TM-294
1st printing

THE ULTIMATE AERIAL EXPERIENCE

Operators
Manual
with
Illustrated
Parts Lists

Atari Games Corporation
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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:

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- 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.

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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.

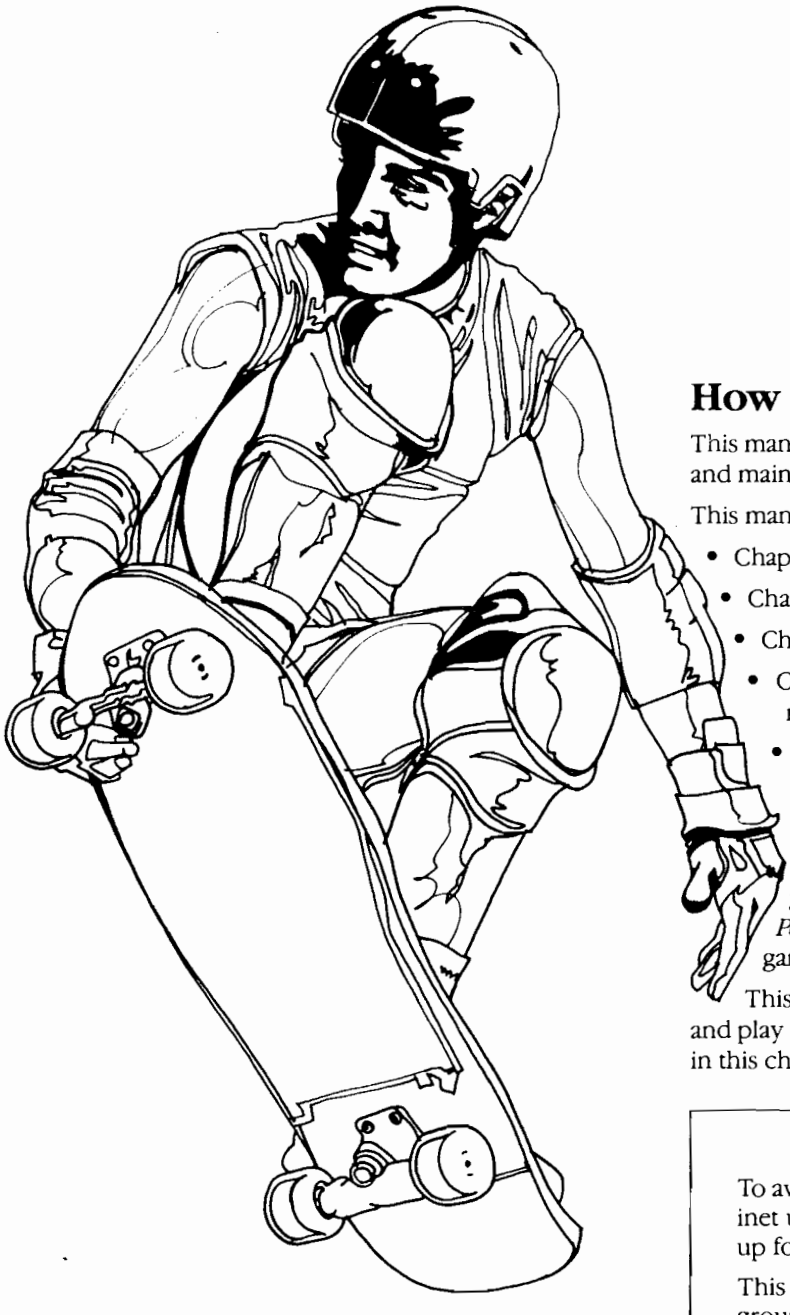
ABOUT NOTES, CAUTIONS, AND WARNINGS

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 mounted securely and that the green ground wires are connected.

Table 1-1 Game Specifications

Characteristic	Specification
Power Consumption	300 V-A, 239 W RMS
Temperature	+5° to +38° C (+37° to +100° F)
Humidity	Not to exceed 95% relative
Line Voltage	105 to 130 VAC (U.S. Games) 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)

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.

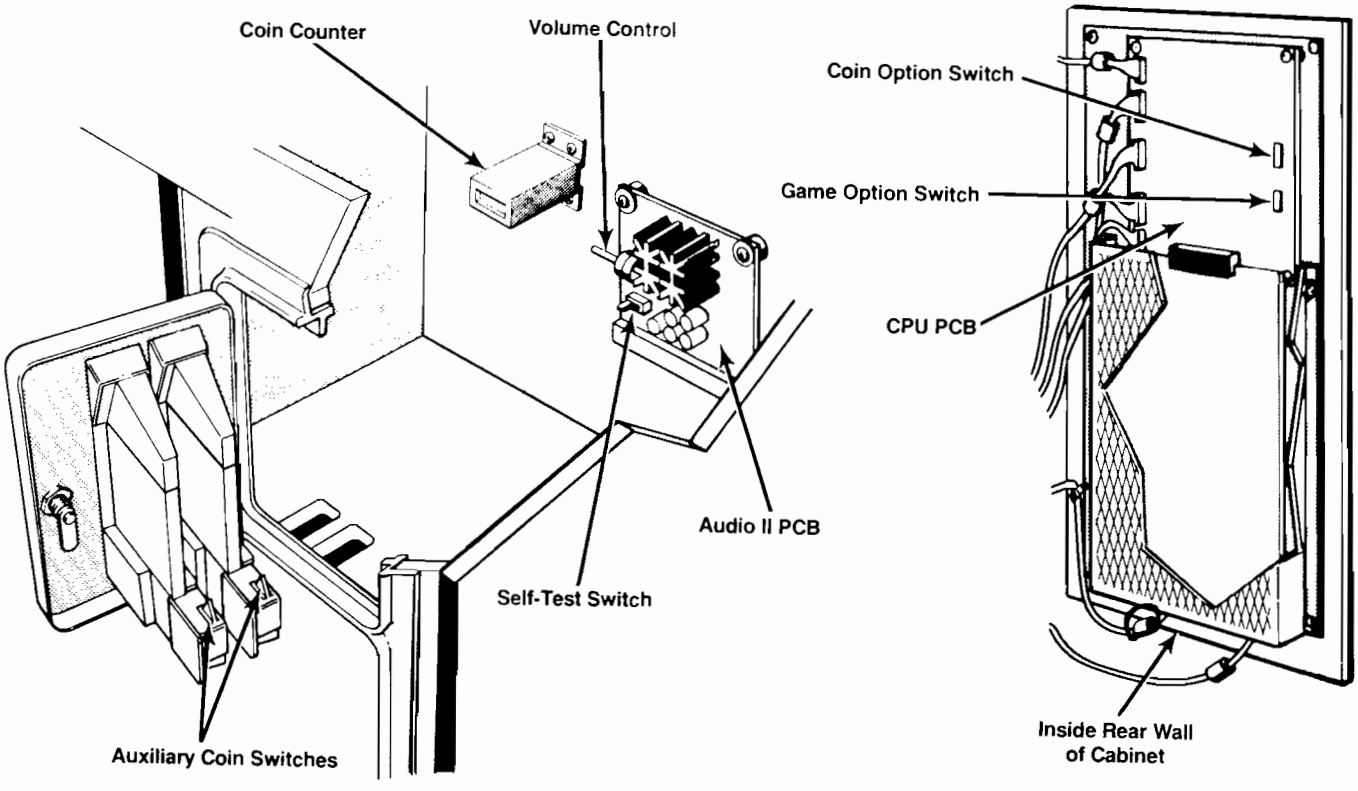


Figure 1-1 Control and Switch Locations

Table 1-2 Coin and Credit Option Settings

Settings of 8-Toggle Switch on 720° CPU PCB (at 6/7A)								Option
1	2	3	4	5	6	7	8	
								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)								Option
1	2	3	4	5	6	7	8	
								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).

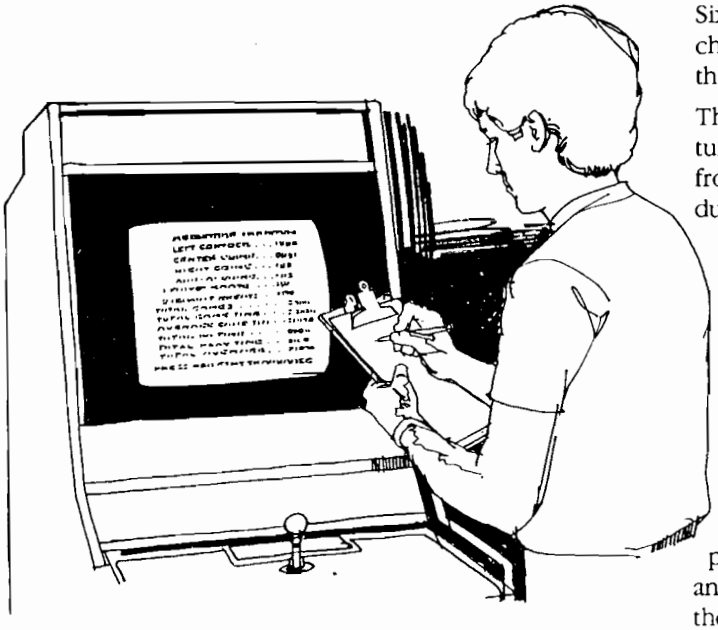
The histogram data in 720° will show a small percentage of players who can play the game for over 5:00. Atari Games research has shown that this is a positive factor in the long-term appeal of a game, as long as the number of longer games represents only a small percentage of the total.

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.

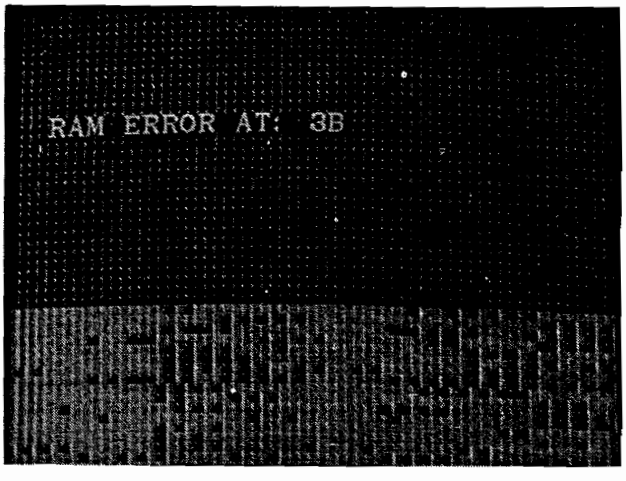


Figure 3-1 RAM Test Fails

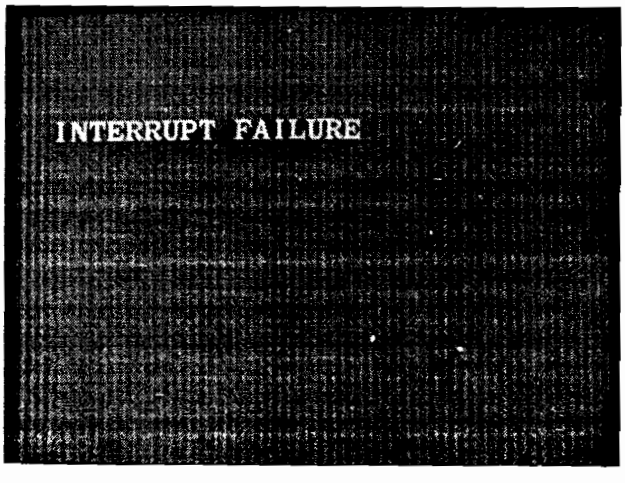


Figure 3-2 Interrupt Test Fails

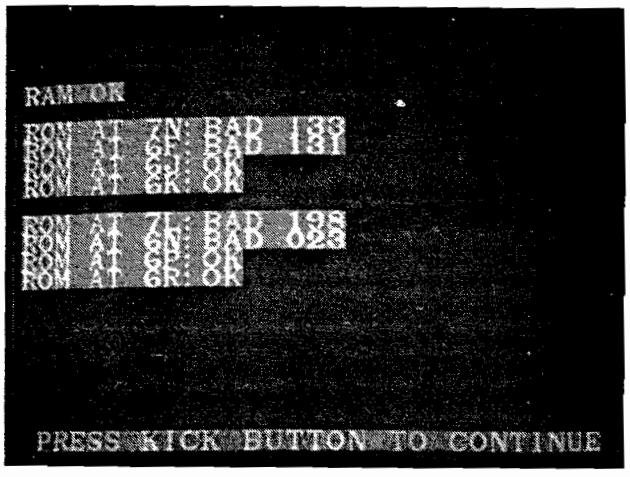


Figure 3-3 ROM Test Fails

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 cir-

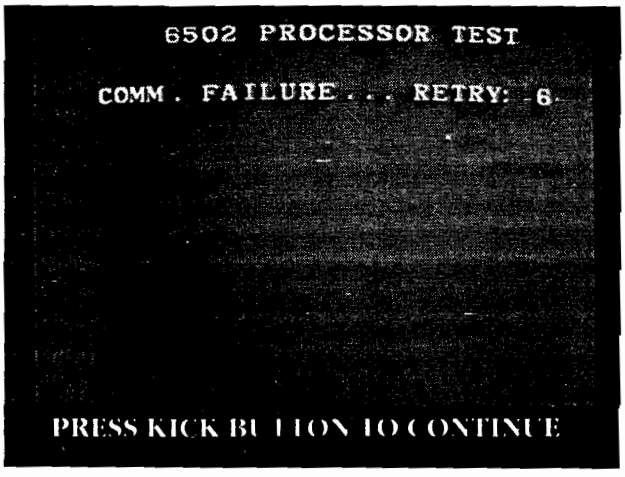


Figure 3-4 Reset Retry

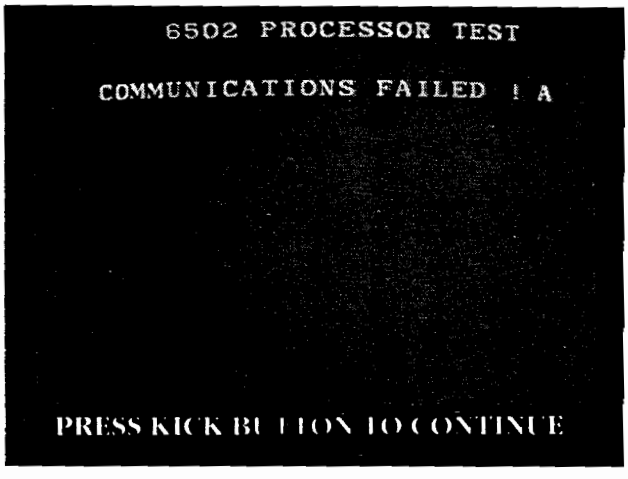


Figure 3-5 Communications Fails

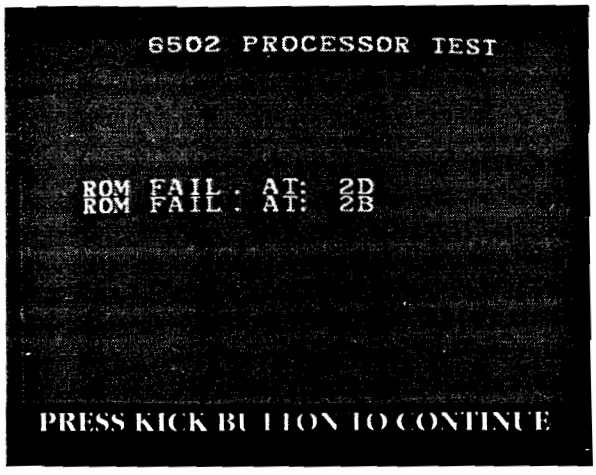


Figure 3-6 Music/RAM/ROM Fails

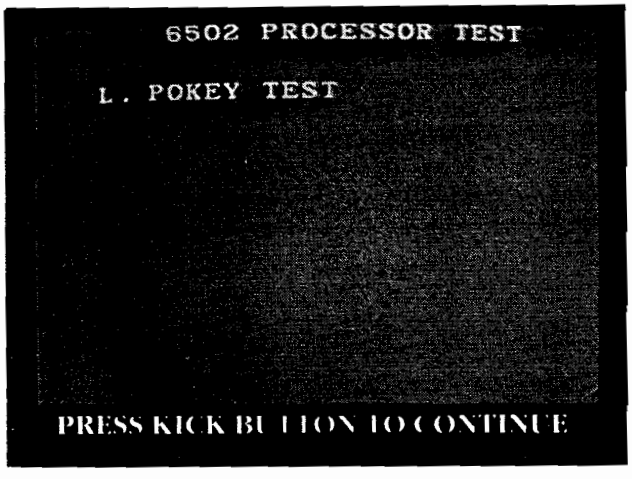


Figure 3-7 Sound Output

cuitry is checked. If one or more of these circuits fails, an error message is displayed as shown in Figure 3-6.

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.

- *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.

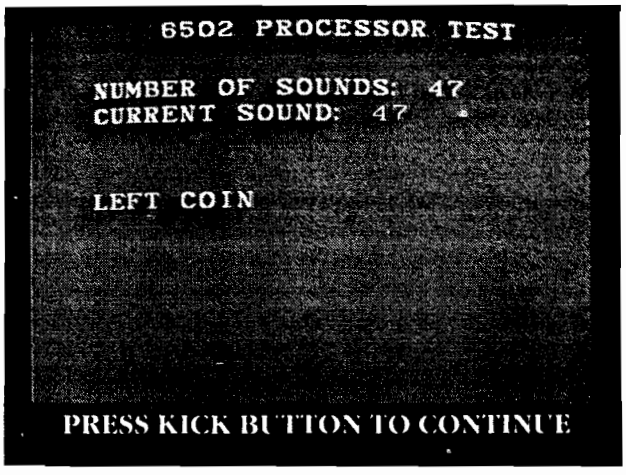


Figure 3-8 Sound Status

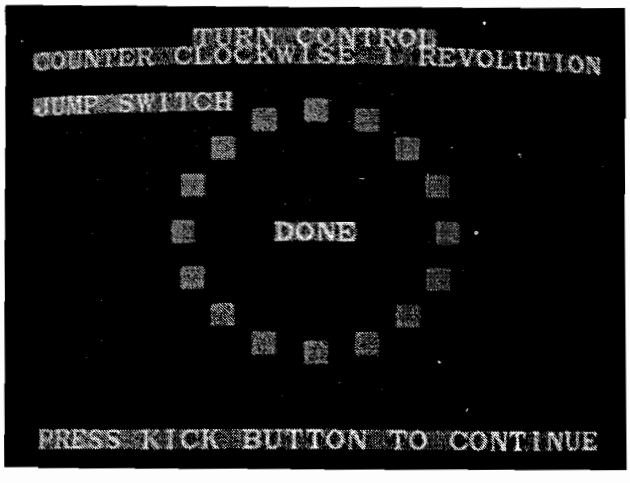


Figure 3-9 Control Test Passes

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.

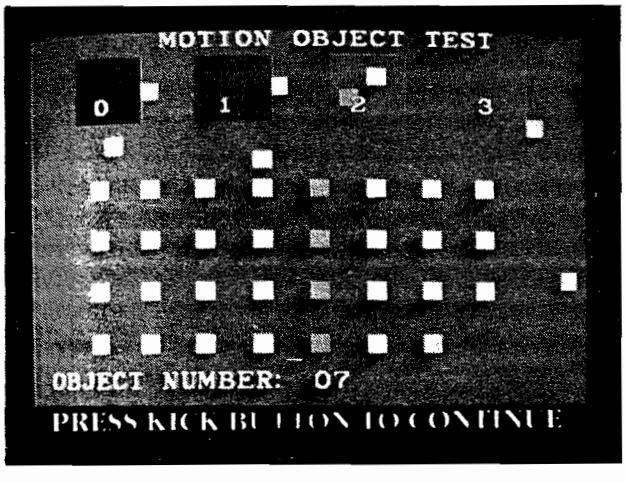


Figure 3-10 Motion Object Test

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.

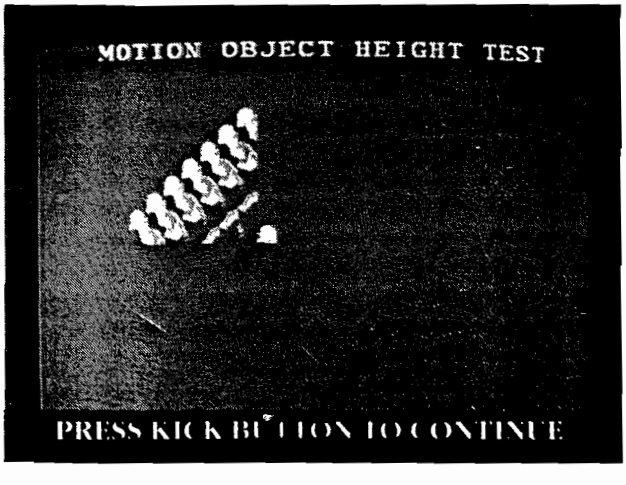


Figure 3-11 Motion Object Height Test

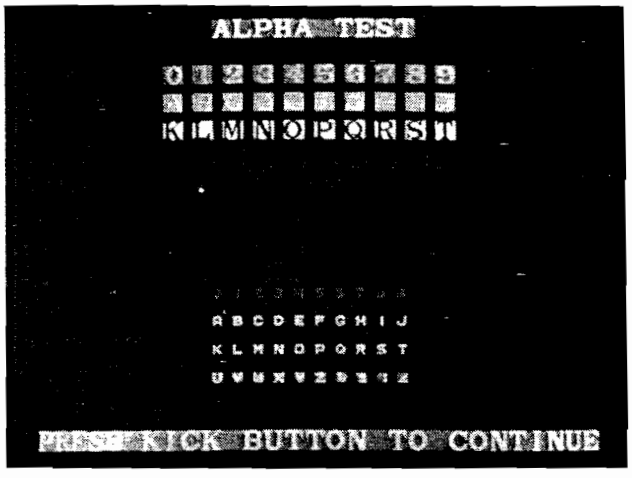


Figure 3-12 Alphanumeric Test

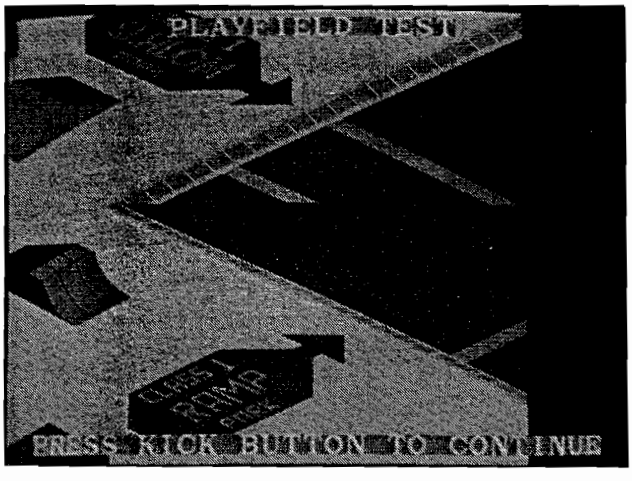


Figure 3-13 Scrolling Playfield Test

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).

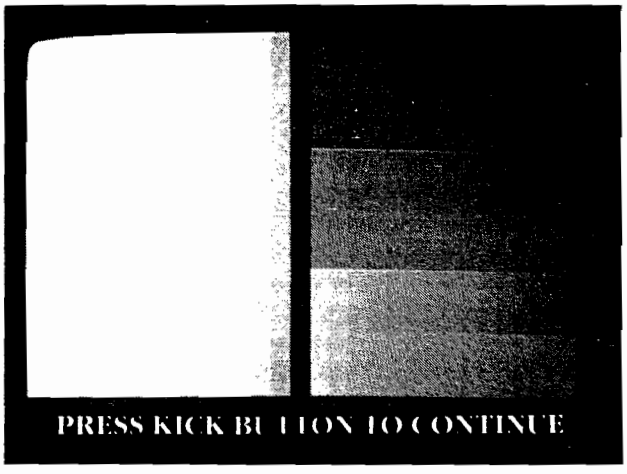


Figure 3-14 Color Bar Test

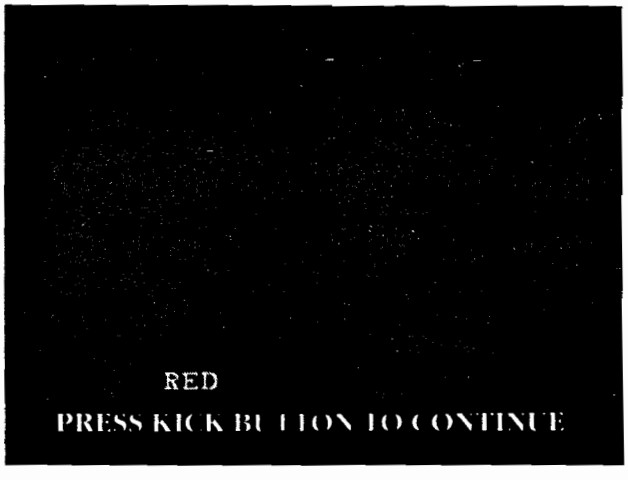


Figure 3-15 Color Purity Test

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.

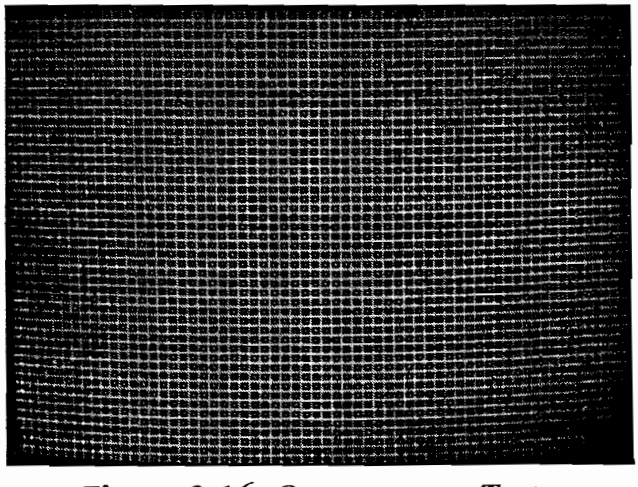


Figure 3-16 Convergence Test

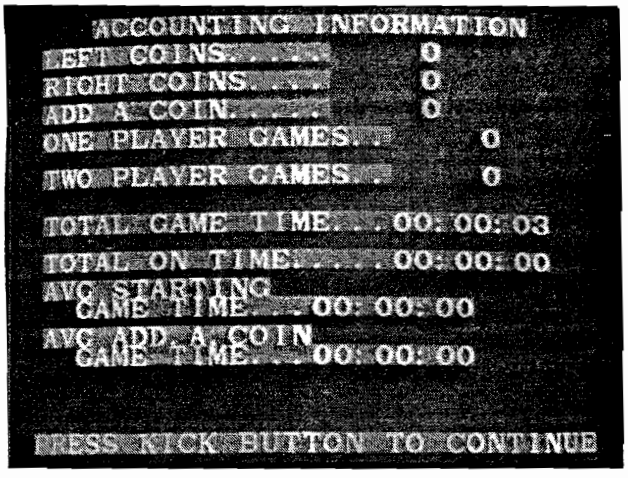


Figure 3-17 Accounting Information

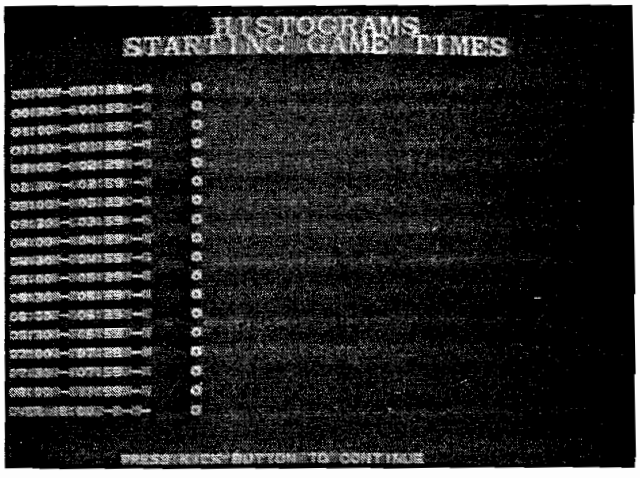


Figure 3-18 Starting Game Time Histogram

- *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.

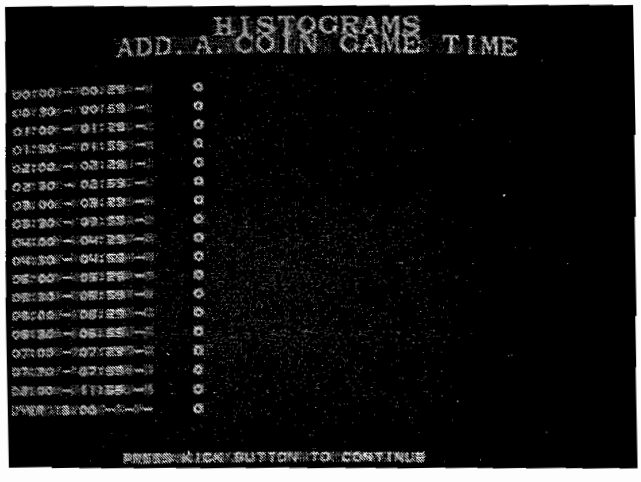


Figure 3-19 Add-A-Coin Game Time Histogram

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:

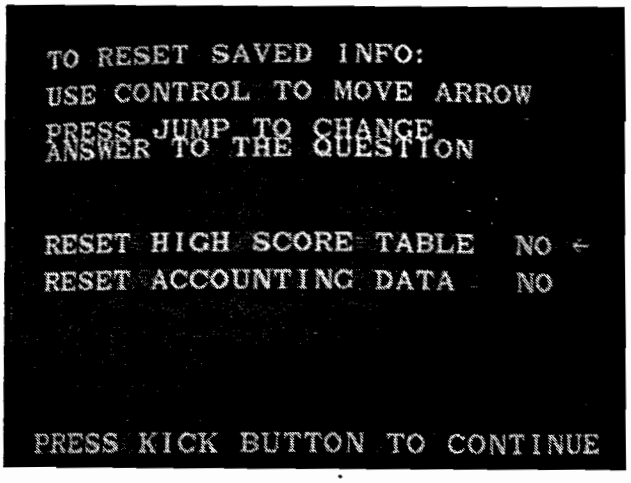


Figure 3-20 Reset Saved Information Screen

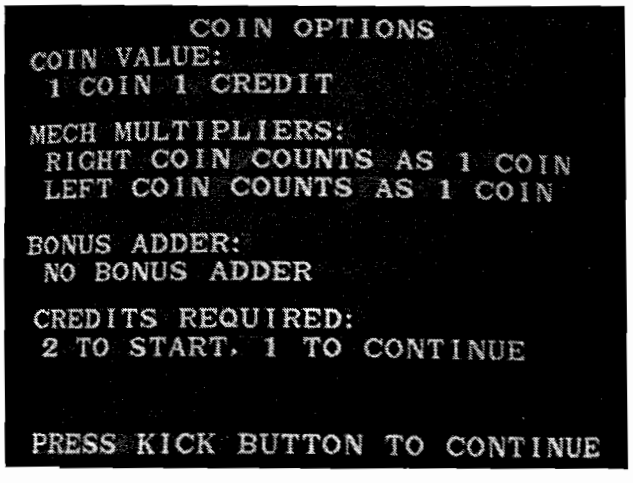


Figure 3-21 Coin Option Settings

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.

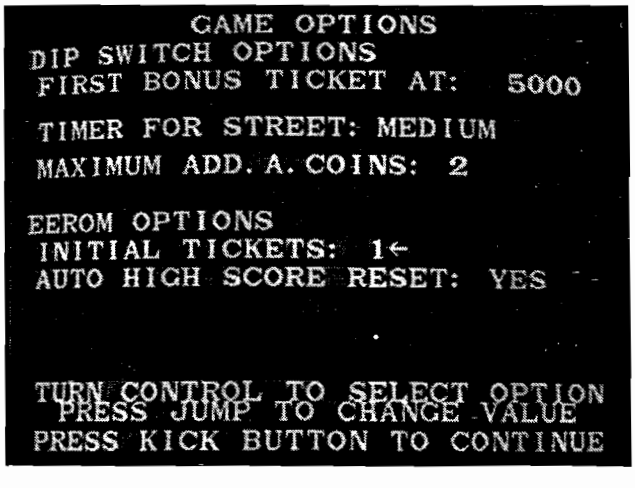


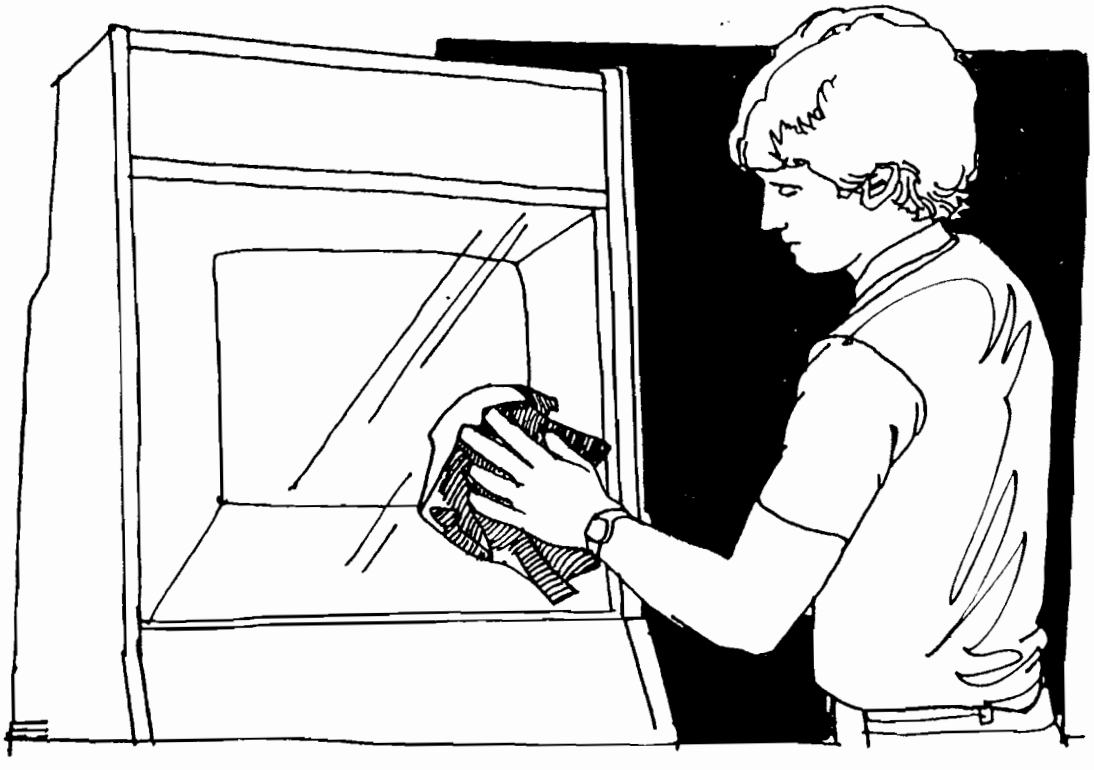
Figure 3-22 Game Option Settings

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.

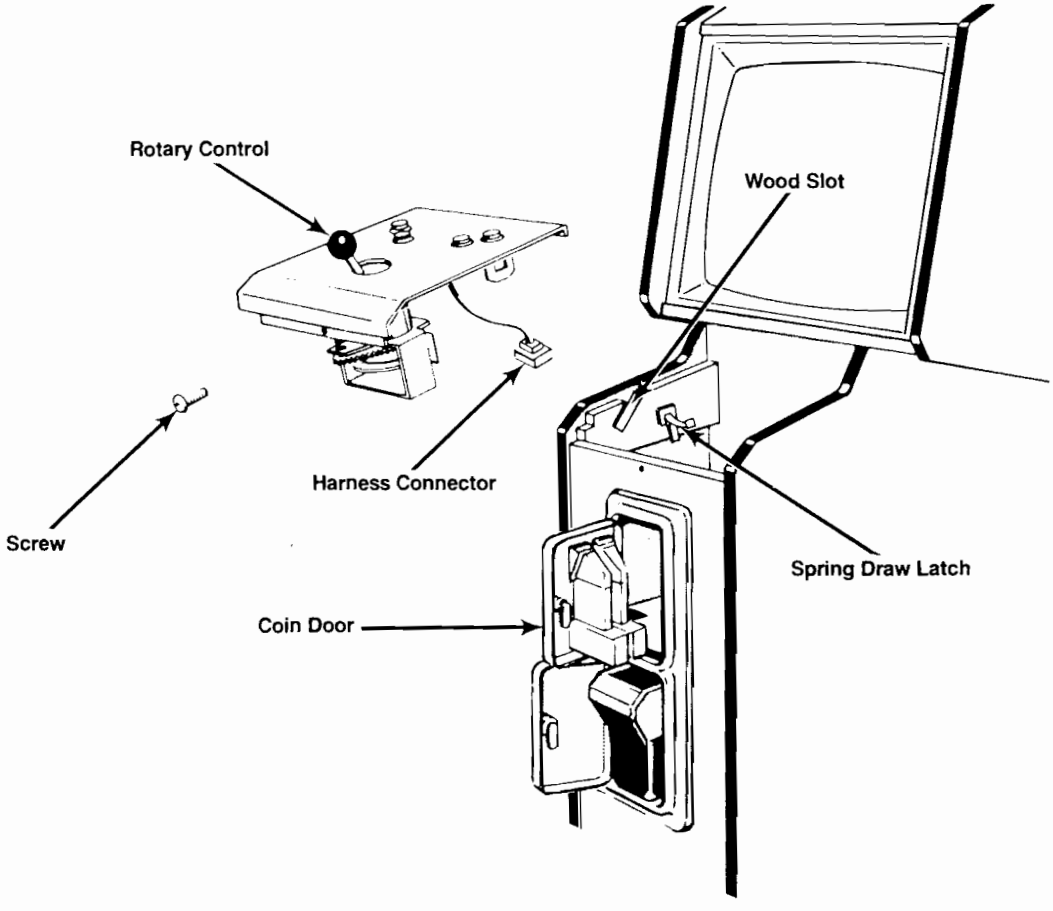


Figure 4-1 Control Panel Removal

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-

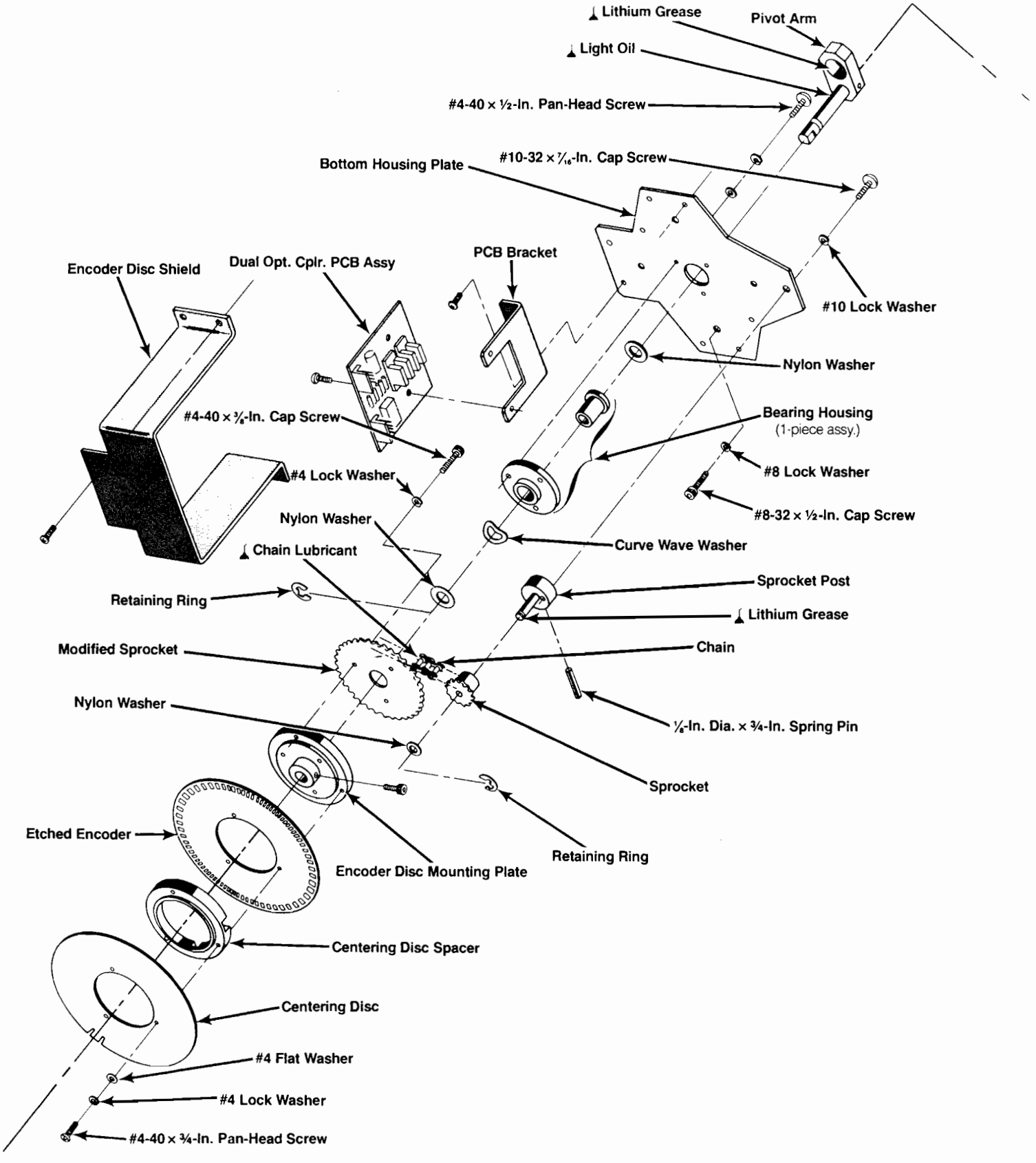


Figure 4-2 Maintaining the Rotary Control

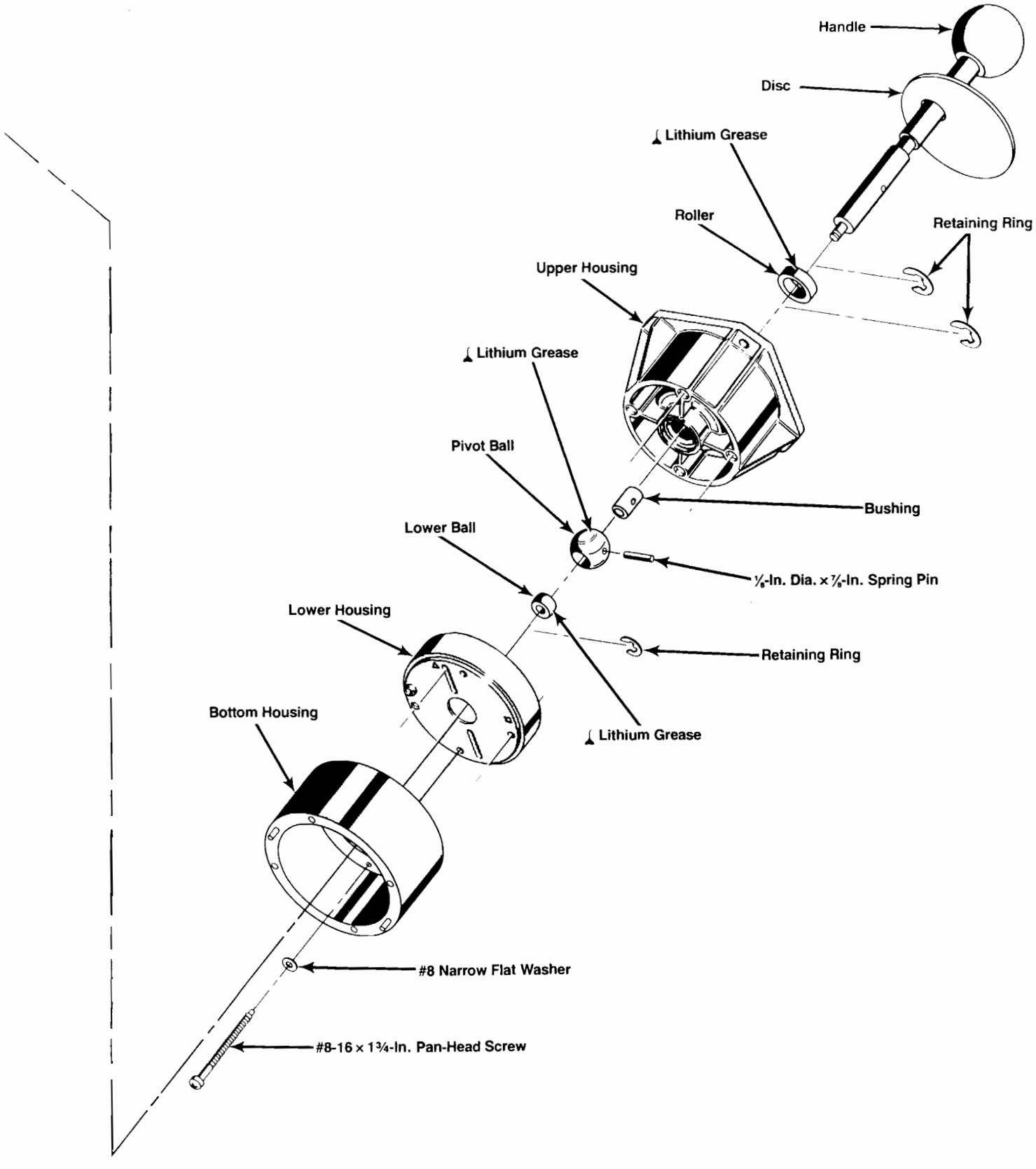


Figure 4-2 Maintaining the Rotary Control, Continued

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.

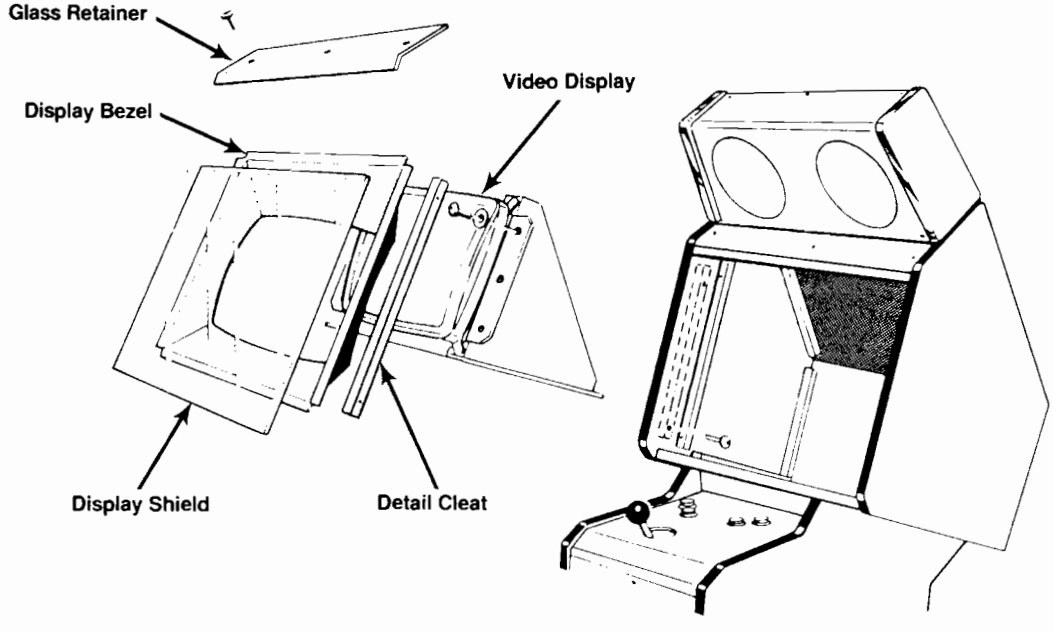


Figure 4-3 Video Display Removal

⚠ 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.

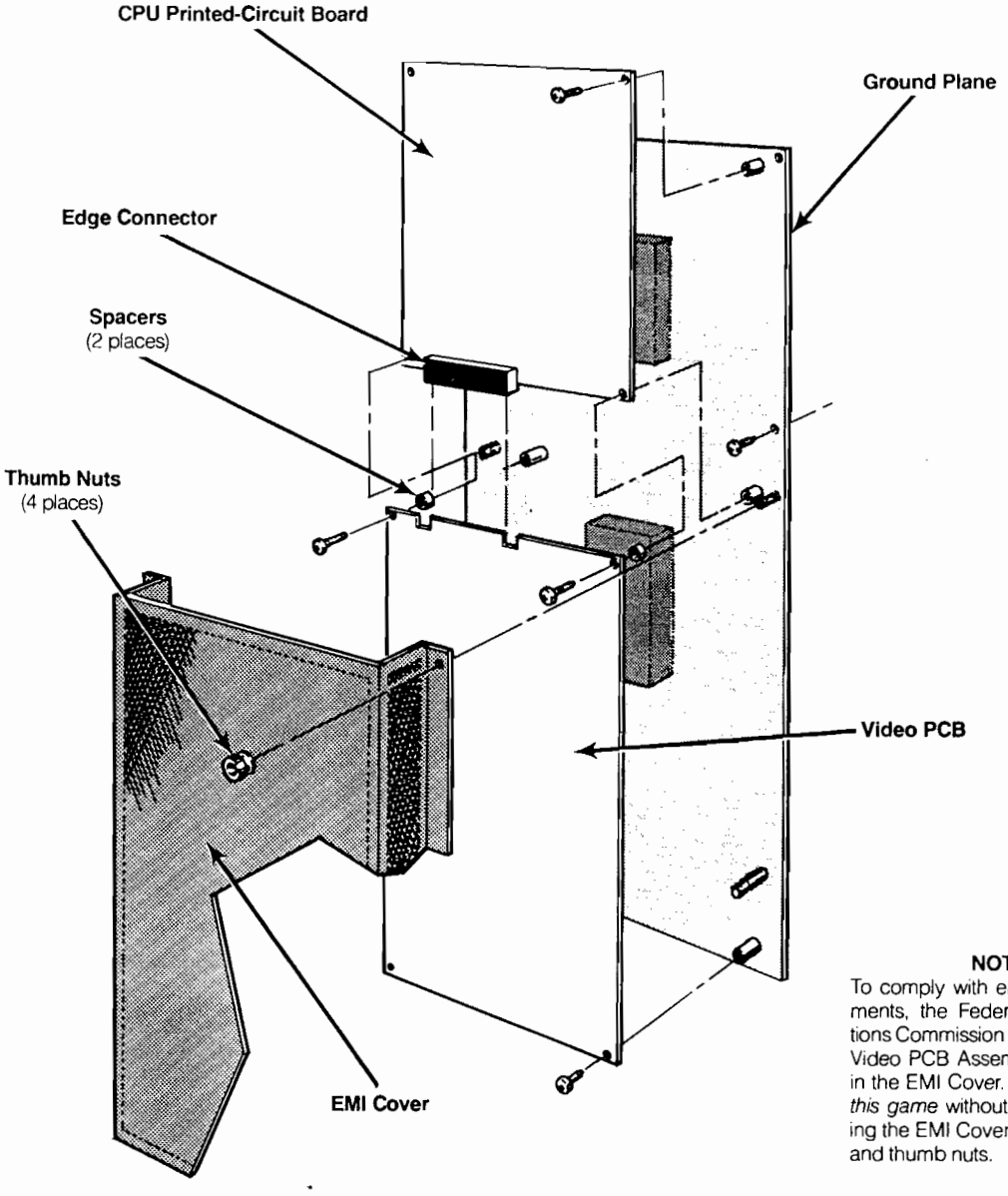
CPU PCB

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.



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 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.

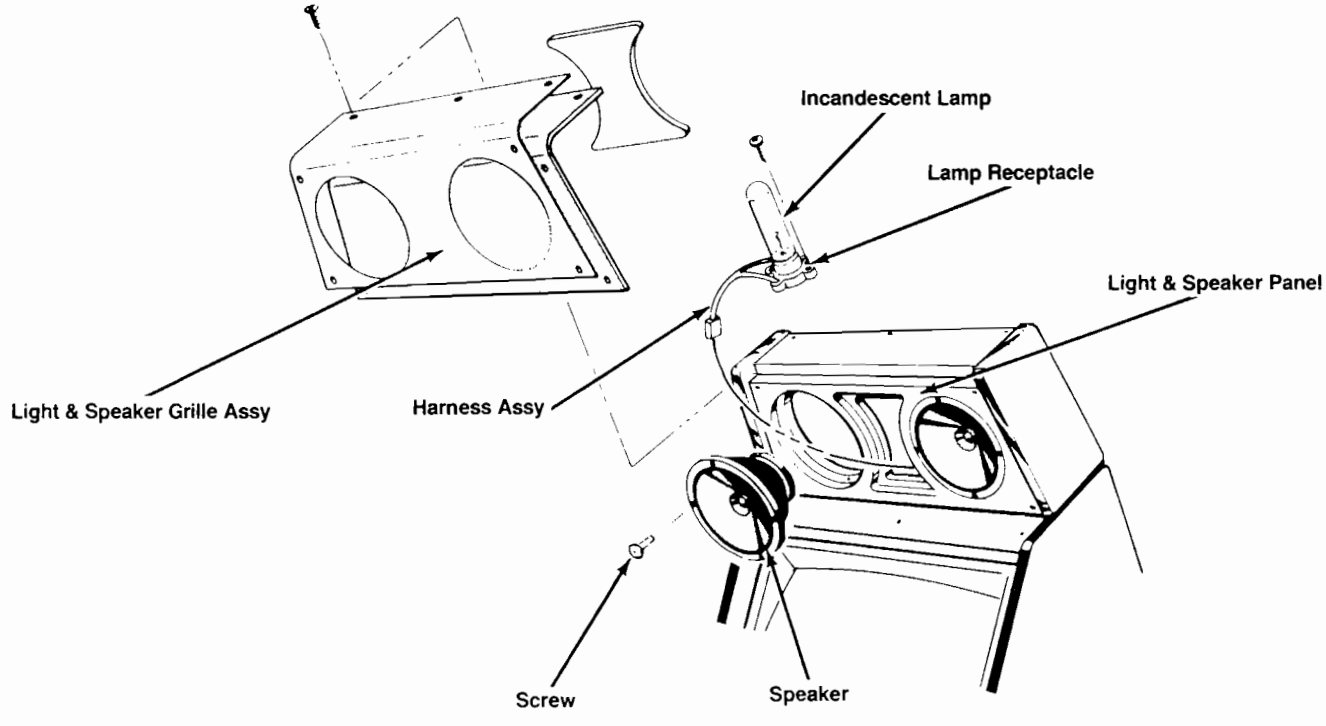


Figure 4-5 Light and Speaker Removal

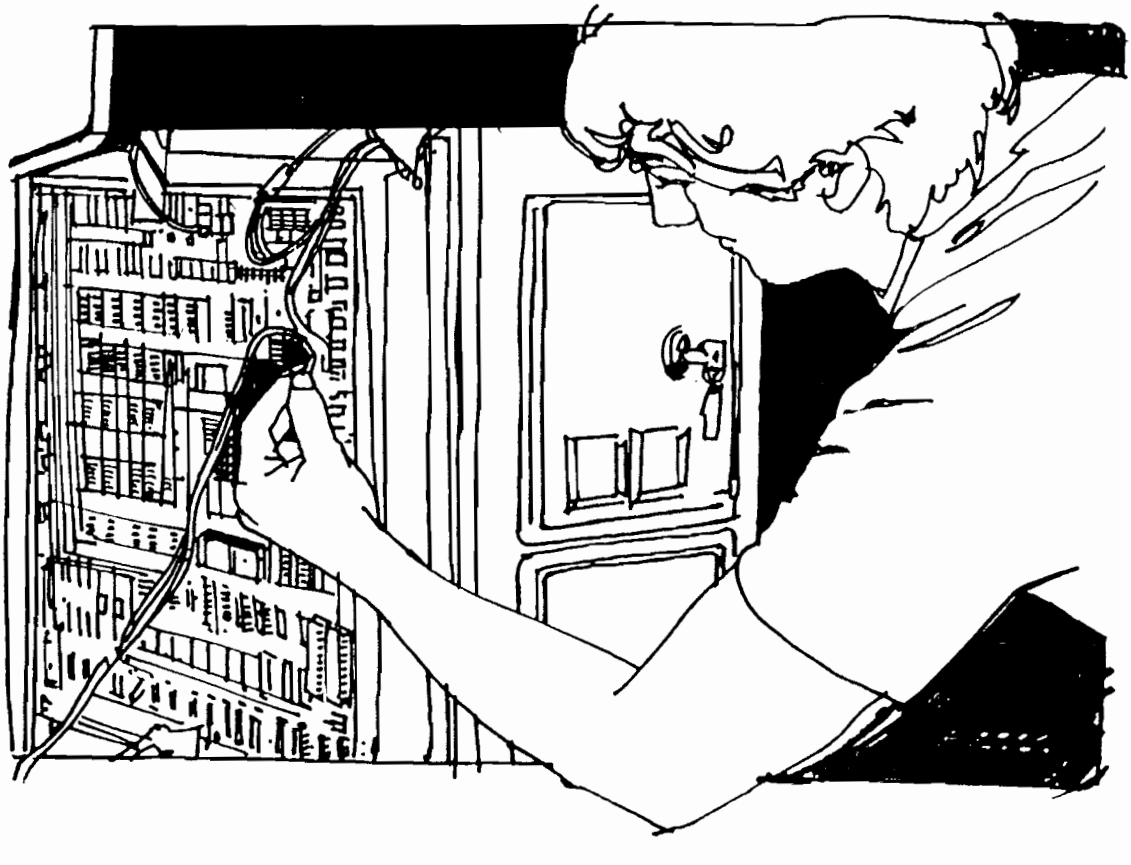
Chapter 5

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

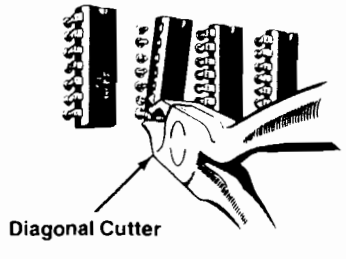


Figure 5-1 Removing IC (Cut-Pin Method)

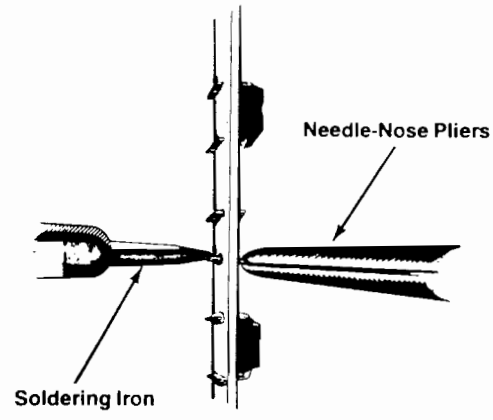


Figure 5-2 Removing IC Pins

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-

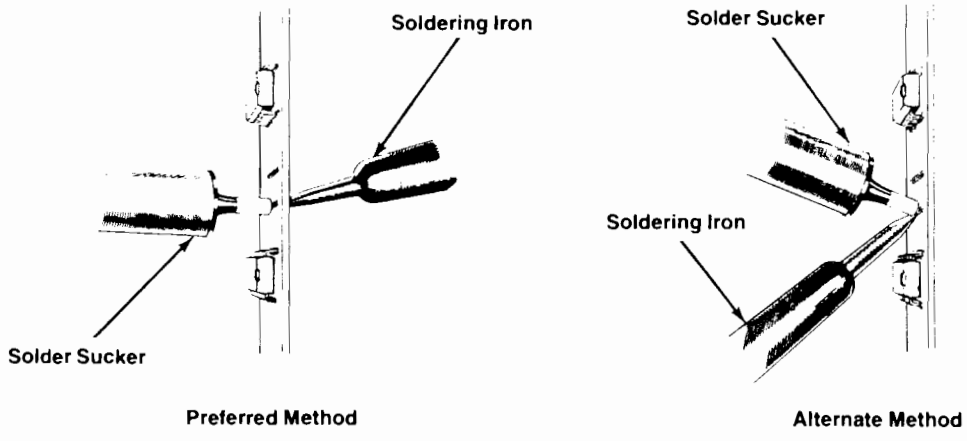


Figure 5-3 Removing Solder from Plated-Through Holes

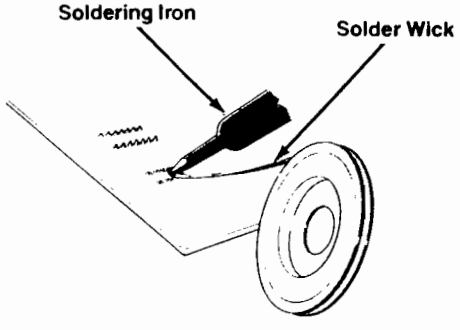


Figure 5-4 Removing Solder from Lead Connection Pads

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

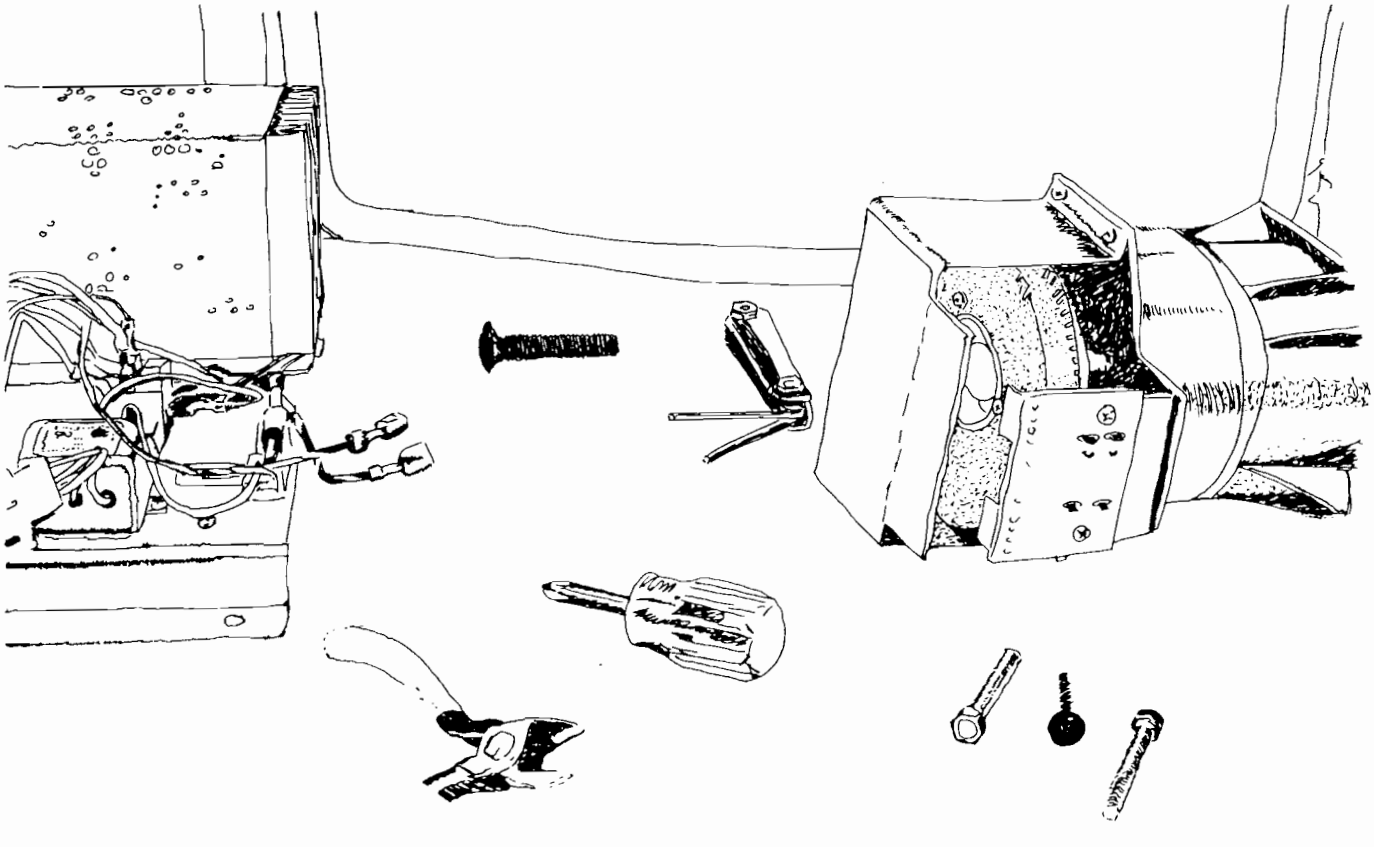
This chapter provides information you need to order parts for your game. Common hardware (screws, nuts, washers, etc.) has been deleted from most of the parts lists.

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

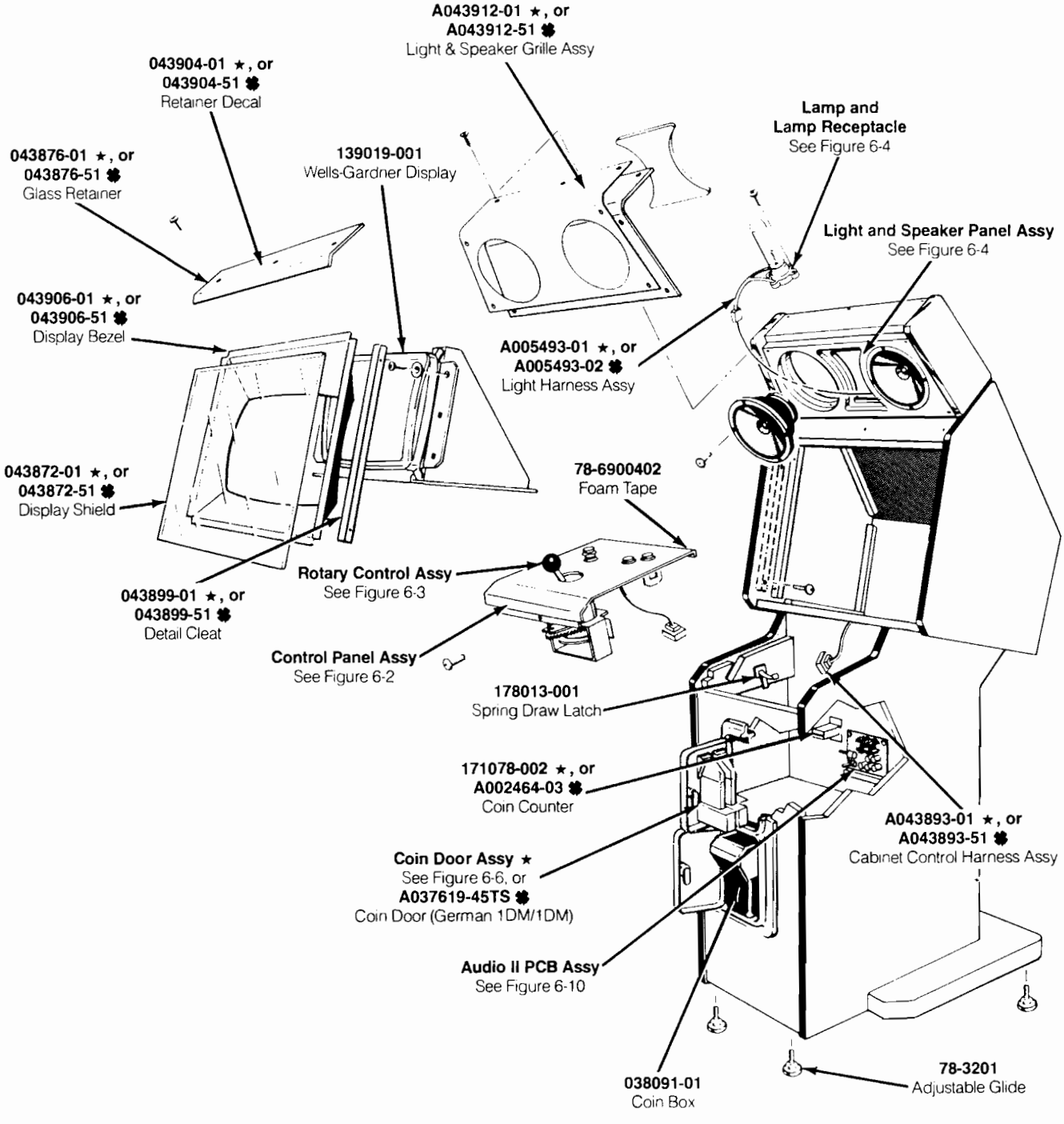


Figure 6-1 Cabinet-Mounted Assemblies
A043870-01 B (US)
and A043870-51 B (Ireland)

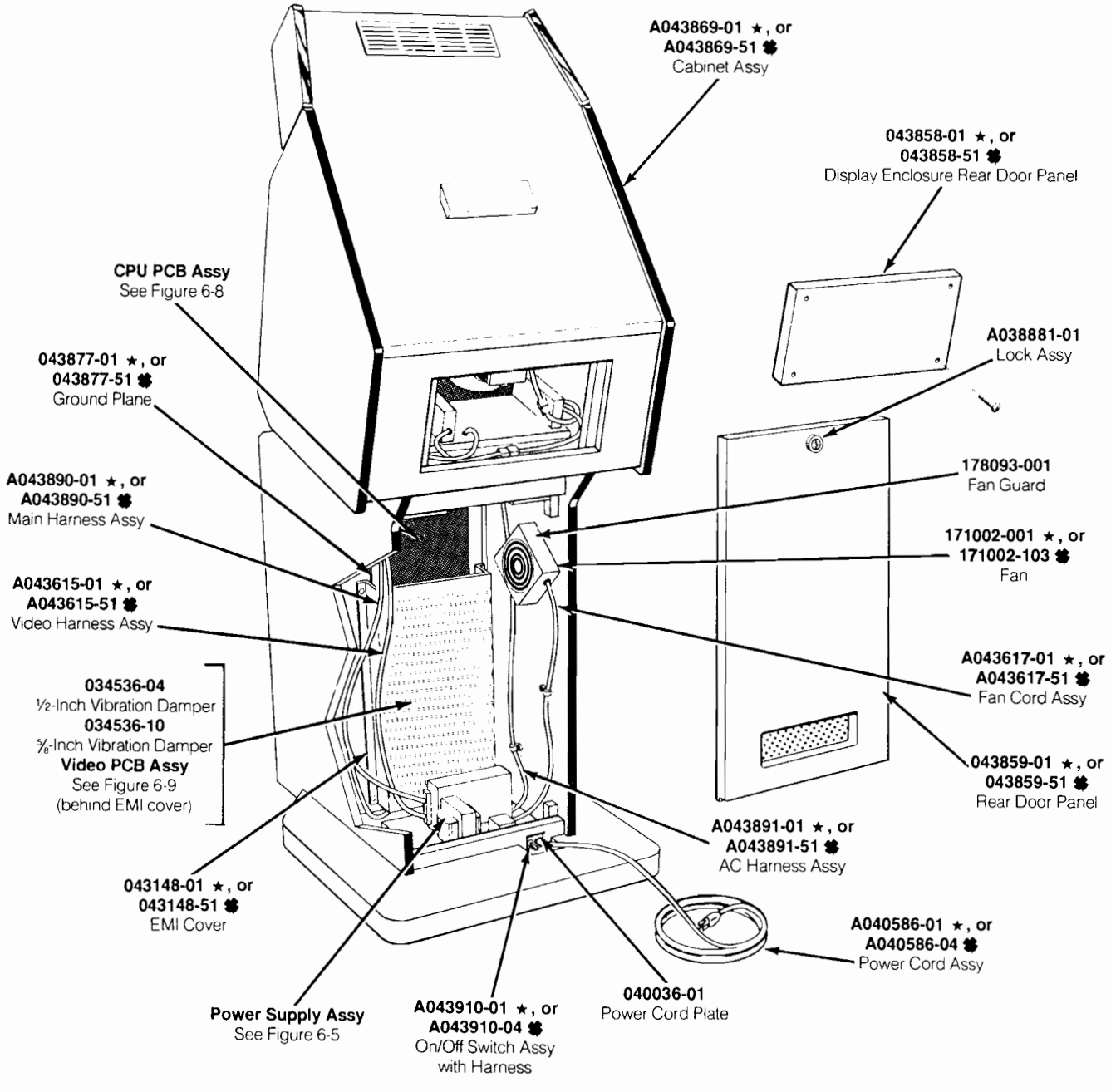


Figure 6-1 Cabinet-Mounted Assemblies, Continued
A043870-01 B (US)
and A043870-51 B (Ireland)

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*

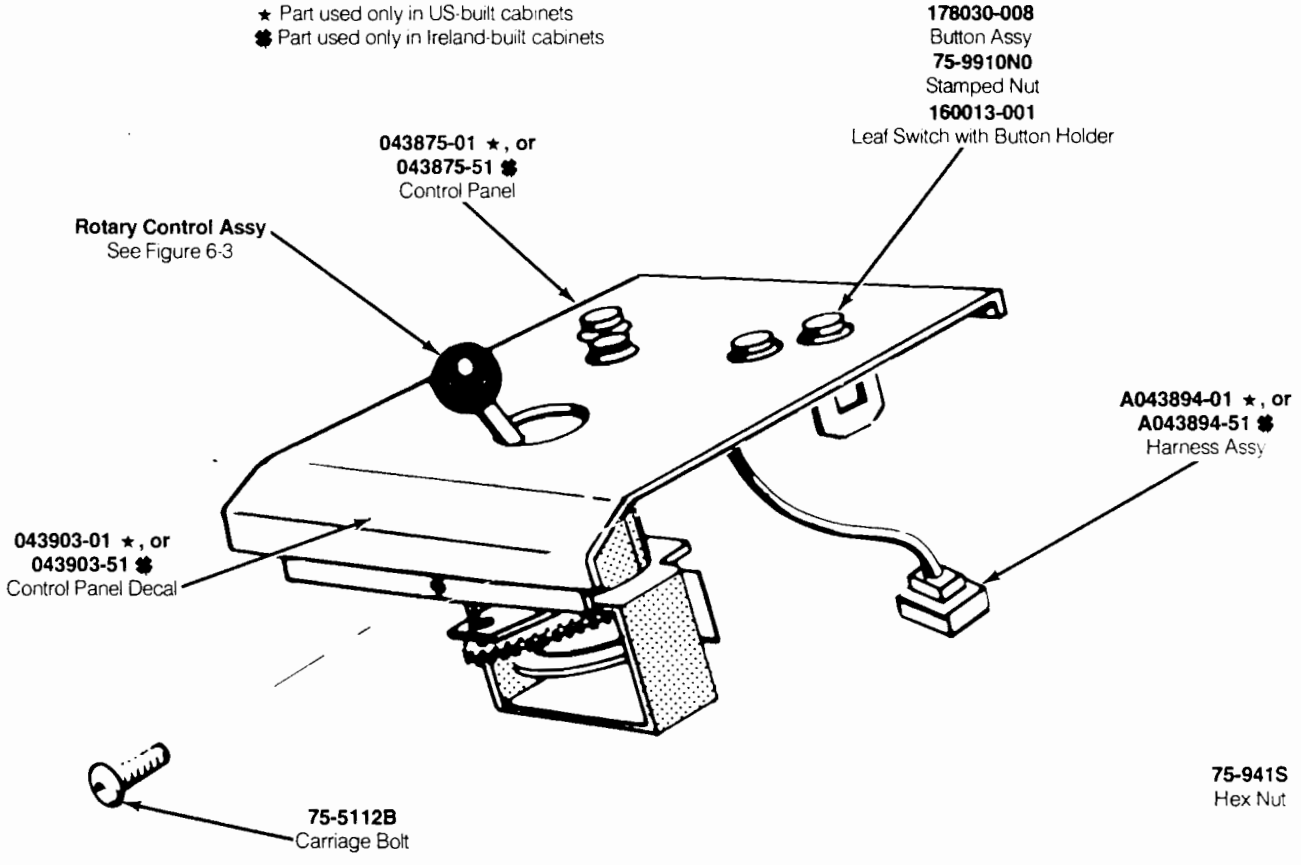


Figure 6-2 Control Panel Assembly A043900-01 B (US) and A043900-51 B (Ireland)

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	#11⁄16-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*

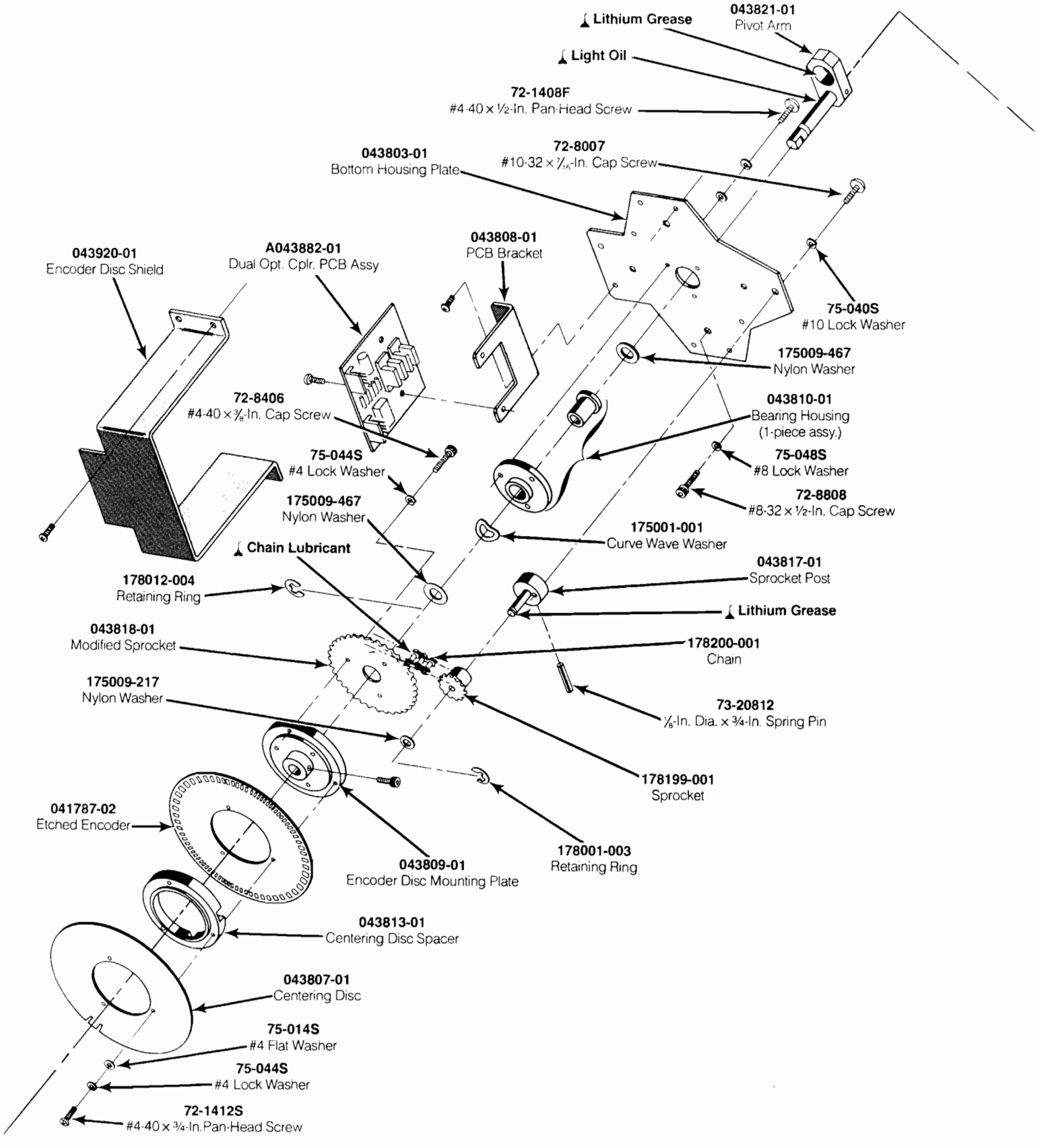


Figure 6-3 Rotary Control Assembly
A043820-01 C

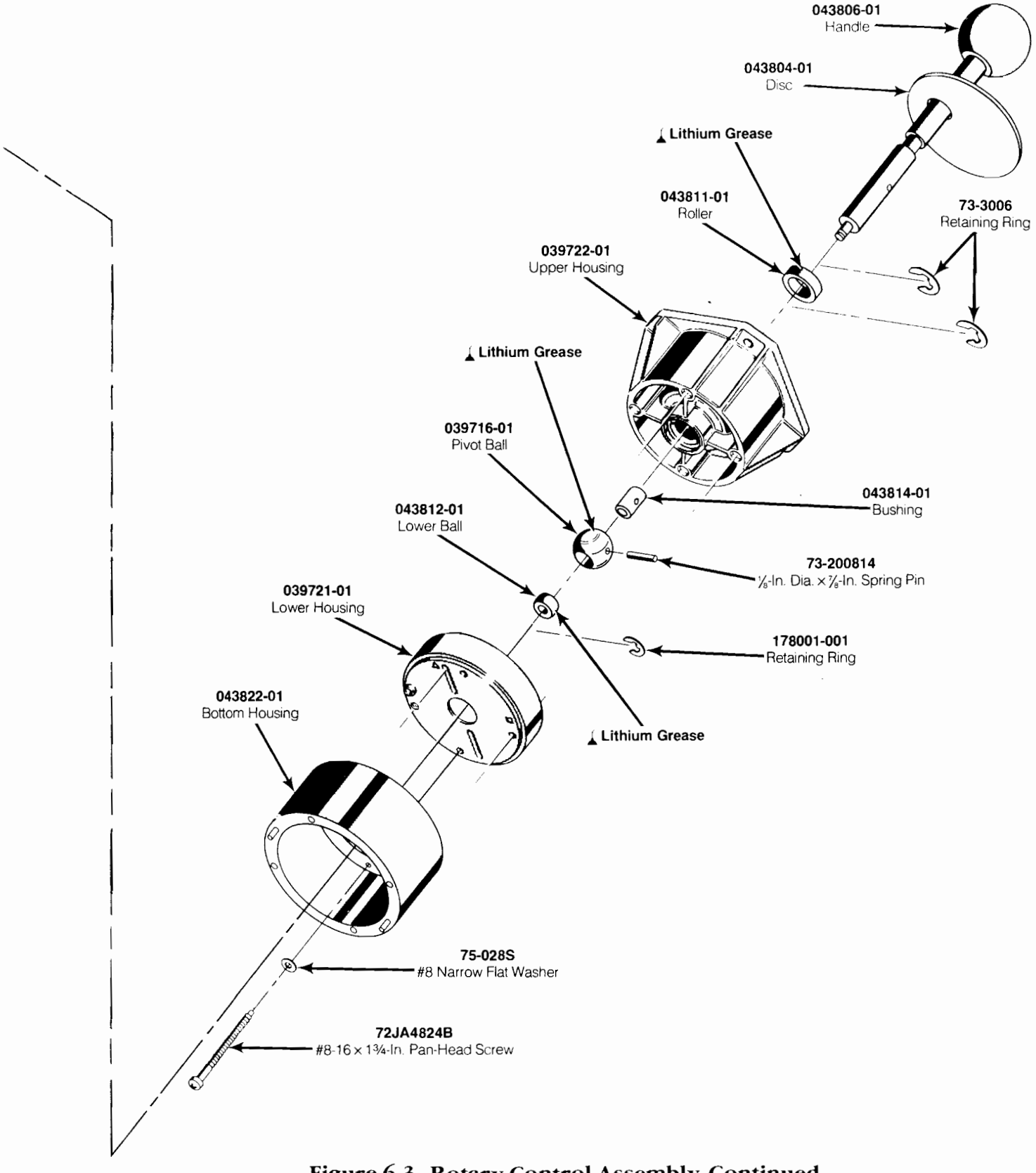


Figure 6-3 Rotary Control Assembly, Continued
A043820-01 C

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 × ¼-Inch Self-Tapping Pan-Head Screw
72-8007	#10-32 × 7/16-Inch Socket Head Cap Screw
72-8406	#4-40 × ¼-Inch Socket Head Cap Screw
72-8806	#8-32 × ¼-Inch Socket Head Cap Screw
72-8808	#8-32 × ½-Inch Socket Head Cap Screw
73-200814	¼-Inch Diameter × ¾-Inch Spring Pin
73-20812	¼-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

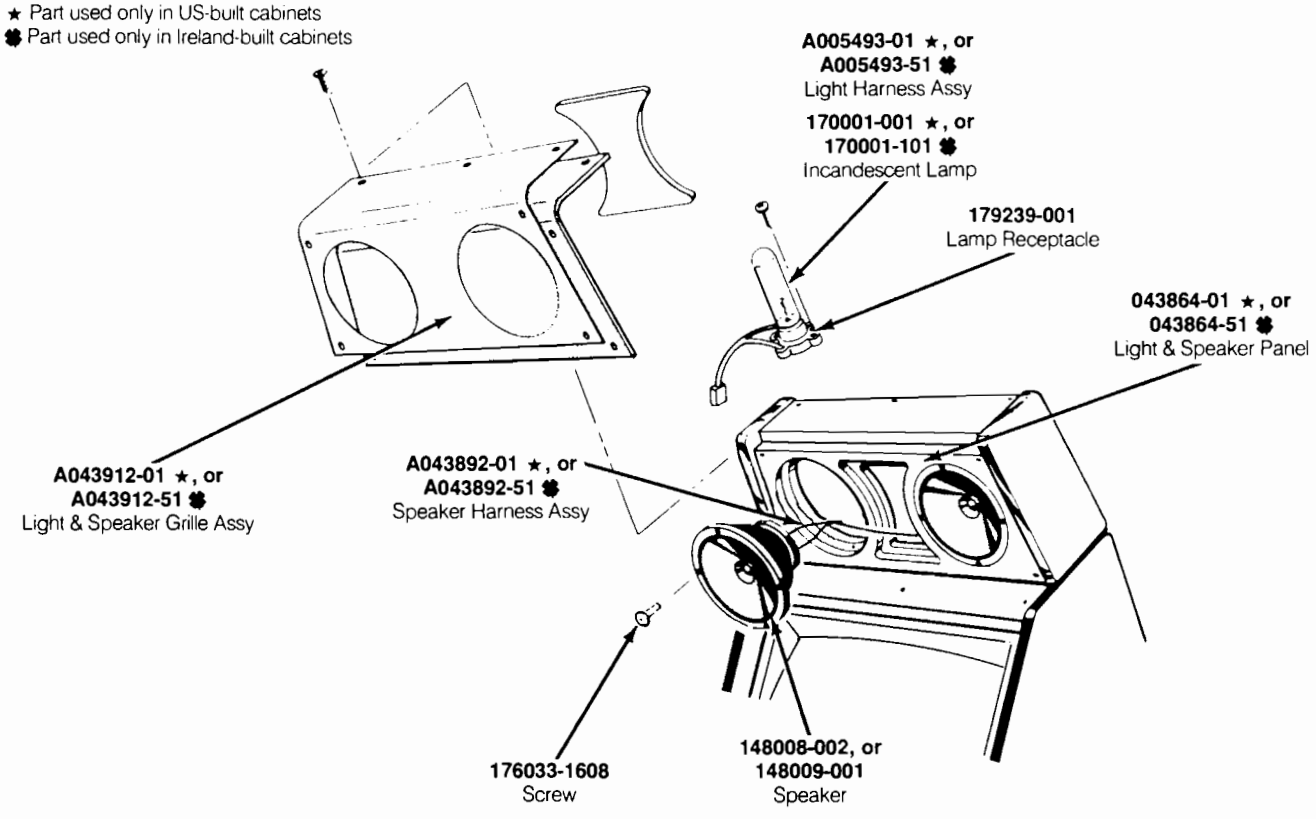


Figure 6-4 Light and Speaker Panel Assembly A043901-01 A (US) and A043901-51 A (Ireland)

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*

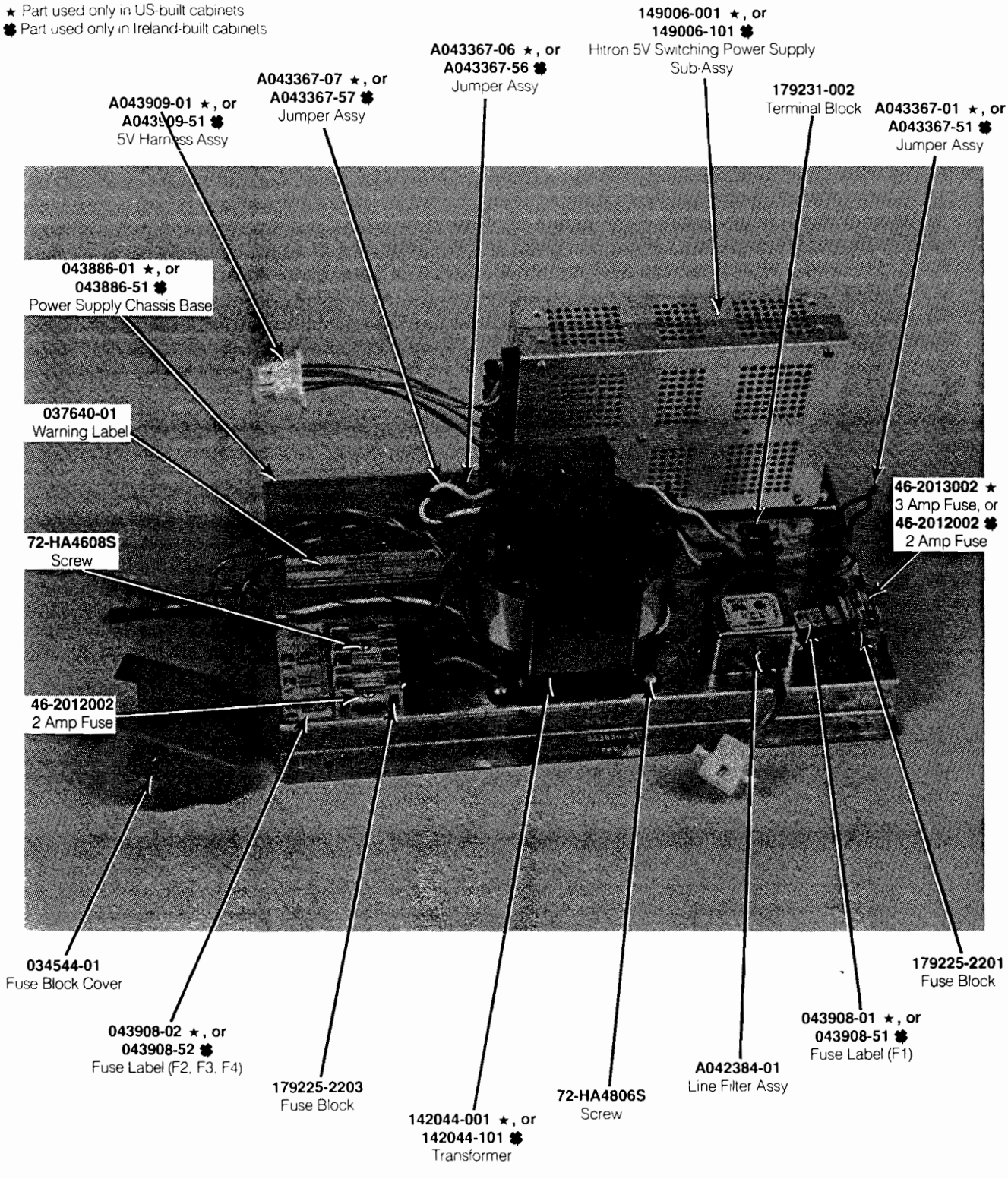


Figure 6-5 Switching/Linear (SL) Power Supply Assembly A043888-01 A (US) and A043888-51 A (Ireland)

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 × ¾-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

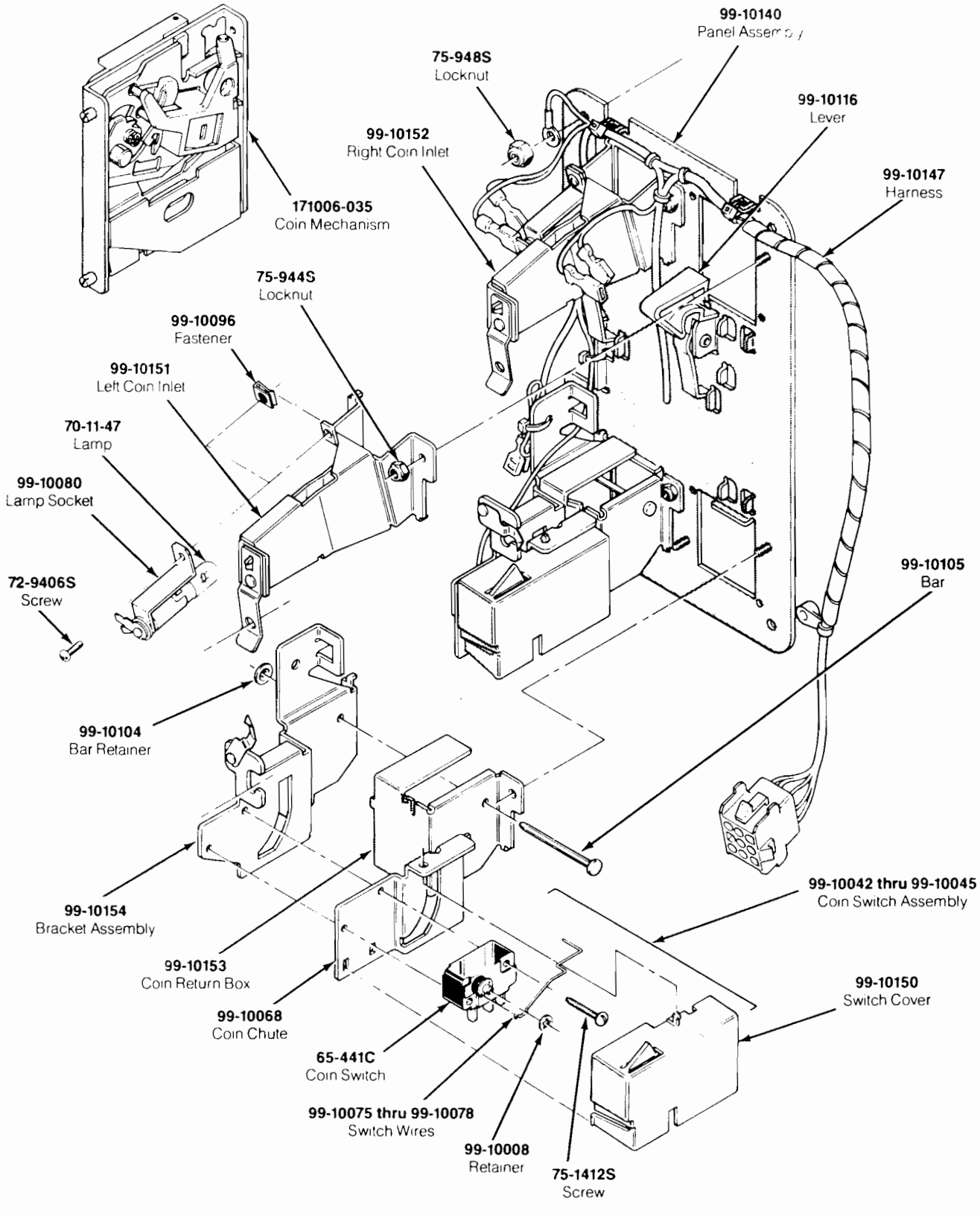


Figure 6-6 Coin Acceptors, Inc. Coin Door Assembly 171027-001 A

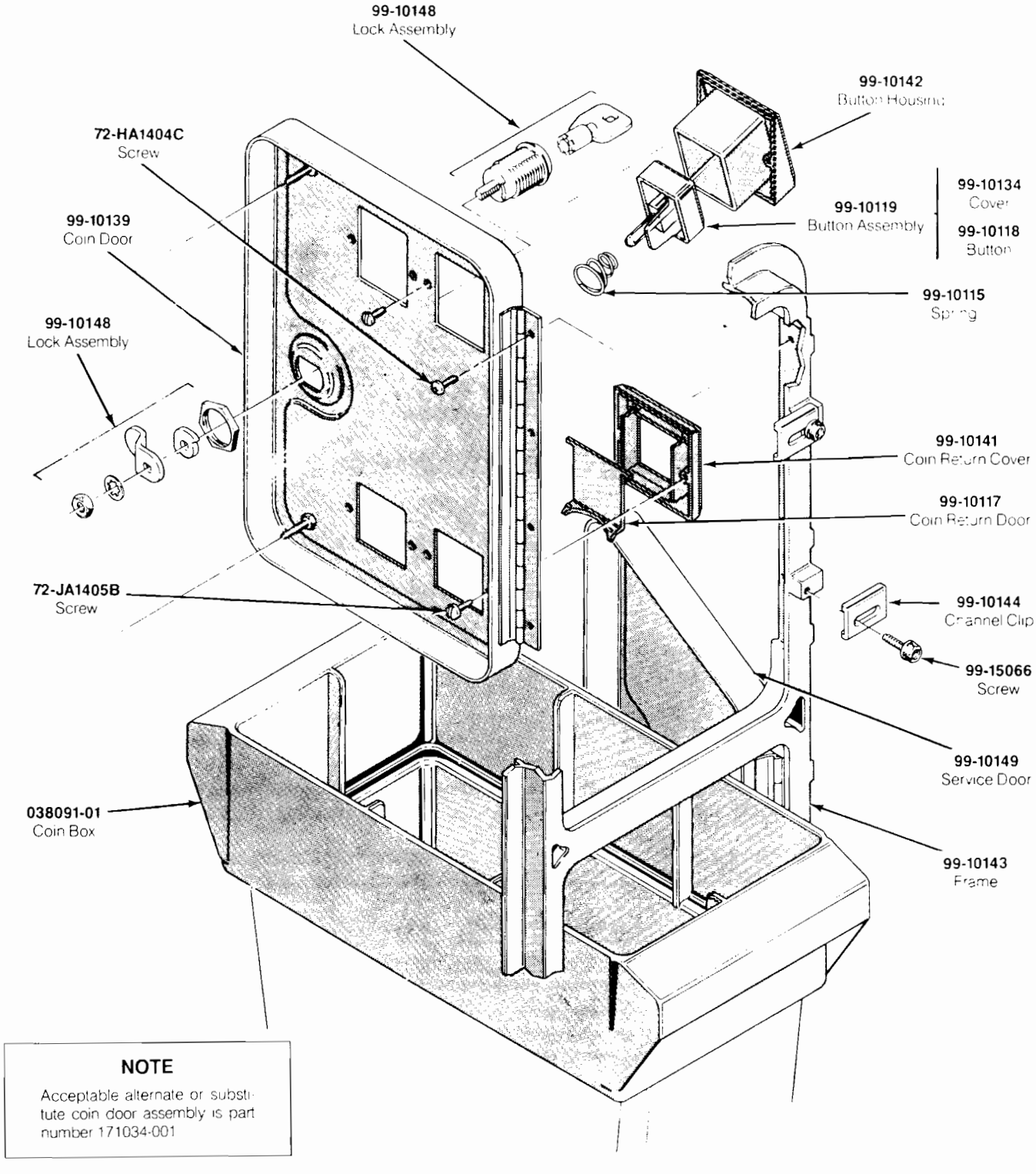
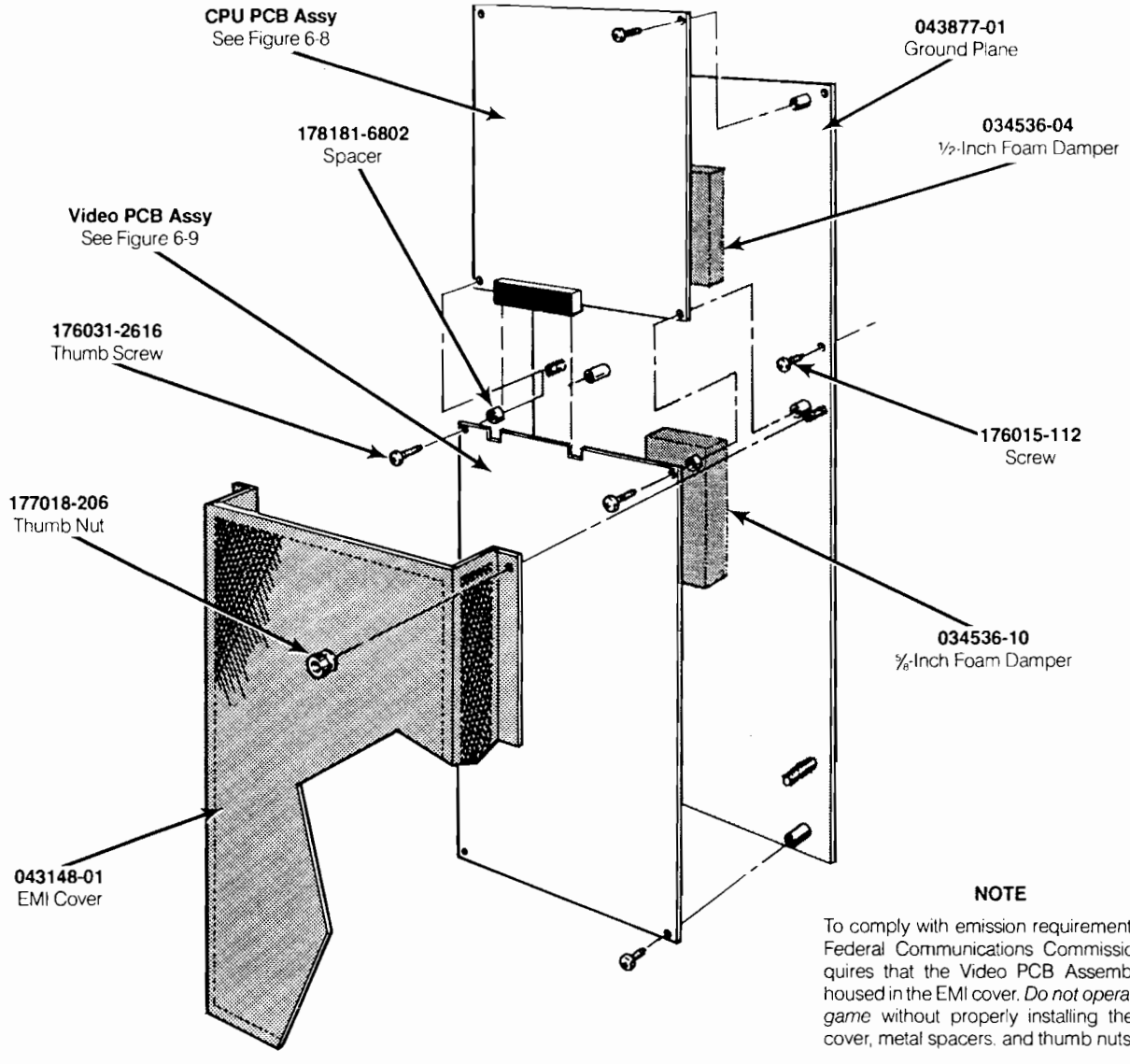


Figure 6-6 Coin Acceptors, Inc. Coin Door Assembly, Continued
171027-001 A

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



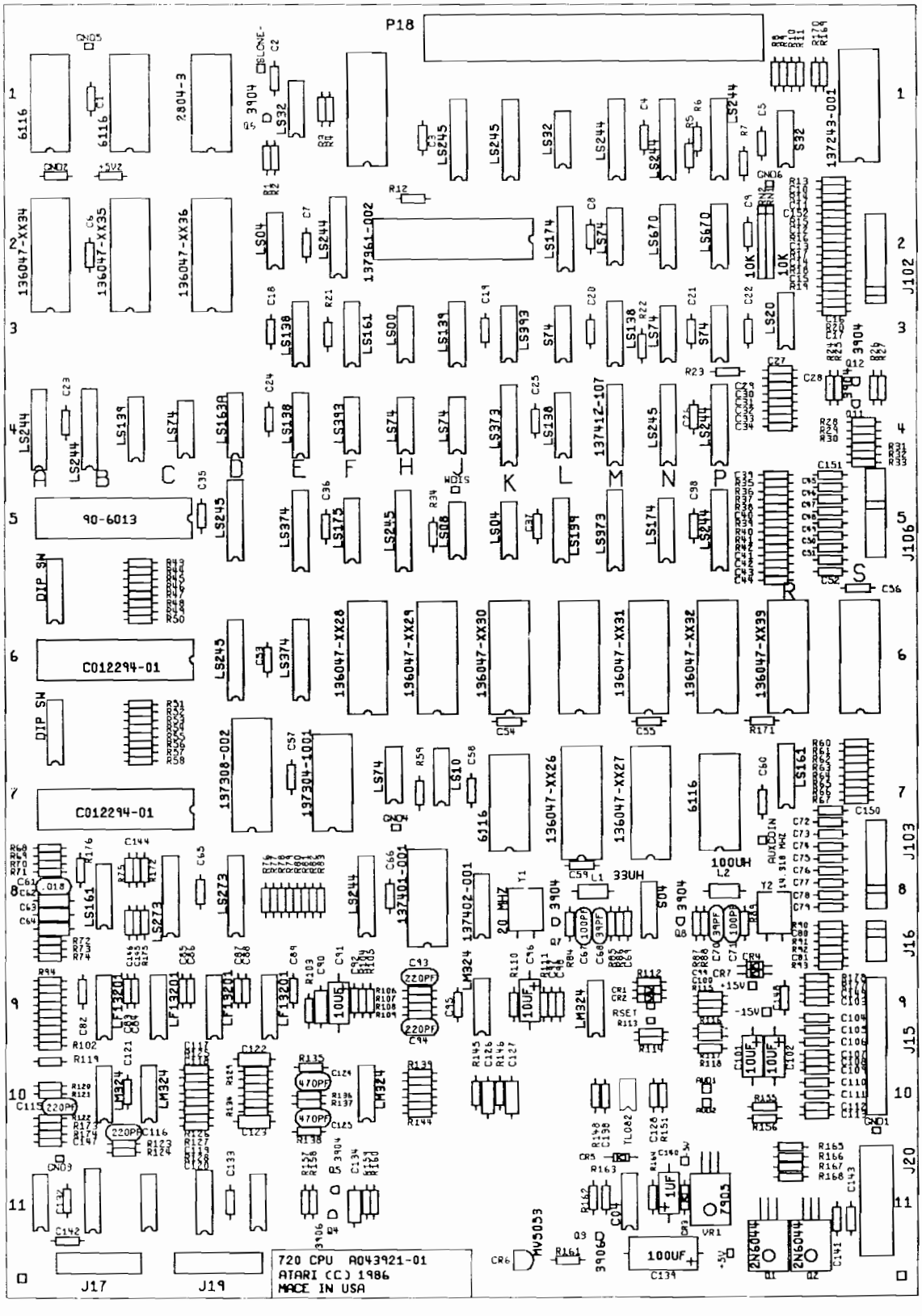
NOTE

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-Inch 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



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	37-74LS244
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

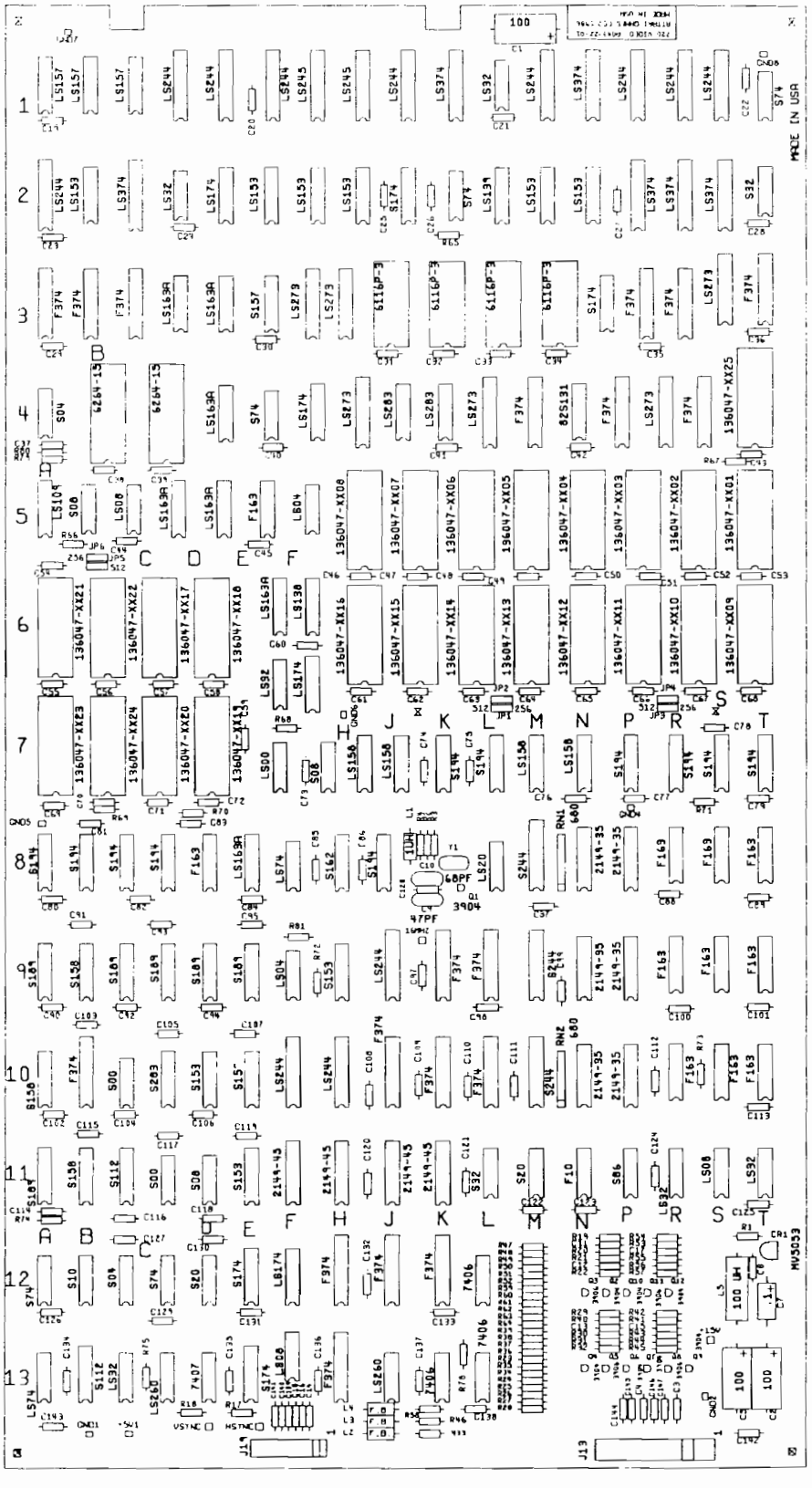
Designator	Description	Part No.
10B	Integrated Circuit, Type-LM324	37-LM324
10C	Integrated Circuit, Type-LM324	37-LM324
10F	Integrated Circuit, Type-LM324	37-LM324
10L/M	Integrated Circuit, Type-TLO82CP	37-TLO82CP
11M	Integrated Circuit, Type-74C04	137309-001
	Sockets	
	16-Pin Medium-Insertion-Force 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 x 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 0206-0-01)	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	37-74S08
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

"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.
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° Video PCB Assembly Parts List, Continued

Designator	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

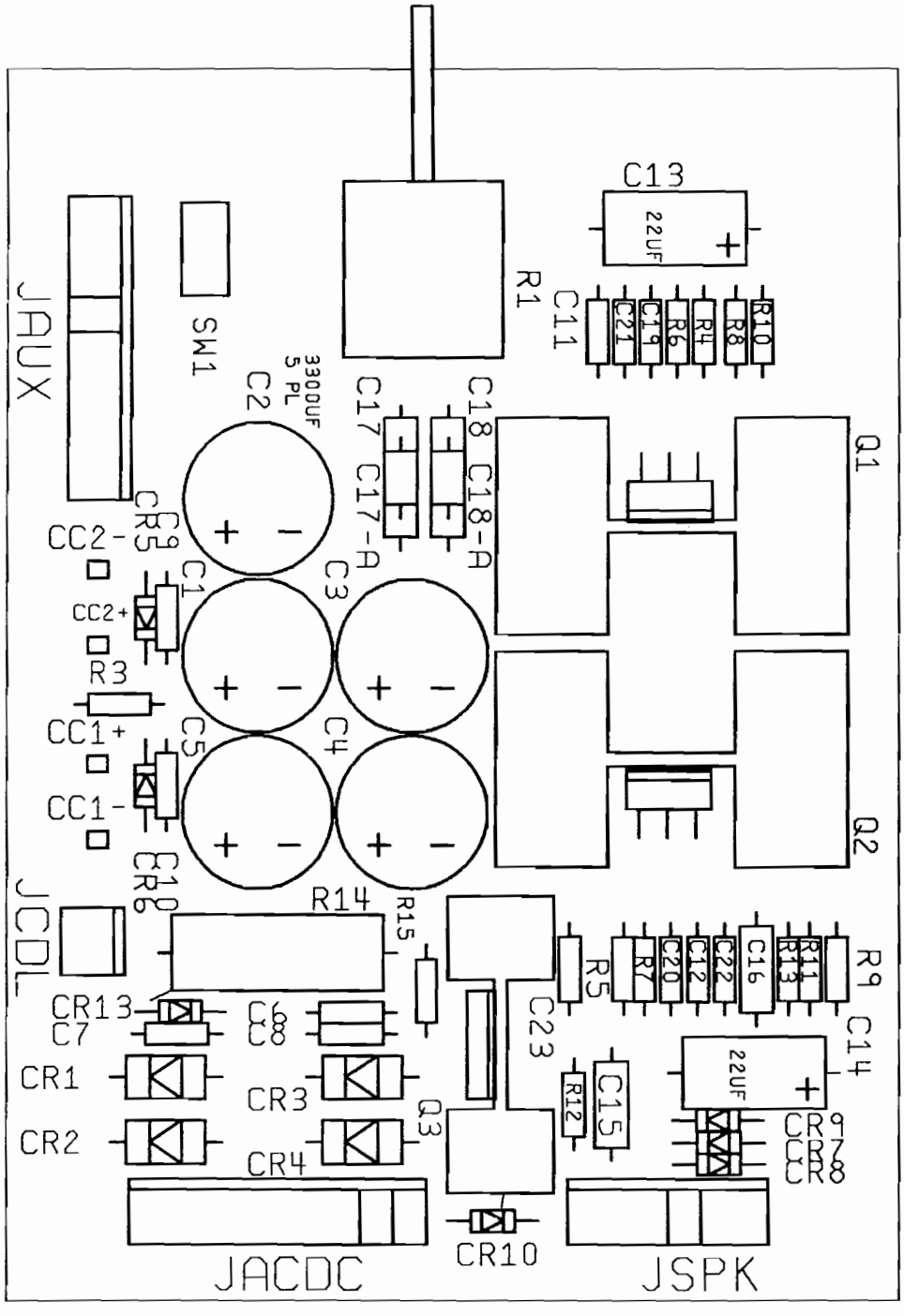

Figure 6-10 Audio II PCB Assembly
A043661-01 B

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