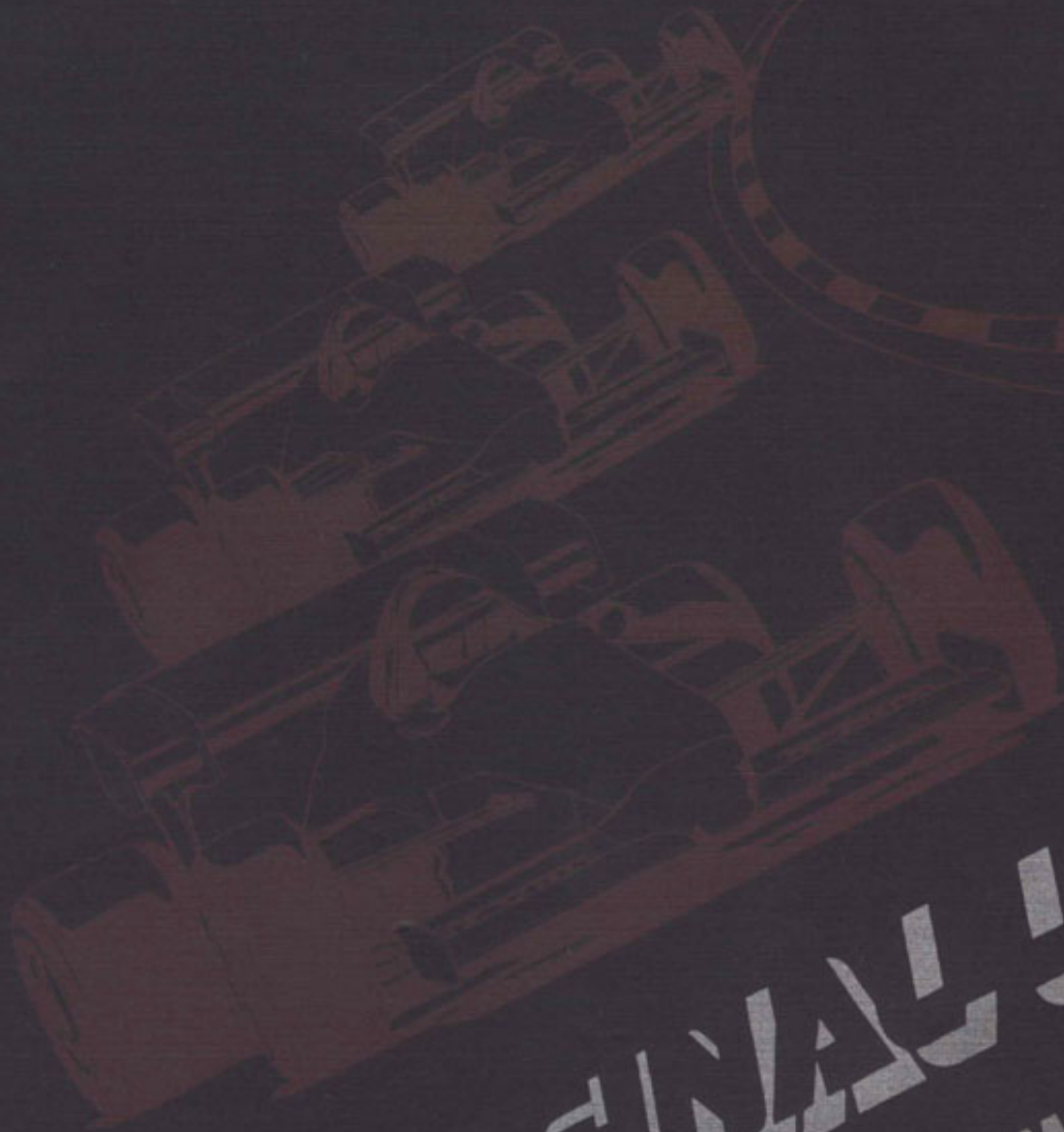




TM-322  
1st printing



# FINAL LAP

## Operators Manual

with Illustrated Parts Lists and Schematics

## For technical assistance:

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:

### UNITED STATES

Atari Games Corporation  
California Customer Service Office  
737 Sycamore Drive  
P.O. Box 361110  
Milpitas, CA 95035  
Fax (408) 434-3945  
Telex 5101007850  
☎ (408) 434-3950

(Monday-Friday, 7:30 a.m.-4:00 p.m. Pacific time)

### EUROPE

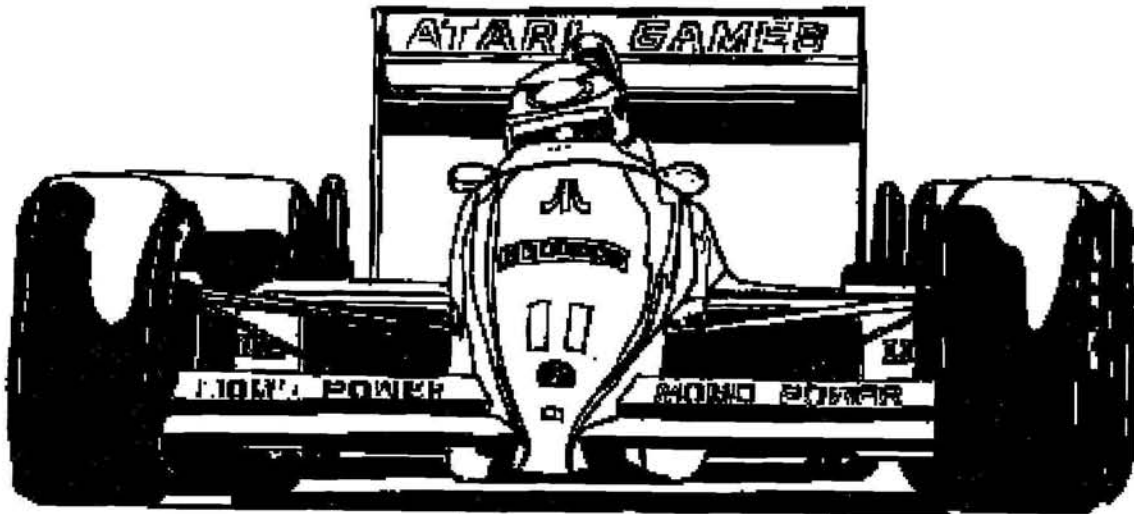
Atari Games Ireland Limited  
European Customer Service Office  
Tipperary Town, Ireland  
Fax 062-51702  
Telex 70665  
☎ 062-52155

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# 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.

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

### NOTE

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

- All 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 plane, be sure the game printed-circuit boards (PCBs) are properly installed on the 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 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™ game.

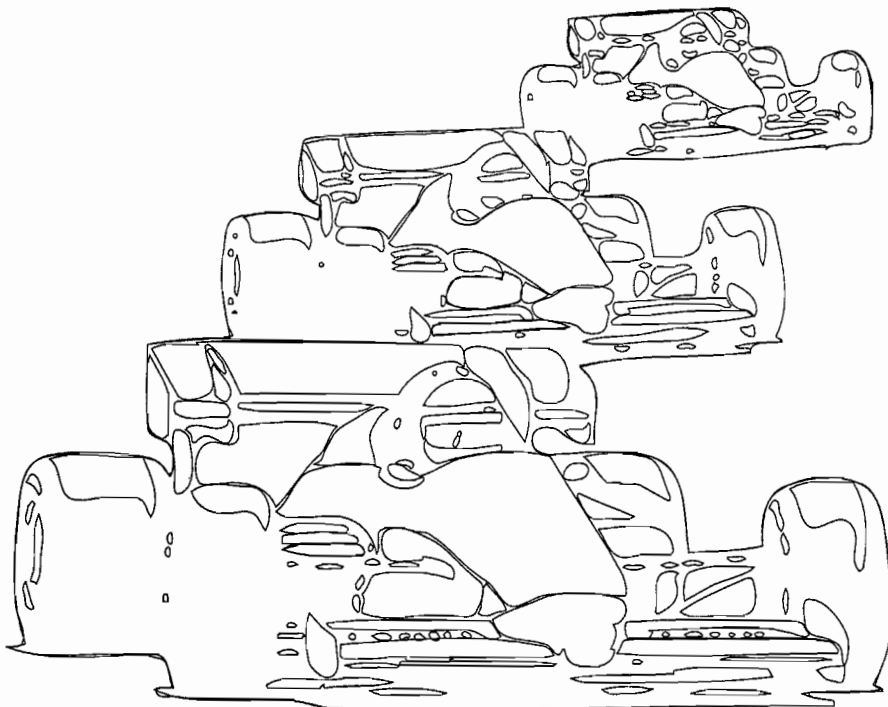
The manual is divided into the following chapters:

- 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 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 game. Carefully read the information in this chapter before applying power.



**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 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.

## Inspecting the Game

**WARNING**

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

Please inspect your Final Lap 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**

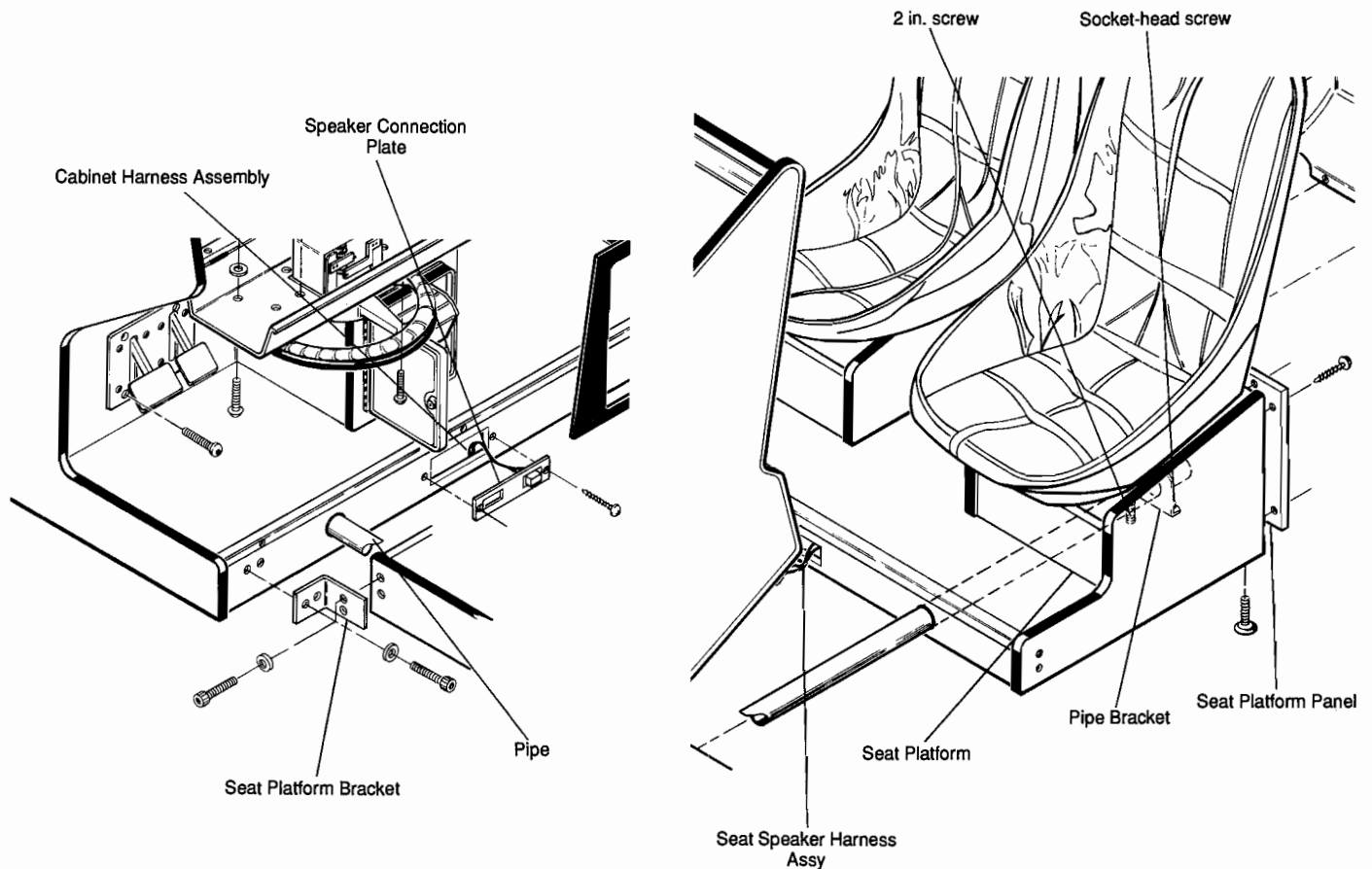
Characteristic	Specification
Power Consumption	150 V-A, 110 W RMS
Temperature	+5° to +50° C (+37° to +122° F)
Humidity	Not to exceed 95% relative
Line Voltage	102 to 132 VAC (U.S. games)
Width	50 in. (127 cm.)
Depth (with seats)	64 1/4 in. (163.2 cm.)
Height	60 in. (152.4 cm.)
Weight	625 lbs. (284 kg.)

## Installing the Seat Platform

The seat platform is shipped separately from the game cabinet. The seat platform must be connected to the game cabinet with two pipes and two side brackets. The parts required for this procedure are packaged with the seat and in the extra parts package. The speaker harnesses must also be connected. See Figure 1-1, *Installing the Seat Platform*, for an illustration.

Installation is easier if you set up the seat platform to face the cabinet before you begin. The seat platform also should be at least three feet away from the game cabinet.

1. Remove the two seat platform panels below and behind the seats by taking out the eight Phillips-head screws that hold each panel on the seat platform.



**Figure 1-1 Installing the Seat Platform**

2. Remove the pipe bracket inside each panel by removing the two hex-head screws that mount the bracket to the platform base.
3. Remove the two pipes from the cabinet packaging and find the 3/8-inch diameter holes drilled near one end of each pipe.
4. Put the pipe bracket on the end of the pipe with the drilled holes. The bracket must be in front of the drilled holes and the flat side of the bracket must face the seat platform.
5. Now, put the pipe in the seat platform and slide it all the way through the platform into the hole in the front.
6. Fit the drilled holes in the pipe over the two-inch screw shaft in the base of the platform.
7. Reinstall the pipe bracket.
8. Repeat steps 4 to 7 for the pipe on the other side.
9. Replace both seat platform panels.
10. Now slide the seat platform forward, and insert both pipes into the holes on the base plate of the cabinet. Stop when the seat assembly is about 8–10 inches from the game cabinet.
11. In the bottom panel, plug left speaker harness into the left connector. Do the same for the right side.
12. Slide the seat platform all the way up to the cabinet. Be careful not to pinch the extra speaker harness wires.
13. In the parts package included with the game are two L-brackets and eight socket-head screws.

Screw these brackets onto the sides of the seat platform and then onto the cabinet base (see Figure 1-1). The holes in the seat platform and the cabinet are already threaded.

### Installing the Attraction Sign

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

1. Rest the attraction sign on the top panel retainer, behind the panel. Center the attraction sign.
2. Screw in the three Phillips-head wood screws to hold it in place.

### Connecting Cabinets

You can connect up to 4 cabinets. Each cabinet is shipped with a 6-foot long connecting cable. If you are connecting 3 or 4 cabinet together, you need longer cables. These 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 1-2. Each cable must be connected from an input to an output.

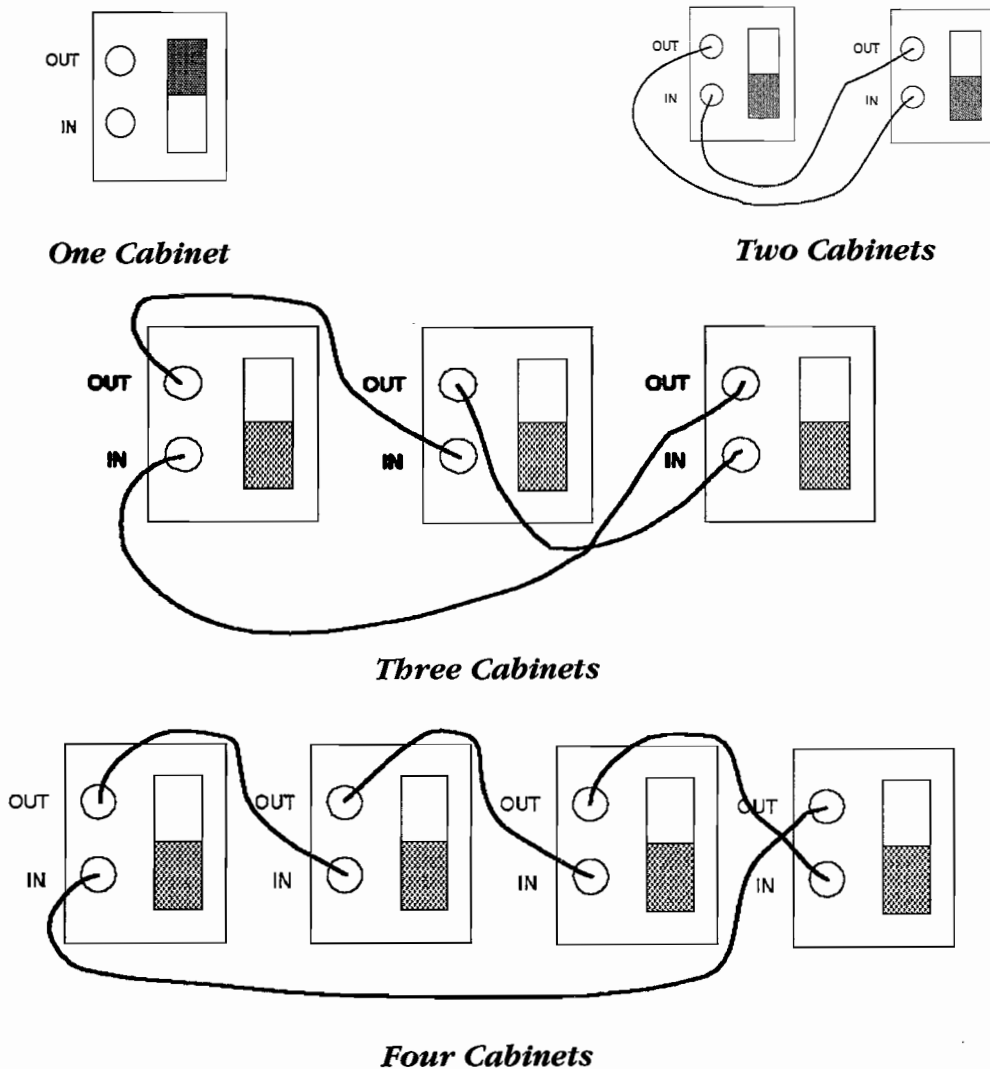
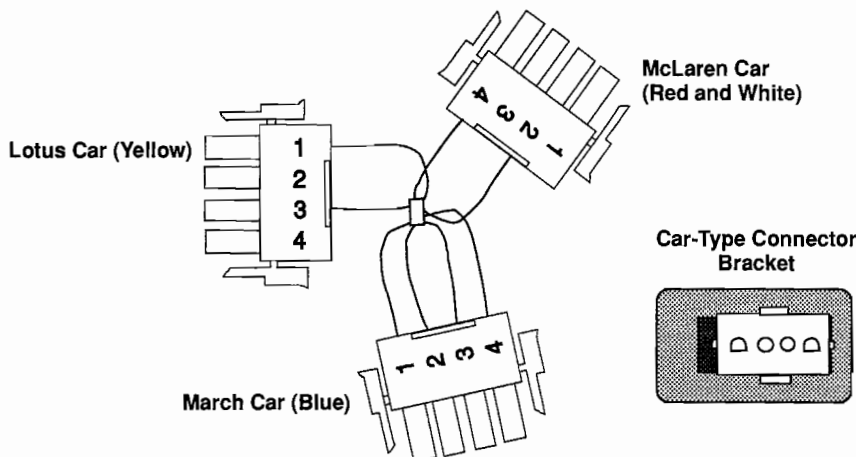


Figure 1-2 Connected Cabinets and Their Link PCBs



**Figure 1-3 Car-Type Connectors**

- 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 1-3.

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.

These are the car types and their connectors:

- March—blue car. Plug in the connector with wires at all 4 pins.
- McLaren—red and white car. Plug in the connector with wires at pins 2 and 4.
- Williams—white, blue, and yellow car. Use *no* connector.
- Lotus—yellow car. Plug in the connector with wires at pins 1 and 3.

## Control and Switch Locations

### 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 1-4.) Each player has two volume controls which adjust the level of sound from the two speakers on the seat

headrest.

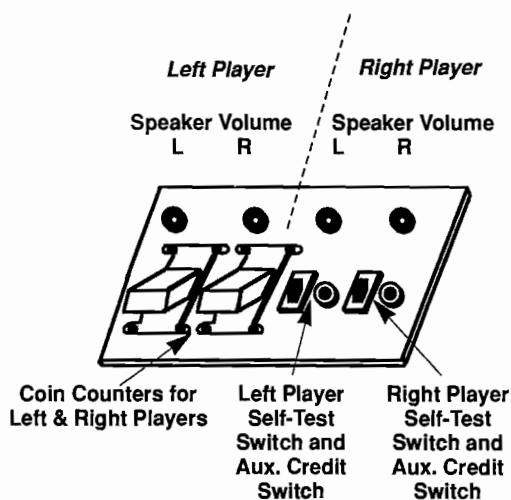
### Self-Test Switch

Each game has two self-test switches located on the utility panel behind the upper coin door. (See Figure 1-4.) The self-test switches are slide switches.

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.



**Figure 1-4 Control and Switch Locations**

## Connection Switch

### NOTE

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

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.

## 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.

## Setting the Coin and Game Options

The Final Lap 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 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 is a realistic racing game in the tradition of Pole Position.

Each Final Lap unit is actually two games in one, with two seats and 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 gas and brake pedals. As many as four Final Lap units can be linked together for unprecedented competition: Up to eight players can compete head-to-head.

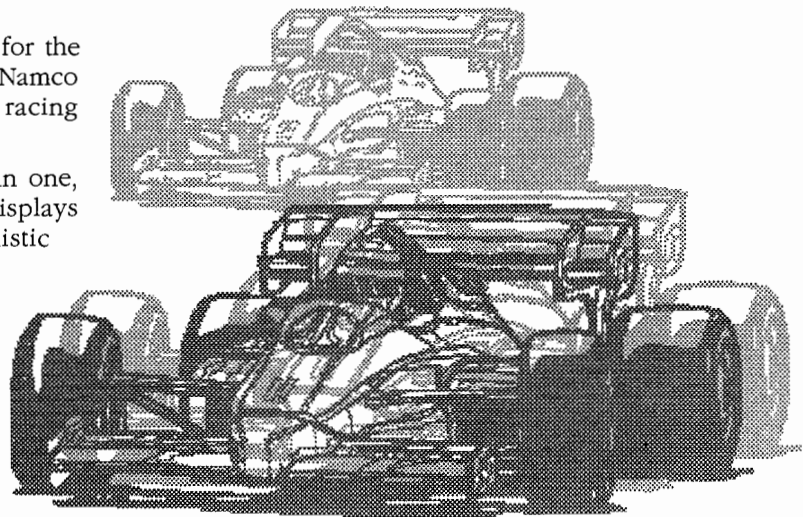
### Play Mode

Imagine yourself racing head-to-head against the player sitting 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 between 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, player(s) deposit coin(s) in the slot corresponding to their seat (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.



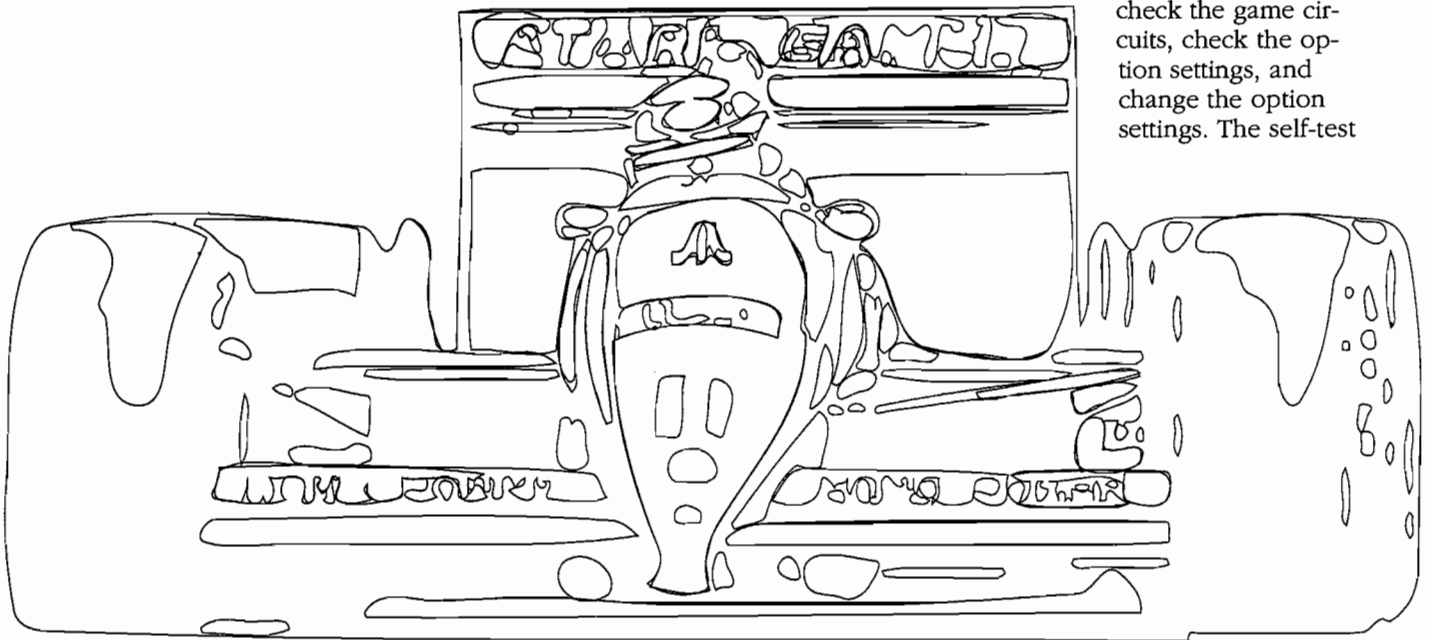
## Chapter 2

# Self-Test

The Final Lap™ 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 both the gas and the brake pedals 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 or brake 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 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 Pedal Test

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

1. Check to make sure the brake pedal is returning to top of its mechanical range. If it does not, repair or replace the brake 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 brake pedal.

## 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.

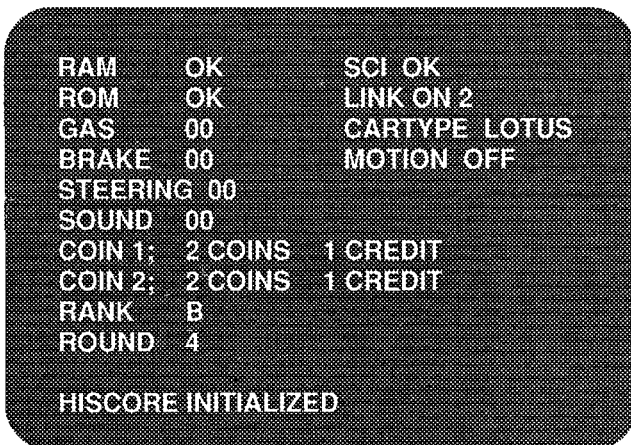


Figure 2-1 Self-Test Screen



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.

---

**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.

---

**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 ON, 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 it is not, check the connecting cables to other games and the connectors.

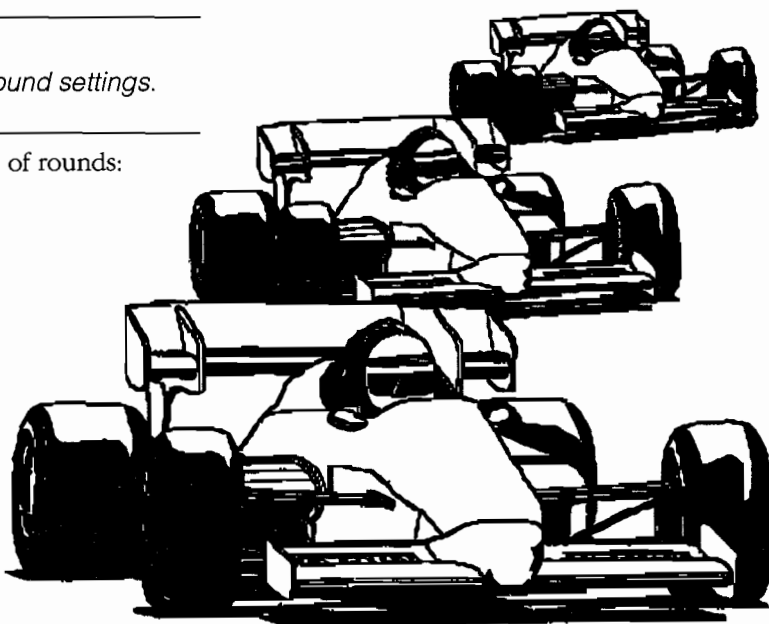
## Linked Games

LINK counts the number of game PCBs connected together (not the number of cabinets). LINK should always read *On*. If it reads *Off*, the switch on the Link PCB is in the wrong position. Check Figure 1-2, *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 Final Lap. 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.

# Maintenance

This chapter includes preventive maintenance and repair procedures for the Final Lap™ 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.

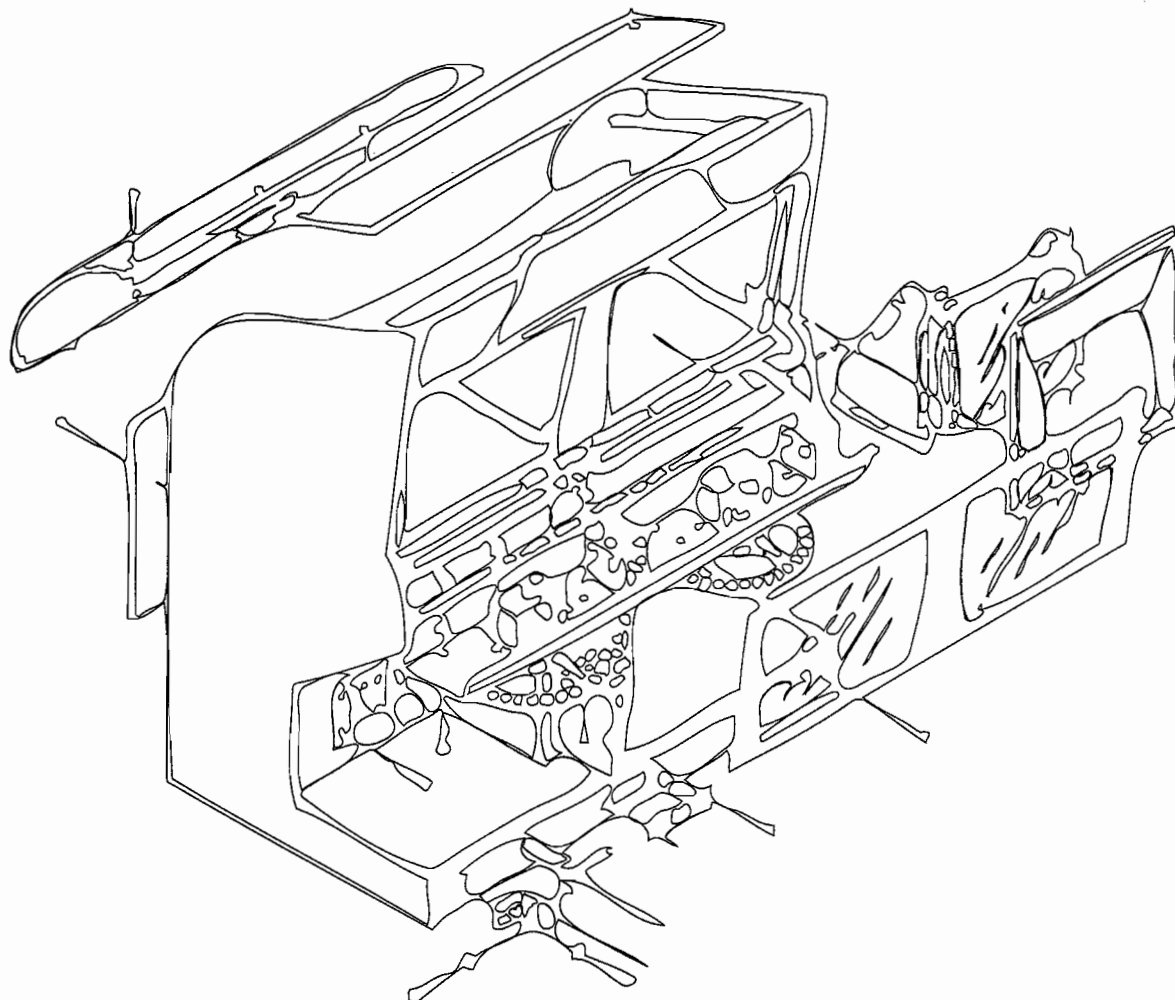
Removal, disassembly, re-assembly, and replacement procedures are provided for components that might need to be repaired. If a game part is mentioned, but not illustrated, refer to Chapter 4, Illustrated Parts Lists, for information.

---

## **NOTE**

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

---



# 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, you should regularly maintain the components listed in Table 3-1, Recommended Preventive-Maintenance Intervals.

## WARNING

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

## Preventive-Maintenance Intervals

For the best performance from your Final Lap game, perform the maintenance in Table 3-1 at the intervals specified.

## Opening the Control Panel

1. Remove the four tamperproof screws on the top of the control panel.
2. Open the control panel on its bottom hinges. See Figure 3-1.

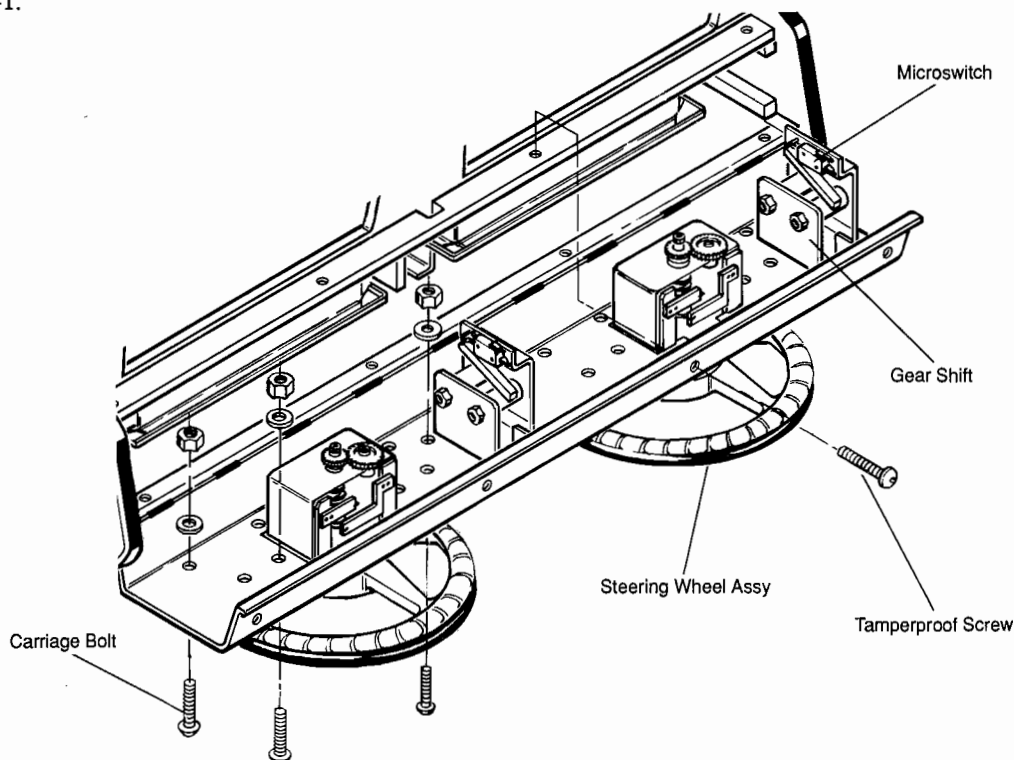
**Table 3-1 Recommended Preventive Maintenance Intervals**

<b>Steering Wheel</b>	Lubricate and tighten every six months.
<b>Gear Shift</b>	Lubricate every six months.
<b>Brake and Gas Pedals</b>	Lubricate and tighten every six months.
<b>Coin Mechanism</b>	Inspect whenever you collect coins. Clean every three months.

## Maintaining the Steering Wheel

You should regularly maintain the steering wheel every 6 months. This maintenance includes the following:

- Tighten the four Phillips head screws on the two stop brackets.
- Tighten the socket-screw on the end of the steering shaft.



**Figure 3-1 Opened Control Panel**

- Tighten the two screws on the spring catch.
- Lubricate the spring with Nyogel, a heavy petroleum grease.
- Lubricate the bronze bearing at the end of the steering wheel case.

### Tightening the Screws on the Stop Brackets

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

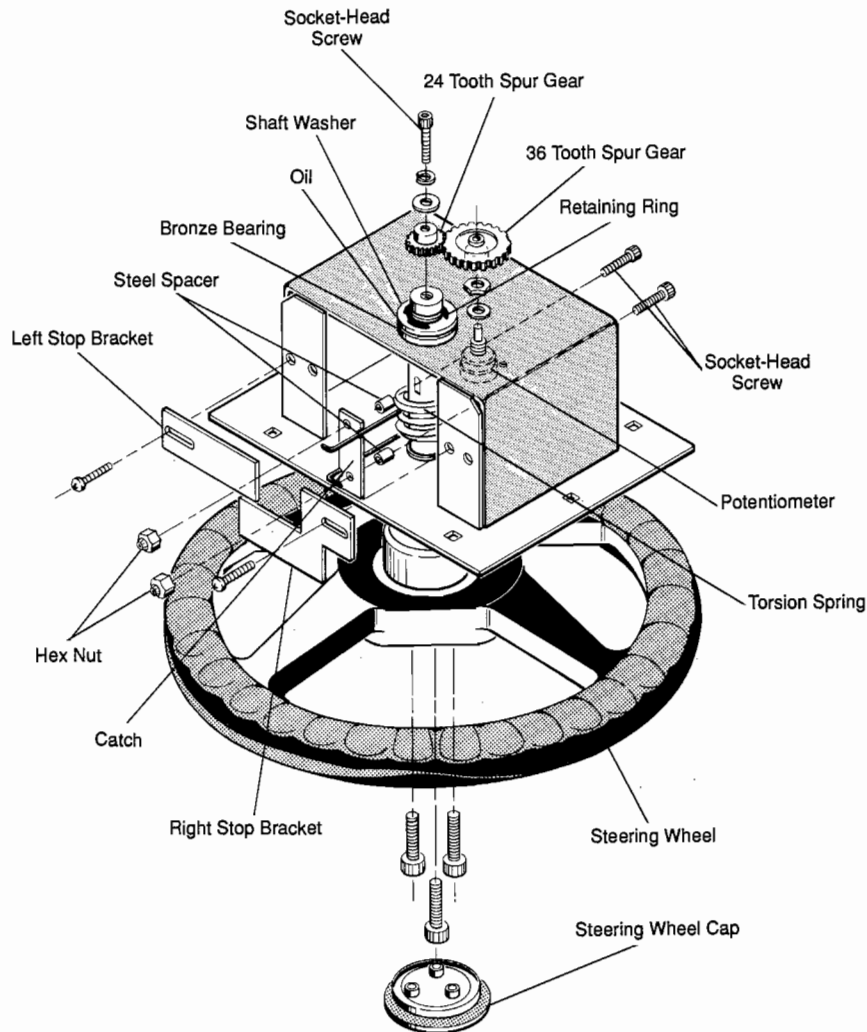
### Tightening the Socket-Head Screw on the End of the Steering Shaft

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

1. Open the control panel.



**Figure 3-2 Steering Wheel Assembly**

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 screw and an 11/32-inch hex driver for nuts, and torque the screws to 28 inch-pounds.

### Lubricating the Spring

Use Nyogel grease to lubricate the spring.

### Lubricating the Bearing

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.

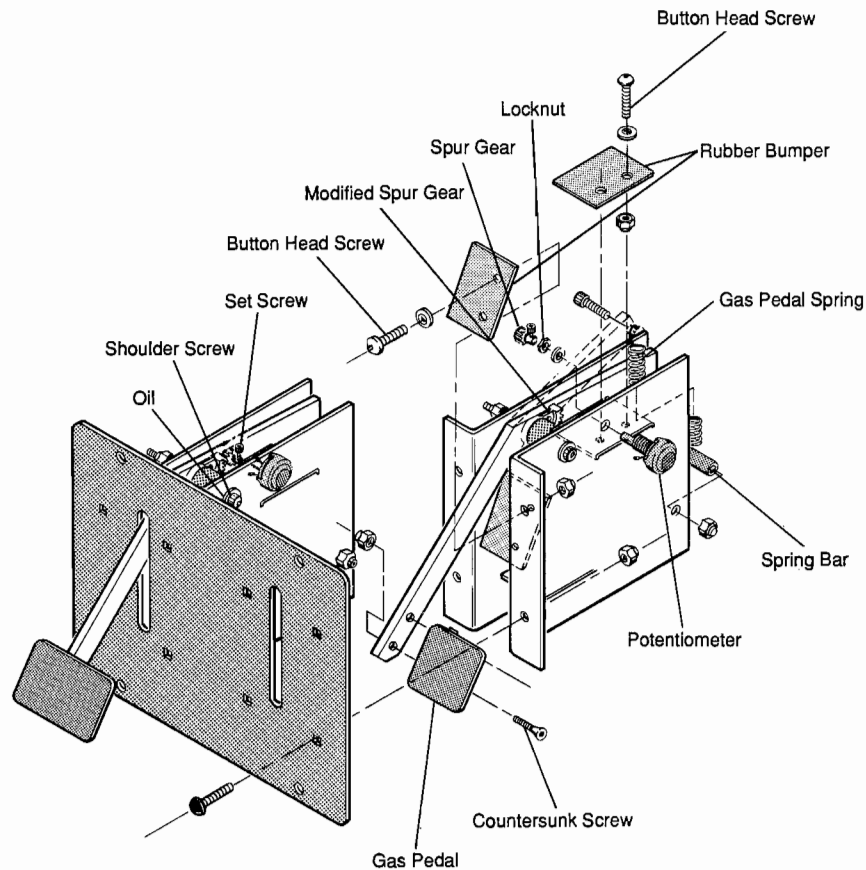
3. Take off the washer.
4. Put two drops of light oil on the top surface and inner surface of the bronze bearing.
5. Reassemble the steering wheel shaft.

## Lubricating the Gear Shift

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

## Maintaining the Pedals

1. Take the pedal assembly out of the game. See Figure 3-3. Use a 5/32-inch Allen head wrench to re-



**Figure 3-3 Pedal Assembly**

move the four screws on the cover plate. These hold the assembly onto the cabinet. Pull the assembly out towards the seat.

2. Make sure the screw on the gear on each pedal is tight. If it is not, tighten it. See Figure 3-3.
3. Put two drops of oil on the shaft of the shoulder screw.
3. Replace the pedal assembly.

## 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

### **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.*

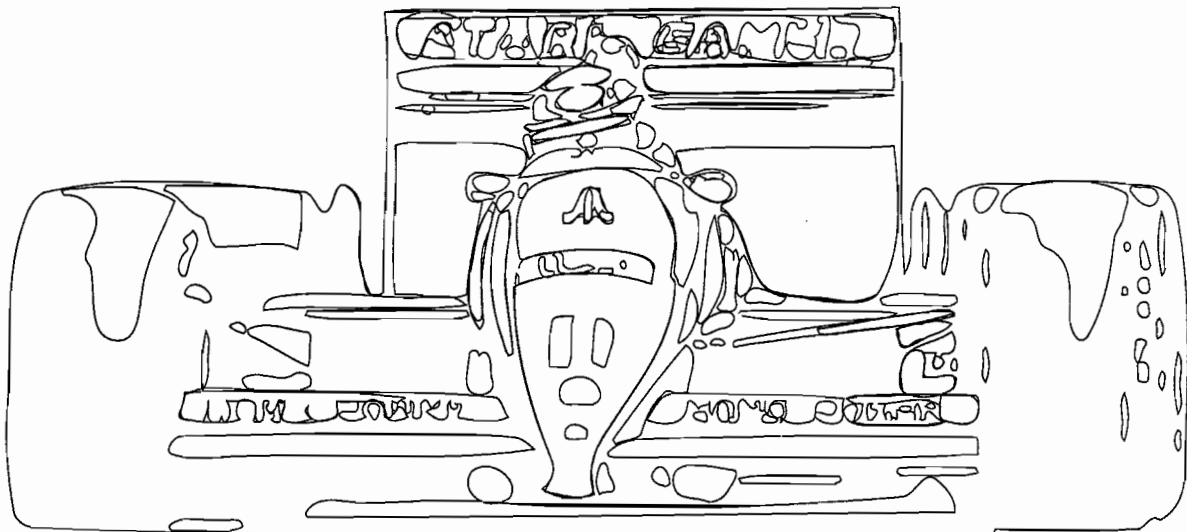
Perform the following procedure to clean the components inside the cabinet.

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

### **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.*

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.).



# Repairs

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

## Replacing 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. Replace the screws and the center cover.

## Replacing the Steering Wheel Spring

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

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 Phillips-head 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 towards the steering wheel.
8. 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 flat part of the potentiometer shaft lines up with the center terminal on the potentiometer.
  - b. 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.
  - 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.

## Replace the Steering Wheel Potentiometer

If the steering wheel is working correctly, but the player's car on the video display is not responding, you may need to replace the potentiometer. First check to see if the steering wheel fails the self-test. If it does, first check the mechanical parts of the steering wheel. If these are working properly, 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 inches-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.

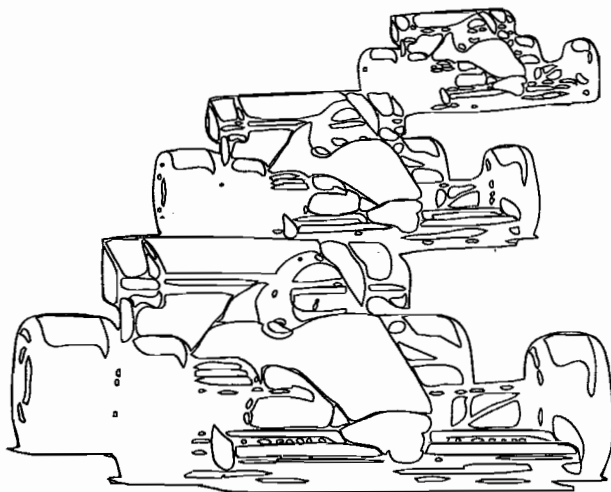
10. Install the wiring harness. The red wire is on the left, the brown wire is in the middle, and the black wire is on the right.

## Replacing the Gear Shift

1. Open the control panel.
2. Disconnect the wiring harness from the gear shift.
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

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



## Replacing the Stops on the Foot Pedal

If one of the pedals sounds as if it is hitting metal when it is pressed or released, replace the rubber stops on the pedal.

1. Take the pedal assembly out of the game. Use a 5/32-inch Allen head wrench to remove the four screws on the cover plate. These hold the assembly onto the cabinet. Pull the assembly out towards the seat.
2. Remove the wiring harness from the gas and brake potentiometers.
3. Remove foot pedal plate by loosening the two countersunk socket-head screws that hold the pedal plate on the pedal arm. Use a 5/32-inch Allen head wrench. See Figure 3-3.
4. Remove the four screws around the pedal that hold it on the cover plate. Loosen the nuts with a 7/16-inch wrench.
5. Loosen the spring bar that holds the spring in tension on the bottom rear of the pedal. Use a 3/16 Allen wrench on the socket-head screw and a 7/16 wrench on the nut. Remove the screw.
6. Remove the two buttonhead screws on the front rubber stop that hold the stop on the metal plate. Use an 1/8-inch Allen wrench on the screws and a 3/8-inch wrench on the nuts. Remove the rubber stop and replace.
7. Replace the screws and nuts holding the rubber stop.
8. To replace the back horizontal stop, first remove the potentiometer and gear.
9. Loosen the lock nut on the potentiometer with a 1/2-inch flat wrench.
10. Loosen the set screw on the gear on the potentiometer.
11. Remove the gear from the potentiometer shaft.
12. Remove the potentiometer.
13. Remove the two button-head screws that hold the stop on the horizontal metal plate. Use an 1/8-inch Allen wrench on the screws and a 3/8-inch wrench on the nuts. Remove the rubber stop and replace.
14. Replace the screws and nuts holding the rubber stops.
15. Replace the potentiometer. Make sure the potentiometer key is in the hole in the case, so the flat side of the potentiometer shaft faces up.
16. Put on the lock nut. Tighten it part way.
17. Put the gear on the shaft. Make sure it completely

meshes with and is the same height as the gear on the pedal.

18. Be sure the gear set screw is on the flat part of the potentiometer shaft and at twelve o'clock. Tighten the set screw.
19. Tighten the lock nut on the potentiometer.
20. Replace the screw in the spring bar. Tighten the screw.
21. Replace the pedal. Tighten the four screws that hold the pedal assembly onto the front plate. Replace the foot pedal plate and tighten the two screws that hold it in place.
22. Reconnect the wiring assembly. The wires to the brake (the left pedal) potentiometer are red on the top, orange in the middle and black on the bottom. The wires to the gas (the right pedal) potentiometer are red on the top, yellow in the middle, and black on the bottom.
23. Install the pedal assembly in the game.

## Replacing the Pedal Potentiometers

If the gas or brake pedal fails the self-test, you may need to replace the potentiometer. However, first make sure that the mechanical parts of the pedal are functioning properly.

1. Take the pedal assembly out of the game. Use a 5/32-inch Allen head wrench to remove the four screws on the cover plate. Pull the assembly out towards the seat.
2. Remove the wiring harness from the gas and brake potentiometers.
3. Loosen the lock nut on the potentiometer with a 1/2-inch flat wrench.
4. Loosen the set screw on the gear on the potentiometer.
5. Take off the nut, washer, and gear and remove the potentiometer.
6. Put on the new potentiometer. Make sure you insert the potentiometer key into the hole in the pedal assembly case.
7. Put on the washer and lock nut. Tighten the lock nut part way.
8. Replace the gear on the shaft. Make sure it completely meshes with and is the same height as the pedal gear.
9. Be sure the gear set screw is on the flat part of the potentiometer shaft and at twelve o'clock. Tighten the set screw.
10. Tighten the lock nut on the potentiometer.

11. Reconnect the wiring assembly. The wires to the brake (the left pedal) potentiometer are red on the top, orange in the middle and black on the bottom. The wires to the gas (the right pedal) potentiometer are red on the top, yellow in the middle, and black on the bottom.

12. Replace the pedal assembly in the game.

## Removing the Video Display

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

1. Turn the game power off and wait two minutes. Unplug the power cord.

---

### **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.*

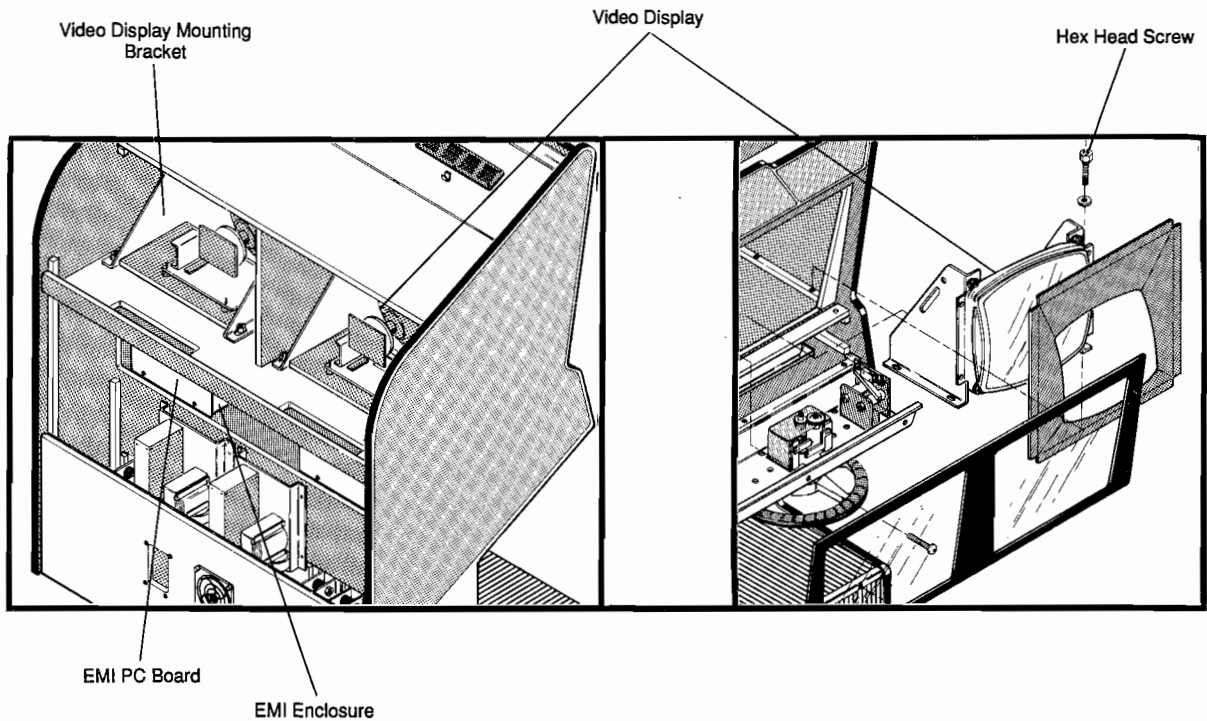
#### **X-Radiation**

*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 curved middle service panel and then the top service panel.
  3. Be sure that the game power is turned off before discharging 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, 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.
  4. Disconnect the display harness connectors from the display.
  5. Use a 3/8-inch nut driver to remove the four hex head screws holding the video display mounting



**Figure 3-4 Video Display and PC Board Removal**

brackets on the cabinet shelf.

6. Carefully lift the display out.

---

**WARNING**

*To avoid dropping the video display, use extreme care when removing the display from the cabinet. We recommend that no one weighing less than 150 pounds should attempt to remove the display. In addition, we recommend that you wear gloves to protect your hands from the sheet-metal edges.*

- 
6. Replace the video display as described in the following procedure.

## Replacing the Video Display

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

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

---

**NOTE**

*Whenever the cathode-ray tube and yoke are replaced as a single unit, readjust the brightness, size, and centering as described in the display manual. Also 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 align with the four holes in the video display shelf.
3. Install the four hex head screws through the mounting brackets and into the video display shelf.
4. With the hex-head screws loosely installed, push the video display forward to meet the bezel.
5. Use a 3/8-inch nut driver to tighten the bolts. Be sure that the display is centered horizontally.
6. Connect the display harnesses to the display.

## 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 lower service door.
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.
4. Remove the 6 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. A bare wire wrapped around your wrist and attached to an earth ground is effective when working extensively with static-sensitive devices.

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 ap-

pear 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 3-5.)

1. Turn the game power off.
2. Remove the red fiberglass seat back. Remove all the screws from the sides of the seat, plus those on and behind the metal plate on the back of the headrest. You will need a Phillips screwdriver, an Apex A-2 square drive wrench, and an 1/8-inch Allen head wrench.

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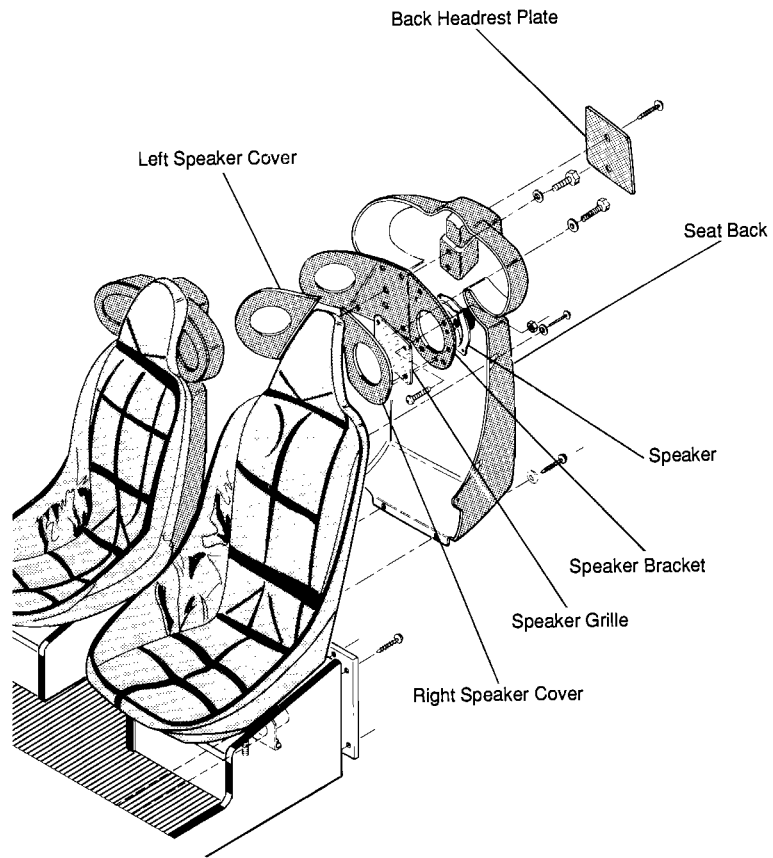
### CAUTION

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

---

3. Disconnect the wires to the speaker.
4. Loosen the four nuts that hold the speaker on the speaker bracket. Remove the speaker.
5. Replace the speaker in the reverse order of removal. Be sure that you hook up the wires correctly.
 

The signal wire on the speaker should be attached to the speaker tab marked with color, a "+" sign, or a round dot. (The signal wire is shown on the game wiring diagram; refer to the Schematic Package included with the game.)
6. Replace the seat back.



**Figure 3-5 Speaker Removal**

N O T E S

# 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 in the parts lists.

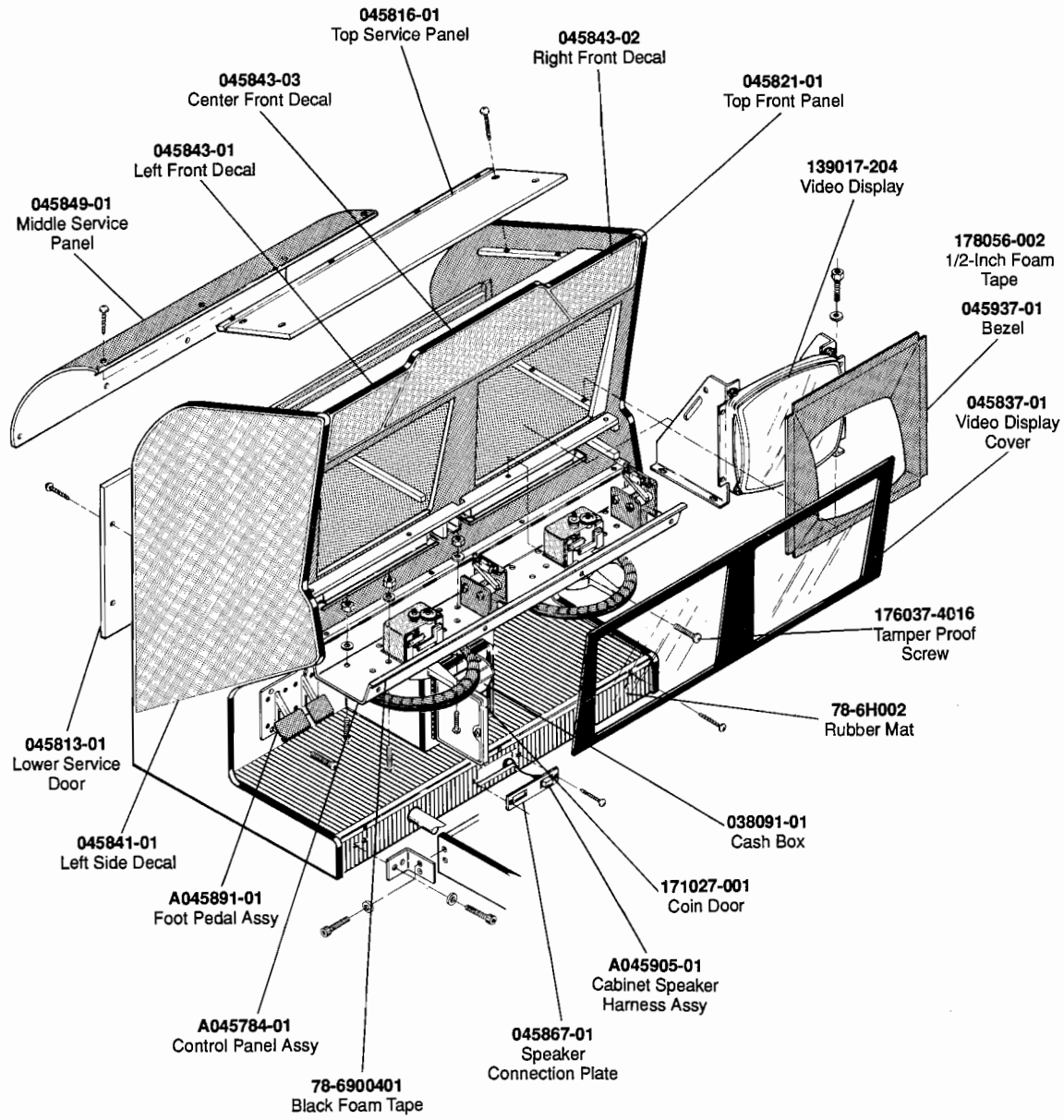
The parts lists (except for the PCB parts lists) are arranged alphanumerically by Atari part number. All A-prefix numbers, which are assemblies, come first. Next are part numbers with six numbers followed by a hyphen (000598- through 201000-). Ending the list are part numbers with a two-number designation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

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

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.

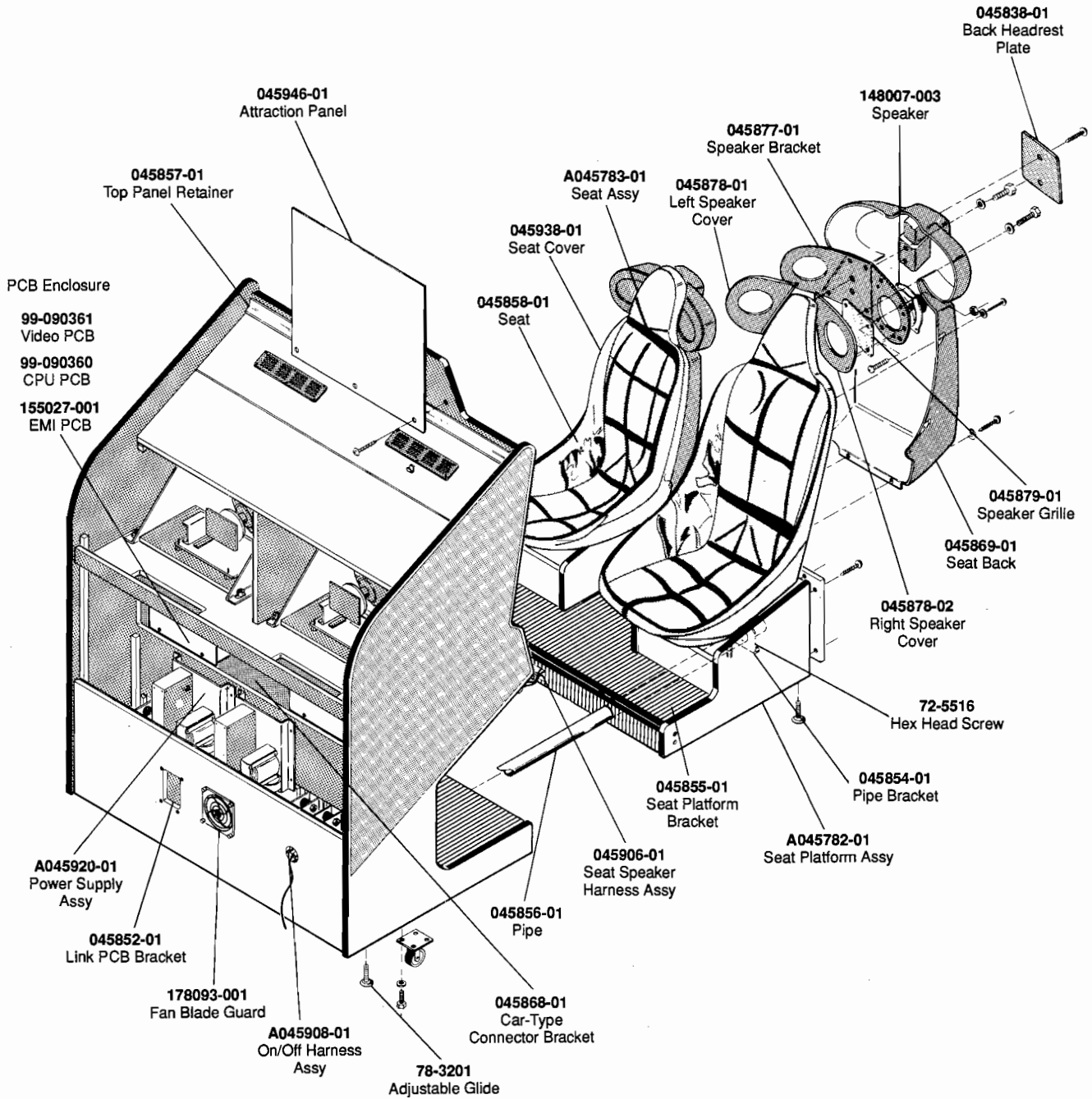
Atari Games Customer Service phone numbers are listed on the inside front cover of this manual.

- Not Shown**
- A045902-01**  
Main Harness  
Assy
  - A045903-01**  
Display Harness  
Assy
  - A045904-01**  
A.C. Power  
Harness Assy
  - A045909-04**  
Jumper Select  
Assy
  - A045918-01**  
Utility Panel Assy
  - 045833-01**  
Seat Platform  
Panel
  - 045939-01**  
Seat Cover  
Retainer
  - 045841-02**  
Right Side Decal
  - 045844-01**  
Seat Back Decal
  - 045845-01**  
Headrest Decal
  - 045948-01**  
Vinyl Number  
Decals
  - 045947-01**  
Attraction Panel  
Decal
  - 155028-001**  
Link PCB
  - 150031-072**  
Connecting  
Cable
  - 178126-002**  
Tamper Proof  
Key Driver



**Figure 4-1 Cabinet-Mounted Assemblies, Front View  
A045781-01 B**





**Figure 4-1 Cabinet-Mounted Assemblies, Rear View  
A045781-01 B**

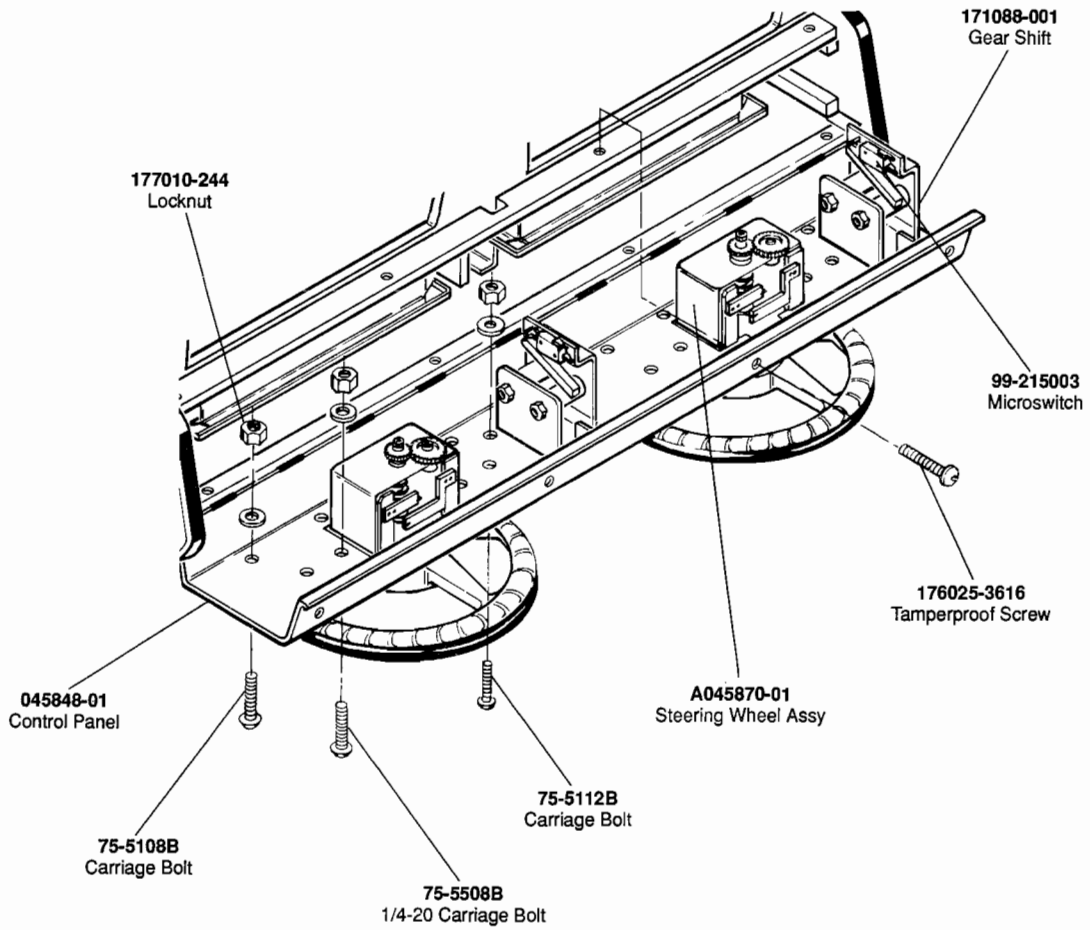
## Cabinet-Mounted Assemblies Parts List

Part No.	Description
A045783-01	Seat Assembly. Replaceable Parts:
A045782-01	Seat Platform Assembly
045838-01	Back Headrest Plate
045839-01	Seat Back Plate
045844-01	Seat Back Decal
045845-01	Headrest Decal
045858-01	Seat
045868-01	Car-Type Connector Bracket
045869-01	Seat Back
045877-01	Speaker Bracket
045878-01	Left Speaker Cover
045878-02	Right Speaker Cover
045879-01	Speaker Grille
045906-01	Seat Harness Assembly for Speaker
045938-01	Seat Cover
045939-01	Seat Cover Retainer
148007-003	4 1/2-inch Round Unshielded Speaker
176013-212	#8 X 3/4-inch Tapping Screw
82-8008B	Button Head 10-32 Black Screw
82-8020B	Button Head 10-32 Black Screw
A045784-01	Control Panel Assembly—see Figure 4-2
A045891-01	Foot Pedal Assembly—see Figure 4-4
A045902-01	Main Harness Assembly
A045903-01	Display Power Harness Assembly
A045904-01	A.C. Power Harness Assembly
A045905-01	Cabinet Speaker Harness Assembly
A045908-01	On/Off Harness Assembly
A045909-04	Jumper Select Assembly
A045918-01	Utility Panel Assembly
A045920-01	Switching/Linear Power Supply Assembly—see Figure 4-5
038091-01	Cash Box
045813-01	Lower Service Door
045816-01	Top Service Panel
045821-01	Top Front Panel
045833-01	Seat Platform Service Panel
045837-01	Video Display Cover
045841-01	Left Side Decal
045841-02	Right Side Decal
045843-01	Left Front Decal
045843-02	Right Front Decal
045843-03	Center Front Decal
045847-01	Cabinet Base Trim
045849-01	Middle Service Panel
045852-01	Link PCB Bracket

## Cabinet-Mounted Assemblies Parts List, Continued

Part No.	Description
045853-01	Seat Platform Trim
045854-01	Pipe Bracket
045855-01	Seat Platform Bracket
045856-01	Pipe
045857-01	Top Front Panel Retainer
045867-01	Speaker Connection Plate
045937-01	Bezel
045946-01	Attraction Panel
045947-01	Attraction Panel Decal
045948-01	Vinyl Number Decals
139017-204	Wells-Gardner Monitor
150031-072	6-Foot Connecting Cable
150031-120	10-Foot Connecting Cable (Not Included in Game; Order Separately)
150031-240	20-Foot Connecting Cable (Not Included in Game; Order Separately)
155027-001	EMI PCB
155028-001	Link PCB
171027-001	Coin Door With Top Sectioned Harness
176037-4016	Tamper Proof Button Head Black Screw
176019-212	LPW Black Screw
178056-002	1/2-Inch Double-Sided Foam Tape
178093-001	Fan Blade Guard
178126-002	10-24 Tamper Proof Hex Key Driver
178129-001	Wire Routing Clip
72-5516	1/4 Hex Head Screw
75-010F	#10 Washer
75-015F	1/4-inch Black Washer
75-015S	1/4-inch Steel Washer
75-045S	1/4-inch Split Lock Washer
75-5524B	1/4 Black Carriage Bolt
78-3201	Adjustable Glide
78-6900401	Black Vinyl Foam Tape
78-6H002	Black Corrugated Rubber Matting
82-8520B	1/4-20 Black Button Head Screw
99-090360	CPU PCB
99-090361	Video PCB
<i>These are the technical supplements to the Final Lap game:</i>	
CO-296-01	TM-296 Supplement
SP-322	Final Lap Schematic Package
TM-296	Wells-Gardner 19" Standard-Resolution Video Display Service Manual
TM-322	Final Lap Operator's Manual

**Not Shown**  
**045843-01**  
 Left Control Panel  
 Decal  
**045844-02**  
 Right Control Panel  
 Decal  
**045858-01**  
 Plastic Formed  
 Dashboard



**Figure 4-2 Control Panel  
 A045784-01 A**

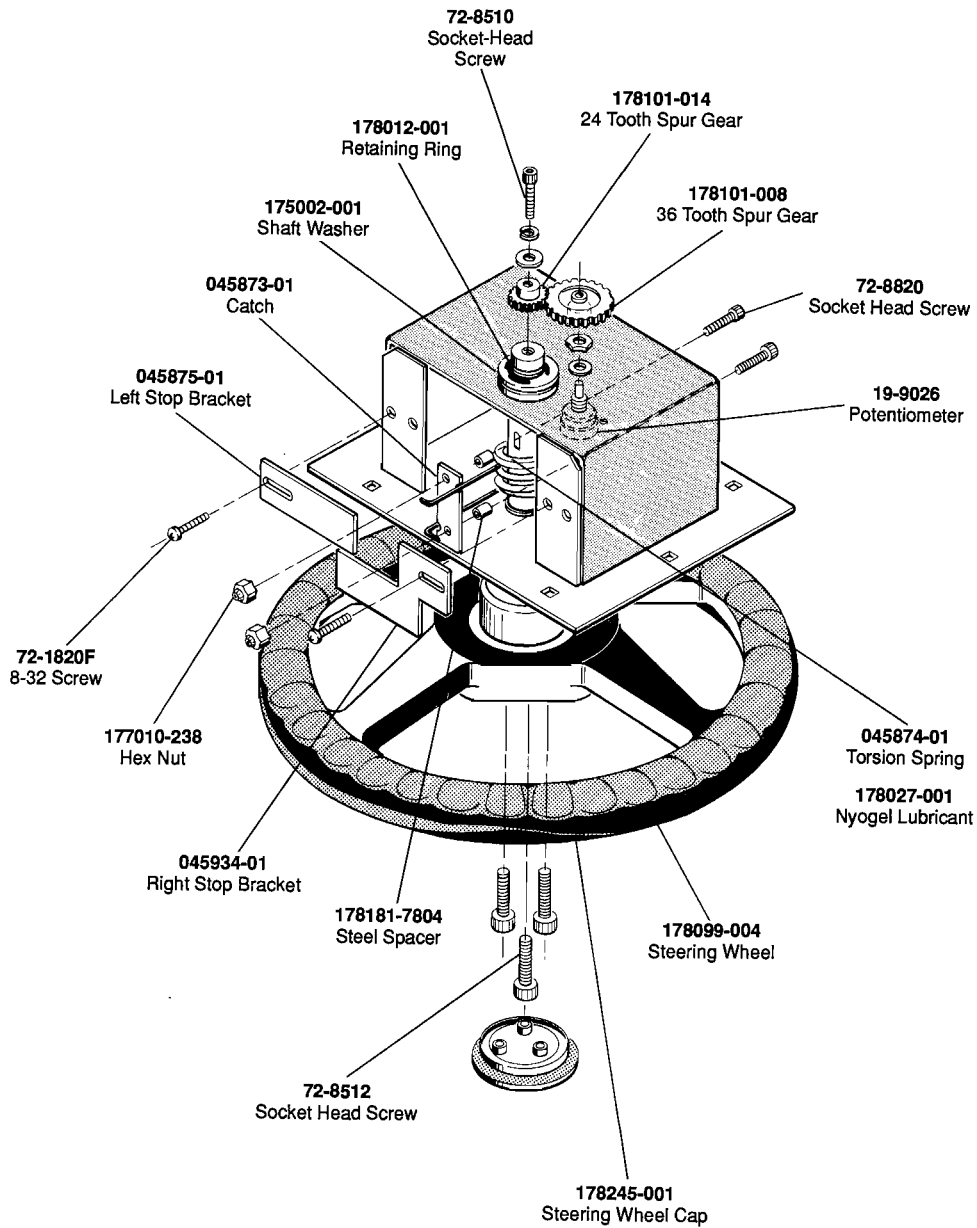
## Control Panel Assembly Parts List

---

Part No.	Description
A045870-01	Steering Wheel Assembly—see Figure 4-3
171088-001	Gear Shift (includes the snap-action switch, part no. 99-215003)
045842-01	Left Control Panel Decal
045842-02	Right Control Panel Decal
045848-01	Control Panel
044751-51	Plastic Formed Dashboard
177010-240	Polymer #10-24 Locknut
177010-244	Polymer 1/4-20 Locknut
75-010S	Flat #10 Washer
75-015S	Flat 1/4 Washer
75-5112B	10-24 Black Carriage Bolt
75-5542B	1/4-20 Carriage Bolt
82-8512B	1/4-20 Button Head Tamperproof Screw

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**Not Shown**  
**A045907-01**  
 Steering Wheel  
 Harness Assembly

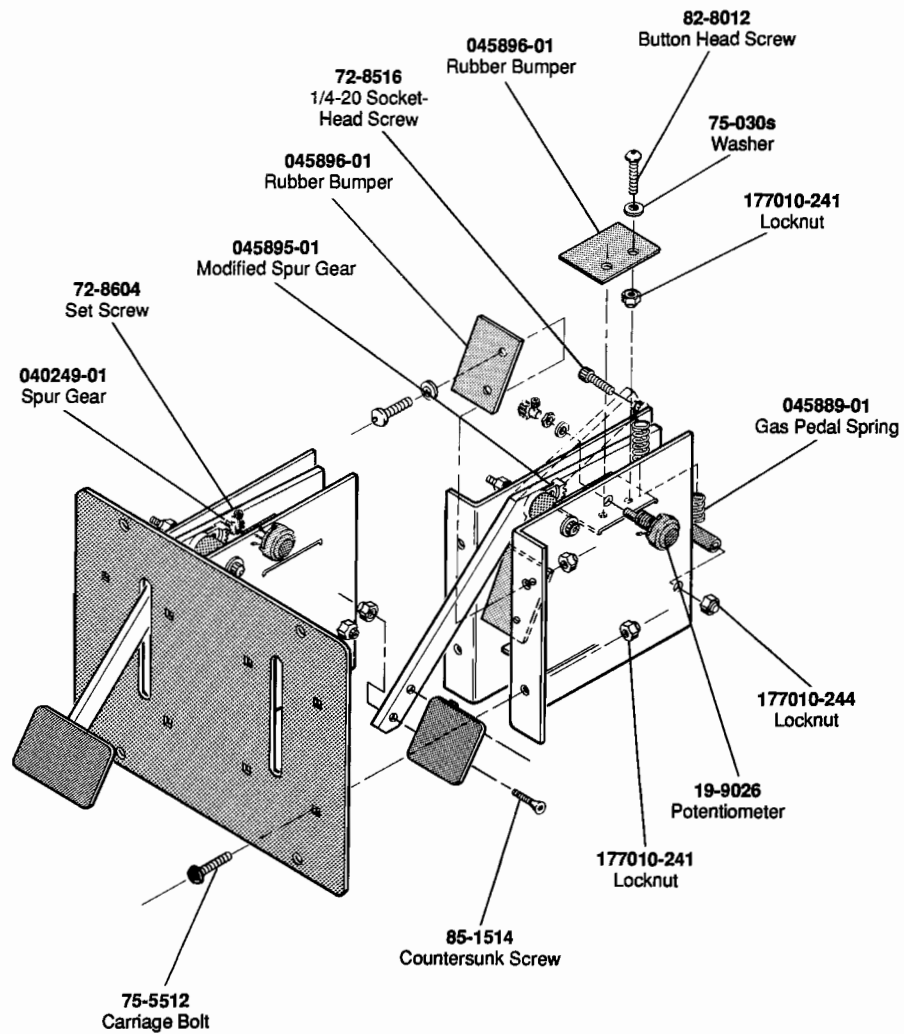


**Figure 4-3 Steering Wheel Assembly**  
**A045870-01 E**

## Steering Wheel Assembly Parts List

Part No.	Description
A045907-01	Steering Wheel Harness Assembly
045873-01	Catch
045874-01	Torsion Spring
045875-01	Left Stop Bracket
045934-01	Right Stop Bracket
175002-001	.750-inch Diameter Shaft Washer
177010-238	8-32 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	.250-Inch Long Steel Spacer
178245-001	Steering Wheel Cap
178101-014	24 Tooth Spur Gear (Acceptable substitute is part no. 178101-007, gear with hub)
19-9026	5K Ohm Potentiometer
72-8822	8-32 Socket Head Screw
75-8510	1/4-20 Socket Head Screw
75-010S	Flat #10 Washer

**Not Shown**  
**A045893-01**  
 Pedal Harness Assy  
**045890-01**  
 Brake Pedal Spring



**Figure 4-4 Foot Pedal Assembly**  
**A045891-01 A**

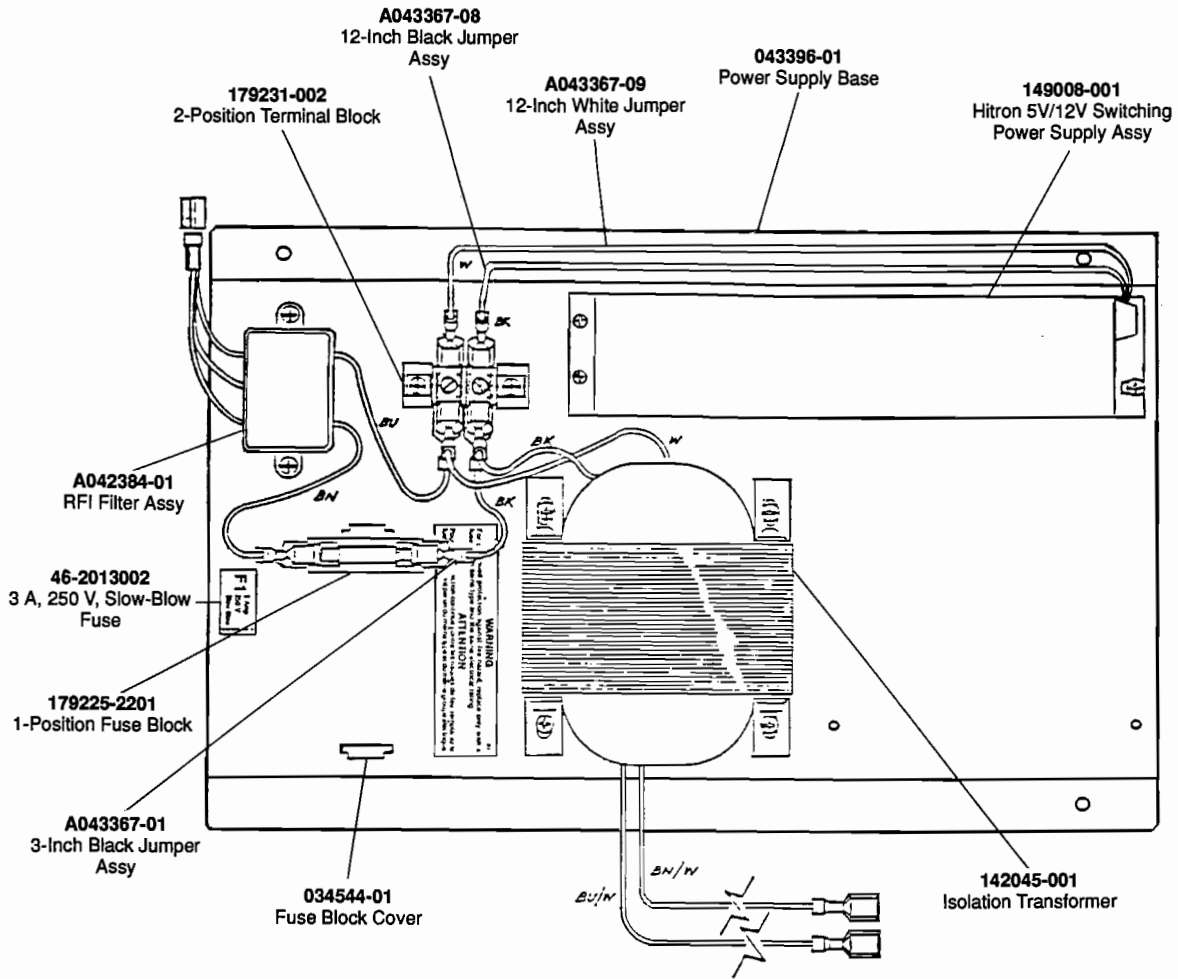


## Foot Pedal Assembly Parts List

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<b>Part No.</b>	<b>Description</b>
A045893-01	Pedal Harness Assembly
045889-01	Accelerator Pedal Spring
045890-01	Brake Pedal Spring
045896-01	Rubber Bumper
177010-241	10-32 Hex Polymer Locknut
177010-244	1/4-20 Hex Polymer Locknut
19-9026	5 K Ohm Potentiometer
72-8408	Socket Head 4-40 Screw
72-8604	Socket Head 6-32 Screw
75-010S	#10 Flat Washer
82-8012	10-32 Button Head Screw
85-1514	1/4-20 Flat Countersunk Socket Head Screw

---



**Figure 4-5 Switching/Linear Power Supply Assembly  
A045920-01 A**

### ***Switching/Linear Power Supply Assembly Parts List***

<b>Part No.</b>	<b>Description</b>
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
46-2013002	3 A, 250 V, Slow-Blow Fuse

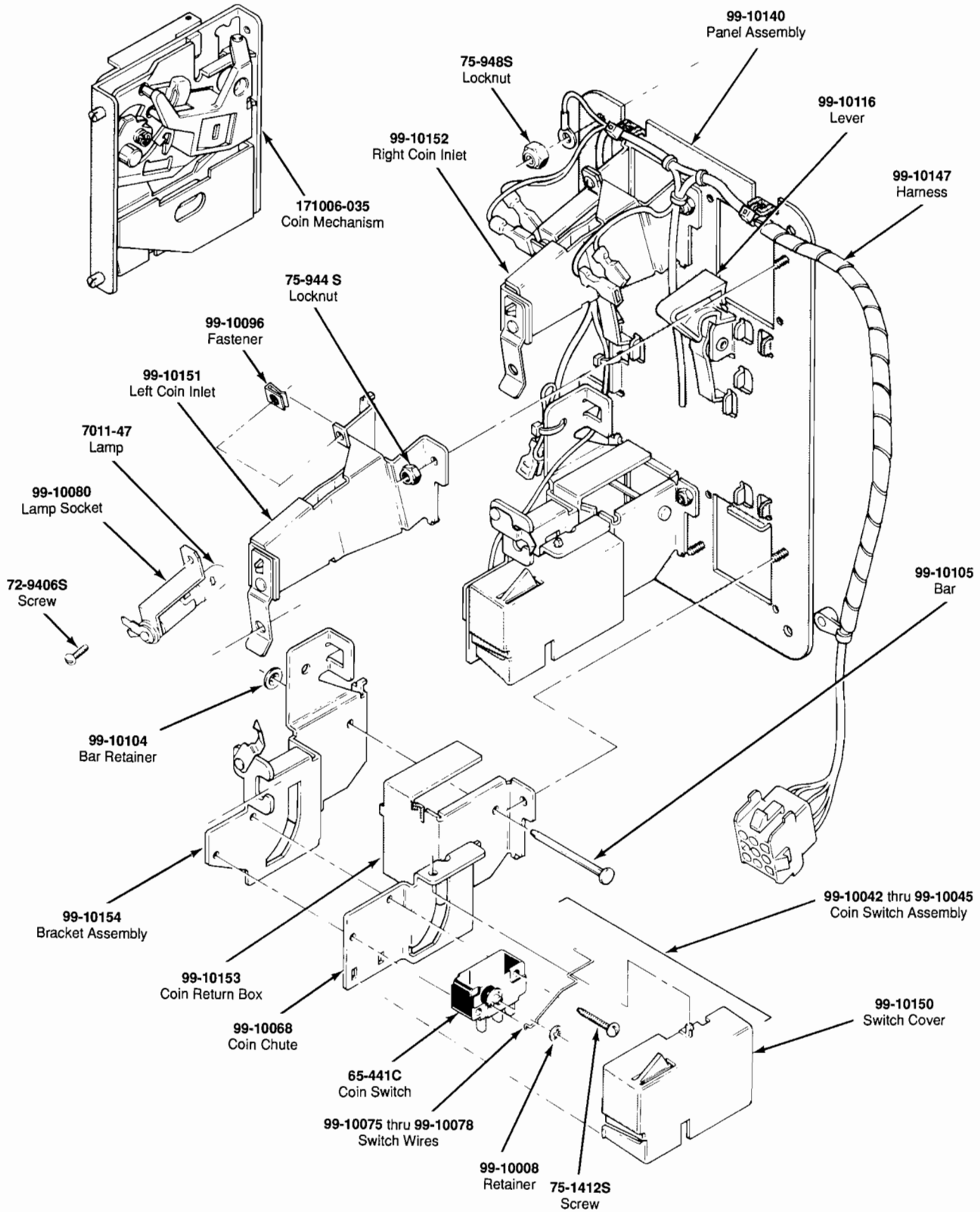
### ***Hitron 5V/12V Power Supply Sub-Assembly Parts List***

<b>Part No.</b>	<b>Description</b>
<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, 0.01 $\mu$ f, 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

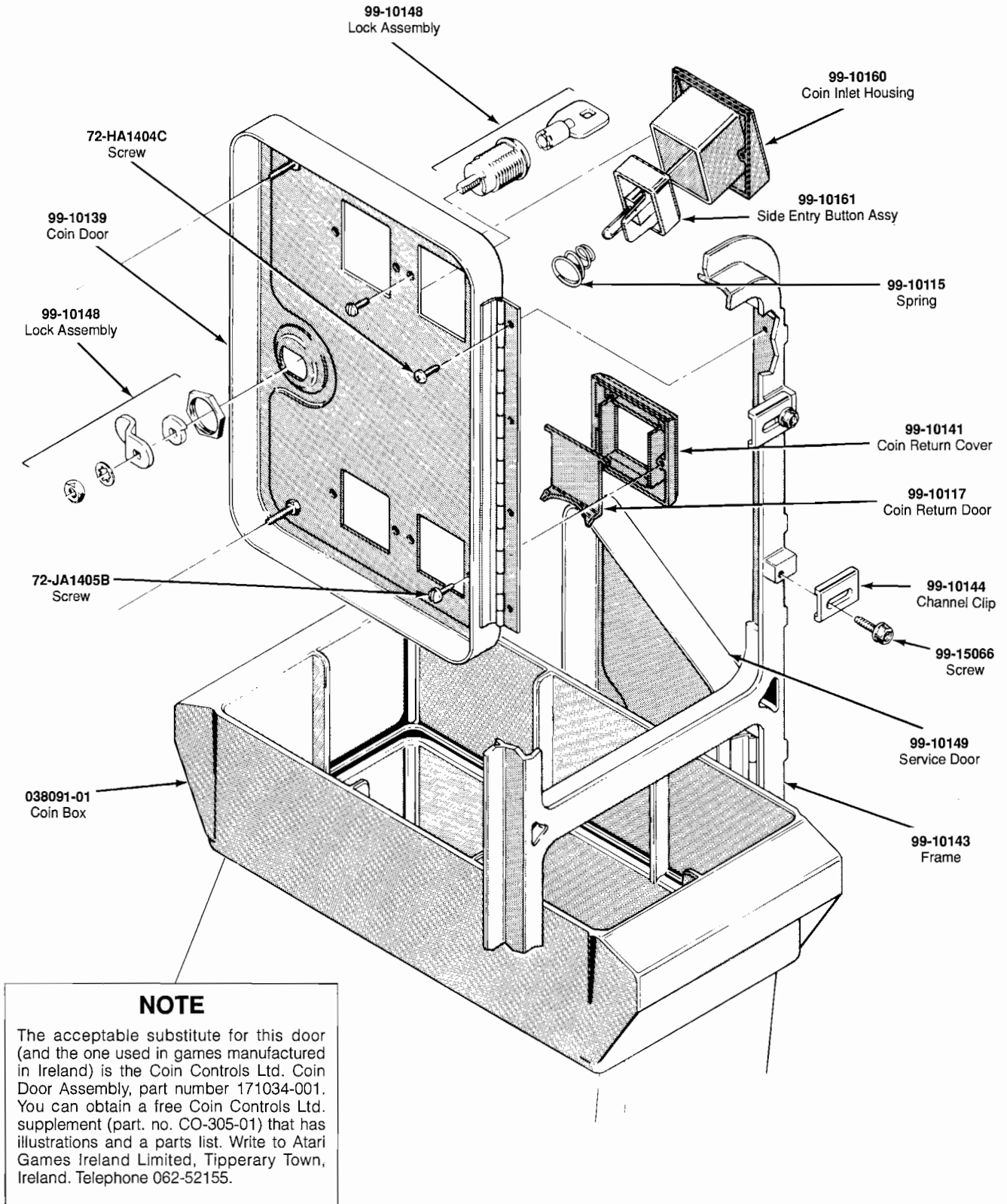
**Hitron 5V/12V Power Supply Sub-Assembly  
Parts List, Continued**

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 4-6 Coin Acceptors, Inc. Coin Door Assembly  
1710270-001 A**



**Figure 4-6 Coin Acceptors, Inc. Coin Door Assembly, Continued  
1710270-001 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

D2.03 1S1598  
 IC1 78L05  
 IC2 78L06

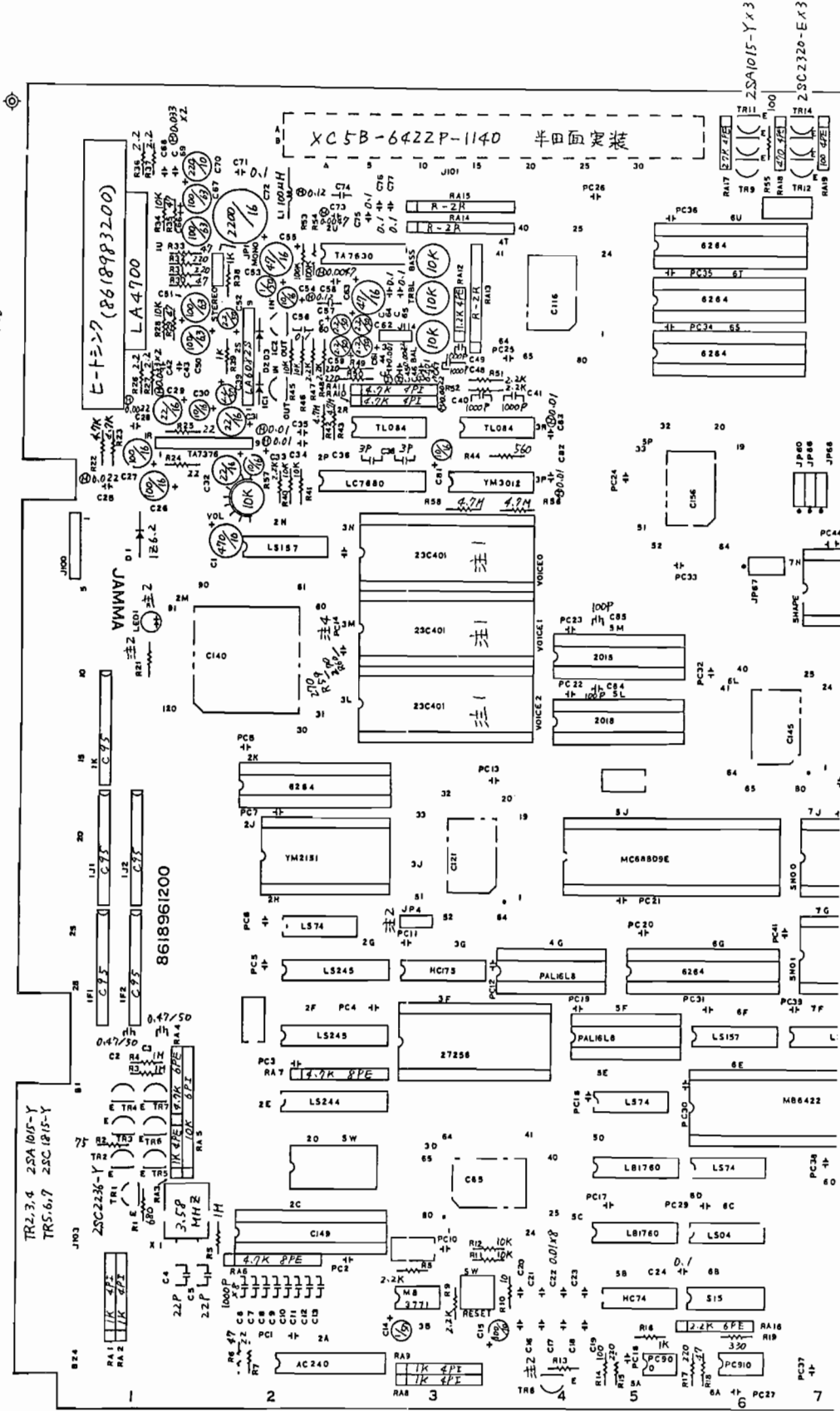


Figure 4-7 Final Lap CPU PCB Assembly  
 99-090360

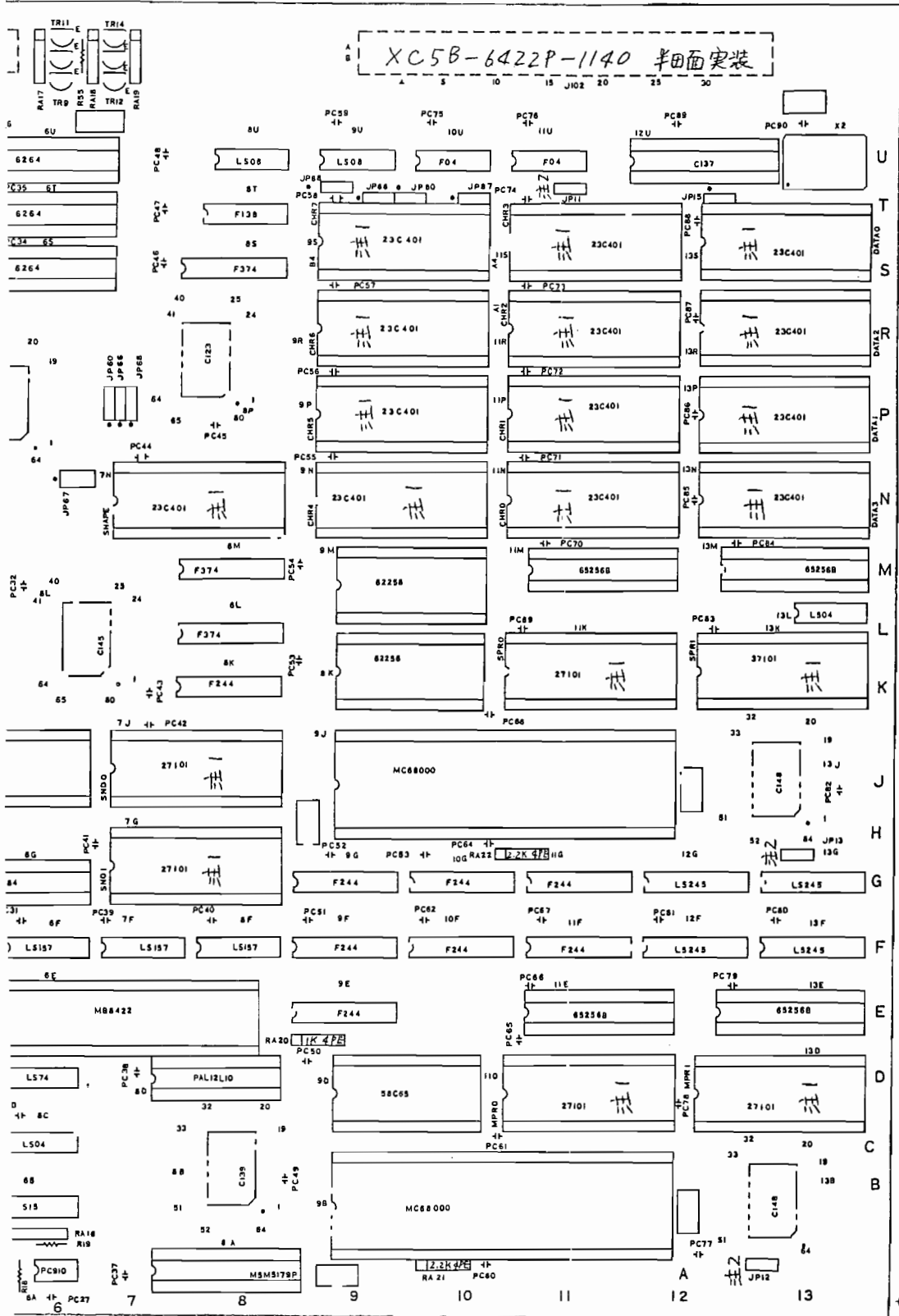


Figure 4-7 Final Lap CPU PCB Assembly, Continued  
99-090360

## Final Lap CPU PCB Assembly Parts List

Part No.	Description
<b>Integrated Circuits</b>	
136063-2101	IC, PR EPROM, Final Lap, MP0, 11D
136063-2102	IC, PR EPROM, Final Lap, MP1, 13D
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
136063-1116	IC, PR ROM, Final Lap, FL3, 5B
136063-1117	IC, PR PROM, Final Lap, 6R
136063-1118	IC, PR ROM, Final Lap, OBJ0B, 5F
136063-1119	IC, PR ROM, Final Lap, OBJ1B, 4F
136063-1120	IC, PR ROM, Final Lap, OBJ2B, 5H
136063-1121	IC, PR ROM, Final Lap, OBJ3B, 4H
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)
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
99-090303	Integrated Circuit, Custom 121
99-090313	Integrated Circuit, 74F138
99-090314	Integrated Circuit, 74F244
99-090315	Integrated Circuit, 74F374
99-090318	Integrated Circuit, Custom 123

## Final Lap CPU PCB Assembly Parts List

Part No.	Description
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
99-090366	Integrated Circuit, CPU, MC68000G12
99-090367	Integrated Circuit, CPU, 68B09EP
99-090368	Integrated Circuit, CPU, HD68B09E
99-090369	Integrated Circuit, RAM, MB8464A-15-SK
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
99-090377	Integrated Circuit, RAM, M5M5179-55
99-090378	Integrated Circuit, RAM, MB8422-12
99-090379	Integrated Circuit, RAM, HM6525GBSP-12
99-090380	Integrated Circuit, PAL, 16L8, SYS87B-1
99-090381	Integrated Circuit, PAL, 16L8, SYS87B-2
99-090382	Integrated Circuit, PAL, 12L10-2, SYS87B-3
99-090383	Integrated Circuit, EEPROM, HN58C65P-25
99-090384	Integrated Circuit, Custom 137
99-090385	Integrated Circuit, Custom 139
99-090386	Integrated Circuit, Custom 140
99-090387	Integrated Circuit, Custom 145
99-090388	Integrated Circuit, Custom 148
99-090389	Integrated Circuit, Custom 149
99-090390	Integrated Circuit, Custom 156
99-090391	Integrated Circuit, Custom 65
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

## Final Lap CPU PCB Assembly Parts List

Part No.	Description
<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
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 $\mu$ f, 25V
99-090175	Capacitor, Ceramic, 0.1 $\mu$ f, 25V
99-090180	Capacitor, Ceramic, .033 $\mu$ f, 50V, $\pm 10\%$
99-090266	Capacitor, Ceramic, .0047 $\mu$ f, 50V, $\pm 10\%$
99-090267	Capacitor, Ceramic, .01 $\mu$ f, 50V, $\pm 10\%$
99-090269	Capacitor, Electrolytic, 10 $\mu$ f, 16V

## Final Lap CPU PCB Assembly Parts List

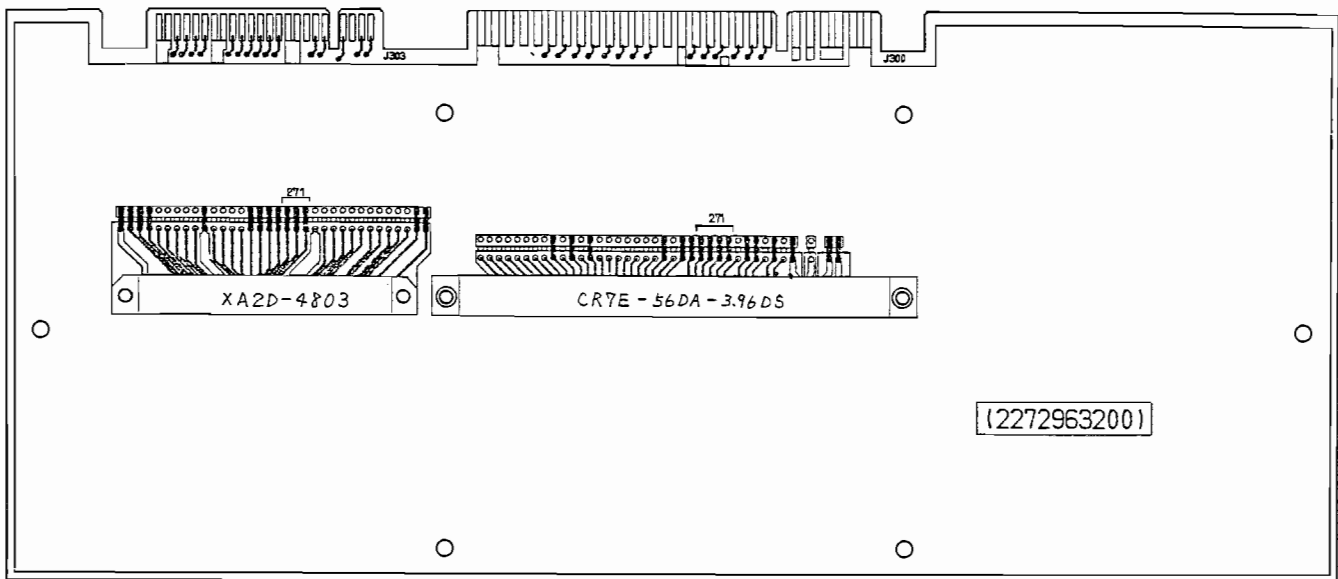
Part No.	Description
99-090270	Capacitor, Electrolytic, 47 $\mu$ f, 16V
99-090273	Capacitor, Electrolytic, 100 $\mu$ f, 16V
99-090347	Capacitor, Electrolytic, 22 $\mu$ f, 16V
99-090350	Capacitor, Electrolytic, .47 $\mu$ f, 50V
99-090411	Capacitor, Ceramic, 1000 pf, 25V
99-090412	Capacitor, Ceramic, 3 pf, 25V
99-090413	Capacitor
99-090414	Capacitor, Ceramic, 0.001 $\mu$ f, 50V
99-090415	Capacitor, Ceramic, 0.0022 $\mu$ f, 50V
99-090416	Capacitor, Ceramic, 0.022 $\mu$ f, 50V
99-090417	Capacitor, Ceramic, 0.12 $\mu$ f, 50V
99-090418	Capacitor, Electrolytic, 1 $\mu$ f, 50V
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
99-090161	Oscillator, KXO-01-49M152
99-090162	Oscillator, MCO-1425B (49.152 MHz)





## Final Lap Video PCB Assembly Parts List

Part No.	Description
<b>Integrated Circuits</b>	
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)
99-090244	Integrated Circuit, 74LS244
99-090288	Integrated Circuit, 74F04
99-090384	Integrated Circuit, Custom 137
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
99-090439	Integrated Circuit, RAM, MB81464-12
99-090440	Integrated Circuit, Custom 45
99-090441	Integrated Circuit, Custom 106
99-090442	Integrated Circuit, Custom 107
99-090443	Integrated Circuit, Custom 134
99-090444	Integrated Circuit, Custom 135
99-090445	Integrated Circuit, Custom 146
<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



**Final Lap EMI PCB Assembly  
155027-001**

**Parts List**

Part No.	Description
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 4-10 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

# N O T E S

# Glossary

## AC

Alternating current; from zero it rises to a maximum positive level, then passes through zero again to a maximum negative level.

## ACTIVE STATE

The true state of a signal. For example: The active state for is low.

## ADDRESS

A value that identifies a specific location of data in memory; normally expressed in hexadecimal notation.

## ANALOG

Measurable in an absolute quantity (as opposed to on or off). Analog devices are volume controls, light dimmers, stereo amplifiers, etc.

## ANODE

The positive (arrow) end of a diode.

## AMPLIFIER

A device used to increase the strength of an applied signal.

## AMPLITUDE

The maximum instantaneous value of a waveform pulse from zero.

## ASTABLE

Having no normal state. An astable device will free-run or oscillate as long as operating voltage is applied. The oscillation frequency is usually controlled by external circuitry.

## AUXILIARY COIN SWITCH

A momentary-contact pushbutton switch with a black cap located on the utility panel. The auxiliary coin switch adds credits to the game without activating a coin counter.

## BEZEL

A cut, formed, or machined retention device, such as the conical device used to mount a pushbutton switch to a control panel, or the formed device used to frame the video display screen.

## BIDIRECTIONAL

Able to send or receive data on the same line (e.g., the data bus of a microprocessor).

## BINARY

A number system that expresses all values by using two digits (0 and 1).

## BIT

A binary digit; expressed as 1 or 0.

## BLANKING

Turning off the beam on a cathode-ray tube during retrace.

## BLOCK DIAGRAM

A drawing in which functional circuitry units are represented by blocks. Very useful during initial troubleshooting.

## BUFFER

1. An isolating circuit designed to eliminate the reaction of a driven circuit on the circuits driving it (e.g., a buffer amplifier).
2. A device used to supply additional drive capability.

## BUS

An electrical path over which information is transferred from any of several sources to any of several destinations.

## CAPACITOR

A device capable of storing electrical energy. A capacitor blocks the flow of DC current while allowing AC current to pass.

## CATHODE

The negative end of a diode.

## CHIP

An integrated circuit comprising many circuits on a single wafer slice.

## CLOCK

A repetitive timing signal for synchronizing system functions.

## COINCIDENCE

Occurring at the same time.

## COIN COUNTER

A 6-digit electromechanical device that counts the coins inserted in the coin mechanism(s).

## COIN MECHANISM

A device on the inside of the coin door that inspects the coin to determine if the correct coin has been inserted.

## COMPLEMENTARY

Having opposite states, such as the outputs of a flip-flop.

## COMPOSITE SYNC

Horizontal and vertical synchronization pulses that are bused together into a single signal. This signal provides the timing necessary to keep the display in synchronization with the game circuitry.

## COMPOSITE VIDEO

Complete video signal from the game system to drive the display circuitry, usually comprising H SYNC, V SYNC, and the video.

## CREDIT

One play for one person based on the game switch settings.

## CRT

Cathode-ray tube.

## DATA

General term for the numbers, letters, and symbols that serve as input for device processing.

## DARLINGTON

A two-transistor amplifier that provides extremely high gain.

## DC

Direct current, meaning current flowing in one direction and of a fixed value.

## DEFLECTION YOKE

Electromagnetic coils around the neck of a cathode-ray tube. One set of coils deflects the electron beam horizontally and the other set deflects the beam vertically.

## DIAGNOSTICS

A programmed routine for checking circuitry. For example: the self-test is a diagnostic routine.

## DIODE

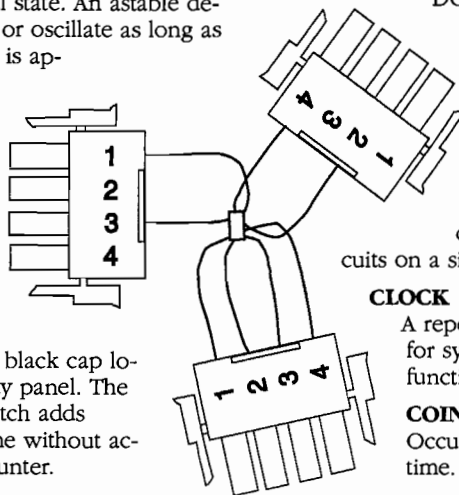
A semiconductor device that conducts in only one direction.

## DISCRETE

Non-integrated components, such as resistors, capacitors, and transistors.

## DMA

Direct memory access. DMA is a process of accessing memory that bypasses the microprocessor logic. DMA is normally used for transferring data between the input/output ports and memory.



**DOWN TIME**

The period during which a game is malfunctioning or not operating correctly due to machine failure.

**EAROM**

Electrically alterable read-only memory (see ROM). The EAROM is a memory that can be changed by the application of high voltage.

**FLYBACK**

A step-up transformer used in a display to provide the high voltage.

**GATE**

1. A circuit with one output that responds only when a certain combination of pulses is present at the inputs.
2. A circuit in which one signal switches another signal on and off.
3. To control the passage of a pulse or signal.

**HARNES**

A prefabricated assembly of insulated wires and terminals ready to be attached to a piece of equipment.

**HEXADECIMAL**

A number system using the equivalent of the decimal number 16 as a base. The symbols 0-9 and A-F are usually used.

**IMPLODE**

To burst inward; the inward collapse of a vacuum tube.

**I/O**

Input/Output.

**IRQ**

Interrupt request. IRQ is a control signal to the microprocessor that is generated by external logic. This signal tells the microprocessor that external logic needs attention. Depending on the program, the processor may or may not respond.

**LED**

The abbreviation for a light-emitting diode.

**LOCKOUT COIL**

Directs coins into the coin return box when there is no power to the game.

**LOGIC STATE**

The binary (1 or 0) value at the node of a logic element or integrated circuit during a particular time. Also called the logic level. The list below shows the voltage levels corresponding to the logic states (levels) in a TTL system.

*Logic 0, Low* = 0 VDC to +0.8 VDC

*Grey Area (Tri-State Level)* = +0.8 VDC to +2.4 VDC

*Logic 1, High* = +2.4 VDC to +5 VDC

**MULTIPLEXER**

A device that takes several low-speed inputs and combines them into one high-speed data stream for simultaneous transmission on a single line.

**NMI**

Non-maskable interrupt. NMI is a request for service by the microprocessor from external logic. The microprocessor cannot ignore this interrupt request.

**PAGE**

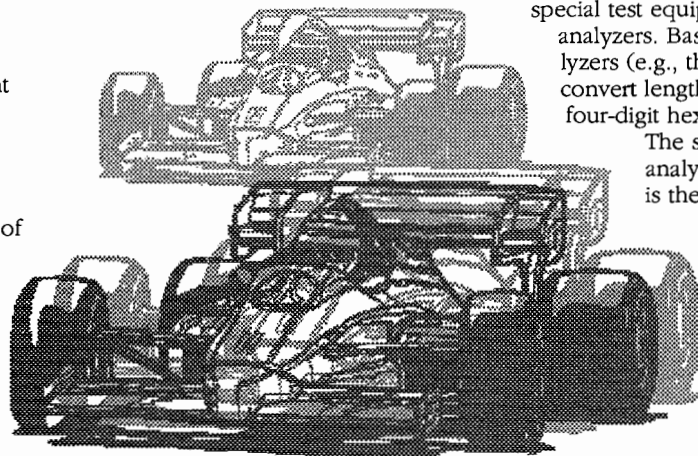
A subsection of memory. A read-only memory device (see ROM) is broken into discrete blocks of data. These blocks are called pages. Each block has X number of bytes.

**PCB**

The abbreviation for a printed-circuit board.

**PHOTOTRANSISTOR**

A transistor that is activated by an external light source.

**POTENTIOMETER**

1. A resistor that has a continuously moving contact which is generally mounted on a moving shaft. Used chiefly as a voltage divider. Also called a pot (slang).

2. An instrument for measuring a voltage by balancing it against a known voltage.

**RAM**

Random-access memory. A device for the temporary storage of data.

**RASTER-SCAN DISPLAY**

A display system whereby images are displayed by continuously scanning the cathode-ray tube horizontally and vertically with an electron beam. The display system controls the intensity of the electron beam.

**RETRACE**

In a raster-scan display, retrace is the time during which the cathode-ray tube electron beam is resetting either from right to left or from bottom to top.

**RESISTOR**

A device designed to have a definite amount of resistance. Used in circuits to limit current flow or to provide a voltage drop.

**ROM**

Read-only memory. A device for the permanent storage of data.

**SIGNATURE ANALYSIS**

A process of isolating digital logic faults at the component level by means of special test equipment called signature analyzers. Basically, signature analyzers (e.g., the ATARI® CAT Box) convert lengthy bit streams into four-digit hexadecimal signatures.

The signature read by the analyzer at each circuit node is then compared with the known good signature for that node. This process continues until a fault is located.

**TROUBLESHOOT**

The process of locating and repairing a fault.

**VECTOR**

A line segment drawn between specific X and Y coordinates on a cathode-ray tube.

**WATCHDOG**

A counter circuit designed to protect the microprocessor from self-destruction if a program malfunction occurs. If a malfunction does occur, the counter applies continuous pulses to the reset line of the microprocessor, which causes the microprocessor to keep resetting.

**X-Y DISPLAY**

A display system whereby images are displayed with vectors.

**ZENER DIODE**

A special diode used as a regulator. Its main characteristic is breaking down at a specified reverse-bias (Zener) voltage.

# 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.

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