25	8S10299B27	0.82, 10%, 200V; Mtlz. Polycarb.	D10	48S191A05	Rectifier, Silicon; 91A05
C26	21S131625	330pf, 10%, X5F, 500V; Cer. Disc.	D11	48S137114	Rectifier, H.V., D2Y
C27	8S10212A11	1.0, 10%, 630V; Mtlz. Poly.	D12	48S137638	Vert. Osc.; MPU6027
C28	8S10571A06	.01, 5%, 1200V; Polyprop. Foil	D13, D14	48S191A05	Rectifier, Silicon; 91A05
C29	8S10212B53	0.47, 10%, 630V; Mtlz. Poly.	D15	48D67120A11	Diode; A11
			D16, D17, D18, D19	48S191A05	Rectifier, Silicon; 91A05
			D20	48S10813A02	Diode, Silicon, Zener; 1N5231B
			D21	48S10813A03	Diode, Silicon, Zener; 1N5242
			D22	48D67120A11	Diode; A11
			D23, D24	48S191A05	Rectifier, Silicon; 91A05

**Table 6-2 Motorola Replacement Part Numbers**

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
<b>Fuses:</b>			R60	18D25245A29	Vert. Size; 250K
F1, F2	65S138269	Fuse, 0.8A–250V	R64	18D25245A31	Vert. Lin.; 100K
<b>Integrated Circuits:</b>			R66	6S10201A04	Varistor, 1 ma, 120V, 0.5W
IC1	51S10732A01	Ref. Ampl.; T3F	R73	18D25245A28	Control, Brightness; 200K
<b>Coils/Chokes:</b>			R84	17S135589	150, 10%, 10W
L1	24C25448A01	Coil, Horiz. Osc.	R93	18D25245A21	Control, +73V out Adj.; 2.5K
L2	24D25603A09	Coil, Horiz. Width	R95	10731A03	1.5K, 10%, 5W
L3	24D25248A14	Coil, Horiz. Lin.	<b>Switches:</b>		
L4	24D25261A09	Coil, Defl. (M5000-155, M5010-155)	SW1	40S10624A07	Switch, Slide; D.P. D.T.
L4	24D25261A10	Coil, Defl. (M7000-155, M7010-155)	<b>Transformers:</b>		
L5	25D25221C12	Choke, Vertical	T1	25D25221A05	Horiz. Driver
<b>Transistors:</b>			T2	24D25240B23	H.V. Transformer
Q1	48S137171	Emitter Follower; A6H	T3	25D25239B20	Transformer, Power (M5010-155, M7010-155)
Q2	48S137172	Video Pre-Ampl.; A6J	T3	25D25239B30	Transformer, Power (M5000-155, M7000-155)
Q3	48S137127	Video Pre-Ampl.; P2S	<b>Misc. Electrical Parts:</b>		
Q4	48S134952	Video Driver; A2J	V1	96S241A01	19"–CRT; Type 19VARP4 (M5000/M5010)
Q5	48S137476	Video Output; B1E	V1	96S10848A01	23"–CRT; Type M22VATP4 (M7000/M7010)
Q6	48S137172	Horiz. Osc.; A6J	<b>Mechanical Parts:</b>		
Q7	48S137127	Horiz. Pulse Shaper; P2S		9B25456A01	Block, Fuse (F1, 2)
Q8	48S137093	Horiz. Driver; A5F		42D25158C01	Clamp, Defl. Coil
Q9	48S137570	Horiz. Output; B2L		26S10251A08	Heat Sink (Q5)
Q10	48S137173	Sync Separator; P2W	P1	15S10183A69	Housing, Connector; Female (12-Contact, Less Contacts)
Q11	48S137172	Sync Ampl.; A6J		39S10184A67	Contact, Plug; 5 Req'd M5000/M7000, 9 Req'd; M5010/M7010
Q12	48S137172	Vert. Sync Integrator; A6J	P2	15S10183A82	Housing, Connector; Male (3-Contact, Less Contacts), M5000/M7000
Q13	48S137172	Vert. Sync Ampl.; A6J	P2	15S10183A81	Housing, Connector; Female (3-Contact, Less Contacts), M5010/M7010
Q14	48S137639	Vert. Driver; MPS A13		39S10184A67	Contact, Plug; 3 Req'd for P2
Q15	48S137596	Vert. Output; B2V	P3	28S10586A35	Header, Connector; 2-Contact
Q16	48S137172	Blanking Ampl.; A6J			
Q17	48S137368	Regulator; A8W			
Q18	48S134952	Reg. Driver; A2J			
Q19	48S137476	Reg. Buffer; B1E			
Q20	48S137476	Spot Kill; B1E			
<b>Resistors/Controls:</b>					
NOTE: Only power or special resistors are listed. Use the description when ordering standard values of fixed resistors up to 2 watts.					
R6	18D25245A27	Control, Contrast; 500			
R14	17S135204	100, 10%, 5W			
R17	17S10731A01	3.9K, 5%, 5W			
R36	17S10130B07	1.5K, 10%, 3W			
R42	18D25218A14	Control, Focus; 2M			

**Table 6-2 Motorola Replacement Part Numbers**

REF. NO.	PART NUMBER	DESCRIPTION	REF. NO.	PART NUMBER	DESCRIPTION
P4, P5	15S10183B12	Housing, Connector; Female (3-Contact, Less Contacts) M5010/M7010		14B25459A01	Insulator, Fuse Cover (F1, 2)
	39S10184A84	Contact, Plug; 3 ea. Req'd for P5, M5010/M7010		14A562353	Insulator, Mica (Q9, Q15, Q17)
S2	15S10183A81	Housing, Connector; Female (3-Contact, Less Contacts), M5000/M7000		14C25230A01	Insulator, Molded (On D11 Body)
S2	15S10183A82	Housing, Connector; Male (3-Contact, Less Contacts), M5010/M7010		14S10157A30	Insulator, Nylon (2-Req'd.); Mtg. P.C. Board
	39S10184A64	Contact, Receptacle; 3 Req'd. for S2		14S10550A02	Insulator, Transistor Cover (Q9, Q15, Q17)
S3	15S10183A94	Housing, Connector; Female (2-Contact, Less Contacts)		3S136050	Screw, Tpg; 6-20x½ CLU Pan (Mtg. Q9, Q15, Q17 and D11 Socket)
	39S10184A72	Contact, Receptacle; 3 Req'd. for S3		9D25470A01	Socket, CRT; Incl's. R77, R78, R79, R80
				9D25201A01	Socket, H.V. and CRT Anode
				9C63825A03	Socket, Power Transistor Q9, Q15, Q17)
				41D65987A01	Spring Special; CRT Aquadag Gnd.



# TEC VIDEOELECTRONICS INC. SERVICE MANUAL

## A. GENERAL

TM-600 and TM-623 is a television monitor for video games. It is designed for operation either from a power supply of 115 volts/50–60 Hz AC or 230 volts/50–60 Hz AC. The complete monitor incorporates a picture tube, an integrated circuit, 20 silicon transistors, 18 silicon diodes, 2 germanium diodes, and a high-voltage selenium diode.

This model is equipped with 5V/3A power supply for the operation of the TTL control board and operation double-pulse-type AFC circuit to obtain a stable picture.

## B. SPECIFICATIONS

### Power Supply Input

115 volts/230 volts 50–60 Hz  $\pm 10\%$

### Power Consumption

60 watts

### Video input

0.5 volts composite P/P for 100 volts

2.5 volts P/P maximum

Sync negative at input

### Picture Tube

19" (500 mm), 114° deflection for Model TM-600

23" (584.2 mm), 114° deflection for Model TM-623

Integral implosion protection

### High Voltage

18 KV nominal at 0 microamperes beam current

### Horizontal Retrace Time

12 microseconds maximum

### Resolution

500 lines minimum at picture center

### Scanning Frequency

Horizontal: 15.750 Hz  $\pm 500$  Hz

Vertical: 50–60 Hz

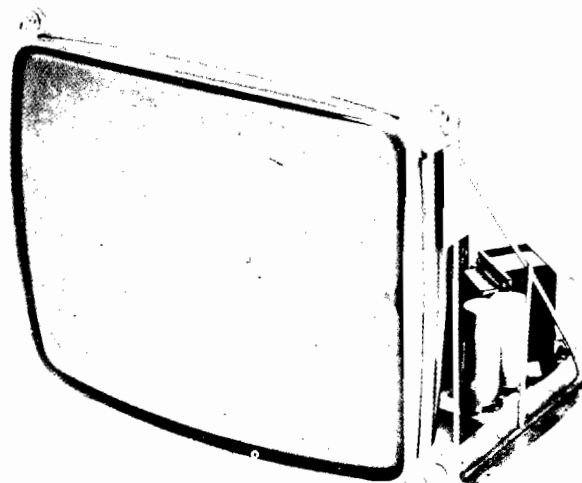
### Tone Burst Amplifier

5 watts peak output with TTL drive at nominal line, fully adjustable. 4 watts peak output at low line.

### Environment

Operation: Maximum ambient temperature 50°C (122°F)

Storage: Temperature range from -40°C to +65°C



Model TM-600 and TM-623 Monitors

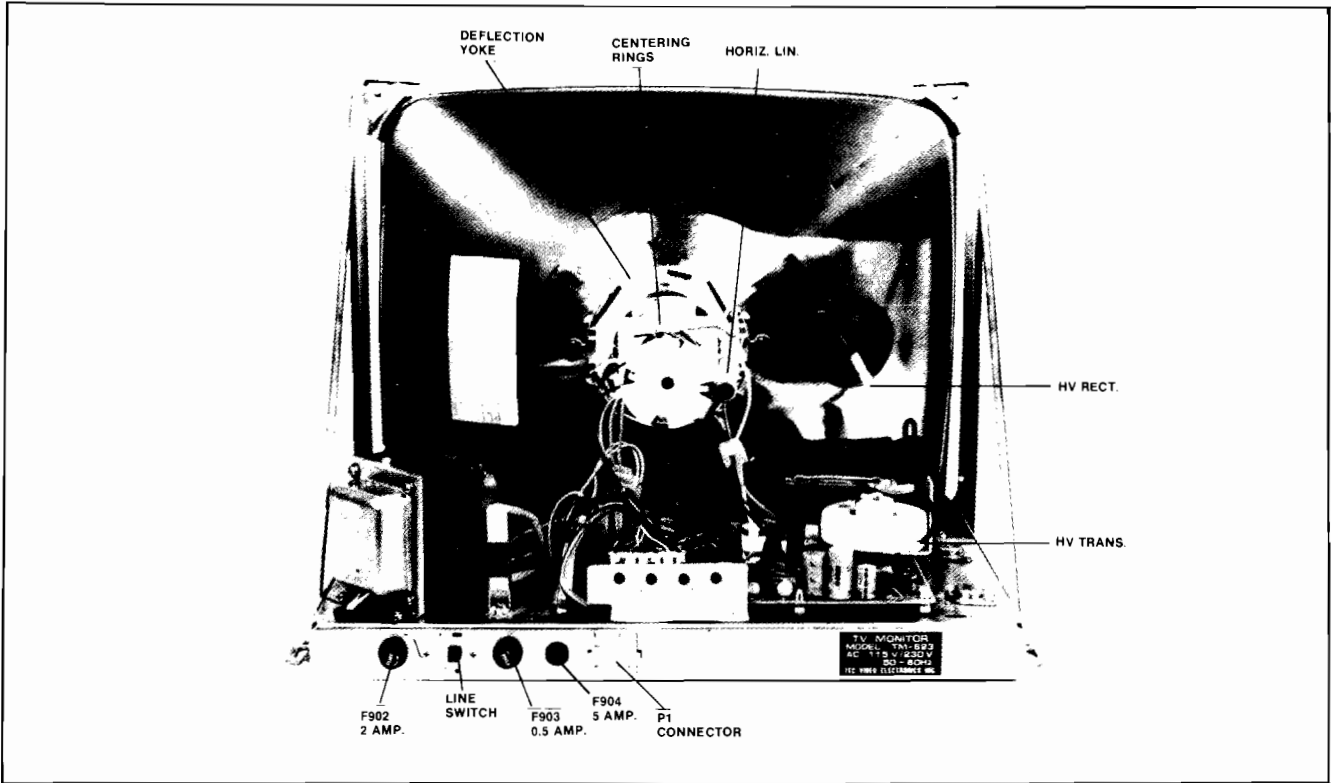


Figure 6-17 TEC Monitor Chassis, Rear View

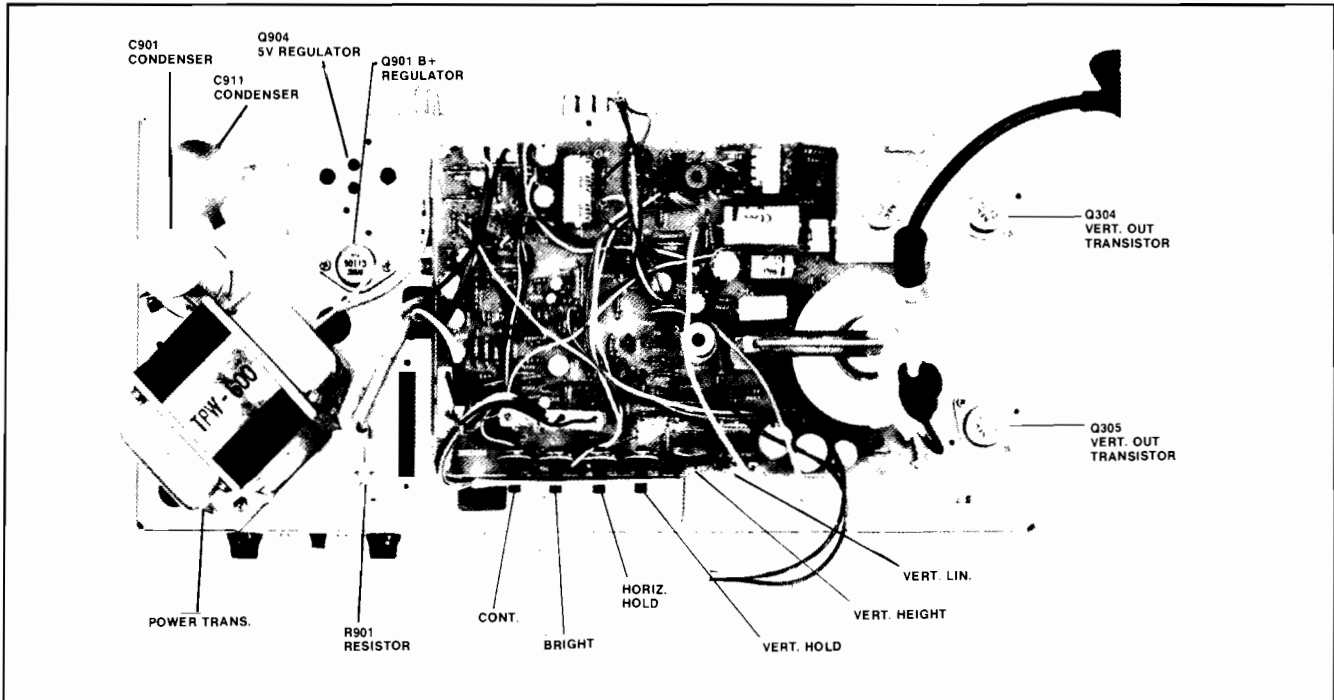


Figure 6-18 TEC Monitor Chassis, Top View

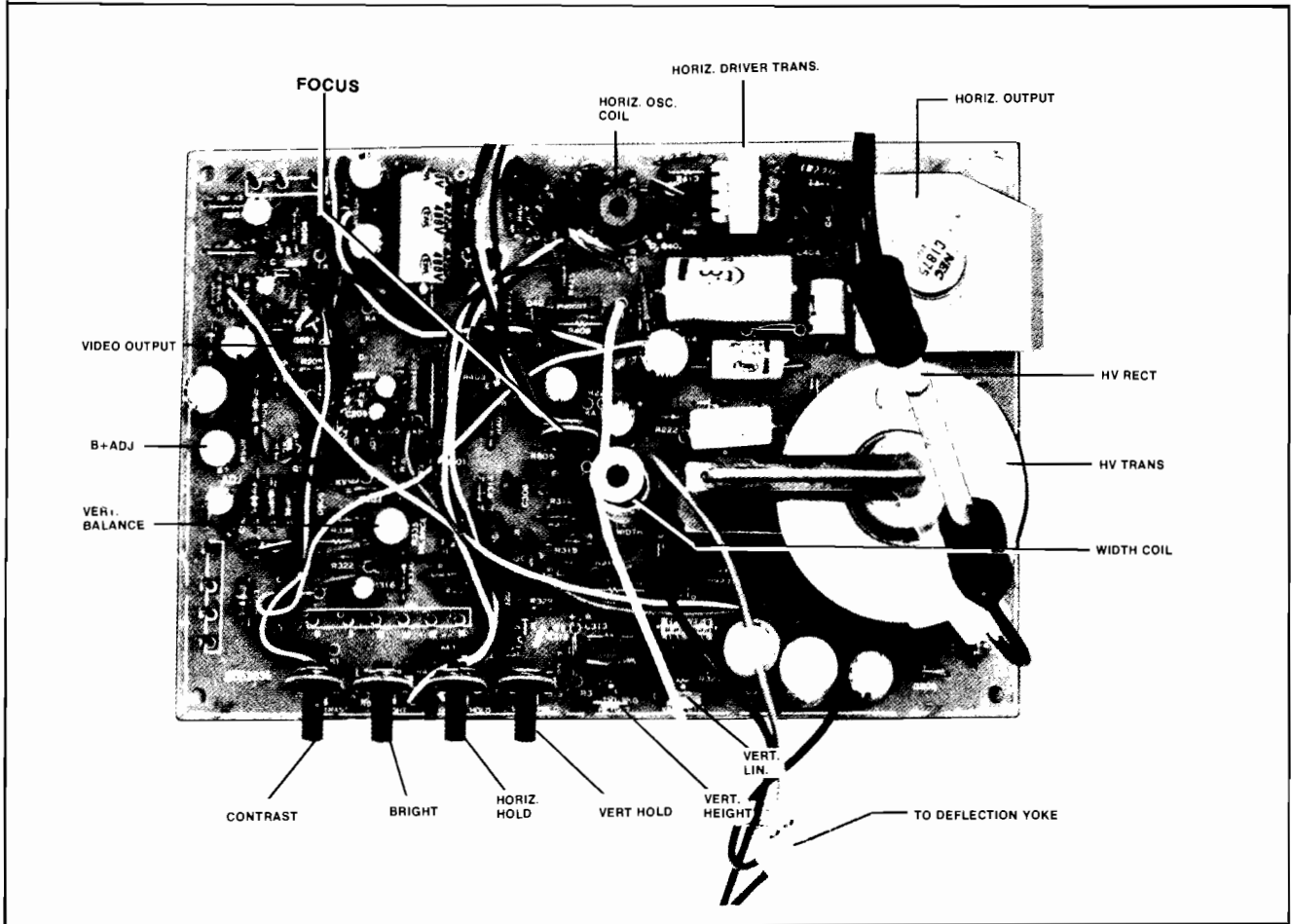


Figure 6-19 TEC Monitor Printed Circuit Board, Top View

Table 6-3 TEC Monitor Replacement Parts Numbers

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
<b>Electrical Parts:</b>			Q303	5300500201	MPS9700U Vert Amp or MPS834
PCB1	2215303600	Main PCB	Q304	4310400030	2SC1106 Vert Output or 2N6307
A801	485TM60003	CRT PCB	Q400	5310500202	MPS9700T Phase Inv or MPS834
<b>Transistor and IC:</b>			Q401	5310500202	MPS9700T Horiz Osc or MPS834
Q200	5310500202	MPS9700T 1st Video Amp or MPS834	Q402	5310500410	2N6558 Horiz Amp or MJE9742 or 2N4354
Q201	5310500261	MPS9750T 2nd Video Amp or MPS4356	Q403	5310400040	2SC1875 Horiz Output or MJ205
Q202	5310500410	2N6558 Video Output or MPSU-10	*Q901	5310400030	2SC1106 Power Regulator or MJ3430
Q301	5310500261	MPS9750T Sync Separator or MPS4356			
Q302	5310500201	MPS9700U Vert Osc or MPS834			

Table 6-3 TEC Monitor Replacement Parts Numbers

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
Q902	5310500410 or 5310500070	2N6558 MPS-U04	Regulator Amp	T401	589514015 TLN-506BX Horiz Osc
Q903	5310500280	LM1796 or MPS-D01	Reference Amp	T402	589518012 TLN-519 Horiz Drive
Q904	5310500450	MJ2955	5V Regulator	* T403	589517017 TFB-1006AS F.B.T.
<b>CRT and Diode:</b>			<b>Resistors</b>		
* V801	5380000060	500SB4	CRT	R201	RD-4L471J 470 ohm J ¼ W
D203	5340200280	MR9712 or IN4004	Silicon Diode L. V. Rectifier	R202	RD-4L223J 22 K ohm J ¼ W
D204	5340200430	IN4148 or IN4002	Silicon Diode Blanking Clip	R203	RD-4L563J 56 K ohm J ¼ W
D205	5340200430	IN4148 or IN4002	Silicon Diode Blanking Clip	R204	RD-4L471J 470 ohm J ¼ W
D206	5340200430	IN4148 or IN4002	Silicon Diode Blanking Clip	R205	RD-4L332J 3.3 K ohm J ¼ W
D207	534020280	MR9712 or IN4004	200V Rect	R206	RD-2L823J 82 K ohm J ½ W
D301	5340200260	MR-9701	Rectifier Silicon Diode	R207	RD-4L560J 56 ohm J ¼ W
D401	5340100040	AA143	Phase Det	R208	RD-4L102J 1 K ohm J ¼ W
D402	5340100040	AA143	Phase Det	R210	RS-029562J 5.6 K ohm J 2 W
D403	5340200300	MR9722	Damper	R215	RD-42101J 1 K ohm J ¼ W
* D404	5340400120	TV20-2K80J or HS30/lb	H.V. Rectifier	* R216	RD-4L101J 100 ohm J ¼ W
D801	5340200290	MR9713	400V Rectifier	* R217	RD-4L470J 47 ohm J ½ W
D901	5340200270	MR9704 or IN4005	Rectifier Silicon Diode	R218	RD-4L223J 22 K ohm J ¼ W
D902	5340200270	MR9704 or IN4005	Rectifier Silicon Diode	R219	RD-4L563J 56 K ohm J ¼ W
D903	5340200270	MR9704 or IN4005	Rectifier Silicon Diode	R220	RD-4L102J 1 K ohm J ¼ W
D904	5340200270	MR9704 or IN4005	Rectifier Silicon Diode	R221	RD-4L102J 1 K ohm J ¼ W
D906	5340300220 or 5340300310	IN5858A IN6002A	Zener Diode	R222	RD-2L102J 1 K ohm J ½ W
D907	5340200690	MDA970-1	Rectifier	R223	RD-2L102J 1 K ohm J ½ W
D908				R224	RD-2L122J 1.2 K ohm J ½ W
D909				* R226	RS01P101J 100 ohm J 1 W
D910				R227	RD-2L123J 12 K ohm J ½ W
<b>Coils and Trans:</b>			R228	RD-2L105J 1.5 K ohm J ½ W	
* L401	589515015	TDY1005	D.Y. Coil	R229	RD-4M681J 680 ohm J ¼ W
L402	589512015	HCH1005	Horiz Choke Coil	R302	RD-4M331J 330 ohm J ¼ W
L403	589512012	HC2-035	Choke Coil	R303	RD-4L562J 5.6 K ohm J ¼ W
L404	589512012	HC2-035	Choke Coil	R304	RD-4M102J 1 K ohm J ¼ W
L405	589514013	AZ-9177DM	Width Coil	R308	RD-4M104J 100 K ohm J ¼ W
L406	589514016	LH-15J54	Lin Coil	R309	RD-4M155T 1.5 M ohm J ¼ W
				R310	RD-4M332J 3.3 K ohm J ¼ W
				R311	RD-4M563J 56 K ohm J ¼ W
				R312	RD-4L182J 1.8 K ohm J ¼ W
				R313	RD-4L153J 15 K ohm J ¼ W
				R314	RD-4L183J 18 K ohm J ¼ W
				R315	RD-4L203J 20 K ohm J ¼ W
				R316	RS-2P333J 33 K ohm J ½ W
				R327	RD-4L104J 100 K ohm J ¼ W
				R320	RD-4L124J 120 K ohm J ¼ W



Table 6-3 TEC Monitor Replacement Parts Numbers

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
R322	RD-4L224J	220 K ohm J ¼ W	R904	RD-2L123J	12 K ohm J ½ W
R323	RD-4L433J	43 K ohm J ¼ W	R905	RD-2L223J	22 K ohm J ½ W
R324	RD-4L471J	470 ohm J ¼ W	R906	RD-2L563J	56 K ohm J ½ W
R326	RD-4L152J	1.5 K ohm J ¼ W	R907	RD-2L563J	56 K ohm J ½ W
R339	RD-4L101J	100 ohm J ¼ W	R909	RD-2L682J	6.8 K ohm J ½ W
R331	RD-4M331J	330 ohm J ¼ W			
R332	RD-4L102J	1 K ohm J ¼ W	<b>Controls:</b>		
R333	RS01P682J	6.8 K ohm J 1 W	R211	553102005E	1 K ohm Contrast
R334	RD-2L183J	18 K ohm J ½ W	R319	553104005B	100 K ohm Vert. Hold
R336	RD-4L221J	220 ohm J ¼ W	R321	553124008B	220 K ohm Vert. Height
R337	5160122901	2.2 ohm J ½ W	R327	553472008B	4.7 K ohm Vert. Linearity
R338	RS-2P150J	15 ohm J ½ W	R335	553102007B	1 K ohm Vert. Balance
R339	5160112901	1.2 ohm J ½ W	R427	553303005B	30 K ohm Horiz Hold
R340	RS01P220T	22 ohm J 1 W	R803	553254005B	250 K ohm Bright
R401	RD-4L153J	15 K ohm J ¼ W	R805	553205005B	2 M ohm Focus
R402	RD-4L821J	820 ohm J ¼ W	R908	553472007B	4.7 K ohm B+ADJ
R403	RD-4M561J	560 ohm J ¼ W			
R404	RD-4M103J	10 K ohm J ¼ W	<b>Capacitors:</b>		
R405	RD-4M103J	10 K ohm J ¼ W	C201	CE2G1C470	47 mF 16V
R406	RD-4L272J	2.7 K ohm J ¼ W	C202	CE2G1F101	100 mF 25V
R407	RD-4L681J	680 ohm J ¼ W	C203	CE2G1C220	22 mF 16V
R408	RS02P682J	4.7 K ohm J ½ W	C204	CE2G1H101	100 mF 35V
R419	RD-4L270J	27 ohm J ¼ W	C205	CE2G1C220	22 mF 16V
R410	RD-4L182J	1.8 K ohm J ¼ W	C206	C1SL1H561K	560 pF K 50V
R411	RD-4L151J	150 ohm J ¼ W	C207	CE2G0J221	220 mF 6.3V
R412	RD-4L561J	560 ohm J ¼ W	C208	5270322401	0.22 mF M 400V
R413	RS01P682J	6.8 K ohm J 1 W	C209	CE2G2F229	2.2 mF 315V
R414	RD-2L221J	220 ohm J ½ W	C210	CE2G1H220	22 mF 35V
R415	5160122903	2.2 ohm J 1 W	C211	CE2G1H339	3.3 mF 50V
R416	RD-2L569J	5.6 ohm J ½ W	C213	CK1F2H102K	0.001 mF 500V
R417	RS02P182J	1.8 K ohm J 2 W	C220	CE2G2F220	2.2 mF 250V
R418	RS01P123J	12 K ohm J 1 W	C301	CQ1M1H473K	0.047 mF K 50V
*R420	RX05P220J	22 ohm J 5 W	C304	CK1B1H391K	470 pF K 50V
*R421	RD-2L569J	5.6 ohm J ½ W	C305	CE2G1H478	0.47 mF 50V
R422	RD-4L153J	47 ohm J 1 W	C306	56405333	0.033 mF K 50V
R425	RD-4L153J	15 K ohm J ¼ W	C307	CQ1M1H562K	0.0056 mF K 50V
R426	55337153	15 K ohm J ¼ W	C308	CQ1M1H273K	0.027 mF K 50V
R802	RD-2L154J	150 K ohm J ½ W	C309	CQ1M1H123K	0.012 mF K 50V
R804	RD-2L474J	470 K ohm J ½ W	C311	CQ1M1H124K	0.12 mF K 50V
R811	RD-2L561J	2MΩ ½ W	C312	CQ1M1H392K	0.0039 mF K 50V
*R901	RX20P251J	250 ohm J 20 W	C313	DS5D1C229M	2.2 mF 16V
R902	RD-2L101J	1 K ohm J ½ W	C314	CQ1M1H474J	0.47 mF 50V
R903	RD-2L123J	12 K ohm J ½ W	C315	CQ1M1H333K	0.033 mF K 50V
			C316	CF2G1A470	47 mF 10V

**Table 6-3 TEC Monitor Replacement Parts Numbers**

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
C317	CE2G2A101	100 mF 100V			
C318	CK1E2H103K	0.01 mF 500V			
C319	5270310301	0.01 mF 630V			
C401	CQ1M1H103K	0.01 mF K 50V			
C402	CQ1M1H103K	0.01 mF K 50V			
C403	CQ1M1H393K	0.039 mF K 50V			
C404	CK1B2H151	150 mF 500V			
C405	CE2G1H339	3.3 mF 50V			
C406	CQ1M1H104K	0.1 mF K 50V			
C407	CQ1M1H223K	0.022 mF J 50V			
C408	CQ1M1H683K	0.068 mF J 50 V			
C409	CE2G1F470	47 mF 25V			
C410	CK1B2H681K	680 pF K 500V			
C411	CK1B2H222K	0.0022 mF K 500V			
C412	CK1B1H152K	0.0015 mF K 50V			
C413	CK1B1H102K	0.001 mF K 50V			
*C414	CK1B3D471K	470 pF K 2KV			
C415	CQ1M2A104K	0.1 mF K 100V			
*C416	5270333201	0.0033 mF 1.5KV			
C417	CE2G2C100	10 mF 160V			
C418	5270333401	0.33 mF K 200V			
C419	56635101	100 mF 35V			
C420	56625471	470 mF 25V			
C801	5270356302	0.056 mF K 630V			
*C901	5240700400	450 mF 200V			
C902		100 mF 160 V			
C904	F2G2C229	2.2 mF 160V			
C905	CK1F2H102K	0.001 mF 500V			
C911	56625105	10000 mF 25V			
C912	56616018	1 mF 16V			
<b>Discharge Gaps:</b>					
Z801	599030001	EGP-H751A			
Z802					
Z803					
<b>Switches:</b>					
*SW-1	PE13-1567	115V/230V Power Line Slide Switch			
			<b>Fuses:</b>		
*F902	6990620011	250V 2 Amp.			
*F903	5990610013	250V 0.5 Amp.			
F904	5990630010	30V 5 Amp.			
			<b>Mechanical Parts:</b>		
*K001	22-463020	Mate-N-Lock Connector (AMP)			
	60085005	Edge Collector (Molex)			
	S-A3915	Transistor Socket (SMK)			
	*TM60085001	Fuse Holder			
	or *TM60085001	Fuse Holder			
K005	1-380826-0	Stand-Off Fastener (AMP)			
P401	PE19-1569	4P Plug Assy. (Yoke Line)			
P402	PE19-1570	4F Recep Assy (Yoke Line)			
P403	PE19-1571	3P Connector Assy. (Video Input)			
A621	PE19-1572	4P Connector Assy. (Q901 Line)			
A631	PE19-1573	6P Connector Assy. (Q304/Q305 Line)			
P406	PE19-1574	2P Plug Assy. (Heater Line)			
P407	PE19-1575	2P Recep Assy. (Heater Line)			
TE901	PE19-1576	Terminator, 6 Pin			
E001	135431015	Ground Plate			
F001	22-164001	Frame			
H003	5432001-1	Plate Heat Sink A			
Q403D	54320011	Plate Heat Sink C			
<b>NOTE</b>					
<ol style="list-style-type: none"> <li>1. Design and specifications are subject to change without notice.</li> <li>2. J—Indicates ± 5% tolerance K—Indicates ±10% tolerance M—Indicates ±20% tolerance</li> </ol>					

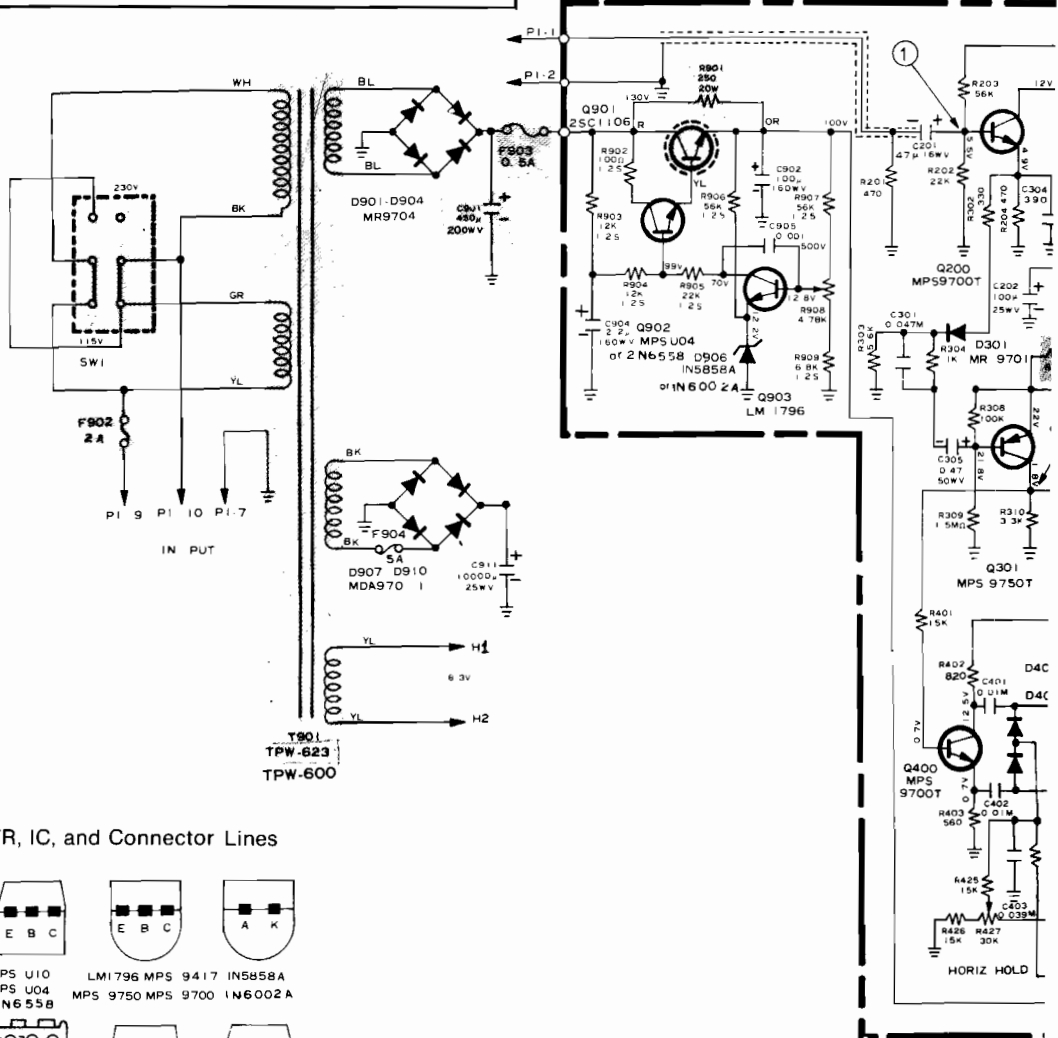


**WARNING**

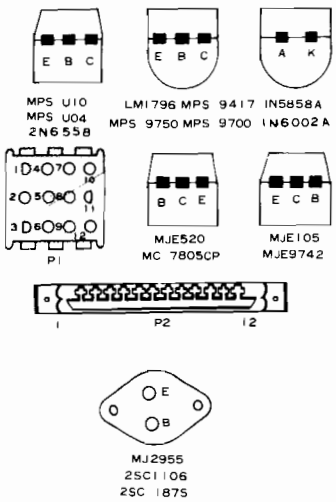
*Safety-Critical Components*

Components marked with an asterisk (\*) on the parts list and with gray shading in the schematic have special characteristics important for safety.

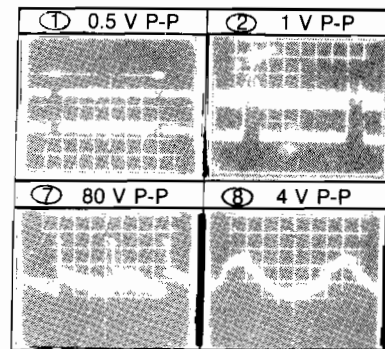
You may create shock, fire, or other hazards by using a replacement that does not have the same characteristics as the recommended part.



TR, IC, and Connector Lines

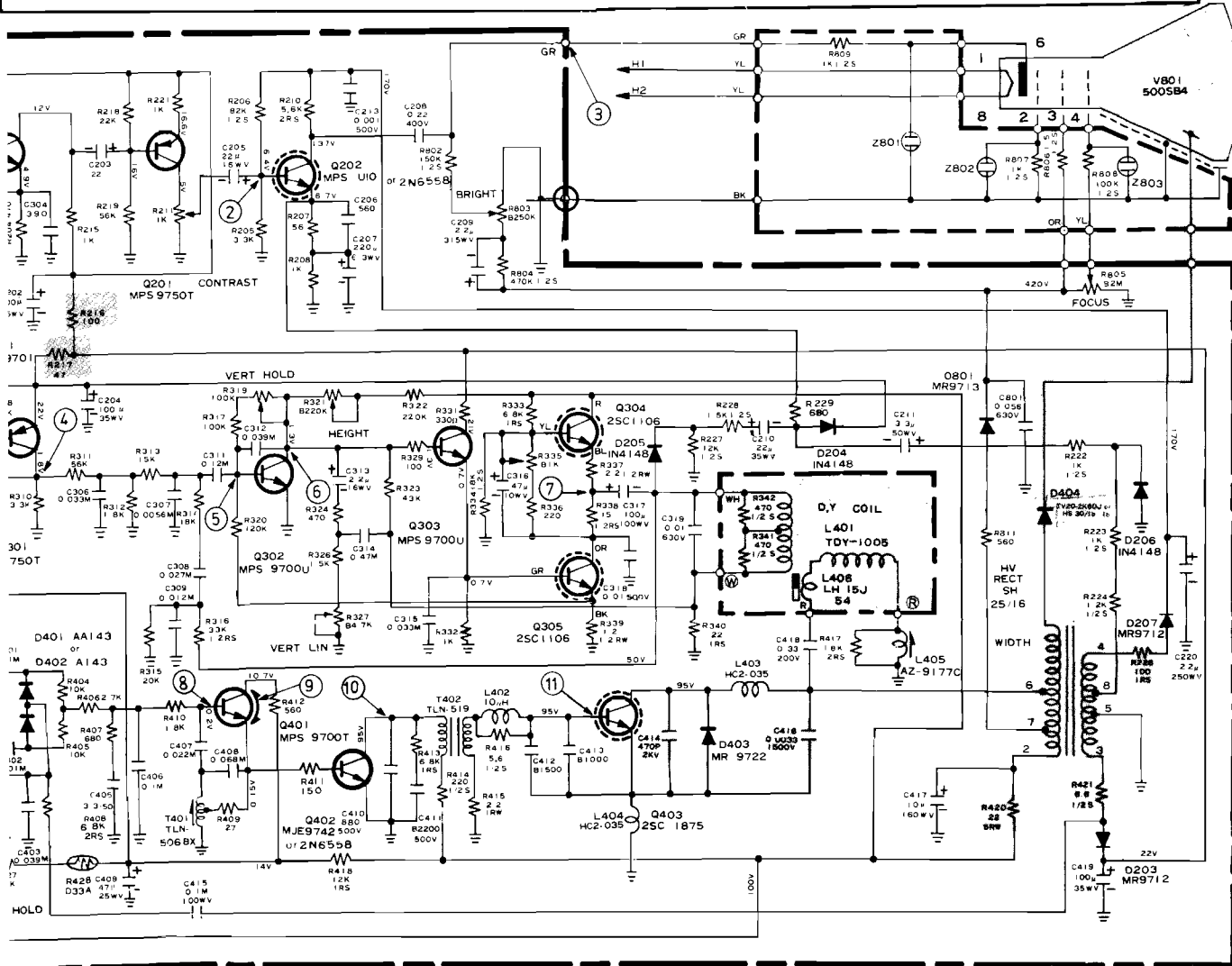


WAVE FORMS



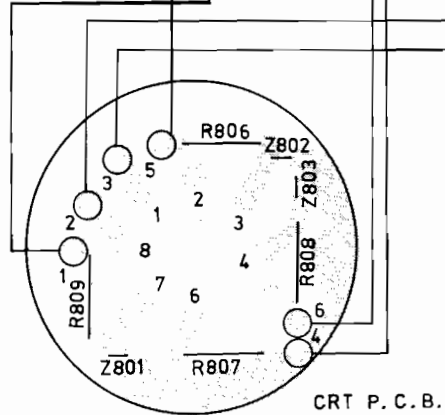
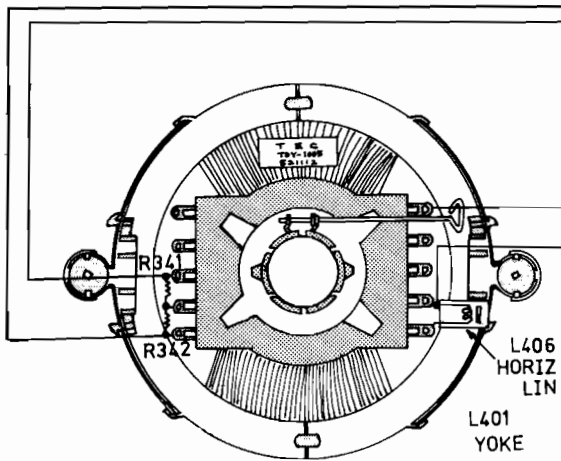
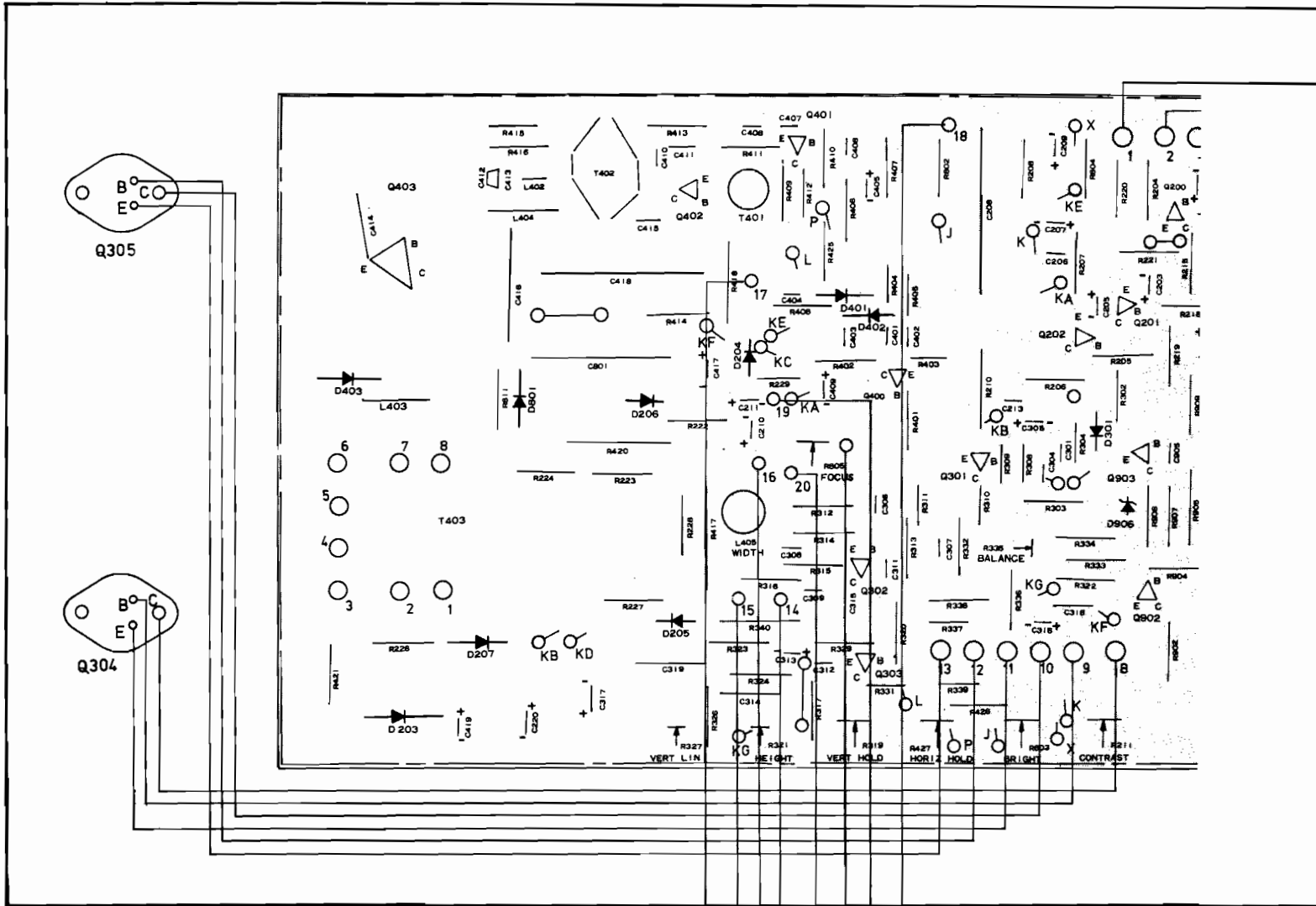
NOTES

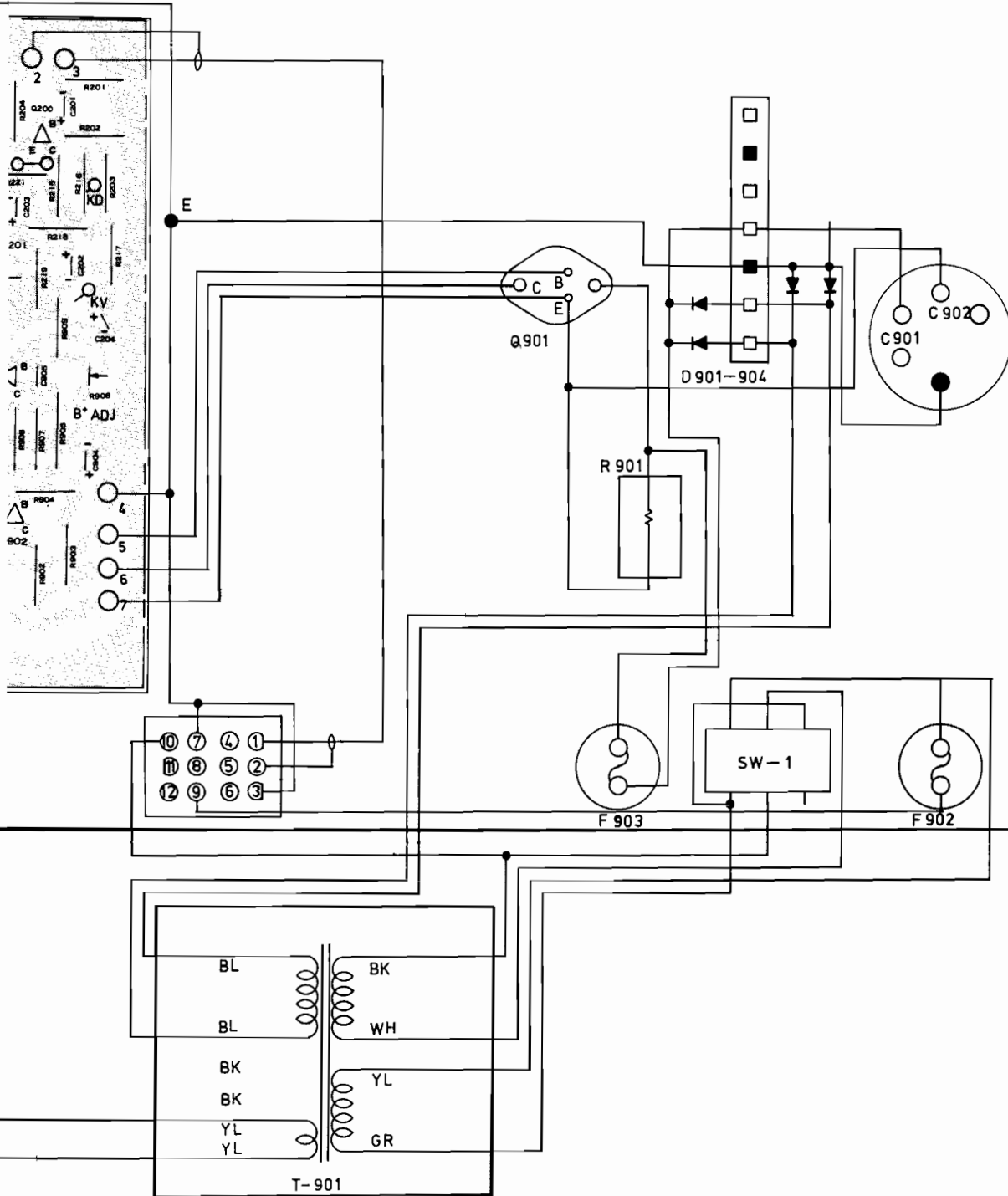
1. Unless otherwise specified, all resistance values are in ohms.
2. Unless otherwise specified, in the schematic diagram all capacitor values less than 1 are expressed in mfd, and values more than 1 are in pfd.
3. Voltage readings are taken with VTVM from point indicated on chassis to ground.
4. All waveforms are measured with strong signal input and contrast set to give normal picture.
5. This schematic diagram covers basic or representative chassis only. There may be some differences between actual components on chassis and the schematic diagram.



③ 100 V P-P	④ 13 V P-P	⑤ 2.7 V P-P	⑥ 1.6 V P-P
⑨ 13.1 V P-P	⑩ 150 V P-P	⑪ 12 V P-P	⑫ 600 V P-P

Figure 6-20 TEC Monitor Schematic Diagram





**BOTTOM VIEW**

Figure 6-21 TEC Monitor Wiring Diagram





## WARRANTY

Seller warrants that its printed circuit boards and parts thereon are free from defects in material and workmanship under normal use and service for a period of ninety (90) days from date of shipment. Seller warrants that its television monitors (in games supplied with monitors) are free from defects in material and workmanship under normal use and service for a period of thirty (30) days from date of shipment. None of the Seller's other products or parts thereof are warranted.

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- (a) Seller is promptly notified in writing upon discovery by Buyer that said products are defective;
- (b) Such products are returned prepaid to Sellers' plant; and
- (c) Seller's examination of said products discloses to Seller's satisfaction that such alleged defects existed and were not caused by accident, misuse, neglect, alteration, improper repair, installation or improper testing.

In no event shall Seller be liable for loss of profits, loss of use, incidental or consequential damages.

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