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# V-V™

## THE ULTIMATE AERIAL EXPERIENCE

Operators
Manual
with
Illustrated
Parts Lists

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# 720°™ Operators Manual

with Illustrated Parts Lists

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# Notice Regarding Non-ATARI® Parts

**⚠ WARNING ⚠**

Use of non-ATARI parts or modifications of any ATARI game circuitry may adversely affect the safety of your game, and may cause injury to you and your players.

You may void the game warranty (printed on the inside back cover of this manual) if you do any of the following:

- Substitute non-ATARI parts in the game.
- Modify or alter any circuits in the game by using kits or parts *not* supplied by Atari Games Corporation.

## NOTE

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of Federal Communications Commission (FCC) Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area or modification to this equipment is likely to cause interference in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference. If you suspect interference from an ATARI® game at your location, check the following:

- All green ground wires in the game are properly connected as shown in the game wiring diagram.
- The power cord is properly plugged into a grounded three-wire outlet.
- The game printed-circuit boards (PCBs) are properly installed with the Electromagnetic Interference (EMI) ground plane.

If you are still unable to solve the interference problem, please contact Customer Service at Atari Games Corporation. See the inside front cover of this manual for service in your area.

# Table of Contents


## 1 Set-Up

How to Use This Manual ..... 1-1
Inspecting the Game ..... 1-2
Control and Switch Locations ..... 1-2
Coin and Game Option Settings ..... 1-2

## 2 Game Play

Introduction ..... 2-1
Operating Modes ..... 2-2
Game Play ..... 2-2
Hints for Game Play ..... 2-2
Operator Hints ..... 2-2

## 3 Self-Test

RAM/Interrupt/ROM Test ..... 3-2
6502 Processor Test ..... 3-2
Control Test ..... 3-4
Motion Object Test ..... 3-4
Motion Object Height Test ..... 3-5
Alphanumeric Test ..... 3-5
Scrolling Playfield Test ..... 3-5
Color Bar Test ..... 3-5
Color Purity Test ..... 3-6
Convergence Test ..... 3-6
Accounting Information ..... 3-6
Starting Game Time Histogram ..... 3-7
Add-A-Coin Game Time Histogram ..... 3-7
Reset Saved Information Screen ..... 3-7
Coin Option Settings ..... 3-8
Game Option Settings ..... 3-8

## 4 Maintenance

**Preventive Maintenance** ..... 4-2
Preventive-Maintenance Intervals ..... 4-2
Removing the Control Panel ..... 4-2
Cleaning the Push Button Leaf Switches ..... 4-2
Maintaining the Rotary Control ..... 4-2
Cleaning the Coin Mechanism ..... 4-3
Cleaning the Interior Components ..... 4-3

**Corrective Maintenance** ..... 4-6
Removing the Video Display ..... 4-6
Removing the Rotary Control ..... 4-7
Disassembling the Rotary Control ..... 4-7
Reassembling the Rotary Control ..... 4-7
Removing the Game PCBs ..... 4-8
Removing the Incandescent Lamp ..... 4-10
Removing the Speakers ..... 4-10

## 5 Troubleshooting

Troubleshooting Aids ..... 5-2
Troubleshooting Techniques ..... 5-2
Soldering Techniques ..... 5-2
Troubleshooting Static-Sensitive Devices ..... 5-3

## 6 Illustrated Parts Lists

See List of Illustrations that follows.






# List of Illustrations


Figure 1-1 Control and Switch Locations ..... 1-3

Figure 3-1 RAM Test Fails ..... 3-2
Figure 3-2 Interrupt Test Fails ..... 3-2
Figure 3-3 ROM Test Fails ..... 3-2
Figure 3-4 Reset Retry ..... 3-3
Figure 3-5 Communications Fails ..... 3-3
Figure 3-6 Music/RAM/ROM Fails ..... 3-3
Figure 3-7 Sound Output ..... 3-3
Figure 3-8 Sound Status ..... 3-4
Figure 3-9 Control Test Passes ..... 3-4
Figure 3-10 Motion Object Test ..... 3-4
Figure 3-11 Motion Object Height Test ..... 3-5
Figure 3-12 Alphanumeric Test ..... 3-5
Figure 3-13 Scrolling Playfield Test ..... 3-5
Figure 3-14 Color Bar Test ..... 3-6
Figure 3-15 Color Purity Test ..... 3-6
Figure 3-16 Convergence Test ..... 3-6
Figure 3-17 Accounting Information ..... 3-7
Figure 3-18 Starting Game Time Histogram ..... 3-7
Figure 3-19 Add-A-Coin Game Time Histogram ..... 3-7
Figure 3-20 Reset Saved Information Screen ..... 3-7
Figure 3-21 Coin Option Settings ..... 3-8
Figure 3-22 Game Option Settings ..... 3-8

Figure 4-1 Control Panel Removal ..... 4-3
Figure 4-2 Maintaining the Rotary Control ..... 4-4
Figure 4-3 Video Display Removal ..... 4-6
Figure 4-4 Game PCB Removal ..... 4-9
Figure 4-5 Light and Speaker Removal ..... 4-10

Figure 5-1 Removing IC (Cut-Pin Method) ..... 5-3
Figure 5-2 Removing IC Pins ..... 5-3
Figure 5-3 Removing Solder from Plated-Through Holes ..... 5-4
Figure 5-4 Removing Solder from Lead Connection Pads ..... 5-4

Figure 6-1 Cabinet-Mounted Assemblies ..... 6-2
Figure 6-2 Control Panel Assembly ..... 6-5
Figure 6-3 Rotary Control Assembly ..... 6-6
Figure 6-4 Light and Speaker Panel Assembly ..... 6-9
Figure 6-5 Switching/Linear (SL) Power Supply Assembly ..... 6-10
Figure 6-6 Coin Acceptors, Inc. Coin Door Assembly ..... 6-14
Figure 6-7 Printed-Circuit Board Mounting Hardware ..... 6-17
Figure 6-8 Central Processing Unit (CPU) PCB Assembly ..... 6-18
Figure 6-9 Video PCB Assembly ..... 6-22
Figure 6-10 Audio II PCB Assembly ..... 6-27


# List of Tables


Table 1-1 Game Specifications ..... 1-2
Table 1-2 Coin and Credit Option Settings ..... 1-4
Table 1-3 Game Option Settings ..... 1-4
Table 4-1 Recommended Preventive-Maintenance Intervals ..... 4-2

# Safety Summary

The following safety precautions apply to all game operators and service personnel. Specific warnings and cautions will be found throughout this manual where they apply.

**⚠ WARNING ⚠**

**Properly Ground the Game.** Players may receive an electrical shock if this game is not properly grounded! To avoid electrical shock, do not plug in the game until it has been inspected and properly grounded. This game should only be plugged into a grounded three-wire outlet. If you have only a 2-wire outlet, we recommend you hire a licensed electrician to install a grounded outlet. Players may receive an electrical shock if the control panel is not properly grounded! After servicing any parts on the control panel, check that the grounding wire is firmly secured to the inside of the control panel. Only then should you lock up the game.

**AC Power Connection.** Before connecting the game to the AC power source, verify that the game's power supply is properly configured for the line voltage in your location.

**Disconnect Power During Repairs.** To avoid electrical shock, disconnect the game from the AC power source before removing or repairing any part of the game. When removing or repairing the video display, extra precautions must be taken to avoid electical shock because high voltages may exist within the display circuitry and cathode-ray tube (CRT) even after power has been disconnected. Do not touch internal parts of the display with your hands or with metal objects! Always discharge the high voltage from the CRT before servicing this area of the game. To discharge the CRT: Attach one end of a large, well-insulated, 18-gauge jumper wire to ground. Momentarily touch the free end of the grounded jumper to the CRT anode by sliding it under the anode cap. Wait two minutes and discharge the anode again.

**Use Only ATARI Parts.** To maintain the safety integrity of your ATARI game, do not use non-ATARI parts when repairing the game. Use of non-ATARI parts or other modifications to the game circuitry may adversely affect the safety of your game, and injure you or your players.

**Handle the CRT With Care.** If you drop the CRT and it breaks, it may implode! Shattered glass can fly six feet or more from the implosion.

**Use the Proper Fuses.** To avoid electrical shock, use replacement fuses which are specified in the parts list for this game. Replacement fuses must match those replaced in fuse type, voltage rating, and current rating. In addition, the fuse cover must be in place during game operation.

**CAUTION**

**Properly Attach All Connectors.** Make sure that the connectors on each printed-circuit board (PCB) are properly plugged in. Note that they are keyed to fit only one way. If they do not slip on easily, do not force them. A reversed connector may damage your game and void the warranty.

**Ensure the Proper AC Line Frequency.** Video games manufactured for operation on 60 Hz line power (i.e., United States) must not be operated in countries with 50 Hz line power (i.e., Europe). The fluorescent light ballast transformer will overheat, causing a potential fire hazard if 60 Hz games are operated on power lines using 50 Hz. Check the product identification label of your game for the line frequency required.

## ABOUT NOTES, CAUTIONS, AND WARNINGS

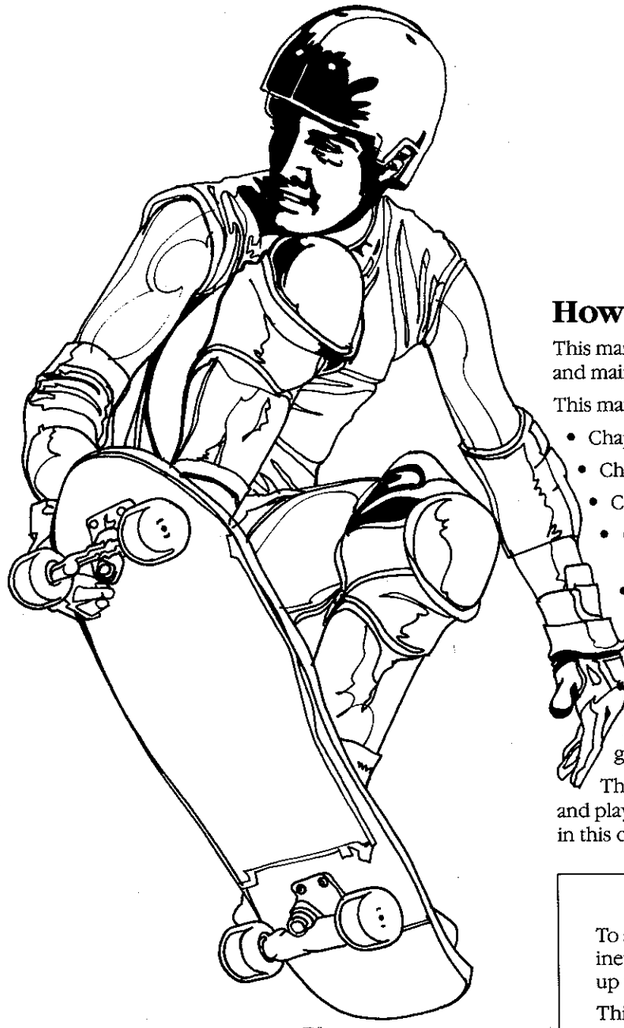
In all Atari publications, notes, cautions, and warnings have the following meaning:

**NOTE**—A highlighted piece of information.

**CAUTION**—Equipment and/or parts can be damaged or destroyed if instructions are not followed. You will void the warranty on Atari printed-circuit boards, parts thereon, and video displays if equipment or parts are damaged or destroyed due to failure of following instructions.

**WARNING**—Players and/or technicians can be injured or killed if instructions are not followed. (The word *WARNING* is always surrounded by international warning symbols—triangles with exclamation marks inside of them.)





Chapter 1

# Set-Up

## How to Use This Manual

This manual includes information for setting up, playing, and maintaining your 720°™ game.

This manual is divided into the following chapters:

- Chapter 1 contains set-up information.
- Chapter 2 contains game play information.
- Chapter 3 contains self-test procedures.
- Chapter 4 contains preventive and corrective maintenance procedures.
- Chapter 5 contains troubleshooting information.
- Chapter 6 contains illustrated parts lists.

Wiring and schematic diagrams for the 720° game circuitry are contained in the *Schematic Package Supplement* (SP-294) included with your game.

This chapter includes information required to set up and play your 720° game. Carefully read the information in this chapter before applying power to the game.

**⚠ WARNING ⚠**

To avoid electrical shock, do not plug in the cabinet until it has been properly inspected and set up for the line voltage in your area.

This cabinet should only be connected to a grounded three-wire outlet. If you have only a two-wire outlet, we recommend that you hire a licensed electrician to install a grounded outlet. Players can receive an electrical shock if the cabinet is not properly grounded.

Do not touch internal parts of the display with your hands or with metal objects.

# Inspecting the Game

> **⚠ WARNING ⚠**
> Do not plug in the game until you have completed the following inspection steps.

Please inspect your 720° game carefully to ensure that the game is complete and delivered to you in good condition. Figure 6-1 shows the locations of the component parts of the game. Table 1-1 lists space, power, and environmental requirements.

Inspect the factory-assembled game as follows:

1. Examine the exterior of the cabinet for dents, chips, or broken parts.
2. Unlock and open the rear access panel. Unlock and open the coin doors. Inspect the interior of the cabinet as follows:
   a. Ensure that all plug-in connectors (on the cabinet harnesses) are firmly plugged in. Do not force connectors together. The connectors are keyed so they only fit in the proper orientation. *A reversed edge connector can damage a printed-circuit board (PCB) and will void your warranty.*
   b. Ensure that all plug-in integrated circuits on each PCB are firmly plugged into their sockets.
   c. Inspect the power cord for any cuts or dents in the insulation.
   d. Inspect the power supply. Make sure that the correct fuses are installed. Check that the harness is plugged in correctly and that the fuse block cover is mounted in place. Check that the green ground wires are connected.
   e. Inspect other major sub-assemblies, such as the video display, printed-circuit boards (PCBs), speakers, and the incandescent lamp. Make sure they are

**Table 1-1 Game Specifications**

| Characteristic | Specification |
|---|---|
| Power Consumption | 300 V-A, 239 W RMS |
| Temperature | +5° to +38° C<br>(+37° to +100° F) |
| Humidity | Not to exceed 95% relative |
| Line Voltage | 105 to 130 VAC (U.S. Games)<br>200 to 264 VAC (Irish Games) |
| Width | 26.75 in. (68 cm) |
| Depth | 37.75 in. (95 cm) |
| Height | 74.75 in. (190 cm) |
| Weight | 330 lbs. (149 kg) |





mounted securely and that the green ground wires are connected.

# Control and Switch Locations

## Power On/Off Switch

The power on/off switch is located at the bottom rear of the cabinet. (See Figure 6-1.)

## Volume Control

The volume control is located on the Audio II PCB on the inner cabinet wall opposite the upper coin door. (See Figure 1-1.) The volume control adjusts the level of sound produced by the game.

## Coin Counter

The coin counter is located on the inner cabinet wall opposite the upper coin door. The coin counter records the number of coins deposited.

## Self-Test Switch

The self-test switch is located on the Audio II PCB on the inner cabinet wall opposite the upper coin door. (See Figure 1-1.) The self-test switch selects the Self-Test Mode to check game operation. Refer to Chapter 3 for a complete description of self-test operation.

# Coin and Game Option Settings

The 720° cabinet has two dual-in-line package (DIP) option switches located on the CPU printed circuit board (PCB). (See Figure 1-1.)

- The option switch at location 6/7A and switches 1 and 2 at location 5/6A are for selecting coin options.
- The option switches 3 through 8 at location 5/6A are for selecting all but two of the game options.

Set the coin and credit option settings, and all but two of the game option settings by changing the settings of the DIP switches. Refer to Table 1-2 and Table 1-3 for the available options and default (recommended) settings.

To change the coin and credit settings, and all but two of the game settings, first remove the thin film of plastic covering the option switch. Use a pen or a sharp-pointed instrument to slide the appropriate small buttons to different settings. Right is the *on position*, and left is the *off position*. The rotary control and the push buttons are *not* used to change these settings.

For the procedure to change two of the game option settings, Initial Tickets and Automatic High Score Reset, refer to *Game Option Settings* in Chapter 3.





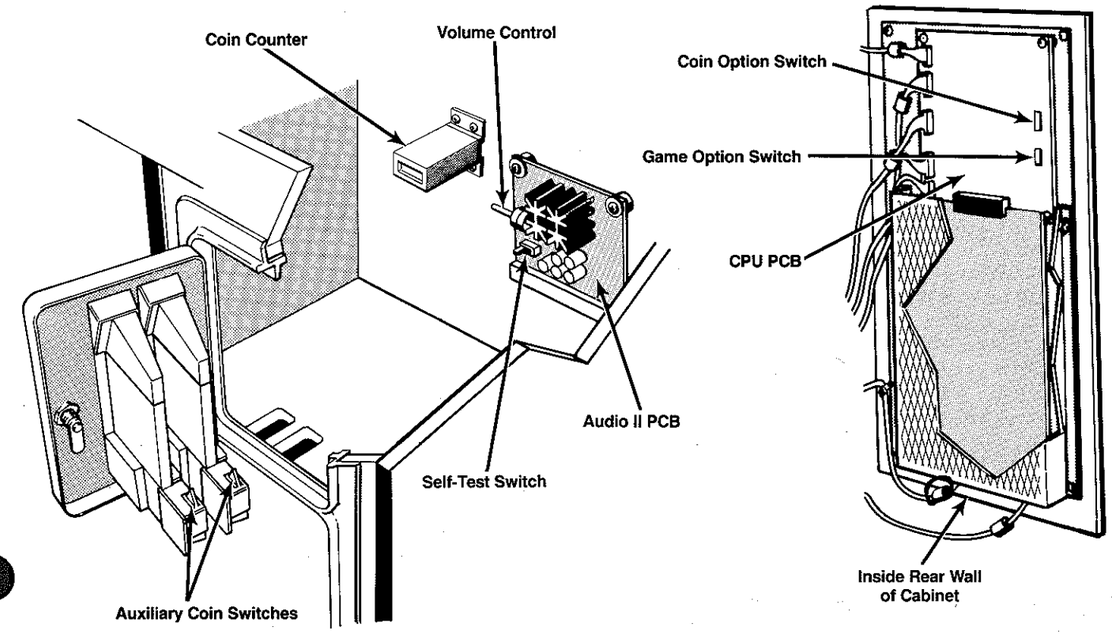



**Figure 1-1 Control and Switch Locations**

### Table 1-2 Coin and Credit Option Settings

| Settings of 8-Toggle Switch on 720° CPU PCB (at 6/7A) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Option |
| | | | | | | | | **Coins Per Credit** |
| | | | | | | Off | Off | 1 Coin 1 Credit ◄ |
| | | | | | | Off | On | 2 Coins 1 Credit |
| | | | | | | On | Off | 3 Coins 1 Credit |
| | | | | | | On | On | 4 Coins 1 Credit |
| | | | | | | | | **All Coin Mechanisms** |
| | | | Off | Off | Off | | | 1 Coin Counts as 1 Coin ◄ |
| | | | Off | Off | On | | | 1 Coin Counts as 2 Coins |
| | | | Off | On | Off | | | 1 Coin Counts as 3 Coins |
| | | | Off | On | On | | | 1 Coin Counts as 4 Coins |
| | | | On | Off | Off | | | 1 Coin Counts as 5 Coins |
| | | | On | Off | On | | | 1 Coin Counts as 6 Coins |
| | | | On | On | Off | | | 1 Coin Counts as 7 Coins |
| | | | On | On | On | | | 1 Coin Counts as 8 Coins |
| | | | | | | | | **Bonus Adder** |
| Off | Off | Off | | | | | | No Bonus Adder ◄ |
| Off | Off | On | | | | | | 2 Coins Give 1 Extra Coin |
| Off | On | Off | | | | | | 4 Coins Give 1 Extra Coin |
| Off | On | On | | | | | | 4 Coins Give 2 Extra Coins |
| On | Off | Off | | | | | | 5 Coins Give 1 Extra Coin |
| On | Off | On | | | | | | 3 Coins Give 1 Extra Coin |
| On | On | On | | | | | | Free Play |

◄ *Manufacturer's recommended settings*

### Table 1-3 Game Option Settings

| Settings of 8-Toggle Switch on 720° CPU PCB (at 5/6A) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Option |
| | | | | | | | | **Ticket Levels** |
| | | | | | | Off | On | Easy (First Ticket: 3000) |
| | | | | | | Off | Off | Medium (First Ticket: 5000) ◄ |
| | | | | | | On | Off | Hard (First Ticket: 8000) |
| | | | | | | On | On | Very Hard (First Ticket: 12,000) |
| | | | | | | | | **Timer for Street** |
| | | | | Off | On | | | Easy (Longest Time) |
| | | | | Off | Off | | | Medium ◄ |
| | | | | On | Off | | | Hard |
| | | | | On | On | | | Very Hard (Shortest Time) |
| | | | | | | | | **Add-A-Coin Control** |
| | | Off | On | | | | | No Add-A-Coin |
| | | On | Off | | | | | Maximum of 1 Add-A-Coin |
| | | Off | Off | | | | | Maximum of 2 Add-A-Coins ◄ |
| | | On | On | | | | | Maximum of 3 Add-A-Coins |
| | | | | | | | | **Start Game/Add-A-Coin Ratio** |
| Off | On | | | | | | | 1:1 (1 Credit to Start/1 Credit to Continue) |
| Off | Off | | | | | | | 2:1 (2 Credits to Start/1 Credit to Continue) ◄ |
| On | On | | | | | | | 3:1 (3 Credits to Start/1 Credit to Continue) |
| On | Off | | | | | | | 3:2 (3 Credits to Start/2 Credits to Continue) |

◄ *Manufacturer's recommended settings*



Chapter 2

# Game Play

## Introduction

720°™ is a one or two-player (alternating) skateboard-themed game with both competitive and street-style skating action. The player portrays the skater who performs skate maneuvers for points and competes in skate parks for medals. The action takes place in a Skate City where all surfaces are skateable. Players can choose where they want to skate in the city, and which skate parks they want to enter, making each new game a different experience.

# Operating Modes

720° has four operating modes: Attract, Play, High Score and Self-Test. In high score mode, there are two Top Skaters tables: one for Overall Score and another for Medals Score (for most medals won in skate parks). If the player ranks among the top 15 for either of these two tables, 40 seconds are allowed to enter initials onto the High Score Table. Initials are selected by using the rotary control and pressing the Kick button when the desired initial is displayed. As in other recent Atari Games products, 720° has an Automatic Reset of High-Score feature. The table is reset to factory scores and initials every 2,000 plays but no less than 200 plays since the last player entered initials.

# Game Play

At the start of each game, players can select one of two play modes. A training game is available for beginning players. In this game, there are numerous playing hints and messages, and the add-a-coin feature is disabled. Experienced players can start off by skating to a higher platform. Fewer game hints are given in this mode, and the add-a-coin feature is offered.

Game play starts with the player in the middle of Skate City. Using a new rotary control and a Jump and a Kick button, players maneuver around the city trying to score points by performing skillful skate moves. At various score thresholds, skate park tickets are rewarded. These tickets allow entry into one of the skate parks, where players compete against the clock for gold, silver or bronze medals.

The player's main objective is to compete in as many skate parks as possible. In the city streets, players have a limited amount of time to win entry tickets and make their way to a skate park. In addition, there are numerous city hazards which must be avoided such as BMX riders, cars, Frisbee throwers, and other gangs. To guide the player in the city, players find map areas in streets which momentarily display the layout of the city and the location of the skate parks.

In 720° there are ten class levels which determine the degree of difficulty in the skate parks and the timer in the streets. Players select the class level in which they want to compete. For instance, at the start of each game, there are four unique skate parks which are located in the outskirts of the city. Each park is a different class ranging from class 1 difficulty, which is the easiest, to class 4 difficulty, the hardest.

In 720° players can compete in over twenty different skate parks. Each one requires unique skill moves to qualify for a medal. There are variations of a half-pipe ramp, a downhill, a slalom and a jump park. Each skate park has a distinct music score of its own, creating a different mood for players.



In the skate parks, cash prizes are awarded to players that qualify for a medal. After each skate park competition, the game continues back in the city for more street-style skating. Players can use their cash winnings to buy equipment from various skate shops which are located throughout the city. Skating equipment helps players perform better moves. *Boards* give faster speed. *Helmets* allow more risk-taking for successful maneuvers. *Pads* give faster recovery from falls. *Shoes* provide more height on jumps and quicker starts. As a reference for locating skate shops and park entrances, players find map areas throughout the city by skating over a map. A layout of the city is momentarily displayed when players skate over a map.

In 720° a game ends only when players run out of time in the city. When the timer is running low, a *SKATE OR DIE* message appears along with a warning in speech. When the timer runs out, killer bees appear as a final warning. If the player is killed by the bees before entering a skate park, the game is over. Using the add-a-coin feature, players can continue where they left off. 720° has an operator option to select maximum number of add-a-coins allowed. By using the add-a-coin, players can keep any special skate equipment they have acquired in the previous game, as well as all accumulated cash, tickets, points, and medals.

# Hints for Game Play

- Develop skill in using the rotary control in conjunction with the Jump button to do aerial moves, because they are worth more points. Press the Jump button after gaining speed, and then rotate the control in a 360-degree motion. In this game, it is possible to do much more than just a 360-degree turn!
- When attempting certain aerial or rotational moves, it is important to be properly aligned on landing, otherwise the skater bails, or falls down.
- To qualify for medals in the higher classes of skate parks, it is best to try to buy some skate equipment first to allow players to perform harder moves.
- Daring players should try to wait out the timer in the streets, performing skate moves and acquiring points until the timer is about to expire.

# Operator Hints

Here are some pointers for maximizing earnings from your 720° game. The factory setting might need to be adjusted after the game has been on location for a long period of time or if your location does not warrant two coins per play.

## Maximizing Earnings

The key to maximum earnings is striking a midpoint on game times. Initially, game times should be short enough to allow higher player turnover. At the same time, game times must be long enough to give the player good value and ensure continued repeat play.







720° has a comprehensive statistics and coin accounting package which is described in detail in Chapter 3 of this manual. To find out whether or not your players are getting adequate value for their money, you should evaluate the following information.

> **NOTE**
>
> For your convenience, a tear-out statistics sheet is included at the back of this manual. Use this sheet to track your 720° game statistics.

## Average Game Times

There are two average game times listed on the Accounting Information screen in the Self-Test Mode. One reading indicates Average Starting Game Time which shows average times per credit for all starting games only. The other reading, Average Add-a-Coin Game Time, represents average times per credit only for games played using the game continuation feature. If the game is set at factory-recommended settings, initially the Average Starting Game Time should be between 2:00 and 2:30 minutes. On factory settings, two credits are required for game start, and one credit for game continuation. The Average Starting Game Time, however is not tied into the number of credits required for game start. Therefore, it is accurate even if you have changed the option setting to one credit to start.

If the Average Starting Game Time is not in the range of 2:00 to 2:30 minutes, refer to the Histogram screens. 720° has two histogram screens representing the distribution of game times in 30-second increments. Be sure to refer to the Histogram screen for Starting Game Times. If a high percentage of game times are under 1:30 (for example, over 40% of total coins collected), the game might be too difficult for the particular location. Game option settings should be adjusted by changing the Timer for Street setting one level easier. If game times are still too short after one or two weeks, try changing the Ticket Levels setting to one level easier, in addition to leaving the Timer for Street option at the easier setting.

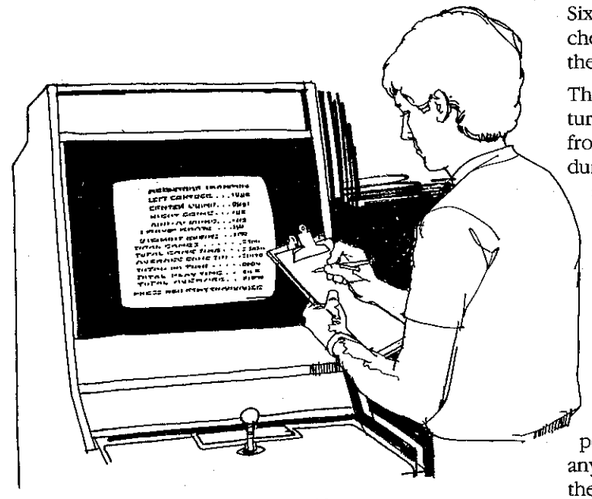
Conversely, if a high percentage of your Average Starting Game Times are over 1:30, the current settings might be too easy. In this case, the Timer for Street setting should be adjusted to one level harder. Again, if game times are not affected, an additional setting change might be required by making the Ticket Levels setting one level harder.

> **NOTE**
>
> The previously mentioned recommendations are based on factory settings of two credits to start, one credit for game continuation (U.S. currency).

The histogram data in 720° will show a small percentage of players who can play the game for over 5:00. Atari Games research has shown that this is a positive factor in the long-term appeal of a game, as long as the number of longer games represents only a small percentage of the total.

Chapter 3

# Self-Test



This game tests itself and provides visual and audible indications of the condition of the game circuitry and controls. Self-test information is displayed on the screen and sent through the sound system. No additional equipment is required.

We suggest that you perform a self-test when you first set up the game, each time you collect the money, or when you suspect game failure. Coin and game option settings are displayed in the Self-Test Mode.

Sixteen self-test screens provide a visual and audible check of the 720°™ game circuits. Refer to Figure 1-1 for the self-test switch location.

The Self-Test Mode can be entered immediately after turning on the game power, either from the Play Mode or from the Attract Mode. If the self-test switch is turned on during the Play or the Attract Mode, the first display to appear is the Accounting Information. By pressing the Kick button, the self-test advances to the Control Test. The self-test then advances from the Control Test to the end. The game power must be turned off, the self-test switch turned on, and the game power turned on again to start the self-test with the RAM/ Interrupt/ROM Test.

The following self-test procedure is presented in the sequence in which the self-test screens appear when the self-test switch is turned on and *then* the game power is turned on. Turning off the self-test switch at any time during the self-test causes the game to return to the Attract Mode.

**NOTE**

During any of the self-tests, press either Kick button to advance to the next screen.

## RAM/Interrupt/ROM Test

The RAM/Interrupt/ROM Test screens are shown in Figures 3-1, 3-2, and 3-3. These screens display the failure information for the RAM, interrupt, and program ROM circuitry on the CPU and Video PCBs. If the RAM/Interrupt/ROM test passes, the display advances to the 6502 Processor Test.

The RAM test checks the condition of the T-11 microprocessor RAM, zero page RAM, motion object RAM, playfield RAM, alphanumeric RAM, and associated circuitry located on the Video PCB. If the RAM test fails, an error message gives the location of the failed RAM or associated circuitry on the Video PCB as shown in Figure 3-1.

If the zero-page RAM or associated circuitry fails, the screen turns red and the address location of the failed component flashes continuously to facilitate troubleshooting.

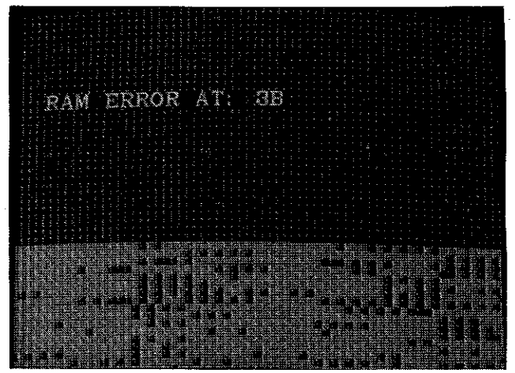



**Figure 3-1 RAM Test Fails**

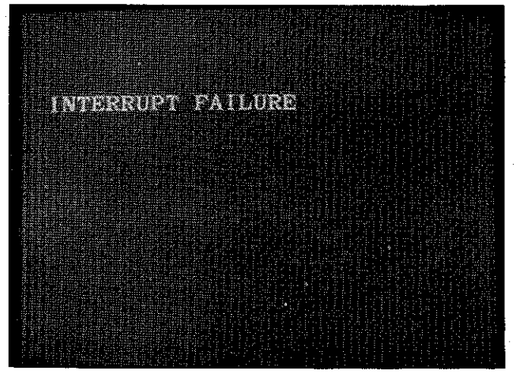



**Figure 3-2 Interrupt Test Fails**

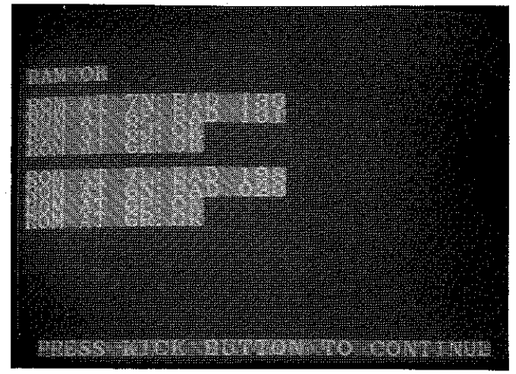



**Figure 3-3 ROM Test Fails**

After the RAM test passes, the interrupts on the CPU and Video PCB are checked. If the interrupt test fails, an error message as shown in Figure 3-2 can appear on a green screen, which indicates a possible vertical-blanking or interrupt-logic failure.

After the interrupt test passes, all eight of the program ROMs on the CPU PCB are tested for check sums. If the ROM test fails, an error message gives the location of the failed ROM or associated circuitry as shown in Figure 3-3.

## 6502 Processor Test

The 6502 Processor Test screen provides visual and audible information to indicate the condition of the 6502 sound microprocessor and associated circuitry. All functions of the sound microprocessor are checked including: RAM/ROM, interrupts, music synthesizer, and sound-effects processor. Basic communication between the T-11 (master) and the 6502 (slave) microprocessors is also checked.

The 6502 test starts with a reset/communications check that first resets the 6502 and then checks for proper response to start up protocol. This test checks the communications ports (T-11 to 6502 and 6502 to T-11), the 6502 reset circuit, and the general condition of the 6502.

If the 6502 circuitry does not respond properly to the reset, the system retries the reset procedure ten times. Then an error message and retry count number is displayed as shown in Figure 3-4.

If the 6502 circuitry fails to reset through all ten attempts, a communications error message is displayed as shown in Figure 3-5.

If the reset/communications check passes, then the condition of the 6502 microprocessor, RAM, ROM, interrupts, music (Yamaha) synthesizer, and associated circuitry is checked. If one or more of these circuits fails, an error message is displayed as shown in Figure 3-6.





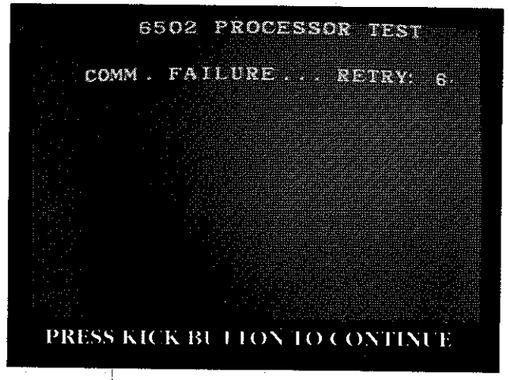



**Figure 3-4 Reset Retry**

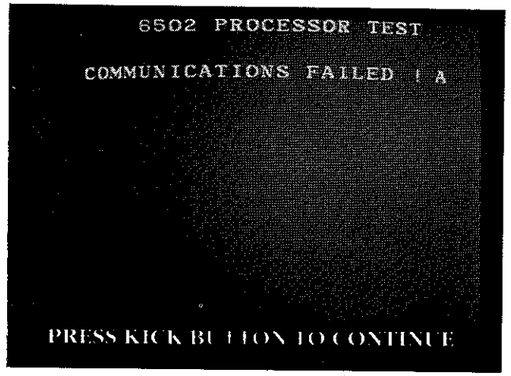



**Figure 3-5 Communications Fails**

If the RAM, ROM, and music synthesizer check passes, then the music (Yamaha) synthesizer, and sound-effects generator (POKEY) sound outputs are checked. As each of these three tests is run, an appropriate message is displayed as shown in Figure 3-7.

- *YAMAHA TEST* consists of eight tones in a major scale that alternate between left and right sound channels (16 tones total).
- *L. POKEY TEST* consists of four tones in a major chord that come from the left sound channel.
- *R. POKEY TEST* consists of four tones in a major chord that come from the right sound channel.

After the three sound output tests are completed, the sound status messages are displayed as shown in Figure 3-8.

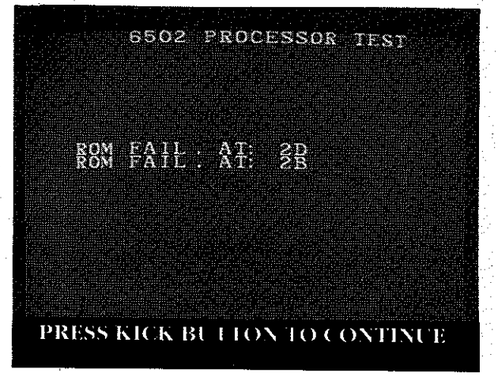



**Figure 3-6 Music/RAM/ROM Fails**

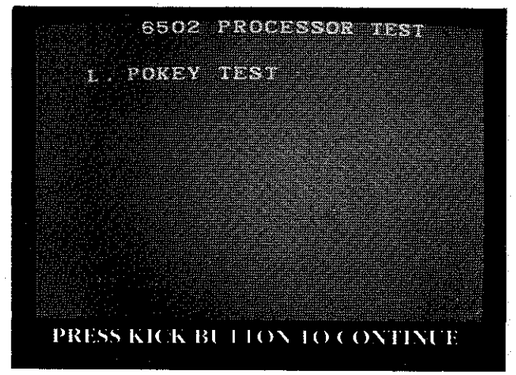



**Figure 3-7 Sound Output**

- *NUMBER OF SOUNDS* is the total number of sounds used in the 720° game.
- *CURRENT SOUND* is the current sound selected for playing.

Press the Jump button to select the sound numbers indicated by the *CURRENT SOUND* message shown in Figure 3-8. Turn the rotary control to sequence through the selected sounds.

The sound status screen also indicates the condition of the left and right coin switches. Press the left and right coin switches, and check the screen for a corresponding *LEFT COIN* and *RIGHT COIN* message. (See Figure 1-1 in Chapter 1 for the switch locations.)

Press either Kick button to obtain the next screen.

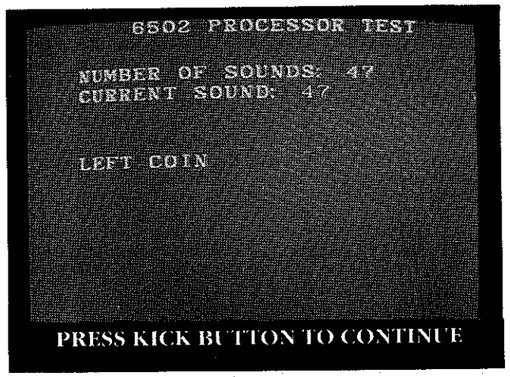



**Figure 3-8 Sound Status**

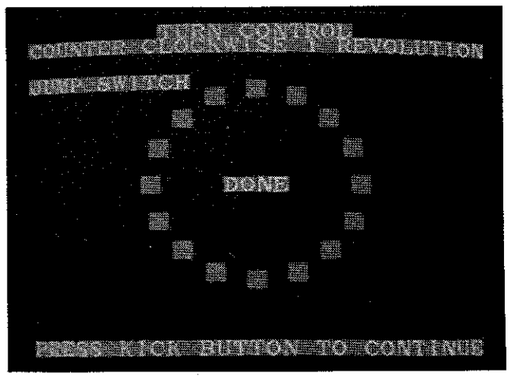



**Figure 3-9 Control Test Passes**

### Control Test

The Rotary Control Test screen is shown in Figure 3-9. The control test checks the rotary control, or rotating skater control, and the Jump switch. (It is assumed that the Kick switch works since it must be functioning to get to this test.)

First, the zeroing function of the control is checked. This function gives the control a point of reference for determining direction. Rotate the control clockwise slowly until the *ZEROED* message is displayed in the center of the test circle. This should occur when the control is at the top, or closest to the video display screen. Then release the control. The test then requires a counterclockwise rotation. (If the control is not at the top, you will be asked to put it in this position.)

As the control turns, the on-screen boxes corresponding to the control's position should fill in. If the control is rotated too quickly, some boxes will be missed. Once all the boxes have been filled, a *DONE* message is displayed in the center of the circle. The test then repeats this procedure for a clockwise rotation. (Again, if the control is not at the top, you will be asked to put it in this position.) After completing the clockwise rotation procedure, the test returns to a counterclockwise rotation and repeats.

At any time during the test, pressing the Jump switch causes a *JUMP SWITCH* message to be displayed as long as the switch is held down.

Press either Kick button to obtain the next screen.

### Motion Object Test

The first Motion Object Test screen is shown in Figure 3-10. This test indicates the motion object horizontal and vertical display locations, motion-object color palettes, and checks the motion/playfield prioritizing logic circuit.

The Motion Object Test screen should show 39 motion objects and four colored boxes (numbered 0 through 3). The left two boxes (0 and 1) should be red, and the right two boxes (2 and 3) should be green. The motion objects should be colored (from left to right) blue, light blue, purple, and white. Any error in color can indicate a problem with the color palette select circuits.

Turn the rotary control to control the direction of the scroll. Hold the Jump button to scroll. Press the Jump button to select the next motion object. Note that the currently displayed motion object moves correspondingly. Move the motion object across the four colored boxes. Note that the motion object moves *behind* the red boxes and *in front of* the green boxes. Press the Jump button to select the next motion object and repeat the preceding procedure.

Press either Kick button to obtain the next screen.

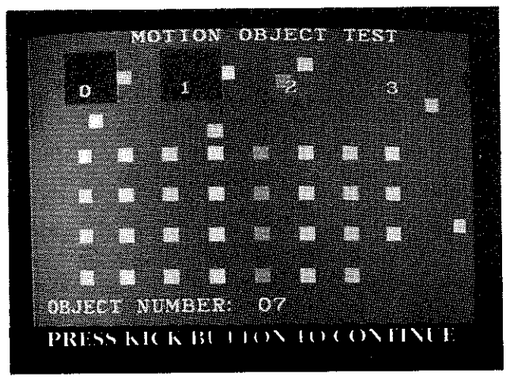



**Figure 3-10 Motion Object Test**





### Motion Object Height Test

The Motion Object Height Test screen is shown in Figure 3-11. This test indicates the condition of the motion object height circuit and the horizontal load disable circuit.

Each successive column of motion objects should be 16 pixels taller than the last. The top 16 pixels of each column should be the same. Each column should add a new 16 × 16 pixel stamp picture to the bottom and slide the previous one up by 16 pixels. Turn the rotary control to control the direction of the scroll. Hold the Jump button to scroll. Press the Jump button to obtain a new set of motion objects.

Press either Kick button to obtain the next screen.

### Alphanumeric Test

The Alphanumeric Test screen is shown in Figure 3-12. This screen indicates the condition of the alphanumeric ROM, alphanumeric color palettes, and associated circuitry.

This screen shows eight lines of alphanumeric characters, the top four lines with large characters and the bottom four lines with small characters. Each line should be displayed in a different color.

Press either Kick button to obtain the next screen.

### Scrolling Playfield Test

The Scrolling Playfield Test screen is shown in Figure 3-13. This screen indicates the condition of the playfield ROM, playfield display circuits, and playfield color palettes.

The display in Figure 3-13 shows the central square of Skate City. Turn the rotary control to control the direction of the scroll. Hold the Jump button to scroll.

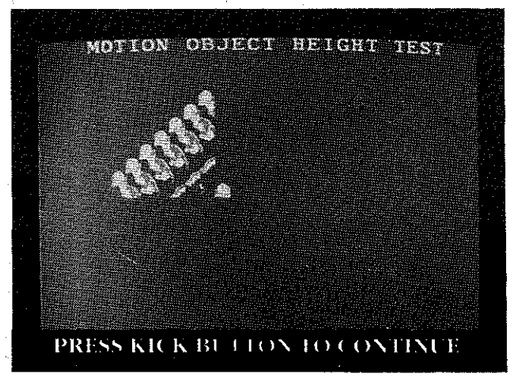



**Figure 3-11 Motion Object Height Test**



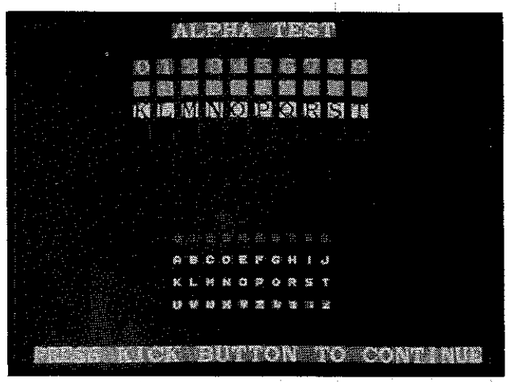



**Figure 3-12 Alphanumeric Test**

**Figure 3-13 Scrolling Playfield Test**

Press either Kick button to obtain the next screen.

### Color Bar Test

The Color Bar Test screen is shown in Figure 3-14. This test indicates the condition of the color RAM, video amplifiers, and associated circuitry.

Sixteen vertical grey-scale bars and three groups of sixteen vertical bars with shades of red, green, or blue are displayed. The brightest bar should be on the left and darkest (black) bar on the right, with a black frame around the screen. Each group of red, green, or blue should be split in half horizontally to show two fade scales. Each upper fade scale is ranged by changes in overall intensity (Z) and each lower fade scale by individual color intensity (R, G, B). This test helps to determine if white tracking is set properly (grey-scale bars range from white to grey).

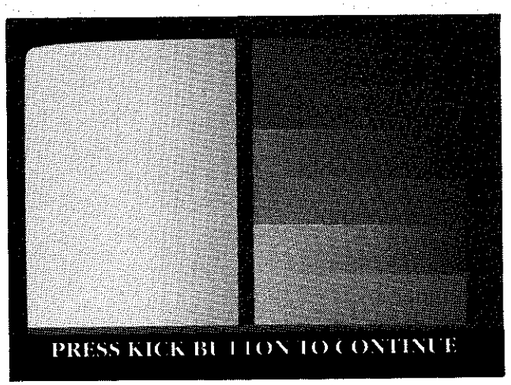



**Figure 3-14 Color Bar Test**

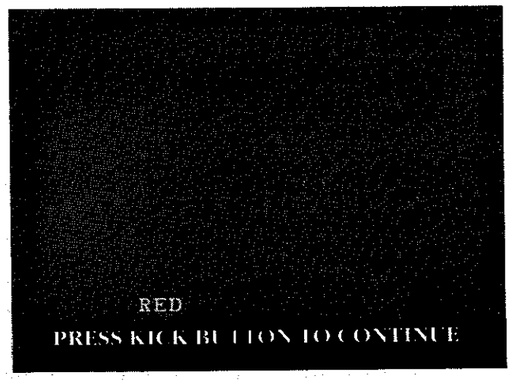



**Figure 3-15 Color Purity Test**

Refer to the white tracking procedure in the video display manual if adjustment is required.

Press either Kick button to obtain the next screen.

## Color Purity Test

The Color Purity Test consists of five color displays that indicate the condition of the display color-purity circuits. The first display to appear should be a red screen with the word *RED* displayed at the top of the screen as shown in Figure 3-15. Also included on all of the color purity screens are small elbow-shaped characters at the four corners of the screen. These characters are used for screen and alignment adjustments.

Press the Jump button, and the next display to appear should be a green screen with the word *GREEN* displayed at the top of the screen. Press the Jump button to obtain a blue, white, and finally a grey screen. After the grey screen, the display repeats this sequence.

If the display characteristics are not correct, refer to the video display manual for the color-purity adjustment procedure or the possible cause of failure.

Press either Kick button to obtain the next screen.

## Convergence Test

The Convergence Test screen is shown in Figure 3-16. This test indicates the condition of the display size, centering, linearity, and convergence.

Initially, a white-dot convergence pattern is displayed. Convergence between any two colors should not exceed 0.7 mm in the middle of the screen and 1.2 mm in the corners.

Press the Jump button to obtain a violet pattern for adjusting the red-to-blue convergence. Pressing the Jump button again displays a green pattern, and then the sequence is repeated.

This pattern can also be used to adjust screen size, centering, and brightness (black level). To obtain the proper screen size, overscan or adjust the pattern to be larger than the face of the CRT: all four pattern corners should be just beyond the corners of the CRT. After adjusting the screen size, check the game playfield in the two-player mode: verify that the score information for both players is on the screen.

Press either Kick button to obtain the next screen.

## Accounting Information

The Accounting Information is shown in Figure 3-17. This screen provides a visual check of the current game statistics. The statistics information is accumulated either from the first time the game was turned on or from the last time the statistics were reset.

The following game statistics appear on the Accounting Information screen:

- *LEFT COINS* shows the total number of coins deposited in the left coin mechanism.

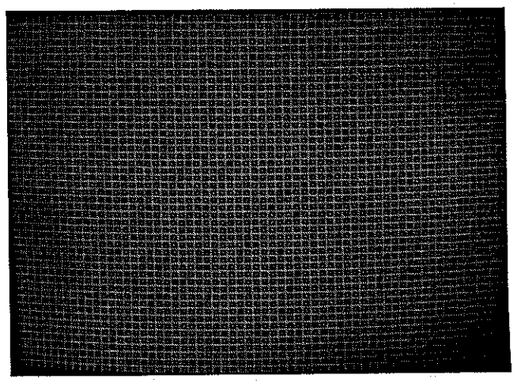


**Figure 3-16 Convergence Test**







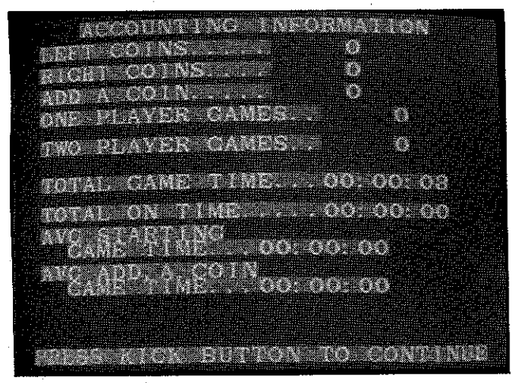



**Figure 3-17 Accounting Information**

- *RIGHT COINS* shows the total number of coins deposited in the right coin mechanism.
- *ADD A COIN* shows the total number of times a game was continued using the add-a-coin feature.
- *ONE PLAYER GAMES* shows the total number of games that were played with one player only.
- *TWO PLAYER GAMES* shows the total number of games that were played with two players.
- *TOTAL GAME TIME* shows the accumulated time of all one- and two-player games played in hours, minutes, and seconds.
- *TOTAL ON TIME* shows the total time in hours, minutes, and seconds that the game has been turned on.
- *AVERAGE STARTING GAME TIME* shows the total game time of all starting games divided by the total number of plays in hours, minutes, and seconds.
- *AVERAGE ADD A COIN GAME TIME* shows the total game time of all continued games divided by the total number of add-a-coin plays in hours, minutes, and seconds.

The game statistics are accumulated from the first time the game is turned on or from the last time the statistics were reset.

Press either Kick button to obtain the next screen.

## Starting Game Time Histogram

The Starting Game Time Histogram screen is shown in Figure 3-18. This screen shows the distribution of times for starting games. These times are measured from game start to first add-a-coin, or from game start to game end if no coin is added. The number of games in each category is indicated numerically and as a bar graph.

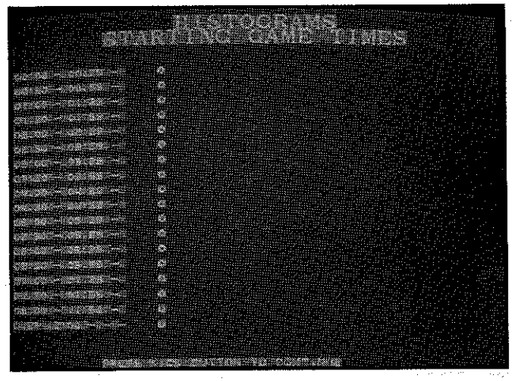



**Figure 3-18 Starting Game Time Histogram**

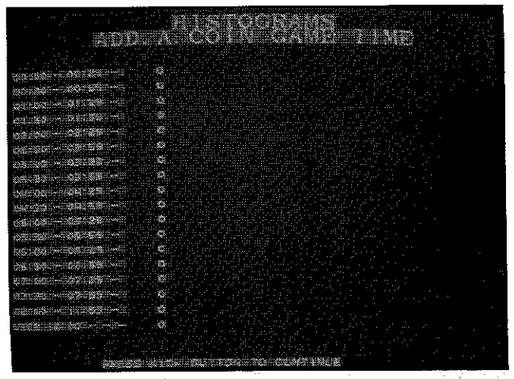



**Figure 3-19 Add-A-Coin Game Time Histogram**

## Add-A-Coin Game Time Histogram

The Add-A-Coin Game Time Histogram screen is shown in Figure 3-19. This screen shows the distribution of times for Add-A-Coins. These times are measured from the time a coin is added until the next coin is added or the game ends. The number of games in each category is indicated numerically and as a bar graph.

Press either Kick button to obtain the next screen.

## Reset Saved Information Screen

The Reset Saved Information screen is shown in Figure 3-20. This screen resets the high score table and the accounting information to the factory settings. Use the following procedure to reset these items:

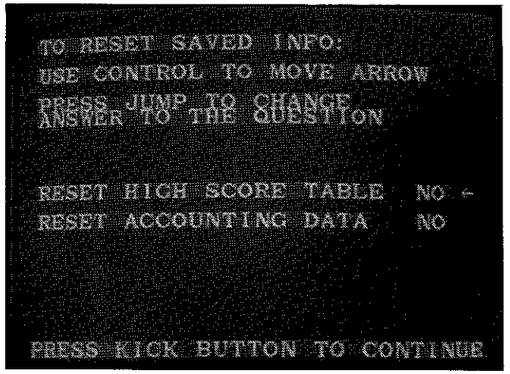



**Figure 3-20 Reset Saved Information Screen**

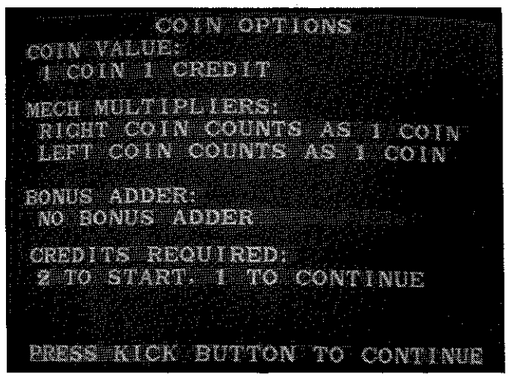



**Figure 3-21 Coin Option Settings**

1. Turn the rotary control to select the item to reset.
2. Press the Jump button to change the *NO* message to *YES*.
3. Press either Kick button to reset the selected tables. After a brief *PLEASE WAIT* message is displayed, the self-test automatically advances to the next screen.

## Coin Option Settings

The Coin Option Settings screen is shown in Figure 3-21. This screen indicates the current coin and credit option settings of the two dual-in-line package (DIP) switches at locations 6/7A and 5/6A on the CPU PCB. The option switches at location 6/7A and switches 1 and 2 of the option switches at location 5/6A are used for selecting the coin and credit options.

Set the coin and credit option settings by changing the settings of the DIP switches located on the CPU PCB. Refer to Tables 1-2 and 1-3 in this manual for the available options and default (recommended) settings.

To change these settings, first remove the thin film of plastic covering the option switch. Use a pen or a sharp-pointed instrument to slide the appropriate small buttons to different settings. Right is the *on position*, and left is the *off position*. The rotary control and the push buttons are *not* used to change these settings.

Press either Kick button to obtain the next screen.

## Game Option Settings

The Game Option Settings screen is shown in Figure 3-22. This screen shows the current game option settings. The first three options listed under DIP Switch Options indicate the settings of switches 3 through 8 of the DIP switch at location 5/6A on the CPU PCB. These switches 3 through 8 are used to select the game options. Refer to the previous section for the procedure for selecting these options.

Two game options, Initial Tickets and Automatic High Score Reset, listed under EEROM Options can be changed *only from this screen*. To change either of these options, turn the rotary control until the arrow on the screen points to the option to be changed. Then press the Jump button to step through the possible values for the option. Each of these options retains the selected value after exiting from the screen.

The factory-recommended settings for these options are:

| | |
|---|---|
| Initial Tickets | 0, 1 ◄, 2, 3 |
| Automatic High Score Reset at 2000 Plays | Yes ◄, No |

Press either Kick button to return to the 6502 Processor Test.

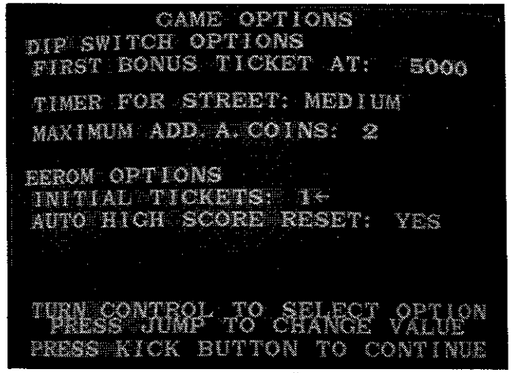



**Figure 3-22 Game Option Settings**

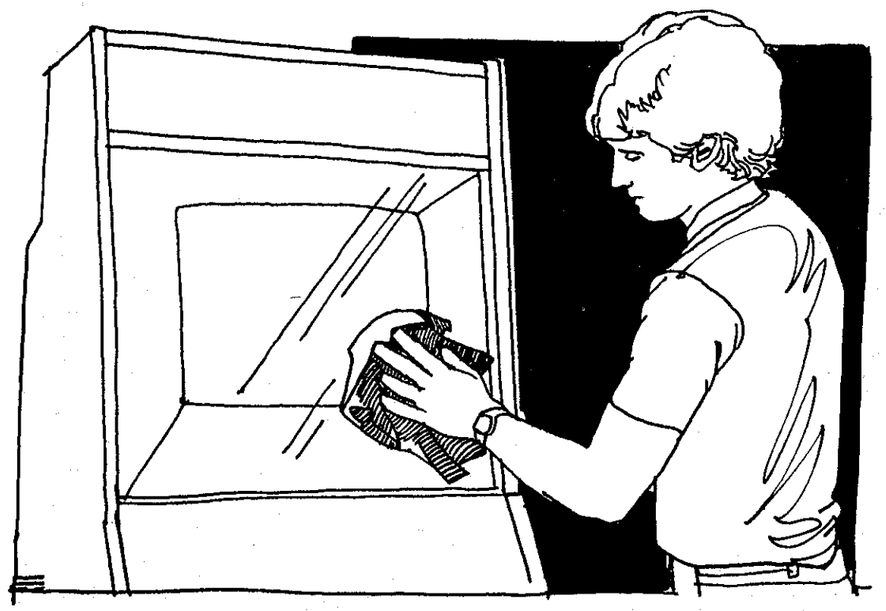


Chapter 4

# Maintenance

This chapter includes preventive and corrective maintenance procedures for the 720°™ game components that are subject to the most use. To assure maximum trouble-free operation from this game, we recommend that preventive maintenance be performed as described in this chapter.

Removal, disassembly, reassembly, and replacement procedures are provided for components that might require corrective maintenance. Appropriate references are provided to Chapter 6, Illustrated Parts Lists, to aid in locating the parts of this game that are mentioned, but not illustrated, in the maintenance procedures.



# Preventive Maintenance

Preventive maintenance includes cleaning, lubricating, and tightening hardware. How often preventive maintenance is performed depends upon the game environment and frequency of play. However, for those components listed in Table 4-1 Preventive-Maintenance Intervals, we recommend that preventive maintenance be performed at the intervals specified.

## Preventive-Maintenance Intervals

The preventive-maintenance intervals specified in Table 4-1 are the recommended minimum requirements for the components listed.

> **⚠ WARNING ⚠**
>
> To avoid possible electrical shock, turn off the game before performing any maintenance procedures.

## Removing the Control Panel

Perform the following procedure to remove/replace the control panel. (See Figure 4-1.)

1. Unlock and open the coin door on the front of the cabinet.
2. Carefully reach up through the top coin door opening and release the spring-draw latches located under the control panel on both sides of the cabinet.
3. Use a 5/32-inch Allen wrench to remove the screw securing the front of the control panel to the cabinet.
4. Grasp the rotary control and gently lift until the bottom edge of the control panel clears the cabinet.
5. Stand the control panel on its back edge by placing it in the wood slots located under the control panel on each side of the cabinet. The panel is now in position for servicing the leaf switches or rotary control.
6. If you need to remove the control panel, disconnect the rotary control harness connector and the two PCB Assembly harness connectors. Remove the control panel from the cabinet.
7. Replace the control panel in the reverse order of removal.

**Table 4-1 Recommended Preventive-Maintenance Intervals**

| | |
|---|---|
| **Rotary Control** | Inspect weekly, lubricate, and tighten hardware at least every three months. |
| **Coin Mechanism** | Inspect whenever you collect coins. Clean at least every three months. |

## Cleaning the Push Button Leaf Switches

Perform the following procedure to clean the leaf switch contacts and tighten the securing hardware.

1. Follow the procedure described in the preceding steps 1–8 for removing the control panel.
2. Use electrical contact cleaner to clean the contacts. Do not burnish them. When the push button is pressed, the wiping action of the cross-bar contacts provides a self-cleaning feature.
3. Using a 15/16-inch open-end wrench, tighten the stamped nut securing the push button leaf switches to the control panel.

## Maintaining the Rotary Control

Preventive maintenance on the rotary control consists of:

- Inspecting the rotary control housing for excessive wear or dirt.
- Inspecting the Dual Optical Coupler PCB Assembly for damage.
- Lubricating the friction-producing surface of the area surrounding the roller in the upper housing and the roller itself, the lower ball in the bearing housing, and the chain in the encoder disc shield area.

> **NOTE**
>
> The rotary control must be removed from the control panel in order to have access to the lubrication points, except for lubricating the chain.

- Replacing or tightening the securing hardware if necessary.

Perform the following procedure to lubricate and tighten the rotary control. (See Figure 4-2.)

1. Open the control panel as previously described.
2. Disconnect the harness connectors from the Dual Optical Coupler PCB Assembly.
3. Using a 3/8-inch nut driver, remove the four hex nuts holding the rotary control assembly to the control panel.





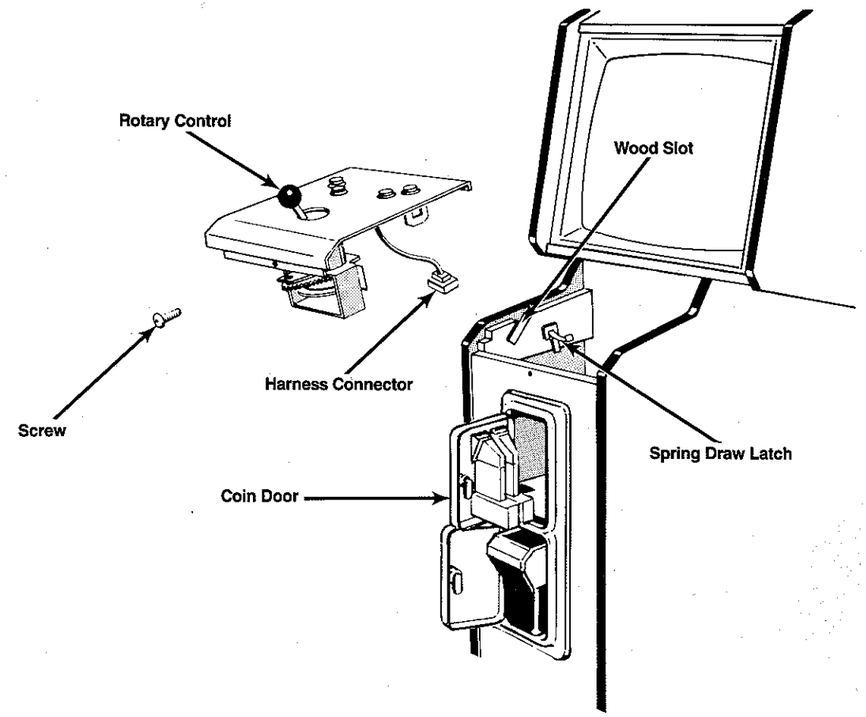



**Figure 4-1 Control Panel Removal**

4. Apply a chain lubricant (Atari part no. 107028-001) to the chain.
5. Disassemble the rotary control as described in *Disassembling the Rotary Control* later in this chapter to gain access to the lubrication points.
6. Apply lithium grease (Atari part no. 107027-001) to the roller and the lower ball of the control handle.
7. Apply a film of light oil (Atari part no. 107013-001) to the pivot arm attached to the bottom housing plate.
7. Apply a chain lubricant (Atari part no. 107028-001) to the chain.
8. Reassemble the rotary control. Reconnect the harness connectors to the PCB Assembly.
9. Using a 3/8-inch nut driver (or an appropriate tool), tighten the hex nuts holding the rotary control assembly to the control panel.

## Cleaning the Coin Mechanism

Use a soft-bristled brush to remove loose dust or foreign material from the coin mechanism. A toothbrush can be used to remove any stubborn build-up of residue in the coin path. After cleaning the coin mechanism, blow out all of the dust with compressed air.

## Cleaning the Interior Components

Perform the following procedure to clean the components inside the cabinet.

> **⚠ WARNING ⚠**
>
> Turn off the game power, but do not unplug the power cord before cleaning inside the cabinet. The power cord provides a ground path for stray static voltages that can be present on the cleaning tools.

1. Unlock and open the rear access door.
2. Discharge the high-voltage from the cathode-ray tube (CRT) before proceeding. The display assembly con-

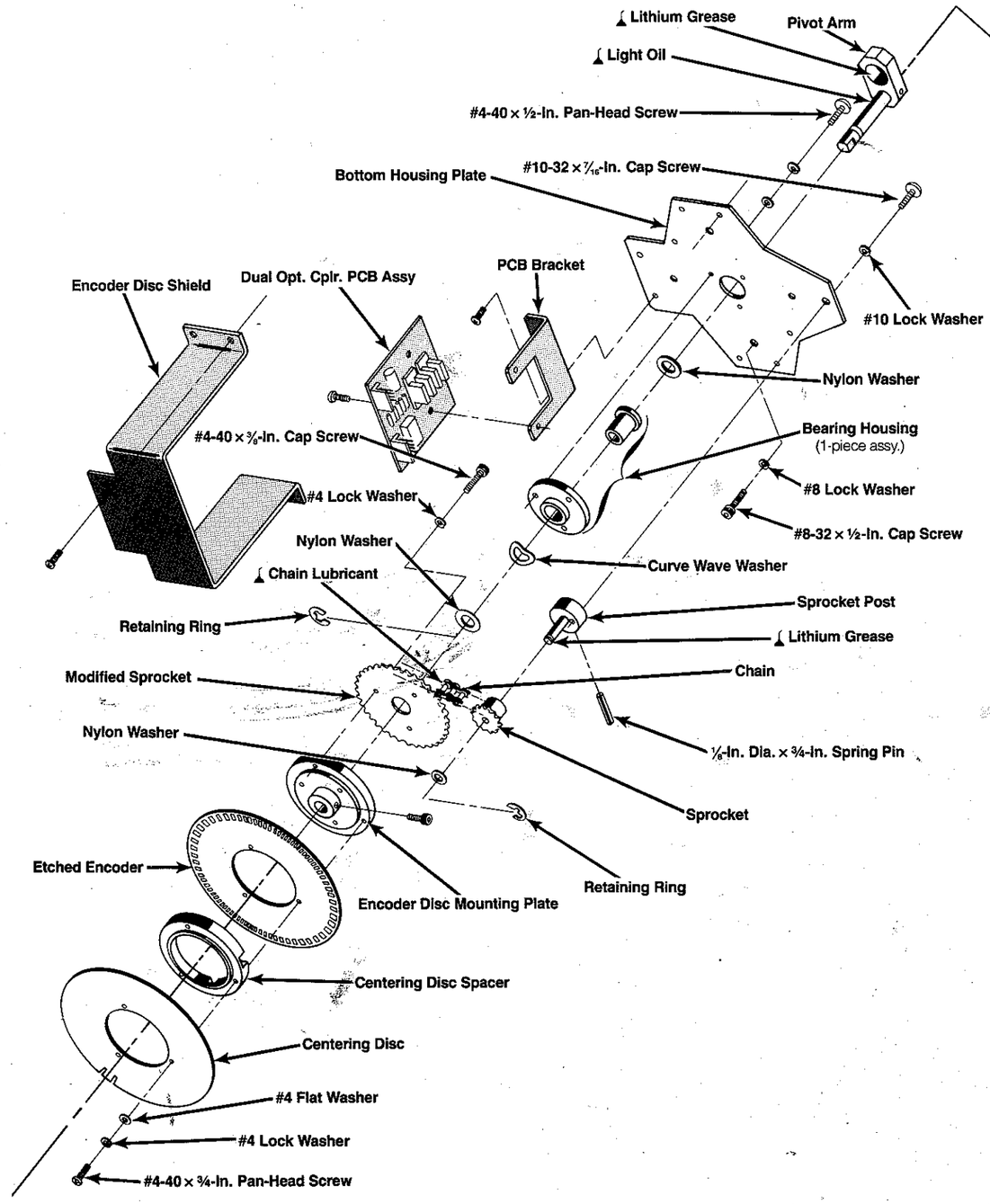



**Figure 4-2 Maintaining the Rotary Control**





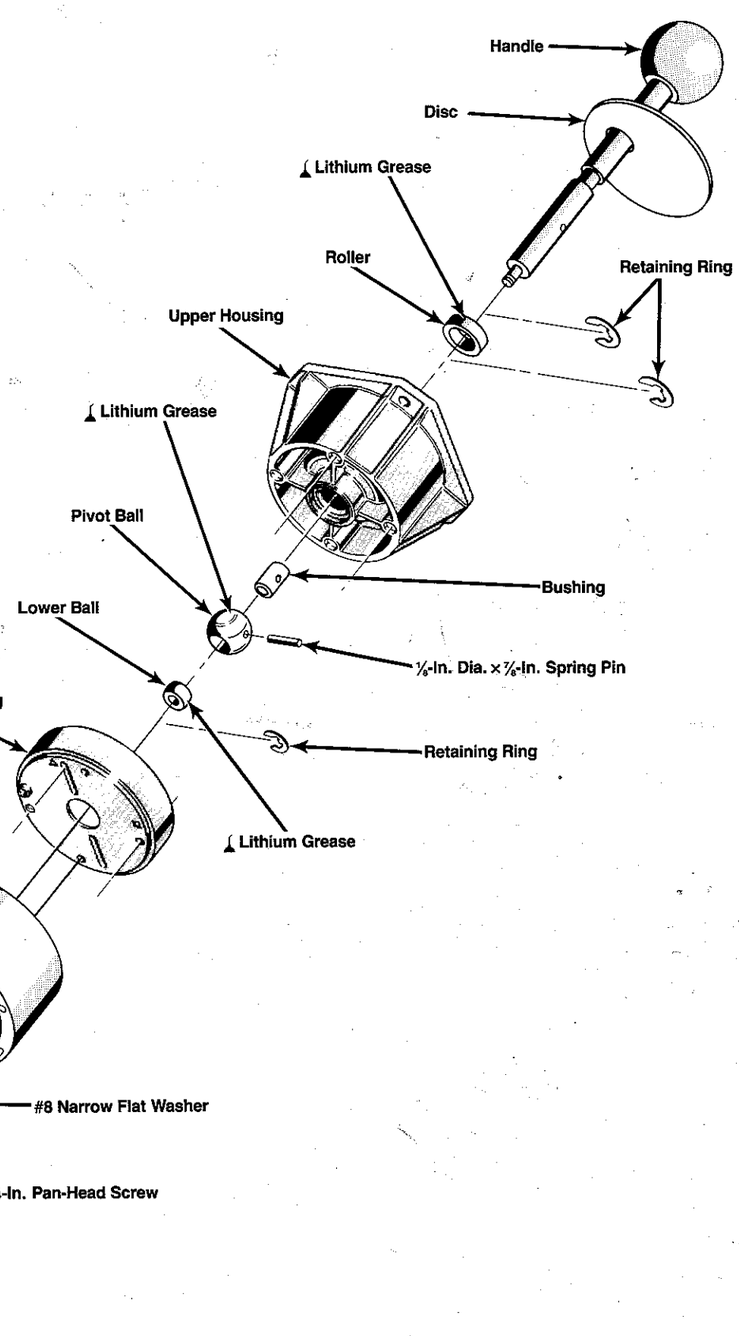



**Figure 4-2 Maintaining the Rotary Control, Continued**

tains a circuit for discharging the high voltage to ground when power is removed. However, to make certain, always discharge the display as follows.

a. Attach one end of a large, well-insulated, 18-gauge jumper wire to ground.

b. Momentarily touch the free end of the grounded jumper to the CRT anode by sliding it under the anode cap.

c. Wait two minutes and repeat part b.

3. Use a vacuum cleaner with a soft long-bristled brush attachment or use a soft-bristled paint brush to remove loose dirt and dust accumulated on the inside of the cabinet. Be sure to clean the electrical components thoroughly (power supplies, PCB assemblies, display, etc.).

**CAUTION**

Be extremely careful when cleaning the electrical components inside the cabinet. Avoid touching the electrical components with any solid object other than the soft bristles of the vacuum attachment or paint brush.

# Corrective Maintenance

Corrective maintenance consists of removal, disassembly, reassembly, and replacement of game components. The following procedures are provided for components that may require corrective maintenance.

## Removing the Video Display

Perform the following procedure to remove/replace the video display. (See Figure 4-3.)

1. Turn the game power off and wait two minutes. Unplug the power cord.
2. Use a 1/8-inch hex driver to remove the three screws securing the glass retainer to the cabinet.
3. Grasp the display shield on the top edge and gently pull it out from the cabinet.
4. Use a flat-head screwdriver to remove the staples, if any, securing the bezel to the cabinet. Remove the bezel.
5. Use a Phillips screwdriver to remove the four screws securing the detail cleat to the cabinet. Remove the cleat.
6. Use a Phillips screwdriver to remove the four screws securing the display rear access panel. Remove the panel.
7. Unlock and open the rear access door.

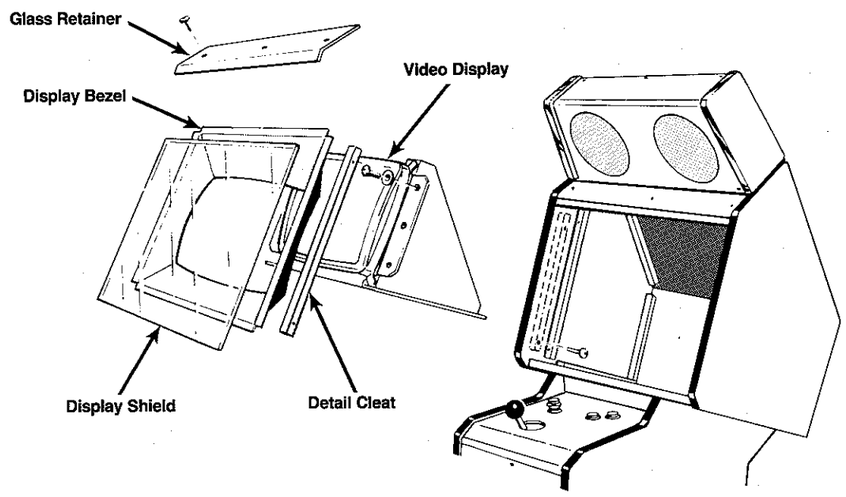



**Figure 4-3 Video Display Removal**





**⚠ WARNING ⚠**

**High Voltage**

The video display contains potentially lethal high voltages. To avoid injury, do not attempt to service this display until you observe all precautions necessary for working on high-voltage equipment.

**X-Radiation**

The video display has been designed to minimize X-radiation. However, to avoid possible exposure to soft X-radiation, *never* modify the high-voltage circuitry.

**Implosion Hazard**

The cathode-ray tube may implode if struck or dropped. Shattered glass may cause injury within a 6-foot radius. Use care when handling the display.

8. Discharge the high-voltage from the cathode-ray tube (CRT) before proceeding. The display assembly contains a circuit for discharging the high voltage to ground when power is removed. However, to make certain, always discharge the display as follows.

a. Attach one end of a large, well-insulated, 18-gauge jumper wire to ground.

b. Momentarily touch the free end of the grounded jumper to the CRT anode by sliding it under the anode cap.

c. Wait two minutes and repeat part b.

9. From the back of the cabinet, disconnect all the upper cabinet harness connectors. Pull these harnesses down into the lower cabinet area.
10. From the front of the cabinet, use a Phillips screwdriver to remove the six screws and washers securing the display to the cabinet.
11. Carefully slide the display out through the front of the cabinet.
12. Replace the video display in the reverse order of removal.

**NOTE**

Whenever the cathode-ray tube is replaced, readjust the brightness, purity, and convergence as described in the display manual.

## Removing the Rotary Control

Perform the following procedure to remove/replace the rotary control. (See Figure 4-2.)

1. Open the control panel as described under *Preventive Maintenance.*
2. Disconnect the harness connectors from the Dual Optical Coupler PCB Assembly.
3. Using a 3/8-inch nut driver, remove the four hex nuts holding the rotary control assembly to the control panel.
4. Lift the rotary control assembly out of the control panel.
5. Replace the rotary control in the reverse order of removal. Reconnect the harness connectors to the PCB Assembly.

## Disassembling the Rotary Control

Perform the following procedure to disassemble the rotary control assembly. (See Figure 4-2.)

1. Disconnect the harness connectors from the PCB Assembly.
2. Using a 3/8-inch nut driver (or appropriate tool), remove the four hex nuts holding the rotary control assembly to the control panel.
3. Using a Phillips screwdriver, remove the four screws holding the encoder disc shield to the bottom housing plate. Remove the shield.
4. Using a Phillips screwdriver, remove the two screws holding the PCB Assembly to the PCB bracket.
5. To remove the chain from its sprockets, use a 5/32-inch Allen wrench to remove the screw and washer holding the sprocket to the sprocket post.
6. Using a 9/64-inch Allen wrench, loosen the two cap screws through the side openings of the centering disc spacer. Remove the etched encoder assembly from the shaft.
7. Using a 9/64-inch Allen wrench, remove the four cap screws holding the bottom housing plate to the bottom housing. Remove the housing plate.

## Reassembling the Rotary Control

Replace the rotary control parts in the reverse order of removal. When reassembling the rotary control, check the following items:

1. Be sure that the control handle is oriented toward the *F* orientation mark located on the underside of the lip of the upper housing assembly.

2. Be sure that the orientation for the etched encoder disc assembly is correct for reassembly. Orient the two cap screws so that one is at the 9-o'clock position and the other at the 12-o'clock position in relation to the PCB Assembly. Each screw head should be seen through the side opening of the disc spacer.
3. Be sure to position the spring pin in the sprocket post so that the chain has enough slack to allow the handle to rotate freely.

## Removing the Game PCBs

Perform the following procedure to remove/replace the game PCBs.

> **CAUTION**
>
> Do not attempt to remove the CPU and Video PCBs while they are connected together. If you are going to remove both of these PCBs, remove the Video PCB first to avoid damaging the PCBs or the edge connectors.

### Video PCB

Perform the following procedure to remove/replace the Video PCB. (See Figure 4-4.)

1. Turn the game power off.
2. Unlock and open the lower rear access panel.
3. Remove the four thumb nuts holding the EMI cover to the ground plane.
4. Disconnect the harness connectors from the bottom of the Video PCB.
5. Remove *one* of the two thumb screws and spacers holding the top of the Video PCB (and the bottom of the CPU PCB) to the ground plane. Loosen, but do not remove, the other thumb screw.

> **NOTE**
>
> The brass thumb screws are easy to cross-thread. Use care when installing and tightening them.

6. Remove the two thumb screws holding the bottom of the Video PCB to the ground plane. Carefully hold the Video PCB in place to prevent the PCB from falling or causing excessive bending at the edge connector.
7. Remove the remaining thumb screw and spacer that was loosened in step 5. Gently disconnect the Video PCB from the CPU PCB.
8. Replace the Video PCB by first connecting the Video PCB to the CPU PCB edge connector. Carefully position both the Video and CPU PCBs so that the holes (in the bottom of the CPU PCB and at the top of the Video PCB) are aligned. Partially install one thumb screw and spacer through both of the PCBs and into the corresponding ground plane post.
9. Install and tighten the two thumb screws holding the bottom of the CPU PCB to the ground plane.
10. Install the remaining thumb screw holding the top of the Video PCB (and bottom of the CPU PCB) to the ground plane.
11. Finger-tighten both thumb screws holding the top of the Video PCB (and bottom of the CPU PCB) to the ground plane.
12. Connect the harness connector to the bottom of the Video PCB.

> **NOTE**
>
> To comply with emission requirements, the Federal Communications Commission requires that the Video PCB Assembly be housed in the EMI cover. *Do not operate* this game without properly installing the EMI cover, metal spacers, and thumb nuts.

### CPU PCB

Perform the following procedure to remove/replace the Central Processing Unit (CPU) PCB. (See Figure 4-4.)

> **NOTE**
>
> If the Video PCB has already been removed, disconnect the harness connectors from the left edge of the CPU PCB, then remove the two thumb screws holding the top of the CPU PCB to the ground plane. Remove the CPU PCB.

1. Turn the game power off.
2. Unlock and open the lower rear access panel.
3. Remove the four thumb nuts holding the EMI cover to the ground plane.
4. Disconnect the harness connectors from the left edge of the CPU PCB.
5. Remove the four thumb screws holding the CPU PCB (and the top of the Video PCB) to the ground plane.
6. Gently disconnect the CPU PCB from the Video PCB.





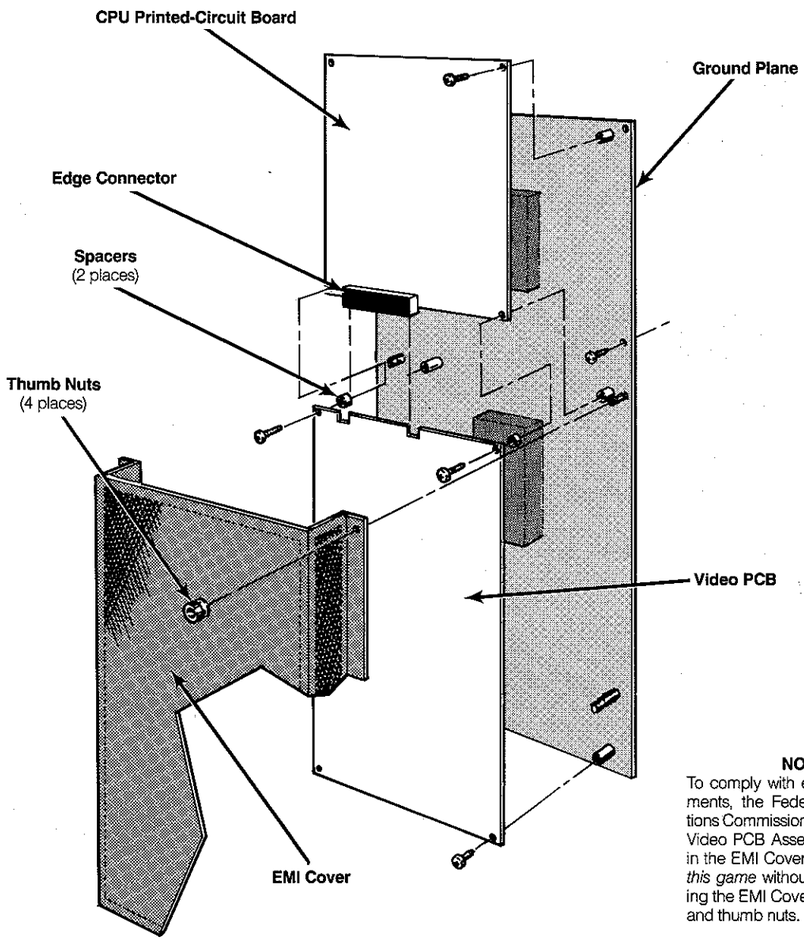



**Figure 4-4 Game PCB Removal**

7. Replace the CPU PCB by first connecting the CPU PCB to the Video PCB edge connector. Carefully position both the CPU and the Video PCBs so that the holes (in the bottom of the CPU PCB and at the top of the Video PCB) are aligned. Partially install one thumb screw and spacer through both of the PCBs and into the corresponding ground plane post.
8. Install and tighten the two thumb screws holding the top of the Video PCB to the ground plane.
9. Install the remaining thumb screw holding the bottom of the CPU PCB (and the top of the Video PCB) to the ground plane.
10. Finger-tighten both thumb screws holding the bottom of the CPU PCB (and the top of the Video PCB) to the ground plane.
11. Connect the harness connectors to the left edge of the CPU PCB. (See Figure 4-4 for the proper connector locations.)

## Removing the Incandescent Lamp

Perform the following procedure to remove/replace the incandescent lamp. (See Figure 4-5.)

1. Turn the game power off.
2. From the front of the cabinet, using a 1/8-inch hex driver, remove the eight screws holding the light and speaker grille to the top of the cabinet.
3. To remove the incandescent lamp, unscrew the lamp and remove it from the socket.
4. To remove the entire lamp fixture, disconnect the light harness connector in the rear of the cabinet. Using a screwdriver, remove the two screws holding the lamp base and lift the base out of the front of the cabinet. Replace the lamp fixture in the reverse order of removal.

## Removing the Speakers

Perform the following procedure to remove/replace the speakers. (See Figure 4-5.)

1. Turn the game power off.
2. From the front of the cabinet, using a 1/8-inch hex driver, remove the eight screws holding the light and speaker grille to the top of the cabinet.
3. Using a Phillips screwdriver, remove the six screws holding the front of the light and speaker panel to the cabinet.
4. Disconnect the speaker harness assembly.
5. Remove the light and speaker panel.

> **CAUTION**
>
> Do not touch the speaker cones when handling the speakers. The cone material is fragile and can be easily damaged.

6. Using a Phillips screwdriver, remove the four screws holding the speaker to the cabinet. Do not let the speaker fall.
7. Lower the speaker just far enough to disconnect the two speaker wires. Ensure that the speakers are properly phased by placing the same color-coded connector on the same tab on each speaker.
8. Replace the speaker in the reverse order of removal.

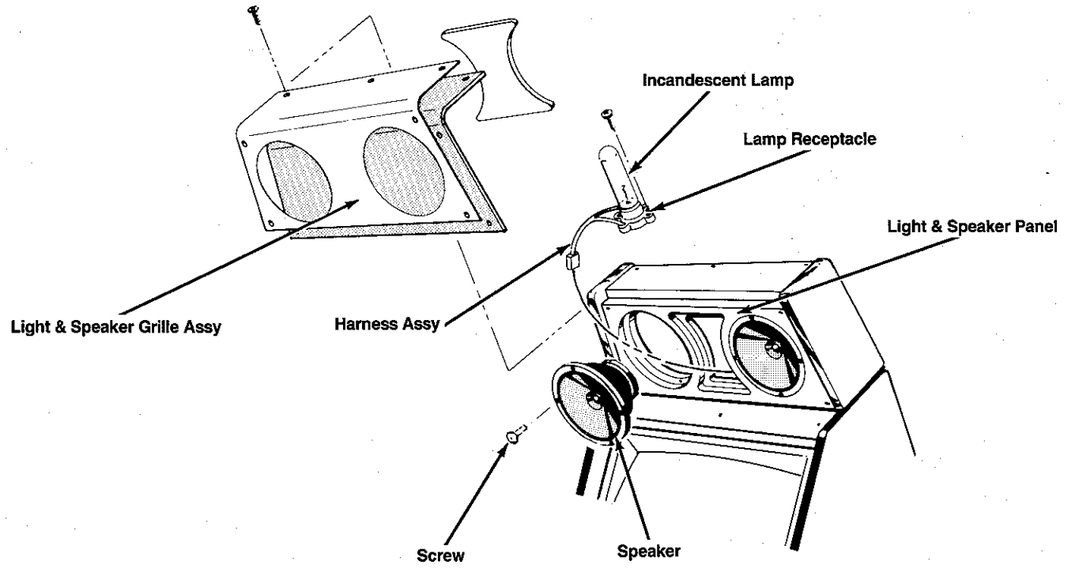



**Figure 4-5 Light and Speaker Removal**

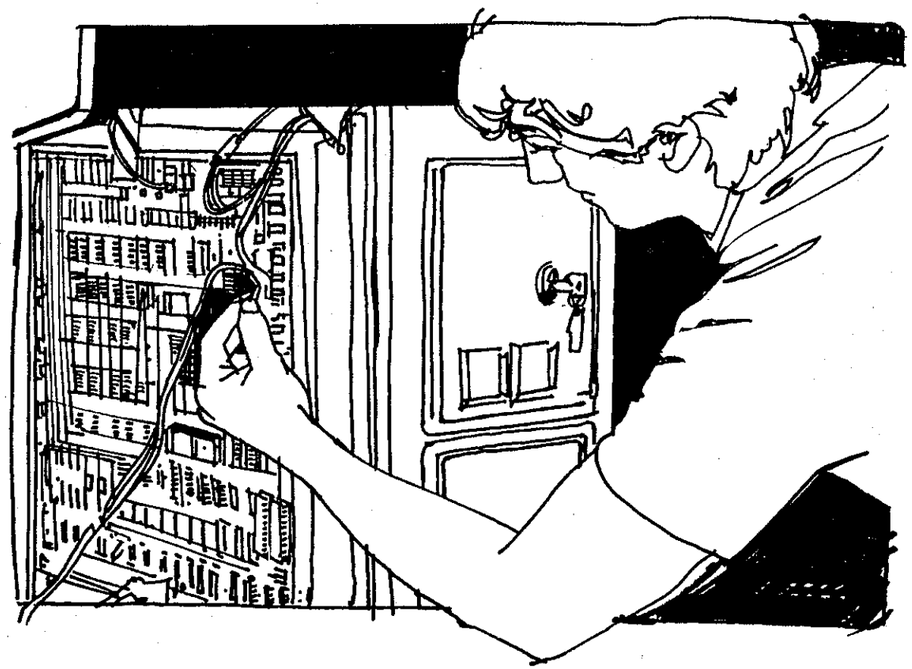


Chapter 5

# Troubleshooting

The information in this chapter discusses troubleshooting aids and techniques to assist the service technician when trouble is suspected in a game. Most troubles can be located quickly by following the information in this chapter. However, if problems persist, contact your local distributor or your Atari Games Corporation Customer Service Office, listed on the inside front cover of this manual, for assistance.

> **NOTE**
>
> We recommend that troubleshooting and repair procedures be performed by a qualified service technician.



# Troubleshooting Aids

Troubleshooting aids are provided throughout this manual and the schematic package supplement. The following information is intended to acquaint the service technician with the portions of these documents that contain useful troubleshooting and repair information.

## Assembly and Component Locations

The parts lists in Chapter 6 of this manual illustrate the locations of assemblies and components. Printed-circuit board (PCB) illustrations aid in rapidly locating components shown on the corresponding schematic diagram(s).

## Diagrams

The schematic package supplement for this manual contains schematic diagrams with component locations, active component type numbers, and electrical values.

# Troubleshooting Techniques

**⚠ WARNING ⚠**

To avoid electrical shock, turn off the game power before attempting to troubleshoot this game.

The following troubleshooting steps are arranged in a sequence recommended for locating a defective component. The procedure begins with a check of the simple trouble possibilities and progresses to more extensive procedures for localizing the problem to an assembly or major circuit, and then to a defective component.

## Check Fuses

Check for open fuses. Refer to the power supply parts list in Chapter 6 and to the display manual for the location and rating of each fuse used in this game. Make sure that replacement fuses are the proper type and rating.

## Check Power-Supply Voltages

Improper operation of all circuits usually indicates a power supply problem. Be sure that the proper line voltage is available to the power supply. Refer to the label on the power supply for its voltage rating.

## Localize Trouble

Determine the trouble symptom. Use the wiring diagrams in the schematic package supplement to determine which assemblies or major circuits could cause the trouble. Perform the self-test procedure provided in Chapter 3 of this manual.





## Visual Check

Visually check for obvious problems in the portion of the game where the trouble is suspected. For example, check for loose or defective solder connections, integrated circuits loose in their sockets, loose cable connections, broken wires, and damaged PCBs or components.

## Check Individual Components

Check soldered-in passive components (e.g., resistors, capacitors, diodes) by disconnecting one end to isolate the measurement from the effects of the surrounding circuitry. Often, direct substitution is the most practical way to determine if a component is faulty. However, eliminate the possibility of some other circuit problem that could damage the substitute component.

## Repair the Assembly

**CAUTION**

Soldered-in transistors and integrated circuits are difficult to remove without damaging the printed-circuit board or component. Refer to the information in this chapter pertaining to soldering and replacing integrated circuits and transistors.

Repair or replace the defective part. Refer to Chapter 4 and information in this chapter for special removal and replacement procedures. Check for proper operation of the repaired circuit.

# Soldering Techniques

Observe the following recommendations when removing or replacing components soldered to a PCB. Poor soldering practices can damage a PCB or heat-sensitive electrical components.

Choosing the proper soldering iron is essential before attempting to remove or replace soldered-in components. Excessive heat is a common cause of damage to a component or PCB. However, transient voltages from solder guns or improperly grounded soldering irons can also damage certain voltage-sensitive semiconductor devices. Refer to *Troubleshooting Static-Sensitive Devices* for more specific information.

A 15- to 27-watt pencil-tip soldering iron is recommended to avoid separating the etched circuit wiring from the board material and to avoid damaging active components. A temperature-controlled soldering station rated at 700°F with a fine cone or a very fine chisel tip can also be used.



**CAUTION**

Solder guns are *not* recommended for removing or replacing soldered-in components on a printed-circuit board. Solder guns can overheat a device, and their large transient voltage can damage a voltage-sensitive device.

The following additional equipment is recommended for removing and replacing soldered-in components:

- Solder Sucker—Hand-operated vacuum tool used to remove liquified solder from the PCB. We recommend the top-of-the-line Soldapullt® brand.
- Solder Wick—Resin-soaked copper braid used for removing excess solder from the lead connections on the PCB. See *Removing Integrated Circuits* for precautions relating to the use of a solder wick on a multilayer PCB with plated-through holes.
- Flux Remover—Non-corrosive chemical used to clean foreign material from the PCB before soldering and to remove any flux residue where components have been replaced. Also used to clean any foreign material from the PCB during preventive maintenance. Isopropyl alcohol is recommended.
- Acid Brush—Small stiff-bristled paint or toothbrush used with flux remover to clean flux and other foreign material from the PCB.

## Removing Integrated Circuits

The easiest and safest method for removing soldered-in integrated circuits (IC) from a PCB is to cut off each pin as close to the IC case as possible with a tip dyke (diagonal cutter) as shown in Figure 5-1.

Use the proper soldering iron as previously described under *Soldering Techniques*. Then, to avoid excessive heat buildup in one area of the PCB, apply heat directly to each pin in a random order. Remove the loosened pin with the tip of the soldering iron or a needle-nose pliers as shown in Figure 5-2. Allow a moment for the PCB to cool before

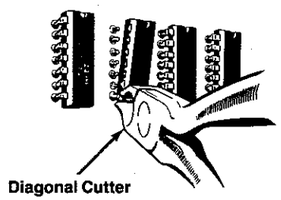



**Figure 5-1 Removing IC (Cut-Pin Method)**



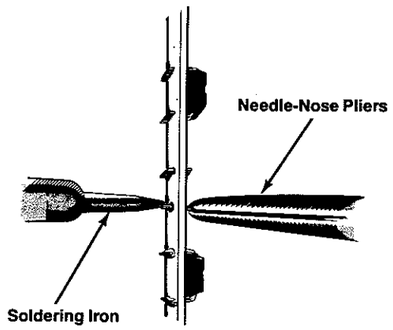



**Figure 5-2 Removing IC Pins**

proceeding to the next pin. Apply just enough heat to remove any stubborn pins.

For a multi-layer PCB with plated-through holes, use a solder sucker to remove the remaining solder from inside each hole as shown in Figure 5-3. If possible, suck the solder from the opposite side of the PCB from where the heat is applied.

Use a solder wick to remove excess solder from around the lead connection pads on the top and/or bottom surface of the PCB as shown in Figure 5-4.

**CAUTION**

Do not use a solder wick to remove solder from inside plated-through holes. The heat required for the solder wick to remove the solder from inside the hole could damage the PCB.

Use an integrated-circuit (IC) pulling tool to remove socketed ICs. Do not pry up on one end of the ICs, because the pins could be bent or broken.

# Troubleshooting Static-Sensitive Devices

Certain precautions must be taken when working with static-sensitive devices, e.g., microprocessors, field-effect transistors (FET), complementary metal-oxide semiconductors (CMOS), and other large-scale integration (LSI) devices that use metal-oxide semiconductor (MOS) technology. Static charge buildup in a person's body or leakage from an improperly grounded soldering iron can cause static-sensitive device failure.

Before handling a static-sensitive device or a PCB with such devices attached to it, ground any static voltage that may have accumulated in your body by touching an ob-

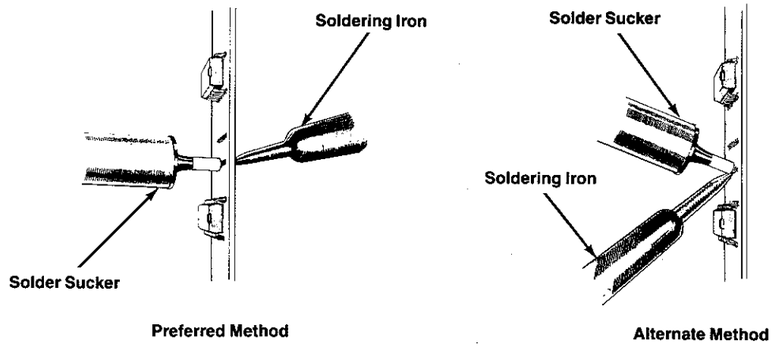



**Figure 5-3 Removing Solder from Plated-Through Holes**

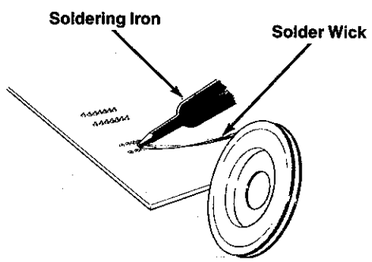



**Figure 5-4 Removing Solder from Lead Connection Pads**

ject that has been earth grounded. A bare wire wrapped around your wrist and attached to an earth ground is effective when working extensively with static-sensitive devices. When soldering a static-sensitive device, use a soldering iron with a properly grounded three-wire cord. (Refer to *Soldering Techniques* for a discussion of recommended soldering irons and procedures.)

A static-sensitive device can appear defective due to leakage on a PCB. Observe the precautions for grounding static voltages described in the preceding paragraph and clean both sides of the PCB with flux remover or an eraser before replacing what can be a good static-sensitive device. For discrete FETs, clean thoroughly between the gate, drain, and source leads.

Static-sensitive devices can be packaged in conductive foam or have a protective shorting wire attached to the pins. Remove the conductive foam just prior to inserting the device into its socket or soldering it to a PCB. Remove the shorting wire only *after* the device is inserted into its socket or *after* all the leads are soldered in place.



## Chapter 6

# Illustrated Parts Lists

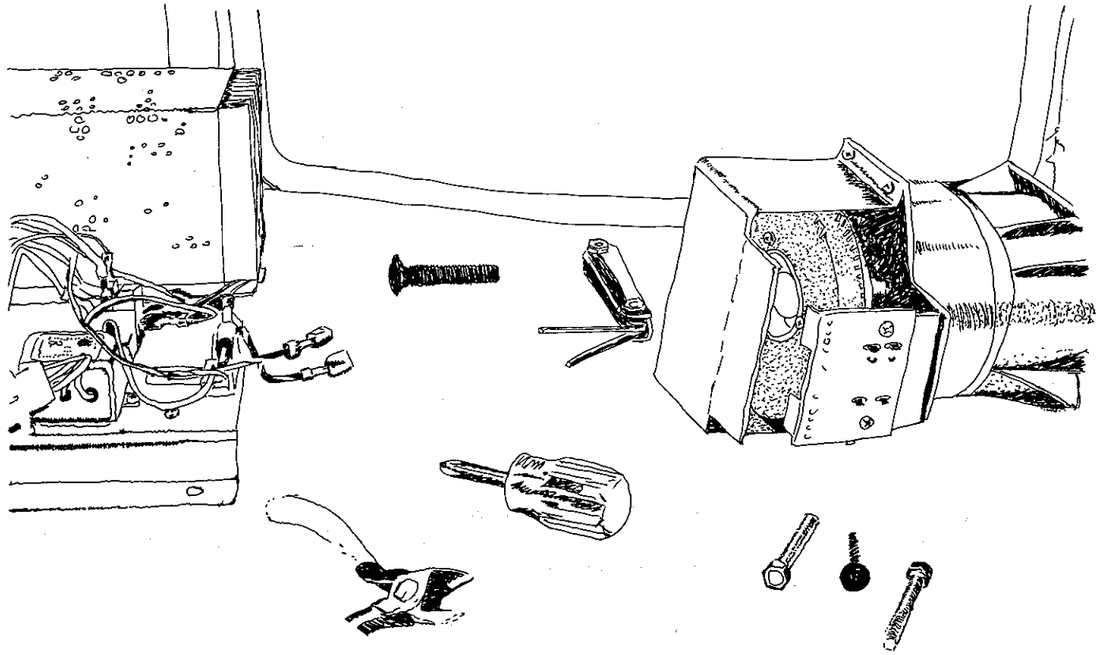
This chapter provides information you need to order parts for your game. Common hardware (screws, nuts, washers, etc.) has been deleted from most of the parts lists.

The PCB parts lists are arranged in alphabetical order by component. Each component subsection is arranged alphanumerically by reference designator.

Other parts lists are arranged alphanumerically by Atari part number. In these parts lists, all A-prefix numbers come first. Following these are numbers in sequence evaluated up to the hyphen, namely 00- through 99-, then 000598- through approximately 201000-.

When ordering parts, please give the part number, part name, number of this manual, and serial number of your game. This will help us fill your order rapidly and correctly. We hope the results will be less downtime and more profit from your game.

Atari Customer Service numbers are listed on the inside front cover of this manual.



★ Part used only in US-built cabinets
❋ Part used only in Ireland-built cabinets

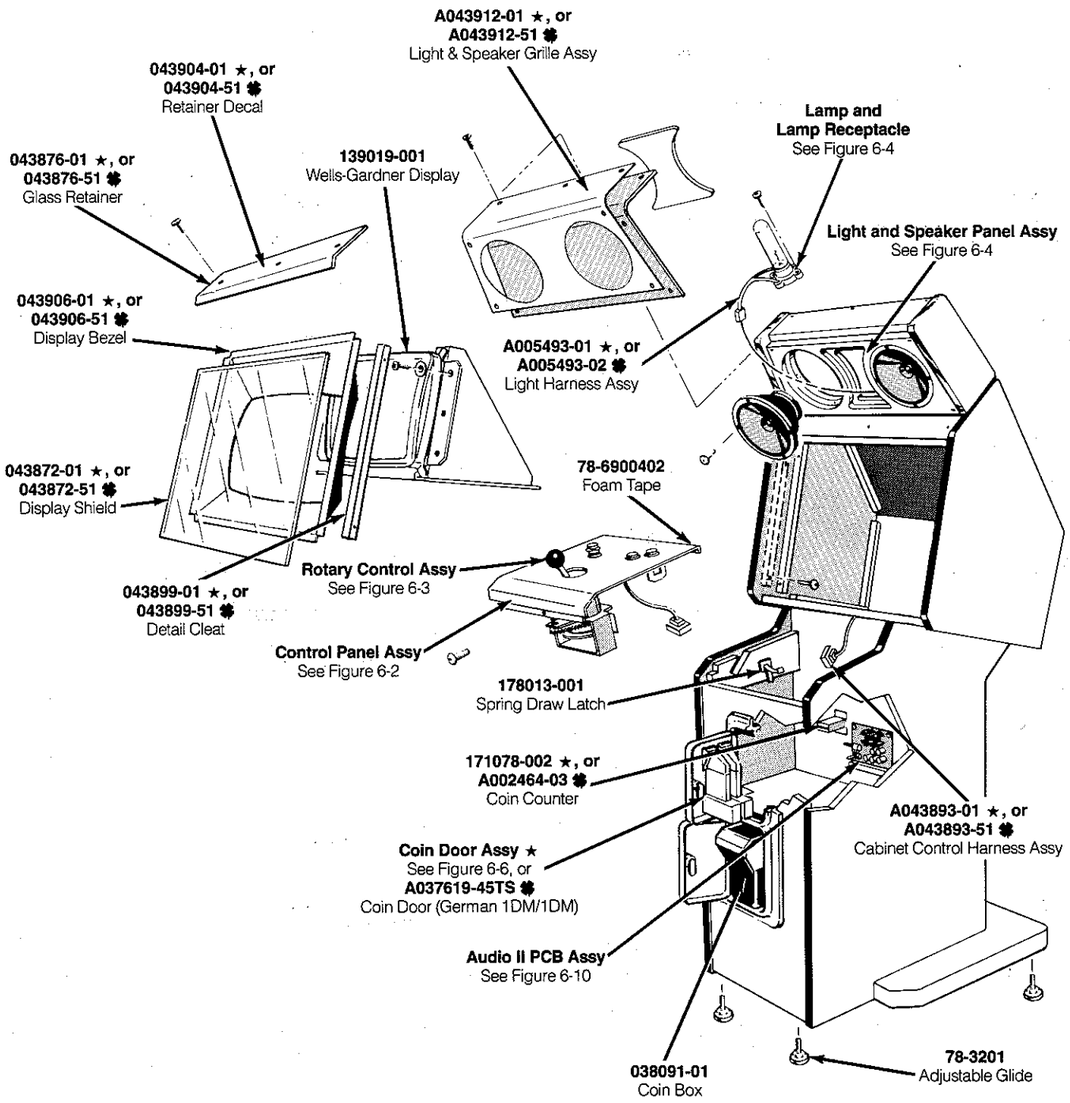



**Figure 6-1 Cabinet-Mounted Assemblies**
**A043870-01 B (US)**
**and A043870-51 B (Ireland)**





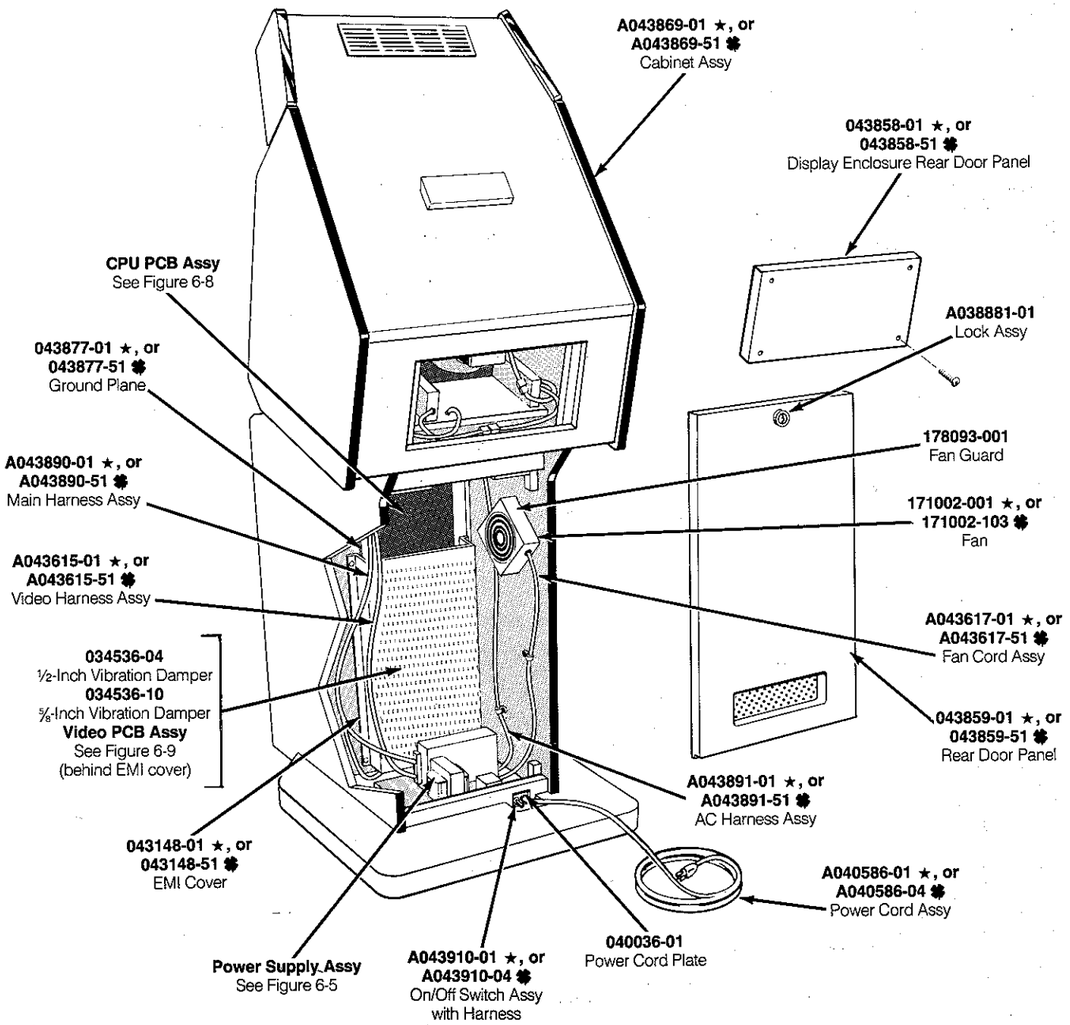



**Figure 6-1 Cabinet-Mounted Assemblies, Continued**
**A043870-01 B (US)**
**and A043870-51 B (Ireland)**

## Cabinet-Mounted Assemblies Parts List

| Part No. | Description |
|---|---|
| A002464-03 ✱ | 10 V Coin Counter Assembly |
| A037619-45TS ✱ | Coin Door for German 1 DM/1 DM |
| A005493-01 ★ | Light Harness Assembly (A005493-02 ✱) |
| A038881-01 | Lock Assembly for Rear Panel |
| A040586-01 | Power Cord Assembly |
| A043615-01 ★ | Video Harness Assembly (A043615-51 ✱) |
| A043617-01 ★ | Fan Cord Assembly (A043617-51 ✱) |
| A043661-01 | Audio II PCB Assembly |
| A043820-01 | Rotary Control Assembly |
| A043869-01 ★ | Cabinet Assembly (A043869-51 ✱) |
| A043888-01 ★ | Power Supply Assembly (A043888-51 ✱) |
| A043890-01 ★ | Main Harness Assembly (A043890-51 ✱) |
| A043891-01 ★ | AC Harness Assembly (A043891-51 ✱) |
| A043893-01 ★ | Cabinet Control Harness Assembly (A043893-51 ✱) |
| A043900-01 ★ | Control Panel Assembly (A043900-51 ✱) |
| A043901-01 ★ | Light and Speaker Assembly (A043901-51 ✱) |
| A043910-01 ★ | On/Off Switch Assembly with Harness (A043910-04 ✱) |
| A043912-01 ★ | Light and Speaker Grille Assembly (A043912-51 ✱) |
| A043921-01 | CPU PCB Assembly |
| A043922-01 | Video PCB Assembly |
| 78-3201 | Adjustable Glide |
| 78-6900402 | ¼-Inch × ⅛-Inch Foam Tape (42 inches required; used on inside lip of retainer) |
| 034536-04 | ½-Inch Thick Vibration Damper |
| 034536-10 | ⅝-Inch Thick Vibration Damper |
| 038091-01 | Coin Box |
| 040036-01 | Power Cord Plate |
| 043148-01 ★ | EMI Cover (043148-51 ✱) |
| 043858-01 ★ | Display Enclosure Rear Door Panel (043858-51 ✱) |
| 043859-01 ★ | Rear Door Panel (043859-51 ✱) |
| 043872-01 ★ | Display Shield (043872-51 ✱) |
| 043876-01 ★ | Glass Retainer (043876-51 ✱) |
| 043877-01 ★ | Ground Plane (043877-51 ✱) |
| 043899-01 ★ | Detail Cleat with Holes and Paint; .75 inches square × 16 inches long (043899-51 ✱) |
| 043904-01 ★ | Retainer Decal (043904-51 ✱) |
| 043906-01 ★ | Display Bezel (043906-51 ✱) |
| 139019-001 | Wells-Gardner 25-Inch Medium-Resolution Framed Color Raster Display, Model 25K5515 |
| 171002-001 ★ | Exhaust Fan, 110 V (70 CFM) |
| 171002-003 ✱ | Exhaust Fan, 220 V (110 CFM) |
| 171078-002 ★ | Terminated Non-Resettable Coin Counter, 12 VDC |
| 178013-001 | Spring Draw Latch |
| 178093-001 | Fan Guard |
| | *The following are technical information supplements for this game:* |
| TM-294 | 720° Operators Manual |
| SP-294 | 720° Schematic Package |
| ST-294 | 720° Self-Test Label |
| TM-295 | Wells-Gardner 25-Inch Medium-Resolution Color Raster Display Manual |

★ *Part used only in US-built cabinets*
✱ *Part used only in Ireland-built cabinets*





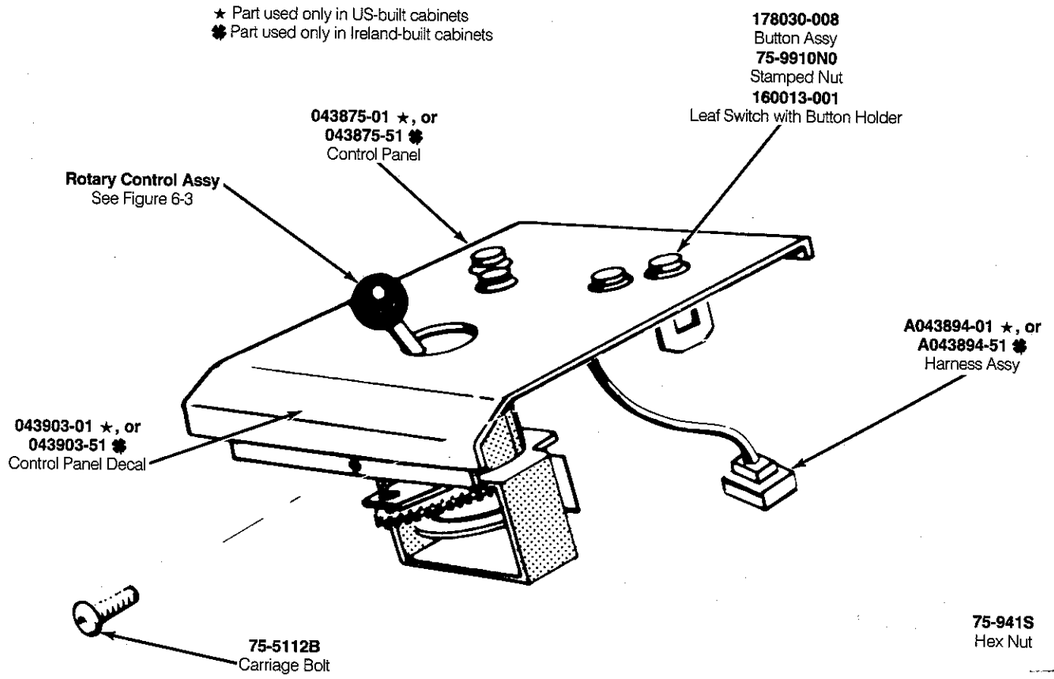



**Figure 6-2 Control Panel Assembly A043900-01 B (US) and A043900-51 B (Ireland)**

## Control Panel Assembly Parts List

| Part No. | Description |
|---|---|
| A043820-01 | Rotary Control Assembly |
| A043894-01 ★ | Control Harness Assembly (A043894-51 ✱) |
| 75-5112B | #10-24 × ½-Inch Black Carriage Bolt |
| 75-941S | Polymer Self-Locking Hex Nut |
| 75-9910N0 | #11⅝-Inch Stamped Nut |
| 043875-01 ★ | Control Panel (043875-51 ✱) |
| 043903-01 ★ | Control Panel Decal (043903-51 ✱) |
| 160013-001 | Leaf Switch with Button Holder |
| 178030-008 | Blue Button Assembly |

★ *Part used only in US-built cabinets*
✱ *Part used only in Ireland-built cabinets*

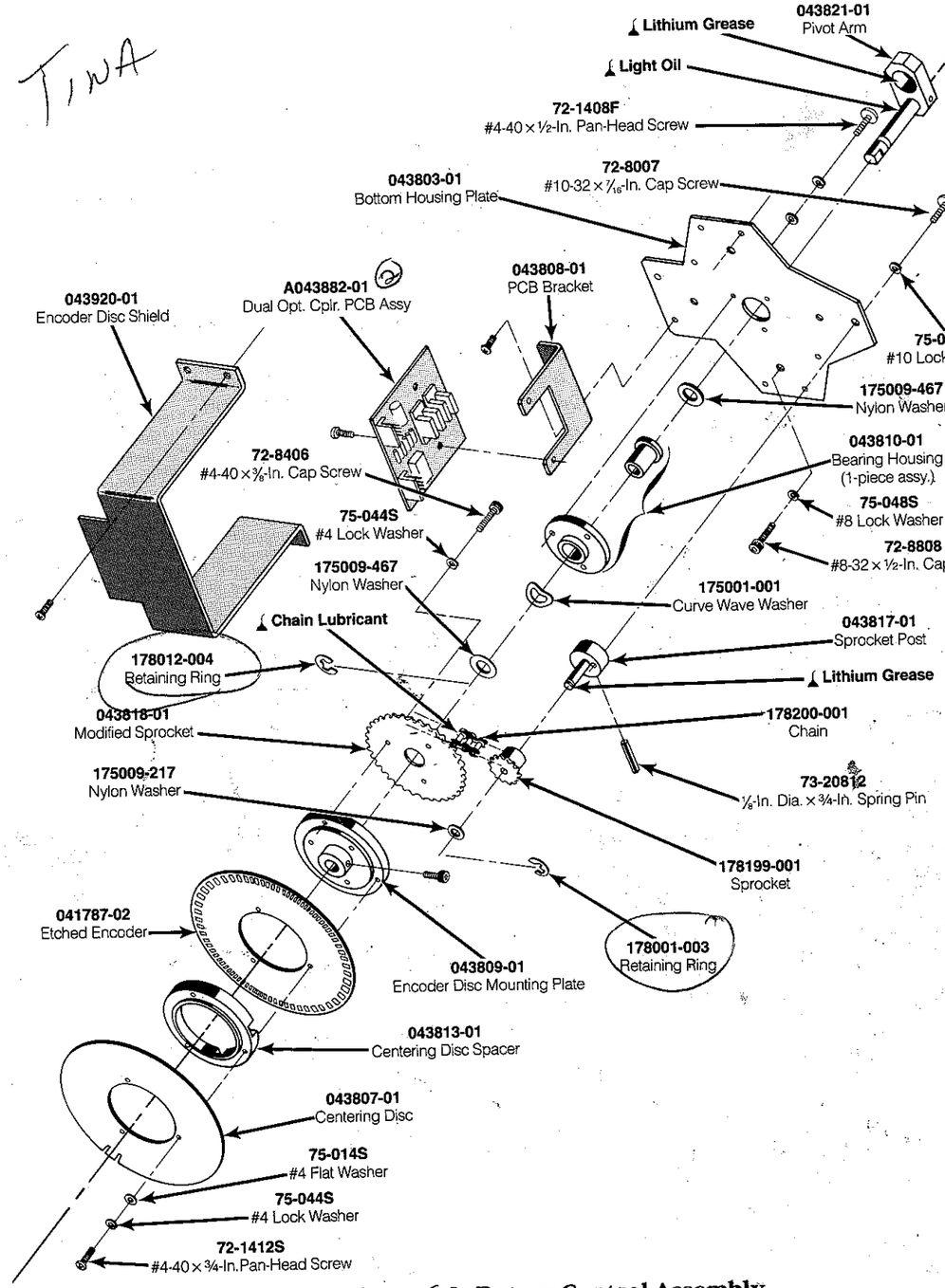



**Figure 6-3 Rotary Control Assembly**
**A043820-01 C**





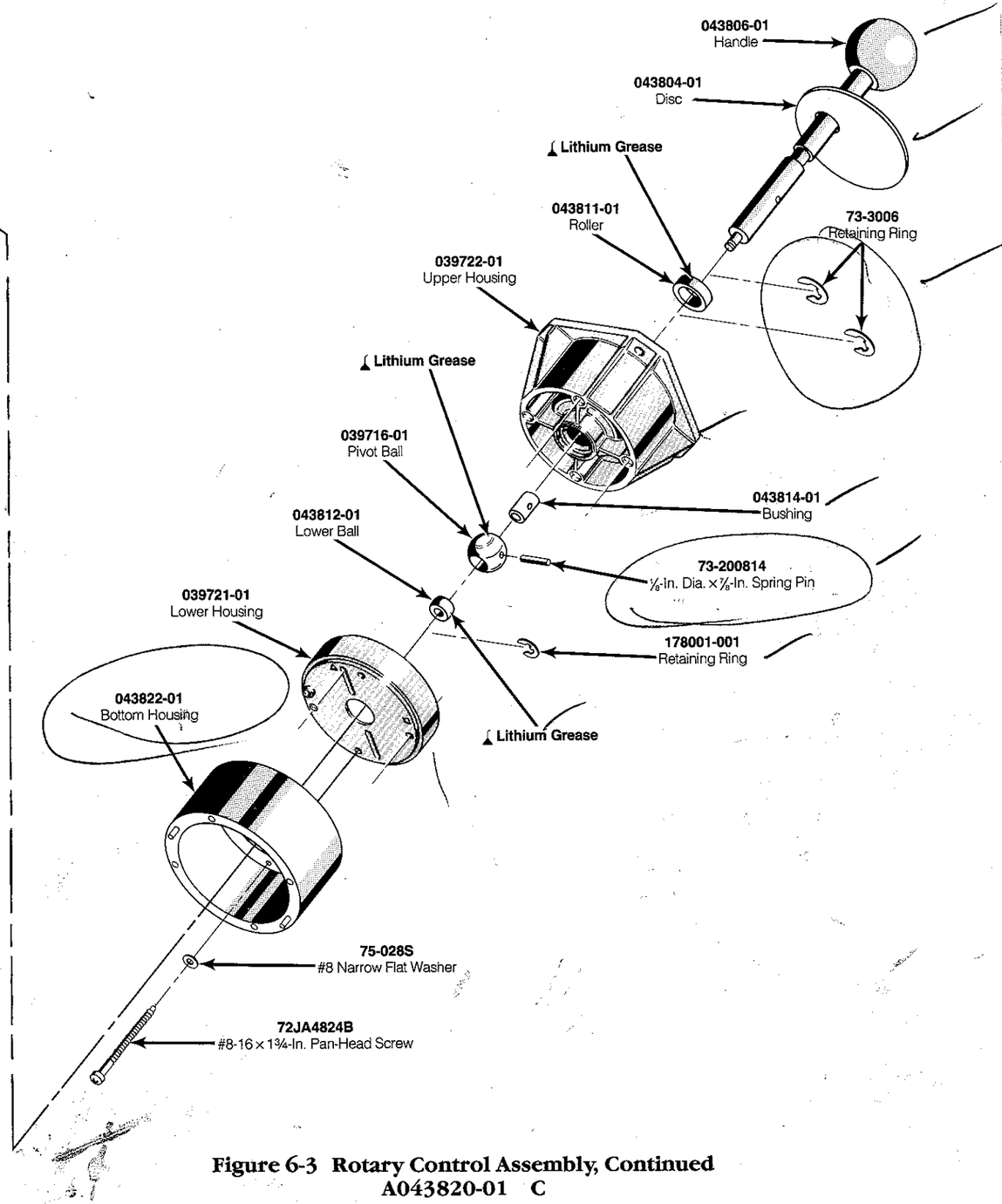



**Figure 6-3 Rotary Control Assembly, Continued**
**A043820-01 C**

## Rotary Control Assembly Parts List

| Part No. | Description |
|---|---|
| A043882-01 | Dual Optical Coupler PCB Assembly |
| 72-1408F | #4-40 × ½-Inch Pan-Head Screw |
| 72-1412S | #4-40 × ¾-Inch Pan-Head Screw |
| 72-6606S | #6-32 × ⅜-Inch Self-Tapping Pan-Head Screw |
| 72-8007 | #10-32 × 7/16-Inch Socket Head Cap Screw |
| 72-8406 | #4-40 × ⅜-Inch Socket Head Cap Screw |
| 72-8806 | #8-32 × ⅜-Inch Socket Head Cap Screw |
| 72-8808 | #8-32 × ½-Inch Socket Head Cap Screw |
| 73-200814 | ⅛-Inch Diameter × ⅞-Inch Spring Pin |
| 73-20812 | ⅛-Inch Diameter × ¾-Inch Spring Pin |
| 73-3006 | Retaining Ring |
| 75-014S | #4 Flat Washer |
| 75-028S | #8 Narrow Flat Washer |
| 75-040S | #10 Lock Washer |
| 75-044S | #4 Lock Washer |
| 75-048S | #8 Lock Washer |
| 039716-01 | Pivot Ball |
| 039721-01 | Lower Housing |
| 039722-01 | Upper Housing |
| 041787-02 | Etched Encoder |
| 043803-01 | Bottom Housing Plate |
| 043804-01 | Disc |
| 043806-01 | Handle |
| 043807-01 | Centering Disc |
| 043808-01 | PCB Bracket |
| 043809-01 | Encoder Disc Mounting Plate |
| 043810-01 | Bearing Housing |
| 043811-01 | Roller |
| 043812-01 | Lower Ball |
| 043813-01 | Centering Disc Spacer |
| 043814-01 | Bushing |
| 043817-01 | Sprocket Post |
| 043818-01 | Modified Sprocket |
| 043821-01 | Pivot Arm |
| 043822-01 | Bottom Housing |
| 043920-01 | Encoder Disc Shield |
| 107013-001 | Light Oil Lubricant |
| 107027-001 | Lithium Grease Lubricant |
| 107028-001 | Chain Lubricant |
| 175001-001 | Curve Wave Washer |
| 175009-217 | Nylon Washer |
| 175009-467 | .032 Thick × .375 I.D. × .687 O.D. Nylon Washer |
| 178001-001 | Retaining Ring |
| 178001-003 | Retaining Ring |
| 178012-004 | Retaining Ring |
| 178199-001 | 9T Sprocket |
| 178200-001 | #25 42-Pitch Endless Chain |
| 72JA4824B | #8-16 × 1¾-Inch Plastite Pan-Head Screw |





★ Part used only in US-built cabinets
● Part used only in Ireland-built cabinets

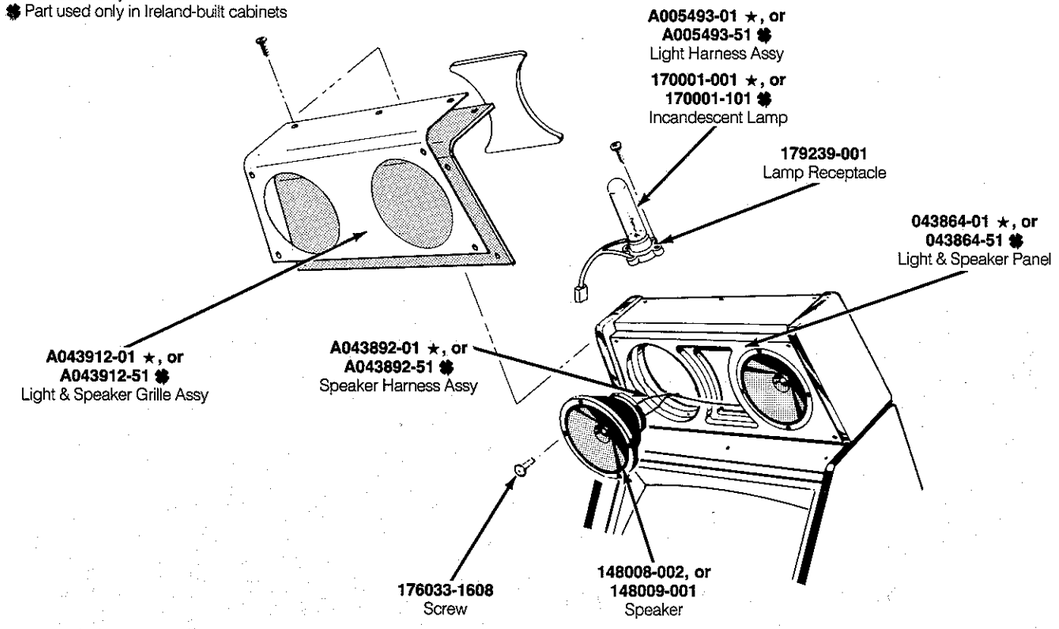



**Figure 6-4 Light and Speaker Panel Assembly A043901-01 A (US) and A043901-51 A (Ireland)**

## Light and Speaker Panel Assembly Parts List

| Part No. | Description |
|---|---|
| A005493-01 ★ | Light Harness Assembly (A005493-51 ●) |
| A043892-01 ★ | Speaker Harness Assembly (A043892-51 ●) |
| A043912-01 ★ | Light and Speaker Grille Assembly (A043912-51 ●) |
| 043864-01 ★ | Light and Speaker Panel (043864-51 ●) |
| 148008-002 | 8-Inch, 8Ω, 20 W Speaker (Pioneer A20EP80-03FW) OR |
| 148009-001 | 8-Inch, 16Ω Speaker (Onk) |
| 170001-001 ★ | Clear 25 W Medium-Base Tubular Incandescent Lamp (170001-101 ●) |
| 176033-1608 | #6 × ½-Inch Cross-Recessed Pan-Head Deep-Thread Screw |
| 179239-001 | Medium-Base Lamp Receptacle |

★ *Part used only in US-built cabinets*
● *Part used only in Ireland-built cabinets*

★ Part used only in US-built cabinets
✱ Part used only in Ireland-built cabinets

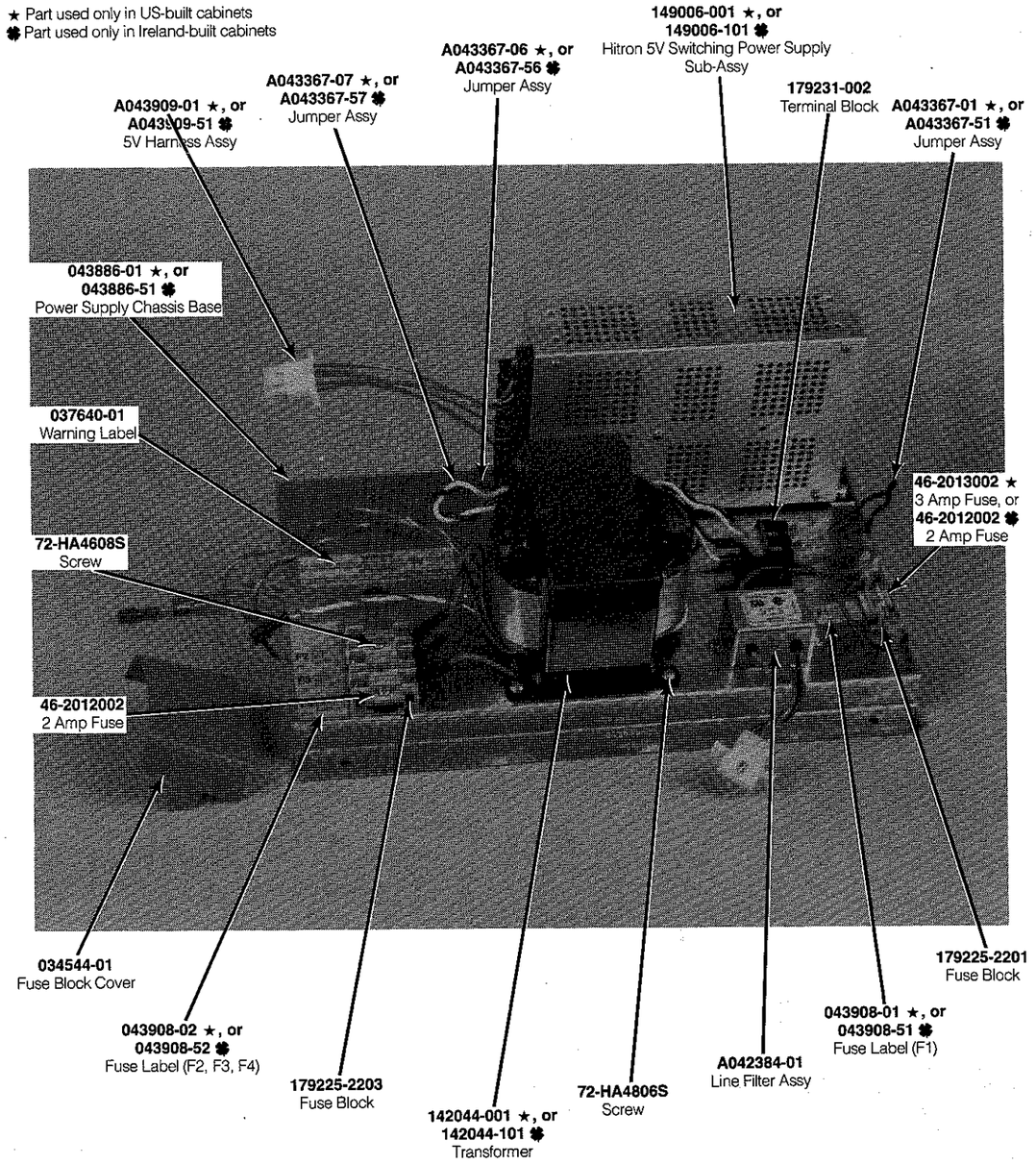



**Figure 6-5 Switching/Linear (SL) Power Supply Assembly A043888-01 A (US) and A043888-51 A (Ireland)**





## *Switching/Linear (SL) Power Supply Assembly Parts List*

| Part No. | Description |
|---|---|
| A042384-01 | Line Filter Assembly |
| A043367-01 ★ | Jumper Assembly (A043367-51 ✱) |
| A043367-06 ★ | 9-Inch, Black Jumper Assembly (A043367-56 ✱) |
| A043367-07 ★ | 9-Inch, White Jumper Assembly (A043367-57 ✱) |
| A043909-01 ★ | 5 V Harness Assembly (A043909-51 ✱) |
| 46-2012002 | 250 V Slow-Blow 2 A Fuse |
| 46-2013002 | 250 V Slow-Blow 3 A Fuse |
| 72-HA4608S | #6-32 × ½-Inch Cross-Recessed Pan-Head Thread-Forming Screw |
| 72-HA4806S | #8-32 × ⅜-Inch Cross-Recessed Pan-Head Thread-Forming Screw |
| 034544-01 | Fuse Block Cover |
| 037640-01 | Power Supply Warning Label |
| 043886-01 ★ | Power Supply Chassis Base (043886-51 ✱) |
| 043908-01 ★ | Power Supply Fuse Label; Fuse F1 (043908-51 ✱) |
| 043908-02 ★ | Power Supply Fuse Label; Fuse F2, F3, F4 (043908-52 ✱) |
| 142044-001 ★ | Transformer (142044-101 ✱) |
| 149006-001 ★ | Hitron 5 V 13 A Switching Power Supply Sub-Assembly (149006-101 ✱); see below. |
| 179225-2201 | 1-Position Fuse Block |
| 179225-2203 | 3-Position Fuse Block |
| 179231-002 | 2-Position Terminal Block |

★ *Part used only in US-built cabinets*
✱ *Part used only in Ireland-built cabinets*

## *Hitron 5-Volt Power Supply Sub-Assembly Parts List*

| Designator | Description | Part No. |
|---|---|---|
| | **Capacitors** | |
| C1 | Capacitor, Metal Film, 0.047 µF, 250 V | 99-211036 |
| C2 | Capacitor, Metal Film, 0.1 µF, 400 V | 99-211038 |
| C3, C4 | Capacitor, Ceramic, 4700 µF, 400 V | 99-211049 |
| C5, C6 | Capacitor, Electrolytic, 100 µF, 200 V | 99-211046 |
| C7 | Capacitor, Metal Film, 0.1 µF, 400 V | 99-211038 |
| C8 | Capacitor, Ceramic, 0.001 µF, 2 kV | 99-211042 |
| C9 | Capacitor, Ceramic, 0.01 µF, 1 kV, Z5U | 99-211041 |
| C10 | Capacitor, Electrolytic, 220 µF, 25 V | 99-211045 |
| C11 | Capacitor, Metal Film, 0.22 µF, 100 V | 99-211037 |
| C12 | Capacitor, Metal Film, 0.022 µF, 100 V | 99-211039 |
| C13 | Capacitor, Metal Film, 0.22 µF, 100 V | 99-211037 |
| C14 | Capacitor, Ceramic, 1800 PF, 2 kV, Z5V | 99-211040 |
| C15–C18 | Capacitor, Electrolytic, 2200 µF, 16 V | 99-211069 |
| C19 | Capacitor, Ceramic, 470 PF, 1 kV, Z5P | 99-211043 |
| C20 | Capacitor, Electrolytic, 2200 µF, 16 V | 99-211069 |
| C21 | Capacitor, Ceramic, 220 µF, 25 V | 99-211070 |
| | **Diodes** | |
| D1, D2 | Diode, Fast Recovery, RPG10K | 99-211064 |
| D3 | Diode, Fast Recovery, RPG15B | 99-211011 |
| D4 | Diode, Fast Recovery, RPG10B | 99-211009 |
| D5–D7 | Diode, Switching, 1N4148 | 99-211012 |

## *Hitron 5-Volt Power Supply Sub-Assembly Parts List, Continued*

| Designator | Description | Part No. |
|---|---|---|
| D8, D9 | Diode, Schottky, S15SC4M | 99-211064 |
| D11, D12 | Diode, Schottky, S10SC4M | 99-211005 |
| D13–D16 | Diode, Rectifier, 1N4006 | 99-211008 |
| | **Inductors** | |
| L1 | Inductor, 15 mH | 99-211052 |
| L2 | Inductor, 9.8 μH | 99-211071 |
| L6, L7 | Inductor, 7 μH (Acceptable substitute is part no. 99-211051) | 99-211050 |
| L4 | Inductor, 2.2 μH | 99-211054 |
| L5 | Inductor, 1.5 mH | 99-211053 |
| | **Resistors** | |
| R1, R2 | Resistor, Carbon Film, 180 kΩ, ±5%, 1 W | 99-211034 |
| R3 | Resistor, Wirewound, 120 Ω, ±5%, 2 W | 99-211019 |
| R4 | Resistor, Wirewound, 0.47 Ω, ±5%, 2 W | 99-211018 |
| R5 | Resistor, Wirewound, 27 Ω, ±5%, 2 W | 99-211065 |
| R6, R7 | Resistor, Carbon Film, 5.6 Ω, ±5%, ¼ W | 99-211027 |
| R8 | Resistor, Wirewound, 0.47 Ω, ±5%, 2 W | 99-211018 |
| R9 | Resistor, Carbon Film, 10 Ω, ±5%, ¼ W | 99-211029 |
| R10 | Resistor, Carbon Film, 1 kΩ, ±5%, ¼ W | 99-211032 |
| R11 | Resistor, Carbon Film, 47 Ω, ±5%, ¼ W | 99-211025 |
| R12 | Resistor, Carbon Film, 5.6 Ω, ±5%, ¼ W | 99-211027 |
| R13 | Resistor, Carbon Film, 330 Ω, ±5%, ¼ W | 99-211026 |
| R14 | Resistor, Carbon Film, 270 Ω, ±5%, ½ W | 99-211023 |
| R15 | Resistor, Carbon Film, 330 Ω, ±5%, ½ W | 99-211022 |
| R16 | Resistor, Carbon Film, 8.2 Ω, ±5%, ¼ W | 99-211028 |
| R17, R18 | Resistor, Carbon Film, 56 Ω, ±5%, ¼ W | 99-211031 |
| R19 | Resistor, Carbon Film, 39 Ω, ±5%, ¼ W | 99-211030 |
| R20 | Resistor, Carbon Film, 2 kΩ, ±5%, ¼ W | 99-211035 |
| R21 | Resistor, Carbon Film, 470 Ω, ±5%, ¼ W | 99-211024 |
| R22 | Resistor, 2.2 kΩ, ±2%, ¼ W | 99-211021 |
| R23 | Resistor, Metal Film, 2 kΩ, ±2%, ¼ W | 99-211033 |
| R25 | Resistor, Carbon Film, 10 Ω, ±5%, ¼ W | 99-211029 |
| R26 | Resistor, Carbon Film, 6.8 Ω, ±5%, ½ W | 99-211066 |
| R27 | Resistor, Carbon Film, 12 Ω, ±5%, ¼ W | 99-211067 |
| R28 | Resistor, Carbon Film, 2.4 Ω, ±5%, ½ W | 99-211068 |
| R31 | Resistor, Wirewound, 150 Ω, ±5%, 2 W | 99-211016 |
| | **Transistors** | |
| Q1 | Transistor, NPN, 2SD725 | 99-211062 |
| Q2 | Transistor, NPN, PE8050B | 99-211003 |
| Q3 | Transistor, PNP, PE8550B | 99-211063 |
| | **Miscellaneous** | |
| F1 | Fuse, 2 A, 125 V, Semko | 99-211058 |
| IC1 | Regulator, UA431AWC | 99-211001 |
| SCR1 | Thyristor, SCR | 99-211013 |
| T1 | Transformer | 99-211055 |
| T2 | Transformer | 99-211055 |
| TR1 | Thermistor, 0.5 Ω, ±5%, 5 W | 99-211020 |
| VR1 | Potentiometer, Trimming, 3 kΩ | 99-211014 |
| ZD1 | Diode, Zener, 1N752A | 99-211007 |
| | Fuse, 2 A, 250 V | 99-211056 |
| | Fuse Holder | 99-211060 |
| | Terminal Block, 8 Ckt. | 99-211057 |
| | Heat Sink | 99-211059 |
| | Heat Sink, 1.5 mm | 99-211061 |





# N O T E S

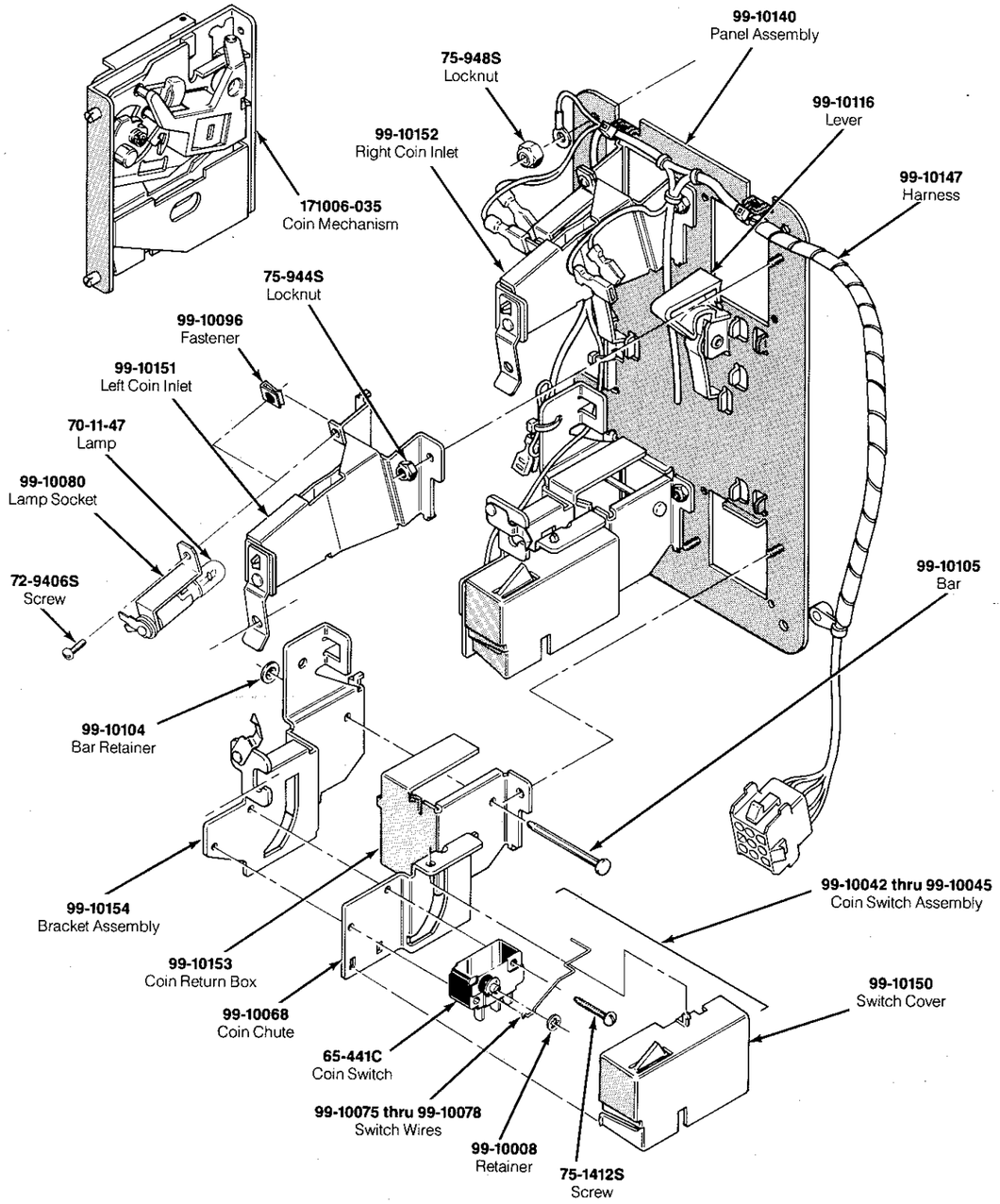
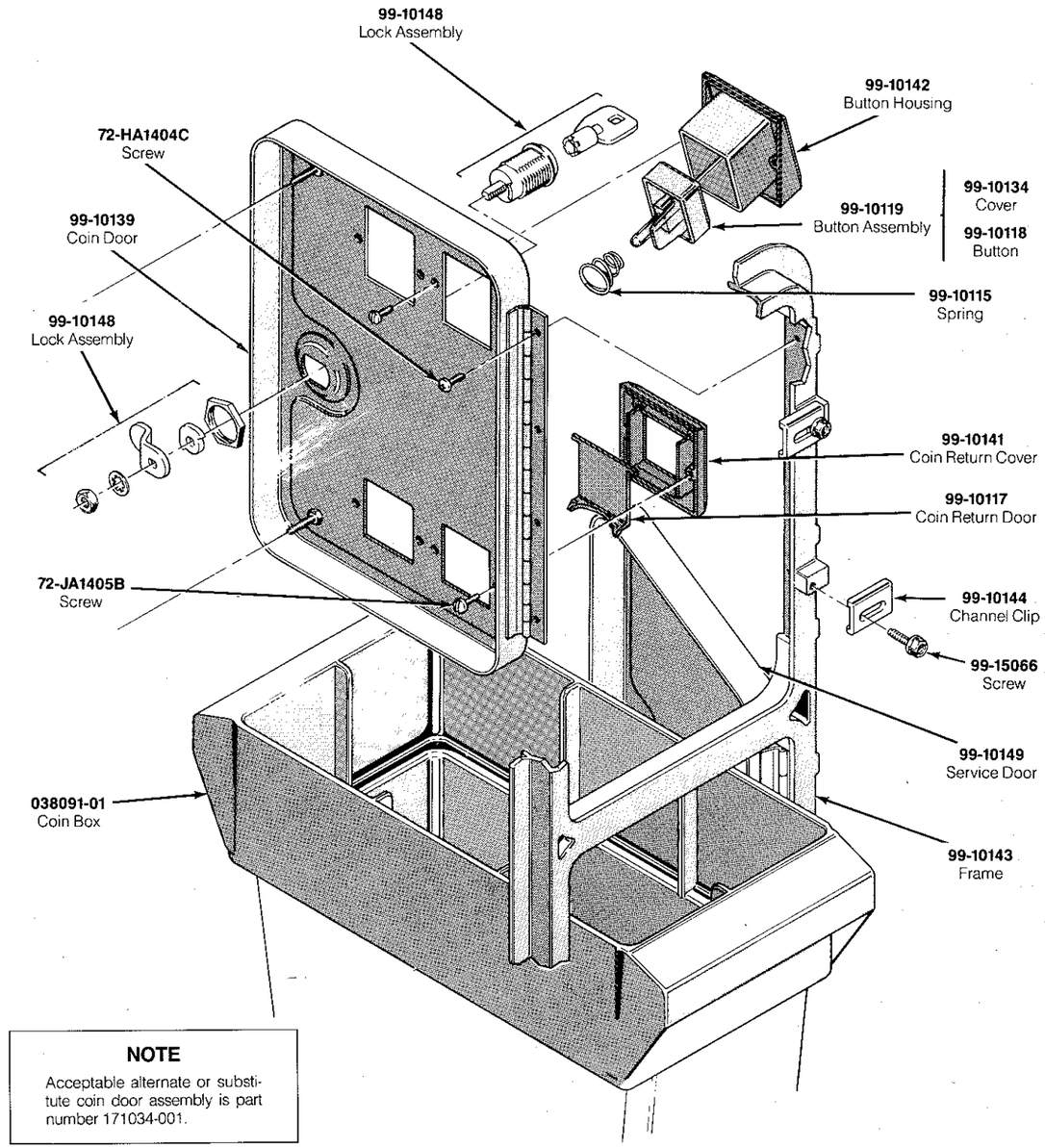



**Figure 6-6 Coin Acceptors, Inc. Coin Door Assembly 171027-001 A**








**NOTE**

Acceptable alternate or substitute coin door assembly is part number 171034-001.

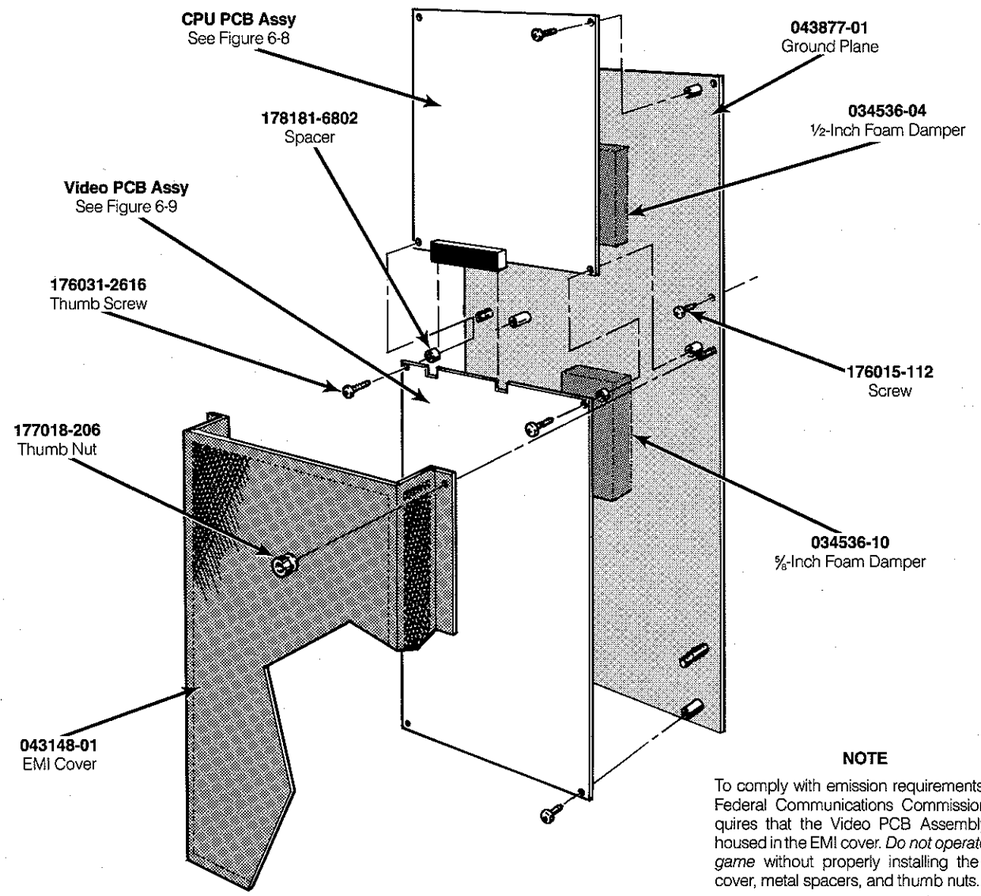
**Figure 6-6 Coin Acceptors, Inc. Coin Door Assembly, Continued 171027-001 A**

## Coin Acceptors, Inc. Coin Door Assembly Parts List

| Part No. | Description |
|---|---|
| 65-441C | Coin Switch |
| 70-11-47 | Miniature Bayonet Lamp |
| 72-9406S | #4-40 × 3/8-Inch Truss-Head Screw |
| 72-HA1404C | #4-40 × 1/4-Inch Pan-Head Screw |
| 72-JA1405B | #4-40 × .31-Inch Pan-Head Screw |
| 75-1412S | #4-40 × 3/4-Inch Pan-Head Screw |
| 75-994S | #4-40 Locknut |
| 99-10008 | Retainer |
| 99-10042 | Coin Switch Assembly for Belgium 5 Fr and U.S. $.25 |
| 99-10043 | Coin Switch Assembly for German 1 DM, Japanese 100 Yen, Swiss 1 Fr |
| 99-10044 | Coin Switch Assembly for German 2 DM, Italian 100 L, U.S. $1.00 |
| 99-10045 | Coin Switch Assembly for Australian $.20, German 5 DM, British 10 P |
| 99-10068 | Coin Return Chute |
| 99-10075 | Switch Wire (included in coin switch assembly 99-10043) |
| 99-10076 | Switch Wire (included in coin switch assembly 99-10042) |
| 99-10077 | Switch Wire (included in coin switch assembly 99-10044) |
| 99-10078 | Switch Wire (included in coin switch assembly 99-10045) |
| 99-10080 | Lamp Socket |
| 99-10081 | Key Holder |
| 99-10096 | Fastener |
| 99-10104 | Bar Retainer |
| 99-10105 | Bar |
| 99-10115 | Spring |
| 99-10116 | Plastic Coin Return Lever |
| 99-10117 | Steel Coin Return Door |
| 99-10118 | Amber Coin Return Button |
| 99-10119 | Amber Coin Button for U.S. $.25 |
| 99-10134 | Coin Button Cover |
| 99-10139 | Coin Door |
| 99-10140 | Coin Door Inner-Panel Assembly |
| 99-10141 | Die-Cast Coin Return Cover |
| 99-10142 | Die-Cast Button Housing |
| 99-10143 | Coin Door Frame |
| 99-10144 | Channel Clip |
| 99-10147 | Harness |
| 99-10148 | Lock Assembly |
| 99-10149 | Service Door |
| 99-10150 | Switch Cover |
| 99-10151 | Left Coin Inlet |
| 99-10152 | Right Coin Inlet |
| 99-10153 | Coin Return Box |
| 99-10154 | Bracket Assembly |
| 99-15066 | Screw for Clamp |
| 171006-035 | Metal Coin Mechanism for U.S. $.25 |







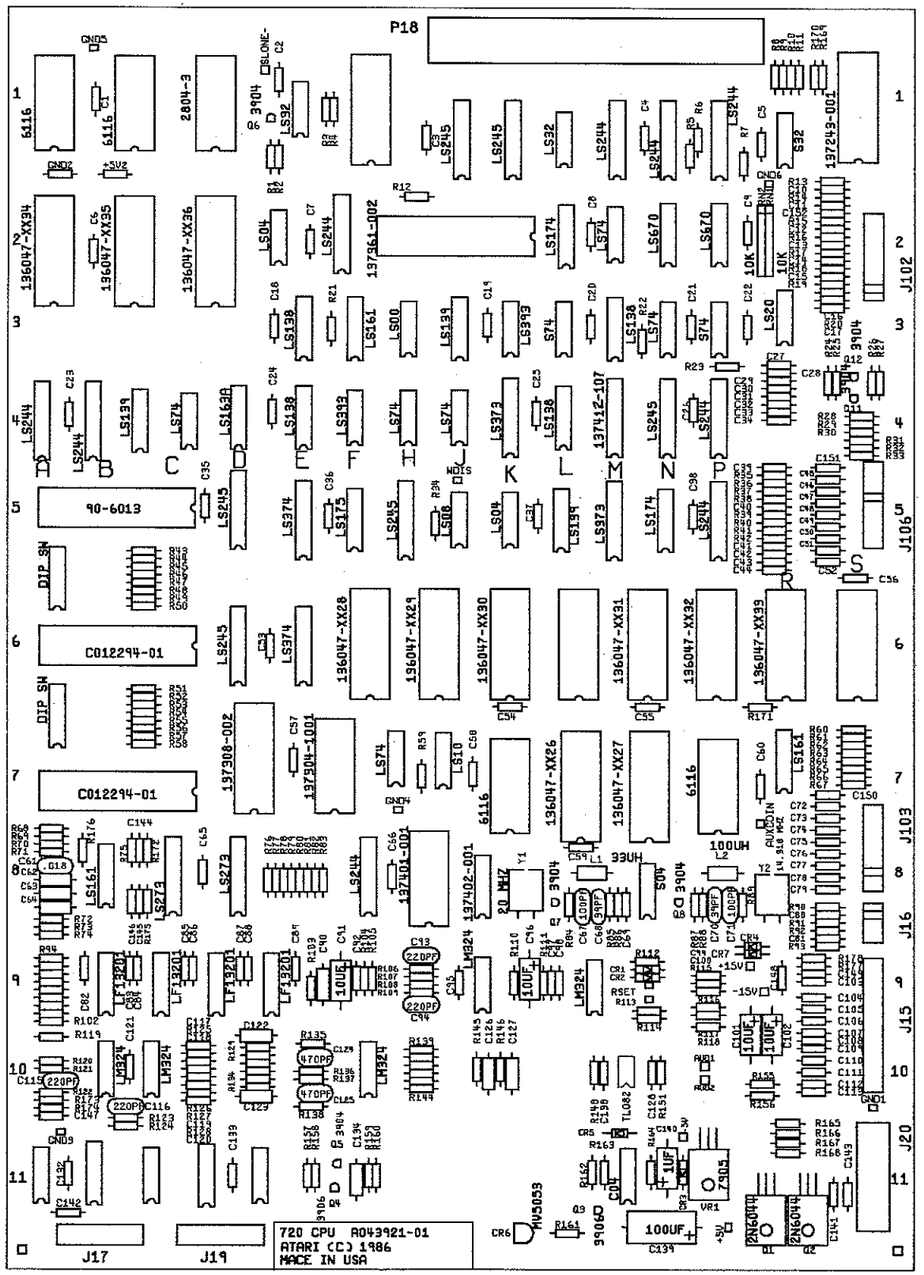

**NOTE**

To comply with emission requirements, the Federal Communications Commission requires that the Video PCB Assembly be housed in the EMI cover. *Do not operate this game* without properly installing the EMI cover, metal spacers, and thumb nuts.

**Figure 6-7 PCB Mounting Hardware**

## PCB Mounting Hardware Parts List

| Part No. | Description |
|---|---|
| A043921-01 | CPU PCB Assembly |
| A043922-01 | Video PCB Assembly |
| 034536-04 | ½-Irich Foam Vibration Damper |
| 034536-10 | ⅝-Inch Foam Vibration Damper |
| 043148-01 | EMI Cover |
| 043877-01 | Ground Plane |
| 176015-112 | 10 × ¾-Inch Cross-Recessed Pan-Head Deep-Thread Screw |
| 176031-2616 | #6-32 × ½-Inch Knurled Thumb Screw |
| 177018-206 | #6-32 Knurled Thumb Nut |
| 178181-6802 | Round Spacer |

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**NOTE:** Install Resistor R179 into position marked C142 located near 11A.

**Figure 6-8 720° Central Processing Unit (CPU) PCB Assembly A043921-01 A**





# 720° Central Processing Unit (CPU) PCB Assembly Parts List

| Designator | Description | Part No. |
|---|---|---|
| | **Integrated Circuits** | |
| 1A | Integrated Circuit, Type-6116 | 137211-001 |
| 1B/C | Integrated Circuit, Type-6116 | 137211-001 |
| 1D | Integrated Circuit, Type-2804-3 EEPROM | 137329-300 |
| 1E | Integrated Circuit, Type-74LS32 | 37-74LS32 |
| 1J | Integrated Circuit, Type-74LS245 | 37-74LS245 |
| 1K | Integrated Circuit, Type-74LS245 | 37-74LS245 |
| 1L | Integrated Circuit, Type-74LS32 | 37-74LS32 |
| 1M | Integrated Circuit, Type-74LS244 | 37-74LS244 |
| 1N | Integrated Circuit, Type-74LS244 | 37-74LS244 |
| 1P | Integrated Circuit, Type-74LS244 | 37-74LS244 |
| 1R | Integrated Circuit, Type-74S32 | 37-74S32 |
| 1S | Integrated Circuit, Type-ADC0809 | 137243-001 |
| 2A | Integrated Circuit, EPROM, Type-27512, 200 ns | 136047-x134 |
| 2B | Integrated Circuit, EPROM, Type-27512, 200 ns | 136047-x135 |
| 2C/D | Integrated Circuit, EPROM, Type-27512, 200 ns | 136047-x136 |
| 2F | Integrated Circuit, Type-74LS244 | 37-74LS244 |
| 2J | Integrated Circuit, Type-T11 (DCT11-XA) | 137361-002 |
| 2L | Integrated Circuit, Type-74LS174 | 37-74LS174 |
| 2M | Integrated Circuit, Type-74LS74 | 37-74LS74 |
| 2N | Integrated Circuit, Type-74LS670 | 37-74LS670 |
| 2P | Integrated Circuit, Type-74LS670 | 37-74LS670 |
| 3E | Integrated Circuit, Type-74LS138 | 137177-001 |
| 3F | Integrated Circuit, Type-74LS161 | 37-74LS161 |
| 3H | Integrated Circuit, Type-74LS00 | 37-74LS00 |
| 3J | Integrated Circuit, Type-74LS139 | 37-74LS139 |
| 3K | Integrated Circuit, Type-74LS393 | 37-74LS393 |
| 3L | Integrated Circuit, Type-74S74 | 37-74S74 |
| 3M | Integrated Circuit, Type-74LS138 | 137177-001 |
| 3N | Integrated Circuit, Type-74LS74 | 37-74LS74 |
| 3P | Integrated Circuit, Type-74S74 | 37-74S74 |
| 3R | Integrated Circuit, Type-74LS20 | 37-74LS20 |
| 4A | Integrated Circuit, Type-74LS244 | 37-74LS244 |
| 4A/B | Integrated Circuit, Type-74LS244 | 37-74LS244 |
| 4B/C | Integrated Circuit, Type-74LS139 | 37-74LS139 |
| 4C/D | Integrated Circuit, Type-74LS74 | 37-74LS74 |
| 4D | Integrated Circuit, Type-74LS163A | 37-74LS163A |
| 4E | Integrated Circuit, Type-74LS138 | 137177-001 |
| 4F | Integrated Circuit, Type-74LS393 | 37-74LS393 |
| 4H | Integrated Circuit, Type-74LS74 | 37-74LS74 |
| 4J | Integrated Circuit, Type-74LS74 | 37-74LS74 |
| 4K | Integrated Circuit, Type-74LS373 | 37-74LS373 |
| 4L | Integrated Circuit, Type-74LS138 | 137177-001 |
| 4M | Integrated Circuit, SLAPSTIC | 137412-107 |
| 4N | Integrated Circuit, Type-74LS245 | 37-74LS245 |
| 4P | Integrated Circuit, Type-74LS244 | 37-74LS244 |
| 5B | Integrated Circuit, Type-6502A | 90-6013 |
| 5D | Integrated Circuit, Type-74LS245 | 37-74LS245 |
| 5E | Integrated Circuit, Type-74LS374 | 37-74LS374 |
| 5F | Integrated Circuit, Type-74LS175 | 37-74LS175 |
| 5H | Integrated Circuit, Type-74LS245 | 37-74LS245 |
| 5J | Integrated Circuit, Type-74LS08 | 37-74LS08 |
| 5K | Integrated Circuit, Type-74LS04 | 37-74LS04 |
| 5L | Integrated Circuit, Type-74LS139 | 37-74LS139 |
| 5M | Integrated Circuit, Type-74LS373 | 37-74LS373 |
| 5N | Integrated Circuit, Type-74LS174 | 37-74LS174 |
| 5P | Integrated Circuit, Type-74LS244 | 37-74LS244 |
| 6B | Integrated Circuit, POKEY | C012294-01 |
| 6D | Integrated Circuit, Type-74LS245 | 37-74LS245 |
| 6E | Integrated Circuit, Type-74LS374 | 37-74LS374 |
| 6F/H | Integrated Circuit, EPROM, Type-27512, 200 ns | 136047-x128 |
| 6H/J | Integrated Circuit, EPROM, Type-27512, 200 ns | 136047-x129 |
| 6K | Integrated Circuit, EPROM, Type-27512, 200 ns | 136047-x130 |
| 6M/N | Integrated Circuit, EPROM, Type-27512, 200 ns | 136047-x131 |
| 6P | Integrated Circuit, EPROM, Type-27512, 200 ns | 136047-x132 |
| 6R | Integrated Circuit, EPROM, Type-27512, 200 ns | 136047-x133 |
| 7B | Integrated Circuit, POKEY | C012294-01 |
| 7D | Integrated Circuit, Type-TMS5220C | 137308-002 |
| 7F | Integrated Circuit, Leta | 137304-1001 |
| 7H | Integrated Circuit, Type-74LS74 | 37-74LS74 |
| 7J | Integrated Circuit, Type-74LS10 | 37-74LS10 |
| 7K | Integrated Circuit, Type-6116 | 137211-001 |
| 7L/M | Integrated Circuit, EPROM, Type-27128, 300 ns | 136047-x126 |
| 7M/N | Integrated Circuit, EPROM, Type-27128, 300 ns | 136047-x127 |
| 7P | Integrated Circuit, Type-6116 | 137211-001 |
| 7R | Integrated Circuit, Type-74LS161 | 37-74LS161 |
| 8B | Integrated Circuit, Type-74LS161 | 37-74LS161 |
| 8C | Integrated Circuit, Type-74LS273 | 37-74LS273 |
| 8D | Integrated Circuit, Type-74LS273 | 37-74LS273 |
| 8F | Integrated Circuit, Type-74LS244 | 37-74LS374 |
| 8H/J | Integrated Circuit, Type-Y2151 | 137401-001 |
| 8J/K | Integrated Circuit, Type-YM3012 | 137402-001 |
| 8N | Integrated Circuit, Type-74S04 | 37-74S04 |
| 9B | Integrated Circuit, Type-LF13201 | 137352-001 |
| 9C | Integrated Circuit, Type-LF13201 | 137352-001 |
| 9D | Integrated Circuit, Type-LF13201 | 137352-001 |
| 9D/E | Integrated Circuit, Type-LF13201 | 137352-001 |
| 9J/K | Integrated Circuit, Type-LM324 | 37-LM324 |
| 9L/M | Integrated Circuit, Type-LM324 | 37-LM324 |

*"x" in the part number denotes the revision level*

## 720° Central Processing Unit (CPU) PCB Assembly Parts List, Continued

| Designator | Description | Part No. |
|---|---|---|
| 10B | Integrated Circuit, Type-LM324 | 37-LM324 |
| 10C | Integrated Circuit, Type-LM324 | 37-LM324 |
| 10F | Integrated Circuit, Type-LM324 | 37-LM324 |
| 10L/M | Integrated Circuit, Type-TLO82CP | 37-TLO82CP |
| 11M | Integrated Circuit, Type-74C04 | 137309-001 |
| | **Sockets** | |
| | 16-Pin Medium-Insertion-Force Socket | 79-42C16 |
| | 20-Pin Medium-Insertion-Force Socket | 79-42C20 |
| | 24-Pin Medium-Insertion-Force Socket | 79-42C24 |
| | 28-Pin Medium-Insertion-Force Socket | 79-42C28 |
| | 40-Pin Medium-Insertion-Force Socket | 79-42C40 |
| | **Capacitors** | |
| C1–C60 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C31–C60 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C61 | Capacitor, Ceramic, .018 μF, 50 V | 122015-183 |
| C62–C64 | Capacitor, Ceramic, .22 μF, 25 V | 122004-224 |
| C65 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C66 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C67 | Capacitor, Mica, 100 pF, 100 V | 128002-101 |
| C68 | Capacitor, Mica, 39 pF, 100 V | 128002-390 |
| C69 | Capacitor, Ceramic, .1μF, 50 V | 122002-104 |
| C70 | Capacitor, Mica, 39 pF, 100 V | 128002-390 |
| C71 | Capacitor, Mica, 100 pF, 100 V | 128002-101 |
| C72–C79 | Capacitor, Ceramic, .01 μF, 25 V | 122005-103 |
| C80 | Capacitor, Ceramic, .001 μF, 50 V | 122002-102 |
| C81 | Capacitor, Ceramic, .001 μF, 50 V | 122002-102 |
| C82–C89 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C90 | Capacitor, Ceramic, .22, 25 V | 122004-224 |
| C91 | Capacitor, Tantalum, 10 μF, 20 V | 29-046 |
| C92 | Capacitor, Ceramic, .01 μF, 25 V | 122005-103 |
| C93 | Capacitor, Mica, 220 pF, 100 V | 128002-221 |
| C94 | Capacitor, Mica, 220 pF, 100 V | 128002-221 |
| C95 | Capacitor, Ceramic, .0027 μF, 50 V | 122015-272 |
| C96 | Capacitor, Tantalum, 10 μF, 20 V | 29-046 |
| C97 | Capacitor, Ceramic, .0027 μF, 50 V | 122015-272 |
| C98–C100 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C101 | Capacitor, Aluminum, 10 μF, 35 V | 24-350106 |
| C102 | Capacitor, Aluminum, 10 μF, 35 V | 24-350106 |
| C103–C109 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C110 | Capacitor, Ceramic, .01 μF, 25 V | 122005-103 |
| C111 | Capacitor, Ceramic, .01 μF, 25 V | 122005-103 |
| C112 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C113 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C115 | Capacitor, Mica, 220 pF, 100 V | 128002-221 |
| C116 | Capacitor, Mica, 220 pF, 100 V | 128002-221 |
| C117 | Capacitor, Ceramic, .01 μF, 25 V | 122005-103 |
| C118 | Capacitor, Ceramic, .001 μF, 50 V | 122002-102 |
| C119 | Capacitor, Ceramic, .001 μF, 50 V | 122002-102 |
| C120 | Capacitor, Ceramic, .01 μF, 25 V | 122005-103 |
| C121 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C122 | Capacitor, Ceramic, .22 μF, 25 V | 122004-224 |
| C123 | Capacitor, Ceramic, .22 μF, 25 V | 122004-224 |
| C124 | Capacitor, Mica, 470 pF, 100 V | 128002-471 |
| C125 | Capacitor, Mica, 470 pF, 100 V | 128002-471 |
| C126 | Capacitor, Ceramic, .22 μF, 25 V | 122004-224 |
| C127 | Capacitor, Ceramic, .22 μF, 25 V | 122004-224 |
| C128 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C132 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C133 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C134 | Capacitor, Ceramic, .22 μF, 25 V | 122004-224 |
| C135 | Capacitor, Aluminum, 470 μF, 25 V | 24-250477 |
| C136 | Capacitor, Aluminum, 470 μF, 25 V | 24-250477 |
| C138 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C139 | Capacitor, Aluminum, 100 μF, 35 V | 24-350107 |
| C140 | Capacitor, Aluminum, 1 μF, 50 V | 24-500105 |
| C141 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C143 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C144 | Capacitor, Ceramic, .0027 μF, 50 V | 122015-272 |
| C145 | Capacitor, Ceramic, .0012 μF, 50 V | 122015-122 |
| C146 | Capacitor, Ceramic, .0039 μF, 50 V | 122015-392 |
| C147 | Capacitor, Ceramic, .0068 μF, 50 V | 122015-682 |
| C148 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| C149–C152 | Capacitor, Ceramic, .1 μF, 50 V | 122002-104 |
| | **Diodes** | |
| CR1–CR3 | Diode, Type-1N100 | 31-1N100 |
| CR4 | Diode, Type-1N4001 | 31-1N4001 |
| CR5 | Diode, Type-1N4001 | 31-1N4001 |
| CR6 | Diode, Light-Emitting, Type-MV5053 | 38-MV5053 |
| CR7 | Diode, Type-1N4001 | 31-1N4001 |
| | **Connectors and Fasteners** | |
| J15 | Connector, Header, 17-Circuit, .100 ctr | 179118-017 |
| J16 | Connector, Header, 5-Circuit, .100 ctr | 179118-005 |
| J20 | Connector, Header, 9-Circuit, .156 ctr, pol | 179014-009 |
| J103 | Connector, Header, 11-Circuit, .100 ctr | 179118-011 |
| J106 | Connector, Header, 11-Circuit, .100 ctr | 179118-011 |
| P18 | Connector, Card Edge, 80-Circuit (40 × 2) | 179221-180 |
| Q1, Q2 | Fastener, Nylon, Snap-in | 81-4302 |
| Q9, Q10 | Fastener, Nylon, Snap-in | 81-4302 |
| VR1 | Fastener, Nylon, Snap-In | 81-4302 |
| | Terminal, Fast-On Tab (Acceptable substitute is part number 020670-01) | 179051-002 |
| | **Inductors** | |
| L1 | Inductor, 33 μH | 141016-007 |
| L2 | Inductor, 100 μH | 141002-001 |
| | **Transistors** | |
| Q1, Q2 | Transistor, 2N6044 | 34-2N6044 |
| Q3, Q4 | Transistor, 2N3906 | 33-2N3906 |
| Q5–Q8 | Transistor, 2N3904 | 34-2N3904 |
| Q11, Q12 | Transistor, 2N3904 | 34-2N3904 |

*"x" in the part number denotes the revision level*

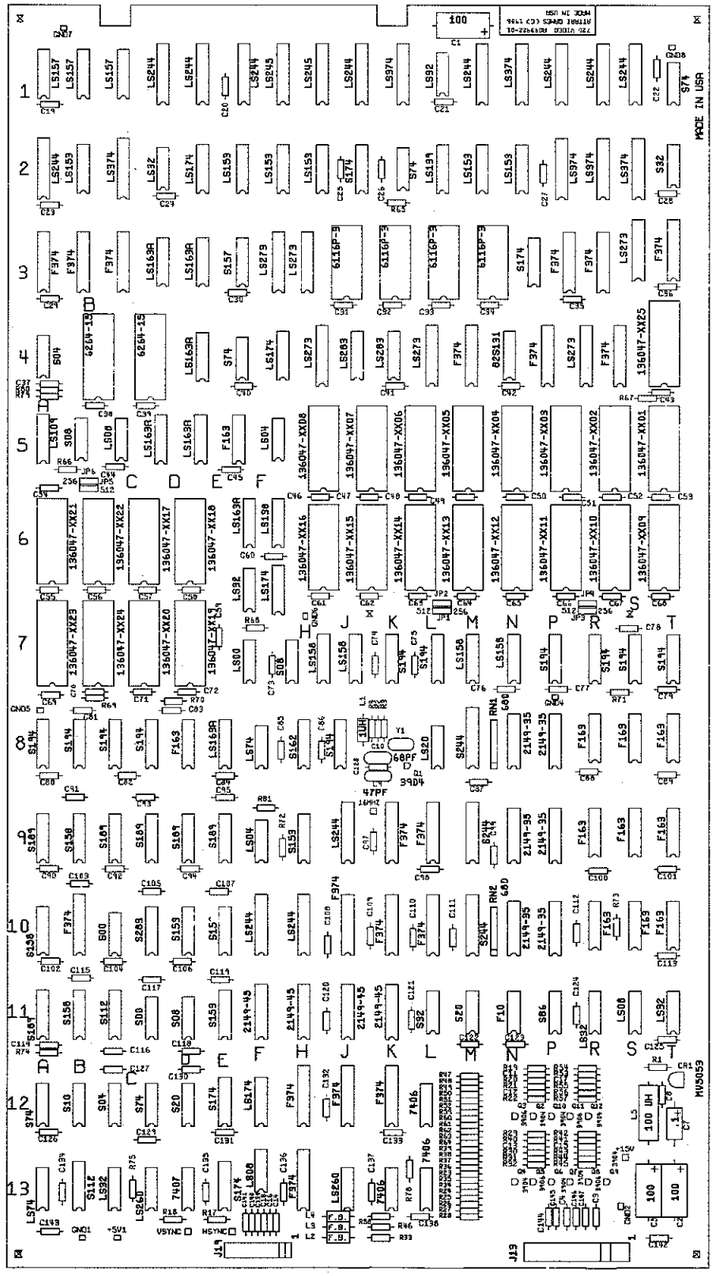




## 720° Central Processing Unit (CPU) PCB Assembly Parts List, Continued

| Designator | Description | Part No. |
|---|---|---|
| | **Resistors** | |
| R1, R2 | Resistor, ¼ W, 10K Ω, ±5% | 110000-103 |
| R3, R4 | Resistor, ¼ W, 1K Ω, ±5% | 110000-102 |
| R5–R7 | Resistor, ¼ W, 220 Ω, ±5% | 110000-221 |
| R8–R11 | Resistor, ¼ W, 4.7K Ω, ±5% | 110000-472 |
| R12 | Resistor, ¼ W, 470 Ω, ±5% | 110000-471 |
| R13–R20 | Resistor, ¼ W, 100 Ω, ±5% | 110000-101 |
| R21–R23 | Resistor, ¼ W, 1K Ω, ±5% | 110000-102 |
| R24–R27 | Resistor, ¼ W, 4.7K Ω, ±5% | 110000-472 |
| R28–R33 | Resistor, ¼ W, 470 Ω, ±5% | 110000-471 |
| R34 | Resistor, ¼ W, 10K Ω, ±5% | 110000-103 |
| R35 | Resistor, ¼ W, 1K Ω, ±5% | 110000-102 |
| R36 | Resistor, ¼ W, 220 Ω, ±5% | 110000-221 |
| R37 | Resistor, ¼ W, 220 Ω, ±5% | 110000-221 |
| R38–R42 | Resistor, ¼ W, 1K Ω, ±5% | 110000-102 |
| R43–R58 | Resistor, ¼ W, 10K Ω, ±5% | 110000-103 |
| R59 | Resistor, ¼ W, 1K Ω, ±5% | 110000-102 |
| R60–R67 | Resistor, ¼ W, 3.3K Ω, ±5% | 110000-332 |
| R68 | Resistor, ¼ W, 1K Ω, ±5% | 110000-102 |
| R69 | Resistor, ¼ W, 1.8K Ω, ±5% | 110000-182 |
| R70 | Resistor, ¼ W, 10K Ω, ±5% | 110000-103 |
| R71 | Resistor, ¼ W, 5.6K Ω, ±5% | 110000-562 |
| R72–R74 | Resistor, ¼ W, 100K Ω, ±5% | 110000-104 |
| R75 | Resistor, ¼ W, 1K Ω, ±5% | 110000-102 |
| R76–R85 | Resistor, ¼ W, 10K Ω, ±5% | 110000-103 |
| R86 | Resistor, ¼ W, 220 Ω, ±5% | 110000-221 |
| R87 | Resistor, ¼ W, 220 Ω, ±5% | 110000-221 |
| R88, R89 | Resistor, ¼ W, 10K Ω, ±5% | 110000-103 |
| R90 | Resistor, ¼ W, 100 Ω, ±5% | 110000-101 |
| R91 | Resistor, ¼ W, 4.7K Ω, ±5% | 110000-472 |
| R92 | Resistor, ¼ W, 100 Ω, ±5% | 110000-101 |
| R93 | Resistor, ¼ W, 4.7K Ω, ±5% | 110000-472 |
| R94 | Resistor, ¼ W, 22K Ω, ±5% | 110000-223 |
| R95 | Resistor, ¼ W, 47K Ω, ±5% | 110000-473 |
| R96 | Resistor, ¼ W, 100K Ω, ±5% | 110000-104 |
| R97 | Resistor, ¼ W, 22K Ω, ±5% | 110000-223 |
| R98 | Resistor, ¼ W, 47K Ω, ±5% | 110000-473 |
| R99 | Resistor, ¼ W, 100K Ω, ±5% | 110000-104 |
| R100 | Resistor, ¼ W, 22K Ω, ±5% | 110000-223 |
| R101 | Resistor, ¼ W, 47K Ω, ±5% | 110000-473 |
| R102 | Resistor, ¼ W, 100K Ω, ±5% | 110000-104 |
| R103 | Resistor, ¼ W, 100K Ω, ±5% | 110000-104 |
| R104, R105 | Resistor, ¼ W, 1K Ω, ±5% | 110000-102 |
| R106 | Resistor, ¼ W, 100K Ω, ±5% | 110000-104 |
| R107, R108 | Resistor, ¼ W, 18K Ω, ±5% | 110000-183 |
| R109 | Resistor, ¼ W, 100K Ω, ±5% | 110000-104 |
| R110 | Resistor, ¼ W, 390 Ω, ±5% | 110000-391 |
| R111 | Resistor, ¼ W, 560 Ω, ±5% | 110000-561 |
| R112 | Resistor, ¼ W, 1K Ω, ±5% | 110000-102 |
| R113 | Resistor, ¼ W, 5.6K Ω, ±5% | 110000-562 |
| R114 | Resistor, ¼ W, 10K Ω, ±5% | 110000-103 |
| R115, R116 | Resistor, ¼ W, 1K Ω, ±5% | 110000-102 |
| R117 | Resistor, ¼ W, 470 Ω, ±5% | 110000-471 |
| R118 | Resistor, ¼ W, 470 Ω, ±5% | 110000-471 |
| R119 | Resistor, ¼ W, 470K Ω, ±5% | 110000-474 |
| R120–R124 | Resistor, ¼ W, 100K Ω, ±5% | 110000-104 |
| R125 | Resistor, ¼ W, 2.2K Ω, ±5% | 110000-222 |
| R126, R127 | Resistor, ¼ W, 4.7K Ω, ±5% | 110000-472 |
| R128 | Resistor, ¼ W, 2.2K Ω, ±5% | 110000-222 |
| R129 | Resistor, ¼ W, 100K Ω, ±5% | 110000-104 |
| R130 | Resistor, ¼ W, 47K Ω, ±5% | 110000-473 |
| R131–R133 | Resistor, ¼ W, 100K Ω, ±5% | 110000-104 |
| R134 | Resistor, ¼ W, 47K Ω, ±5% | 110000-473 |
| R135–R138 | Resistor, ¼ W, 100K Ω, ±5% | 110000-104 |
| R139 | Resistor, ¼ W, 47K Ω, ±5% | 110000-473 |
| R140 | Resistor, ¼ W, 68K Ω, ±5% | 110000-683 |
| R141, R142 | Resistor, ¼ W, 47K Ω, ±5% | 110000-473 |
| R143 | Resistor, ¼ W, 68K Ω, ±5% | 110000-683 |
| R144 | Resistor, ¼ W, 47K Ω, ±5% | 110000-473 |
| R148, R151 | Resistor, ¼ W, 100K Ω, ±5% | 110000-104 |
| R155, R156 | Resistor, ¼ W, 470 Ω, ±5% | 110000-471 |
| R157 | Resistor, ¼ W, 10K Ω, ±5% | 110000-103 |
| R158, R159 | Resistor, ¼ W, 3.3K Ω, ±5% | 110000-332 |
| R160 | Resistor, ¼ W, 1K Ω, ±5% | 110000-102 |
| R161 | Resistor, ¼ W, 150 Ω, ±5% | 110000-151 |
| R162 | Resistor, ¼ W, 10K Ω, ±5% | 110000-103 |
| R163 | Resistor, ¼ W, 3.3K Ω, ±5% | 110000-332 |
| R164, R166 | Resistor, ¼ W, 1K Ω, ±5% | 110000-102 |
| R168 | Resistor, ¼ W, 1K Ω, ±5% | 110000-102 |
| R169, R170 | Resistor, ¼ W, 4.7K Ω, ±5% | 110000-472 |
| R171 | Resistor, ¼ W, 270 Ω, ±5% | 110000-271 |
| R172 | Resistor, ¼ W, 12 Ω, ±5% | 110000-123 |
| R173 | Resistor, ¼ W, 56 Ω, ±5% | 110000-563 |
| R174 | Resistor, ¼ W, 10K Ω, ±5% | 110000-103 |
| R175 | Resistor, ¼ W, 8.2 Ω, ±5% | 110000-822 |
| R176 | Resistor, ¼ W, 3.9K Ω, ±5% | 110000-392 |
| R177 | Resistor, ¼ W, 470 Ω, ±5% | 110000-471 |
| R178 | Resistor, ¼ W, 1K Ω, ±5% | 110000-102 |
| R179 | Resistor, ¼ W, 0 Ω, ±5% | 110005-001 |
| RN1, RN2 | Resistor Network, SIP, 10K × 8, 1/8 W | 118002-103 |
| | **Miscellaneous** | |
| VR1 | Voltage Regulator, Type-7905 | 37-7905 |
| Y1 | Crystal, 20 MHz | 144000-003 |
| Y2 | Crystal, 14.318 MHz | 90-101 |
| 5/6A | Switch, 8-Position, DIP | 160031-008 |
| 6/7A | Switch, 8-Position, DIP | 160031-008 |

*"x" in the part number denotes the revision level*



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**NOTE:**
1. DO NOT INSTALL R3 AND C143.

**Figure 6-9 720° Video PCB Assembly A043922-01 A**







# 720° Video PCB Assembly Parts List

| Designator | Description | Part No. |
|---|---|---|
| | **Integrated Circuits** | |
| 1A | Type-74LS157 Integrated Circuit | 37-74LS157 |
| 1B | Type-74LS157 Integrated Circuit | 37-74LS157 |
| 1B/C | Type-74LS157 Integrated Circuit | 37-74LS157 |
| 1C/D | Type-74LS244 Integrated Circuit | 37-74LS244 |
| 1D/E | Type-74LS244 Integrated Circuit | 37-74LS244 |
| 1E/F | Type-74LS244 Integrated Circuit | 37-74LS244 |
| 1F/H | Type-74LS245 Integrated Circuit | 37-74LS245 |
| 1H | Type-74LS245 Integrated Circuit | 37-74LS245 |
| 1J | Type-74LS244 Integrated Circuit | 37-74LS244 |
| 1K | Type-74LS374 Integrated Circuit | 37-74LS374 |
| 1L | Type-74LS32 Integrated Circuit | 37-74LS32 |
| 1M | Type-74LS244 Integrated Circuit | 37-74LS244 |
| 1N | Type-74LS374 Integrated Circuit | 37-74LS374 |
| 1P | Type-74LS244 Integrated Circuit | 37-74LS244 |
| 1R | Type-74LS244 Integrated Circuit | 37-74LS244 |
| 1S | Type-74LS244 Integrated Circuit | 37-74LS244 |
| 1T | Type-74S74 Integrated Circuit | 37-74S74 |
| 2A | Type-74LS244 Integrated Circuit | 37-74LS244 |
| 2B | Type-74LS153 Integrated Circuit | 37-74LS153 |
| 2B/C | Type-74LS374 Integrated Circuit | 37-74LS374 |
| 2C/D | Type-74LS32 Integrated Circuit | 37-74LS32 |
| 2D/E | Type-74LS174 Integrated Circuit | 37-74LS174 |
| 2E/F | Type-74LS153 Integrated Circuit | 37-74LS153 |
| 2F/H | Type-74LS153 Integrated Circuit | 37-74LS153 |
| 2H | Type-74LS153 Integrated Circuit | 37-74LS153 |
| 2J | Type-74S174 Integrated Circuit | 137209-001 |
| 2K | Type-74S74 Integrated Circuit | 37-74S74 |
| 2L | Type-74LS139 Integrated Circuit | 37-74LS139 |
| 2M | Type-74LS153 Integrated Circuit | 37-74LS153 |
| 2N | Type-74LS153 Integrated Circuit | 37-74LS153 |
| 2P | Type-74LS374 Integrated Circuit | 37-74LS374 |
| 2R | Type-74LS374 Integrated Circuit | 37-74LS374 |
| 2S | Type-74LS374 Integrated Circuit | 37-74LS374 |
| 2T | Type-74S32 Integrated Circuit | 37-74S32 |
| 3A | Type-74F374 Integrated Circuit† | 137420-001 |
| 3B | Type-74F374 Integrated Circuit† | 137420-001 |
| 3B/C | Type-74F374 Integrated Circuit† | 137420-001 |
| 3C/D | Type-74LS163A Integrated Circuit | 37-74LS163A |
| 3D/E | Type-74LS163A Integrated Circuit | 37-74LS163A |
| 3E/F | Type-74S157 Integrated Circuit | 37-74S157 |
| 3F/H | Type-74LS273 Integrated Circuit | 37-74LS273 |
| 3H | Type-74LS273 Integrated Circuit | 37-74LS273 |
| 3H/J | Type-6116P-3, 150 ns RAM Integrated Circuit | 137211-001 |
| 3K | Type-6116P-3, 150 ns RAM Integrated Circuit | 137211-001 |
| 3L | Type-6116P-3, 150 ns RAM Integrated Circuit | 137211-001 |
| 3M | Type-6116P-3, 150 ns RAM Integrated Circuit | 137211-001 |
| 3N | Type-74S174 Integrated Circuit | 137209-001 |
| 3P | Type-74F374 Integrated Circuit† | 137420-001 |
| 3R | Type-74F374 Integrated Circuit† | 137420-001 |
| 3S | Type-74LS273 Integrated Circuit | 37-74LS273 |
| 3T | Type-74F374 Integrated Circuit† | 137420-001 |
| 4A | Type-74S04 Integrated Circuit | 37-74S04 |
| 4B/C | Type 6264-15 RAM Integrated Circuit | 137441-001 |
| 4C/D | Type 6264-15 RAM Integrated Circuit | 137441-001 |
| 4D/E | Type-74LS163A Integrated Circuit | 37-74LS163A |
| 4E/F | Type-74S74 Integrated Circuit | 37-74S74 |
| 4F/H | Type-74LS174 Integrated Circuit | 37-74LS174 |
| 4H | Type-74LS273 Integrated Circuit | 37-74LS273 |
| 4J | Type-74LS283 Integrated Circuit | 137204-001 |
| 4K | Type-74LS283 Integrated Circuit | 137204-001 |
| 4K/L | Type-74LS273 Integrated Circuit | 37-74LS273 |
| 4M | Type-74F374 Integrated Circuit† | 137420-001 |
| 4M/N | Type-82S131 Programmable PROM Integrated Circuit | 136034-131 |
| 4N/P | Type-74F374 Integrated Circuit† | 137420-001 |
| 4P/R | Type-74LS273 Integrated Circuit | 37-74LS273 |
| 4R/S | Type-74F374 Integrated Circuit† | 137420-001 |
| 4T | Type-27128, EPROM, Integrated Circuit | 136047-x125 |
| 5A | Type-74LS109 Integrated Circuit | 37-74LS109 |
| 5B | Type-74S08 Integrated Circuit | 37-74LS08 |
| 5B/C | Type-74LS08 Integrated Circuit | 37-74LS08 |
| 5C/D | Type-74LS163A Integrated Circuit | 37-74LS163A |
| 5D/E | Type-74LS163A Integrated Circuit | 37-74LS163A |
| 5E/F | Type-74F163 Integrated Circuit* | 137345-001 |
| 5F/H | Type-74LS04 Integrated Circuit | 37-74LS04 |
| 5H/J | Type-27512, EPROM, Integrated Circuit | 136047-x108 |
| 5J/K | Type-27512, EPROM, Integrated Circuit | 136047-x107 |
| 5L | Type-27512, EPROM, Integrated Circuit | 136047-x106 |
| 5M | Type-27512, EPROM, Integrated Circuit | 136047-x105 |
| 5N | Type-27512, EPROM, Integrated Circuit | 136047-x104 |
| 5P | Type-27512, EPROM, Integrated Circuit | 136047-x103 |
| 5R/S | Type-27512, EPROM, Integrated Circuit | 136047-x102 |
| 5T | Type-27512, EPROM, Integrated Circuit | 136047-x101 |
| 6A | Type-27512, EPROM, Integrated Circuit | 136047-x121 |
| 6B | Type-27512, EPROM, Integrated Circuit | 136047-x122 |
| 6C | Type-27256, EPROM, Integrated Circuit | 136047-x117 |
| 6D | Type-27512, EPROM, Integrated Circuit | 136047-x118 |
| 6/7E/F | Type-74LS32 Integrated Circuit | 37-74LS32 |
| 6/7F/H | Type-74LS174 Integrated Circuit | 37-74LS174 |

*"x" in the part number denotes the revision level*
**Acceptable substitute is Type-74AS163N Integrated Circuit, part no. 137421-001*
*†Acceptable substitute is Type-74AS374N Integrated Circuit, part no. 137422-001*

# 720° Video PCB Assembly
## Parts List, Continued

| Designator | Description | Part No. |
|---|---|---|
| 6E/F | Type-74LS163A Integrated Circuit | 37-74LS163A |
| 6F/H | Type-74LS138 Integrated Circuit | 137177-001 |
| 6H/J | Type-27512, EPROM, Integrated Circuit | 136047-x116 |
| 6J/K | Type-27512, EPROM, Integrated Circuit | 136047-x115 |
| 6L | Type-27512, EPROM, Integrated Circuit | 136047-x114 |
| 6M | Type-27512, EPROM, Integrated Circuit | 136047-x113 |
| 6N | Type-27512, EPROM, Integrated Circuit | 136047-x112 |
| 6P | Type-27512, EPROM, Integrated Circuit | 136047-x111 |
| 6R/S | Type-27512, EPROM, Integrated Circuit | 136047-x110 |
| 6T | Type-27512, EPROM, Integrated Circuit | 136047-x109 |
| 7A | Type-27512, EPROM, Integrated Circuit | 136047-x123 |
| 7B | Type-27256, EPROM, Integrated Circuit | 136047-x124 |
| 7C | Type-27512, EPROM, Integrated Circuit | 136047-x120 |
| 7D | Type-27512, EPROM, Integrated Circuit | 136047-x119 |
| 7E/F | Type-74LS00 Integrated Circuit | 37-74LS00 |
| 7F/H | Type-74S08 Integrated Circuit | 37-74S08 |
| 7H/J | Type-74LS158 Integrated Circuit | 137203-001 |
| 7J | Type-74LS158 Integrated Circuit | 137203-001 |
| 7K | Type-74S194 Integrated Circuit | 137424-001 |
| 7L | Type-74S194 Integrated Circuit | 137424-001 |
| 7M | Type-74LS158 Integrated Circuit | 137203-001 |
| 7N | Type-74LS158 Integrated Circuit | 137203-001 |
| 7P | Type-74S194 Integrated Circuit | 137424-001 |
| 7R | Type-74S194 Integrated Circuit | 137424-001 |
| 7S | Type-74S194 Integrated Circuit | 137424-001 |
| 7T | Type-74S194 Integrated Circuit | 137424-001 |
| 8A | Type-74S194 Integrated Circuit | 137424-001 |
| 8B | Type-74S194 Integrated Circuit | 137424-001 |
| 8B/C | Type-74S194 Integrated Circuit | 137424-001 |
| 8C/D | Type-74S194 Integrated Circuit | 137424-001 |
| 8D | Type-74F163 Integrated Circuit* | 137345-001 |
| 8E | Type-74LS163A Integrated Circuit | 37-74LS163A |
| 8F | Type-74LS74 Integrated Circuit | 37-74LS74 |
| 8H | Type-74S162 Integrated Circuit | 137342-001 |
| 8J | Type-74S194 Integrated Circuit | 137424-001 |
| 8L | Type-74LS20 Integrated Circuit | 37-74LS20 |
| 8M | Type-74S244 Integrated Circuit | 137333-001 |
| 8N | Type-2149, 35 ns Static RAM Integrated Circuit | 137199-003 |
| 8P | Type-2149, 35 ns Static RAM Integrated Circuit | 137199-003 |
| 8R | Type-74F163 Integrated Circuit* | 137345-001 |
| 8S | Type-74F163 Integrated Circuit* | 137345-001 |
| 8T | Type-74F163 Integrated Circuit* | 137345-001 |
| 9A | Type-74S189 Integrated Circuit | 37-74S189 |
| 9B | Type-74S158 Integrated Circuit | 137312-001 |
| 9B/C | Type-74S189 Integrated Circuit | 37-74S189 |
| 9C/D | Type-74S189 Integrated Circuit | 37-74S189 |
| 9D | Type-74S189 Integrated Circuit | 37-74S189 |
| 9E | Type-74S189 Integrated Circuit | 37-74S189 |
| 9F | Type-74LS04 Integrated Circuit | 37-74LS04 |
| 9H | Type-74S153 Integrated Circuit | 137207-001 |
| 9J | Type-74LS244 Integrated Circuit | 37-74LS244 |
| 9K | Type-74F374 Integrated Circuit† | 137420-001 |
| 9L | Type-74F374 Integrated Circuit† | 137420-001 |
| 9M | Type-74S244 Integrated Circuit | 137333-001 |
| 9N | Type-2149, 35 ns Static RAM Integrated Circuit | 137199-003 |
| 9P | Type-2149, 35 ns Static RAM Integrated Circuit | 137199-003 |
| 9R | Type-74F163 Integrated Circuit* | 137345-001 |
| 9S | Type-74F163 Integrated Circuit* | 137345-001 |
| 9T | Type-74F163 Integrated Circuit* | 137345-001 |
| 10A | Type-74S158 Integrated Circuit | 137312-001 |
| 10B | Type-74F374 Integrated Circuit† | 137420-001 |
| 10B/C | Type-74S00 Integrated Circuit | 37-74S00 |
| 10C/D | Type-74S283 Integrated Circuit | 137241-001 |
| 10D | Type-74S153 Integrated Circuit | 137207-001 |
| 10E | Type-74S153 Integrated Circuit | 137207-001 |
| 10F | Type-74LS244 Integrated Circuit | 37-74LS244 |
| 10H | Type-74LS244 Integrated Circuit | 37-74LS244 |
| 10J | Type-74F374 Integrated Circuit† | 137420-001 |
| 10K | Type-74F374 Integrated Circuit† | 137420-001 |
| 10L | Type-74F374 Integrated Circuit† | 137420-001 |
| 10M | Type-74S244 Integrated Circuit | 137333-001 |
| 10N | Type-2149, 35 ns Static RAM Integrated Circuit | 137199-003 |
| 10P | Type-2149, 35 ns Static RAM Integrated Circuit | 137199-003 |
| 10R | Type-74F163 Integrated Circuit* | 137345-001 |
| 10S | Type-74F163 Integrated Circuit* | 137345-001 |
| 10T | Type-74F163 Integrated Circuit* | 137345-001 |
| 11A | Type-74S189 Integrated Circuit | 37-74S189 |
| 11B | Type-74S158 Integrated Circuit | 137312-001 |
| 11B/C | Type-74S112 Integrated Circuit | 137334-001 |
| 11C/D | Type-74S00 Integrated Circuit | 37-74S00 |
| 11D | Type-74S08 Integrated Circuit | 37-74S08 |
| 11E | Type-74S153 Integrated Circuit | 137207-001 |
| 11F | Type-2149, 45 ns Static RAM Integrated Circuit | 137199-002 |
| 11H | Type-2149, 45 ns Static RAM Integrated Circuit | 137199-002 |
| 11J | Type-2149, 45 ns Static RAM Integrated Circuit | 137199-002 |
| 11K | Type-2149, 45 ns Static RAM Integrated Circuit | 137199-002 |
| 11L | Type-74S32 Integrated Circuit | 37-74S32 |
| 11M | Type-74S20 Integrated Circuit | 137423-001 |
| 11N | Type-74F10 Integrated Circuit | 137428-001 |
| 11P | Type-74S86 Integrated Circuit | 137002-001 |
| 11R | Type-74LS32 Integrated Circuit | 37-74LS32 |
| 11S | Type-74LS08 Integrated Circuit | 37-74LS08 |
| 11T | Type-74LS32 Integrated Circuit | 37-74LS32 |
| 12A | Type-74S74 Integrated Circuit | 37-74S74 |
| 12B | Type-74S10 Integrated Circuit | 137236-001 |
| 12B/C | Type-74S04 Integrated Circuit | 37-74S04 |
| 12C/D | Type-74S74 Integrated Circuit | 37-74S74 |
| 12D | Type-74S20 Integrated Circuit | 137423-001 |
| 12E | Type-74S174 Integrated Circuit | 137209-001 |
| 12F | Type-74LS174 Integrated Circuit | 37-74LS174 |
| 12H | Type-74F374 Integrated Circuit† | 137420-001 |
| 12J | Type-74F374 Integrated Circuit† | 137420-001 |
| 12K | Type-74F374 Integrated Circuit† | 137420-001 |
| 12L | Type-7406 Integrated Circuit | 37-7406 |
| 13A | Type-74LS74 Integrated Circuit | 37-74LS74 |
| 13B | Type-74S112 Integrated Circuit | 137334-001 |
| 13B/C | Type-74LS32 Integrated Circuit | 37-74LS32 |
| 13C/D | Type-74LS260 Integrated Circuit | 137332-001 |
| 13D | Type-7407 Integrated Circuit | 37-7407 |
| 13E | Type-74S174 Integrated Circuit | 137209-001 |
| 13F | Type-74LS08 Integrated Circuit | 37-74LS08 |
| 13H | Type-74F374 Integrated Circuit† | 137420-001 |
| 13J | Type-74LS260 Integrated Circuit | 137332-001 |
| 13K | Type-7406 Integrated Circuit | 37-7406 |
| 13L | Type-7406 Integrated Circuit | 37-7406 |
| | **Sockets** | |
| | 28-Contact, Medium-Insertion-Force IC Socket | 79-42C28 |
| | **Capacitors** | |
| C1, C2 | Capacitor, Aluminum, 100 µF, 35 V | 24-350107 |
| C3, C4 | Capacitor, Ceramic, .1 µF, 50 V | 122002-104 |
| C5 | Capacitor, Aluminum, 100 µF, 35 V | 24-350107 |
| C7 | Capacitor, Electrolytic, 1 µF, 50 V | 24-500105 |
| C8 | Capacitor, Ceramic, .1 µF, 50 V | 122002-104 |
| C9 | Capacitor, Mica, 47 pF, 100 V | 128002-470 |
| C10 | Capacitor, Mica, 68 pF, 100 V | 128002-680 |
| C11–C13 | Capacitor, Ceramic, .1 µF, 50 V | 122002-104 |
| C14 | Capacitor, Ceramic, 100 pF, 100 V | 122016-101 |
| C15 | Capacitor, Ceramic, .1 µF, 50 V | 122002-104 |
| C16 | Capacitor, Ceramic, 100 pF, 100 V | 122016-101 |
| C17 | Capacitor, Ceramic, .1 µF, 50 V | 122002-104 |
| C18 | Capacitor, Ceramic, 100 pF, 100 V | 122016-101 |
| C19–C138 | Capacitor, Ceramic, .1 µF, 50 V | 122002-104 |
| C139–C141 | Capacitor, Ceramic, .001 µF 50 V | 122002-102 |
| C144–C147 | Capacitor, Ceramic, .1 µF, 50 V | 122002-104 |
| | **Connectors** | |
| J13 | Connector, Header, 11-Circuit .156 Ctr., Pol | 179014-011 |
| J19 | Connector, Header, Sq. Pin, 11-Circuit, .100 Ctr. | 179118-011 |
| JP1–JP6 | Connector, Header, 6 Ckt. (2 rows × 3 Ckt.), .100 Ctr. | 179177-006 |
| JP1–JP6 | Connector, Receptacle, 2 Ckt. | 179178-002 |
| | **Ferrite Beads and Inductors** | |
| L1 | Inductor, 1 µH | 141007-001 |
| L2–L4 | Ferrite Bead | 141003-005 |
| L5 | Inductor, 100 µH | 141019-001 |
| | **Transistors** | |
| Q1, Q2 | Type-2N3904 Transistor | 34-2N3904 |
| Q3 | Type-2N3906 Transistor | 33-2N3906 |
| Q4 | Type-2N3904 Transistor | 34-2N3904 |
| Q5 | Type-2N3906 Transistor | 33-2N3906 |
| Q6, Q7 | Type-2N3904 Transistor | 34-2N3904 |
| Q8 | Type-2N3906 Transistor | 33-2N3906 |
| Q9, Q10 | Type-2N3904 Transistor | 34-2N3904 |
| Q11 | Type-2N3906 Transistor | 33-2N3906 |
| Q12 | Type-2N3904 Transistor | 34-2N3904 |
| | **Resistors** | |
| R1 | 150 Ω, ±5%, ¼ W Resistor | 110000-151 |
| R2 | 10K Ω, ±5%, ¼ W Resistor | 110000-103 |
| R4 | 68 Ω, ±5%, ¼ W Resistor | 110000-680 |
| R17, R18 | 220 Ω, ±5%, ¼ W Resistor | 110000-221 |
| R19 | 1K Ω, ±5%, ¼ W Resistor | 110000-102 |
| R20 | 120 Ω, ±5%, ¼ W Resistor | 110000-121 |
| R21, R22 | 180 Ω, ±5%, ¼ W Resistor | 110000-181 |
| R23 | 220 Ω, ±5%, ¼ W Resistor | 110000-221 |
| R24 | 470 Ω, ±5%, ¼ W Resistor | 110000-471 |
| R25 | 1K Ω, ±5%, ¼ W Resistor | 110000-102 |
| R26 | 2K Ω, ±5%, ¼ W Resistor | 110000-202 |
| R27 | 150 Ω, ±5%, ¼ W Resistor | 110000-151 |
| R28 | 3.9K Ω, ±5%, ¼ W Resistor | 110000-392 |
| R29 | 390 Ω, ±5%, ¼ W Resistor | 110000-391 |
| R30 | 68 Ω, ±5%, ¼ W Resistor | 110000-680 |
| R31 | 470 Ω, ±5%, ¼ W Resistor | 110000-471 |

*"x" in the part number denotes the revision level*
**Acceptable substitute is Type-74AS163N Integrated Circuit, part no. 137421-001*
*†Acceptable substitute is Type-74AS374N Integrated Circuit, part no. 137422-001*



720° Illustrated Parts Lists

720° Video PCB Assembly
Parts List, Continued

*"x" in the part number denotes the revision level*
**Acceptable substitute is Type-74AS163N Integrated Circuit, part no. 137421-001*
*†Acceptable substitute is Type-74AS374N Integrated Circuit, part no. 137422-001*

## 720° Video PCB Assembly
## Parts List, Continued

| Desig-nator | Description | Part No. |
|---|---|---|
| R32 | 68 Ω, ±5%, ¼ W Resistor | 110000-680 |
| R33 | 10 Ω, ±5%, ¼ W Resistor | 110000-100 |
| R34 | 620 Ω, ±5%, ¼ W Resistor | 110000-621 |
| R35 | 1.2K Ω, ±5%, ¼ W Resistor | 110000-122 |
| R36 | 2.4K Ω, ±5%, ¼ W Resistor | 110000-242 |
| R37 | 5.1K Ω, ±5%, ¼ W Resistor | 110000-512 |
| R38 | 820 Ω, ±5%, ¼ W Resistor | 110000-821 |
| R39 | 10K Ω, ±5%, ¼ W Resistor | 110000-103 |
| R40, R41 | 160 Ω, ±5%, ¼ W Resistor | 110000-161 |
| R42 | 390 Ω, ±5%, ¼ W Resistor | 110000-391 |
| R43 | 68 Ω, ±5%, ¼ W Resistor | 110000-680 |
| R44 | 470 Ω, ±5%, ¼ W Resistor | 110000-471 |
| R45 | 68 Ω, ±5%, ¼ W Resistor | 110000-680 |
| R46 | 10 Ω, ±5%, ¼ W Resistor | 110000-100 |
| R47 | 620 Ω, ±5%, ¼ W Resistor | 110000-621 |
| R48 | 1.2K Ω, ±5%, ¼ W Resistor | 110000-122 |
| R49 | 2.4K Ω, ±5%, ¼ W Resistor | 110000-242 |
| R50 | 5.1K Ω, ±5%, ¼ W Resistor | 110000-512 |
| R51 | 820 Ω, ±5%, ¼ W Resistor | 110000-821 |
| R52 | 10K Ω, ±5%, ¼ W Resistor | 110000-103 |
| R53 | 160 Ω, ±5%, ¼ W Resistor | 110000-161 |
| R54 | 390 Ω, ±5%, ¼ W Resistor | 110000-391 |
| R55 | 68 Ω, ±5%, ¼ W Resistor | 110000-680 |
| R56 | 470 Ω, ±5%, ¼ W Resistor | 110000-471 |
| R57 | 68 Ω, ±5%, ¼ W Resistor | 110000-680 |
| R58 | 10 Ω, ±5%, ¼ W Resistor | 110000-100 |
| R59 | 620 Ω, ±5%, ¼ W Resistor | 110000-621 |
| R60 | 1.2K Ω, ±5%, ¼ W Resistor | 110000-122 |
| R61 | 2.4K Ω, ±5%, ¼ W Resistor | 110000-242 |
| R62 | 5.1K Ω, ±5%, ¼ W Resistor | 110000-512 |
| R63 | 820 Ω, ±5%, ¼ W Resistor | 110000-821 |
| R64 | 10K Ω, ±5%, ¼ W Resistor | 110000-103 |
| R65–R75 | K Ω, ±5%, ¼ W Resistor | 110000-102 |
| R78 | 220 Ω, ±5%, ¼ W Resistor | 11000-221 |
| R79–R81 | 470 Ω, ±5%, ¼ W Resistor | 110000-471 |
| RN1, RN2 | Resistor Network, SIP, 680 Ω × 7 | 118007-681 |
| | **Miscellaneous** | |
| C142 | Filter, Feed-Thru, 2000pF, 15A | 140002-001 |
| CR1 | Diode, Light-Emitting, Type-MV5053 | 38-MV5053 |
| TAB | Terminal, Fast-On (Acceptable substitute is Test Point, part no. 020670-001) | 179051-002 |
| Y1 | Crystal, 32 MHz | 144003-002 |
| | Terminal, Ring Lug, #8, Solder Tab | 179005-002 |

*"x" in the part number denotes the revision level*
**Acceptable substitute is Type-74AS163N Integrated Circuit, part no. 137421-001*
*†Acceptable substitute is Type-74AS374N Integrated Circuit, part no. 137422-001*





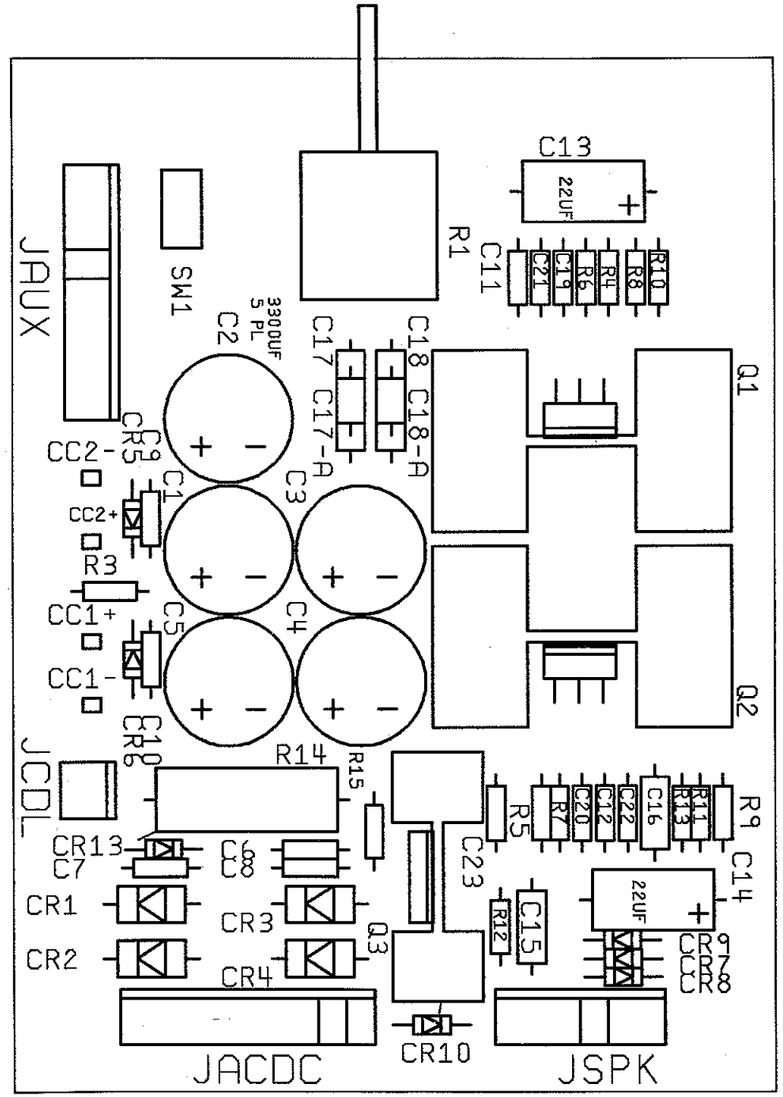


**Figure 6-10 Audio II PCB Assembly**
**A043661-01 B**

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## Audio II PCB Assembly
## Parts List

| Designator | Description | Part No. |
|---|---|---|
| | **Capacitors** | |
| C1–C5 | 3300 μF, 25 V Radial Electrolytic Capacitor | 123003-338 |
| C6–C12 | .1 μF, 50 V Ceramic Capacitor | 122002-104 |
| C13–C14 | 22 μF, 35 V Electrolytic Capacitor | 24-350226 |
| C15–C18 | .22 μF, 25 V Ceramic Capacitor | 122006-224 |
| C19–C20 | .001 μF, 50 V Ceramic Capacitor | 122002-102 |
| C21–C23 | .1 μF, 50 V Ceramic Capacitor | 122002-104 |
| | **Diodes** | |
| CR1–CR4 | Type-1N5401 Diode | 31-1N5401 |
| CR5–CR10 | Type-1N4001 Diode | 31-1N4001 |
| CR13 | Type-1N4002 Diode | 31-1N4002 |
| | **Connectors** | |
| JACDC | Key 2, 9 Ckt., .156-Inch Ctr. Header Connector | 179213-009 |
| JAUX | Key 6, 9 Ckt., .156-Inch Ctr. Header Connector | 179213-009 |
| JCDL | 2 Ckt., .156-Inch Ctr. Header Connector | 179213-002 |
| JSPK | Key 3, 6 Ckt., .156-Inch Ctr. Header Connector | 179213-006 |
| | **Integrated Circuits** | |
| Q1–Q2 | Type-TDA-2030 Amplifier | 137301-001 |
| Q3 | Standup Type-7815 Integrated Circuit | 37-7815 |
| | **Resistors** | |
| R1 | 10 kΩ, Dual Horizontal Pot Resistor | 119011-103 |
| R3 | 10 Ω, ±5%, ¼ W Resistor | 110000-100 |
| R4–R7 | 22 kΩ, ±5%, ¼ W Resistor | 110000-223 |
| R8–R9 | 10 kΩ, ±5%, ¼ W Resistor | 110000-103 |
| R10–R11 | 1 kΩ, ±5%, ¼ W Resistor | 110000-102 |
| R12–R13 | 1 Ω, ±5%, ¼ W Resistor | 110000-010 |
| R14 | 0 Ω, ±5%, ¼ W Resistor | 110005-001 |
| | **Miscellaneous** | |
| SW1 | SPDT Miniature Slide Self-Test Switch | 69-004 |
| TP28–TP29 | #6-32 × 3/8-Inch Cross-Recessed Pan-Head Screw | 72-1606S |
| TP28–TP29 | #6-32 Nut/Washer Assembly | 75-99516 |
| TP28–TP29 | Thermal Compound | 78-16001 |
| TP28–TP29 | Type-TDA-230 Heat Sink | 178190-032 |
| TP101 | #4-40 × 3/8-Inch Cross-Recessed Pan-Head Screw | 72-1406S |
| TP101 | #4-40 Nut/Washer Assembly | 75-99514 |
| TP101 | Thermal Compound | 78-16001 |
| TP101 | Type-7815 Heat Sink | 178190-124 |
| | Hot Melt Adhesive | 106006-001 |
| | Test Point | 179051-001 |



# 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 video displays and laser video disc players (in games supplied with displays and video-disc players) 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.

If the products described in this manual fail to conform to this warranty, Seller's sole liability shall be, at its option, to repair, replace, or credit Buyer's account for such products which are returned to Seller during said warranty period, provided:

(a) Seller is promptly notified in writing upon discovery by Buyer that said products are defective;

(b) Such products are returned prepaid to Seller's 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.

*Except for any express warranty set forth in a written contract between Seller and Buyer which contract supersedes the terms herein, this warranty is expressed in lieu of all other warranties expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose, and of all other obligations or liabilities on the Seller's part, and it neither assumes nor authorizes any other person to assume for the Seller any other liabilities in connection with the sale of products by Seller.*

The use of any non-Atari parts may void your warranty, according to the terms of the warranty. The use of any non-Atari parts may also adversely affect the safety of your game and cause injury to you and others. Be very cautious in using non-Atari-supplied components with our games, in order to ensure your safety.

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