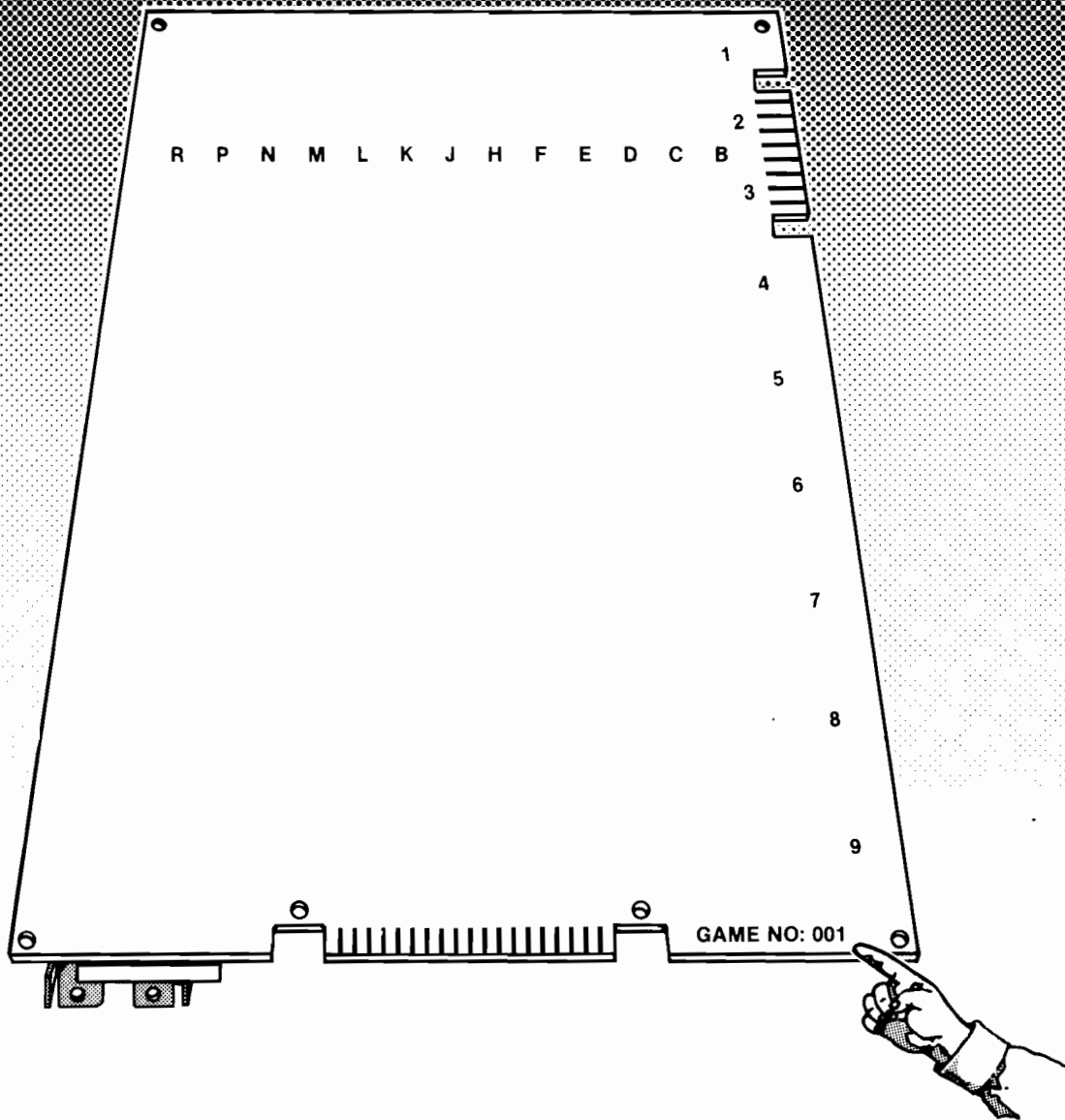


ATARI **A** PLAYER FOOTBALL™

A PLAYER



Operation, Maintenance and Service Manual
Complete with Illustrated Parts Catalog



GAME SERIAL NUMBER LOCATION

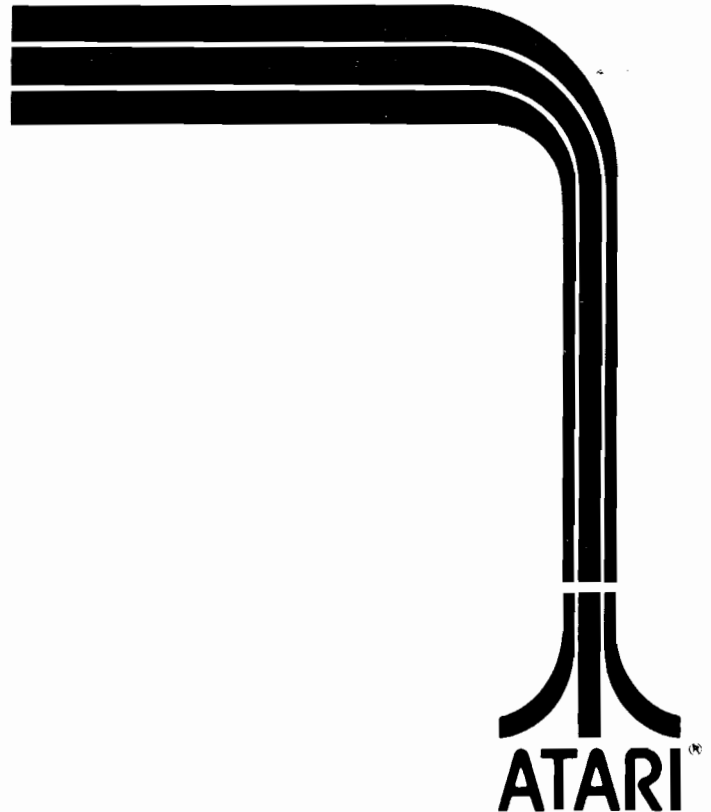
Your game's serial number is stamped on the circuit (back) side, bottom right corner, of the printed circuit board—see the illustration below. The same number is also stamped on the label located on the rear of the game cabinet. Please mention this number whenever calling your distributor for service.




Operation, Maintenance and Service Manual

Complete with Illustrated Parts Catalog

ATARI, INC.
1265 BORREGAS AVENUE
P.O. BOX 427
SUNNYVALE, CALIFORNIA 94086
408/745-2000 • TELEX 35-7488



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NOTE

If reading through this manual does not lead to solving a certain maintenance problem, call Tele-Help™ at the Atari Customer Service office in your geographical area, as shown in *one* of the two maps below. Order all parts from the California office.

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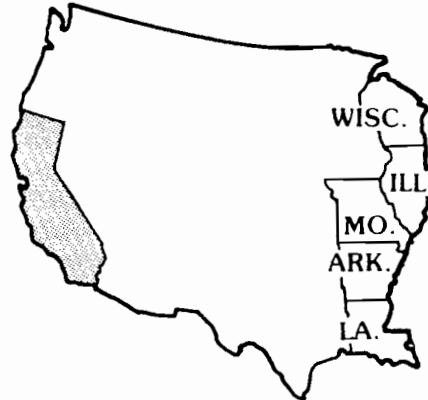
Atari Coin-Op Customer Service
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Telex 17-1103
(Monday - Friday, 7:30 - 4:00 pm Pacific Time)



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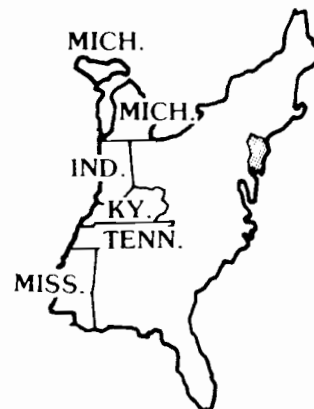
Atari Inc.
New Jersey Customer Service Office
44 Colonial Drive, Piscataway, NJ 08854
Telex 37-9347
(Monday - Friday, 8:30 - 5:00 pm Eastern time)



From New Jersey
(201) 981-0490



From anywhere else in this area
toll-free (800) 631-5374



location setup



A. Overview of Game

The 4-Player Football™ game has two new Atari parts. If you have worked on Atari video games in the past, then you should be aware of these important differences. The new parts are described below and shown in Figure 1.

- *Power Supply Assembly.* It covers a wider voltage range than before, has higher reliability, a smaller overall size, and all fuse numbers and fuse amperages are marked directly on the metal chassis.
- *Regulator/Audio PCB.* Most of the heat-producing components have been moved off the game PCB and onto this smaller board, so the parts will not be prone to a higher rate of failure. Throughout this manual and illustrated parts catalog, wherever one of these two new parts is mentioned, you will see this symbol in the page margin:



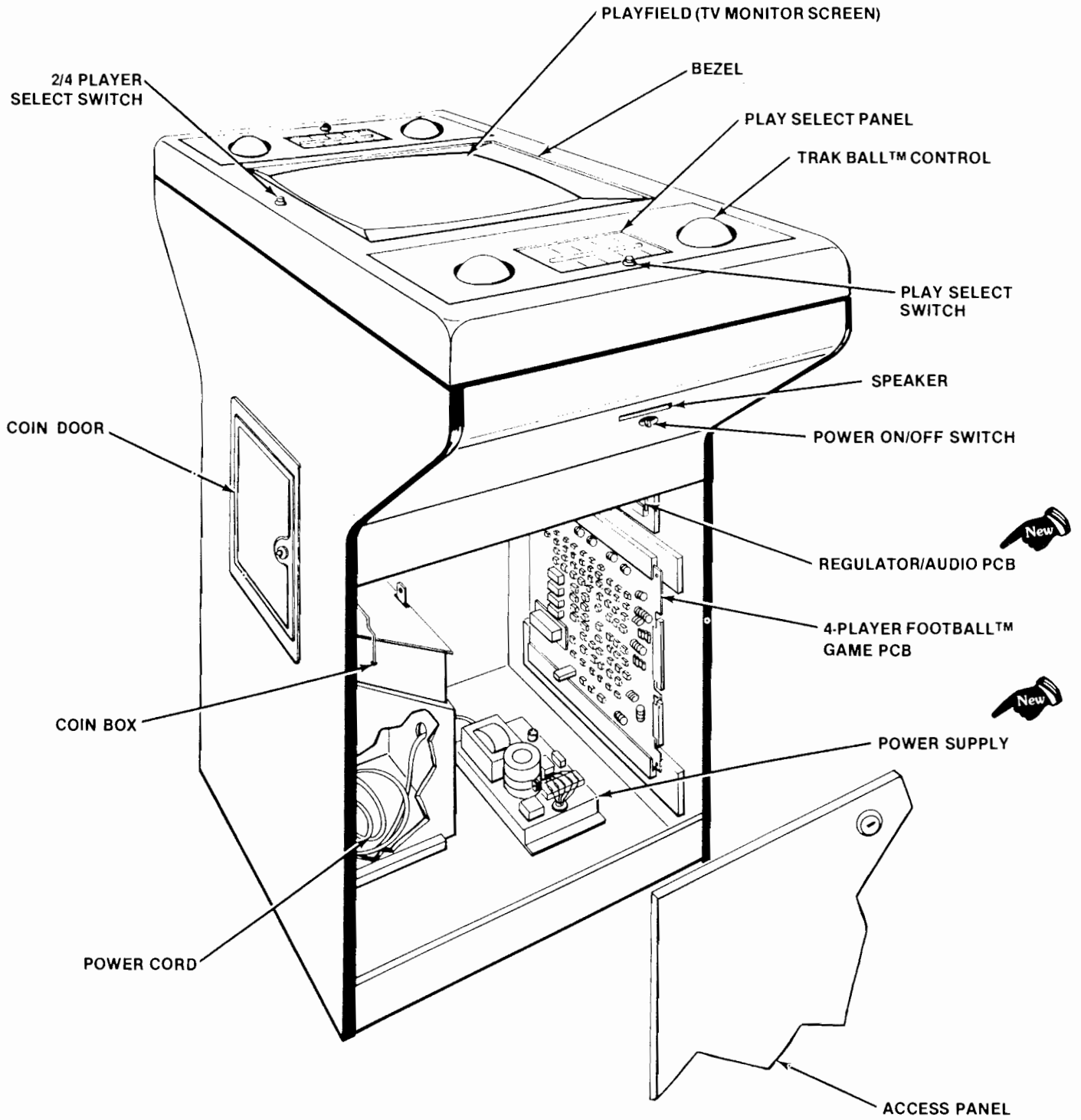


Figure 1 Overview of Game

B. Game Inspection

This new game is ready to play upon removal from the shipping carton. However, your careful inspection is needed to supply the final touch of quality control. Please follow these steps to help us insure that your new game was delivered to you in good condition.

NOTE

Do not plug the game in yet!

1. Examine the exterior of the game cabinet for dents, chips, or broken parts.
2. Unlock and open the access panel of the cabinet and inspect the interior of the game as follows:
 - a. Check that all plug-in connectors (on the game harness) are firmly seated.
 - b. Remove the game printed circuit board (PCB) as follows:
 - Remove the screws at the edge of the PCB closest to you.
 - Unplug the edge connectors carefully. **DO NOT BEND THE PCB.**
 - Slide the PCB out of its slots.
 - c. Verify that all integrated circuits (ICs) are firmly seated in their sockets or soldered in place. You should eliminate any foreign material such as loose bits of wire or solder splashes that could cause unwanted conductive paths.
 - d. Note the location of the game's serial number—it is on the metallic label in the upper left corner on the side of the cabinet. A serial number (not necessarily the same one) also appears in the corner of the back side of the game PCB. A drawing of this is on the inside front cover of this manual. Please mention this number whenever you call your distributor for service.
 - e. Carefully slide the PCB back into its slot in the game cabinet and secure with the two screws at the board's edge closest to you.
 - f. Plug the edge connectors back onto the PCB. **DON'T FORCE THEM.** The connectors are keyed so they will only go on in the proper orientation. *A reversed edge connector will damage the PCB.*

WARNING

To avoid possible unpleasant electrical shock, do not touch internal parts of the video monitor with your hands or metal objects held in your hands! Check the monitor chassis mounting hardware only.

3. Check all major subassemblies such as the power supply, loudspeaker (which contains powerful magnets that will attract small metal items—remove these items), and all player-operated controls and switches. Check that the video monitor is securely mounted; tighten the hex nuts below the monitor shelf as necessary.

C. Game Installation

Figure 2 Installation Requirements

Power	110 VAC, 60 Hz (nominal), 120 watts OR 220 VAC, 50 Hz (nominal), 120 watts
Temperature	0 to 38°C (32 to 100°F)
Humidity	Not over 95% relative
Space Required	75 × 135 cm (29½ × 53 in.)
Game Height	94 cm (37 in.)

1. Voltage Selection

Before plugging in your game, make sure that the voltage selection plug on the power supply (see Figure 3) is correct for your location's line voltage. Check the wire color on the plug and see if it is correct per the list below.

Line Voltage Range	Voltage Selection Plug Color
90-110 VAC	Violet
105-135 VAC	Yellow
200-240 VAC	Blue
220-260 VAC	Brown



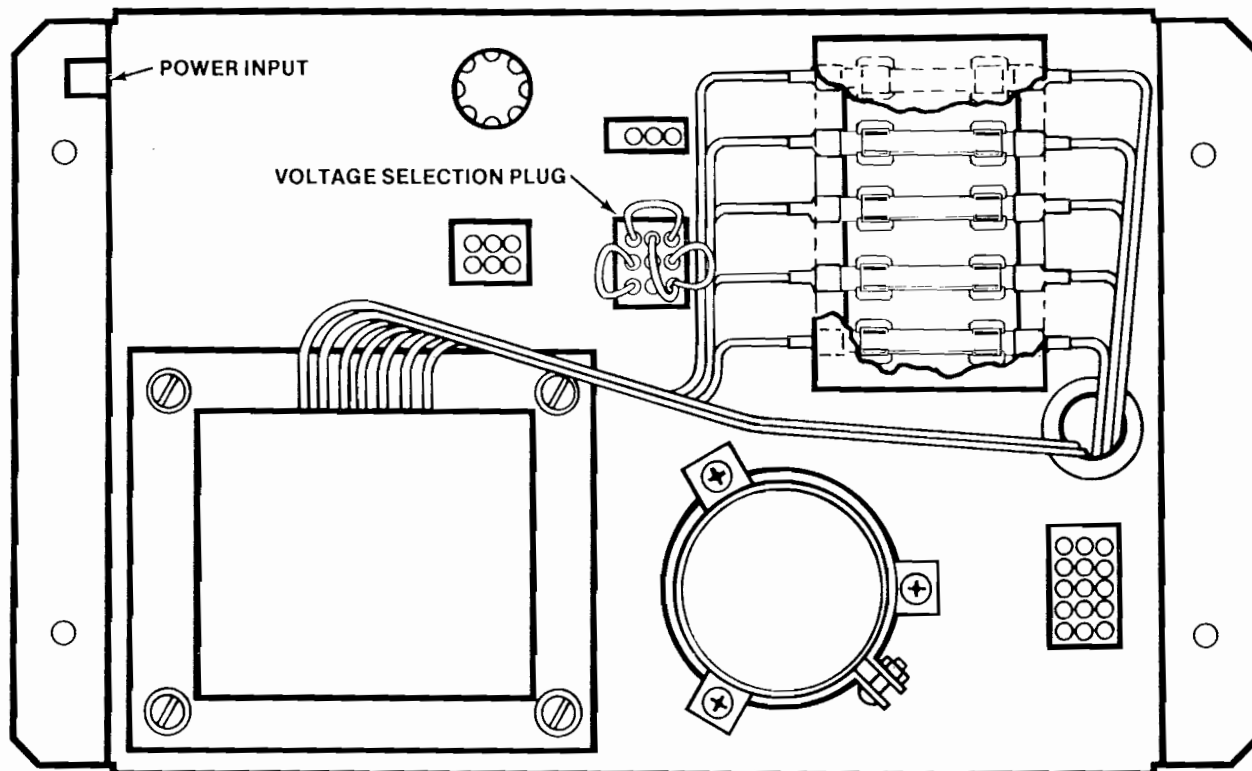


Figure 3 Power Supply

2. Interlock and Power On/Off Switches

To minimize the hazard of electrical shock while you are working on the inside of the game cabinet, two interlock switches have been installed (see Figure 4). One is located behind the access panel and one is behind the coin door. These switches remove all the AC line power from the game circuitry when a door is opened.

Check for proper operation of the interlock switches by performing the following steps:

1. Unlock and open the rear access panel and the coin door.
2. Plug the AC line power cord into an AC outlet.
3. Set the on/off switch to its *on* position.
4. Close the rear access panel and coin door. Within approximately 30 seconds after closing the panel and door, the TV monitor should display a picture (the game lighting should light immediately).

5. Slowly open the rear access panel. The TV monitor picture should disappear and the game lighting should go off when the panel is opened to approximately 2.5 cm (1 inch). Close and lock the rear access panel, and repeat this step with the coin door.
6. If the results of step 5 are satisfactory, the interlock switches are operating properly. If the TV monitor and game lighting don't go off as described, check to see if the corresponding interlock switch is broken from its mounting or stuck in the *on* position.

3. Game Fuses

Fuse locations and values are marked on the power supply chassis (see Figure 22). For continued protection of your game, as well as for the safety of the player, fuses must be replaced *only* with identically rated ones.

Information on the TV monitor fuses is printed in the TV monitor manual that has been supplied with your 4-Player Football game.

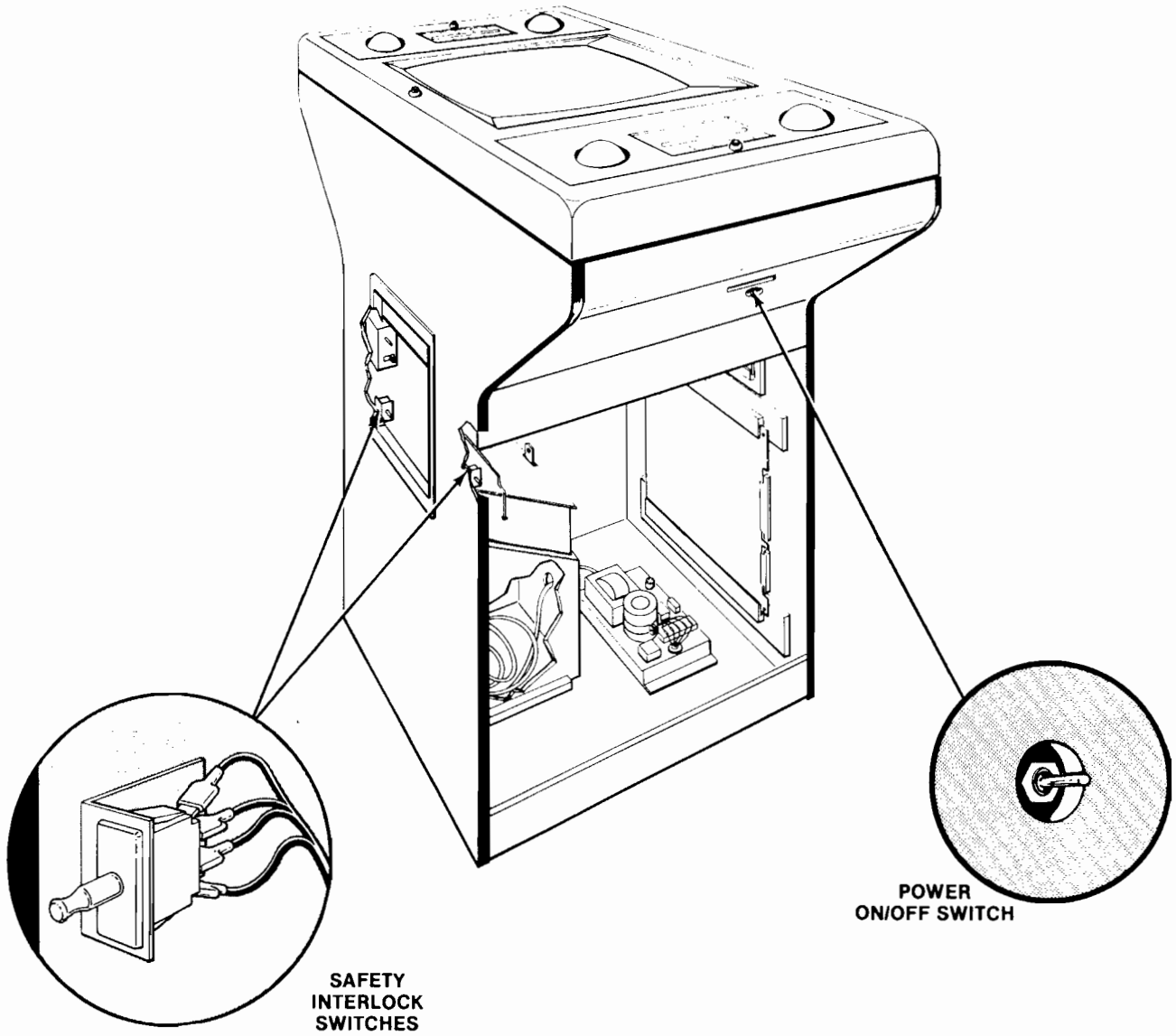


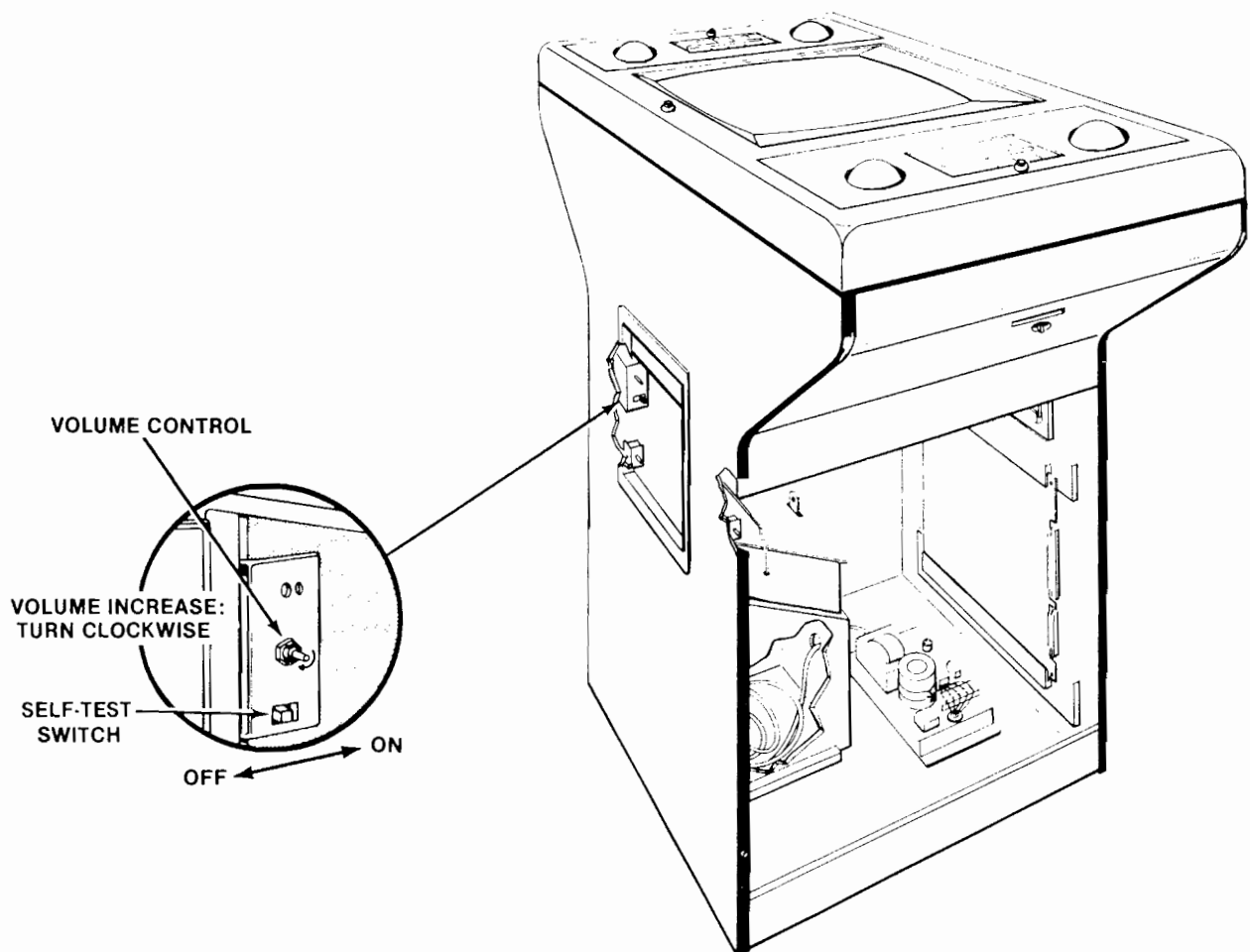
Figure 4 Interlock and Power On/Off Switches

D. Self-Test Procedure

This game will test itself and provide data to demonstrate that the game's circuitry and controls are operating properly. The data is provided on the TV monitor and the game speakers: no additional equipment is required.

Part of the self-test includes a test of the volume level and a display of the operator-selected game options. Therefore, we suggest you run the self-test anytime you need to adjust the volume or change the options. Besides, this method will eliminate an inaccurate coin count, which would be gotten by tripping the coin switch wire merely to change the volume level during game play.

To begin the self-test, follow the instructions outlined in Figure 5.



Location of Self-Test Switch and Volume Control

Option Switch Settings

To change the toggle positions of the switch assembly, you need not remove the PCB. The switch, usually colored blue, is easily accessible when the PCB is left mounted in place.

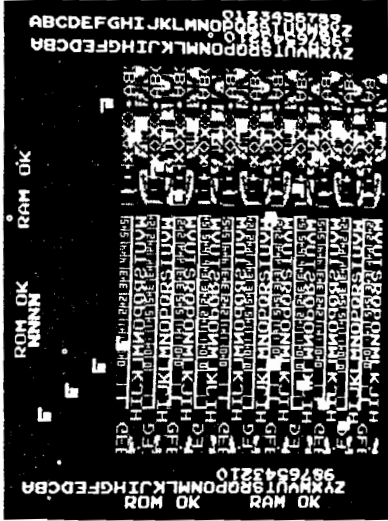
Switch Setting on 4-Toggle DIP Switch (on game PCB)				Result	Display During Self-Test
4	3	2	1		
			Off	70 seconds per coin	<div style="display: flex; align-items: center;"> <div style="margin-right: 5px;">F</div> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 10px; width: 10px;"></div> </div>
			On	90 seconds per coin \$	
		On		1-coin minimum	<div style="display: flex; align-items: center;"> <div style="margin-right: 5px;">N</div> <div style="border-left: 1px solid black; border-right: 1px solid black; height: 10px; width: 10px;"></div> </div>
		Off		2-coin minimum † \$	
				Right coin mechanism (as you face the game) registers:	<div style="display: flex; align-items: center; margin-top: 10px;"> <div style="margin-right: 10px;">N</div> <div style="margin-right: 10px;">N</div> </div>
On	On			1 unit of time per coin	
Off	On			4 units of time per coin	<div style="display: flex; align-items: center; margin-top: 5px;"> <div style="margin-right: 10px;">F</div> <div style="margin-right: 10px;">N</div> </div>
On	Off			5 units of time per coin \$	
Off	Off			6 units of time per coin	<div style="display: flex; align-items: center; margin-top: 10px;"> <div style="margin-right: 10px;">X</div> <div style="margin-right: 10px;">X</div> </div>
				(Left coin mechanism <i>always</i> registers 1 unit of time per coin)	

Xs represent switch numbers 4,3,2,1 on the 4-toggle DIP switch, namely N = on, F = off.

\$ Indicates settings made at the factory and/or recommended settings.

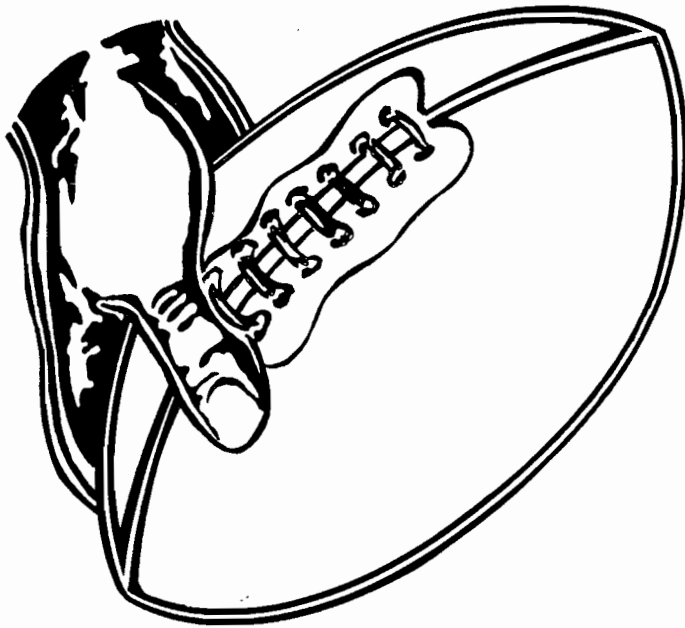
† Game time is shown after one coin, but the controls are inactive until the second coin is inserted.

Self-Test Procedure

Instruction	Result if Test Passes	Result if Test Fails
<p>1. RAM AND ROM TEST</p> <p>Set self-test slide switch to the <i>on</i> position (located below the volume potentiometer, immediately behind and to the left of the coin door).</p>	<p>TV monitor displays ROM OK RAM OK as shown below:</p>  <p style="text-align: center;">↕ Scrolling Directions ↕</p>	<p>BAD RAM and/or BAD ROM will be displayed on the monitor.</p>
<p>2. SCROLLING PLAYFIELD TEST</p> <p>Press the Play Select pushbutton on either control panel.</p> <p>Release the Play Select pushbutton.</p>	<p>Playfield scrolls towards the pressed button.</p> <p>Playfield will freeze.</p>	<p>No playfield scrolling motion.</p>
<p>3. TRAK BALL TEST</p> <p>Roll any Trak Ball in random motion and observe TV monitor.</p> <p>Press and hold down either Play Select button; then roll all 4 Trak Ball controls in sequence.</p>	<p>An L-shaped arrow pointing towards that Trak Ball will move around the entire playfield exactly as you move the control.</p> <p>Each switch activation (closed or open) enables a different set of arrows to move for all 4 Trak Balls. A press/release/press/release series will cycle thru all 4 arrows of each Trak Ball.</p>	<p>The appropriate arrow does not move in the same direction as the Trak Ball.</p>
<p>4. AUDIO, SWITCH AND LAMP TEST</p> <p>Press all the following switches: slam, the coin switches, play select and 2/4 players switches.</p>	<p>Background crowd sound increases in volume, the more switches you hold down simultaneously.</p> <p>Each pressed switch generates 2 beeps — one beep when pressed and a second beep when released.</p> <p>All incandescent lamps are lit (LEDs remain dark).</p>	<p>No crowd sound: indicates bad sound circuitry, loose speaker wires, bad switch circuitry, or volume control turned all the way down.</p> <p>Crowd sound does not increase or no beep sound: indicates a bad switch.</p> <p>Either some or all lamps are dark (burned out).</p>

Self-Test Procedure

Instruction	Result if Test Passes	Result if Test Fails
<p>5. OPTION SWITCH DISPLAY</p> <p>Observe the open dark-gray playfield area on the screen, near the ROM OK or BAD ROM message.</p>	<p>A combination of Ns and Fs is displayed under the ROM message. This indicates how the option switches have been set on the game PCB. See the <i>Option Switch Settings</i> list on page 7 for how to set your 4-Player Football game to its various options.</p>	<p>N or F does not match actual DIP switch setting. Indicates a game circuitry malfunction.</p>



game play

A. Introduction

The Atari 4-Player Football™ game has three different modes of normal operation. These modes are described below:

Attract — when power is applied or as a result of a game ending with no further credits.

Select Play — before each scrimmage.

Play — begins after the hike.

The 4-Player Football game consists of two player control panels (illustrated in Figure 6). These two control panels are operated independently by opponents. Each control panel is capable of operating either the offense or defense, depending on the point in time during the game.

Each control panel consists of two Trak Ball controls, a Play Select PCB and its acrylic graphics panel, and a triple-function LED pushbutton. The LED's primary function is to select one of the various plays, and its other functions allow passing or kicking. When the Play Select switch is active, the LED flashes. Once the ball is hiked, the LED will go dark, changing the switch function to passing or kicking (offense only).



The play select panel illustrates five offensive and five defensive plays. The panel is backlit by six incandescent lamps. Prior to selecting any of the five plays, the five LED lamps are dark.

Pressing the Play Select pushbutton lights a random LED. The player may now make a selection by “stepping” the LED from left to right, before the scrimmage begins. On the next play, the LEDs stay dark until the pushbutton is pressed again.

The Trak Ball is the control for the wide receiver or quarterback if you’re the offensive player, or for the defensive backs. This control is operated by rolling it in any direction with the palm of your hand. It moves the appropriate man to any position on the scrolling playfield by moving him at a rate proportional to the roll of the ball. The Trak Ball and the Play Select pushbuttons will only be enabled during the play select and the play modes. Otherwise, these controls are disabled.

B. Attract Mode

The attract mode begins when AC power is applied to the game and the power on/off switch is turned on. While in the attract mode, the TV monitor randomly displays the plays, and the game simultaneously lights up the corresponding LED. The Xs indicate defensive players, and the Os indicate offensive players. This mode alternates randomly between 2- and 4-player games; it also demonstrates use of the 2/4 player pushbutton by lighting and turning it off, as appropriate.

C. Play Select Mode

The play select mode begins immediately after the necessary coins are accepted by the coin mechanism. After this, the Play Select pushbutton switch becomes active. The screen then changes from the attract mode display to the huddle. The game is now in the players’ hands, and the crowd audio is turned on.

Actually this mode exists at each huddle, regardless of the score or of offense or defense conditions. The coin message is no longer displayed in the scoreboard display area. Instead, the scoreboard indicates whether you are the offense or defense for the current scrimmage; it also shows a zero

score when first placed into the play select mode. The down number and yards to go are displayed, and time begins counting down. The Play Select LED flashes, and the switch becomes enabled.

During the play select mode the player may select either the 2- or 4-player option. The LED pushbutton on top of the game above the coin door is identified with the corresponding 2/4 player status. During 2-player games, only the two right Trak Balls are enabled (as seen when facing each control panel). The 2/4 Player pushbutton is only enabled during the time between scrimmages—when play selections are made.

During the play select mode, the players may select a certain play by pressing the Play Select pushbuttons. Immediately after doing so, that team’s players are set to the line of scrimmage.

Note: Even after your opponent has men at the line of scrimmage, you may continue to select plays, providing you do not wait too long. Waiting too long will give you a 5-yard penalty (lose 5 yards) for delaying the game.

The game circuitry accepts coins at any time. Each coin adds time to the game timer (either 70 or 90 seconds—selected by the operator). However, if the operator sets the game for the 2-coin minimum, one of those coins buys the player into the game (game time is displayed); the controls are inactive until the second coin is inserted. In either 1- or 2-coin minimum situations, if coins are added during a *game*, the time is extended with no other effect. If coins are added in the *attract mode*, the scores are reset to zero, and the game enters the play select mode.

D. Play Mode

Seven players are on each side or team, indicated by the seven Xs for defense and seven Os for offense. Two or four players control the flashing Xs and Os with their Trak Balls; the balance is controlled by the game’s computer.

Refer to Figure 6 for details on the ten different plays and game instructions. The play select panel shows exactly how all the defensive and offensive players maneuver. Where the panel actually shows yellow players that you control, we have printed those players in light grey in the figure.

INSTRUCTIONS ▶

- INSERT COINS AND MORE COINS FOR MORE TIME
- SELECT 2 OR 4 PLAYERS PRESS BUTTON ABOVE COIN DOOR
- SELECT PLAY PRESS PLAY SELECT BUTTON UNTIL DESIRED PLAY IS LIST

▶

- 2 PLAYER GAME RIGHT TRAK BALLS ACTIVE YOU CONTROL FLASHING PLAYER
- 4 PLAYER GAME RIGHT TRAK BALLS QUARTERBACK DEFENSIVE TRAK LEFT TRAK BALLS RECEIVER DEFENSIVE BACK

- TO PASS PRESS PLAY SELECT BUTTONS MULTIPLE PASSES ALLOWED BEHIND LINE OF SCRIMMAGE ON SLANT PLAYS
- TO KICK PRESS PLAY SELECT BUTTON (COMPUTER CONTROLS DIRECTION)

PUNT FORWARD SPEED OF TRAK BALL AT START OF KICK DETERMINES DISTANCE OF KICK
FIELD GOAL FIELD GOAL ATTEMPT ALLOWED INSIDE 30 YARD LINE.

5 yard penalty for delay of game 2 points Safety
6 points Touchdown 2 points Conversion (run or pass)
3 points Field goal 1 point Field goal conversion

AFTER SCORING: Ball starts on 20 yard line

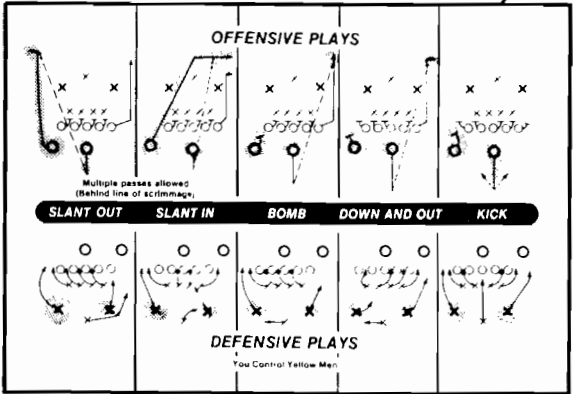
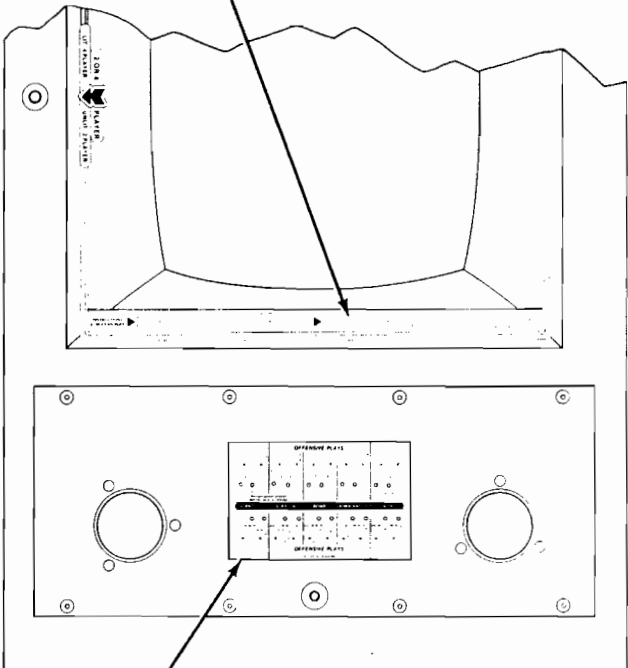


Figure 6 Player Control Panel

maintenance and adjustments



A. Cleaning

The exterior of the game cabinet and the glass and acrylic panels may be cleaned with any non-abrasive household cleaner. If desired, special coin machine cleaners that leave no residue can be obtained from your distributor. Do *not* dry-wipe the small acrylic play select panel, because any dust can scratch the surface and result in fogging the plastic. (The large monitor shield is made of tempered glass and should be scratch resistant.)



B. Fuse Replacement

This game contains six fuses — all on the power supply assembly (not including the TV monitor fuses). Replace fuses only with the same type as listed below. See the TV monitor manual for the monitor fuse data.

F1, F2, F3 7-amp. 250V 3AG slow-blow glass cartridge-type fuse

F4, F5, F6 3-amp. 250V 3AG slow-blow glass cartridge-type fuse



The metal power supply chassis is marked with all six fuse numbers and amperages. Figure 22 shows the power supply in detail, including top and bottom views.

C. Opening the Game Top

Prior to repairing or replacing any component on the game top or prior to removing the TV monitor, unplug the game. Then open the coin door.

Reach through the opening and unlock both luggage-style latches above the coin door (see Figure 7). Lift up the game top and tilt it away from you. The two gas springs will hold the top up. *Do not* jam the game top up against its top-most position — this is hard on the gas spring mounting hardware.

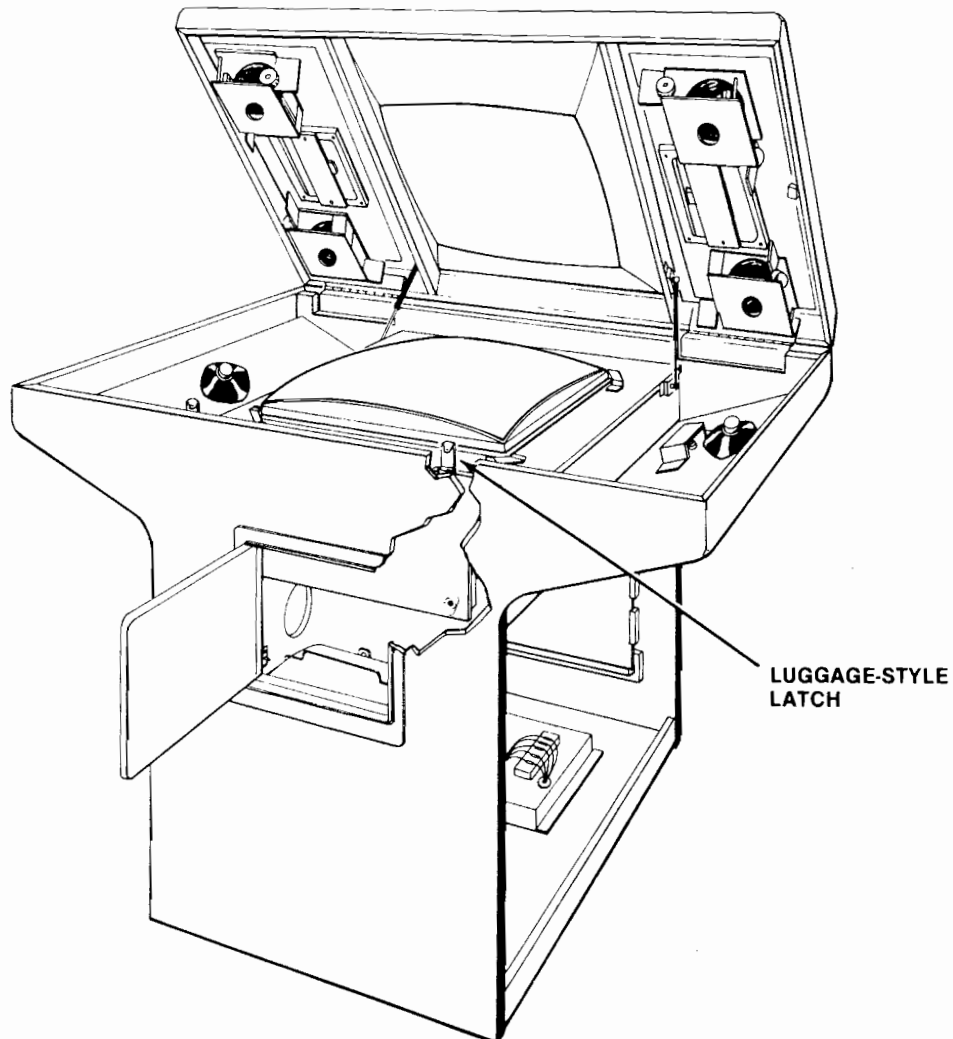
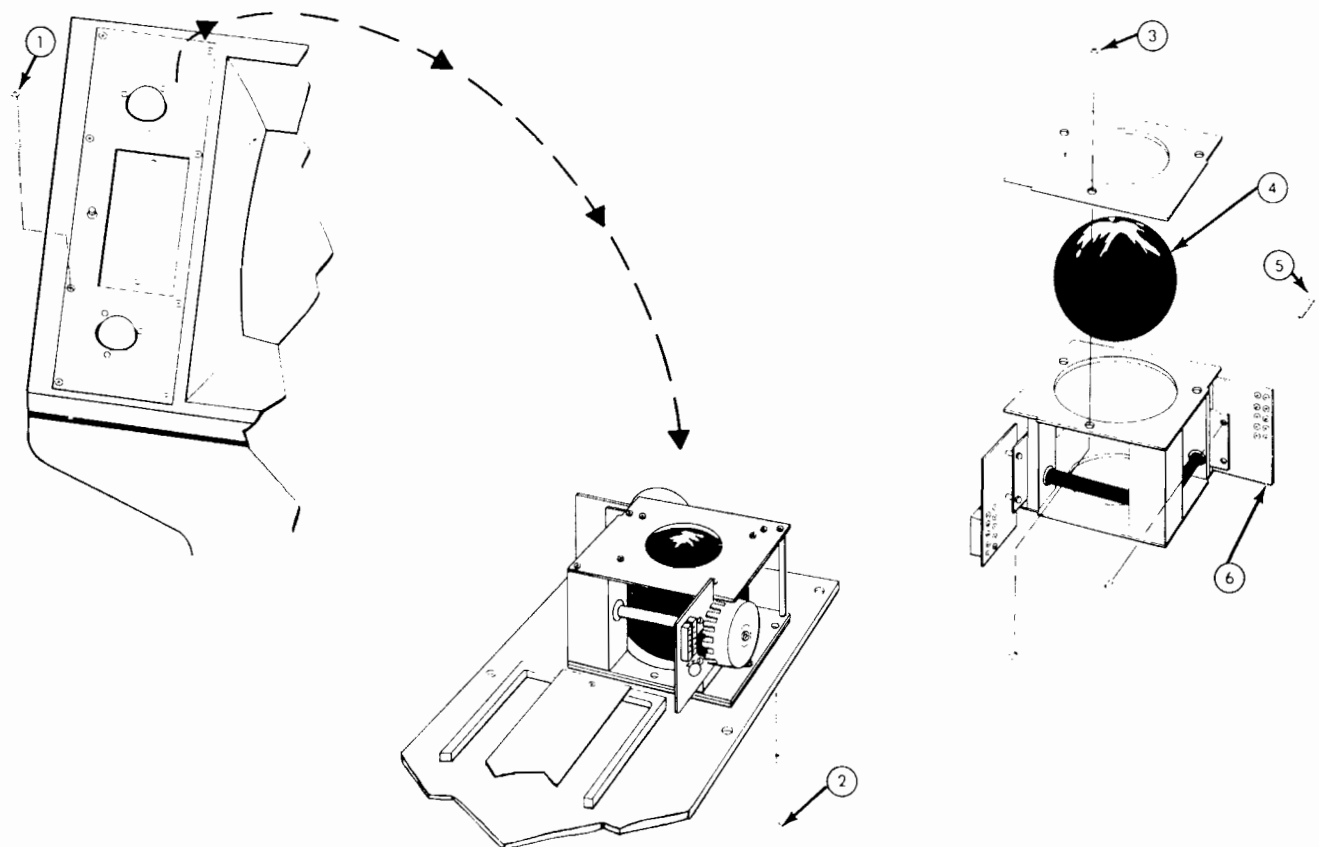


Figure 7 Opening the Game Top

1. Trak Ball™ Maintenance and Repair

To maintain this control, you will only have to lubricate the bearings approximately every \$1,000 in income earned or every 2,000 credits. The number of credits can be read off the coin counter, located on the coin door. Use *only 2 drops* of 3-in-One® oil in each of the ball bearings. (Each Trak Ball control has five bearings.)

For further instructions on how to replace the Trak Ball or either steering PCB, see Figure 8.



Trak Ball™ Control Removal

- Open game top as illustrated in Figure 7.
- Remove eight Allen-head screws from the control panel. See ① in this figure.
- Lift out entire control panel as shown by direction of arrow.
- Remove three carriage bolts from Trak Ball assembly. See ⑦. Remove the Trak Ball assembly.

Ball Replacement

- Remove three countersunk machine screws from the Trak Ball assembly's acrylic top plate. (When the assembly is installed, these three screws are right underneath the control panel.) See ③.
- Remove and replace the ball. See ④.

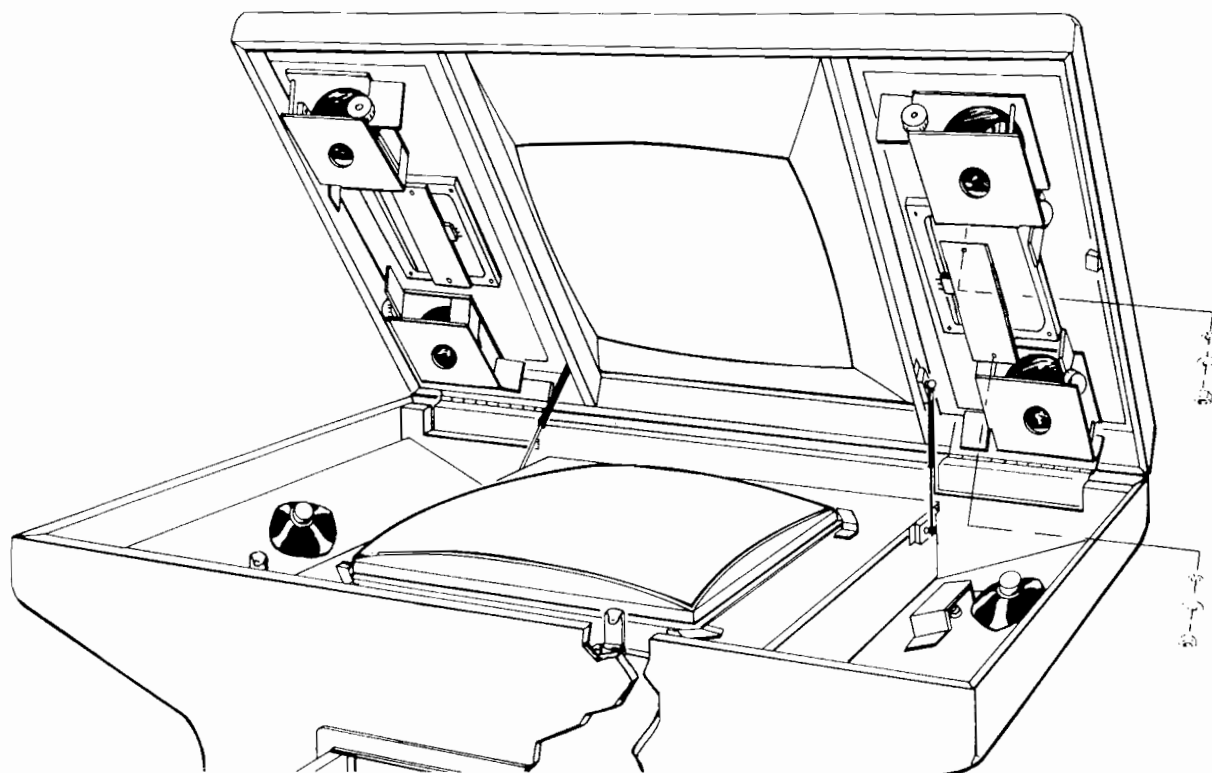
Steering PCB

- Unplug connector on steering PCB. Remove two cross-recessed machine screws, associated washers and hex nuts from the steering PCB. See ⑤.
- Remove the steering PCB. See ⑥.
- When replacing this PCB assembly, be certain that the black toothed wheel turns freely between the two halves of the red photo sensor device.

Figure 8 Trak Ball™ Control Repair

2. Play Select PCB Repairs

Two problems could occur with this PCB. A light-emitting diode could burn out, or one of the six incandescent lamps could burn out. To replace any LED or lamp, open the game top and remove this small PCB as described in Figure 9.



1. Open the game top as illustrated in Figure 7.
2. Unplug the white connector on the Play Select PCB.
3. Remove the two flat washers, split lock washers, and hex nuts that hold down the Play Select PCB. Remove this board.
4. Replace the small burned-out lamp or light-emitting diode, as needed.

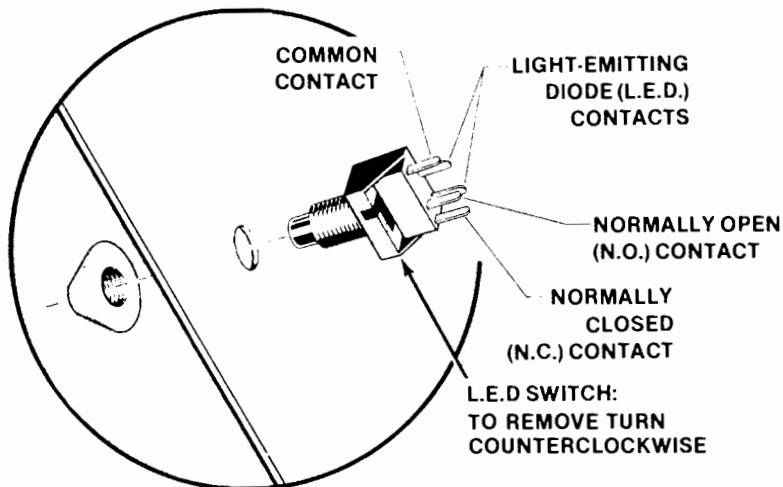
Figure 9 Play Select Lamp and LED Replacement

3. Pushbutton Switch Replacement

The three light-emitting diode (LED) switches on top of the game have a very low failure rate. In case a switch should ever be suspect, first test it per the description that follows. To replace the switch, refer to Figure 10.

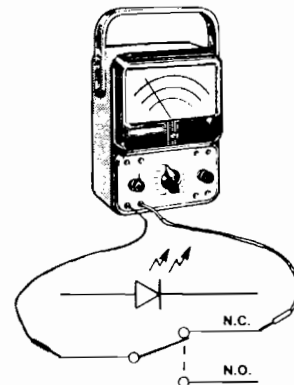
- Remove the wires from the suspected switch.
- Set multimeter to ohms scale. Set ohms scale to R \times 1, then zero the meter.

- Connect multimeter leads to appropriate LED switch contacts. (See Figure 10 for designation of switch contacts and meter lead placement.)
- Check contacts (push and release the switch button) for closed and open continuity.
- If the contacts do not operate sharply or always remain closed or open, then replace the LED switch as described in Figure 10.



- Remove all wires from the faulty switch.
- Turn the switch counterclockwise while holding the black cone-shaped molding on the outside of the control panel.
- Install a new switch using the reverse procedure.
- Reconnect the harness wires.

LED SWITCH TESTING

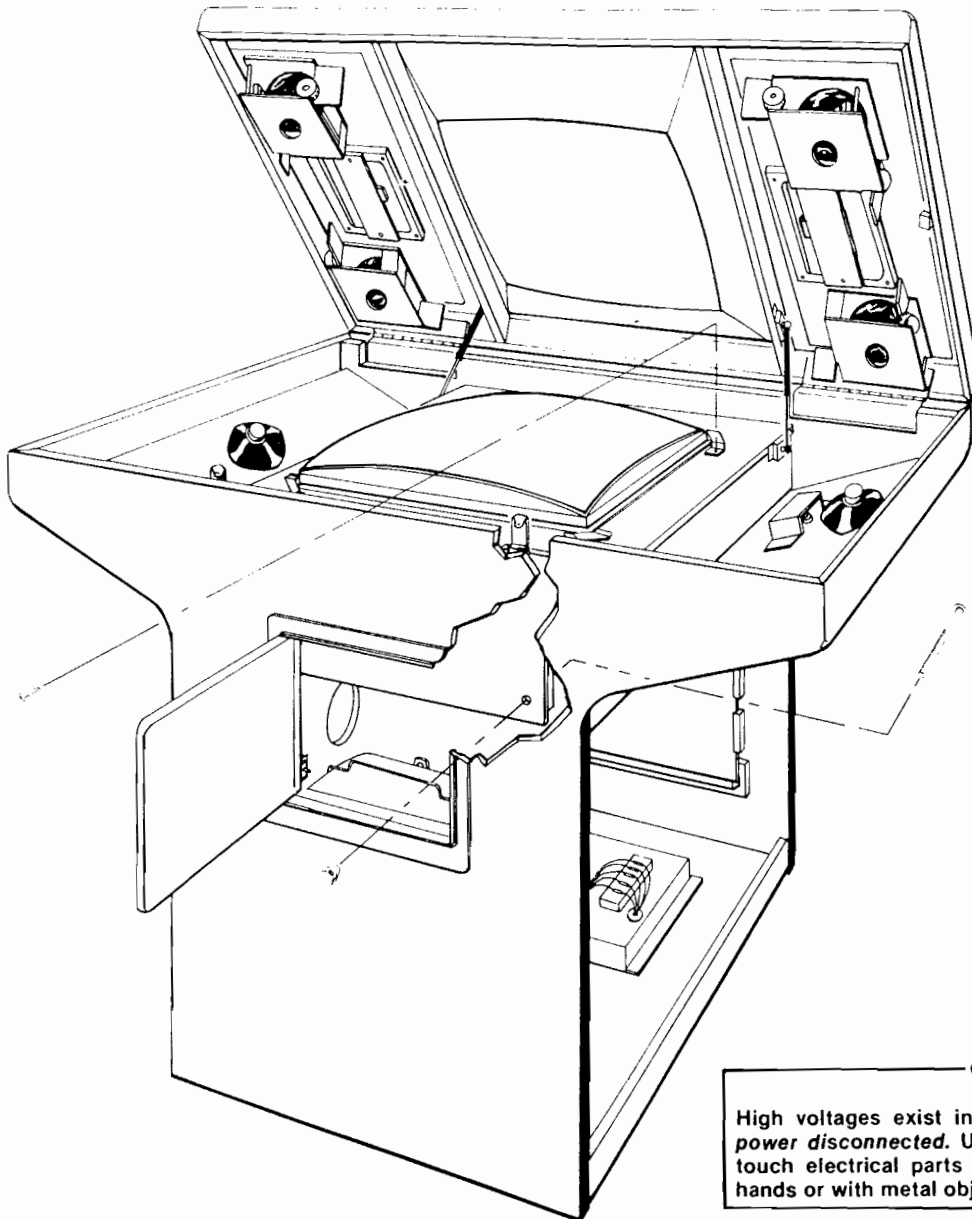


SINGLE-POLE DOUBLE-THROW (SPDT) SWITCH WITH INTERNAL LED

Figure 10 Pushbutton Switch Replacement

4. TV Monitor Removal

If you should need to service or replace the 23-inch TV monitor, you must first remove it from the game cabinet. To avoid possible back strains you should have a helper assist you in this procedure. Follow the instructions in Figure 11.



CAUTION

High voltages exist in any television unit, *even with power disconnected*. Use extreme caution and do not touch electrical parts or the TV yoke area with your hands or with metal objects in your hands!

1. Open the game top as described in Figure 7. Be sure the game is unplugged.
2. Unplug the TV monitor harness connector.
3. Remove the eight TV monitor wood screws and tie-down brackets. Then remove the two carriage bolts and wing nuts on the TV's metal chassis.
4. With the help of another person, if possible, lift the monitor assembly up and out of the game.

Figure 11 TV Monitor Removal

D. Printed Circuit Board Replacement

You may wish to remove the game printed circuit board (PCB) or the Regulator/Audio PCB for service or inspection. To do this, refer to Figure 12 and proceed as follows:

1. Open the side access panel. Be sure the game's power is off.
2. Locate the securing screws and fiber washers that hold down the PCB in its slots, and remove them (two screws and washers for each PCB).
3. If you are removing the game board, first remove the four machine screws that hold the small black connector mounts along the game PCB's edge. Then unplug the edge connectors (on game board) or the three small harness connectors (on Regulator/Audio board).
4. Carefully slide the PCB straight out of its slots. Be careful not to twist the board, as this may loosen connections or components. Replace or repair as required.
5. Reinstall the PCB, making sure that the connectors are properly plugged in. Note they are keyed to fit on only one way, so if they don't slip on easily, don't force them! *A reversed connector can damage the machine.*
7. Replace the securing screws and fiber washers in the PCB. Reinstall the black connector mounts on the P.C. board. Close and lock the side access panel.
8. Check that the operation of the game is correct and *perform the self-test*. This is especially important with any game when you replace a PCB. Normally the *only* adjustments on the game PCB are option switch changes (made on the 4-toggle DIP switch).

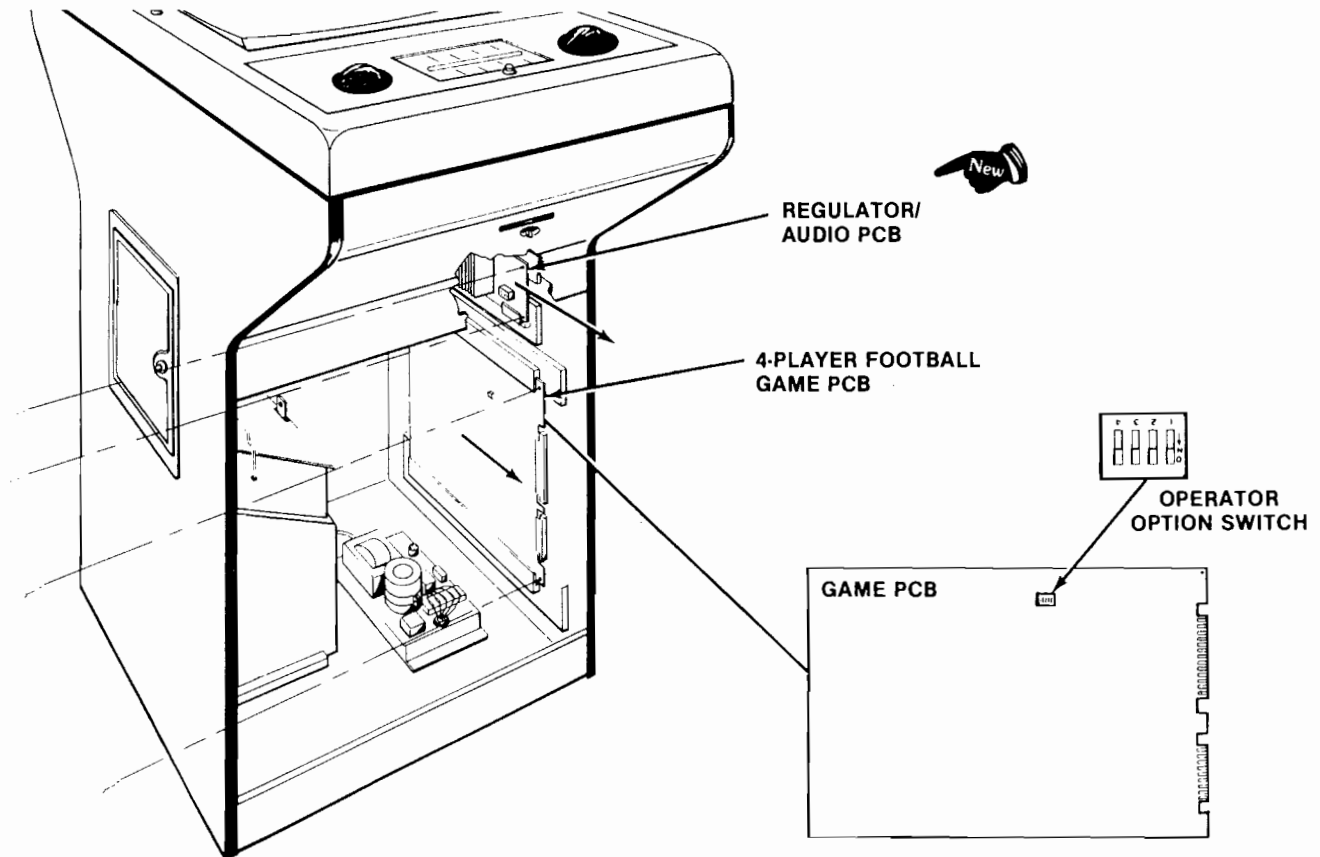


Figure 12 Game & Regulator/Audio PCB Replacement

details of electronic operation



With this manual you received two large sheets that contain the wiring and schematic diagrams for the 4-Player Football™ game. Sheet 1, Side A, includes an index that shows the arrangement of these diagrams. These diagrams include information that explains the functions of the circuits and defines inputs and outputs. We hope these larger schematics solve the problems some technicians were having with the smaller diagrams in our previous manuals. By putting them on large sheets, we were able to make them much easier to read, as well as maintaining smoother continuity from one circuit function to another.

4

4-Player Football™

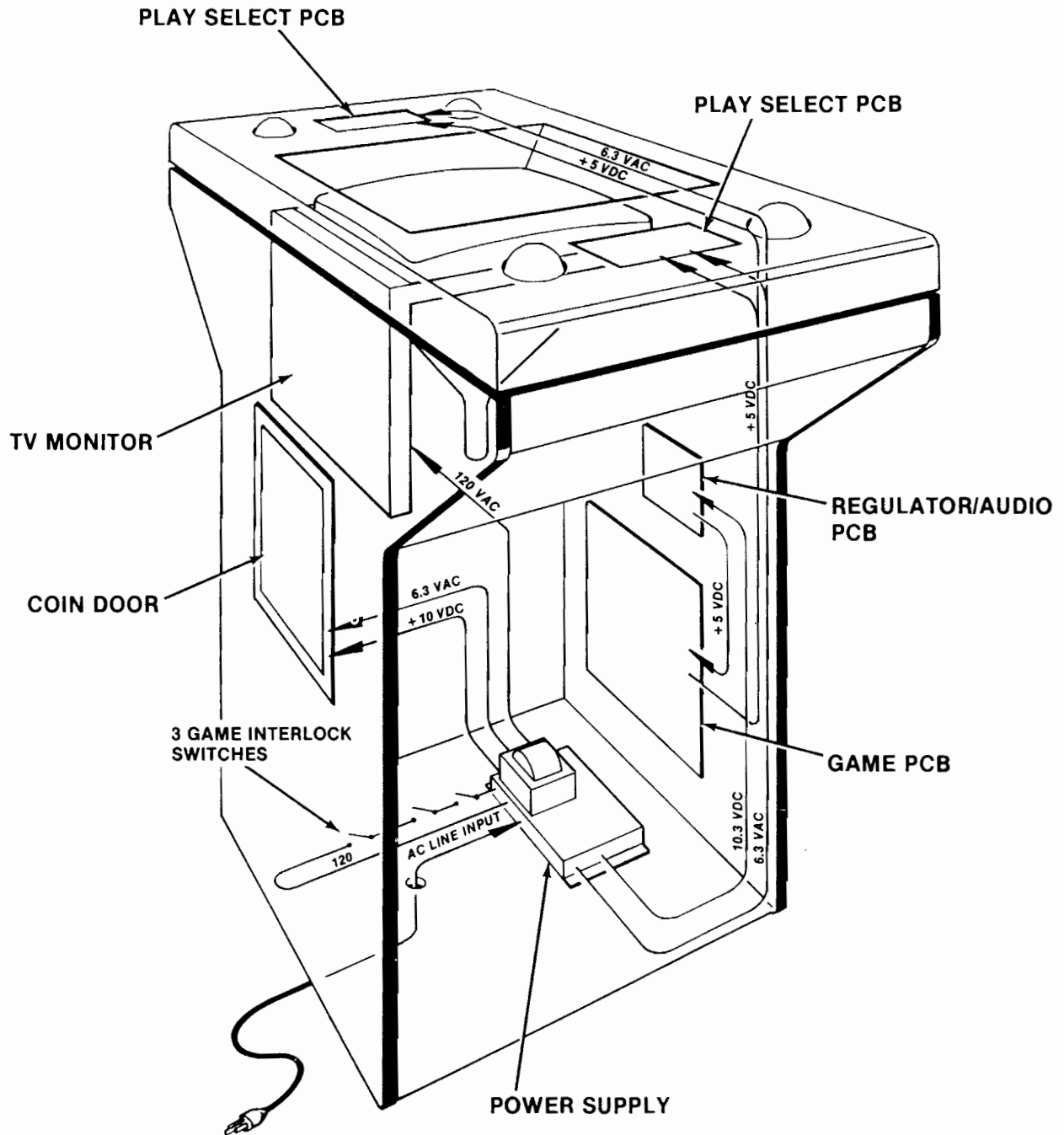


Figure 13 Power Distribution

A. Overview of Game

Electrically and electronically 4-Player Football operates the same as the 2-player Football, except for the following differences:

- 1) Two additional Trak Ball controls.
- 2) Additional connector on the game PCB.
- 3) Power regulator removed from the game PCB.
- 4) Audio amplifier removed from the game PCB.
- 5) Addition of various test points on the game PCB.
- 6) Addition of the 2 PLAYER/4 PLAYER pushbutton.
- 7) Addition of the Regulator/Audio PCB.
- 8) Newly designed Power Supply.

As in the 2-player game, 4-Player Football contains a raster-type monitor. The raster monitor generates the horizontal and vertical raster scanning signals internally. The game PCB contains a standard sync circuit that synchronizes the game PCB with the scanning of the monitor raster. The composite video output of the game PCB contains the following signals: 1) vertical sync; 2) horizontal sync; and 3) Z axis output for intensity modulation of the monitor raster beam.

B. Game Wiring and Power Distribution

The wiring diagram for the 4-Player Football game is located on Sheet 1, Side A, of the large sheets that came with this manual. Included on this sheet are the schematic diagrams for the power supply, Regulator/Audio PCB, coin door, and control panel.

Figure 13 of this manual shows the distribution of the power of this game.

C. Description of Electronic Assemblies

The following sections describe the electronic assemblies within the 4-Player Football game. For information on the monitor, refer to the monitor manual.

Figure 14 of this manual shows the distribution of signals of this game.

1. Power Supply

The power supply is located on the floor of the game cabinet. This supply was specifically designed to provide the

voltages required for both raster and X-Y games. Some of the features of this new supply include: a new transformer with greater power output and additional secondary windings; one unregulated DC voltage output, and various AC voltage outputs; a line-filtered AC line input; appropriate voltage selection plugs for different ranges of AC line voltages; and a bank of fuses located on an easily accessible fuse block, with fuse values plainly labeled beside each fuse.

2. Regulator/Audio PCB

The Regulator/Audio PCB is the smaller PCB mounted on the inside wall of the game. It was designed for two reasons: 1) to remove high-heat-producing components from the game PCB, and 2) to provide better regulation of the +5 VDC logic power for the game PCB. A description of both the regulator and audio sections of this PCB is included on Sheet 1, Side A, of the large sheets included with this manual.

3. Control Panel

The two control panels at each end of the game are identical, and each contains two Trak Balls and one 4-Player Football Play Select PCB. The wiring diagram for the control panels is on Sheet 1, Side A, of the large sheets. Schematic diagrams for the LED circuits of the Play Select PCB and Trak Ball Steering PCB are located on Sheet 1, Side B, of the large sheets.

As shown on the wiring diagram, the six #47 lamps contained on each Play Select PCB are connected in parallel. However, the lamp circuits of the two PCBs are wired in series and connected to 6.3 VAC.

4. Game PCB

The game PCB is the larger PCB mounted on the inside wall of the game. This PCB contains a standard sync circuit, microcomputer (see Sheet 1, Side B), video generator (see Sheet 2, Side A), player control inputs and option switch circuitry, and control panel and audio outputs (see Sheet 2, Side B).

a. Standard Sync; Watchdog and Power Reset

The standard Sync Circuit and the Watchdog and Power Reset circuits are the only circuits on the game PCB that are not controlled by the microprocessor. The sync circuit provides the $\Phi 0$ clock input (4H @ 750 KHz) to the microprocessor and synchronizes the video generator with the scanning of the monitor's raster. The Watchdog and Power Reset circuit causes the microprocessor to start its instruction sequence from the beginning of the program after power-up or after a program error.

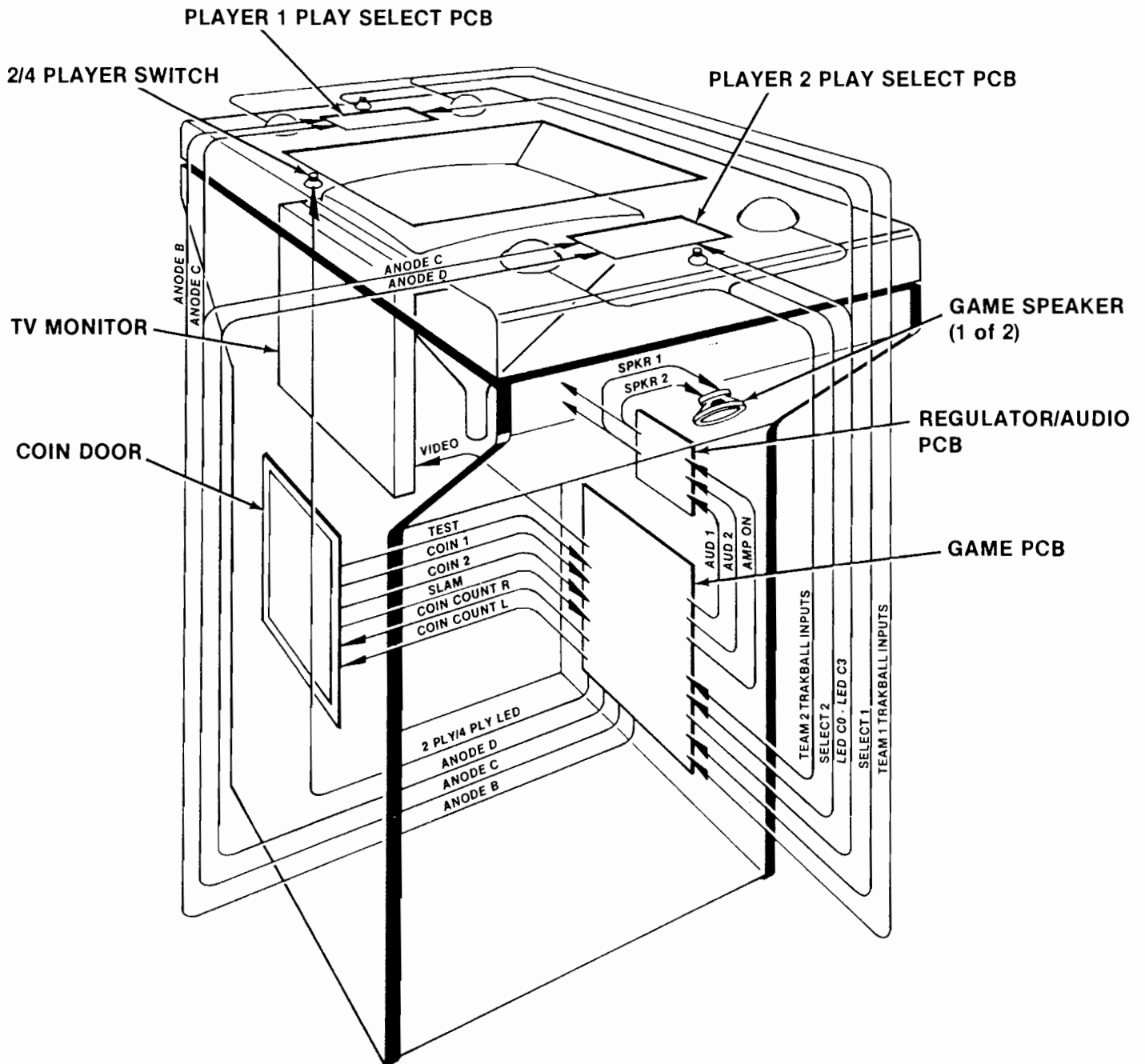


Figure 14 Signal Distribution

b. The Microcomputer

The microcomputer consists of the microprocessor, address decoder, and memory. The microprocessor (MPU) is the "master controller" of all action that takes place in the game circuitry. Upon initialization, the MPU (via ABUS0 thru ABUS14) addresses data locations in the program ROMs or PROMs. The data from the addressed locations then travels to the MPU via the 8-bit data bus (D0 thru D7). The MPU decodes this data to determine what action it should perform next (i.e., "read coin switch 1", "PASS", etc.). The MPU uses RAM memory to temporarily store information which it will later recall. The MPU is capable of writing (or putting data into) the RAM and then later reading (pulling data out of the RAM) via the address bus and bidirectional data bus.

The address decoder performs the critical function of turning on or enabling the appropriate game circuitry (i.e., RAM, ROM, latches, etc.) at the correct times, so that information can be transferred back and forth between the game circuitry and the MPU. An address map for the address decoder is included on the schematic diagram on Sheet 1, Side B.

c. Video Generator

The video generator produces all the video seen on the monitor. It produces three signals: 1) the playfield; 2) the moving objects (Xs, Os, football, and scrimmage line marker); and 3) all alphanumerics at each end of the playfield. When you play 4-Player Football, your view of the monitor is from the side. However, *the following information is in reference to the monitor sitting in its normal orientation with the longer sides of the screen at the top and bottom.* The schematic diagram for this circuit is on Sheet 2, Side A, of the large sheets included with this manual.

The monitor display for this game has a raster of 240 horizontal lines. These lines are separated into three sections. The message section on each side of the screen that displays game-related messages is generated by the alphanumerics generator. The video for the playfield and moving objects in the center section are generated by the graphics generator. Both the alphanumerics and graphics generators produce picture elements called "stamps", that are eight horizontal bits wide by eight vertical lines high. The playfield is 24 stamps wide by 30 stamps high. Each message section is 3 stamps wide by 30 stamps high.

The alphanumerics generator receives data from the microcomputer that addresses the alphanumerics PROM. However, the PROM can only output data to the video summer during a window period that occurs at the beginning and end of the horizontal scan period. The data from the PROM may be outputted forwards or backwards from the circuit, so that the messages may be read from either

end of the game.

The playfield and motion object pictures are developed through a process called "direct memory access" (abbreviated DMA) or "cycle sharing". This is done by the microcomputer directly accessing the video generator's RAM. The microcomputer addresses the RAM and writes data into it that designates which stamp is to be displayed. Then the microcomputer's address lines are removed, and sync addresses the RAM. Since sync represents the location of the monitor beam, the RAM outputs data that defines the picture stamps at the desired locations. The graphics PROM receives the data output from the RAM as an address input, and outputs eight picture elements for each line of each stamp.

d. Input Circuits

The schematic diagram for the input circuits is located on Sheet 2, Side B, of the large sheets.

The input circuits receive data from all the game switches, the option switches and Trak Balls. The game switch and option switch inputs are all connected to pullups. Each switch input pulls its related signal input to ground when the switch is closed. Each Trak Ball has two steering PCBs that produce pulses to define in what direction and how fast the Trak Ball is turning. These pulses are processed by the input circuitry to develop binary signals that represent the direction and speed of the Trak Ball. This information is read by the microcomputer on its data line input.

e. Output Circuits

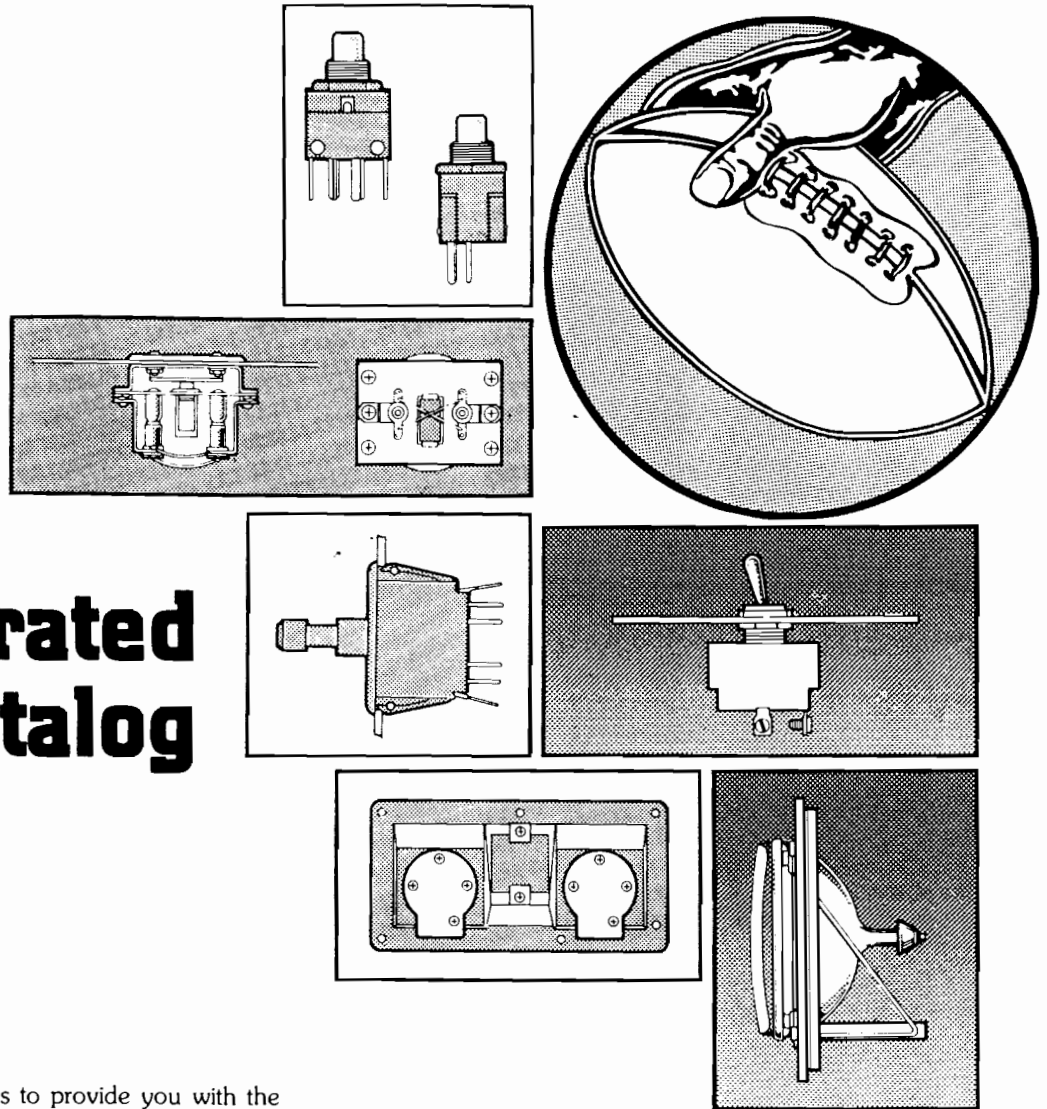
The schematic diagram for the output circuits is on Sheet 2, Side B, of the large sheets.

The output circuits generate the audio, trip the coin counters on the coin doors, and light the LEDs of the game. The audio is produced when the microcomputer addresses the audio circuit (i.e. the address decoder outputs OUT1 or OUT2) and writes data to the audio data latches. The data creates the audio from either a random noise generator or a 555 timer. The audio is then sent to the audio section of the Regulator/Audio PCB for controllable volume amplification. The AMP ON signal, when low, enables the audio amplifier.

The coin counter output circuit accommodates up to three counters. The counters are tripped when the coin counter drivers receive high data signals from the microcomputer.

The *anodes* of all the game LEDs are connected to drivers that are controlled by vertical sync. The *cathodes* are connected to drivers that are controlled by data signals from the microcomputer. The resulting matrix of LEDs is lighted or turned off at the command of the microcomputer.

illustrated parts catalog



The purpose of this chapter is to provide you with the necessary information for ordering replacement parts for the 4-Player Football™ game. Please note that, for simplicity, all common hardware has been deleted from these parts lists (except for Figure 18, Trak Ball Assembly). This includes screws, nuts, washers, bolts, etc.

When ordering parts from your distributor, give the part number, part name, applicable figure number of this catalog, and serial number of your game. This will help to avoid confusion and mistakes in your order. We hope the results will be less downtime and more profit from your game.

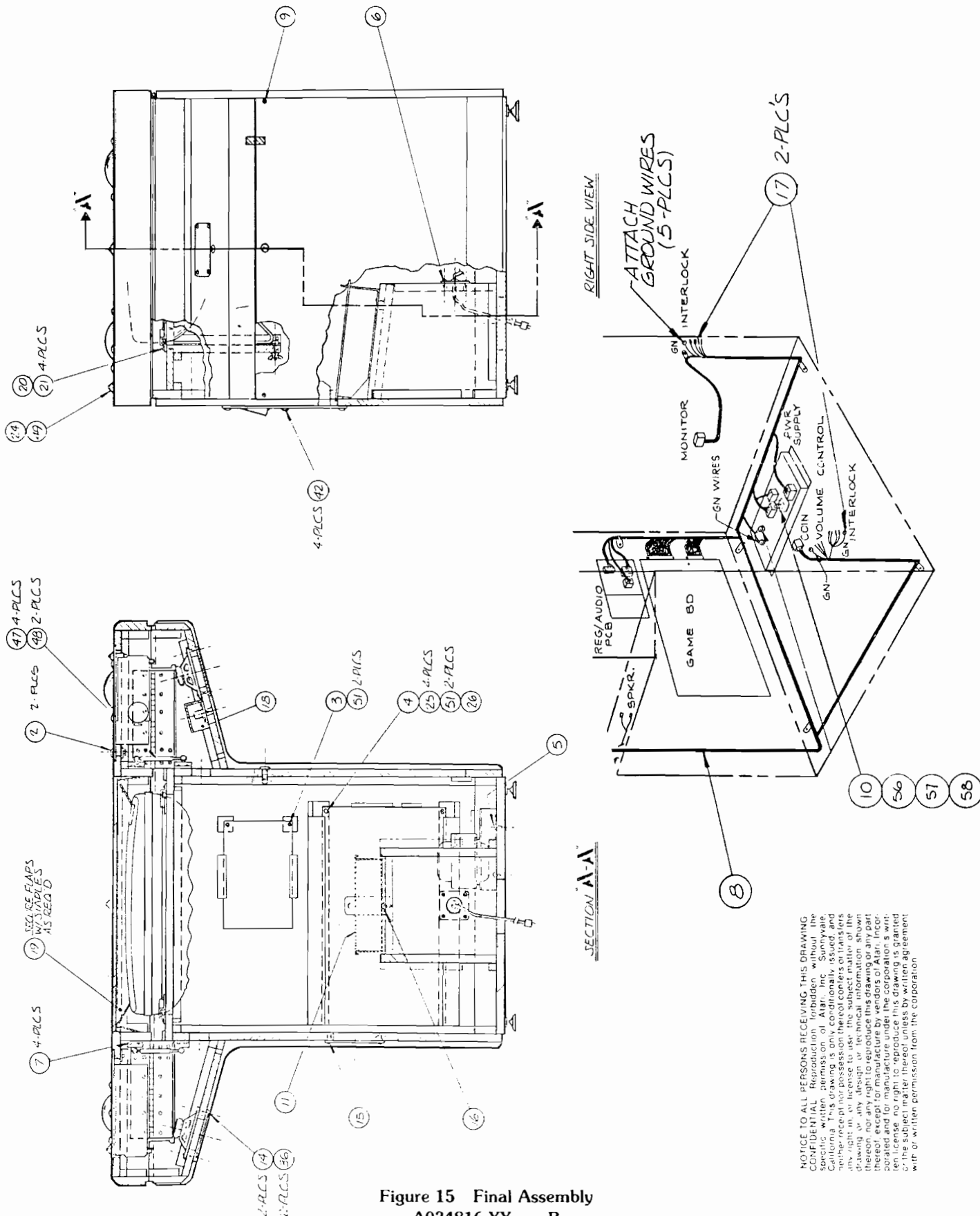


Figure 15 Final Assembly
A034816-XX B

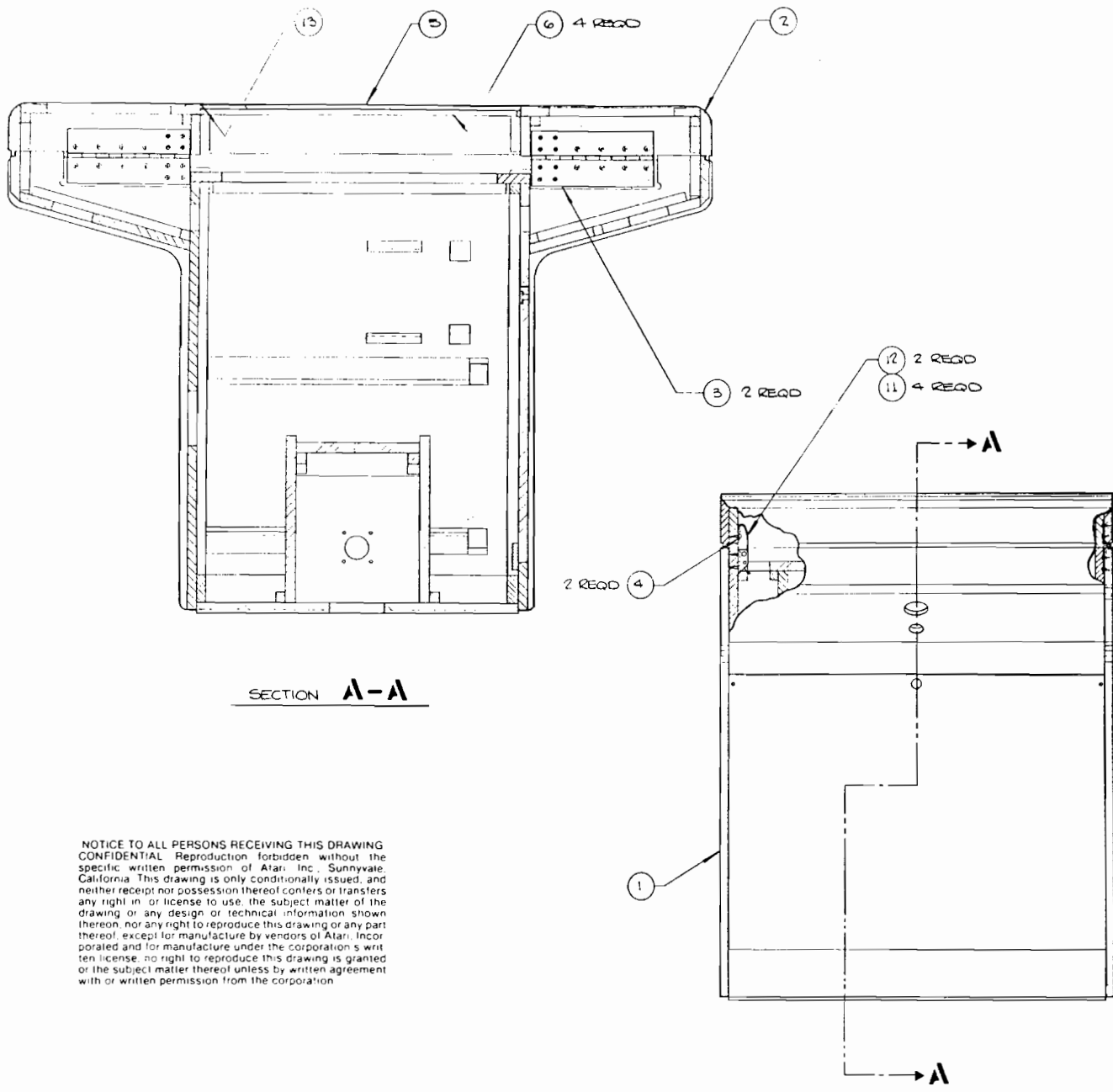
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**Figure 15 Final Assembly
Parts List**

Item	Part No.	Qty.	Description
2	A034821	2	Control Panel Assembly — see Figure 17
3	A034485-01	1	Regulator/Audio PCB Assembly — see Figure 21
4	A034754-01*	1	4-Player Football PCB Assembly (PROM version) — see Figure 24
5	A034560-01	1	Power Supply Assembly for Raster-Scan Games — see Figure 22
6	A034841-03	1	Power Cord Assembly (domestic)
7	A034974-01	4	Gas Spring Mounting Assembly
8	A034980-01	1	Main Harness and Component Assembly
9	A034820-01	1	Access Door Assembly
10	A021084-01	1	Voltage Selection Plug (100V)
11	A030268-01	1	Coin Box Assembly
12	A035319-01	1	Coin Door Adapter Harness Assembly
14	000869-01	2	Speaker Grille
15	034537-01	1	Mesh Ventilation Grille
16	006870-01	1	Coin Box Bracket
17	007882-02	2	Interlock Switch Cover
18	009992-01	1	On/Off Switch Cover
19	034973-01	1	Cardboard Bezel with Graphics
20	034971-01	1	23" Monitor (modified)
21	005594-01	4	Monitor Tie-Down Bracket
24	033127-01	1	Black Molded Switch Bushing
25	030868-01	4	Connector Mount
26	034536-01	1	Foam Vibration Damper
27	TM-139	1	4-Player Football Technical Manual with Illustrated Parts Catalog
28	DP-139-01	1	Schematic Drawing Package, Sheet 1
29	DP-139-02	1	Schematic Drawing Package, Sheet 2
36	48-004	2	5" 8-ohm Speaker
42	75-990505S	4	#1/4-20 Shallow-Pattern Prevailing-Torque Steel Lock Nut
47	73-3029	4	Special Retaining Clip for Gas Spring
48	78-3116	2	Gas Spring
49	62-039	1	Pushbutton LED Switch
51	75-07017	4	Fiber Washer with 5/32" Inside Diameter 3/8" O.D. × 1/8" Thick
53	A009083-XX	1	Coin Door Assembly — see Figure 23
55	035118-01	3	Warning Label for Interlock and Power On/Off Switch Covers
56	A021084-02	1	Voltage Selection Plug (120 V)
57	A021084-04	1	Voltage Selection Plug (220 V)
58	A021084-05	1	Voltage Selection Plug (240 V)

* A034754-02 is an acceptable substitute (ROM version) — see Figure 24





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Figure 16 Tabletop Hinges, Latches and Shield A034817-01 A
 Parts List

Item	Part No.	Qty.	Description
3	034383-01	2	Hinge
4	034388-01	2	Latch Keeper Bracket
5	034387-01	1	Tempered Glass Monitor Shield
6	034970-01	4	Shield-Mounting Cleat
12	78-3408	2	Spring Draw Latch (Hook End)
13	78-13003	A/R	R.T.V. Glue, General Electric Part No. 108

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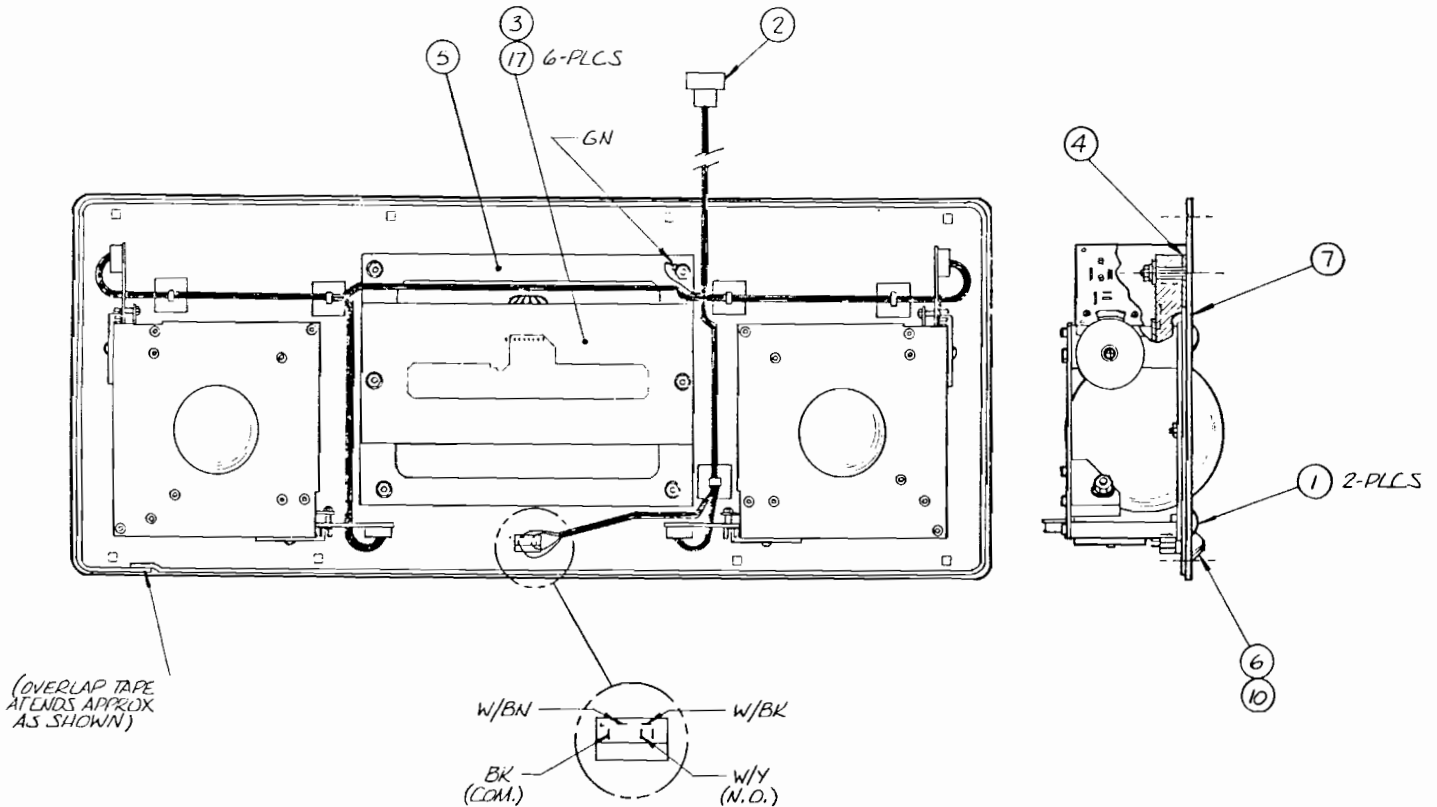


Figure 17 Control Panel Assembly A034821-01 A
 Parts List

Item	Part No.	Qty.	Description
1	A033360-01	2	Trak Ball Assembly — see Figure 18
2	A034981-01	1	Control Harness Assembly
3	A034872-01	1	Play Select PCB Assembly — see Figure 20
4	034385-01	1	Acrylic Play Select Panel
5	033097-01	1	Wood Support for Play Select PCB
6	033127-01	1	Black Molded Switch Bushing
7	034384-01	1	Metal Control Panel
10	62-039	1	Pushbutton LED Switch
17	70-11-47	6	NEMA #47 Incandescent Miniature Bayonet-Base Lamp

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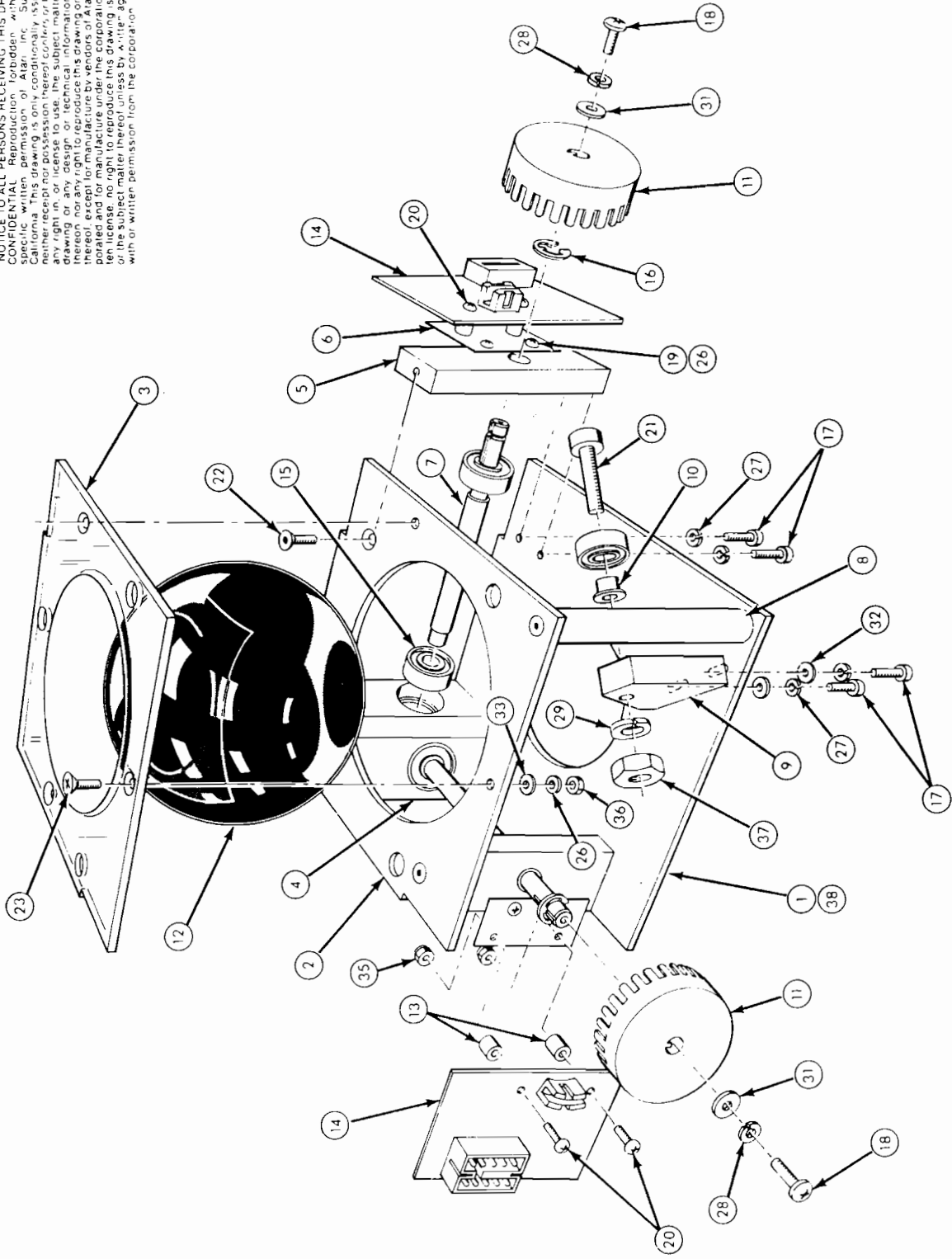


Figure 18 Trak Ball™ Assembly
A033360-01 G

Figure 18 Trak Ball™ Assembly
Parts List

Item	Part No.	Qty.	Description
1	033355-01	1	Base Plate
2	033356-01	1	Top Plate
3	033357-01	1	Cover Plate (Acrylic)
4	033358-01	1	Corner Post
5	033359-01	2	End Post
6	033361-01	2	Steering PCB Bracket
7	033362-01	2	Roller Shaft
8	033363-01	1	Cylindrical Post
9	033364-01	1	Adjustable Post
10	033365-01	1	Spacer
11	000616-01	2	Light Hub
12	033366-01	1	Trak Ball™
13	74-A00011	4	Phenolic Spacer, 1/8" inside diameter × 1/4" outside diameter × 1/4" long
14	A009060-02	2	Steering Printed Circuit Board Assembly — see Figure 19
15	033367-01	5	Bearing
16	73-3006	2	Carbon Spring Steel External Retaining Ring, for 3/8" shaft diameter
17	72-8808	9	#8-32 × 1/2" Hex Socket-Head Cap Alloy Steel Machine Screw
18	72-1006S	2	#10-32 × 3/8" Cross-Recessed Pan-head Cadmium-Plated Steel Machine Screw
19	72-1606S	4	#6-32 × 3/8" Cross-Recessed Pan-Head Cadmium-Plated Steel Machine Screw
20	72-1408S	4	#4-40 × 1/2" Cross-Recessed Pan-Head Cadmium-Plated Steel Machine Screw
21	72-8920	1	#3/8-16 × 1 1/4" Hex Socket-Head Cap Alloy Steel Machine Screw
22	85-1808B	4	#8-32 × 1/2" Socket Cap Flat Countersunk-Head Black-Oxide Steel Screw
23	75-3608S	3	#6-32 × 1/2" Cross-Recessed Flat-Head Cadmium-Plated Steel Machine Screw
26	75-046S	7	#6 Zinc-Plated Steel Split Lock Washer
27	75-048S	9	#8 Zinc-Plated Steel Split Lock Washer
28	75-040S	2	#10 Zinc-Plated Steel Split Lock Washer
29	75-041S	1	#3/8 Zinc-Plated Steel Split Lock Washer
31	75-010S	2	#10 Flat Plain SAE-Standard Zinc-Plated Steel Washer
32	75-018S	2	#8 Flat SAE-Standard Zinc-Plated Steel Washer
33	75-016S	3	#6 Flat Plain SAE-Standard Zinc-Plated Steel Washer
35	75-990504C	4	#4-40 Shallow-Pattern Prevailing-Torque Corrosion-Resistant Steel Lock Nut
36	75-916S	3	#6-32 Standard Cadmium-Plated Steel Machine Hex Nut
37	75-919S	1	#3/8-16 Standard Cadmium-Plated Steel Machine Hex Nut
38	034168-01	1	Label with Lubrication Instructions



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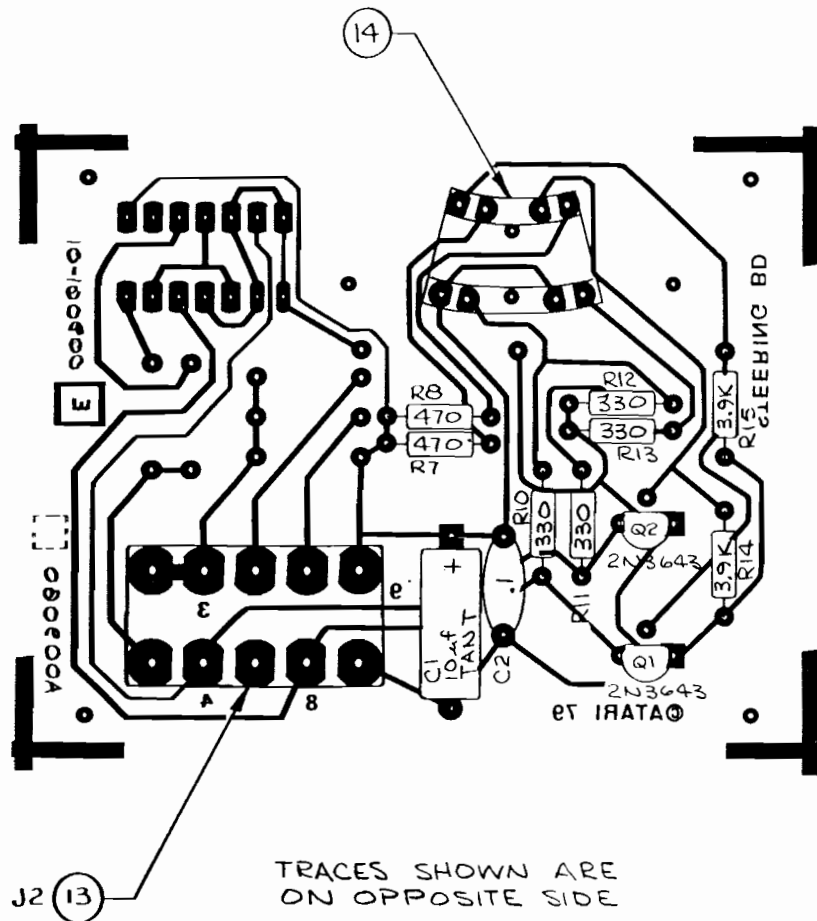


Figure 19 Steering Board Assembly
 A009060-02 C

Parts List

Item	Part No.	Qty.	Description	Ref. Designation
5	10-5392	2	3.9K ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R14, 15
6	10-5331	4	330 ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R10-13
7	10-5471	2	470 ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R7, 8
8	27-250104	1	0.1 μf , $\pm 20\%$, 25V Ceramic-Disk Radial-Lead Capacitor	C2
9	29-046	1	10 μf , $\pm 10\%$, 20V Tantalum Axial-Lead Capacitor	C1
10	34-2N3643	2	Type 2N3643 NPN Switching Transistor	Q1, 2
13	79-58005	1	10-Contact Connector	
14	030369-01	1	Radial Optical Coupler	



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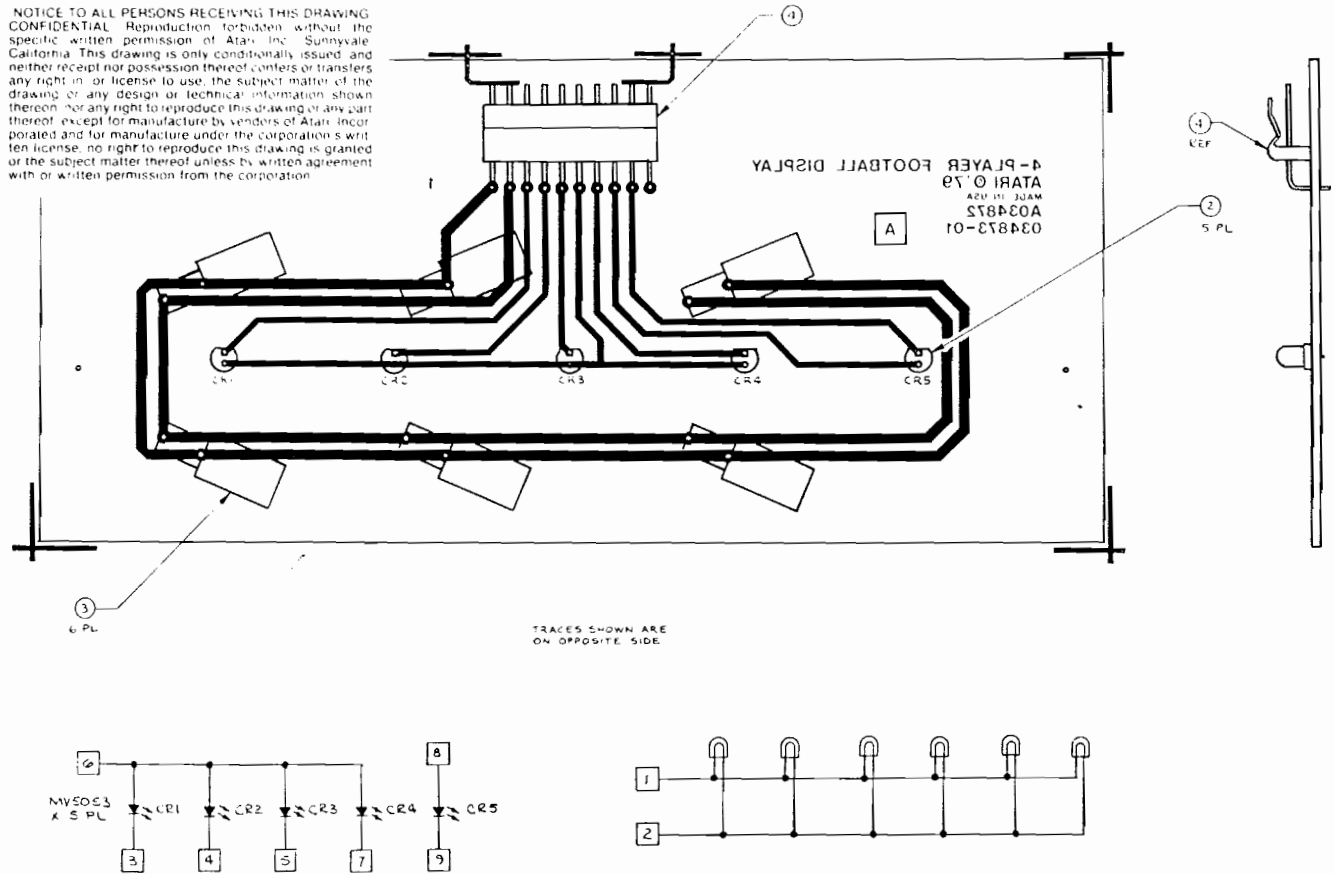
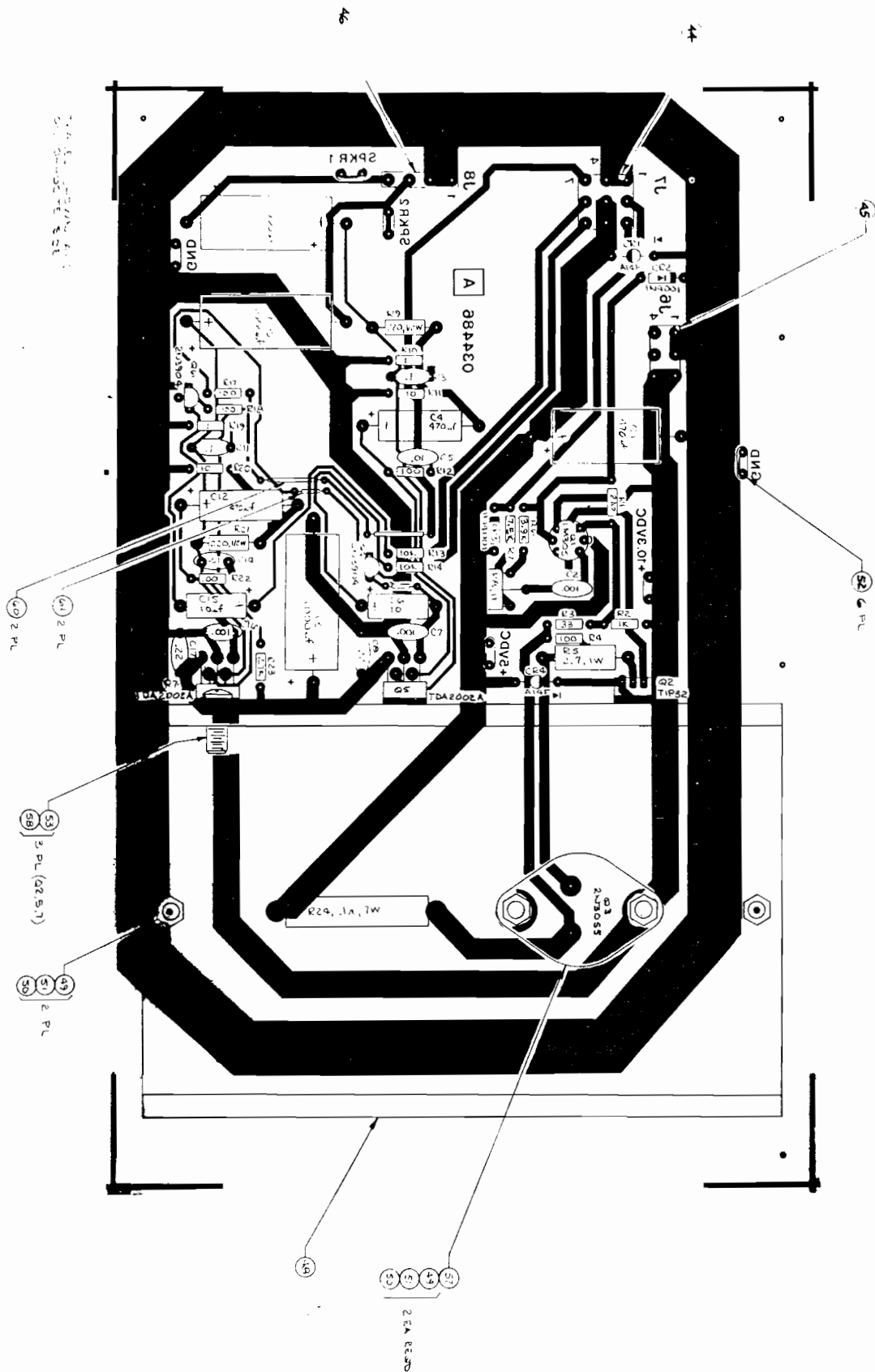


Figure 20 Play Select PCB Assembly
 A034872-01 A

Parts List

Item	Part No.	Qty.	Description
2	38-MV5053	5	Light-Emitting Diode with Red Diffused Cap: 1.6 mcd, 20 mA, 1.7 Volts (Type MV5053) CRI-5
3	79-4312	6	NEMA #T-3¼ Right-Angle PCB-Mounting Miniature Bayonet-Base Lamp Socket
4	79-58313	1	Right-Angle Header with 10 Contacts





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Figure 21 Regulator/Audio PCB Assembly
 A034485-01 D

**Figure 21 Regulator/Audio PCB Assembly
Parts List**

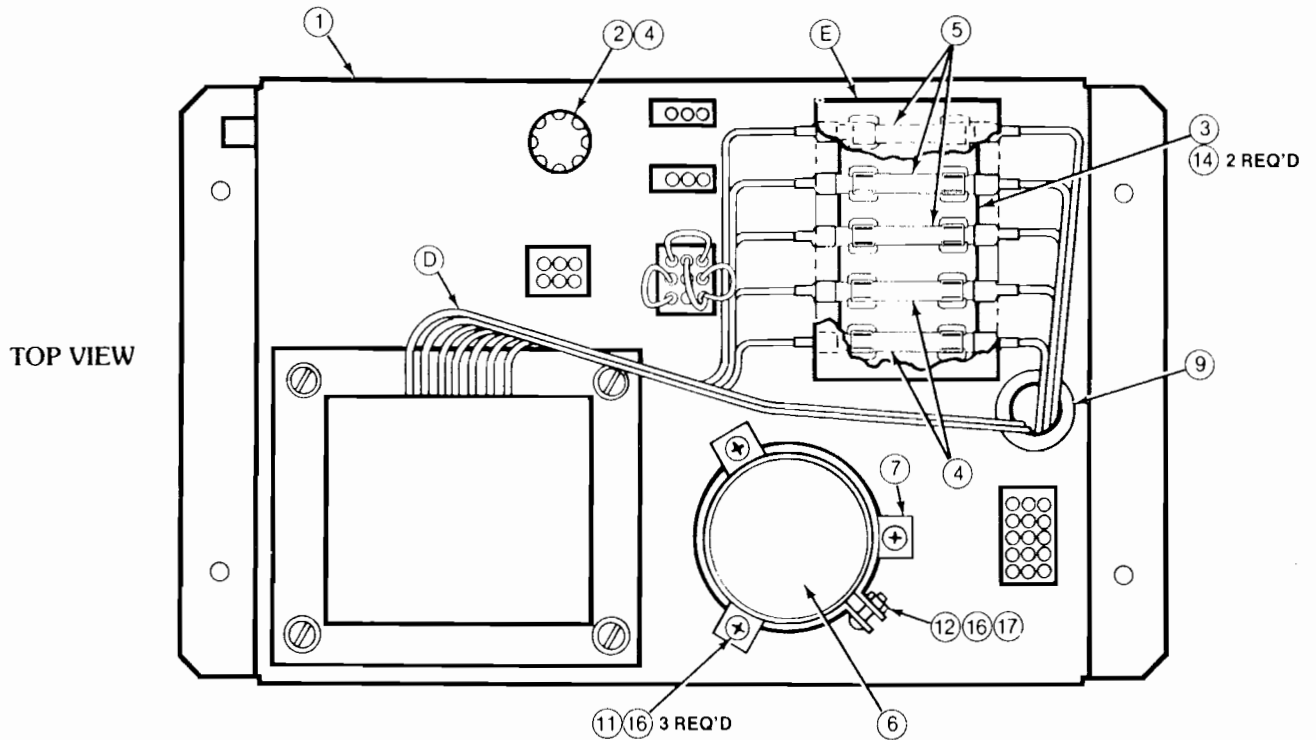
Item	Part No.	Qty.	Description	Ref. Design./ Location
2	10-51P0	2	1 ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R10, 19
3	10-5100	2	10 ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R11, 20
4	10-5330	1	33 ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R3
5	10-5101	5	100 ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R4, 12, 17, 18, 22
6	10-5271	1	270 ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R1
7	10-5102	1	1K ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R2
8	10-5272	1	2.7K ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R23
9	10-5752	1	7.5K ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R7
10	10-5103	2	10K ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R13,14
11	10-5392	1	3.9k ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R6
13	11-5221	2	220 ohm, $\pm 5\%$, $\frac{1}{2}W$ Carbon Composition Resistor	R9, 21
15	12-52P7	1	2.7 ohm, $\pm 5\%$, 1W Carbon Composition Resistor	R5
16	19-100P1015	1	.1 ohm, $\pm 3\%$, 7W Wirewound Resistor	R24
17	19-315102	1	1K ohm Vertical PCB-Mounting Cermet Trimpot, Bournes Series 3352V-1-1K	R8
20	24-250106	2	10 μf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor	C6, 15
22	24-250477	3	470 μf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor	C1, 4, 12
23	24-250108	3	100 μf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor	C9, 10, 13
25	27-250103	2	.01 μf Ceramic-Disc 25V Radial-Lead Capacitor	C5, C14
26	27-250104	2	.1 μf Ceramic-Disc 25V Radial-Lead Capacitor	C3, C11
27	27-250224	2	.22 μf , Ceramic-Disc 25V Radial-Lead Capacitor	C8, 17
29	27-250102	3	.001 μf , Ceramic-Disc 25V Radial-Lead Capacitor	C2, 7, 16
31	31-A14F	2	50V 2.5A Miniature Axial-Lead High-Current Rectifier	CR1, CR4
32	31-1N4001	2	50V Silicon Rectifier 1N4001 Diode	CR2-3
34	33-TIP32	1	PNP Power Transistor, Type TIP32	Q2
35	34-2N3055	1	NPN Silicon Transistor, Type 2N3055	Q3
36	34-2N3904	2	NPN Silicon Transistor, Type 2N3904	Q4, 6
38	37-LM305	1	5V Linear Voltage Regulator	Q1
39	37-TDA2002A	2	Type TDA2002A 8W Linear Audio Amplifier Integrated Circuit	Q5, 7
44	79-58008	1	9-Position Connector Receptacle	J7
45	79-58092	1	6-Position Connector Receptacle	J6
46	79-58059	1	4-Position Connector Receptacle	J8
47	79-20230	19	Female PCB-Mounting Terminal	
48	034531-01	1	Heat Sink	



**Figure 21 Regulator/Audio PCB Assembly,continued
Parts List**

Item	Part No.	Qty.	Description	Ref. Design./ Location
49	72-1608C	4	#6-32 × 1/2" Cross-Recessed Pan-Head Corrosion-Resistant Steel Machine Screw	
50	75-99516	7	#6-32 Nut/Washer Assembly	
51	75-056	7	#6 Internal-Tooth Steel Lock Washer	
52	020670-01	6	Test Point	
53	75-F60805	3	#6-32 × 1/2" Binder-Head Nylon Screw	
57	78-16008	1	Thermally Conductive Compound for the 2N3055	
58	78-16014	3	Thermally Conductive Compound for TDA2002A and TIP32	
60	52-003	2	Teflon-Insulated Solder-Plated Solid Copper PCB-Mounting Jumper Wire with .6" Centers	
61	52-004	2	Teflon-Insulated Solder-Plated Solid Copper PCB-Mounting Jumper Wire with .3" Centers	





NOTE:
 THE FOUR AVAILABLE VOLTAGE SELECTION PLUGS ARE LISTED IN
 FIGURE 15, FINAL ASSEMBLY.

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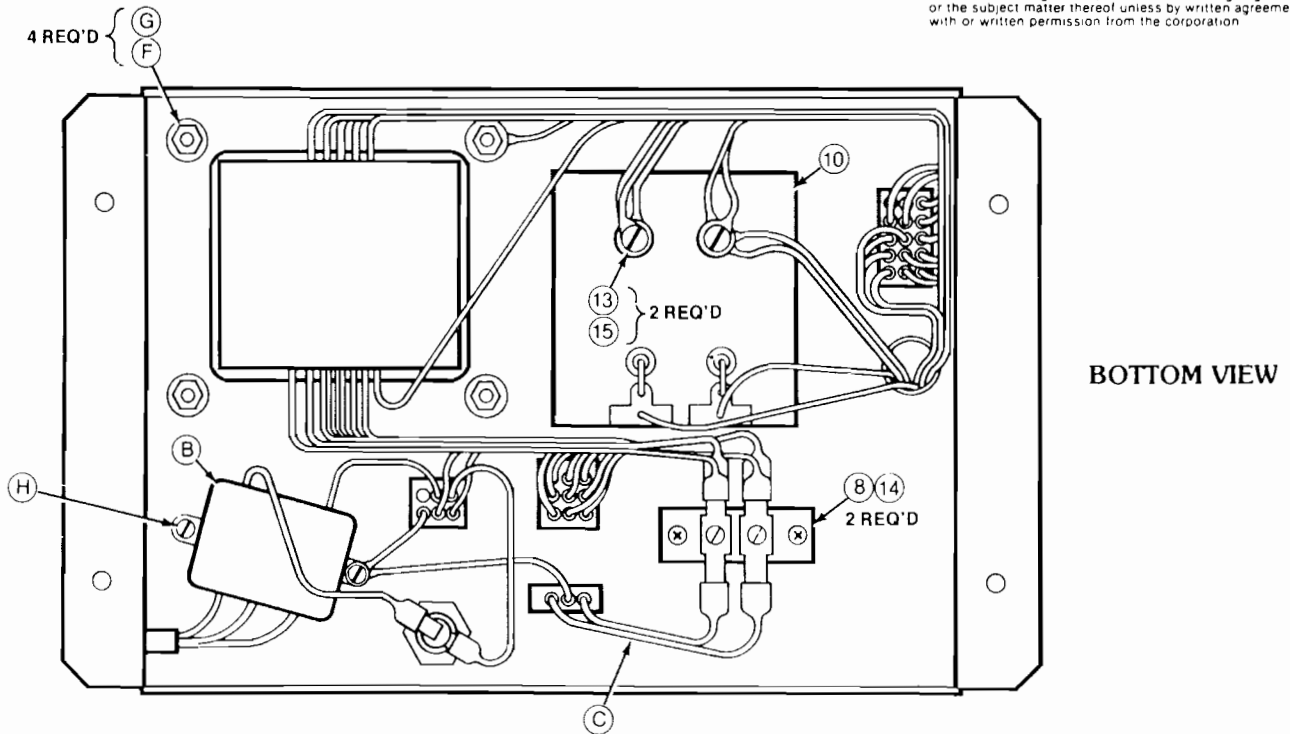
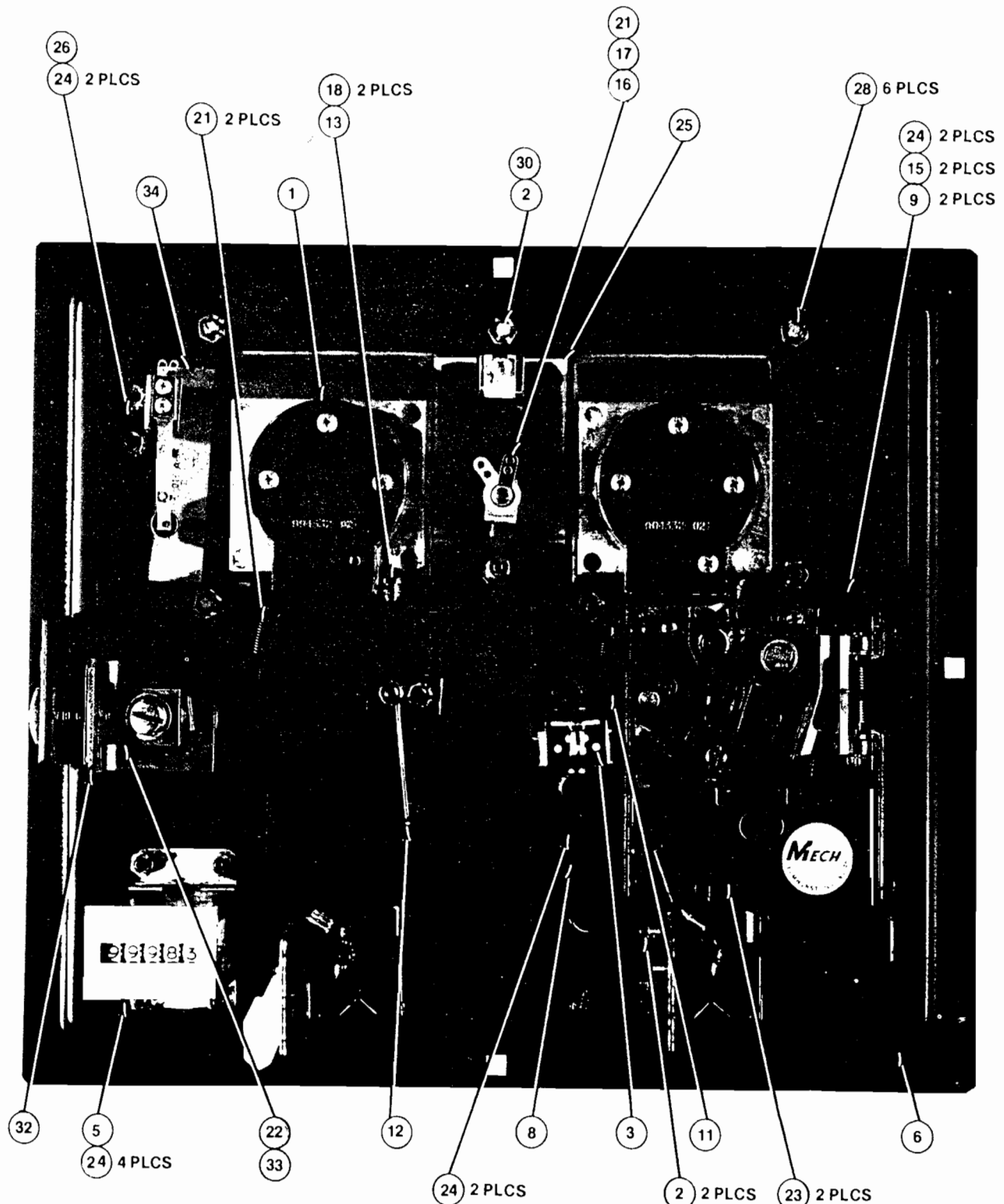


Figure 22 Power Supply Assembly for Raster-Scan Games
 A034560-01 A

**Figure 22 Power Supply Assembly for Raster-Scan Games
Parts List**

Item	Part No.	Qty.	Description
A	A034955-01	1	Power Supply Sub-Assembly. consisting of the following 17 items:
1	034482-01	1	Base for Power Supply Chassis
2	79-4411006	1	Panel-Mounting Non-Indicating 3AG Cartridge-Type Fuse Post
3	79-3206	1	5-Position 3AG Fuse Block with 1/4" Quick-Disconnect Terminals
4	46-2017002	3	7-Amp. 250V 3AG Slow-Blow Glass Cartridge-Type Fuse
5	46-2013002	3	3-Amp. 250V 3AG Slow-Blow Glass Cartridge-Type Fuse
6	29-053	1	26,000 μ f, 15V Electrolytic Capacitor
7	78-70501SC	1	2" Diameter Capacitor Mounting Bracket
8	79-15021001	1	2-Circuit Single-Row Terminal Block
9	78-2708	1	Nylon Type 6/6 Hole Bushing with 5/8" Inside Diameter \times 55/64" Outside Diameter \times 1/4" Thick
10	A006555-01	1	Rectifier Printed Circuit Board Assembly
11	72-HA4804S	3	#8-32 \times 1/4" Cross-Recessed Pan-Head Zinc-Plated Steel Thread-Rolling Tri-Fluted "Taptite" Screw
12	72-HA4812S	1	#8-32 \times 1/4" Cross-Recessed Pan-Head Zinc-Plated Steel Thread-Rolling Tri-Fluted "Taptite" Screw
13	72-1008F	2	#10-32 \times 1/2" Cross-Recessed Pan-Head Zinc-Plated Steel Thread-Rolling Tri-Fluted "Taptite" Screw
14	72-HA4606S	4	#6-32 \times 3/8" Cross-Recessed Pan-Head Zinc-Plated Steel Thread-Rolling Tri-Fluted "Taptite" Screw
15	75-010S	2	#10 Flat Plain SAE-Standard Zinc-Plated Steel Washer
16	75-018S	4	#8 Flat Plain SAE-Standard Zinc-Plated Steel Washer
17	75-99518	1	#8-32 Nut/Washer Assembly
B	A034630-01	1	RFI Filter Assembly
C	A034629-01	2	A.C. Harness Assembly
D	A034623-01	1	Power Supply Harness Assembly (for Raster-Scan Games)
E	034544-01	1	Fuse Block Cover
F	75-018S	4	#8 Flat Plain SAE-Standard Zinc-Plated Steel Washer
G	75-99518	4	#8-32 Nut/Washer Assembly
H	72-HA4814S	2	#8-32 \times 7/8" Cross-Recessed Pan-Head Zinc-Plated Steel Thread-Rolling Tri-Fluted "Taptite" Screw





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Not shown:
 (10) (24) 2 PLCS
 A006921-01
 Harness Assy.

Figure 23 Coin Door Assembly
 A006794-16 thru -28 K

**Figure 23 Coin Door Assembly
Parts List**

Item	Part No.	Qty.	Description
1	A007637-16	↑ One of these used per coin door ↓	Front Bezel Assy. --Used only on -16 Coin Door Assy. (25¢)
	A007637-17		Front Bezel Assy. --Used only on -17 Coin Door Assy. (5 Fr)
	A007637-18		Front Bezel Assy. --Used only on -18 Coin Door Assy. (1 DM)
	A007637-19		Front Bezel Assy. --Used only on -19 Coin Door Assy. (1 Kr)
	A007637-20		Front Bezel Assy. --Used only on -20 Coin Door Assy. (100 Y)
	A007637-21		Front Bezel Assy. --Used only on -21 Coin Door Assy. (10 pence)
	A007637-22		Front Bezel Assy. --Used only on -22 Coin Door Assy. (20¢ Australian)
	A007637-23		Front Bezel Assy. --Used only on -23 Coin Door Assy. (1 DM/2 DM)
	A007637-24		Front Bezel Assy. --Used only on -24 Coin Door Assy. (1 Fr)
	A007637-25		Front Bezel Assy. --Used only on -25 Coin Door Assy. (1 Baht)
	A007637-26		Front Bezel Assy. --Used only on -26 Coin Door Assy. (1 DM/5 DM)
	A007637-27		Front Bezel Assy. --Used only on -27 Coin Door Assy. (100 Lire)
	A007637-28		Front Bezel Assy. --Used only on -28 Coin Door Assy. (U.S. \$1.00 coin)
			<i>For breakdown of Front Bezel Assy., see Figure 24</i>
2	72-HA4608C	3	#6-32 x 1/2" Cross-Recessed Pan-Head Cadmium-Plated Steel Tri-Fluted Thread-Rolling Screw
3	A030362-01	1	Coin Lockout Assembly
4	A030250-01	2	Coin Switch Assembly
5	A002465-01	1	Coin Counter Assembly
6	004320-01	1	Coin Door Weldment
8	004344-01	1	Key Loop
9	004340-01	2	Spring Return (used only on German DM coin doors)
10	004337-01	2	Bracket for Lock-Out Wires
11	004338-01	1	Right-Hand Lock-Out Wire
12	004336-01	1	Left-Hand Lock-Out Wire
13	004326-01	2	Scavenger Button
15	006904-01	2	Spacer (used only on German DM coin doors)
16	030257-01	1	Lamp Socket
17	70-11-47	1	NEMA #47 Incandescent Miniature Bayonet-Base Lamp
18	73-3008	2	Carbon Spring Steel External Retaining Ring, for 1/4" Diameter Shaft
20	72-HA4604C	2	#6-32 x 1/4" Cross-Recessed Pan-Head Cadmium-Plated Steel Tri-Fluted Thread-Rolling Screw
21	008629-01	2	Spring
22	71-2118	1	Cam Lock, Hudson #CR73A045S
23	71-1225CU	↑ 2 of any of these used per coin door, as required ↓	Coin Mechanism for American Quarter
	71-1205FF		Coin Mechanism for French 5-Francs Coin
	71-1201MG		Coin Mechanism for German 1-Mark Coin
	71-1201KS		Coin Mechanism for Swedish 1-Krona Coin
	71-12100YJ		Coin Mechanism for Japanese 100-Yen Coin
	71-1210PE		Coin Mechanism for English 10-Pence Coin
	71-1220CA		Coin Mechanism for Australian 20-Cent Coin
	71-1202MG		Coin Mechanism for German 2-Mark Coin
	71-1201FF		Coin Mechanism for French 1-Franc Coin
	71-1201BT		Coin Mechanism for Thai 1-Baht Coin
	71-1205MG		Coin Mechanism for German 5-Mark Coin
	71-12100LI		Coin Mechanism for Italian 100-Lire Coin
71-1201ADU	Coin Mechanism for U.S. \$1.00 Coin		

Figure 23 Coin Door Assembly, continued
Parts List

Item	Part No.	Qty.	Description
24	75-99516	13*	#6-32 Steel Nut and Spring Washer Assembly *Quantity of 15 is used on the German DM coin doors
25	007753-01	1	Anti-Probe Plate
26	A007638-01	1	Slam Switch Assembly
27	75-036S	4	#6 Flat Plain SAE-Standard Zinc-Plated Steel Washer
28	73-3025	6	Carbon Spring Steel External Retaining Ring, for 0.184" Diameter Shaft
30	75-056	1	#6 Internal-Tooth Zinc-Plated Steel Lock Washer
32	033368-01	1	Lock Bracket
33	033369-01	1	Lock Arm
34	033371-01	1	Slam Switch Insulator

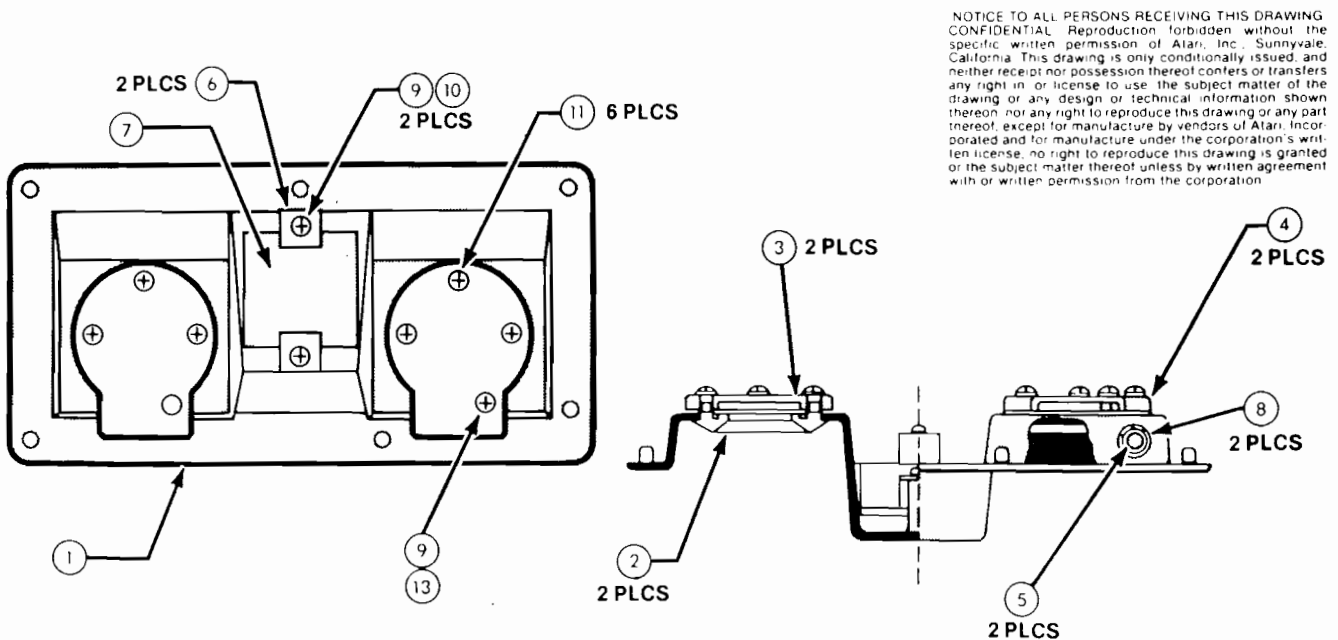


Figure 24 Front Bezel Assembly
A007637-16 thru -28 H

Figure 24 Front Bezel Assembly
Parts List

Item	Part No.	Qty.	Description
1	004328-02	1	Bezel
2	004330-02	↑ Two of these used per coin door ↓	Ring for American Quarter
	004330-02		Ring for French 5-Franc Coin
	009153-02		Ring for German 1-Deutschmark Coin
	004330-02		Ring for Swedish 1-Krona Coin
	009153-02		Ring for Japanese 100-Yen Coin
	007752-02		Ring for English 10-Pence Coin
	007752-02		Ring for Australian 20¢ Coin
	030677-02		Ring for German 2-Deutschmark and U.S. \$1.00 Coins
	009153-02		Ring for French 1-Franc Coin
	030677-02		Ring for Thai 1-Baht Coin
	007752-02		Ring for German 5-Deutschmark Coin
	030677-02		Ring for Italian 100-Lire Coin
3	004331-02	2	Coin Shield
4	004332-02	2	Primary Coin Chute
5	004327-01	2	Scavenger Button Bearing
6	004328-01	2	Price Plate Clamp
7	004343-01	↑ One of these used per coin door ↓	Price Plate—25¢
	004343-06		Price Plate—5 FR
	004343-04		Price Plate—1 DM
	004343-03		Price Plate—1 KR
	004343-05		Price Plate—¥ 100
	004343-02		Price Plate—10 P
	004343-07		Price Plate—20¢ Australian
	004343-08		Price Plate—Einwurf 1 DM/2 DM
	004343-09		Price Plate—1 FR
	004343-10		Price Plate—1 Baht
	004343-11		Price Plate—Einwurf 1 DM/5 DM
	004343-12	Price Plate—100 Lire	
	004343-13	Price Plate—25¢/\$1	
8	73-3009	2	Carbon Spring Steel External Retaining Ring, for 3/8" Shaft Diameter
9	72-1604S	3	#6-32 × 1/4" Cross-Recessed Pan-Head Cadmium-Plated Steel Machine Screw
10	75-046	2	#6 Corrosion-Resistant Steel Split Lock Washer
11	72-CL606	6	#6-32 × 3/8" Phillips Pan-Head Steel "Rolok" Self-Threading, Thread-Rolling Machine Screw
13	75-056	1	#6 Internal-Tooth Zinc-Plated Steel Lock Washer



**Figure 25 4-Player Football Game PCB Assembly
Parts List**

Item	Part No.	Qty.	Description	Ref. Design./ Location
2	100000-330	1	33 Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R50
3	100000-101	4	100 Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R3-6
4	100000-221	1	220 Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R14
5	100000-331	3	330 Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R12, 13, 29
6	100000-471	2	470 Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R10, 31
7	100000-102	22	1K Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R1, 2, 7-9, 11, 15, 16, 21, 32, 40, 41, 45-47, 51-55, 87, 88
8	100000-152	1	1.5K Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R27
9	100000-222	4	2.2K Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R30, 38, 39, 48
10	100000-392	1	3.9K Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R28
11	100000-562	1	5.6K Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R74
12	100000-103	32	10K Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R17-20, 42-44, 60-73, 75-84, 89
15	100000-223	2	22K Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R33, 34
16	100000-473	3	47K Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R36, 85, 86
17	100000-563	1	56K Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R25
18	100000-104	1	100K Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R22
21	100000-224	4	220K Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R23, 35, 37, 49
22	100000-334	1	330K Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R26
23	100000-394	1	390K Ohm, $\pm 5\%$, $\frac{1}{4}W$ Carbon Composition Resistor	R24
26	100013-330	4	33 Ohm, $\pm 5\%$, $\frac{1}{2}W$ Carbon Composition Resistor	R56-59
32	24-250106	1	10 μf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor	C41
33	24-250107	1	100 μf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor	C50
37	27-250102	1	.001 μf Ceramic-Disc 25V Radial-Lead Capacitor	C45
38	27-250103	19	.01 μf Ceramic-Disc 25V Radial-Lead Capacitor	C42-44, 60-65, 74-83
39	27-250104	64	.1 μf Ceramic-Disc 25V Radial-Lead Capacitor	C1-20, 22-32, 35-38, 40, 46-49, 51-59, 66-73, 84-90
42	28-101101	1	100 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor	C21
43	28-101221	2	220 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor	C39, 91
46	21-101103	1	.01 μf , $\pm 10\%$, Radial-Lead Epoxy-Dipped 100V Mylar Capacitor	C33
47	21-101223	1	.022 μf , $\pm 10\%$, Radial-Lead Epoxy-Dipped 100V Mylar Capacitor	C34
50	31-1N914	1	75V 1N914 Switching Diode	CR1
54	33-2N3644	3	Type 2N3644 PNP Transistor	Q9-11
55	34-2N3643	7	Type 2N3643 NPN Switching Transistor	Q1, 3-8
56	34-2N6044	3	Type 2N6044 NPN Darlington Transistor	Q2, 12, 13
59	37-7400	2	Type 7400 Integrated Circuit	B5, R8
60	37-7402	2	Type 7402 Integrated Circuit	A6, N7
61	37-7404	3	Type 7404 Integrated Circuit	R7, E8, D10
63	37-7408	2	Type 7408 Integrated Circuit	F8, E9

Figure 25 4-Player Football Game PCB Assembly, continued
Parts List

Item	Part No.	Qty.	Description	Ref. Design./ Location
64	37-74LS08	2	Type 74LS08 Integrated Circuit	D2, D3
65	37-7410	2	Type 7410 Integrated Circuit	P4, P8
66	37-7414	1	Type 7414 Integrated Circuit	M8
67	37-74LS14	4	Type 74LS14 Integrated Circuit	B4, E10, E11, L11
68	37-7430	1	Type 7430 Integrated Circuit	J8
69	37-7432	5	Type 7432 Integrated Circuit	D4, E4, C5, C6, A7
70	37-7442	3	Type 7442 Integrated Circuit	C4, E7, D11
71	37-7474	3	Type 7474 Integrated Circuit	P7, A8, R9
72	37-74S74	1	Type 74S74 Integrated Circuit	N8
73	37-74LS74	4	Type 74LS74 Integrated Circuit	F10, F11, M11, N11
74	37-74LS83	3	Type 74LS83 Integrated Circuit	E5, H8, K8
75	37-74LS86	3	Type 74LS86 Integrated Circuit	R3, D6, M7
76	37-7490	1	Type 7490 Integrated Circuit	A4
77	37-74LS151	1	Type 74LS151 Integrated Circuit	C8
78	37-74LS153	9	Type 74LS153 Integrated Circuit	F4, H4, J4, K4, E6, F6, H6, J6, K6
79	37-74LS157	7	Type 74LS157 Integrated Circuit	B1, C1, D1, R1, N6, L7, P6
81	37-74LS163A	2	Type 74LS163A Integrated Circuit	B7, C7
82	37-74LS164	3	Type 74LS164 Integrated Circuit	B8, A9, B9
83	37-74LS166	1	Type 74LS166 Integrated Circuit	P5
84	37-74LS174	3	Type 74LS174 Integrated Circuit	F9, H9, J9
85	37-74LS175	1	Type 74LS175 Integrated Circuit	L5
86	37-74LS191	8	Type 74LS191 Integrated Circuit	M9, N9, H10, J10, M10, N10, H11, J11
87	37-74195	1	Type 74195 Integrated Circuit	P1
88	37-74LS374	6	Type 74LS374 Integrated Circuit	P2, D5, L6, M6, D7, L8
91	37-LM324	1	Type LM324 Integrated Circuit	C10
92	37-555	1	Type 555 Integrated Circuit	A10
94	37-8T28	2	Type 8T28 Integrated Circuit	L3, M3
95	37-9316	5	Type 9316 Integrated Circuit	M4, N4, R4, R5, R6
96	37-9321	1	Type 9321 Integrated Circuit	D8
97	37-8097	5	Type 8097 Integrated Circuit	K9, L9, K10, L10, K11
101	41-3003	9	100 μ H, \pm 5%, Hot-Molded Plastic Fixed R.F. Choke	L1-9
102	81-4302	3	Nylon Snap-In Fastener (for Item 56)	
103	62-001	1	SPST Pushbutton Switch	A4/5
104	66-114P1T	1	4-Station Single-Throw, Dual-Inline-Package Bit Switch	P9
106	009470-01	1	Heat Sink	B6
107	78-13016	A/R	Tra-Bond Cement for Heat Sink	
109	79-42C40	1	40-Contact Medium-Insertion-Force IC Socket	C2/3

**Figure 25 4-Player Football Game PCB Assembly, continued
Parts List**

Item	Part No.	Qty.	Description	Ref. Design./ Location
110	020670-01	19	Test Point	
111	90-102	1	12.096 MHz, $\pm .005\%$, Crystal	Y1
112	90-6010	1	Microprocessor	C2/3
113	90-7008	1	Random-Access Memory	B6
114	90-7031	8	Random-Access Memory	F5, H5, J5, K5, F7, H7, J7, K7
115	90-7033	2	Random-Access Memory	
118	034006-01	1	Programmable Read-Only Memory (Sync)	L4
120	033029-01	1	Programmable Read-Only Memory (Alphanumerics)	R2
122	033030-01	1	Programmable Read-Only Memory (Graphics/LSB)	M5
123	033031-01	1	Programmable Read-Only Memory (Graphics/MSB)	N5

*For remaining memory components and their
part numbers, see next page.*

Figure 25 4-Player Football Game PCB Assembly, continued
A034754-01 and -02 A

*Parts List of Memory Components and Their Equivalents
(Locations are Shown in Bold)*

-01 P.C. Boards (PROMs)	Alternate -01 P.C. Boards (PROMs)	-02 P.C. Boards (ROMs)
034883-01 H2		
034884-01 J2	034896-01 H2	
034881-01 H1		034902-01 F3
034882-01 J1	034895-01 H1	
034879-01 E2		
034880-01 F2	034894-01 E2	
034877-01 E1		034901-01 E3
034878-01 F1	034893-01 E1	
034887-01 K2		
034888-01 L2	034898-01 K2	
034885-01 K1		034903-01 J3
034886-01 L1	034897-01 K1	
034891-01 M2		
034892-01 N2	034900-01 M2	
034889-01 M1		034904-01 K3
034890-01 N1	034899-01 M1	

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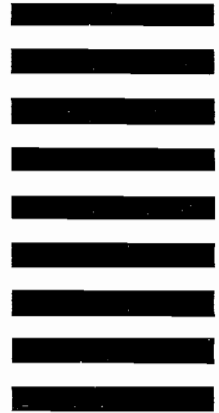
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Except for any express warranty set forth in a written contract between Seller and Buyer which contract supersedes the terms of this order, this warranty is expressed in lieu of all other warranties expressed or implied, including the implied warranties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

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