MIDWAY GAMES INC.

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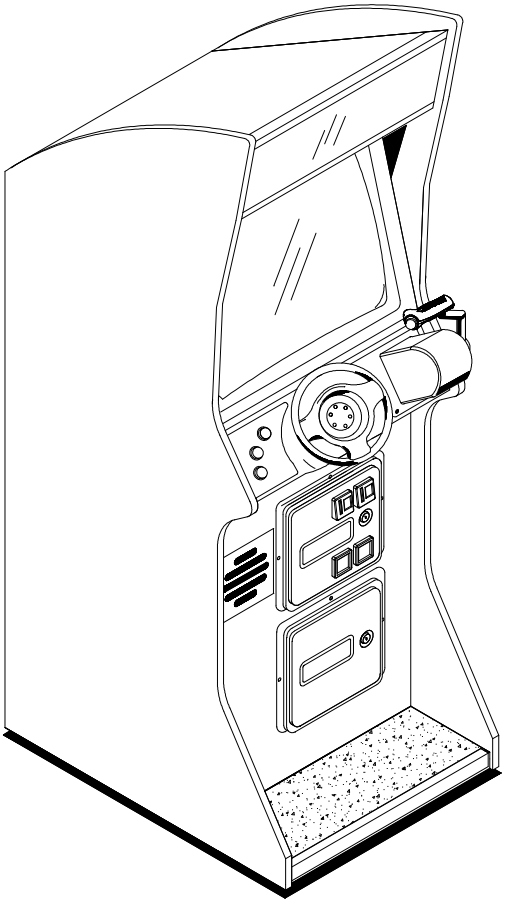
HYDRO THUNDER



UPRIGHT DEDICATED VIDEO GAME 25” CABINET

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Operations Manual Includes

● Installation ● Operation ● Testing & Problem Diagnosis
● Parts Information ● Wiring Diagrams ● Product Service

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HYDROTHUNDER™

CHAPTER ONE

PRODUCT SAFETY, SPECIFICATIONS, SETUP, & MAINTENANCE

NOTICE: This manual is subject to change without notice. MIDWAY reserves the right to make improvements in equipment function, design, or components as progress in engineering or manufacturing methods may warrant.

Fill out and mail in the Game Information Card. Include the game serial number from the label on the rear of the cabinet. For your records, write the game serial number in the manual.
SERIAL NUMBER _____

SAFETY INSTRUCTIONS

The following safety instructions apply to operators and service personnel. Read these instructions before preparing the game for play. Other safety instructions appear throughout this manual.

DEFINITIONS OF SAFETY TERMS

DANGER indicates an imminent hazard. If you fail to avoid this hazard, it WILL cause death or serious injury.

WARNING indicates a potential hazard. If you fail to avoid this hazard, it COULD cause death or serious injury.

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

NOTICE indicates information of special importance.

	WARNING: TRANSPORTING GAMES. This game contains glass and fragile electronic devices. Use appropriate care when transporting this game. Avoid rough handling when moving the cabinet. Do not move this game with the power on.
	WARNING: DISCONNECT POWER. Always turn the power OFF and unplug the game before attempting service or adjustments unless otherwise instructed. Installing or repairing PC boards with power ON can damage components and void the warranty.
	WARNING: GROUND GAMES. Avoid electrical shocks! Do not plug in a game until you have inspected and properly grounded it. Only plug this game into a grounded, three-wire outlet. Do not use a “cheater” plug, or cut off the ground pin on the line cord.
	WARNING: AVOID ELECTRICAL SHOCKS. This video game system does not utilize an isolation transformer. Internal cabinet AC is not isolated from the external AC line.
	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.
	CAUTION: CHECK POWER SELECTOR, LAMP. Set the 115/230VAC selector on the power supply for the correct line voltage. Check the selector setting before switching on the game. Verify that the fluorescent lamp assembly is correct for the local line voltage.
	CAUTION: USE PROPER FUSE. Avoid electrical shock! Replacement fuses must be of the same type as those they replace. Fuse voltage and current ratings must match ratings on the original fuse.
	CAUTION: ATTACH CONNECTORS PROPERLY. Be sure that printed circuit board (PCB) 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 only allow a connector to fit one set of pins on a board.

	CAUTION: USE CARE WHEN SHIPPING HARD DISKS. The hard disk drive must be packed in an anti-static bag. When shipping the drive for repair or replacement, pack it in an approved container (P/N 08-8068). Do not stack or drop hard disk drives.
	WARNING: HAZARD TO EPILEPTICS. A very small portion of the population has a condition which may cause them to experience epileptic seizures or have 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.

PRODUCT SPECIFICATIONS

Operating Requirements

Location	*Electrical Power*	*Temperature*	*Humidity*
Domestic	120VAC @ 60Hz 4.0 Amps	32°F to 100°F	Not to exceed 95% relative
Foreign	230VAC @ 50Hz 2.0 Amps	(0°C to 38°C)	
Japan	100VAC @ 50Hz 4.0 Amps		

Cabinet Statistics

Shipping Dimensions		*Shipping Weight*	
Cabinet		**Cabinet**	
Width	32.0" (81.3 cm)	Boxed	328 lbs. (149 kg.)
Depth	66.5" (169 cm)		
Height	76.0" (193 cm)		

Equipment Characteristics

Video Display Monitor	*Audio System*	*Currency Acceptors*
Medium Resolution RGB 25” (63.5 cm) CRT	Digital Stereo Sound Two 5.5” (14 cm) and One 6.5” (16.5 cm) Spkr	2 Coin Mechanism, Coin Counter Dollar Bill Validator Ready Electronic Coin Acceptor Ready

Game Characteristics

Player Variables	*Operator Variables*	*Diagnostics*
1 to 4 players per game (with linking) Choice of craft and course High Score Recognition	Coinage, Game Options Difficulty, Force, Volume, Audits, Statistics	Automatic Power-Up Self-Test Manual Multi-Level Menu System

PRODUCT CONFIGURATION

♦ Stand Alone Units

Each game is ready to play right out of the box. Operators may use the menu screens in the game menu system to determine some player variables in advance or leave the choices up to the players.

♦ Linked Units

Linking allows players to compete against each other (on one course). Operator menus are the same as in stand alone games. Crossover couplers and linking cables to connect two games are factory installed. Use the optional Hub Linking Kit to interconnect up to eight games (two groups of four).

MAINTENANCE

♦ Viewing Glass

It is not necessary to switch off power to the game to clean the glass. Apply a mild glass cleaner to a clean cloth or sponge, then use this to wipe the viewing glass. ***Do not apply the cleaner directly on the glass!*** Liquid could drip down into switch or control circuits and cause erratic game operation.

♦ Player Controls

Use plastic-safe non-abrasive cleaners to avoid damage. Apply cleaner to a clean cloth or sponge, then use this to wipe the player controls. ***Do not apply the cleaner directly on the controls!***

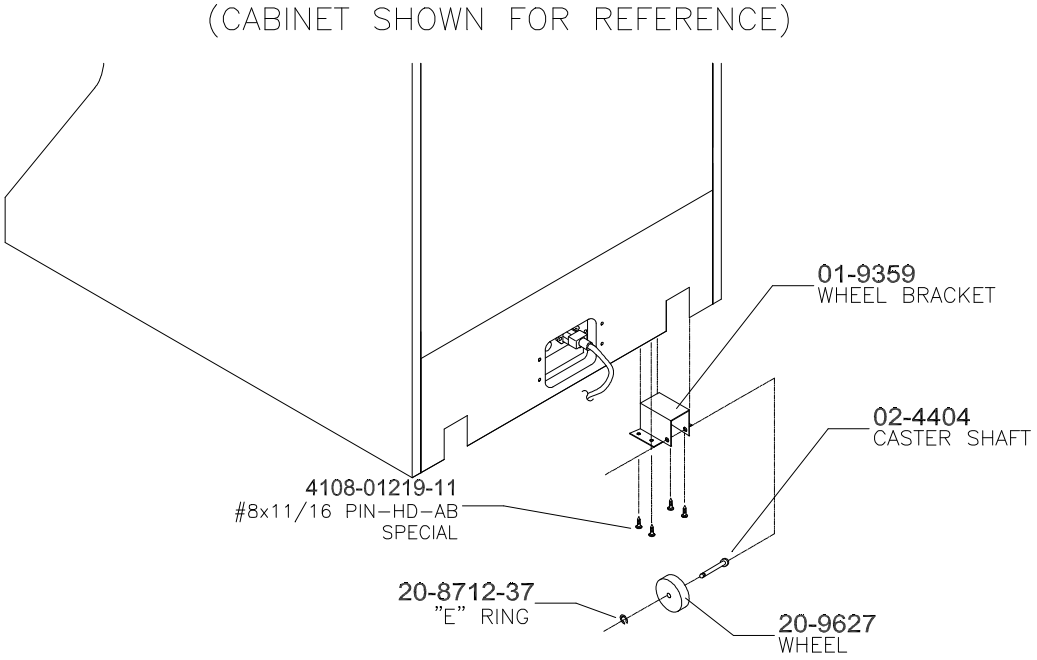
♦ Cabinet

Use plastic-safe non-abrasive cleaners to avoid damage. Apply cleaner to a clean cloth or sponge, then use this to wipe the cabinet. ***Do not apply cleaner directly on artwork or cabinet!***

GAME SETUP

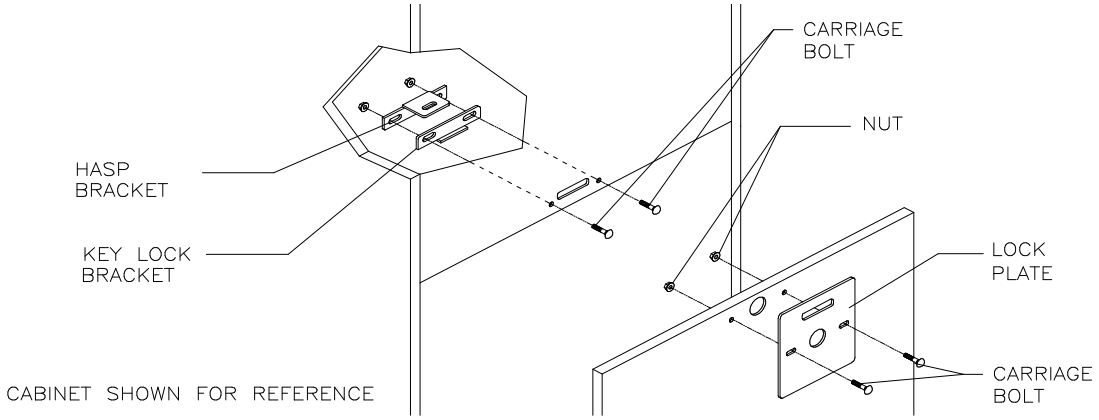
WARNING: The cabinet is top heavy. Use the two handles on the back of the cabinet when moving the game.

1. Remove all items from shipping containers and set aside. Casters, levelers, and mounting hardware are packed with the pedestal section. Inspect the exterior of the cabinet for any signs of damage.
2. Remove the keys from the steering wheel. Unlock and open the coin door and cash box. Remove the rear door. Inspect cabinet interior for any signs of damage. Check all major assemblies to assure that they are mounted securely. Ensure that nothing blocks fan airflow.
3. Electrical cords and game spare parts are in the cash box. Locate the casters and levelers first.



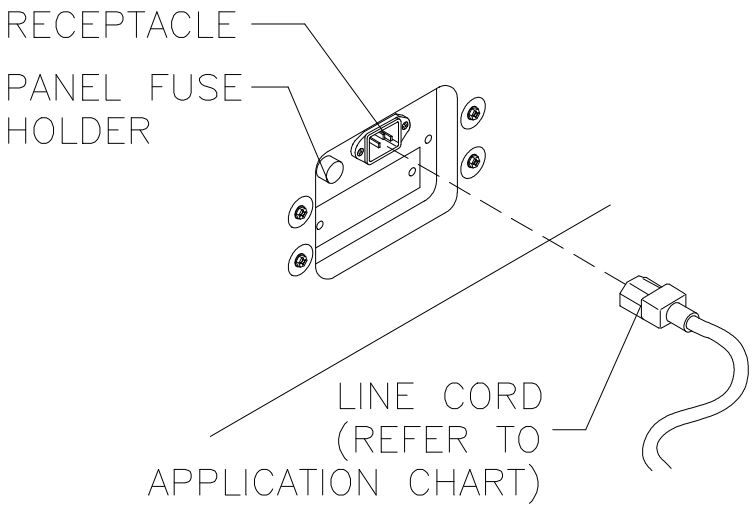
INSTALL CASTERS

4. Fasten caster wheels to their wheel brackets with caster shafts and e-rings. Mount the two wheel brackets to the bottom-rear of the game cabinet. Each bracket requires four screws.
5. Install one nut onto each leg leveler. Tilt as needed to locate four threaded holes under the cabinet. Install a leveler and nut into each hole. Do not tighten nuts at this time.
6. You can install an extra padlock to secure the rear door. You'll find a hasp in the spare parts bag. Remove the two lock bracket nuts from inside the cabinet, above the rear door opening. Slide the hasp onto the bolts so that it protrudes from the hole in back of the cabinet. Reinstall nuts and tighten.



INSTALL THE DOOR LOCK AND SECURITY BRACKETS

7. Modify the lock plate at the top of the rear door. Remove the bolts and nuts from the lock plate. Rotate the plate so that the slot will be above the door. Reinstall the bolts and nuts and tighten firmly.



INSTALL THE POWER CORD

8. The power cord is with the spare parts. Match the holes on the IEC plug with the prongs in the receptacle. Push the plug firmly to seat it. Route the cord away from cabinet wheels and foot traffic areas.
9. Refer to the game's Cabinet Wiring Diagram in Chapter 5 and check to see that all cable connectors are correctly secured. Inspect for damaged connectors. Be sure that you **DO NOT FORCE CONNECTORS**. Most connectors are keyed to prevent making reversed connections.

	CAUTION: CHECK POWER SUPPLY LINE VOLTAGE SELECTOR SWITCH. Set the 110/220 VAC selector on the power supply for the correct local line voltage. Check the selector setting before switching on the game.

10. Reinstall the rear door and close it. Lock the rear door and remove the key. If required, install the extra padlock through the hasp. Install the screws at the top and sides of the rear door. Tighten the screws snugly. Close and lock the cash box and coin doors.

	NOTICE: Tamper-resistant screws and a matching wrench are provided with this game for additional security. Four tamper-resistant screws and a wrench are located in the spare parts bag. If desired, replace the original screws with the tamper-resistant screws. Tighten the screws firmly with the wrench.

11. Move the game to its play location. Lower each leg leveler until the cabinet is stable and level. Adjust the levelers as required to raise wheels and distribute weight equally on each corner. Tighten the nuts.
12. Plug the game into a grounded (3-terminal) AC wall outlet. Switch on the game, using the on/off switch at the top-left rear of the cabinet. The game will power up and begin self-diagnostics. If diagnostics find no errors, the game enters its Attract Mode of operation.
13. Unlock and open the coin door. Locate the control switches. Press TEST MODE to enter the Menu System.
14. Follow the on-screen instructions to select the Diagnostics Menu, then choose Hard Drive Tests. Perform each of the routines to verify hard disk drive operation. If no errors are found, the program should function well.
15. Return to the Diagnostics screen, then choose Monitor Patterns. Use the various patterns to verify that the monitor is properly adjusted.

16. Return to the Diagnostics screen, then choose Switch and Lamp Tests. Follow the on-screen instructions to verify that each of the controls and lights is operational. If no errors are found, the controls should function well.
17. Return to the Diagnostics screen, then choose Stereo Sound Tests. Follow the on-screen instructions to verify that each of the speakers is operational. If no errors are found, the audio should function well.
18. Return to the Diagnostics screen, then choose Force Feedback Tests. Follow the on-screen instructions to verify that steering resistance is present. If no errors are found, the aim should be good.
19. Return to the Main Menu screen, then choose Calibrate Steering and Throttle. Follow the on-screen instructions to set steering and throttle limits. If no errors are found, the controls will have the maximum accuracy.
20. Return to the Main Menu screen, then choose Start the Game. The game will automatically enter its Attract Mode of operation (scenes and sounds from typical races, players' scores, messages, etc.).
21. Insert currency or tokens and play a game. Change the volume and make any other adjustments. Install the rear door. Close and lock all doors. Tighten the leveler nuts and engage the caster locks.

HYDROTHUNDER™

CHAPTER TWO

OPERATION, FEATURES, AUDITS, & ADJUSTMENTS

NOTICE: This manual is subject to change without notice. MIDWAY reserves the right to make improvements in equipment function, design, or components as progress in engineering or manufacturing methods may warrant.

GAME OPERATION

DESIGN PHILOSOPHY

This game uses an “Arcade Computer” to control its functions. The “Arcade Computer” is a hybrid cross between the custom game computer circuits used in most games and the personal computers found in many offices. The “Arcade Computer” uses a familiar case enclosure with a motherboard, plug-in cards, a modular power supply, disk drives, etc., but it has been optimized specifically for playing this game. This design permits improved upgrade and service access without sacrificing game ruggedness or reliability.

PLAYER CONTROLS

- **BOOST Button**
  This button allows a player to begin or continue play, select tracks and boats, etc. If the Boost feature is active, this adds a burst of power (the button is illuminated when Boost is available during a race). An on-screen gauge shows exactly how much Boost fuel has been collected by a player.

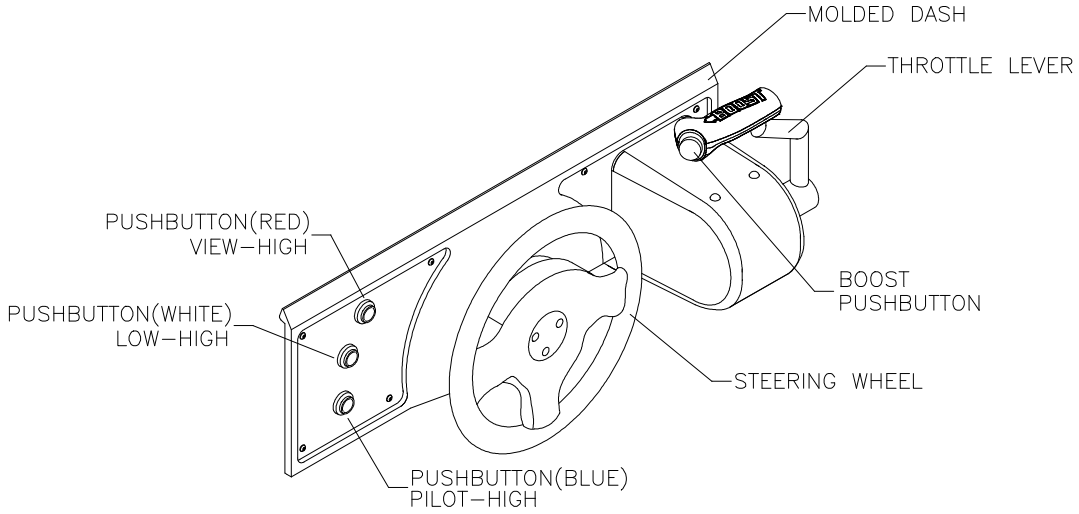
- **THROTTLE Lever**
  Controls craft speed. Push up to move forward, down to back up. Stop is a detent position in between. Reverse is spring loaded, but forward speeds may be maintained without attention (cruise).

- **STEERING WHEEL**
  The steering wheel is used to aim the craft. It provides course condition feedback to the pilot.

- **HIGH View**
  This button gives a distant aerial view of the track. The position is from above and behind the boat. This is what a helicopter camera would see.

- **LOW View**
  This button gives a close up aerial view of the track. The position is from above and behind the boat. This is what a boat camera would see.

- **PILOT View**
  This button shows the cockpit view. The position is from the driver’s seat inside the boat. This is the view through the windshield as seen from normal driving perspective.



PLAYER CONTROL LOCATIONS

OPERATOR CONTROLS

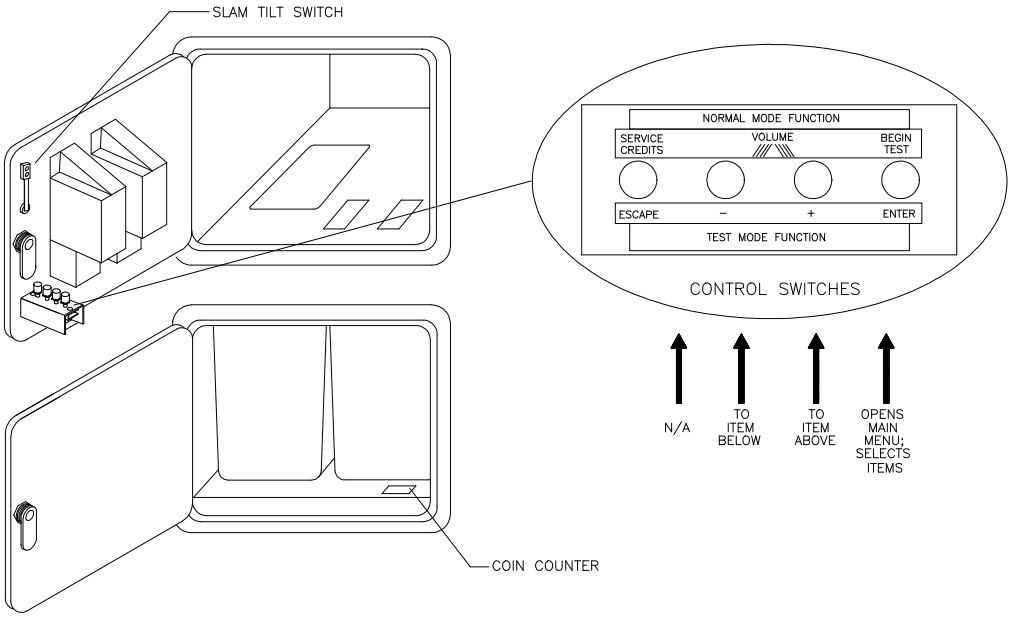
CABINET CONTROLS

- **The DIP Switches** set some system variables. You can set other variables in the menu system.
- **The Monitor Remote Control Board** allows you to adjust the video display for optimum viewing.
- **The Cabinet POWER Switch** turns off the entire game, but does not reset game variables.
- **The Computer POWER Switch** turns off the computer. It is internally located. Use it for servicing.

CONTROL SWITCHES

- **TEST MODE Button** causes the game to enter the menu system. Press the TEST MODE button briefly to run automatic tests. Or, press and hold TEST MODE Button until the Main Menu appears. Within the menu system, the TEST MODE Button's function is described on each screen.
- **VOLUME DOWN and VOLUME UP Buttons** adjust the 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 and VOLUME DOWN moves the item selector through each of the menus.
- **SERVICE CREDITS Button** allots credits without changing the game's bookkeeping total. SERVICE CREDITS Button functions in the menu system are also described on each screen.

NOTICE: The Attract Mode volume level is separate from the Game Mode volume level. For greater profits, raise volume levels to add realism and draw attention to this game.



OPERATOR CONTROL SWITCH LOCATIONS

GAME FEATURES

STARTING UP

Each time the game is first turned on or power is restored, it begins executing code out of the boot ROM. These self-diagnostic tests automatically verify and report condition of the CPU and the game hardware. If any of the individual tests fails, the game may display an error message.

Once all Power-up tests are complete, the game goes into the “attract mode”. Scenes and sounds from a typical game alternate with previous high scores in an endless pattern until game play starts.

Insert currency to start the game. Players select a boat and a track. Play begins after a countdown period. The game will progress until time is exhausted or play is over. If no more play is required, the game automatically returns to the “attract mode”.

GAME RULES *Play instructions are on the information panels over and under the video monitor.*

INDIVIDUAL PLAY

Insert currency to start the game. Select a boat and a track. Additional game information appears on the screen when needed. Individual statistics are shown periodically during the race and its end.

PLAYER CHOICES

Any boat can be used on any track. Each boat handles and performs differently. Players will learn which boats are best for a given track and driving style. Press one of the VIEW buttons to select more boats.

CONTROLLING THE BOAT

The steering wheel and throttle control the boat. The steering wheel directs the boat while the throttle sets its speed. A “BOOST” button on the throttle gives an extra burst of power. This button flashes when the additional “BOOST” is available. In order to use “BOOST,” players must collect “BOOST” icons along a track by steering directly under them. A gauge shows exactly how much “BOOST” power is available.

INDICATORS

On-screen indicators give the players information about their boat and those of competitors. Across the top of the screen are numeric indicators for elapsed time, time remaining to pass the next checkpoint, and race position. Gauges show engine R.P.M., vehicle speed, and “BOOST” fuel remaining.

DISPLAYS

A superimposed radar map shows the terrain and the position of all boats, with your craft at the center. Computer-controlled boats are shown as green triangles, other human-piloted boats are shown as red triangles, and police craft are shown as blue triangles. At the bottom of the screen, another display shows the relative position of nearby boats.

GAME ACTION

Action begins when the three-two-one countdown ends and the announcer yells “Go!” Boats must pass checkpoints within time limitations to continue play. Players must avoid fixed obstacles and other boats to decrease their time between checkpoints. Ramps along the route allow players to advance more quickly, collect hovering “BOOST” icons, or avoid obstacles.

Players can change their view of the action by pressing the view buttons on the left side of the control panel. The game includes announcer comments, engine sounds, and other noises.

SCORING

Players who set a speed record for any track may enter their initials in the high score table. After a certain number of tracks are completed (determined by the adjustments), additional tracks become available.

MENU SYSTEM

SYSTEM OVERVIEW

A series of on-screen menus present game variables and diagnostics. The Main Menu screen allows the operator to view information, make changes, or verify equipment operation. Each Sub Menu screen displays one specific group of choices. Detail Menus present data or run the required tests. You must be at the Detail Menu level to detect errors, make changes, or activate tests. The operator control switches are used to move through the menus, select items, and start or stop particular routines.

Each time the game is turned on or switched from normal play mode to the menu system and back, the startup routine is activated. These basic system checks run automatically; their purpose is to detect those faults that would prevent the game or the menu system from operating properly. Messages appear on the screen as each item runs, including any error information. Successful startup takes less than one minute to complete. Write down any messages or information before proceeding to the menus or game play.

SCREEN LAYOUT

Each menu screen is different, but the material presented stays in the same physical location each time.

The color bar at the top center of each screen displays the current menu title.

The center of the screen shows data (menu items, video signals, statistics, reports, etc.)

The bottom of the screen displays messages (explanations, control functions, revision levels, etc.)

ORGANIZATION

The operator must activate and deactivate the menu system manually using control switches.

The Main Menu screen items are divided into categories: tests, statistics, audits, adjustments, etc.

Tests can verify proper operation of the equipment assemblies one at a time.

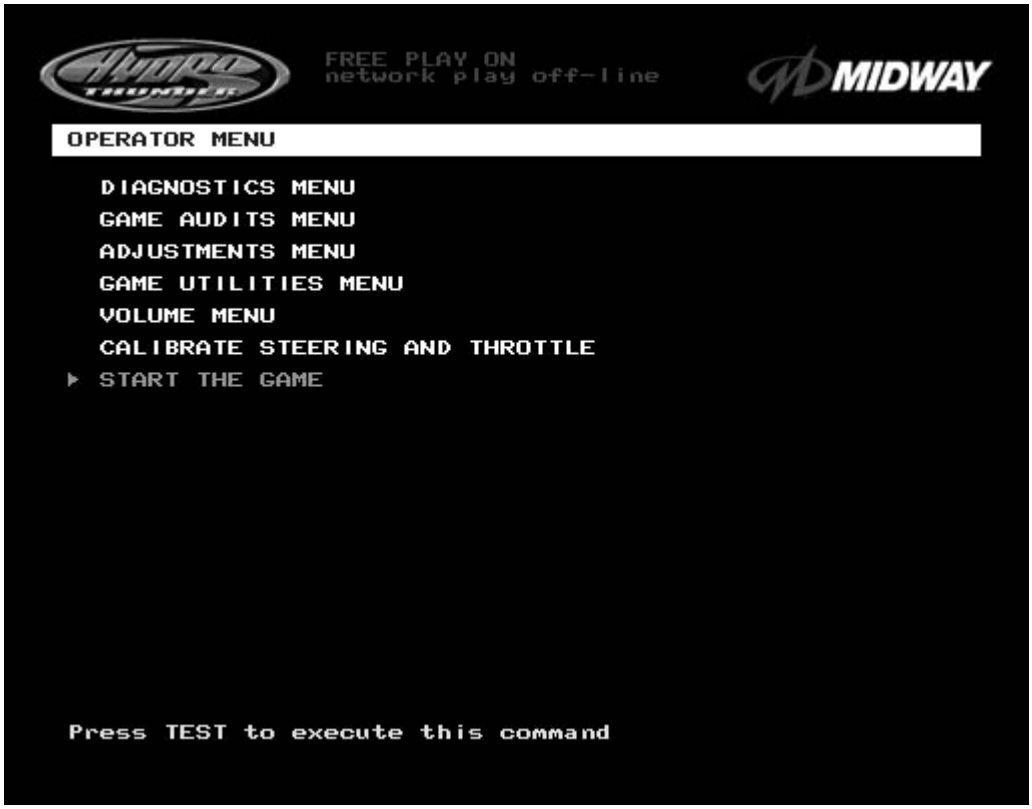
Other items allow operators to assess game performance and customize or return to factory defaults.

Sub Menu screen items present the operator choices within a category. Some items have no Sub Menu while others may have more than one. It is always possible either to return to the previous menu or go on to the next menu. The instructions are usually listed at the bottom of each individual screen.

Detail Menu screen items display specific information. The operator must command the system to get results or to make changes. There is always a way to go back to the previous menus from this screen.

Switch functions are listed on each screen. Use the control switches to highlight an item on any menu. *Only one highlighted item can be selected at a time.* Press the indicated button to select a highlighted item. To return the game to normal play mode, use the switches to return to the main Operator Menu and select START THE GAME, then press TEST. The menu screens will be replaced by the “Attract” scenes.

OPERATOR MENU



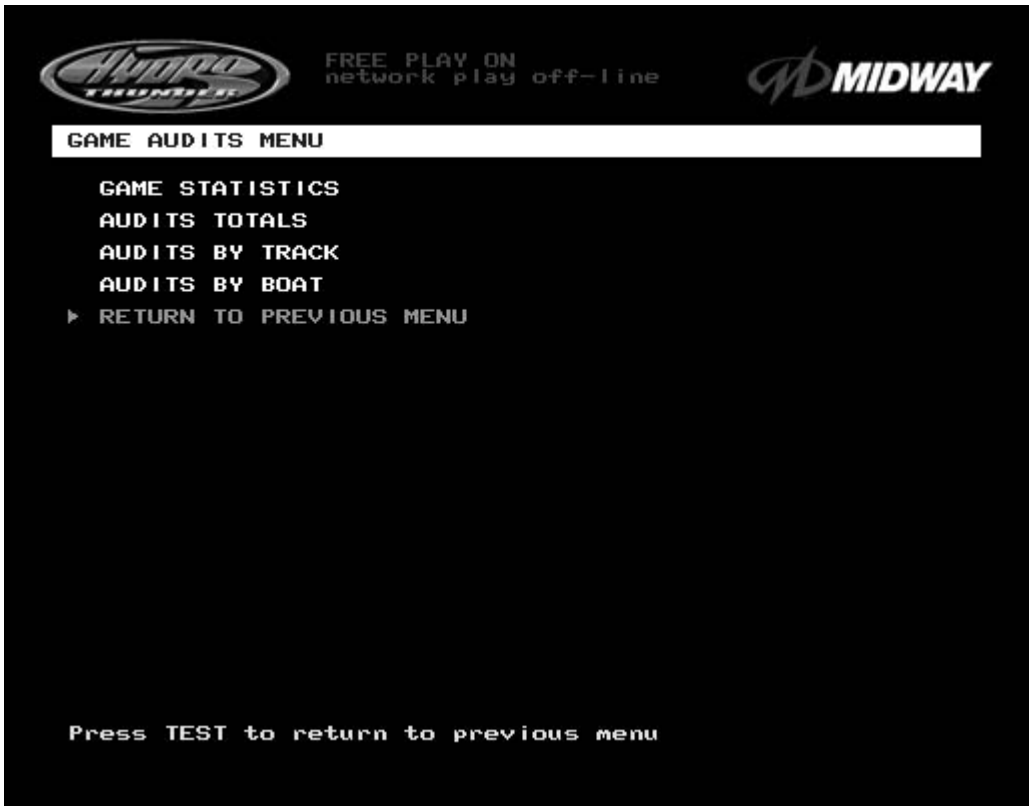
MAIN OPERATOR MENU SCREEN

The **Operator Menu** is the top-level screen of the Menu System. It presents the general categories of operator selectable items. All subsequent screens show more detail than this one. This screen does not permit changes. This is the only menu that allows the operator to exit from the menu system by choosing **Start the Game**.

Unlock and open the door to use the operator control switches. Press the TEST button to enter the **Operator Menu** screen. Use the **Volume Up** and **Volume Down** buttons to move up or down through the list of items. Follow the on-screen instructions to continue to other menu screens.

The top center area of the screen between the game and manufacturer's logos displays information about major variables that affect game operation. **FREE PLAY ON** indicates that the game will start without inserting currency or tokens). **Network play off-line** indicates that this game is not linked to another at this time. These items may be changed from the **Adjustments** menus.

GAME AUDITS



GAME AUDITS MENU SCREEN

The **Game Audits Menu** provides the operator with options for various summaries of the game statistics and audits. Detailed reports give statistics based on player selections and performance.

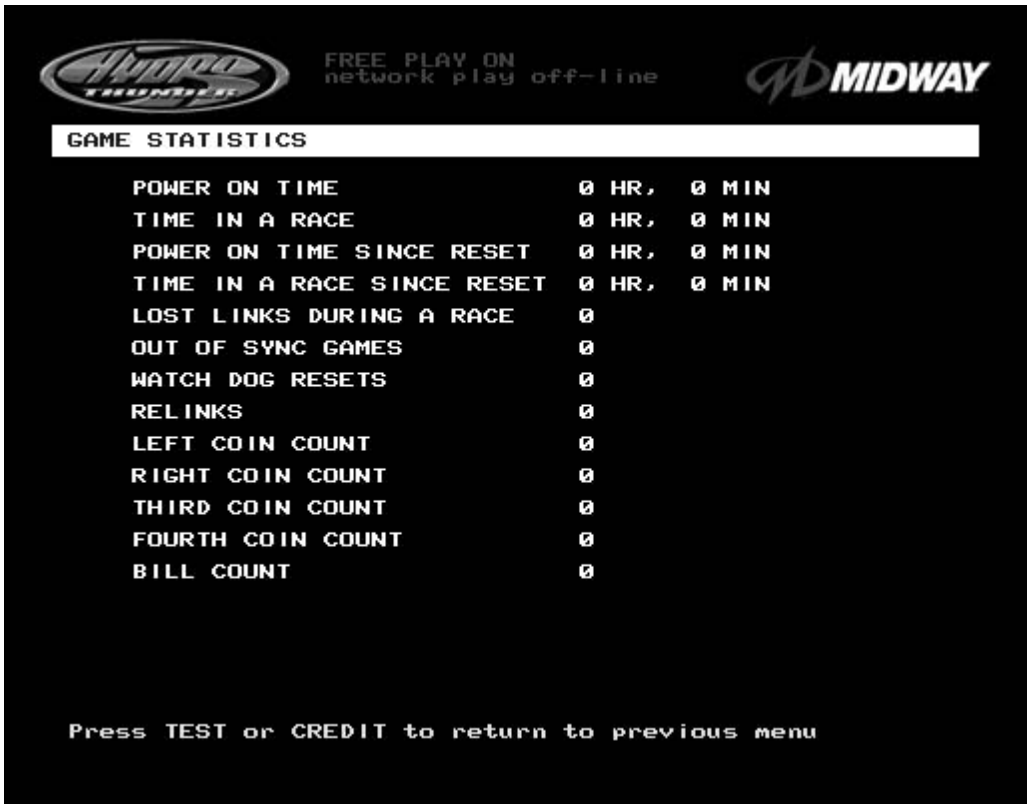
To view a report, use the operator control switches to select the **Game Audits Menu** and a specific report. Press TEST to activate the report. Follow the on-screen instructions to continue to other menu screens.

Use the information in these reports to keep records of the game's popularity and earnings. The operator may also analyze favorite tracks, most frequently used boats, and other statistics. These screens report information but do not permit changes.

Examine and record all game audit values before doing service or making repairs on this game.

*NOTE: Use caution when clearing audit information. Once data has been cleared, it cannot be restored. Use the "Save Audits to Floppy Disk" option on the **Game Utilities Menu** to save the data for analysis. To clear these statistics or audits, go to the **Game Utilities Menu.***

GAME STATISTICS



GAME STATISTICS SCREEN

The **Game Statistics** report displays general information about coin counts and game usage. Use the operator control switches to select **Game Statistics** from the **Game Audits** menu. Press TEST to enter the **Game Statistics** display. This screen reports information but does not permit changes.

The **Coin Count** and **Bill Count** items permit the operator to assess currency collection. The other items present information on game operation.

Reset, link, and **sync** statistics are measures of the game software's ability to recover from conditions that adversely affect game play.

AUDITS TOTALS

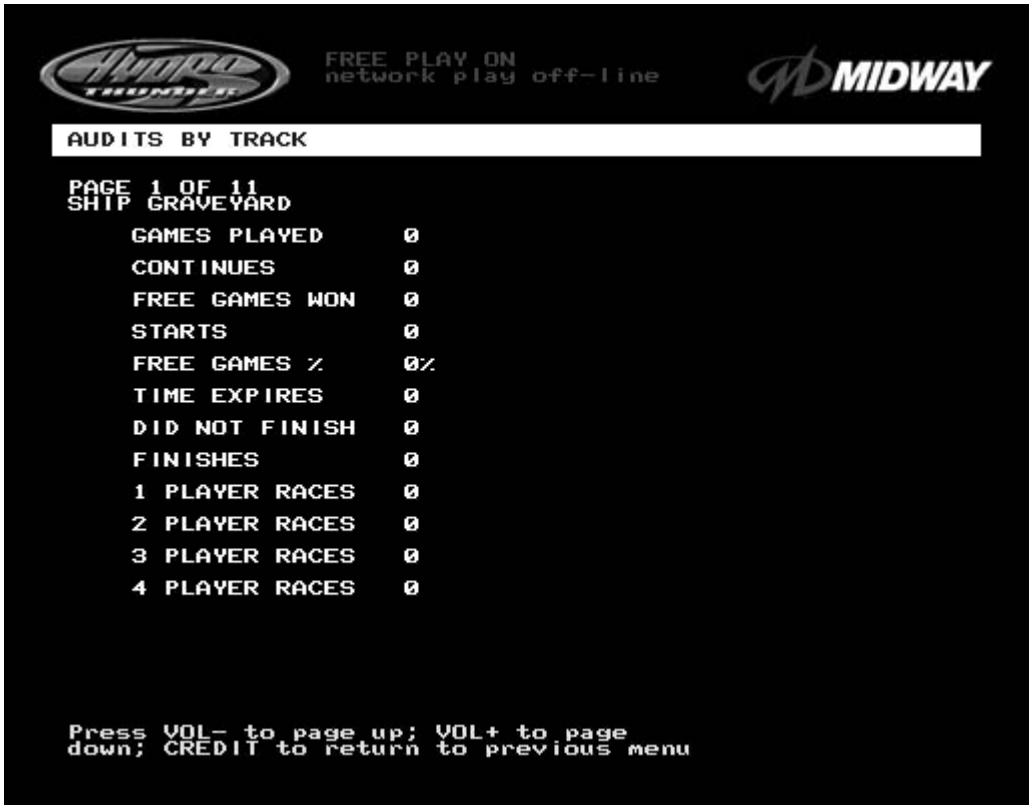
AUDITS TOTALS SCREEN

The **Audits Totals** display additional information about player statistics and ability. This information assists the operator in understanding game usage and profitability. Use the operator control switches to select **Audits Totals** from the **Game Audits** menu. Press TEST to enter the **Audits Totals** display. This screen reports information but does not permit changes.

Free Games Won remains at zero if the bonus and award options are set to **OFF**. Refer to the **General Adjustments Menu** for the bonus and award options settings.

Two-, Three-, and Four Player Races remain at zero if no other games are linked to this one.

AUDITS BY TRACK

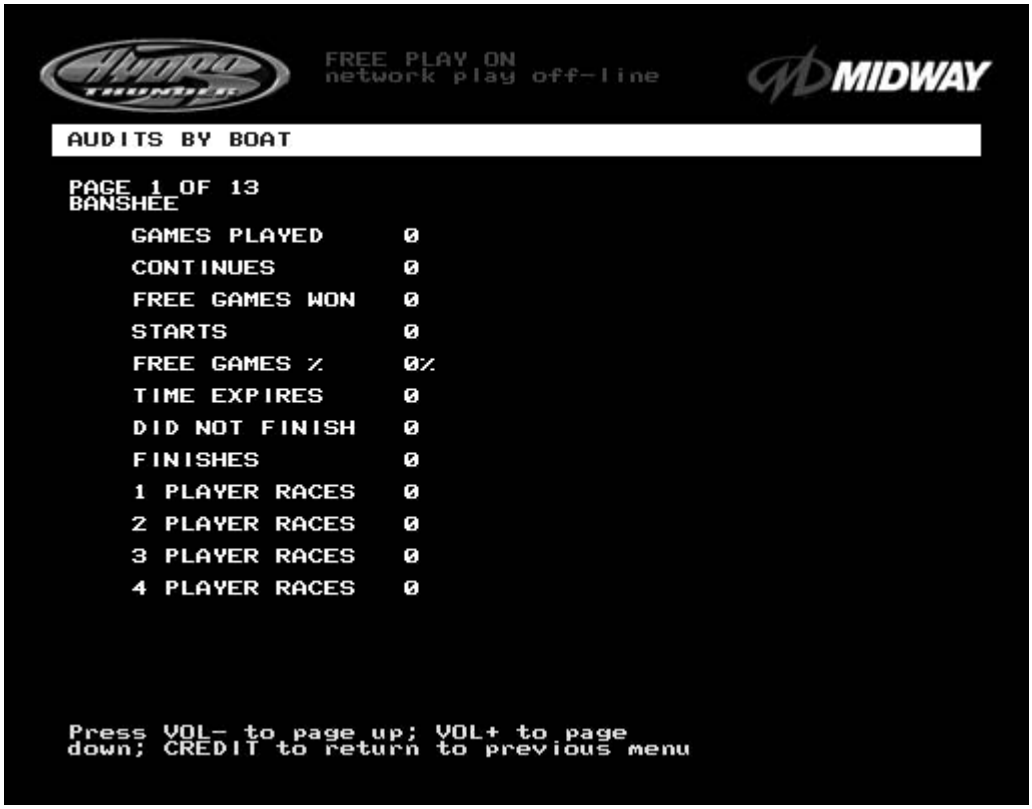


TYPICAL AUDITS BY TRACK SCREEN

The **Audits by Track** report gives operators more specific information about player choices and ability. Use the operator control switches to select **Audits by Track** from the **Game Audits** menu. Press TEST to enter either display. This screen reports information but does not permit changes.

There are several pages of these audits. The name of the track appears at the top of the page. Press the VOLUME UP or VOLUME DOWN buttons to move through these pages.

AUDITS BY BOAT

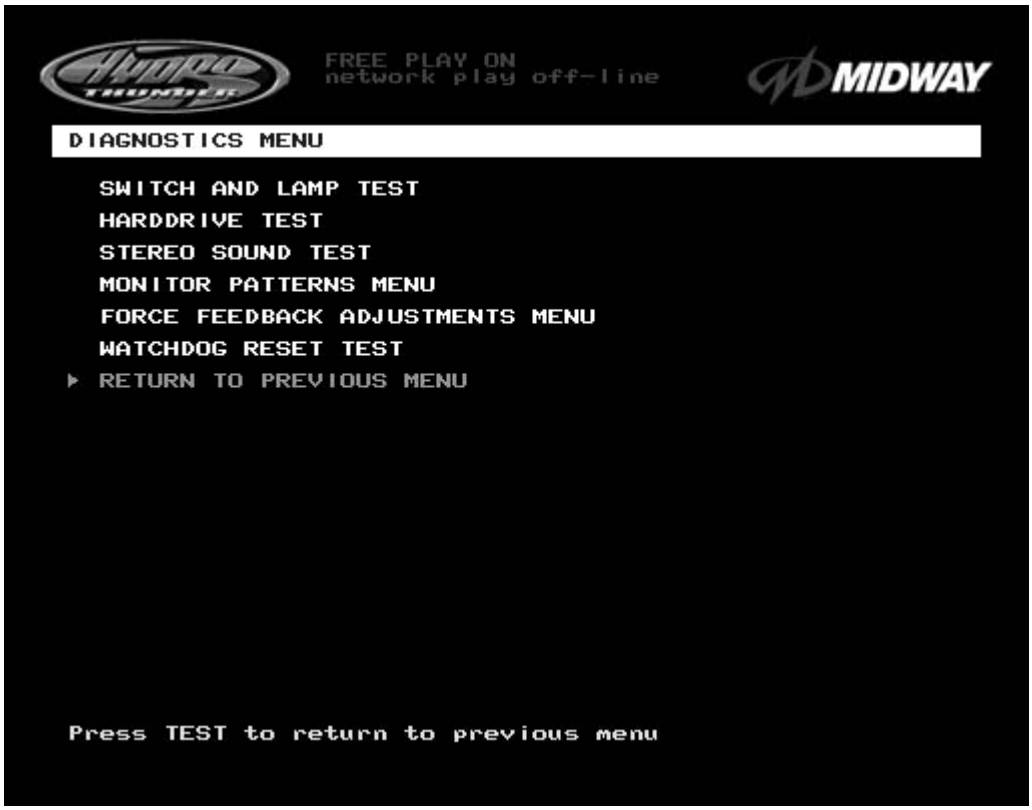


TYPICAL AUDITS BY BOAT SCREEN

The **Audits by Boat** report gives operators more specific information about player choices and ability. Use the operator control switches to select **Audits by Boat** from the **Game Audits** menu. Press TEST to enter either display. These screens report information but do not permit changes.

There are several pages of these audits. The name of the boat appears at the top of the page. Press the **Volume Up** or **Volume Down** buttons to move through these pages.

DIAGNOSTICS

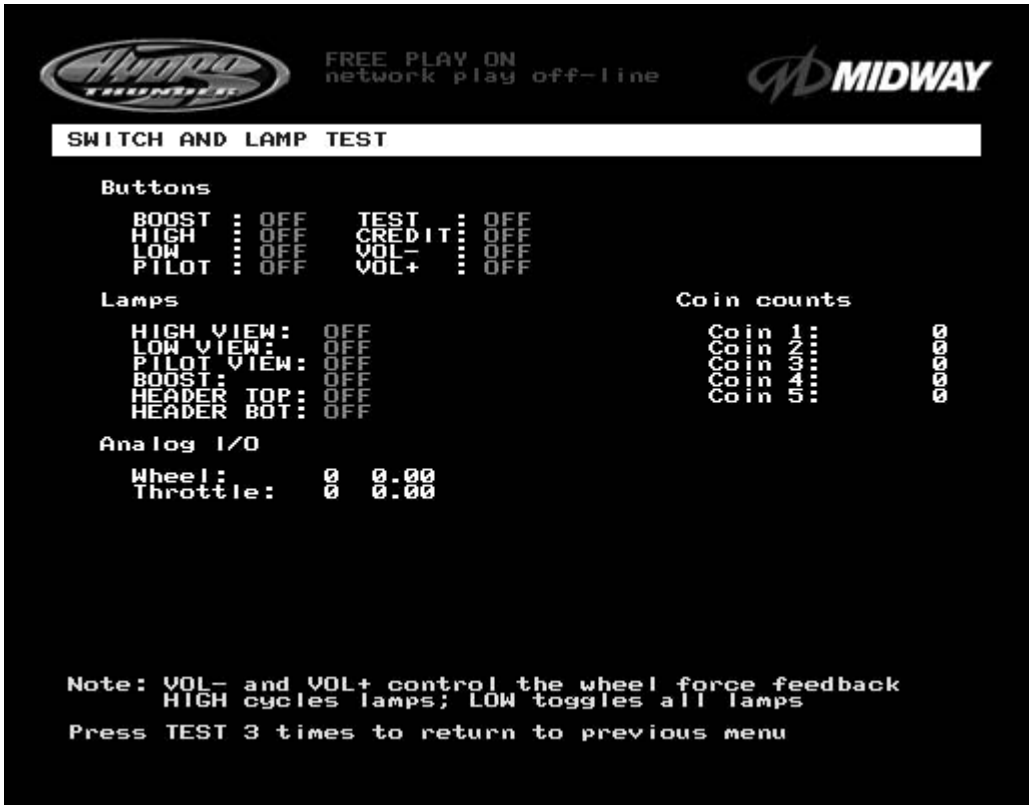


DIAGNOSTICS SUB MENU SCREEN

These tests allow the operator to verify the electrical and electronic condition of the game. This screen does not permit changes.

To select these tests, use operator control switches to select the DIAGNOSTICS MENU and press TEST to activate it. The screen displays the sub menu. Use the same steps to activate any one of the items listed. Follow the on-screen instructions to continue to other menu screens.

SWITCH AND LAMP TEST



SWITCH AND LAMP TEST SCREEN

Use the operator control switches to select the **Switch and Lamp Test** and press the TEST button. This screen reports information but does not permit changes.

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. Switches may be tested in any combination. These Switch Tests are used to verify crossed wires, intermittent conditions, and stuck switches.

The **Buttons** tests include the player control switches and operator control switches. Activating any of these switches causes the indicator on screen to change from OFF to ON and from gray to green. Each button change should be exactly duplicated by a single indication on the menu screen.

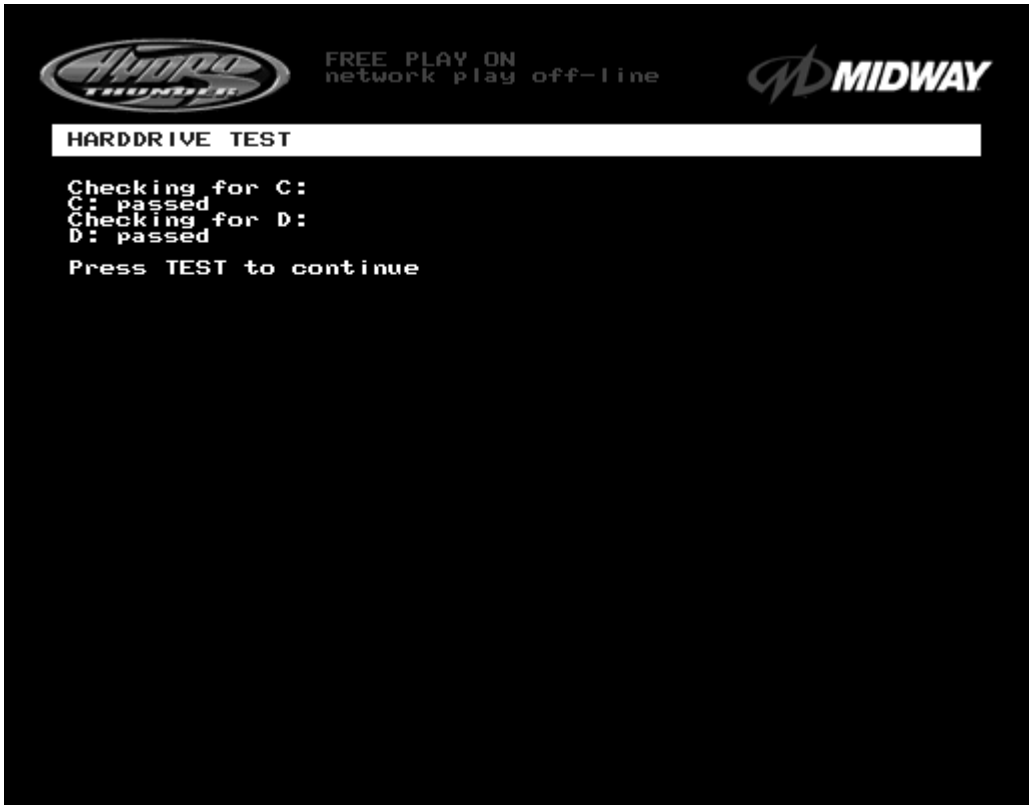
The Coin and Cabinet Switches are shown on the screen without regard for their actual game location. Each switch change should be exactly duplicated by a single indication on the menu screen.

The **Lamps** tests indicate the state of each of the lamps within control panel and overhead linking sign, or “header” (if installed). Press the LOW button to activate all of the lamps simultaneously, or the HIGH button to cycle the lamps in order. The HEADER TOP and HEADER BOT lamp tests have no effect unless a header or leader light is installed on the cabinet.

The **Analog I/O** test displays a value relative to the travel limits of the steering wheel or throttle indicating the current position of each control. **Wheel** position varies between 0 (full left) and 255 (full right). **Throttle** position varies between 0 (full back) and 255 (full forward).

The **Coin Counts** display the total number of coins deposited through each mechanism. Insert currency or tokens to perform these tests.

HARD DRIVE TEST



HARD DRIVE TEST SCREEN

The **Hard Drive Test** verifies the functioning of the Hard Disk Drive Assembly.

Highlight the test by using the operator control switches to select the option; then press TEST to begin. This screen reports information but does not permit changes.

The Hard Drive Test verifies the existence of the data necessary for the game to operate. Each test should return a “passed” result. Other results may indicate a problem with the hard disk drive.

There is a single hard disk drive unit in this game. It is partitioned into two virtual drives, C: and D:. The test should report “passed” for both drives for the game to work properly.

Press TEST to exit the Hard Drive Test.

STEREO SOUND TEST

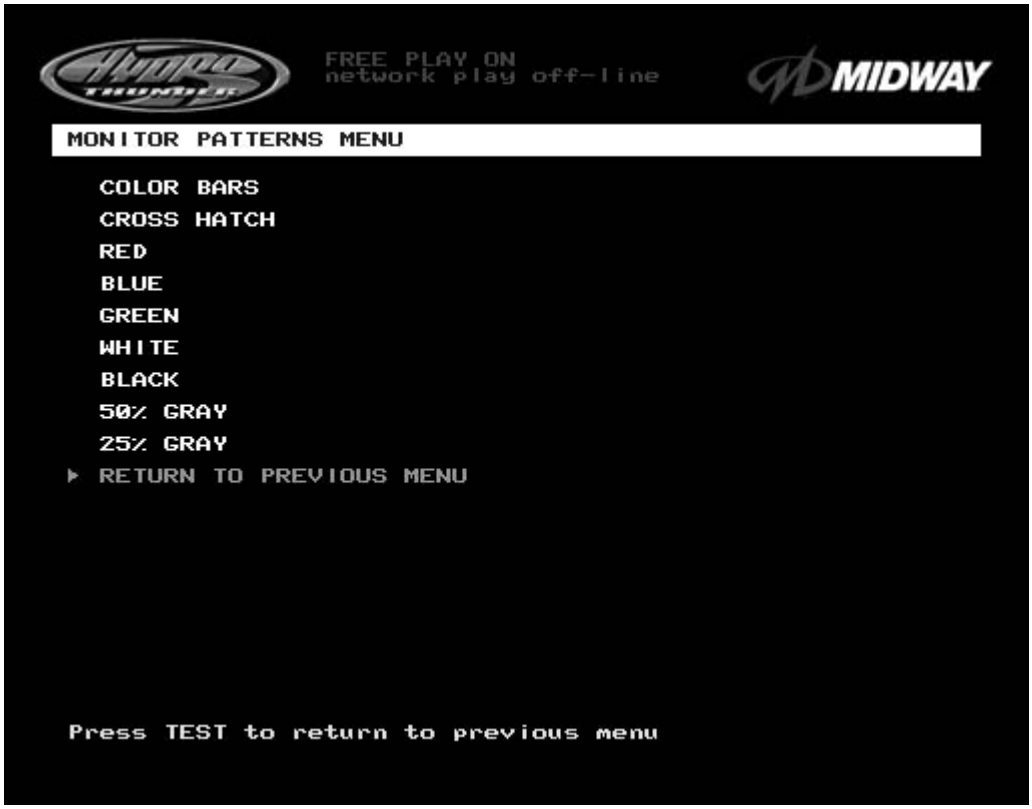
STEREO SOUND TEST SCREEN

The **Stereo Sound Test** verifies the operation of the stereo sound hardware and cabinet speakers. *Increase the master volume level before beginning this test*. Use the operator control switches to select this test and press TEST to activate it. This screen reports information but does not permit changes.

Press the TEST button when prompted by on-screen instructions to check each speaker and the game sound hardware. Listen to the audio signals from the speakers listed on the screen. There should be little or no sound coming from other speakers during each test. Use these tests to find crossed connections, incorrect phase, rattles, vibration, distortion, etc.

Press the TEST button to exit the Stereo Sound Test.

MONITOR PATTERNS TEST



MONITOR PATTERNS SUB MENU SCREEN

NOTE: This game uses a medium resolution monitor. The increased resolution means that more video information is displayed on the screen than with standard resolution monitors. Use of an industrial-grade degaussing coil is recommended before any corrections to monitor adjustments are attempted.

The Monitor Patterns routine provides test screens to verify monitor performance or make adjustments. To begin the tests, use the operator control switches to choose **Monitor Patterns Menu** from the **Diagnostics Menu** screen and press TEST to activate the sub-menu. Select a test from the sub-menu and press TEST to activate it. Press TEST once again to return to the **Monitor Patterns** sub menu.

Color Bars fills the screen with shades of colors to verify red, green, blue and white level dynamic adjustments. Each color bar should appear sharp, clear, and distinct from bars on either side.

There are 31 levels of intensity displayed in each of the color bars. Incorrect adjustment can cause detail to be missing at the top or bottom of a color bar. Set the monitor controls so that the maximum number of levels is visible in every bar.

The Color Bars screen helps to adjust the monitor brightness and contrast.

Cross Hatch fills the screen with a grid and a series of dots. The grid and the dots should be completely white, with no fringes or parallel images. The lines should be straight and the dots round.

Consult the service literature from the manufacturer of the monitor for more detail on these adjustments.

The Crosshatch Patterns assist in verifying the monitor convergence, linearity, and dynamic focus.

MONITOR PATTERNS TEST (continued from previous page)

Red, Blue, and Green Color Screen tests fill the screen with 100% of the chosen color at normal intensity. Each screen should be absolutely uniform from top to bottom and side to side. No retrace lines or noise should be visible.

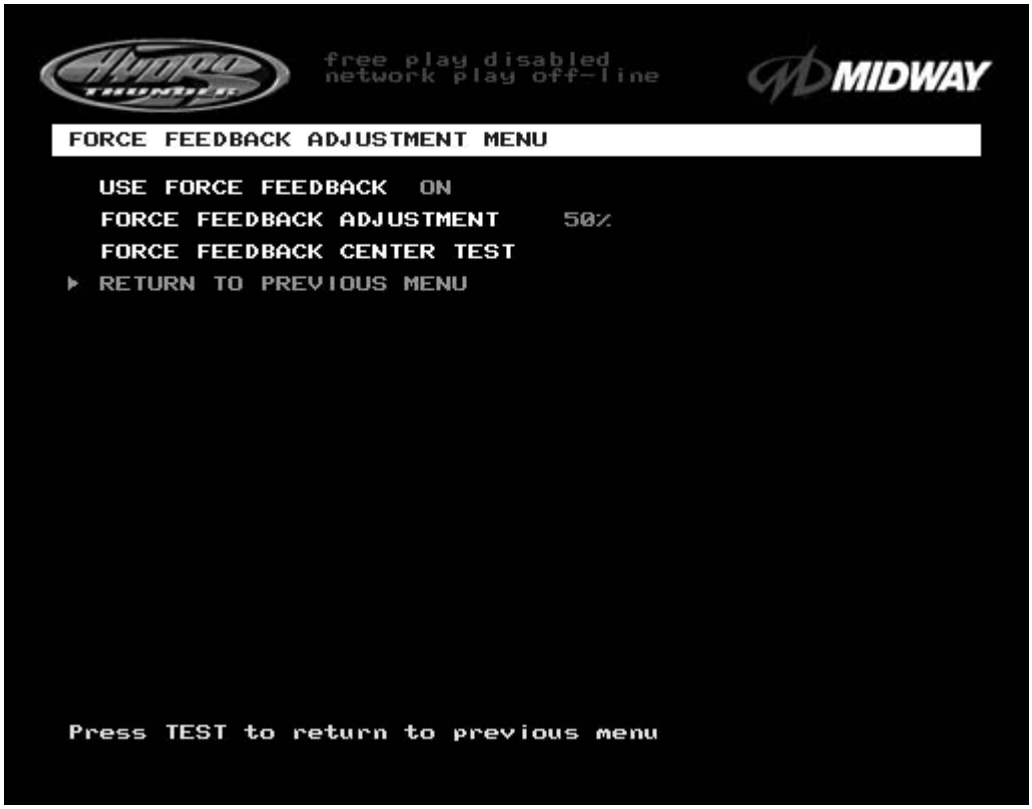
The Color Screen tests can verify monitor intensity, black level, blanking and color purity.

Color Screens may not hold their uniformity if the monitor degaussing circuit is defective.

White, Black, 50% Gray, and 25% Gray Screens fill the screen with black, gray or white at various intensities. The screens should be uniform with no color tints or distortion. No retrace lines or noise should be visible.

If any of the tests shows a need for adjustment, use the proper controls on the Video Monitor.

FORCE FEEDBACK ADJUSTMENTS



FORCE FEEDBACK ADJUSTMENT MENU SCREEN

The **Force Feedback Adjustment Menu** allows operators to set the use and intensity of feedback from the steering wheel motor. Select the test or adjustment with the operator control switches and press TEST to activate it. This screen permits changes to the existing values.

The **Force Feedback Adjustment** ranges from 0% (minimum) to 100% (maximum) with 50% as the factory default setting. Use a higher amount of force for players with greater upper body strength. Younger players may be more comfortable with lower force settings.

The **Force Feedback Center Test** checks the functioning of the steering wheel motor drive circuits. Select this item and move the steering wheel to any position. The wheel must automatically return to its center position as soon as it is released. If it does not do this, the boat will not respond properly.

WATCHDOG RESET

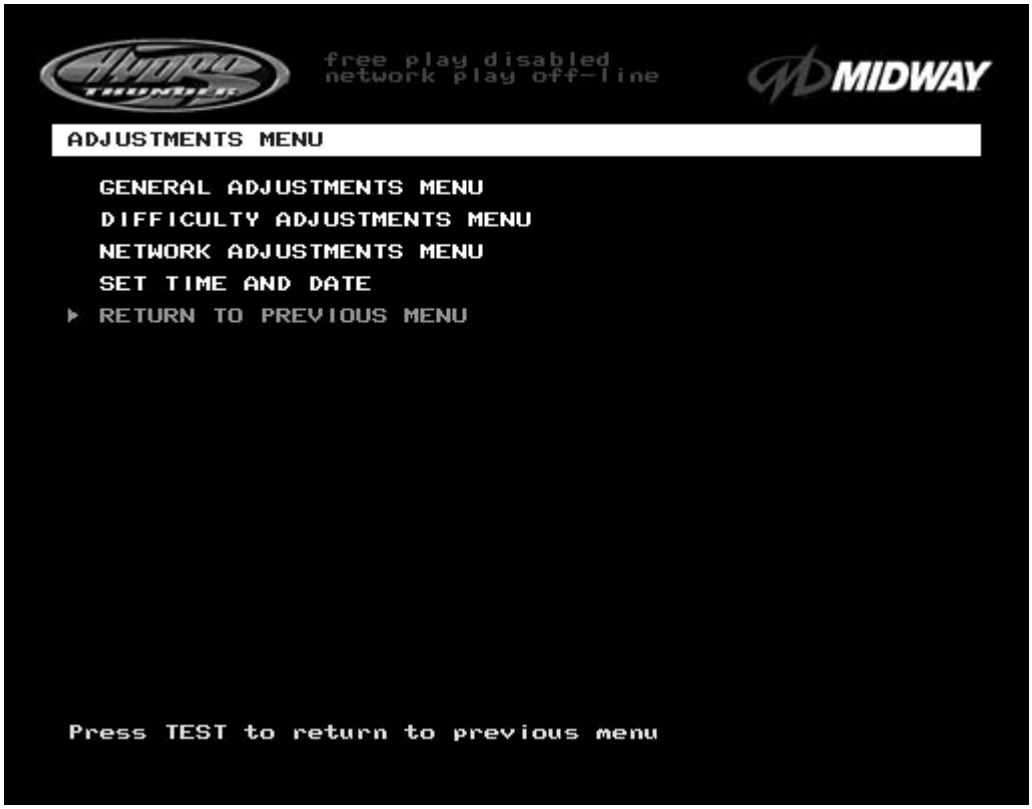
WATCHDOG RESET TEST CONFIRMATION BOX

The **Watchdog Reset Test** checks the function of the game's watchdog circuit by causing a forced reset. Use the operator control switches to select the **Watchdog Reset Test**, then press TEST to activate it. This test is similar to the restart command available on many personal computers.

Note: *Use caution when performing a Watchdog Reset Test. Although game information should not be affected, audit data could be changed. Once data has been changed, it cannot be restored. Use the "Save Audits to Floppy Disk" option on the* ***Game Utilities Menu*** *to save the data for analysis.*

When the operator chooses the **Watchdog Reset Test,** a confirmation box appears superimposed on the screen (as shown above). Select YES to reset the game or NO to return to the **Diagnostics Menu.** Upon reset, the screen blanks and the game starts up again. Note and record any messages that occur during this startup sequence.

ADJUSTMENTS MENU



ADJUSTMENTS MENU SCREEN

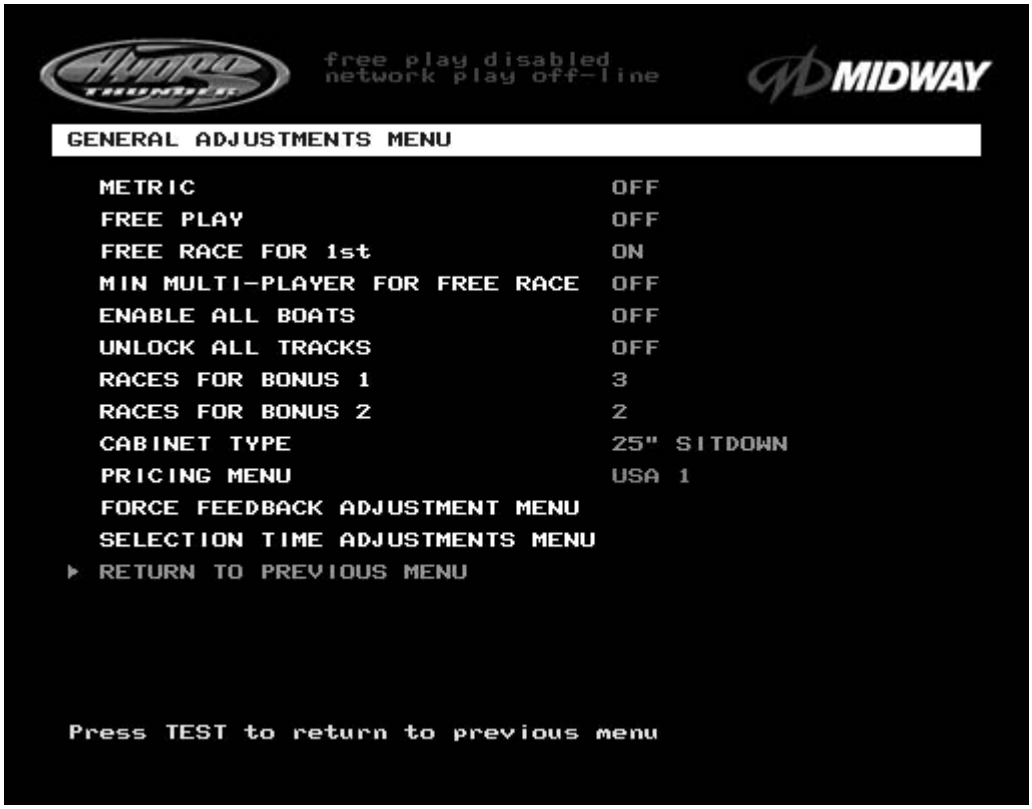
The **Adjustments Menu** allows operators to set game and player variables. Use these screens to optimize game performance and earnings.

The **General Adjustments** include pricing, game variables and cabinet type variables. Select these items to set player incentives, the cost of playing, and the size of game equipment.

The **Difficulty Adjustments** set the level of game difficulty. These adjustments can optimize the game's characteristics to best suit the needs of players.

The **Network Adjustments** control variables related to linking. These items are required to establish the identity of all cabinets in a network. These adjustments are transparent to the players.

GENERAL ADJUSTMENTS MENU



GENERAL ADJUSTMENTS MENU SCREEN

The **General Adjustments Menu** contains options to control the cost and type of play. It also sets the cabinet type game display and measurement system. Select a variable with the operator control switches. Use the VOLUME UP and VOLUME DOWN buttons to change a variable. Certain items have sub-menus. This screen permits changes to the existing values.

Metric sets the measurement system for display on game screens. Set this option to ON to display speed in kilometers per hour. Set this option to OFF to display speed in miles per hour. Factory default is OFF.

Free Play determines whether the game accepts currency or tokens for play, or allows operation without cost. Set this option to ON for free play. Set this option to OFF for paid play. Factory default is OFF.

Free Race for 1st permits a free game incentive for players who finish a race in first place. Set this option to ON to award a free race to a first-place finisher. Set this option to OFF to eliminate the free race award. Factory default is ON.

Min Multi-Player For Free Race sets the minimum number of players needed to activate the free race award for a first-place finish. The choices are OFF, two, three, or four players. Factory default is OFF. Use this feature to encourage players to participate in linked races.

Enable All Boats determines whether all boats are available for player selection at the start of a race. Set this option to OFF to hide certain boats from first time players. Set this option to ON to enable players to choose from all possible boats at all times. Players can override this option to choose from all boats by pressing any of the view buttons during the boat selection screen. Factory default is OFF.

GENERAL ADJUSTMENTS MENU (continued)

Unlock All Tracks enables or disables certain tracks until players finish a certain number of races. The hidden tracks are revealed as “bonus” tracks. Set this option to OFF to hide the “bonus” tracks. Set this option to ON to enable players to choose from all tracks at all times. Factory default is OFF.

Races for Bonus 1 is available only when **Unlock All Tracks** is turned OFF. This adjustment sets the number of races a player must complete to unlock the first of the hidden tracks. The range of adjustment is from 1 to 8 races. Factory default is 3.

Races for Bonus 2 is also available only when **Unlock All Tracks** is turned OFF. This adjustment sets the number of races a player must complete to unlock the second of the hidden tracks. The range of adjustment is from 1 to 8 races. Factory default is 2.

Pricing Menu allows the operator to choose from several pre-determined currency combinations. Select this item and press TEST to change the cost of starting and continuing a game. This option is disabled if **Free Play** is ON. Factory default is USA1.

Force Feedback Adjustment Menu allows changes to the amount of feedback from the steering wheel. Refer to **Force Feedback Adjustment** description on a previous page.

Selection Time Adjustments Menu permits operators to set the amount of time for a player to make selections at the beginning or end of play. Longer than necessary times cut into the number of games that can be played in one day. Slower or first time players may not be able to read information and act with very short times. When this adjustment is chosen, another menu screen presents the following items:

Track Select Time and **Boat Select Time** set the limits for player decisions at the beginning of a race. The range of adjustment for each item is from 10 to 60 seconds. Factory defaults are 15 seconds.

High Score Time and **Continue Time** set the limits for player decisions at the conclusion of each race. The range of adjustment for each item is from 10 to 60 seconds. Factory default for **High Score Time** is 20 seconds. Factory default for **Continue Time** is 17 seconds.

PRICING MENU

PRICING MENU SCREEN

The **Pricing Menu** contains options for selecting standard and custom currency combinations. Use the operator control switches to select **Pricing Menu** from the **General Adjustments Menu** and press TEST.

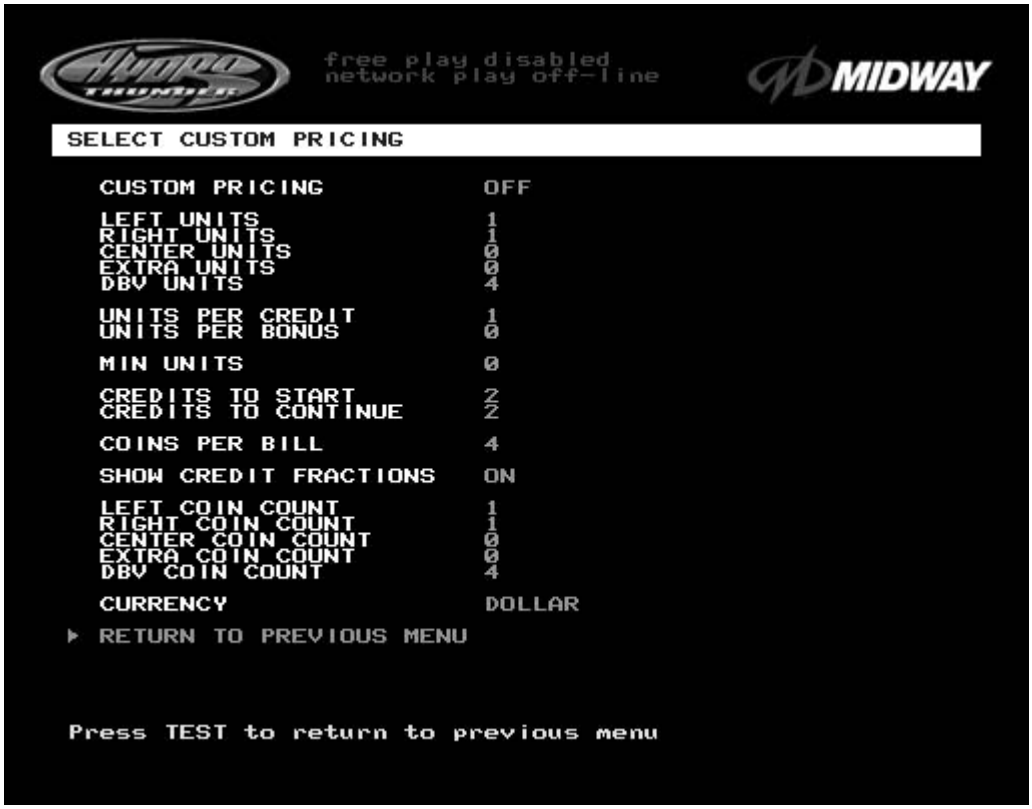
Select Custom Pricing allows the operator to set coinage and credits options manually. Use this item to set up combinations not found in the standard listing. This screen permits changes to the existing values.

Select Standard Pricing allows the operator to select from several standard price schemes. The most commonly used currency requirements to start and to continue games are ready for operator selection. This screen permits changes to the existing values.

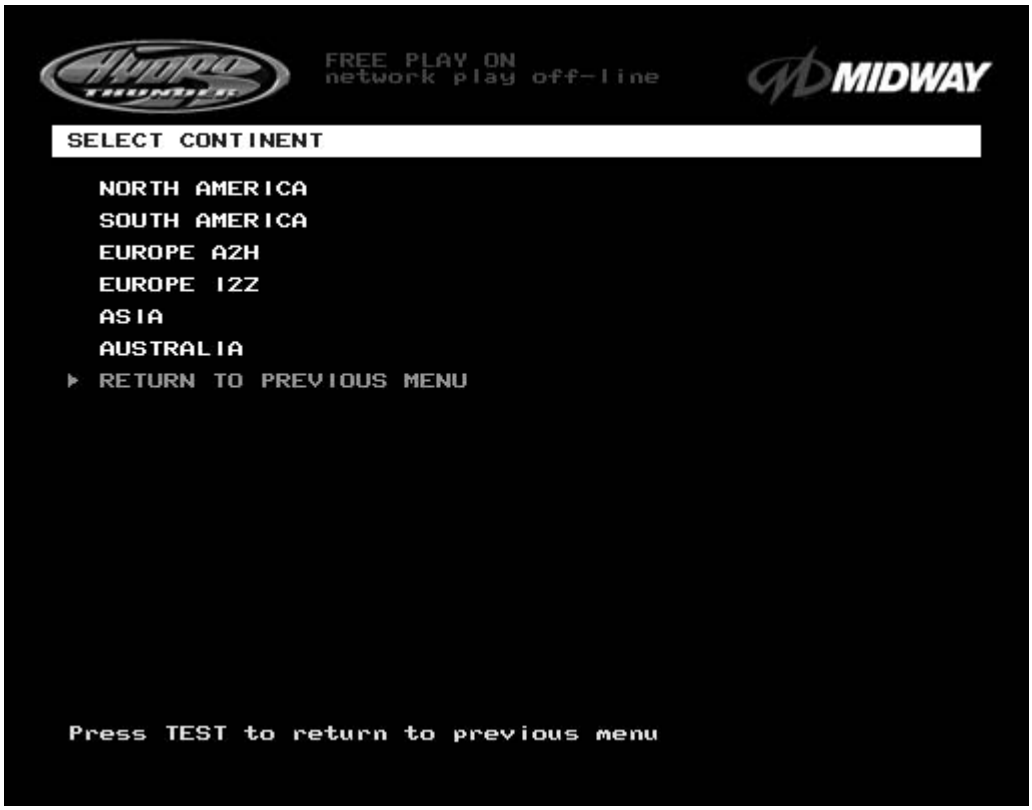
View Current Pricing displays the present currency and credit settings. Choose this item to review the active game price scheme. This screen reports information but does not permit changes. Use either of the Select Pricing options to make changes, then return to this screen to verify the settings.

Reset to Defaults returns the price settings to factory defaults. Choose this item to return all variables to their original values. This screen permits changes all of the existing values at one time.

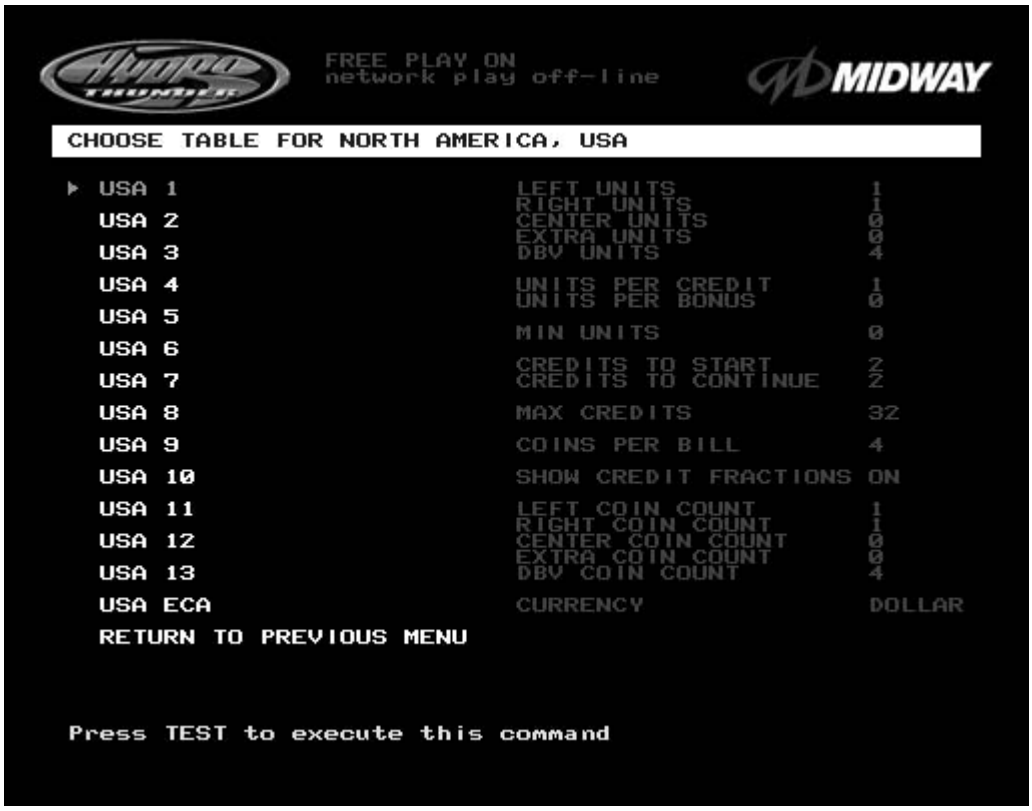
PRICING SUBMENUS



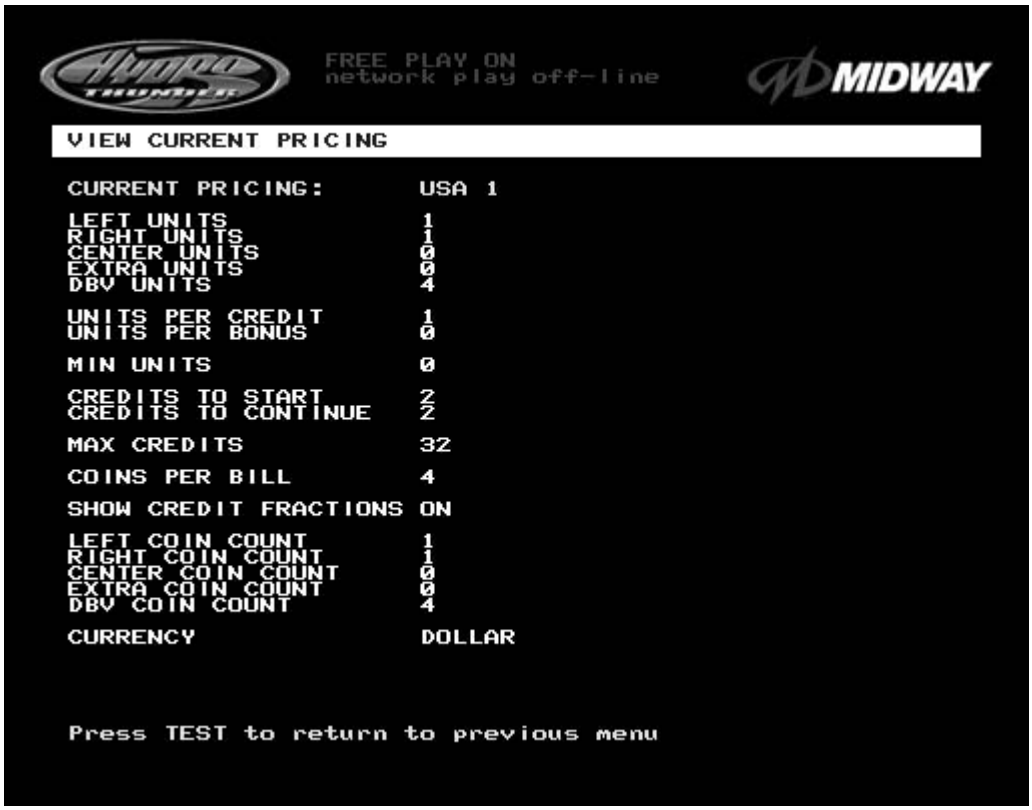
TYPICAL CUSTOM PRICING MENU



STANDARD PRICING MAIN MENU

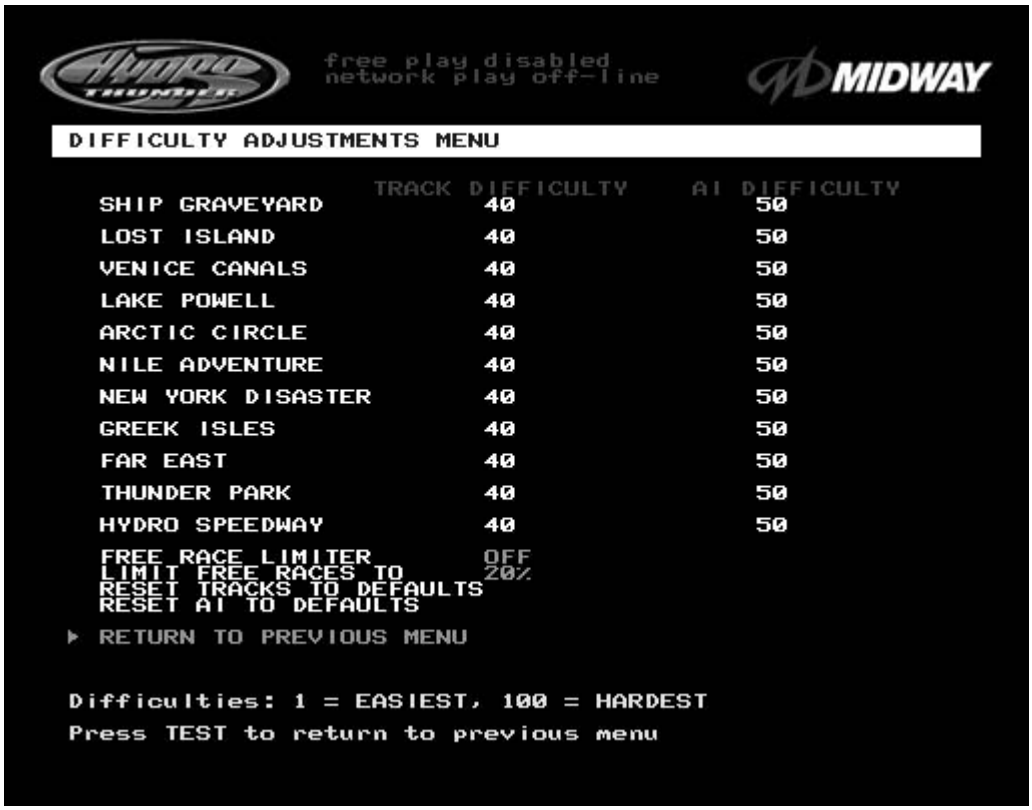


TYPICAL STANDARD PRICING SUB-MENU



TYPICAL VIEW CURRENT PRICING DISPLAY

DIFFICULTY ADJUSTMENTS



DIFFICULTY ADJUSTMENTS MENU SCREEN

The **Difficulty Adjustments** set how much skill players must have to complete a race. Use the operator control switches to select **Difficulty Adjustments** and press the TEST button to activate the sub menu. Select each variable using the operator control switches and press TEST to enter change mode. Use the operator control switches to change the variable, then press TEST to save changes and exit the variable.

Track Difficulty sets the initial time available for play. Higher values require players to maintain faster average speeds between checkpoints. The range of adjustment is from 1 to 100. Factory default is 40.

AI Difficulty sets the competitiveness of drone boats. The number of boats does not change, but their skill at negotiating the track does. The range of adjustment is from 1 to 100. Factory default is 50.

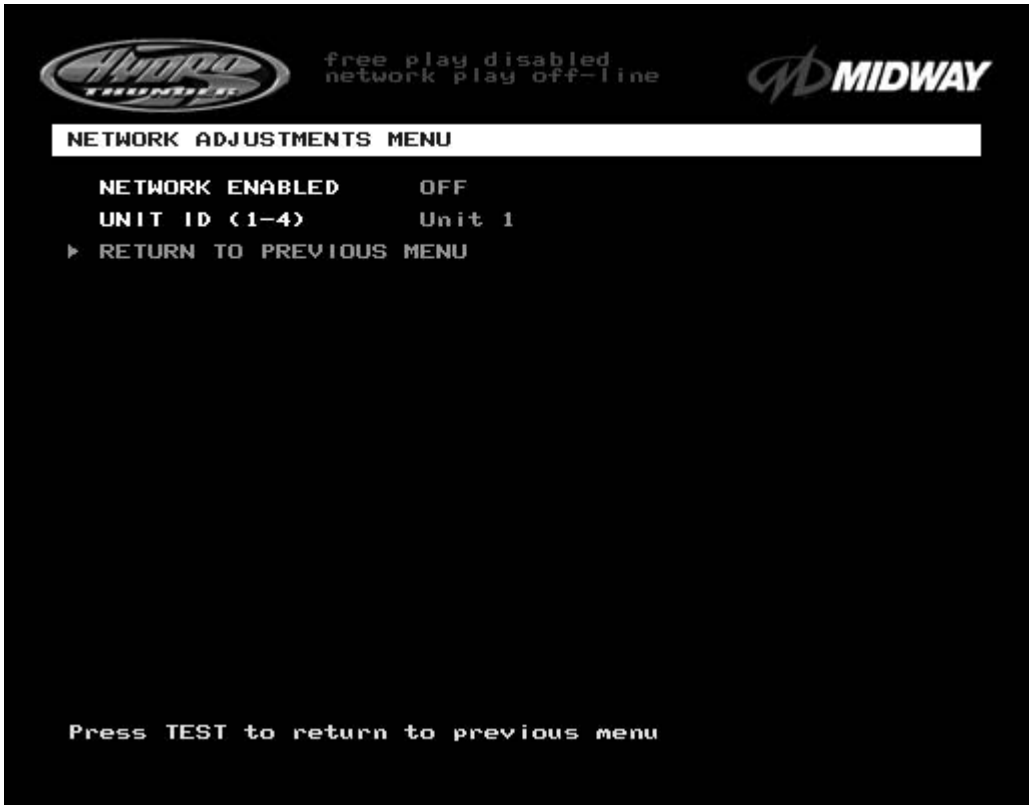
The **Free Race Limiter** enables the **AI** (Artificial Intelligence) to keep pace with players' skill levels. Set this to ON to limit the number of free races based on player ability. Set it to OFF to keep **AI** values at a fixed level regardless of the number of free races won. The range is OFF or ON. Factory default is OFF.

Limit Free Races To is the award cut-off point. It prevents expert players from monopolizing a cabinet. It may be fixed or variable (see **Free Race Limiter** above). The range is 1 to 100%. Factory default is 20%.

Reset Tracks to Defaults returns the Track Difficulty settings to factory defaults. Choose this item to return this variable to its original value. This screen permits changes all of the existing values at one time.

Reset AI to Defaults returns the Track Difficulty settings to factory defaults. Choose this item to return this variable to its original value. This screen permits changes all of the existing values at one time.

NETWORK ADJUSTMENTS



NETWORK ADJUSTMENTS MENU SCREEN

The **Network Adjustments Menu** allows an operator to set the game cabinet network identity. Use the operator control switches to select the **Network Adjustments Menu** and press TEST to enter the sub-menu. Use the operator control switches to select one of the items and press TEST to permit change. Select a new value, then press TEST once again to save changes and return to the above screen.

The best way to set these variables is to set all cabinets to this adjustment menu at the same time.

Set **Network Enabled** to ON if the cabinet is linked to other games. This allows the game electronics to communicate with other cabinets. Choose OFF to disable linked game play. Factory Default is OFF.

Unit ID determines the address of the game. Each linked game must have a unique number to prevent network confusion. Sequence is not important, only that no two are the same. Factory Default is 1.

SET THE TIME AND DATE

TIME AND DATE MENU SCREEN

The **Set Time and Date** menu provides the current date and time for the game. This screen also allows operators to adjust the clock for changes in time zones and seasonal changes in time. Use the operator control switches to select **Set Time and Date,** then press TEST to activate the sub-menu. Use the operator control switches to select a variable and press TEST to make changes. Select a new value, then press TEST once again to save changes and return to the above screen.

Once set, the clock runs until the battery dies or the electrical circuits are disrupted by service or a major fault. The clock assists in providing accurate game statistics. It does not affect the game operation.

GAME UTILITIES MENU

GAME UTILITIES MENU SCREEN

The **Game Utilities Menu** permits operator changes to credits, player statistics, and game audits. It also allows the operator to restore game settings to factory defaults or save audit information for later use. A confirmation screen appears before changes become final. Use the operator control switches to select the **Game Utilities Menu** and press TEST to activate the sub-menu. Follow the on-screen instructions to select any item and activate it.

Clear Credits resets the existing number of game credits to zero.

Reset Operator Settings returns the **Adjustments Menus** variables to the original factory defaults.

Reset High Scores and Split Times resets the player high score table to factory default ghost data.

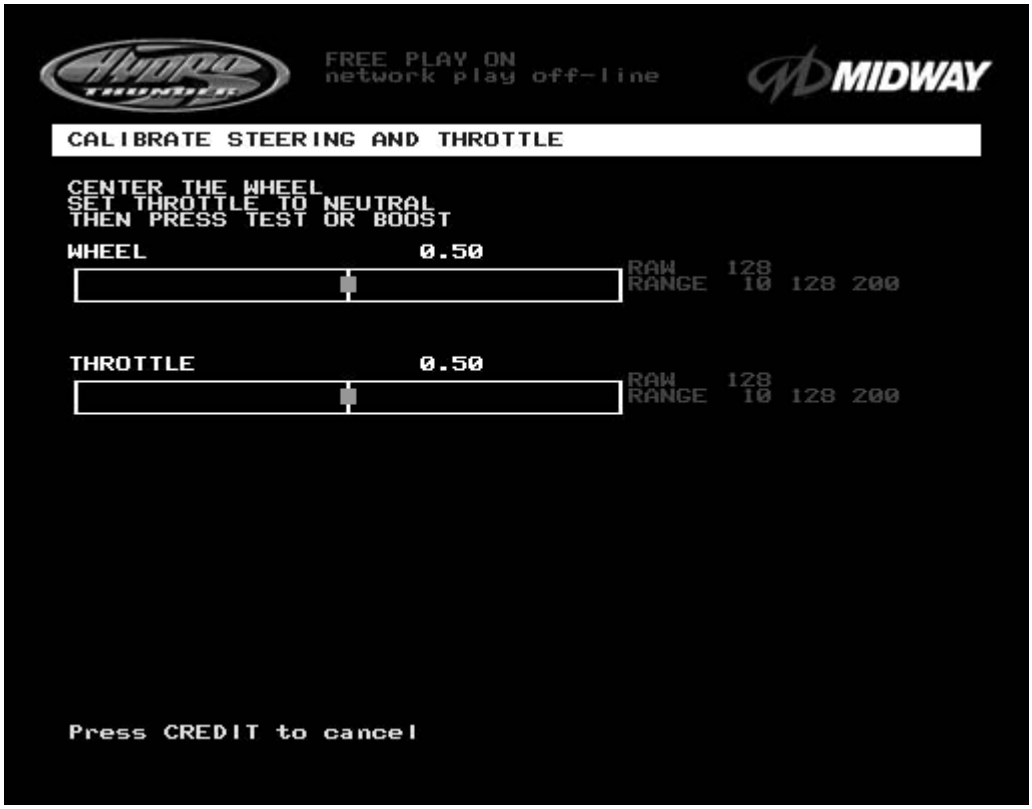
Reset Audit Stats resets the track and boat audit values to zero.

Full Factory Restore resets all of the game variables above to factory default values at one time.

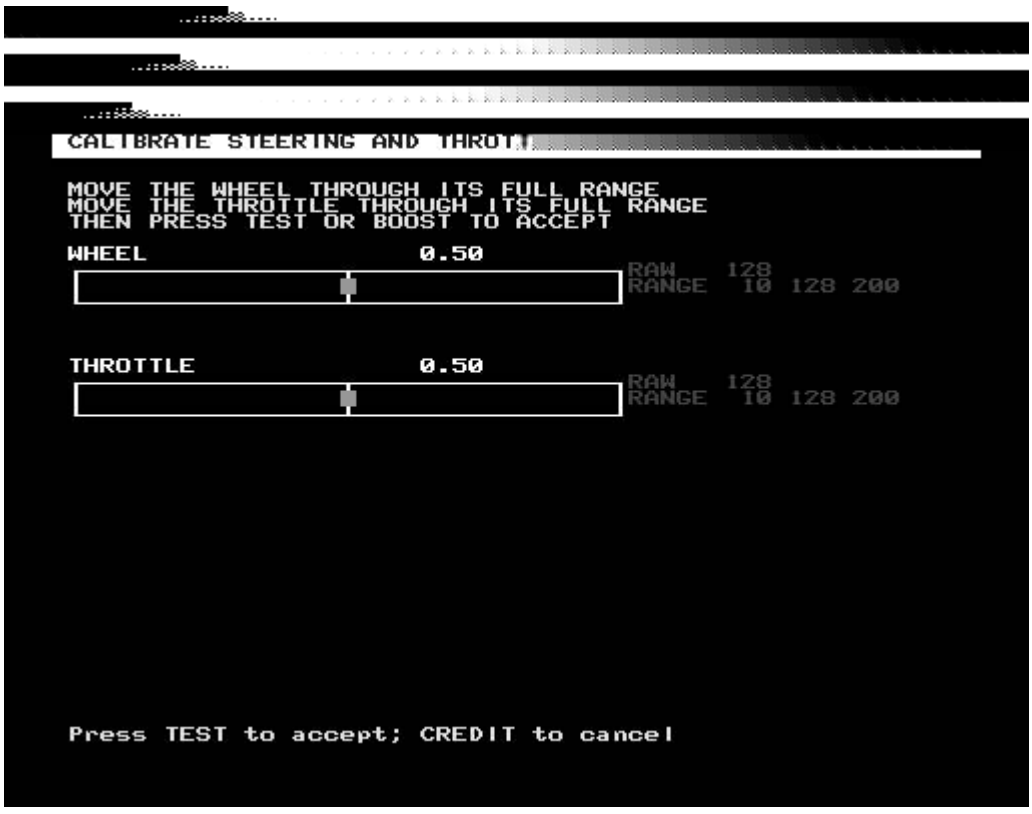
Save Audits to Floppy Disk allows the operator to save game data to a formatted 1.44MB high-density diskette before clearing values. The floppy disk drive is in the CPU cabinet. Comparison of audit data over time can provide the operator with useful information about the effect of game variables on profits.

*Note: Once data has been cleared, it cannot be restored. Use the "Save Audits to Floppy Disk" option on this menu to save the data for analysis. Use caution when clearing audit information. To clear these registers, use the **Reset** or **Full Factory Restore** functions of this menu.*

CALIBRATE STEERING AND THROTTLE



STEERING AND THROTTLE CALIBRATION INSTRUCTION SCREEN



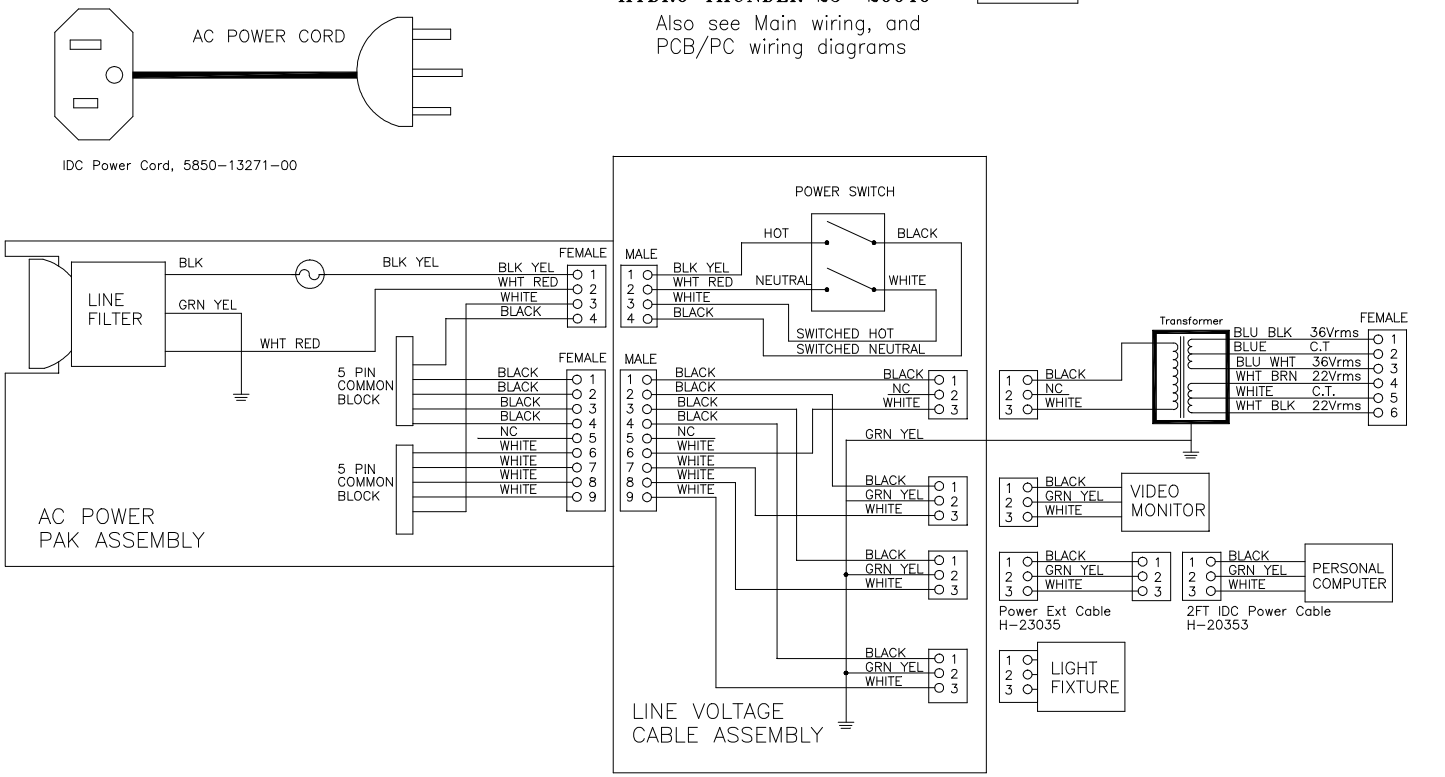
STEERING AND THROTTLE CALIBRATION ACTION SCREEN

Power Wiring Diagram

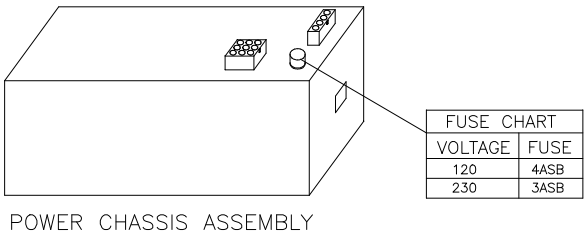
HYDRO THUNDER 25" 20040

Also see Main wiring, and PCB/PC wiring diagrams

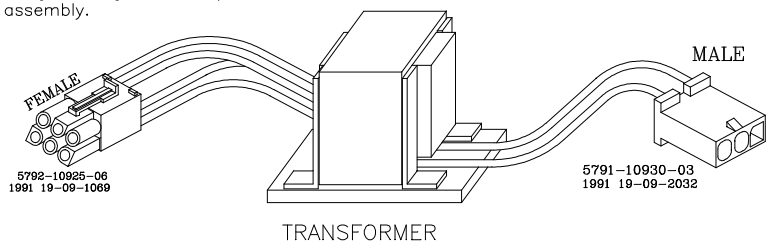
Revision 02



NOTE 1: All Earth Ground Wires (green-yellow) connect to grounding stud on power Chassis assembly.

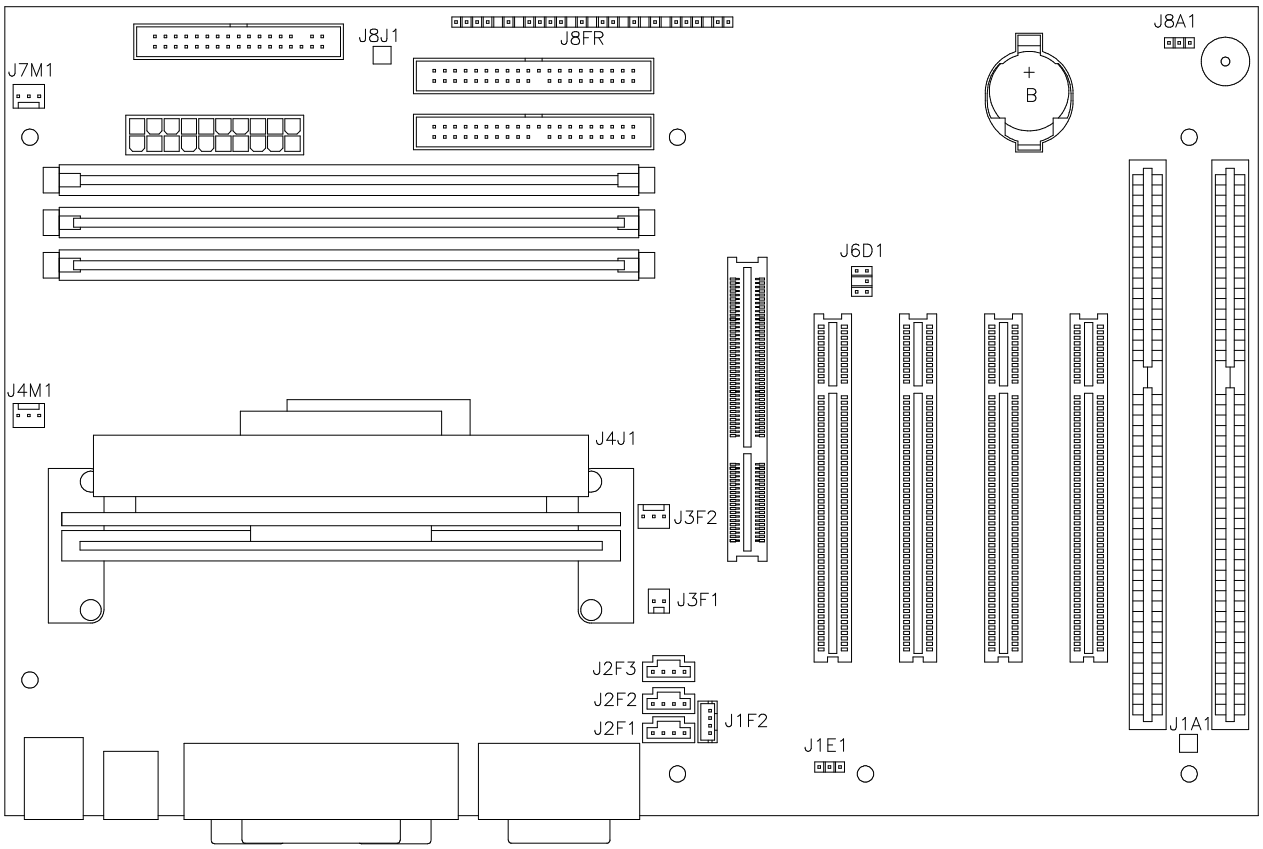


FUSE CHART	
VOLTAGE	FUSE
120	4ASB
230	3ASB



COMPUTER MOTHERBOARD ASSEMBLY

20-10554



MOTHERBOARD CONNECTOR AND JUMPER STATUS

(NOTES FOR CHART ON FOLLOWING PAGE)

NOTES:

1. Jumper is not required for this game. No telephone connection necessary for operation.
2. Jumper is not required for this game. A proprietary network is used for game linking.
3. Connections not required for this game. No ATAPI devices (CD ROM) are used in this game.
4. Jumper is not required for this game. The tamper detection security feature is not installed.
5. Connect processor module fan to this jack. Computer may become unreliable if processor overheats.
6. Connect processor module to this jack. The 242-pin socket accepts single microprocessor modules.
7. Connections not required for this game. The case cooling fans connect directly to the power supply.
8. Connections not required for this game. No SCSI device (Hard Disk Drive) are used in this game.
9. Connect the reset cable from the Filter Card Assembly to this jack. No front panel devices are used.
10. Jumper must be set over pins 1 & 2 for this game. Game will not run if jumper is incorrect or missing.

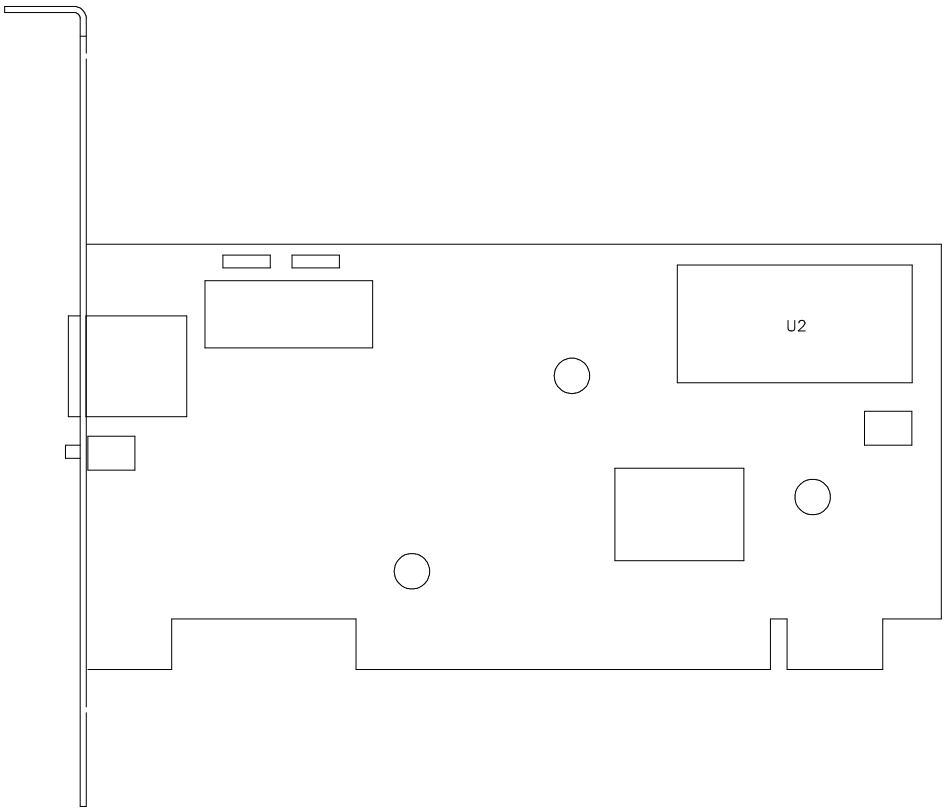
* Replacement Motherboards may not include this jumper. Refer to Parts to order extra shunt jumpers.

MOTHERBOARD CONNECTOR AND JUMPER STATUS CHART

DESIGNATION	LOCATION	FUNCTION	MEANING	SETTING	DEFAULT
J1A1	LOWER RIGHT	WAKE	NOT USED IN THIS	OPEN	■
	NEAR BOARD	ON	GAME (NO	1 & 2	
(NOTE 1)	EXPANSION SLOT	RING	TELEPHONE)		
J1E1	LOWER CENTER	WAKE	NOT USED IN THIS	OPEN	■
	NEAR BOARD	ON	GAME (NO		
(NOTE 2)	EXPANSION SLOT	LAN	PC LAN)		
J1F2	LOWER CENTER	CD AUDIO	NOT USED IN THIS	OPEN	■
	NEAR BOARD	INPUT	GAME (NO		
(NOTE 3)	EXPANSION SLOT	CIRCUIT	CD PLAYER)		
J2F1	LOWER CENTER	CD DATA	NOT USED IN THIS	OPEN	■
	NEAR BOARD	INPUT	GAME (NO		
(NOTE 3)	EXPANSION SLOT	CIRCUIT	CD PLAYER)		
J2F2	LOWER CENTER	TELEPHONY	NOT USED IN THIS	OPEN	■
	NEAR BOARD	INPUT	GAME (NO		
(NOTE 1)	EXPANSION SLOT	CIRCUIT	TELEPHONE)		
J2F3	LOWER CENTER	AUXILLIARY	NOT USED IN THIS	OPEN	■
	NEAR BOARD	INPUT	GAME (NO		
(NOTE 3)	EXPANSION SLOT	CIRCUIT	AUX DEVICES)		
J3F1	MIDDLE CENTER	CHASSIS	NOT USED IN THIS	OPEN	■
	NEAR CPU	INTRUSION	GAME (NO	1 & 2	
(NOTE 4)	AND FAN	CIRCUIT	INTRUSION)		
J3F2	MIDDLE CENTER	PROCESSOR	TWO SPEED FAN	OPEN	
	NEAR CPU	FAN	FOR PROCESSOR	1, 2, & 3	■
(NOTE 5)	AND FAN	CIRCUIT	COOLING		
J4J1	CENTER LEFT	SYSTEM	SYSTEM	OPEN	
	MODULE WITH	MICRO-	MICRO-	FILLED	■
(NOTE 6)	FAN ASSEMBLY	PROCESSOR	PROCESSOR		
J4M1	CENTER LEFT	PROCESSOR	CONTROLLED FAN	OPEN	■
	NEAR CPU	FAN	FOR PROCESSOR	1, 2, & 3	
(NOTE 7)	MODULE	CIRCUIT	COOLING		
J7M1	UPPER LEFT	CASE	CONTROLLED FAN	OPEN	■
	NEAR POWER &	FAN	FOR HARD DISK	1, 2, & 3	
(NOTE 7)	FLOPPY JACKS	CIRCUIT	DRIVE COOLING		
J8J1	UPPER LEFT	SCSI	NOT USED IN THIS	OPEN	■
	BETWEEN HARD	DRIVE	GAME (NO	1 & 2	
(NOTE 8)	& FLOPPY JACKS	INDICATOR	SCSI DRIVES)		
J8FR	UPPER CENTER	FRONT	ONLY RESET	OPEN	
	NEAR HARD DISK	PANEL	PINS ARE USED	1 & 2	■
(NOTE 9)	DRIVE JACKS	DEVICES	IN THIS GAME		
J8A1	UPPER RIGHT	CONFIGU-	STARTS SYSTEM	OPEN	
	NEAR BATTERY	RATION	SETUP ROUTINE	1 & 2	■
(NOTE 10)	AND SPEAKER	SELECT	OR OPERATION	2 & 3	

NETWORK INTERFACE CARD ASSEMBLY

20-10550



NETWORK INTERFACE LED INDICATOR STATUS CHART

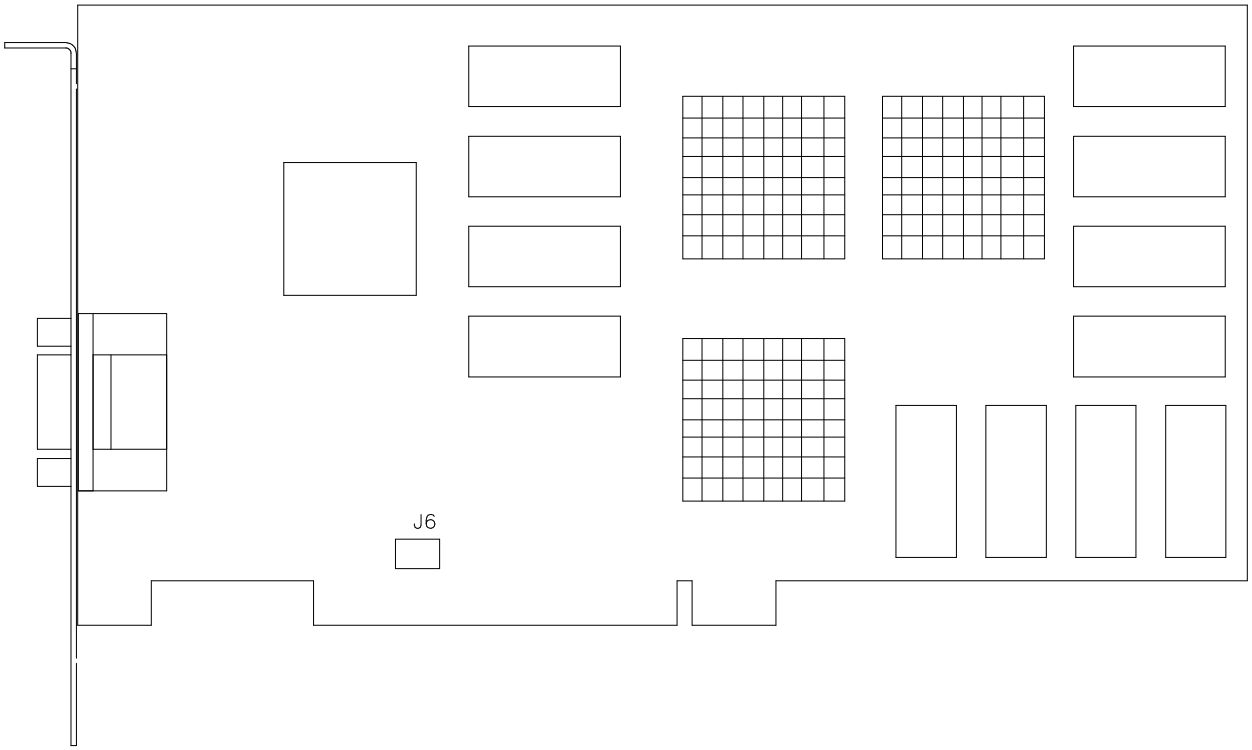
DESIGNATION	LOCATION	FUNCTION	COLOR	STATE	MEANING
LED 1 (LNK)	LEFT CENTER UNDER JACK	LINK VERIFY INDICATOR	GREEN	OFF	NOT IN USE (NO GAME LINK)
				ON	NORMAL OPERATION
				BLINKING	LINK FAULT (NOTE 1)
LED 2 (ACT)	RIGHT CENTER UNDER JACK	ACTIVITY INDICATOR	GREEN	OFF	NOT IN USE (NO DATA)
				ON	RECEIVING DATA (NOTE 2)
				BLINKING	NORMAL OPERATION

NOTES:

1. Intermittent cable or hub problems may cause blinking. Must be continuous at all times when linked.
2. Blinks as data packets are exchanged. May appear almost continuous during heavy network activity.

VIDEO GRAPHICS CARD ASSEMBLY

20-10551



VIDEO GRAPHICS CONNECTOR AND JUMPER STATUS CHART

DESIGNATION	LOCATION	FUNCTION	MEANING	SETTING	DEFAULT
J1	LEFT CENTER	VIDEO	GRAPHIC	OPEN	
	(DB-15 ON	SIGNAL	INFORMATION	1-15	■
(NOTE 1)	BRACKET)	OUTPUT	TO INTERFACE		
J2-J7	NONE	---	NOT USED	OPEN	■
(NOTE 2)					
JP2	NONE	---	NOT USED	OPEN	■
(NOTE 2)					

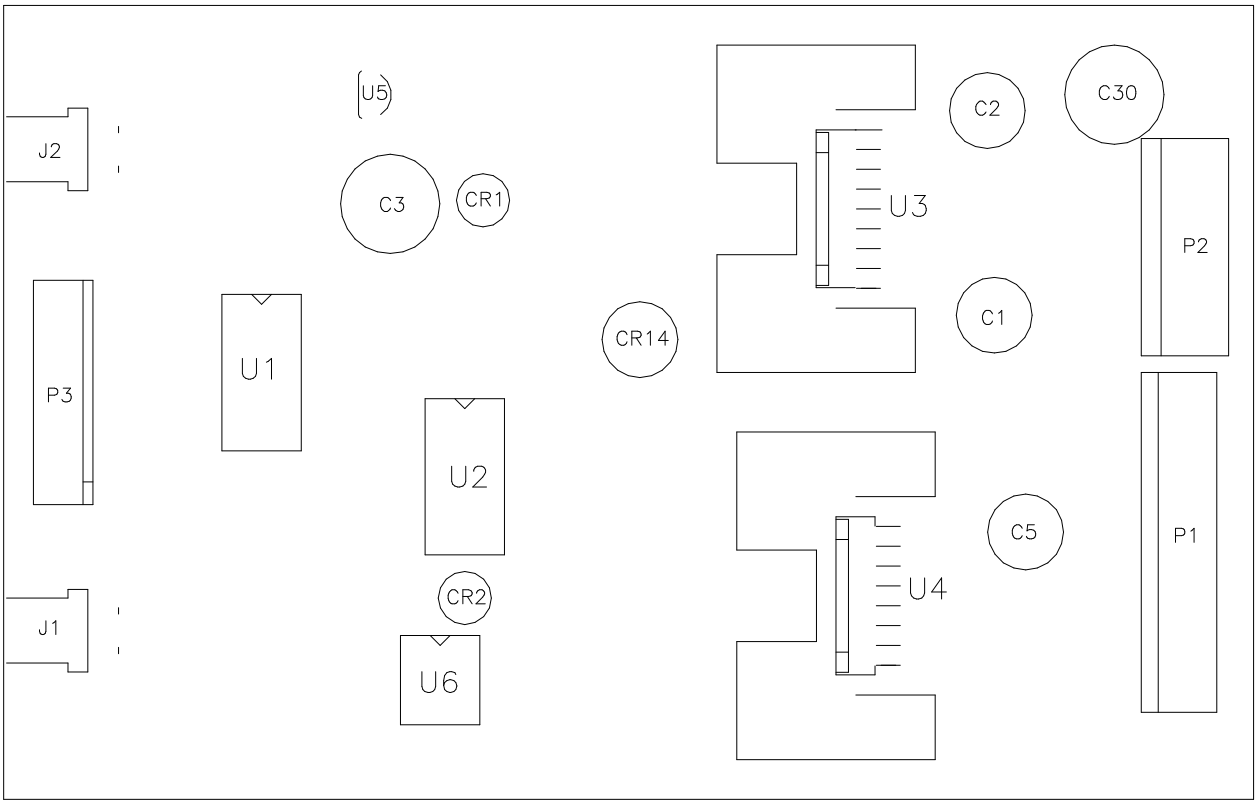
NOTES:

1. Connects to Interface Board Assembly through shielded cable. Does not connect directly to monitor.

2. Manufacturer option connectors and jumpers. Not required for this game.

AUDIO AMPLIFIER BOARD ASSEMBLY

04-12529.1



AUDIO AMPLIFIER LED INDICATOR STATUS CHART

DESIGNATION	LOCATION	FUNCTION	COLOR	STATE	MEANING
LED 1 (CR1)	UPPER CENTER NEAR C3	FAULT INDICATOR	RED	OFF	NORMAL OPERATION
				ON	LOCKED UP (NOTE 1)
				BLINKING	OVERLOAD (NOTE 2)
LED 2 (CR2)	LOWER CENTER NEAR U2 & U6	FAULT INDICATOR	RED	OFF	NORMAL OPERATION
				ON	LOCKED UP (NOTE 1)
				BLINKING	OVERLOAD (NOTE 2)

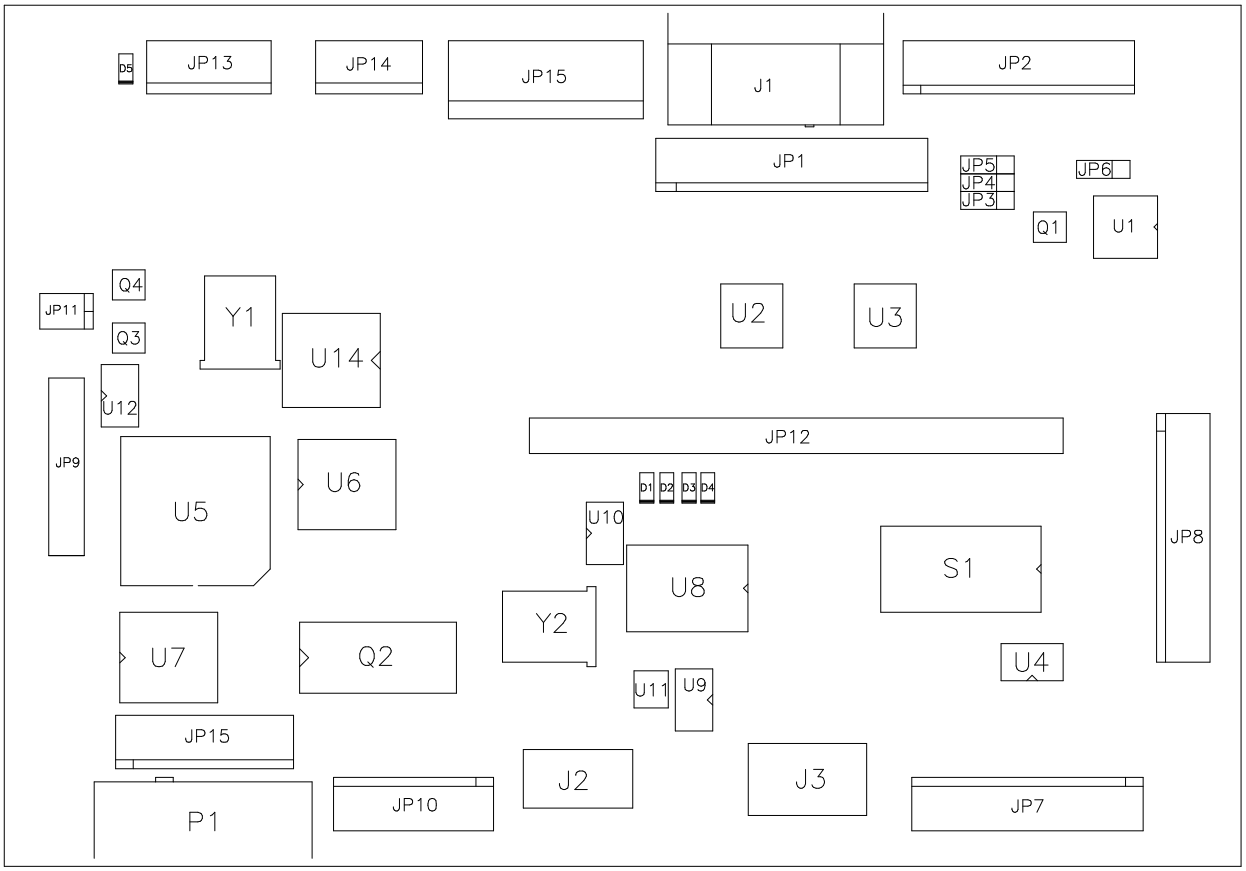
NOTES:

1. Output protection circuit has been activated. Clear fault and remove power to attempt a circuit reset.

2. Intermittent audio overload or overheating may cause blinking. LED should flash only during start up.

DIEGO INTERFACE BOARD ASSEMBLY

04-12522.4



DIEGO INTERFACE BOARD SWITCHES

DESIGNATION	LOCATION	FUNCTION	POSITIONS	STATE	MEANING
S1-3	RIGHT CENTER NEAR JP7 & JP8	GAME MODES	2	OFF*	NORMAL OPERATION
				ON	FIXED IN TEST MODE
S1-4	RIGHT CENTER NEAR JP7 & JP8	CABINET SIZE	2	OFF	STANDARD 25” CABINET
				ON*	39” CABINET
S1-8	RIGHT CENTER NEAR JP7 & JP8	RESET MODES	2	OFF	WATCHDOG DISABLED
				ON*	WATCHDOG ENABLED

NOTES:
1. Use S1-3 only during testing or troubleshooting. The game will not start if this switch is left ON.
2. Use S1-4 to set game type. The speakers and leader lights will not work properly if set incorrectly.
3. Use S1-8 only during testing or troubleshooting. The game may lock up or freeze if this is disabled.
4. S1-1, -2, -5, -6, and -7 have no assigned function. Leave these switches in their OFF positions.

DIEGO INTERFACE BOARD LED INDICATOR STATUS CHART

DESIGNATION	LOCATION	FUNCTION	COLOR	STATE	MEANING
LED 1 (D1)	MIDDLE CENTER NEAR JP12 & U10	INDICATOR	GREEN	OFF	NOT IN USE
				ON	LOCKED UP (NOTE 1)
				BLINKING	NORMAL OPERATION
LED 2 (D2)	MIDDLE CENTER NEAR JP12 & U10	INDICATOR	RED	OFF	NOT IN USE
				ON	LOCKED UP (NOTE 1)
				BLINKING	NORMAL OPERATION
LED 3 (D3)	MIDDLE CENTER NEAR JP12 & U10	INDICATOR	GREEN	OFF	NOT IN USE
				ON	LOCKED UP (NOTE 2)
				BLINKING	NORMAL OPERATION
LED 4 (D4)	MIDDLE CENTER NEAR JP12 & U10	INDICATOR	RED	OFF	NOT IN USE
				ON	LOCKED UP (NOTE 2)
				BLINKING	NORMAL OPERATION
LED 5 (D5)	UPPER LEFT NEAR JP13 & L37	POWER INDICATOR	RED	OFF	NO POWER
				ON	NORMAL OPERATION
				BLINKING	POWER FAULT (NOTE 3)

NOTES:

1. LED 1 and LED 2 are active on all versions of this board. LEDs may flash together during game start up. If these LEDs are always ON, there may be a fault that has caused the game freeze or lock up.

2. LED 3 and LED 4 are active on some versions of this board. May flash together during game start up. If these LEDs are always ON, there may be a fault that has caused the game to freeze or lock up.

3. LED 5 monitors a regulated power supply voltage source. Must be on continuously at all times. Flash or blinking indicates an intermittent connection, a power problem, a circuit fault, etc.

DIEGO INTERFACE CONNECTOR AND JUMPER STATUS CHART

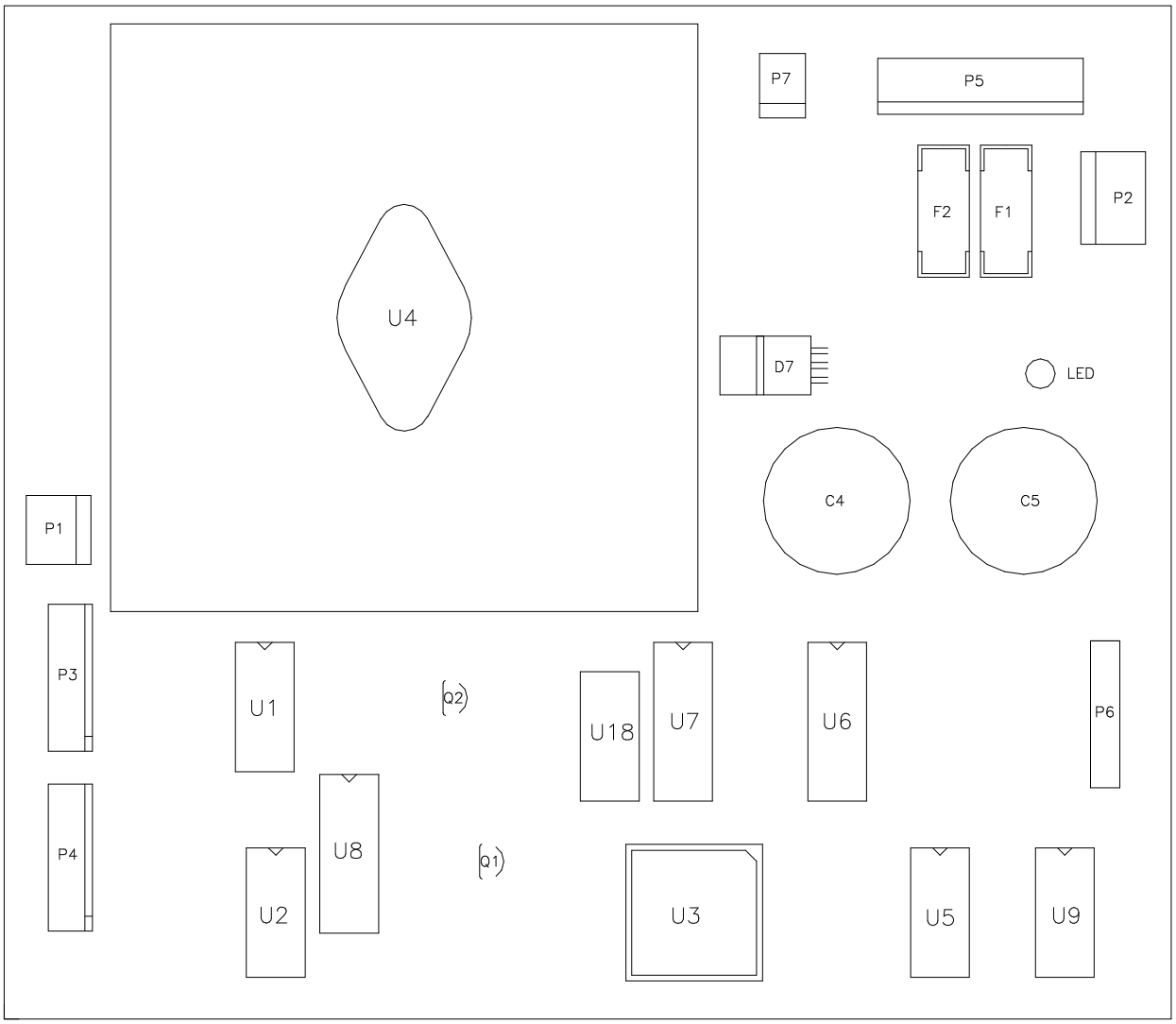
DESIGNATION	LOCATION	FUNCTION	MEANING	SETTING	DEFAULT
J1 & JP1	UPPER RIGHT	VIDEO	SIGNALS FROM	OPEN	
	BETWEEN	INPUT	COMPUTER VIDEO	J1 ALL	■
(NOTE 1)	JP2 AND JP16	SIGNALS	GRAPHICS CARD	JP1 ALL	
J2 & J3	LOWER CENTER	SERIAL	NOT USED IN THIS	OPEN	■
	BETWEEN	COMM	GAME (NO		
(NOTE 2)	JP7 & JP10	SIGNALS	USB COMM)		
JP2	UPPER RIGHT	VIDEO	SIGNALS TO	OPEN	
	BETWEEN	OUTPUT	GAME VIDEO	JP2 ALL	■
	J1 & JP6	SIGNALS	MONITOR		
JP3	UPPER RIGHT	BLUE	MATCHES	OPEN	■
	BETWEEN	VIDEO	DRIVE LEVEL	1 & 2	
(NOTE 3)	JP1 & JP6	LEVEL	TO MONITOR	2 & 3	
JP4	UPPER RIGHT	GREEN	MATCHES	OPEN	■
	BETWEEN	VIDEO	DRIVE LEVEL	1 & 2	
(NOTE 3)	JP1 & JP6	LEVEL	TO MONITOR	2 & 3	
JP5	UPPER RIGHT	RED	MATCHES	OPEN	■
	BETWEEN	VIDEO	DRIVE LEVEL	1 & 2	
(NOTE 3)	JP1 & JP6	LEVEL	TO MONITOR	2 & 3	
JP6	UPPER RIGHT	VIDEO	LOCKS VIDEO	OPEN	■
	BETWEEN	SYNC	MONITOR TO	1 & 2	
(NOTE 4)	L7 & U1	POLARITY	SYNC SIGNAL	2 & 3	
JP7	LOWER RIGHT	PLAYER	SIGNALS FROM	OPEN	
	NEAR	INPUT	SWITCHES AND	JP7 ALL	■
	J3 & JP8	SIGNALS	STEERING WHEEL		
JP8	LOWER RIGHT	OPERATOR	SIGNALS FROM	OPEN	
	NEAR	INPUT	CURRENCY AND	JP8 ALL	■
	JP7 & S1	SIGNALS	TEST SWITCHES		
JP9	CENTER LEFT	WHEEL	STEERING MOTOR	OPEN	
	NEAR	DRIVER	FEEDBACK AND	JP9 ALL	■
	JP11 & U5	SIGNALS	LEADER LIGHTS		
JP10	LOWER LEFT	COIN	INDIVIDUAL	OPEN	
	BETWEEN	OUTPUT	COIN METER	JP10 ALL	■
	J2 & P1	SIGNALS	DRIVE CIRCUITS		
JP11	CENTER LEFT	GAME	WATCHDOG	OPEN	
	BETWEEN	RESET	TIMER	JP11 ALL	■
	C134 & JP9	SIGNAL	CIRCUIT		
JP12	CENTER RIGHT	BOARD	CONNECTOR USED	OPEN	■
	NEAR	TEST	FOR CIRCUIT	JP12 ALL	
	S1 & U8	SIGNALS	DEVELOPMENT		
JP15 & P1	LOWER RIGHT	SERIAL	DATA EXCHANGE	OPEN	
	NEAR	COMM	TO COMPUTER	JP15	
(NOTE 1)	JP10 & U7	SIGNALS	CIRCUITS	P1	■

NOTES:

1. Connectors wired in parallel. Use based on type of interconnect cable connector.
2. Alternate forms of communications. Not required for this game.
3. Jumper not required for production video monitors. Install for early production Neotec or other units.
4. Jumper factory set for production video monitors. Change for older positive sync video monitors.

WHEEL DRIVER BOARD ASSEMBLY

04-11127



WHEEL DRIVER BOARD LED INDICATOR STATUS CHART

DESIGNATION	LOCATION	FUNCTION	COLOR	STATE	MEANING
LED 1	RIGHT CENTER NEAR C5 & P2	INDICATOR	RED	OFF	NOT IN USE
				ON	NORMAL OPERATION
				BLINKING	POWER FAULT (NOTE 1)

NOTES:

1. LED 1 monitors a regulated power supply voltage source. Must be on continuously at all times. Flash or blinking indicates an intermittent connection, a power problem, a circuit fault, etc.

HYDROTHUNDER™

CHAPTER SIX

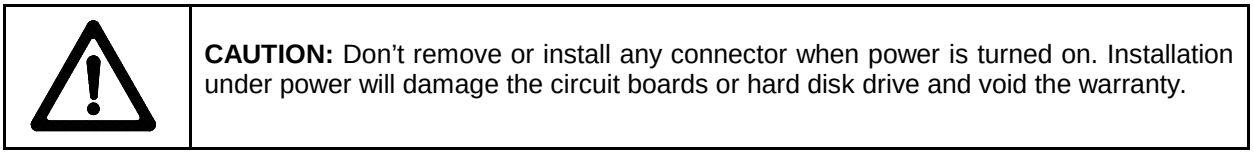
TROUBLESHOOTING

	NOTICE: The term VGM refers to the video game machine.
	CAUTION: This VGM uses complex electronic components that are *very sensitive to static electricity.* Observe the following precautions before handling VGM electronics. Failure to do so may void your warranty and could 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

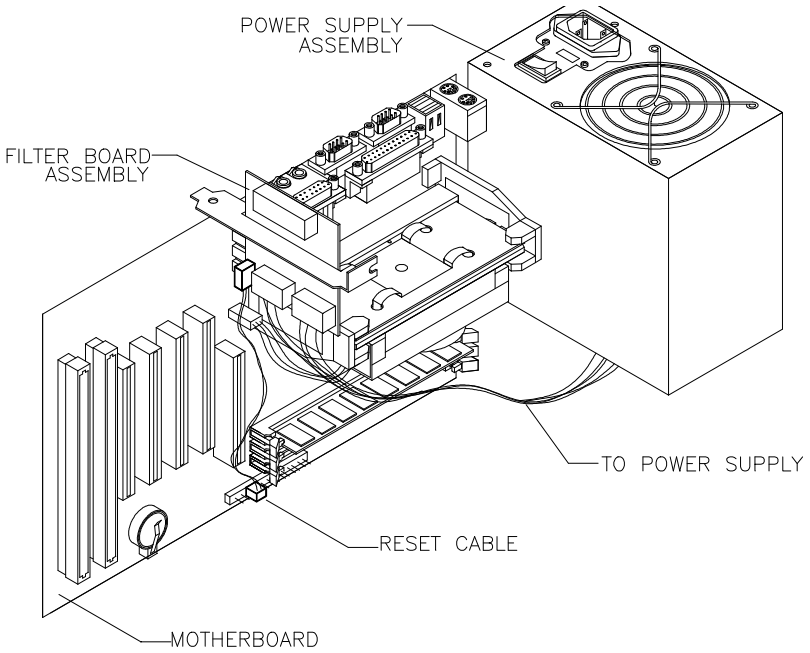
SYMPTOM	CAUSE	REQUIRED ACTION
• VGM *(video game machine)* accepts currency or tokens, but number of credits per coin or bill is incorrect.	Improper settings at Pricing Menu	1. Enter Menu System by pressing and holding TEST MODE switch inside coin door. From Diagnostics Menu, choose SWITCH TEST. Use tests to confirm operation of switches. 2. From Adjustments Menu, choose PRICING MENU. Verify that units and credits are set correctly.
	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.
• 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.
	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. Inspect computer to see if fans are turning. *If not:* Is computer power supply connected to its power cable? Is computer power supply turned on? 3. 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. Check computer cord in same manner. 3. Assure that cabinet wiring harness connectors fully seat in corresponding power supply and board connectors. 4. Inspect wiring for breaks or damage.
	Arcade computer problem	Turn off power for one minute and turn VGM on again. Power On Self-Test checks electronics. Screen may report errors. If video circuits don't operate properly, computer produces series of beeps. (See *Error Message Troubleshooting Table.)*

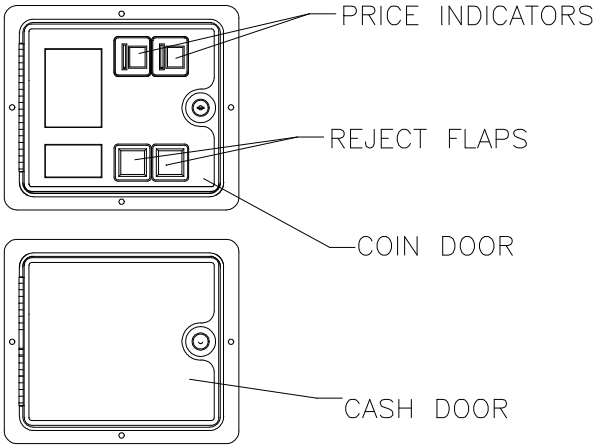


Location of Power Supply

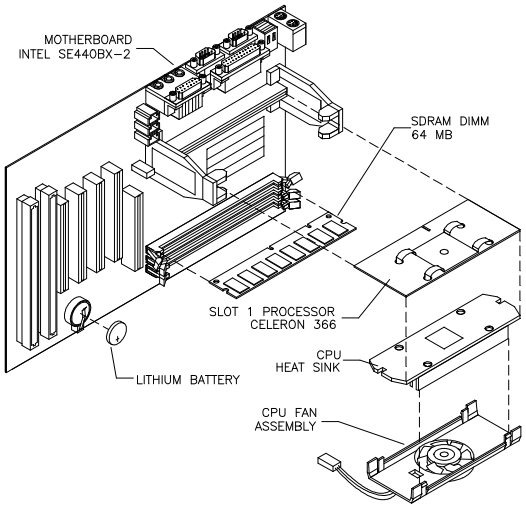
VGM Startup Troubleshooting Table, *continued*

SYMPTOM	CAUSE	REQUIRED ACTION
• VGM *(video game machine)* appears non-functional. • Currency acceptor price indicator is illuminated.	Power problem	1. Inspect circuit boards under low-light conditions. LEDs glow if processor circuits receive voltage. Fan should be turning. These indications prove presence of DC from power supply. Still, voltages or signals may not be normal. Computer has no internal LEDs. 2. Turn on VGM power. Using 20-volt DC setting on digital voltmeter, measure DC voltages at power connector pins. (Power supply voltage isn't adjustable.) 3. Using 2-volt AC setting on digital voltmeter, measure same DC voltages as above. Any reading here indicates that supply voltages are unstable and may contain ripple or noise.
	Faulty wiring	Turn off VGM power. Assure that wiring harness connectors fully seat onto mating board connectors. Verify that harness connects to computer. Check other connectors in same way.
	Improper jumper or DIP switch settings	Verify that circuit board jumpers are set as intended. Check DIP switch settings.
	Faulty circuit boards or arcade computer	1. Run power-up self-test sequence. Note errors or failures during tests. Compare LEDs with LED indicator status charts. Note discrepancies. 2. Turn off computer. Wait for hard disk to stop spinning. Leave VGM power on. Loosen computer case thumbscrews and lift off cover. Turn computer power on. Listen for beeping sounds. Compare beeps with *Error Message Troubleshooting Table.*

CAUTION: Don't remove or install any connector while power is turned on. Doing so will damage circuit boards or hard disk drive, and void warranty.



Front View of Coin Door



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. 3. 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 Diagnostics Menu, choose SWITCH AND LAMP TESTS. 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.

Audio Troubleshooting Table

SYMPTOM	CAUSE	REQUIRED ACTION
• No audio • Video is present • VGM *(video game machine)* appears to operate normally	Improper volume setting	Enter Menu System by pressing and holding TEST MODE switch. From Operator (Main) Menu, choose VOLUME MENU. Check that Attract Music is on (enabled). Verify that all volume levels are set well above zero. If necessary, change levels to make VGM audible.
	Faulty wiring	Turn off VGM power. Assure that wiring harness connectors attach and fully seat onto mating board connectors. Verify that harness connects to computer. Check audio cable connectors in same way.
	Faulty or obstructed speaker	Remove grilles and inspect speakers. Free speaker cones, terminals, mounting screws and magnets of loose parts or wires.
	Faulty Audio Board	Verify proper operation of Audio Board by placing it in working VGM.
• 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 Audio Board	1. Run power-up self-test sequence. Note errors that VGM finds during tests. Compare Diego Board LEDs with LED indicator status charts. Note discrepancies. 2. Verify that Audio Board operates by placing it in working VGM. Replace bad parts.
	Faulty power supply	Using 2 Volt AC setting on digital voltmeter, measure voltages at speaker terminals. Any reading indicates unstable supply that may contain ripple or noise.
• Audio is distorted, muffled or has missing frequencies.	Faulty or improper speaker	1. Turn off VGM power. Remove grilles and check speakers. Assure that speakers are full range (100 to 10,000 Hz response) and rated for at least 20 watts. Woofers must be rated for at least 40 watts. 2. 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 condition, but you can hear it during VGM operation.
• Dead sound channel	Faulty speaker	1. From Diagnostics Menu, choose SOUND TEST. Recheck speakers with audio signals provided by test. 2. Verify proper speaker operation by connecting speaker in question to working VGM.
	Faulty circuit board	Run power-up self-test sequence. Note errors that VGM finds during tests. Compare circuit board LEDs with LED indicator status charts. Note discrepancies.
	Faulty wiring	Verify that cabinet wiring is correct. Assure that all speakers connect to audio wires. Audio cable must be fully seated in Computer Line Output Jack. Check for broken or shorted wires.

Error Message Troubleshooting Table

Power-On Self-Test Beep Codes

(Audio beeps only. Video may or may not be present): See Note 1

MESSAGE	MEANING	REQUIRED ACTION
No beep	No system power	Check power supply and cables
1 continuous beep	Partial system power	Check power supply and cables
1 short beep	Normal start; no errors	Check other VGM components
2 short beeps	Processor problem	Check processor/fan module
3 short beeps	Graphics initialization problem	Check Video Board, cables
4 short beeps	Processor problem	Check processor/fan module
5 short beeps	Insufficient system memory	Check DIMM circuit modules
6 short beeps	Peripheral problem	Check other VGM components

System Error Message Codes

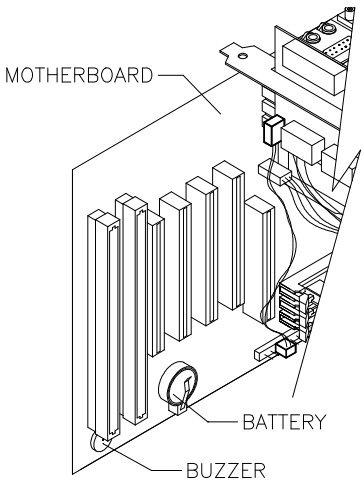
(One or more lines of text appear on video screen): See Note 2

MESSAGE	MEANING	REQUIRED ACTION
CONFLICTING UNIT ID:	Linking problem	Check for unique unit ID number
GAME STARTUP:	Normal start; no errors	Check other VGM components
VERSION MISMATCH	Software problem	Check for differing revision level
XXXX DATA LOAD:	Corrupted files or failing circuits	Check named drive or circuit
XXXX INIT OR INIT FAILURE:	Circuit/file initialization problem	Check named drive or circuit

Notes

1. The audio buzzer that generates 1 kHz beeps is on the computer, inside the VGM *(video game machine)*. If hearing beep codes is difficult, remove the cabinet doors and computer cover.
2. Arcade Computer circuit boards resemble those in personal computers. Yet Midway engineers reprogrammed the boards for application to this VGM. *Power-On Self-Test codes are unique to the Arcade Computer in this VGM*.
3. Wiring or peripheral circuit problems may not trigger on-screen error messages. You may discover difficulties during Menu System diagnostic or calibration procedures.
4. Call your authorized distributor for help with unresolved error messages.

NOTICE: Don't attempt to move computer circuit boards into alternate slots. Midway assigned boards to specific slots. The custom operating system won't recognize improperly placed boards, even though they function normally.



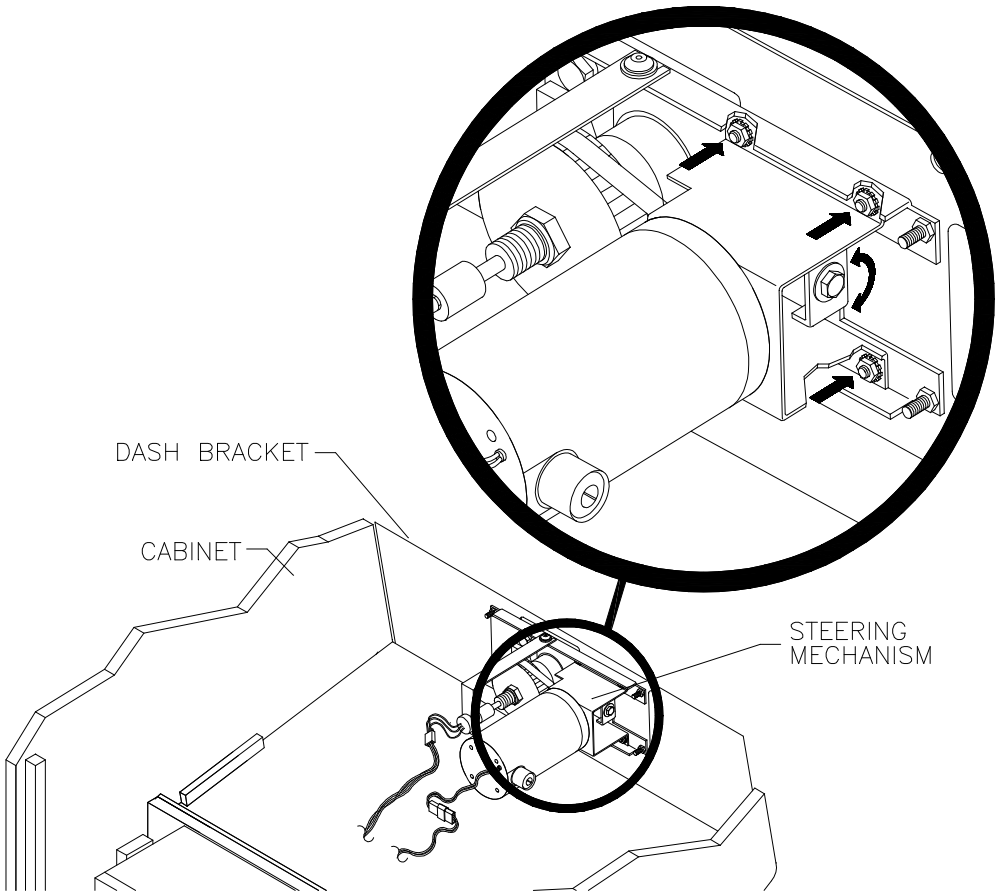
Location of Beeper in Arcade Computer

Link Troubleshooting Table

SYMPTOM	CAUSE	REQUIRED ACTION
• Can't connect VGMs *(video game machines)* together	Faulty wiring	1. Don't extend linking cables that come with VGM. 2. Install required crossover between VGM cabinets. Each coupler connects two cabinets (one pair). *Don't use standard telephone type couplers or wiring to link cabinets*. 3. Use only 10Base-T, Ethernet-type, Category 5, twisted-pair wiring for VGM data.
	Improper linking hardware	Use required network hub for your local network. Hub Link Kit permits up to four cabinet connections. Cabinet array completion requires basic kit brackets and spacers.
• VGM doesn't recognize other players in linking operation • VGM functions normally by itself	Improper settings	1. Record any error messages that occur during self-test. 2. From Operator (Main) Menu, choose Adjustments Menu. Then select Linked Play Adjustments Menu. Assure that you've set LINKED PLAY to ON. 3. Be sure that each VGM has unique ID number.
	Power problem	If hub is in use, verify that power is applied. AC adapter wires are thin and easily damaged.
	Faulty wiring *(3 or more cabinets)*	1. Inspect hub indicator lights. Each active port should have illuminated indicator. If cable connects, and that position has no lit indicator, check for cable continuity from hub to cabinet. 2. Assure that no loose wires catch in hinges, doors, or under cabinet. 3. Verify that linking cable connects to Network Board at each VGM's computer. 4. Verify that each linking cable operates properly by placing it in working VGM.
• Some VGMs in group link properly, while others don't	Improper hub switch setting	1. Assure that switches on hub are set correctly according to Hub Link Kit instructions. (Networked cabinets don't require couplers. Hub has electronic crossover.) 2. Inspect hub indicator lights for link activity. See manufacturer's literature for diagnostics.
	Wrong software version	Verify that all linked cabinets use same software version. Otherwise, linked cabinets won't recognize each other. Contact your distributor.
	Faulty wiring *(2 cabinets)*	1. Insert crossover connections between coupled cabinets. Standard couplers appear identical to devices supplied with cabinets, but don't include internal crossover. 2. Verify that each linking crossover coupler operates properly by placing it in working link between two cabinets.
	Faulty wiring *(3 or more cabinets)*	1. You used additional crossover connector and cable to extend VGM or hub link connection. Two crossovers cancel and cause same problem as no link crossover. 2. Connect cables directly to hub. Don't use crossover coupler and hub together in single network. 3. Separate communications wiring from other wiring. Wires that must cross should cross at right angles to limit noise pickup.

Player Control Troubleshooting Table

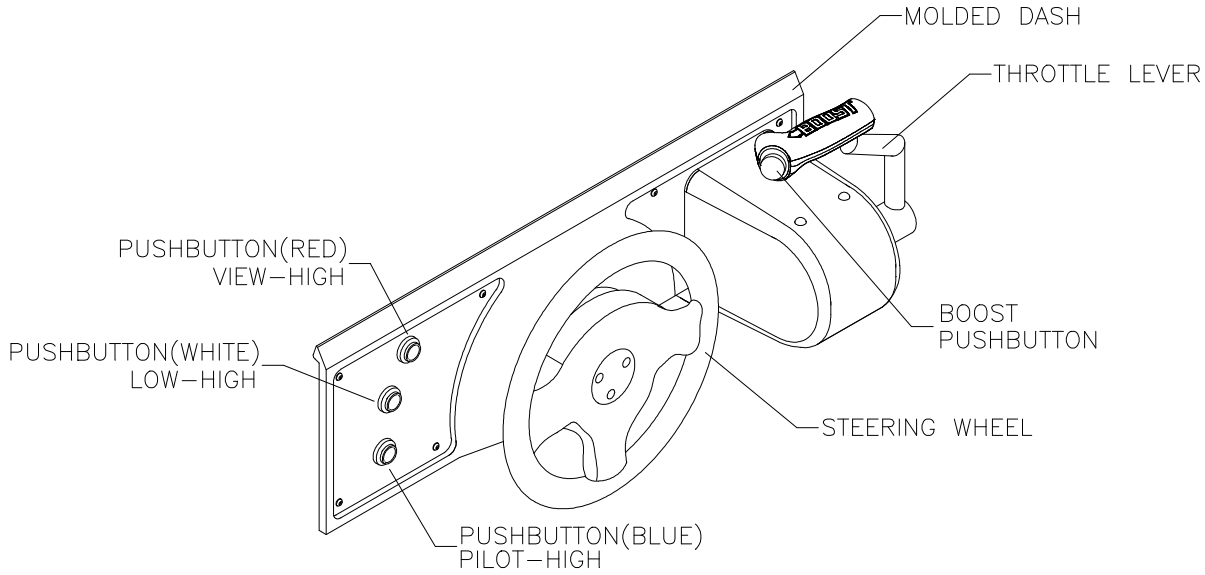
SYMPTOM	CAUSE	REQUIRED ACTION
• Intermittent or completely non-functional player controls • VGM *(video game machine)* starts normally.	Faulty switches or lamps	1. Enter Menu System by pressing and holding TEST MODE switch inside coin door. From Diagnostic Menu, choose SWITCH TEST. Run tests to confirm 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 control operates properly by placing it in working VGM. 5. Verify that dashboard switch light bulbs are type specified in parts listing. Other types light, but may produce too much heat. Eventually excess heat may cause switches to bind.
	Faulty switch wiring	1. Check for wires caught in door hinges, latches, or switch contacts. 2. Verify that harness connectors are attached and fully seated. 3. Assure that control switches connect properly to control input wires. 4. Check that cabinet wiring is correct for this VGM.
• Steering pulls to one side	Faulty Wheel Driver Board	Find power amp on Wheel Driver Board's large heatsink. Test and replace bad part or board.



How to Adjust Belt Tightness

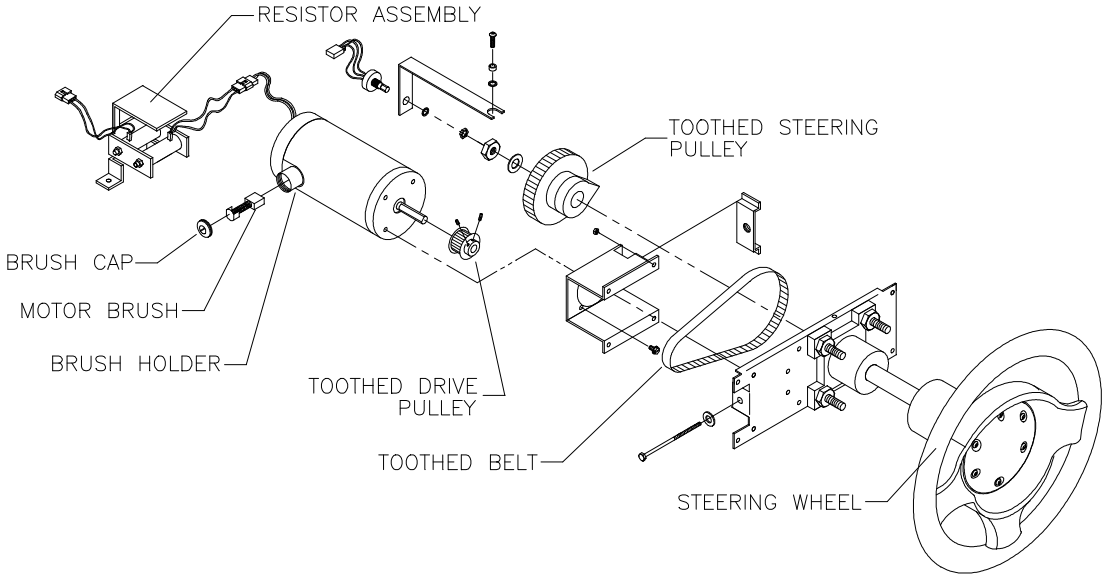
Player Control Troubleshooting Table, *continued*

SYMPTOM	CAUSE	REQUIRED ACTION
• Sloppy, unpredictable or ineffective steering • Video appears on screen • VGM *(video game machine)* starts normally	Blocked or faulty fan	With VGM power on, check airflow near each computer fan. Case cooling fans are intake fans. Power supply fan is exhaust fan. Assure that nothing blocks airflow.
	Faulty mechanical parts	Turn off VGM power. Open dashboard. Support steering wheel and remove outer mounting screws. Remove metal shield (if your VGM has one) over motor. Inspect for faulty or worn belts, bearings, couplings, gears, etc.
	Faulty Wheel Driver Board	1. Inspect Wheel Driver Board under low-light conditions. LEDs glow if motor driver circuits receive AC power from transformer. (Voltages or signals may or may not be normal.) 2. Examine fuses and cables on Wheel Driver Board. Replace bad fuses. Using digital voltmeter, verify AC voltage between each fuse holder and ground. You should measure approximately 25V. See Wiring Diagram. 3. Using 20 VAC setting on digital voltmeter, measure DC voltage at motor. *Don't move steering wheel, drive belt, or motor while making this measurement.* Any reading indicates unstable supply that may contain ripple or noise. 4. Verify proper operation of Wheel Driver Board by placing it in working VGM.
	Loose or worn drive belt	1. Turn off VGM power. Open dashboard. Support steering wheel and remove outer mounting screws. Remove metal shield (if your VGM has one) over motor. Inspect for faulty or worn belts, bearings, couplings, gears, etc. 2. If drive belt isn't worn or damaged, check its tightness.
• No wheel feedback • Steering aims vehicle as expected	Improperly set feedback	1. From Diagnostics Menu, choose FORCE FEEDBACK ADJUSTMENT. 2. Set feedback to match player requirements. Maximum force may be too extreme for very young or inexperienced customers.
	Faulty circuit	1. Examine fuses and cables on Wheel Driver Board. 2. Check cables and wiring between computer, interface, driver and motor. 3. Check resistance of motor series resistors 4. Replace bad parts.
	Faulty motor	1. Turn off VGM power. Open dashboard. Support steering wheel and remove outer mounting screws. 2. Remove metal shield (if you VGM has one) over motor. 3. Unscrew caps. 4. Inspect motor brushes. Replace worn parts.



Player Panel Controls

WARNING: The Wheel Driver Board heatsink, power resistors, and other components may be very hot. The DC Motor in the steering wheel may also be hot.



Steering Components

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 proves that some monitor circuits receive power. Still, voltages or signals may not be normal.
	Faulty wiring	1. Turn off VGM power. Verify that video signal and Remote Adjustment Board connectors seat properly on Video Monitor Board. 2. Assure that video cables connect to circuit boards and computer. 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 on Video Monitor Board. 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	Floppy disk in drive	Check floppy drive for diskette. If you find disk, eject it. Leave VGM power on. Turn off computer. Wait for hard disk to stop spinning. Turn on computer.
	Faulty wiring	Loosen computer case lid thumbscrews and lift off cover. Assure that hard drive ribbon cable connector is fully seated into mating connector on motherboard. Check hard drive power cable.
	Improper components	1. Verify that hard disk drive is correct for this VGM. Label on drive records manufacturer name, assembly number and program version. 2. Verify that circuit boards are correct for this VGM. Label on each board records manufacturer name, assembly number and hardware version. 3. Verify that ROM instruction set is correct for this VGM. VGM set includes more than one ROM. Label on each ROM records assembly number and software version.
	Hard drive problems	1. Turn computer on. Immediately look *under* hard drive. Hard Drive Activity LED flashes if drive is operating properly. 2. Allow VGM to load normally. Note and record any error messages that occur during self-test. 3. Remove hard drive and install it in working VGM. If symptom recurs there, hard drive is faulty. Replace it.
• 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 Operator (Main) Menu, select Diagnostic Menu. Then select Monitor Patterns Menu. Run through Crosshatch, Red, Green and Blue screens to find clearest display of problem. 3. Display screen with greatest problem. 4. Display 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 Crosshatch Screen. Touch up adjustments while watching screen in mirror.

	CAUTION: Don't operate the monitor without its Remote Adjustment Board.
	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 ovoid 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 computer to circuit boards, and then 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. 2. Assure that video monitor is correct type for this VGM. Video monitors with wrong resolution can't lock sync.
	Improper sync signals	1. Check to see if Video Board puts out type of sync that your monitor requires. 2. Verify that jumpers are set correctly for monitor. 3. If necessary, change video sync jumper on Diego Board. Refer to Wiring chapter for details.
	Electromagnetic fields	Move cabinet far away from machines, appliances, or VGMs *(video game machines)*.
• 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 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. Also check White Screen. Touch up controls. 6. 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 Patterns Menu. Watch 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 Patterns Menu. Watch 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 Patterns Menu. Watch 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.

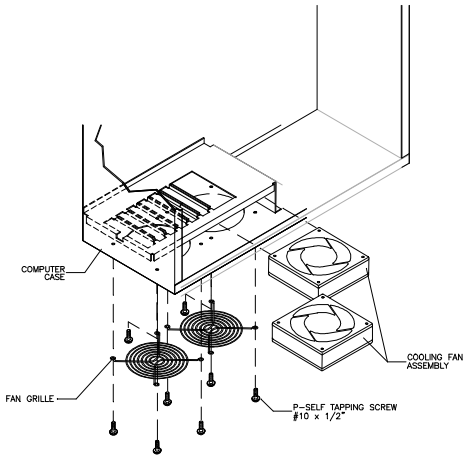
Software Update Troubleshooting Table

SYMPTOM	CAUSE	REQUIRED ACTION
• Update didn't work • After update procedure, screen reports lower than latest version	You skipped steps or performed them out of sequence.	Return update components to kit, reinstall original parts in cabinet, and try process again.
	You connected linked VGMs *(video game machines)* to cabinet being updated.	1. Network communication circuits may have prevented full update. Turn off power to all connected cabinets. 2. Perform update on one cabinet at time. If power is off, you need not disconnect linking cables.
	Installation error may have damaged device.	1. Inspect for bent or broken pins. 2. If you have another kit, try it. 3. Ask your distributor to check your floppy disk.

NOTICE: Someday, software updates for your VGM *(video game machine)* might become available. These upgrades may improve your VGM's performance or add new VGM features. Such upgrades tend to appear sometime after factory first releases VGM. Contact your distributor for information about updates.

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	Measure fluorescent lamp AC voltages. Check wiring and connector continuity from AC power chassis to lamp assembly.
• VGM operates normally • Cabinet becomes warm after several hours of use	Obstructed fan	1. Check bottom and rear of cabinet for blocked airflow. 2. Move VGM away from sources of heat. 3. Turn off VGM power. Remove dust from vent holes with high-power vacuum cleaner.
	Faulty wiring	Check fan wiring and connectors.
	Faulty fan	Check operation of all fans.
• 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.



Fan Location and Mounting

WARNINGS & NOTICES

WARNING

USE OF NON-MIDWAY PARTS OR CIRCUIT MODIFICATIONS MAY CAUSE SERIOUS INJURY OR EQUIPMENT DAMAGE! USE ONLY MIDWAY AUTHORIZED PARTS.

* Use only authorized components and parts. Failure to do so will void warranty and may result in incorrect and/or unsafe operation. Substitute parts or modifications may void EMC directive or FCC type acceptance.
* This game is protected by federal copyright, trademark and patent laws. Unauthorized modifications may be illegal under federal law. This also applies to MIDWAY GAMES INC. and HYDROTHUNDER 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 game operation. Plug this game only 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 them to experience epileptic seizures or have 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.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

NOTICE - FCC COMPLIANCE LABEL

NOTICE

When MIDWAY ships a game, it is in compliance with FCC regulations. The FCC label on your cabinet is proof. If this label is missing or damaged, legal repercussions to the owner or distributor of the game may result. If your game does not have an FCC label, contact MIDWAY immediately.

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