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:

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California Customer Service Office
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P.O. Box 361120
Milpitas, CA 95035
Fax (408) 434-3945
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☎ (408) 434-3950
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Fax 062-51702
Telex 70665
☎ 062-52155
(Monday-Friday, 9:00 a.m.–5:30 p.m. GMT)

Dedicated three-player game
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---

**Notice Re: Non-Atari Parts**

**Warning**

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

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

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

**Note**

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

- All 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 that the game printed circuit boards (PCBs) are properly installed on 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.

---

**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 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 the 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 re-placed 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 counties 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:

**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 therein, 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.
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5 Schematic Diagrams
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Set-Up

How to Use This Manual

This manual is written for operators and service personnel. It provides information for setting up, playing, testing, and maintaining your Rampart™ three-player game. The manual is divided into the following chapters: 

♦ Chapter 1 contains set-up and game playing information. 
♦ Chapter 2 describes the self-test and how to use the self-test screens. 
♦ Chapter 3 contains maintenance, repair, and troubleshooting procedures. Be sure to perform the preventive maintenance tasks to keep the game in good condition. 
♦ Chapter 4 contains the parts illustrations. 
♦ Chapter 5 contains the schematics for the Rampart game printed-circuit board (PCB) and the Midi Trak-Ball coupler PCB, plus the game wiring diagram.
Inspecting the Game

WARNING
To avoid electrically shocking yourself and damaging the game electronics, do not plug in the game until it has been inspected and set up for your line voltage.

This cabinet should be connected to a grounded three-wire outlet only. 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.

Inspect your Rampart game carefully to ensure that the game is complete and well delivered to you in good condition.

Inspect the cabinet as follows:

1. Examine the exterior of the cabinet for dents, chips, or broken parts.
2. Open the service door. Unlock and open the coin doors. Inspect the interior of the cabinet as follows:
   a. Check that all plug-in connectors on the cabinet harnesses are firmly plugged in. Do not force connectors together. The connectors are keyed so they fit only in the proper orientation. A reversed connector can damage a printed-circuit board (PCB). This voids 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 wire is connected.

Table 1-1 Game Specifications

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Consumption</td>
<td>127 (99 W maximum)</td>
</tr>
<tr>
<td>Line Fuse Rating</td>
<td>3 Amps</td>
</tr>
<tr>
<td>Line Voltage</td>
<td>102 to 132 VAC</td>
</tr>
<tr>
<td>Temperature</td>
<td>5° to 38° C (47° to 100° F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>Not to exceed 95% relative</td>
</tr>
<tr>
<td>Width</td>
<td>53.25 inches (84 cm)</td>
</tr>
<tr>
<td>Depth</td>
<td>58.25 inches (97 cm)</td>
</tr>
<tr>
<td>Height</td>
<td>71.75 inches (182 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>325 lbs. (148 kg)</td>
</tr>
</tbody>
</table>

e. Inspect other sub-assemblies, such as the video display, controls, printed-circuit boards (PCBs), and speakers. Make sure that they are mounted securely and that the ground wires are connected.

Control and Switch Locations

Most of the controls are located inside the drawer, behind the control panel (see Figure 1-1). The only exception is the power on/off switch.

Power On/Off Switch

The power on/off switch is located at the top left of the cabinet (behind the peak).

Volume Control

The volume control is located on the Rampart game PCB, which is in the drawer behind the control panel.

Self-Test Switch

The self-test switch is also located on the game PCB, in the drawer behind the control panel.

Coin Counter

The coin counter is located on the bottom of the coin box, inside the lower coin door.

Installing the Control Panel

Make sure the game power is turned off. To install the separately packaged control panel, you need the following tools:

- Hex driver or wrench
- Four flat washers (provided with game)
- Four nut-washer assemblies (provided with game)

1. Reach in through the openings on the front of the drawer, and open the spring draw latch on each side. Pull the drawer out partly. (See Figure 1-1.)

2. Hold the control panel up to the front of the drawer, and match up the four threaded studs with the four small holes (one in each corner). See Figure 1-2.

3. Install one flat washer and nut/washer assembly onto each threaded stud.

4. Plug the two control panel harness connectors into the game harness inside the drawer. These connectors are interchangeable, so be sure to match wire colors. Plug the ground wires together at the Fast-on connectors. This step is very important, since this wire grounds the control panel.

5. Close the drawer and snap shut both latches.

6. Turn on the game power. Check that the video display and the attraction lamp have power.

7. Observe the screen: you should see the attract mode displayed. If the screen remains a solid white, red, or blue color, you have a RAM failure. These failures are as follows:
   White: Color RAM
   Red: Bit-map RAM
   Blue: Motion-object RAM

NOTE

The Rampart game does a short RAM test whenever you turn on the power. If you want to circumvent the solid white, red, or blue RAM failure screen and enter the self-test, push the self-test switch to the "on" position (to the right). Then turn the game power off and on again.

Setting the Coin and Game Options

The Rampart coin and game options are set in the self-test. 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 Rampart game and the game play features.

Introduction

Rampart combines the best of strategy puzzle games with dynamic action and the excitement of head-to-head competition. Up to three players can play at once to see who becomes the medieval overlord.

Play Mode

In the first phase of game play, players select a site for their home castle and position their cannons. Then, it's on with the battle, as each side hurlcs projectiles to destroy enemy walls. Once the onslaught ends, the players must quickly rebuild and extend their walls before the next battle. The players must completely surround at least one castle in order to continue play.

In a multiple-player game, the content is head-to-head for an operator-selectable maximum of player battles (the factory setting is for seven battles per game). As long as a player can place pieces to surround at least one castle, he continues. If a player is eliminated, he may deposit another coin to continue.

In a one-player game, the computer directs an invading army against the player's castle. The objective is to establish a fort and expand your realm to the entire island. You must destroy the computer's fleet before they reach shore and move their cannons onto the land. In higher levels of game play, the computer cannon fire will leave behind burning rubble, preventing the player from repairing and extending his walls.

Rampart's action is lightning fast. The strategy is exhilarating. The thrill of head-to-head competition is intense.
Use the Rampart self-test to check the condition of the game circuitry and controls. You will see the self-test information on the video display and hear the sound test information through the speakers. You do not need any additional equipment to perform the self-test. You should perform the self-test when you first set up the game, each time you collect the money, or when you suspect game failure.

This chapter shows the screens in the self-test and explains each of the tests. The screens and explanations are arranged in the order they appear in the self-test. Table 2-1 lists all of the self-test screens and their purposes.
Entering and Exiting the Self-Test

To enter the self-test, turn on the self-test switch on the game PCB. Exit the self-test by switching off the self-test switch.

Select Test Menu

Choose which test or screen you want to see from this menu, shown in Figure 2-1. Move up and down the list by rolling the Track-Ball; the corresponding test is highlighted in white. Choose the screen by pressing the red PLACE button.

Statistics

Use the information shown on the statistics screen, in Figure 2-2, and on the histogram screens to keep track of your game use and maximize your profits. Record the information on the Rampart statistics page in the back of this manual. The statistics are collected from the last time the statistics were cleared. You can clear the statistics by holding down the red ROTATE button and pressing the red PLACE button at the same time.

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

Press the red PLACE button to leave this screen and go to the histogram.

- **Left Coins** show the number of coins counted in the left coin mechanism.
- **Right Coins** show the number of coins counted in the right coin mechanism.

**Table 2-1 Summary of All Self-Test Screens**

<table>
<thead>
<tr>
<th>Screen</th>
<th>Use or Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistics Screen</td>
<td>Displays the game statistics.</td>
</tr>
<tr>
<td>Game Options Screen</td>
<td>Use to set and check the game options settings.</td>
</tr>
<tr>
<td>Coin Options Screen</td>
<td>Use to check the coin options settings.</td>
</tr>
<tr>
<td>Sound Test Screen</td>
<td>Use to check the audio circuits.</td>
</tr>
<tr>
<td>Controls Test Screen</td>
<td>Use to test the player controls.</td>
</tr>
<tr>
<td>RAM Test Screen</td>
<td>Use to check the video RAM.</td>
</tr>
<tr>
<td>Video RAM (looping)</td>
<td>Use to check the color RAM.</td>
</tr>
<tr>
<td>All RAM (looping)</td>
<td>Use to check all RAM.</td>
</tr>
<tr>
<td>ROM Test Screen</td>
<td>Use to check the program ROMs.</td>
</tr>
<tr>
<td>Playfield Test Screen</td>
<td>Use to test the movement and color of game objects.</td>
</tr>
<tr>
<td>Motion Object Screen</td>
<td>Use to test the movement and color of game objects.</td>
</tr>
<tr>
<td>Color Test Screen</td>
<td>Use to check the video display color circuits.</td>
</tr>
<tr>
<td>Purity Test Screen</td>
<td>Use to check the red color purity in the video display.</td>
</tr>
<tr>
<td>Red Color Purity Screen</td>
<td>Use to check the green color purity in the video display.</td>
</tr>
<tr>
<td>Blue Color Purity Screen</td>
<td>Use to check the blue color purity in the video display.</td>
</tr>
<tr>
<td>White Color Purity Screen</td>
<td>Use to check the white color in the video display.</td>
</tr>
<tr>
<td>Grey Color Purity Screen</td>
<td>Use to check the grey color in the video display.</td>
</tr>
<tr>
<td>White Convergence Screen</td>
<td>Use to check and adjust video display convergence of red, blue, and green.</td>
</tr>
<tr>
<td>Violet Convergence Screen</td>
<td>Use to check and adjust video display convergence of red to blue.</td>
</tr>
<tr>
<td>Green Convergence Screen</td>
<td>Use to check and adjust video display convergence of red and blue to green.</td>
</tr>
</tbody>
</table>

**Figure 2-2 Statistics Screen**

- **Axes Coins** shows the number of coins counted on the auxiliary coin input.
- **Idle Mins** shows the number of minutes the game was not being played.
- **1 Player/2 Player/3 Player Mins** is the number of minutes the game was played by one, two, or three players.
- **New Game Mins** is the amount of time the game is played before continuation.
- **Cont Game Mins** is the amount of time the game was played during "add-a-coin" (continuation).
- **Left/Right PIR Mins** is the number of minutes the game was played at the left, center, and right player stations.
- **Active Mins** is the number of minutes the game was being played in any mode.
- **Total Games** is the number of games played (one game per player).
- **Total Sessions** is the number of sessions played. For example, one 3-player game counts as one session.
- **1-Pl Beginners** is the number of 1-player beginner games played.
- **1-Pl Advanced** is the number of 1-Player "veteran" games played.
- **Error Count** shows the number of errors counted in the erasable memory. If you have an error count, the statistics may be wrong. If you consistently have errors counted for several weeks, replace the ERROM at 34F.
- **Avg Time/Coin** is the average amount of seconds played per coin.
- **Percentage Play** is the amount of time, as a percentage, that the game is played while it is powered on.

**Figure 2-3 Game Options Screen**

default settings are shown in green. To change a setting, roll the Track-Ball right or left. To save the new settings, press the red PLACE button. This returns you to the select test screen. If you want to keep the original setting, although you have changed it, press the red ROTATE button. This brings back the original setting. Use the red PLACE button to exit. The game options settings with factory defaults are shown in Table 2-2.
Table 2-2 Game Option Settings

<table>
<thead>
<tr>
<th>Option</th>
<th>Settings</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restore Factory Options</td>
<td>Yes</td>
<td>No ❑ Lets you set all the game options to the factory defaults or use your own settings. Make sure you set this to no to use your own settings.</td>
</tr>
<tr>
<td>Clear High Scores</td>
<td>Off</td>
<td>On ❑ Let's you clear the high score table.</td>
</tr>
<tr>
<td>Game Difficulty</td>
<td>Easy</td>
<td>Medium ❑ Pre-programmed obstacles and more enemy cannons being fixed contribute to increased difficulty.</td>
</tr>
<tr>
<td></td>
<td>Hard</td>
<td>Very Hard</td>
</tr>
<tr>
<td>Length of 2- or 3-Player Game</td>
<td>5, 7, 10, 15 battles</td>
<td></td>
</tr>
<tr>
<td>Additional Rounds After</td>
<td>2, 4</td>
<td>6, 8 Let's you adjust the additional number of rounds (battles) after an add-a-coin in multiplayer games.</td>
</tr>
<tr>
<td>Add-a-coin</td>
<td>Off</td>
<td>On ❑ Automatically resets the high scores to the factory defaults after 2000 games, unless a player has entered his initials within the previous 200 games.</td>
</tr>
</tbody>
</table>

❑ Manufacturer's recommended settings. These settings are shown in green on the screen.

Coin Options

Check and select the coin options on this screen, shown in Figure 2-4. To move through the options, roll the Trak-Ball up or down. Change the option in yellow type. The factory default settings are shown in green. To change a setting, roll the red Midi Trak-ball right or left. To save the new settings, press the red PLACE button. This returns you to the select test screen. If you want to keep the original setting, although you have changed it, press the red ROTATE button. This brings back the original setting. Use the red PLACE button to exit.

The coin option settings and factory defaults are explained in Table 2-3.

Table 2-3 Coin Option Settings

<table>
<thead>
<tr>
<th>Option</th>
<th>Settings</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free Play</td>
<td>No</td>
<td>Yes ❑ Set this to &quot;Yes&quot; for demonstrating the game.</td>
</tr>
<tr>
<td>Discount to Continue</td>
<td>No</td>
<td>Yes ❑ Lets you offer a reduced price per credit when players want to continue the game.</td>
</tr>
<tr>
<td>Game Cost</td>
<td>1 coin 1 credit</td>
<td>❑ Sets the number of coins required for one credit.</td>
</tr>
<tr>
<td></td>
<td>2 coins 1 credit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8 coins 1 credit</td>
<td></td>
</tr>
<tr>
<td>Bonus for Quantity Buy-in</td>
<td>None ❑</td>
<td>Lets you choose various levels of bonus coins or no bonus.</td>
</tr>
<tr>
<td></td>
<td>2 coins give 1 (extra coin)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 coins give 1 (extra coin)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 coins give 2 (extra coins)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 coins give 2 (extra coins)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9 coins give 2 (extra coins)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 coins give 3 (extra coins)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 coins give 3 (extra coins)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9 coins give 3 (extra coins)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11 coins give 3 (extra coins)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 coins give 2 (extra coin)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 coins give 2 (extra coins)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 coins give 2 (extra coins)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 coins give 2 (extra coins)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9 coins give 2 (extra coins)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11 coins give 2 (extra coins)</td>
<td></td>
</tr>
<tr>
<td>Right Mech Value</td>
<td>1 coin counts as 1 coin ❑</td>
<td>Is the number of coins each coin counts as in the right coin mechanism.</td>
</tr>
<tr>
<td>Left Mech Value</td>
<td>1 coin counts as 1 coin ❑</td>
<td>Is the number of coins each coin counts as in the left coin mechanism.</td>
</tr>
</tbody>
</table>

❑ Manufacturer's recommended settings. These settings are shown in green on the screen.

Sound Test

The sound test indicates the condition of the sound effects circuit on the game PCB. The sound test screen appears in Figure 2-5.

Use the Trak-Ball to select the sound and press the red ROTATE button to listen to it. Pressing the red PLACE button returns you to the select test menu.

Controls Test

The controls test screen is shown in Figure 2-6. Test the coin mechanism switches, control panel buttons, and Midi Trak Balls. As you use the control, the red control name changes to yellow on the screen. If the name does not change to yellow, check the connections, switches, and mechanism. Ignore the "RIGHT PLACE ALT" and "RIGHT ROTATE ALT" screen displays; they are not applicable to this game. Simultaneously press the red ROTATE and red PLACE buttons to return to the test select screen.

Moving each Trak-Ball causes the yellow hexadecimal numbers to change when you roll it up and down (UP/DN) or left and right (LT/RT). Use these numbers to help correctly orient the Trak-Ball, if you are installing a new one. If the numbers on the screen do not change, check the optical coupler PCBs, connectors, and harnesses for that direction of movement.

Complete RAM Test

Use this selection screen, shown in Figure 2-7, to choose which RAM test you want to perform. Use the different tests according to Table 2-4.
If you get an error in any of the RAM tests, see Table 2-5 for more information. If you have serious RAM problems, you may see only a colored screen. Press the red PLACE button to leave the individual RAM test and return to the RAM test menu screen. Press the red PLACE button once more to return to the test select screen.

Complete ROM Test

The ROM test screen is shown in Figure 2-8. The OK information appears. If the game has no ROM errors, you see the message ALL ROMS are OK. If the game does have ROM errors, the ROM test screen will remain until the ROM error information is complete. Press the red PLACE button several times to pass the ROM errors. The ROM error test takes a few seconds.

Table 2-6 Bad ROM Locations by Error Address

<table>
<thead>
<tr>
<th>Error Address</th>
<th>ROM Location High</th>
<th>ROM Location Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>0K-H</td>
<td>13H</td>
<td>0K-L</td>
</tr>
<tr>
<td>20K-H</td>
<td>13H</td>
<td>20K-L</td>
</tr>
<tr>
<td>40K-H</td>
<td>13H</td>
<td>40K-L</td>
</tr>
<tr>
<td>80K-H</td>
<td>13H</td>
<td>80K-L</td>
</tr>
<tr>
<td>C0K-H</td>
<td>13H</td>
<td>C0K-L</td>
</tr>
<tr>
<td>Program ROM 8x1024 Configuration:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OK-H</td>
<td>13H</td>
<td>0K-L</td>
</tr>
<tr>
<td>20K-H</td>
<td>13H</td>
<td>20K-L</td>
</tr>
<tr>
<td>40K-H</td>
<td>13H</td>
<td>40K-L</td>
</tr>
<tr>
<td>80K-H</td>
<td>13H</td>
<td>80K-L</td>
</tr>
<tr>
<td>C0K-H</td>
<td>13H</td>
<td>C0K-L</td>
</tr>
<tr>
<td>Program ROM 2x512 and 2x4096 Configuration:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OK-H</td>
<td>13H</td>
<td>0K-L</td>
</tr>
<tr>
<td>20K-H</td>
<td>13H</td>
<td>20K-L</td>
</tr>
<tr>
<td>40K-H</td>
<td>13H</td>
<td>40K-L</td>
</tr>
<tr>
<td>80K-H</td>
<td>13H</td>
<td>80K-L</td>
</tr>
<tr>
<td>C0K-H</td>
<td>13H</td>
<td>C0K-L</td>
</tr>
</tbody>
</table>

If you have 8x32-pin ceramic parts in column 13 on your Rampant Game PCB, you have an 8x1024 configuration. If you have 2x28-pin ceramic parts and 2x12-pin plastic parts in column 13 of this board, you have a 2x512 and 2x4096 configuration.

Press the red PLACE button to move to the next object. Simultaneously press the red ROTATE and red PLACE buttons to go to the test select screen.

Color Test

This test indicates the dynamic range of the video display color circuit. The screen is shown in Figure 2-11.

The left side of the screen should be black, with a grey scale changing to white in the middle. The right half of the screen should be red, green, and blue from top to bottom, each with a color scale from dark to bright, left to right.

If the screen does not match this description, adjust the video display as described in the video display manual. Return to the test select screen by pressing the red PLACE button.

Color Purity Test

The color purity test has five screens. Each screen is a solid rectangle of color. The first screen is red. The other screens, which you can see by pressing the left ROTATE button, are green, blue, white, and gray.

These screens show the adjustment of the color purity of the video display. Each screen should display a rectangle of color, with no curving at the corners, no unevenness of color, and no lines in the display.

If the screens are not correct, adjust the video display as described in the video display manual. Return to the test select screen by pressing the red PLACE button.

Motion Object Test

The motion object test screen, shown in Figure 2-10, tests the movement and color of various game objects. Select the test function with the left ROTATE button. Use the Trak-Ball to move objects, change pictures, change object size, change object palette, and to toggle the horizontal flip. If there is an error, check the motion object ROM at 2N, also check the motion object RAM at 5N and 6N (see the RAM test above).

Table 2-5 Bad RAM Locations by Error Address

<table>
<thead>
<tr>
<th>Type of RAM</th>
<th>Address</th>
<th>RAM Location</th>
<th>Data Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Playfield RAM</td>
<td>200000 to 21FFF</td>
<td>11H</td>
<td>0-3</td>
</tr>
<tr>
<td></td>
<td>9H</td>
<td>8-11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8H</td>
<td>12-15</td>
<td></td>
</tr>
<tr>
<td>Motion Object</td>
<td>3E0000 to 3EFFF</td>
<td>6N</td>
<td>0-7</td>
</tr>
<tr>
<td></td>
<td>5N</td>
<td>8-15</td>
<td></td>
</tr>
<tr>
<td>Color RAM</td>
<td>3C0000 to 3C0FFF</td>
<td>4H</td>
<td>8-15</td>
</tr>
</tbody>
</table>
Convergence Test

The convergence test has three screens: first white, then violet, and finally green. The white screen is shown in Figure 2-13. To see the violet and green screens, press the left ROTATE button. Press the red PLACE button to go to the test select screen.

Check the following on the screens:

- The grid lines should be straight within 3 mm, and the lines should not punctuate or barret.
- The convergence of the lines on the violet and white screens should be within 2 mm.

If these screens do not meet these criteria, adjust the video display as described in the video display manual.

Figure 2-12 Convergence Test Screen

This chapter contains troubleshooting tables and repair procedures for your Rampart™ game. The chapter has two parts. The first part contains three troubleshooting tables. The tables contain general troubleshooting information, the voltage levels and test points on the game printed-circuit board, and a list of ROM-caused problems, with specific ROMs to check and replace. The last part of the chapter has information about connecting the video display if it requires separate positive sync and repair information for the Midi Trak-Ball control assembly.
Table 3-1 Troubleshooting Table

<table>
<thead>
<tr>
<th>Problem</th>
<th>Suggested Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coin Mechanism Problem</td>
<td>1. Check the wiring to the coin mechanism.</td>
</tr>
<tr>
<td></td>
<td>2. Check the voltage to the + side of the mechanism.</td>
</tr>
<tr>
<td></td>
<td>3. Test the coin mechanisms with the sound test screen in the self-test.</td>
</tr>
<tr>
<td>Game Play Problem</td>
<td>1. Check the harness and connectors.</td>
</tr>
<tr>
<td></td>
<td>2. Perform the self-test.</td>
</tr>
<tr>
<td>Trak-Ball Control Problem</td>
<td>1. Has the Trak-Ball been lubricated with the correct type of lubricant?</td>
</tr>
<tr>
<td></td>
<td>If not, lubricate it as shown in Figure 4-2.</td>
</tr>
<tr>
<td></td>
<td>2. Check the harnesses and connectors.</td>
</tr>
<tr>
<td></td>
<td>3. Check the optical coupler PCBs on the control.</td>
</tr>
<tr>
<td></td>
<td>4. If you took the control apart, have you reassembled it correctly?</td>
</tr>
<tr>
<td></td>
<td>5. Make sure all the parts on the control are in good repair. Replace or replace parts.</td>
</tr>
<tr>
<td>Sound Problem</td>
<td>1. Is the speaker volume turned up?</td>
</tr>
<tr>
<td></td>
<td>2. Check the voltage on the JAMMA connector.</td>
</tr>
<tr>
<td></td>
<td>3. Check the wiring from the PCB to the speaker.</td>
</tr>
<tr>
<td>Video Display Problem</td>
<td>1. Is the game plugged in?</td>
</tr>
<tr>
<td></td>
<td>2. Is the game turned on?</td>
</tr>
<tr>
<td></td>
<td>3. Are the connections good?</td>
</tr>
<tr>
<td></td>
<td>4. Is the line fuse good?</td>
</tr>
<tr>
<td></td>
<td>5. Is the display brightness turned up?</td>
</tr>
<tr>
<td></td>
<td>6. Are the solder connections on the line filter and transformer good?</td>
</tr>
<tr>
<td></td>
<td>7. Is the connector on the PCB tightly connected?</td>
</tr>
<tr>
<td></td>
<td>8. Check all of the items below. If you answer no to any question, you have a</td>
</tr>
<tr>
<td></td>
<td>problem with the video display, not with the game circuitry.</td>
</tr>
<tr>
<td></td>
<td>a. Do you have power to the video display?</td>
</tr>
<tr>
<td></td>
<td>b. Are the video display’s brightness and contrast set correctly?</td>
</tr>
<tr>
<td></td>
<td>c. Do you have high voltage to the video display?</td>
</tr>
<tr>
<td></td>
<td>9. Are the voltage levels to the video display PCB correct?</td>
</tr>
<tr>
<td></td>
<td>(Power voltage is 100 VAC or 110 VAC, depending on the type of video display.</td>
</tr>
<tr>
<td></td>
<td>Video signal voltage is 0.5 to 3.5 Volts.)</td>
</tr>
<tr>
<td></td>
<td>10. If the level is not correct, check the connectors and the harness.</td>
</tr>
<tr>
<td>Display area waves or is too small</td>
<td>1. Do you have correct power voltage to the video display PCB?</td>
</tr>
<tr>
<td>Picture is wavy.</td>
<td>2. Do you have correct high voltage to the video display?</td>
</tr>
<tr>
<td>Convergence, purity or color problems</td>
<td>Use the screens in the self-test to adjust the display. Use the adjustment</td>
</tr>
<tr>
<td>Picture is upside down.</td>
<td>procedures in your video display manual.</td>
</tr>
<tr>
<td></td>
<td>Switch the horizontal or vertical sync wires on the display.</td>
</tr>
<tr>
<td></td>
<td>Use the centering procedures in your video display manual.</td>
</tr>
</tbody>
</table>

Repairing the Video Display

The video display frame in this game is designed to be used with both horizontal- and vertical-mounting displays, as well as 19- and 25-inch displays.

Removing the Video Display

If you have a problem with the video display, first run the self-test procedure to narrow down the cause. To make adjustments to the video display, unlock the service door on the rear of the cabinet.

If you want to repair the video display, remove it from the game by following this procedure:
1. Turn the game power off and wait two minutes. Unplug the power cord for safety.

Table 3-2 Voltage Inputs and Test Points on the PCB

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Test Point or LED</th>
<th>Source and Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>+5 ± 0.25 VDC</td>
<td>+SVI</td>
<td>Logic power from the switching power supply.</td>
</tr>
<tr>
<td>CR8 LED</td>
<td></td>
<td>Lights when 5 V is applied to the PCB and the reset (RST) jumper is open.</td>
</tr>
<tr>
<td>CR5 LED</td>
<td></td>
<td>Lights when the +12 V supply is good.</td>
</tr>
<tr>
<td>CR4 LED</td>
<td></td>
<td>Lights when the -5 V supply is good.</td>
</tr>
<tr>
<td>+12V</td>
<td>+VDP</td>
<td>+12 V from the switching power supply.</td>
</tr>
<tr>
<td>(pin 4 of LM324)</td>
<td></td>
<td>Positive supply for the analog circuitry.</td>
</tr>
<tr>
<td>-5V</td>
<td>-VDP</td>
<td>-5V from the switching power supply (if connected). Negative supply for the analog circuitry.</td>
</tr>
</tbody>
</table>

Table 3-3 What ROM Problems Look Like

<table>
<thead>
<tr>
<th>Problem</th>
<th>ROM Causing the Problem</th>
<th>Check the ROM at</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program works, but the motion object is wrong.</td>
<td>Graphics 2N</td>
<td></td>
</tr>
<tr>
<td>Garbage on screen; program doesn’t work. or game program is erratic.</td>
<td>Processor 13C</td>
<td></td>
</tr>
<tr>
<td>No sound or erratic sound.</td>
<td>Audio ROM 2D, 1D</td>
<td></td>
</tr>
</tbody>
</table>

2. While you wait, unlock the top service door on the rear of the cabinet.
3. Remove the three screws that attach the attraction shield retainer, and remove retainer, shield, and attraction film. Then remove the display shield, cardboard bezels, and cleats in front of the display.

WARNING

High Voltage

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

X-Radiation

This video display is 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 (CRT) may implode if struck or dropped. The shattered glass from the tube may cause injury up to six feet away. Use care when handling the display and when removing it from the game cabinet. Also, wear gloves to protect your hands from the sheet-metal edges.

4. Remove the four nuts and washers that secure the video display.
5. 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, always 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.
6. Disconnect the harness connector from the video display.
7. Pull the video display assembly out of the cabinet. Be extremely careful.

Replacing the Video Display

Perform the following procedure to replace the video display in the cabinet.
1. Carefully lift the video display into the cabinet.
2. Install the nuts that hold the video display assembly.
3. Connect the power and signal harnesses to the video display.
If you replace the CRT and yoke together, adjust the brightness, size, and centering as described in
the video display service manual. Check the purity
and convergence according to that manual, but ad-
just both only if required.
4. Install the video display shield, bezel, and cleats.
Replace the attraction film, shield, and retainer.
5. Lock the rear service door on the cabinet.

Midi Trak-Ball Control

Routine maintenance of the Midi Trak-Ball control con-
sists mainly of inspecting the roller shafts for excessive
wear and periodically lubricating the bearings.

Removing the Midi Trak-Ball

1. Open the control panel, and disconnect the har-
ness at the six-pin connector.
2. Remove the four nuts and carriage bolts that secure
the Midi Trak-Ball assembly to the control panel.

Disassembling the Midi Trak-Ball

To disassemble the Midi Trak-Ball after it has been re-
moved from the control panel, remove the six screws
that secure the upper and lower frames (see Figure
4-3). Lift off the upper frame. The Midi Trak-Ball can
now be disassembled.

Inspecting the Midi Trak-Ball

1. With the Midi Trak-Ball disassembled, inspect the
roller shafts and the idler shaft for excessive wear
(see Figure 3-1). If the wear band exceeds 1/8
inch, replace the roller shaft as described in steps
2-6, or replace the idler shaft as described in steps
7-10.
2. To replace a roller shaft, first remove the roller
shaft from the lower frame.
3. Remove the metal encoding wheel by loosening
the socket-head screw, flat washer, and split-lock
washer. Remove the encoding wheel and bearings.
4. Remount the bearings and encoding wheel on a
new roller shaft.
5. Tighten the encoding wheel by inserting a 1/8-
inch-diameter pin or screwdriver through the hole
in the shaft. Tighten the socket-head screw with an
Allen wrench.
6. Reinstall the roller shaft in the lower frame.
7. To replace the idler shaft, first remove the idler
shaft from the lower frame.
8. Remove the bearings from the ends of the idler
shaft.
9. Remount the bearings on a new idler shaft.
10. Reinstall the idler shaft in the lower frame.

Lubricating the Midi Trak-Ball

Lubrication of the Midi Trak-Ball assembly should be
performed every three months or 6,000 credits (as
counted on the coin counter). To lubricate, place two
drops of a light-duty oil, such as 3-In-One oil, on each
of the six ball bearings shown in Figure 4-2.

Replacing the Coupler PCB

1. To remove the Coupler PCB, first disassemble the
Midi Trak-Ball. Lift the PCB out of its slot. Carefully
disconnect the red connector and remove the PCB.
2. To reinstall the Coupler PCB, place the PCB in the
slot in the lower frame, and reconnect the red con-
nector.

NOTE

When you reinstall the Coupler PCB, make sure that the metal encoding wheel
is not bent or damaged. Be sure the en-
coding wheel turns freely between the
two halves of the radial optical coupler.

Reassembling the Midi Trak-Ball

1. Install the upper frame of the Midi Trak-Ball over
the assembly. Be sure that each Coupler PCB is en-
gaged in the slots of the upper frame.
2. Replace the six screws that secure the upper and
lower frames together.
3. Remount the Midi Trak-Ball assembly to the control
panel using the four nuts and carriage bolts.
4. Reconnect the six-pin connector of the harness.

ROMs and RAMs

If you have think you have bad ROMs or RAMs, pre-
form the ROM or RAM test in the self-test. If you have
a ROM problem, see Table 3-3.

This chapter provides information you need to order re-
placement parts for your Rampa-
rt™ three-player game. Common hardware parts, such
as screws, nuts, washers, and
so on, are included in these parts illustrations.
When you order parts, give the part num-
ber, 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 num-
bers are listed on the inside front cover of
this manual.
### Schematic Diagrams

This chapter contains the schematics diagrams for your Rampart™ game PCB. The game wiring diagram is also included in this chapter. The Rampart 3-player game PCB assembly drawing is illustrated in Chapter 4 of this manual.
Figure 5-1 Rampart™ Game PCB Assembly Schematic Diagram
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 a 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 (zero).

ASTABLE
Having no normal state. An unstable 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.

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 direct current while allowing AC current to pass.

CATHODE
The negative end of a diode.

CEP
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 mechanisms.

COIN MECHANISM
A device on the inside of the coin door that inspects the coins 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 based 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
Our 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 remains in one state only when a certain combination of inputs 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.

HARNESS
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.

IMPOUND
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
- 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 (plug).
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.

RAPID-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.

RETRO
In a raster-scan display, retro is the time during which the cathode-ray tube electron beam is emitting 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 lengthly 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.

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Rampart Statistics Sheet

Date Recorded: ___________________ Location: ___________________

Meter: ___________________

Statistics Screen

Left Coins: ___________________
Right Coins: ___________________
Auxiliary Coins: ___________________
Idle Minutes: ___________________
1-Player Minutes: ___________________
2-Player Minutes: ___________________
3-Player Minutes: ___________________
New Game Minutes: ___________________
Continued Game Minutes: ___________________
Left Player Minutes: ___________________
Center Player Minutes: ___________________
Right Player Minutes: ___________________
Active Minutes: ___________________
Total Games: ___________________
Total Sessions: ___________________
1-Player Beginners: ___________________
1-Player Advanced: ___________________
Error Count: ___________________
Total Coins: ___________________
Average Time/Coin: ___________________ sec.
Percentage Play: ___________________