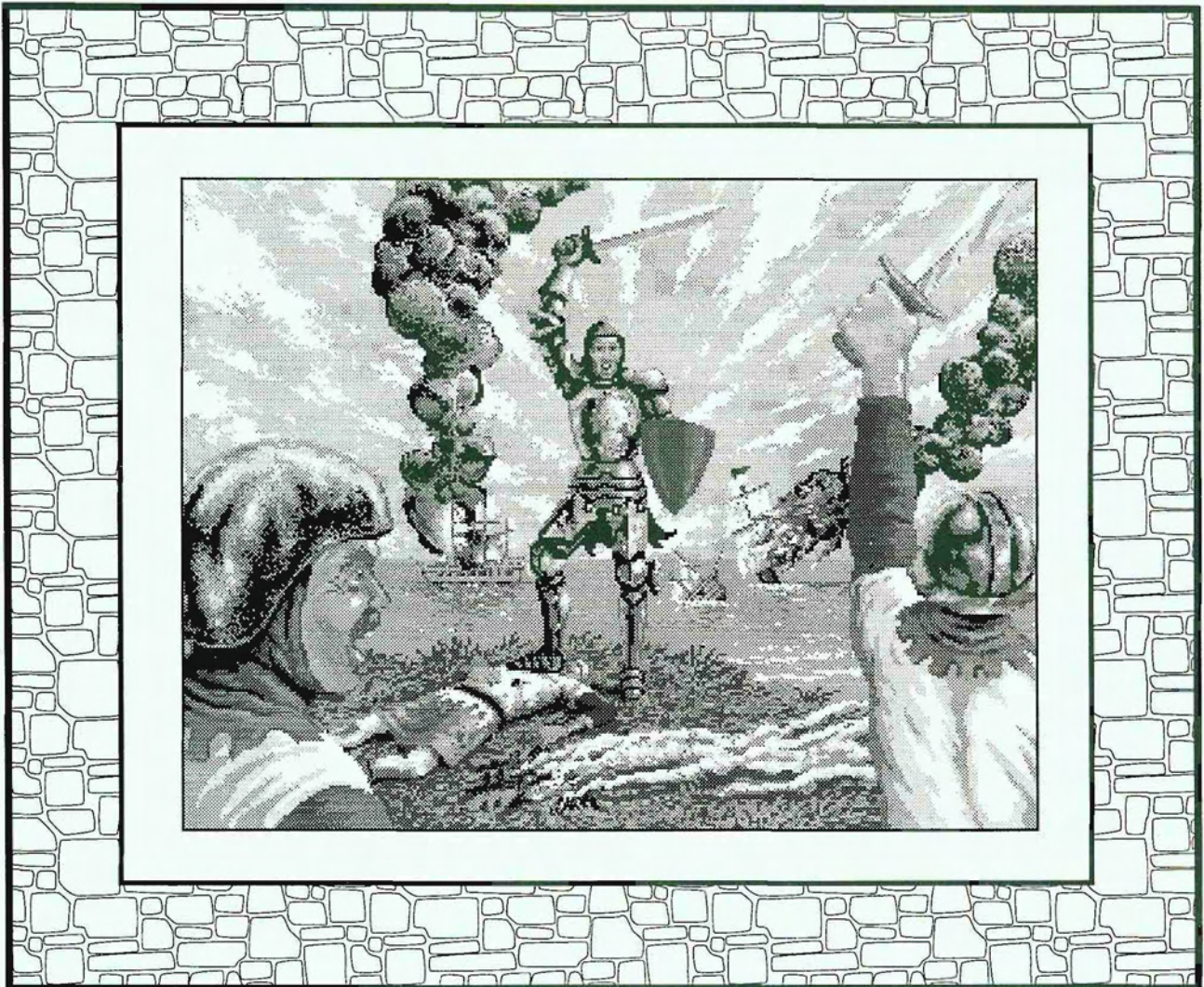


RAWIPART™

Universal Kit Installation Instructions



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
Milpitas, CA 95036-1110

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

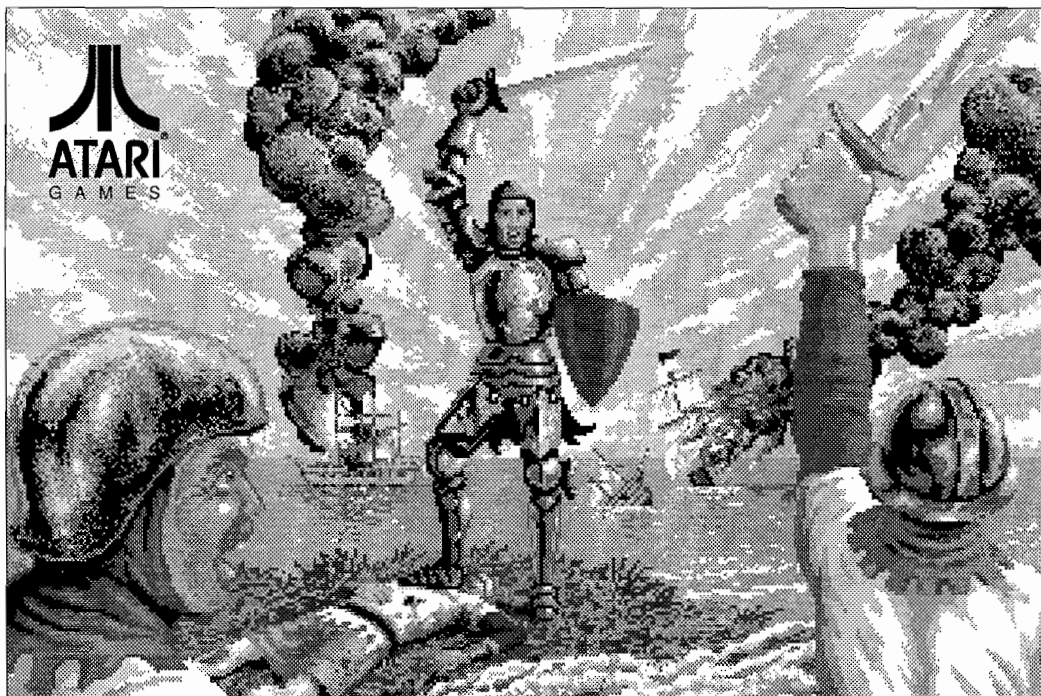
Fax 062-51702

Telex 70665

☎ 062-52155

(Monday–Friday, 9:00 a.m.–5:30 p.m. GMT)

RAMPART™



Universal Kit Installation Instructions

Conversion kit for upright games

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**NOTICE RE.
NON-ATARI
PARTS**

WARNING

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

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

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

NOTE

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

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

S A F E T Y S U M M A R Y

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 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.

CONTENTS

1 Set-Up

How to Use This Manual	1-1
Cabinet Equipment Requirements	1-2
Tools Required.....	1-2
Inspecting the Kit	1-3
Preparing the Cabinet for the Kit Installation	1-3
Assembling the Control Panel.....	1-6
Connecting the JAMMA Harness.....	1-7
Installing the Rampart Game PCB	1-8
Installing the Bezel, Decals, Labels, and Attraction Assembly	1-8
Setting the Coin and Game Options.....	1-8
Maximizing Earnings	1-8
Game Play	1-8
Hole-Cutting Template.....	1-11

2 Self-Test

Introduction	2-1
Entering and Exiting the Self-Test.....	2-2
Select Test Menu.....	2-2
Statistics	2-2
Game Options.....	2-3
Coin Options.....	2-3
Sound Test.....	2-4

Controls Test	2-4
Complete RAM Test	2-5
Complete ROM Test	2-6
Playfield Test.....	2-6
Motion Object Test	2-6
Color Test.....	2-7
Color Purity Test	2-7
Convergence Test	2-7

3 Maintenance and Troubleshooting

Introduction	3-1
Video Display Sync Problems	3-3
Troubleshooting.....	3-3
Joystick Controls	3-3
ROMs and RAMs	3-4

4 Parts Illustrations

See the List of Illustrations that follows.

5 Schematic Diagrams

See the List of Illustrations that follows.

Statistics Sheet

ILLUSTRATIONS

Figure 1-1 Installed Kit Parts..... 1-3
 Figure 1-2 Locations of Control Panel Holes to be Drilled..... 1-6

Figure 2-1 Self-Test Menu Screen 2-2
 Figure 2-2 Statistics Screen..... 2-3
 Figure 2-3 Game Options Screen 2-3
 Figure 2-4 Coin Options Screen 2-4
 Figure 2-5 Sound Test Screen 2-4
 Figure 2-6 Controls Test Screen 2-5
 Figure 2-7 RAM Test Menu..... 2-6
 Figure 2-8 Complete ROM Test Screen 2-6
 Figure 2-9 Playfield Test Screen 2-6
 Figure 2-10 Motion Object Test Screen 2-7
 Figure 2-11 Color Test Screen..... 2-7
 Figure 2-12 Convergence Test Screen 2-8

Figure 4-1 Parts for Rampart Universal Kit..... 4-2
 Figure 4-2 8-Position Microswitch Joystick Assembly 4-3
 Figure 4-3 Rampart Game PCB Assembly 4-4

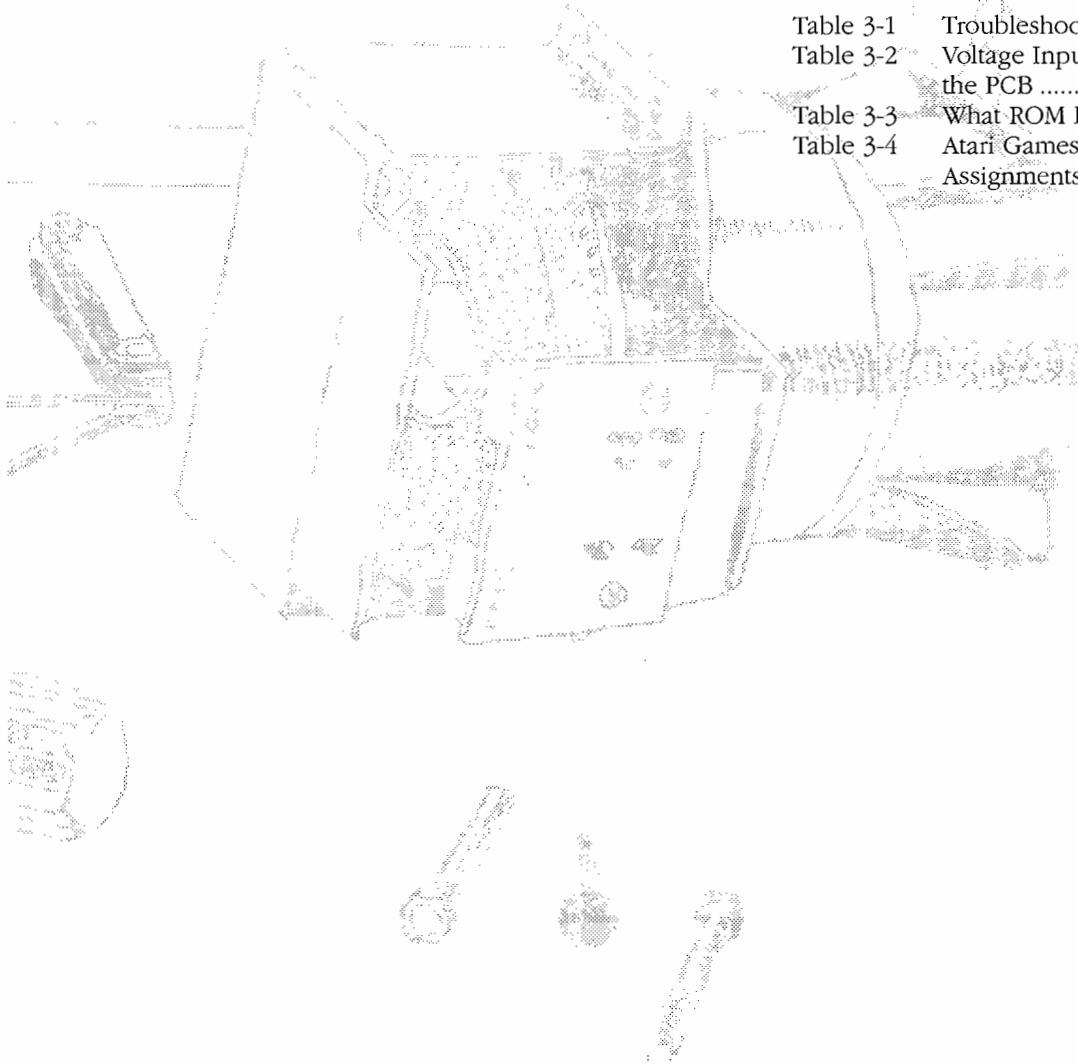
Figure 5-1 Rampart Game PCB Assembly Schematic Diagram..... 5-2

TABLES

Table 1-1 Equipment Requirements 1-2
 Table 1-2 Contents of Rampart Kit 1-2
 Table 1-3 JAMMA Pin and Wire Connections 1-4

Table 2-1 Summary of All Self-Test Screens 2-2
 Table 2-2 Game Option Settings 2-4
 Table 2-3 Coin Option Settings 2-5
 Table 2-4 When to Run the RAM Tests 2-6
 Table 2-5 Bad RAM Locations by Error Address..... 2-6
 Table 2-6 Bad ROM Locations by Error Address 2-7

Table 3-1 Troubleshooting Table..... 3-2
 Table 3-2 Voltage Inputs and Test Points on the PCB 3-3
 Table 3-3 What ROM Problems Look Like..... 3-3
 Table 3-4 Atari Games Video Connector Pin Assignments 3-3



N O T E S



CHAPTER 1

Installation

HOW TO USE THIS MANUAL

This manual provides information for installing, testing, and troubleshooting the Rampart™ conversion kit. ❖ Chapter 1 describes how to install the Rampart kit in your cabinet. This chapter also describes game play. ❖ Chapter 2 contains self-test procedures and additional diagnostic tests. The self-test is important in the Rampart game. You can troubleshoot the PC boards, main circuits, and controls using the screens in the self-test. You should regularly test the boards and controls with the self-test to keep your game in peak condition and at top earnings. ❖ Chapter 3 contains troubleshooting and maintenance procedures for the joystick control. ❖ Chapter 4 contains the kit parts list and parts illustrations. ❖ Chapter 5 contains the schematics for the Rampart game PCB.

WARNING

To avoid electrical shock, unplug the cabinet while installing the kit. After installation, plug the game only into a grounded 3-wire outlet.

Cabinet Equipment Requirements

Table 1-1 lists the equipment required in the cabinet into which you are installing the Rampart kit.

CAUTION

Do not unplug or plug in the Rampart game printed-circuit board (PCB) edge connector while the power is on. You could seriously damage the PCB.

Table 1-1 Equipment Requirements

Equipment	Specification
Video Display	Color RGB monitor Separate positive horizontal and vertical sync or negative composite sync Horizontal mounting Horizontal frequency: 15.750 KHz Vertical frequency: 60 Hz Video input: 1V to 3V peak-to-peak positive polarity
Control Panel	Metal only
Speaker	8 Ω, 10 W
Coin Counter	+5 VDC or +12 VDC
Power Cord	Three-conductor with ground
Power Supply	+5 VDC ± 0.25V @ 3.0 amps +12 VDC @ 1.0 amp -5 VDC @ 1.0 amp (optional)

Tools Required

- Drill with a 1/2-inch and 5/16-inch drill bits
- Phillips screwdriver
- Flat-blade screwdriver
- Socket wrench set and ratchet
- 1/4-20 hex wrench
- Wire cutters and strippers
- Straight edge
- Squeegee
- X-ACTO™ knife
- Insulated wire connectors (if you are installing a new JAMMA harness)
- Carbon paper
- Saber saw
- File
- Bandsaw
- Tape or glue

Table 1-2 Contents of Rampart Kit

Part No.	Description	Part No.	Description
72-6608S	#6 x 1/2"-Long, Type AB, Pan-Head, Cross-Recessed Screws (4)	160044-001	Snap-Action Switches (8)
75-5112B	#10-24 x 3/4"-Long Black Carriage Bolts (12)	175014-1040	#10 Flat Washers (8)
177026-0040	#10-24 Nut/Washer Assemblies (12)	178032-002	#10 Wire & Cable Tie
038158-01	Product I.D. Label	178237-001	Red Button Assemblies (4)
039450-01	FCC Compliance Label	178237-005	Blue Button Assemblies (4)
047205-01	Shield, Attraction	178265-001	L-Style Nylon Standoffs (4)
047209-01	Control Panel Cover	048437-01	Set of Eight Labels for Buttons (Place Piece/Fire/Start and Rotate Piece/Speed-up in both blue and red)
048451-01	Control Panel Decal	A040933-03	8-Position Microswitch Joystick Assy (2)
048452-01	Side Panel Decals (2)	A046501-01	JAMMA Harness Assy.
048453-01	Attraction Panel Film	A048869-13	Rampart Kit PCB Assy.
048455-01	Monitor Bezel with Graphics	TM-359	Rampart Universal Kit Installation Instructions (with control panel template)
048879-01	Instructions Label for Monitor Bezel		
141026-001	.50"-Inside Diameter Ferrite Split Beads (2)		

Packaging materials are not listed. All parts are a quantity of 1, except as noted in parentheses.

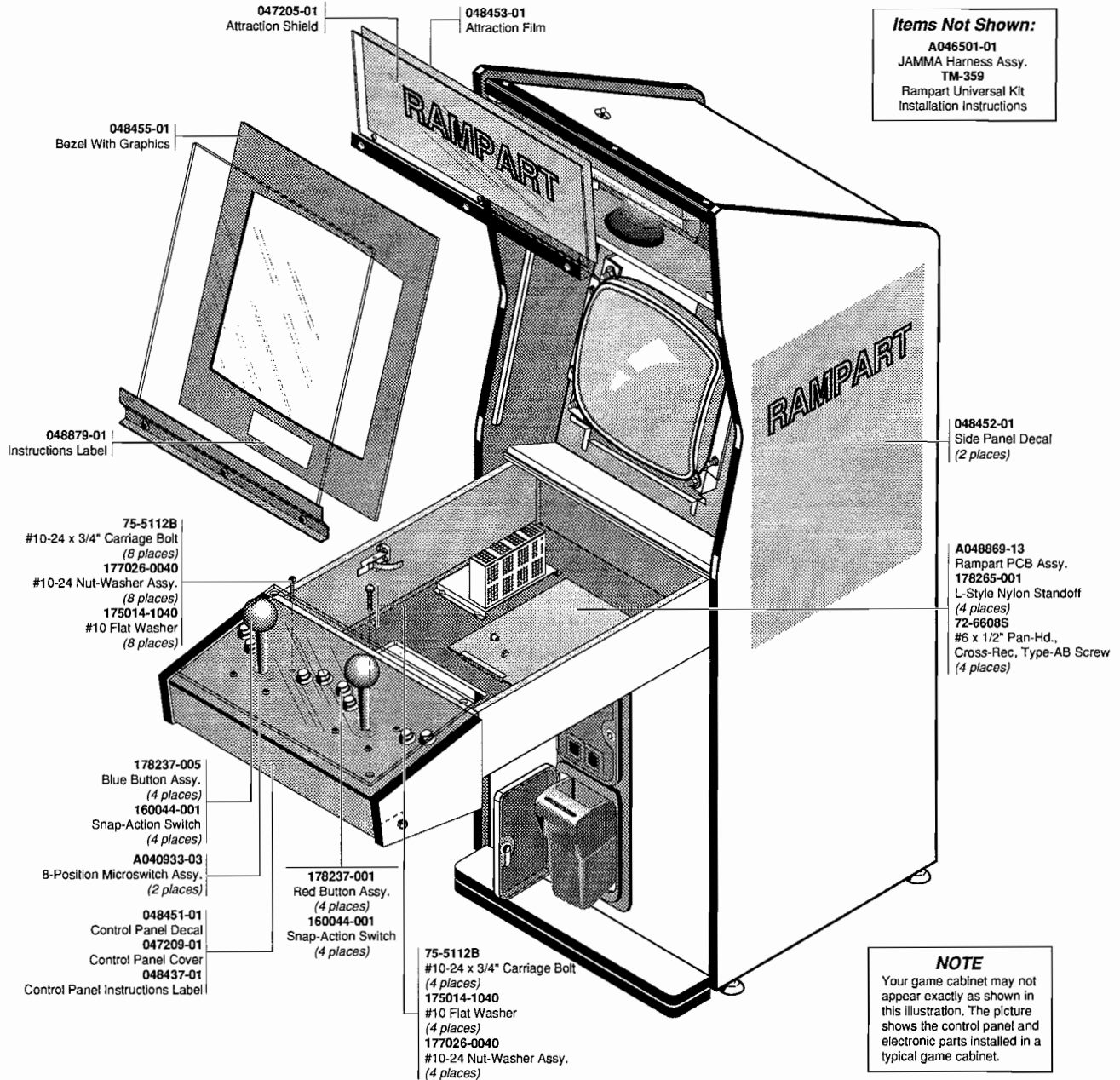


Figure 1-1 Installed Kit Parts

Inspecting the Kit

Check to see that you have all the parts listed in the kit parts list in Table 1-2. If any part is missing or damaged, contact your distributor with the Rampart kit serial number, part number, and description of the missing or damaged parts, and date received.

Preparing the Cabinet for the Kit Installation

WARNING

To avoid electrical shock, unplug the cabinet while installing the kit. After installation, plug the game only into a grounded 3-wire outlet.

Table 1-3 JAMMA Pin and Wire Connections

Pin	Wire Color	Signal	Instructions
Component Side			
1	BN	GND	Connect to the 5V RTN (GND) terminal on the power supply. However, if you have 12V RTN, connect <i>one</i> of the BN wires at pin 1, 2, A, or B to the 12V RTN terminal.
2	BN	GND	Same as pin 1.
3	R	+5V	Connect to the +5V terminal on the power supply. However, if your power supply has a +SENSE terminal, connect <i>one</i> of the R wires at pin 3, 4, or C to +SENSE instead of +5V.
4	R	+5V	Same as pin 3.
5	OR	-5V	Connect to the -5V terminal of the power supply. If -5V is not available, connect to the 12V RTN or the 5V RTN (GND) or leave it unconnected. <i>NOTE: If you do not have (or use) -5V, the maximum power to the speaker will be reduced by half.</i>
6	Y	+12V	Connect to the +12V terminal of the power supply. If your coin counter(s) require 12V, also connect to the + side of the coin counter(s).
7		Key	
8	BU/W	COIN CTR 1	Connect this wire to one side of the left 12V coin counter. <i>Note: Do not use 24V counters.</i> Connect the + side to +5V or +12V on the power supply, as appropriate.
9		Not used	
10	BN	SPKR +	Connect to the + terminal on the speaker. (This wire is part of a twisted pair.)
11		Not used	
12	R	RED	Attach to the video display.
13	BU	BLUE	Attach to the video display.
14	BK	VIDEO GND	Attach to the video display.
15	W	SELF-TEST	Use this wire if you want an external self-test switch. However, the kit already has a self-test switch on the PCB. <i>(If you connect an external self-test switch, switch off the switch on the PCB. Connect the wire to the N.O. terminal on the external self-test switch. Connect the common terminal of the switch to a BK/W wire [GND].)</i>
16	Y	LT COIN	Connect to the N.O. terminal of the left coin switch. Connect the common terminal of the switch to a BK/W wire.
17	W/BK	PLYR 1 ROTATE	Connect this wire to the N.O. terminal of the PLYR 1 ROTATE switch. Connect the common terminal of the switch to one of the BK/W wires.
18	W/BN	PLYR 1 JOYST UP	Connect to the N.O. terminal of the switch. Connect the common terminal of the switch to one of the BK/W wires.
19	W/R	PLYR 1 JOYST DN	Same as pin 18.
20	W/OR	PLYR 1 JOYST LT	Same as pin 18.
21	W/Y	PLYR 1 JOYST RT	Same as pin 18.
22	W/GN	PLYR 1 PLACE	Connect this wire to the N.O. terminal of the PLYR 1 PLACE switch. Connect the common terminal of the switch to one of the BK/W wires.
23	W/BU	Not used	
24	W/V	Not used	
25	W/GY	Not used	
26	V	Not used	
27	BK/W	GND	Connect one of the BK/W wires at pin 27, 28, e, and f to the negative sense terminal of the power supply (if it exists) and one to the common terminals of the coin switches. Connect two of these wires to the common terminals of the control switches on the control panel.
28	BK/W	GND	Same as pin 27.

Table 1-3 JAMMA Wire Connections, Continued

Pin	Wire Color	Signal	Instructions
Solder Side			
A	BN	GND	Connect to the 5V RTN (GND) terminal on the power supply. However, if you have 12V RTN, connect <i>one</i> of the BN wires at pin 1, 2, A, or B to the 12V RTN terminal.
B	BN	GND	Same as pin A .
C	R	+5V	Connect to the +5V terminal on the power supply. However, if your power supply has a +SENSE terminal, connect <i>one</i> of the R wires at pin 3, 4, or C to +SENSE instead of +5V.
D	R	+5V	Same as pin C .
E	OR	-5V	Connect to the -5V terminal of the power supply. If -5V is not available, connect to the 12V RTN or the 5V RTN (GND) or leave it unconnected. <i>NOTE: If you do not have (or use) -5V, the maximum power to the speaker will be reduced by half.</i>
F	Y	+12V	Connect to the +12V terminal of the power supply.
H		Key	
J	V/W	COIN CTR 2	Connect this wire to one side of the right 12V coin counter. Clip R28 on the game PCB if you use a second coin counter. <i>Note: Do not use 24V counters.</i> Connect the + side to +5V or +12V on the power supply, as appropriate.
K		Not used	
L	W	SPKR-	Connect to the - terminal on the speaker. (This wire is one of a twisted pair.)
M		Not used	
N	GN	GREEN	Attach to the video display.
P	BN	COMPSYNC	Attach to the video display.
R	GY	Service	
S		Not used	
T	OR	RT COIN	Connect to the N.O. terminal of the right coin switch. Connect the common terminal of the switch to a BK/W wire.
U	Y/BK	PLYR 2 ROTATE	Connect this wire to the N.O. terminal of the PLYR 2 ROTATE switch. Connect the common terminal of the switch to one of the BK/W wires.
V	Y/BN	PLYR 2 JOYST UP	Connect to the N.O. terminal of the switch. Connect the common terminal of the switch to one of the BK/W wires.
W	Y/R	PLYR 2 JOYST DN	Same as pin V .
X	Y/OR	PLYR 2 JOYST LT	Same as pin V .
Y	Y/W	PLYR 2 JOYST RT	Same as pin V .
Z	Y/GN	PLYR 2 PLACE	Connect this wire to the N.O. terminal of the PLYR 2 PLACE switch. Connect the common terminal of the switch to one of the BK/W wires.
a	Y/BU	Not used	
b	Y/V	Not used	
c	Y/GY	Not used	
d	GY/W	Not used	
e	BK/W	GND	Connect one of the BK/W wires at pin 27, 28, e, or f to the negative sense terminal of the power supply (if it exists) and one to the common terminals of the coin switches. Connect two of these wires to the common terminals of the control switches on the control panel.
f	BK/W	GND	Same as pin e .

NOTE: In the table on both of these pages, PLYR1 means left player; PLYR 2 means right player (or center player on the schematic diagram).

Figure 1-1 shows almost all kit parts installed in a typical cabinet. Use this illustration as a guide while you install the parts.

1. Turn off power to the game, and unplug the power cord.
2. Remove the following from the cabinet:
 - Existing PCBs
 - Game harness, if it is not Japan Amusement Machinery Manufacturers Association (JAMMA)-compatible
 - Control panel decals, labels, and controls
 - Side decals, graphics, and adhesive. If the cabinet sides are damaged, repair them before putting on the new decals.
 - Video display (monitor) shield, display bezel, attraction shield, and marquee.
3. Wipe down and vacuum the cabinet. Paint the cabinet, if required.

- Control panel decal
- Four red and four blue button assemblies
- Eight snap-action switches
- Eight control-panel button labels (on a sheet)
- Two joystick controls
- Eight #10-24 x 3/4"-long black carriage bolts, flat washers, and nut/washer assemblies for the joysticks
- Four #10 x 3/4"-long black carriage bolts, flat washers, and nut/washer assemblies for the corners of the control panel cover

Assembling the Control Panel

Parts Needed

To assemble the control panel, you need the control panel hole-cutting template, which is printed on page 1-11. Cut out the template sheet from the manual. You will also need the following parts from the kit:

- Clear cover for the control panel

Installing the Parts

1. Using carbon paper, transfer the joystick mounting pattern from the template to the control panel. Save the template. Also refer to Figure 1-2 for the exact locations of all holes.
2. Drill four 3/8" holes in the metal control panel for each joystick's mounting bolts.
3. Using a saber saw, carefully cut out the large holes for the joysticks. Deburr the sharp edges with a file.
4. Lay the plexiglass cover over the top of the control panel and mark the outside shape of the panel on the plastic. Also mark the eight button holes as close as possible to the locations shown on the template.

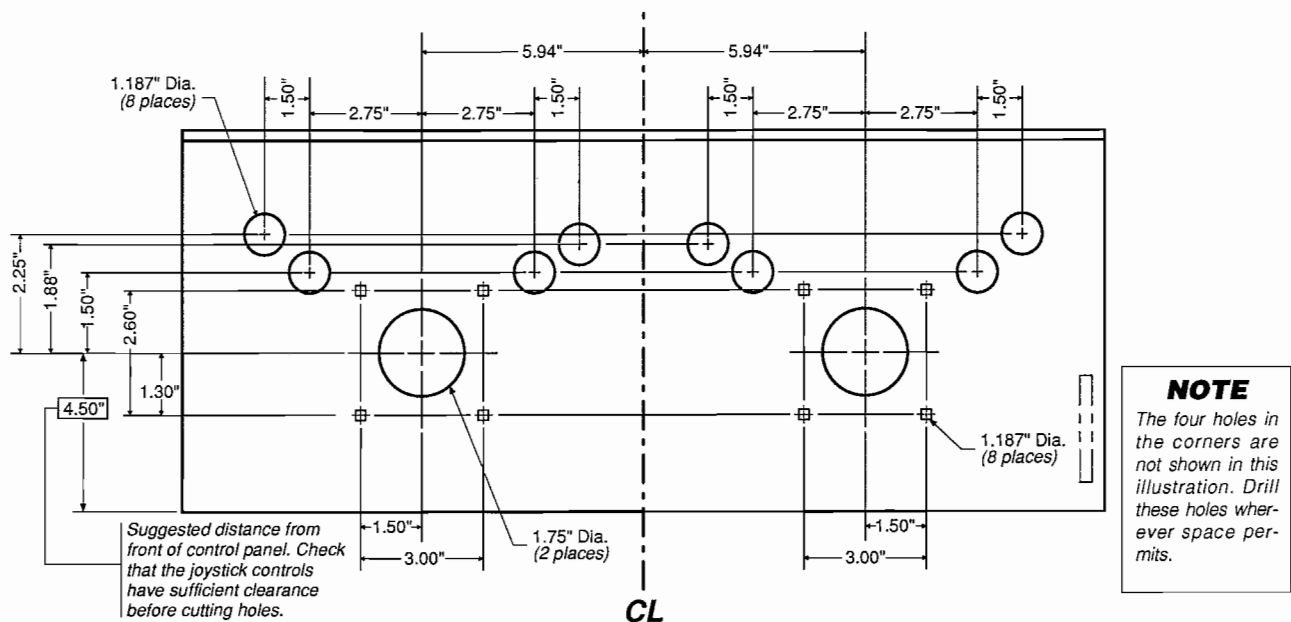


Figure 1-2 Locations of Control Panel Holes to be Drilled

NOTE

To accommodate different playing styles, it is **very important** to install all eight button assemblies on the control panel. Trak-ball players are used to buttons on the left side of their controls, and joystick players are used to buttons on the right. With buttons installed on both sides of the joysticks, you reduce the potential for player frustration.

Lastly, mark the positions of the four holes that will be used for securing the cover to the control panel. These four holes can be placed anywhere near the corners—wherever space permits.

- Using a bandsaw, cut the control panel cover to its correct outside shape.

WARNING

Wear safety glasses when drilling the plastic control panel cover. Use care to avoid shattering or chipping the plastic.

- Tape or glue the template to the plexiglass cover. To start the saber saw cut, drill a 1/2" hole inside the joystick holes and the button holes.
- Saw out the two large joystick holes and the eight button holes.
- Drill the four 5/16" holes that will be used to mount the cover to the control panel and the eight 5/16" holes to mount the joysticks.
- To prevent injury, carefully deburr all the edges of the plexiglas cover.
- Install the control panel decal on the control panel. Use a sharp X-ACTO knife to trim the outside edge and to cut out the holes for the controls.
- Install the cover on the control panel with the four 3/4"-long carriage bolts, washers, and locknuts.
- Install the joysticks using the eight 3/4"-long carriage bolts. Install the eight button assemblies and the eight labels.

For maintenance and servicing information on the joystick controls, refer to Chapter 3 of this manual.

Connecting the JAMMA Harness

- If your game cabinet does not already have a JAMMA harness, install the JAMMA harness in the cabinet.
- Install the split beads on the harness as close to the PCB edge connector as possible. Hold the beads on the harness with the tie wraps included in the kit.

CAUTION

You must install the split beads included in the kit on the JAMMA harness to meet FCC requirements.

- Using Table 1-2 for wiring information, connect the JAMMA harness to existing component harnesses. Use crimp splices or butt soldering.

WARNING

Do not simply tie the wires together. If you do, you could cause intermittent problems, loose connections, oxidation, or a fire.

Connecting Power Wires

- Connect the wires on the JAMMA harness to the wires for the power supply, as shown in Table 1-3. The Rampart kit requires +5V and +12V. If -5V is available, it should be used too. Tie off any other voltage wires on the power supply besides +5V, -5V, and +12V.

There is more than one wire for each voltage in the JAMMA harness. Use more than one wire for each voltage (connecting them as described in Table 1-3) so that the power wiring does not overload and burn.

Connecting Video Display Wires

NOTE

The JAMMA harness provides only negative composite sync. If your video display requires separate positive sync, see Chapter 3 for alternative wiring.

Connect the wires designated for the red, green and blue video guns along with the sync and ground wires, according to Table 1-3.

Connecting Coin Door Wires

1. Connect the wires on the JAMMA harness to the coin switches and meter according to Table 1-3.
2. Connect one terminal of the door lamps to one of the BK/W wires. Connect the other terminal of the door lamps to the R wire supplying +5V.

NOTE

Do not use -5V for the coin door lamps. -5V is required for audio.

Some games have separate power supply outputs for the coin door lamps. If you choose to use these outputs, make sure you connect both terminals of each lamp to the terminals on the power supply.

Connecting the Control Wires

Connect the joystick harness and the button harnesses to the JAMMA harness using crimp splices or butt soldering, according to the information in Table 1-3.

Grounding the Cabinet

Find the ground lead (green) of the 115V input power line. Connect this lead in daisy-chain fashion to a bare metal part of the coin door, the control panel, the video display, and the power supply. This AC ground must be of #18 AWG wire or larger.

WARNING

For the safety of players, you must connect the green ground wire as indicated above.

Checking the JAMMA Connections

Before plugging in the game PCB, turn on the power to the game, and check +5 Volts on pins 3, 4, C, and D of the JAMMA connector; +12 Volts on pins F and 6; and -5 Volts on pins E and 5.

Check that the video display and the attraction lamp have power. Now turn off the power to the game.

Installing the Rampart Game PCB

1. After you have checked the power on the JAMMA connector (above), install the Rampart game board set in the cabinet. Use the nylon standoffs and four #6-32 screws in the kit.
2. Connect the JAMMA connector to the PCB.
3. Secure the JAMMA harness away from the PCB with cable ties.
4. Turn on the power to the game. Check that the game PCB functions. If a video picture is not present, see Chapter 3.

Installing the Bezel, Decals, Labels, and Attraction Assembly

The kit parts are shown assembled in a cabinet in Figure 1-1.

Installing the Display Bezel

Find the cardboard display bezel in the kit. This bezel can accommodate both 19-inch and 25-inch video displays. Follow the instructions on the back of the bezel, and cut the hole and outside edges as required.

Installing the Product ID and FCC Label

Place the product ID label (part no. 038158-01) and FCC compliance label (part no. 039450-01) on the back of the cabinet.

Installing the Side Panel Decals

Find the side panel decals in the kit. Wet the left and right side panels of the cabinet with slightly soapy water. Then position the decals as shown in Figure 1-1. Remove any wrinkles in the artwork using a squeegee. Allow the sides to dry.

Installing the Attraction Assembly

Find the Rampart attraction shield and the attraction film in the kit. Using the existing shield as a template, cut the shield and film to size, if necessary. Install them on the cabinet as shown in Figure 1-1.

Setting the Coin and Game Options

Set the coin and game options in the self-test. See Chapter 2 for information about the option settings.

Maximizing Earnings

For maximum earnings, regularly maintain your Rampart game following the instructions in Table 3-1, in Chapter 3.

When you set up the game and when you collect money, perform the automated self-test and check the controls with the Controls Test in the self-test.

Game Play

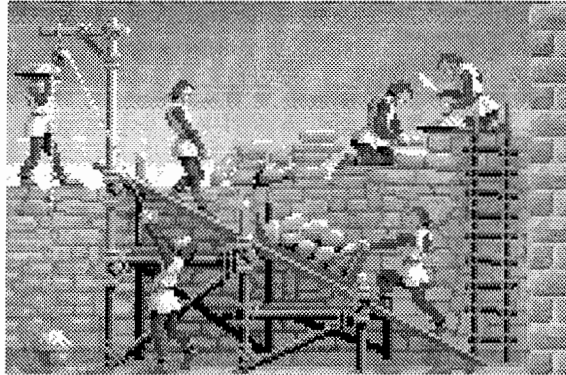
This section describes the theme of the Rampart game and the game play features.

Introduction

Rampart combines the best of strategy puzzle games with dynamite action and the excitement of head-to-head competition. Two 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 hurls 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.



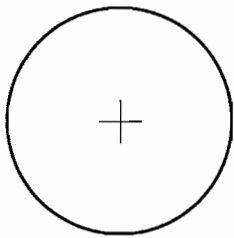
In a two-player game, the contest is head-to-head for an operator-selectable maximum number of battles (the factory setting is for seven battles per game). As long as a player can place pieces to surround at least one castle, he continues. If a player is eliminated, he may deposit another coin to continue.

In a one-player game, the computer directs an invading armada against the player's castles. 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.

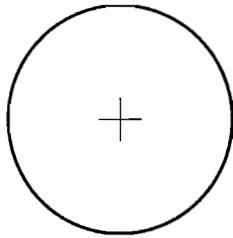
Rampart's action is lightning fast. The strategy is exhilarating. The thrill of head-to-head competition is intense.

N O T E S

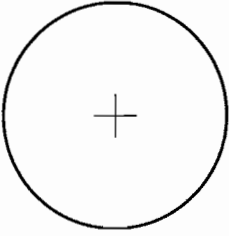
Rotate/Speed-up



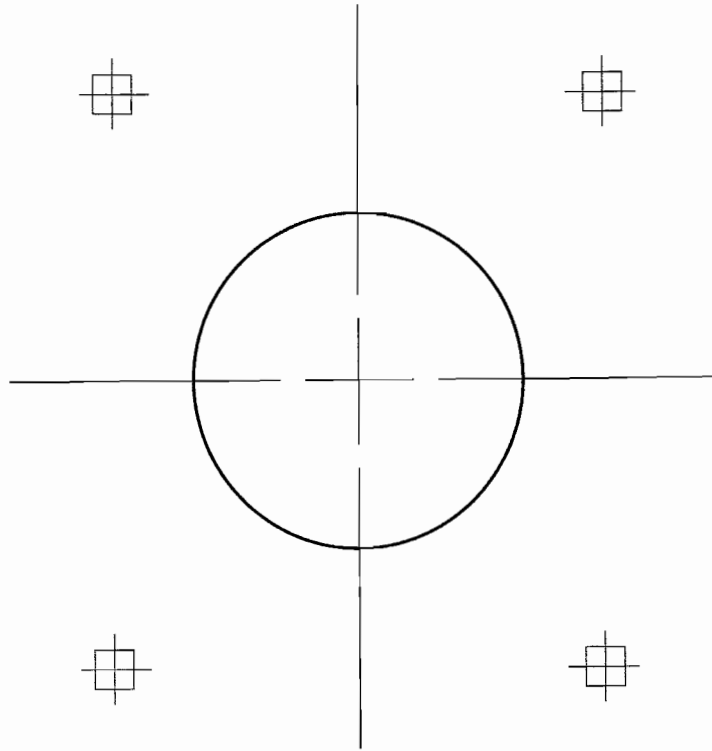
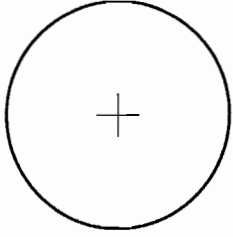
Place/Fire



Rotate/Speed-up



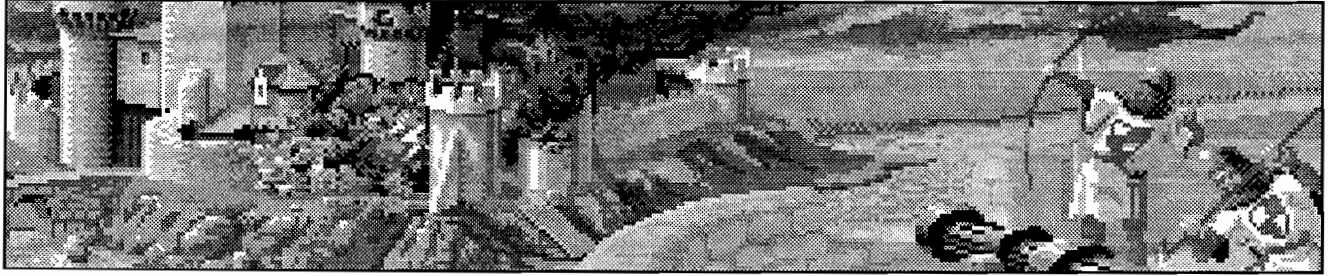
Place/Fire



Hole-Cutting Template for Rampart™ Kit Control Panel

NOTE

To accommodate different playing styles, it is **very important** to install all eight button assemblies on the control panel. Trak-ball players are used to buttons on the left side of their controls, and joystick players are used to buttons on the right. With buttons installed on both sides of the joysticks, you reduce the potential for player frustration.



CHAPTER 2

Self-Test

INTRODUCTION

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 moving the joystick; the corresponding test is highlighted in white. Choose the screen by pressing the red PLACE button.

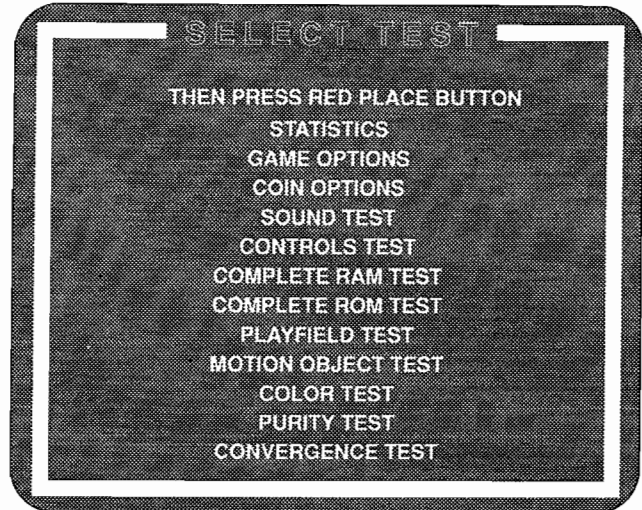


Figure 2-1 Self-Test Menu Screen

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.

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

- *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

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

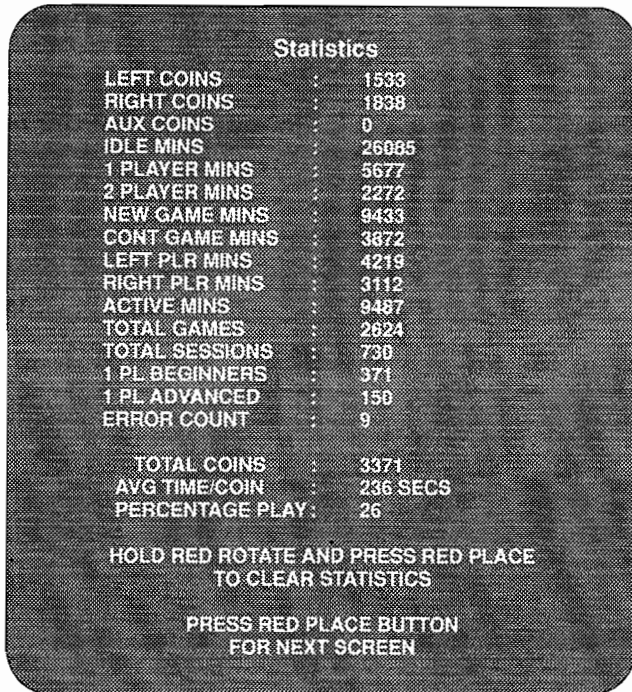


Figure 2-2 Statistics Screen

- *Aux 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 Mins* are the number of minutes the game was played by one or two 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 is played during “add-a-coin” (continuation).
- *Left/Right Plr Mins* are the number of minutes the game was played at the left 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 2-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 EEROM at 38F.

- *Avg Time/Coin* is the average number 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.

Game Options

Check and select the coin options on this screen, shown in Figure 2-3.

To move through the options, move the joystick up or down. Change the option in yellow type. The factory default settings are shown in green. To change a setting, move the joystick right or left. To save the new settings, press the red PLACE button. This returns you

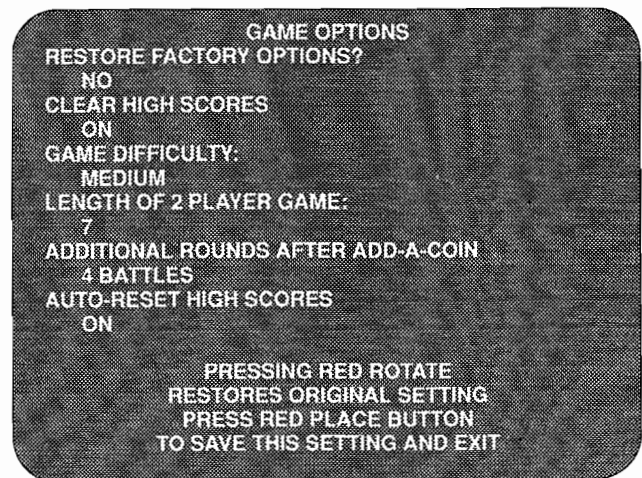


Figure 2-3 Game Options Screen

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 option settings with factory defaults are shown in Table 2-2.

Coin Options

Check and select the coin options on this screen, shown in Figure 2-4.

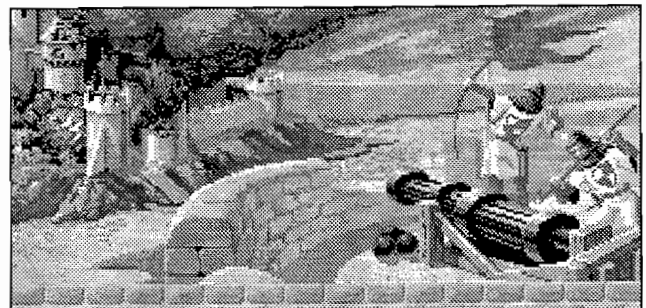


Table 2-2 Game Option Settings

Option	Settings	Explanation
Restore Factory Options	Yes No ✓	Lets you set all the game options to the factory options or lets you use your own settings. Make sure you set this to <i>no</i> to use your own chosen settings.
Clear High Scores	Off On ✓	Lets you clear the high score table.
Game Difficulty	Easy Medium ✓ Hard Very Hard	Pre-programmed obstacles and more enemy cannons being fired contribute to increased difficulty.
Length of 2-Player Game	5, 7 ✓, 10, 15 battles	Lets you adjust the maximum number of rounds (battles) allowed for two-player games.
Additional Rounds After Add-a-coin	2, 4 ✓, 6, 8	Lets you adjust the additional number of rounds (battles) after an add-a-coin in multi-player games.
Auto-Reset High Scores	Off 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.

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

To move through the options, move the joystick up or down. Change the option in yellow type. The factory default settings are shown in green. To change a setting, move the joystick 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.

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.

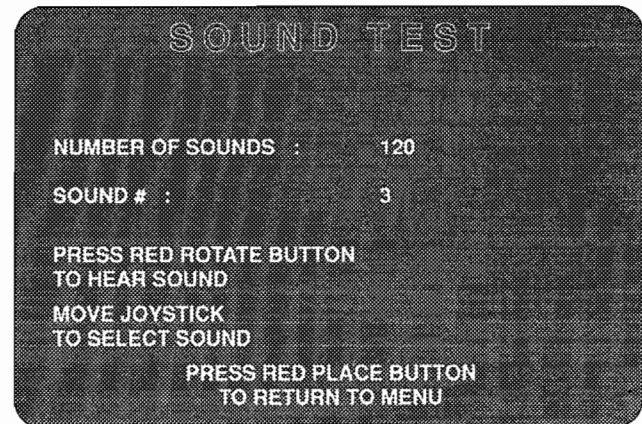


Figure 2-5 Sound Test Screen

Use the joystick 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.

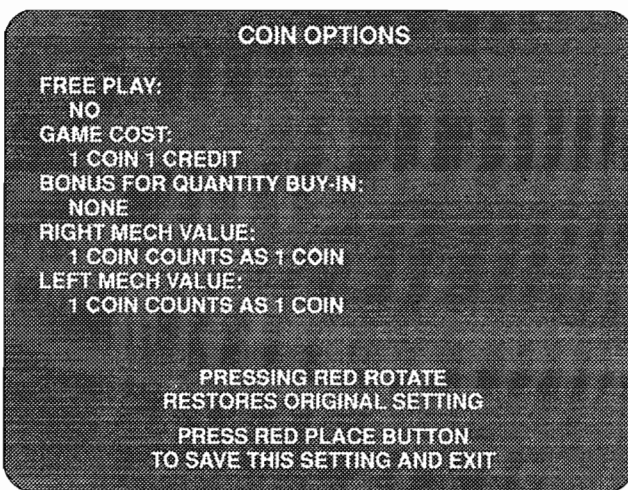


Figure 2-4 Coin Options Screen

Controls Test

The controls test screen is shown in Figure 2-6. Test the coin mechanism switches, control panel buttons, and joysticks. 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. Simultaneously press the red ROTATE and red PLACE buttons to return to the test select screen.

Moving each joystick causes the yellow hexadecimal numbers to change when you move it up and down (UP/DN) or left and right (LT/RT). Use these numbers to help correctly orient the joystick, if you are installing a new one. If the numbers on the screen do not

Table 2-3 Coin Option Settings

Option	Settings	Explanation
Free Play	No ✓ Yes	Set this to "Yes" for demonstrating the game.
Discount to Continue	No ✓ Yes	Lets you offer a reduced price per credit when players want to continue a game.
Game Cost	1 coin 1 credit ✓ 2 coins 1 credit ... 8 coins 1 credit	Sets the number of coins required for one credit.
Bonus for Quantity Buy-in	None ✓ 2 coins give 1 (extra coin) 3 coins give 1 (extra coin) 3 coins give 2 (extra coins) 4 coins give 1 (extra coin) 4 coins give 2 (extra coins) 4 coins give 3 (extra coins) 5 coins give 1 (extra coin) 5 coins give 2 (extra coins) 5 coins give 3 (extra coins) 6 coins give 1 (extra coin) 6 coins give 2 (extra coins) 6 coins give 3 (extra coins) 7 coins give 1 (extra coin) 7 coins give 2 (extra coins) 7 coins give 3 (extra coins) 8 coins give 1 (extra coin) 8 coins give 2 (extra coins) 8 coins give 3 (extra coins) 9 coins give 1 (extra coin) 9 coins give 2 (extra coins) 9 coins give 3 (extra coins)	Lets you choose various levels of bonus coins or no bonus.
Right Mech Value	1 coin counts as 1 coin ✓ ... 8 coins count as 1 coin	Is the number of coins each coin counts as in the right coin mechanism.
Left Mech Value	1 coin counts as 1 coin ✓ ... 8 coins count as 1 coin	Is the number of coins each coin counts as in the left coin mechanism.

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

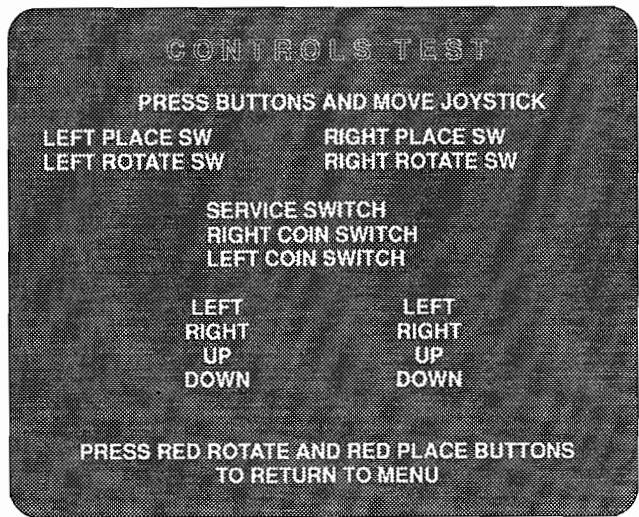


Figure 2-6 Controls Test Screen

change, check the 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.

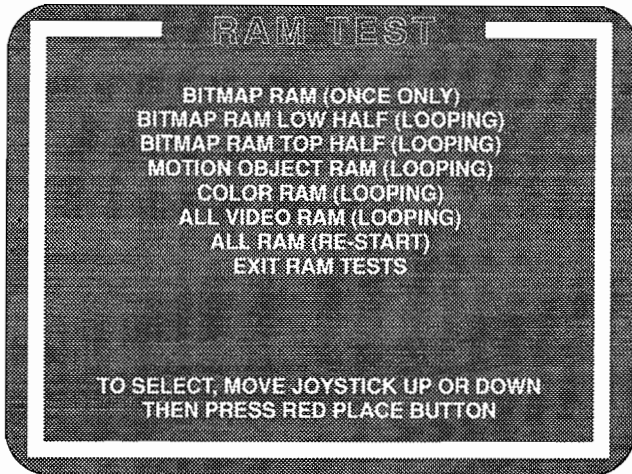


Figure 2-7 RAM Test Menu

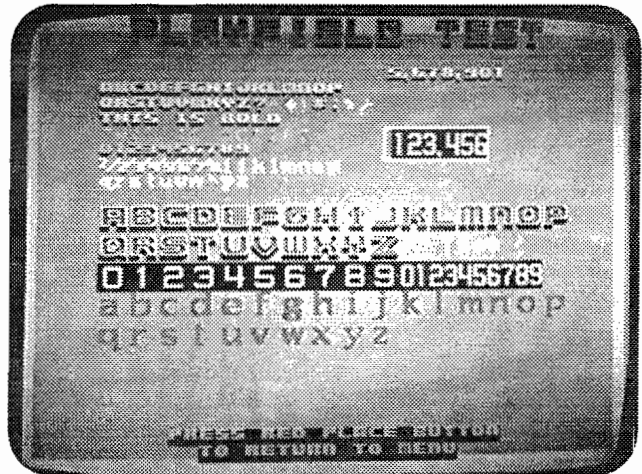


Figure 2-9 Playfield Test Screen

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.

See Table 2-6 for the locations of the ROM errors. Press the red PLACE button to return to the test select screen.

Playfield Test

This test, shown in Figure 2-9, checks the condition of the bitmaps in the game. If you see an error on the screen, this indicates an error with the bitmap display



Figure 2-8 Complete ROM Test Screen

circuit. Press the red PLACE button to go to the test select screen.

Motion Object Test

The motion object test screen, shown in Figure 2-10, tests the movement and color of various game objects.

Table 2-4 When to Run the RAM Tests

Problem	Type of Test	Location of RAMs Tested
Playfield is erratic or looks wrong	Bitmap RAM*	8H, 9H, 10H, and 11H
Motion objects are not working properly or game play is erratic.	Motion object RAM	5N, 6N
Colors look wrong.	Color RAM	4H

*Bitmap RAM (once only) is a thorough test, and takes about 1 minute to run. The "half" tests are significantly faster, but may not find all types of errors.

Table 2-5 Bad RAM Locations by Error Address

Type of RAM	Address	RAM	
		Location	Data Bits
Playfield RAM	200000 to 21FFFF	11H	0-3
		10H	4-7
		9H	8-11
		8H	12-15
Motion Object RAM	3E0000 to 3E3FFF	6N	0-7
		5N	8-15
Color RAM	3C0000 to 3C07FF	4H	8-15

Table 2-6 Bad ROM Locations by Error Address

Error Address	ROM Location High	Error Address	ROM Location Low
Program ROM 8x1024 Configuration*:			
0K-H	13H	0K-L	13H/J
20K-H	13H	20K-L	13H/J
40K-H	13J	40K-L	13K
80K-H	13K/L	80K-L	13L
C0K-H	13M	C0K-L	13N
Program ROM 2x512 and 2x4096 Configuration*:			
0K-H	13H	0K-L	13H/J
20K-H	13J	20K-L	13K
40K-H	13J	40K-L	13K
80K-H	13J	80K-L	13K
C0K-H	13J	C0K-L	13K

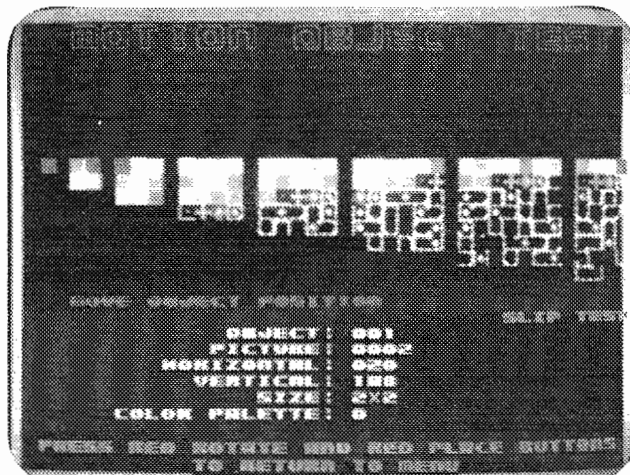
**If you have 8x32-pin ceramic parts in column 13 on your Rampart Game PCB, you have an 8x1024 configuration. If you have 2x28-pin ceramic parts and 2x32-pin plastic parts in column 13 of this board, you have a 2x512 and 2x4096 configuration.*

Select the test function with the left ROTATE button. Use the joystick 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).

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.

**Figure 2-10 Motion Object Test Screen**

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.

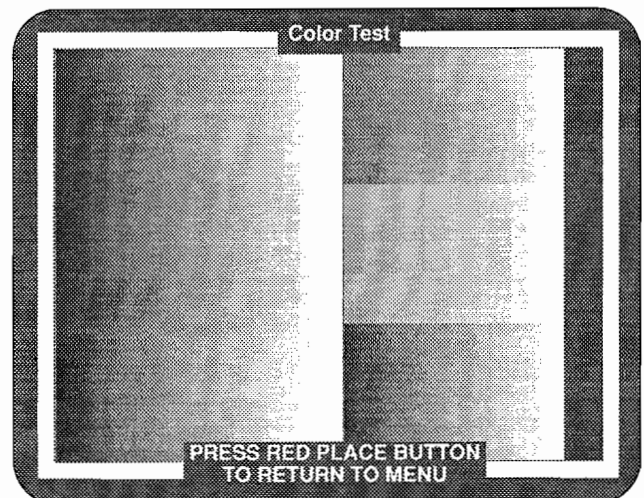
If the screens are not correct, adjust the video display as described in the video display manual.

Return to the test select screen by pressing the red PLACE button.

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:

**Figure 2-11 Color Test Screen**

- The grid lines should be straight within 3 mm, and the lines should not pincushion or barrel.
- 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.

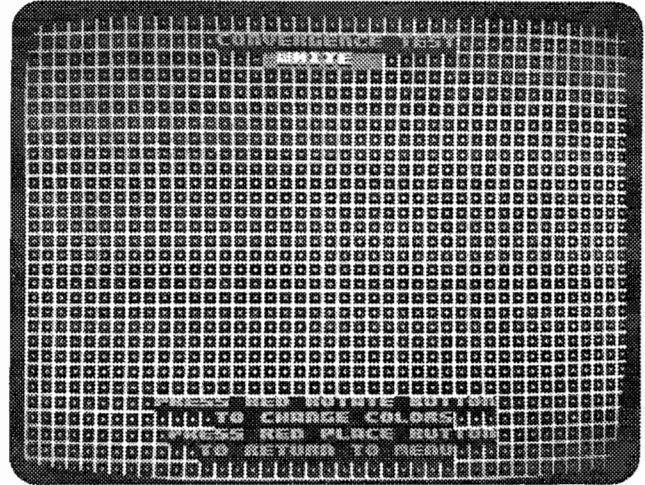


Figure 2-12 Convergence Test Screen



CHAPTER 3

Troubleshooting and Maintenance

INTRODUCTION

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 joystick control assembly.

Table 3-1 Troubleshooting Table

Problem	Suggested Action
Coin Mechanism Problem	<ol style="list-style-type: none"> 1. Check the wiring to the coin mechanism. 2. Check the voltage to the + side of the mechanism. 3. Test the coin mechanisms with the sound test screen in the self-test.
Game Play Problem	<ol style="list-style-type: none"> 1. Check the harness and connectors. 2. Perform the self-test. 3. Check the voltage levels on the PCB. See Table 3-2, <i>Voltage Inputs and Test Points</i>. 4. Check <i>What ROM Problems Look Like</i>, Table 3-3, for specific ROM problems.
Joystick Control Problem	<ol style="list-style-type: none"> 1. Has the joystick been lubricated with the correct type of lubricant? If not, lubricate it as shown in Figure 4-2. 2. Check the harnesses and connectors. 3. If you took the control apart, have you reassembled it correctly? 4. Make sure all the parts on the control are in good repair. Repair or replace parts.
Sound Problem	<ol style="list-style-type: none"> 1. Is the speaker volume turned up? 2. Check the voltage on the JAMMA connector. 3. Check the wiring from the PCB to the speaker. 4. Check the voltage level to the PCB. See Table 3-2, <i>Voltage Inputs and Test Points</i>. 5. Replace the speaker.
Video Display Problem	
Sync problems.	Does your display need separate positive sync? See the <i>Video Display Sync Problems</i> section in this chapter.
Screen is dark.	<ol style="list-style-type: none"> 1. Is the game plugged in? 2. Is the game turned on? 3. Are the connections good? 4. Is the line fuse good? 5. Is the display brightness turned up? 6. Are the solder connections on the line filter and transformer good? 7. Is the JAMMA connector on the PCB tightly connected? 8. Check all of the items below. If you answer "no" to any question, you have a problem with the video display, not with the game circuitry. See your video display service manual. <ol style="list-style-type: none"> a. Do you have power to the video display? b. Are the video display's filaments lit? c. Do you have high voltage to the video display? 9. Are the voltage levels to the video display PCB correct? (Power voltage is 100 VAC or 110 VAC, depending on the type of video display. Video signal voltage is 0.5 to 3.5 Volts.) 10. If the level is not correct, check the connectors and the harness.
Display area wavers or is too small.	<ol style="list-style-type: none"> 1. Do you have correct power voltage to the video display PCB? 2. Do you have correct high voltage to the video display?
Picture is wavy.	<ol style="list-style-type: none"> 1. Is the video ground connected to the display? 2. Are the sync inputs connected properly? Does your monitor need a separate positive sync? See the <i>Video Display Sync Problems</i> section in this chapter.
Picture is upside down.	Switch the horizontal or vertical yoke wires on the display.
Convergence, purity or color problems.	Use the screens in the self-test to adjust the video display. Use the adjustment procedures in your video display manual.
Picture is not centered.	Use the centering procedures in your video display manual.

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

Voltage	Test Point or LED	Source and Purpose
+5 ± 0.25 VDC	+5V1	Logic power from the switching power supply.
	CR8 LED	Lights when 5 V is applied to the PCB and the reset (RST) jumper is open.
	CR5 LED	Lights when the +12 V supply is good.
	CR4 LED	Lights when the -5 V supply is good.
+12V	+VOP (pin 4 of LM324)	+12 V from the switching power supply. Positive supply for the analog circuitry.
-5V	-VOP (pin 11 of LM324)	-5V from the switching power supply (if connected). Negative supply for the analog circuitry.

Table 3-3 What ROM Problems Look Like

Problem	ROM Causing the Problem	Check the ROM at:
Program works, but the motion objects or playfield are wrong.	Graphics	2N
Garbage on screen; program doesn't work, or game program is erratic.	Processor Program ROM 0	13C 13H, 13K/L
No sound or erratic sound.	Audio ROM: Audio ADPCM	1D, 2D

Video Display Sync Problems

Some video displays cannot use the composite negative sync that is on the JAMMA connector. The Rampart kit includes a place for a standard Atari Games video connector (not supplied) that provides separate positive sync. Refer to Table 3-4 and make the appropriate connections for your video display.

For other problems, see the video display manual that came with your game.

Troubleshooting

The tables in this chapter (3-1, 3-2, and 3-3) can help you troubleshoot problems in your game. The troubleshooting table lists possible sources of problems of

Table 3-4 Atari Games Video Connector Pin Assignments

Pin	Signal	Pin	Signal
1	Red	7	GND
2	GND	8	GND
3	Key	9	Negative composite sync
4	Green		
5	GND	10	Positive V sync
6	Blue	11	Positive H sync

various parts of the game. The voltage inputs and test points can help you troubleshoot PCB problems. The ROM problems table can help determine exactly which ROM might be causing game play problems.

Joystick Controls

Routine maintenance of the joystick controls consists mainly of inspecting the roller shafts for excessive wear and periodically lubricating the bearings.

Maintaining the Joystick

Maintain the joystick by inspecting the pivot ball, actuator half-ball, and the shaft and by lubricating the joystick with lithium grease.

1. Turn off the power to the game.
2. Open the control panel and disconnect the harness connector.
3. Remove the joystick from the control panel. Use a 3/8-inch wrench to remove the nuts and washers that hold the joystick on the control panel.
4. Remove the four long screws that hold the joystick together. See Figure 4-2.
5. Take off the 8-position plate, the actuator, and the lower housing.

6. Check the actuator half-ball, the pivot ball, and the shaft for dirt and wear.
7. Lubricate the actuator half-ball on the end of the joystick shaft, the pivot ball below the upper housing, and the spring inside the upper housing. Use lithium grease.
8. Put the joystick assembly back together. Fit the pin in the pivot ball into the slot in the lower housing.
9. Replace the long screws and tighten them. Do not over-tighten the screws. The joystick handle must return to center easily.

NOTE

Do not over-tighten the long screw. Over-tightening can cause difficulty in moving the handle and frustration for players.

10. Replace the joystick assembly on the control panel.
11. Use the self-test to make sure you have reassembled the joystick correctly. Dust and dirt out with compressed air.

Repairs

This section includes the procedure for repairing the joystick assembly.

Disassembling the Joystick

Perform the following procedure to disassemble the joystick (see Figure 4-2).

1. Take off the control panel and disconnect the harness connectors.
2. Remove the joystick from the control panel. Use a 3/8-inch wrench to remove the four locknuts and washers holding the joystick onto the control panel.
3. Remove the four screws holding the 8-position plate on the bottom of the assembly.
4. Remove the white plastic actuator and the lower housing that the four switches are attached to.
5. Remove the small roll pin holding the actuator half-ball on the bottom of the shaft by pushing the roll pin all the way through the shaft. Slide the actuator half-ball off the end of the shaft.
6. Remove the large roll pin holding the large pivot ball on the shaft below the upper housing. Push the pin through the ball and the shaft. The pin will not be easy to remove because of the pressure on the pivot ball from the spring above it. After you push the pin all the way through the ball, slide the pivot ball off the shaft.
7. Slide the upper housing off the shaft.

8. Slide the plunger and the spring off the shaft.
9. Slide the disc off the shaft.

Reassembling the Joystick

1. Install the disc on the shaft.
2. Slide the spring on the shaft. Push the large end of plunger onto the shaft and over part of the spring (see Figure 4-2).

NOTE

Lubricate the plunger, ball, and housing at this point in the reassembly procedure.

3. Slide the upper housing onto the shaft.
4. Before you put the pivot ball on the shaft, insert the large roll pin partway into the pivot ball. The roll pin should not interfere with sliding the pivot ball onto the shaft. Slide the ball onto the shaft, and line up the roll pin with the hole in the shaft. Now push the pin through the shaft.
5. Put the small roll pin part way into the actuator ball and slide the ball onto the shaft. Line up the roll pin with the shaft hole. Push the roll pin through the ball and the shaft.
6. Fit the lower housing over the shaft so that the ends of the large roll pin fit into the slots on the inside of the housing. Turn the lower housing so that screw casings align with the holes in the upper housing.
7. Put on the white plastic actuator so that the black cushion ring is opposite the switches.
8. Now install the 8-position plate below the actuator so that you can reinsert the long screws.
9. Put the long Phillips head screws through the 8-position plate and up through the housings. Do not over-tighten the screws, or the joystick will be too hard to move.

NOTE

The joystick handle must return freely to the center position. If it does not, players are likely to become frustrated with the game.

10. Reinstall the joystick on the control panel.

ROMs and RAMs

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

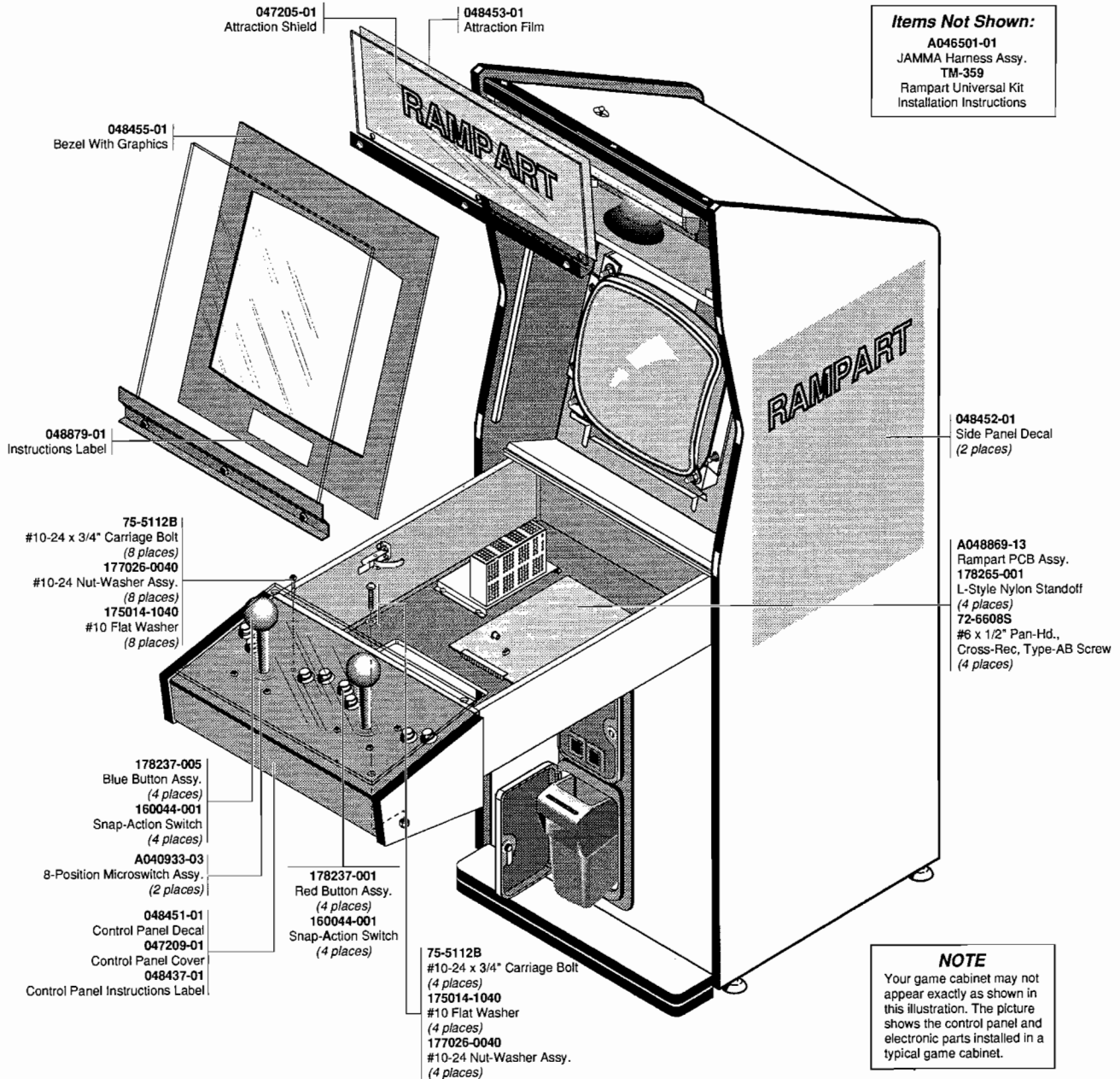


CHAPTER 4

Parts Illustrations

INTRODUCTION

This chapter provides information you need to order replacement parts for your kit. Common hardware parts, such as screws, nuts, washers, and so on, are included in these parts illustrations. When you order parts, give the part number, part name, the number of this manual, and the serial number of your game. ❖ With this information, we can fill your order rapidly and correctly. We hope this will create less downtime and more profit from your games. Atari Games Customer Service phone numbers are listed on the inside front cover of this manual.



**Figure 4-1 Parts for Rampart Universal Kit
 A048475-01 E**

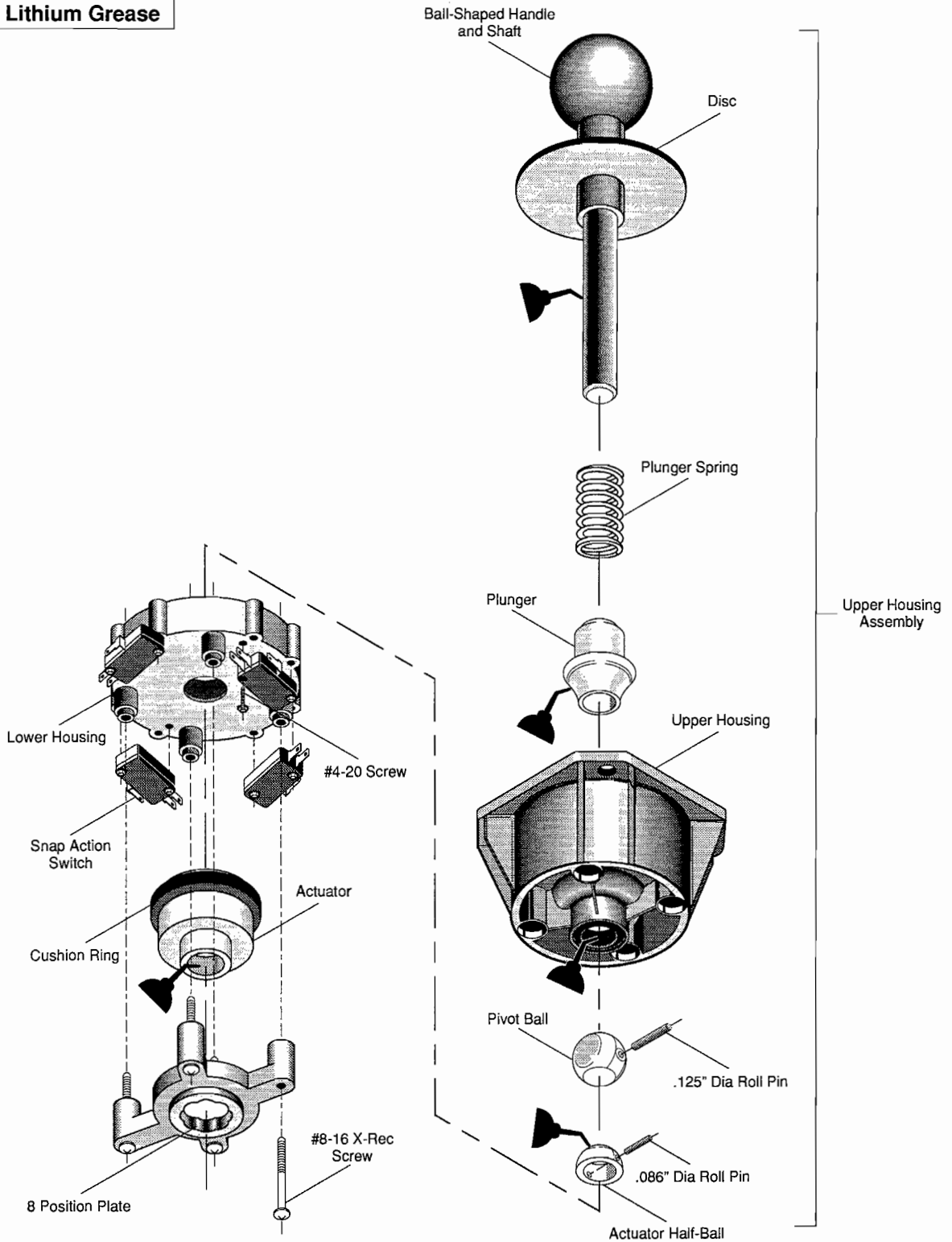


Figure 4-2 8-Position Microswitch Joystick Assembly
A040933-03 F

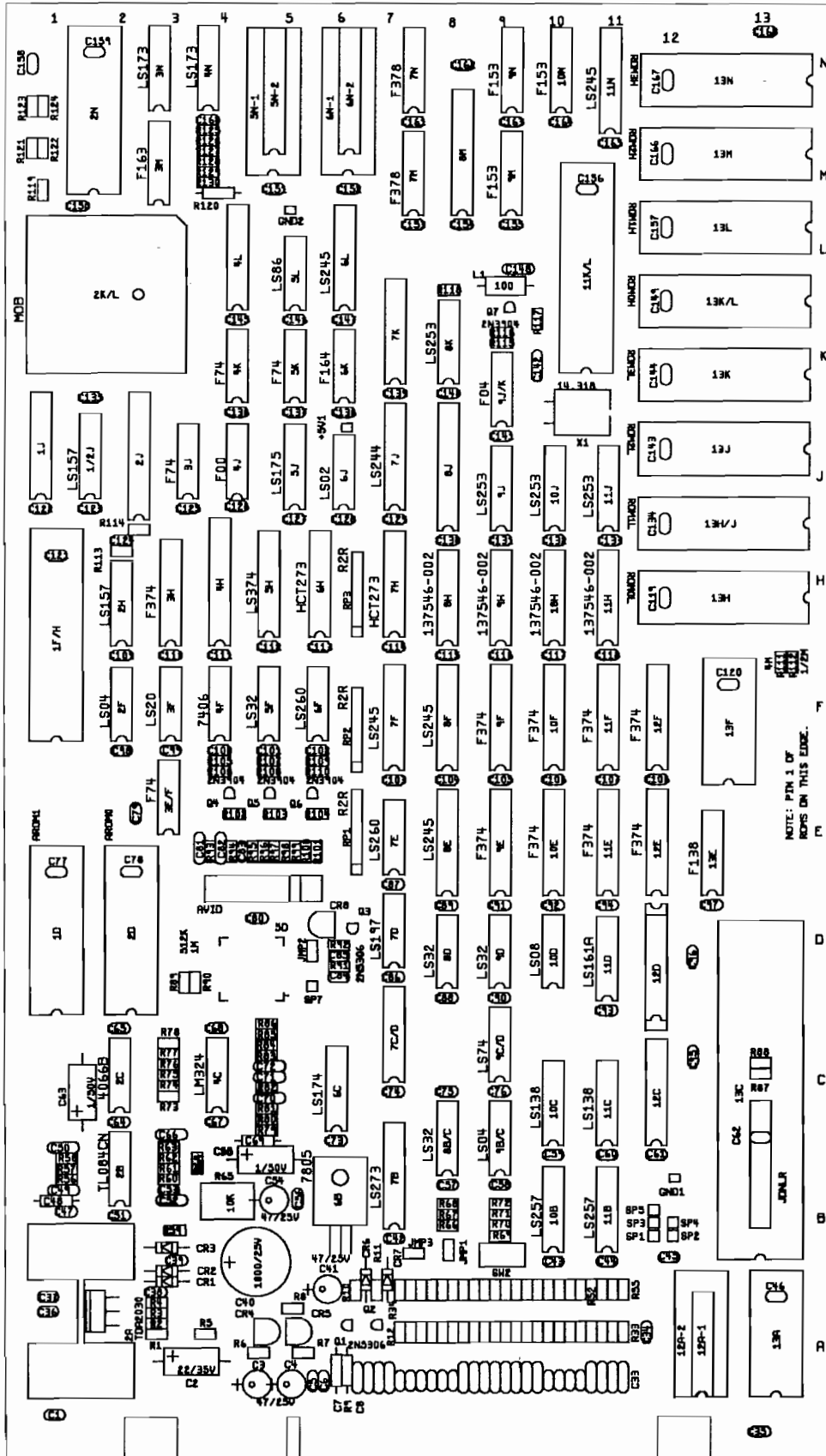


Figure 4-3 Rampart Game PCB Assembly
A048869-07 A

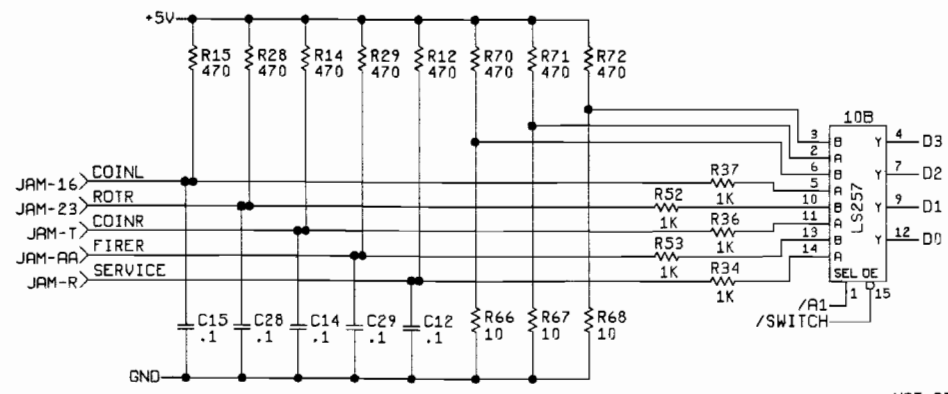
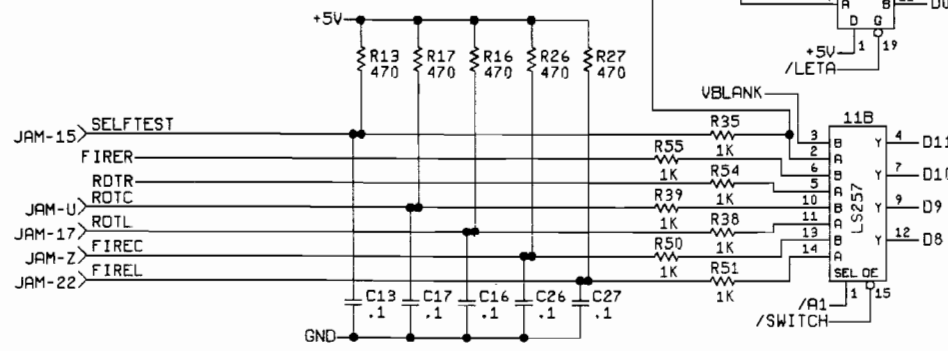
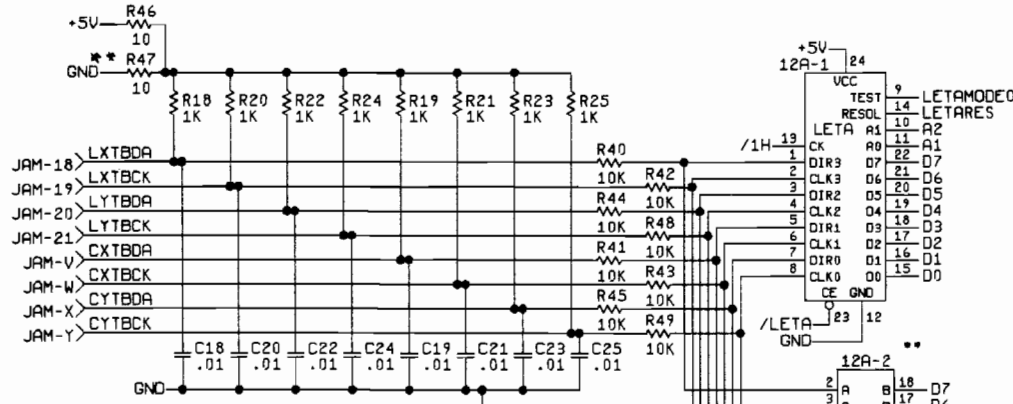
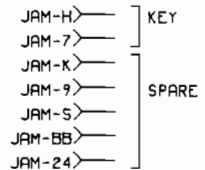
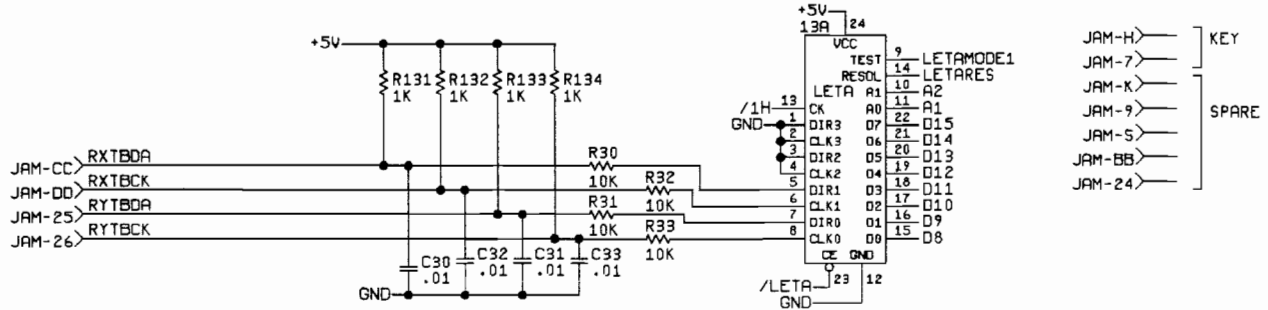


CHAPTER 5

Schematic Diagrams

INTRODUCTION

This chapter contains the schematic diagrams for your Rampart™ game PCB. The game PCB *assembly drawing* is illustrated in Chapter 4, Parts Illustrations.



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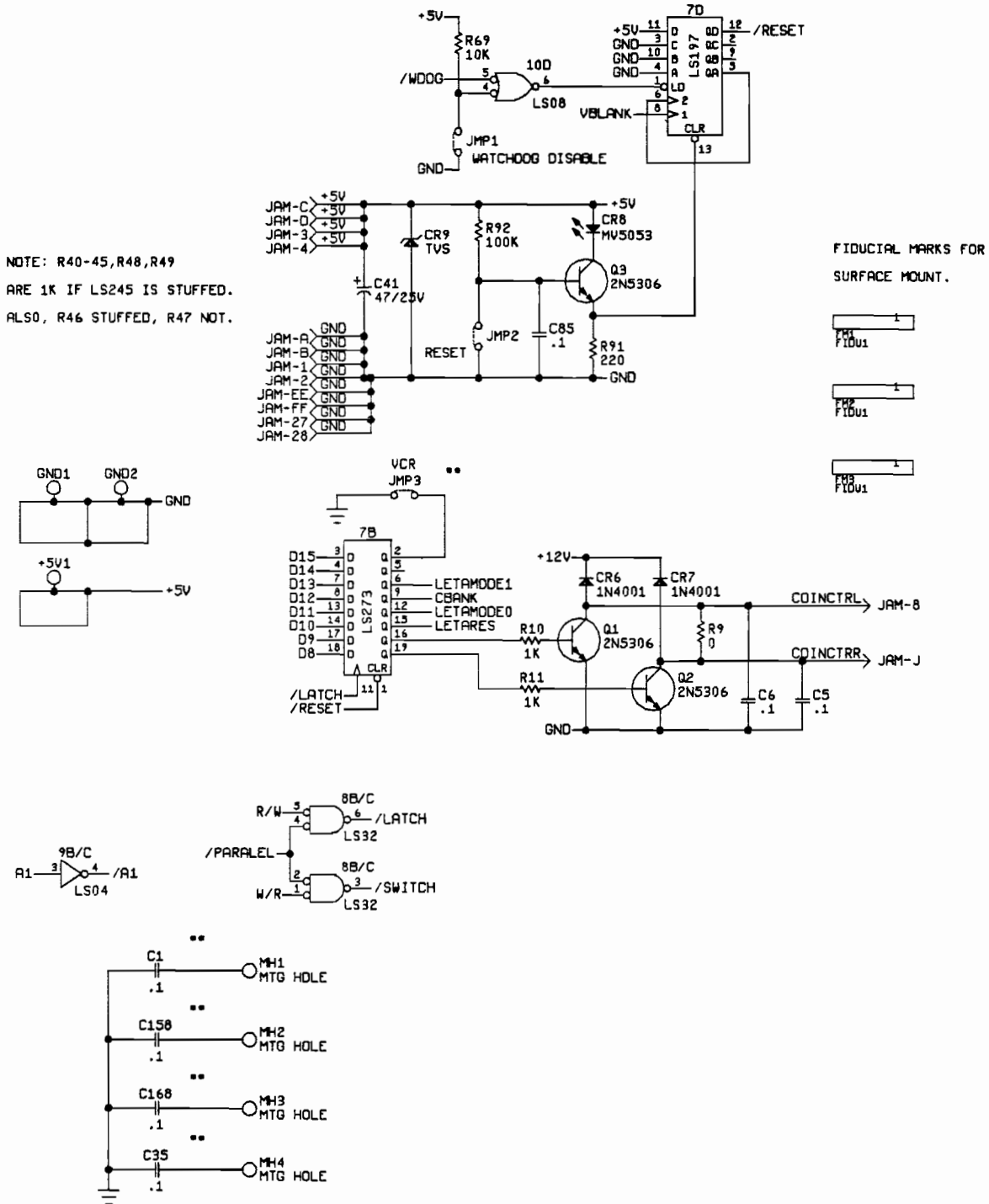
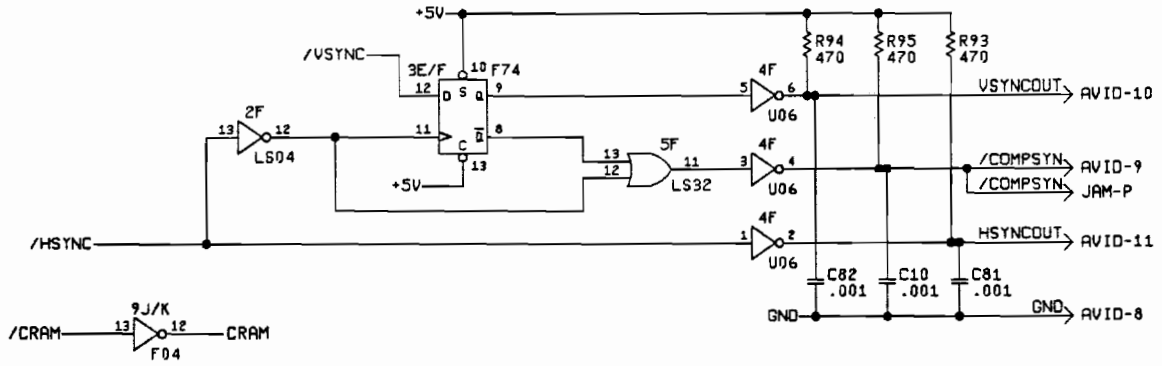


Figure 5-1 Rampart Game PCB Assembly Schematic Diagram

048868-01 F



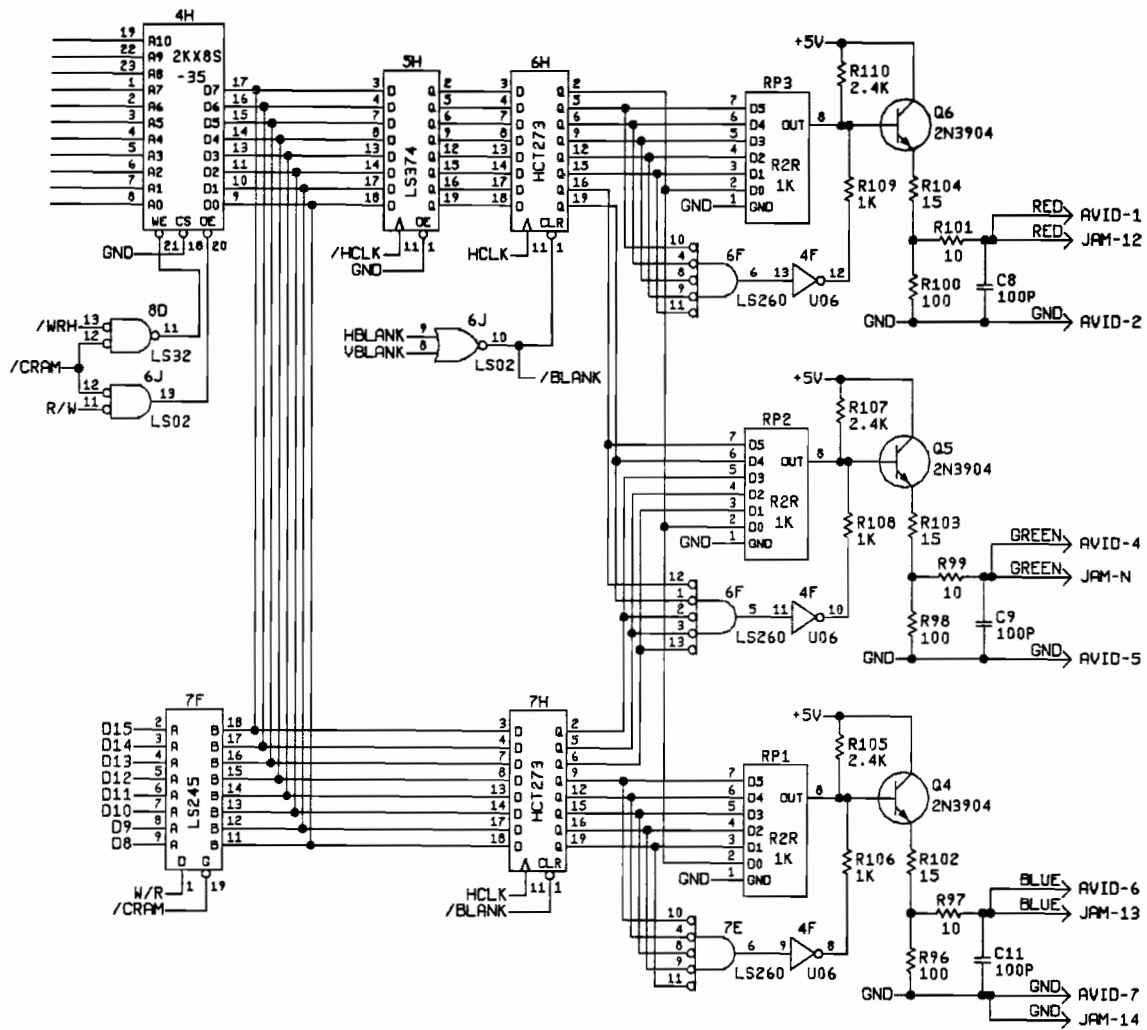
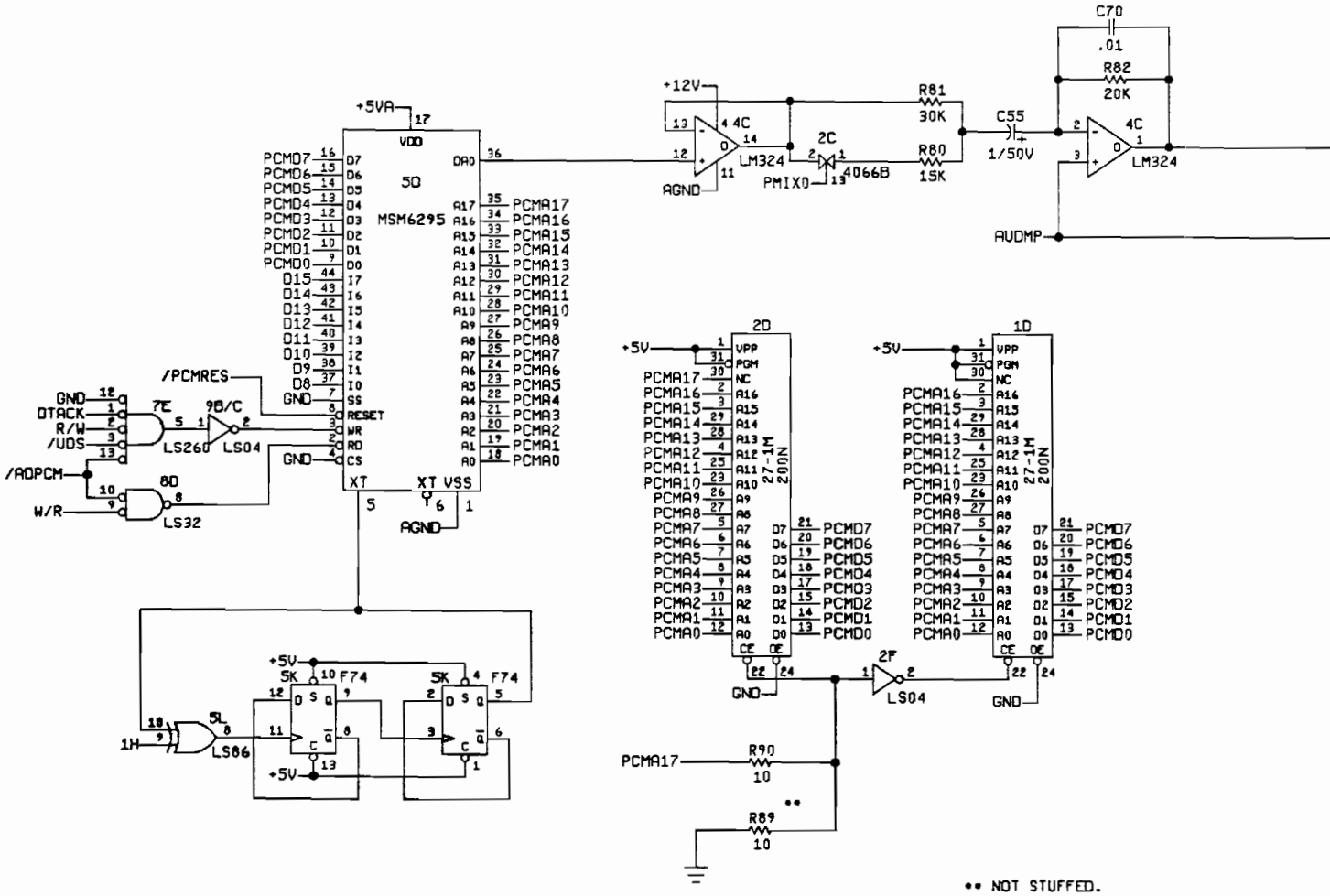
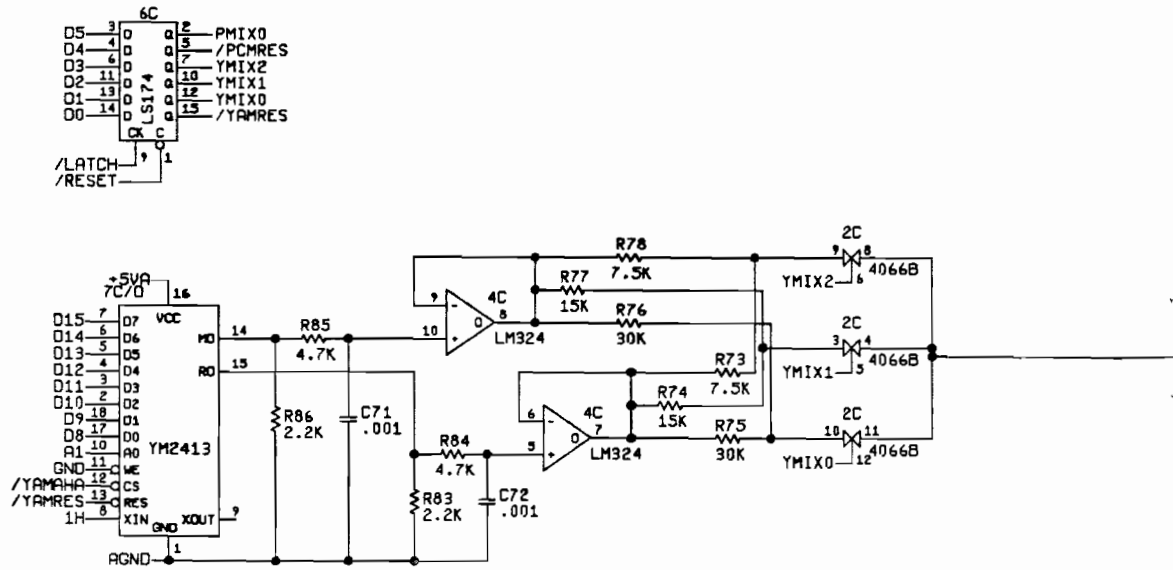


Figure 5-1 Rampart Game PCB Assembly Schematic Diagram

048868-01 F



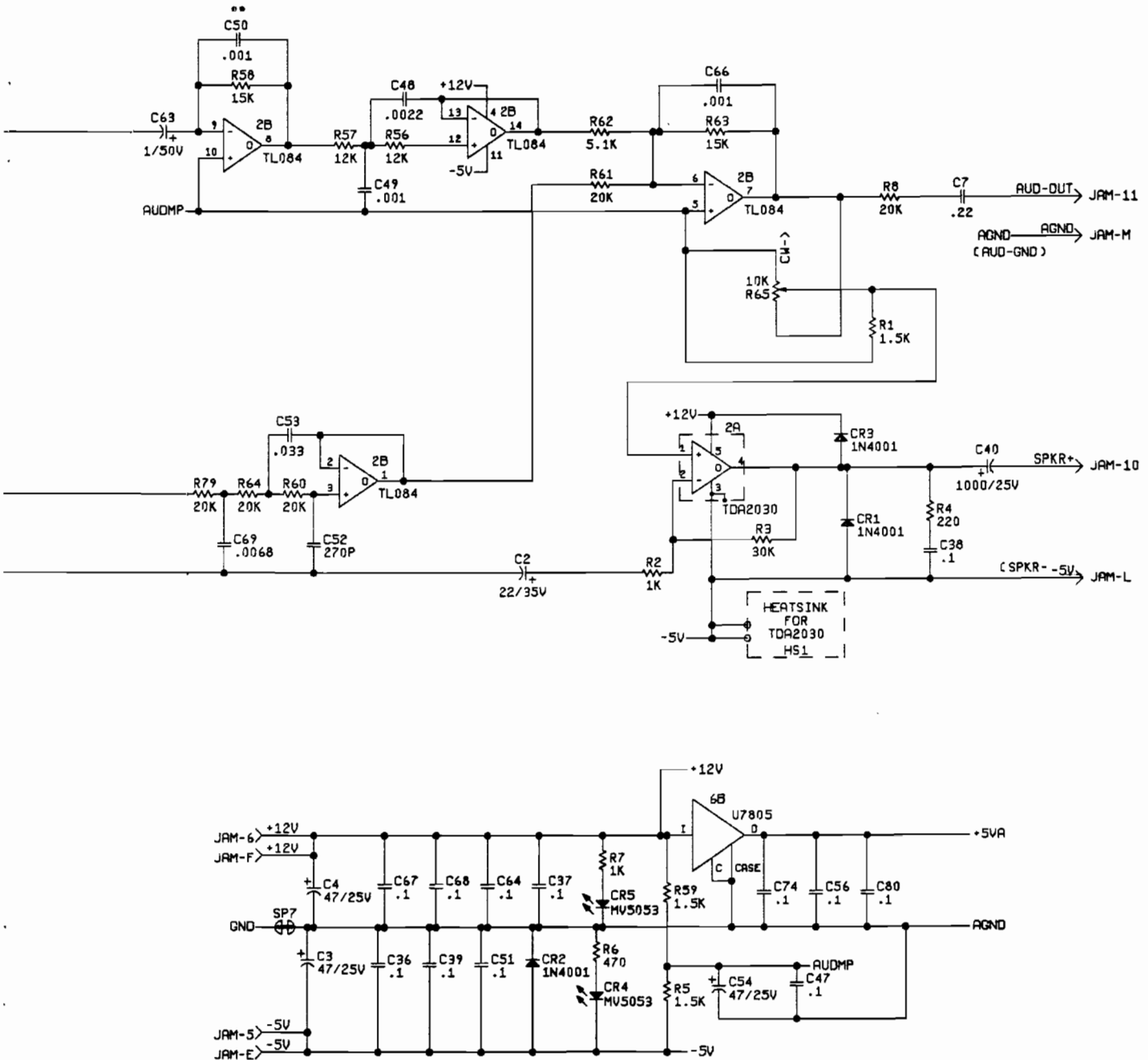


Figure 5-1 Rampart Game PCB Assembly Schematic Diagram

048868-01 F

N O T E S



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: _____



Warranty

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

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

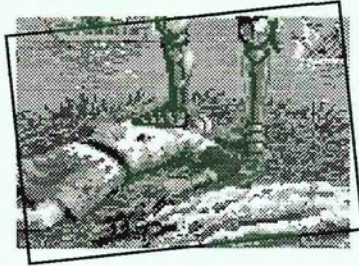
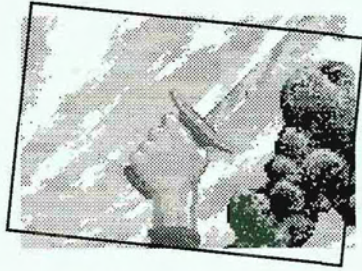
- (a) Seller is promptly notified in writing upon discovery by Buyer that said products are defective;
- (b) Such products are returned prepaid to Seller's plant; and
- (c) Seller's examination of said products discloses to Seller's satisfaction that such alleged defects existed and were not caused by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

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

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

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