



TM-325  
1st printing



# FINAL LAP

## Operators Manual

with Illustrated Parts Lists and Schematics



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If reading through this manual does not lead to solving your game maintenance or repair problem, call TELE-HELP® at one of these Atari Games Customer Service offices:

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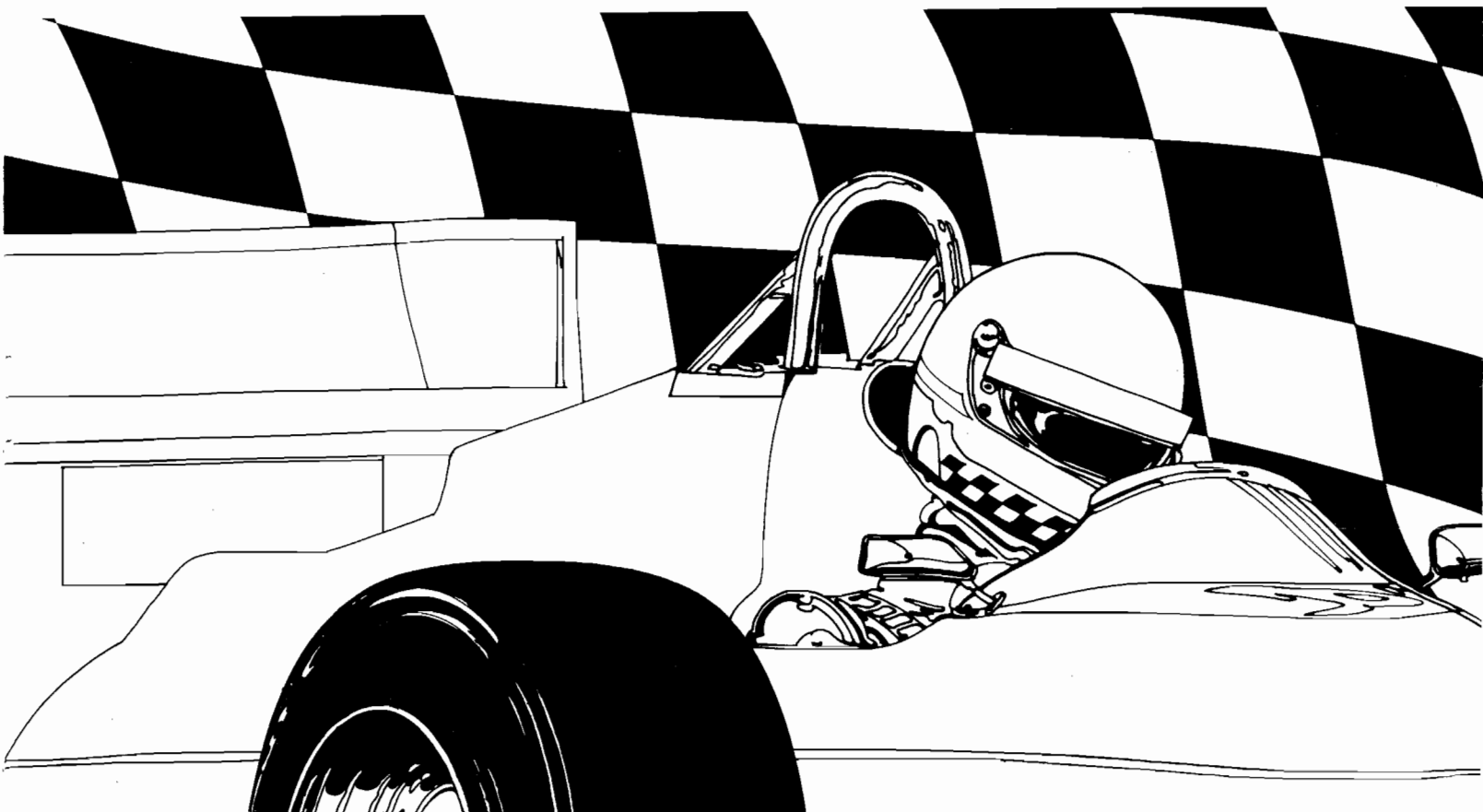


*Upright Model*

# Final Lap™

## Operators Manual

with Illustrated Parts Lists



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### WARNING

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

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

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

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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 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.
- On games provided with an Electromagnetic Interference (EMI) ground cage, be sure the printed-circuit boards (PCBs) are properly installed in the EMI ground cage and that the end board is securely installed with **all** screws in place and tightened.

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 in this manual whenever 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 be only be plugged into a grounded three-wire outlet. If you have only a two-wire outlet, we recommend you hire a licensed electrician to install a three-wire grounded outlet. If the control panel is not properly grounded, players may receive an electrical shock! After servicing any part on the control panel, check that the grounding wire is firmly secured to the inside of the control panel. After you have checked this, lock up the game.

**AC Power Connection.** Before you plug in the game, be sure that the game's power supply can accept the AC line voltage in your location. The line voltage requirements are listed in the first chapter of this manual.

**Disconnect Power During Repairs.** To avoid electrical shock, disconnect the game from the AC power before removing or repairing any part of the game. If you remove or repair the video display, be very careful to avoid electrical shock. High voltages continue to exist even after power is disconnected in the display circuitry and the cathode-ray tube (CRT). Do not touch the internal parts of the display with your hands or with metal objects! Always discharge the high voltage from the CRT before servicing it. Do this after you disconnect it from the power source. First, attach one end of a large, well-insulated, 18-gauge jumper wire to ground. Then momentarily touch the free end of the grounded jumper wire to the CRT anode by sliding the wire under the anode cap. Wait two minutes and do this again.

**Use Only Atari Parts.** To maintain the safety of your Atari game, use only Atari parts when you repair it. Using non-Atari parts or modifying the game circuitry may be dangerous, and could injure you and your players.

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

**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. The connectors are keyed to fit only one way. If they do not slip on easily, do not force them. If you reverse a connector, it may damage your game and void your warranty.

**Ensure the Proper AC Line Frequency.** Video games manufactured for operation on 60 Hz line power (used in the United States) must not be operated in countries with 50 Hz line power (used in Europe). If a 60 Hz machine operates on 50 Hz line power, the fluorescent line ballast transformer will overheat and cause a potential fire hazard. Check the product identification label on your machine for the line frequency required.

## ABOUT NOTES, CAUTIONS, AND WARNINGS

In 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 killed or injured if instructions are not followed.



# Chapter 1

# Set-Up

## How to Use This Manual

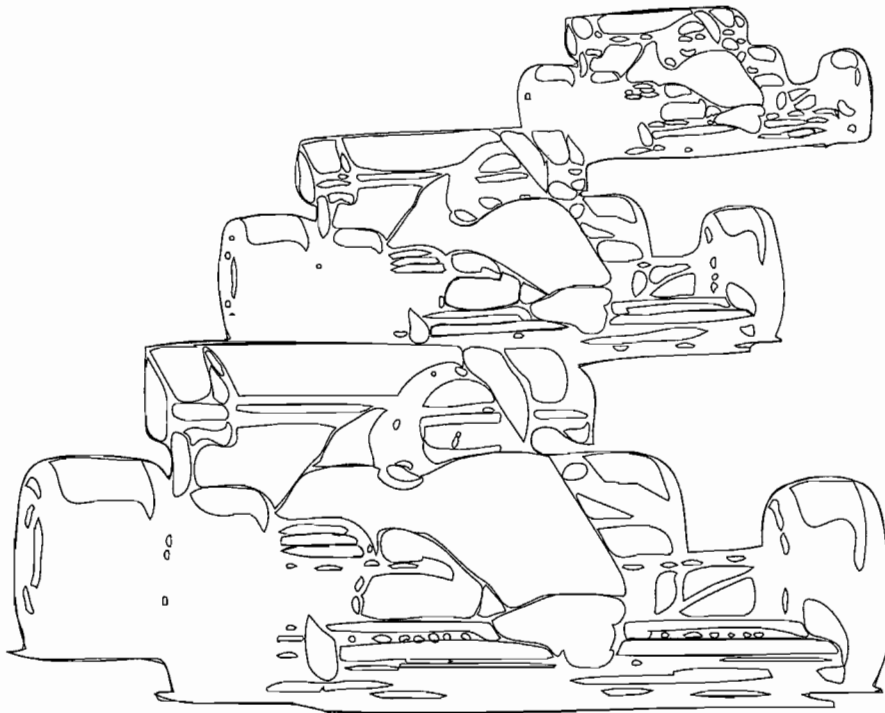
This manual is written for game operators and service personnel, and provides information for setting up, playing, testing, and maintaining your Final Lap™ Upright game.

The manual is divided into the following chapters:

- Chapter 1 contains set-up and game play information.
- Chapter 2 contains self-test procedures.
- Chapter 3 contains preventive maintenance and repair procedures.
- Chapter 4 contains illustrated part lists.

Wiring and schematic diagrams for the Final Lap Upright game circuitry are contained in the Schematic Package Supplement (SP-322) included with your game.

This chapter includes information required to set up and play your Final Lap Upright game. Read this chapter carefully before you turn on the game.



**WARNING**

*This game must be levelled before anyone plays it. If it is not levelled, a player can pull the cabinet over on top of himself.*

This cabinet should be connected to a grounded three-wire outlet only. If you have several cabinets, each one should be connected to its own separate grounded outlet.

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

**WARNING**

*To avoid electrical shock, do not plug in the cabinet until you have inspected it. After you have inspected it, plug it in only to a grounded three-wire outlet.*

## Inspecting the Game

Please inspect your Final Lap Upright game carefully to ensure that the game is complete and was delivered to you in good condition.

Figure 4-1 shows the locations of the parts of the game. Table 1-1 lists space, power, and environmental requirements.

Inspect the game cabinet and seat assembly as follows:

1. Examine the exterior of the cabinet for dents, chips, or broken parts.
2. Unlock and open the lower service door. 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. (The connector bracket next to the EMI enclosure is for the car type selection. One of three connectors can be plugged into the connector bracket or none of them may be. For more information, see *Choosing the Car Type* in this chapter.)  
Do not force connectors together. The connectors are keyed so they fit only 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), and speaker. Make sure that they are mounted securely and that the ground wires are connected.

**Table 1-1 Game Specifications**

Characteristic	Specification
Power Consumption	150 V-A, 110 W RMS
Temperature	+5° to +50° C (+37° to +122° F)
Humidity	Not to exceed 95% relative
Line Voltage	102 to 132 VAC (U.S. games)
Width	49 in. (124.5 cm.)
Depth	33 in. (84 cm.)
Height	72 3/8 in. (184 cm.)
Weight	450 lbs. (204.5 kg.)

## Installing the Attraction Sign

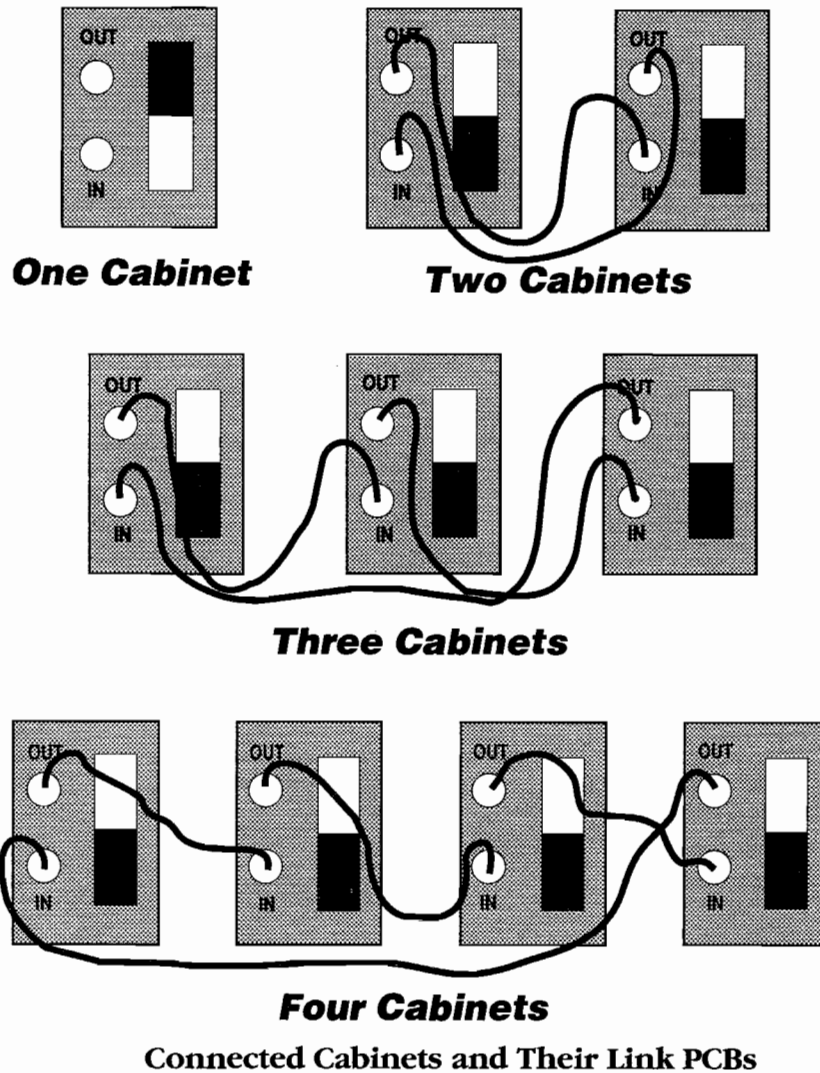
The attraction sign mounts on the top panel of the game. See Figure 4-1.

Put the attraction sign on top of the game and center it. The front edge should be behind the retainer. Peel off the covering on the tape on the bottom of the sign and press the tape down on the cabinet.

## Connecting Cabinets

You can connect up to four cabinets together. Each cabinet is shipped with a 6-foot-long connecting cable. If you are connecting three or four cabinets together, you will need longer cables, which are available from Atari Games Customer Service. These cables are 10 feet long (part no. 150031-120) and 20 feet long (part no. 150031-240).

1. Turn off the game power to all the cabinets.
2. Find the Link PCB in the back of the game. Plug in the connecting cables as shown in Figure 1-1. Each cable must be connected from an input to an output.
3. Switch the connecting switch located on the Link PCB to the *down* position on all the cabinets that are linked together.

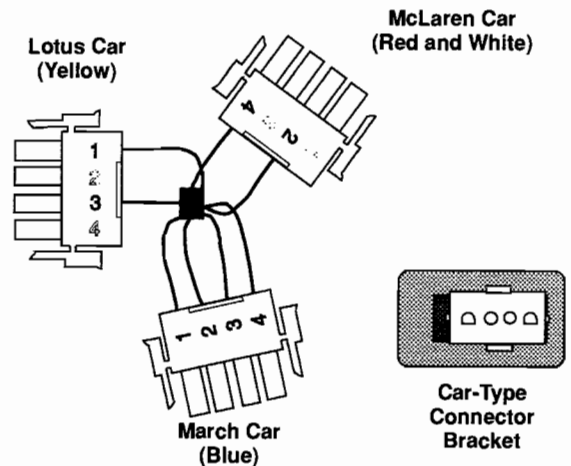


## Choosing the Car Type

Each player can have one of four car types. These are selected by plugging in different connectors (included with the game) into the car-type connector bracket. The car-type connector bracket is next to the PCB enclosure and shown in Figure 1-4.

At the factory, one car-type connector is plugged into the car-type connector bracket and the other two connectors are attached to it by a tie wrap. In Figure 1-2 the car-type connectors are shown with the wires at the different locations.

The car types and colors with their corresponding connectors are shown in Table 1-2.



**Figure 1-2 Car-Type Connectors**

Car Type	Color	Connector
March	Blue	Has wires at all 4 pins.
McLaren	Red and white	Has wires at pins 2 and 4.
Williams	White, blue, and yellow	<b>No</b> connector.
Lotus	Yellow	Has wires at pins 1 and 3.

## Control and Switch Locations

The controls and switches are located on the utility panel behind the upper coin door and on the back of the game.

### Power On/Off Switch

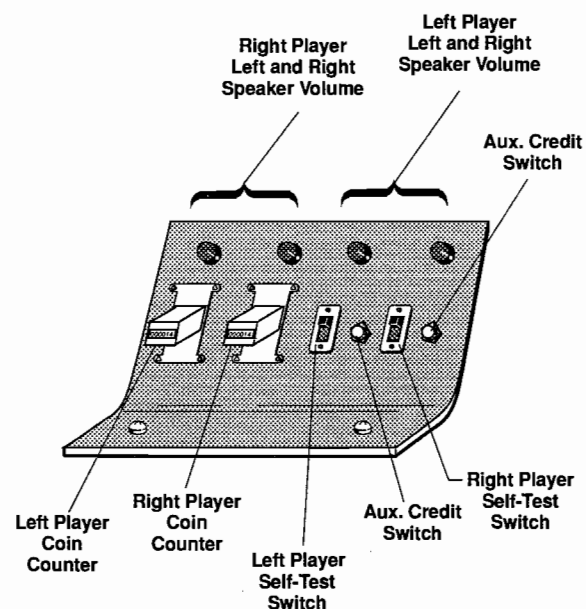
The power on/off switch is located at the bottom left of the cabinet. (See Figure 4-1.)

### Volume Control

The volume controls are located on the self-test utility panel behind the upper coin door. (See Figure 1-3.) Each player has two volume controls which adjust the level of sound from two speakers over each video display.

### Self-Test Switch

Each game has two self-test switches located on the utility panel behind the upper coin door. (See Figure 1-3.) The self-test switches are slide switches.



**Figure 1-3 Utility Panel Controls**

Each video display has its own self-test switch that selects the Self-Test Mode to check game operation. See Chapter 2 for a complete description of the self-test.

### Auxiliary Credit Switches

Each game also has two auxiliary credit switches, next to the self-test switches on the utility panel. These are push button switches. Use either auxiliary credit switch to give a player coin credits. These switches do not activate the coin counter when they are used. This may be helpful if you need to troubleshoot the player start circuitry.

### Connection Switch

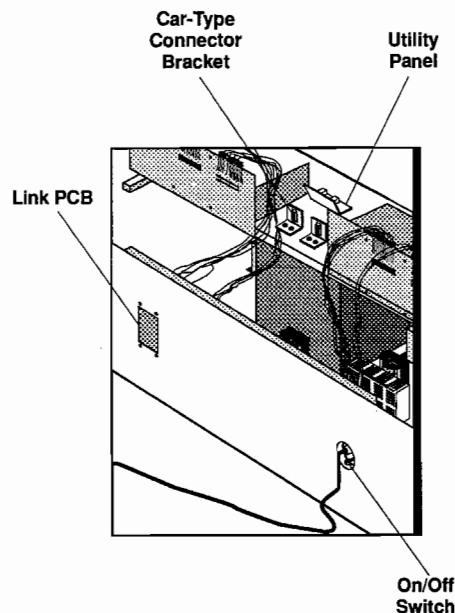
The connection switch is on the Link PCB (see Figure 1-2). This switch should be in the down position with connecting cables plugged in, if you have two or more cabinets connected together. For more information, read *Connecting Cabinets* in this chapter.

### NOTE

*If you have one cabinet, be sure the Link PCB switch is in the **up** position. Otherwise the game will not function properly.*

### Coin Counter

The two coin counters, one for each player, are located on the utility panel inside the upper coin door. The coin counter records the number of coins deposited.



**Figure 1-4 Other Game Control Locations**

## Setting the Coin and Game Options

The Final Lap Upright coin and game options are set in the Self-Test Mode. Refer to Chapter 2 for the recommended settings and the procedure for setting the options.

## Game Play

This section of the manual describes the theme of the Final Lap Upright game and the game play features.

### Introduction

Final Lap is the first linked game designed for the amusement industry. Originally created by Namco Limited of Japan, Final Lap Upright is a realistic racing game in the tradition of Pole Position.

Each Final Lap Upright unit is actually two games in one, with two separate video displays linked together for interactive play. Realistic player controls consist of a steering wheel with return-to-center steering, a high/low shifter, and a gas pedal. As many as four Final Lap Upright units can be linked together for unprecedented competition: Up to eight players can compete head-to-head.

### Play Mode

Imagine yourself racing head-to-head against the player next to you. You see his car approaching in the rear-view mirror, and suddenly, he passes you on the inside, narrowly missing a road sign. You weave be-

tween the other competitive cars in hot pursuit. You are on his tail through the hairpin and pass him in the straightaway! The status screen tells you that you are now in first position. You pass the finish line before the time runs out and again get extended time, but the question still remains: can you complete the final lap?

To start the game, one or more players deposit coin(s) in the slot corresponding to their video display (e.g., the right player uses the right coin slot and the left player the left slot). The green light flashes, the green flag is waved and the race is on!

- To begin a head-to-head race, players must deposit coins within 16 seconds of each other.
- One player can compete against the clock or multiple players race can simultaneously on the same course.
- Each player has his own realistic first-person perspective of the track and sees his competitors' cars on his screen.
- New players can start a new game even if another race is in progress.
- As an incentive for multiple-player games, all players can continue for an extended time, as long as at least one player completes the lap within the time allowed on the computer clock shown in the center of the video display.
- Players who set the best lap time are rewarded with a bottle of champagne in the winner's circle.
- If a player's time is fast enough, the player can enter his initials on the high score table.

N O T E S

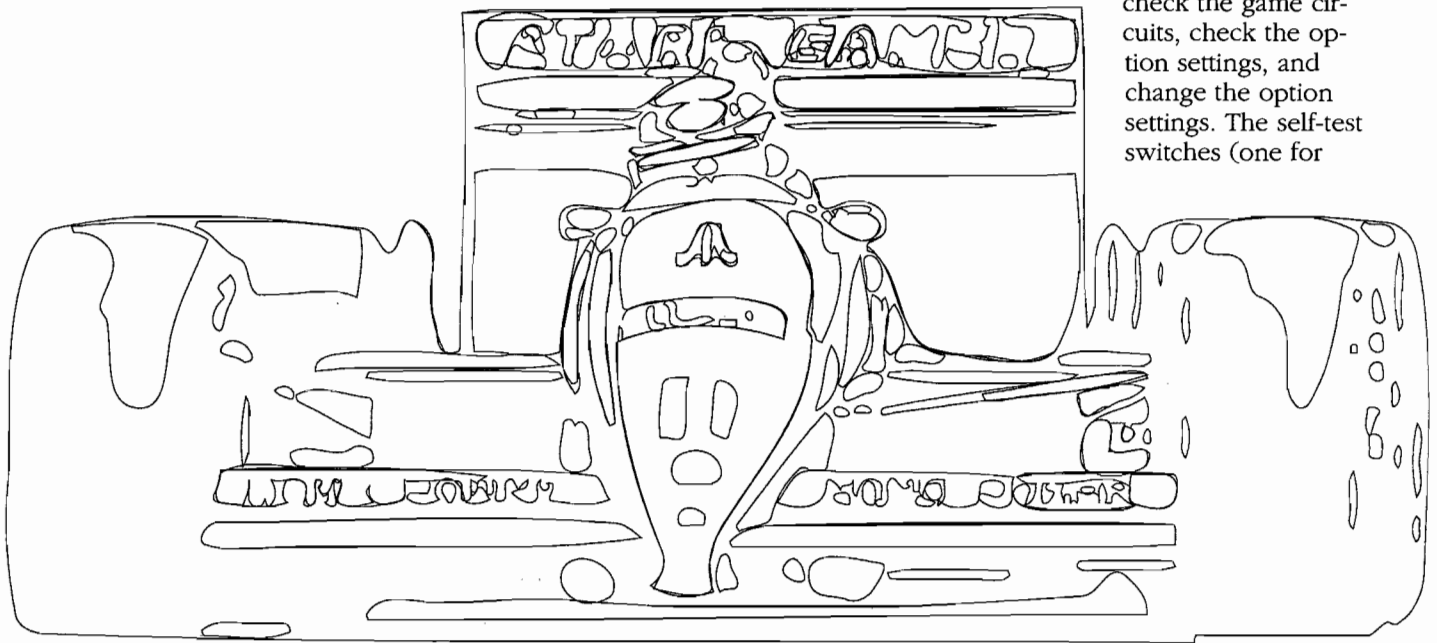
## Chapter 2

# Self-Test

The Final Lap™ Upright 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 through the sound system. No additional equipment is required.

We suggest that you perform a self-test at least once a day and when you first set up the game, connect additional cabinets, collect coins, or when you suspect game failure.

Use the self-test to check the game circuits, check the option settings, and change the option settings. The self-test switches (one for



each display) are located on the utility panel behind the upper coin door. The self-test switches are the slide switches on the bottom of the utility panel.

When you turn off the self-test switch, the game returns to the attract mode. When you turn on the self-test switch, the self-test screen appears.

To move through the options and tests, press the gas pedal and change the gear shift from low to high. (You will hear a roar through the speakers when you change the gear shift.) The next option setting now flashes. To move to the next option or test, do the same procedure.

You can only move down the screen. When you reach the end of the list, you return to the Sound test.

To change a flashing option setting, move the gear shift from low to high. Do not press the gas pedal. Every time you move the gear shift, a new setting appears. Once you choose a new setting, you can return immediately to the attract mode, if you like.

## RAM Test

This tests the game RAMs. If the game RAMs are working correctly, *OK* appears. If the screen shows anything besides *OK*, a qualified technician should check the game boards.

## ROM Test

This tests the game ROMs. If the game ROMs are working correctly, *OK* appears. If the screen shows anything besides *OK*, a qualified technician should check the game boards.

## Gas Pedal Test

*GAS* is the gas pedal test. Press the gas pedal, and the number to the right increases. Release the pedal, and the number decreases. If you are not pressing on the gas pedal, the number should be 00. If the number does not appear this way, then do the following:

1. Check to make sure the gas pedal is returning to the top of its mechanical range. If it does not, repair or replace the gas pedal.
2. Turn the self-test switch off and then on again.
3. The number should reset to zero.
4. If it does not, check the potentiometer on the gas pedal.

## Brake Test

*BRAKE* does not apply to the Final Lap Upright game. It will show the same values as the gas test.

## Steering Wheel Test

*STEERING* is the steering wheel test. When you turn the wheel to the left, the number increases. When you turn the wheel to the right, the number decreases. If you are not turning the steering wheel, the number should be 00 or FF. If the number does not appear this way, then do the following:

1. Check to make sure the steering wheel returns to the center. If it does not, repair the steering wheel.
2. Turn the self-test switch off and then on again.
3. The number should reset to zero.
4. If it does not, check the potentiometer on the steering wheel.

## Sound Test

*SOUND* is the sound test. Cycle through the five sounds to test the audio circuitry.

## Coin Options

The *COIN 1* option sets the coin option for each player. The *COIN 2* setting does not apply to this game.

You can choose 1 to 8 coins and 1 to 8 credits. The coin amounts and the credit amounts change independently of each other.

The recommended option setting is 2 coins for 1 credit.

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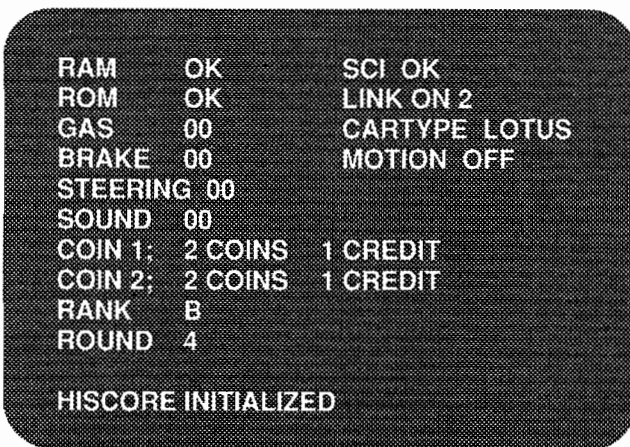
### NOTE

*All players must have identical Coin 1 settings.*

---

## Difficulty Level

*RANK* is the difficulty level of the game. When you change the rank, you shorten or lengthen the game time.



**Figure 2-1 Self-Test Screen**



**NOTE**


---

*All players must have identical Rank settings.*

---

The levels are:

- A (easy)
- B (medium)—recommended setting
- C (hard)
- D (difficult)

## Number of Laps

*ROUND* is the number of laps each player is permitted to complete in each game. If one player completes a lap in less than the allotted time, then all players receive another lap.

**NOTE**


---

*All players must have identical Round settings.*

---

These are the settings for the number of rounds:

- 3
- 4 (recommended setting)
- 5
- 6

## Communication Circuit Test

*SCI*, at the top right of the screen, indicates whether the Game PCB communications circuits are working correctly. *SCI ON* should be followed by four letters and numbers if the circuits are working correctly. If you see *SCI NG*, then a problem exists. Check the connecting cables to other games and the connectors.

## Linked Games

*LINK* counts the number of game PCBs connected together (not the number of cabinets). *LINK* should al-

ways read *On*. If it reads *Off*, the switch on the Link PCB is in the wrong position. Check Figure 1-1, *Link PCBs on Connected Cabinets*, for the correct position of your switch.

If you have one cabinet, the number of linked games should be 2. If you have 3 cabinets connected, the link number should be 6. If you do not have the correct number of links, check the connections between your games.

## Car Type

The *CAR TYPE* is the type and color of car that each player has. Each type of car has a different color. For more information about choosing the car type, see *Choosing the Car Type* in Chapter 1.

## Motion Test

*MOTION* does not apply to the Final Lap Upright game. It should always read *Off*.

## Test Pattern

When you turn off the self-test, you will briefly see a test pattern. Use this screen to check the convergence and the color balance of the video display. For more information, see your video display service manual.

## Reset the High Score Table

To reset the high score table, turn the steering wheel until the number 1F appears and change the gear shift to high. The words *HISCORE INITIALIZED* appear at the bottom of the self-test screen. The high score table now shows the default names and times.

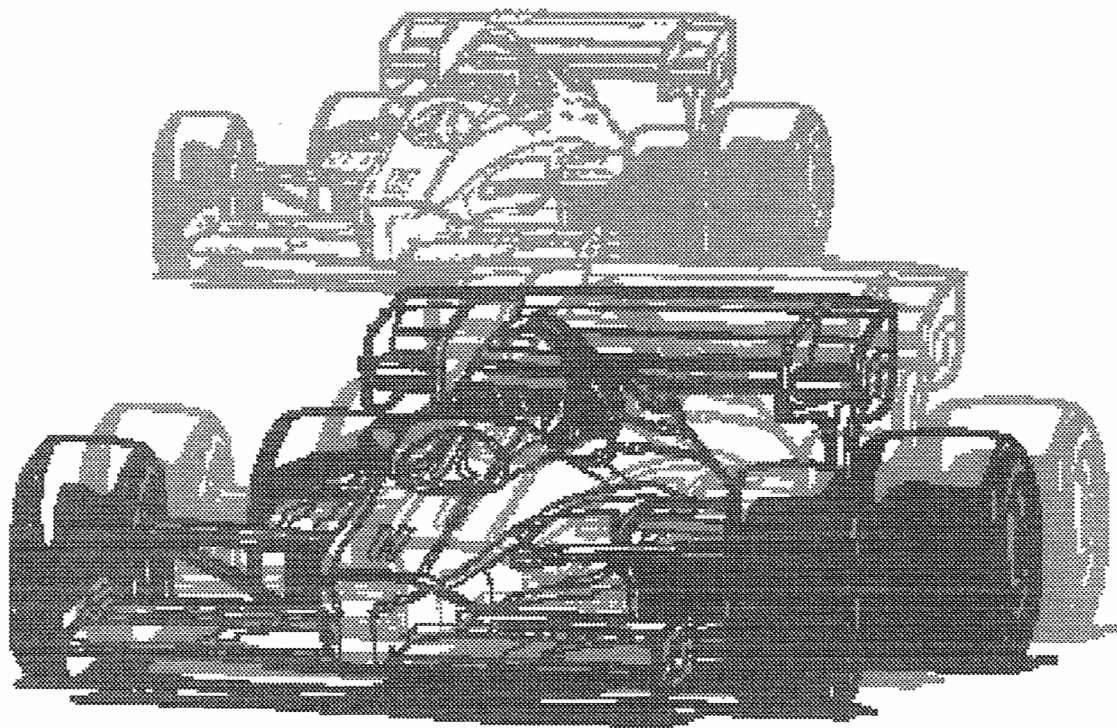
# N O T E S

## Chapter 3

# Maintenance

This chapter includes preventive maintenance and repair procedures for the Final Lap™ Upright game components that have the most use. To assure maximum trouble-free operation from this game, you should perform preventive maintenance described in this chapter.

Removal, disassembly, reassembly-assembly, and replacement procedures are provided for components that might need to be repaired. If a game part is mentioned, but not illustrated, refer to Chapter 4, Illustrated Parts Lists, for information.



# Preventive Maintenance

Preventive maintenance includes cleaning, lubricating, and tightening hardware. Preventive maintenance should be performed regularly, so the game stays in top condition and major problems are avoided. Preventive maintenance tasks and intervals are shown in Table 3-1. More information about performing each task follows the table.

## Maintaining Your Game

For the best performance from your Final Lap game, you should check and maintain your game according to the times and tasks shown in Table 3-1. How to check and maintain these items is explained further in this section. You may want to perform these tasks more often if the game is heavily used.

## Opening the Control Panel

1. Remove the four tamperproof screws and washers in the front of the control panel.

**NOTE**

*A hole is provided inside the upper coin door to store the tamperproof key wrench when it is not in use.*

2. Open the control panel. See Figure 3-1.

## Maintaining the Steering Wheel Assembly

This section explains how to maintain the steering wheel assembly on your Final Lap Upright game. For repair and replacement procedures, see *Repairs*.

### Tightening the Screws on the Stop Brackets

1. When the control panel is open, the two stop brackets on the steering assembly face out. See Figure 3-2.
2. Make sure the four cross-recessed screws are tight. They should be torqued to 28 inch-pounds.
3. If a screw has fallen out, replace it immediately.

### Tightening the Socket-Head Screw on the End of the Steering Shaft

1. Open the control panel.
2. Use a 3/16-inch Allen head wrench to tighten the screw on the end of the steering shaft. See Figure 3-2. Make sure it is torqued to 95 inch-pounds.

### Tightening the Screws on the Spring Catch

The stop catch is mounted directly on the steering shaft, over the spring. The screws secure the spring

**Table 3-1 Preventive Maintenance Items**

Part	When to Check	What to Check and Maintain
<b>Steering Wheel</b>	Every 3 months	Does the steering wheel return to center? If it does not, repair it immediately. Turn the steering wheel as far as you can. Does it hit metal? Replace the O-rings on the stop. Open the control panel. Check the catches on the ends of the spring. Are they bent or broken? If so, replace the spring. Open the control panel and tighten these screws on the steering wheel: 4 cross-recessed screws on the stop brackets Screw on the end of the steering shaft 2 socket-head screws on the spring catch.
	Every 6 months	Lubricate the spring with Nyogel grease. Lubricate the bronze bearing on the case with light oil.
<b>Gear Shift</b>	Every 3 months	Check the gear shift for wear. If a rubber stop is wearing, turn the stop. Lubricate the shifter plate.
<b>Pedal</b>	Every 6 months	Check the springs to make sure they are not sprung and are returning the pedal to the top position. Replace if necessary. Lubricate the pin in the pedal link with lithium grease. Check the front and back rubber stops for wear.
<b>Coin Mechanism</b>	Every 3 months	Clean.
<b>Interior Components</b>	Every 6 months	Clean.

catch, which keeps the spring in tension. See Figure 3-2.

1. Open the control panel.
2. Turn the steering wheel so you can reach both the socket-head screws and the nuts on the spring catch.
3. Use a 5/64-inch Allen head wrench for socket-head screws and an 11/32-inch hex driver for nuts, and torque the screws to 28 inch-pounds.

### Lubricating the Spring

1. Open the control panel.
2. The spring is inside the steering wheel housing. Lubricate the spring with Nyogel grease.

### Lubricating the Bearing

To lubricate the steering assembly bearing you must take off the screw on the end of the steering wheel shaft, the gear on the shaft, the retaining ring, and the washer.

1. Take off the gear on the steering wheel shaft by removing the socket-head screw on the end of the shaft. See Figure 3-2.
2. Pry off the retaining ring. Cover the ring with a cloth while you pry it, so it doesn't fly off.
3. Take off the washer.

4. Put two drops of light oil on the top surface and inner surface of the bronze bearing.
5. Reassemble the steering wheel shaft.

## Lubricating the Gear Shift Assembly

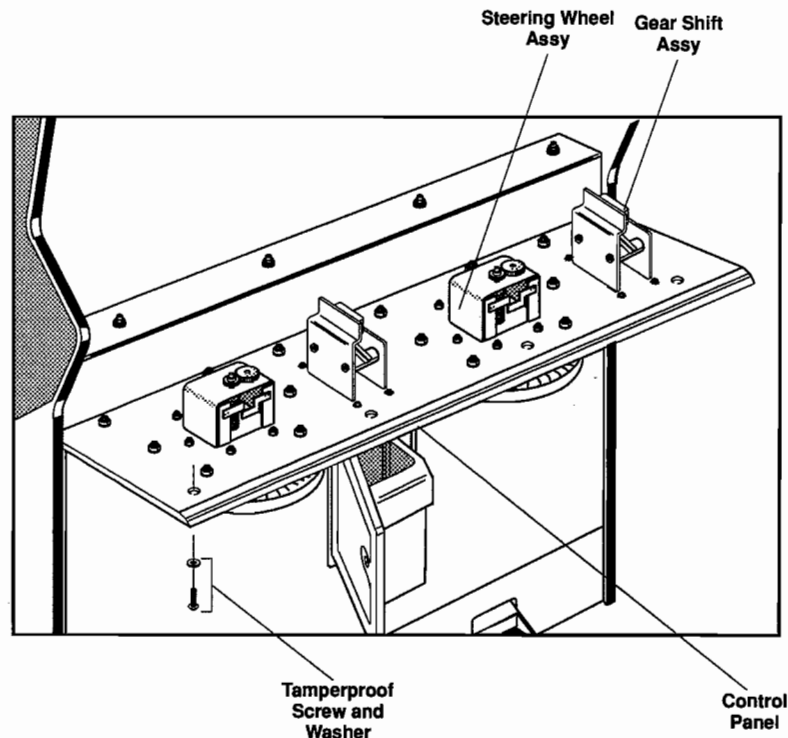
1. Open the control panel.
2. Grease the shifter plate with lithium grease. See Figure 3-4.
3. Check the round rubber bumpers for wear. If a bumper is worn, turn it.

## Maintaining the Pedal Assembly

To maintain the pedal, grease the pin in the pedal link and check the springs and stops for wear.

Push the pedal down a few times to make sure it returns easily to the top position. If it does not return easily, probably the pin in the pedal link needs to be lubricated. If the pin is lubricated, check the springs at the rear of the pedal to make sure they are not sprung.

While you are looking at the pedal, also check the front and rear rubber stops for wear.



**Figure 3-1 Opened Control Panel**

### Lubricating the Pin

1. Turn off the power to the game.
2. Disconnect the pedal wiring harness from the main harness.
3. Remove the four nuts that hold the pedal in the game. Use a 7/16-inch wrench.
4. Take the pedal out of the game.
5. On the left side of the pedal assembly at the bottom is a hole for lubricating the pin and the slot. Put lithium grease on the pin and in the slot. Push the pedal up and down to work the grease around to lubricate the slot.

6. Reinstall the pedal in the game and reconnect the harness.

### 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.

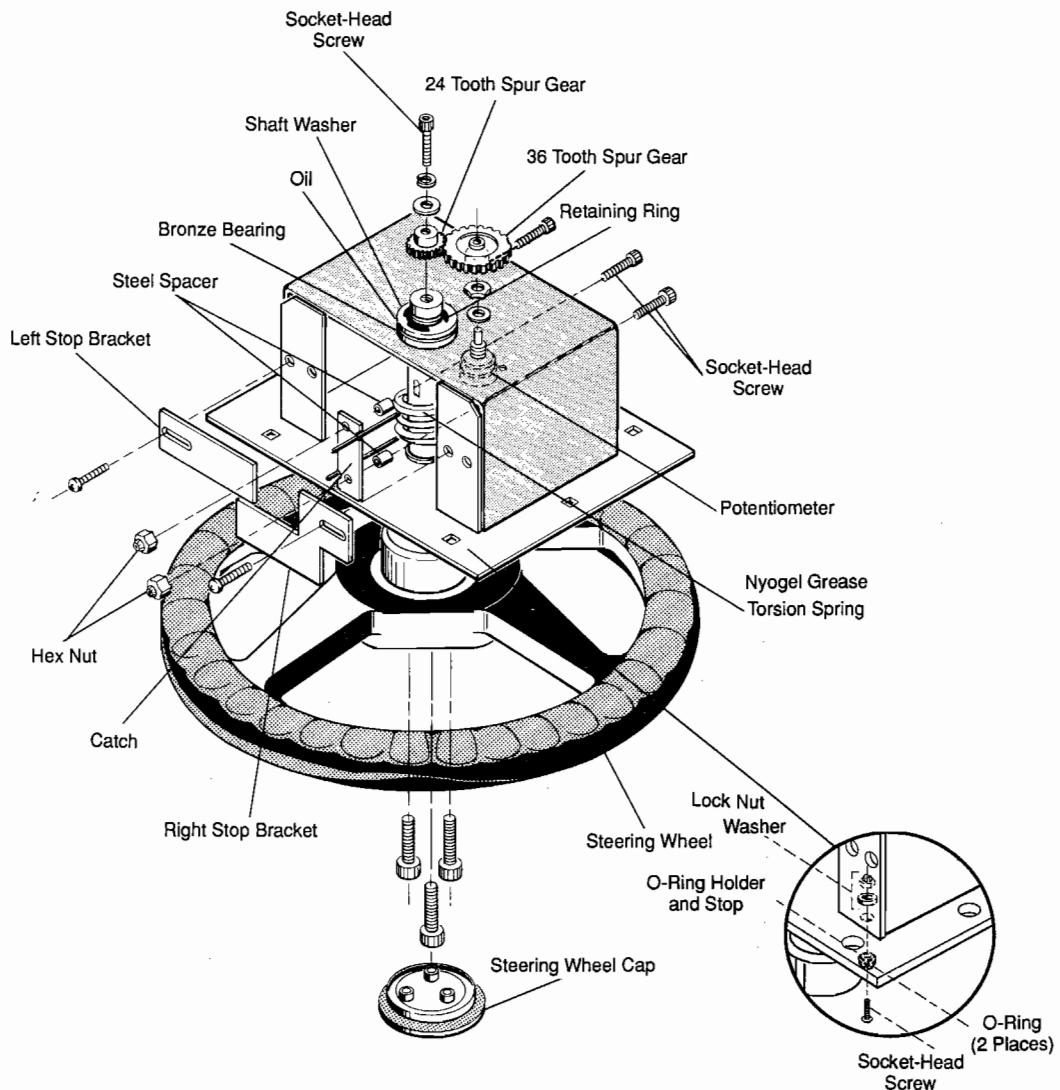


Figure 3-2 Maintaining the Steering Wheel Assembly

# Cleaning the Interior Components

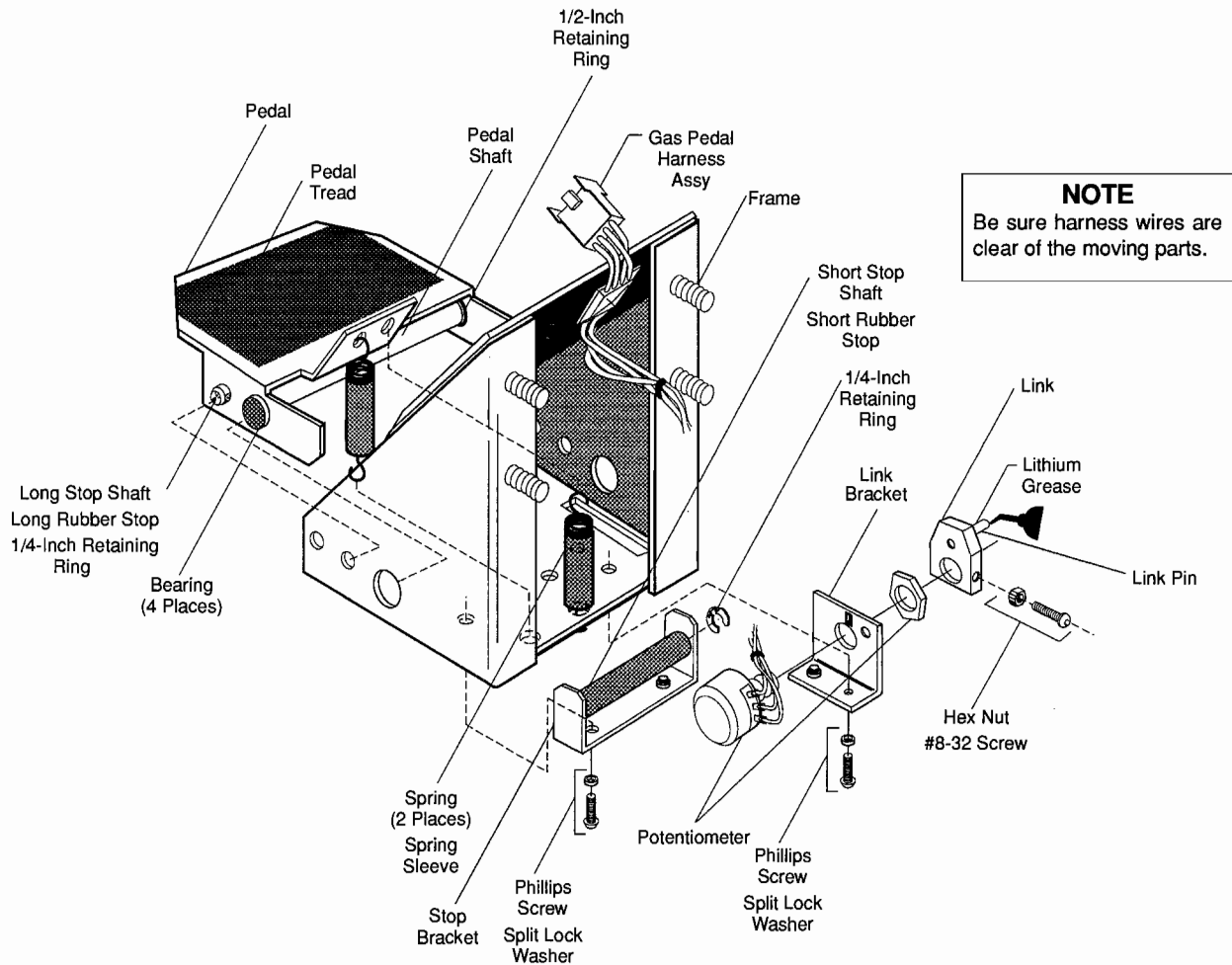
Perform the following procedure to clean the components inside the cabinet.

1. Open the rear access panel and display service panel.

## 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.*

2. 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 solid gauge wire to a well-insulated screwdriver or wooden handle.
  - b. Attach the other end of the wire to an earth ground.
  - c. Quickly touch the blade end of the screwdriver to the CRT anode by sliding it under the anode cap.
  - d. Wait two minutes and repeat part c.
3. Use a vacuum cleaner with a soft long-bristled brush attachment or use a soft-bristled paint brush



**Figure 3-3 Maintaining the Pedal Assembly**

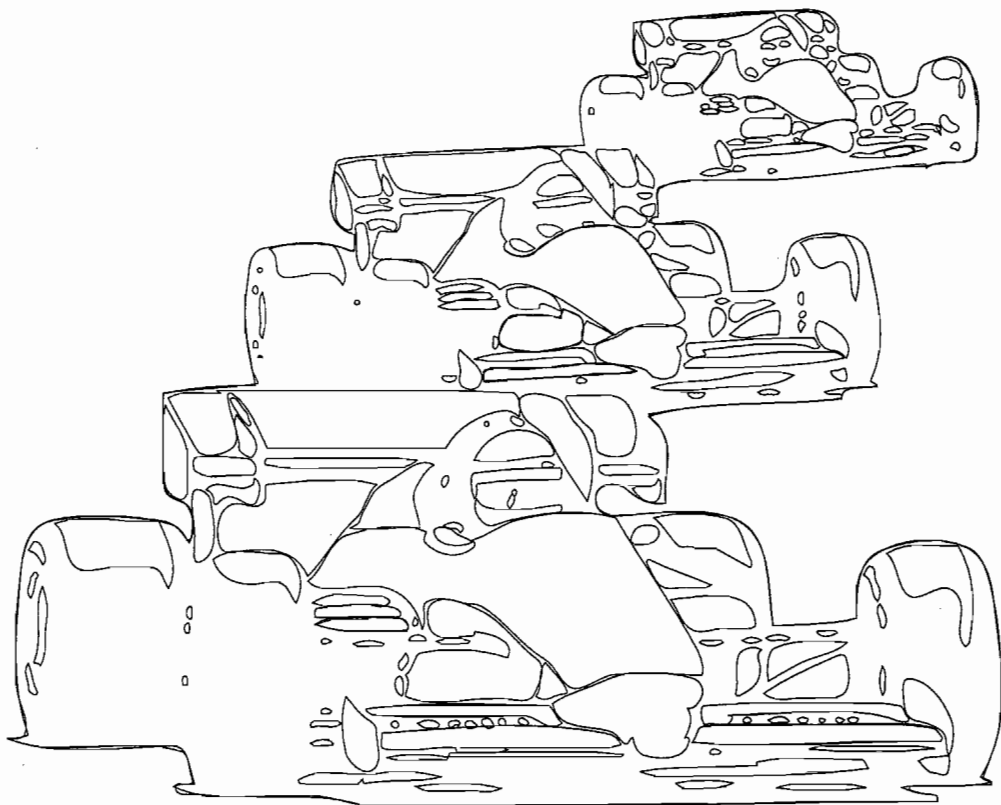
to remove loose dirt and dust accumulated on the inside of the cabinet. Be sure to clean the electrical components thoroughly (power supplies, PCB assemblies, display, etc.).

---

**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.*

---





# Repairs

Repairs include the removal, disassembly, reassembly-assembly, and replacement of game components. The following procedures are provided for components that may require repairs.

Use Table 3-2 to find the solution to problems you may be having with your Final Lap Upright game.

## Replacing the O-Rings on the Steering Wheel Stop

If the steering wheel hits metal when it turns, the O-rings on the steering wheel stop must be replaced. See Figure 3-2.

1. Open the control panel.
2. Remove the steering wheel.
  - a. Pry off the center steering wheel cover.
  - b. Remove the three hex-head screws underneath the cover that hold the steering wheel on the steering wheel assembly. Take off the steering wheel.
3. Take off the nuts that hold the plastic dashboard in place. Use a 7/16-inch wrench.

The stop is located on the front of the steering wheel assembly and is held on by a nut inside the steering

**Table 3-2 Game Troubleshooting**

Problem	Solution
<b>Steering Wheel</b>	
Hits metal when it turns	Replace O-rings on the stop.
Spins freely	Replace stop and spring.
Does not return to center, but does not spin freely	Replace spring.
Fails the self-test	Check mechanical parts, then replace potentiometer.
Steering wheel is broken, but internal mechanism is undamaged.	Replace steering wheel.
<b>Shifter</b>	
No response from screen; no change in volume when shifter is moved	Replace the microswitch if other parts are in good condition.
<b>Pedal</b>	
Sticks	Grease pin on pedal link (described in <i>Preventive Maintenance</i> ).
Does not return	First grease pin, then check springs. Replace springs if necessary.
Fails the self-test	Check mechanical parts, then replace potentiometer.
At top or bottom of the movement, the pedal hits metal.	Replace rubber stops.
<b>Video Display</b>	
Any problem	Refer to video display service manual.
<b>Speaker</b>	
No sound	Make sure volume is turned up for each speaker. If the volume is turned up, do the following: Do the self-test. Check the wiring and the volume control potentiometer. Replace the defective speaker.
<b>Non-Mechanical Problems</b>	
Players cannot race together.	Check the switch on the link PCB to make sure it is in the right position. (This is described in Chapter 1.)
Players have the same color of cars.	With one or two cabinets linked, each player can have an individual color. With more than two cabinets linked, some players will have the same color cars. For more information, see Chapter 1, <i>Choosing the Car Type</i> .
Players do not receive the same number of laps, even though they are racing together.	Check that the ROUND setting in the self-test is the same for all players.

wheel assembly housing. Two O-rings are mounted on the stop. If one is broken or worn, replace both.

4. Slide the old O-rings off and slide the new O-rings on. Make sure the O-rings fit properly in the grooves on the stop.
5. Install the plastic dashboard.
6. Install the steering wheel. Install the three screws and tighten them to 95 inch-pounds.
7. Close the control panel.

## If the Steering Wheel Does Not Return to the Center

If the steering wheel does not snap back to the center when you turn it, you may need to replace the stop and the spring. See Figure 3-2.

Replace the stop and the spring if you can spin the steering wheel in a complete circle.

Replace the spring if the steering wheel does not return to the center, but does not spin in a complete circle.

## Replacing the Spring on the Steering Wheel Assembly

1. Open the control panel.
2. Loosen the screw on the end of the steering shaft. Take off small gear at the end of the steering shaft.
3. Pry off the retaining ring. Be careful when you pry it off, since it will fly off the shaft.
4. Remove the large washer below the retaining ring.
5. Take off both stop brackets by removing the cross-recessed screws holding the brackets on the case.
6. Take off the catch on the spring. Use 9/64-inch Allen wrench on the socket-head screws and an 11/32-inch hex driver on the Nyloc nuts. Remove the screws, nuts, spacers, and catch.
7. Pull the shaft out a small amount towards the steering wheel and remove the spring.
8. Grease the shaft with Nyogel, if necessary. Put on a new spring. The spring must be well lubricated with Nyogel grease.
9. Replace the washer and retaining ring.
10. Replace the catch. Make sure it holds the spring in tension.
11. Replace the gear and the socket-head screw on the end of the shaft. The steering shaft gear must mesh with the gear on the potentiometer shaft and must be the same height. If not, move the gear on the potentiometer shaft.

12. If you move the gear on the potentiometer shaft:
  - a. Make sure the flat part of the potentiometer shaft lines up with the center terminal on the potentiometer.
  - b. Now put the gear on the potentiometer. Make sure it completely meshes with the gear on the steering shaft and is the same height as the other gear.
  - c. Check to be sure the potentiometer gear set screw is on flat part of potentiometer shaft and lines up with the center terminal on the potentiometer. Tighten the set screw.
13. When the gears mesh and are the same height, tighten the set screw on the gear on the potentiometer shaft.
14. Reassemble the steering shaft. If you do not need to replace the stop, close the control panel and install the tamperproof screws.

## Replacing the Stop on the Steering Wheel Assembly

1. Open the control panel.
  2. Remove the steering wheel.
    - a. Pry off the center steering wheel cover.
    - b. Remove the three hex-head screws underneath the cover that hold the steering wheel on the steering wheel assembly. Take off the steering wheel.
  3. Take off the nuts that hold the plastic steering wheel cover in place. Use a 7/16-inch wrench.
- The stop is located on the front of the steering wheel assembly and is held on by a nut inside the steering wheel assembly housing. See Figure 3-3. If the steering wheel can be turned in a complete circle, then the stop is probably sheared off in front.
4. Remove the nut that holds the stop on the inside of the steering wheel assembly. Use a 3/8-inch flat wrench. Insert the wrench through the back of the housing to get the nut off.
  5. Put on a new stop. Tighten the nut to 47 inch-pounds.
  6. Make sure the two O-rings are securely in the grooves.
  7. Install the plastic dashboard.
  8. Install the steering wheel. Put a drop of glue on each of the three screws before you install them, and then tighten the screws to 95 inch-pounds.
  9. Close the control panel.

## Replacing the Steering Wheel Potentiometer

If the steering wheel spring and the stop are good, but the player's car on the video display is not responding, check to see if the steering wheel fails the self-test. If it fails, you may need to replace the potentiometer.

1. Open the control panel. See Figure 3-2.
2. Take off large gear on the potentiometer shaft. Use a 5/64-inch Allen head wrench to loosen the gear set screw.
3. Use a 1/2-inch hex driver to remove the lock nut and washer that hold the potentiometer on the case.
4. Push the potentiometer out towards steering wheel. Remove the wiring harness.
5. Replace the potentiometer. Put the key into the hole in the case.
6. Make sure flat part of the potentiometer shaft lines up with the center terminal on the potentiometer.
7. Tighten the potentiometer lock nut to 30 inch-pounds.
8. Now put on the gear on the potentiometer. Make sure it completely meshes with the gear on the steering shaft and is the same height as the other gear.
9. Check to be sure the potentiometer gear set screw is on flat part of potentiometer shaft and lines up with the center terminal on the potentiometer. Tighten the set screw.
10. Install the wiring harness. The red wire is on the left, the brown wire is in the middle, and the black wire is on the right.

## Replacing the Steering Wheel

If you want to replace the steering wheel, but not the inside controls, follow this procedure. You do not need to open the control panel.

1. Pry the center cover off of the steering wheel.
2. Use a 1/4-inch Allen wrench to remove the three screws in the center of the wheel.
3. Remove the steering wheel.
4. Install the new steering wheel. Install the screws and torque each one to 95 inch-pounds.
5. Replace the center cover.

## Replacing the Gear Shift Assembly

1. Open the control panel.
2. Disconnect the wiring harness from the micro-switch.
3. With a 3/8-inch nut driver, remove the four nuts holding the gear shift on the panel.
4. Remove the gear shift through the front of the control panel.
5. Replace the gear shift. Assemble in reverse order.

## Replacing the Microswitch on the Gear Shift Assembly

1. Open the control panel.
2. Disconnect the wires to the switch on the gear shift. See Figure 3-4.
3. Remove the screws that hold the switch on the gear shift.
4. Remove the switch.
5. Replace in reverse order.

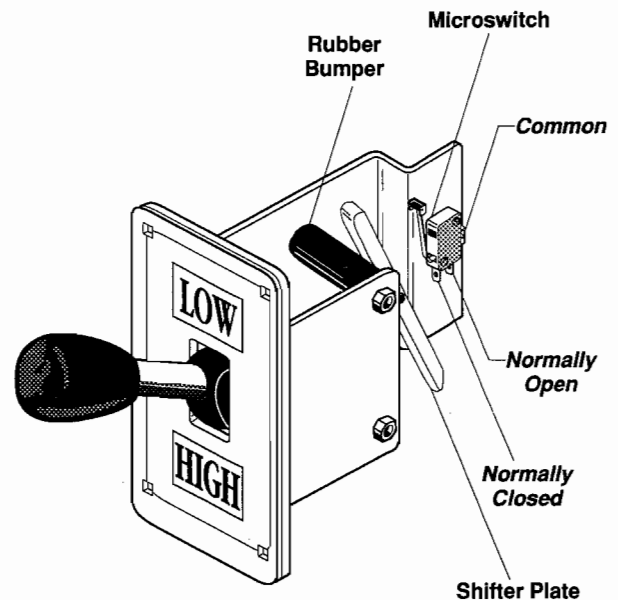


Figure 3-4 Repairing the Gear Shift

## Replacing the Stops on the Foot Pedal Assembly

If the pedal has worn through the rubber stops on the back or the front, you should replace the stops.

1. Turn off the power to the game.
2. Disconnect the pedal wiring harness from the main harness.
3. Remove the four nuts that hold the pedal in the game. Use a 7/16-inch wrench.
4. Take the pedal out of the game.

### Replacing the Front Stop

5. Remove the retaining rings from the stop shaft. Now remove the shaft from the frame. See Figure 3-3.
6. Take off the old rubber stop. Slide on the new stop.
7. Reinstall the shaft in the frame and put on the retaining rings.
8. Put the pedal back into the game, put on the nuts, and reconnect the harness.

### Replacing the Back Stop

5. Take the springs off the frame. See Figure 3-3.
6. Remove the cross-recessed screws on the bottom of the pedal that hold the stop bracket on the frame. Remove the stop bracket.
7. Remove the retaining rings from both ends of the stop shaft. Now remove the shaft from the bracket.
8. Take off the old rubber stop. Slide on the new stop.
9. Put the shaft back in the bracket. If you bend the bracket taking the shaft out or putting it in, be sure to bend it back before you reinstall it.
9. Install the stop bracket in the frame. Reconnect the springs.
10. Put the pedal back into the game, put on the nuts, and reconnect the harness.

## Replacing the Pedal Potentiometer

If the pedal fails the self-test, you may need to replace the potentiometer. However, first make sure that the link and the pin are functioning properly. See Figure 3-3.

1. Take the pedal assembly out of the game.
2. Remove the wiring harness from the potentiometer.
3. Take the bracket with the potentiometer on it out of the pedal frame by removing the two cross-recessed screws in the bottom of the frame.
4. Take the pedal link off the potentiometer shaft by loosening the lock nut holding the link on the shaft. Take off the nut and washer and remove the potentiometer.
5. Put on the new potentiometer. Make sure you insert the potentiometer key into the hole at the top of the bracket.
6. Put on the washer and lock nut. Tighten the lock nut on the potentiometer.
7. Install the pedal link the potentiometer shaft. Be sure to tighten the lock nut on the flat part of the shaft.
8. Reconnect the wiring assembly to the potentiometer. The wires to the potentiometer are red on the top, white in the middle, and black on the bottom.
9. Install the bracket back in the pedal frame.
10. Replace the pedal assembly in the game. Connect the pedal wiring harness to the main wiring harness.

## Removing the Video Display

Perform the following procedure to remove the video display. (See Figure 3-5.)

1. Turn the game power off and wait two minutes. Leave the power cord plugged in.

---

### **WARNING**

#### **High Voltage**

*The video display contains 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**

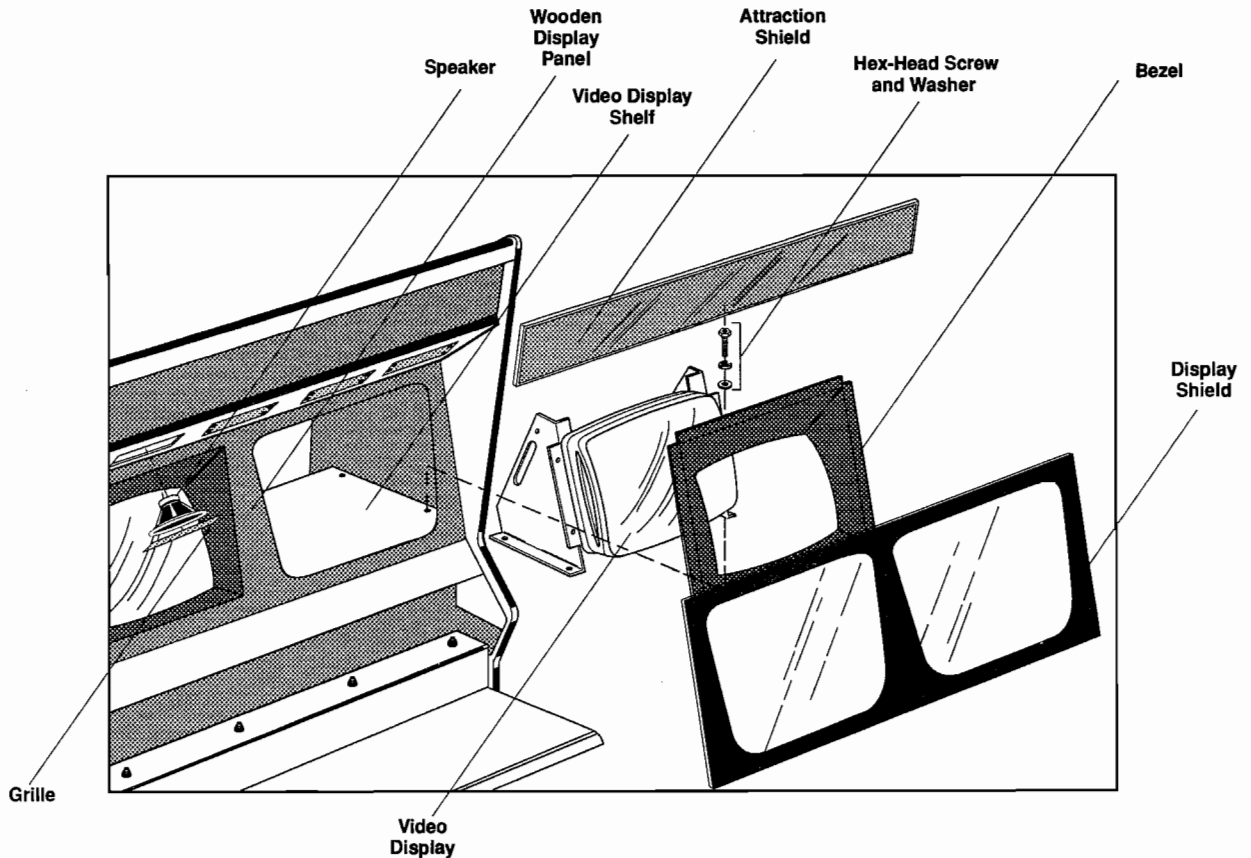
*The video display has been designed to minimize X-radiation. However, to avoid possible exposure to soft X-radiation, never modify the high-voltage circuitry.*

#### **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.*

---

2. Remove the top access panel and the small access panel.
3. Discharge the high voltage from the cathode-ray tube (CRT). The display assembly contains a circuit for discharging the high voltage to ground when power is removed. However, to make certain, al-



**Figure 3-5 Video Display Removal**

ways discharge the display as follows:

- a. Attach one end of a solid 18-gauge wire to a well-insulated screwdriver or wooden handle.
- b. Attach the other end of the wire to an earth ground.
- c. Quickly touch the blade end of the screwdriver to the CRT anode by sliding it under the anode cap.
- d. Wait two minutes and repeat part c.
4. Disconnect the display harness connectors from the display.
5. Remove the four tamperproof screws in the control panel and open the control panel.
6. Use a screwdriver to pry up the bottom edge of the display shield. Remove the display shield.
7. Take out the bezel.
8. Remove the wooden display panel which is held on the cabinet with six cross-recessed screws.
9. Use a 3/8-inch nut driver to remove the four hex head screws holding the video display mounting brackets on the cabinet shelf.

10. Pull the display forward and carefully lift the display out.
11. Replace the video display as described in the following procedure.

### **WARNING**

*When you take the video display out of the cabinet, do not drop it!*

*To make the removal easier, we recommend that two people work together to remove the display and that you wear gloves to protect your hands from the sheet-metal edges.*

## **Replacing the Video Display**

Perform the following procedure to replace the video display in the cabinet. (See Figure 3-5.)

1. Carefully lift the video display onto the display shelf in the cabinet.

**NOTE**

*When you replace the cathode-ray tube and yoke as a single unit, adjust the brightness, size, and centering as described in the display manual. Check the purity and convergence according to the display manual instructions, but adjust both only if required.*

2. Position the display so that the four holes in the video display mounting brackets line up with the four holes in the video display shelf.
3. Loosely install the four hex-head screws through the mounting brackets and into the video display shelf.
4. Install the wooden display panel the with six cross-recessed screws.
5. Install the bezel.
6. Install the video display shield by resting it on the lip above the control panel.
7. Close the control panel and screw in the four tamperproof screws.
8. With the hex-head screws loosely installed, push the video display forward to meet the bezel.
9. Use a 3/8-inch nut driver to tighten the bolts. Be sure that the display is centered horizontally.
10. Connect the display harnesses to the display.
11. Replace the access panels.

## Removing the Game PCBs

Perform the following procedure to remove or replace the Final Lap Video, CPU or EMI PCBs.

1. Turn the game power off.
2. Open and remove the service panel.
3. The vertical green PC board is the EMI board. It is connected to the CPU PCB and the video PCB inside the EMI enclosure. The EMI enclosure is the perforated metal box. See Figure 1-4.
4. Remove the six screws that hold the EMI PC board on the enclosure.
5. Take off the edge connectors on the EMI PC board.
6. Carefully pull the EMI PC board out, along with the CPU and the video PCBs.
7. Replace the Game PCBs in the reverse order of removal.

## Replacing Static-Sensitive Devices

Be careful when you are working with static-sensitive devices on the game PCBs. These can be 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 that has built up in your body can cause a static-sensitive device to fail. Leakage from an improperly grounded soldering iron can also cause a static-sensitive device to fail.

Before you handle 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 object that has been earth grounded. When you solder a static-sensitive device, use a soldering iron with a properly grounded three-wire cord.

Before you replace a static-sensitive device, make sure it is actually defective. A static-sensitive device can appear defective due to leakage on a PCB. To make sure a device is defective, ground any static voltages as described in the paragraph above. Clean both sides of the PCB with flux remover or an eraser. For discrete FETs, clean thoroughly between the gate, drain, and source leads. Then test the device.

If you are replacing a static sensitive device, new static-sensitive devices may be packaged in conductive foam or may 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.

## Removing the Speakers

Perform the following procedure to remove the speakers. See Figure 4-1 for the location of the speakers.

1. Turn the game power off.

---

### **CAUTION**

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

---

2. Remove the speaker grille and remove the screws that hold the speaker in place.

# Illustrated Parts Lists

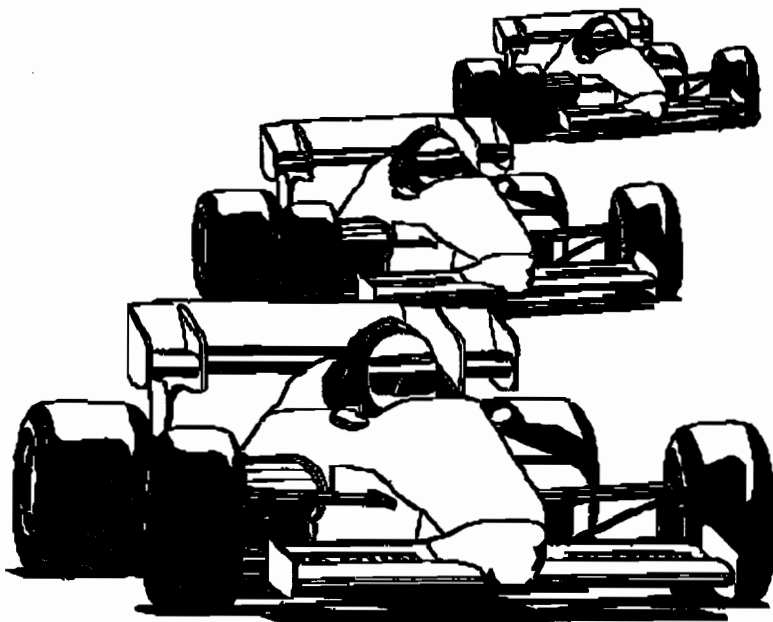
This chapter provides information you need to order parts for your game. Common hardware parts, such as screws, nuts, washers, and so on usually are not listed in the parts lists.

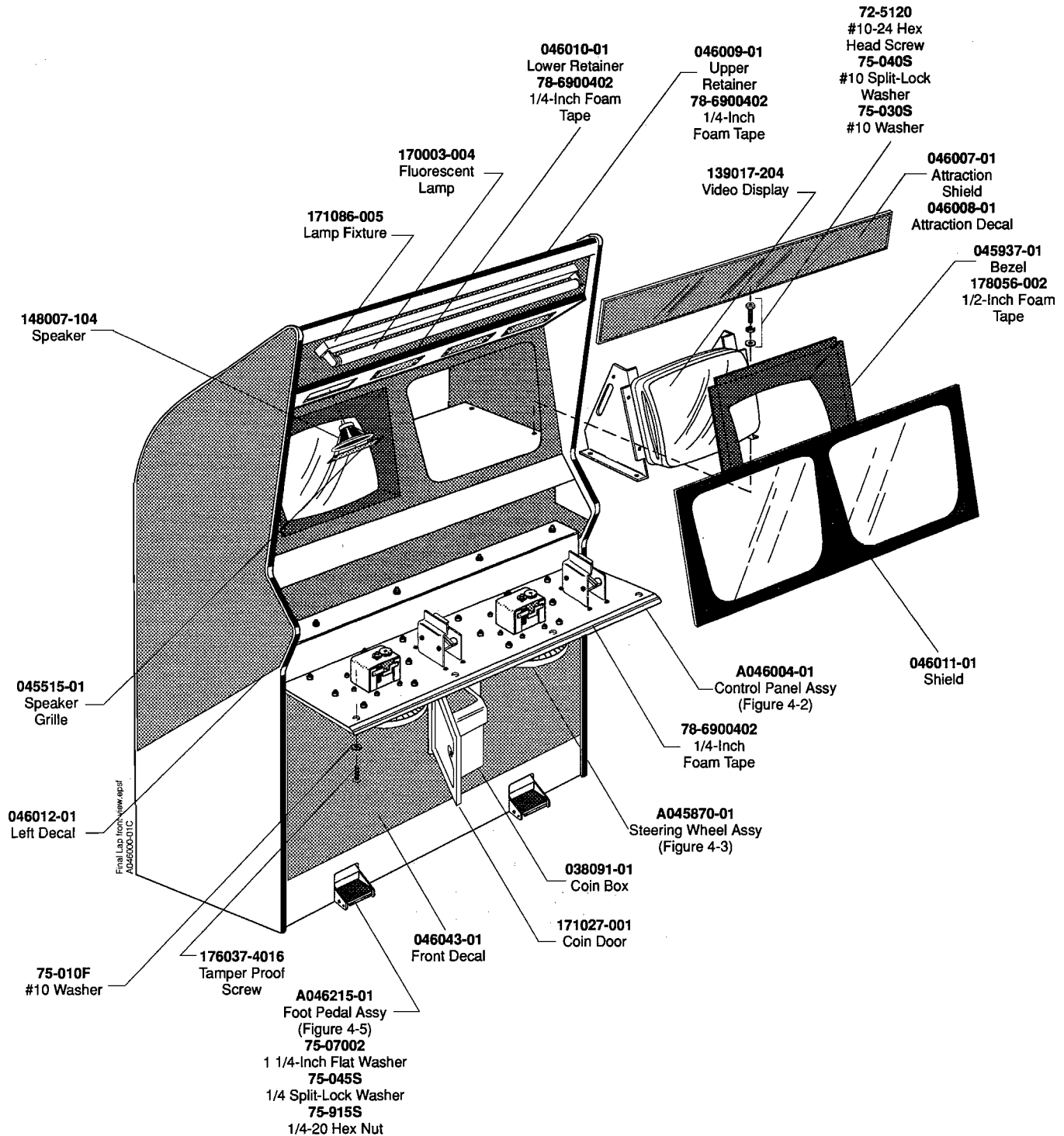
The parts lists (except for the PCB parts lists) are arranged alphanumerically by Atari part number. All A-prefix numbers, which are assemblies, come first. Next are part numbers with six numbers followed by a hyphen (000598- through 201000-). Ending the list are part numbers with a two-number designation followed by a hyphen (00- through 99-).

The PCB parts lists are arranged in alphabetical order by component. Within each section the parts are arranged numerically by part number.

When you order parts, give the part number, part name, the number of this manual, and the serial number of your game. With this information, we can fill your order rapidly and correctly. We hope this will create less downtime and more profit from your games.

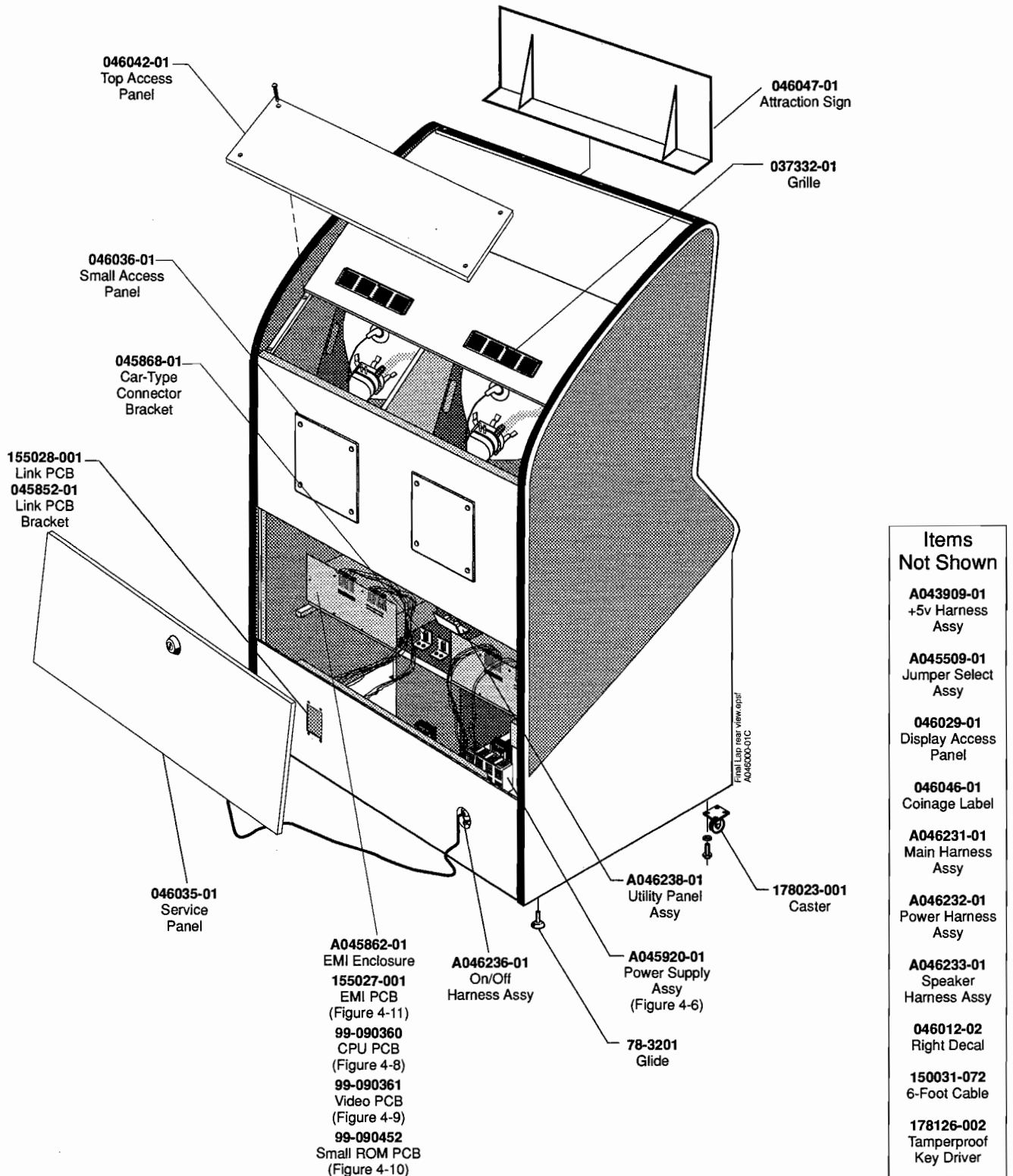
Atari Games Customer Service phone numbers are listed on the inside front cover of this manual.





**Figure 4-1 Cabinet-Mounted Assemblies, Front View  
A046000-01 D**





**Figure 4-1 Cabinet-Mounted Assemblies, Rear View  
A046000-01 D**

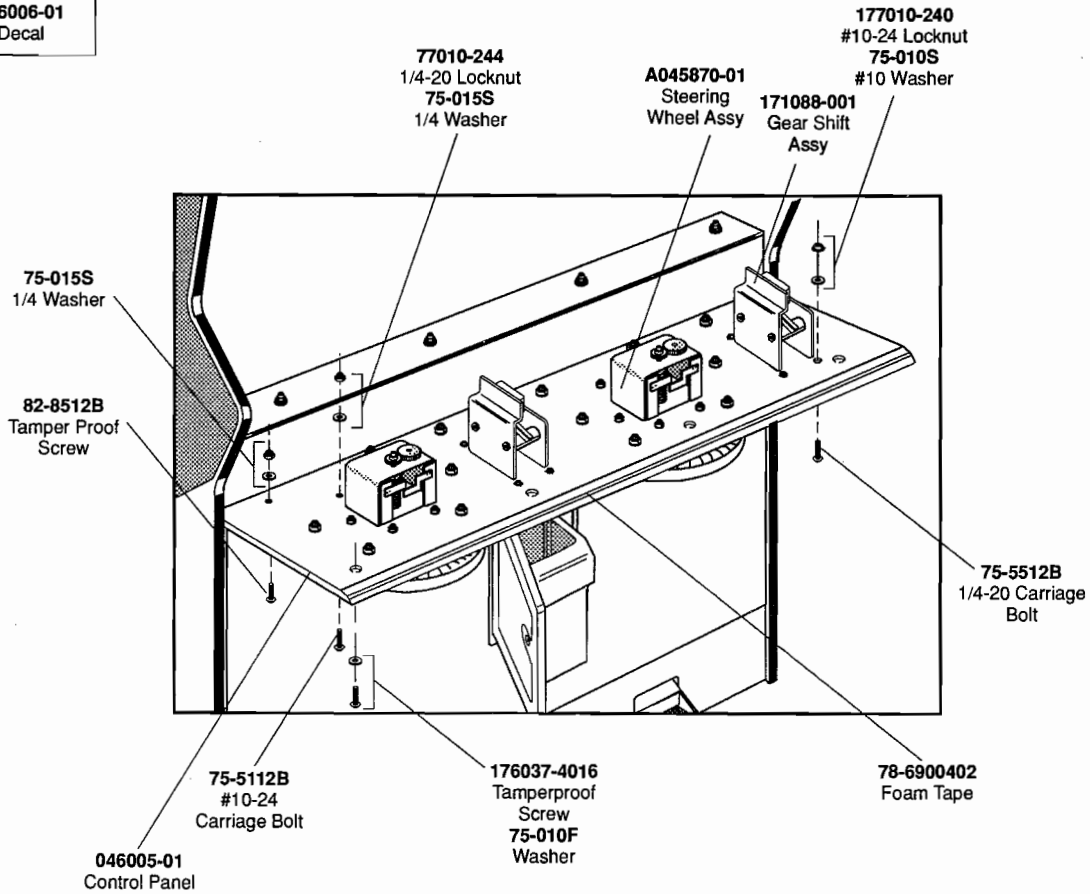
## Cabinet-Mounted Assemblies Parts List

Part No.	Description
A043909-01	+5v Harness Assembly
A045846-01	Coin Door Label
A045862-01	EMI Enclosure Assembly
A045909-04	Jumper Select Assembly
A045920-01	Power Supply Assembly (See Figure 4-6)
A046004-01	Control Panel Assembly (See Figure 4-2)
A046215-01	Foot Pedal Assembly (See Figure 4-5)
A046231-01	Main Harness Assembly
A046232-01	Power Harness Assembly
A046233-01	Speaker Harness Assembly
A046236-01	On/Off Harness Assembly
A046238-01	Utility Panel Assembly
037332-01	Louvered Grille
038091-01	Molded Coin Box
045515-01	Speaker Grille
045846-01	Coin Door Label
045852-01	Link PCB Bracket
045868-01	Car-Type Selection Connector Bracket
045937-01	Display Bezel
046007-01	Attraction Shield
046008-01	Attraction Decal
046009-01	Upper Retainer
046010-01	Lower Retainer
046011-01	Silkscreened Video Display Shield
046012-01	Left Decal
046012-02	Right Decal
046029-01	Display Access Panel
046035-01	Service Door
046036-01	Small Access Panel
046042-01	Top Access Panel
046043-01	Front Decal
046046-01	Coinage Decal
046047-01	Attraction Sign
139017-204	19-Inch Wells-Gardner Video Display
148007-104	Speaker
150031-072	6-Foot Connecting Cable with Phono Plugs
150031-120	10-Foot Connecting Cable with Phono Plugs (Not included with game; order separately.)
150031-240	20 Foot Connecting Cable with Phono Plugs (Not included with game; orderseparately.)
155027-001	EMI PCB (See Figure 4-11)
155028-001	Link PCB (See Figure 4-12)
170003-004	36-Inch, 30W Cool White Fluorescent Lamp
171027-001	Over/Under 25¢/25¢ USA Coin Door (See Figure 4-7)
171086-005	36-Inch Fluorescent Lamp Fixture
176037-4016	Tamper Proof Black Screw
178023-001	4-Inch Swivel Caster
178056-002	Double-Sided 1/2-Inch Wide Foam Tape
178126-002	Tamperproof Hex Key Driver

## Cabinet-Mounted Assemblies Parts List

Part No.	Description
178232-001	Lamp Retainer Clip
72-5120	#10-24 Hex Head Screw
72-5516	1/4-20 Hex Head Screw
75-010F	#10 Black Washer
75-030S	#10 Flat Washer
75-040S	#10 Split-Lock Washer
75-045S	1/4 Split-Lock Washer
75-07002	1 1/4-Inch Diameter Flat Washer
75-915S	1/4-20 Hex Nut
78-3201	Adjustable Glide
78-6900402	1/4-Inch Wide Foam Tape
99-090360	Final Lap CPU PCB (See Figure 4-8)
99-090361	Final Lap Video PCB (See Figure 4-9)
99-090452	Final Lap Piggyback PCB (See Figure 4-10)
<i>These are the technical supplements to the Final Lap Upright game:</i>	
SP-322	Schematic Package
ST-322	Self-Test Label
TM-296	19-inch Wells-Gardner Video Display (#19K7901) Service Manual
TM-325	Upright Final Lap Operator's Manual

Item  
Not Shown  
046006-01  
Decal



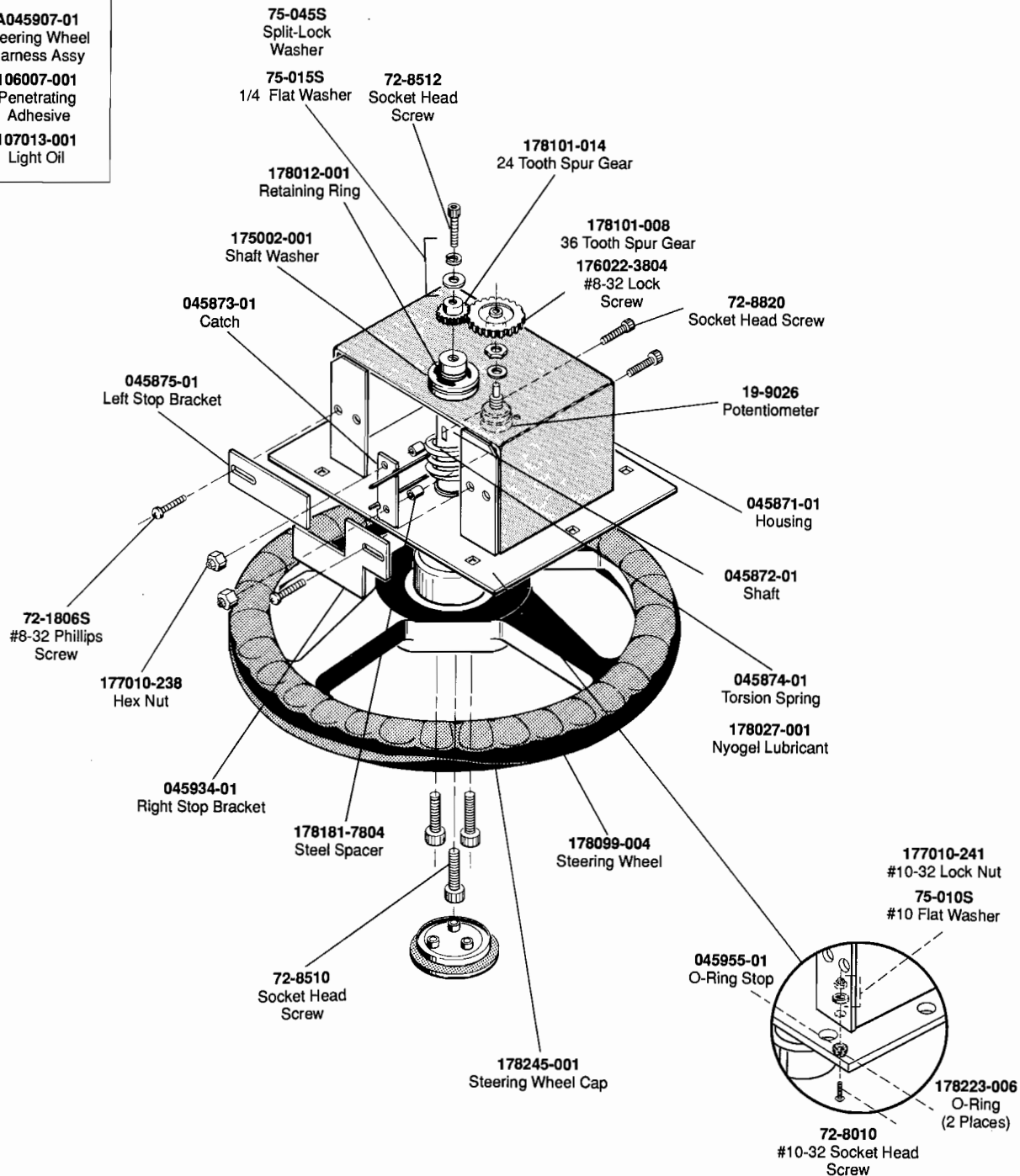
**Figure 4-2 Control Panel Assembly  
A046004-01 A**

**Control Panel Assembly  
Parts List**

Part No.	Description
A045870-01	Steering Wheel Assembly
044751-01	Formed Plastic Dashboard
046005-01	Control Panel
046006-01	Control Panel Decal
171088-001	Gear Shift Assy
177010-240	#10-24 Polymer Locknut
77010-244	1/4-20 Polymer Locknut
75-010S	#10 Flat Washer
75-015S	1/4 Flat Washer
75-5112B	#10-24 Black Carriage Bolt
75-5512B	1/4-20 Black Carriage Bolt
82-8512B	Tamperproof Screw

N O T E S

**Items Not Shown**  
 A045907-01 Steering Wheel Harness Assy  
 106007-001 Penetrating Adhesive  
 107013-001 Light Oil



**Figure 4-3 Steering Wheel Assembly  
 A045870-01 F**

## Steering Wheel Assembly Parts List

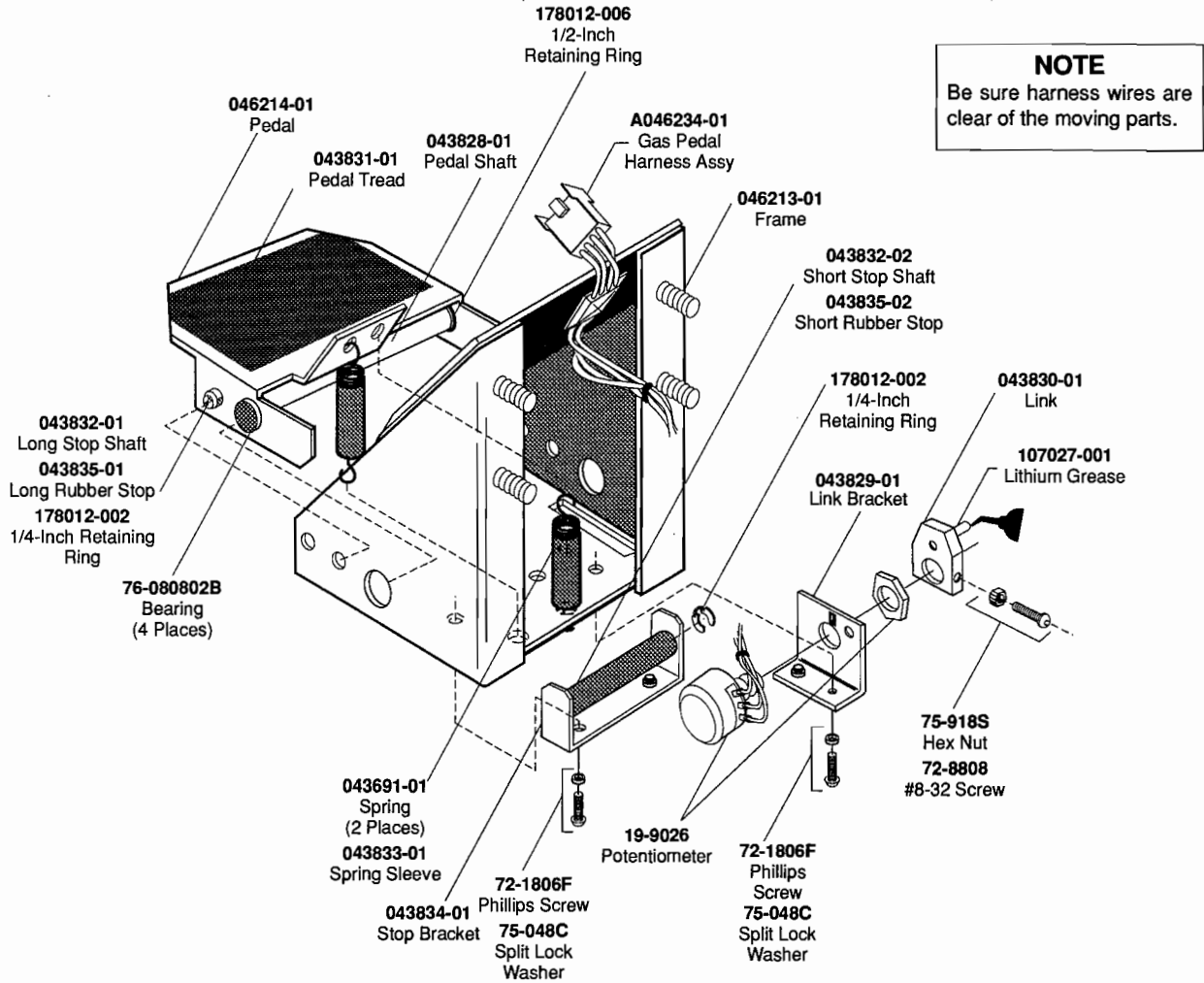
Part No.	Description
A045907-01	Steering Wheel Harness Assembly
045871-01	Housing
045872-01	Shaft
045873-01	Catch
045874-01	Torsion Spring
045875-01	Left Stop Bracket
045934-01	Right Stop Bracket
045955-01	O-Ring Stop
106007-001	Penetrating Adhesive
107013-001	Light Oil
175002-001	.750-Inch Diameter Shaft Washer
176022-3804	#8-32 x 1/4-Inch Socket Head Lock Screw
177010-238	#8-32 Nyloc Hex Nut
177010-241	#10-32 Nyloc Hex Nut
178012-001	.750-Inch Diameter Retaining Ring
178027-001	Nyogel Lubricant
178099-004	Steering Wheel
178101-008	36-Tooth Spur Gear with Hub
178181-7804	Steel Spacer
178223-006	O-Ring
178245-001	Steering Wheel Cap
178101-014	24-Tooth Spur Gear (Acceptable replacement is part no. 178101-007, spur gear with hub, with part no. 72-8518 (1/4-20 x 1.12-inch socket head screw) replacing part no. 75-8512 (#1/4-20 x .75-inch socket head screw).)
119008-1001	5K Ohm Potentiometer
72-8512	#1/4-20 Socket Head Screw
72-1806s	#8-32 Cross-Recessed Screw
72-8010	#10-32 Socket Head Screw
72-8510	#1/4-20 Socket Head Screw
72-8820	#8-32 Socket Head Screw
75-010s	#10 Flat Washer
75-015s	1/4 Flat Washer
75-045s	1/4 Flat Washer



**Figure 4-4 Gear Shift Assembly  
A045870-01 E  
Gear Shift Assembly  
Parts List**

<b>Part No.</b>	<b>Description</b>
99-215001	Handle and Shaft
99-215002	"Low/High" Cover Plate
99-215003	Microswitch
99-215004	Rubber Stop

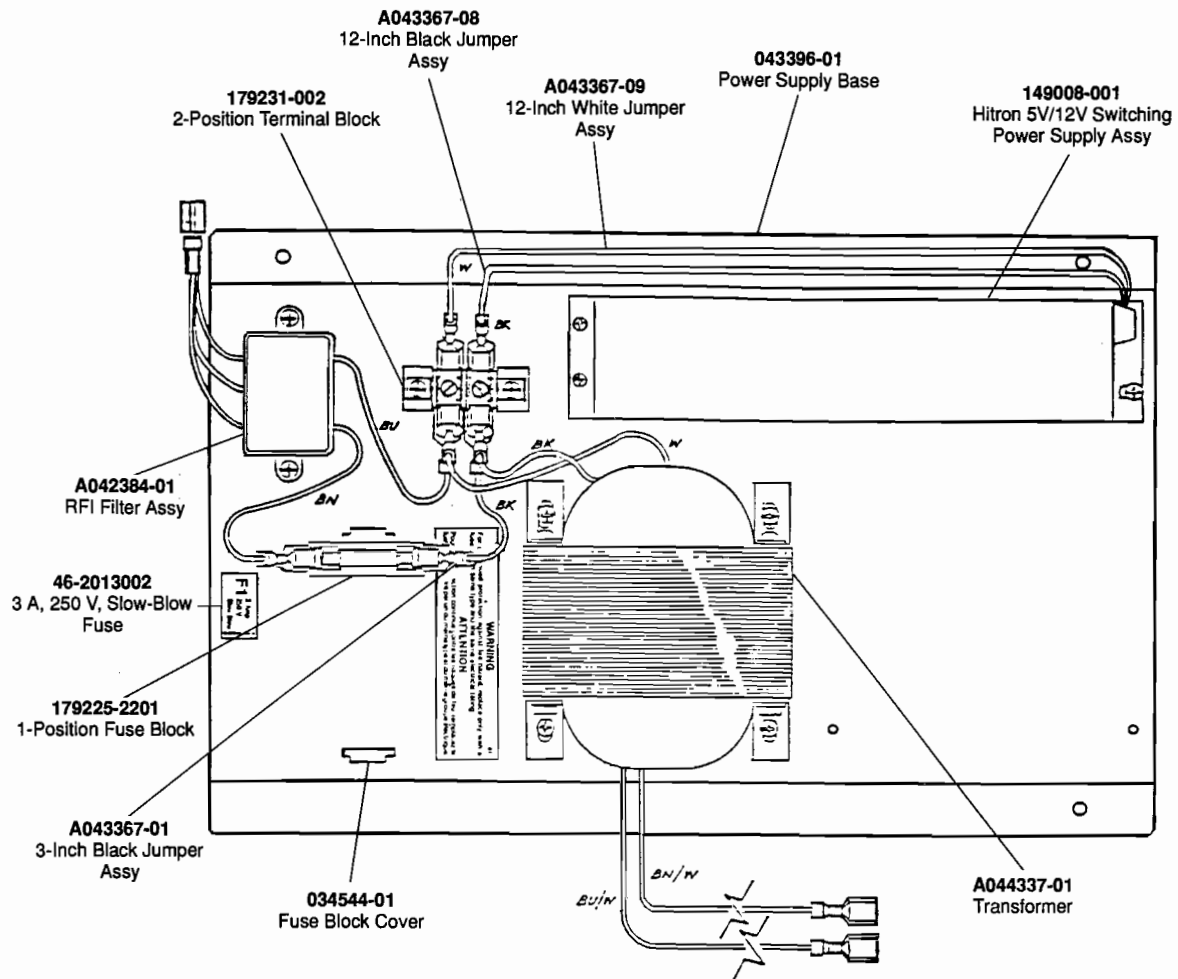




**Figure 4-5 Foot Pedal Assembly  
A046215-01A**

**Foot Pedal Assembly  
Parts List**

Part No.	Description	Part No.	Description
A046234-01	Gas Pedal Harness Assembly	046213-01	Frame
043691-01	Spring	046214-01	Pedal
043828-01	Pedal Shaft	107027-001	Lithium Grease
043829-01	Pedal Bracket	178012-002	1/4-Inch Diameter Retaining Ring
043830-01	Link	178012-006	1/2-Inch Diameter Retaining Ring
043831-01	Pedal Tread	19-9026	5K Ohm Potentiometer
043832-01	Long Stop Shaft	72-1806F	#8-32 Phillips Screw
043832-02	Short Stop Shaft	72-8808	#8-32 Hex Socket Head Screw
043833-01	Spring Sleeve	75-048C	#8 Split Lock Washer
043834-01	Stop Bracket	75-918S	#8-32 Hex Nut
043835-01	Long Rubber Stop	76-080802B	1/2-inch I.D. Nylon Bearing
043835-02	Short Rubber Stop		



**Figure 4-6 Switching/Linear Power Supply Assembly  
A045920-01 A**

## Switching/Linear Power Supply Assembly Parts List

Part No.	Description
A042384-01	RFI Filter Assembly
A043367-01	3-Inch Black Jumper Assembly
A043367-08	12-Inch Black Jumper Assembly
A043367-09	12-Inch White Jumper Assembly
034544-01	Fuse Block Cover
043396-01	Power Supply Base
142045-001	120 VAC Isolation Transformer
149008-001	Hitron 5V/12V Switching Power Supply Assembly—see below
179225-2201	1-Position Fuse Block
179231-002	2-Position Terminal Block
146008-2022	3 A, 250 V, Slow-Blow Fuse

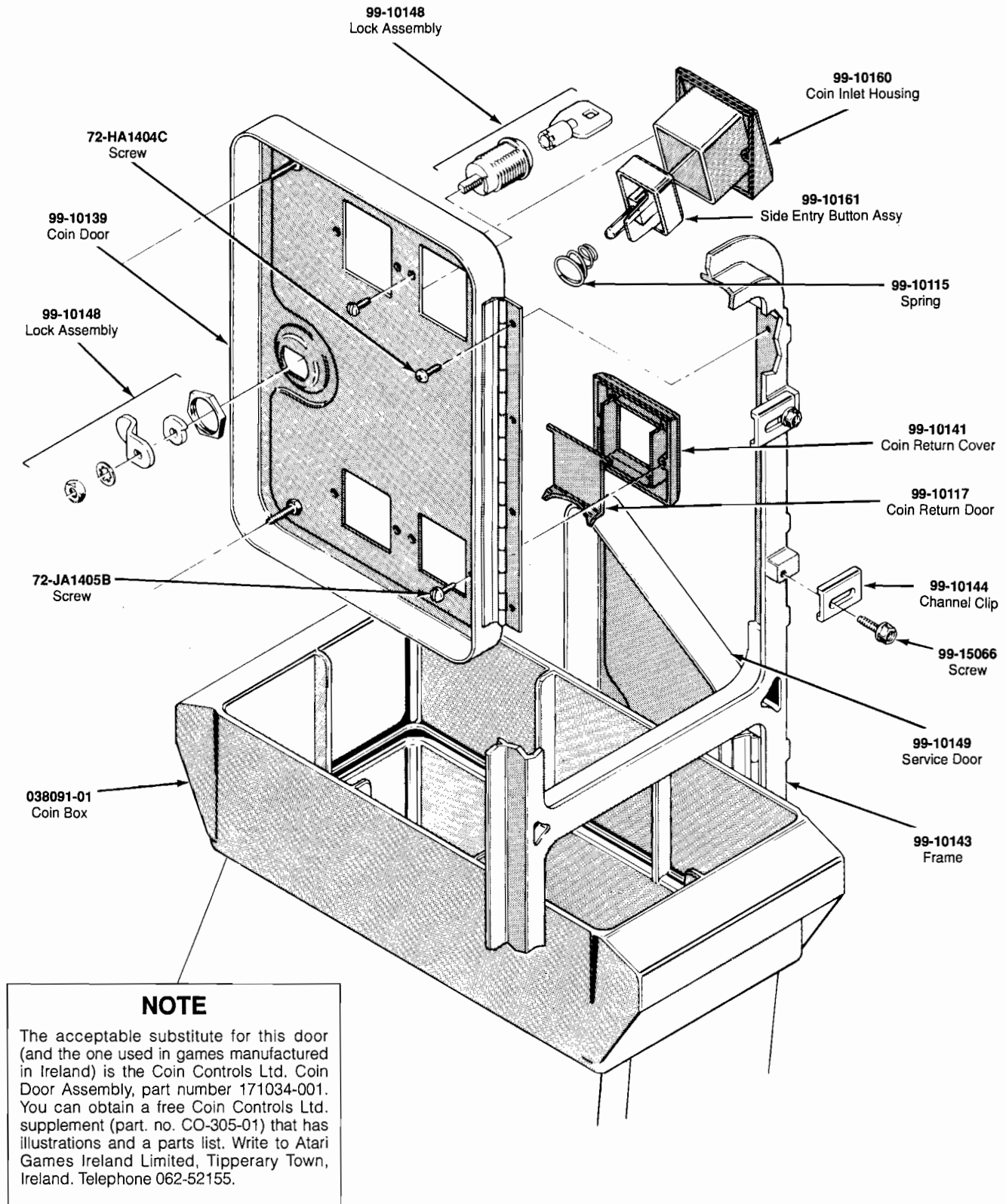
## Hitron 5V/12V Power Supply Sub-Assembly Parts List

Part No.	Description
<b>Capacitors</b>	
99-211036	Capacitor, Metal Film, 0.047 $\mu$ f, 250V
99-211037	Capacitor, Metal Film, 0.22 $\mu$ f, 100V
99-211038	Capacitor, Metal Film, 0.1 $\mu$ f, 400V
99-211039	Capacitor, Metal Film, 0.022 $\mu$ f, 100V
99-211040	Capacitor, Ceramic, 1800pf, 2 KV, Z5V
99-211041	Capacitor, Ceramic, 0.01uf, 1 KV, Z5U
99-211042	Capacitor, Ceramic, 0.001 $\mu$ f, 2 KV
99-211043	Capacitor, Ceramic, 470 Pf, 1KV, Z5P
99-211046	Capacitor, Electrolytic, 100 $\mu$ f, 200V
99-211047	Capacitor, Electrolytic, 1000 $\mu$ f, 25V
99-211079	Capacitor, DE7100F22M
99-211080	Capacitor, 1000 $\mu$ f, 35V
99-211081	Capacitor, 470 $\mu$ f, 25V
99-211082	Capacitor, 220 $\mu$ f, 16V
<b>Diodes</b>	
99-211005	Diode, Schottky, S10SC4M
99-211007	Diode, Zener, 1N752A
99-211008	Diode, Rectifier, 1N4006
99-211009	Diode, Fast Recovery, RPG10B
99-211010	Diode, Fast Recovery, RPG10K
99-211011	Diode, Fast Recovery, RPG15B
99-211012	Diode, Switching, 1N4148
99-211076	Diode, 31DQ04
<b>Inductors</b>	
99-211084	Inductor, 8 $\mu$ h

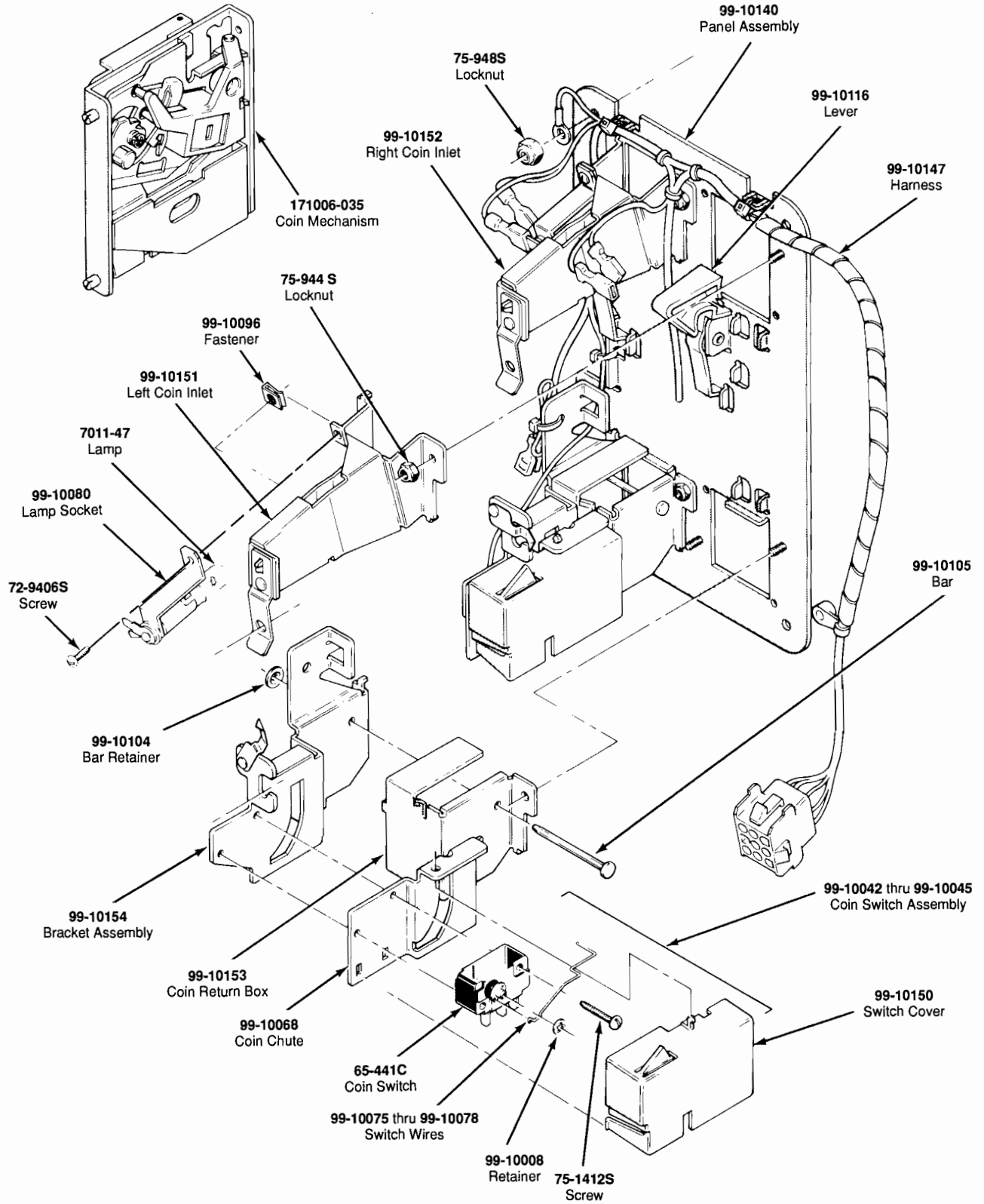
**Hitron 5V/12V Power Supply Sub-Assembly  
Parts List, Continued**

Part No.	Description
99-211085	Inductor, 9.8 $\mu$ h
99-211086	Inductor, 0.75 mh
99-211087	Inductor, 2.2 $\mu$ h
99-211088	Inductor, 60 mh
<b>Resistors</b>	
99-211014	Potentiometer, Trimming, 3K Ohm
99-211016	Resistor, Wire Wound, 150 Ohm, $\pm$ 5%, 2W
99-211017	Resistor, Wire Wound, 33 Ohm, $\pm$ 5%, 2W
99-211018	Resistor, Wire Wound, 0.47 Ohm, $\pm$ 5%, 2W
99-211019	Resistor, Wire Wound, 120 Ohm, $\pm$ 5%, 2W
99-211020	Thermistor, 0.5 Ohm, $\pm$ 5%, 5W
99-211021	Resistor, 2.2K Ohm, $\pm$ 2%, 1/4W
99-211023	Resistor, Carbon Film, 270 Ohm, $\pm$ 5%, 1/2W
99-211024	Resistor, Carbon Film, 470 Ohm, $\pm$ 5%, 1/4W
99-211025	Resistor, Carbon Film, 47 Ohm, $\pm$ 5%, 1/4W
99-211026	Resistor, Carbon Film, 330 Ohm, $\pm$ 5%, 1/4W
99-211027	Resistor, Carbon Film, 5.6 Ohm, $\pm$ 5%, 1/4W
99-211028	Resistor, Carbon Film, 8.2 Ohm, $\pm$ 5%, 1/4W
99-211029	Resistor, Carbon Film, 10 Ohm, $\pm$ 5%, 1/4W
99-211030	Resistor, Carbon Film, 39 Ohm, $\pm$ 5%, 1/4W
99-211031	Resistor, Carbon Film, 56 Ohm, $\pm$ 5%, 1/4W
99-211032	Resistor, Carbon Film, 1K Ohm, $\pm$ 5%, 1/4W
99-211033	Resistor, Metal Film, 2K Ohm, $\pm$ 2%, 1/4W
99-211035	Resistor, Carbon Film, 2K Ohm, $\pm$ 5%, 1/4W
99-211077	Resistor, 470 Ohm, 1/2W, $\pm$ 5%
99-211078	Resistor, 120K Ohm, 1W, $\pm$ 5%
<b>Transistors</b>	
99-211002	Transistor, NPN, 2SC1413A
99-211003	Transistor, NPN, PE8050B
<b>Miscellaneous</b>	
99-211059	Heat Sink
99-211061	Heat Sink, 1.5mm
99-211089	Transformer, 4.75 mh
99-211083	Transformer, Power
99-211001	Regulator, UA431AWC
99-211013	Rectifier, Silicon-Controlled, S2800

# N O T E S



**Figure 4-7 Coin Acceptors, Inc. Coin Door Assembly  
171027-001 A**



**Figure 4-7 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 x 3/8-Inch Truss-Head Screw
72-HA1404C	#4-40 x 1/4-Inch Pan-Head Screw
72-JA1405B	#4-40 x .31-Inch Pan-Head Screw
75-1412S	#4-40 x 3/4-Inch Pan-Head Screw
75-994S	#4-40 Locknut
99-10008	Retainer
99-10042	Coin Switch Assembly for Belgian 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
99-10139	Coin Door
99-10140	Coin Door Inner-Panel Assembly
99-10141	Die-Cast Coin Return Cover
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
99-10160	1-Inch Wide Die-Cast Coin Inlet Housing
99-10161	25¢ Amber Side-Entry Coin Button Assembly
99-15066	Screw for Clamp
171006-035	Metal Coin Mechanism for U.S. 25¢



# N O T E S

D2.P3 1S15P8  
IC1 78L05  
IC2 78L06

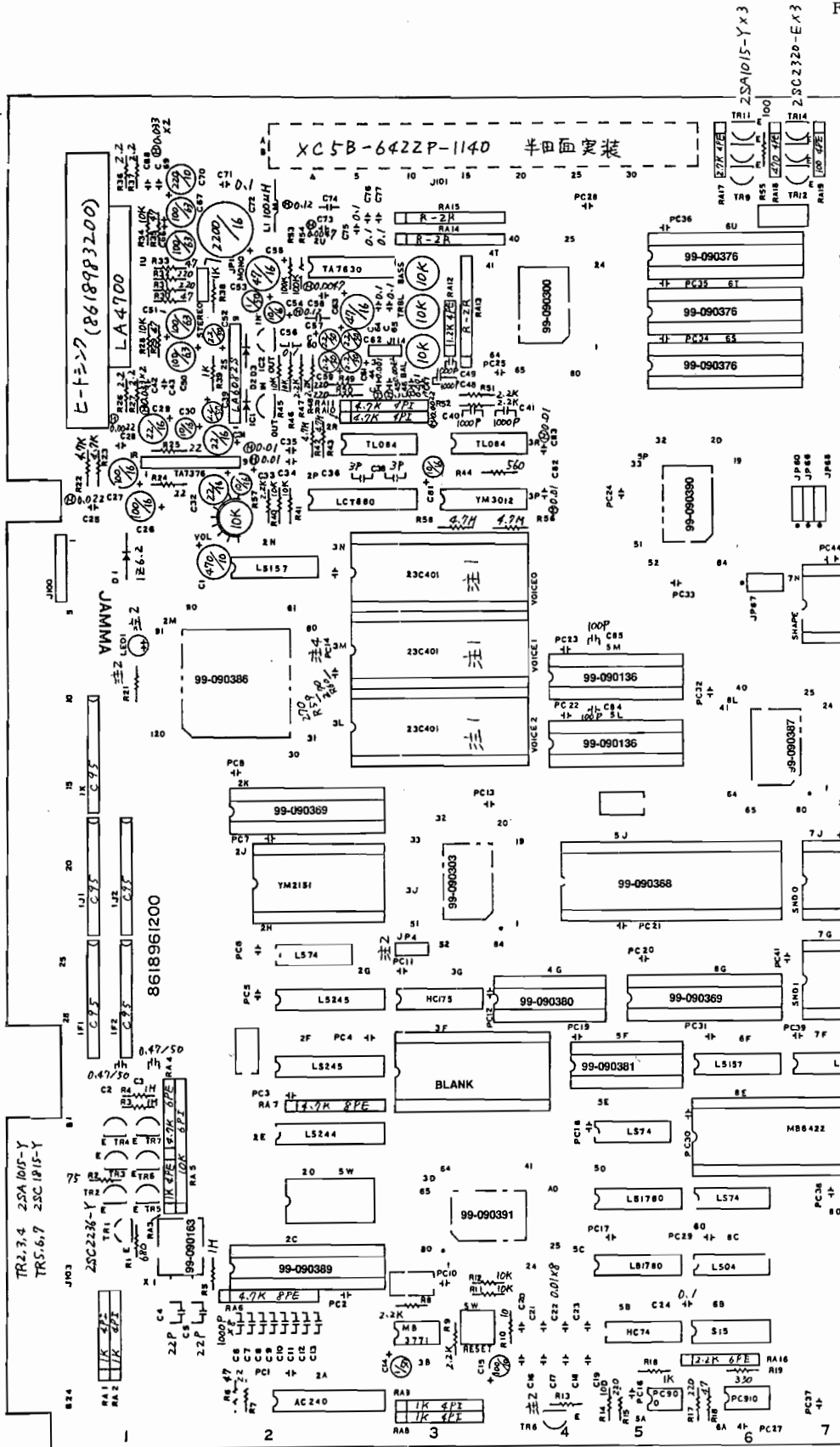


Figure 4-8 Final Lap CPU PCB Assembly  
99-090360

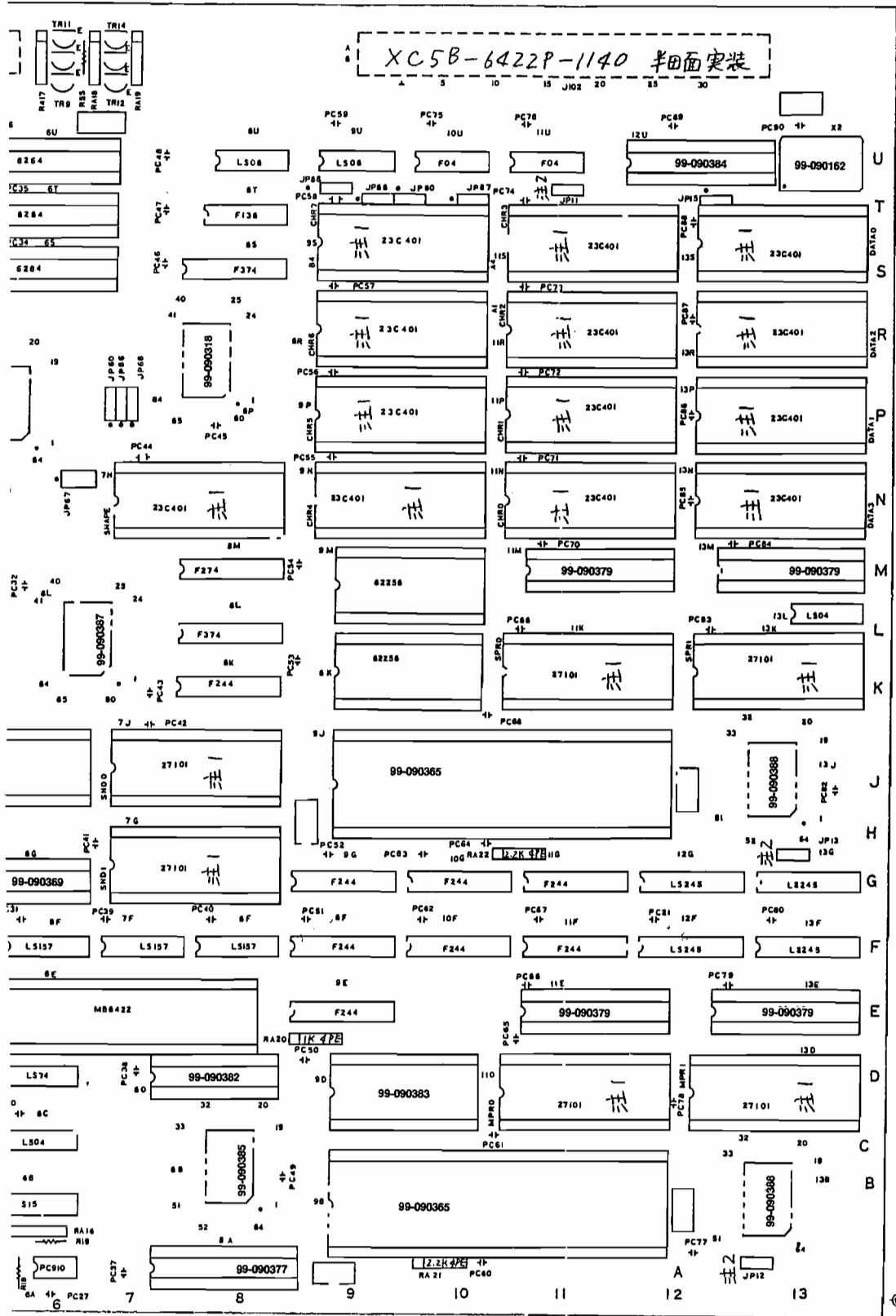


Figure 4-8 Final Lap CPU PCB Assembly, Continued  
99-090360

## Final Lap CPU PCB Assembly Parts List

Part No.	Description	Location
<b>Integrated Circuits</b>		
136063-1103	IC, PR EPROM, Final Lap, SP0	11K
136063-1104	IC, PR EPROM, Final Lap, SP1	13K
136063-1105	IC, PR EPROM, Final Lap, CHR0	11N
136063-1106	IC, PR EPROM, Final Lap, CHR1	11P
136063-1107	IC, PR EPROM, Final Lap, CHR2	11R
136063-1108	IC, PR EPROM, Final Lap, CHR3	11S
136063-1109	IC, PR EPROM, Final Lap, CHR4	9N
136063-1110	IC, PR EPROM, Final Lap, CHR5	9P
136063-1111	IC, PR EPROM, Final Lap, CHR6	9R
136063-1112	IC, PR EPROM, Final Lap, SND0	7J
136063-1113	IC, PR EPROM, Final Lap, SHA0	7N
136063-1114	IC, PR EPROM, Final Lap, VOI1	3M
136063-1115	IC, PR EPROM, Final Lap, VOI2	3L
136063-2101	IC, PR EPROM, Final Lap, MP0	11D
136063-2102	IC, PR EPROM, Final Lap, MP1	13D
99-090110	Integrated Circuit, 74LS04	
99-090111	Integrated Circuit, 74LS08	
99-090115	Integrated Circuit, 74LS74	
99-090120	Integrated Circuit, 74LS157	
99-090124	Integrated Circuit, 74LS245	
99-090136	Integrated Circuit, TMM2018D-45 (45ns)	5L, 5M
99-090147	Integrated Circuit, YM2151	
99-090155	Integrated Circuit, Custom 95	
99-90158	Integrated Circuit, DAC, YM3012	
99-090244	Integrated Circuit, 74LS244	
99-090248	Integrated Circuit, Op-Amp, TL084CN	
99-090288	Integrated Circuit, 74F04	
99-090291	Integrated Circuit, 74HC175	
99-090300	Integrated Circuit, Custom 116	4T
99-090303	Integrated Circuit, Custom 121	3J
99-090313	Integrated Circuit, 74F138	
99-090314	Integrated Circuit, 74F244	
99-090315	Integrated Circuit, 74F374	
99-090318	Integrated Circuit, Custom 123	7R
99-090320	Integrated Circuit, 78L06	
99-090322	Integrated Circuit, TA7630	
99-090323	Integrated Circuit, LB1760	
99-090324	Integrated Circuit, MB3771	
99-090362	Integrated Circuit, 74S15	
99-090363	Integrated Circuit, 74AC240	
99-090364	Integrated Circuit, 74HC74	
99-090365	Integrated Circuit, CPU, HD68000-12	9J, 9B
99-090366	Integrated Circuit, CPU, MC68000G12	
99-090367	Integrated Circuit, CPU, 68B09EP	
99-090368	Integrated Circuit, CPU, HD68B09E	5J
99-090369	Integrated Circuit, RAM, MB8464A-15-SK	2K, 6G

## Final Lap CPU PCB Assembly Parts List

Part No.	Description	Location
99-090370	Integrated Circuit, RAM, MPD4364CX-15	
99-090371	Integrated Circuit, RAM, HM6225GP-120	
99-090372	Integrated Circuit, RAM, M5M5256AP-12	
99-090373	Integrated Circuit, RAM, MPD4325GC-120	
99-090374	Integrated Circuit, RAM, SRM2025GLC12	
99-090375	Integrated Circuit, RAM, MB84256-10	
99-090376	Integrated Circuit, RAM, M5M5178-55	6S, 6T, 6U
99-090377	Integrated Circuit, RAM, M5M5179-55	8A
99-090378	Integrated Circuit, RAM, MB8422-12	
99-090379	Integrated Circuit, RAM, HM6525GBSP-12	11E, 13E, 11M, 13M
99-090380	Integrated Circuit, PAL, 16L8, SYS87B-1	
99-090381	Integrated Circuit, PAL, 16L8, SYS87B-2	5F
99-090382	Integrated Circuit, PAL, 12L10-2, SYS87B-3	8D
99-090383	Integrated Circuit, EEPROM, HN58C65P-25	9D
99-090384	Integrated Circuit, Custom 137	12U
99-090385	Integrated Circuit, Custom 139	8B
99-090386	Integrated Circuit, Custom 140	2M
99-090387	Integrated Circuit, Custom 145	6L
99-090388	Integrated Circuit, Custom 148	13B, 13J
99-090389	Integrated Circuit, Custom 149	2C
99-090390	Integrated Circuit, Custom 156	5P
99-090391	Integrated Circuit, Custom 65	3D
99-090392	Integrated Circuit, Op-Amp, LA6082S	
99-090393	Integrated Circuit, Audio Amp, LA4700	
99-090394	Integrated Circuit, DAC, LC7880	
99-090395	Integrated Circuit, TA7376	
99-090396	Integrated Circuit, Voltage regulator, 78L05	
99-090398	Integrated Circuit, PC900	
99-090399	Integrated Circuit, PC910	
<b>Diodes</b>		
99-090250	Diode, 1S1588	
99-090326	Diode, 1Z6.2	
<b>Inductor</b>		
99-090274	Inductor, 100 $\mu$ H, SP0406-101K	
<b>Resistors</b>		
99-090183	Resistor, SIP, 1 K Ohm x 4, 1/8 W	
99-090185	Resistor, SIP, 4.7 K Ohm x 8, 1/8 W	
99-090188	Resistor, 680 Ohm, $\pm$ 5%, 1/4 W	
99-090189	Resistor, 330 Ohm, $\pm$ 5%, 1/4 W	
99-090192	Resistor, 560 Ohm, $\pm$ 5%, 1/4 W	
99-090193	Resistor, 1 K Ohm, $\pm$ 5%, 1/4 W	
99-090194	Resistor, 4.7 K Ohm, $\pm$ 5%, 1/4 W	
99-090196	Resistor, 10 K Ohm, $\pm$ 5%, 1/4 W	
99-090199	Resistor, 1 M Ohm, $\pm$ 5%, 1/4 W	
99-090252	Resistor, SIP, 2.2 K Ohm x 4, 1/8 W	
99-090255	Resistor, 100 Ohm, $\pm$ 5%, 1/4 W	

## Final Lap CPU PCB Assembly Parts List

Part No.	Description	Location
99-090257	Resistor, 2.2 K Ohm, $\pm 5\%$ , 1/4 W	
99-090305	Resistor, SIP, 100 Ohm, 1/8 W	
99-090306	Resistor, SIP, 2.7 K Ohm, 1/8 W	
99-090307	Resistor, SIP, 470 Ohm, 1/8 W	
99-090309	Resistor, SIP, 1 K Ohm	
99-090331	Resistor, 100 K Ohm, 1/4 W, $\pm 5\%$	
99-090332	Resistor, SIP, 1 K Ohm, 1/8 W	
99-090333	Resistor, SIP, 1.2 K, 1/8 W	
99-090336	Resistor, SIP, 10 K Ohm, 1/8 W	
99-090351	Potentiometer, 10 K Ohm	
99-090400	Resistor, SIP, 4.7 K Ohm, 1/8 W	
99-090401	Resistor, SIP, 2.2 K Ohm, 1/8 W	
99-090402	Resistor, SIP, 4.7 K Ohm, 1/8 W	
99-090403	Resistor, 2.2 Ohm, 1/4 W	
99-090404	Resistor, 10 Ohm, 1/4 W	
99-090405	Resistor, 22 Ohm, 1/4 W	
99-090406	Resistor, 47 Ohm, 1/4 W	
99-090407	Resistor, 75 Ohm, 1/4 W	
99-090408	Resistor, 220 Ohm, 1/4 W	
99-090409	Resistor, 4.7 M Ohm, 1/4 W	
99-090410	Resistor, 270 Ohm, 1/8 W	
<b>Transistors</b>		
99-090310	Transistor, 2SA1015-Y	
99-090311	Transistor, 2SC2320-E	
99-090328	Transistor, 2SC2236-Y	
99-090397	Transistor, 2SC1815-Y	
<b>Capacitors</b>		
99-090171	Capacitor, Ceramic, 22 pf, 25V	
99-090172	Capacitor, Ceramic, 100 pf, 25V	
99-090174	Capacitor, Ceramic, 0.01 $\mu\text{f}$ , 25V	
99-090175	Capacitor, Ceramic, 0.1 $\mu\text{f}$ , 25V	
99-090180	Capacitor, Ceramic, .033 $\mu\text{f}$ , 50V, $\pm 10\%$	
99-090266	Capacitor, Ceramic, .0047 $\mu\text{f}$ , 50V, $\pm 10\%$	
99-090267	Capacitor, Ceramic, .01 $\mu\text{f}$ , 50V, $\pm 10\%$	
99-090269	Capacitor, Electrolytic, 10 $\mu\text{f}$ , 16V	
99-090270	Capacitor, Electrolytic, 47 $\mu\text{f}$ , 16V	
99-090273	Capacitor, Electrolytic, 100 $\mu\text{f}$ , 16V	
99-090347	Capacitor, Electrolytic, 22 $\mu\text{f}$ , 16V	
99-090350	Capacitor, Electrolytic, .47 $\mu\text{f}$ , 50V	
99-090411	Capacitor, Ceramic, 1000 pf, 25V	
99-090412	Capacitor, Ceramic, 3 pf, 25V	
99-090413	Capacitor	
99-090414	Capacitor, Ceramic, 0.001 $\mu\text{f}$ , 50V	
99-090415	Capacitor, Ceramic, 0.0022 $\mu\text{f}$ , 50V	
99-090416	Capacitor, Ceramic, 0.022 $\mu\text{f}$ , 50V	
99-090417	Capacitor, Ceramic, 0.12 $\mu\text{f}$ , 50V	
99-090418	Capacitor, Electrolytic, 1 $\mu\text{f}$ , 50V	

### Final Lap CPU PCB Assembly Parts List

<b>Part No.</b>	<b>Description</b>	<b>Location</b>
99-090419	Capacitor, Electrolytic, 2.2 $\mu$ f, 50V	
99-090420	Capacitor, Electrolytic, 100 $\mu$ f, 10V	
99-090421	Capacitor, Electrolytic, 220 $\mu$ f, 10V	
99-090422	Capacitor, Electrolytic, 470 $\mu$ f, 10V	
99-090423	Capacitor, Electrolytic, 2200 $\mu$ f, 16V	
99-090424	Capacitor, Electrolytic, 100 $\mu$ f, 6.3V	
	<b>Miscellaneous</b>	
99-090352	Switch, DIP 8 Circuit	
99-090163	Crystal, 3.579545 MHz	1C
99-090161	Oscillator, KXO-01-49M152	
99-090162	Oscillator, MCO-1425B (49.152 MHz)	13U

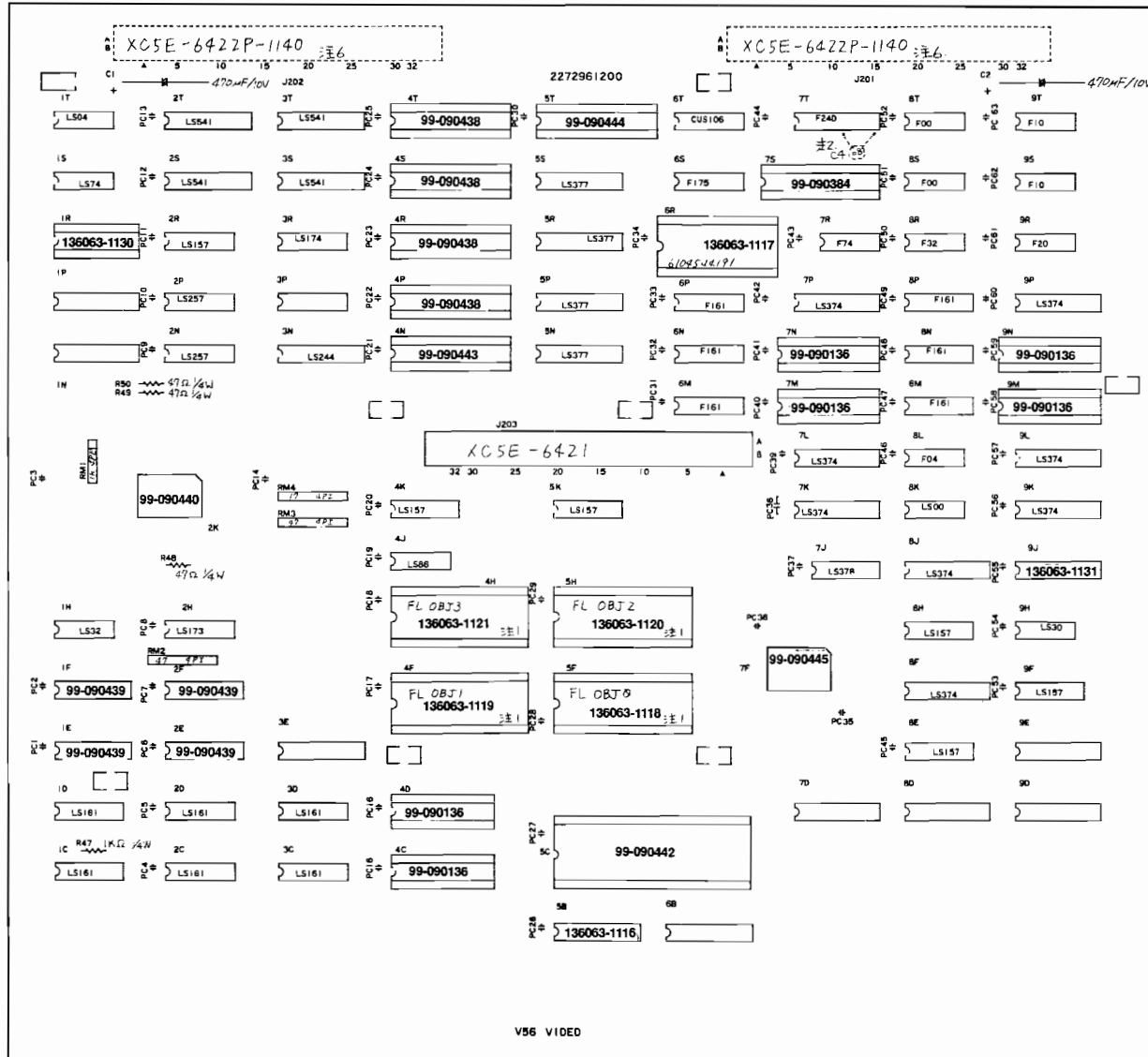


Figure 4-9 Final Lap Video PCB Assembly  
99-090361

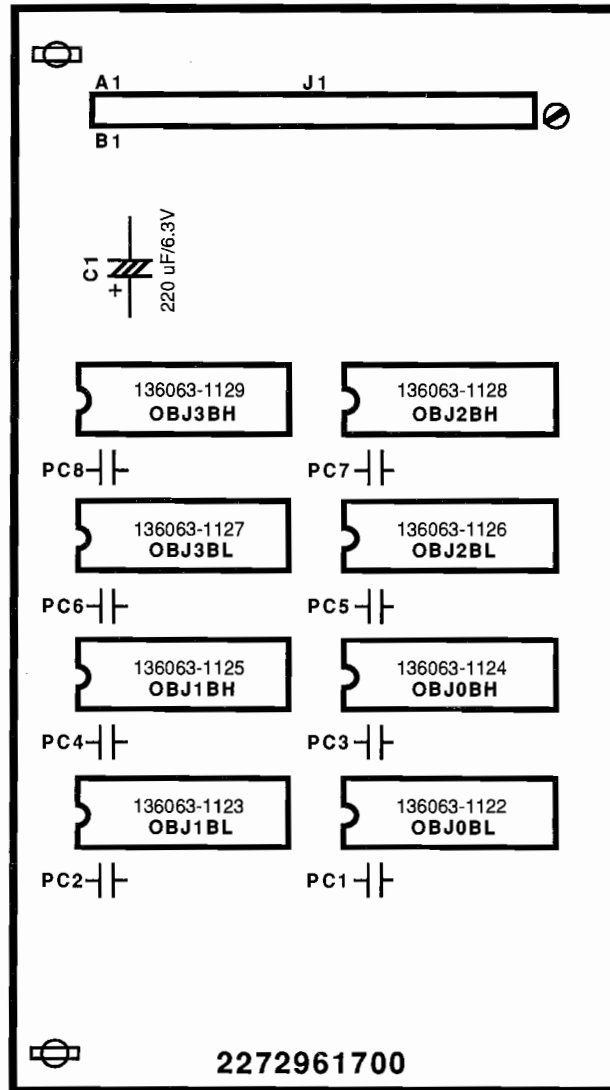


## Final Lap Video PCB Assembly Parts List

Part No.	Description	Location
<b>Integrated Circuits</b>		
136063-1116	Integrated Circuit, PR ROM, Final Lap, FL3	5B
136063-1117	Integrated Circuit, PR PROM, Final Lap	6R
136063-1118	Integrated Circuit, PR ROM, Final Lap, OBJ0B	5F
136063-1119	Integrated Circuit, PR ROM, Final Lap, OBJ1B	4F
136063-1120	Integrated Circuit, PR ROM, Final Lap, OBJ2B	5H
136063-1121	Integrated Circuit, PR ROM, Final Lap, OBJ3B	4H
136063-1130	Integrated Circuit, PAL16L8A, FLI-1	1R
136063-1131	Integrated Circuit, PAL16L8A, FLI-2	9J
99-090108	Integrated Circuit, 74LS00	
99-090110	Integrated Circuit, 74LS04	
99-090113	Integrated Circuit, 74F20	
99-090114	Integrated Circuit, 74LS32	
99-090115	Integrated Circuit, 74LS74	
99-090120	Integrated Circuit, 74LS157	
99-090122	Integrated Circuit, 74LS173	
99-090123	Integrated Circuit, 74LS174	
99-090125	Integrated Circuit, 74LS257	
99-090128	Integrated Circuit, 74LS374	
99-090130	Integrated Circuit, 74LS377	
99-090131	Integrated Circuit, 74LS378	
99-090136	Integrated Circuit, TMM2018D-45 (45ns)	4C, 4D, 7M, 7N, 9M, 9N
99-090244	Integrated Circuit, 74LS244	
99-090288	Integrated Circuit, 74F04	
99-090384	Integrated Circuit, Custom 137	7S
99-090425	Integrated Circuit, 74LS30	
99-090426	Integrated Circuit, 74LS86	
99-090427	Integrated Circuit, 74LS161	
99-090428	Integrated Circuit, 74LS541	
99-090429	Integrated Circuit, 74F00	
99-090430	Integrated Circuit, 74F10	
99-090431	Integrated Circuit, 74F32	
99-090432	Integrated Circuit, 74F74	
99-090433	Integrated Circuit, 74F161	
99-090434	Integrated Circuit, 74F175	
99-090435	Integrated Circuit, 74F240	
99-090436	Integrated Circuit, RAM, TMM2018AP-25	
99-090437	Integrated Circuit, RAM, HM6716-25	
99-090438	Integrated Circuit, RAM, MB8464-10-SK	4P, 4R, 4S, 4T
99-090439	Integrated Circuit, RAM, MB81464-12	1E, 1F, 2E, 2F
99-090440	Integrated Circuit, Custom 45	2K
99-090441	Integrated Circuit, Custom 106	
99-090442	Integrated Circuit, Custom 107	5C
99-090443	Integrated Circuit, Custom 134	4N
99-090444	Integrated Circuit, Custom 135	5T

**Final Lap Video PCB Assembly  
Parts List**

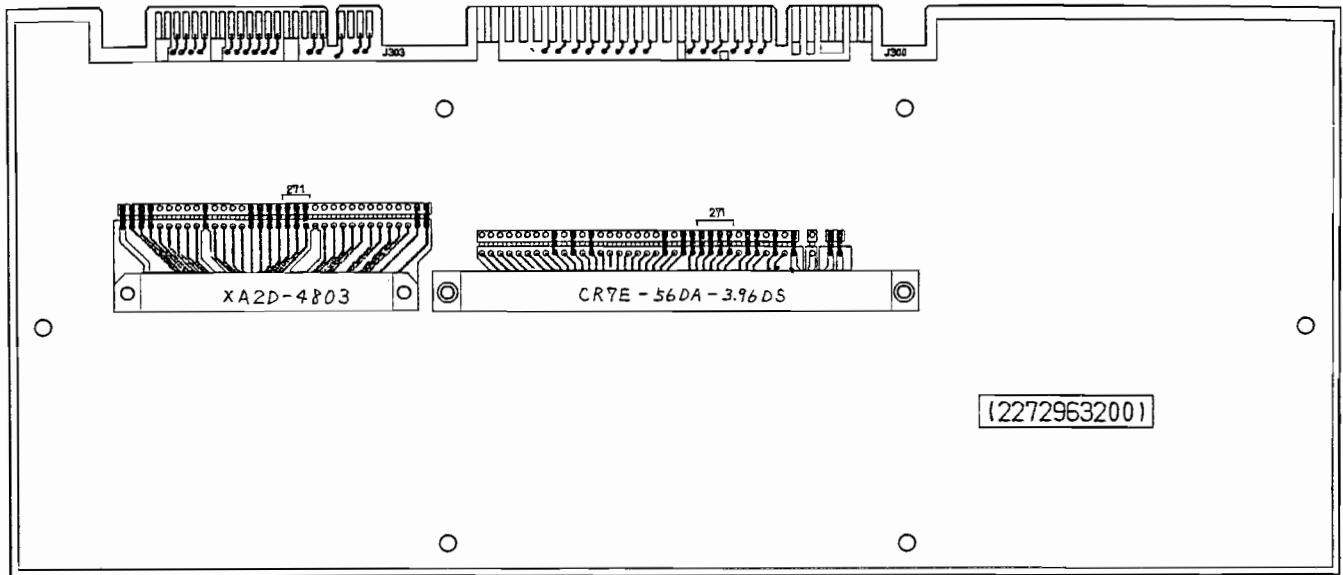
<b>Part No.</b>	<b>Description</b>	<b>Location</b>
99-090445	Integrated Circuit, Custom 146	7F
<b>Resistors</b>		
99-090193	Resistor, 1 K Ohm, $\pm 5\%$ , 1/4 W	
99-090332	Resistor, SIP, 1 K Ohm, 1/8 W	
99-090406	Resistor, 47 Ohm, 1/4 W	
99-090446	Resistor, SIP, 47 Ohm, 1/4 W	
<b>Capacitors</b>		
99-090344	Capacitor, Electrolytic, 470 $\mu\text{f}$ , 10V	
99-090447	Capacitor	



**Figure 4-10 Final Lap Small ROM PCB Assembly  
99-090452**

**Final Lap Small ROM PCB Assembly  
Parts List**

Part No.	Description	Designator
99-090453	Capacitor, 220µF, 6.3V	C1
136063-1122	Integrated Circuit, ROM, Motion Object 0 BL	
136063-1123	Integrated Circuit, ROM, Motion Object 1 BL	
136063-1124	Integrated Circuit, ROM, Motion Object 0 BH	
136063-1125	Integrated Circuit, ROM, Motion Object 1 BH	
136063-1126	Integrated Circuit, ROM, Motion Object 2 BL	
136063-1127	Integrated Circuit, ROM, Motion Object 3 BL	
136063-1128	Integrated Circuit, ROM, Motion Object 2 BH	
136063-1129	Integrated Circuit, ROM, Motion Object 3 BH	
99-090416	Capacitor, Ceramic, 0.022 µF, 50 V	PC1-PC8



**Figure 4-11 Final Lap EMI PCB Assembly  
155027-001**

**Parts List**

Part No.	Description
179174-056	Connector, Edge, 56 Ckt
99-090448	Filter, EMI, 270 pf, Ferrite
99-090449	Filter, EMI, 2200 pf, Ferrite

This assembly drawing was not available at press time. Contact your Atari Games Customer Service Office for a copy of this drawing.

**Figure 4-12 Final Lap Link PCB Assembly  
155028-001**

**Parts List**

<b>Part No.</b>	<b>Description</b>
99-090450	Relay
99-090325	Diode, 1S1885
99-090451	Switch, Slide

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# Warranty

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

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

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

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

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

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