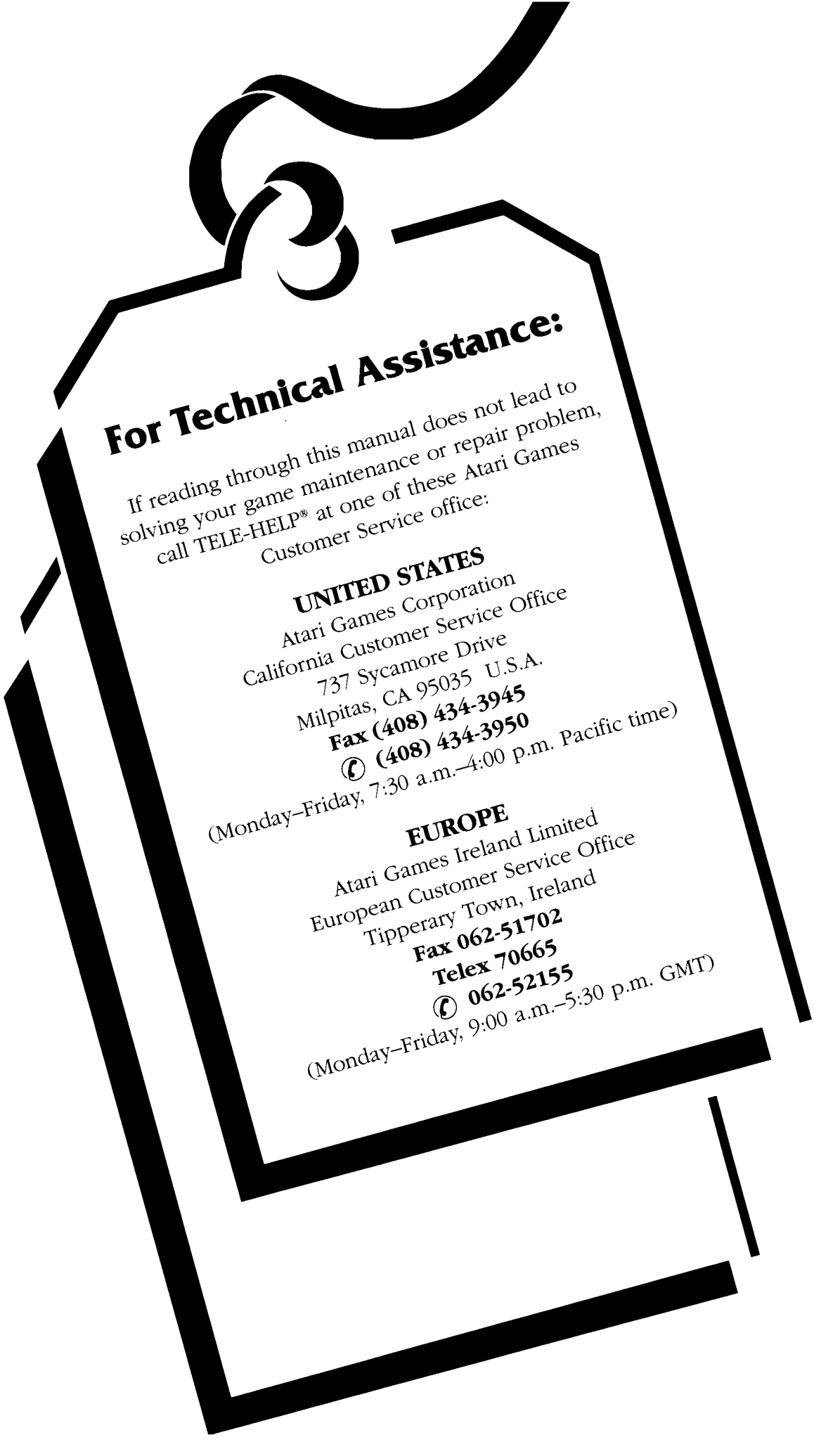
TM-397
1st printing

Universal Kit Installation Instructions

ATARI GAMES

TIME WARNER INTERACTIVE



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 office:

UNITED STATES

Atari Games Corporation
California Customer Service Office
737 Sycamore Drive
Milpitas, CA 95035 U.S.A.
Fax (408) 434-3945
✆ **(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)

ATARI GAMES

TIME WARNER INTERACTIVE

Kit Installation Instructions

Universal conversion kit for two-player upright games

Patents are pending on several parts of the Primal Rage game.

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Writing: Alan Whitehorn
Design and Editing: Andrea Dencker

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

NOTE

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

- All ground wires in the game are properly connected as shown in the game wiring diagram.
- The power cord is properly plugged into a grounded three-wire outlet.
- On games provided with an Electromagnetic Interference (EMI) ground plane, be sure that the game printed-circuit boards (PCBs) are properly installed on the EMI ground plane 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.

Important Notice

If you are installing this Primal Rage kit into a Showcase 33 cabinet with serial no.:	You have a Showcase 33 cabinet part no.:
PED0100 through PED0599	-01
PED0600 through PED0750	-02
PED0751 or higher	-03

Follow the table below and check for the parts you need (or the optional parts you would like to order).

	Quantity Required for			
Part Number	**-01 cab.**	**-02 cab.**	**-03 cab.**	**Description**
A053517-01	1	1	1	Subwoofer Harness Assembly
A053518-01	1	1	1	XBUS Harness Assembly
148016-001	1	1	1	Subwoofer Speaker
A052910-02	1	1		Main Harness Assembly
149016-002	1			Power Supply Assembly
A052917-01	1			Fan Assembly
178392-001	1			Fan Guard
052896-01*	1	1	1	Attraction Film
052897-01*		1	1	Wide Control Panel Decal
052899-01*		1	1	Wide Plastic Control Panel Cover
052898-01*		1	1	Metal Control Panel
A053516-01*	2	2	2	Control Panel Harness Assembly

**Indicates an optional part that enhances the appearance of the converted Showcase 33 cabinet or eases installation.*

To order these parts, contact your distributor or the Atari Games Customer Service office nearest you; see the inside front cover of this manual.

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 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.

Précautions de'Emploi Générales

PRÉCAUTIONS DE'EMPLOI GÉNÉRALES

Les précautions d'emploi ci-dessous s'adressent à toutes les personnes susceptibles d'utiliser ou de réparer ce jeu. La présente notice renferme également d'autres mises en garde et avertissements spécifiques.

MISES EN GARDE

Mettez le jeu à la terre. Les joueurs risquent de recevoir une décharge électrique si le jeu n'est pas correctement mis à la terre! Pour éviter les décharges électriques, assurez-vous que le jeu est correctement mis à la terre avant de le brancher. Branchez-le uniquement dans une prise tripolaire avec mise à la terre. Si vous n'avez pas de prise tripolaire, il est recommandé de faire appel à un électricien breveté pour en installer une. Si la console de commande n'est pas correctement mise à la terre, les joueurs risquent de recevoir une décharge électrique! Si une réparation quelconque a été faite sur la console de commande, assurez-vous que le fil de mise à la terre est solidement attaché à l'intérieur de la console. Ceci fait, verrouillez le jeu.

Branchement sur secteur. Avant de brancher le jeu, assurez-vous que son bloc d'alimentation est compatible avec la tension secteur locale. Les conditions d'alimentation du jeu apparaissent au premier chapitre de la présente notice.

Débranchez le jeu du secteur avant toute réparation. Pour éviter les décharges électriques, débranchez le jeu du secteur avant de le démonter ou de le réparer. Lors de la dépose ou de la réparation de l'affichage vidéo, attention aux décharges électriques. Les hautes tensions subsistent dans les circuits et le tube à rayon cathodique de l'affichage même après son débranchement. Ne touchez pas aux pièces internes de l'affichage avec les mains ou des objets métalliques! Prenez soin de toujours décharger le courant haute tension accumulé dans l'écran cathodique avant de le réparer, après avoir débranché l'appareil du secteur. Premièrement, reliez à la terre l'une des extrémités d'un gros fil de connexion bien isolé de calibre 18 [gauge]. Puis, touchez momentanément l'anode de l'écran cathodique avec l'extrémité libre du fil de connexion mis à la terre en glissant le fil sous le chapeau de l'anode de l'écran. Attendez deux minutes et recommencez.

Utilisez uniquement des pièces Atari. Pour éviter les risques d'accidents, utilisez toujours des pièces Atari pour réparer le jeu. L'emploi de pièces d'autres marques ou la modification des circuits du jeu sont potentiellement dangereux pour le réparateur et pour les joueurs.

Prenez soin de l'écran cathodique. Si vous faites tomber l'écran cathodique et qu'il se brise, il risque d'imploser et de projeter des débris de verre à six pieds ou plus!

Utilisez les fusibles appropriés. Pour éviter les décharges électriques, remplacez les fusibles par ceux indiqués dans la nomenclature du jeu. Les fusibles de rechange doivent être du même type, de la même tension et de la même intensité que ceux d'origine.

ATTENTION

Attachez correctement tous les connecteurs. Assurez-vous que tous les connecteurs sont bien enfichés dans les cartes circuits. Ces connecteurs sont dotés d'un détrompeur qui évite les erreurs de branchement. S'ils s'enfichent difficilement, ne forcez pas. Si vous branchez un connecteur à l'envers, vous risquez d'endommager le jeu et d'en annuler la garantie.

Vérifiez la fréquence de ligne du courant secteur. Les jeux vidéo fabriqués pour fonctionner à une fréquence de ligne de 60 Hz (fréquence utilisée en Amérique du Nord) ne doivent pas être utilisés dans les pays dont le courant a une fréquence de 50 Hz (Europe). Si vous branchez un appareil conçu pour une fréquence de 60 Hz sur un courant d'une fréquence de 50 Hz, le transformateur ballast de l'éclairage fluorescent surchauffera, ce qui présente des risques d'incendie. Vérifiez la fréquence de ligne requise par votre machine; elle est indiquée sur sa plaque signalétique.

REMARQUES, AVERTISSEMENTS ET MISES EN GARDE

Dans les publications d'Atari, les conventions, en ce qui concerne les remarques, avertissements et mises en garde, sont les suivantes:

REMARQUE — Sert à attirer l'attention sur un point particulier.

AVERTISSEMENT — Le non-respect des directives présente des risques d'endommagement et/ou de destruction pour le matériel et/ou les pièces. En cas d'endommagement ou de destruction du matériel ou des pièces, résultant du non-respect des directives, la garantie offerte sur les cartes circuits Atari, les pièces connexes et les affichages vidéo Atari sera annulée.

MISE EN GARDE — Le non-respect des directives présente des risques de blessures ou d'accidents mortels pour les joueurs et/ou les réparateurs.

CONTENTS

ILLUSTRATIONS

TABLES

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CHAPTER 1

Installation

How to Use This Manual

THE PRIMAL RAGE™ conversion kit is a one- or two-player head-to-head fighting game for upright cabinets. ♦ This manual provides information for installing, testing, and troubleshooting the Primal Rage™ conversion kit. ♦ Chapter 1 describes how to install the Primal Rage kit in your cabinet, and also describes game play. ♦ Chapter 2 contains self-test procedures. The self-test is important in the Primal Rage game. You can troubleshoot the PC boards, main circuits, and controls using the screens in the self-test. ♦ Chapter 3 provides information about maintenance, troubleshooting and repair procedures for your Primal Rage game. ♦ Chapter 4 provides information you need to order parts for your game. ♦ Chapter 5 contains the schematic diagrams for most of the Primal Rage™ game printed-circuit boards.

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

WARNING

For safe use, you must install this Primal Rage kit in a standard Atari Games "family" cabinet, or in any universal kit cabinet that is Underwriters Laboratories listed.

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

CAUTION

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

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
Speakers	One or two 8 Ω, 10 W for mono/stereo; One 4 Ω, 10 W subwoofer (optional: for Showcase 33 cabinets only. See page iii.)
Coin Counter	+5 VDC or +12 VDC
Power Cord	Three-conductor with ground
Power Supply	+5 VDC ± 0.25V @ 12.0 amps minimum
	+12 VDC @ 2.0 amp

Table 1-1 Equipment Requirements

Tools Required

- Drill with a ½-inch and 5/16-inch drill bits
- Phillips screwdriver
- Flat-blade screwdriver
- Socket wrench set and ratchet
- 5/32-inch hex wrench
- Wire cutters and strippers
- Straight edge

Qty.	Description	Part No.
1	JAMMA Filter PC Board Assy.	A047292-01
1	Product I.D. Label	038158-01
1	FCC Compliance Label	039450-01
1	FBI Warning Label	042452-01
1	Black Bezel for Kits	049774-01
1	1/16-inch Polycarbonate Control Panel Cover	054307-01
2	Side Panel Decal	053652-01
1	Attraction Film	053403-02
1	Control Panel Decal	053402-02
1	Instruction Label	052893-01
2	.50-inch I.D. Split Ferrite Beads	141026-001
8	Snap-Action Switch	160044-001
2	Joystick Assy.	171128-003
1	Attraction Shield	047205-01
1	Bezel Label	053942-01
1	Primal Rage Game PCB Assy.	A053926-01
12	#10 Flat Washers	175014-1040
12	#10-24 Zinc Nut/Washer Assemblies	177026-0040
12	#10-24 Carriage Bolts	75-5112B
1	#10 Wire and Cable Ties	178032-002
4	Red Button Assembly	178237-001
4	Yellow Button Assembly	178237-002
2	"Quick" Indicator Plate	178283-019
2	"Fierce" Indicator Plate	178283-021
2	Inverted "Fierce" Indicator Plate	178283-024
2	Inverted "Start/Quick" Indicator Plate	178283-026
12	#10-24 x ¾-inch Long Carriage Bolts	75-5112B
1	*Primal Rage Universal Kit Installation Instructions*	TM-397

Note: A JAMMA harness is not included in this kit. If your game cabinet does not already have a JAMMA harness installed in it, you can order this harness from Atari Games Customer Service. Also, packaging materials are not listed above.

Table 1-2 Contents of Primal Rage Kit

- Squeegee
- X-ACTO™ knife
- Insulated wire connectors (if you are installing a new JAMMA harness)
- Carbon paper
- Saber saw
- File
- Bandsaw
- Tape or glue

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 Primal Rage 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.

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.

Assembling the Control Panel

Parts Needed for this Kit

To assemble the control panel, you must first decide where to cut the control panel holes (refer to Figure 1-1). Create a template sheet from the illustration. You will also need the following parts from the kit:

- Clear control panel cover
- Control panel decal
- Red and yellow button assemblies
- Snap-action switches
- Indicator plates: Fierce, Start, Quick, etc.
- Twelve #10 flat washers, #10-24 x ¾-inch-long black carriage bolts, and #10-24 nut/washer assemblies
- Joystick assemblies

Installing the Parts

1. Using carbon paper, transfer the design from the template to the control panel. Save the template.
2. Using a saber saw, carefully cut out the two large holes for the joystick assemblies. Deburr the sharp edges with a file.
3. Drill the eight 1.187-inch holes for the buttons.
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 button holes as close as possible to the locations shown on the template.
5. 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.
6. 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.

7. Tape or glue the template to the plexiglass cover. To start the saber saw cuts, drill a ½-inch hole inside the hole for the joystick, and the button holes.

Pin	Signal	Instructions
		Component Side
1	POWER GND	Connect to the 5V RTN terminal on the power supply. However, if you have 12V RTN, connect *one* of the wires at pin 1, 2, A, or B to the 12V RTN terminal.
2	POWER GND	Same as pin 1.
3	+5V DC	Connect to the +5V terminal on the power supply.
4	+5V DC	Connect to the +5V terminal on the power supply. However, if your power supply has a + Sense terminal, connect to the + Sense.
5	-5V	
6	+12V DC	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	COIN CTR 1	Connect this wire to one side of the left 12V coin counter. *Note: Do not use 24V counters.* Connect the + side to +5V or +12V on the power supply, as appropriate.
9	Not used	
10	SPKR + L	Connect to the + terminal on the left speaker.
11	SPKR + R	Connect to the + terminal on the right speaker.
12	RED	Attach to the video display.
13	BLUE	Attach to the video display.
14	VIDEO GND	Attach to the video display.
15	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. *(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 GND wire.)*
16	LT COIN	Connect to the N.O. terminal of the left coin switch. Connect the common terminal of the switch to a ground wire.
17	START1/QUICK HIGH	Connect to the N.O. terminal of the switch.
18	UP1	Connect to the N.O. terminal of the switch.
19	DOWN1	Connect to the N.O. terminal of the switch.
20	LEFT1	Connect to the N.O. terminal of the switch.
21	RIGHT1	Connect to the N.O. terminal of the switch.
22	FIERCE HIGH	Connect to the N.O. terminal of the switch.
23	QUICK/LOW	Connect to the N.O. terminal of the switch.
24	FIERCE/LOW	Connect to the N.O. terminal of the switch.
25	Not used	
26	Not used	
27	GND	Connect to the common terminal of the switches.
28	GND	Connect to the common terminal of the switches.

Pin	Signal	Instructions
		Solder Side
A	RTN	Connect to the 5V RTN terminal on the power supply. However, if you have 12V RTN, connect *one* of the wires at pin 1, 2, A, or B to the 12V RTN terminal.
B	RTN	Same as pin A.
C	+5V DC	Connect the +5V terminal on the power supply.
D	+5V DC	Connect the +5V terminal on the power supply.
E	-5V DC	
F	+12V DC	Connect to the +12V terminal of the power supply.
H	**Key**	
J	COIN CTR 2	Connect this wire to one side of the right 12V coin counter. Clip R18 on the game PCB if you use a second coin counter. *Note: Do not use 24V counters.* Connect the + side to +5V or +12V on the power supply, as appropriate.
K	Not used	
L	SPKR – L	Connect to the – terminal on the left speaker.
M	SPKR – R	Connect to the – terminal on the right speaker.
N	VIDEO GREEN	Attach to the video display.
P	COMPSYNC	Attach to the video display.
R	Not used	
S	Not used	
T	RT COIN	Connect to the N.O. terminal of the right coin switch. Connect the common terminal of the switch to a GND wire.
U	START2/QUICK HIGH	Connect to the N.O. terminal of the switch.
V	UP2	Connect to the N.O. terminal of the switch.
W	DOWN2	Connect to the N.O. terminal of the switch.
X	LEFT2	Connect to the N.O. terminal of the switch.
Y	RIGHT2	Connect to the N.O. terminal of the switch.
Z	FIERCE HIGH	Connect to the N.O. terminal of the switch.
a	QUICK/LOW	Connect to the N.O. terminal of the switch.
b	FIERCE LOW	Connect to the N.O. terminal of the switch.
c	Not used	
d	Not used	
e	GND	Connect to the common terminal of the switches.
f	GND	Connect to the common terminal of the switches.

Table 1-3 JAMMA Pin and Wire Connections

NOTE

The four holes in the corners for securing the control panel cover are not shown in this illustration. Drill these holes wherever space permits.

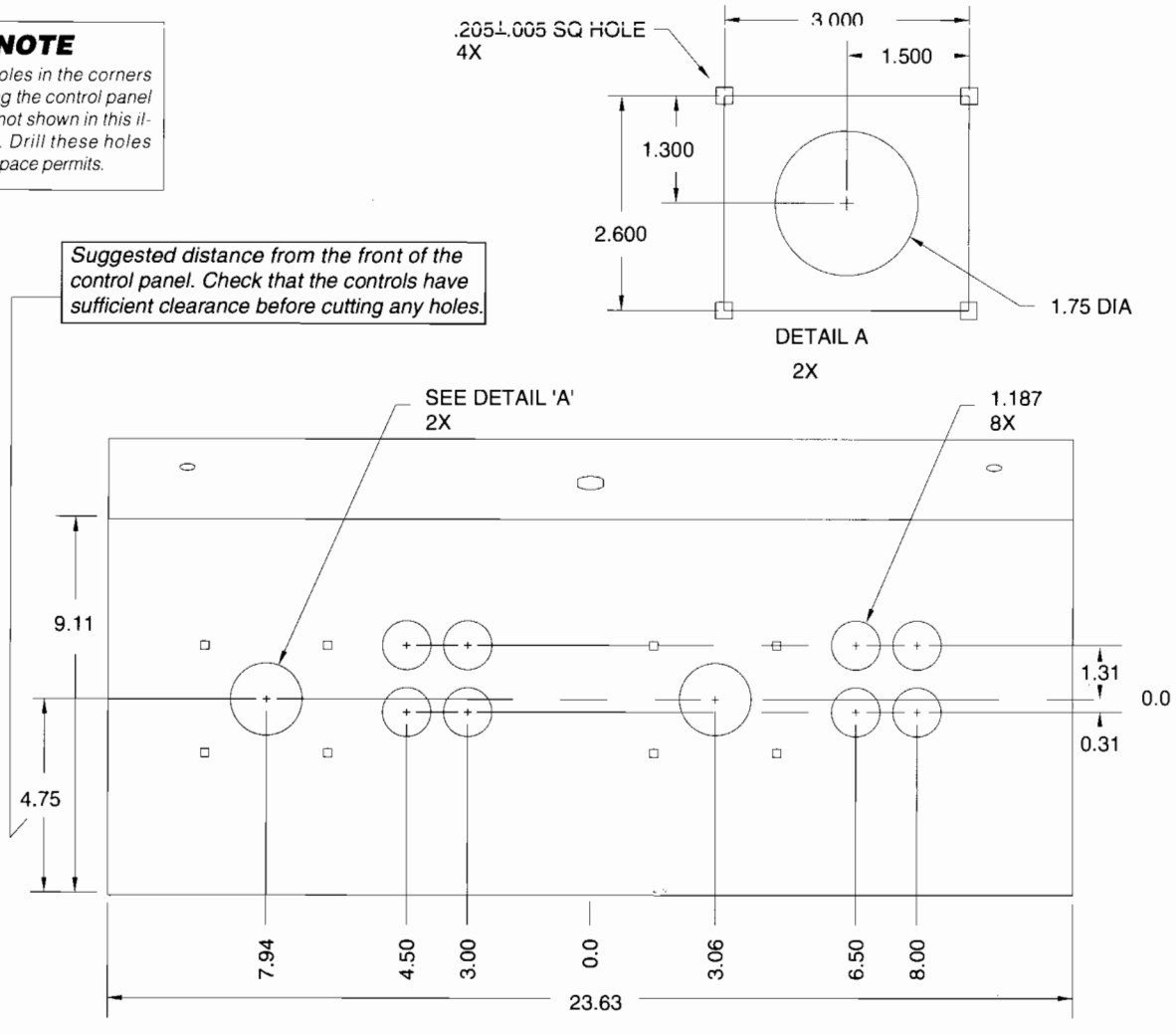


Figure 1-1 Locations of Control Panel Holes to be Drilled

8. Saw out the large holes for the joysticks and the button holes.
9. Drill the four ¼-inch holes that will be used to mount the cover to the control panel and the eight 0.205-inch bolt holes to mount the joysticks.
10. To prevent injury, carefully deburr all the edges of the plexiglass cover.
11. 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.
12. Install the cover on the control panel using the four ¾-inch-long carriage bolts, washers, and nut/washer assemblies.
13. Install the joysticks using the the ¾-inch-long carriage bolts, washers, and nut/washer assemblies.
14. Install the button assemblies with their indicator plates and snap-action switches (refer to Figure 1-2 for correct placement).

For maintenance and servicing information on the controls, refer to Chapters 2 and 3 of this manual.

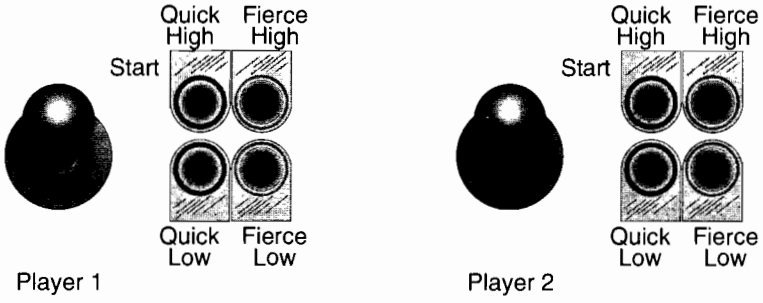


Figure 1-2 Named Locations of Control Panel Assemblies

Connecting the JAMMA Harness

1. If your game cabinet does not already have a JAMMA harness, install a JAMMA harness in the cabinet. To purchase a JAMMA harness, contact the Atari Games Customer Service office closest to you.
2. Install the pair of 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 and the JAMMA Filter PCB on the JAMMA harness to meet FCC requirements. (These parts are included in the kit.)

3. Using Table 1-3 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

1. Connect the wires on the JAMMA harness to the wires for the power supply, as shown in Table 1-3. The Primal Rage kit requires +5V and +12V. The –5V is not needed and should *not* be used. Tie off any other voltage wires on the power supply besides +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.

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.

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 and 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 foot pedal, 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; and +12 Volts on pins F and 6.

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

Installing the Primal Rage Game PCB

1. After you have checked the power on the JAMMA connector (described above), install the Primal Rage game board in the cabinet. Use the four screws and standoffs supplied with the game board to mount it onto the wooden cabinet surface.
2. Connect the JAMMA harness connector to the Filter 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

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. Then find the game instructions label in the kit, and adhere that label to the bottom center of the bezel.

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 on the side panels of the cabinet. Remove any wrinkles in the artwork using a squeegee. Allow the sides to dry.

Installing the Attraction Assembly

Find the Primal Rage attraction film in the kit (the attraction shield may be reused from your cabinet). Using the existing shield as a template, cut the film to size, if necessary. Install them in the cabinet attraction assembly.

Adjusting the Volume

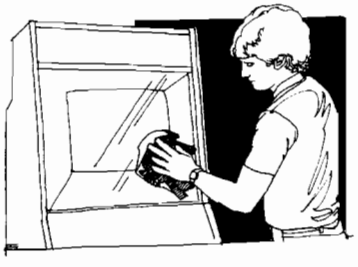
There is no volume adjustment knob on any PCB in this game. Instead, volume is adjusted in the self-test software. The attract-mode and game-play volumes can be adjusted separately. Refer to Chapter 2 of this manual for more information.

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 Primal Rage game. When you set up the game and when you collect money, use all the screens in the self-test procedure — especially the Control Test.



Game Play

This section describes the features and play of the Primal Rage game.

Introduction

Primal Rage is a head-to-head fighting game featuring state-of-the-art stop-motion animated characters. Players choose from seven different giant fantasy creatures in an attempt to dominate the new "Urth," using fighting moves, powerful "secret" moves, masterful combo hits and graphic finishing sequences to eliminate their opponent.

Primal Rage utilizes a proprietary new stop-motion animation technique that provides realistic and life-like character motion. In addition to state-of-the-art graphics, Primal Rage features the new CAGE "Total Immersion Audio" system, providing great stereo sound that punctuates high-impact game play.

Due to their great size and special powers, each of the seven available characters in Primal Rage is worshiped as a "god" by the surviving humans of Urth. As players go through the game, they amass additional followers with every victory. Followers can also be eaten to replenish strength, if needed, but this is really a matter of personal taste.

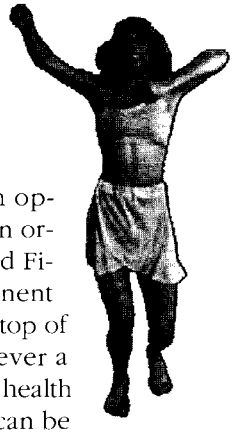
Primal Rage features a four-button control that allows "power" hits to be mapped onto both the top and bottom button pairs. To execute special moves, players must press and hold button combinations while moving the joystick at the same time, in a method that differs from standard fighting game controls. This allows for a diversity of regular hits while at the same time providing a new way of executing special moves. Because of this feature, Primal Rage controls allow for very fluid combination potential. Advanced players will be motivated to learn all of the moves to develop the best combinations, providing the driving force for high-level competitive action.

CAGE™
Total Immersion Audio

Game Play

The game offers two basic types of play:

- One-player game. The player must defeat all seven opposing characters to get to the Bonus Round and Final Battle.
- Two-player game. Players battle each other for trophies, human followers, and World Domination. The winner is the player who captures the most "globes" and amasses the most followers.



One-Player Game

The player must defeat all seven opposing characters, one at a time, in order to get to the Bonus Round and Final Battle. Each player and opponent character has a "health bar" at the top of the screen that is reduced whenever a damaging hit is made. If a player's health bar is reduced, human followers can be eaten for bonus health. Each opponent defeated will result in a new territory being awarded.

Finishing Moves

When an opponent character has lost all its health and is standing there dizzy, the character is in its "death throes" and is about to die. The "finishing move" is a special button combination (different with each character) that can be used to "finish off" an opponent while it is in its death throes. Using a finishing move demonstrates technique and generates excitement, but, most importantly, affects the status of opponent characters when they return during the Final Battle. Players will be motivated to master all of the finishing moves in order to play a perfect game.

Bonus Round and Final Battle

After defeating all seven opponents, the player is awarded a Bonus Round, during which points and bonus health can be collected by snacking on human followers. After the Bonus Round, the player moves to the Final Battle, during which all of the player's foes must be quickly vanquished once again, only this time with a twist: the player has only one health bar plus bonus health, and each opponent character will return either as a normal character or as a ghost-like character. Any character that the player did not eliminate using a finishing move during the regular rounds will come back as a normally healthy character. Characters on which a player successfully executed finishing moves will return as ghosts that suffer more damage per hit inflicted.

Any player who has won the Final Battle is rewarded with the story line for that character and a special graphic picture depicting that character's life after they have captured Urth. Players who lose all of their health

during the Final Battle have the opportunity to continue the game by adding more coins.

Challenge Game

During a 1-player game, another player can challenge the current player by inserting coins in the unused side of the game. The original player now competes against the new challenger.

Two-Player Game

Players battle each other in a match decided by winning two out of three rounds. A trophy and human followers are awarded to the player who wins each round, and a new territory on the globe is awarded to the winner of the match.

Human Followers

Human followers are awarded for various accomplishments in the game. The number of followers awarded depends upon how well a player fights, including attack combinations, damage to the opponent, use of finishing moves, and fatalities.

Sudden Death

If the two players are tied at the end of the third round (same number of trophies and both players still alive), then a Sudden Death round is started. At the beginning of Sudden Death, the timer is reset to 20 and players receive full health bars. During play, each player's health bar will be reduced by time and hits. If Sudden Death ends without a victor, both players will die and the game will end in a tie.

World Domination

In order to achieve World Domination, a player must win all seven territories on the globe. When this is achieved, the player will be awarded a globe and more human followers. There is no limit to the number of globes awarded in a 2-player game. The winner is the player who captures the most globes and amasses the most human followers.

Hidden Features

Many hidden features are included in Primal Rage. Some of these features are activated by different joystick and button combinations. Some are skill-specific and some require cooperation between players. Many hidden features depend upon which character is being played, which background is in view, or which combination of moves is used.

NOTES

CHAPTER 2

Self-Test

INTRODUCTION

THIS CHAPTER contains a description of the self-test for your Primal Rage™ game. Use the 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. Perform the self-test when you first set up the game, each time you collect the money, or when you suspect game problems. 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 the self-test screens.

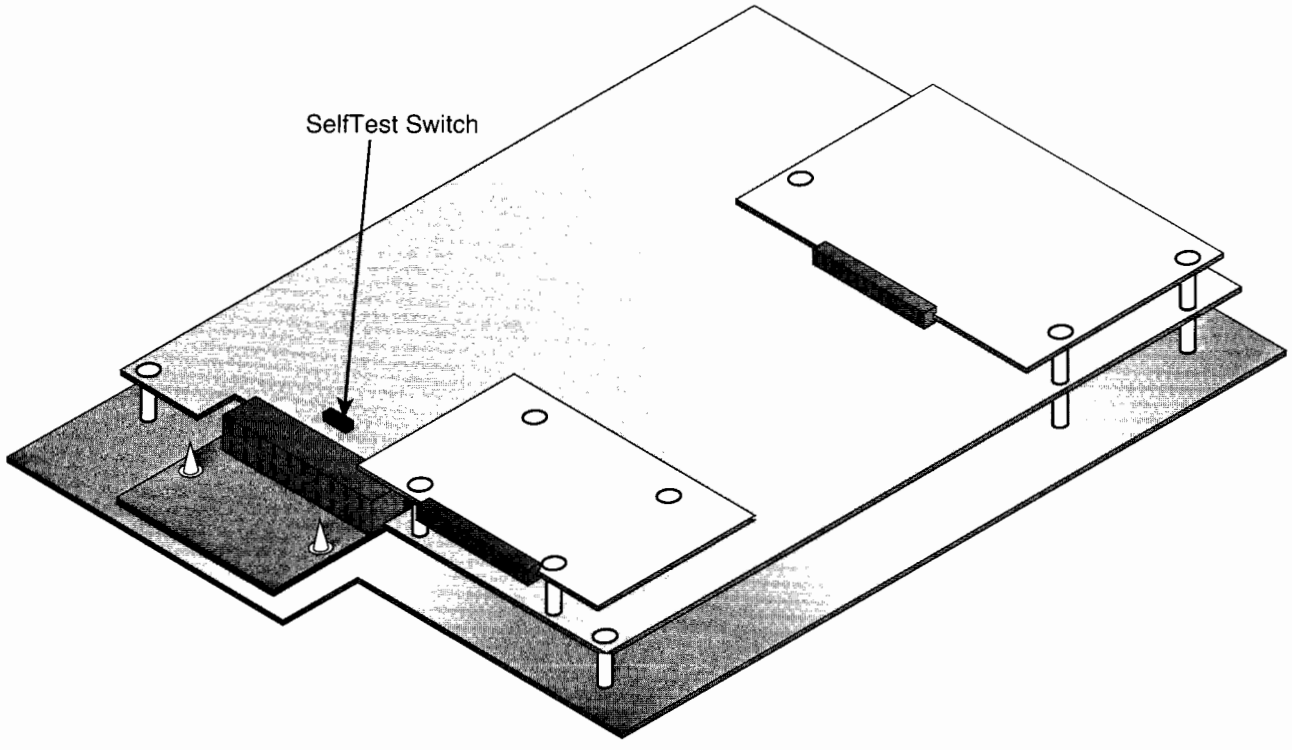


Figure 2-1 Location of Self-Test Switch

Entering and Exiting the Self-Test

The game's self-test switch is located on the Game PCB (see Figure 2-1). Also, in Table 1-3, refer to the instructions regarding Pin 15 if you want to install an external self-test switch. Turning on this switch causes the screen to enter the self-test mode. Doing so displays the Select Test menu; see Figure 2-2. Exit the self-test by turning off the self-test switch at any time.

At the bottom of the self-test screen you may find that the MOS or OS versions shown in this manual are different from your game. Any version differences in the software are unimportant.

Select Test Menu

Choose which test or screen you want to see from this menu, shown in Figure 2-2. Move up and down the menu by moving either joystick up or down (or by pressing the left player upper right button). Start the selected test by pressing the left player upper left button.

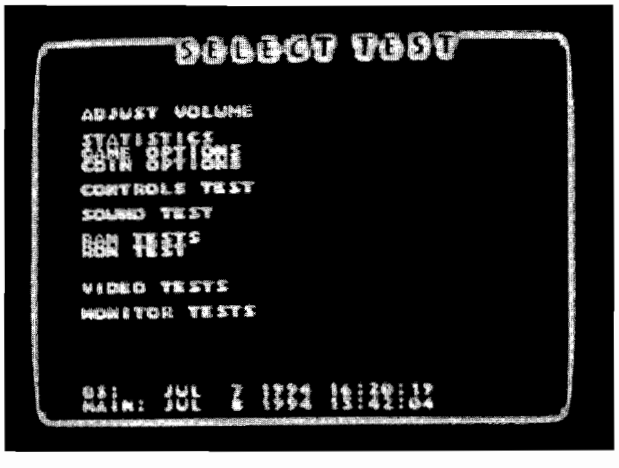


Figure 2-2 Select Test Menu Screen

Adjust Volume

Adjust the volume of the game using this screen, shown in Figure 2-3. Follow the instructions at the bottom of the screen to restore the old volume level or to save the new volume and return to the select test menu.

Select Test Menu
Adjust Volume
Statistics Statistics More Statistics Histograms
Game Options
Coin Options
Controls Test
Sound Test
RAM (Memory) Tests Video RAM Video RAM (quick) Color RAM Working RAM Working RAM (quick) All RAM
ROM Test
Video Tests Playfield Scrolling MOB (Moving Objects) Checksums Alphanumerics
Monitor Tests Color Test Purity Test Convergence Test

Table 2-1 Summary of All Self-Test Screens

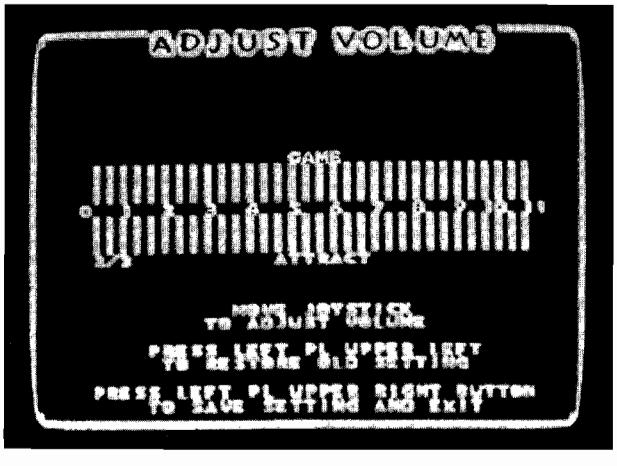


Figure 2-3 Adjust Volume Screen

The software continuously plays music to allow you to adjust both the game and attract-mode volume levels. The word *GAME* or *ATTRACT* flashes to show which of the two volumes levels you are adjusting. Move either joystick up or down to select either one. The attract-mode volume level has four steps: mute, 1/3, 2/3 or full volume level (these are fractions of the game volume level).

Statistics

Use the information shown in the statistics and histogram (bar graph) screens to keep track of your game use and maximize your profits.

The game statistics are collected from the last time the statistics were cleared. Follow the instructions at the bottom of the screen to clear the statistics or to advance to the next statistics or histogram screen.

Statistics Screen

The Statistics screen (see Figure 2-4) lists the following information:

- Left Coins shows the number of coins counted in the left coin mechanism.
- Right Coins shows the number of coins counted in the right coin mechanism.
- Aux Coins shows the number of coins manually added by the operator. (not inserted into any mechanism).
- Idle Minutes shows the number of minutes that the game was idle and not being played.
- 1-Player Minutes/2-Player Minutes shows the number of minutes that the game was played by one or two players.
- New Game Minutes shows the number of minutes played after starting a new game.
- Continued Game Minutes shows the number of minutes played after continuing a game.
- EEPROM 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 EEPROM at 22H on the Primal Rage game PCB.

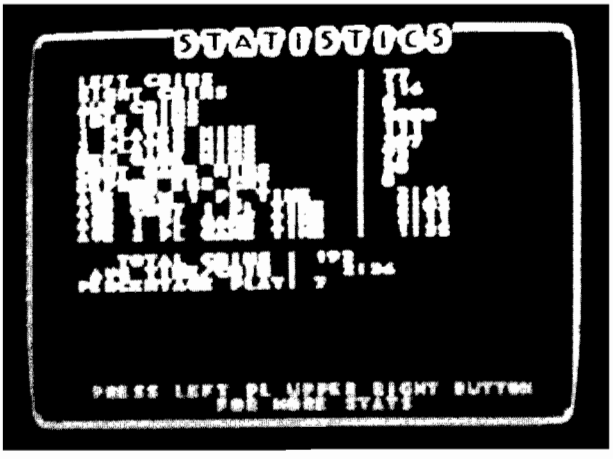


Figure 2-4 Statistics Screen

Figure 2-5 More Statistics Screen

- Average New/Continued 1 Player Time shows an average of the number of minutes played by one player in a new or continued game.
- Average 1 Player/2 Player Game Time shows an average of the number of minutes played in one game by one or two players.
- Total Coins shows the number of coins counted in both left and right coin mechanisms.
- Average Time per Coin shows an average of the number of minutes played for every coin counted.
- Percentage Play shows the ratio of game playing time to total time the game has been turned on.

More Statistics Screen

The More Statistics screen (see Figure 2-5) lists the following information:

- 1 Player/2 Player Games shows the number of games played by 1 or 2 players.
- 1 Player/2 Player Continues shows the number of games continued by 1 or 2 players.
- 1 Player Finishes shows the number of games finished in 1-player game mode.
- Challenge Games shows the number of 1-player games interrupted by a 2nd-player challenge.
- Sudden Deaths shows the number of tie games decided by sudden death.
- Final Battles shows the number of times a single player achieved a Final Battle.
- Final Continues shows the number of credits used during a Final Battle.

Histogram Screens

The Histograms screen is a menu that lets you display one of three screens (see Figure 2-6). These show various horizontal bar graphs for round time, match time, and selections per character.

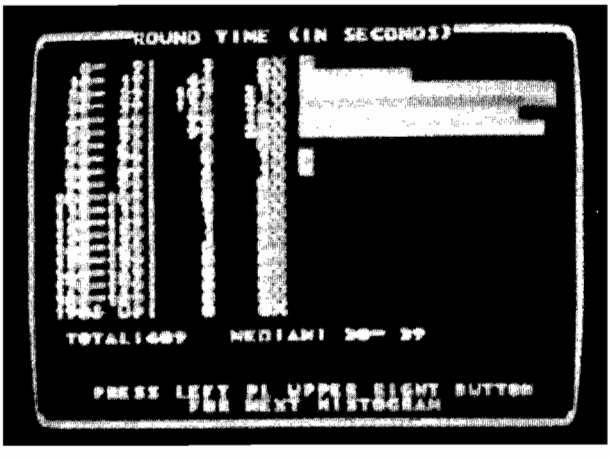


Figure 2-6 Histograms Screen

Game Options

Check and select the game options on this screen, shown in Figure 2-7. The screen shows the factory default settings in green.

To move through the options, to change or save the settings, or to return to the select test menu, follow the instructions shown at the bottom of the screen. The game options, with defaults, are shown and explained in Table 2-2.

Game Option	Available Settings		Explanation
Game Difficulty	Easiest Most Difficult	Medium ✔	Provides a choice of 16 levels of game difficulty.
Game Gore	No Gore	Full Gore ✔	Provides a choice of two levels of gory effects. *No Gore* disables all blood and finishing moves.
Censor Strictness	Easygoing	Strict ✔	*Strict* setting disallows certain vulgar letter combinations in the high score table and in the top score display.
Demo Mode	Yes	No ✔	In demo mode, characters never die. This setting should be used for demonstrations only.
Restore Factory Coin Default	Yes	No ✔	Returns coin settings to factory default.
Auto Reset High Score Table	Yes ✔	No	Automatically clears the high score table periodically.
Reset High Score Table	Yes	No ✔	Clears the high score table the next time you start a game (one time only).
Restore Factory Default	Yes	No ✔	Returns all game settings to factory default.

✔ *Manufacturer's recommended settings*

Table 2-2 Game Option Settings

Coin Option	Available Settings	Explanation
Free Play	No ✔ Yes	Lets you choose free play to demonstrate the game.
Discount to Continue	No ✔ Yes	When set to *Yes*, this option reduces by 50% the player's cost to continue a game (always rounded up to the next full coin).
Game Cost	1 coin 1 credit 2 coins 1 credit ✔ 3 coins 1 credit ... 8 coins 1 credit	The number of coins required for one credit.
Bonus for Quantity Buy-in	None ✔ 2 coins give 1 3 coins give 1 3 coins give 2 ... 9 coins give 2 9 coins give 3	Lets you choose from various kinds of bonuses or no bonus.
Right Mech Value	1 coin counts as 1 coin ✔ 1 coin counts as 2 coins ... 1 coin counts as 7 coins 1 coin counts as 8 coins	The number of coins each coin counts as in the right coin mechanism.
Left Mech Value	1 coin counts as 1 coin ✔ 1 coin counts as 2 coins ... 1 coin counts as 7 coins 1 coin counts as 8 coins	The number of coins each coin counts as in the left coin mechanism.

✔ *Manufacturer's recommended settings*

Table 2-3 Coin Option Settings

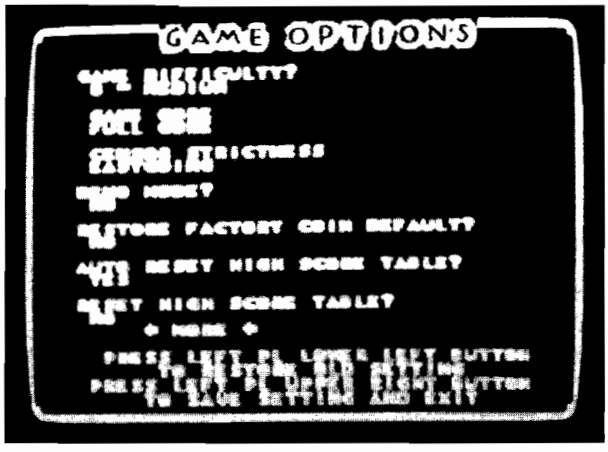


Figure 2-7 Game Options Screen

Coin Options

Check and select the coin options on this screen, shown in Figure 2-8. The screen shows the factory default settings in green.

To move through the options, to change or save the settings, or to return to the select test menu, follow the instructions shown at the bottom of the screen. The coin option settings, with defaults, are shown and explained in Table 2-3.

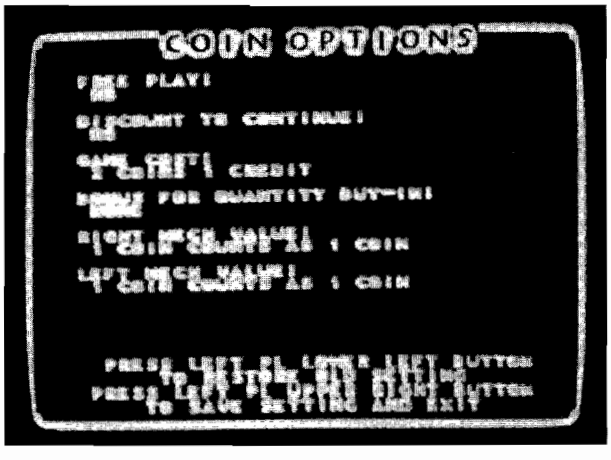


Figure 2-8 Coin Options Screen

Controls Test

The controls test screen is shown in Figure 2-9. This test checks all the pushbutton switches and the joystick potentiometers.

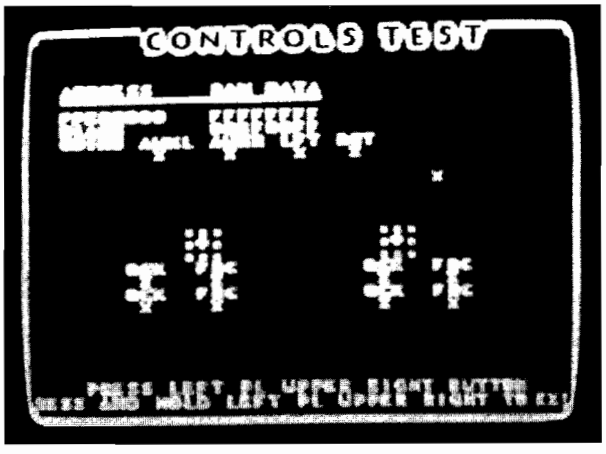


Figure 2-9 Controls Test Screen

As you use each control, the numbers for the joystick pots increase or decrease, or the red Xs for switches become 0s. If the changes do not appear on the screen, check the controls and their wiring.

To reset the joystick pot limits, to change or save the settings, or to return to the select test menu, follow the instructions shown at the bottom of the screen.

Press and *hold* the left player upper right button to exit from the controls test.

Sound Test

Use this selection screen, shown in Figure 2-10, to test the sound board.

NOTE

The audio boards must be installed and connected in the game to perform this test.

To check the audio ROMs, run the Audio Checksums test. To determine if all three speakers are working properly, select the Speaker Test.

In the Audio Checksums test, verify that all the checksums are displayed in white. If any of them show red numbers, you have a problem with the circuitry or ROMs. If all ROMs are bad, suspect the circuitry. If a single checksum is bad, check for improper ROM seating.

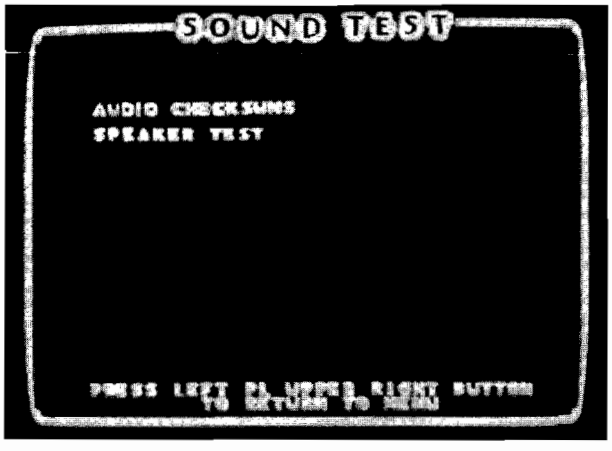


Figure 2-10 Sound Test Screen

When you select the Speaker Test, you will hear a sequence of three sounds, with a different sound coming from each speaker: the left speaker will emit a frog sound, the right speaker will emit a woman's scream, and the sub-woofer will emit a booming footfall sound.

NOTE

The footfall sound coming from the sub-woofer will also be heard to a certain extent from the other two speakers.

RAM (Memory) Tests

Use this selection screen, shown in Figure 2-11, to run any of the five RAM tests. These tests check the RAM chips in various ways.

When you turn on the power, the game automatically runs through the random-access memory (RAM) tests. Refer to Chapter 3 of this manual for more details.

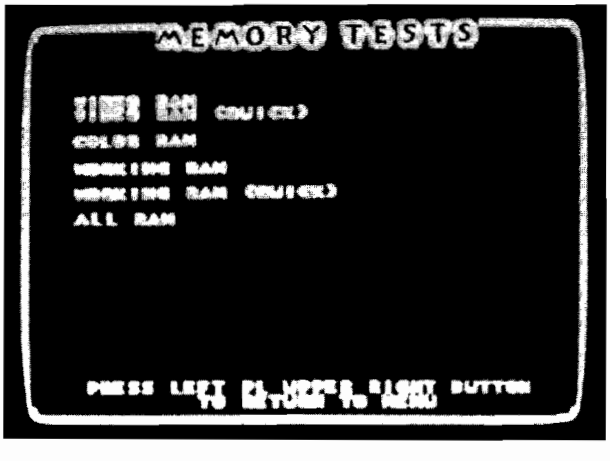


Figure 2-11 Memory Tests Screen

ROM Test

This screen displays any ROM errors by showing a non-zero number after a particular item. A properly working board should cause your screen to display only 0s in the right column.

If a ROM fails, a message may be displayed. However, depending on how bad the ROM error is, you may not be able to enter the self-test.

If you have a ROM error, check the four ROMs labeled PGM_LL, PGM_LM, PGM_UM, and PGM_UU at 24L through 29L on the Primal Rage game PCB. Check these locations for bent pins or incorrectly inserted chips. Also see Table 3-2 for information about the locations of the ROMs and their functions.

Video Tests

Use this selection screen, shown in Figure 2-12, to determine the condition of the video circuitry on the game PCB.

Figure 2-12 Video Tests Screen

Playfield Scrolling

The playfield scrolling test is shown in Figure 2-13. To scroll the playfield continuously in a horizontal or vertical direction, move the joystick in the corresponding direction. Make sure that the playfield screen is clean and scrolls smoothly across the screen.

If the screen image does not move, or appears different from Figure 2-14, you have a problem in the playfield circuitry at locations 25N–28N on the Primal Rage game PCB. To return to the select test menu, follow the instructions shown at the bottom of the screen.

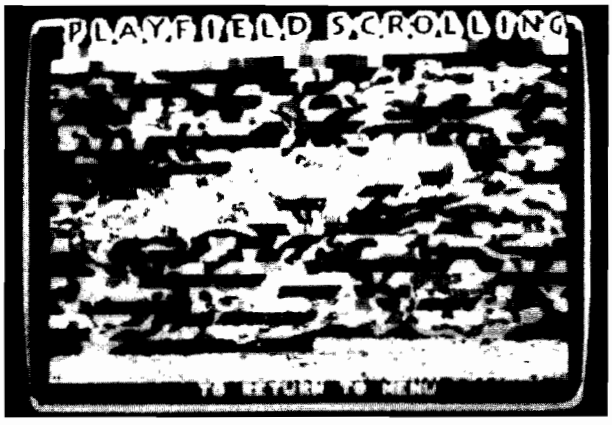


Figure 2-13 Playfield Scrolling Screen

MOB (Moving Objects) Checksums

The first MOB test screen examines the checksums of the MOB ROMs. If the checksums match, you should see the white numbers displayed as shown in Figure 2-14. The twelve designations listed in the left column on the screen (MOH0/MOL0 through 1.3) are the labels on the chips, located on the Primal Rage PCB and the GT24M8 piggyback board. If the checksums do not match, either you have a defective EPROM/ROM or a chip may be installed incorrectly.

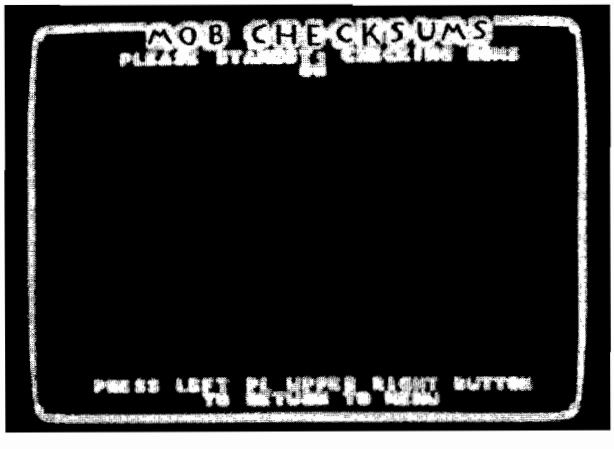


Figure 2-14 MOB Checksums Screen

Alphanumerics

The alphanumerics test is shown in Figure 2-15. To page (scroll) the screen up/down, move the joystick accordingly. If the screen image does not move, or appears different from this figure, you have a problem in the alphanumeric circuitry at location 22P/R on the Primal Rage game PCB. To return to the select test menu, follow the instructions shown at the bottom of the screen.

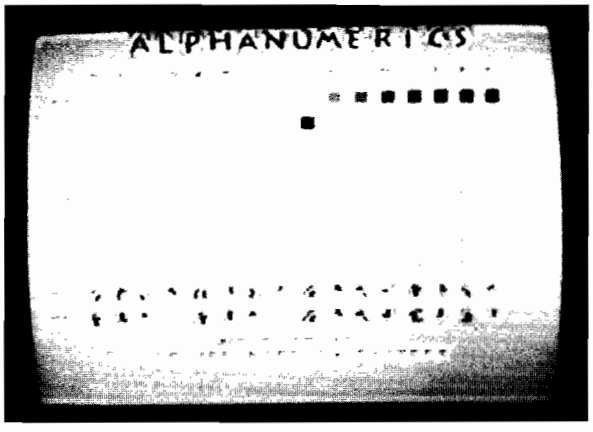


Figure 2-15 Alphanumerics Test Screen

Monitor Tests

The monitor test selection screen lets you select from three screens — color, purity, and convergence. Advance to each screen to completely test the monitor.

Color Test

The color test (see Figure 2-16) indicates the dynamic range of the video display color circuitry. The screen should show three bands (red, green, and blue) in the left half, plus white in the right half, ranging from black to white, from left to right. The red, green, and blue bands are produced by only one color gun being turned on in each band.

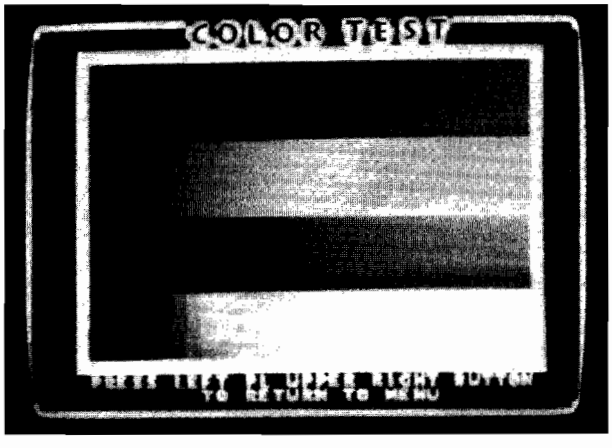


Figure 2-16 Color Test Screen

Purity Test

The next five screens are color purity tests. The entire screen will be red (see Figure 2-17), green, blue, white, and grey. Press the left player upper left button to

change colors. Each screen should show no unevenness of color and no lines in the display.

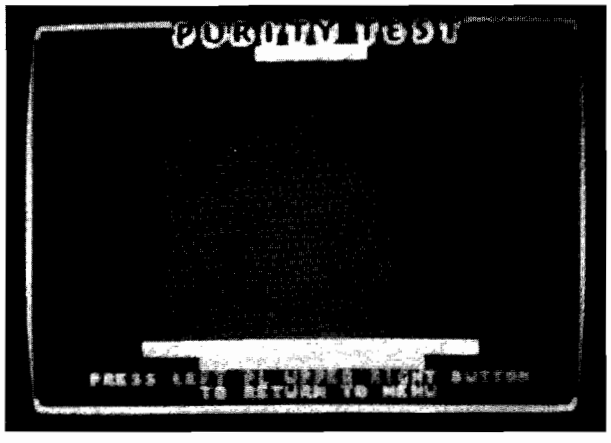


Figure 2-17 Purity Test Screen

Convergence Test

The convergence test has three screens — white, violet, and green backgrounds with grid lines. This sequence is then repeated but without any text on the screen. The green screen is shown in Figure 2-18. To see the remaining screens or return to the select test menu, follow the instructions shown at the bottom of the screen.

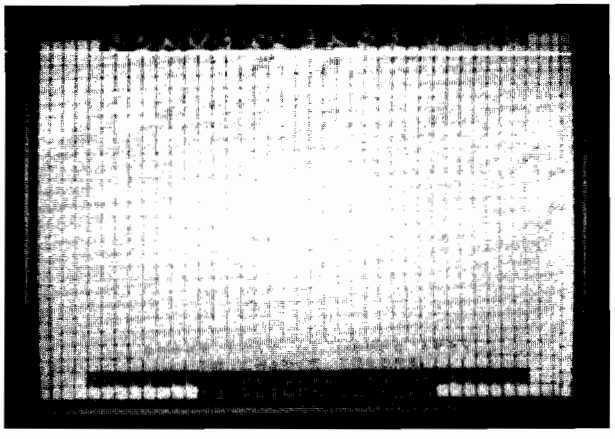


Figure 2-18 Convergence Test Screen

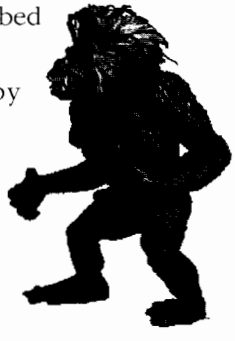
Check the following on the screens:

- The grid lines should be straight within 3.0 mm and the lines should not pincushion or barrel.
- The convergence of the lines on the violet and green screens should be within 2.0 mm.

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

Return to the select test menu by pressing the thumb button.

Causes of errors could be problems with the cable, terminators installed incorrectly, harnesses, or connectors.



NOTES

CHAPTER 3

Troubleshooting and Maintenance

INTRODUCTION

THIS CHAPTER provides information about maintenance, troubleshooting and repair procedures for your Primal Rage™ game. The maintenance section gives information on cleaning the parts. The troubleshooting section contains several tables to help determine the source of a problem and the steps necessary to repair it. The repair section contains the steps necessary to remove and install the serviceable parts. Together, these three sections provide a complete guide to servicing your Primal Rage™ game.

Maintenance Precautions

Introduction

This section describes the precautions that you should be aware of when performing maintenance procedures on the game. Maintenance procedures should be performed every 3–4 months on a regular basis.

WARNING

Before performing any maintenance or repairs, please observe all of the following safety precautions:

1. *Turn the game's power off.*
2. *Unplug the power cord from the electrical socket.*
3. *Secure loose clothing such as ties and long sleeves that could get caught within the game.*
4. *Remove all metal jewelry such as watches and necklaces that could conduct electricity from the game's power sources.*

Troubleshooting Procedures

This section is designed to help determine the source of a malfunction and contains detailed information on repairing the problem.

Table 3-1 General Troubleshooting, is divided into two columns. The left-hand column is broken down into the general nature of problems. The right-hand column lists suggested solutions to solve the problem.

Table 3-2 ROMs and RAMs Troubleshooting, is designed to help determine the specific ROMs and RAMs that are the source of a game logic malfunction. The left-hand column shows some problems that may result from malfunctioning ROMs and RAMs. The middle column shows the ROMs and RAMs that may be the source of the problem and their purposes. The right-hand column shows the PCB locations of the ROMs and RAMs that may be causing the problem.

Table 3-3 Voltage Inputs and Test Points, is divided into three columns. The left-hand column shows the correct voltages that should be measured. The middle column shows the physical locations of the test points or LEDs. The right-hand column shows the sources and purposes of the voltages.

Repair Procedures

Introduction

This section describes the repair procedures for all of the major assemblies and components of the game. Before performing any repairs, use the tables in the *Troubleshooting Procedures* section to help narrow the source of the problem.

Speakers

The game is designed to use three speakers: two top speakers under the attract panel and a sub-woofer next to the coin door. The speakers provide the music and sounds for the game and self-tests. Failure of the speakers may result in distorted or no sound. If this is the case, replace the speakers by following the removal and installation steps below.

1. Remove the screws securing the speaker grille; remove the speaker grille and set it aside.
2. Remove the speaker mounting screws.
3. Disconnect the harness from the speaker.
4. Replace and reinstall the speaker in reverse order.

Pot Joysticks

If you want to repair the joystick control, you must disassemble it by removing it from the control panel.

System Logic Assemblies

This section describes the repair and maintenance procedures for the major assemblies and components that are related to the system's logic and electronics, including the printed-circuit boards (PCBs) and the power supply.

Primal Rage Game PCB Set

The Primal Rage game PCB set (board stack) is responsible for the display graphics and game play. Failure of the game PCB set may result in erratic or no game play. If this is the case, repair or replace the game PCB set by following the removal and installation steps below.

1. Turn off power to the game.
2. Disconnect the harness connectors from the game PCB set. (There are 5 connectors in all.)
3. Movement of the game PCB may be hindered by the joystick and button harnesses. If this is the case, disconnect the harnesses.
4. Unfasten the hardware that secures the game PCB set to to its mounting. Remove the game PCB set.
5. Re-install the game PCB set by following the previous steps in the reverse order.

CAUTION

Before handling static-sensitive components, properly ground yourself to discharge buildup of static charges.

Power Supply

The power supply is responsible for providing power to all of the game assemblies that require it. Failure of the power supply may result in erratic game play or no power at all. If this is the case, repair or replace the power supply assembly by following the steps below.

WARNING

A power supply can contain high voltages even after the power is turned off. To avoid injury, observe all of the safety precautions before working on the power supply. (Refer to the Introduction in the Maintenance Procedures section.)

1. Unplug the game from its AC power source.
2. Disconnect the wiring harnesses from the power supply.
3. Unfasten the screws that secure the power supply assembly to the cabinet, and remove the power supply assembly.
4. To re-install the power supply assembly, follow the previous steps in the reverse order.

ROMs/RAMs

The ROMs and RAMs contain the programming routines used by the game PCB set to control game play. Refer to *Table 3–2 ROMs and RAMs Troubleshooting* to determine the ROMs or RAMs that are malfunctioning. Replace the damaged ROMs or RAMs by following the removal and installation steps below.

1. Remove the game PCB set according to the procedure in the *Primal Rage Game PCB Set* section.

CAUTION

Before handling static-sensitive components, properly ground yourself to discharge buildup of static charges.

2. Remove the damaged ROMs and RAMs from the game PCB set using a chip extraction tool.
3. Install the new ROMs and RAMs by plugging them in the game PCB set sockets.
4. Re-install the game PCB set by following the steps in the *Primal Rage Game PCB Set* section in the reverse order.

Video Display

To repair, replace or make adjustments to the video display, follow the removal and installation steps below. These instructions are for your general information only. Please refer to the documentation that came with your video display before beginning any repairs.

WARNING

High Voltage

Video displays contain lethal high voltages. To avoid injury, do not service a display until you observe all precautions necessary for working on high-voltage equipment.

X-Radiation

Video displays are 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.

1. Discharge the high-voltage from the cathode-ray tube (CRT).

NOTE

There may be a label on the video display assembly showing a circuit for discharging the high-voltage contained in the CRT to ground when the power is off.

a. Secure one end of a solid 18-gauge wire to a well-insulated or wooden handle screwdriver.

b. Secure the other end of the wire to an earth ground.

c. Briefly touch the blade end of the screwdriver to the CRT anode by sliding it under the anode cap.

d. Wait 2 minutes and repeat the previous step.

2. Disconnect all of the wire harnesses from the video display.
3. Remove the video display assembly from the cabinet.

CAUTION

Do not attempt to remove the video display without its chassis.

4. Install the new video display by following the previous steps (excluding steps 1a.–1d.) in the reverse order.
5. If necessary, adjust the new video display's brightness, size, centering, purity and convergence according to the video display service manual.

Problem	Suggested Action
Coin Mechanism Problem	1. Check the wiring connections to the coin mechanism. 2. Check the voltage to the + side of the mechanism. 3. Test the coin mechanism with the Controls Test screen in the self-test. 4. Check the power distribution board fuses.
Joystick Problem	1. Check the switches and potentiometers using the Controls Test in the self-test. 2. Reset the limits on the joystick using the Controls Test in the self-test. 3. Has the control been lubricated with the correct type of lubricant? If not, lubricate it. 4. Check the harnesses and connectors. 5. If you took the control apart, have you reassembled it correctly? 6. Make sure all the parts of the control are in good order. Repair or replace parts as needed.
Sound Problem	1. Check the speaker volume setting: make sure the volume isn't zero! 2. Check both parts of the Sound Board Test in the self-test. 3. Check the voltage on the JXPWR connector. 4. Check the connections from the Quad Amp PCB to the speakers. 5. Check the audio ROMs' checksums in the Sound Board Test of the self-test procedure. 6. Check the resistance of the speakers for 8 Ohms on the 4-inch speakers and 4 Ohms on the 8-inch woofer next to the coin box.
Video Display Problem	
Screen is dark	1. Check to see that the game is plugged in and powered on. 2. Check the line fuse if no power is present. 3. Check the display brightness. 4. Check the solder connections on the line filter and the transformer. 5. Check the edge connector to the PCB. 6. Check the harnesses and connectors to the video display PCB. 7. Check the voltage levels to the video display PCB. 8. Run through the following checklist. If you answer *no* to any question, you have a problem with the video display, not with the game circuitry. In this case, refer to your video display service manual. a. Do you have power to the video display? b. Are the video display's filaments lit? c. Do you have the correct voltage to the video display?
Only a colored screen appears	1. Attempt to run a complete RAM/ROM test in the self-test. 2. Replace the RAM if a RAM failure is reported in the self-test.
Picture wavers or is too small	1. Check the voltage levels to the video display PCB. 2. Check the B+ to the video display. (Refer to the video display manual.)

Table 3-1 General Troubleshooting

Problem	Suggested Action
Attract panel does not light	1. Check the bulb in the attract panel. 2. Check the Power Distribution Board fuses.
Picture is wavy	1. Check the connection of the monitor ground wire to the monitor. 2. Check the connections of the sync inputs.
Picture is upside down or reversed	1. If you replaced the monitor recently, check the horizontal or vertical yoke wire connections to the video display. They may be switched.
Convergence, purity or color problems	1. Use the self-test mode to digitally adjust the video display. 2. Use the adjustment procedures in your video display manual.
Picture is not centered	1. Use the centering procedures in your video display manual.

Table 3-1 General Troubleshooting, Continued

Problem	ROMs/RAMs Source and Purpose	Location
ROMs		
The program works, but the motion objects are incorrect or non-existent.	Motion Object ROMs and GALs (responsible for moving graphic objects)	1S, 11S–15S, 9T, 17P, 22U. Also, ROMs on rows V, W
Garbage appears on the screen or game play doesn't work correctly.	Program ROMs (responsible for game control)	24L–29L
The text or numbers are incorrect or non-existent.	Alphanumeric ROM (responsible for controlling graphic text and numbers)	22P/R
The sound is incorrect or non-existent.	Audio ROMs (responsible for controlling sound)	ROMs on Row 11 of Sound CH31 board.
The moving backgrounds graphics are incorrect or non-existent.	Playfield ROMs (responsible for controlling background graphics)	25N–28N
RAMs		
The display color is yellow.	Working RAM	
The display color is green.	Video RAM	
The display color is white.	Color RAM	

Table 3-2 ROMs and RAMs Troubleshooting

Voltage	Test Point or LED Location	Voltage Source and Purpose
+5 ± 0.25 VDC	+5V Low, 5V High	Logic power from the switching power supply.

Table 3-3 Voltage Inputs and Test Points

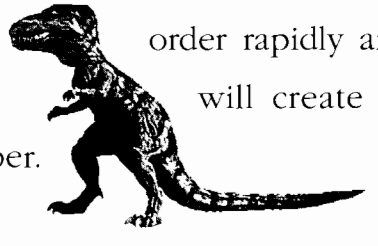
NOTES

CHAPTER 4

Parts Illustrations

INTRODUCTION

THIS CHAPTER provides information you need to order parts for your game. The printed-circuit board (PCB) parts lists are arranged in alphabetical order by component. Within each section the parts are arranged numerically by part number.



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

Figure 4-1 Primal Rage Kit Contents

A053660-01 A

Parts List

Qty.	Description	Part No.
1	JAMMA Filter PC Board Assy.	A047292-01
1	Product I.D. Label	038158-01
1	FCC Compliance Label	039450-01
1	FBI Warning Label	042452-01
1	Black Bezel for Kits	049774-01
1	1/16-inch Polycarbonate Control Panel Cover	054307-01
2	Side Panel Decal	053652-01
1	Attraction Film	053403-02
1	Control Panel Decal	053402-02
1	Instruction Label	052893-01
2	.50-inch I.D. Split Ferrite Beads	141026-001
8	Snap-Action Switch	160044-001
2	Joystick Assy.	171128-003
1	Attraction Shield	047205-01
1	Bezel Label	053942-01

Qty.	Description	Part No.
1	Primal Rage Board Stack Assy.	A053926-01
12	#10 Flat Washers	175014-1040
12	#10-24 Zinc Nut/Washer Assemblies	177026-0040
12	#10-24 Carriage Bolts	75-5112B
1	#10 Wire and Cable Ties	178032-002
4	Red Button Assembly	178237-001
4	Yellow Button Assembly	178237-002
2	"Quick" Indicator Plate	178283-019
2	"Fierce" Indicator Plate	178283-021
2	Inverted "Fierce" Indicator Plate	178283-024
2	Inverted "Start/Quick" Indicator Plate	178283-026
12	#10-24 x 3/4-inch Long Carriage Bolts	75-5112B
1	Primal Rage Universal Kit Installation Instructions	TM-397

Note: A JAMMA harness is not included in this kit. If your game cabinet does not already have a JAMMA harness installed in it, you can order this harness from Atari Games Customer Service.
Packaging materials are not listed above.

NOTE

If you are installing this kit into a Showcase 33 cabinet, see page iii of this manual for additional parts you may need to order.

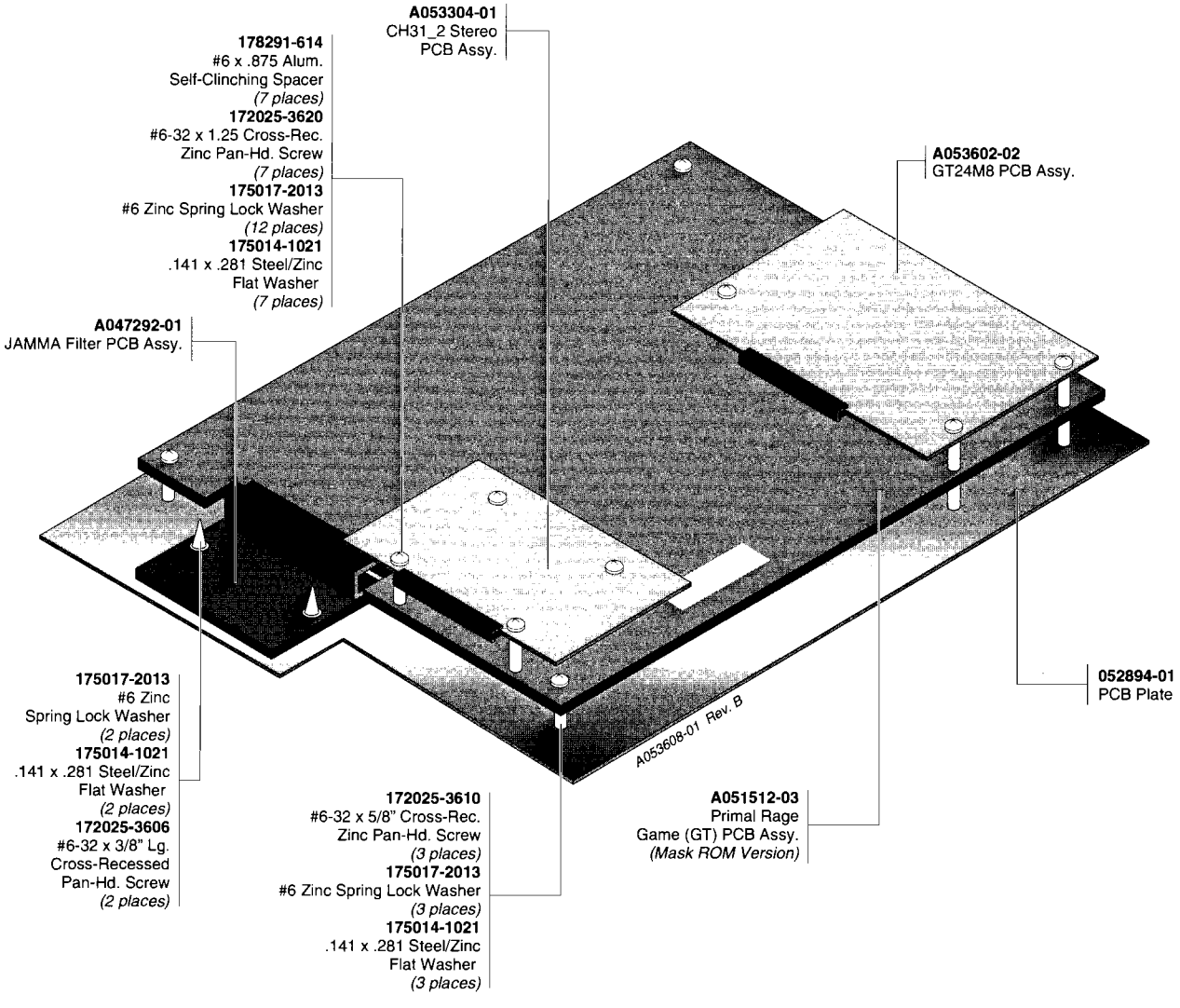
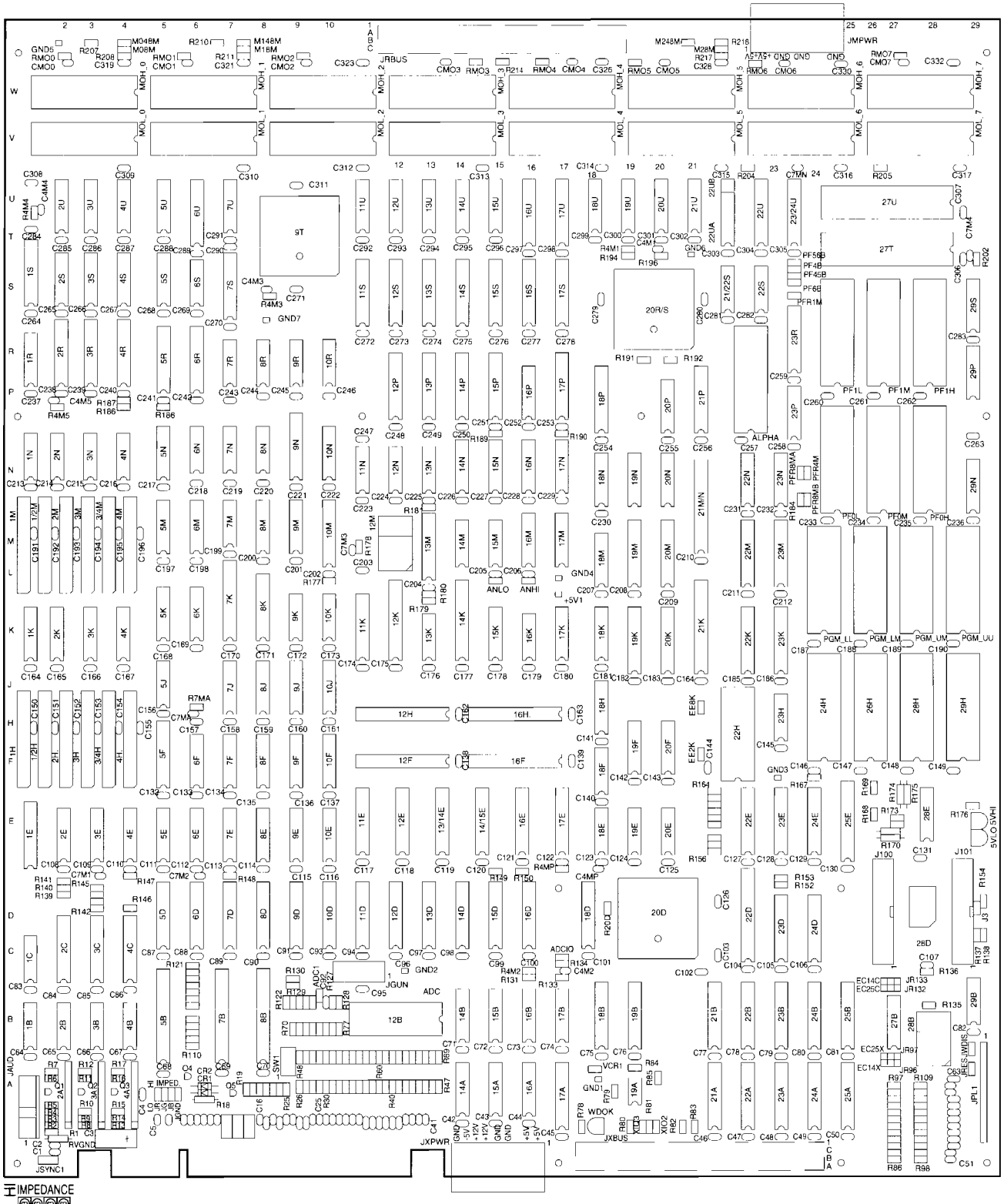


Figure 4-2 Board Stack Assembly

A053926-01



Detail of jumpers: For best display quality, install all 4 jumpers in the low position (on pins 1 and 2) for low-impedance monitors such as Neotec. Install all 4 jumpers in the high position (on pins 2 and 3) for high-impedance monitors such as Wells-Gardner.

Figure 4-3 Primal Rage Game (GT) PCB Assembly

A051512-04

Primal Rage Game PCB Assembly
Parts List

Designator	Description	Part No.
1/2H, 1/2M, 1H., 1M	Socket, Zip 28	179302-028
1S	Socket, 20 Pin, .300, Dbl Wipe	179356-0320
2H., 2M, 3/4H, 3/4M, 3H, 3M, 4H., 4M	Socket, Zip 28	179302-028
5B	Socket, 28 Pin, .300, Dbl Wipe	179356-0328
5F	Socket, 20 Pin, .300, Dbl Wipe	179356-0320
5N	Socket, 16 Pin, .300, Dbl Wipe	179356-0316
7B	Socket, 28 Pin, .300, Dbl Wipe	179356-0328
7K	Socket, 24 Pin, .300, Dbl Wipe	179356-0324
8B	Socket, 28 Pin, .300, Dbl Wipe	179356-0328
8K, 9N	Socket, 20 Pin, .300, Dbl Wipe	179356-0320
9T	Socket, 68 Pin, PGA for 68PLCC Integrated Circuit	179237-068
10M,11K,11S	Socket, 20 Pin, .300, Dbl Wipe	179356-0320
12B	Socket, 28 Pin, .600, Dbl Wipe	179356-0628
12F, 12H	Socket, 28 Pin, .300, Dbl Wipe	179356-0328
12K	Socket, 24 Pin, .300, Dbl Wipe	179356-0324
12S,13M,13S	Socket, 20 Pin, .300, Dbl Wipe	179356-0320
14K	Socket, 24 Pin, .300, Dbl Wipe	179356-0324
14S, 15S	Socket, 20 Pin, .300, Dbl Wipe	179356-0320
16F, 16H.	Socket, 28 Pin, .300, Dbl Wipe	179356-0328
17P, 17S	Socket, 20 Pin, .300, Dbl Wipe	179356-0320
20D, 20R/S	Socket, 68 Pin, PGA for 68PLCC Integrated Circuit	179237-068
21K, 21M/N	Socket, 28 Pin, .300, Dbl Wipe	179356-0328
22A	Socket, 20 Pin, .300, Dbl Wipe	179356-0320
22D	Socket, 28 Pin, .300, Dbl Wipe	179356-0328
22E	Socket, 20 Pin, .300, Dbl Wipe	179356-0320
22H	Socket, 24 Pin, .600 Dbl Wipe	179356-0624
22UB, 23E, 24E	Socket, 20 Pin, .300, Dbl Wipe	179356-0320
24H	Socket, 32 Pin, .600, Dbl Wipe	179356-0632
25E	Socket, 24 Pin, .300, Dbl Wipe	179356-0324
26H	Socket, 32 Pin, .600, Dbl Wipe	179356-0632
27T, 27U	Socket, 40 Pin, .600, Dbl Wipe	179356-0640
28H, 29H	Socket, 32 Pin, .600, Dbl Wipe	179356-0632
JXBUS	Shroud, 96CKT DIN41621	179369-0096
++1005V1	Test Point	179051-001
1	Pr, 1020-68PLCC Fpga, 20D Xxxx	136101-1005
1	Pr, EPROM, 128KX8, 100 ns, Alpha Xxxx	136102-0045
1	Pr, EPROM, 512KX8, 100 ns, Pgm Lm Xxxx	136102-0042
1	Pr, EPROM, 512KX8, 100 ns, Pgm Uu Xxxx	136102-0044
1	Pr, EPROM, 512KX8, 100 ns, Moh 0 1C39	136102-0301
1	Pr, EPROM, 512KX8, 100 ns, Mol 0 2C11	136102-0300
1	Pr, EPROM, 512KX8, 150 ns, PF0M Xxxx	136102-0051
1	Pr, EPROM, 512KX8, 150 ns, PF0L Xxxx	136102-0050
1	Pr, EPROM, 512KX8, 150 ns, PF0H Xxxx	136102-0052
1	Pr, EPROM, 512KX8, 100 ns, Pgm Ll Xxxx	136102-0041
1	Pr, EPROM, 512KX8, 100 ns, Pgm Um Xxxx	136102-0043
1/2M	Integrated Circuit, VRAM, 256KX4, 100 ns	137682-100
1B	Integrated Circuit, 74LS11	137149-001
1C	Integrated Circuit, 7406	137052-001
1E	Integrated Circuit, 74LS244	137038-001
1K	Integrated Circuit, 74F157	137494-001
1M	Integrated Circuit, VRAM, 256KX4, 100 ns	137682-100
1N	Integrated Circuit, 74F08	137483-001
1R	Integrated Circuit, 74F163	137345-001
2A	Res, R2R10, 1K/2K, SIP10	118015-001
2B	Integrated Circuit, 74LS27	137062-001
2C	Integrated Circuit, 74HCT273	137655-001
2E	Integrated Circuit, 74LS157	137029-001
2K	Integrated Circuit, 74F157	137494-001
2M	Integrated Circuit, VRAM, 256KX4, 100 ns	137682-100
2N	Integrated Circuit, 74F08	137483-001
2R	Integrated Circuit, 74LS377	137145-001
2S	Integrated Circuit, 74F378	137612-001
2U	Integrated Circuit, 74F163	137345-001
3/4M	Integrated Circuit, VRAM, 256KX4, 100 ns	137682-100
3A	Res, R2R10, 1K/2K, SIP10	118015-001
3B	Integrated Circuit, 74LS27	137062-001
3C	Integrated Circuit, 74HCT273	137655-001
3E	Integrated Circuit, 74LS157	137029-001
3K	Integrated Circuit, 74F157	137494-001
3M	Integrated Circuit, VRAM, 256KX4, 100 ns	137682-100
3N	Integrated Circuit, 74F08	137483-001
3R	Integrated Circuit, 74F377	137622-001
3S	Integrated Circuit, 74F157	137494-001
3U	Integrated Circuit, 74F378	137612-001
4A	Res, R2R10, 1K/2K, SIP10	118015-001
4B	Integrated Circuit, 74LS27	137062-001
4C	Integrated Circuit, 74HCT273	137655-001
4E	Integrated Circuit, 74LS157	137029-001
4K	Integrated Circuit, 74F157	137494-001
4M	Integrated Circuit, VRAM, 256KX4, 100 ns	137682-100

Primal Rage Game PCB Assembly, Continued
Parts List

Designator	Description	Part No.
4N	Integrated Circuit, 74F32	137486-001
4R	Integrated Circuit, 74LS377	137145-001
4S	Integrated Circuit, 74F157	137494-001
4U	Integrated Circuit, 74F163	137345-001
5D	Integrated Circuit, 74LS245	137134-001
5E	Integrated Circuit, 74LS157	137029-001
5J	Integrated Circuit, 74F08	137483-001
5K, 5M	Integrated Circuit, 74F157	137494-001
5R	Integrated Circuit, 74LS244	137038-001
5S, 5U	Integrated Circuit, 74F169	137496-001
5VHI,5VLO	LED, Red, T1-3/4, Diffused, .5MCD, 80-Deg	138021-001
6D	Integrated Circuit, 74F374	137420-001
6E	Integrated Circuit, 74LS157	137029-001
6F, 6K, 6M	Integrated Circuit, 74F157	137494-001
6N	Integrated Circuit, 74F32	137486-001
6R	Integrated Circuit, 74LS244	137038-001
6S	Integrated Circuit, 74F260	137570-001
6U	Integrated Circuit, 74F377	137622-001
7D	Integrated Circuit, 74LS245	137134-001
7E	Integrated Circuit, 74LS157	137029-001
7F, 7J	Integrated Circuit, 74F153	137492-001
7M	Integrated Circuit, 74LS74	137023-001
7N	Integrated Circuit, 74F32	137486-001
7R	Integrated Circuit, 74F08	137483-001
7S	Integrated Circuit, 74F377	137622-001
7U	Integrated Circuit, 74F169	137496-001
8D	Integrated Circuit, 74F374	137420-001
8E	Integrated Circuit, 74LS157	137029-001
8F, 8J	Integrated Circuit, 74F153	137492-001
8M	Integrated Circuit, 74F174	137531-001
8N	Integrated Circuit, 74F08	137483-001
8R	Integrated Circuit, 74F02	137481-001
9D	Integrated Circuit, 74LS245	137134-001
9E	Integrated Circuit, 74LS157	137029-001
9F, 9J	Integrated Circuit, 74F153	137492-001
9K	Integrated Circuit, 74F260	137570-001
9M	Integrated Circuit, 74F163	137345-001
9R	Integrated Circuit, 74F00	137327-001
10D	Integrated Circuit, 74F374	137420-001
10E	Integrated Circuit, 74LS157	137029-001
10F, 10J	Integrated Circuit, 74F153	137492-001
10K	Integrated Circuit, 74LS86	137079-001
10N	Integrated Circuit, 74LS163 A	137114-001
10R	Integrated Circuit, 74F04	137437-001
11D, 11E	Integrated Circuit, 74F273	137610-001
11N	Integrated Circuit, 74F04	137437-001
11U	Integrated Circuit, 74F163	137345-001
12D, 12E	Integrated Circuit, 74F374	137420-001
12H	Integrated Circuit, SRAM, 32KX8, 25 ns, .3	137670-025
12M	Crystal, 28.636 MHz, Osc. Module	144008-009
12N	Integrated Circuit, 74F74	137436-001
12P	Integrated Circuit, 74F273	137610-001
12U	Integrated Circuit, 74F163	137345-001
13/14E,13D	Integrated Circuit, 74LS245	137134-001
13K	Integrated Circuit, 74F32	137486-001
13N	Integrated Circuit, 74F74	137436-001
13P	Integrated Circuit, 74F374	137420-001
13U	Integrated Circuit, 74F163	137345-001
14/15E	Integrated Circuit, 74F273	137610-001
14A, 14B	Integrated Circuit, 74LS257	137136-001
14D	Integrated Circuit, 74F273	137610-001
14M	Integrated Circuit, 74F00	137327-001
14N	Integrated Circuit, 74F157	137494-001
14P	Integrated Circuit, 74F374	137420-001
14U	Integrated Circuit, 74F163	137345-001
15A, 15B	Integrated Circuit, 74LS257	137136-001
15D	Integrated Circuit, 74F374	137420-001
15K	Integrated Circuit, 74F153	137492-001
15M	Integrated Circuit, 74F86	137649-001
15N	Integrated Circuit, 74F153	137492-001
15P	Integrated Circuit, 74F374	137420-001
15U	Integrated Circuit, 74F163	137345-001
16A, 16B	Integrated Circuit, 74LS257	137136-001
16D	Integrated Circuit, 74LS245	137134-001
16E	Integrated Circuit, 74F374	137420-001
16H.	Integrated Circuit, SRAM, 32KX8, 25 ns, .3	137670-025
16K	Integrated Circuit, 74LS04	137009-001
16M, 16N	Integrated Circuit, 74F153	137492-001
16P	Integrated Circuit, 74F151	137490-001
16S	Integrated Circuit, 74F374	137420-001
16U	Integrated Circuit, 74F244	137502-001
17A	Integrated Circuit, 74LS273	137040-001
17B	Integrated Circuit, 74LS148	137417-001
17E	Integrated Circuit, 74LS245	137134-001
17K	Integrated Circuit, 74LS157	137029-001
17M, 17N	Integrated Circuit, 74F153	137492-001

Primal Rage Game PCB Assembly, Continued
Parts List

Designator	Description	Part No.
17U	Integrated Circuit, 74F244	137502-001
18B, 18D	Integrated Circuit, 74LS245	137134-001
18E	Integrated Circuit, 74F04	137437-001
18F	Integrated Circuit, 74LS74	137023-001
18H	Integrated Circuit, 74F138	137521-001
18K, 18M	Integrated Circuit, 74F153	137492-001
18N	Integrated Circuit, 74LS163 A	137114-001
18U	Integrated Circuit, 74F163	137345-001
19A	Integrated Circuit, DS1232	137762-001
19B	Integrated Circuit, 74LS273	137040-001
19E	Integrated Circuit, 74LS74	137023-001
19F	Integrated Circuit, 74F138	137521-001
19K, 19M	Integrated Circuit, 74LS245	137134-001
19N	Integrated Circuit, 74LS163 A	137114-001
19U	Integrated Circuit, 74F163	137345-001
20E	Integrated Circuit, 74F08	137483-001
20F	Integrated Circuit, 74F138	137521-001
20K, 20M	Integrated Circuit, 74LS374	137144-001
20N	Integrated Circuit, 74LS163 A	137114-001
20P	Integrated Circuit, 74LS378	137305-001
20R/S	Integrated Circuit, CPU, PLCC	137658-101
20U	Integrated Circuit, 74F163	137345-001
21/22S	Integrated Circuit, 74F04	137437-001
21B	Integrated Circuit, 74LS245	137134-001
21K,21M/N	Integrated Circuit, SRAM, 32KX8, 25 ns, .3	137670-025
21P	Integrated Circuit, 74LS377	137145-001
21U	Integrated Circuit, 74F163	137345-001
22B	Integrated Circuit, 74LS245	137134-001
22D	Integrated Circuit, SRAM, 8KX8, 25 ns, .3	137667-025
22H	Integrated Circuit, 28C16-200, 200 ns	137648-200
22K, 22M	Integrated Circuit, 74LS245	137134-001
22N	Integrated Circuit, 74LS378	137305-001
22S	Integrated Circuit, 74F04	137437-001
22U,23/24U	Integrated Circuit, 74LS273	137040-001
23A	Integrated Circuit, 74LS244	137038-001
23B	Integrated Circuit, 74LS273	137040-001
23D	Integrated Circuit, 74LS245	137134-001
23H	Integrated Circuit, 74F32	137486-001
23K, 23M	Integrated Circuit, 74LS374	137144-001
23N	Integrated Circuit, 74LS378	137305-001
23P	Integrated Circuit, 74LS157	137029-001
23R	Integrated Circuit, 74LS377	137145-001
24A	Integrated Circuit, 74LS245	137134-001
24B, 24D	Integrated Circuit, 74F245	137591-001
24H	Integrated Circuit, SRAM, 32KX8, 70 ns, .6	137615-070
25A	Integrated Circuit, 74LS245	137134-001
25B	Integrated Circuit, 74F245	137591-001
26H	Integrated Circuit, SRAM, 32KX8, 70 ns, .6	137615-070
27B	Integrated Circuit, 74F163	137345-001
27T	Integrated Circuit, SOS	137550-001
27U	Integrated Circuit, Pfhs	137419-104
28B	Crystal, 50.000 MHz, Osc. Module	144008-005
28D	Integrated Circuit, CPU, 68EC020, 25 MHz, 100PQFP	137691-025
28E	Integrated Circuit, LM613	137746-001
28H	Integrated Circuit, SRAM, 32KX8, 70 ns, .6	137615-070
29B	Integrated Circuit, 74F20	137530-001
29H	Integrated Circuit, SRAM, 32KX8, 70 ns, .6	137615-070
29N	Integrated Circuit, 74LS298	137201-001
29P	Integrated Circuit, 74LS153	137104-001
29S	Integrated Circuit, 74LS298	137201-001
A	Pr, Fpla, 20NS, 9T 446D	136094-0004
A	Pr, GAL16V8, 25NS, 11K 72ED	136101-0011
A	Pr, GAL16V8, 10NS, 22UB 3863	136101-1220
A	Pr, GAL16V8, 15NS, 22A 2A8 A	136101-0021
A	Pr, GAL16V8, 15NS, 23E 75C3	136101-0013
A	Pr, GAL16V8, 25NS, 12S 4A81	136094-0014
A	Pr, GAL16V8, 25NS, 9N 5AED	136101-0012
A	Pr, GAL16V8, 25NS, 17S 3139	136094-0007
A	Pr, GAL16V8, 25NS, 13M 5C94	136101-1008
A	Pr, GAL16V8, 25NS, 17P 270 A	136094-0015
A	Pr, GAL16V8, 25NS, 11S 25F2	136094-0016
A	Pr, GAL16V8, 25NS, 24E 477 A	136101-0018
A	Pr, GAL16V8, 10NS, 1S B535	136101-0006
A	Pr, GAL16V8, 25NS, 10M 326F	136101-0009
A	Pr, GAL20V8, 25NS, 7K 9CA6	136101-0019
A	Pr, GAL22V10, 10NS, 25E D358	136101-0017
A	Pr, GAL22V10, 15NS, 12K 7553	136101-1022
A	Pr, PROM, 82S147, 13S 76B6	136094-0001
A	Pr, PROM, 82S147, 14S FD85	136094-0002
A	Pr, PROM, 82S147, 15S 9B61	136094-0003
ADC1	Connector, 2 Circuit, Header, .100 Ctr	179048-002
ALPHA	Socket, 32 Pin, .600, Dbl-Wipe	179356-0632

Primal Rage Game PCB Assembly, Continued
Parts List

Designator	Description	Part No.
ANLO	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
B	Pr, GAL16V8, 25NS, 22E B82E	136101-1025
B	Pr, GAL16V8, 25NS, 8K 5ADE	136101-0010
C1, C2	Capacitor, 100 pF, 100 V, ±5%, Ceramic	122016-101
C3	Capacitor, 100 µF, 16 V, Electrolytic, Axial	124008-107
C4	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C4M1-C4M5, C4MP	Capacitor, 47 pF, 100 V, ±5%, Ceramic	122016-470
C5-C8	Capacitor, .01 µF, 50 V, +80%–20%, Cer.	122002-103
C7M1-C7M4, C7MA, C7MN	Capacitor, 47 pF, 100 V, ±5%, Ceramic	122016-470
C9-C12	Capacitor, 1000 pF, 100 V, ±10%, Cer.	122015-102
C13-C15	Capacitor, 270PFC, 50 V, EMI Filter	140006-271
C16	Capacitor, 100 pF, 100 V, ±5%, Ceramic	122016-101
C17	Capacitor, .1 µF, 50 V, ±80%–20%, Cer.	122002-104
C18	Capacitor, .01 µF, 50 V, ±80%–20%, Cer.	122002-103
C19	Capacitor, .1 µF, 50 V, ±80%–20%, Cer.	122002-104
C20, C21	Capacitor, .01 µF, 50 V, ±80%–20%, Cer.	122002-103
C22, C23	Capacitor, .1 µF, 50 V, ±80%–20%, Cer.	122002-104
C24-C31	Capacitor, .01 µF, 50 V, ±80%–20%, Cer.	122002-103
C32-C37	Capacitor, .1 µF, 50 V, ±80%–20%, Cer.	122002-104
C38-C41	Capacitor, .01 µF, 50 V, ±80%–20%, Cer.	122002-103
C42-C50	Capacitor, .1 µF, 50 V, ±80%–20%, Cer.	122002-104
C51, C52	Capacitor, .01 µF, 50 V, ±80%–20%, Cer.	122002-103
C53-C60	Capacitor, .1 µF, 50 V, ±80%–20%, Cer.	122002-104
C61, C62	Capacitor, .01 µF, 50 V, ±80%–20%, Cer.	122002-103
C63-C317, C319, C321, C323, C326, C328, C330, C332	Capacitor, .1 µF, 50 V, ±80%–20%, Cer.	122002-104
CMO0–7	Capacitor, 47 pF, 100 V, ±5%, Ceramic	122016-470
CR1, CR2	Diode, 1N4001	131048-001
EC25C, EC25X, EE2K	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
GND1–7	Test Point	179051-001
J3	Connector, 2 Circuit, Header, .100 Ctr	179048-002
JAUD	Connector, 6 Ckt, Header, .156 Ctr, Key 3	179213-006
JMPWR	Connector, 9 Ckt, Header, .156 Ctr, Rt, Key 3	179165-009
JPL1	Connector, 15 Ckt, Header, .100 Ctr	179118-015
JRBUS	Connector, 96 Ckt, Rcpt, Pressfit, Long	179368-0096
JRBUS)	Shroud, 96CKT, DIN41621	179369-0096
JRES	Connector, 2 Circuit, Header, .100 Ctr	179048-002
JSYNC1	Connector, 3 Ckt, Header, .100 Ctr	179048-003
JWDIS	Connector, 2 Circuit, Header, .100 Ctr	179048-002
JXBUS	Connector, 96 Ckt, Rcpt, Pressfit, Long	179368-0096
JXPWR	Connector, 9 Ckt, Header, .156 Ctr, Rt, Key 3	179165-009
M28M, M48M, M148M, M248M	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
MOH_0-MOH_7, MOL_0-MOL_7, PF0H, PF0L, PF0M, PF1H, PF1L, PF1M	Socket, 32 Pin, .600, Dbl Wipe	179356-0632
PGM_LL	Socket, 32 Pin, .600, Dbl Wipe	179356-0632
PGM_LM	Socket, 32 Pin, .600, Dbl Wipe	179356-0632
PGM_UM	Socket, 32 Pin, .600, Dbl Wipe	179356-0632
PGM_UU	Socket, 32 Pin, .600, Dbl Wipe	179356-0632
Q1-Q3	Transistor, 2N3904	133041-001
Q4, Q5	Transistor, 2N5306	133033-001
PF6B, PF56B, PFR4M	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R1	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R2	Resistor, 75 Ω, ±5%, 1/8 W	110027-750
R3	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R4	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R4M1-R4M5, R4MP	Resistor, 47 Ω, ±5%, 1/8 W	110027-470
R5	Resistor, 100 Ω, ±5%, 1/8 W	110027-101
R6	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R7	Resistor, 2.4 K Ω, ±5%, 1/8 W	110027-242
R7MA	Resistor, 47 Ω, ±5%, 1/8 W	110027-470
R8	Resistor, 75 Ω, ±5%, 1/8 W	110027-750
R9	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R10	Resistor, 100 Ω, ±5%, 1/8 W	110027-101
R11	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R12	Resistor, 2.4 K Ω, ±5%, 1/8 W	110027-242
R13	Resistor, 75 Ω, ±5%, 1/8 W	110027-750
R14	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R15	Resistor, 100 Ω, ±5%, 1/8 W	110027-101
R16	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R17	Resistor, 2.4 K Ω, ±5%, 1/8 W	110027-242
R18	Resistor, 0 Ω, ±5%, 1/4 W	110005-001
R19, R20	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R20D	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R21	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R22-R25	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102

Primal Rage Game PCB Assembly, Continued
Parts List

Designator	Description	Part No.
R26, R27	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R28-R35	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R36-R45	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R46	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R47	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R48, R49	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R50-R57	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R58-R68	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R69	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R70-R77	Resistor, 10 K Ω, ±5%, 1/8 W	110027-103
R78-R83	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R84	Resistor, 4.7 K Ω, ±5%, 1/8 W	110027-472
R85-R97	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R98-R109	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R110-R123	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R124	Resistor, 100 Ω, ±5%, 1/8 W	110027-101
R125	Resistor, 220 Ω, ±5%, 1/8 W	110027-221
R126, R127	Resistor, 100 Ω, ±5%, 1/8 W	110027-101
R128	Resistor, 10 K Ω, ±5%, 1/8 W	110027-103
R129, R130	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R131	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R133	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R134	Resistor, 4.7 K Ω, ±5%, 1/8 W	110027-472
R136	Resistor, 10 K Ω, ±5%, 1/8 W	110027-103
R137, R138	Resistor, 220 Ω, ±5%, 1/8 W	110027-221
R139-R146	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R147, R148	Resistor, 47 Ω, ±5%, 1/8 W	110027-470
R149, R152	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R153	Resistor, 2.2 K Ω, ±5%, 1/8 W	110027-222
R154	Resistor, 10 K Ω, ±5%, 1/8 W	110027-103
R156-R158	Resistor, 100 Ω, ±5%, 1/8 W	110027-101
R159	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R160	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R161, R162	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R163, R164	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R167	Resistor, 510 Ω, ±5%, 1/8 W	110027-510
R168	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R169	Resistor, 10 K Ω, ±5%, 1/8 W	110027-103
R170	Resistor, 11.0 K Ω, ±1%, 1/4 W	110034-1102
R171	Resistor, 10.5 K Ω, ±1%, 1/4 W	110034-1052
R172	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R173	Resistor, 39 K Ω, ±5%, 1/8 W	110027-393
R174, R175	Resistor, 39.2 K Ω, ±1%, 1/4 W	110034-3922
R176	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R178	Resistor, 47 Ω, ±5%, 1/8 W	110027-470
R179, R180	Resistor, 10 K Ω, ±5%, 1/8 W	110027-103
R181	Resistor, 4.7 K Ω, ±5%, 1/8 W	110027-472
R184	Resistor, 10 K Ω, ±5%, 1/8 W	110027-103
R186	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R188	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R189	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R190	Resistor, 10 K Ω, ±5%, 1/8 W	110027-103
R191, R192	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R194	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R196	Resistor, 1 K Ω, ±5%, 1/8 W	110027-102
R202	Resistor, 47 Ω, ±5%, 1/8 W	110027-470
R204	Resistor, 4.7 K Ω, ±5%, 1/8 W	110027-472
R205	Resistor, 47 Ω, ±5%, 1/8 W	110027-470
R207, R208, R210, R211, R214, R217, R218	Resistor, 10 K Ω, ±5%, 1/8 W	110027-103
RMO0-RMO7	Resistor, 47 Ω, ±5%, 1/8 W	110027-470
RVGND	Resistor, 0 Ω, ±5%, 1/4 W	110005-001
SW1	Switch, Slide, SPDT	160040-001
VCR1	Connector, 2 Circuit, Header, .100 Ctr	179048-002
WDOK	LED, Red, T1-3/4, Diffused, .5MCD, 80-Deg	138021-001
XIQ2	Resistor, 10 Ω, ±5%, 1/8 W	110027-100

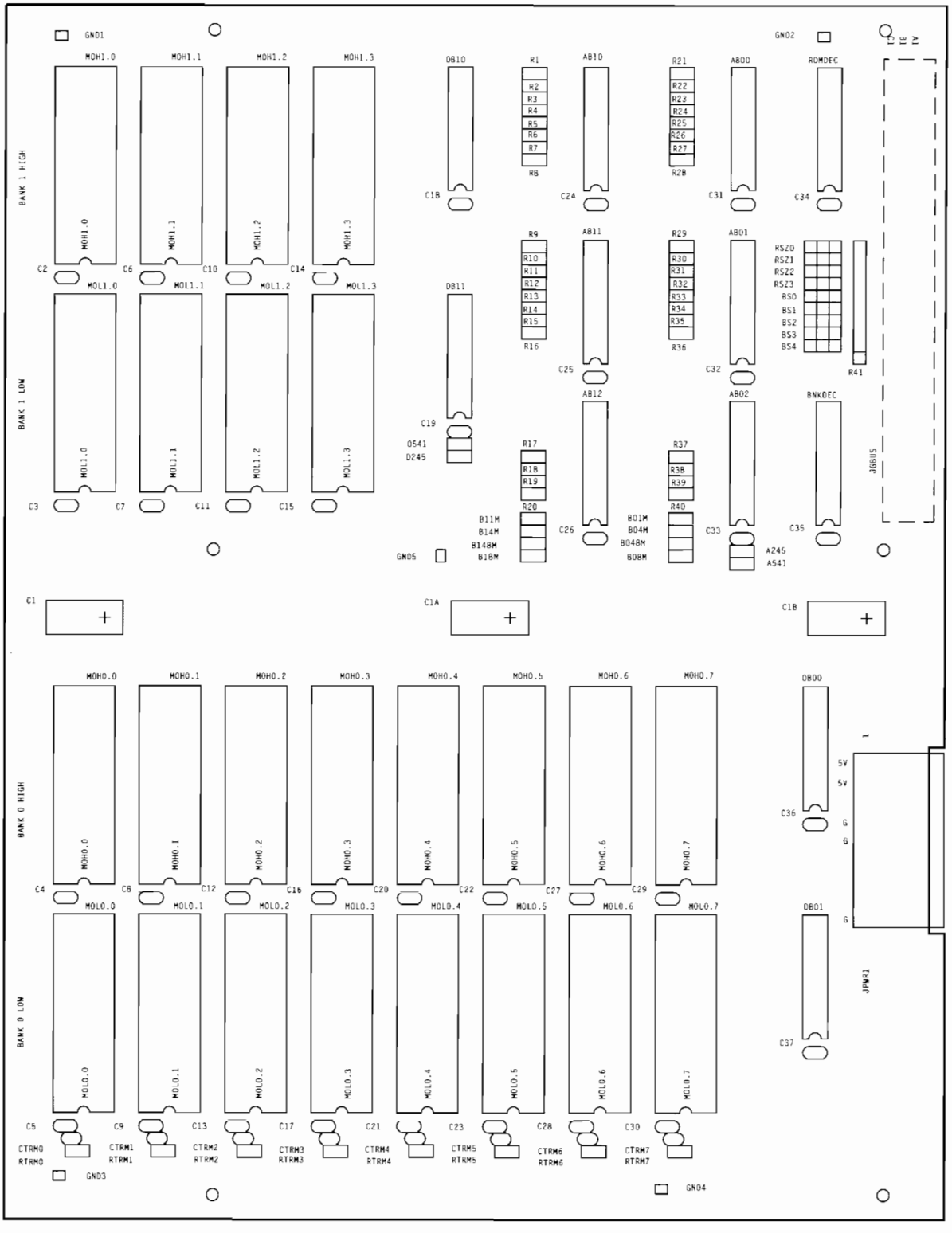


Figure 4-4 GT24M8 PCB Assembly

A053602-02 A

GT24M8 PCB Assembly
Parts List

Designator	Description	Part No.
(HS1-HS3)	Screw, Pan, 4-40X3/8, X-Rec, Cad	172025-3206
A	Pr, GAL16V8, 10NS, Romdec 50F8	136102-0260
A	Pr, GAL16V8, 15NS, Bnkdec 1FD0	136102-0261
A	Pr, Mrom, 1MX8, 100NS, MOL0.2 5FC8	136102-0320
A	Pr, Mrom, 1MX8, 100NS, MOL0.6 96C1	136102-0328
A	Pr, Mrom, 1MX8, 100NS, MOL0.4 90BD	136102-0324
A	Pr, Mrom, 1MX8, 100NS, MOL1.0 9FB6	136102-0332
A	Pr, Mrom, 1MX8, 100NS, MOH1.2 40E9	136102-0337
A	Pr, Mrom, 1MX8, 100NS, MOH0.7 F538	136102-0331
A	Pr, Mrom, 1MX8, 100NS, MOH0.1 89F0	136102-0319
A	Pr, Mrom, 1MX8, 100NS, MOL0.0 B69E	136102-0316
A	Pr, Mrom, 1MX8, 100NS, MOL0.7 82B5	136102-0330
A	Pr, Mrom, 1MX8, 100NS, MOH0.5 9060	136102-0327
A	Pr, Mrom, 1MX8, 100NS, MOL0.1 CF92	136102-0318
A	Pr, Mrom, 1MX8, 100NS, MOH0.3 D5E7	136102-0323
A	Pr, Mrom, 1MX8, 100NS, MOL1.2 0777	136102-0336
A	Pr, Mrom, 1MX8, 100NS, MOH0.6 87C4	136102-0329
A	Pr, Mrom, 1MX8, 100NS, MOL1.3 0E47	136102-0338
A	Pr, Mrom, 1MX8, 100NS, MOL0.5 660E	136102-0326
A	Pr, Mrom, 1MX8, 100NS, MOH0.0 9AB3	136102-0317
A	Pr, Mrom, 1MX8, 100NS, MOH0.2 B2A6	136102-0321
A	Pr, Mrom, 1MX8, 100NS, MOL0.3 D4DF	136102-0322
A	Pr, Mrom, 1MX8, 100NS, MOH1.3 6AFB	136102-0339
A	Pr, Mrom, 1MX8, 100NS, MOH1.1 E50C	136102-0335
A	Pr, Mrom, 1MX8, 100NS, MOL1.1 BA48	136102-0334
A	Pr, Mrom, 1MX8, 100NS, MOH1.0 1D6 A	136102-0333
A	Pr, Mrom, 1MX8, 100NS, MOH0.4 F3EE	136102-0325
A245	Res, 10 Ω, ±5%, 1/8 W	110027-100
AB0-AB2, AB10-AB12	Integrated Circuit, 74F245	137591-001
B1M, B4M	Res, 10K Ω, ±5%, 1/8 W	110027-103
B8M	Res, 10 Ω, ±5%, 1/8 W	110027-100
B11M,B14M	Res, 10K Ω, ±5%, 1/8 W	110027-103
B18M, B48M, B148M	Res, 10 Ω, ±5%, 1/8 W	110027-100
BNKDEC	Socket, 20 Pin, .300, Dbl Wipe	179356-0320
BS1, BS2	Res, 10 Ω, ±5%, 1/8 W	110027-100
C1,C1A,C1B	Capacitor, 100 µF, 16 V, Electrolytic, Axial	124008-107
C2-C37	Capacitor, .1 µF, 50 V, +80%-20%, Cer.	122002-104
CTRM0-CTRM7	Capacitor, 47 pF, 100 V, ±5%, Cer.	122016-470
D245	Res, 10 Ω, ±5%, 1/8 W	110027-100
DB0, DB1, DB10, DB11	Integrated Circuit, 74F245	137591-001
GND1-GND5	Test Point	179051-001
JBS0, JBS3	Connector, 2 Ckt, Header, .100 Ctr	179048-002
JPWR1	Connector, 9 Ckt, Header, .156, Key 3, Rt	179213-109
JRSZ0	Connector, 2 Ckt, Header, .100 Ctr	179048-002
MOH0.0-MOH0.7, MOH1.0-MOH1.3, MOL0.0-MOL0.7, MOL1.0-MOL1.3	Socket, 32 Pin, .600, Dbl Wipe	179356-0632
R1-R40	Resistor, 33 Ω, ±5%, 1/8 W	110027-330
R41	Resistor, 4.7 ΩKx9, ±2%, 1/8 W	118010-472
ROMDEC	Socket, 20 Pin, .300, Dbl Wipe	179356-0320
RSZ1-RSZ3	Res, 10 Ω, ±5%, 1/8 W	110027-100
RTRM0-RTRM7	Res, 47 Ω, ±5%, 1/8 W	110027-470

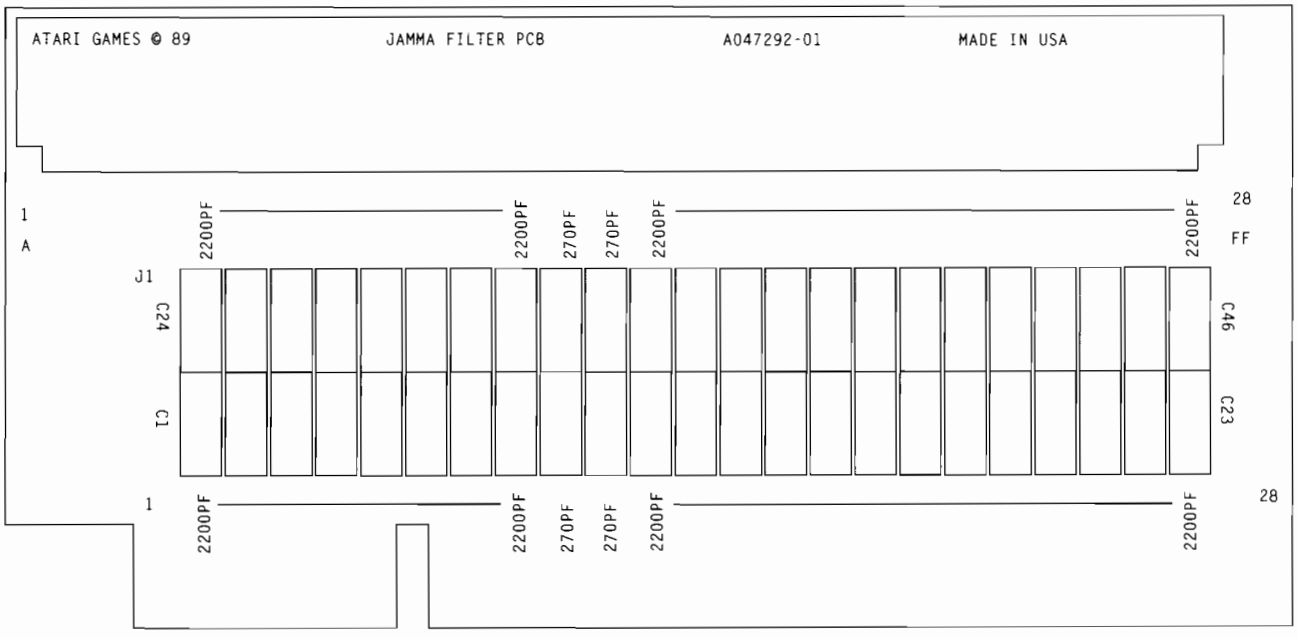


Figure 4-5 JAMMA Filter PCB Assembly

A047292-01 B

JAMMA Filter PCB Assembly Parts List

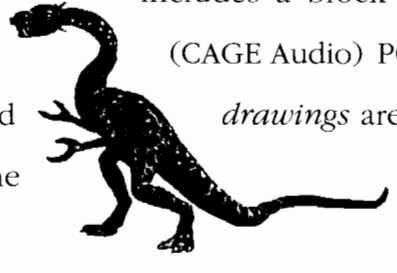
Designator	Description	Part No.
C1–8	2200 pF, 50V, 3-Pin EMI Filter Cap.	140006-222
C9, C10	270 pF, 50V, 3-Pin EMI Filter Cap.	140006-271
C11–31	2200 pF, 50V, 3-Pin EMI Filter Cap.	140006-222
C32, C33	270 pF, 50V, 3-Pin EMI Filter Cap.	140006-271
C34–46	2200 pF, 50V, 3-Pin EMI Filter Cap.	140006-222
J1	Connector, 56 Ckt., .156 Ctr, RT	179240-056

CHAPTER 5

Schematic Diagrams

INTRODUCTION

THIS CHAPTER contains the schematic diagrams for most of the Primal Rage™ game printed-circuit boards, including the game PCB (also called the GT board), the GT24M8 PCB, and the JAMMA Filter PCB. In addition, this chapter includes a block diagram of the CH31 (CAGE Audio) PCB. The PCB *assembly drawings* are illustrated in Chapter 4, *Parts Illustrations.*



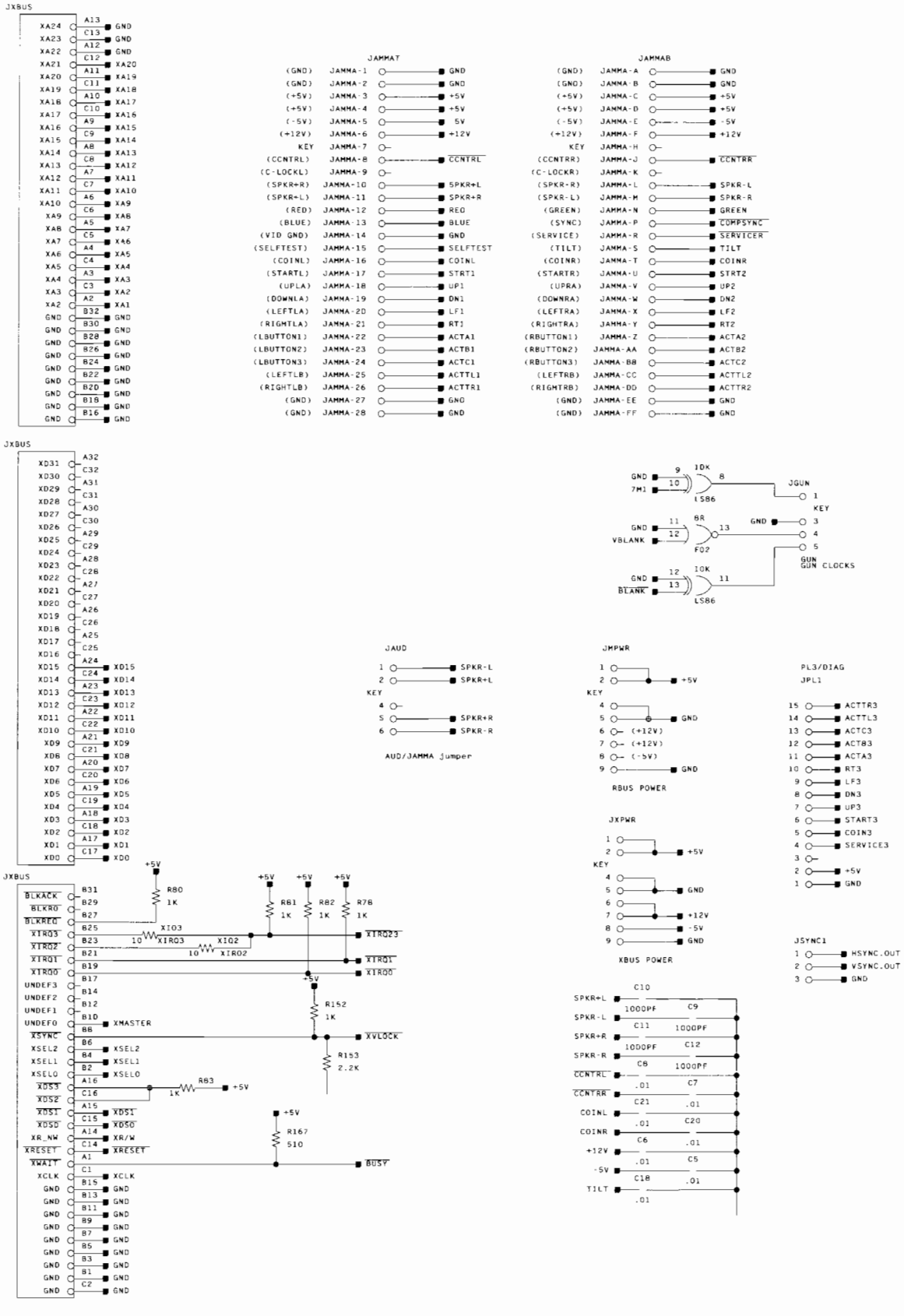


Figure 5-1 Primal Rage Game (GT) PCB Schematic Diagram

051511-01 Rev. J (Sheet 1)

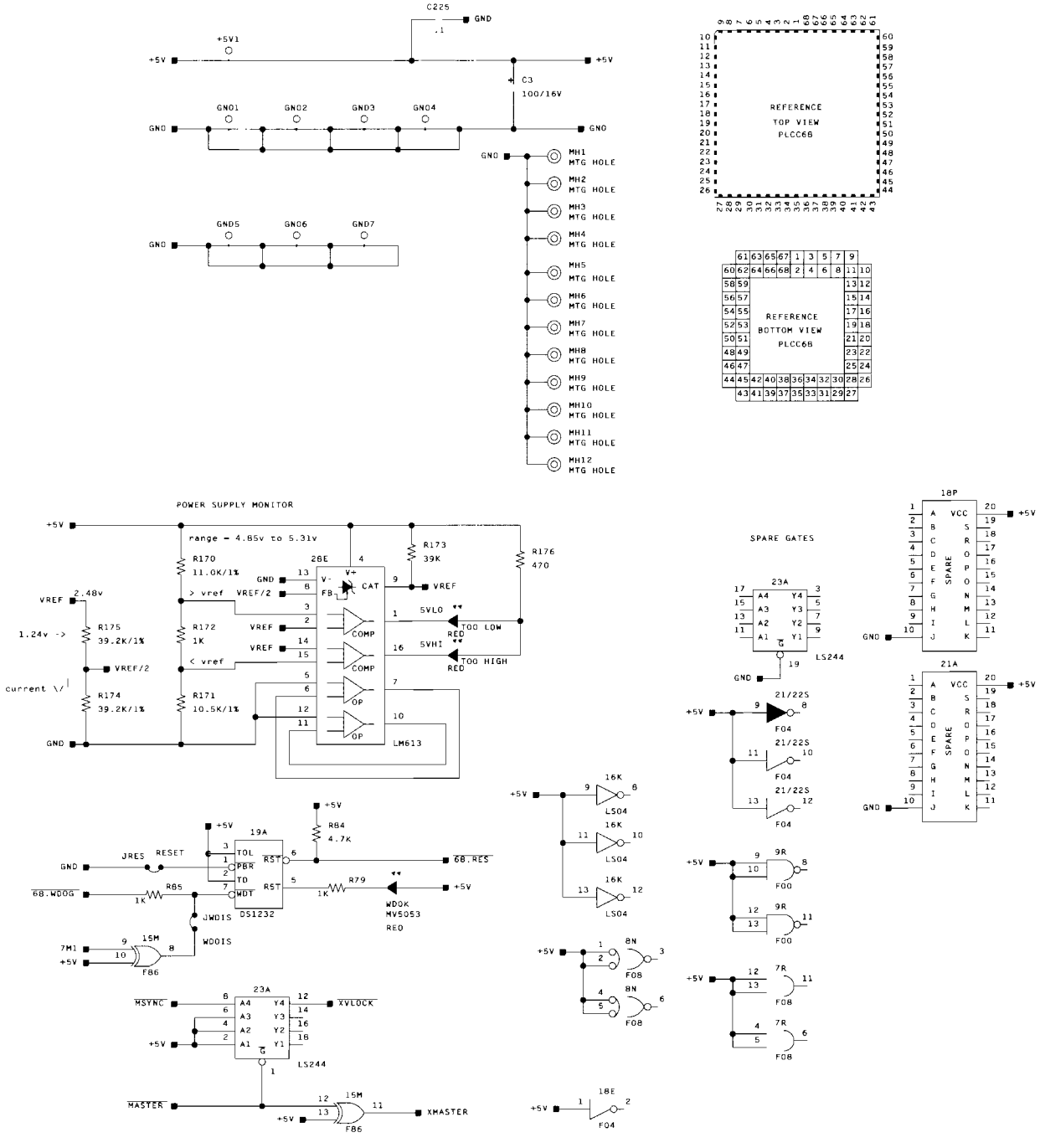


Figure 5-1 Primal Rage Game (GT) PCB Schematic Diagram, Continued

051511-01 Rev. J (Sheet 1)

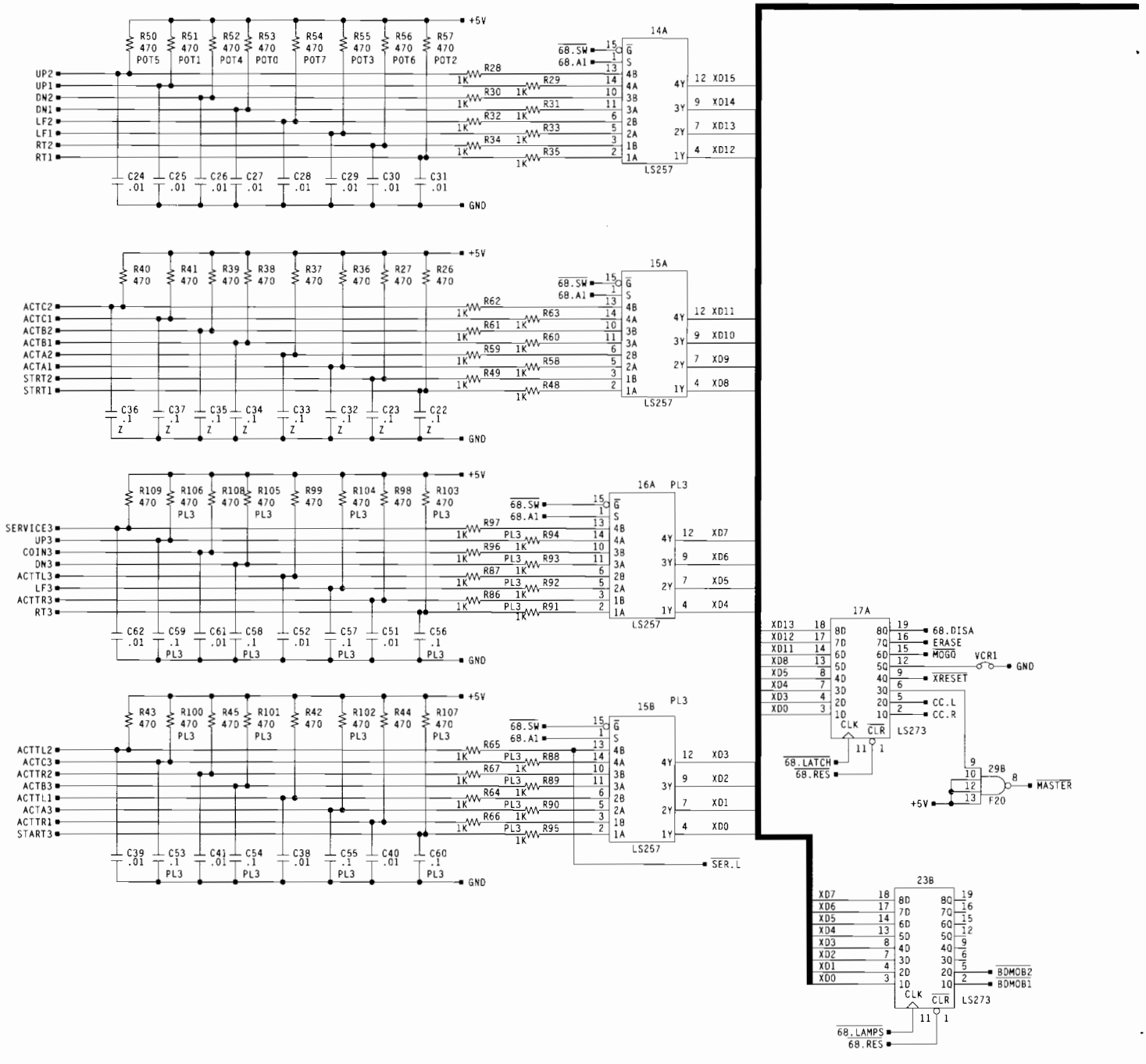


Figure 5-1 Primal Rage Game (GT) PCB Schematic Diagram

051511-01 Rev. D (Sheet 9)

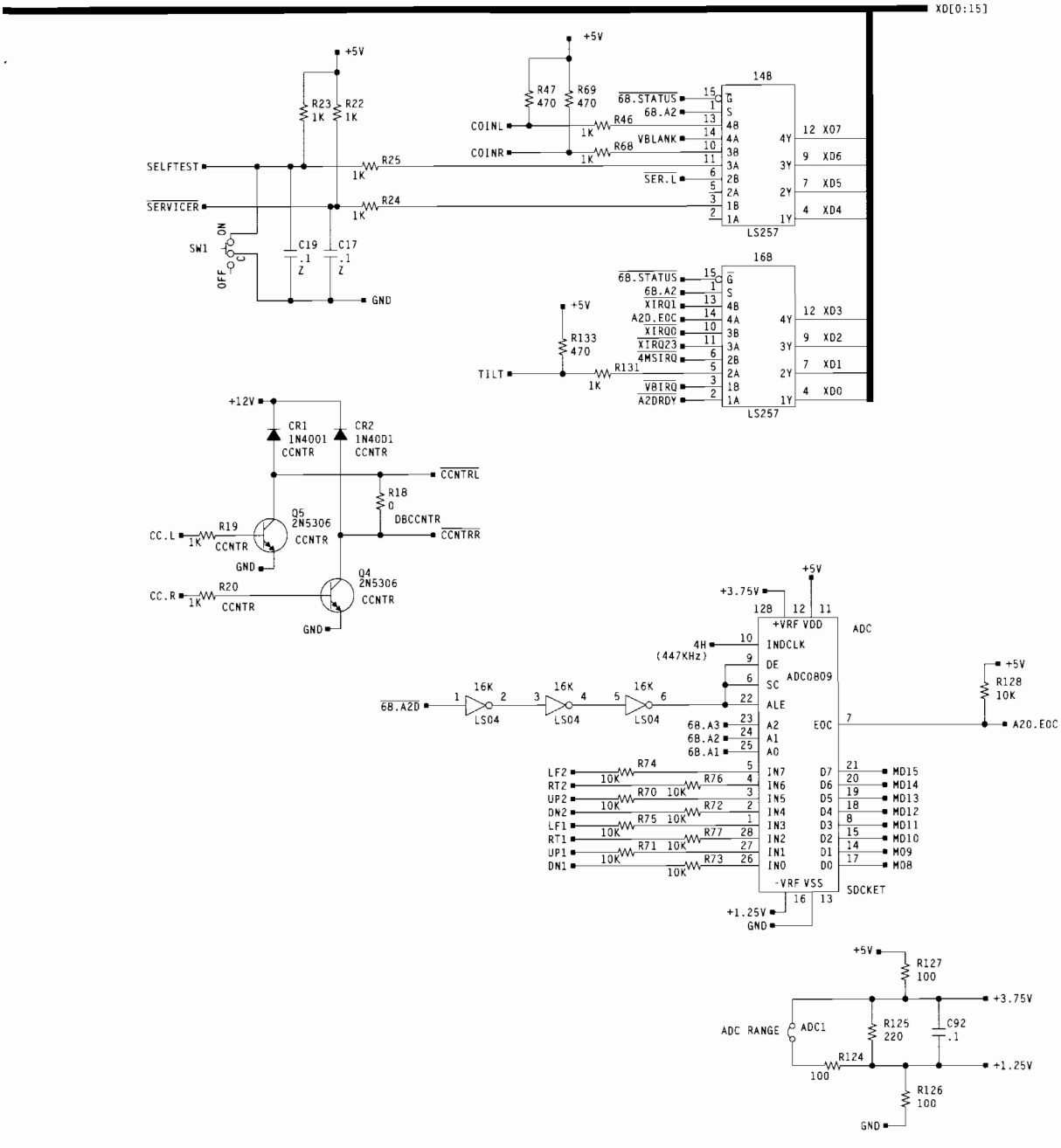


Figure 5-1 Primal Rage Game (GT) PCB Schematic Diagram, Continued

051511-01 Rev. D (Sheet 9)

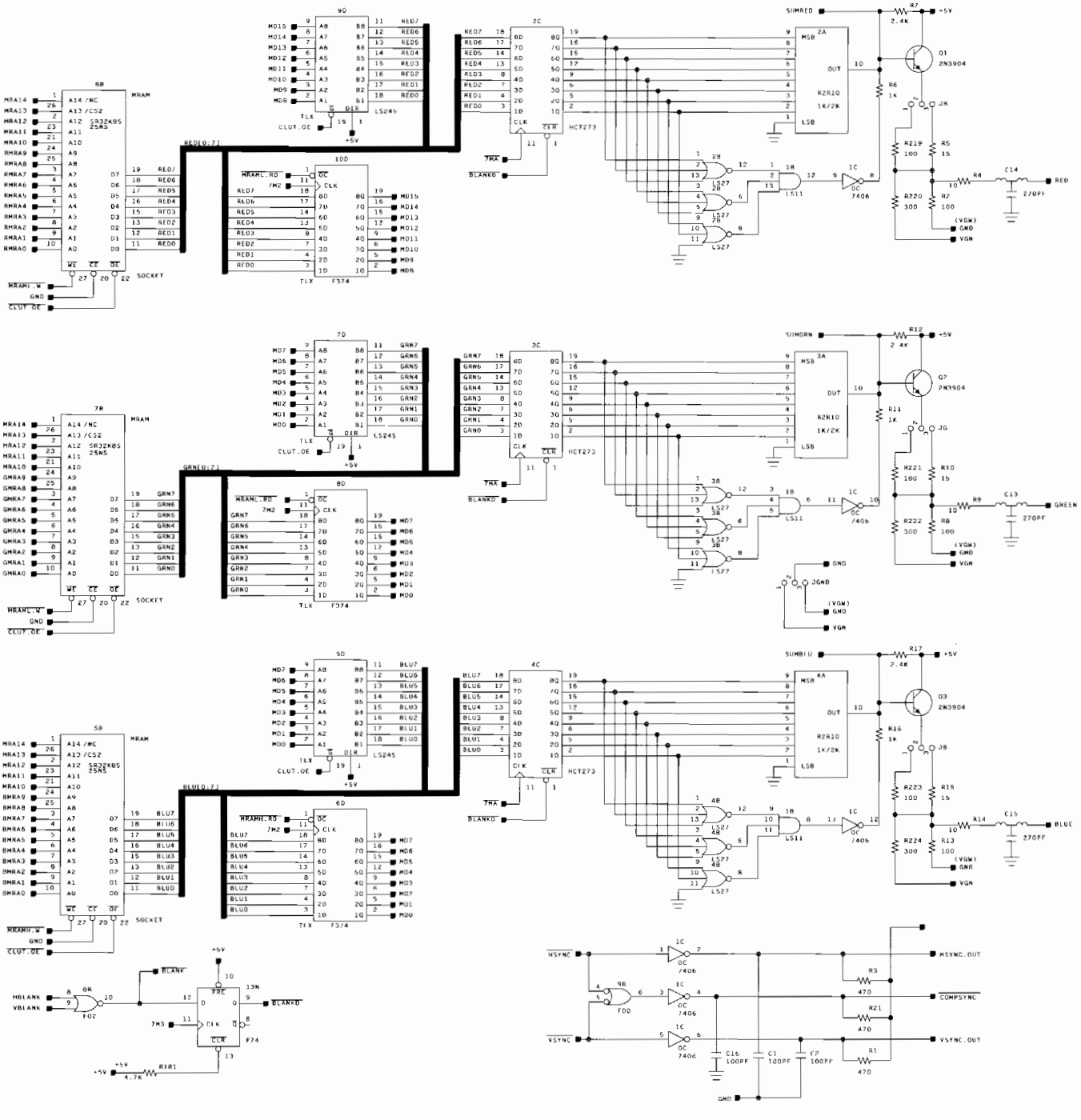


Figure 5-1 Primal Rage Game (GT) PCB Schematic Diagram

051511-01 Rev. J (Sheet 15)

NOTES

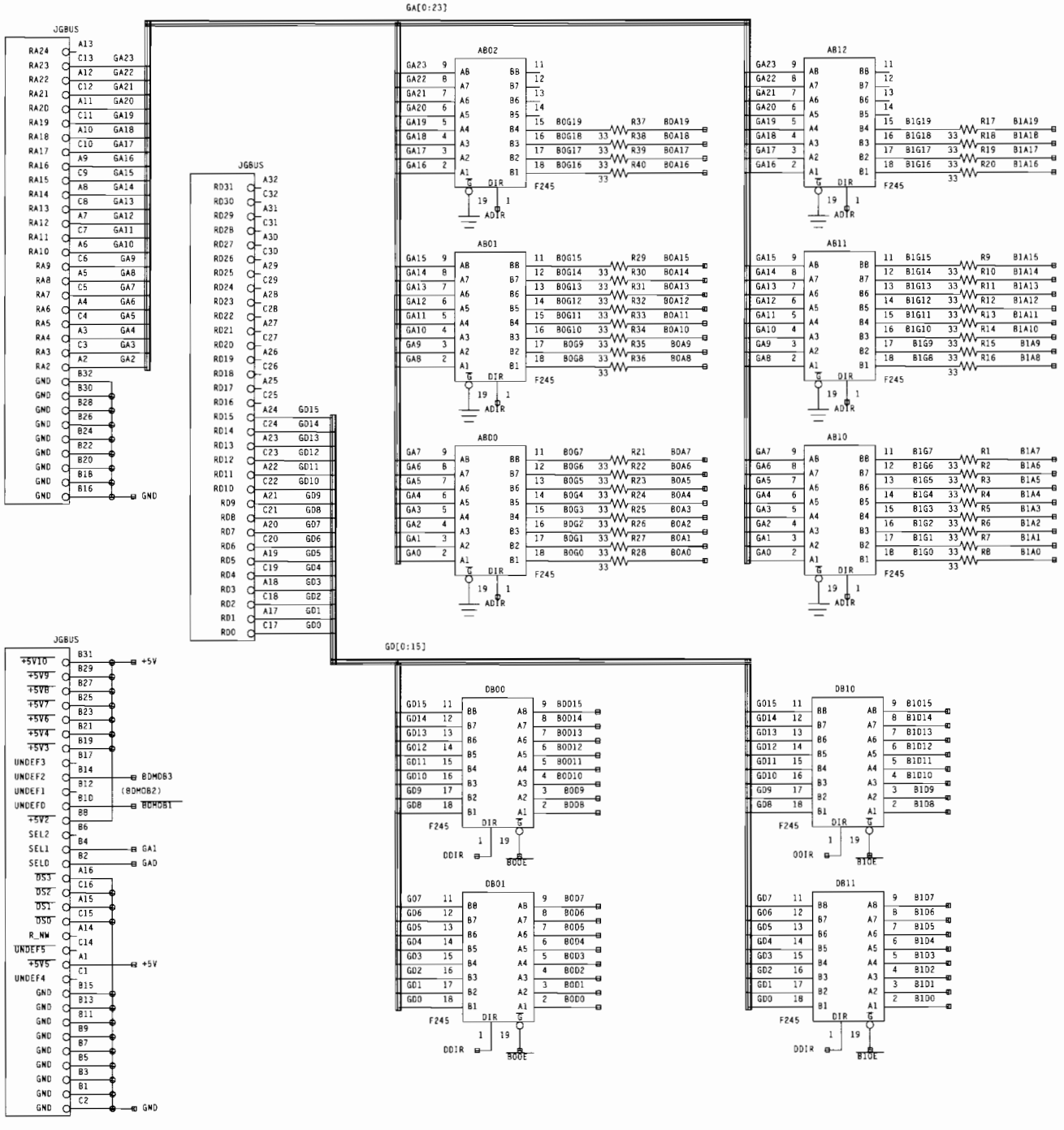


Figure 5-2 GT24M8 PCB Schematic Diagram

053601-xx Rev. B (Sheet 1)

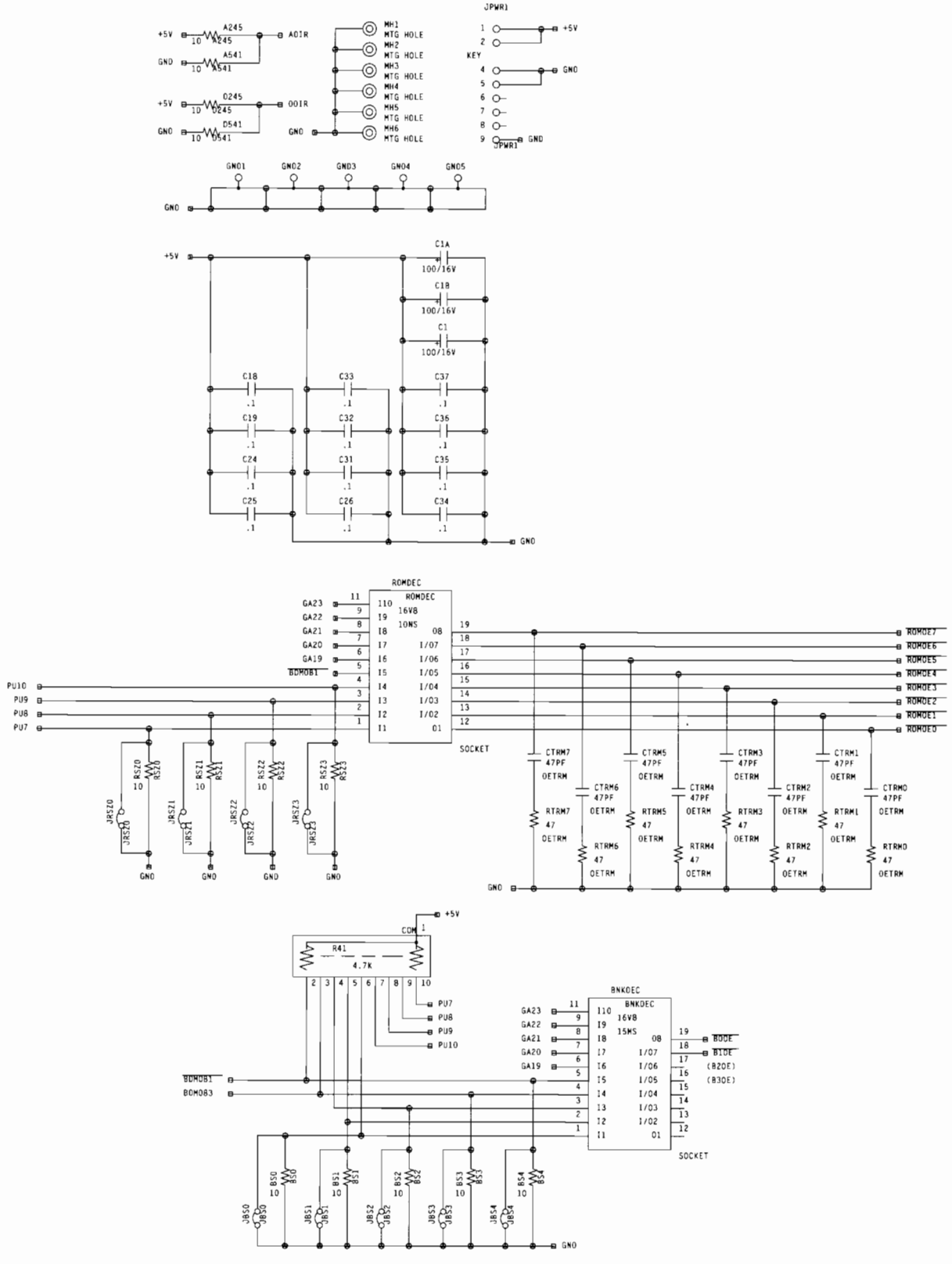


Figure 5-2 GT24M8 PCB Schematic Diagram, Continued

053601-xx Rev. B (Sheet 1)

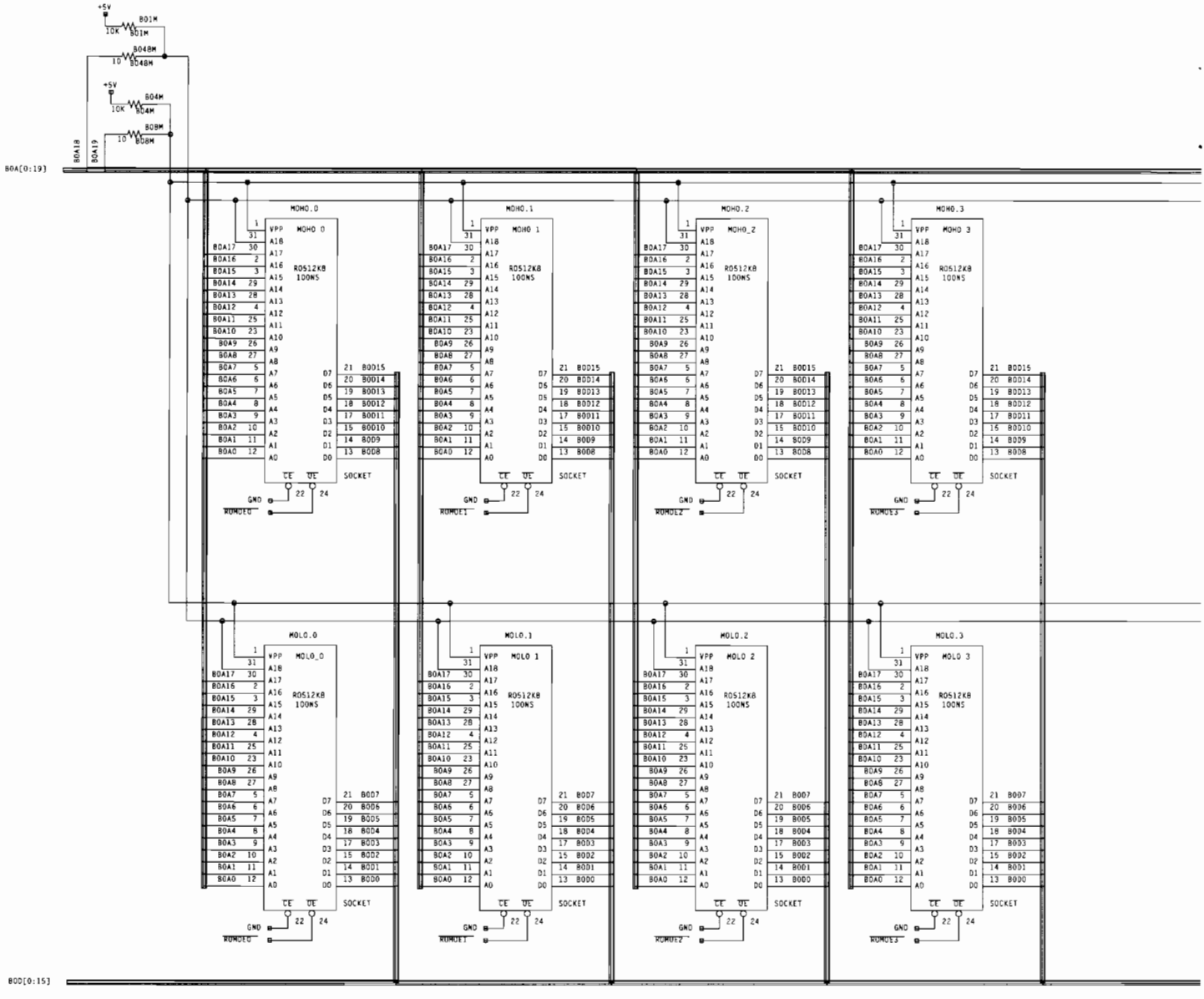


Figure 5-2 GT24M8 PCB Schematic Diagram

053601-xx Rev. B (Sheet 2)

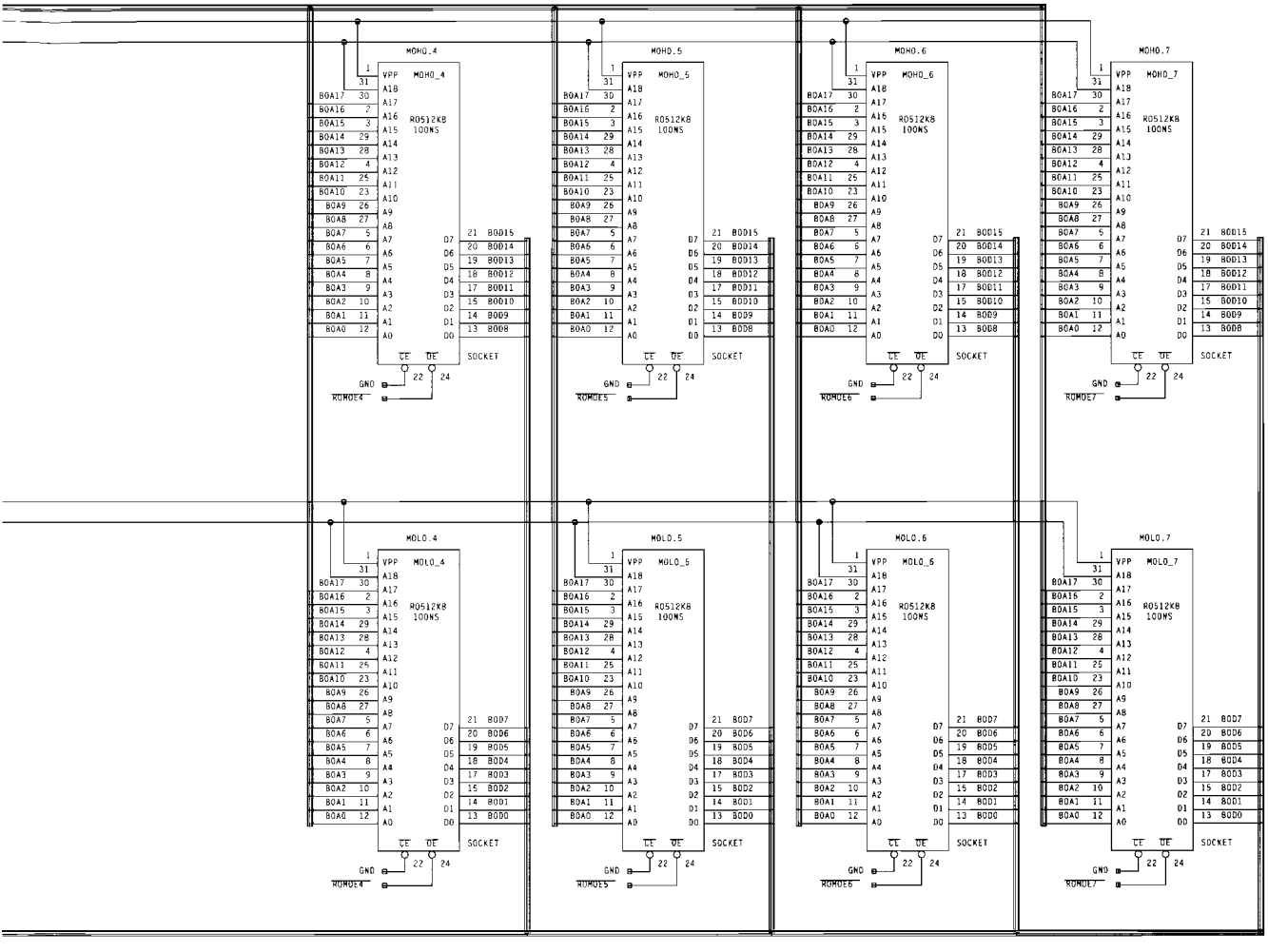


Figure 5-2 GT24M8 PCB Schematic Diagram, Continued

053601-xx Rev. B (Sheet 2)

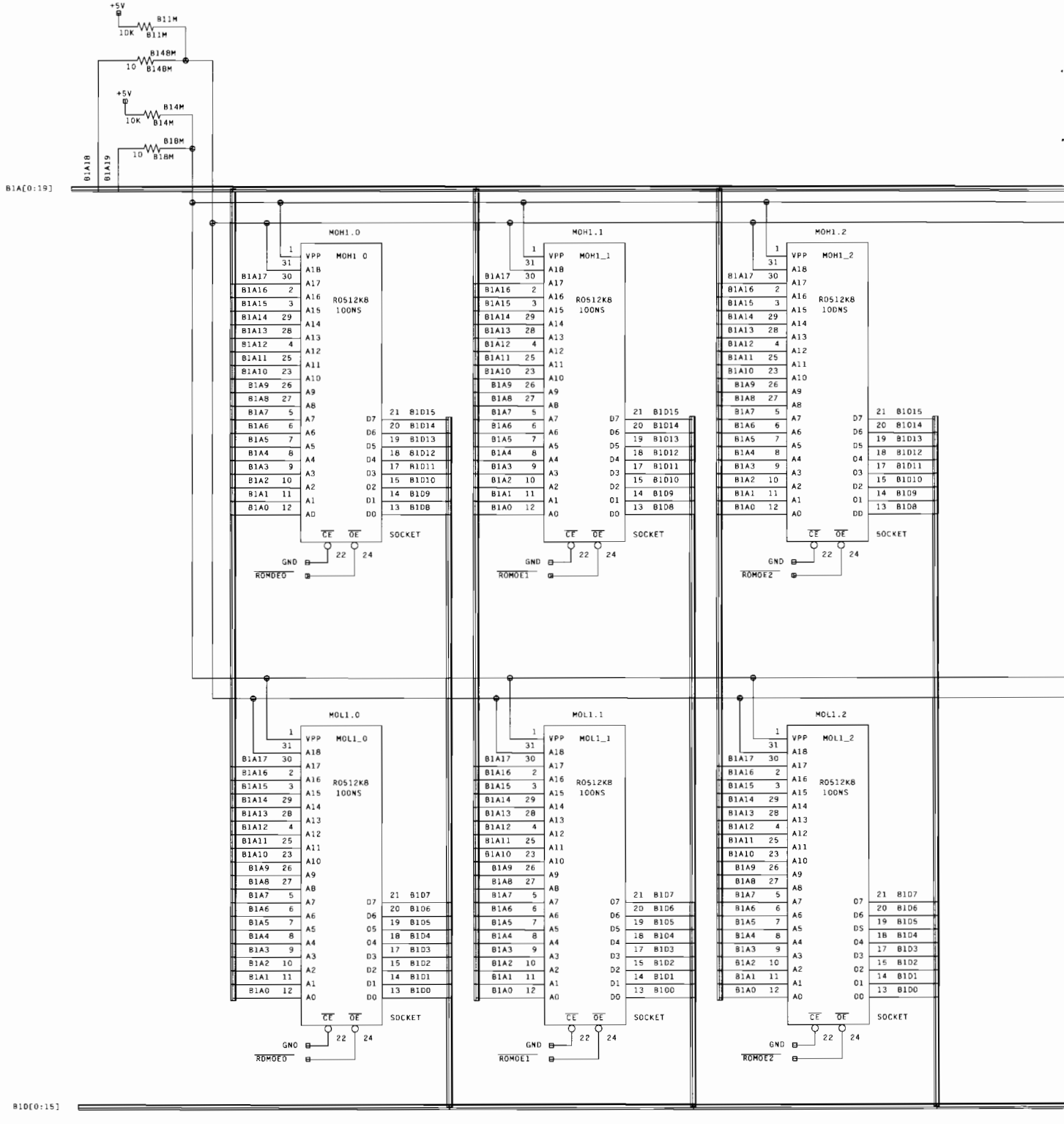


Figure 5-2 GT24M8 PCB Schematic Diagram

053601-xx Rev. B (Sheet 3)

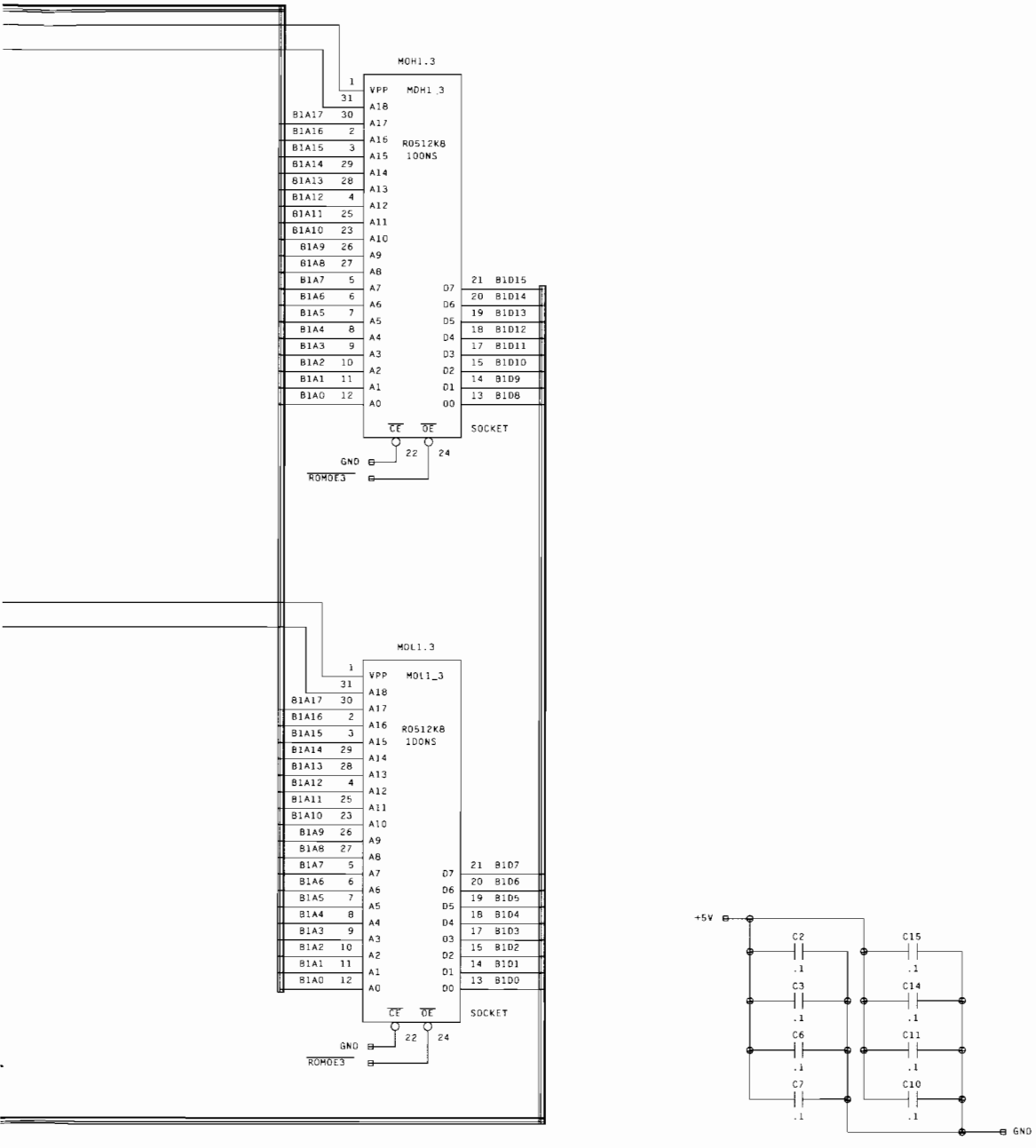


Figure 5-2 GT24M8 PCB Schematic Diagram, Continued

053601-xx Rev. B (Sheet 3)

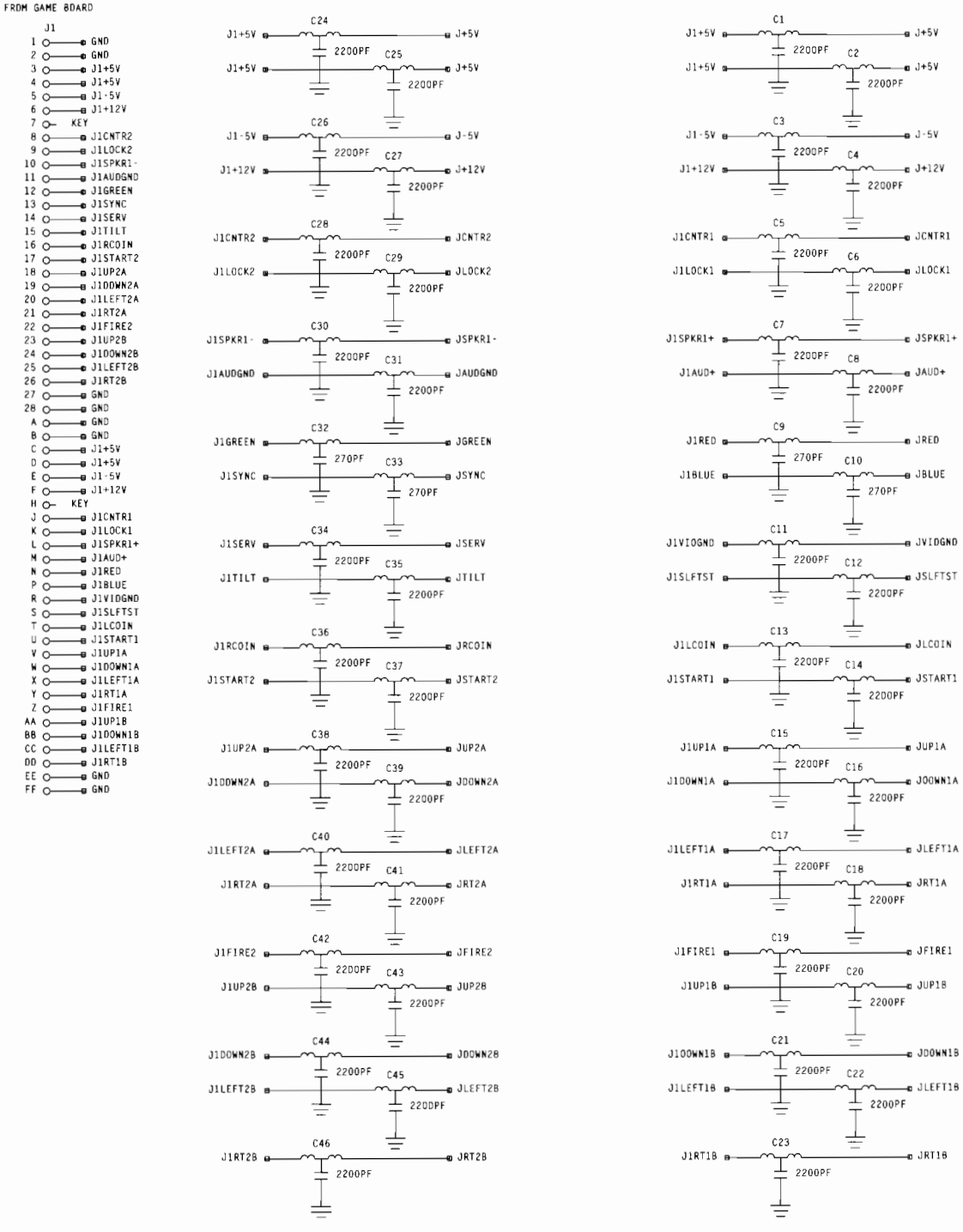


Figure 5-3 JAMMA Filter PCB Schematic Diagram

047292-01 B

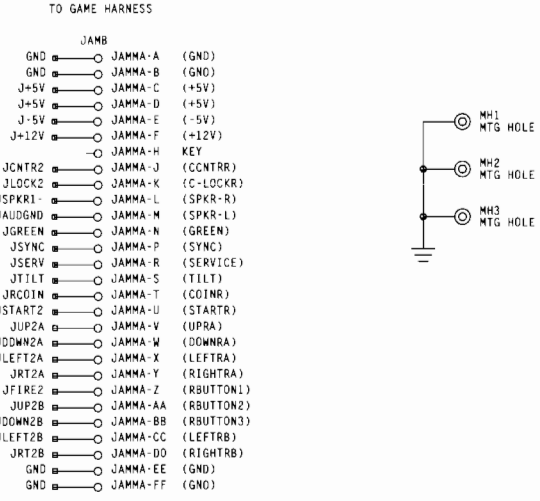


Figure 5-3 JAMMA Filter PCB Schematic Diagram

047292-01 B

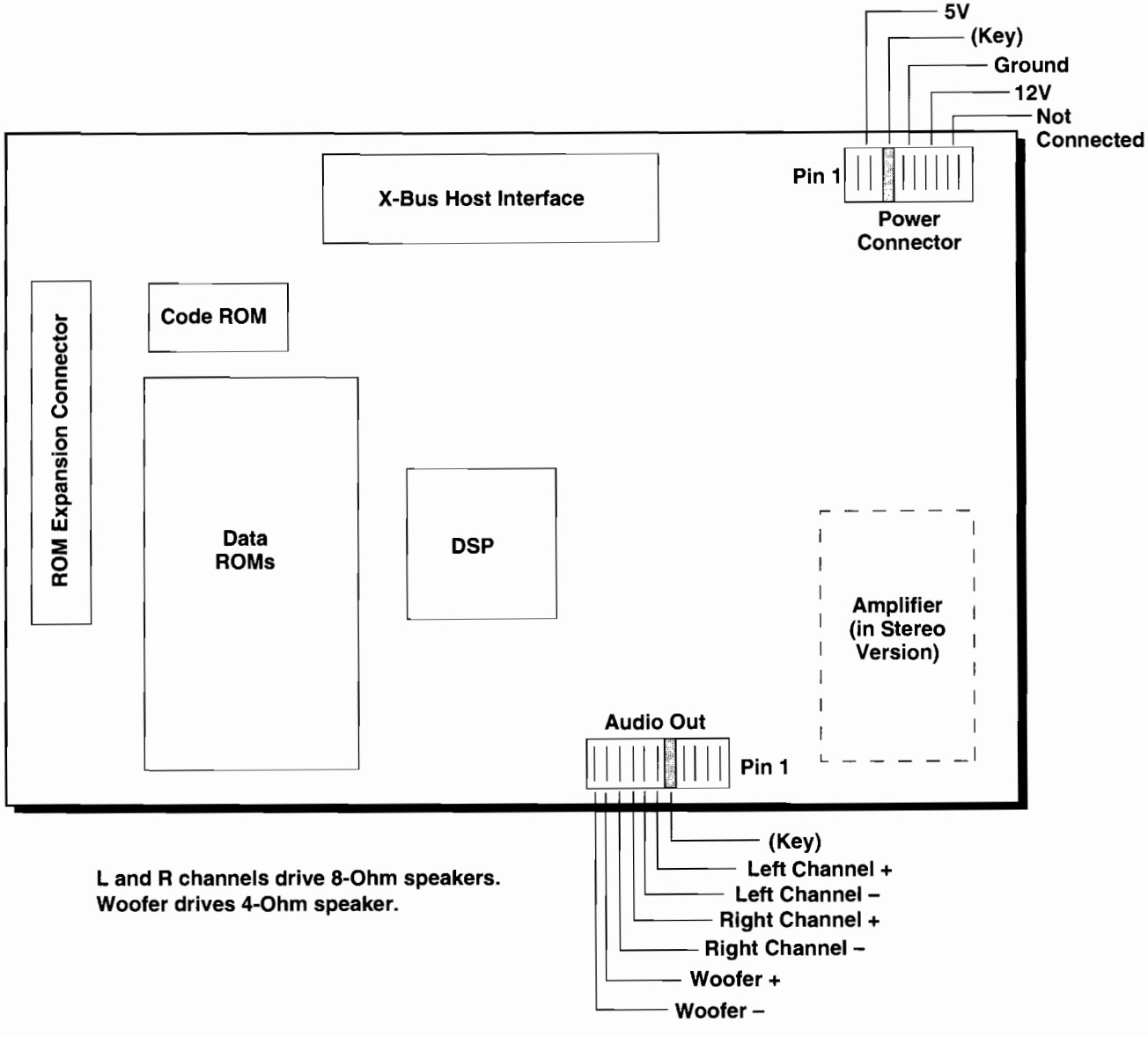


Figure 5-4 CH31_2 (CAGE Audio) Board Block Diagram

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.

The use of any non-Atari parts may void your warranty, according to the terms of the warranty. The use of any non-Atari parts may also adversely affect the safety of your game and cause injury to you and others. Be very cautious in using non-Atari-supplied components with our games, in order to ensure your safety.

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