TM-1
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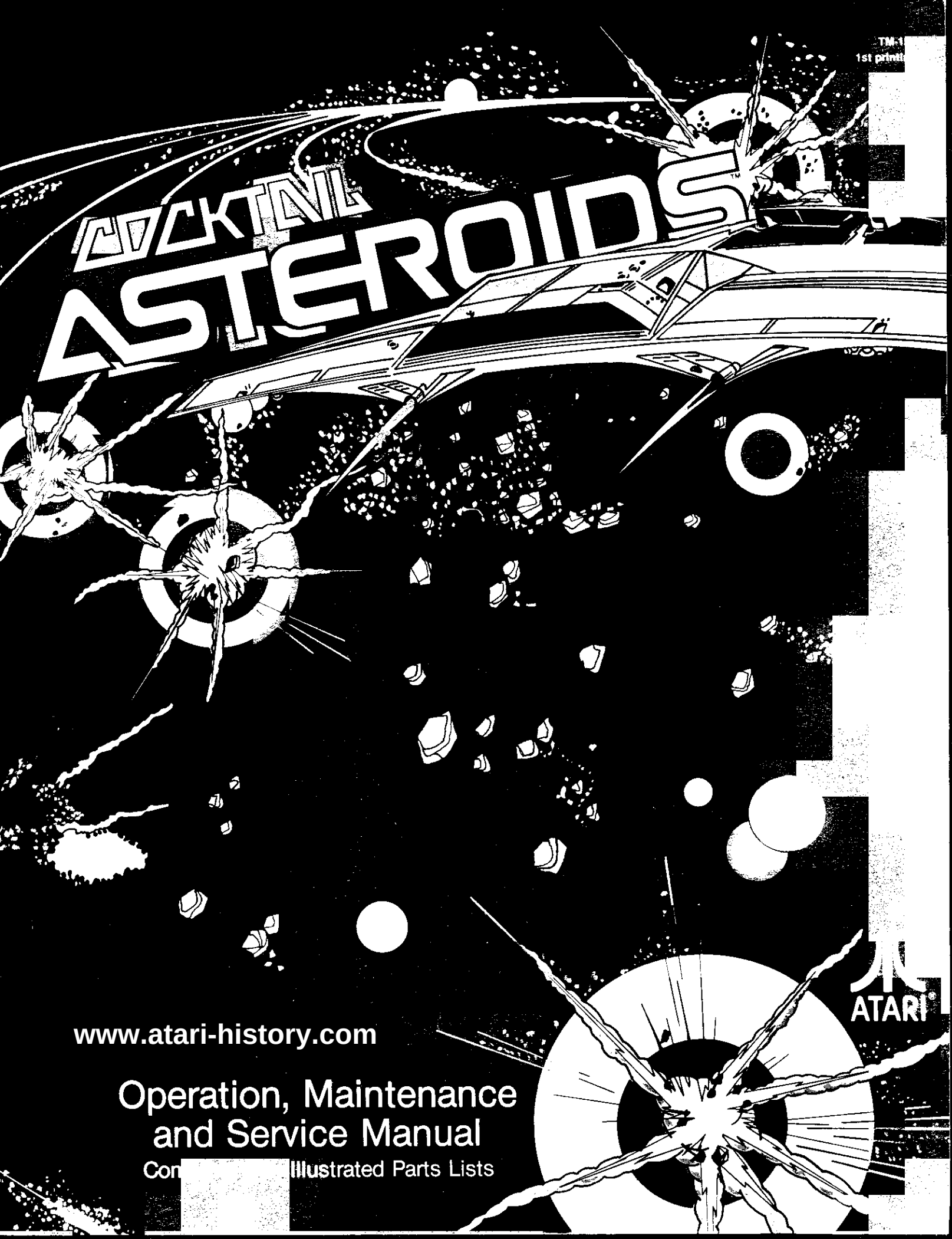
COCKTAIL ASTEROIDS™



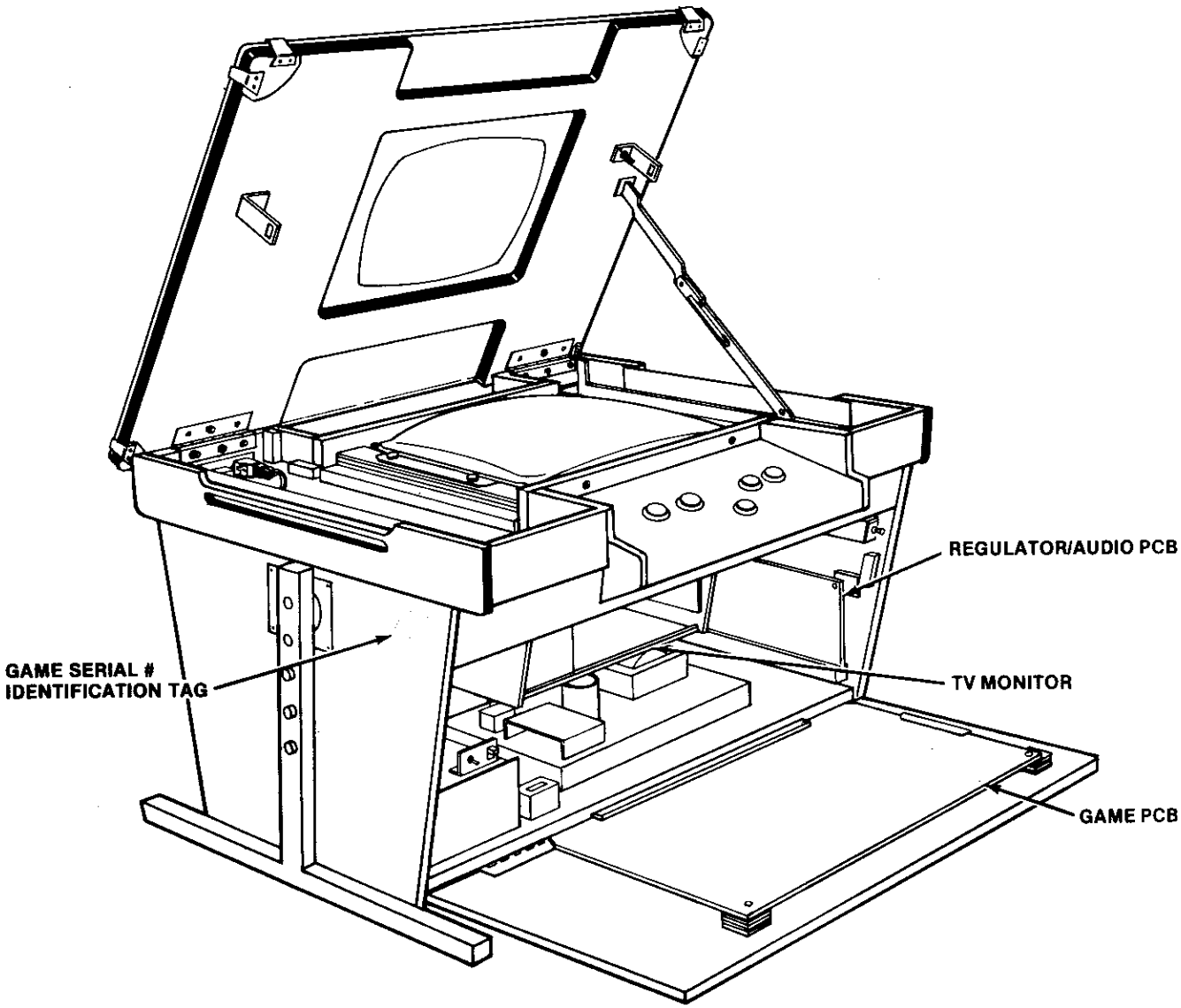
ATARI®

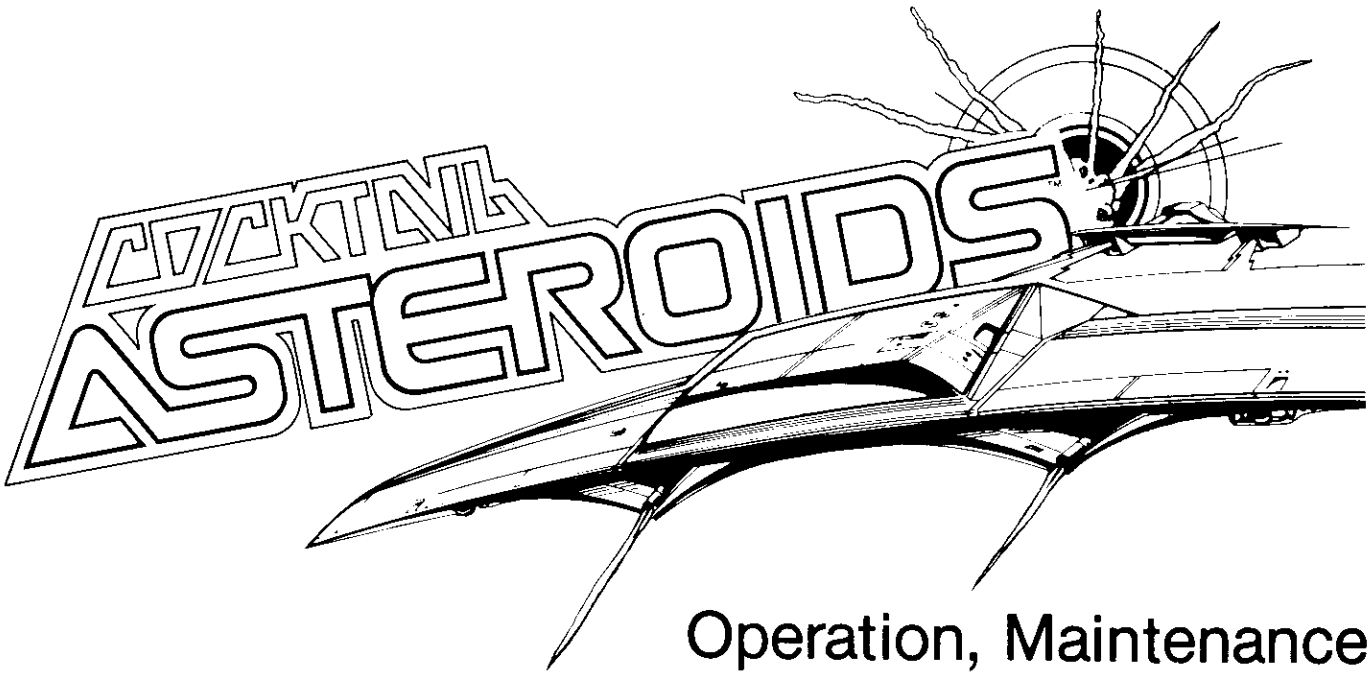
Operation, Maintenance and Service Manual

Con Illustrated Parts Lists

GAME SERIAL NUMBER LOCATION

Your game's serial number is located on the outside rear of the game. The same number is also stamped on the chassis of the TV monitor, Game PCB and Regulator/Audio PCB. Please mention this number whenever calling your distributor for service.





Operation, Maintenance and Service Manual

Complete with Illustrated Parts Lists

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ATARI®

A Warner Communications Company

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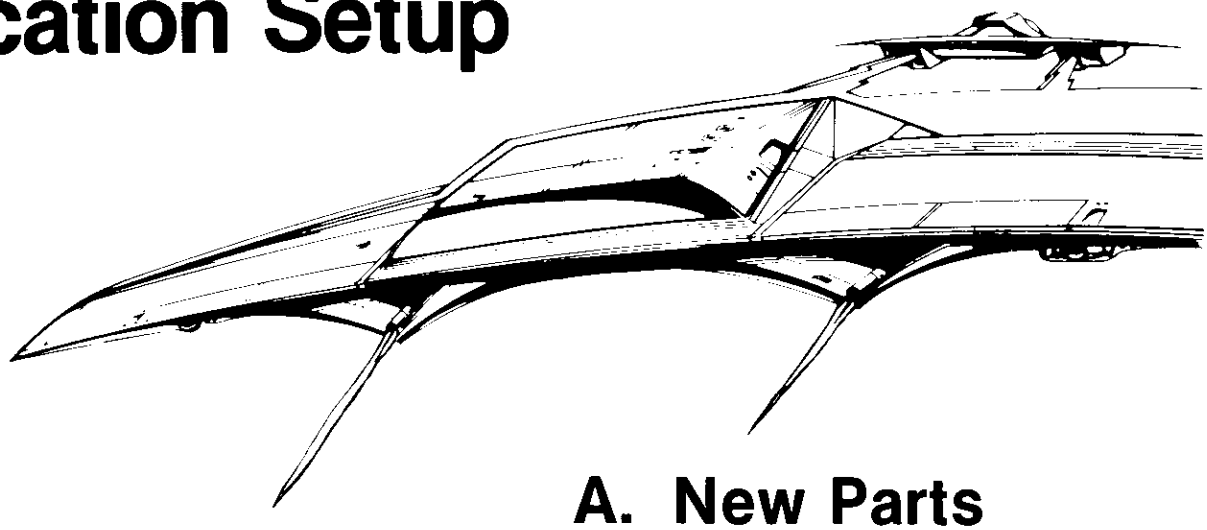
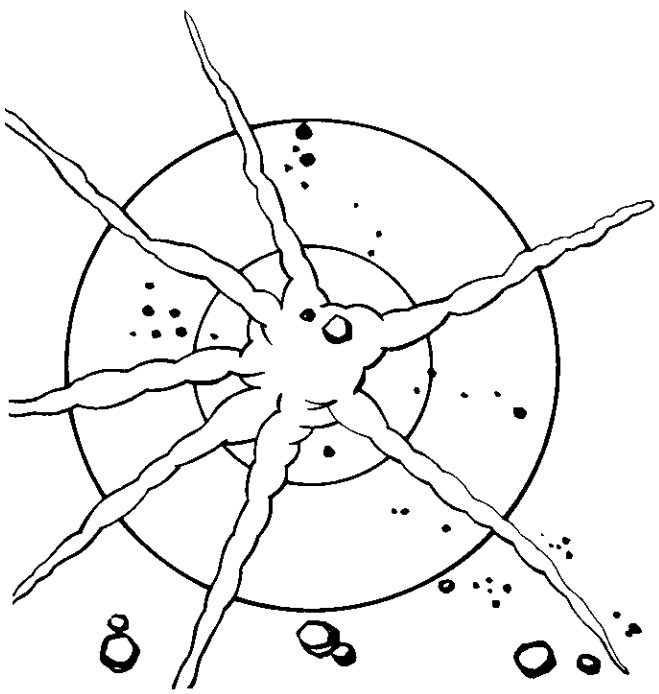


A. New Parts

The Cocktail Asteroids game has four new parts. If you have worked on Atari games in the past, then you should be aware of these important differences. The new parts are:

- 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.
- Game PCB Circuitry and TV Monitor. Most video games to date have used the raster scan method of display. This game uses vector generation with X and Y axes to allow greater contrast, a greater number of moving objects on the screen, and lines at any angle to be "drawn" on the screen.
- Cocktail Table Cabinet. This new cabinet design allows for adjustable height and easy access for servicing. The tempered glass top eliminates the possibility of spilled liquids entering into the cabinet.
- Coin Acceptor. This is the first use of this fixed mounting coin acceptor.



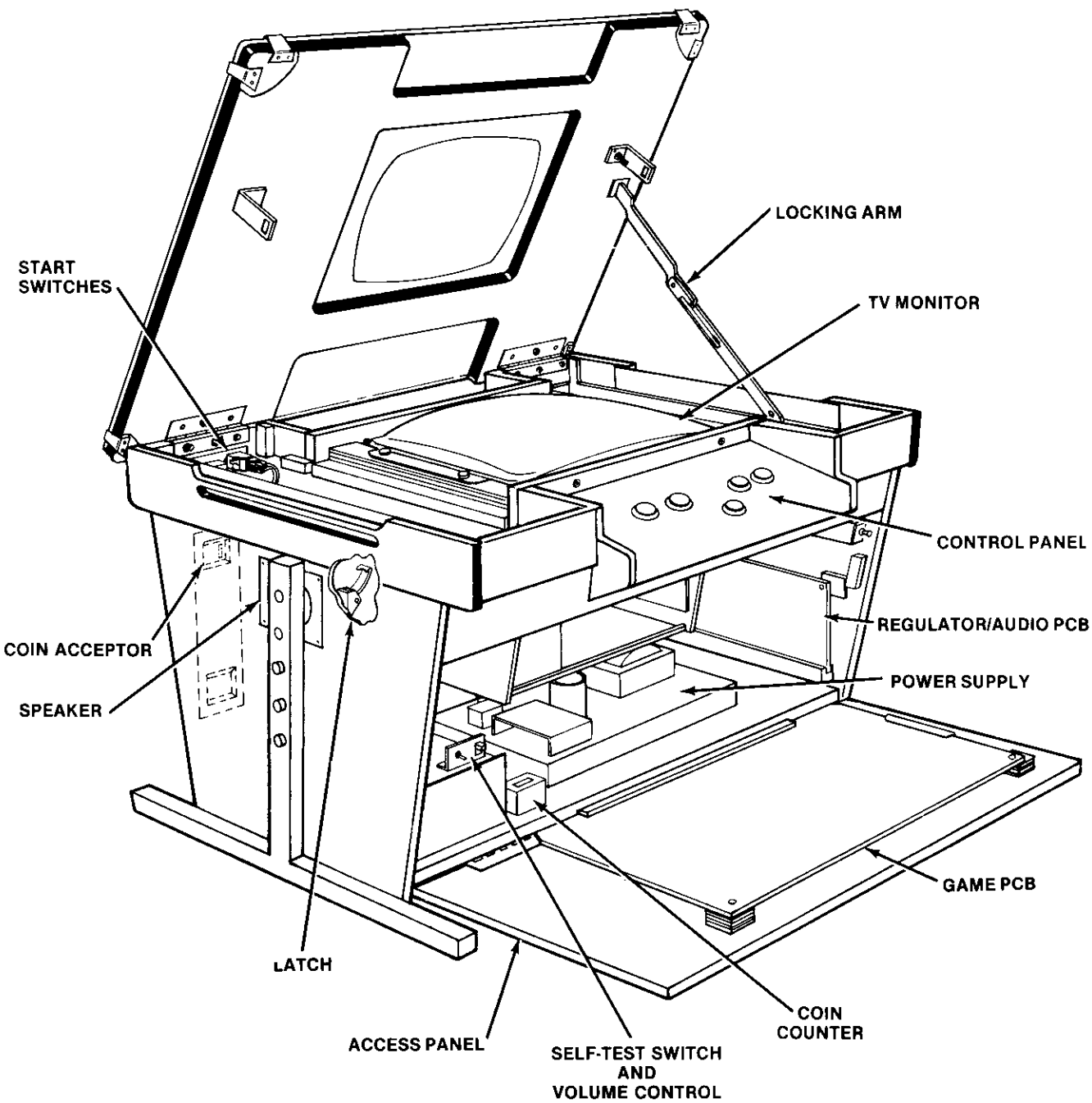


Figure 1 Overview of Game

B. Opening the Game Cabinet

Refer to Figure 1 and do the following:

1. Unlock and open the access panel
2. Reach inside and unfasten the hook fasteners on each end of the cabinet.
3. Lift the table top until the support arm locks into place.

The inside of the cabinet, excluding the two control panels, is fully accessible for servicing.

To close the cabinet, do the following:

1. Stand on the access panel side of the cabinet and grasp the table top with the left hand.
2. With the right hand, press the button at the middle of the support arm and pull the support arm toward you.
3. Gently lower the table top to the closed position.
4. Reach inside the access panel and latch the two hook fasteners on each side of the game cabinet.
5. Close and lock the access panel.

C. Game Inspection

This 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. Replug any connectors found unplugged. **DON'T FORCE CONNECTORS TOGETHER.** The connectors are keyed so they only go on in the proper orientation. A reverse edge connector will damage a PCB.
   b. Check that all plug-in integrated circuits on the game PCB are firmly seated in their sockets.

⚠ WARNING ⚠

To avoid possible unpleasant electrical shock, do not touch internal parts of the TV monitor with your hands or metal objects held in your hands!

   c. Note the location of the game's serial number—it is on the metallic label on the speaker side of the cabinet. Verify that the serial numbers also stamped on the Game PCB, Regulator/Audio PCB and TV Monitor are all identical. A drawing of the serial number locations is on the inside front cover of this manual. Please mention this number whenever you call your distributor for service.
   d. Check all major subassemblies such as the Power Supply, Control Panel and TV Monitor for secure mounting.

D. Game Installation

Figure 2 Installation Requirements

Power	175 watts
Temperature	0 to 38° C (32 to 100°F)
Humidity	Not over 95% relative
Space required	60 × 81 cm (23¾ × 31¾ in.)
Game height	61 to 71 cm (24 × 28½ 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 following list.

Line Voltage Range	Voltage Selection Plug Color
90-110 VAC (100)	Violet
105-135 VAC(120)	Yellow
200-240 VAC(220)	Blue
220-260 VAC(240)	Brown

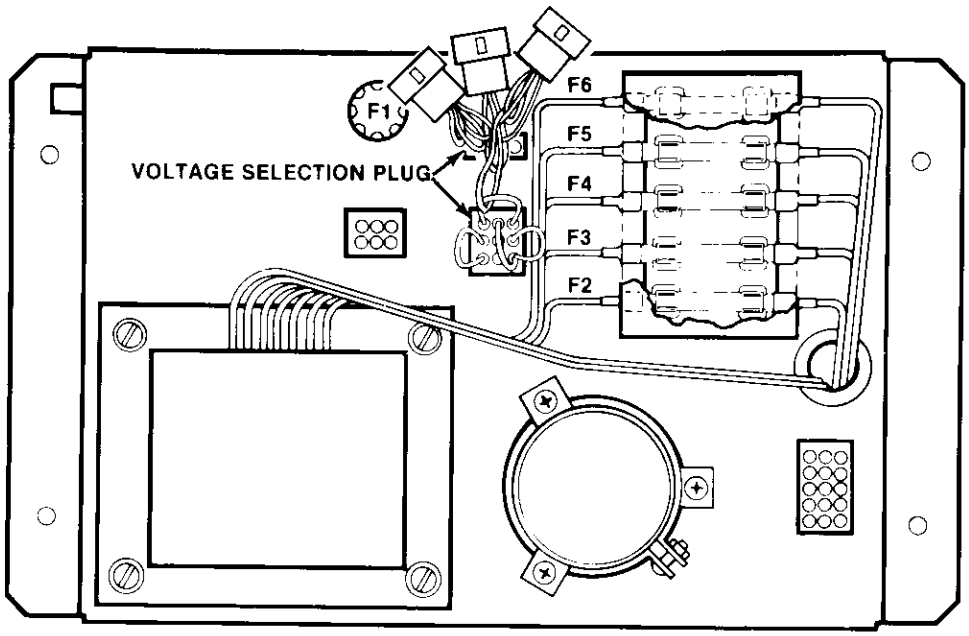


Figure 3 Power Supply

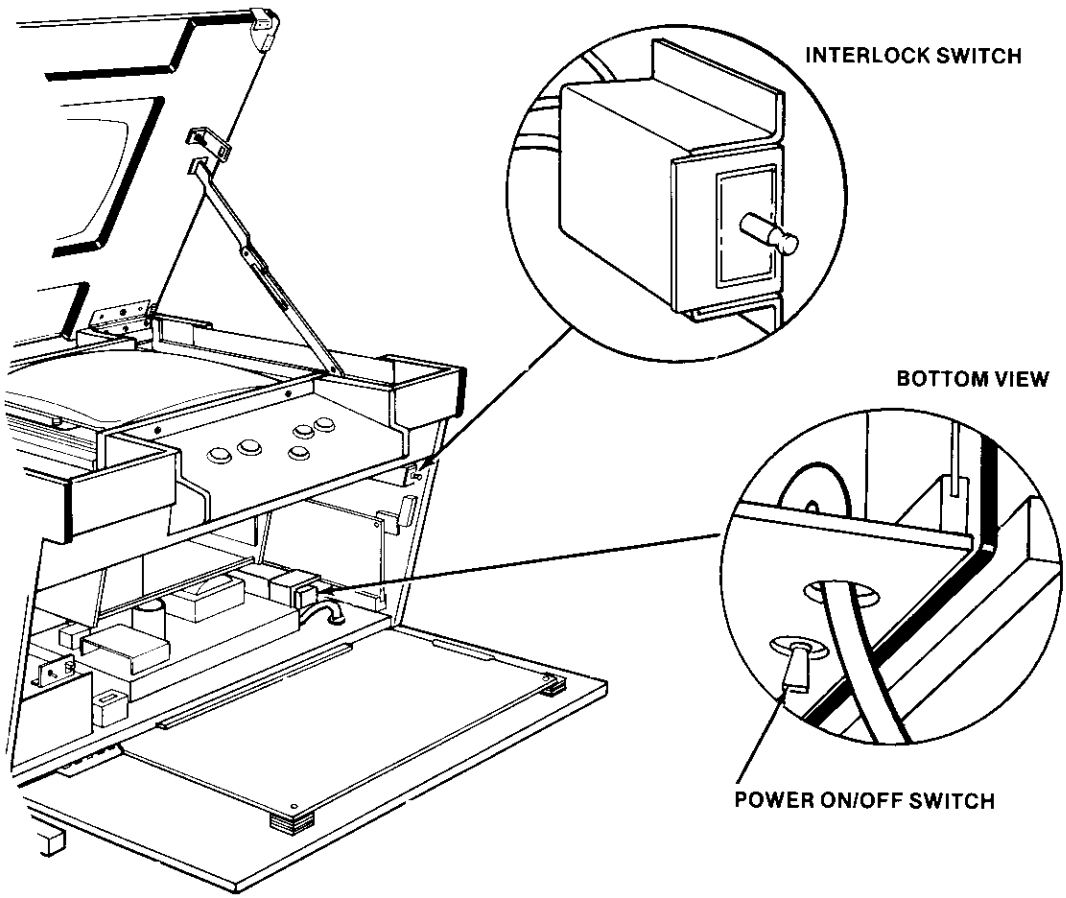


Figure 4 Interlock and Power On/Off Switches

2. Interlock and Power On/Off Switches

To minimize the hazard of electrical shock while working on the inside of the game cabinet, an interlock switch has been installed (see Figure 4). This switch removes all AC line power from the game circuitry when the access panel is opened.

Check for proper operation of the interlock switch by doing the following:

1. Unlock and open the access panel.
2. Plug the AC line power cord into an AC outlet.
3. Close the access panel.
4. Set the power on/off switch to the on position. Within 30 seconds the TV monitor should display a picture.
5. Slowly open the access panel. The TV monitor picture should disappear when the panel is opened approximately 2.5cm (1 inch).

3. Game Fuses

For continued protection of your game, as well as for the safety of the players, fuses must be replaced **only** with fuses with identical ratings. These ratings are shown in Figure 17. See the schematic Drawing Package for the fuse functions.

Information on the TV monitor fuses is contained in the TV monitor manual that is supplied with this game.

E. Adjusting the Table Legs

NOTE

To ensure cabinet strength, you must use all three bolts when attaching table legs. Using only two screws may result in the breakage of the cabinet wall when sliding the cabinet across the floor.

This cocktail table game is designed for three adjustable heights from 61 to 71 cm (24 to 28 1/2 in.). The table may be set at 61 cm (24 in.), 66 cm (26 1/8 in.) or 71 cm (28 1/2 in.). To adjust the table height refer to Figure 5.

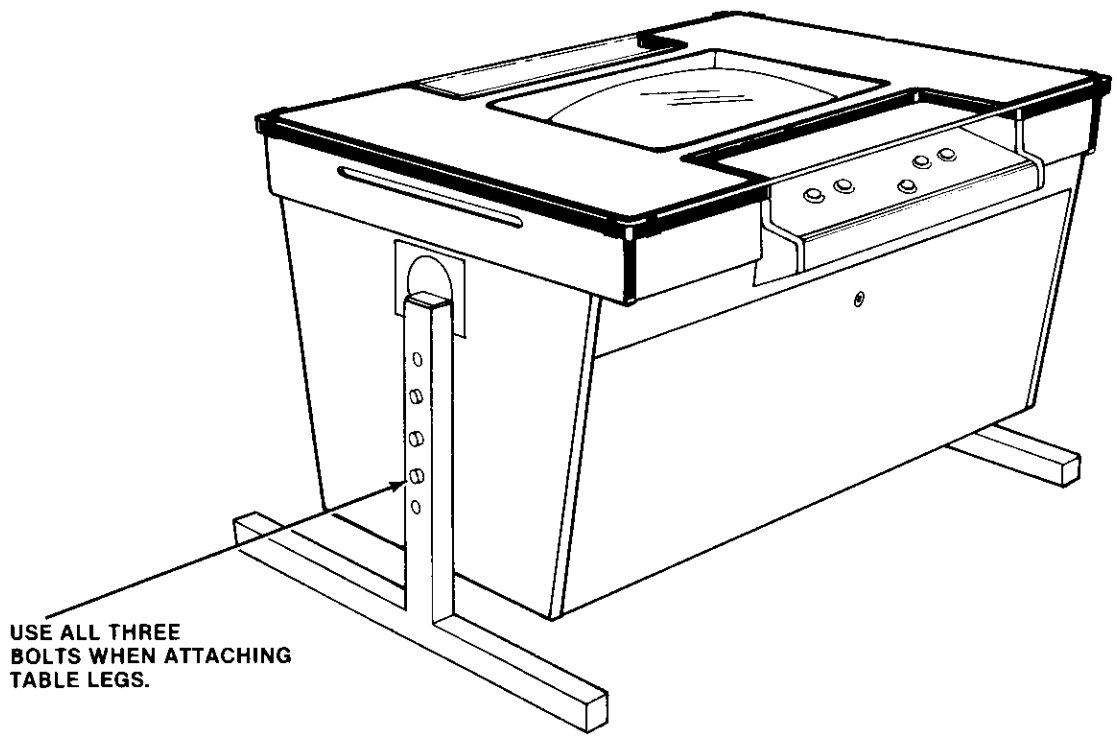


Figure 5 Adjustilng the Table Legs

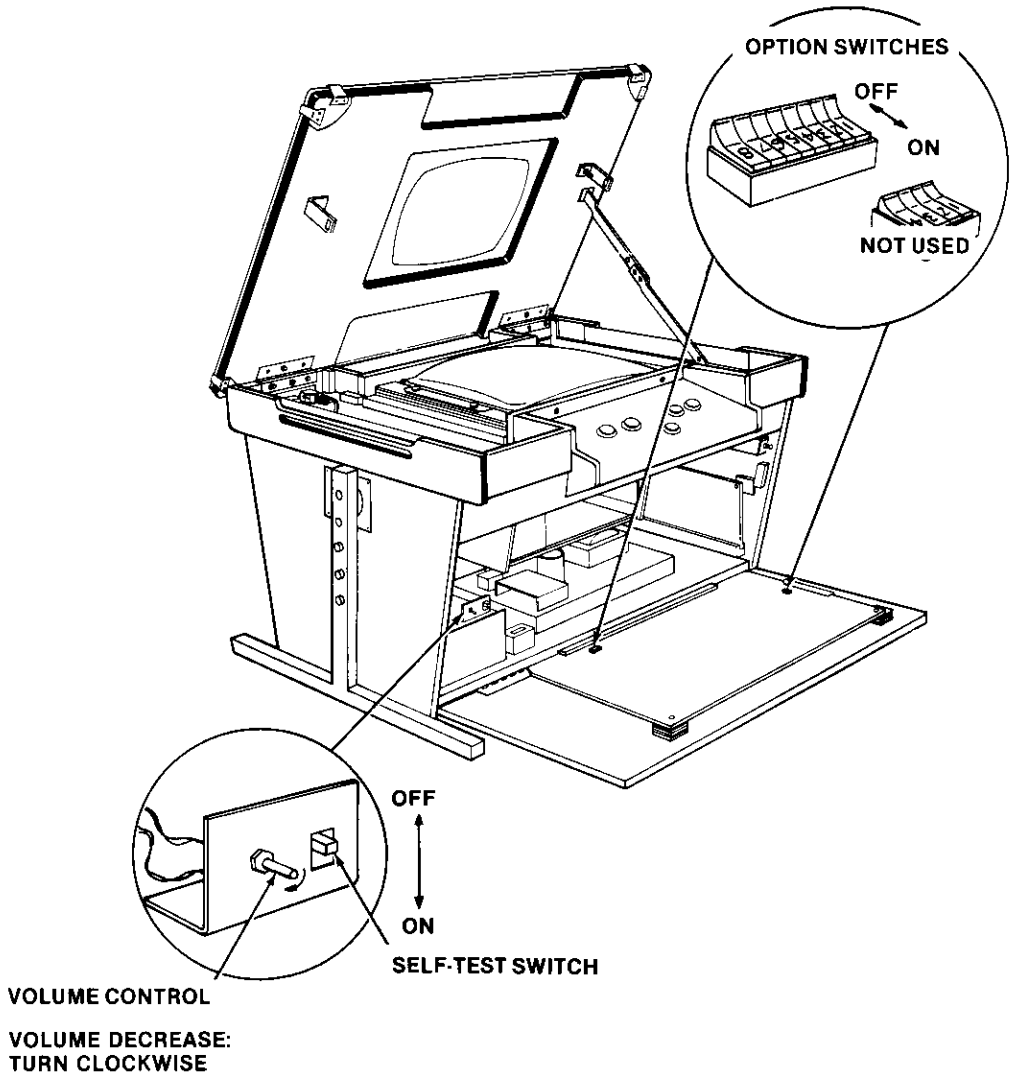


Figure 6 Location of Self-Test Switch, Volume Control and Option Switches

F. 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 speaker; no additional equipment is necessary.

Part of the self-test procedure includes a display of the operator-selectable game options. Therefore, we suggest you run the self-test procedure anytime you need to change the game's options.

To run the self-test, follow the instructions outlined in Figure 7

Figure 7 Self-Test Procedure

INSTRUCTION	RESULTS IF TEST PASSES	RESULTS IF TEST FAILS
1. Set self-test switch to **on** position (see Figure 6).	TV monitor displays picture as shown in Figure 8.	*RAM FAILURE* is indicated by a sequence of from 1 to 6 tones. A low-frequency tone is heard for each good RAM chip. A much lower frequency is heard for a failing RAM chip. The sequence stops with the last failing RAM chip. To restart the sequence, press the Reset pushbutton on the game PCB or set the self-test switch to **off**, then again to the **on** position. Identify the bad RAM chip with table below. Example: Three tones, then a tone of much lower frequency indicates failure of RAM chip R4.

TONE #	RAM CHIP LOCATION
1	D2
2	E2
3	M4
4	R4
5	N4
6	P4

ROM/PROM FAILURE is indicated by two columns or lines of numbers in the upper left-hand corner of the display. The number in the left column or first line indicates the failing ROM/PROM chip(s). Identify the bad ROM/PROM with table below.

The number in the right column or second line indicates the failing data bit of the failing ROM/PROM. Identify the bad bit with the second table below. If more than one bit is failing, the displayed number(s) are hexadecimal combinations of the numbers shown below. Examples:

1) If bits D2 and D3 fail, C is displayed.
2) If bits D2, D3 and D7 fail, 8C is displayed.
3) If bits D4 and D5 fail, 30 is displayed.
4) If bits D1, D3, D5 and D6 fail, 6A is displayed

DISPLAYED NO.	FAILING ROM/PROM		
0 1	N/P3	K4, L4	
2 3	F1	F2, L1	F2, H1 L2, L1
4 5	D/E1	H2, J1	H2, J1 M2, M1
6 7	C1	K1, J2	J2, K1 N2, N1

DISPLAYED NO.	FAILING BIT
1	D0
2	D1
4	D2
8	D3
10	D4
20	D5
40	D6
80	D7

RAMSEL SIGNAL FAILURE is indicated by a **BANK ERROR** or **PAGE SELECT ERROR** message at lower middle of display.

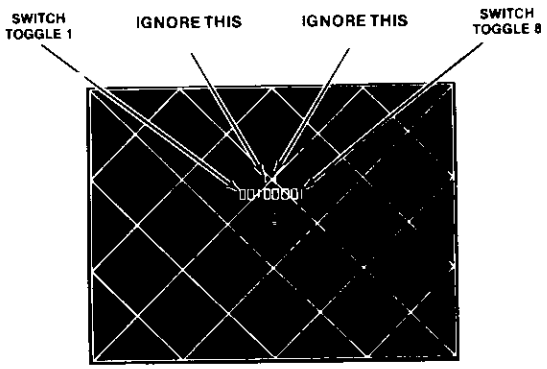
2. Activate all control panel and coin acceptor switches. When satisfied with test, set self-test switch to **off** position.	1 PLAYER START and 2 PLAYER START LEDs are lighted. High-pitched click for each activated switch.	1 PLAYER START and/or 2 PLAYER START LEDs not lighted. High-pitched click sound is not heard for any particular switch.

Figure 8 Option Switch Settings

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

When changing the options, verify proper results on the TV monitor display during self-test. A switch toggle in the **on** position is indicated by a **0** for that switch on the TV monitor display. A switch in the **off** position is indicated by the number **1**.

Toggle Settings of 8-Toggle Switch on Game PCB								Option
8	7	6	5	4	3	2	1	
						On	On	English
						On	Off	German
						Off	On	French
						Off	Off	Spanish
					On			4-Ship Game
					Off			3-Ship Game
On	On							Free Play
On	Off							1 Coin* for 2 Plays
Off	On							1 Coin* for 1 Play
Off	Off							2 Coins* for 1 Play



Photograph above shows toggles 1, 2, 4-7 on, and toggles 3 and 8 off.

G. Game Play

Atari's Asteroids game has five possible modes of operation: Attract, Ready-to-Play, Play, High Score Initial, and Self-Test. Self-Test is a special mode for checking the game switches and computer functions. You may enter this mode at any time. When entered, all game credits are cancelled.

1. Attract Mode

The attract mode begins when power is applied to the game, after a play or high score initial mode, or after self-test. This mode is continuous and is only interrupted when a coin is inserted and accepted or when in self-test. In this mode, the TV monitor displays two possible pictures. Both pictures have three score values across the top of the screen and a message that states the number of coins for a game. The middle score represents the high score to date. The left score is for player 1. The right score is for player 2.

One picture displays asteroids and an occasional enemy spaceship "floating" across the screen. The second picture displays up to 10 of the highest scores since the game was last powered up or since the last self-test. These two displays alternate every 16 seconds.

2. Ready-to-Play Mode

This mode begins when sufficient coins have been accepted for a one or two-player game. It ends when the 1 PLAYER START or 2 PLAYER START pushbutton is pressed. When this mode begins, the message PUSH START flashes immediately below the center score at the top of the screen. The displayed pictures are otherwise the same as those shown in the attract mode.

3. Play Mode

The play mode begins when either start pushbutton is pressed. The mode ends when the player's last ship of the game is lost.

If the 1 PLAYER START pushbutton was pressed, the following picture is displayed: the PLAYER 2's score disappears; the PLAYER 1's score becomes 00, and the number of ships (3 or 4, depending on the operator's setting) for the game appears below that score. The message PLAYER 1 also appears below the high score to date. Two seconds after pressing the 1 PLAYER START button the PLAYER 1 message disappears, and the game ship appears at the center of the display. Four large asteroids appear and drift in from the outer edges of the display.

If the 2 PLAYER START pushbutton is pressed, the following picture is displayed: the PLAYER 1 and PLAYER 2 scores become 00, and the number of ships for the game appears below each score. The player 1 score also flashes as the message PLAYER 1 appears below each score. The player 1 score also flashes as the message PLAYER 1 appears below the high score to date. Two seconds after the 2 PLAYER START pushbutton is pressed, the PLAYER 1 message disappears. The game ship for player 1 appears at the center of the display as four large asteroids appear and drift in from the outer edges of the display.

By pressing the LEFT ROTATE and RIGHT ROTATE pushbuttons on the control panel, the player may aim the spaceship toward any of the asteroids. By pressing the FIRE pushbutton, the player may shoot at the asteroids.

When shot, each large asteroid divides into two medium-sized asteroids and the game adds twenty points to the player's score. Medium-sized asteroids, when shot, divide into two small-sized asteroids, and the player receives fifty points. Small-sized asteroids, when shot, will completely disappear, and the game awards 100 points to the player. When a player has shot all asteroids, a new set of large asteroids again appear and drift in from the outer edges of the TV monitor display. At the beginning of the game, four large asteroids appear. At the beginning of the next cycle when large asteroids reappear, there are six, the next time eight, and thereafter ten—to increase player challenge.

At any time during game play, a flying saucer may appear from either side of the display. The game awards 200 points for shooting a large saucer and 1000 points for a small saucer. (The latter is a smaller target for players, though not any faster moving than the large one. It also shoots more accurately.)

The player's objective in the game is to shoot and destroy as many asteroids as possible before all his or her spaceships are destroyed. A ship is destroyed if an asteroid or saucer smashes into it, or if a flying saucer shoots it. To prevent losing a ship, the player may press the THRUST pushbutton to move out of the path of an asteroid or saucer. As an emergency maneuver, players can press the HYPERSPACE pushbutton: the ship disappears and reappears at a random location on the display—however, possibly right on top of, or in the path of, an asteroid. The ship may also explode on reentry.

The game awards an extra ship each time a player's score reaches multiples of 10,000; i.e., one ship is awarded at 10,000 points, another ship at 20,000 points, etc.

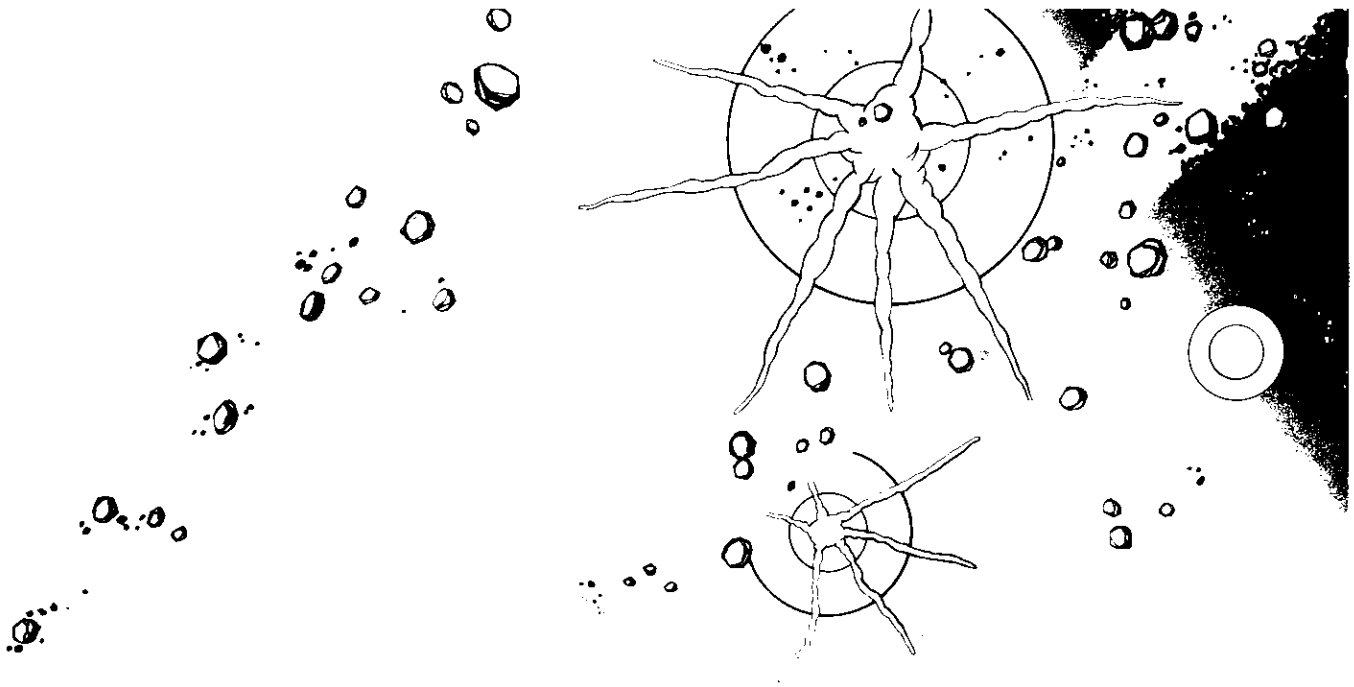
When the last ship of the game is destroyed, the message GAME OVER appears below the high score. This message remains for 3 seconds before the high score initial mode begins.

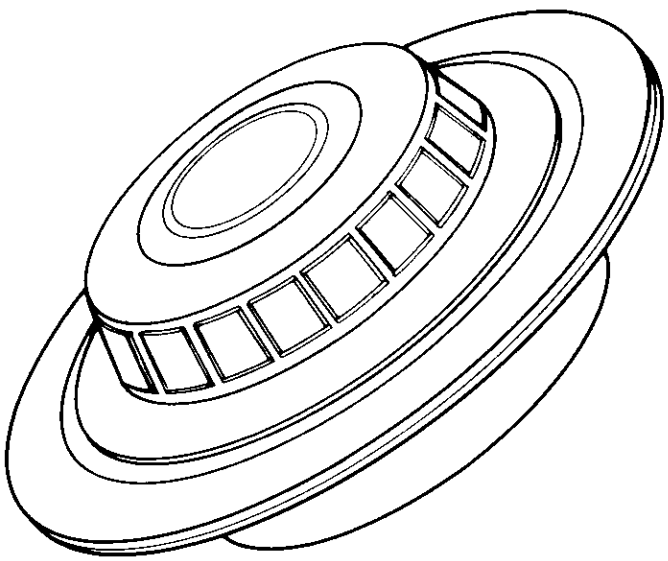
4. High Score Initial Mode

At the beginning of the high score initial mode, the player instructions appear at the top of the screen, and **A** _ _ appears at the lower center of the display. Players enter initials one character at a time. By pressing the LEFT ROTATE pushbutton, the display character steps through the alphabet from A to Z. By pressing the RIGHT ROTATE pushbutton, the character steps through the alphabet from A to a blank, then from Z to A.

Once the game displays the desired letter, players should press the HYPERSPACE pushbutton to record the letter: then an A appears in the next space.

If players need only two letters for their initials, they should use the blank between Z and A in one of the three locations. Pressing the HYPERSPACE pushbutton a third time will cause the initials and game score to be transferred to the "10 highest scores" listing that appears during the attract mode.





This Atari game requires certain maintenance to keep it in good working order. Clean, properly maintained games attract players and earn more profits.

The most important maintenance item is running the self-test every time you collect money from the cash box. Just looking at a game will not tell you if LED switches or leaf switches are broken or if LEDs have burned out. The self-test will inform you of any of these problems.

Second, you should regularly clean the outside of the game and the coin acceptor. In addition, you will need to regularly clean the leaf switch contacts: for details see this chapter.

Maintenance and Repair

2

A. Cleaning

The exterior of the game cabinet and the metal and glass surfaces 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.

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 in Figure 18 of this manual. See the Quadrascan TV monitor manual, TM-151, for the monitor fuse data.

C. Opening the Control Panel

To open the control panel, simply unscrew the two Allen-head screws at the top of each control panel. Once the screws are removed, tilt the control panel towards you.

1. Leaf Switch Replacement

All five of these leaf switches operate on 5 volts at very low current. Therefore, pitting of these switches will be extremely rare. Probably the only reason that pitting would occur is in very high-humidity locations.

Don't burnish the switch contacts. Burnishing them removes their plating, thus increasing the corrosion of the contacts. **The best method of cleaning the switch contacts is to wipe them with a non-abrasive surface.** A business card works great.

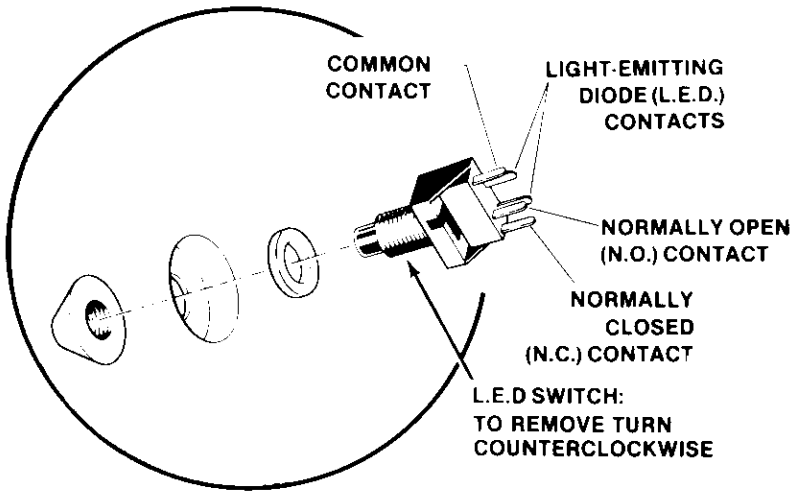
To replace any switch, remove both of its screws with a Philips-head screwdriver—see Figure 9.

If the white button itself needs to be replaced, turn the stamped nut with a wrench in a counter-clockwise direction, as seen from the inside of the control panel. The white ring on the outside of the control panel should not spin, due to its design.

2. LED Switch Replacement

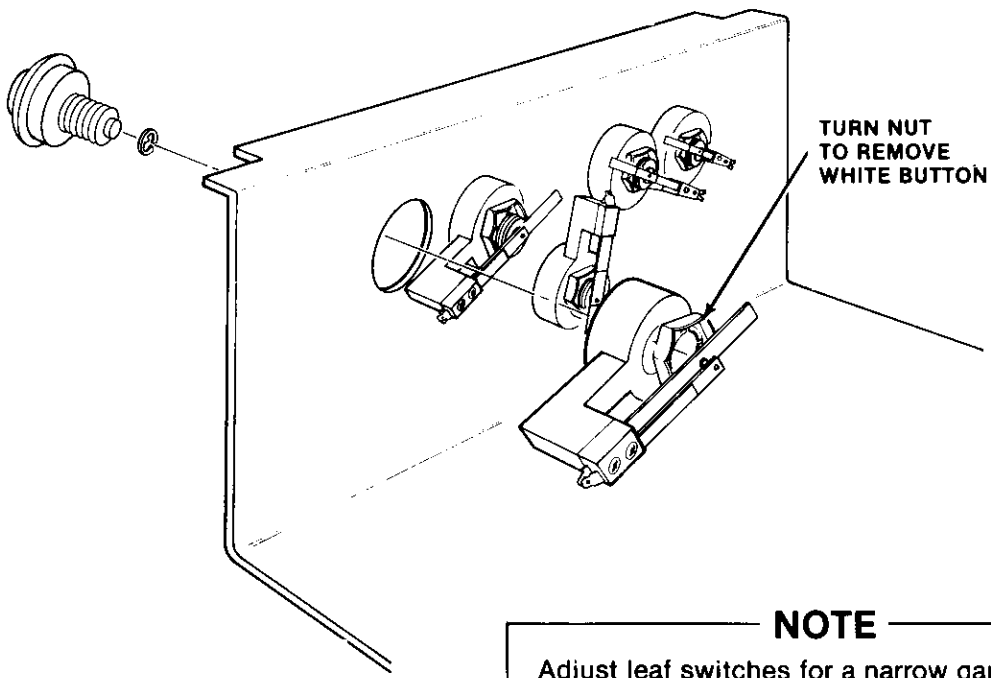
The light-emitting diode (LED) switches on the side of the cabinet above the coin machine have a very low failure rate. In case a switch should ever be suspect, first test it per the description that follows. To replace a switch, refer to Figure 9.

1. Remove the wires from the suspected switch.
2. Set ohmmeter to R × 1 scale, then zero the meter.
3. Connect ohmmeter leads to appropriate LED switch contacts (see Figure 9 for designation of switch contacts).
4. Check contacts (push and release the switch button) for closed and open continuity.
5. If the contacts do not operate sharply or always remain closed or open, then replace the LED switch as outlined in the figure.



To remove LED switch:

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



NOTE

Adjust leaf switches for a narrow gap. When a switch button is depressed, the resulting wiping action of the contacts provides a self-cleaning feature.

Figure 9 Opening the Control Panel and Replacing Switches

D. TV Monitor Replacement

⚠ WARNING ⚠

High voltages may exist in any TV monitor, even with power disconnected. Use extreme caution and do not touch electrical parts of the TV yoke area with your hands or with metal objects in your hands! If you drop the TV monitor and it breaks, **it will implode!** Shattered glass and the yoke can fly 6 feet or more from the implosion. Use care when replacing any TV monitor.

If you should need to remove the Quadrascan X-Y TV monitor, follow steps 1 thru 4 as follows. Refer also to Figure 10

1. Unlock and open the access panel.
2. Unfasten and open the table top.
3. Locate the 12-pin Molex connector between the game PCB and the TV monitor. Separate this connector.
4. Locate the four Philips-head screws (one at each corner of the TV monitor screen) that attach the TV monitor to the top of the cabinet. Remove these screws.
5. Carefully lift the TV monitor up and out of the cabinet.

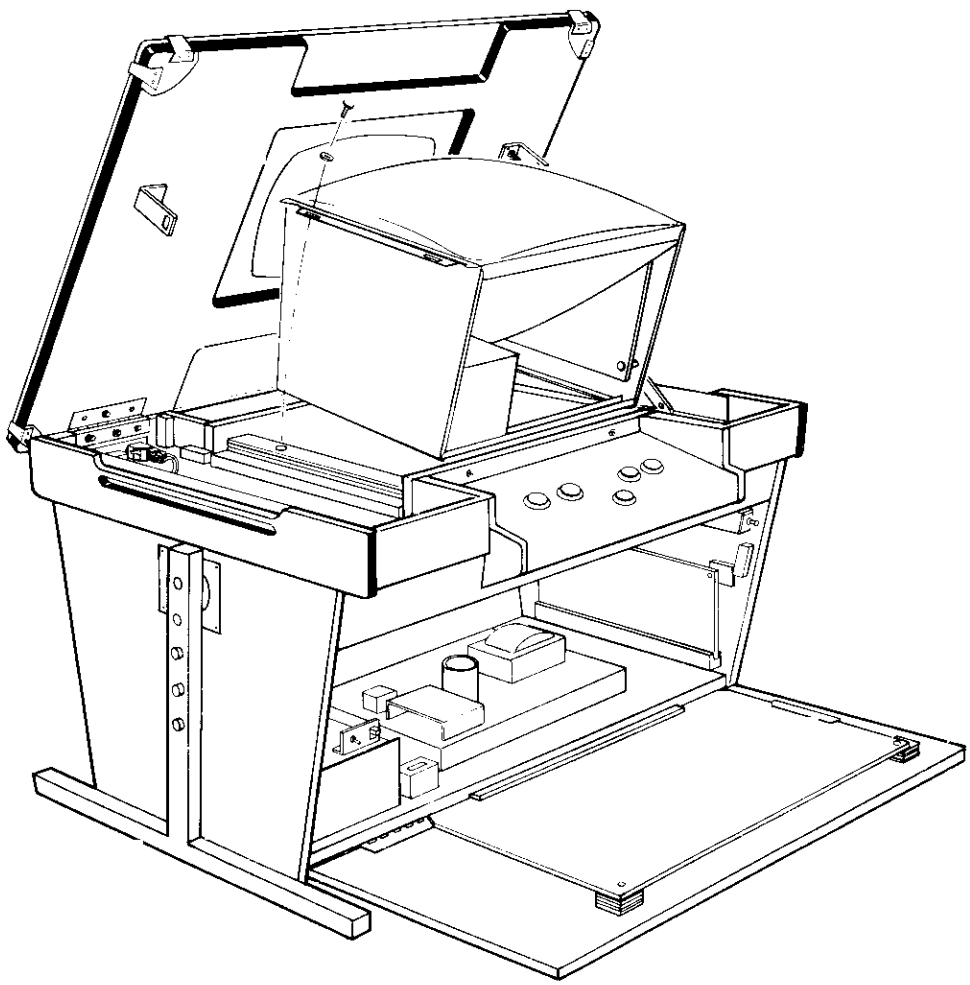


Figure 10 TV Monitor Removal

E. 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 11 and proceed as follows:

1. Game PCB Removal

a. Unlock and open the access panel.

b. Remove the 44-pin edge connector from the right-side of the game PCB.

c. Locate the two Philips-head screws that extend through the PCB and into the two wood blocks at the lock side of the access panel. Remove these two screws.

d. Remove the PCB from the access panel by lifting up and pulling it out of the plastic PCB mounting (extrusion) at the hinge-side of the access panel.

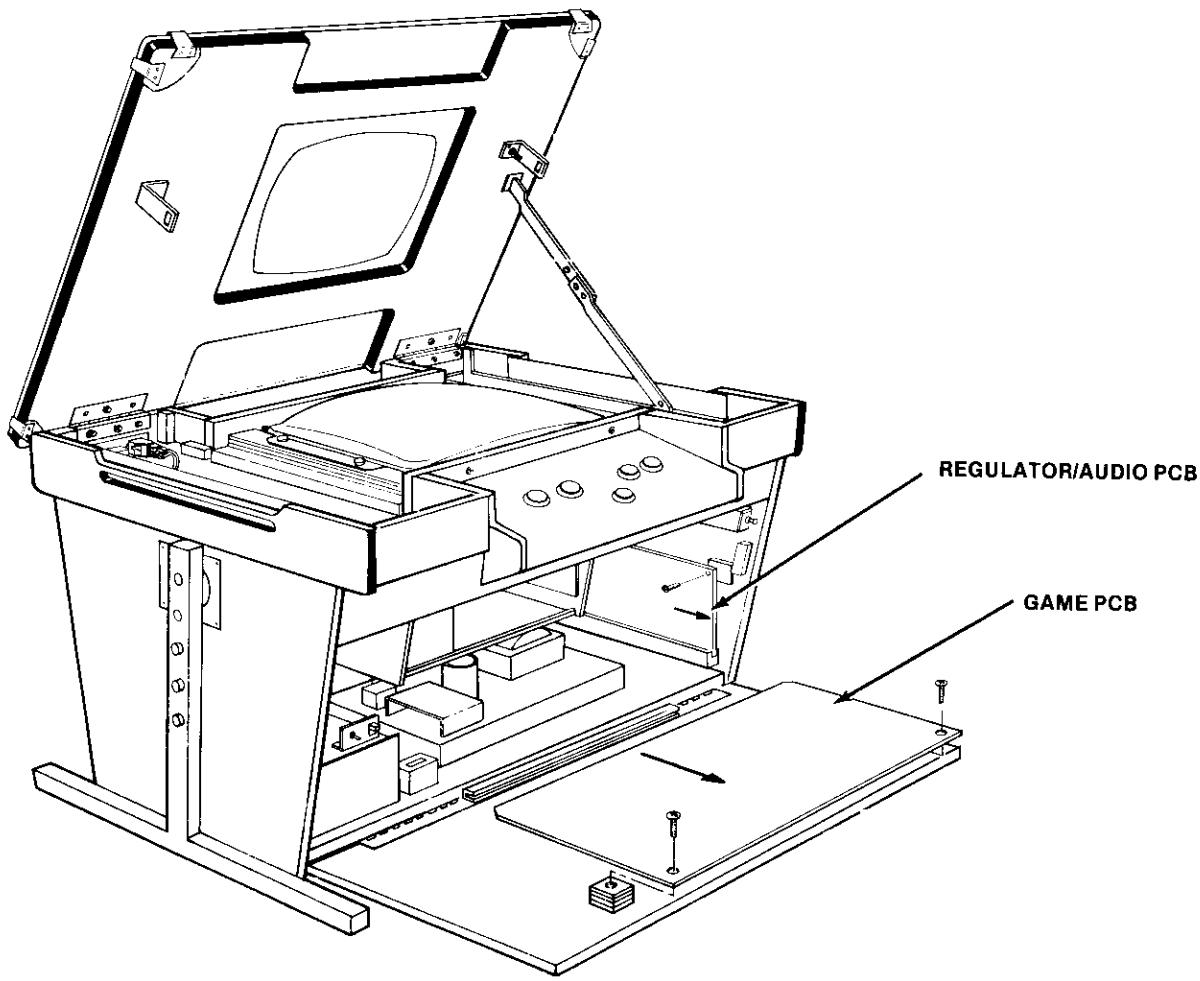


Figure 11 Printed Circuit Board Removal

e. Reinstall the PCB, making sure that the 44-pin edge connector is properly plugged in. Note that the connector is keyed to fit in only one way, so if it doesn't slip on easily, don't force it! **A reversed connector will probably damage your game** and will void the warranty.

f. Check that the operation of the game is correct by **performing the self-test.** This is especially important with any game when you replace a PCB. Unless you are a qualified technician, **do not adjust the knob on the PCB.**

2. Regulator/Audio PCB Removal

a. Unlock and open the access panel.

b. Remove the three plug-in connectors.

c. Locate the two Philips-head screws that extend through the PCB and into the two wood blocks at the top two corners of the PCB. Remove these two screws.

d. Remove the PCB from the wall of the cabinet by pulling it up and out of the wood slot.

e. Reinstall the game PCB.

f. Check that the operation of the game is correct by **performing the self-test.** This is especially important with any game when you replace a PCB. Unless you are a qualified technician, **do not adjust the knob on the PCB.**

F. Game Operation

With this manual you received two large sheets that contain the wiring and schematic diagrams for the Asteroids game. Sheet 1, Side A, includes information that shows the arrangement of these diagrams. These diagrams include information that explains the functions of the circuits and defines inputs and outputs.

Atari's Asteroids is a microprocessor-controlled game. The microprocessor is contained on the game PCB. The game PCB receives switch inputs from the control panel, coin mechanism and start switches. These inputs are processed by the game PCB and output to the TV monitor, Regulator/Audio PCB and LED switches.

The TV monitor is an X-Y monitor. Therefore, the monitor receives signals for the X,Y and Z axes. Since the location of the beam in the monitor is totally controlled by the X- and Y-axis outputs of the game PCB, the game PCB does not contain a standard sync circuit. The X- and Y-axis inputs to the monitor step in increments of 1024 steps for the X (horizontal) axis and 768 steps for the Y (vertical) axis. The Z axis merely controls the intensity of the beam.

The Regulator/Audio PCB performs two functions: 1) regulates the +10.3 VDC from the power supply to +5 VDC, and 2) amplifies the audio output from the game PCB. The +5 VDC from the Regulator/ Audio PCB provides most logic power to the game PCB. The audio output from the Regulator/Audio PCB directly drives the game speakers and is controlled by the volume control located inside the access panel and on the floor of the cabinet.

The Power Supply is the source of all voltages in the game. These voltages are protected by five fuses in the fuse block on the Power Supply chassis. The primary winding of the Power Supply transformer is protected by the cartridge type fuse in the power supply chassis

Figure 12 illustrates the distribution of power in this game. Figure 13 illustrates the distribution of signals.

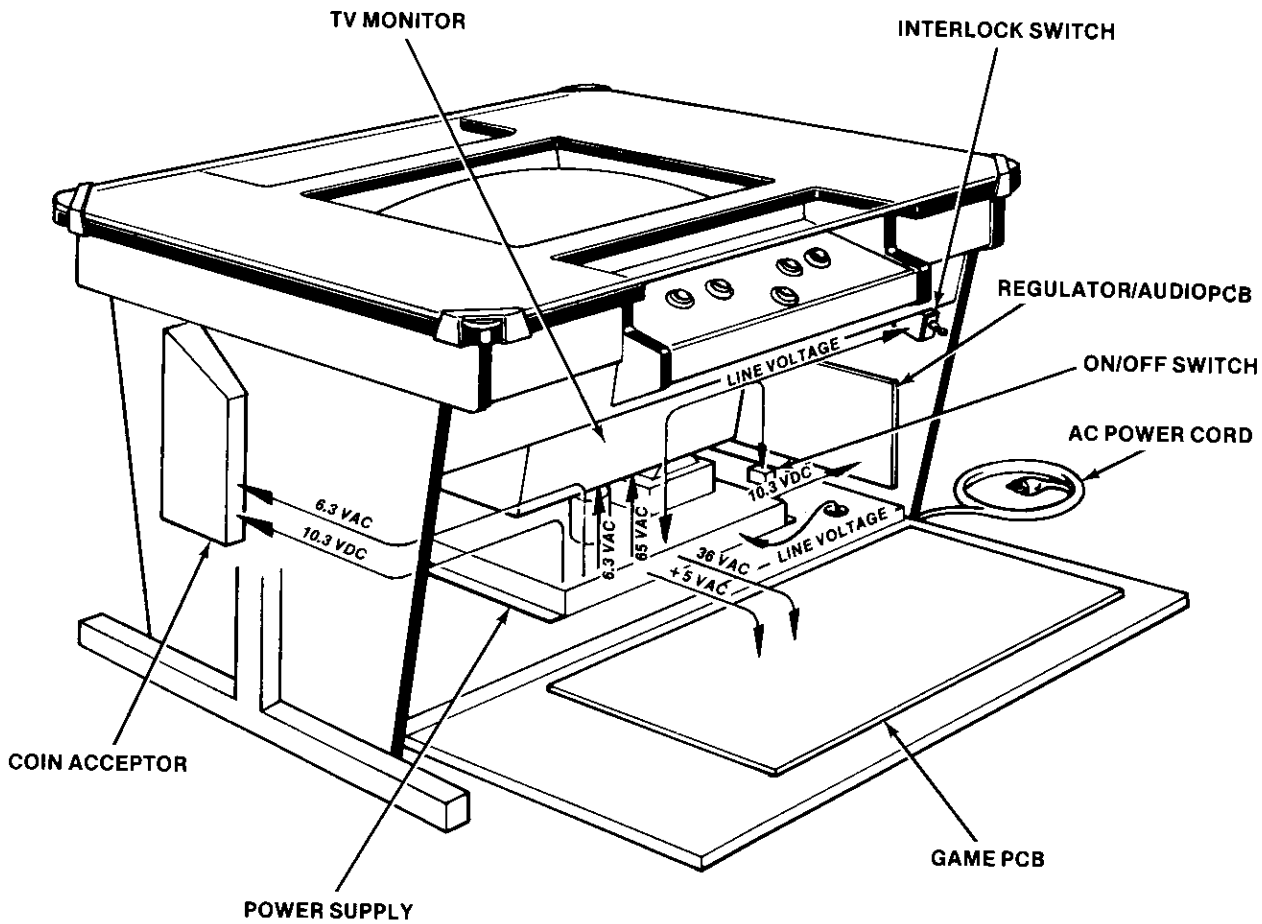


Figure 12 Power Distribution

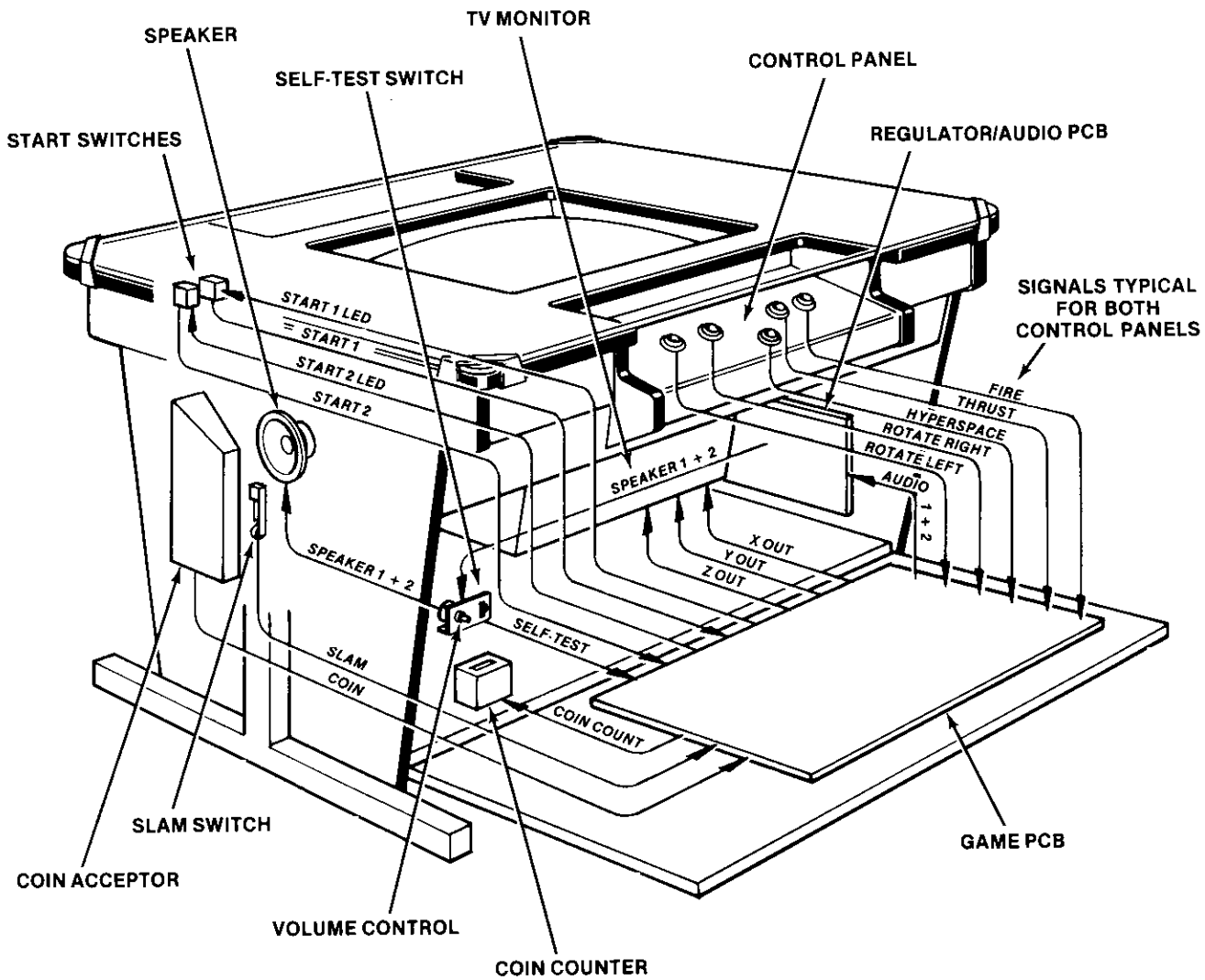
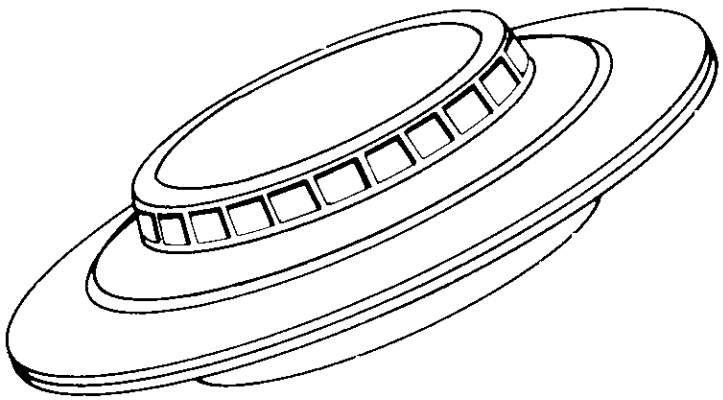


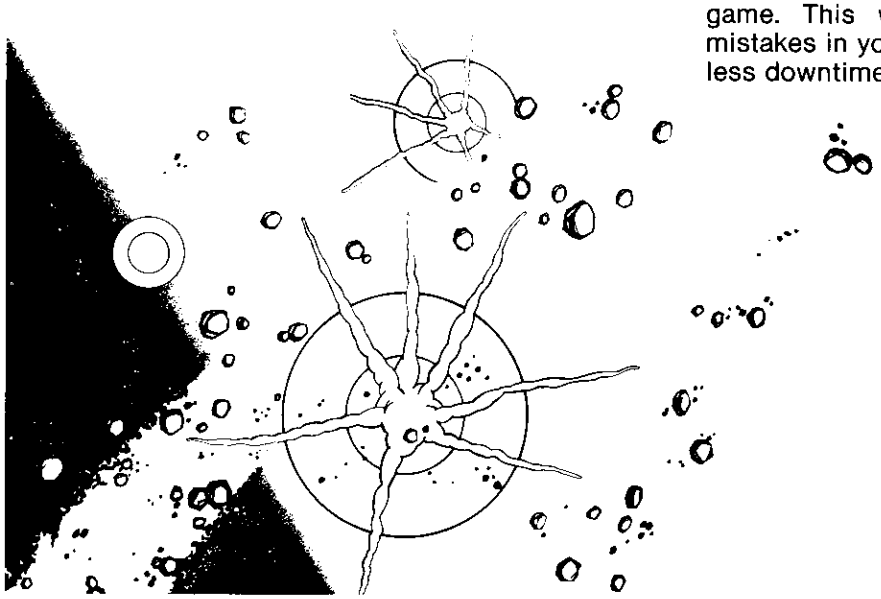
Figure 13 Signal Distribution

Illustrated Parts Lists



The purpose of this chapter is to provide you with the necessary information for ordering replacement parts for your Atari Asteroids game. Please note that, for simplicity, **common hardware has been deleted** from most of these parts lists. This includes screws, nuts, washers, bolts, etc.

When ordering parts from your distributor, give the part number, part name, applicable figure number of this manual, 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.



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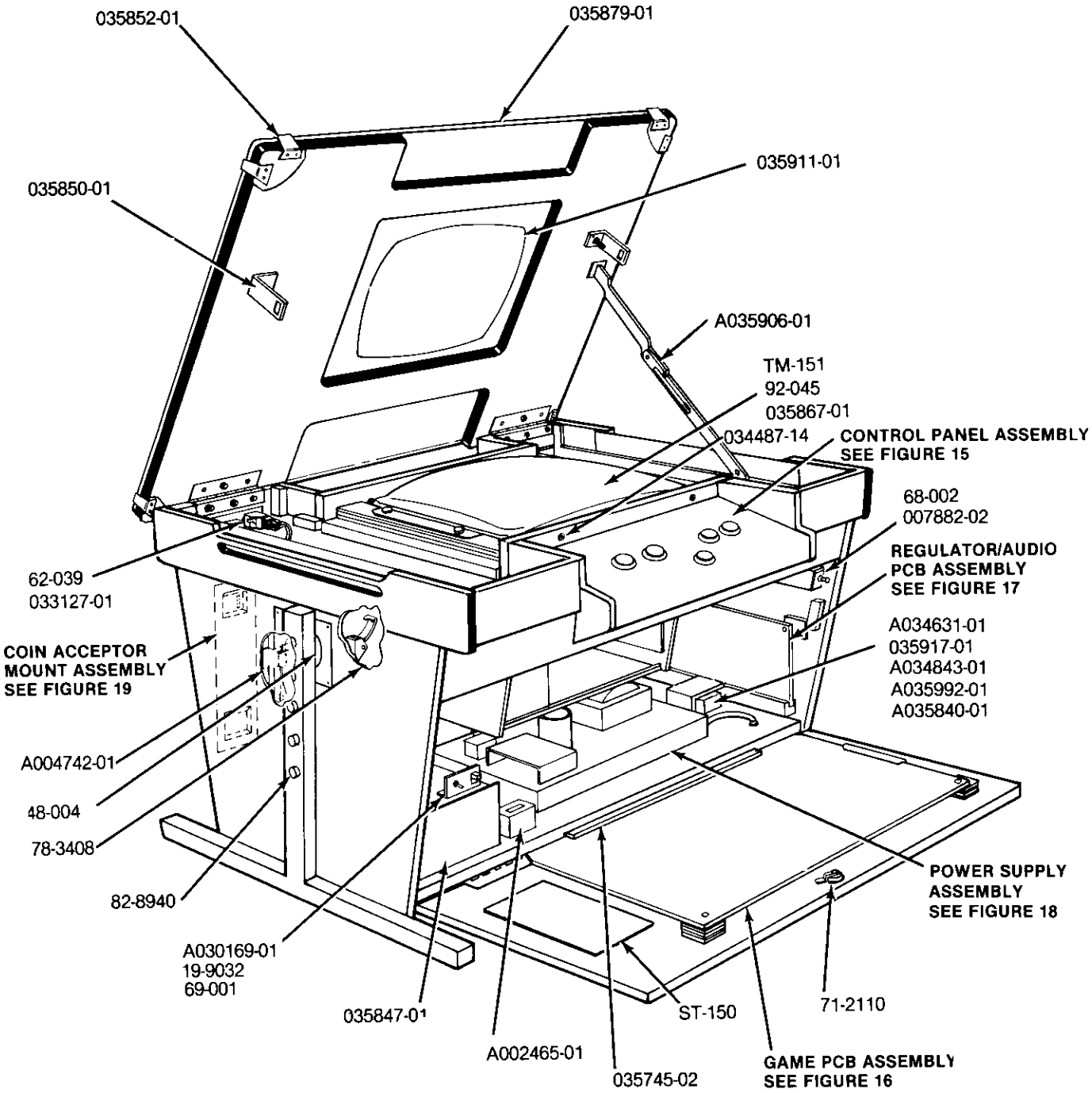


Figure 14 Final Assembly
A035836-XX A

Figure 14 Parts List

Part No.	*Description*
A002465-01	Coin Counter Assembly
A004742-01	Slam Switch Assembly
A030169-01	Audio Control/Test Switch Assembly
A034631-01	15 Amp @ 125 V (10 Amp @ 250 V) DPDT Toggle Switch
A034843-01	AC Harness Assembly
A035840-01	Main Harness Assembly
A035906-01	Top Support Assembly
A035992-01	Strain Relief Power Cord Assembly for use in USA and Japan
ST-150	Self-Test Label
TM-151	Quadrascan "X-Y" Monitor Manual
19-9032	50-Ohm, 12.5 Watt, Wire Wound Rheostat
48-004	16-Ohm, 4 Watt, 4-inch General Loudspeaker
62-039	SPDT Momentary-Contract Pushbutton Switch
68-002	30 Amp Interlock Switch
69-001	DPDT Slide Switch
71-2110	Panel Cartridge Lock Mechanism
82-8940	#3/8-16 × 2½" Button Head Hex Socket Machine Thread Screw
92-045	15" X-Y Monitor
007882-02	Interlock Switch Cover
033127-01	Black Moulded Polycarbonate Switch Bushing
034487-14	#10-32 × 7/8" Button Head Hex Head Machine Thread Screw with Thread Lock Compound
035745-02	18" PCB Extrusion
035845-01	Coin Box Lid
035847-01	Coin Box
035850-01	Latch Bracket
035852-01	Corner Bracket
035867-01	Transparent Blue Acrylic Overlay
035879-01	Glass Top with Graphics
035911-01	Monitor Bezel
035917-01	On/Off Switch Cover

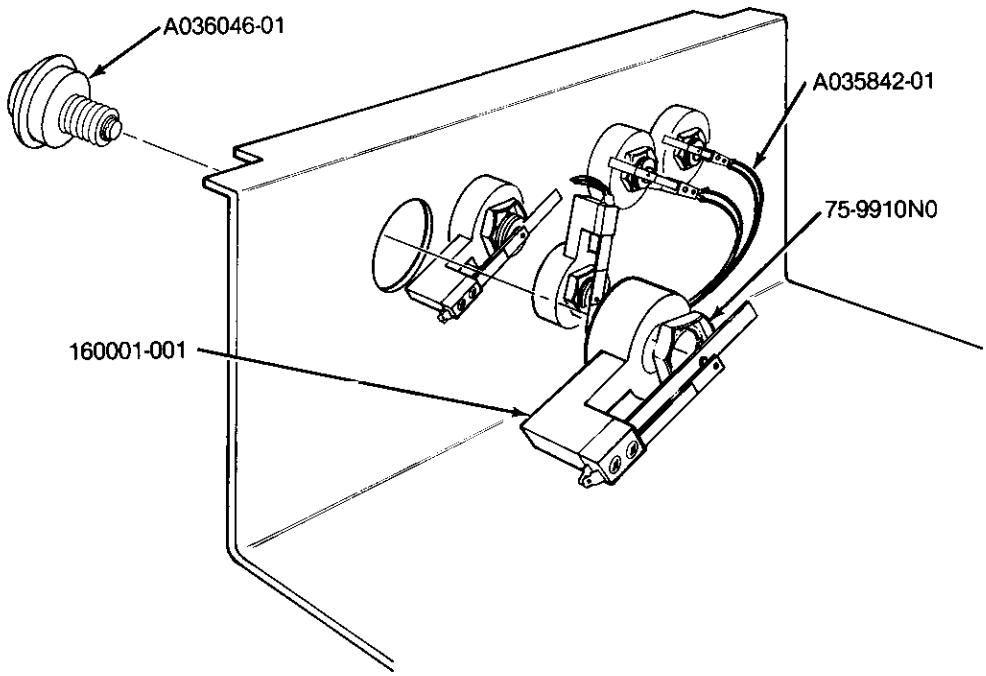
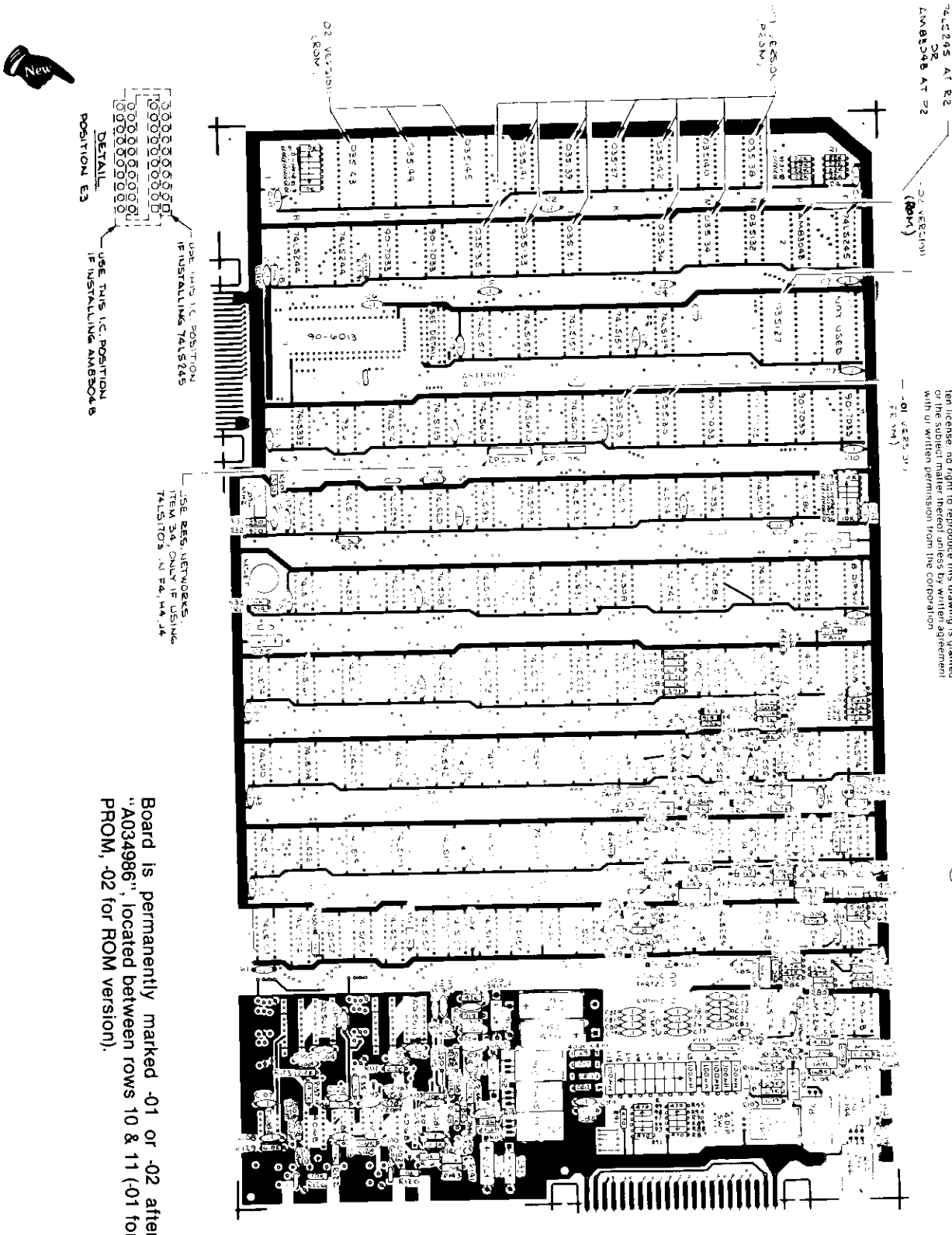


Figure 15 Control Panel Assembly A035910-01 C

Part No.	*Description (Reference Designations and Locations in Bold)*
A035842-01	Control Panel Harness Assembly
A036046-01	Button Assembly
75-9910N0	#5/8-11 Stamped Nut
160001-001	Switch with Button Holder



Board is permanently marked -01 or -02 after "A034986", located between rows 10 & 11 (-01 for PROM, -02 for ROM version).

Figure 16 Asteroids™ Game PCB Assembly A034986-03 and -04 G

Figure 16 Asteroids Game PCB Assembly Parts List

Item	Part No.	Description (Reference Designations and Locations in Bold)
2	100000-270	27 Ohm, ±5%, ¼W Resistor **(R72)**
3	100000-680	68 Ohm, ±5%, ¼W Resistor **(R71)**
4	100000-121	120 Ohm, ±5%, ¼W Resistor **(R105, 109)**
5	100000-151	150 Ohm, ±5%, ¼W Resistor **(R55)**
6	100000-331	330 Ohm, ±5%, ¼W Resistor **(R30, 31, 115)**
7	100000-471	470 Ohm, ±5%, ¼W Resistor **(R32, 87-99)**
8	100000-681	680 Ohm, ±5%, ¼W Resistor **(R57, 61)**
9	100000-102	1K Ohm, ±5%, ¼W Resistor **(R27, 29, 53, 73, 85, 86, 132, 134)**
10	100000-271	270 Ohm, ±5%, ¼W Resistor **(R112, 113)**
11	100000-122	1.2K Ohm, ±5%, ¼W Resistor **(R35, 100)**
12	100000-222	2.2K Ohm, ±5%, ¼W Resistor **(R36, 75, 117, 123, 133, 141)**
13	100000-272	2.7K Ohm, ±5%, ¼W Resistor **(R66)**
14	100000-332	3.3K Ohm, ±5%, ¼W Resistor **(R56, 65, 74, 142)**
15	100000-392	3.9K Ohm, ±5%, ¼W Resistor **(R39, 64, 106-108)**
16	100000-472	4.7K Ohm, ±5%, ¼W Resistor **(R37, 82, 102, 137, 140, 144)**
17	100000-562	5.6K Ohm, ±5%, ¼W Resistor **(R40, 62, 67)**
18	100000-682	6.8K Ohm, ±5%, ¼W Resistor **(R49, 104, 128, 129)**
20	100000-103	10K Ohm, ±5%, ¼W Resistor **(R9-26, 28, 33, 38, 54, 58-60, 63, 69, 70, 79, 80 103, 110, 111, 116, 122, 130, 131, 135, 136, 138, 139)**
21	100000-123	12K Ohm, ±5%, ¼W Resistor **(R43)**
22	100000-153	15K Ohm, ±5%, ¼W Resistor **(R68)**
23	100000-183	18K Ohm, ±5%, ¼W Resistor **(R51, 146)**
24	100000-223	22K Ohm, ±5%, ¼W Resistor **(R1-8, 34, 41, 45, 50)**
25	100000-333	33K Ohm, ±5%, ¼W Resistor **(R52)**
26	100000-473	47K Ohm, ±5%, ¼W Resistor **(R42, 44, 48, 76, 78, 83, 114)**
27	100000-563	56K Ohm, ±5%, ¼W Resistor **(R145)**
28	100000-104	100K Ohm, ±5%, ¼W Resistor **(R46, 81, 84, 143)**
29	100000-224	220K Ohm, ±5%, ¼W Resistor **(R47)**
30	100000-274	270K Ohm, ±5%, ¼W Resistor **(R101)**
33	100000-393	39K Ohm, ±5%, ¼W Resistor **(R77)**
34	19-007	10K Ohm, 8-Pin Resistor Network. Use with the LS170 only, item 120. **(RP1, 2)**
35	19-315103	10K Ohm Vertical PCB-Mounting Cermet Trimpot, Bournes Series 3352V-1-10K **(R120, 126)**
39	21-101104	.1 uf, ±10%, Radial-Lead Epoxy-Dipped 100V Mylar Capacitor **(C64, 67-69)**
40	21-101224	.22 uf, ±10%, Radial-Lead Epoxy-Dipped 100V Mylar Capacitor **(C33)**
41	21-101473	.047 uf, ±10%, Radial-Lead Epoxy-Dipped 100V Mylar Capacitor **(C46)**
44	24-250105	1.0 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor **(C25, 70, 90, 92, 93)**
45	24-250107	100 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor **(C19)**
46	24-250477	470 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor **(C86, 87)**
47	24-250226	22 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor **(C117)**
49	27-250102	.001 uf Ceramic-Disc 25V Radial-Lead Capacitor **(C56)**
50	27-250103	.01 uf Ceramic-Disc 25V Radial-Lead Capacitor **(C27, 32, 36, 40, 55, 58)**
51	29-088	.1 uf Ceramic-Disc 25V Radial-Lead Capacitor **(C1-18, 20-23, 26, 28-31, 34, 37, 41-44, 49, 51-54, 57, 60, 61, 63, 65, 66, 71-85, 91, 94-96, 99, 100, 103, 104, 107, 108, 111, 112, 114-116, 120-123)**
53	28-101100	10 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor **(C97, 105)**
54	28-101680	68 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor **(C102, 110)**
55	28-101101	100 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor **(C89)**
56	28-101221	220 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor **(C98, 106, 118, 119)**
57	28-101271	270 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor **(C59)**
58	28-101391	390 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor **(C88)**
61	29-006	1.0 uf, ±10%, 35V Tantalum Capacitor **(C24, 35, 47, 50, 62, 113)**
63	29-046	10 uf, ±10%, 20V Tantalum Capacitor **(C38, 39, 45, 48)**
65	65-1N100	General Purpose Germanium Diode **(CR14)**
66	31-1N914	75V 1N914 Switching Diode **(CR1-4, 6-8, 15)**

Figure 16 Asteroids Game PCB Assembly, continued Parts List

Item	*Part No.*	*Description (Reference Designations and Locations in Bold)*
67	31-1N4001	50V 1N4001 Silicon Rectifier Diode **(CR9-12)**
68	31-1N756A	8.2V, ±5%, 1N756A Zener Diode **(CR13, 14)**
71	33-2N3906	Type 2N3906 PNP Switching and Amplifying Transistor **(Q1-5, 7, 10, 16, 17)**
72	34-2N3643	Type 2N3643 NPN Silicon Transistor **(Q6)**
73	34-2N3904	Type 2N3904 NPN 60V 1-Watt Transistor **(Q8, 9)**
74	34-2N6044	Type 2N6044 Darlington NPN Transistor **(Q11-13)**
75	34-MPSA06S	Type MPSA06S NPN 80V 500ma Transistor **(Q14, 15)**
78	37-74LS00	Type 74LS00 Integrated Circuit **(N5, C6)**
79	37-74LS02	Type 74LS02 Integrated Circuit **(D6)**
80	37-7404	Type 7404 Integrated Circuit **(H10)**
81	37-74LS04	Type 74LS04 Integrated Circuit **(B5, L5)**
82	37-7406	Type 7406 Integrated Circuit **(N9)**
83	37-74LS08	Type 74LS08 Integrated Circuit **(E6, K6, R7, B8)**
84	37-74LS10	Type 74LS10 Integrated Circuit **(A8)**
85	37-74LS14	Type 74LS14 Integrated Circuit **(B6)**
86	37-74LS20	Type 74LS20 Integrated Circuit **(E5)**
87	37-74LS32	Type 74LS32 Integrated Circuit **(M5, N6, B9)**
88	37-74LS42	Type 74LS42 Integrated Circuit **(L6, E7, E8)**
89	37-74LS74	Type 74LS74 Integrated Circuit **(D4, A7, R8)**
91	37-74LS83	Type 74LS83 Integrated Circuit **(M6)**
92	37-74LS86	Type 74LS86 Integrated Circuit **(P5)**
93	37-7497	Type 7497 Integrated Circuit **(F8, H8, J8, K8)**
94	37-74LS109	Type 74LS109 Integrated Circuit **(A9)**
95	37-74LS139	Type 74LS139 Integrated Circuit **(L3, E4)**
97	37-74LS157	Type 74LS157 Integrated Circuit **(F3, H3, J3, K3, F6, A10, B/C10, F/H10, C10 D/E10, E10)**
98	37-74LS161	Type 74LS161 Integrated Circuit **(C5, P8, B7, C7, D7)**
99	37-74LS164	Type 74LS164 Integrated Circuit **(K9, P9, R9)**
101	37-74LS174	Type 74LS174 Integrated Circuit **(N7, P7, D8, N11, F10)**
102	37-74LS175	Type 74LS175 Integrated Circuit **(M7)**
104	37-74LS191	Type 74LS191 Integrated Circuit **(K5, C9, D9, E9, F9, H9, J9)**
105	37-74LS193	Type 74LS193 Integrated Circuit **(F5, H5, J5)**
106	37-74LS244	Type 74LS244 Integrated Circuit **(B2, C2)**
107	37-74LS245	Type 74LS245 Integrated Circuit **(R2, E3)**
	OR	
108	37-8304B	Type 8304B Integrated Circuit—substitute for item 107 **(P2, E3)**
110	37-74LS251	Type 74LS251 Integrated Circuit **(J10, L10)**
111	37-74LS253	Type 74LS253 Integrated Circuit **(P6)**
112	37-74LS259	Type 74LS259 Integrated Circuit (M10)
114	37-74LS367	Type 74LS367 Integrated Circuit **(H6, J6)**
116	37-74LS393	Type 74LS393 Integrated Circuit **(B4, D5)**
117	37-74LS374	Type 74LS374 Integrated Circuit **(B10, D10)**
	OR	
118	37-74LS273	Type 74LS273 Integrated Circuit—substitute for item 117
119	37-74LS670	Type 74LS670 Integrated Circuit **(F4, H4, J4)**
	OR	
120	37-74LS170	Type 74LS170 Integrated Circuit—substitute for item 119
121	37-9316	Type 9316 Integrated Circuit **(C4)**
122	37-LM324	Type LM324 Integrated Circuit **(L8, P11)**
124	37-555	Type 555 Timer Integrated Circuit **(M8, N8, L9, R10)**
125	37-566	Type 566 Function Generator Integrated Circuit **(P10)**
127	37-4016B	Type 4016B Integrated Circuit **(M9, N10, R11, B12, D12)**
128	37-TL082CP	Type TL082CP Integrated Circuit **(A12, C12)**
129	37-AD561J	Type AD561J Integrated Circuit **(B11, D11)**
130	137108-001	Operational Amplifier Integrated Circuit **(B/C12, E12)**

Figure 16 Asteroids Game PCB Assembly, continued Parts List

Item	*Part No.*	*Description (Reference Designations and Locations in Bold)*
132	37-7805	+ 5V Voltage Regulator **(VR3)**
133	37-7812	+ 12V Voltage Regulator **(VR1)**
134	37-7815	+ 15V Voltage Regulator **(VR4)**
135	37-7915	– 15V Voltage Regulator **(VR2)**
137	38-MV5053	Type MV5053 Light-Emitting Diode **(CR5)**
139	41-3003	100 uH, ± 5%, Hot-Molded Plastic Fixed R.F. Choke **(L1-L15)**
141	62-001	SPST Pushbutton Switch **(A6)**
142	66-118P1T	8-Station Single-Throw, Dual-Inline-Package Bit Switch **(R6)**
143	66-114P1T	4-Station Single-Throw, Dual-Inline-Package Bit Switch **(M12)**
144	79-42C40	40-Contact Medium-Insertion-Force Integrated Circuit Socket **(C3)**
146	81-4302	Nylon Snap-In Fastener
148	020670-01	Test Point
150	90-102	12.096 MHz, ± .005%, Crystal **(Y1)**
151	90-6013	Microprocessor **(C3)**
152	90-7033	Random-Access Memory **(D2, E2, M4, N4, P4, R4)**
155	034602-01	Programmable Read-Only Memory **(C8)**
157	035127-01	Read-Only Memory **(N/P3)**
		OR THE FOLLOWING TWO ITEMS:
159	035129-01	Programmable Read-Only Memory, MSB—substitute for half of item 157 **(K4)**
159	035130-01	Programmable Read-Only Memory, LSB—substitute for half of item 157 **(L4)**

For remaining memory components and their part numbers, see listing below.

Memory Components and Their Equivalents (Locations Shown in Bold)

-01 P.C. Boards (PROMs)	Alternate -01 P.C. Boards (PROMs)	-02 P.C. Boards (ROMs)
035131-02 **J2**	035150-02 **J2**	035143-02 **C1**
035132-02 **N2**		
035137-02 **K1**	035153-02 **K1**	
035138-02 **N1**		
035133-02 **H2**	035151-02 **H2**	035144-02 **D/E1**
035134-02 **M2**		
035139-02 **J1**	035154-02 **J1**	
035140-02 **M1**		
035135-02 **F2**	035152-02 **F2**	035145-02 **F1**
035136-02 **L2**		
035141-02 **H1**	035155-02 **L1**	
035142-02 **L1**		

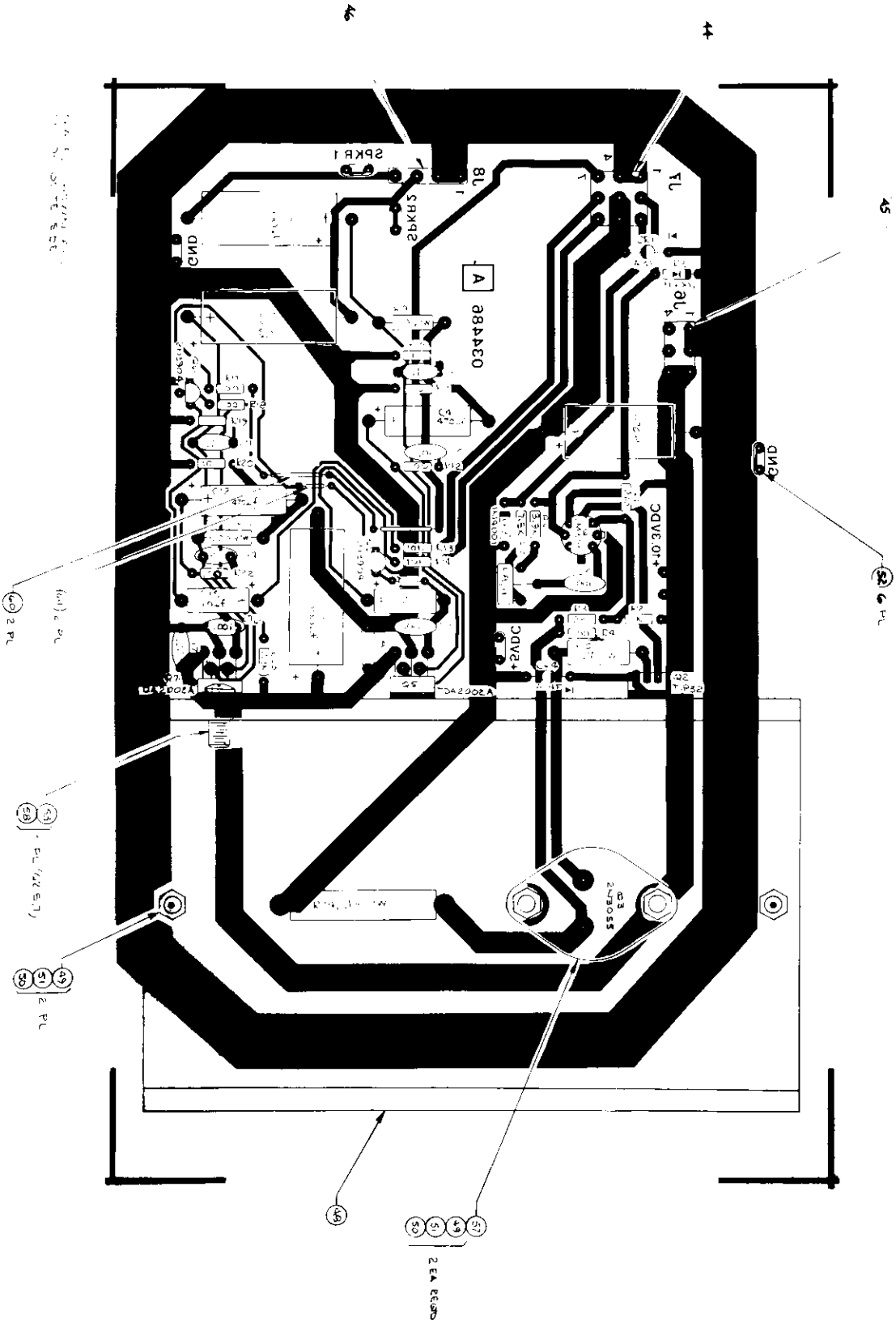
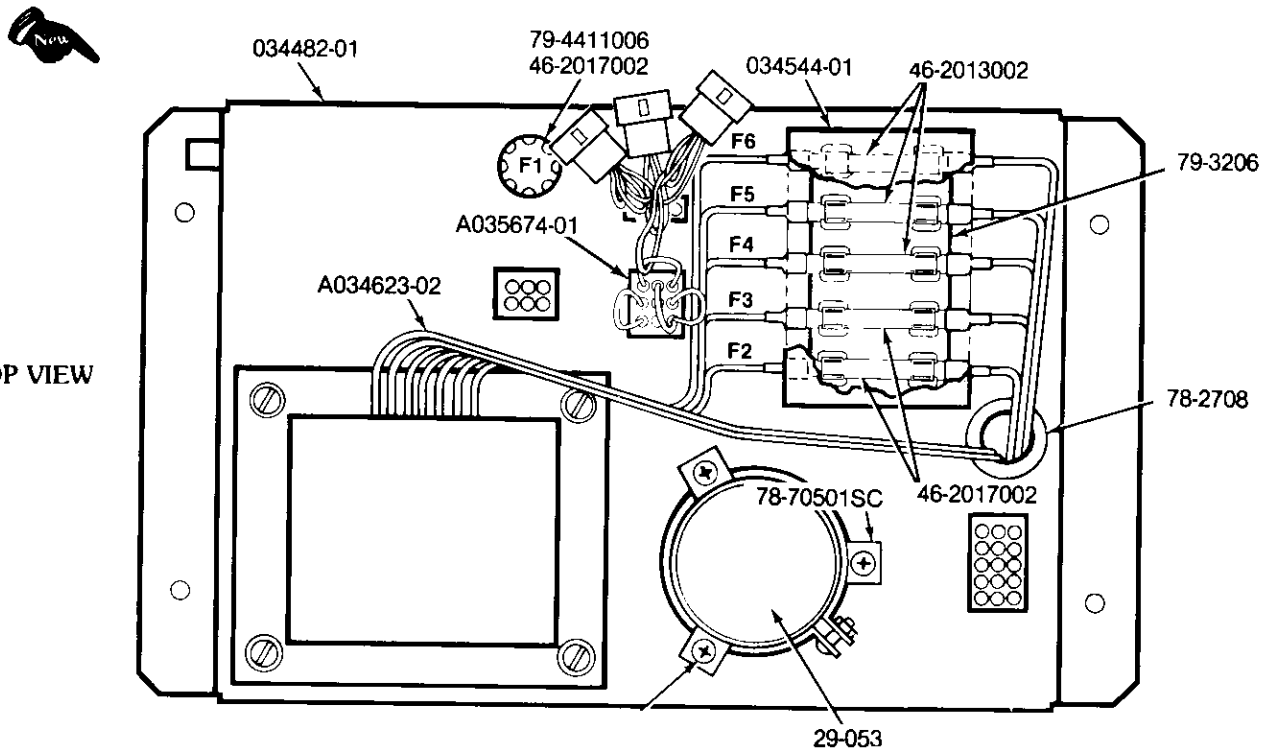


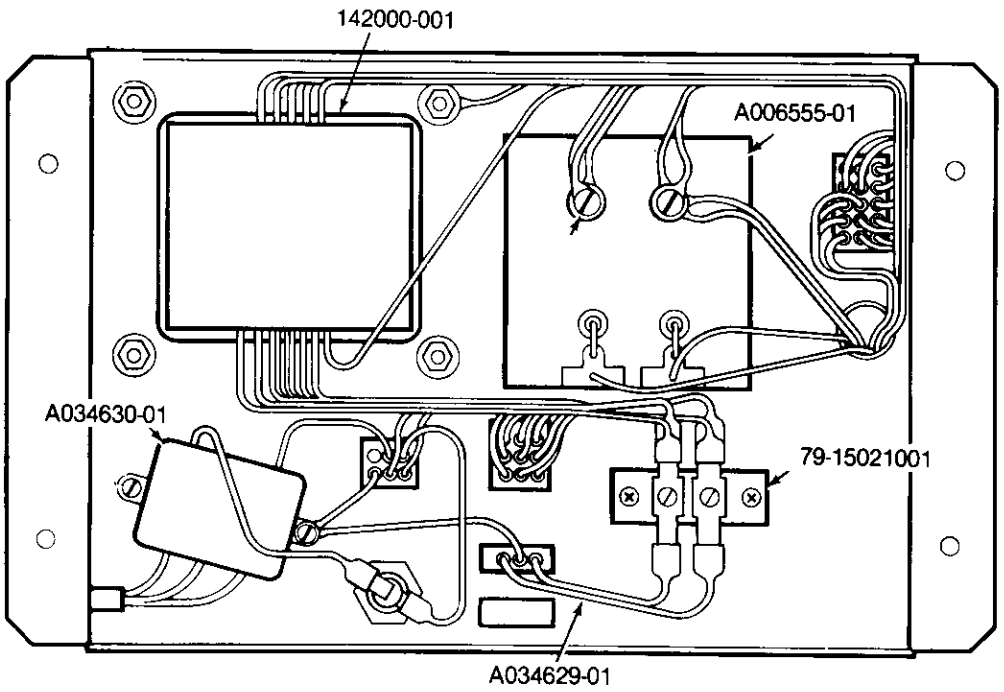
Figure 17 Regulator/Audio PCB Assembly A034485-01 D

Figure 17 Regulator/Audio PCB Assembly Parts List

Item	*Part No.*	*Qty.*	*Description (Ref. Designations in Bold)*
2	110000-010	2	1 Ohm, ± 5%, ¼W Resistor **(R10, 19)**
3	110000-100	2	10 Ohm, ± 5%, ¼W Resistor **(R11, 20)**
4	110000-330	1	33 Ohm, ± 5%, ¼W Resistor **(R3)**
5	110000-101	5	100 Ohm, ± 5%, ¼W Resistor **(R4, 12, 17, 18, 22)**
6	110000-271	1	270 Ohm, ± 5%, ¼W Resistor **(R1)**
7	110000-102	1	1K Ohm, ± 5%, ¼W Resistor **(R2)**
8	110000-272	1	2.7K Ohm, ± 5%, ¼W Resistor **(R23)**
9	110000-752	1	7.5K Ohm, ± 5%, ¼W Resistor **(R7)**
10	110000-103	2	10K Ohm, ± 5%, ¼W Resistor **(R13, 14)**
11	110000-392	1	3.9K Ohm, ± 5%, ¼W Resistor **(R6)**
13	110001-221	2	220 Ohm, ± 5%, ½W Resistor **(R9, 21)**
15	12-52P7	1	2.7 Ohm, ± 5%, 1W Resistor **(R5)**
16	19-100P1015	1	.1 Ohm, ± 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 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor **(C6, 15)**
22	24-250477	3	470 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor **(C1, 4, 12)**
23	24-250108	3	100 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor **(C9, 10, 13)**
25	27-250103	2	.01 uf Ceramic-Disc 25V Radial-Lead Capacitor **(C5, C14)**
26	27-250104	2	.1 uf Ceramic-Disc 25V Radial-Lead Capacitor **(C3, C11)**
27	27-250224	2	.22 uf Ceramic-Disc 25V Radial-Lead Capacitor **(C8, 17)**
29	27-250102	3	.001 uf 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
49	72-1608C	4	#6-32 × ½" 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 × ½" 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



TOP VIEW



BOTTOM VIEW

Figure 18 Power Supply Assembly for X-Y Games
A034561-03 E

Figure 18 Power Supply Assembly for X-Y Games Parts List

Part No.	*Description*
A006555-01	Rectifier Printed Circuit Board Assembly
A034623-03	Power Supply Harness Assembly, includes Shielded Power Transformer
A034629-01	A.C. Harness Assembly
A034630-01	RFI Filter Assembly
A035674-01	Voltage Plug Assembly
29-053	26,000 uf 15 V Electrolytic Capacitor
46-2013002	3-Amp. 250 V 3AG Slow-Blow Glass Cartridge-Type Fuse
46-2017002	7-Amp. 250 V 3AG Slow-Blow Glass Cartridge-Type Fuse
78-2708	Nylon Type 6/6 Hole Bushing with 5/8" Inside Diameter × 55/64" Outside Diameter × ¼" Thick
78-705015C	2" Diameter Capacitor Mounting Bracket
79-15021001	2-Circuit Single-Row Terminal Block
79-3206	5-Position 3AG Fuse Block with ¼" Quick-Disconnect Terminals
79-4411006	Panel-Mounting Non-Indicating 3AG Cartridge-Type Fuse Post
142000-001	Shielded Power Transformer
034544-01	Fuse Block Cover

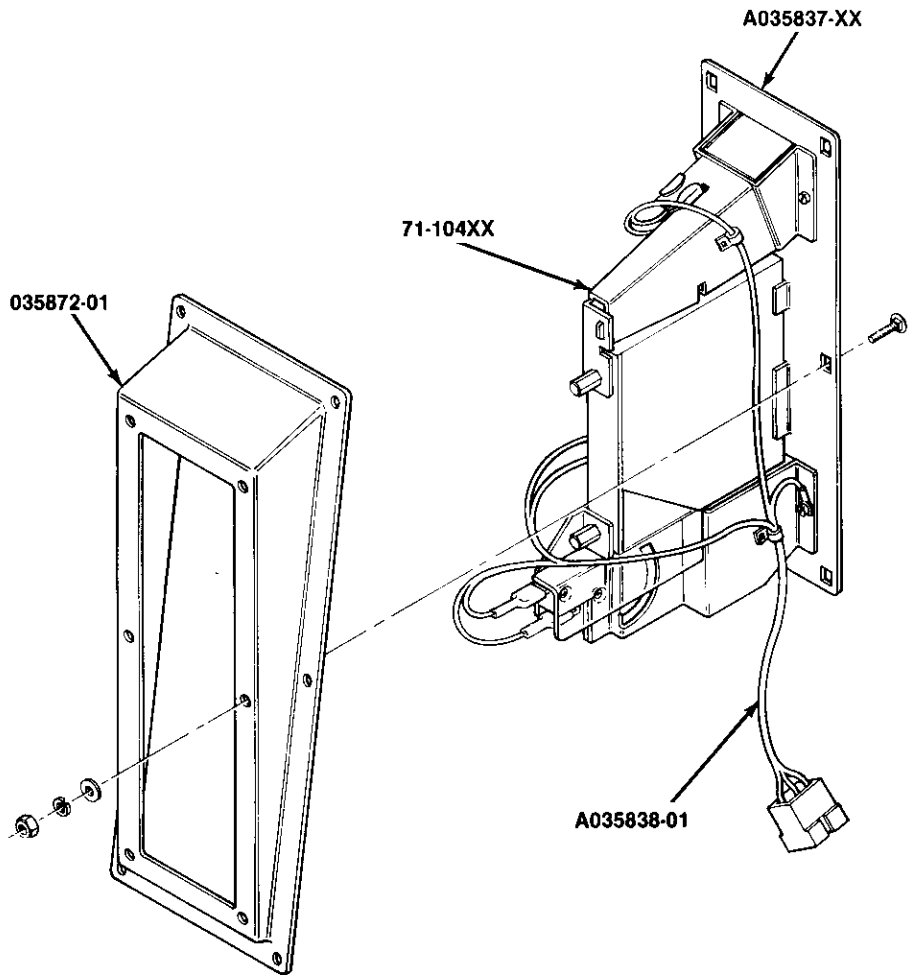


Figure 19 Coin Acceptor Assembly A035837-XX A

Part No.	*Description (Reference Designations and Locations in Bold)*
A035837-01	Face Plate, Coin Controls, Final Assy (25¢)
A035837-02	Face Plate, Coin Controls, Final Assy (100 Yen)
A035838-01	Coin Mech Harness (& Wiring Diagram)
035872-01	Mount, Coin Accepter
71-10425CU	Acceptor, Coin, 25¢
71-104100YJ	Acceptor, Coin, 100 Yen