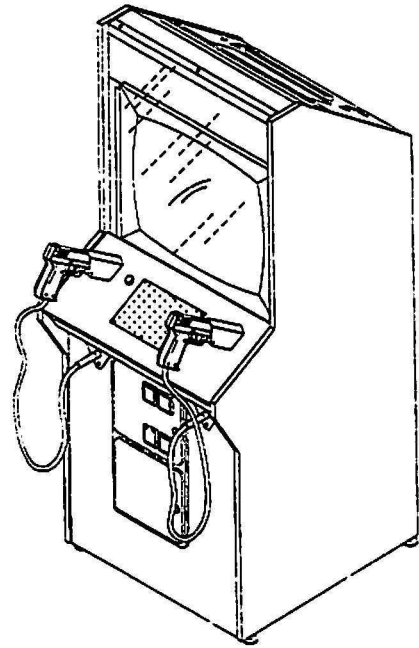# INVASION
THE ABDUCTORS

™

2-PLAYER
25" VIDEO GAME
MACHINE
CONVERSION KIT

Manual Includes
• Installation & Parts • Operation • Wiring Diagrams
Menu System • Testing & Problem Diagnosis •

INVASION™ KIT

Chapter

INSTALLATION AND PARTS

⚠	**WARNING** Use of non-Midway Games, Inc. parts or circuit modifications could cause serious injury or equipment damage! Use only Midway-authorized parts.
	For safety and reliability, do not substitute parts or modify Midway products. Substitute parts or modifications may void EMC directive or FCC type acceptance.
	Read all warnings and instructions before attempting conversion.

SAFETY INSTRUCTIONS

The following safety instructions apply to operators and service personnel. Read all instructions before preparing your Video Game Machine (VGM) for play. Other safety instructions appear throughout this manual.

DEFINITIONS OF SAFETY TERMS

DANGER indicates an imminent hazard. Failing to avoid this hazard WILL cause death or serious injury.

WARNING indicates a potential hazard. Failing to avoid this hazard COULD cause death or serious injury.

CAUTION indicates a potential hazard. Failing to avoid this hazard MAY cause minor or moderate injury. CAUTION also alerts you about unsafe practices.

NOTICE indicates information of special importance. Observing notices may prevent you from damaging the VGM equipment.

	NOTICE: CONVERSION CABINETS. While you can install this kit into many cabinets, Midway Games, Inc. recommends you convert a shooting-style VGM. The similarity of the control panel and internal construction will make it easier. This manual details how to convert a typical VGM, but your circumstances may require further modifications. Midway. accepts no responsibility for the condition of your existing VGM.
	WARNING: DISCONNECT POWER. Always turn the AC power off and unplug the line cord before attempting service or adjustments. Installing or repairing board assemblies while the power is on can cause injury, damage components, and void the warranty.
	WARNING: GROUND VGMs. Avoid electrical shock! Do not plug a line cord in until you have inspected and properly grounded the VGM. Only use a grounded, three-wire outlet. Do not use a "cheater" plug, or cut off the ground pin on the line cord. Be certain that you have reinstalled any internal ground wires removed during service.
	WARNING: INSPECT SALVAGED PARTS. Kit completion requires reusing parts from an existing VGM. Salvaged parts must operate perfectly. Otherwise, the converted VGM will not perform properly or safely. Before you attempt conversion, repair board assembly malfunctions and cabinet damage.
	WARNING: HAZARD TO EPILEPTICS. A very small portion of the population has a condition which may cause epileptic seizures or momentary loss of consciousness when viewing certain kinds of flashing lights or patterns that are present in our daily environment. These persons may experience seizures while watching some kinds of television pictures or playing certain video games. People who have not had any previous seizures may nonetheless have an undetected epileptic condition.
	If you or anyone in your family has experienced symptoms linked to an epileptic condition (e.g., seizures or loss of awareness), immediately consult your physician before using any video games.
	We recommend that parents observe their children while they play video games. If you or your child experience the following symptoms: dizziness, altered vision, eye or muscle twitching, involuntary movements, loss of awareness, disorientation, or convulsions, *discontinue use immediately* and consult your physician.
	This warning label is in your kit and must be posted on game's bezel if not already present.

⚠	**CAUTION: HANDLE ELECTRONIC DEVICES WITH CARE.** The electronic components in this kit are sensitive to static electricity. Before handling electronics, observe the following precautions. • Before handling electronics, discharge static electricity on your body. Touch the safety ground stud on the power chassis or the power supply case before touching electronics. • Store electronic assemblies in an anti-static area. Use an anti-static bag to store the CPU Board Assembly. After you install the new unit, reuse the same bag to protect the existing CPU Board Assembly. • Do not remove or connect electronics when cabinet power is on. Otherwise, you will damage the electronics and void your warranty.
⚠	**CAUTION: USE PROPER FUSE.** Avoid electrical shock! Replacement fuses must be of the same type as the originals. Fuse voltage and current ratings on the replacement fuse must match voltage and current ratings on the original fuse.
FRAGILE	**WARNING: HANDLE FLUORESCENT TUBE AND CRT WITH CARE.** A dropped fluorescent tube or CRT will break and explode, sending shattered glass flying eight feet or more. Do not drop them.
⚠	**CAUTION: CHECK WIRING.** This kit uses much of the existing VGM's wiring, including your JAMMA harness. Avoid improper operation! Check the wiring after you complete the conversion but before turning on the power. Verify that the wiring matches the diagrams in the Wiring Chapter.
☞	**NOTICE: INSPECT POWER SUPPLY.** Be sure your existing power supply can produce these voltages and currents: +5VDC at 6A, -5VDC at 1A and +12VDC at 2A. Measure these operating voltages before disconnecting the existing electronics. Power supply voltages must measure within +/-5% under load. Your power supply must be approved for radio frequency interference and product safety.
☞	**NOTICE: CHECK MONITOR TYPE.** This kit is not compatible with X-Y monitors. Suitable monitors have horizontally mounted CRTs and raster electronics. Only use a monitor with inputs for RGB video and composite or negative sync.
☞	**NOTICE: SERVICE COIN MECHANISMS.** Clean your existing VGM's coin mechanisms and test them with appropriate currency. Servicing these mechanisms is crucial to your VGM's earning potential. For your convenience, the factory provides meter wiring information. Currency acceptors and coin meters are not included in the kit.

PRODUCT SPECIFICATIONS

Equipment Characteristics

Video Display Monitor
Low (standard) resolution, RGB
with composite, negative sync

Audio System
Mono sound for
4 ohm or greater load
1 audio channel

Currency Acceptors
4 mechanical coin switch inputs,
Dollar bill validator input,
Electronic coin acceptor input

Game Characteristics

Player Variables
1 or 2 players per game,
High score recognition

Operator Variables
Coinage, Game options,
Difficulty, Volume,
Audits, Statistics

Diagnostics
Automatic power-up self-test,
Manual multi-level menu system

INSPECT THE KIT

Unpack the materials from the carton and check for obvious signs of damage. Use this checklist to ensure the kit is complete. You must supply the remainder of the materials required for this conversion.

Before attempting any step in this manual, read through the procedure to make sure you understand it. Also ensure that the components and tools for the procedure are handy before attempting the procedure.

Item	Part #	Qty	Item	Part #	Qty
ARTWORK AND DOCUMENTS			**GUN COMPONENTS**		
❏ Marquee decal	31-3186-2	1	❏ 1-1/4 inch 10-24 carriage bolt	4310-01123-20B	6
❏ Bezel instructions decal	31-3188.1	1	❏ Keps nut 10-24	4410-01128-00	6 of 12
❏ Cabinet side panel decal	31-3192	2	❏ Gun assembly, mount and cable	04-11243	2
❏ Manual, Invasion conversion kit	16-44068-101	1	❏ Flat washer .203 x .468 x .030 inch	4700-00129-00	12
❏ Gun mount template	16-10397-2	1			
❏ Holster mount template	16-10397-1	1	**HOLSTER COMPONENTS**		
❏ VGM registration card	16-10650	1	❏ Holster bracket	178398-001	2
❏ Copyright 1998 label	16-10594	1	❏ Keps nut	4410-01128-00	6 of 12
❏ FBI warning label	16-8587-825	1			
❏ Epilepsy warning label	16-9922.1	1	**TOOLS**		
			❏ T-20 Torx long arm key	20-9620	1
CABLES			❏ T-8 Torx long arm key	20-10561	1
❏ Gun/PCB cable	H-21896	2			
❏ Ground wire	H-21672	1	**MOTHERBOARD COMPONENTS**		
❏ Ground braid	H-21894	2	❏ Spacer PCB mtg 1/4"	03-8338-1	6
			❏ ¾ inch sheet metal screw #6 plain hex washer head	4106-01115-12	6
CONTROL PANEL COMPONENTS			❏ Invasion CPU Board Assembly	A-22541	1
❏ Control panel wallpaper decal	31-3193	1			
❏ Decal, control panel add-ons	31-3194.1	1	**DAUGHTERBOARD COMPONENTS**		
❏ Control panel cover	03-9664	1	❏ Gun Interface Board Assembly	04-11315.2	1
❏ Red button assembly	20-10209-1	1	❏ 5/8 inch spacer PCB mtg, #8	03-8338-5	2
❏ Blue button assembly	20-10209-3	1	❏ 1-1/4 inch sheet metal screw #6 plain hex washer head	4106-01115-20	2

YOU WILL NEED THESE TOOLS AND SUPPLIES:

- ❑ Black, semi-gloss paint
- ❑ Electric drill and wood bit set
- ❑ Screwdrivers
- ❑ Liquid soap (dish detergent)
- ❑ Grease pencil or marker

- ❑ Center punch
- ❑ 180 grit sandpaper or power sander
- ❑ Quick-hardening wood putty
- ❑ Electrical tape or heat shrink tubing
- ❑ Small screw assortment

- ❑ Nut drivers or socket wrench set
- ❑ Safety utility knife
- ❑ Squeegee or soft sponge
- ❑ Hole saw or equivalent
- ❑ Continuity tester (V.O.M. or equivalent)

CABINET MODIFICATIONS

1. Verify operation of the existing VGM before making changes to the cabinet. Pay special attention to components you will reuse, such as power supply, video monitor, currency acceptors, JAMMA harness, cabinet locks, marquee fluorescent light, speaker(s), etc.

2. Switch AC power OFF. Disconnect line cord from AC power.

3. Clear work area. Cover or protect non-wood items, such as marquee, monitor, coin door, brackets, line cord, etc.

4. **STRAIGHTEN TEMPLATE** Locate gun and holster mount template. Stack large, heavy items like newspapers, books, or magazines on the template so it will be flat when you are ready to use it.

PREPARING TEMPLATE PRIOR TO USE

5. **SIDE PANELS** Remove existing decals and artwork from the cabinet sides. Clean off glue residue. Fill gouges, unused holes, etc. with quick-hardening wood putty. Sand smooth and remove dust.

6. **PAINT** Cover both side panels evenly with black paint. Allow paint to dry completely.

7. **DECALS** Hold left side panel decal in position and mark a line at the top. Remove decal.

8. Lightly moisten panel with soapy water. Remove decal backing and apply decal. Start at top, using pencil line as a guide.

9. Moving outward from center of decal, smooth it down with a squeegee or sponge. Squeeze out any air bubbles. Pop stubborn bubbles with utility knife and smooth down.

10. Repeat previous step for right side panel. Allow at least 12 hours for adhesive in decals to set.

11. **MARQUEE HARDWARE** Remove viewing glass or marquee glass and set in safe place. Remove existing backlit marquee artwork at cabinet top.

12. **MARQUEE ILLUMINATION** Clean inside of the marquee. Inspect lamp assembly. If you find cracks or darkened ends in the original fluorescent lamp tube, install a new one.

13. **MARQUEE ARTWORK** Use previous marquee artwork as a guide to trim kit artwork to size.

14. Clean new marquee artwork and install on VGM. Reinstall marquee glass

15. **MONITOR BEZEL.** Clean existing monitor bezel. Remove labels that cannot be covered.

16. **BEZEL DECALS** Apply player instructions decal to bottom of the bezel. Apply epilepsy warning label on top of monitor bezel. Do not let decals or labels obstruct viewing area.

16-9922.1
EPILEPSY WARNING
DECAL

31-3186-2
MARQUEE
DECAL

31-3188.1
INSTRUCTIONS
DECAL
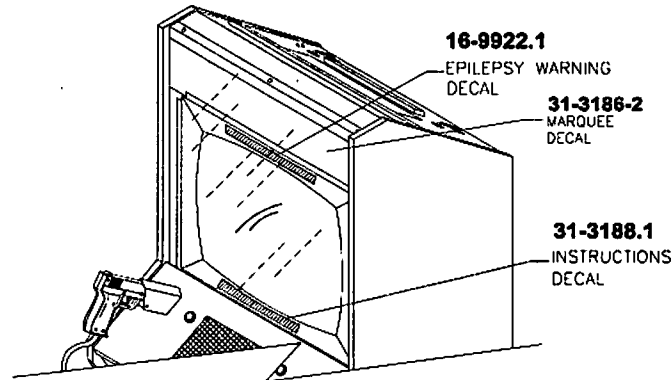
LOCATION OF DECALS AND LABELS

17. **VIEWING GLASS** Clean CRT face and viewing glass and replace them.

18. **REAR DOOR** Remove and save screws at top and sides of rear door. Unlock rear door, lift from cabinet, and set aside.

19. **CLEAN INTERIOR** Cover existing electronics with plastic sheet for protection. Vacuum dirt or debris from inside cabinet. Be careful to keep vacuum cleaner motor away from electronics and monitor.

20. **CONTROL PANEL** Unscrew and remove speaker grill(s) from control panel. Unscrew speaker(s) and gently place inside cabinet. If you must disconnect speaker harness(es), mark wire polarity and functions. Incorrectly phased speakers can cause weak, low frequencies or thin, hollow sound quality.

21. Remove controls and decals from control panel. Disconnect START button switches from main harness and mark function of each wire for later use.

22. **PLAYER CONTROLS** This kit requires two START buttons. Note button locations on drawing below. Fill extra holes with suitable material, like quick-hardening wood putty. Sand smooth. Remove dust.

23. **ARTWORK** Peel off backing from wallpaper decal and place it over the control panel board, smoothing from the center out with a squeegee or sponge. Trim edges to fit.


START BUTTONS

SPEAKER — SPEAKER GRILLE
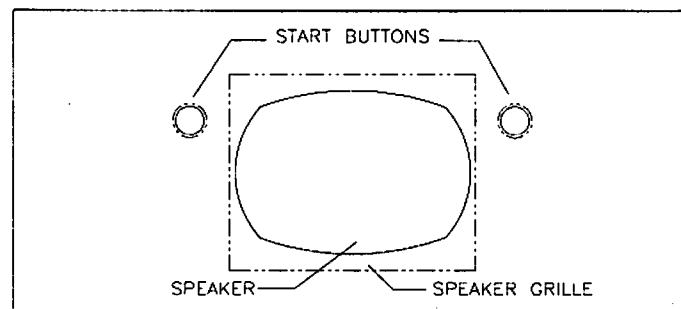
TYPICAL CONTROL LOCATIONS

24. **CABINET FRONT** Disconnect existing gun cables from the main harness. Unscrew gun mounts, and remove guns and gun cables. If you wish to replace your holsters, remove existing holsters, screws, or other items from the front of the cabinet.

25. Compare the previous gun mount hole pattern with the pattern on the kit template. If the existing pattern of four holes matches the template pattern, do not fill the existing holes. Fill all other holes with putty. Sand smooth and remove dust.
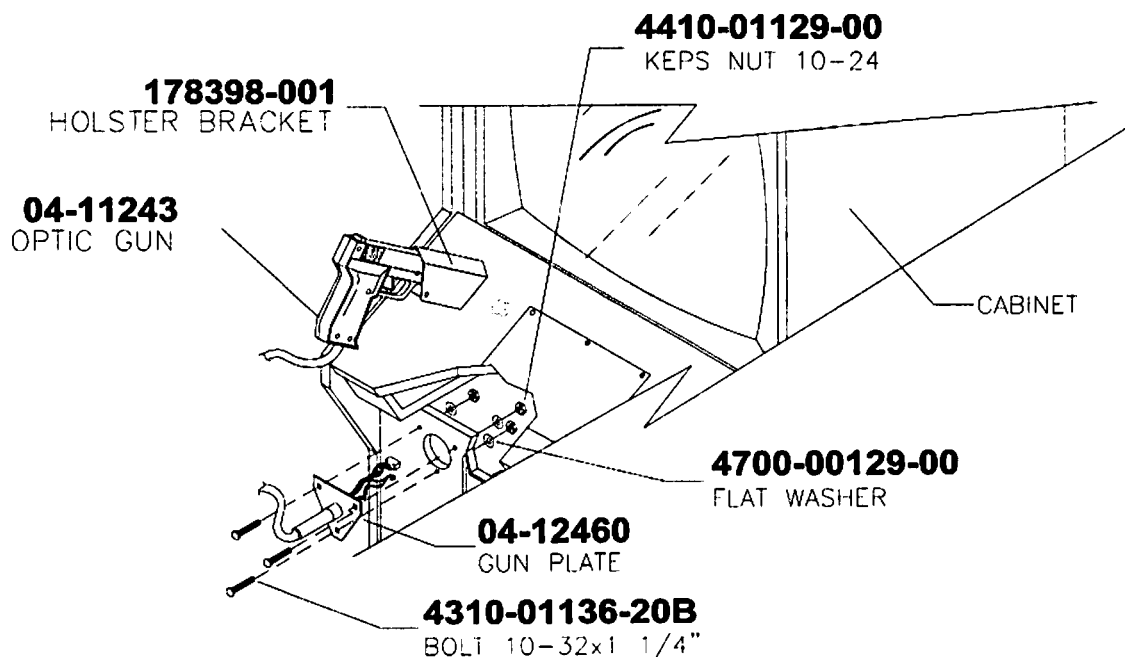
INSTALL GUN HOLSTERS

1. **HOLE LOCATIONS** Identify the right gun holster portion of the template. Position the right holster template on the control panel so there will be clearance from the speaker(s) and buttons. Tape the template in place.

2. Verify that when you drill holes you will not encounter any internal bracing, wires or cables, or other interference. When you are certain the screws will be able to penetrate the panel without resistance, center punch the hole locations.

3. Repeat the previous step for the left gun holster hole locations and remove the template.

4. Cut or drill all the holes. Deburr the holes.

5. **HOLSTER BRACKETS** Remove speaker or lift control panel to access bottom of panel. Line up three bolts and insert right holster into control panel. Fasten nuts over bolts inside control panel and tighten.

6. Repeat previous step for left gun holster.

7. To remove rubber tube for replacement, cut rubber off metal tube. Grasp metal tube with pliers and remove screws. Place new rubber tube over metal tube and hold in position in holster. Insert both screws and hand tighten. Using two screwdrivers, tighten both screws at once.
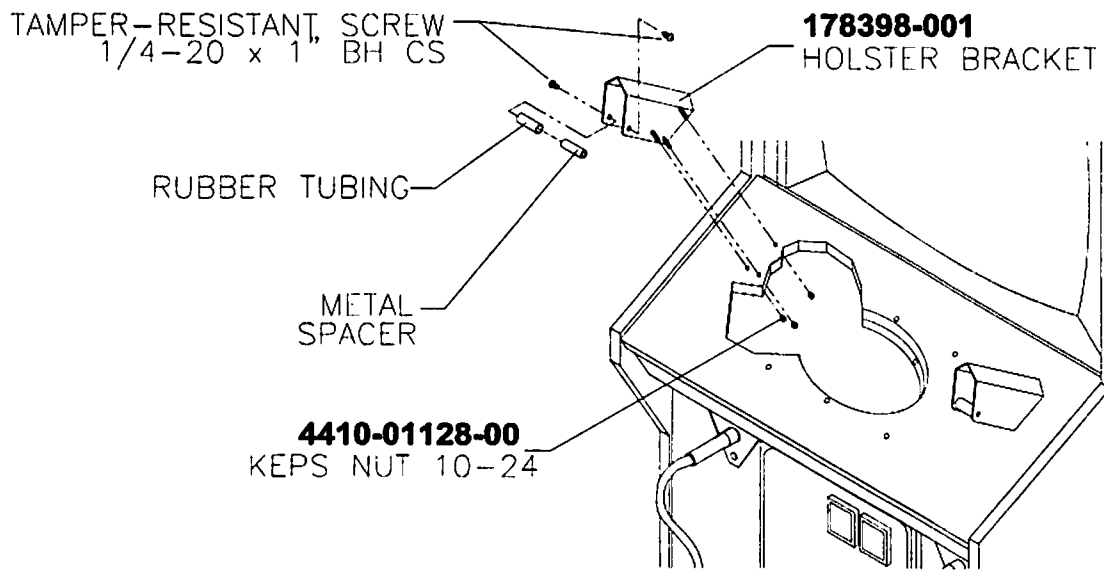
TYPICAL HOLSTER INSTALLATION

INSTALL GUNS

8. **GUNS** Insert one gun (both guns are identical) into each holster. Straighten the armored gun cables and let them hang freely.

9. If the four holes needed are missing, locate a position for them. Position the gun mount portion of the template beneath the control panel. Locate the mount so players can move the gun freely. Align the two top holes of the triangular template parallel to the ground. Tape the template into position.

10. Verify that when you drill holes you will not encounter any internal bracing, wires or cables, or other interference. When you are certain the bolts will be able to penetrate the panel without resistance, center punch the hole locations.

11. Repeat the previous two steps for the left gun mount and remove the template.

12. Cut or drill all the holes with a hole saw and deburr them.

13. Insert the left gun cable connector and grounding wire through the large central gun mount hole on the left side of the front panel. Align the gun plate with the three holes. Install three 10-32 by 1-1/4" carriage bolts through the gun plate into the mounting holes. Press the bolts to seat them fully.

4410-01129-00
KEPS NUT 10-24

178398-001
HOLSTER BRACKET

04-11243
OPTIC GUN

CABINET

4700-00129-00
FLAT WASHER

04-12460
GUN PLATE

4310-01136-20B
BOLT 10-32x1 1/4"

TYPICAL GUN MOUNT INSTALLATION

14. **GROUNDING RING** Place the ring terminal of the cable over any one of the carriage bolts.

15. Install a flat washer and KEPS nut on each bolt on the inside of the panel. Tighten the bolts securely.

16. Repeat the previous three steps for the right side. Check that gun cables move freely in all directions.

17. Inside the cabinet, mate the left gun assembly connector to a gun-to-main-harness cable. Route the cables away from the other cabinet wiring.

18. Repeat the previous step for the right gun.

COMPLETE CONTROL PANEL

1. Peel off backing from add-on decals and place them on the control panel where the START buttons will go. Be sure that the blue start decal is on the left and the red on the right.

2. Locate and drill holes through the wallpaper and control panel wood for the start button and speaker(s), if not already present. If the holes are already there, use a utility knife to cut through the wallpaper where the speaker and START button holes are. Deburr the holes.

3. **BUTTONS** Separate microswitches from pushbutton housings.

4. Place the transparent control panel cover over the wallpaper. Use the utility knife to cut out the shape of the speaker(s). Use the hole saw to drill holes for the start buttons.

5. Insert blue button into left start hole and hand-tighten nut. Attach switch to blue button.

6. Insert red button into right start hole and hand-tighten nut. Attach switch to red button.

7. Attach a button assembly switch to the main harness connectors under the left button hole. Refer to the labels you previously placed on the connectors. Repeat for right button hole.

8. Replace speaker(s) and tighten screws snugly. Replace speaker grill(s). Do not overtighten screws.
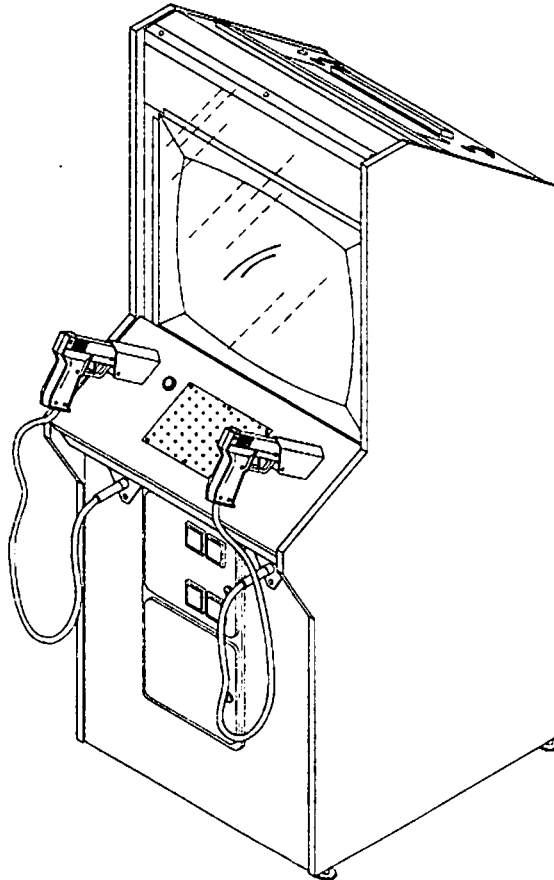
TYPICAL COMPLETED CONTROL PANEL AND CABINET

INSTALL ELECTRONICS COMPONENTS

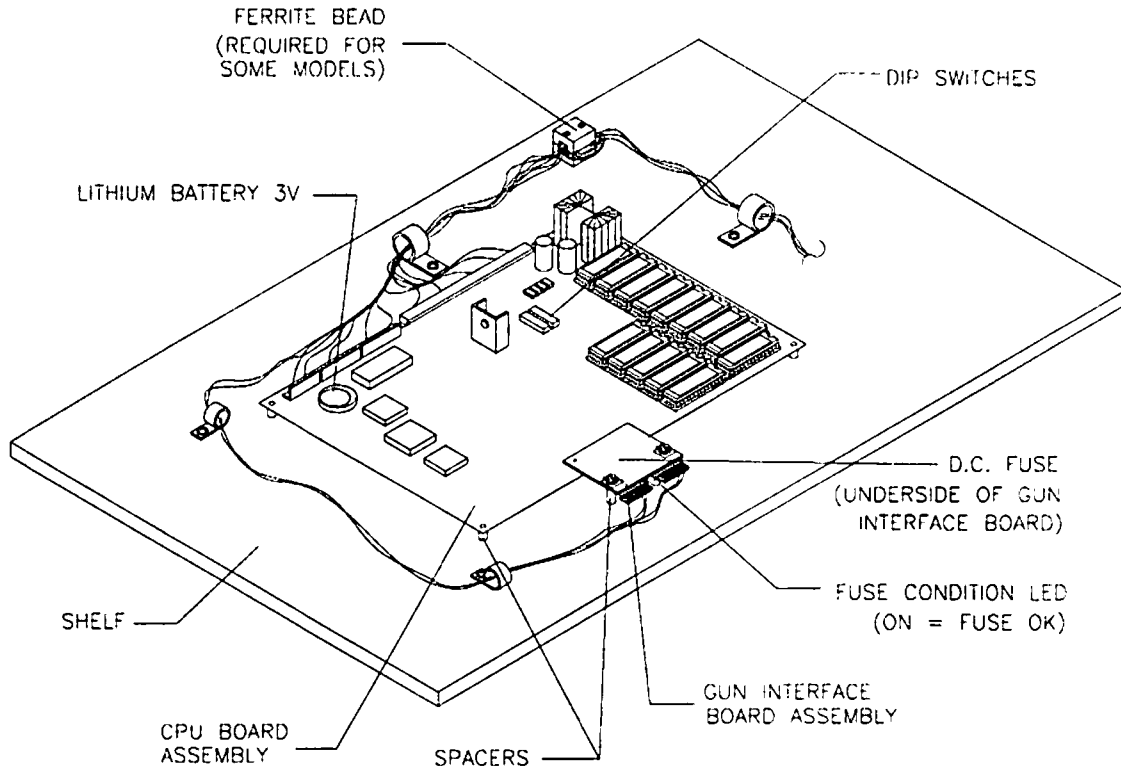|	
☞	**NOTICE: DIAGNOSTIC SWITCHES** Some early video game machines did not require external switches. If your cabinet does not already have TEST, VOLUME, and CREDIT switches installed, you should do this before completing the conversion. Tests and adjustments may be very difficult without these switches.
⚡	**CAUTION** Game electronic components are static sensitive. Prepare an anti-static work area. Ground yourself before removing the CPU Board Assembly from its protective shipping materials.
⚠	**WARNING** Do not connect cables to the CPU Board Assembly or power supply while the power is on. Doing so can cause injury, damage game electronics, and void your warranty.
⚠	**CAUTION: ATTACH CONNECTORS PROPERLY.** Be sure that board assembly connectors mate properly. If connectors do not slip on easily, do not force them. A reversed connector may damage your game and void the warranty. Connector keys allow a connector to fit only one set of pins on a board.
⚠	**CAUTION: DO NOT OVERTIGHTEN SCREWS.** Overtightening screws through circuit boards can damage the board. Tighten the screws firmly, but not so tight that they cause the board to warp or crack. Circuit board damage can void the warrantee.
⚠	**CAUTION: SEAT CONNECTORS GENTLY BUT FIRMLY.** Connectors are keyed and should fit snugly onto board assemblies. Never force a connector, as you may damage the wires on the board.
☞	**NOTICE: RADIO FREQUENCY INTERFERENCE.** A ferrite bead, or other radio frequency interference suppression device, may be required to help your VGM model comply with EMI requirements.

1. **MOTHERBOARD** Disconnect the JAMMA harness from all existing board assemblies. Remove board assemblies, disk drives, drive mounting plates, etc. Store items in anti-static packaging.

2. If the electronics mounting shelf is vertical, remove it from its mount. If no shelf exists, supply one that you can fasten safely into the cabinet. If the shelf is horizontal, proceed to the next step.

3. Place spacers beneath the corner and middle holes of the CPU Board Assembly. Mount the assembly on the shelf in same location as original assembly. Mark and drill pilot holes if necessary. Fasten screws through corner and middle holes of the board, spacers, and shelf, but do not tighten. After each screw is seated, tighten them all.

☞	**NOTICE: DRILL HOLES IF NECESSARY.** Depending on mounting surface material, you may want to drill pilot holes before you insert the screws. If this is the case, use the board assemblies as templates to mark hole locations with a pencil, then drill the holes before mounting the board assemblies with the screws.

FERRITE BEAD
(REQUIRED FOR
SOME MODELS)

DIP SWITCHES

LITHIUM BATTERY 3V

D.C. FUSE
(UNDERSIDE OF GUN
INTERFACE BOARD)

FUSE CONDITION LED
(ON = FUSE OK)

SHELF

GUN INTERFACE
BOARD ASSEMBLY

CPU BOARD
ASSEMBLY

SPACERS

TYPICAL ELECTRONICS TRAY INSTALLATION

4. **DAUGHTERBOARD** Insert a standoff spacer into a corner hole of the Gun Interface Board Assembly. The spacer should go into the side with the components and snap into the holes.

5. Turn the board so the spacers are on the bottom. Insert screws down through the spacers from the non-component side of the board.

6. Connect the Gun Interface Board Assembly to CPU Board Assembly at P3. Press the connector down firmly but do not force.

7. Fasten the two gun interface board screws into the shelf. The screws will drill their own holes.

8. If you have a vertical shelf, return it to its position inside the cabinet.

9. Mate the existing JAMMA harness connectors to the CPU Board Assembly sockets.

SCREW

GUN INTERFACE BOARD ASSEMBLY

PCB STANDOFF
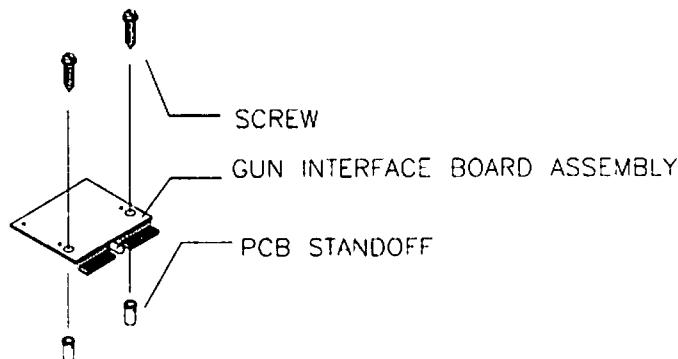
GUN INTERFACE BOARD AND HARDWARE

LAMP ACCESS PANEL

CAM LOCK

LOUVERED VENT

OPTIC GUN

HANDLE

HOLSTER

PLASTIC CLIP

POWER SUPPLY
AND MOUNTING BRACKET

LINE CORD

GAME ELECTRONICS

REAR DOOR ASSEMBLY
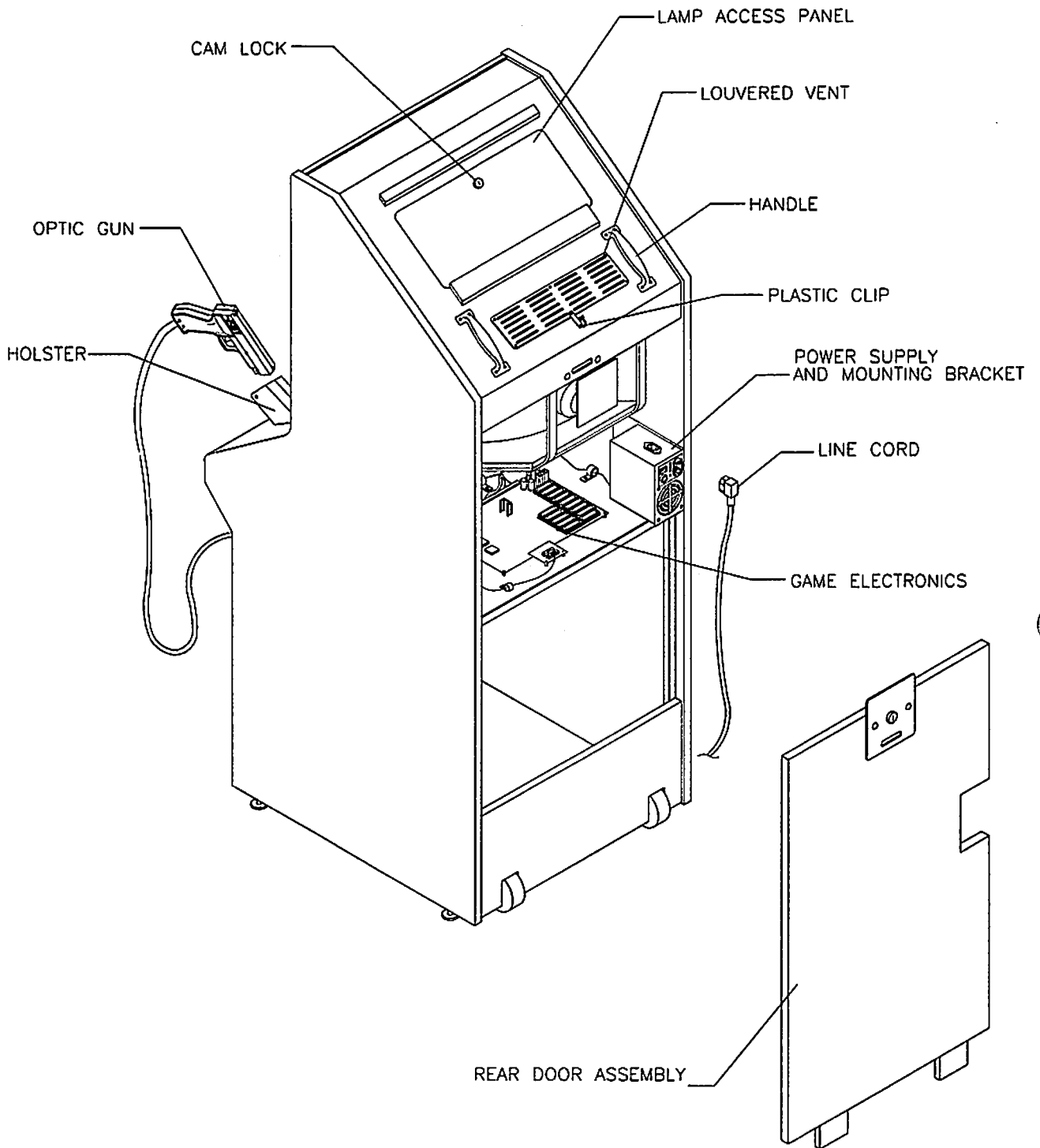
REAR VIEW OF TYPICAL COMPLETED CABINET

WIRE THE CABINET

👉	**NOTICE: JAMMA HARNESS REQUIRED.** This kit does not include a JAMMA harness, which is required to complete installation.
⚠	**CAUTION** Properly insulate unused wires within the JAMMA harness, especially power wires. (Power wires are red, yellow, orange or black.) Secure unused connectors away from the VGM electronics.

1. **GROUND WIRES** Locate the braided ground wires with the kit. Remove a KEPS nut on one of the gun mount bolts inside the cabinet. Repeat for the other gun mount. Attach one end of each ground wire to a bolt and reinstall the nuts. Attach the free ends of the ground wires to the central, common ground point in the cabinet. (Ground wires are usually green, although some may be green with a yellow stripe.) Verify low resistance continuity between the gun mounts and the cabinet's line cord ground pin.

⚠	**NOTICE** Electrical codes require you to ground exposed conductive assemblies for safe product operation. Proper grounding protects both the equipment and the players.

2. **DC POWER** Inspect existing cabinet wiring and compare it with the Typical Cabinet Wiring Diagram. Make all connections necessary. Be especially careful to correctly wire +5, -5 and +12-volt connections.

3. **START** Connect JAMMA harness wires to START buttons. Insulate unused control panel wires.

4. **GUNS** Mate the remaining connector of the right gun-to-main-harness cable with Gun Interface Board Assembly at (P2).
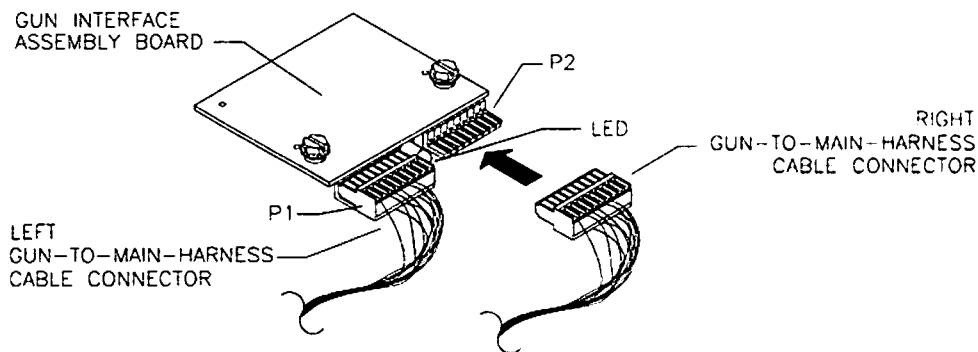
GUN-TO-MAIN-HARNESS CABLE CONNECTORS

5. Mate the remaining connector of the left gun-to-main-harness cable with Gun Interface Board Assembly at (P1). Connect the monitor sync cable to Gun Interface Board sync jack J1. (The sync cable is part of the JAMMA harness.) Secure cables to the cabinet with your own cable clamps and screws.

6. Connect JAMMA harness wires to speaker wires. Be certain to observe correct speaker polarity.

7. Connect ground wires that you loosened or removed earlier (control panel, coin door, etc.).

8. Place the FBI Warning Label next to the VGM electronics. Be certain the label is completely visible.

POWER UP AND TEST

1. Plug the power cord into the AC line and turn on the power. LEDs on the CPU Board Assembly should illuminate.

2. The game program loads and begins self-diagnostics. If no errors occur, the game automatically enters Attract Mode. If problems occur, note any on screen errors, check wiring, and troubleshoot the machine (see Troubleshooting Chapter).

3. Press and hold the TEST MODE switch button until the Test Menu appears.

4. Select Diagnostic Tests at the Main Menu.

Diagnostic Test Menu
Scroll with vol+ / vol-   Select with Any Button
Switch Test
Dip-Switch Test
System Test
Sound Test
Monitor Patterns
Burn-In Test
Coin Counter Test
Return To Main Menu
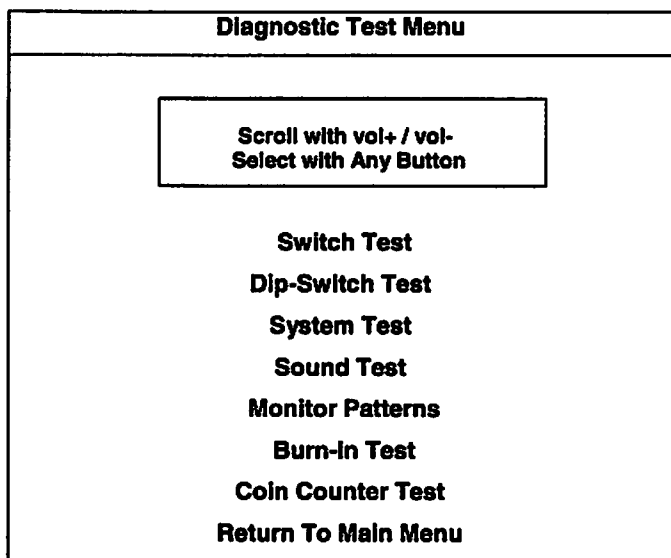
5. Perform each test in the Illustrated Diagnostic Test Menu list above. Tests are explained in the Operations Chapter.

6. When finished with the Coin Counter Test, select Return to Main Menu.

7. Select Exit to Game Over at the Test Menu. The system should enter Attract Mode. Press the SERVICE CREDITS button to allow game play. Choose a gun and press the START button to begin play. Listen to the audio while playing the game. Note sound irregularities (phase problems, no low frequencies, etc.). If you find problems, check the wiring harness for internal shorts or breaks.

8. Replace the rear cabinet door. Allow the system to operate for several hours before attempting any game changes. Verify that the monitor is adjusted for best video display characteristics.

9. After you confirm proper operation, submit the VGM for FCC or other agency approval.

	NOTICE: FCC COMPLIANCE. Installing this kit in an existing VGM does not guarantee compliance with FCC requirements. You are solely responsible for acquiring an FCC compliance label. Remove existing FCC compliance labels and do not install a new label on the converted VGM until you have verified compliance at a certified test facility.

10. Press and hold the TEST MODE button until the Invasion Test Menu appears on the screen.

11. Select Game Violence at the Game Adjustments Menu. Set the game violence level as desired. Return to the Game Adjustments Menu and set the other variables as desired. Exit to Game Over.

12. Shoot aliens. Collect currency or tokens. Enjoy.

⊕— Bolt Hole .25"

START Button
1.187"

⊕   ⊕
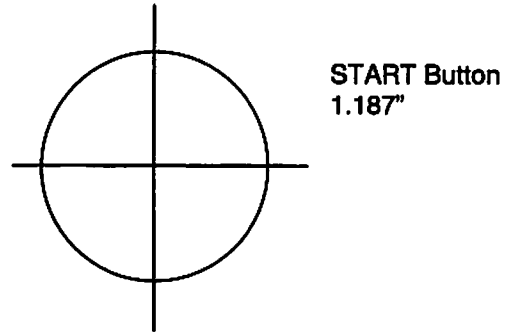
Bolt Hole .25"   Bolt Hole .25"

LEFT HOLSTER/START BUTTON MOUNTING TEMPLATE

⊕— Bolt Hole .25"
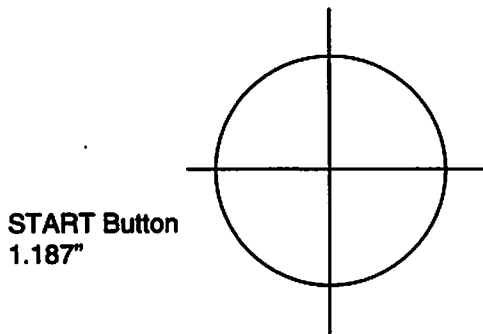
START Button
1.187"

Bolt Hole .25"   Bolt Hole .25"

⊕   ⊕

RIGHT HOLSTER/START BUTTON MOUNTING TEMPLATE

TOP EDGE

Bolt Hole .27"

Bolt Hole .27"

Cable Thru Hole 1.75"

Bolt Hole .27"
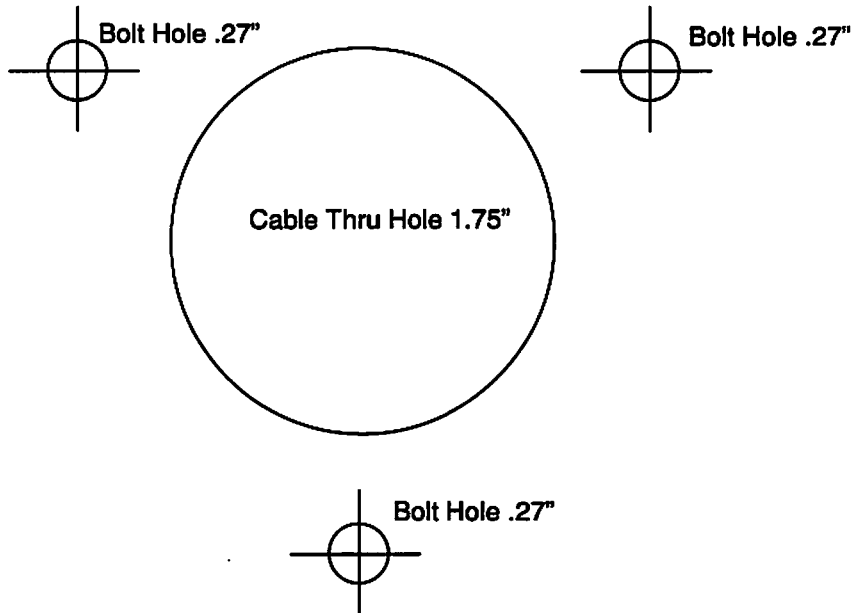
GUN MOUNTING TEMPLATE (LEFT AND RIGHT)

INVASION™ KIT
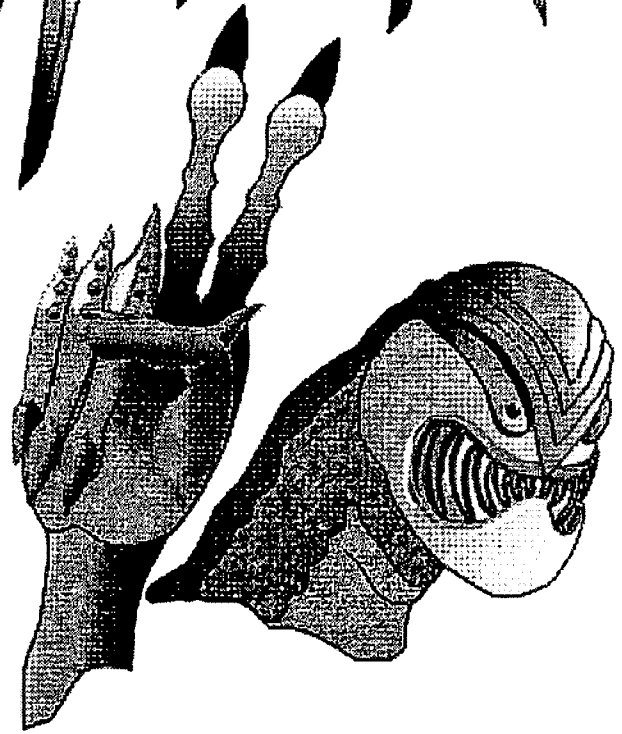
OPERATION, FEATURES, MAINTENANCE & SERVICING

GAME OPERATION
STARTING UP
Whenever you turn on the machine or restore power, the system executes boot ROM code. The boot ROM contains self-diagnostic tests. These tests automatically verify and report the condition of game hardware. The screen is blank during these tests. If the hardware fails a test, the system displays an error message. The message appears for 30 seconds or until someone presses a button.

* If nobody presses a button, the system quickly completes tests, and then loads game software.
* To skip boot ROM tests and activate the Menu System, press and hold the TEST MODE button.

Having passed power-up tests, the system enters Attract Mode. Attract Mode consists of typical game scenes and sounds, alternating with high scores. Attract Mode continues until game play commences.

GAME RULES

ONE OR TWO PLAYERS
Players insert currency to start the game. Each player chooses a gun and presses the nearest START button. One player selects a theater of war by shooting its name on the screen. (The first to shoot a theater of war selects for both players.) Each character receives a starting health level. The game commences. Indicator bars at the top of the screen graphically compare player scores. New players can join the ongoing competition by inserting currency and pressing START. Play progresses until players exhaust their characters' health. If players choose not to continue, the system returns to Attract Mode.

PLAYER CONTROLS

* **START Buttons**
  These buttons allow players to begin or continue play. These same buttons select items from the menu during service.

* **GUNS**
  Use a gun (Multi-Mode Plasma Disrupter) to shoot aliens and other enemies. Also use a gun to shoot player health and gun-upgrade symbols. Upgrades include rapid fire, missiles, the death ray, a shield and an extra life.
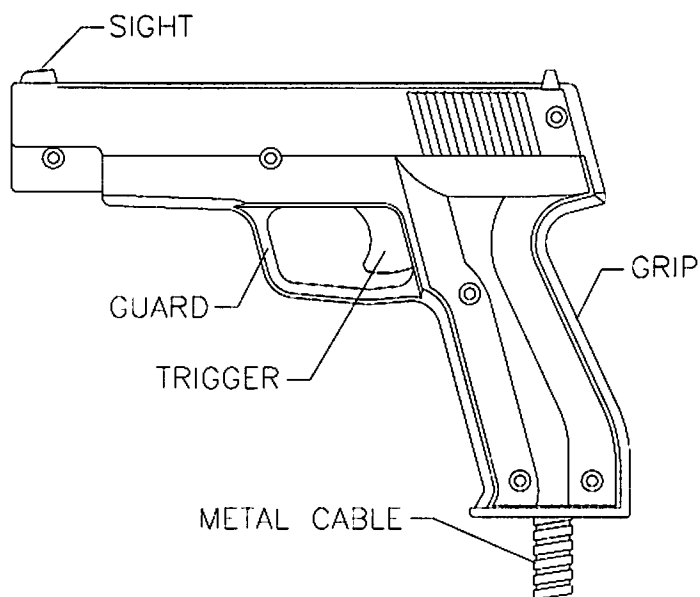
GUN PARTS

OPERATOR CONTROLS

CABINET CONTROLS

- **The DIP Switches** set some system variables. You can set other variables with diagnostic control switches.

- **The Monitor Remote Control Board** allows you to adjust the video display for optimum viewing.

- **The POWER Switch** turns off the game, but does not reset game variables.

DIAGNOSTIC CONTROL SWITCHES

- **The SERVICE CREDITS Button** allots credits without changing the game's bookkeeping total. SERVICE CREDITS has no function in the menu system.

- **The TEST MODE Button** causes the game to enter the menu system. Press the TEST MODE button briefly to run automatic tests. To make game adjustments, press and hold TEST MODE until the Main Menu appears. Within the menu system, TEST MODE assumes another function. There, it selects a menu line item and calls up the item's submenu. The screen displays this submenu.

- **VOLUME DOWN and VOLUME UP Buttons** set game sound levels. To make minor volume changes, press either button briefly. To make major changes, press and hold a button. In the menu system, VOLUME UP moves the item highlight bar up the menu. VOLUME DOWN moves the item highlight bar downward.

(⟨·⟩)	**NOTICE:** You must adjust Attract Mode volume independently of Game Mode volume. For greater profits, increase volume levels to draw attention to this game.

EQUIVALENT MENU NAVIGATION CONTROLS
In most cases, certain player switches can duplicate the functions of the diagnostic buttons. Before player switches assume diagnostic functions, you must enter the Menu System. Press TEST MODE to invoke the Main Menu. You may find menu navigation easier with the player switches. Here are the player switch functions within the Menu System...

Player Panel Button	Function	Equivalent Diagnostic Switch
PLAYER-1 GUN	Move up the menu	VOLUME UP
PLAYER-2 GUN	Move down the menu	VOLUME DOWN
PLAYER-1 START	Select a menu item	TEST MODE
PLAYER-2 START	Select a menu item	TEST MODE

GAME FEATURES

Invasion is the quintessential, take-no-prisoners dream of every intergalactic soldier of fortune. Dastardly, insectivoid aliens have once again infested several of your leading Earth cities. Earthlings, according to their custom, offer meteoric mercenaries a generous bounty to rescue the planet. The player, our Pleiades paladin, proudly casts a humble homburg into the ring. At last, fortune has smiled upon planet Earth! Here in our hour of need, is our perfect protector. For who else could avenge our beleaguered urban centers? Who else displays boundless, bare-knuckled bravado? Who else possesses that mighty, silver weapon, the dynamic demon demodulator? No one else but this heroic, humanoid hombre.

The theaters of war include Chicago, New York, Los Angeles and the Mother Ship. The game associates an individual difficulty level with each theater. Play begins after a player selects any of the three city theaters. Only after securing all cities can vital, veteran players undertake the macabre Mother Ship mission. Two players can play simultaneously.

As play commences, the game assigns each player a set number of lives. A mission's object is to preserve these lives and exterminate aliens or demolish war materiel. While avoiding collateral damage to civilians, players must also rescue civilians from alien tractor beams. Otherwise, aliens heinously hydrogenate the minds of their prisoners of war. After reformulation, the pitiful POW wretches return as ferocious, flesh-eating zombies. Ah, the humanity! These tragic, rabid creatures mindlessly and mercilessly plunder player positions. Only benevolent bullets can offer them surcease.

Block by block and sector by sector, players advance through each city. Feelers fly. Pincers percolate. Exoskeletons explode. To secure a sector, players must eliminate a quota of aliens, zombies or equipment. Progress from one sector to the next is automatic. After each mission, players who retain lives select another mission and continue crumbling chitinous creatures.

If antagonistic, arthropod attackers succeed in taking a player's last life, a "Continue" message appears. The message invites the player to reenlist by inserting currency.

Between sector sorties, game action pauses. The system reports player scores and performance ratings. A second player can enlist whenever the game displays a "Join-In" message.

At various intervals throughout the game, players can acquire weaponry. Players shoot floating "Power-Up" symbols to obtain rapid-fire or special weapons. During single-fire play, screen messages periodically remind each player to reload the gun. An ammunition display also provides a bar graph of remaining bullets in the player's clip. During rapid-fire play, the game automatically resupplies the player's weapon.

Aliens return players' fire and attack player positions. An alien hit reduces player health. Play continues until both players exhaust their lives.

At the end of the game, high-scoring players can enter their initials. If players don't purchase more credits, the game returns to its Attract Mode.
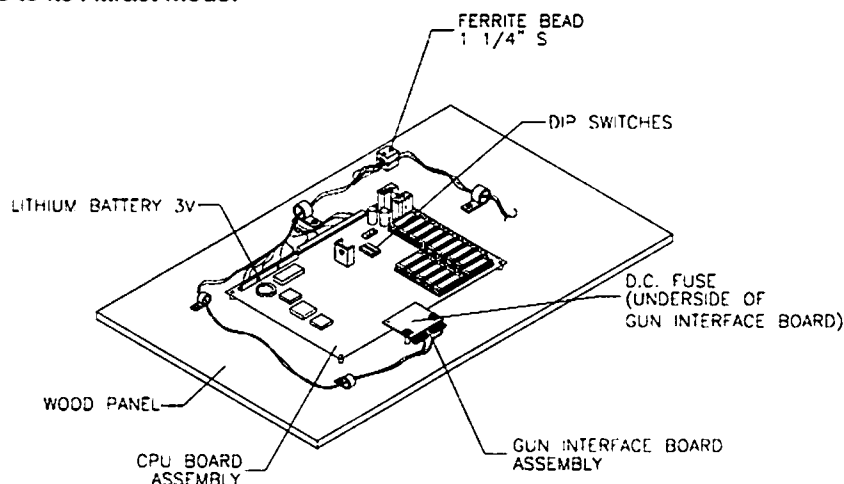
INTERNAL COMPONENTS

MAINTENANCE AND SERVICING

● **Guns**

Dirt or debris on a gun lens can affect accuracy. Apply the cleaner to a clean cloth or cotton swab. Use the swab to wipe the lens clean. *Don't apply cleaner directly into the gun barrel!*

Only qualified service personnel should perform maintenance and repairs. The following product guidelines apply to all game operators and service personnel. Notes, cautions and warnings appear throughout this manual where they apply. Read the SAFETY pages thoroughly before beginning service.

● **Battery**

Switch off power to the game. Unlock and remove the rear door. If the electronics assembly has a cover, open it. Note the battery position in the socket. Gently lift the contact arm to release tension. *Don't bend the arm.* Apply slight finger pressure to pry the cell from its holder. Slide the battery out and remove it from the cabinet. *Avoid shorts across terminals or between terminals and ground.*

To reinstall the battery, orient it near its holder and slide it in under the contact arm. *Don't use force.*

⚠️	**CAUTION:** If you incorrectly install the battery, it may explode. Replace the battery only with the same type, or an equivalent recommended by the manufacturer. Match original batteries in size, voltage rating, and composition. Dispose of used batteries according to instructions printed on the battery or the manufacturer's packaging.
👉	**NOTICE:** Avoid an explosion! These batteries are designed for very long life. Don't attempt to recharge them! Avoid direct shorts across battery terminals, or from terminals to ground. While servicing the game, remove batteries from their holders and store them in a safe place. *The battery is on the CPU Board.*

● **CPU Board**

Switch off power to the game. Open the rear door. If the electronics assembly has a cover, open it. Carefully note the orientation of the JAMMA connector and the other cables. Remove CPU Board mounting screws. Separate the Gun Interface Board from the CPU Board. Lift the CPU Board out of the cabinet and set it in a safe place. Use anti-static packaging from new parts to store boards that you won't reinstall.

● **Gun Interface Board**

Switch off power to the game. Unlock and remove the rear cabinet door. If the electronics assembly has a cover, open it. Disconnect the wiring harness from the Interface Board. Remove the board-mounting screws and washers and retain them. Lift the board out of the cabinet and set it in a safe place. Position the replacement board over the CPU Board, align the holes and install the screws. Reinstall the Interface Board wiring harness.

● **Guns**

Switch off power to the game. Unlock and open the coin door. Disconnect the gun cable from the wiring harness. Remove the locking nuts. Lift the gun cable mount off the front of the cabinet. Retain carriage bolts and nuts from the mount for reinstallation. Reattach the ground connection. Check that the gun cable rotates freely in its mount. Reinstall carriage bolts. Tighten locking nuts.

To disassemble a gun, lay the gun on a work surface and remove the screws. Separate the gun halves, beginning at the handle. Take care not to dislodge parts. (The trigger is spring loaded.) Clean the lens to remove fingerprints and dust. If you removed shields from the gun, reinstall them. After reinstallation, verify that a good electrical connection exists between the shield and cable ground.

BACK LIT MARQUEE

BEZEL

VIEWING GLASS

MONITOR

OPTIC GUN

HOLSTER

START BUTTONS

HOLSTER

CONTROL
PANEL DECAL

OPTIC GUN

SPEAKER

COIN DOOR

CASH DOOR

SCREENED CABINET

LEG LEVELERS
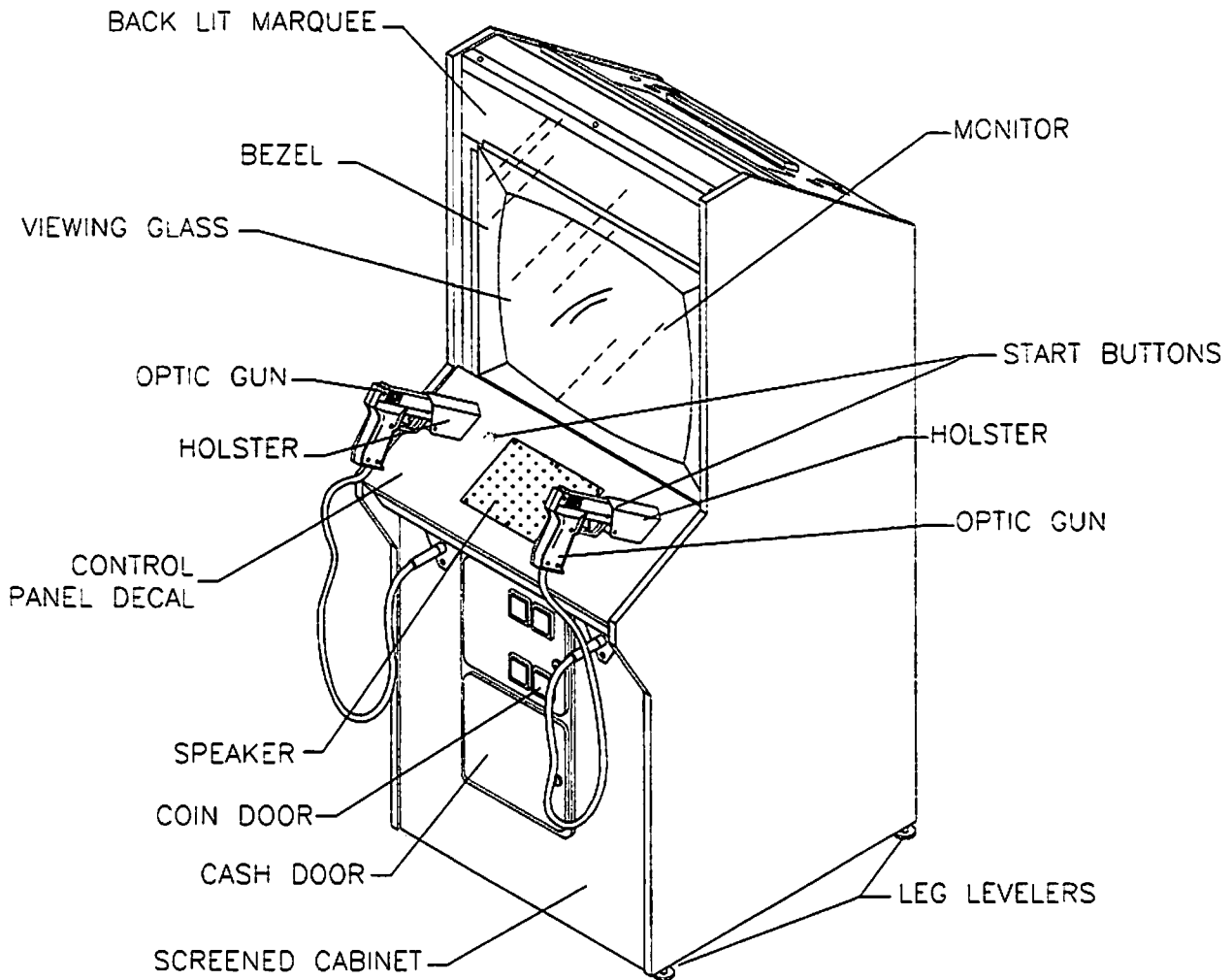
TYPICAL EXTERNAL COMPONENTS

CAUTION: Static electricity builds up on your body. This static can damage or destroy sensitive game circuits. BEFORE touching or handling electronic assemblies, discharge static electricity by touching the power supply chassis.

- ## Memory: ROMs

  ROM *(Read Only Memory)* circuits permanently store your game's-operating instructions. Switch off power to the game. Unlock and remove the rear door. If the electronics assembly has a cover, open it. Note the ROM chip position. Remove the device with a chip extraction tool. To reinstall a ROM chip, orient the device over its socket. Press the chip firmly to seat pins. *Don't force the chip into the socket.*

- ## Memory: RAMs

  DIP *(Dual Inline Package)* circuits contain your game's random-access, or read-write memory. In this game, RAM chips are soldered to the CPU Board. As a result, these RAMs aren't user serviceable.

INVASION™ KIT

Chapter

DIAGNOSTIC, AUDIT & ADJUSTMENT MENU SYSTEM

MENU SYSTEM

WHAT IS THE MENU SYSTEM?
The game's Menu System is a series of auditing, game adjustment and diagnostic screens. You can easily access and apply these screens to optimize game performance. For instance...

- Use game audits screens to assess game performance.
- Use adjustment screens to help you to customize game performance. For instance, you can restore factory default game settings. You can also calibrate player controls for accuracy.
- Use diagnostic screens to verify proper equipment operation.

ACTIVATING THE MENU SYSTEM
Open the coin door. Find the TEST MODE switch inside. Press TEST MODE to invoke the Menu System. The game system responds by exiting Game Mode and entering Diagnostic Mode. The system runs a brief self-test, and then displays the Main Menu. The Main Menu is the opening screen of the Menu System.

Game audits, adjustments and diagnostics are line items on the Main Menu. Selecting an item opens its submenu. Every submenu presents various options that you may act upon.

```
┌─────────────────────────────────────────────────────┐
│              Invasion Test Menu                      │
│              Game Code Version X.X                    │
├─────────────────────────────────────────────────────┤
│    ┌──────────────────────────────┐                  │
│    │  Scroll with vol+ / vol-     │                  │
│    │  Select with Any Button      │                  │
│    └──────────────────────────────┘                  │
│    ┌──────────────────────────┐                      │
│    │     Diagnostic Tests     │  ┌────────────────┐  │
│    │    Coin Bookkeeping      │  │  Switch Test   │  │
│    │      Game Audits         │  │ DIP Switch Test│  │
│    │    Main Adjustments      │  │  System Test   │  │
│    │    Game Adjustments      │  │   Sound Test   │  │
│    │       Utilities          │  │ Monitor Patterns│ │
│    │      System Info         │  │  Burn-In Test  │  │
│    │    Volume Adjustment     │  │ Coin Counter Test│ │
│    │    Exit to Game Over     │  └────────────────┘  │
│    └──────────────────────────┘                      │
└─────────────────────────────────────────────────────┘
```
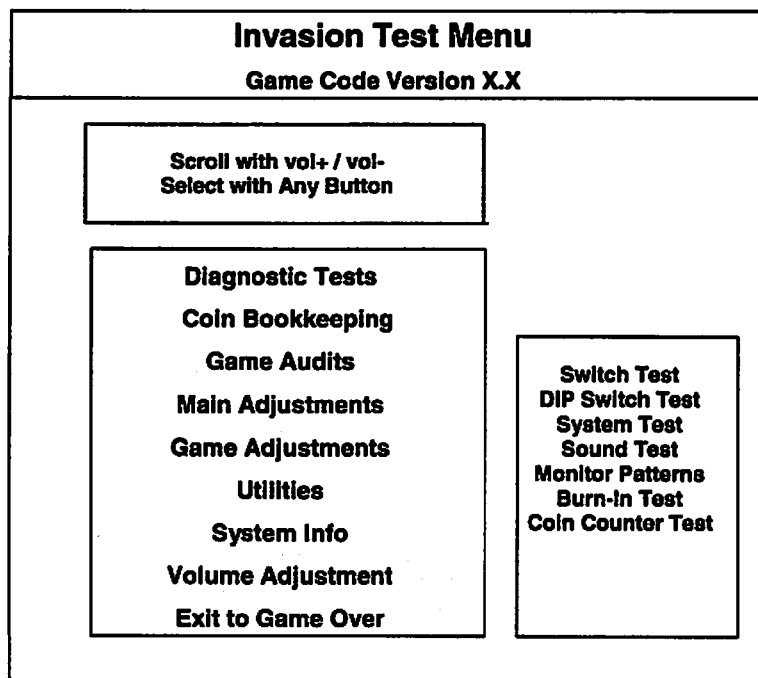
MAIN TEST MENU

MENU LAYOUT
Menus differ, but related information tends to occupy the same screen locations.

- The block at the top, center of each screen displays the current menu title.
- Data (menu items, video signals, statistics, reports, etc.) appears in the center of the screen.
- Messages (explanations, control functions, revision levels) display at the bottom of the screen.

MENU NAVIGATION CONTROLS
Use VOLUME UP and VOLUME DOWN buttons to highlight an item on any menu. (These buttons are inside the coin door.) Alternately, you may highlight an item with the LEFT GUN and RIGHT GUN triggers. *You can only select one highlighted item at a time.* To select a highlighted item, press either

START button. You can also select with the TEST MODE (rightmost) button inside the coin door. To return the game to play, highlight EXIT TO GAME OVER. Then press either START button.

AUTOMATIC SELF TEST
Whenever you switch the game between Play Mode and the menu system, the self-test activates. This routine runs automatically. It can detect faults that cause game or menu system malfunctions. A self-test usually takes less than a minute.

Main Menu *(continued)*
Diagnostic Test Menu

DIAGNOSTIC TESTS
Select DIAGNOSTIC TESTS at the Main Menu. Diagnostic tests allow you to verify the condition of the electrical and electronic hardware in the game.

Highlight a test with the middle two control buttons inside the coin door. Select the option with either START button.
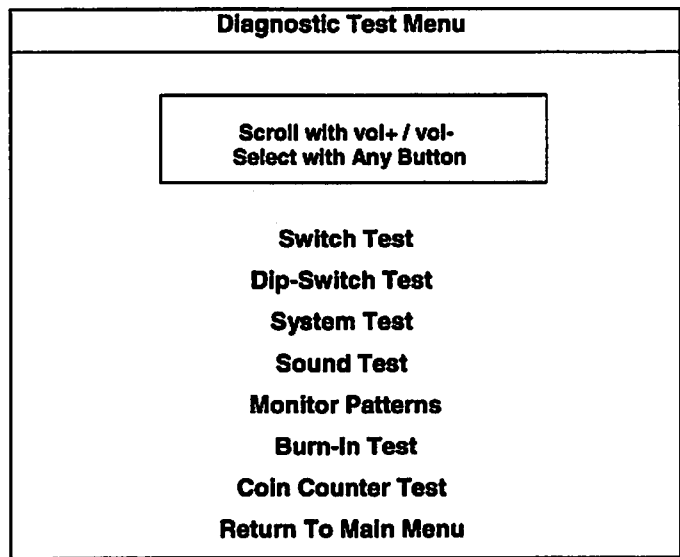
DIAGNOSTIC TEST MENU
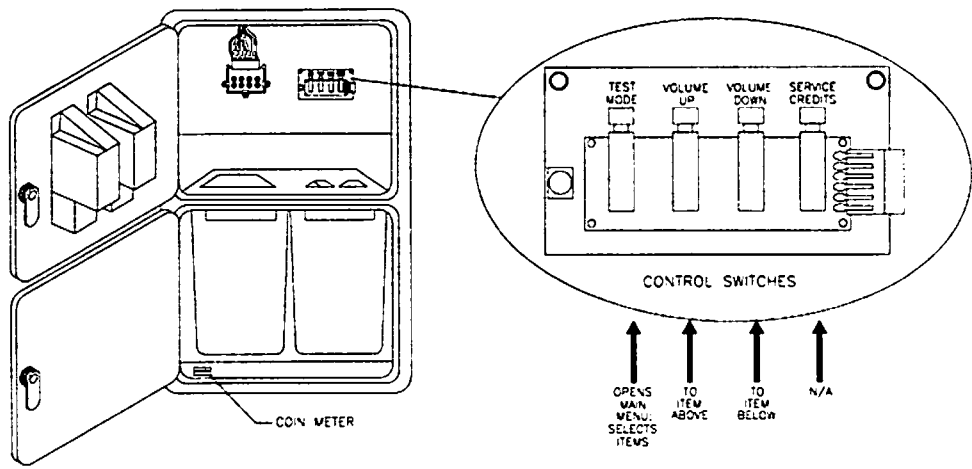
TYPICAL DIAGNOSTIC SWITCHES

SWITCH TEST

Select SWITCH TEST at the Diagnostic Test Menu. The Switch Test Menu opens. This menu verifies proper operation of the game's switches, including buttons and gun switches.

Activate each switch, and the indicator on the screen changes state. Release the switch and the indicator returns to its previous, normally open or closed condition. You can test any combination of switches. To exit the test, simultaneously press both START buttons.

```
 ○  Start 1              ○  Start 2

 ○  Gun 1                ○  Gun 2

○ Coin 1     ○ Coin 2    ○ Coin 3    ○ Coin 4

○ Vol +      ○ Vol -     ○ Bills     ○ Door

○ Credit     ○ Tilt      ○ Service

         Press Both Start Buttons To Exit
```

SWITCH TEST SCREEN

Switch Indications. Switches appear on the screen as hollow, blue circles. A circle with a black center indicates an open switch. A circle with a yellow center indicates a closed switch. Any other center color indicates a fault. Whenever you toggle a button or pull a gun trigger, a circle should change color.

Use the Switch Test to locate crossed wires, improper cabling, intermittent conditions and stuck switches.

	NOTICE: This game may not use some switches. If you can't find one of the listed switches, check the wiring diagram.

DIP SWITCH TEST

Select DIP SWITCH TEST at the Diagnostic Test Menu. Two 8-position DIP switch banks reside on the CPU Board. The DIP Switch Test Menu reports the positions of 16 switches in these banks.

Highlight a test with the middle two control buttons inside the coin door. Select the option with either START button. The screen displays an illustration of each switch block and the current settings.

You can change DIP switch positions with power on. Set any switch. Then check the screen to verify that the new setting is enabled. Turning on the COINAGE CONTROL disables country switch settings.

Refer to the DIP Switch Tables for assistance in choosing switch positions (* indicates factory defaults). To exit the DIP Switch Test, press any game button.
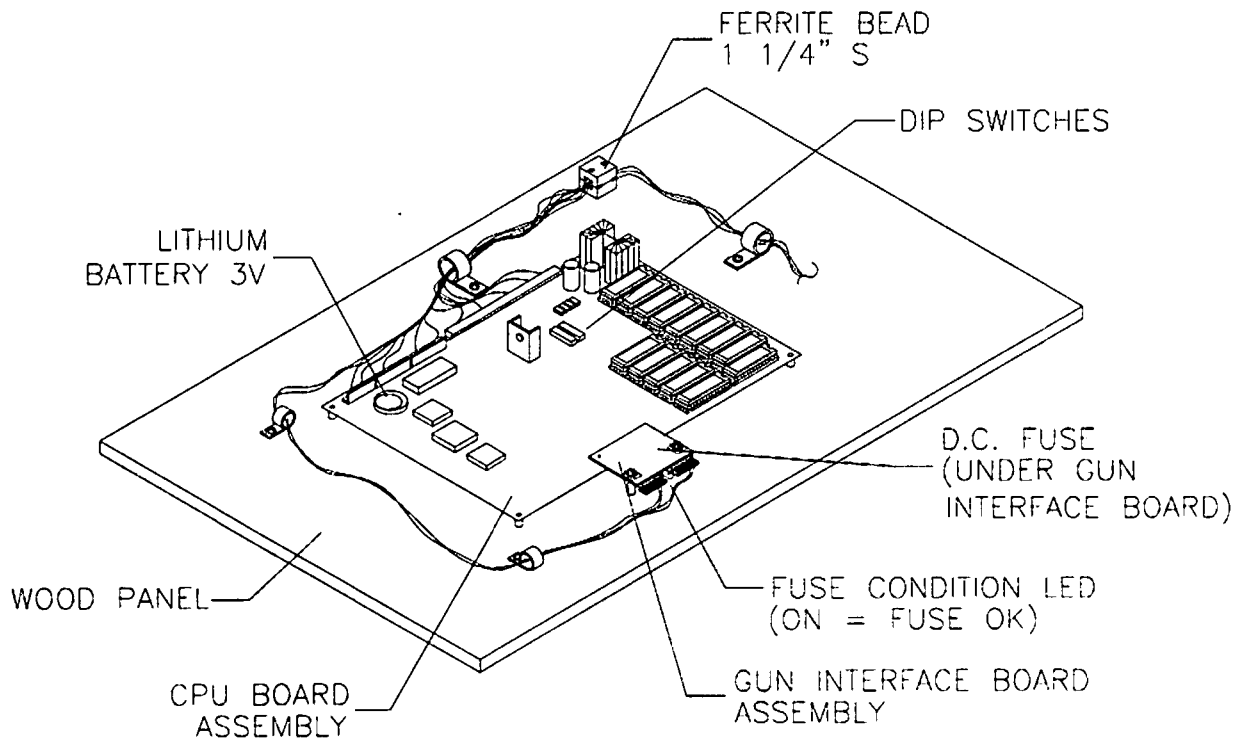
CPU BOARD, SHOWING DIP SWITCH LOCATION

DIP SWITCH TABLES

DIP Switch 1	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
Normal Display (for game play)[1]	Off*							
Inverted Displ (for mirror viewing)	On							
Show Blood		Off*						
Don't Show Blood		On						
Not Used			Off*					
Not Used			On					
Not Used				Off*				
Not Used				On				
Not Used					Off*			
Not Used					On			
Not Used						Off*		
Not Used						On		
Not Used							Off*	
Not Used							On	
Not Used								Off*
Not Used								On

DIP Switch 2	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
Coinage DIP Switch	Off							
Control CMOS	On*							
CMOS Pricing Selector								
USA1 Ger1 Fr ECA1 UK1		Off*	Off*	Off*				
USA2 Ger2 Fr ECA2 UK2		On	Off	Off				
USA3 Ger3 Fr ECA3 UK3		Off	On	Off				
USA4 Ger4 Fr ECA4 UK4		On	On	Off				
USA5 Ger5 Fr ECA5 UK5		Off	Off	On				
USA9 Ger9 Fr ECA9 UK9		On	Off	On				
USA10/Ger10/Fr ECA10/UK ECA		Off	On	On				
USA ECA / Ger ECA / Fr ECA8		On	On	On				
Free Play (All Countries)		On	On	On				
Country Selector								
USA					Off*	Off*		
France					On	Off		
Germany					Off	On		
United Kingdom[2]					On	On		
Not Used							Off*	
Not Used							On	
Operating Mode								
Game Mode								Off*
Test Mode								On

[1]The screen doesn't flip until you reenter Game Mode.
[2]Except Free Play, which is "on" for SW2 through SW6.
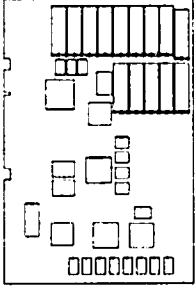
SYSTEM TEST

Select SYSTEM TEST at the Diagnostic Test Menu. The System Test Menu opens. This menu verifies that crucial system components operate properly. These components include the controller (PIC), clock, RAM and ROM memory chips, microprocessor, etc.

Highlight a test with the middle two control buttons inside the coin door. Select the option with either START button.
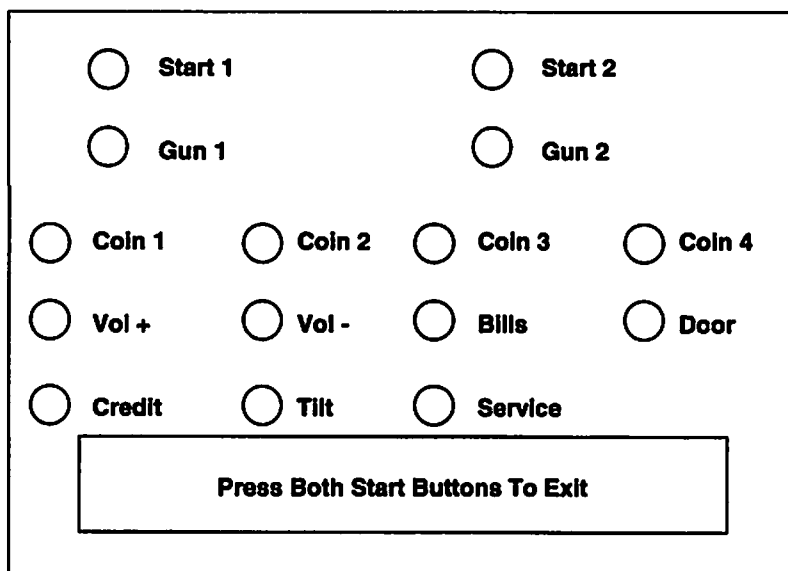
```
System Test

(Hold any button to skip)

00:00:00 AM

Day-name Month-name DD YYYY

          PIC                OK
          PIC NV RAM         OK
          Clock              OK
          Wave RAM Bank 1    OK
          Wave RAM Bank 0    OK
          Fast RAM           OK
          Game ROMs          OK
          CMOS Memory        OK
          Display INT        OK
          ZEUS Chip          OK
          Sound System       OK

        ┌─────────────────────────────────┐
        │    Hit Any Button to Continue   │
        └─────────────────────────────────┘
```

SYSTEM TEST MENU

The System Test incorporates several diagnostic routines. These routines analyze the digital system circuits, and can detect system memory problems. Test results appear on the screen as messages. Reports other than OK indicate a problem.

SOUND TEST

Select SOUND TEST at the Diagnostic Test Menu. The Sound Test Menu appears. This menu helps you to verify that audio components are connected and operate properly.

Highlight a test with the middle two control buttons inside the coin door. Select the option with either START button.

> **NOTICE:** To provide a realistic challenge to the sound system, increase the volume level. Check the volume setting before testing. Before returning to Game-Over Mode, reset the volume level to its original setting.

```
                      Sound Test Menu
            ┌──────────────────────────────────┐
            │      Scroll with vol +/ vol-     │
            │                                  │
            │      Select with Any Button      │
            └──────────────────────────────────┘

                    Sound System Test
                      Play Sounds
                   Return to Diags Menu
```

SOUND TEST MENU

```
        Sound DSP Test

   Sound system status:    OK




   ┌──────────────────────────┐
   │  Hit Any Button to Continue │
   └──────────────────────────┘
```
SOUND DSP TEST SCREEN

```
          Play Sounds

   Select sounds with vol+ / vol-

        Hit Buttons to Repeat

        Hit Start Button to Exit


            explosion 1
```
PLAY SOUNDS SCREEN

Sound DSP runs a diagnostic routine. This routine analyzes the digital signal processor circuit. Reports other than SOUND SYSTEM: OK indicate a problem.

Play Sounds allows you to recall and play certain game sounds from read-only memory. Distorted, duplicate, mislabeled or missing sounds indicate a problem. (On this menu, you can't use the guns to select sounds. Only the volume buttons serve that purpose.)

MONITOR TEST PATTERNS

Select MONITOR PATTERNS at the Diagnostic Test Menu. The Monitor Test Patterns Menu opens. This menu provides screens that help you to verify or adjust monitor performance.

Highlight a test with the middle two control buttons inside the coin door. Select the option with either START button.

Monitor Test Patterns Menu
Scroll with vol +/ vol-
Select with Any Button
Red Screen
Green Screen
Blue Screen
Color Bars
Gray Scale
Sizing Pattern
Return to Diags Menu
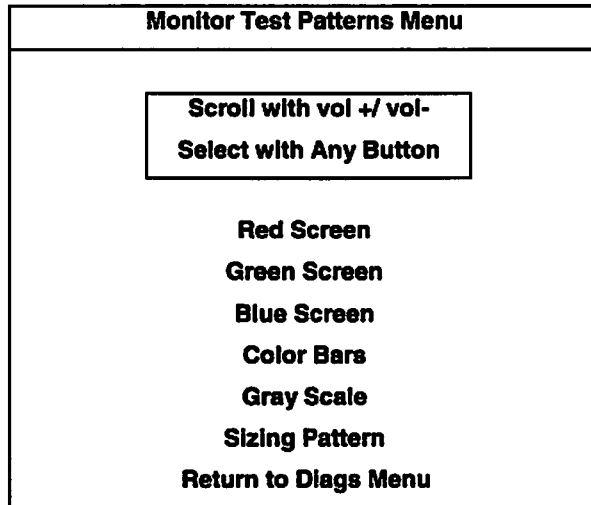
MONITOR PATTERNS MENU

Red, Green and Blue Screens fill the screen with the chosen color at normal intensity. These screens help you to adjust monitor intensity, black level, blanking and color purity. Color should remain uniform from one edge of the screen to the other. No retrace lines or color contamination (streaks of the wrong color) should appear. Defective monitor degaussing circuitry will contaminate one or more color screens.

Color Bars paints colored stripes down the screen. Use the color bars to help you to check or adjust monitor brightness and contrast. The color bars also expose defects in horizontal linearity. Each color bar consists of 16 intensity levels. On a properly adjusted monitor, the top 15 of these levels are visible. Each bar should appear sharp, clear, and distinct from bars on either side. Incorrect adjustment can cause missing detail at the top or bottom of a bar. Bent bars indicate horizontal linearity flaws, such as pie crust, pincushion or barrel distortion. *(Correct color bar colors, left to right: Red, Green, Blue, Black, White, Cyan, Yellow, Violet.)* Set controls as follows: 1. Adjust BRIGHTNESS and CONTRAST to minimum. 2. Turn up BRIGHTNESS until the pixels in the black stripe begin to glow (turn dark gray). 3. Bring up the CONTRAST control until you can see 15 bars.

Gray Scale creates a monochrome, middle-gray screen. This screen helps you to check or adjust monitor convergence, purity, contrast and intensity. This screen also simplifies black level and color gun control settings. The screen should be uniform, with no color tints, distortion, retrace lines or noise.

Sizing (Crosshatch) Pattern fills the screen with a grid and a series of dots. Crosshatch Patterns help you to check or adjust several monitor parameters: These include convergence, linearity, active viewing area and dynamic focus. The grid and the dots should be all white in color, with no fringes or parallel images. The lines should be straight and the dots round. For more detail on these adjustments, consult service literature from the monitor manufacturer.

If tests indicate a need for adjustment, use controls on the Monitor Remote Adjustment Board.

BURN-IN TEST

Select BURN-IN TEST at the Diagnostic Test Menu. The Burn-In Test Menu appears. Meanwhile, the system performs a semi-automatic test routine. Use this test to locate the cause of intermittent failures in these parts...

- Programmable Intelligent Controller chip (PIC)
- RAM chips
- Clock chip
- Battery-backed CMOS RAM chips
- Display interface
- Zeus microprocessor

When the test detects a CPU Board error, the test displays an error message.

Use the Burn-In Test to reproduce intermittent faults or infrequent failure modes. After the malfunction occurs, you can locate the cause of the problem troubleshoot the game.

```
Burn In Test

(Press and hold any button to exit)

Total Cycles Completed:              0
```

Description	Status	Pass	Fail
PIC	OK	1	0
PIC N/V RAM	OK	1	0
Clock	OK	1	0
Fast RAM	OK	1	0
CMOS Memory	OK	1	0
Display INT	OK	1	0
ZEUS	OK	1	0
Wave RAM 0	OK	1	0
Wave RAM 1	OK	1	0

BURN-IN TEST MENU

Highlight a test with the middle two control buttons inside the coin door. Select the option with either START button. The test you've selected becomes the first test of an automatic cycle. The cycle can detect faults that cause game or menu system malfunctions. One cycle through all the tests usually takes less than a minute. Messages appear on the screen as each item runs. These messages may describe errors. Write down messages before proceeding to the menus or game play.

To abort the test cycle and exit to the Main Menu, press either START button.

MECHANICAL COIN COUNTER TEST

Select COIN COUNTER TEST at the Diagnostic Test Menu. The Mechanical Coin Counter Test Menu appears. The Mechanical Coin Counter Test is a manual test. Use this test to locate jammed, burned-out or malfunctioning meters.

Open the coin and cash box doors. Highlight a meter designation. (METER 1, METER 2, etc.) Use the middle two control buttons inside the coin door. Watch the meter, which is inside the cash box door. Press either START button. A good meter will increment once for each time that you press START.

```
+-------------------------------------------------+
|           Mechanical Coin Counter Test          |
|-------------------------------------------------|
|                                                 |
|  Use vol +/ vol- to select meter.               |
|  Press any button to click selected meter.      |
|  Hit START to exit.                             |
|                                                 |
|                                                 |
|                                                 |
|  METER 1     METER 2     METER 3     METER 4    |
|                                                 |
|                                                 |
+-------------------------------------------------+
```

MECHANICAL COIN COUNTER MENU

COIN BOOKKEEPING

Select COIN BOOKKEEPING at the Main Menu. The Coin Bookkeeping Menu permits you to assess the currency collection. The report screen presents revenue quantities and other important game statistics.

Highlight a line item with the middle two control buttons inside the coin door. Select the option with either START button. A menu screen appears as below.

COIN BOOKKEEPING

Left Slot Coins	XXXXXXXX
Right Slot Coins	XXXXXXXX
Center Slot Coins	XXXXXXXX
Fourth Slot Coins	XXXXXXXX
Bill Validator Count	XXXXXXXX
Paid Credits	XXXXXXXX
Service Credits	XXXXXXXX
Total Plays	XXXXXXXX
Total Collection	XXXXXXXX

Hit Any Button to Continue

COIN BOOKKEEPING MENU

The Coin Bookkeeping Menu reports total quantities of coins, bills or credits collected by each active device. The menu doesn't calculate the value of the collected currency.

This screen reports information, but doesn't permit you to make changes. To reset the coin, bill, and credit counters to zero, use the Clear Audits menu.

Examine and record audit information before you make changes. Once you've cleared the counters, you can't retrieve the previous data from the system.

GAME AUDITS

Select GAME AUDITS at the Main Menu. The Game Audits menus permit you to review game play statistics. Additional menus give detailed reports for each player position on game starts, ends, cabinet abuse, fault conditions, etc.

Highlight a line item with the middle two control buttons inside the coin door. Select the option with either START button. The screen displays a list of the statistics available to you. Select an item to view the detailed report.

Audits Menu
Scroll with vol+ / vol- Select with Any Button
View Game Audits **Return To Main Menu**
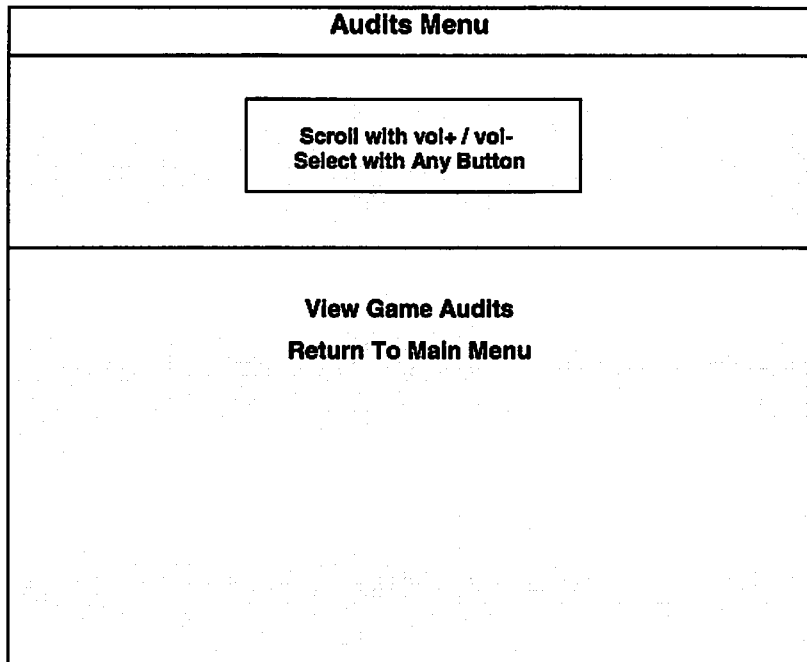
AUDITS MENU (SCREEN 1)

Data in the Audits menus helps you to keep records of the game's popularity and earning potential. Each Audits Menu entry is the subject for one or more screens of bookkeeping information. Use the highlight bar to select the desired subject.

Examine and record all audit values before performing game service or repairs.

	NOTICE: Be careful when clearing audit information. Once you clear data, you cannot restore it.

```
                        Audits

        UP TIME H : M: S                    XX:XX:XX
        NUMBER OF GAMES                          XXX
        TOTAL STARTS (ALL BUY-INS)               XXX
        TOTAL CREDITS                            XXX
        TOTAL PLAY TIME H: M: S:            XX:XX:XX
        AVG PLAY TIME H: M: S:              XX:XX:XX
        AVG CONTINUES PER GAME                   XXX
        AVG TIME PER CREDIT H: M: S:        XX:XX:XX
        AVG CREDITS PER GAME                     XXX
        ONE PLAYER TIME H: M: S:            XX:XX:XX
        TWO PLAYER TIME H: M: S:            XX:XX:XX


                    Next Page

                  Return to Menu
```

AUDITS MENU (SCREEN 2)

UPTIME H: M: S. Total on time, measured in hours, minutes and seconds.

NUMBER OF GAMES. Number of games that players played on this Video Game Machine *(VGM)*.

TOTAL STARTS (ALL BUY-INS). Number of games initiated by inserting currency into the VGM. (Sum of Player Starts, Player Joins and Player Continues.)

TOTAL CREDITS Number of credits that players purchased on this VGM.

TOTAL PLAY TIME H: M: S: Hours, minutes and seconds of play for this VGM.

AVG PLAY TIME H: M: S: Approximately how long one game lasts. (Total Play Time / Total Starts.) Two minutes is typical for a new VGM. If games seem to run too long, adjust difficulty settings to make games shorter. If games don't seem to last long enough, adjust difficulty settings to lengthen games.

AVG CONTINUES PER GAME. Approximately how often players pay to continue a game.

AVG TIME PER CREDIT H: M: S: Approximately how long players play per each credit.

AVG CREDITS PER GAME. Approximate number of credits players buy during the course of a game.

ONE PLAYER TIME H: M: S: Length of all one-player games, measured in hours, minutes and seconds.

TWO PLAYER TIME H: M: S: Length of all two-player games, measured in hours, minutes and seconds.

```
                        Audits

        PLAYER STARTS                    XXX
        PLAYER JOINS                     XXX
        PLAYER CONTINUES                 XXX
        PLAYER ENDS                      XXX
        GAME OVERS                       XXX
        GAME WINS                          X
        TWO COUNT                        XXX
        PLAYTIME SECONDS               XXXXX
        TWO PLAYER SECONDS             XXXXX
        UP TIME                      XXXXXXX

                     ┌──────────────────┐
                     │    Next Page     │
                     ├──────────────────┤
                     │  Previous Page   │
                     ├──────────────────┤
                     │  Return to Menu  │
                     └──────────────────┘
```

AUDITS MENU (SCREEN 3)

PLAYER STARTS. Number of games that players started without anyone else playing.

PLAYER JOINS. Number of games where a second player paid to join in.

PLAYER CONTINUES. Number of games that players paid to continue.

PLAYER ENDS. Number of times that the player lost all his character's lives.

GAME OVERS. Number of games where the player didn't continue. (The VGM displays GAME OVER).

GAME WINS. Number of games where the player completed all waves, including the Mother Ship Wave.

TWO COUNT. Number of two-player games.

PLAYTIME SECONDS. Total game play time, expressed in seconds.

TWO PLAYER SECONDS. Total two-player play time, expressed in seconds.

UP TIME. Video game machine on time, expressed in seconds.

```
┌──────────────────────────────────────────────┐
│                    Audits                      │
├──────────────────────────────────────────────┤
│  SYSTEM FLAGS                           XXX    │
│  WATCHDOGS                              XXX    │
│  VERSION                                XXX    │
│  CSUM                                   XXX    │
│  FACTORY RESET            XXX/XX/XX  X:XX      │
│  COINS CLEARED            XXX/XX/XX  X:XX      │
│  CREDITS CLEARED          XXX/XX/XX  X:XX      │
│                                                │
│                                                │
│              ┌─────────────────────┐           │
│              │   Previous Page     │           │
│              ├─────────────────────┤           │
│              │   Return to Menu    │           │
│              └─────────────────────┘           │
└──────────────────────────────────────────────┘
```

AUDITS MENU (SCREEN 4)

SYSTEM FLAGS is a hexadecimal number that counts hardware status messages. System flags include peripheral messages such as whether the bill validator is on or off.

WATCHDOGS. Watchdogs record the number of times that the watchdog circuit reset the game software. Watchdog resets may occur due to VGM *(video game machine)* hardware problems or corrupted software. External circumstances, such as power line glitches or electromagnetic interference may also cause resets. The watchdog hardware times out and resets the system during any unusually long software loop. If unchecked, such loops tend to freeze game action indefinitely. Of course, the reset terminates the game in play. But the reset also returns the VGM to a playable state. If the Watchdogs indication reveals frequent resets, check the VGM and its power environment.

VERSION. Version number of game software in this video game machine. (BCD format)

CSUM. CMOS RAM checksum in hexadecimal. This number depends on the game version.

FACTORY RESET. Date and time when someone last reset game software to factory defaults.

COINS CLEARED. Date and time when someone last cleared coin totals.

CREDITS CLEARED. Date and time when someone last cleared credit totals.

MAIN ADJUSTMENTS

Select MAIN ADJUSTMENTS at the Main Menu. Main Adjustments is a menu of screens that permit you to change game characteristics. Use these screens to optimize game performance and earnings. You'll find more of this type of adjustments on the Game Adjustments Menu.

Highlight a line item with the middle two control buttons inside the coin door. Select the option with either START button.

```
┌─────────────────────────────────────────────────┐
│           MAIN ADJUSTMENTS MENU                 │
├─────────────────────────────────────────────────┤
│                                                 │
│          ┌───────────────────────┐              │
│          │   Scroll with vol+ / vol- │           │
│          │   Select with Any Button  │           │
│          └───────────────────────┘              │
│                                                 │
│              Standard Pricing                   │
│              Custom Pricing                     │
│             Mechanical Counters                 │
│                Bill Validator                   │
│                 Free Play                       │
│             Attract Mode Sounds                 │
│             Gun Flash Brightness                │
│             Return To Main Menu                 │
│                                                 │
└─────────────────────────────────────────────────┘
```
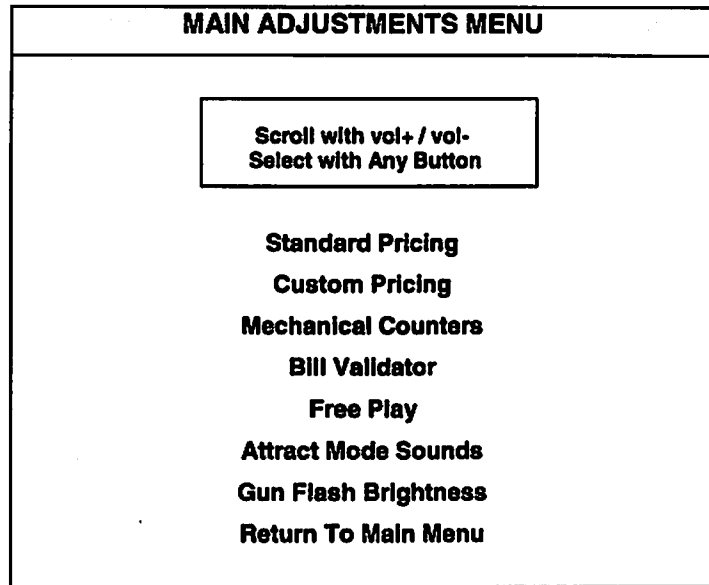
MAIN ADJUSTMENTS MENU

Standard Pricing opens a menu that allows you to choose from among numerous standard pricing schemes. None of these schemes require setting DIP switches.

Custom Pricing opens a menu that allows you to devise your pricing schemes. On the menu, you specify "slot units" for each coin mechanism (coinage, such as Lira, Marks, etc.). You must also calculate and enter the number of credits per coin. Custom Pricing schemes don't require setting DIP switches.

Mechanical Counters allows you to add, remove and test coin and bill mechanisms. You set the number of totalizer clicks for each coin through a chute. The Mechanical Counters Menu displays values for all possible devices. Changes to unused inputs have no effect.

Bill Validator opens a menu that allows you to enable or disable bill validator support.

Free Play allows you to enable or disable free game operation.

Attract Mode Sounds opens a menu that allows you to enable or disable attract mode sounds.

Gun Flash Brightness optimizes gun operation. Adjust brightness so that the guns function, but the screen flash doesn't irritate players. See the separate discussion on Gun Flash Brightness.

GUN FLASH BRIGHTNESS

Select GUN FLASH BRIGHTNESS at the Main Adjustments Menu. Use the Gun Flash Brightness Menu to adjust gun operation. But take care: If you set flash brightness too low, the guns may not operate. If set too high, gun flash brightness might irritate players or reduce monitor life. On a video game machine with a new CRT, set flash brightness to 1 NORMAL.

Increase gun flash brightness by repeatedly pressing VOLUME UP. Decrease flash brightness by repeatedly pressing VOLUME DOWN. Save your setting and exit the Gun Flash Brightness screen by pressing any button.

```
┌─────────────────────────────────────┐
│          Gun Flash Brightness        │
├─────────────────────────────────────┤
│                                      │
│       Adjusts Gun Flash Brightness.  │
│                                      │
│       Factory setting is 1 Normal.   │
│       Current setting is 1 Normal.   │
│                                      │
│                                      │
│            ┌──────────────┐          │
│            │   1 Normal    │          │
│            └──────────────┘          │
│                                      │
│                                      │
│         Select with vol+ / vol −     │
│      Confirm choice with any button. │
│                                      │
└─────────────────────────────────────┘
```
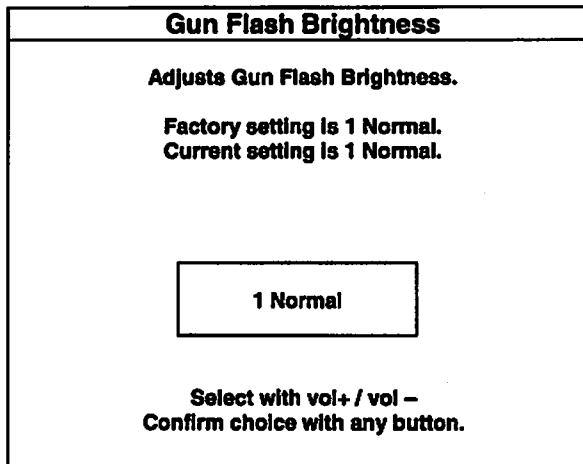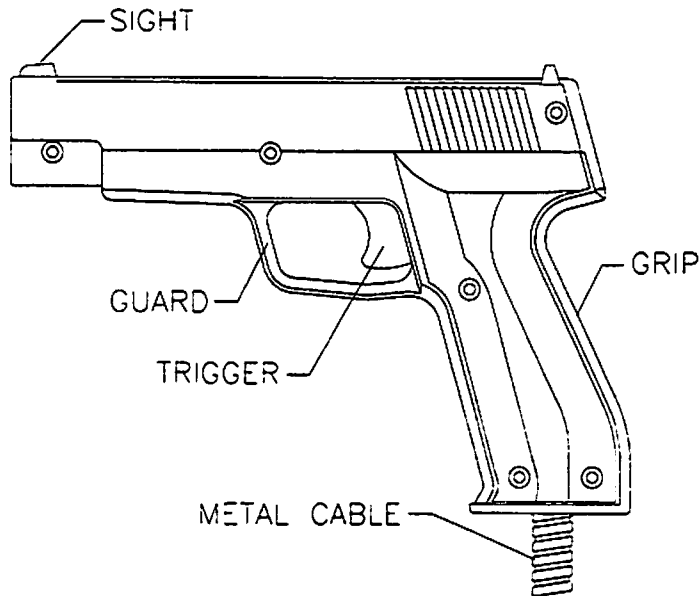
GUN FLASH BRIGHTNESS SCREEN

GUN PARTS

STANDARD PRICING

Select STANDARD PRICING at the Main Adjustments Menu. The Standard Pricing Menu allows you to view current settings or change the cost of games. The system restores factory default pricing if the backup battery fails.

Highlight a line item with the middle two control buttons inside the coin door. Select the option with either START button. You may reset options to factory defaults or change an option after viewing it.

We recommend examining and recording all pricing options before making changes.

Select Standard Pricing Mode	
Vol+ / vol– selects pricing mode.	
Hit any button to confirm choice.	
1 of 85	
Pricing Mode:	USA 1
2 to Start, 2 to Continue	
1 CREDIT / 1 COIN	
Coin 1 (Left):	.25
Coin 2 (Right):	.25
Coin 3 (Center):	--
Coin 4 (Extra):	--
Bill Validator:	$1.00

STANDARD PRICING MENU

An additional box appears on screen to explain the available functions as you select each item.

STANDARD PRICING TABLE

NAME	START	CONTINUE	CREDITS/COIN	COIN 1	COIN 2	COIN 3	COIN4	BILL
ANTILLES	2	2	1/25¢, 4/1g	.25¢	1g			
AUSTRALIA 1	2	2	1/3X20¢, 2/$1.00	.20¢	$1.00			
AUSTRALIA 2	2	2	1/5X20¢, 1/$1.00	.20¢	$1.00			
AUSTRIA 1	2	2	1/5Sch, 2/10Sch	5 Sch	10 Sch			
AUSTRIA 2	2	2	1/2X5Sch, 3/2X10Sch	5 Sch	10 Sch			
BELGIUM 1	2	2	1/20BF	20BF	20BF			
BELGIUM 2	2	2	3/20BF	20BF	20BF			
BELGIUM 3	2	2	2/20BF	20BF	20BF			
BELGIUM ECA	2	2	1/20BF	50BF	20BF	5BF		
CANADA 1	2	2	1 / 2 x 25¢, 3 / $1	25¢	25¢			
CANADA 2	2	2	1 / 2 x 25¢, 3 / $1	25¢	$1.00			
CANADA 3	2	2	3 / $1.00, 6 / $2.00	$1.00	$2.00			
CANADA ECA	2	2	1 / 2 x 25¢, 3 / $1	25¢		$1.00	$2.00	
DENMARK	2	2	3/5DKr, 7/10DKr	5DKr	10DKr			
FINLAND	2	2	1/1Fmk	1Fmk	5Fmk			
FRANCE 1	2	2	2/5Fr, 5/10Fr	5Fr	10Fr			
FRANCE 2	2	1	2/5Fr, 4/10Fr	5Fr	10Fr			
FRANCE 3	2	1	1/5Fr, 3/10Fr	5Fr	10Fr			
FRANCE 4	2	1	1/5Fr, 2/10Fr	5Fr	10Fr			
FRANCE 5	2	1	2/5Fr, 5/10Fr, 11/2 X 10Fr	5Fr	10Fr			
FRANCE 6	2	1	2/5Fr, 4/10Fr, 9/2 X 10Fr	5Fr	10Fr			
FRANCE 7	2	1	1/5Fr, 3/10Fr, 7/2 X 10Fr	5Fr	10Fr			
FRANCE 8	2	1	1/5Fr, 2/10Fr, 5/2 X 10Fr	5Fr	10Fr			
FRANCE 9	2	1	1/3 X 1Fr, 2/5Fr	1Fr	5Fr			
FRANCE 10	2	1	1/2 X 1Fr, 3/5Fr	1Fr	5Fr			
FRANCE 11	2	1	1/3 X 1Fr, 2/5Fr, 5/2 X 5Fr	1Fr	5Fr			
FRANCE 12	2	1	1/2 X 1Fr, 3/5Fr, 7/2 X 5Fr	1Fr	5Fr			
FRANCE ECA 1	1	1	2/5Fr, 5/10Fr	1Fr	5Fr	10Fr	20Fr	
FRANCE ECA 2	1	1	2/5Fr, 4/10Fr	1Fr	5Fr	10Fr	20Fr	
FRANCE ECA 3	1	1	1/5Fr, 3/10Fr	1Fr	5Fr	10Fr	20Fr	
FRANCE ECA 4	1	1	1/5Fr, 2/10Fr	1Fr	5Fr	10Fr	20Fr	
FRANCE ECA 5	1	1	2/5Fr, 5/10Fr, 11/2 X 10Fr	1Fr	5Fr	10Fr	20Fr	
FRANCE ECA 6	1	1	2/5Fr, 4/10Fr, 9/2 X 10Fr	1Fr	5Fr	10Fr	20Fr	
FRANCE ECA 7	1	1	1/5Fr, 3/10Fr, 7/2 X 10Fr	1Fr	5Fr	10Fr	20Fr	
FRANCE ECA 8	1	1	1/5Fr, 2/10Fr, 5/2 X 10Fr	1Fr	5Fr	10Fr	20Fr	
FRANCE ECA 9	1	1	1/3 X 1Fr, 2/5Fr	1Fr	5Fr	10Fr	20Fr	
FRANCE ECA 10	1	1	1/2 X 1Fr, 3/5Fr	1Fr	5Fr	10Fr	20Fr	
FRANCE ECA 11	1	1	1/3 X 1Fr, 2/5Fr, 5/10Fr	1Fr	5Fr	10Fr	20Fr	
FRANCE ECA 12	1	1	1/2 X 1Fr, 3/5Fr, 7/10Fr	1Fr	5Fr	10Fr	20Fr	
FRANCE ECA 13	1	1	1/10Fr, 2/20Fr, 4/30Fr	1Fr	5Fr	10Fr	20Fr	
FREE PLAY	--	--	--	None	None	None	None	None
GERMANY 1	2	2	1/1DM, 6/5DM	1DM	5DM			
GERMANY 2	2	1	1/1DM, 7/5DM	1DM	5DM			
GERMANY 3	2	1	1/1DM, 8/5DM	1DM	5DM			
GERMANY 4	2	1	1/1DM, 5/5DM	1DM	5DM			
GERMANY 5	2	1	1/1DM, 6/5DM	1DM	5DM			
GERMANY ECA 1	2	2	1/1DM, 2/2DM, 6/5DM	1DM	2DM	5DM		
GERMANY ECA 2	2	1	1/1DM, 2/2DM, 6/5DM	1DM	2DM	5DM		
GERMANY ECA 3	1	1	1/1DM, 2/2DM, 6/5DM	1DM	2DM	5DM		
HUNGARY	2	2	1/2X10Ft, 3/2X20Ft	10Ft	20Ft			
ITALY	2	2	1/500Lit	500Lit	500Lit			
JAPAN 1	2	2	1/100Yen	100Yen	100Yen			
JAPAN 2	2	2	2/100Yen	100Yen	100Yen			
NETHERLANDS	2	2	1/1fl, 3/2.5fl	1fl	2.5fl			
NEW ZEALAND 1	1	1	1/$1	$1	$2			
NEW ZEALAND 2	1	1	2/$1	$1	$2			
NORWAY	2	2	3/5NKr, 6/10NKr	5NKr	10NKr			
SPAIN 1	2	2	1/100Pta, 6/500Pta	100Pta	500Pta			
SPAIN 2	2	2	1/100Pta, 5/500Pta	100Pta	500Pta			
SWEDEN	2	2	1/3X1SKr, 2/5SKr	1SKr	5SKr			
SWITZERLAND 1	2	2	1/1SFr, 6/5SFr	1SFr	5SFr			
SWITZERLAND 2	2	2	1/1SFr, 7/5SFr	1SFr	5SFr			
SWITZERLAND 3	2	2	1/1SFr, 8/5SFr	1SFr	5SFr			

(Table continues on next page)

STANDARD PRICING TABLE, *continued*

NAME	START	CONTINUE	CREDITS/COIN	COIN 1	COIN 2	COIN 3	COIN4	BILL
UK ECA 1	1	1	1/50p, 3/£1.00	£1.00	50p	20p	10p	£2.00
UK ECA 2	1	1	1/50p, 2/£1.00	£1.00	50p	20p	10p	£2.00
UK ECA 3	1	1	1/30p, 2/50p, 5/£1.00	£1.00	50p	20p	10p	£2.00
UK 4	1	1	1/50p, 3/£1.00	£1.00	50p			
UK 5	1	1	1/50p, 2/£1.00	£1.00	50p			
UK ECA 6	1	1	1/30p, 2/50p, 4/£1.00	£1.00	50p	20p	10p	£2.00
UK ECA 7	1	1	3/£1.00	£1.00	50p	20p	10p	£2.00
UK ECA 8	1	1	1/50p, 2/£1.00, 4/£2.00	£1.00	50p	20p	10p	£2.00
USA1	2	2	1/25¢	25¢	25¢			$1.00
USA2	2	1	1/25¢	25¢	25¢			$1.00
USA3	1	1	1/25¢	25¢	25¢			$1.00
USA4	1	1	1/50¢, 3/$1.00	25¢	25¢			$1.00
USA5	2	1	1/50¢, 4/$1.00	25¢	25¢			$1.00
USA6	1	1	1/50¢	25¢	25¢			$1.00
USA7	1	1	1/50¢, 3/$1.00	25¢	25¢			$1.00
USA8	2	2	1/50¢, 4/$1.00	25¢	25¢			$1.00
USA9	3	2	1/25¢, 4/$1.00	25¢	25¢			$1.00
USA10	3	3	1/25¢, 4/$1.00	25¢	25¢			$1.00
USA11	4	2	1/25¢, 4/$1.00	25¢	25¢			$1.00
USA12	4	3	1/25¢, 4/$1.00	25¢	25¢			$1.00
USA13	4	4	1/25¢, 4/$1.00	25¢	25¢			$1.00
USA ECA	3	3	1/25¢, 4/$1.00	$1.00	25¢	10¢	05¢	$1.00

Main Menu *(continued)*
Main Adjustments Menu *(continued)*
Custom Pricing Menu

CUSTOM PRICING

Select CUSTOM PRICING at the Main Adjustments Menu. The Custom Pricing Menu allows you to select the number of coins or credits required for each game. The system restores factory default pricing if the backup battery fails.

Highlight a line item with the middle two control buttons inside the coin door. Select the option with either START button. As you select each item, the screen displays its definition. You may reset options to factory defaults or change an option after viewing it.

Examine and record pricing options before making changes.

```
┌─────────────────────────────────────────┐
│         Custom Pricing Settings          │
├─────────────────────────────────────────┤
│                                          │
│        Use vol+ / vol– to select item.   │
│     Hit any button to change selected item.│
│                                          │
│      Left Units       XX                 │
│      Right Units      XX                 │
│      Center Units     XX    ┌──────────────┐ │
│      Extra Units      XX    │ Units given for each │ │
│      Validator Units  XX    │ coin the player puts │ │
│      Units Per Credit XX    │ in the left chute    │ │
│      Units Per Bonus  NONE  │ (default is 1).      │ │
│      Minimum Units    NO MIN└──────────────┘ │
│      Credits To Start XX                 │
│      Credits To Cont. XX                 │
│      Maximum          XX                 │
│      Credits          XX                 │
│      Coins Per Bill   XX                 │
│      Show Fractions   YES                │
│      Return to Menu                      │
└─────────────────────────────────────────┘
```
CUSTOM PRICING MENU

BASIC CUSTOM PRICING. Custom pricing creates an imaginary currency exchange. In this currency exchange, the coins of the realm are "units." Think of units as a type of cyber-currency, useful only within the game software. By inserting coins, you purchase units.

Since units are only negotiable within game software, the system stores your units for you. When the system receives enough units, it buys a game for you. The price of a game is one "credit." You can think of credits as a second form of cyber-currency.

Even though you've now bought one game, you may not be able to begin playing. In many pricing schemes, you must buy two or more credits to begin play. The idea here is something like a minimum order of goods at a store. That is, the operator can "shrink-wrap" two or more games in a package. You can't play unless you buy the entire package.

•1 / 25¢ COIN; 1 CREDIT TO START. In a simple, quarter pricing scheme, the player inserts one coin to buy one unit. The system exchanges that unit for one credit. If CREDITS TO START contains the value one, then play commences. A dollar bill buys four units.

Left Slot Units	Validator Units	Units / Credit	Credits to Start	Coins / Bill
1	4	1	1	4

•1 / 3 X 25¢; 2 CREDITS TO START. Again, assuming quarter slots, here's one way to implement 75¢ pricing... In this scheme, each coin that the player inserts buys one unit. The system exchanges three units for one credit. CREDITS TO START contains the value two. To play, the player must pay for two credits. In this scheme, a dollar buys four units.

Left Slot Units	Validator Units	Units / Credit	Credits to Start	Coins / Bill
1	4	3	2	4

•2 / 1 COIN; 6 CREDITS TO START. Now let's consider a more unusual pricing scheme. Here, the player can buy two units with one coin. The system exchanges each of these units for one credit. Notice that CREDITS TO START contains the value six. To play, the player must insert two more coins to pay for six credits. Also notice that if the player pays with a bill, the system throws in an extra unit.

Left Slot Units	Validator Units	Units / Credit	Credits to Start	Coins / Bill
2	9	1	6	4

The following table clarifies Custom Pricing Menu terms...

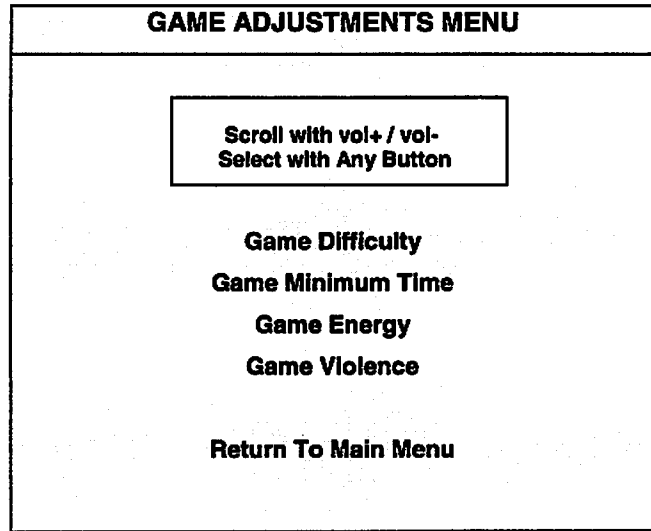| SCREEN TERM	DISCUSSION
Slot Units; Validator Units	Cyber-currency. This adjustment assigns a number of "units" to each coin mechanism or bill acceptor. For instance, if a quarter buys 1 unit, then $1 buys 4 units. *(See Coins per Bill.)* You insert a coin into a 1-unit coin acceptor. The system, due to its programming, knows that your coin is worth one unit.
Units per Credit	How many units equal one credit. (Units buy credit, the price of one game.)
Units per Bonus	Units awarded when a player earns a bonus.
Minimum Units	Until this many units accumulate, the system awards no credits.
Credits to Start	Number of games a player must purchase to begin play.
Credits to Continue	Number of games a player must purchase to resume play.
Maximum Credits	Limits the number of credits that the game will accept.
Coins per Bill	How many coins one bill is worth.

GAME ADJUSTMENTS

Select GAME ADJUSTMENTS at the Main Menu. Screens in the Game Adjustments Menu permit you to alter game characteristics. Use these screens to optimize game performance and earnings. You'll find more of this type of adjustments on the Main Adjustments Menu.

Highlight a line item with the middle two control buttons inside the coin door. Select the option with either START button.

```
GAME ADJUSTMENTS MENU
─────────────────────────

        Scroll with vol+ / vol-
        Select with Any Button


        Game Difficulty
      Game Minimum Time
         Game Energy
        Game Violence


       Return To Main Menu
```

GAME ADJUSTMENTS MENU

Game Difficulty allows you to adjust the challenge that the game presents to players. Consider altering this setting when you move the game to a new location. In the same location, you might add play to the game by periodically upgrading difficulty. That way, experienced players won't become bored.

Game Minimum Time allows you to increase or decrease the minimum amount of play time in a game.

Game Energy opens a menu that allows you increase or decrease the amount of "energy" that each player begins with. "Energy" enables the player to recover from enemy hits and continue playing without inserting coins.

Game Violence opens a menu that allows you to choose the level of gore depicted during game play.
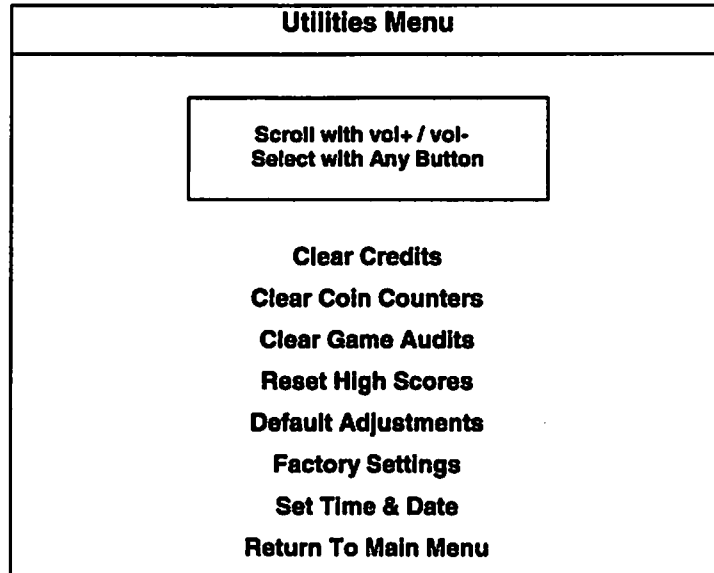
UTILITIES

Select UTILITIES at the Main Menu. Utilities Menu items allow you restore game operation to original software performance. Of course, game performance also depends on the condition of game hardware.

Highlight a line item with the middle two control buttons inside the coin door. Select the option with either START button.

```
┌─────────────────────────────────────────────┐
│                Utilities Menu                │
├─────────────────────────────────────────────┤
│                                             │
│         ┌─────────────────────────┐         │
│         │   Scroll with vol+ / vol-│        │
│         │   Select with Any Button │        │
│         └─────────────────────────┘         │
│                                             │
│                                             │
│                Clear Credits                │
│                                             │
│             Clear Coin Counters             │
│                                             │
│              Clear Game Audits              │
│                                             │
│               Reset High Scores             │
│                                             │
│             Default Adjustments             │
│                                             │
│               Factory Settings              │
│                                             │
│                Set Time & Date              │
│                                             │
│              Return To Main Menu            │
│                                             │
└─────────────────────────────────────────────┘
```

UTILITIES MENU

Clear Credits opens a menu that allows you to zero the game's credit data. Examine and record audit information before you make changes.

Clear Coin Counters opens a menu that allows you to zero the game's coin collection data. Examine and record audit information before you make changes.

**Clear Game Audits** opens a menu that allows you to zero the game's audit data.

Dump Audits allows you to replace current audit data with previously saved data.

Reset High Scores permits you to delete player names and scores that appear in the Attract Mode. This feature may be useful if players insert inappropriate language into the high score table.

Default Adjustments opens a menu that allows you to reset game adjustments to factory settings.

Factory Settings allows you to reset adjustments and audits to values set by the factory.

Set Time & Date allows you to adjust the game's real-time clock. You may adjust for time zone changes, clock resets, backup battery replacements, etc.
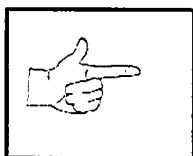
☞	**NOTICE:** Be careful when clearing audit information. Once you clear data, you can't restore it.

SYSTEM INFORMATION

Select SYSTEM INFO at the Main Menu. The System Information Menu presents hardware and software data for your game. Use these numbers to describe the system during part replacement, service calls, etc.

Highlight a test with the middle two control buttons inside the coin door. Select the option with either START button.

```
┌─────────────────────────────────────────────────┐
│                System Information                │
├─────────────────────────────────────────────────┤
│                                                  │
│                                                  │
│     Game Serial Number:   Xxxxxxxxx              │
│                                                  │
│     Game Type:   Xxx                             │
│                                                  │
│     Date Of Manufacture:   Xx/Xx/Xx              │
│                                                  │
│     Game Code Version:   X.X                     │
│                                                  │
│     Game Code Compiled:                          │
│                                                  │
│     Diagnostic Code Version:   X.X               │
│                                                  │
│     Disk Asic U11 Version:   Xx                  │
│                                                  │
│     System Date:   Weekday, Mm, Dd, Yyyy         │
│                                                  │
│     System Time:   00:00:00 Am                   │
│      ┌─────────────────────────────────┐         │
│      │                                 │         │
│      │    Hit Any Button to Continue   │         │
│      │                                 │         │
│      └─────────────────────────────────┘         │
│                                                  │
└─────────────────────────────────────────────────┘
```
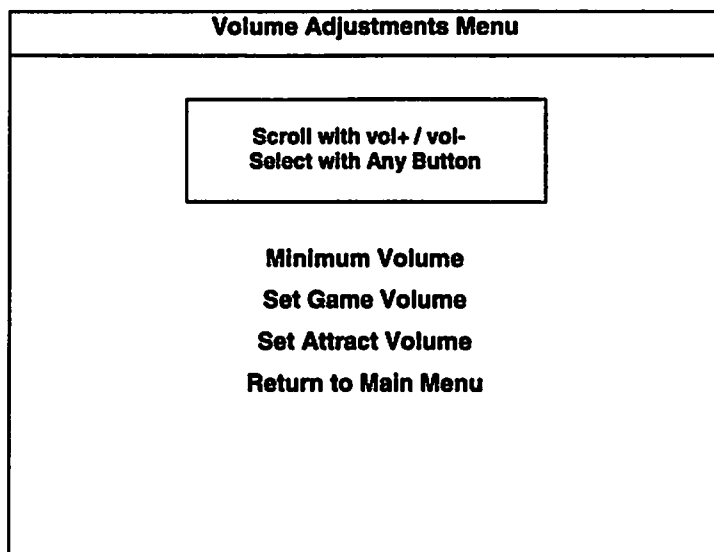
SYSTEM INFORMATION MENU

The System Information screen reports information but doesn't permit you to make changes. This screen identifies the game's date of manufacture and the code versions for programmed chips. The Serial Number, Game Type and Compilation Date help to identify the production run.

VOLUME ADJUSTMENT

Select VOLUME ADJUSTMENT at the Main Menu. The Volume Adjustments Menu assists you in tailoring sound levels to your environment and your players.

Highlight a test with the middle two control buttons inside the coin door. Select the option with either START button. Music plays continuously during volume adjustment. Use the volume buttons on the diagnostic switch bracket to change the sound level of the game.

```
┌─────────────────────────────────────────────┐
│           Volume Adjustments Menu             │
├─────────────────────────────────────────────┤
│                                               │
│         ┌─────────────────────────┐           │
│         │   Scroll with vol+ / vol-│          │
│         │   Select with Any Button │          │
│         └─────────────────────────┘           │
│                                               │
│              Minimum Volume                   │
│                                               │
│              Set Game Volume                  │
│                                               │
│              Set Attract Volume               │
│                                               │
│              Return to Main Menu              │
│                                               │
│                                               │
└─────────────────────────────────────────────┘
```

VOLUME ADJUSTMENTS MENU

Loud games attract more player interest than games with low-level sound. If your location is noisy, you may want to increase the minimum volume setting.

The Attract Mode sound level is lower than the game play sound level. You can enable or disable Attract Mode sound without changing the game volume level. (See Adjustments.)

	NOTICE: These adjustments affect the volume of tests as well as of game play. If you set volume levels to minimum (zero), the speakers are silent during audio tests. We recommend setting volume levels to a moderately high value whenever you perform sound tests. After you complete tests, you may return sound levels to previous settings.

Minimum Volume opens a new menu. This menu allows you to set the quietest game sound. No game sound will be quieter than this setting.

Set Game Volume allows you to set the loudest game sound. No game sound will be louder than this setting.

Set Attract Volume allows you to adjust the volume of the game's Attract Mode. No Attract Mode sound will be louder than this setting.

```
┌─────────────────────────────────────────┐
│           Set Minimum Volume            │
├─────────────────────────────────────────┤
│                                         │
│        Sets the minimum level allowed   │
│          when setting the volume        │
│                                         │
│                                         │
│          Factory setting is 15.         │
│          Current setting is 30.         │
│        ┌─────────────────────────┐      │
│        │     Minimum Volume      │      │
│        │                         │      │
│        │           30            │      │
│        └─────────────────────────┘      │
│           Select with vol+ / vol-       │
│        Confirm choice with any button   │
│                                         │
└─────────────────────────────────────────┘
```

MININUM VOLUME MENU

```
┌─────────────────────────────────────────┐
│            Set Game Volume              │
├─────────────────────────────────────────┤
│          Adjust Volume with vol+ / vol-  │
│          Hit Any Other Button to Exit   │
│                                         │
│                  ┌──────┐               │
│          MAX     │      │               │
│                  │      │               │
│                  │      │               │
│                  │      │    Volume: 30 │
│                  │      │               │
│          MIN     │▓▓▓▓▓▓│               │
│                  └──────┘               │
└─────────────────────────────────────────┘
```

SET GAME VOLUME MENU

```
┌─────────────────────────────────────────┐
│           Set Attract Volume            │
├─────────────────────────────────────────┤
│          Adjust Volume with vol+ / vol-  │
│          Hit Any Other Button to Exit   │
│                                         │
│                  ┌──────┐               │
│          MAX     │      │               │
│                  │      │               │
│                  │      │               │
│                  │▓▓▓▓▓▓│    Volume: 70 │
│                  │▓▓▓▓▓▓│               │
│          MIN     │▓▓▓▓▓▓│               │
│                  └──────┘               │
└─────────────────────────────────────────┘
```

SET ATTRACT VOLUME MENU

NOTES

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INVASION™ KIT
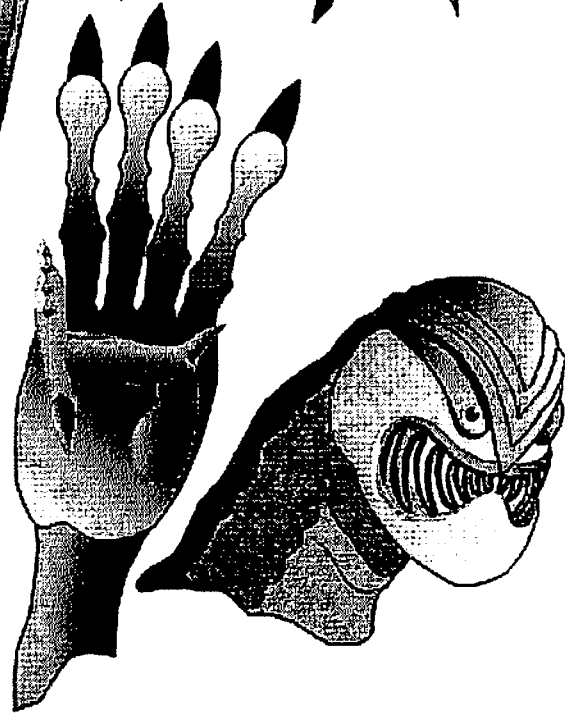
WIRING

> ⚠ **WARNING:** Failure to reconnect ground wires or replace metal shields and covers with mounting hardware installed and properly tightened may result in radio frequency interference.

JAMMA Table

Function	Wire Color	Pin	Function	Wire Color	Pin
Ground	Black	A	Ground	Black	1
Ground	Black	B	Ground	Black	2
+5VDC	Red	C	+5VDC	Red	3
+5VDC	Red	D	+5VDC	Red	4
-5VDC	Yellow	E	-5VDC	Yellow	5
+12VDC	Orange	F	+12VDC	Orange	6
Key	--	H	Key	--	7
Not Connected	--	J	Coin Counter 1	Brown	8
Not Connected	--	K	Not Connected	--	9
Speaker -, Left	Brown-Gray	L	Speaker +, Left	Red-Gray	10
Not Connected	--	M	Not Connected	--	11
Video Green	Yellow-Green	N	Video Red	Yellow-Red	12
Video Sync	Yellow-White	P	Video Blue	Yellow-Blue	13
Service Credits	White-Gray	R	Video Ground	Yellow-Black	14
Slam Tilt	Black-Green	S	Test	Black-Blue	15
Coin 2 Input	Black-Red	T	Coin 1 Input	Black-Brown	16
Player 2 Start	Violet-White	U	Player 1 Start	White	17
Not Connected	--	V	Not Connected	--	18
Not Connected	--	W	Not Connected	--	19
Not Connected	--	X	Not Connected	--	20
Not Connected	--	Y	Not Connected	--	21
Not Connected	--	Z	Not Connected	--	22
Not Connected	--	a	Not Connected	--	23
Not Connected	--	b	Not Connected	--	24
Not Connected	--	c	Not Connected	--	25
Not Connected	--	d	Not Connected	--	26
Not Connected	--	e	Coin Lights Gnd	Yellow-Brown	27
Ground	Black	f	Ground	Black	28
Solder Side			**Component Side**		

Gun Wiring

Function	Wire In Gun	Player 1 Wire	Player 2 Wire
+5VDC	Red	Red	Red
Ground	Brown	Brown	Brown
Sense	Blue	Blue	Blue
Not Used	Green	Green	Green
Trigger	White	White	White
Ground	Black	Black	Black

Option Wiring *(Not Part of JAMMA Harness)*

Function	Wire Color	Cabinet Origin	Cabinet Conn.	Cabinet Pin	CPU Board Conn.	CPU Bd. Pin
+5VDC	Red	Coin Door	8P1	1	1P21	3
+12VDC	Orn	Coin Door	8P1	2	1P21	4
Ground	Blk	Coin Door	8P1	4	1P21	1
Coin 3	Blk-Orn	Coin Door	8P1	5	1P21	2
Coin 4	Blk-Yel	Coin Door	8P1	6	1P21	6
Bill In	Blk-Wht	Coin Door	8P1	7	1P21	7
Vol -	Orn-Grn	Diag Switch Conn	8P4	4	1P21	9
Vol +	Orn-Red	Diag Switch Conn	8P4	5	1P21	8
(None)	--	--	--	--	1P13	P13: Not Used
(None)	--	--	--	--	1P16	P16: Not Used
(None)	--	--	--	--	1P19	P19: Not Used
(None)	--	--	--	--	1P20	P20: Not Used

Typical DC Power Source Voltage Limits

Function	Range Limits	Color	Function	Range Limits	Color
Digital Circuits	+4.90V to +5.10V	Red	Coin Lights	-4.75V to -5.25V	Yellow
Audio, Lights	+11.5V to +12.5V	Orange	Auxiliary Power	-11.5V to -12.5V	Blue

Harness Connector Prefixes

Prefix	Connector Location	Example
1	CPU Board	1P1
2	Gun Interface Board	2P1
3	--	--
4	Fluorescent Lamp	4P1
5	Power Supply	5P1
6	Video Monitor	6P1
7	--	--
8	Coin Door Area	8P1
9	Guns (Internal)	9P1
10	--	--
11	Cabinet	11P1
12	--	--
JAMMA	CPU Board	JAMMA

NOTICE: Look for the connector prefix on wiring diagrams. The prefix shows you where you'll find the connector.

CABINET WIRING DIAGRAM

CPU BOARD ASSEMBLY
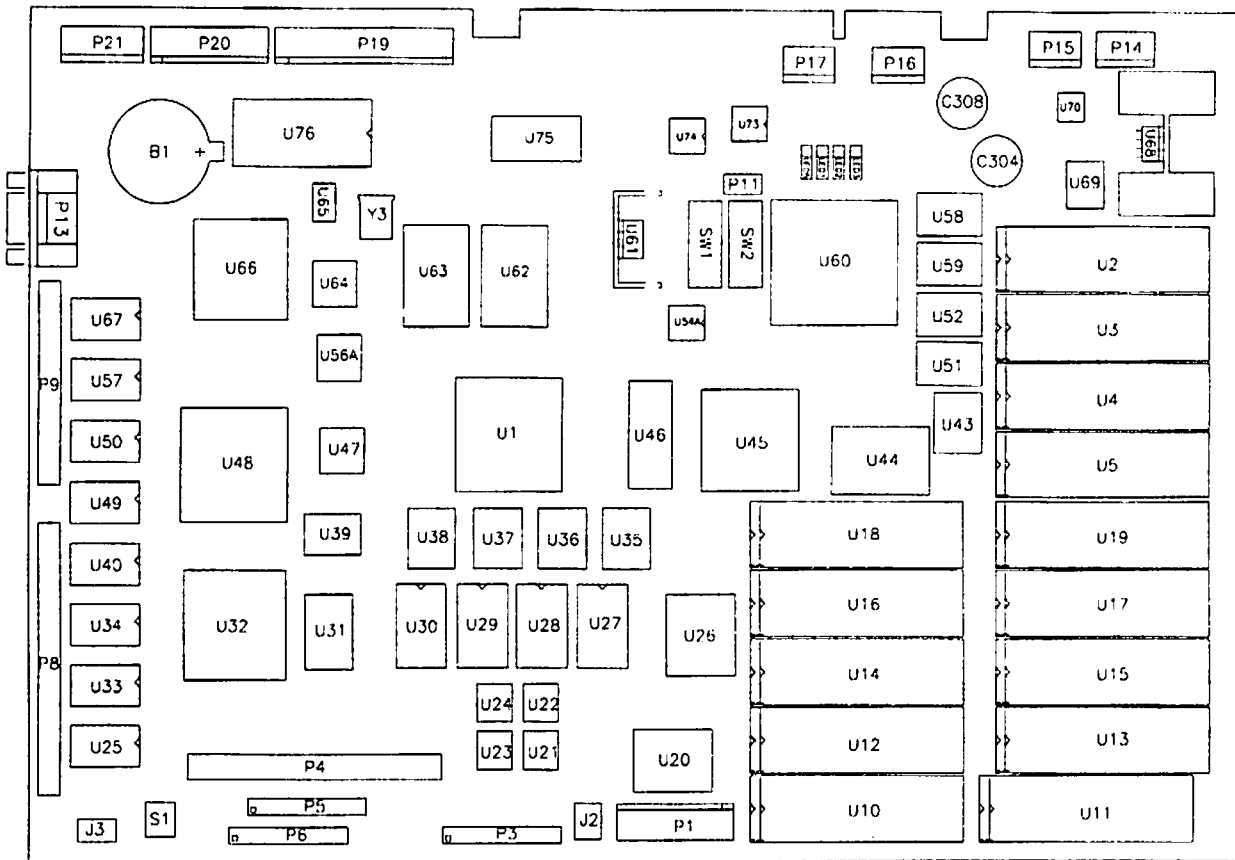
INDICATOR, SWITCH AND JUMPER LOCATIONS

CPU Switches

Designation	Location	Function	State	Meaning
S1	Near Connectors P4, P5 & P6	Reset Switch	Off	Normal Operation
			On	Forced Test Mode
SW1, SW2	Near Integrated Circuits U60, U61	Coin Mode and Game Functions	(2) 8-Switch Banks	See DIP Switch Tables in Chapter 3

CPU Board Data

♦ **BOARD REVISION LEVEL.** How to determine *Invasion* CPU Board revision number: (1) Check PCB for paper label with part number beginning with "A-." (2) Check EPROM revision number on white labels glued to EPROM chips.

♦ **JUMPERS.** The CPU Board has no jumpers.

♦ **SWITCH S1 is the HARDWARE RESET switch.** S1 is on the CPU Board.

♦ **TEST MODE SWITCH.** The TEST MODE switch activates brief automatic tests, followed by the Menu System. You'll find TEST MODE behind the Coin Door.

CPU LED INDICATOR TABLE

Designation	Location	Function	Color	State	Meaning
LED 5 (+5V)	Near U60, U71 and U73	+5V Power Indicator	Red	Off	No +5VDC Power
				On	Normal Operation
				Blinking	Power Fault (Note A)
LED 1 (Code Version)	Near U60, U71 and U73	Game Code	Green	Off	Locked Up (Note B)
				On	Locked Up (Note B)
				Blinking	Normal Operation
LED 2 (Sound)	Near U60, U71 and U73	Sound Activity	Yellow	Off	No Audio (Note C)
				On	Locked Up
				Blinking Fast	Resetting
				Blinking Slowly	Running Normally
LED 3 (Not Used)	Near U60, U71 and U73	Not Used	Green	On	Not Applicable (Note D)

NOTES:

A. LED 5 monitors a regulated power supply voltage source. + 5VDC must be on continuously.

B. LED 1 flashes the software version in Morse Code. You can also read the version off the screen in the Menu System.

C. LED 2 (Sound) blinks during normal operation.

D. LED 3 doesn't indicate anything in this game.
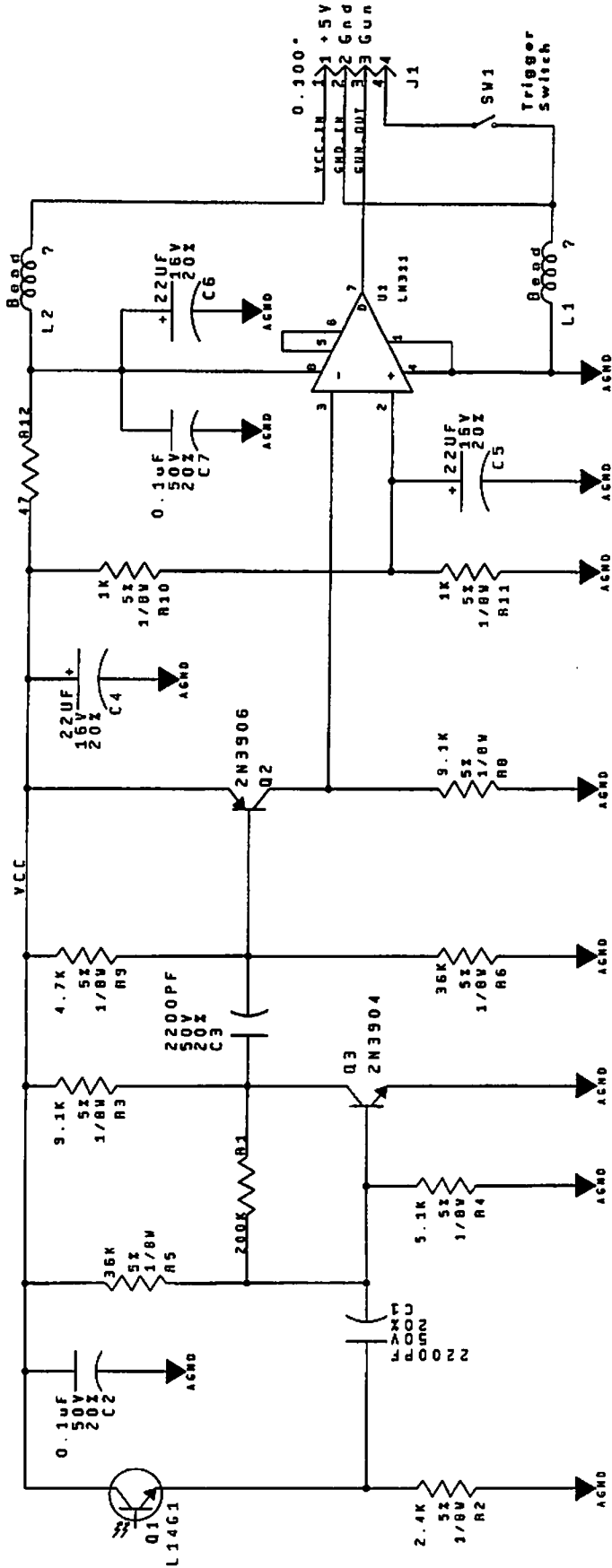
GUN CIRCUIT BOARD SCHEMATIC
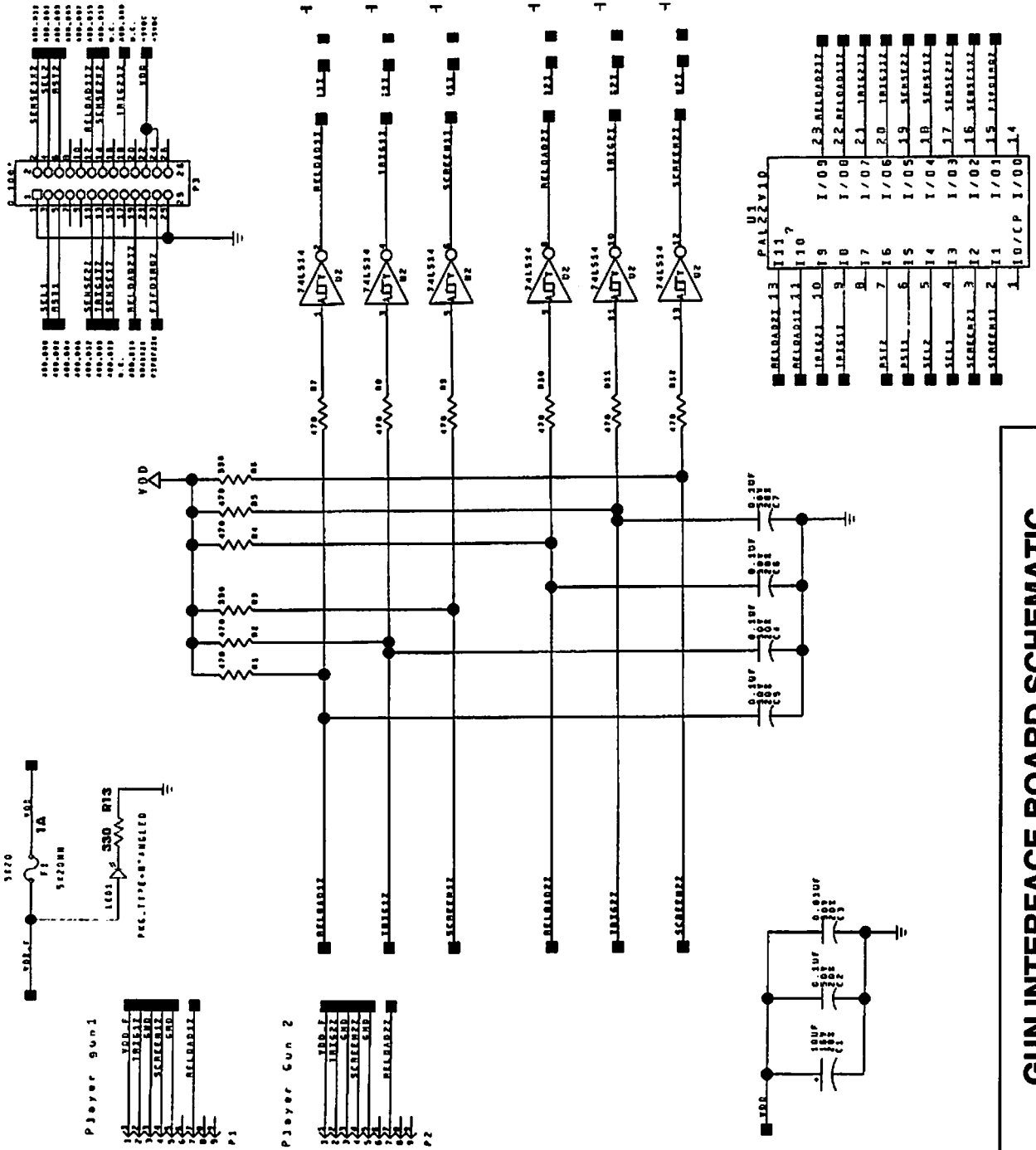
GUN INTERFACE BOARD SCHEMATIC

INVASION™ KIT
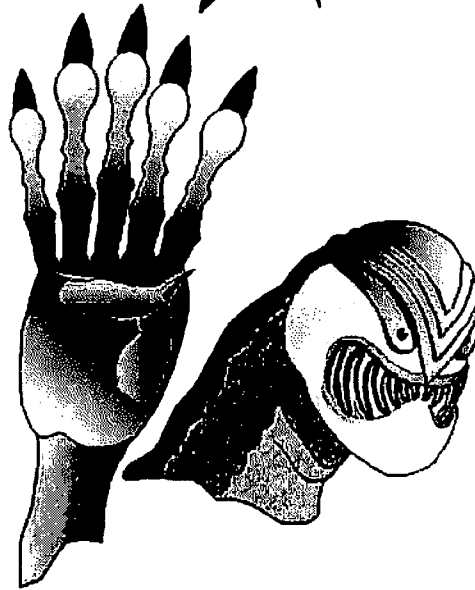
TROUBLESHOOTING

⚠️	**CAUTION:** This Video Game Machine (VGM) uses complex electronic components that are very sensitive to static electricity. Observe precautions below before handling electronics. Failure to do so may void the warranty and damage electronic assemblies.

- Before servicing electronics, turn off AC power to the VGM. Wait for capacitors to discharge.
- Before touching or handling electronic assemblies, discharge static electricity on your body. To discharge this static, begin by connecting the line cord to a grounded outlet. Don't turn on the VGM! Next, touch the safety ground stud of the power supply chassis.
- Store electronic assemblies in an anti-static area. Use anti-static bags to store or transport VGM circuit boards. Transport the hard drive in its shipping container.
- Don't remove or connect electronic assemblies when cabinet power is on. Otherwise, you'll damage electronic assemblies and void the VGM warranty.
- After you complete maintenance or service, replace ground wires, shields, safety covers, etc. Install and tighten ground and mounting screws.

Coin Mechanism and Pricing Troubleshooting Table

SYMPTOM	CAUSE	REQUIRED ACTION
• VGM *(video game machine)* accepts currency or tokens, but number of credits per coin or bill is incorrect.	Improper settings at Pricing Menu	1. From Adjustments Menu, choose PRICING. Verify that units and credits are set correctly. 2. Verify that coin mechanism is enabled.
	Incorrect pulse width on bill validators	1. Consult bill validator manufacturer's literature. Adjust pulse width on validator to *long* setting. 2. Retest validator operation.
	Faulty wiring	1. Check that cabinet wiring is correct for this VGM. 2. Assure that coin meter and coin switches connect properly to control input wires from JAMMA connector and CPU wiring. 3. Assure that coin meter and coin switches connect properly to control input wires.
	Faulty coin mechanism	1. Verify that coin mechanism works correctly by testing it in working VGM. 2. If mechanism is bad, replace it.
• VGM won't accept currency or tokens. • VGM won't start. • Audio and video are present.	Improper currency	1. Unlock and open cash door. Empty cash box. Inspect revenue for counterfeit currency. 2. Check vault. Remove any items that block path from mechanism.
	Faulty coin mechanism	1. Unlock and open coin door. Check each mechanism for proper mounting. 2. Remove mechanism. 3. Clear currency path. 4. Reinstall mechanism and latch it. 5. Enter Menu System by pressing and holding TEST MODE switch inside coin door. From Diagnostic Test Menu, choose SWITCH TEST. Use tests to confirm operation of switches.
	Tilted coin mechanism or VGM	1. Verify that mechanism is level after doors close. 2. Repair or replace coin door if it is bent or damaged. 3. If necessary, adjust cabinet leg levelers to keep mechanisms vertical.
• Coin indicators don't light	Burned-out bulb	1. Burned-out bulbs may appear white or darkened. Check continuity with DVM. 2. Replace burned-out bulb with same type.
	Open fuse circuit	1. Check fuse continuity with DVM. 2. If fuse is blown, replace fuse with same type. 3. If fuse isn't blown, check wiring.

⚠ **CAUTION:** Don't remove or install any connector when power is turned on. Installation under power will damage the circuit boards or hard disk drive and void the warranty.

VGM Startup Troubleshooting Table

SYMPTOM	CAUSE	REQUIRED ACTION
• VGM *(video game machine)* doesn't start. • VGM appears completely non-functional. • No audio • No illumination • No video display	Power problem	1. Check that VGM power switch is on. 2. Plug VGM into AC power outlet. Verify presence of AC line voltage.
	Improper line voltage switch setting	Turn off VGM power. Unplug AC line cord. Check line voltage switch. If necessary, set it to agree with local AC line voltage. Retest VGM.
	Open fuse	1. Turn off VGM power. Examine AC fuse on power chassis, under computer. 2. Examine DC fuses on cabinet wall or electronic equipment shelf. 3. Replace faulty fuses with identically rated parts. 4. Turn on VGM power. If fuse opens again, check DC wiring harness and connectors.
	Faulty wiring	1. Remove line cord. Test line cord, power plug, and IEC connector for breaks or damage. Verify continuity of each wire in cord. Install cord at power chassis. Press connector firmly to seat it. 2. Assure that cabinet wiring harness connectors fully seat in corresponding power supply and board connectors. 3. Inspect wiring for breaks or damage.
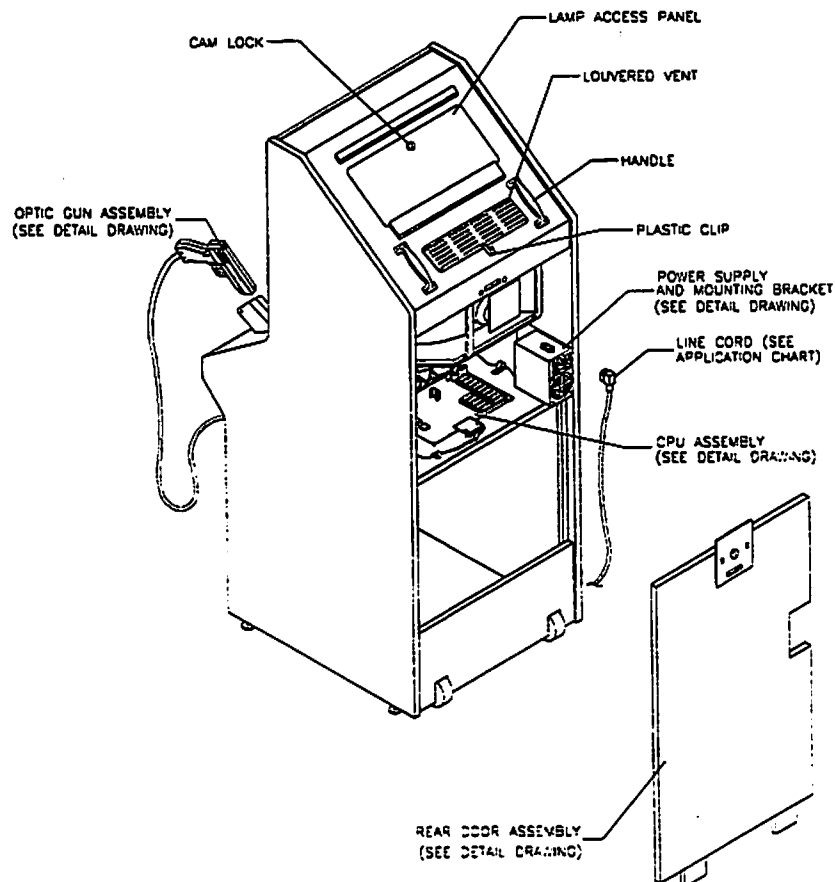
TYPICAL LOCATION OF POWER SUPPLY AND LINE CORD

VGM Startup Troubleshooting Table, *continued*

SYMPTOM	CAUSE	REQUIRED ACTION
• VGM *(video game machine)* appears non-functional. • Currency acceptor price indicator is illuminated.	Faulty power supply	1. Inspect CPU Board under low-light conditions. LEDs glow if processor circuits receive voltage. Fan should also be operating. These indications prove presence of some DC from power supply. Still, voltages or signals may not be normal. 2. Turn on VGM power. Using 20 Volt DC setting on digital voltmeter, measure DC voltages present at power connector pins. Adjust +5V source if necessary. 3. Using 2-volt AC setting on digital voltmeter, measure same DC voltages as above. Any reading indicates ripple or noise. In that case, service power supply.
	Faulty wiring	1. Turn off VGM power. 2. Inspect CPU Board. Assure that JAMMA Wire Harness connector is attached and fully seated onto mating board connector. 3. Verify connection of monitor AC power. 4. Check seating of other harness connectors.
	Improper DIP switch settings	Verify that CPU DIP Switches are set as intended.
	Faulty circuit boards	Verify that VGM runs and completes power-up self-tests without errors. Note errors or failures during tests (VGM doesn't save error messages).

⚠️ **CAUTION:** Don't remove or install any connector while power is turned on. Doing so will damage the CPU Board and void the warranty.
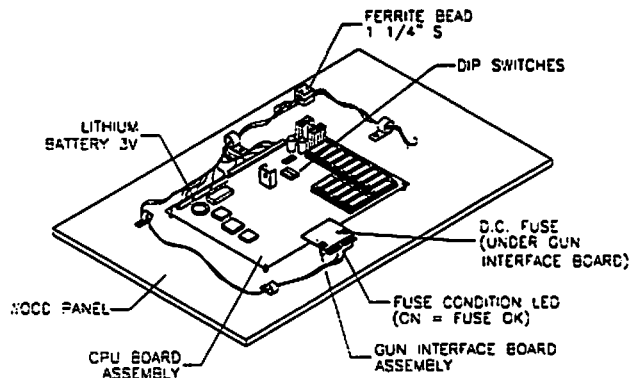
INTERIOR VIEW OF ELECTRONICS

VGM Startup Troubleshooting Table, *continued*

SYMPTOM	CAUSE	REQUIRED ACTION
• *VGM (video game machine)* doesn't start. • VGM accepts currency or tokens. • Audio and video are present.	Faulty coin mechanism	1. Unlock and open coin door. Check each currency acceptor to assure proper mounting. Verify that each release latch is closed and locked. Does mechanism accept and reject currency correctly? Test mechanism with good and bad coins. 2. Inspect to see if external acceptor indicators (Pricing, Flashing Arrows, etc.) are lit. 1. Verify that each acceptor operates properly by placing it in working VGM. Replace bad parts.
	Faulty switches	1. Enter Menu System by pressing and holding TEST MODE switch inside coin door. From Diagnostic Test Menu, choose SWITCH TEST. Use tests to confirm operation of each switch in VGM. 2. Assure that no loose parts or wires are caught in switch contacts. 3. Check for continuity in each suspect switch connection (Common to Normally Open or Common to Normally Closed). 4. Replace faulty switches (bent levers, broken actuators, etc.).
	Faulty wiring	1. Assure that no wires are caught in hinges, latches or switch contacts. 2. Check wiring continuity from circuit board connectors to acceptors.

Gun Troubleshooting Table

SYMPTOM	CAUSE	REQUIRED ACTION
• Players complain that one or both guns fail to hit targets	Lighting or sun glare on screen	1. Turn off room lights to eliminate glare on monitor. 2. Retest guns. 3. If guns now work properly, eliminate glare.
	Maladjusted gun software	1. Turn on room lights. Unlock and open coin door. 2. Enter Menu System by pressing and holding TEST MODE switch inside coin door. 3. From Main Adjustments Menu, choose GUN FLASH BRIGHTNESS. 4. Increase flash brightness as necessary. 5. Retest guns. 6. Repeat steps 4 and 5 until guns work properly.
• Intermittent or completely non-functional guns • VGM *(video game machine)* starts normally.	Dirty optics	1. Examine gun barrel and lens for dirt or debris. 2. Clean lens. *Don't apply cleaner directly into gun barrel.*
	Loose or missing parts	1. Inspect each gun for missing screws, loose or damaged parts, broken cables, etc. 2. Verify that each gun operates properly by connecting it to working VGM. 3. If gun doesn't work properly, repair or replace it.
	Faulty switches	1. Enter Menu System by pressing and holding TEST MODE switch inside coin door. From Diagnostic Test Menu, choose SWITCH TEST. Run tests to confirm switch operation. 2. Check for loose parts or wires caught in switch contacts. 3. Check continuity at each switch connection (Common to Normally Open or Common to Normally Closed). 4. Verify that gun operates properly by placing it in working VGM.
	Faulty Gun Interface Board fuse	1. Check gun fuse LED on Gun Interface Board inside cabinet. 2. If LED is out, fuse is probably open. Check gun fuse on Gun Interface Board. 3. Rplace bad fuse with identically rated type.
	Faulty gun circuit board	1. Verify that each gun operates properly by connecting it to working VGM. 2. If gun still doesn't work, gun circuit board may be bad. Repair or replace board.

NOTICE: Bright overhead lights occasionally interfere with optical gun operation. Neon lights might also interfere. To eliminate this interference, reduce light levels and adjust gun flash brightness.

Gun Troubleshooting Table, *continued*

SYMPTOM	CAUSE	REQUIRED ACTION
• Intermittent or completely non-functional guns • VGM *(video game machine)* starts normally.	Faulty wiring	1. Check for wires caught in door hinges, latches, or switch contacts. 2. Verify that harness connectors are attached and fully seated. 3. Check that cabinet wiring is correct for this VGM. Assure that control switches connect properly to control input wires. 4. Assure that gun switch wires connect properly to Gun Interface Board connectors P1 and P2. 5. Check sync connection between JAMMA connector on CPU Board and sync connector on Gun Interface Board. Sync must be connected, or guns won't operate. 6. Remove screws from gun. Separate pieces at handle end first, using care not to dislodge parts. (Trigger and pump are spring loaded.) Check gun board, switches and switch connectors. Clean lens to remove fingerprints and dust. Reinstall shields removed during disassembly. After you reassemble gun, verify that good connection exists between static shield and cable ground. 7. Check gun cable ground connections.
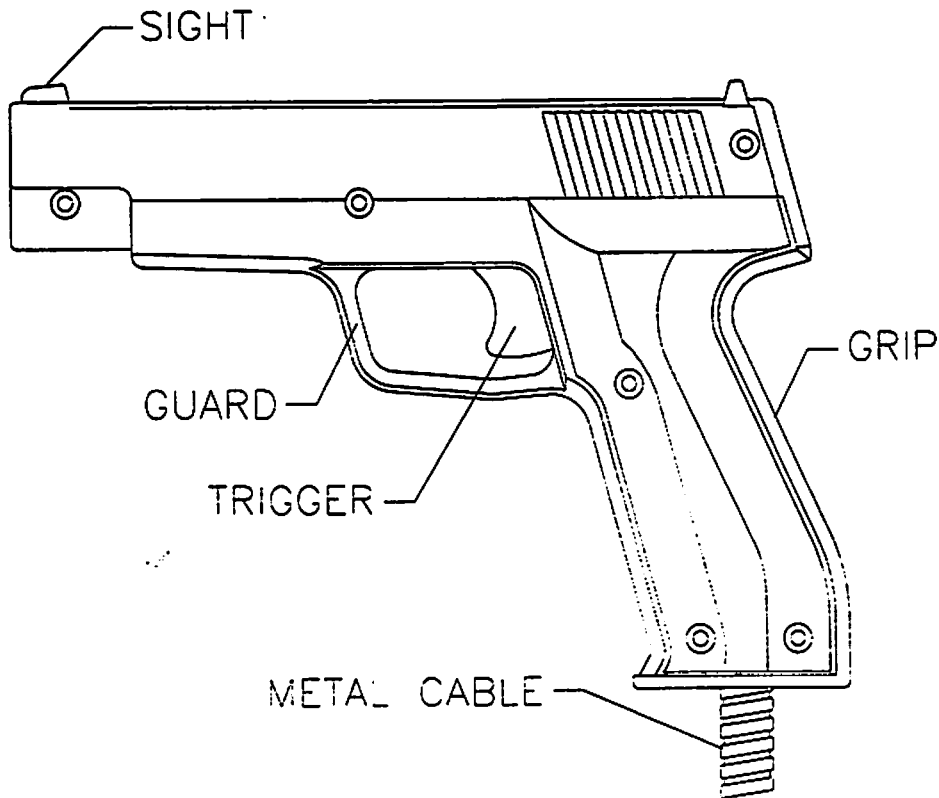
GUN PARTS

Audio Troubleshooting Table

SYMPTOM	CAUSE	REQUIRED ACTION
• No audio • Video is present • VGM *(video game machine)* appears to operate normally	Improper volume setting	1. Unlock and open coin door. Enter Menu System by pressing and holding TEST MODE switch inside coin door. From Main Menu, choose VOLUME ADJUSTMENT. Verify that volume levels have not been set at zero. Change levels if necessary to make VGM audible. 2. From Main Adjustments Menu, choose ATTRACT MODE SOUNDS to see if this feature is active (on).
	Faulty CPU Board	1. From Sound Test Menu, run SOUND SYSTEM TEST. Test checks entire sound system. 2. Run power-up self-test sequence. Note errors that VGM finds during these tests. Compare circuit board LEDs with LED indicator status charts. Note discrepancies. 3. Verify proper operation of CPU Board by connecting it to working VGM. 4. If board is faulty, replace it.
• Constant low hum from all speakers	Faulty wiring	1. Check that cabinet wiring is correct for this VGM. 2. Verify that cabinet wiring provides separate wires (not common return) for each speaker. 3. Check connection of all cabinet ground wires.
	Faulty power supply	Using 2 Volt AC setting on digital voltmeter, measure same DC voltages. Any reading indicates ripple or noise. In that case, service power supply.
• Audio is distorted, muffled or has missing frequencies • Some sounds appear to be missing	Faulty or improper speaker	1. Turn off VGM power. Remove grilles and check speakers. Free speaker cones, terminals, mounting screws and magnets of loose parts. 2. Assure that speakers are FULL RANGE (100 to 10,000 Hz response) and rated for at least 20 WATTS. 3. Verify proper speaker operation by connecting speaker in question to working VGM.
	Faulty wiring	Multiple-speaker installations: Check for reversed wires at one speaker. Weak low frequencies and thin or hollow sound quality is symptom of incorrectly phased speakers. Sound tests may not detect this, but you can detect it during game play.
• Dead sound channel	Faulty speaker	1. From Sound Test Menu, choose PLAY SOUNDS. Recheck speakers with audio signals provided by test. 2. Verify proper speaker operation by connecting speaker in question to working VGM.
	Faulty CPU Board	1. From Sound Test Menu, run SOUND SYSTEM TEST. Test checks entire sound system. 2. Run power-up self-test sequence. Note errors that VGM finds during these tests. Compare circuit board LEDs with LED indicator status charts. Note discrepancies. 3. Verify CPU Board operation by connecting board to working VGM. 4. If board is faulty, replace it.
	Faulty wiring	Verify that correct cabinet wiring is correct. Assure that all speakers connect to audio wires from JAMMA connector.

Video Troubleshooting Table

SYMPTOM	CAUSE	REQUIRED ACTION
• Monitor appears non-functional • Audio is present • VGM *(video game machine)* controls operate normally	Power problem	Verify connection of AC Power to video monitor. Inspect CRT neck in dim light. Glowing filament near CRT base suggests some monitor circuits receive power. Voltages or signals be abnormal.
	Faulty wiring	1. Turn off AC power. Verify that video signal and Remote Adjustment Board connectors seat properly on Video Monitor. 2. Assure that video cables connect to Video Monitor and CPU Board. 3. Assure that no wires are caught on chassis or mounting brackets.
	Improper monitor adjustments	Check that BRIGHTNESS (intensity) and CONTRAST are set above their minimum levels.
	Faulty monitor circuitry	1. Examine AC line fuse in Video Monitor. If fuse is faulty, replace it with identical fuse. 2. If fuse is good: Verify that video monitor operates correctly by placing it in working VGM. 3. If monitor is bad: Check monitor power supply. 4. If power supply is good: Check monitor horizontal output transistor and related circuitry.

⚠	**WARNING: HIGH VOLTAGE.** VGM *(video game machine)* monitors generate and store potentially lethal high voltages. Avoid touching any part of the monitor until power has been off for some time. A picture tube can maintain a hazardous charge for up to several days. Only qualified technicians should service monitors. Turn off the power, unplug the VGM and discharge the CRT before attempting service. Even properly discharged tubes can revert to a highly charged state, *without reapplication of power.*
⚠	**WARNING:** In normal operation, the monitor doesn't require isolation from AC line voltage. During bench servicing, you may need to operate the monitor outside the cabinet. If you do, *isolate the monitor from line voltage with an isolation transformer.*

Video Troubleshooting Table, *continued*

SYMPTOM	CAUSE	REQUIRED ACTION
• VGM *(video game machine)* doesn't appear • No audio • Power-up self-test runs	Improper components	1. Verify that ROM instruction set is correct for this VGM. Instruction set includes more than one ROM. Assembly number and software version appear on each ROM's label. 2. Verify that CPU Board is correct for this VGM. Manufacturer name, assembly number and hardware version appear on each CPU Board.
	Faulty wiring	Inspect CPU Board. Assure that JAMMA cable connector seats properly into mating edge connector on CPU Board. Check cable connectors for correct alignment and continuity.
	Faulty power supply	1. Turn on VGM power. Using 20 Volt DC setting on digital voltmeter, measure DC voltages at power connector pins. Verify +5V source if it is adjustable. 2. Using 2 volt AC setting on digital voltmeter, measure same DC voltages as above. Any reading indicates ripple or noise. In that case, service power supply.
	Faulty CPU Board	1. During self-test, record error messages. 2. Compare CPU Board LED states with CPU LED Indicator Table (Chapter Five).
• Blotches of color appear on screen	Picture tube aperture mask is magnetized	Remove diskettes from room. Demagnetize monitor with external degaussing coil. Take care not to magnetize neighboring VGMs. Monitor may be on or off for this procedure.
• White areas in center of screen appear tinged with color • Object edges have fringe of one or more colors	Picture tube purity or static convergence is out of alignment	1. Turn on VGM. 2. Press and hold TEST MODE to enter Menu System. At Main Menu, select Diagnostic Menu. Then select Monitor Patterns Menu. Run through these screens to find clearest display of problem: Sizing Pattern (Crosshatch), Red, Green and Blue Screen. 3. Display screen with greatest problem. 4. Display Sizing Pattern (Crosshatch) Screen. Locate purity and static convergence ring magnets on back of monitor neck. Watch screen in mirror. Adjust magnets to minimize problem. Follow instructions from monitor manufacturer. 5. Display Sizing Pattern (Crosshatch) Screen. Touch up adjustments while watching screen in mirror.

⚠	CAUTION: Don't operate the monitor without its Remote Adjustment Board.
FRAGILE	**WARNING: HANDLE FLUORESCENT TUBE AND CRT WITH CARE.** If you drop a fluorescent tube or CRT and it breaks, it will implode! Shattered glass can fly eight feet or more from the implosion.

Video Troubleshooting Table, *continued*

SYMPTOM	CAUSE	REQUIRED ACTION
• White areas at screen edges appear tinged with color • Dots at screen edges appear oval or cylindrical	Picture tube dynamic convergence is out of alignment	Have service bureau dynamically reconverge monitor. This procedure requires removing and repositioning yoke. Service bureau must follow instructions from monitor manufacturer.
• Video tears or rolls, or has black bar down middle of screen	Faulty wiring	1. Check connectors and cables for wiring continuity. Video cables connect CPU Board to video monitor. 2. Assure connection of all cabinet ground wires, especially at video monitor chassis.
	Faulty monitor circuitry	1. Verify that video monitor operates correctly by connecting it to working VGM *(video game machine).* 2. Assure that video monitor is correct type for this VGM. Video monitors with wrong resolution can't lock sync.
	Improper sync signals	Check to see if CPU Board puts out type of sync that your monitor requires.
	Electromagnetic fields	Move cabinet far away from machines, appliances, or competitors' VGMs.
• Missing colors	Faulty wiring	Check connectors and cables for wiring continuity from circuit boards to video monitor.
	Faulty monitor color drive circuitry	Verify that video monitor operates correctly by connecting it to working VGM.
• One color is dimmer or brighter than others • Whites appear tinted everywhere on screen	Maladjusted color bias pots	1. Turn on VGM. 2. Enter Monitor Test Patterns Menu. 3. Watch Color Bars screen in mirror. 4. Adjust three bias pots for best colors. (Most monitor neck boards include these pots.) 5. If whites still seem tinted, have service bureau rejuvenate picture tube.
• Picture is dim or faded	Maladjusted BRIGHTNESS pot or subnormal picture tube emission	1. Watch Color Bars screen. Adjust BRIGHTNESS and CONTRAST pots for greatest number of grays. You'll find these pots on Monitor Remote Control Board, behind coin door. 2. If pots have no effect, have service bureau rejuvenate picture tube.
• Picture is too narrow	Maladjusted WIDTH pot	Enter Monitor Test Patterns Menu. Watch Sizing Pattern (Crosshatch) Screen while adjusting WIDTH pot for best picture. You'll find this pot on Monitor Remote Control Board, behind coin door.
• Picture is too short	Maladjusted HEIGHT pot or damaged vertical circuit	1. Enter Monitor Test Patterns Menu. Watch Sizing Pattern (Crosshatch) Screen while adjusting HEIGHT pot for best picture. You'll find this pot on Monitor Remote Control Board, behind coin door. 2. If pot has no effect, service vertical output circuit.
• Picture seems shifted to one side	Maladjusted HORIZONTAL POSITION pot	Enter Monitor Test Patterns Menu. Watch Sizing Pattern (Crosshatch) Screen while adjusting HORIZONTAL POSITION pot for best picture. You'll find this pot on Monitor Remote Control Board, behind coin door.
• Keystone-shaped picture	Shorted turns in yoke	1. Substitute working yoke. 2. Have service bureau converge monitor. 3. Retest monitor.

Miscellaneous Problem Troubleshooting Table

SYMPTOM	CAUSE	REQUIRED ACTION
• Marquee lamp is intermittent or non-functional • VGM *(video game machine)* starts and plays normally	Faulty fluorescent tube	1. Remove fluorescent tube from its sockets. If you find cracks or darkened ends, install new lamp. Clean tube. 2. Check continuity of both fluorescent tube filaments. 3. Verify that fluorescent tube operates by placing it in working VGM.
	Faulty lamp fixture	Verify that lamp pins make good connection with socket contacts.
	Faulty wiring	1. Measure fluorescent lamp AC voltages. Check wiring and connector continuity from AC power chassis to lamp assembly. 2. If you find faulty wiring, repair or replace it.
• VGM operates normally • Cabinet becomes warm after several hours of use	Obstructed fan	1. Check bottom and rear of cabinet for blocked air flow. 2. Clear obstructions. 3. Move VGM away from sources of heat. 4. Turn off VGM power. Remove dust from vent holes with high-power vacuum cleaner.
	Faulty wiring	1. Check fan wiring and connectors. 2. If wiring is faulty, repair or replace it.
	Faulty fan	1. Check operation of all fans. 2. If fan is faulty, replace it.
• Players complain that VGM resets intermittently • Audits Menu displays an unusual number of watchdog resets	Corrupt software	1. Press and hold TEST MODE to enter Menu System. At Main Menu, enter Audits Menu. 2. Select VIEW GAME AUDITS. 3. On fourth audit screen, note WATCHDOGS indication. 4. If you find numerous watchdog resets, clear bookkeeping totals and restore factory settings. Retest VGM. 5. If resets recur, game software may be corrupt. Test game ROMs in working VGM. If second VGM develops reset problem, replace ROMs.
	Faulty hardware	1. Turn on VGM power. 2. Using 2 volt AC setting on digital voltmeter, measure DC voltages at power connector pins. Any reading indicates ripple or noise. In that case, service power supply. 3. If power supply is OK, test CPU Board in working VGM. If second VGM develops reset problem, service CPU Board.
	Power line problems or electromagnetic interference	1. Use oscilloscope to view power line waveform. Check for noisy power, glitches, spikes, etc. 2. If you find problems, consult with your power company. 3. Remove interfering appliances from VGM circuit. (These might interfere: Nearby VGMs, radio transmitters, equipment with large motors, etc.) 4. VGM line filter should remove small power problems. If necessary, add more robust power conditioning equipment between line and VGM.
• Error messages appear on screen	Faulty hardware	1. Check any assembly (RAM, ROM, Battery, etc.) identified in error messages. 2. Call your authorized distributor for help with unresolved screen messages.

WARNINGS & NOTICES

WARNING

- Use of non-MIDWAY parts or circuit modifications may cause serious injury or equipment damage!
- Use only MIDWAY authorized components and parts. Failure to do so will void your warranty and may result in incorrect or unsafe operation. Substitute parts or modifications may void the EMC directive or FCC type acceptance.
- Federal copyright, trademark and patent laws protect this Video Game Machine (VGM). Unauthorized modifications may be illegal under Federal law. The modification ban also applies to Midway Games, Inc. and VGM logos, designs, publications and assemblies. Moreover, facsimiles of MIDWAY equipment (or any feature thereof) may be illegal under federal law, regardless of whether or not such facsimiles are manufactured with Midway Games, Inc. components.

WARNING

Prevent shock hazard and assure proper VGM operation. Plug this VGM into a properly grounded outlet. Do not use a cheater plug to defeat the power cord's grounding pin. Do not cut off the ground pin.

WARNING

A very small portion of the population has a condition which may cause epileptic seizures or momentary loss of consciousness when viewing certain kinds of flashing lights or patterns that are present in our daily environment. These persons may experience seizures while watching some kinds of television pictures or playing certain video games. People who have not had any previous seizures may nonetheless have an undetected epileptic condition.

If you or anyone in your family has experienced symptoms linked to an epileptic condition (e.g. seizures or loss of awareness), immediately consult your physician before using any video games.

We recommend that parents observe their children while they play video games. If you or your child experience the following symptoms: dizziness, altered vision, eye or muscle twitching, involuntary movements, loss of awareness, disorientation, or convulsions, *discontinue use immediately* and consult your physician.

NOTICE

This kit has been tested. It complies with limits for a Class A digital device, under FCC Rules, Part 15. These limits provide reasonable protection against harmful interference when the equipment operates in a commercial environment. This equipment generates, uses and can radiate radio frequency energy. If not installed and used according to the instruction manual, this equipment may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference. If interference occurs, the user must correct it at his own expense.

NOTICE

When Midway Games, Inc. ships a VGM, it complies with FCC regulations. Your label is proof of compliance. Legal repercussions to the owner or distributor may result if the label is missing or damaged. If your VGM does not contain an FCC compliance label, call Midway Games, Inc. immediately.

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MIDWAY GAMES INC.
3401 N. California Ave. Chicago, Illinois 60618-5899 USA
Visit our Web site at http://www.midway.com