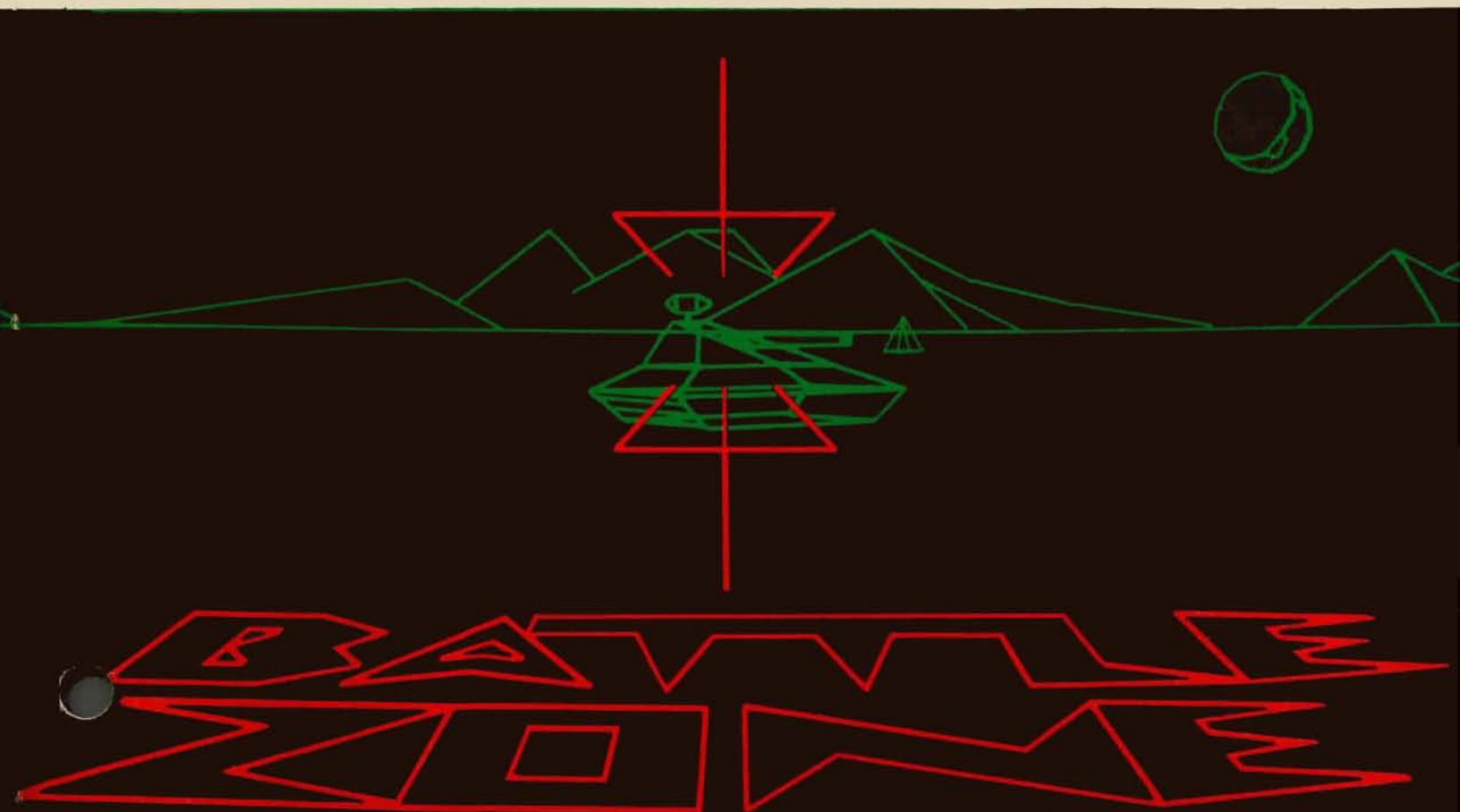


*See page 2
For game warning.*



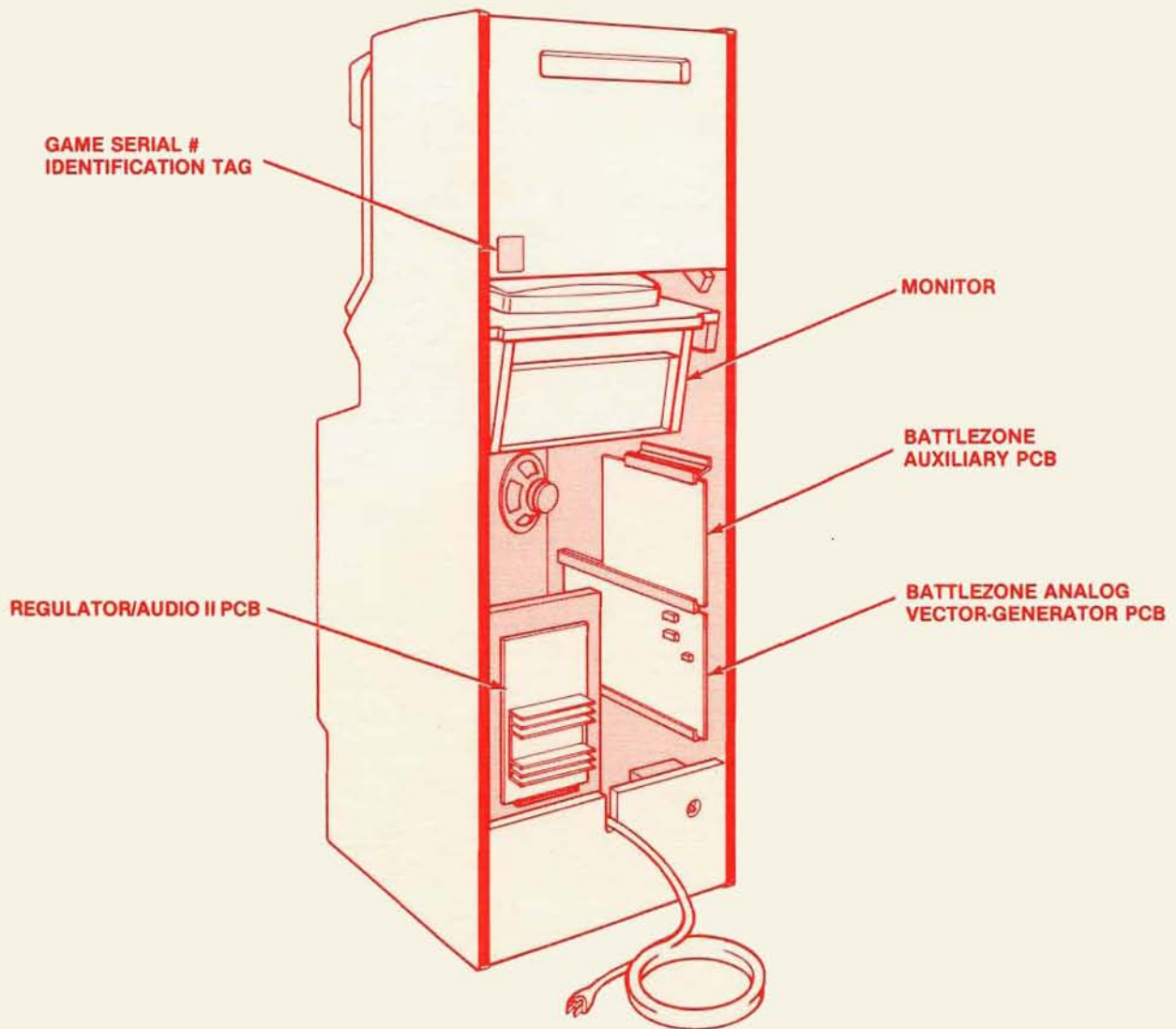
Operation Maintenance and Service Manual

Complete with Illustrated Parts Lists

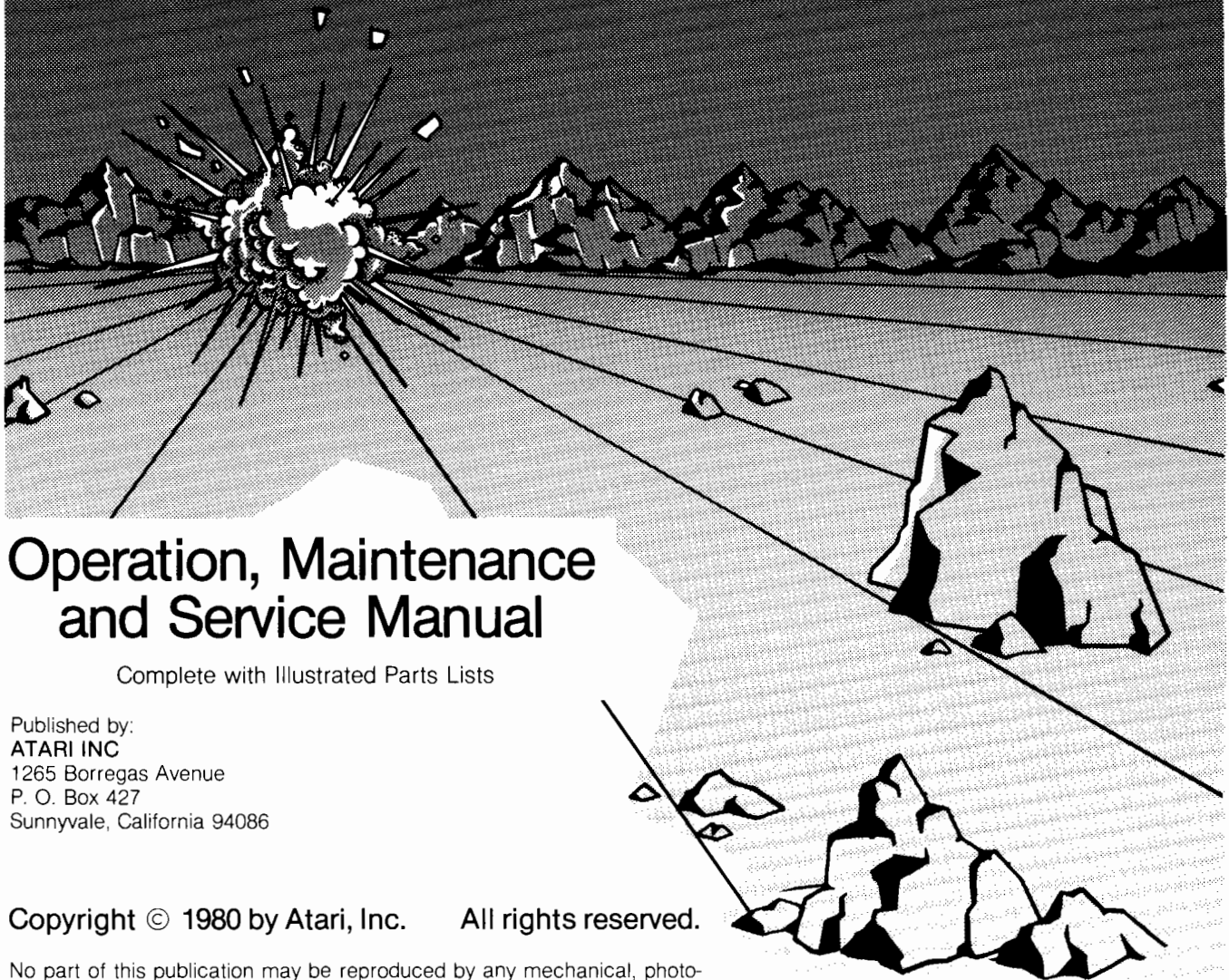


GAME SERIAL NUMBER LOCATION

Your game's serial number is stamped on a plate on the outside of the game. The same number is also stamped on the chassis of the TV monitor, Regulator/Audio II PCB, Battlezone Analog Vector-Generator PCB, and Battlezone Auxiliary PCB. Please mention this number whenever calling your distributor for service.



BATTLE ZONE™



Operation, Maintenance and Service Manual

Complete with Illustrated Parts Lists

Published by:
ATARI INC
1265 Borregas Avenue
P. O. Box 427
Sunnyvale, California 94086

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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.


WEST and CENTRAL U.S.A.

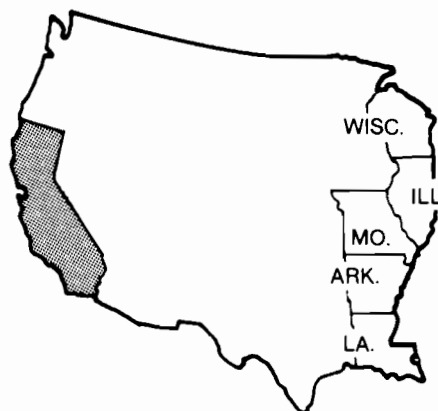
Parts for all Atari Customers. Sales and Service

Atari Coin-Op Customer Service
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Telex 17-1103

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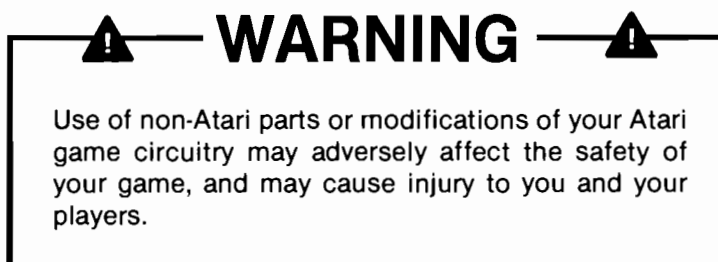
(Monday - Friday, 7:30 - 4:00 pm Eastern time)

 From New Jersey
(201) 469-5993

 From anywhere else in this area
toll-free (800) 526-3849



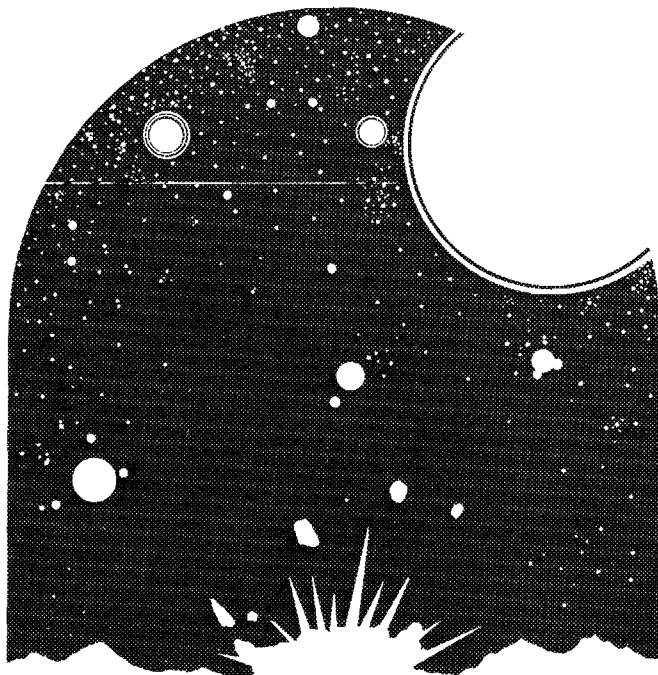
Notice Regarding Non-Atari Parts



Atari, Inc.'s warranty (printed on the inside back cover of this manual) may be voided, if you do any of the following:

- 1.) you substitute non-Atari parts in your coin-operated game, or
- 2.) you modify or alter any circuits in your Atari game by using kits or parts **not** supplied by Atari.

Not only may the use of any non-Atari parts void your warranty, but any such alteration may also adversely affect the safety of your game, and may cause injury to you and your players.



Location Setup



A. New Parts

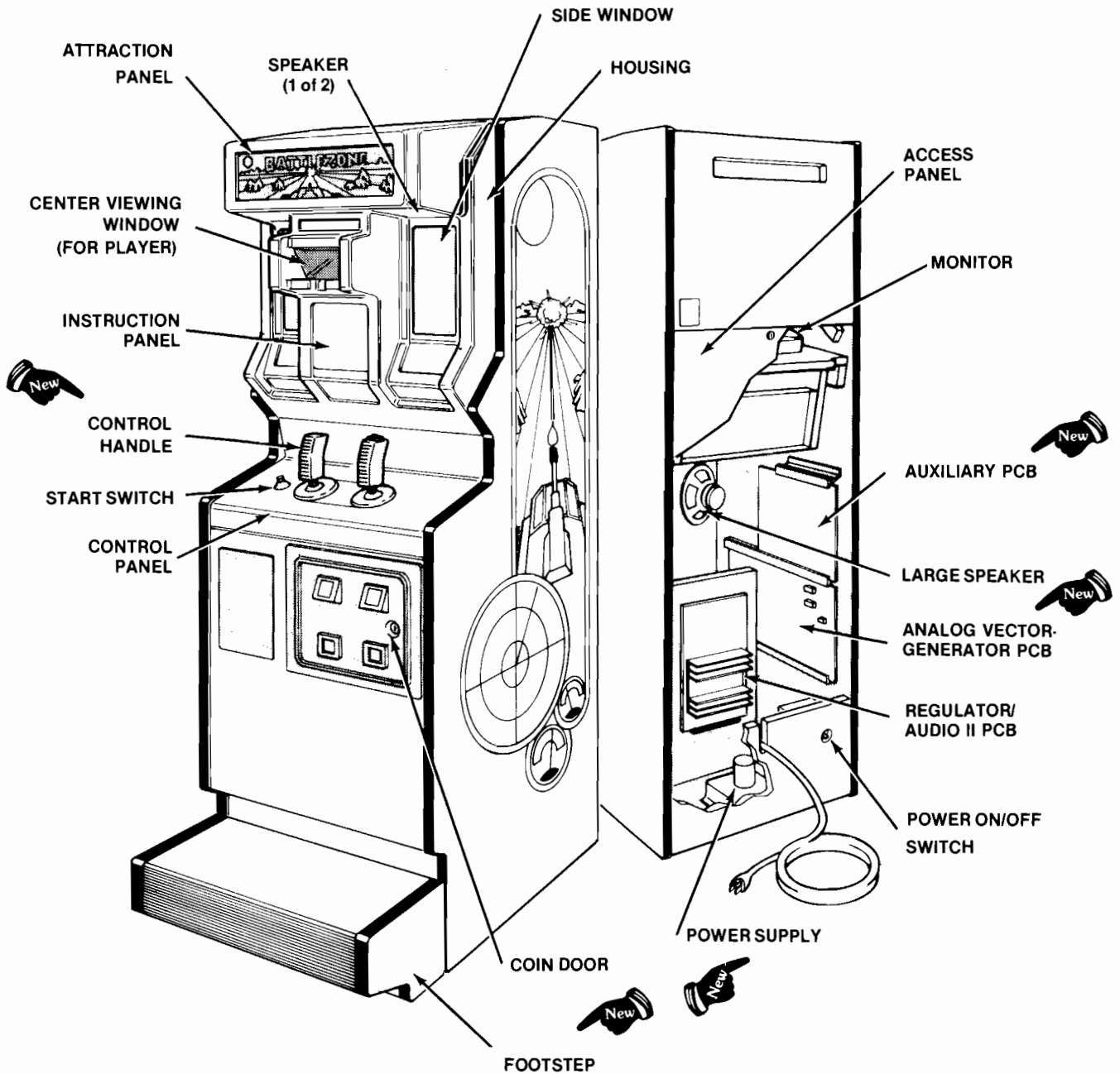
The Battlezone™ game has five new parts. If you have worked on Atari games in the past, then you should be aware of these important differences. The new parts are:

- The **control handle** is a redesign of the Atari gear shifter. It has been strengthened by adding several additional ribs to the interior and exterior of the housing. These ribs keep the assembly properly aligned to assure proper switch contact. Another new feature is the rubber centering bellows; it acts as a centering spring to return the control handle to the center position. The microswitches are now mounted with locknuts for easy replacement.



⚠ WARNING - SHOCK HAZARD ⚠

This game is designed to be connected only to a grounded 3-wire outlet. If you have only a 2-wire outlet, we recommend you hire a licensed electrician to install a grounded outlet. **Players may receive an electric shock** if this game is not properly grounded!



! WARNING !
 The footstep **must be installed** for cabinet stability. Without the footstep, this game can tip over onto an aggressive player.

! ATTENTION !
 Le piedestal doit être installé pour la stabilité du cabinet. Sans le piedestal, ce jeu pourrait se renverser sur un joueur enthousiaste.

Figure 1 Overview of Game

- Atari's X-Y game circuitry has expanded into **two interconnected printed-circuit boards**—the Analog Vector-Generator and the Auxiliary PCBs. The circuitry produces more lines on the screen at a faster rate, thus creating a smoother screen image.
- This game includes a newly designed **power supply assembly**. This power supply has a larger transformer to handle the increased power requirements of the expanded game circuitry.
- Battlezone's **new cabinet design** will accept Atari's new deep-well coin box that holds more coins.
- The cabinet also includes a removable footstep which **must** be mounted on the front of the game when on location. (You can store the footstep inside the cabinet, however, during transportation.)

These new parts, as well as all other major parts in the game, are illustrated in Figure 1. Throughout this manual, wherever one of these new parts is mentioned, you will see this symbol:



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:
 - 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 reversed edge connector will damage a PCB.**
 - 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!

- Note the location of the game's serial number—it is printed on the special label on the outside of the game cabinet. Verify that the serial numbers also stamped on the Battlezone Analog Vector-Generator PCB, Auxiliary PCB, Regulator/Audio II PCB and 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.
- Check all major subassemblies such as the power supply, control panel and monitor for secure mounting.
- Finally, turn on the game and look at the screen through the player's viewing hole. Check that the radar "screen" is centered in the bright orange-banded round hole of the graphics bezel (the upper cardboard). If it's misaligned, carefully remove the staples that hold the graphics bezel to the wood mounting. Then shift the bezel until the monitor image is centered in the hole of the bezel.



C. 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	With footstep: 64 × 84½ cm (25¼ × 33¼ in.) Without footstep: 64 × 64 cm (25¼ × 25¼ in.)
Game Height	190 cm (74¾ in.)

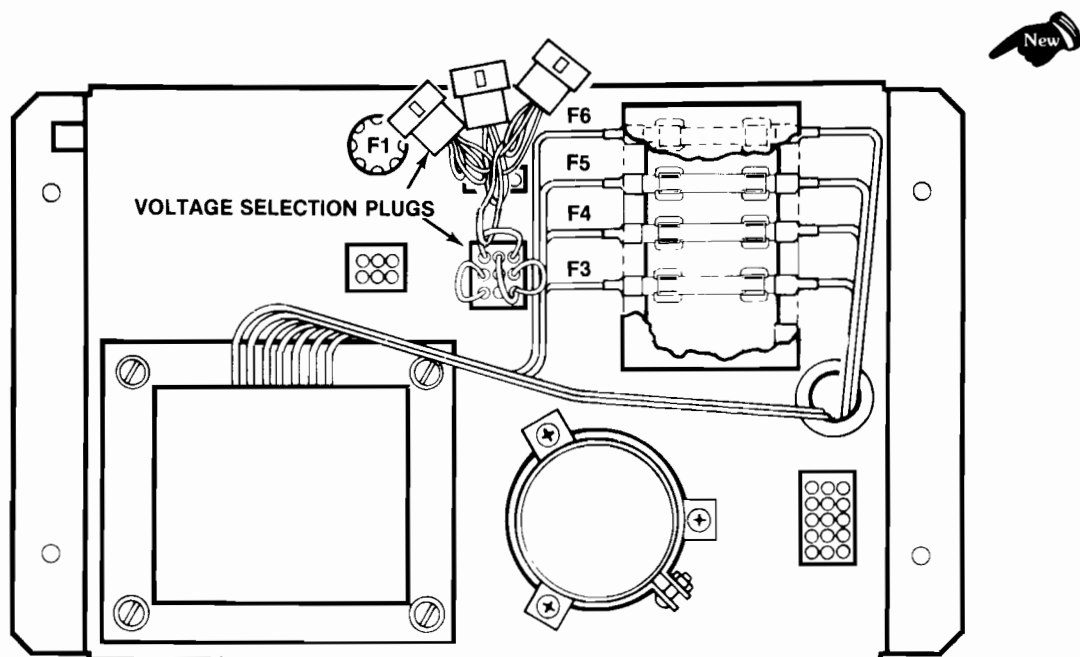


Figure 3 International Line Voltage Selection

1. Line Voltage Selection

The international power supply has 4 colored plugs. 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 (100)	Violet
105-135 VAC (120)	Yellow
200-240 VAC (220)	Blue
220-260 VAC (240)	Brown

2. Interlock and Power On/Off Switches

To minimize the hazard of electrical shock while 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 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:

- Unlock and open the access panel and the coin door.
- Plug the AC line power cord into an AC outlet.
- Close the access panel and coin door.
- Set the power on/off switch to the on position. Within 30 seconds the TV monitor should display a picture.
- Slowly open the access panel. The TV monitor picture should disappear when the panel is opened approximately 2.5 cm (1 inch). Close and lock the access panel and repeat this step with the coin door.
- If the results of the preceding step are satisfactory, the interlock switches are operating properly. If the TV monitor doesn't go off as described, check to see if the corresponding interlock switch is broken from its mounting or stuck in the "on" position.

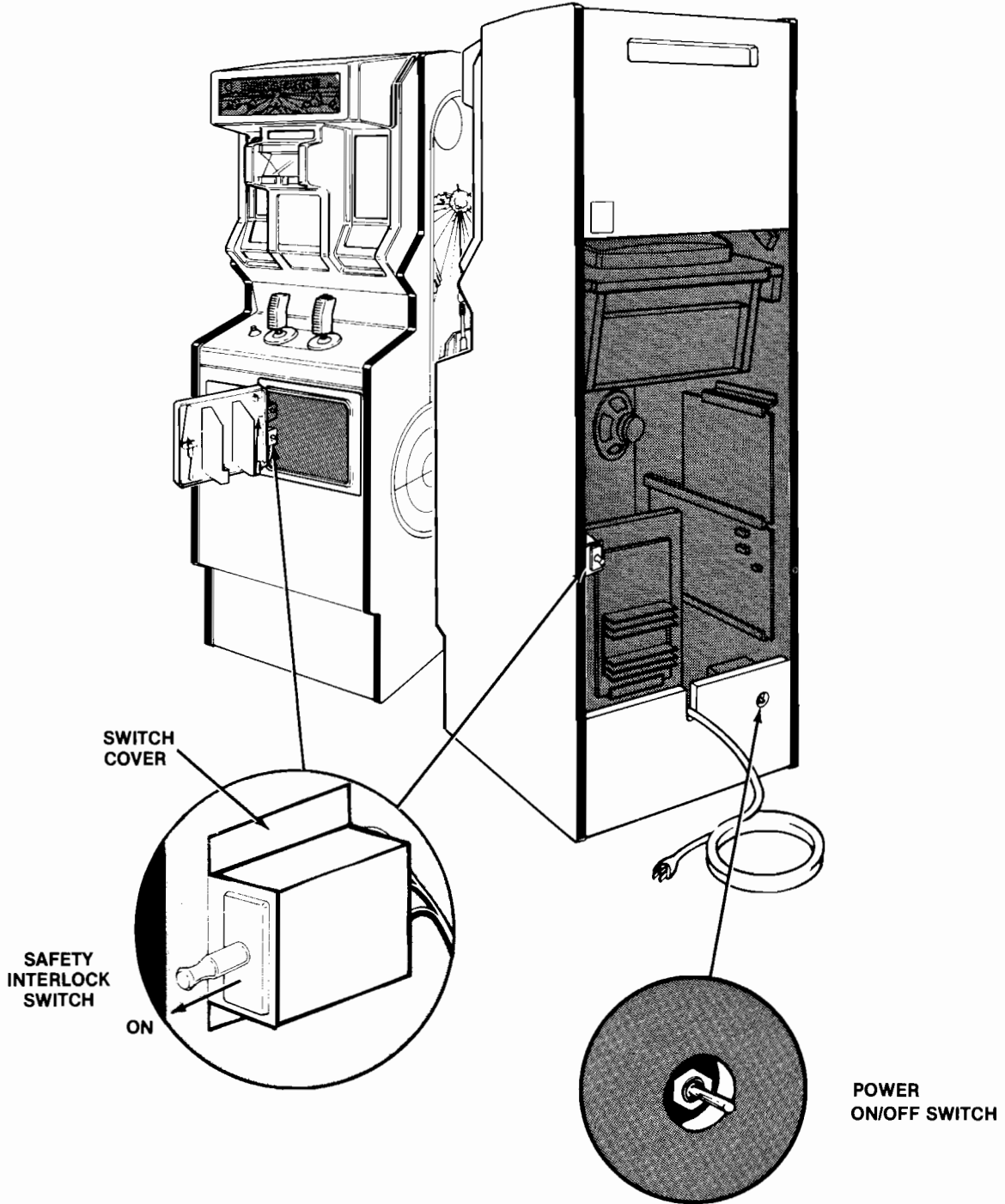


Figure 4 Interlock and Power On/Off Switches

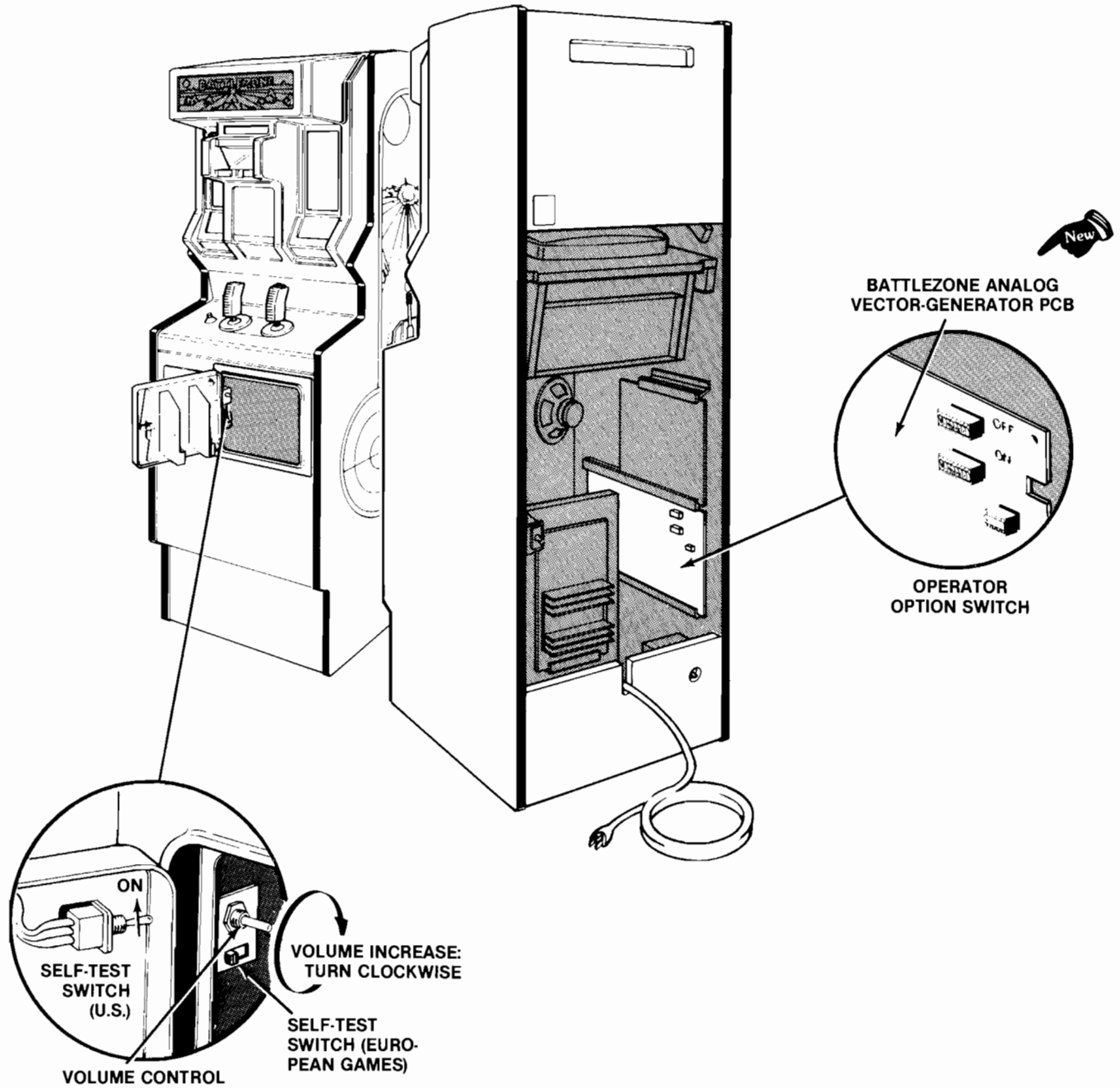


Figure 5 Location of Self-Test Switch, Volume Control and Option Switches

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 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 6.

Figure 6 Self-Test Procedure

Instruction	Results if Test Passes	Results if Test Fails																											
1. Set self-test switch to on position (see Figure 5).	After about 3 seconds, the monitor displays the picture below.	RAM FAILURE is indicated by a sequence of 1 to 10 tones. You will hear a short low tone for each good RAM chip, and a long high tone for a failing RAM chip. The test stops with the first failing RAM-chip pair (example: J2 and H2 are a pair). To restart the sequence, press the reset pushbutton on the Battlezone™ Analog Vector-Generator PCB, or set the self-test switch to off, then again to the on position. Identify the bad RAM chip with the table below. Example: four short low tones followed by a long high tone indicates failure of RAM at location B2.																											
<p>The diagram shows a screen with a grid of characters. Labels point to various controls: CENTER COIN MECH MULTIPLIER (LEFT MECH OF A 2-MECH DOOR), RIGHT COIN MECH MULTIPLIER, SWITCH TOGGLE 1, SWITCH TOGGLE 8, SWITCH AT P10 (TOP ONE), SWITCH AT M10 (BOTTOM ONE), and DISPLAY OF COMPLETE CHARACTER SET. The character set includes letters A-Z and numbers 0-9.</p>		<table border="1"> <thead> <tr> <th>Long High Tone</th> <th>Bad RAM Chip Location</th> </tr> </thead> <tbody> <tr><td>1st</td><td>J2</td></tr> <tr><td>2nd</td><td>H2</td></tr> <tr><td>3rd</td><td>A2</td></tr> <tr><td>4th</td><td>A1</td></tr> <tr><td>5th</td><td>B2</td></tr> <tr><td>6th</td><td>B1</td></tr> <tr><td>7th</td><td>C2</td></tr> <tr><td>8th</td><td>C1</td></tr> <tr><td>9th</td><td>D2</td></tr> <tr><td>10th</td><td>D1</td></tr> </tbody> </table>	Long High Tone	Bad RAM Chip Location	1st	J2	2nd	H2	3rd	A2	4th	A1	5th	B2	6th	B1	7th	C2	8th	C1	9th	D2	10th	D1					
Long High Tone	Bad RAM Chip Location																												
1st	J2																												
2nd	H2																												
3rd	A2																												
4th	A1																												
5th	B2																												
6th	B1																												
7th	C2																												
8th	C1																												
9th	D2																												
10th	D1																												
		<p>ROM/PROM FAILURE is indicated by two columns of numbers on the left side of the screen. The number in the left column indicates the location of the failing ROM/PROM(s). Identify the bad ROM/PROM with the table immediately below. Ignore the hexadecimal numbers in the right column.</p> <table border="1"> <thead> <tr> <th>Displayed No.</th> <th>Failing ROM</th> <th>Failing PROM</th> </tr> </thead> <tbody> <tr><td>0</td><td>B/C3*</td><td>B/C3*, E3</td></tr> <tr><td>1</td><td>A3</td><td>A3, F/H3</td></tr> <tr><td>2</td><td>E1</td><td></td></tr> <tr><td>3</td><td>F/H1</td><td></td></tr> <tr><td>4</td><td>J1</td><td></td></tr> <tr><td>5</td><td>K1</td><td></td></tr> <tr><td>6</td><td>L/M1</td><td></td></tr> <tr><td>7</td><td>N1**</td><td></td></tr> </tbody> </table>	Displayed No.	Failing ROM	Failing PROM	0	B/C3*	B/C3*, E3	1	A3	A3, F/H3	2	E1		3	F/H1		4	J1		5	K1		6	L/M1		7	N1**	
Displayed No.	Failing ROM	Failing PROM																											
0	B/C3*	B/C3*, E3																											
1	A3	A3, F/H3																											
2	E1																												
3	F/H1																												
4	J1																												
5	K1																												
6	L/M1																												
7	N1**																												
		<p>* If ROM or PROM B/C3 is bad, you will hear a continuous low tone, and the program may be unable to display a screen image.</p> <p>** If ROM N1 is bad, program will be unable to produce tones in RAM test.</p>																											

Figure 6 Self-Test Procedure, continued

Instruction	Results if Test Passes	Results if Test Fails								
<p>2. Activate slam switch, all control panel switches and coin door switches. When satisfied with test, set self-test switch to off position.</p>	<p>As switch activates, you'll hear a low beep. As switch deactivates, you'll hear a high beep.</p>	<p>MATH BOX FAILURE is indicated by a single letter displayed in the upper right corner of the display. Math-box failure is explained in the Signature Analysis Procedure, on the game schematic Sheet 1, Side B. Identify the failure with the table below.</p> <table border="0" data-bbox="776 512 1370 619"> <thead> <tr> <th data-bbox="776 512 935 534">Displayed Letter</th> <th data-bbox="1230 512 1300 534">Failure</th> </tr> </thead> <tbody> <tr> <td data-bbox="846 540 862 561">T</td> <td data-bbox="1192 540 1338 561">Time out error</td> </tr> <tr> <td data-bbox="846 568 862 589">H</td> <td data-bbox="1159 568 1370 589">Data error—high byte</td> </tr> <tr> <td data-bbox="846 595 862 617">L</td> <td data-bbox="1159 595 1370 617">Data error—low byte</td> </tr> </tbody> </table> <p>You will not hear a low or high beep for the defective switch.</p>	Displayed Letter	Failure	T	Time out error	H	Data error—high byte	L	Data error—low byte
Displayed Letter	Failure									
T	Time out error									
H	Data error—high byte									
L	Data error—low byte									
<p>3. Sounds Test (Optional) You may test the hardware-generated sounds by starting a game and proceeding as follows:</p> <p>Engine Rumble (Idle): Should be heard as soon as start button is pushed.</p> <p>Engine Rumble (Active): Pushing both control handles forward should cause an increase in pitch. Releasing control handles</p>	<p>should cause engine rumble to return to idle.</p> <p>Loud Shot: Press the fire button.</p> <p>Loud Explosion: Heard when you get hit, indicated by cracked windshield.</p> <p>Soft Explosion: Is heard when you hit an enemy tank or another object.</p>									

E. Option Switch Settings

1. Bonus Play Feature

Battlezone™ offers a bonus play for certain combinations of coins inserted. This bonus feature is operator-selectable, meaning you may choose to offer it or not.

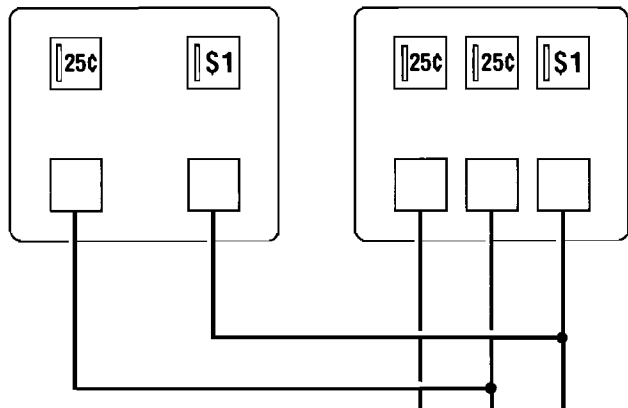
For example, with your game set at 50¢ per play, players who deposit four successive quarters or a \$1.00 coin, then press the start button, can receive a bonus play. Therefore, players can receive 3 plays for \$1.00.

This bonus feature encourages players to insert more money than just the minimum 50¢ required for one game. Various other bonuses are also available (see Figure 8).

2. Coin Mechanism Multipliers

Since early in 1980, Atari has made available its new coin door which has either two or three mechanisms. All recent Atari game PCBs identify the different mechanisms in a certain pattern.

The right coin mechs are all the same to the game's logic, regardless of whether you have two or three mechs in your door. In addition, the logic sees the left mech in a 2-mech door and the center mech in a 3-mech door as the same. Refer to the diagram below.



This pattern is important for you to know, so you can correctly set the "multipliers" for each mech. The multipliers determine how much each mechanism will be worth to the game's logic.

The basic unit of measurement is 25¢, which equals a multiplier of $\times 1$. Therefore, if you have a 25¢/25¢/\$1 coin door, you will probably want to set the center and right option-switch multipliers at $\times 1/\times 4$. (The left mech in a 3-mech door always has a value of $\times 1$ —you cannot change its value.)

You can set these multipliers with toggles 3 thru 5 on the Battlezone PCB switch assembly at location P10. For exact settings of these toggles, refer to Figure 8.

3. Examples of Option Switch Settings

Figure 8 explains the options, giving fourteen examples of the most common U.S. situations. The toggles mentioned are all in the switch at location P10; they **only** relate to game price, coin mechanism multipliers, and bonus play. You should set the toggles relating to other functions as you see fit, although Figure 7 provides "\$" symbols indicating Atari's recommendations.

Figure 7 Game Option Settings

To change toggle positions on the switch assemblies, you need not remove the game PCB. The switches, usually colored blue, are easily accessible when the Battlezone Analog Vector-Generator PCB is mounted in place.

When changing the options, verify proper results on the TV monitor display **by performing the self-test**. Note that changing an option on any of the following eight toggles will cause an immediate change on the TV monitor screen during the self-test.

Toggle Settings of 8-Toggle Switch on Battlezone PCB (at M10) (BOTTOM switch when PCB is in game)								Option
8	7	6	5	4	3	2	1	
						On	On	Game starts with 2 tanks
						On	Off	Game starts with 3 tanks \$
						Off	On	Game starts with 4 tanks
						Off	Off	Game starts with 5 tanks
				On	On			Missile appears after 5,000 points
				On	Off			Missile appears after 10,000 points \$
				Off	On			Missile appears after 20,000 points
				Off	Off			Missile appears after 30,000 points
		On	On					No bonus tank
		On	Off					Bonus tank at 15,000 and 100,000 points \$
		Off	On					Bonus tank at 25,000 and 100,000 points
		Off	Off					Bonus tank at 50,000 and 100,000 points
On	On							English language \$
Off	On							French language
On	Off							German language
Off	Off							Spanish language

Figure 8 Game Price Settings



The white block below contains the manufacturer's suggested settings. All numbers 1 thru 8 are toggle settings on the 8-toggle switch at location

P10, on the Battlezone™ Analog Vector-Generator PCB (the TOP switch assembly).

50¢ PER PLAY:

	No bonus				Bonus \$1.00 = 3 plays				Bonus \$.50 = 1 play \$.75 = 2 plays \$1.00 = 3 plays			
	8	7	6	5	8	7	6	5	8	7	6	5
Straight 25¢ Door	On	On	On	On	On	Off	Off	On	On	On	Off	On
	① 4	3	2	1	③ 4	3	2	1	④ 4	3	2	1
	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off
25¢/\$1.00 Door or 25¢/25¢/\$1.00 Door	On	On	On	On	③ On	Off	Off	On	④ On	On	Off	On
	① 4	3	2	1	⑤ 4	3	2	1	⑤ 4	3	2	1
	On	Off	Off	Off	On	Off	Off	Off	On	Off	Off	Off

25¢ PER PLAY:

	No bonus				Bonus \$.50 = 3 plays				Bonus \$1.00 = 5 plays			
	8	7	6	5	8	7	6	5	8	7	6	5
Straight 25¢ Door	On	On	On	On	On	On	Off	On	On	Off	On	On
	② 4	3	2	1	⑦ 4	3	2	1	⑦ 4	3	2	1
	On	On	Off	On	On	On	Off	On	On	On	Off	On
25¢/\$1.00 Door or 25¢/25¢/\$1.00 Door	On	On	On	On	On	On	Off	On	On	Off	On	On
	② 4	3	2	1	⑦ 4	3	2	1	⑦ 4	3	2	1
	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On

Circled numbers refer to coin-door labels you should use with each situation (labels are illustrated on opposite page).

Figure 8 Game Price Settings, continued

For your information, we have defined below the switch settings for those options relating to game price, coin mechanism multipliers, and bonus play. This information is useful in case you

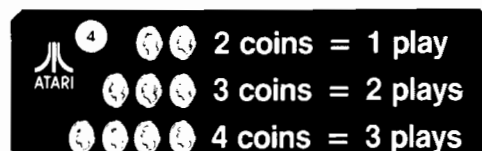
need to temporarily set the Battlezone™ game on free play, or if you have German coin mechanisms in your door.

Toggle Settings of 8-Toggle Switch on Battlezone PCB (at P10). TOP switch when PCB is in game								Option
8	7	6	5	4	3	2	1	
							On	Free play
							On	1 coin* for 2 plays
							Off	1 coin* for 1 play
							Off	2 coins* for 1 play \$
				On	On			Right coin mech × 1 \$
				On	Off			Right coin mech × 4
				Off	On			Right coin mech × 5
				Off	Off			Right coin mech × 6
			On					Center coin mech × 1 \$
			Off					Center coin mech × 2 \$ (Both these settings affect the left mech in a 2-mech door)
On	On	On						No bonus coins
On	On	Off						For every 2 coins* inserted, game logic adds 1 more coin*
On	Off	On						For every 4 coins* inserted, game logic adds 1 more coin*
On	Off	Off						For every 4 coins* inserted, game logic adds 2 more coins* \$
Off	On	On						For every 5 coins* inserted, game logic adds 1 more coin*

*In the U.S., a "coin" is defined as 25¢. In Germany a "coin" is 1 DM.

\$ Manufacturer's suggested settings

To achieve bonus plays, all coins must be inserted before pushing start button.



Note: Battlezone **cannot** be set for a 2-coin minimum. Therefore, do not stick the above label no. 6 on the Battlezone coin door.

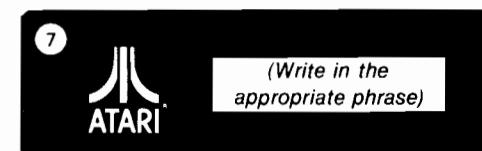


Figure 9 Coin Counter Option Settings

[These toggles determine which coin mechanisms activate which counters]

Toggle Settings of 4-Toggle Switch on Game PCB (at L11)				For Games Having These Coin Doors:	Option
4	3	2	1		
		On	On	Thai 1 Baht/1 Baht, German 1 DM/1 DM, U.S. 25¢/25¢, Belgian or French 5 Fr/5 Fr, Swiss or French 1 Fr/1 Fr, U.S. 25¢/25¢/25¢, Japanese Y100/Y100, Swedish 1 Kr/1 Kr, U.K. 10 P/10 P, Australian 20¢/20¢, or Italian 100 L/100 L.	All 3 coin mechanisms are same denomination; all register on one coin counter.
		Off	On	German 2 DM/1 DM, German 1 DM/5 DM, U.S. 25¢/25¢/\$1, or U.S. 25¢/\$1.	Left and center mechanisms are same denomination; right mech is another denomination. Requires two coin counters.
		On	Off	<i>No coin door is currently designed for this configuration.</i>	Left mech is one denomination; center and right mech are another denomination. Requires two coin counters.
		Off	Off	German 1 DM/2 DM/5 DM.	Left, center and right mechs are 3 different denominations. Requires three coin counters.

F. Game Play

Atari's Battlezone™ is a one-player game with an X-Y or vector-generation monitor. The game depicts a first-person view from inside a tank. The battles are fought in a large valley that is completely surrounded by mountains and volcanos. The valley floor contains pyramids and boxes that can provide temporary protection for players. (These cannot be destroyed by shots.)

The enemy consists of slow and fast "super" tanks and intelligent missiles—all of which become more evasive as the game progresses. In addition, flying saucers appear periodically. These don't shoot at players, but players can get very high point scores for shooting them.

The Battlezone 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 func-

tions. You may enter this mode at any time. When entered, all game credits are cancelled and the high score initials are reset.

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 game is paid for and accepted or when in self-test.

In this mode, the monitor displays three possible pictures. One is a simulation of a typical game, another is the high score table, and the third picture shows the **Battlezone** logo rolling up from the bottom of the screen.

2. Ready-to-Play Mode

This mode begins when sufficient coins have been accepted for a game. It ends when the start pushbutton is pressed. When this mode begins, the message **PUSH START** flashes in the center of the

screen, and the start button will also flash on and off. The sequence of displayed pictures are otherwise the same as those shown in the attract mode.

3. Play Mode

The play mode begins when the start pushbutton is pressed. The start LED will then stay on, and the audio will begin. The mode ends when the player's last tank of the game is lost.

The game starts with the slow tank visible on the screen. The player can determine the position of either type of tank or the missile by reading the messages in the upper left corner of the screen. For example, **ENEMY TO RIGHT** may be displayed. In addition, the sweeping radar display shows a dot for the enemy's location, accompanied by a sonar "blip" sound.

The upper pie-shaped area on the radar represents the player's range of view on the screen below. If the enemy falls anywhere within the radar circle, the message **ENEMY IN RANGE** is displayed.

Occasionally the flying saucer appears on the screen. It is a harmless observer to the battle and will not destroy the enemy or player. Its position is never shown on the radar, but players can earn 5,000 points for shooting it down. The saucer **does** act as a distraction, though, since it usually appears at the same time as the enemy tanks or missile. Saucers can be shot down by the player as well as enemy tanks.

Scoring for hitting the enemy is as follows: the slow tank earns a player 1,000 points; the missile earns 2,000 points; and the super tank earns 3,000 points. A super tank moves and turns twice as fast as both the slow tank and the player's tank.

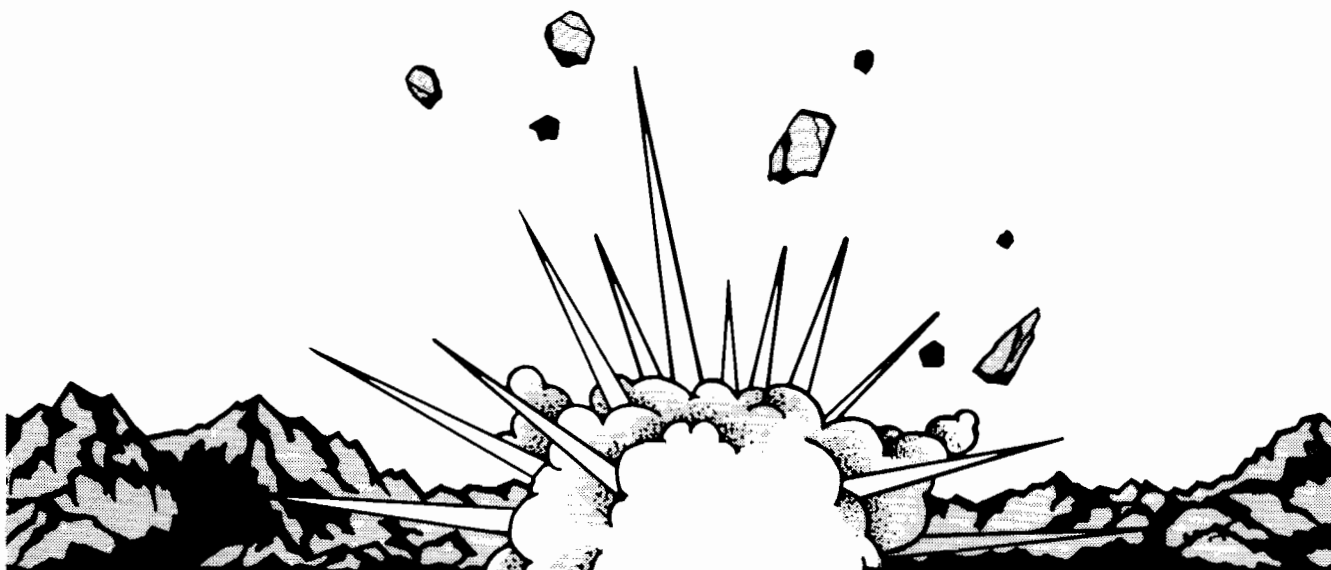
Several options allow operators to set the Battlezone™ game for 2 through 5 tanks, for giving a bonus tank after earning various point scores, and for adjusting difficulty by having the missile appear for the first time at various point scores. For information on how to set your game for these options, refer to Figure 7 in this manual.

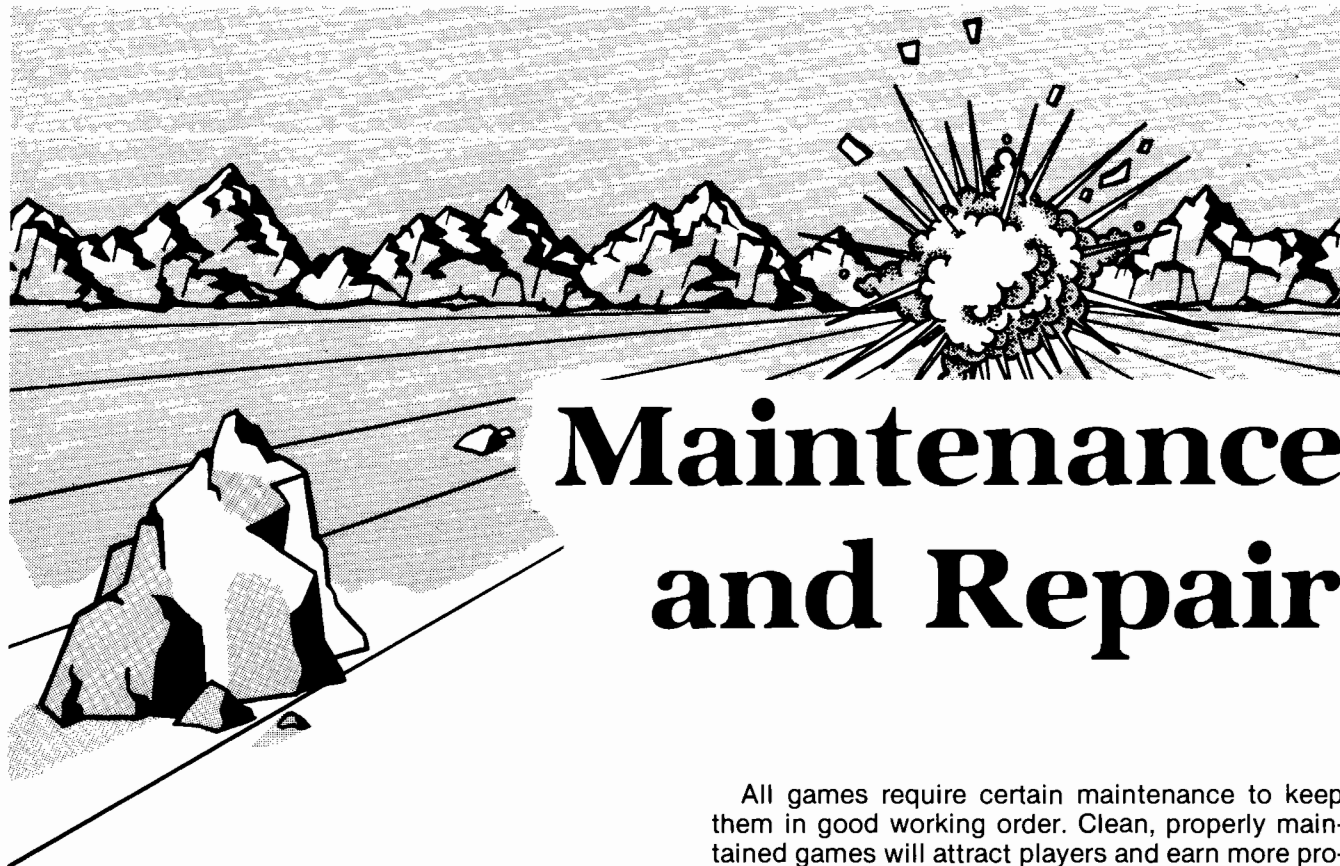
4. High Score Initial Mode

If a player's score exceeds the minimum on the high score initial list, he or she may put up to three initials on this list at the end of the game. The instructions are self-explanatory and are provided in four languages.

Note that this list is erased whenever you enter the self-test, press the RESET button on the Battlezone™ Analog Vector-Generator PCB, or turn off the power. This resetting will put a list of ten "highest" scores and initials on the screen (to provide player challenge).

Any score on the list over 100,000 points is specially highlighted with a tank symbol following the player's initials. If a player doesn't enter his or her initials within about 60 seconds, the game will automatically enter dashes instead. After this, the game reverts to the attract mode.





Maintenance and Repair

All games require certain maintenance to keep them in good working order. Clean, properly maintained games will 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 the control handle switches, fire button, or start switch is broken, or if the LED has burned out. The self-test will inform you of any of these possible problems.

Second, you should regularly clean the outside of the game and the coin mechanisms. In addition, you will need to regularly lubricate the control handle: for details see this chapter.



A. Cleaning

The exterior of the game cabinet and the metal and acrylic 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. **Do not** dry-wipe any of the acrylic panels, because any dust can scratch the surface and result in fogging the plastic.

B. Fuse Replacement

This game contains five fuses—all on the power supply assembly (not including the monitor fuses). Note that the F2 holder is unused. Replace fuses only with the same type as listed in Figure 24 of this manual. See the Quadrascan™ monitor manual, TM-151, for the monitor fuse data.

C. Opening the Control Panel

Prior to repairing or replacing any switch on the control panel, unplug the game. Then open the coin door.

Reach through the opening and remove all three sets of carriage bolts, wing nuts, split lock washers, and flat washers, located on the underside of the control panel (see Figure 10). Lift up on the control panel and tilt it towards you.

1. LED Start Switch Replacement

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

To remove LED switch:

- Remove all wires from the faulty switch.
- Turn the switch counterclockwise (as viewed from inside of control panel) 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.

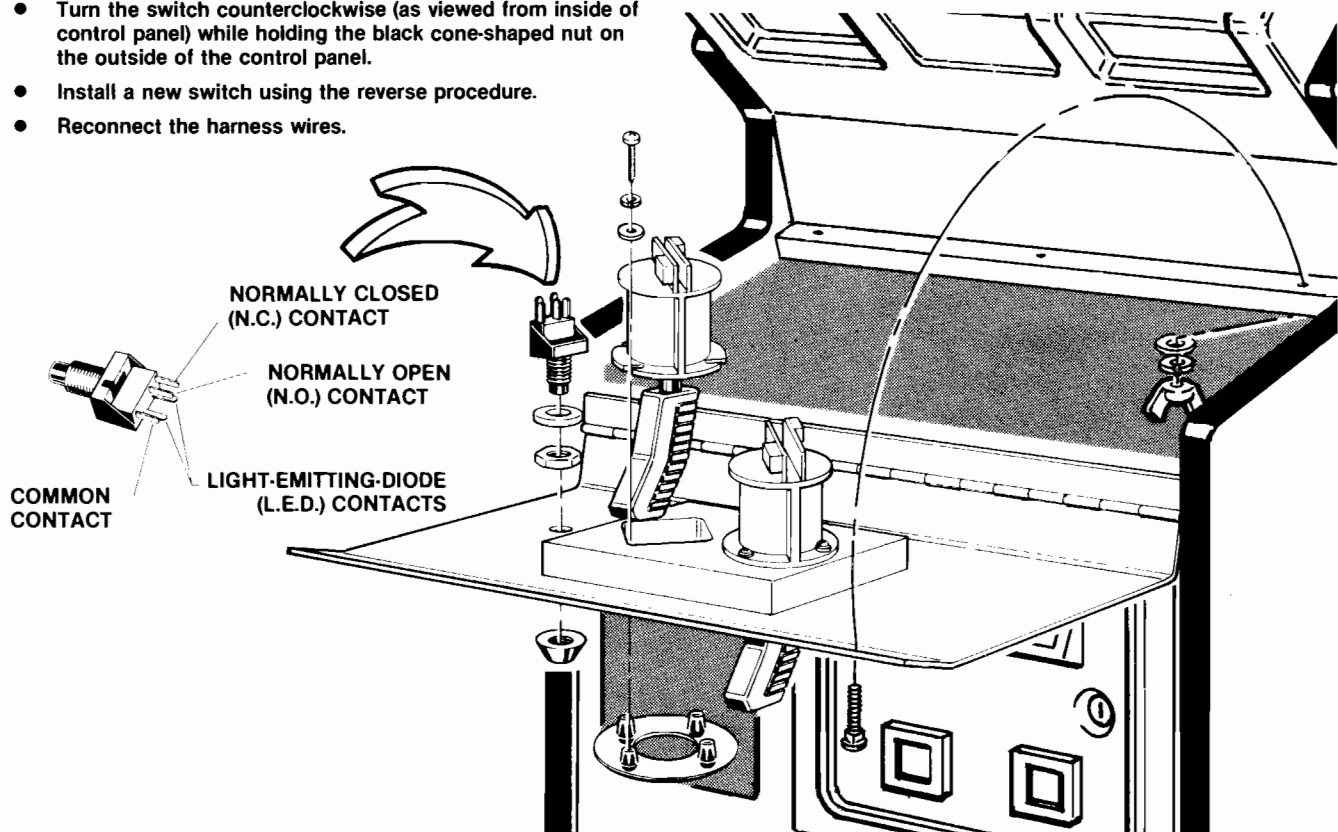


Figure 10 Opening the Control Panel

TO REPLACE THE BELLOWS:

Open the housing. Remove both halves of plastic control handle from shaft assembly. If you are replacing bellows in right-hand handle (one with switch), remove tie-wrap at lower end of fire-switch wires. Pull sleeving down until it touches connectors at bottom.

Hold three wires tightly against shaft, and slide bellows off the bottom of shaft. Slide new bellows up over the wires and shaft. Then slide sleeving back up over the wires. Leave about 3 inches of sleeving on wires beyond small side hole in shaft. Attach new tie-wrap as shown.

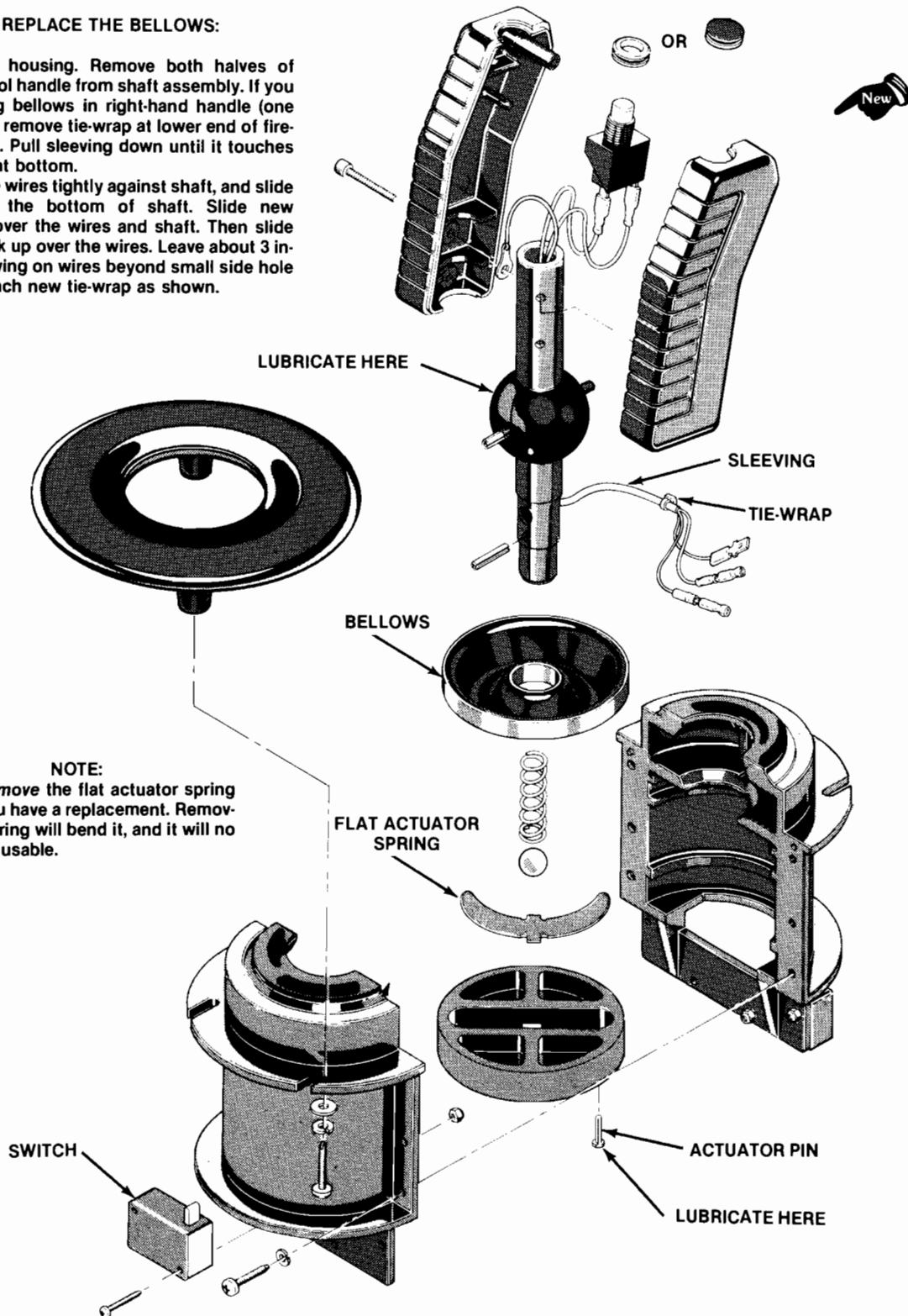


Figure 11 Control Handle Maintenance and Repair

1. Remove the wires from the suspected switch.
2. Set multimeter to ohms scale. Set ohms scale to $R \times 1$, then zero the meter.
3. Connect multimeter leads to appropriate LED switch contacts (see Figure 10 for designation of switch contacts and meter lead placement).
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.



2. Control Handle Maintenance and Repair

Normal maintenance involves lubricating three parts in the control handle approximately every six months (this requires removing the controls). First open the control panel as described in Figure 10. Then unplug the "quick-disconnect" connectors on the four control switches, as well as the three connectors for the fire switch.

From the inside of the control panel, remove the four flat and lock washers and four screws that mount the control onto the wood support and the round bezel.

Then open up the control handle assembly by removing the six split lock washers and screws (see Figure 11). In addition, remove the two switches and carefully save the small actuator pins.

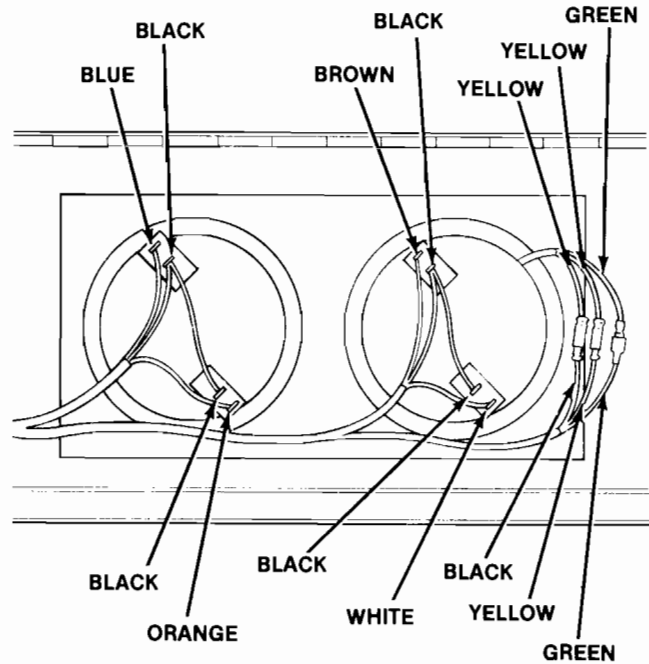
For lubrication, use only Dow Corning #111 heavy silicone lubricant (Atari part no. 78-1710). Lubricate the following two parts inside the control:

- The spherical part of the shaft and the two small pivot pins that protrude from this area, and
- The two clear plastic actuator pins, located over the switches (push the narrow ends of the pins into the tube to cover them with lubricant).

NOTE

Do not remove the flat actuator spring unless you have a replacement on hand! Removing the spring will bend it, and it will no longer be usable.

Reassemble the control handle, and then reinstall it in the control panel. Reconnect the harness wires as shown in the following diagram: **make sure the right colors go to each switch.**



Repairs on the control handle would probably only involve replacement of switches. When removing a switch, be careful not to lose the small clear plastic actuator pins that sit above the white switch actuators. Note: the flat head of the pin must **always** face towards the switch actuator.

D. Monitor Removal

⚠ WARNING ⚠

High voltages may exist in any television monitor, even with power disconnected. Use extreme caution and do not touch electrical parts of the yoke area with your hands or with metal objects in your hands! If you drop the 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 monitor.

If you should need to remove the Quadrascan X-Y monitor, follow steps 1 thru 6 as listed on this page. Refer to Figure 12.

1. Unplug the harness connector underneath the monitor. **Be sure the game is unplugged from its wall outlet!**
2. Remove the two sets of carriage bolts, flat and

split lock washers, and hex nuts that hold down the chassis. (This hardware is located at the left and right side of the monitor, near the access panel opening.)

3. Carefully slide the monitor chassis out the rear of the game.
4. If you must replace the monitor, place the red and green overlays on the face of the new picture tube as follows. Place the red overlay within the top 4 inches of the screen; then butt up the green overlay to the red one. (These overlays may overlap by a maximum of 1/8 inch.)
5. Once the monitor has been installed in the cabinet, check for proper alignment with the graphics bezel as follows. The horizon line (the floor of the valley) should be even with the short horizontal line in the graphics bezel. This line is located between the two screws in the bezel design. Also, the vertical center line of the gunsight should be directly under the **D** in **RADAR** (at the top center of the bezel).

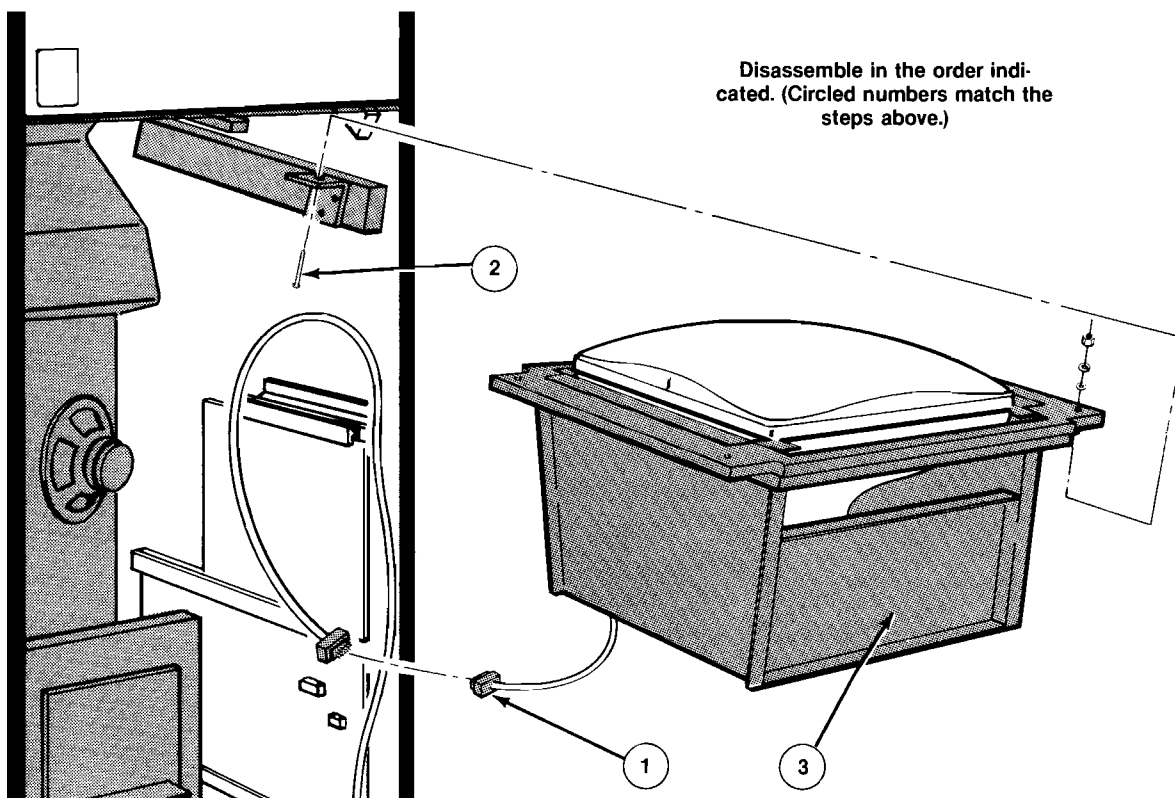


Figure 12 Monitor Removal

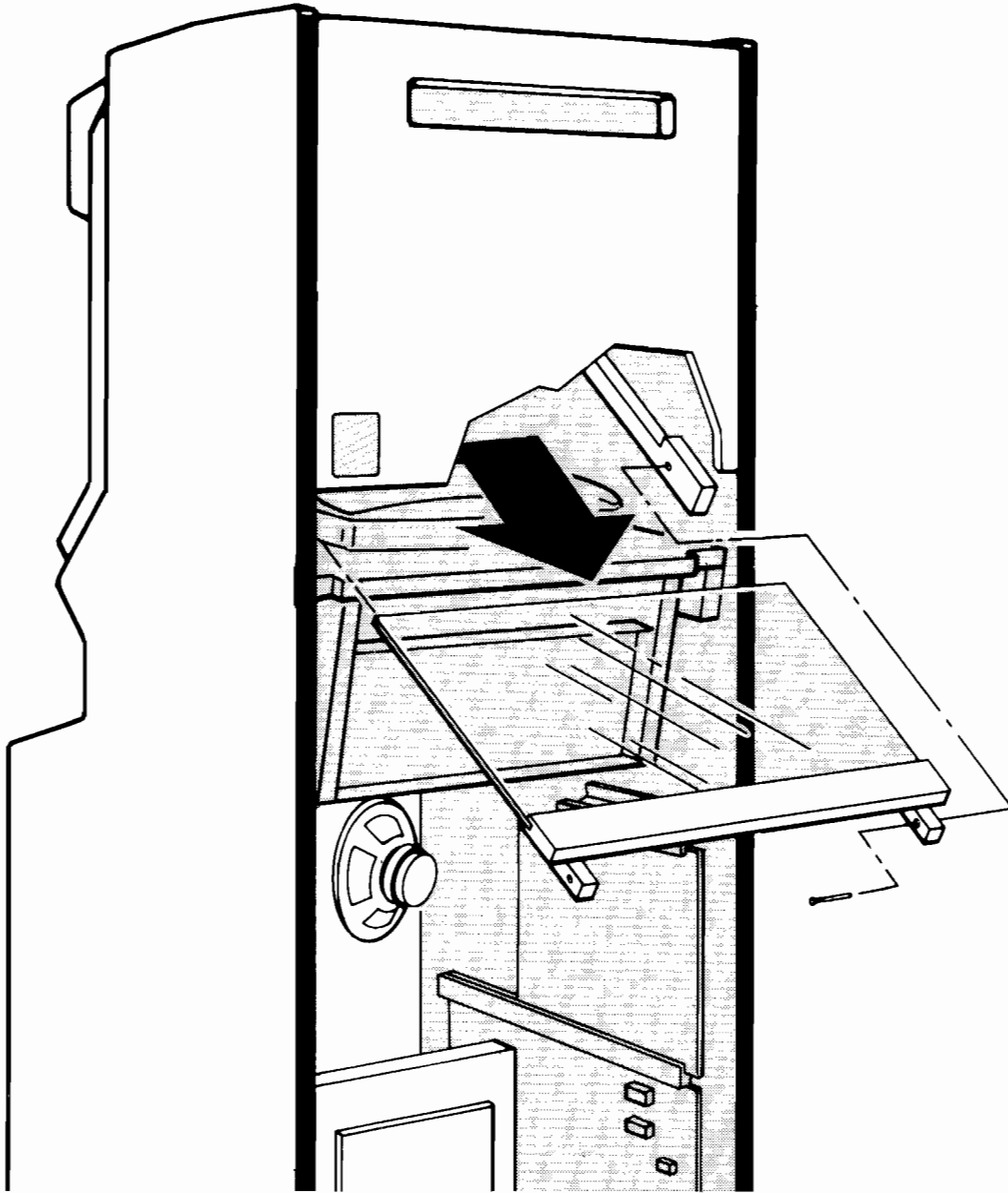


Figure 13 Mirror Removal

E. Mirror Removal

If you wish to remove the half-silvered mirror for cleaning or replacement, follow these instructions. **Handle the glass mirror with care**—it is heavy! Never wipe the silvered side with an abrasive cloth: you will scratch the coating.

Unlock and remove the rear access panel. Unplug the harness connector located at the left side of the cabinet opening.

Remove the two Phillips screws that secure the wood support (located at the mirror's rear edge): see Figure 13. Carefully slide the wood support and the mirror out of the cabinet. Note that the wood is **NOT** attached to the mirror!

When replacing the mirror in the game, be sure the silvered side is facing **downwards** towards the lower front of the game. If you see double monitor images when looking through the player's viewing window, the mirror has been installed incorrectly.

F. Housing Removal

If you wish to replace the fluorescent tube, either speaker or any of the acrylic panels, you will need to remove the front housing from the game. Follow the illustration in Figure 14.

Remove the three Allen-head screws and split lock washers at the top of the game, as well the three at the bottom of the housing. They secure the housing to the cabinet.

Tilt the top of the housing towards you, then unplug the harness connector for the speakers. Remove the housing and lay it on a clean surface, with its inside facing up. You can now service any parts in the housing, as well as replace either fluorescent tube. You'll find a list of housing replacement parts in Figure 23.

When reinstalling the housing on the game, be sure the inside surfaces of the three windows are clean. The acrylic windows tend to attract dust more easily than glass.

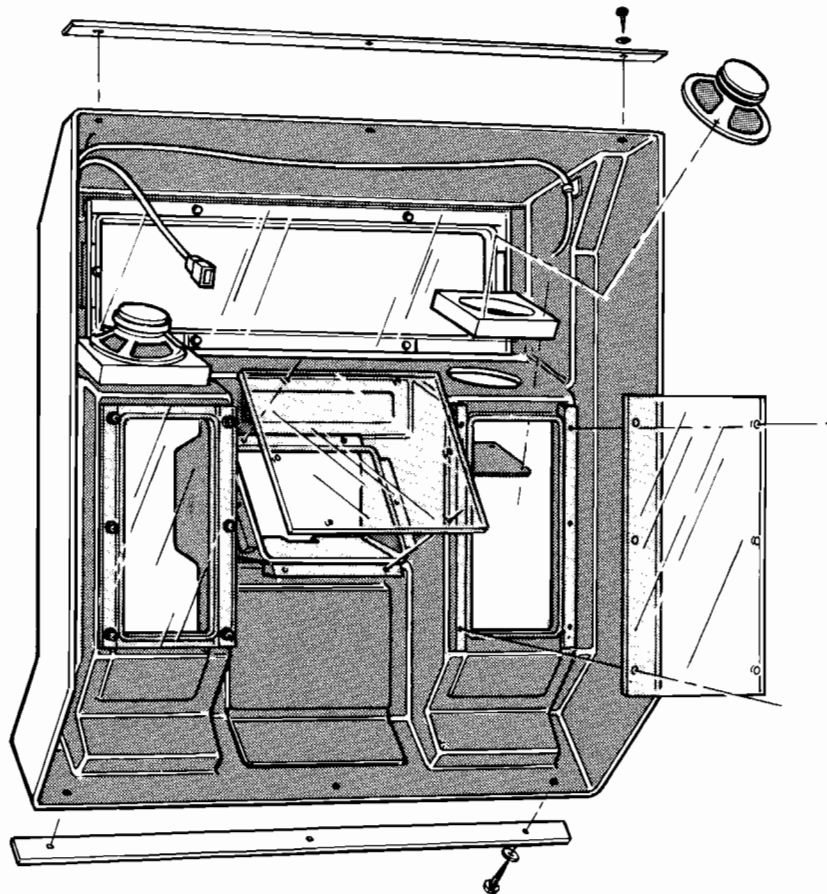


Figure 14 Housing Removal and Speaker Replacement

1. Fluorescent Tube Replacement

⚠ WARNING ⚠

If you drop a fluorescent tube and it breaks, **it will implode!** Shattered glass can fly 6 feet or more from the implosion. Use care when replacing any fluorescent tube.

To replace the white fluorescent or blacklight tube behind the front graphics attraction panel, follow this procedure (see Figure 15):

1. Remove the housing as described previously. Unplug the harness connectors for both fluorescent tubes. To replace the **blacklight** tube, remove the two screws that secure the light board to the cabinet, and slide out the whole assembly.

2. Remove the two Y-shaped connectors from the ends of the fluorescent tube. Now carefully remove the tube from its clamps by pulling it towards you.
3. Replace with a new tube. Do not snap the tube in vigorously—**you may break it, causing an implosion!**
4. Reconnect the Y-shaped connectors. Reinstall the fluorescent light assembly with the two screws (if you removed it). Reconnect the harness connectors, and replace the housing on the front of the game.

2. Speaker Replacement

First disconnect the harness plugs for the defective speaker. Then remove the four screws that hold the speaker in the wood mounting block (the wood block and speaker grille remain attached to the housing with rivets). Replace the speaker, then reconnect the harness connectors.

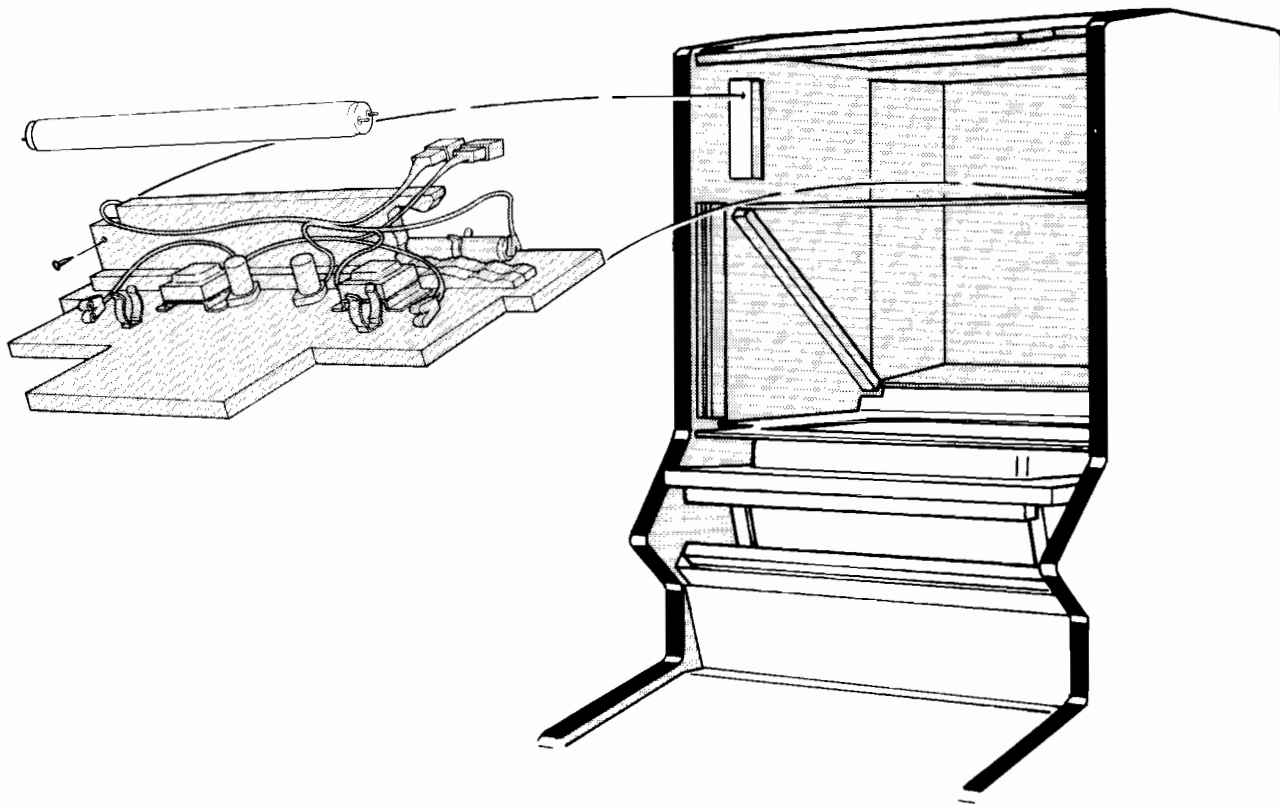


Figure 15 Fluorescent Tube Replacement

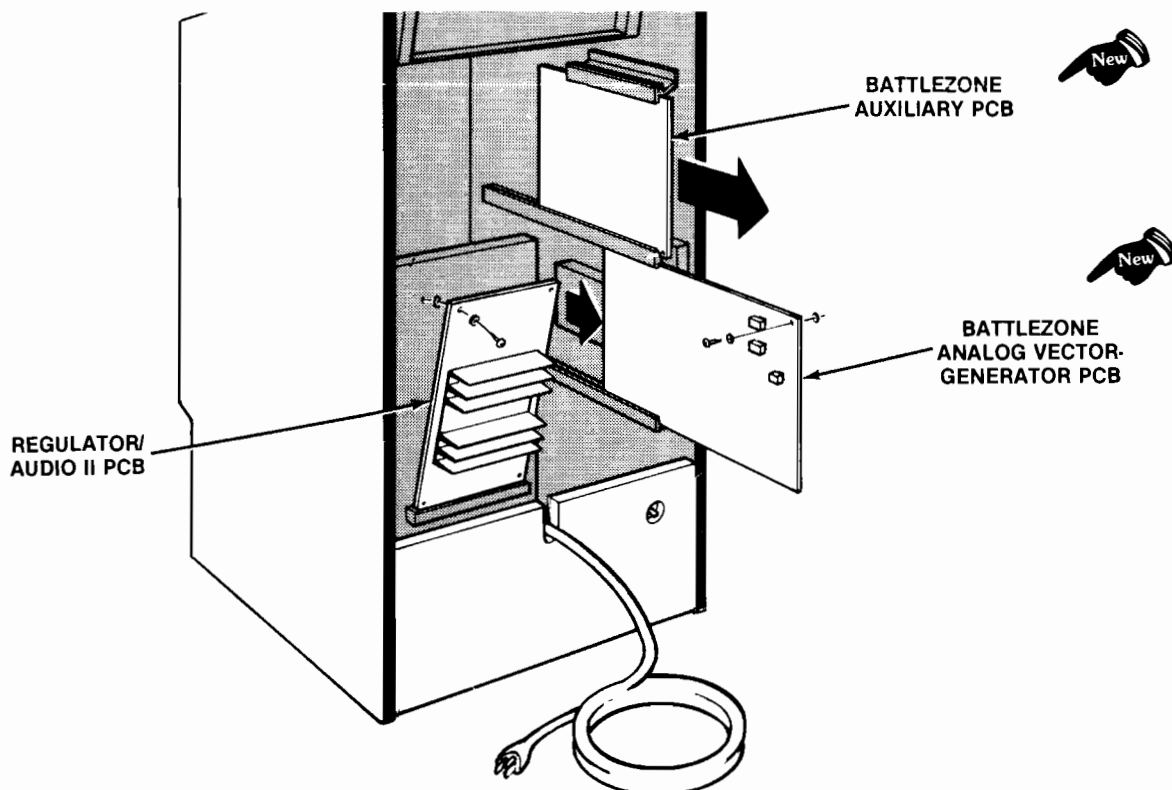


Figure 16 Printed-Circuit Board Replacement

G. Printed-Circuit Board Replacement

You may wish to remove the Battlezone™ Analog Vector-Generator printed-circuit board (PCB), Auxiliary PCB, or the Regulator/Audio II PCB for service or inspection. To do this, refer to Figure 16 and proceed as follows:



1. Analog Vector-Generator and Auxiliary PCB Removal

- Unlock and open the access panel.
- Unplug the 24-pin PCB interconnector from the Auxiliary PCB or the Analog Vector-Generator PCB (whichever board you are removing).
- Remove the 44-pin edge connector from the right side of the PCB.
- Locate the Phillips-head screw that extends through the PCB and into the wood block (at the right side of the board). Remove this screw.

- Remove the PCB from the cabinet by pulling it out of the plastic PCB retainer.
- Reinstall the PCB, making sure that the 44-pin edge connector is properly plugged in. Note that the connector is keyed to fit on 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.
- 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.

2. Regulator/Audio II PCB Removal

- Unlock and open the access panel.
- Remove the five plug-in connectors. Note that all of these connectors are also keyed for proper orientation.
- Locate the four Phillips-head screws that extend through the PCB and into the wood behind the PCB. Remove and save these four screws and the fiber washers behind the board.
- Remove the PCB from the interior wall of the cabinet.

H. Game Operation

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

Battlezone™ is a microprocessor-controlled game. The microprocessor is contained on the Analog Vector-Generator PCB. This board receives switch inputs from the control panel and coin door. These inputs are then processed by the Analog Vector-Generator PCB and output to the monitor, Regulator/Audio II PCB, and control panel.

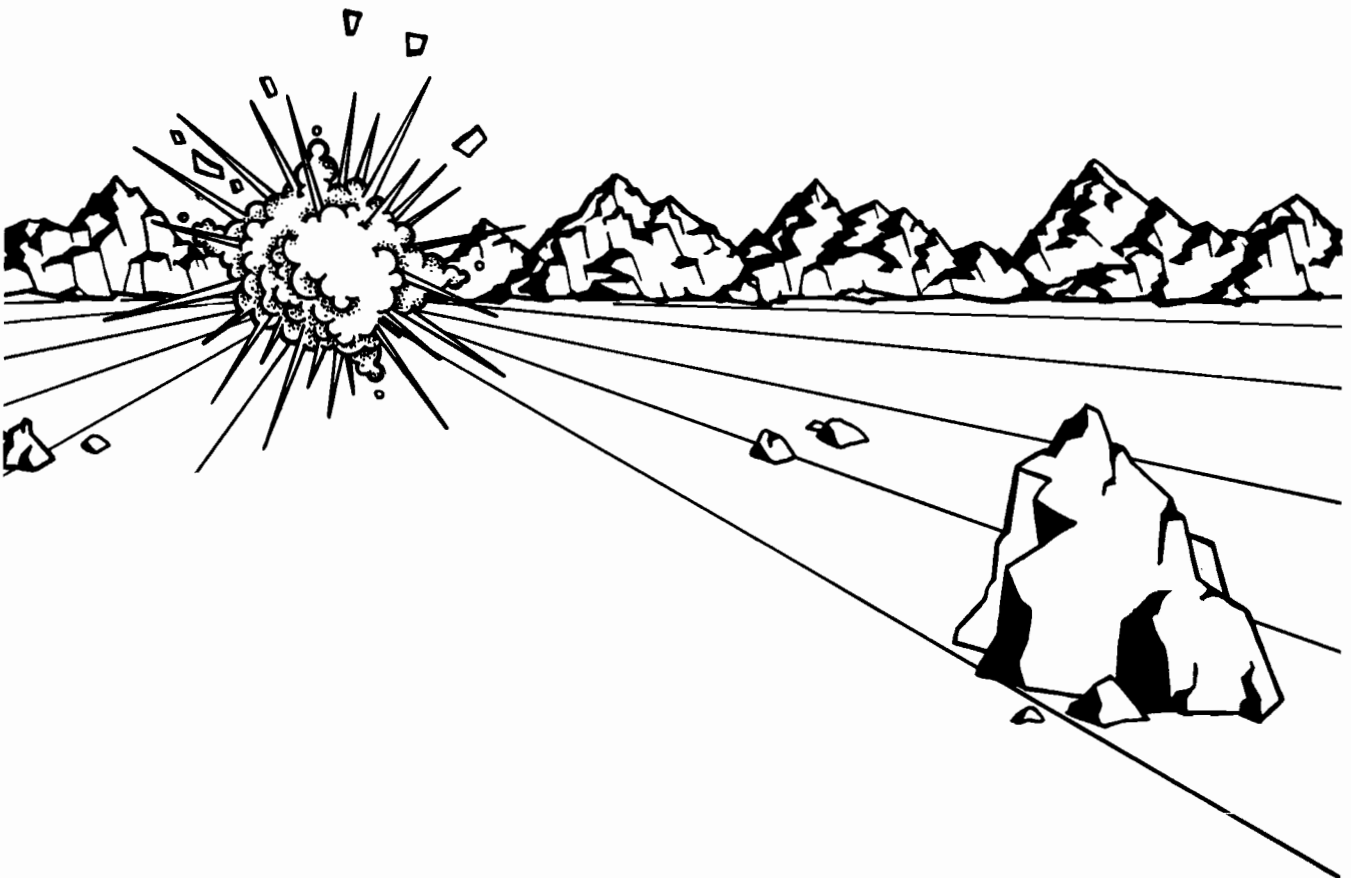
The monitor is an X-Y monitor. Therefore, the monitor receives signals for the X, Y and Z axes. Since the location of the beam in the monitor is totally controlled by the X- and Y-axis outputs of the Analog Vector-Generator PCB, this board does not contain a standard sync circuit. The X- and Y-axis inputs 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 II PCB performs two functions: 1) it regulates the voltages from the power supply to ± 5 VDC and ± 12 VDC, and 2) it amplifies the audio output from the Auxiliary PCB.

Specifically, the $+5$ VDC from the Regulator/Audio II PCB provides most logic power to the Analog Vector-Generator and Auxiliary PCB; ± 22 VDC is regulated on the Analog Vector-Generator PCB to produce ± 15 and $+5$ VDC (the latter for the digital-to-analog converters); and $+22$ VDC provides power for the audio output of the Auxiliary PCB. The audio output from the Regulator/Audio II PCB directly drives the game speakers and is controlled by the volume control, mounted inside the coin door.

The Power Supply is the source of all voltages in the game. These voltages are protected by four 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 17 illustrates the distribution of power in this game. Figure 18 illustrates the distribution of signals.



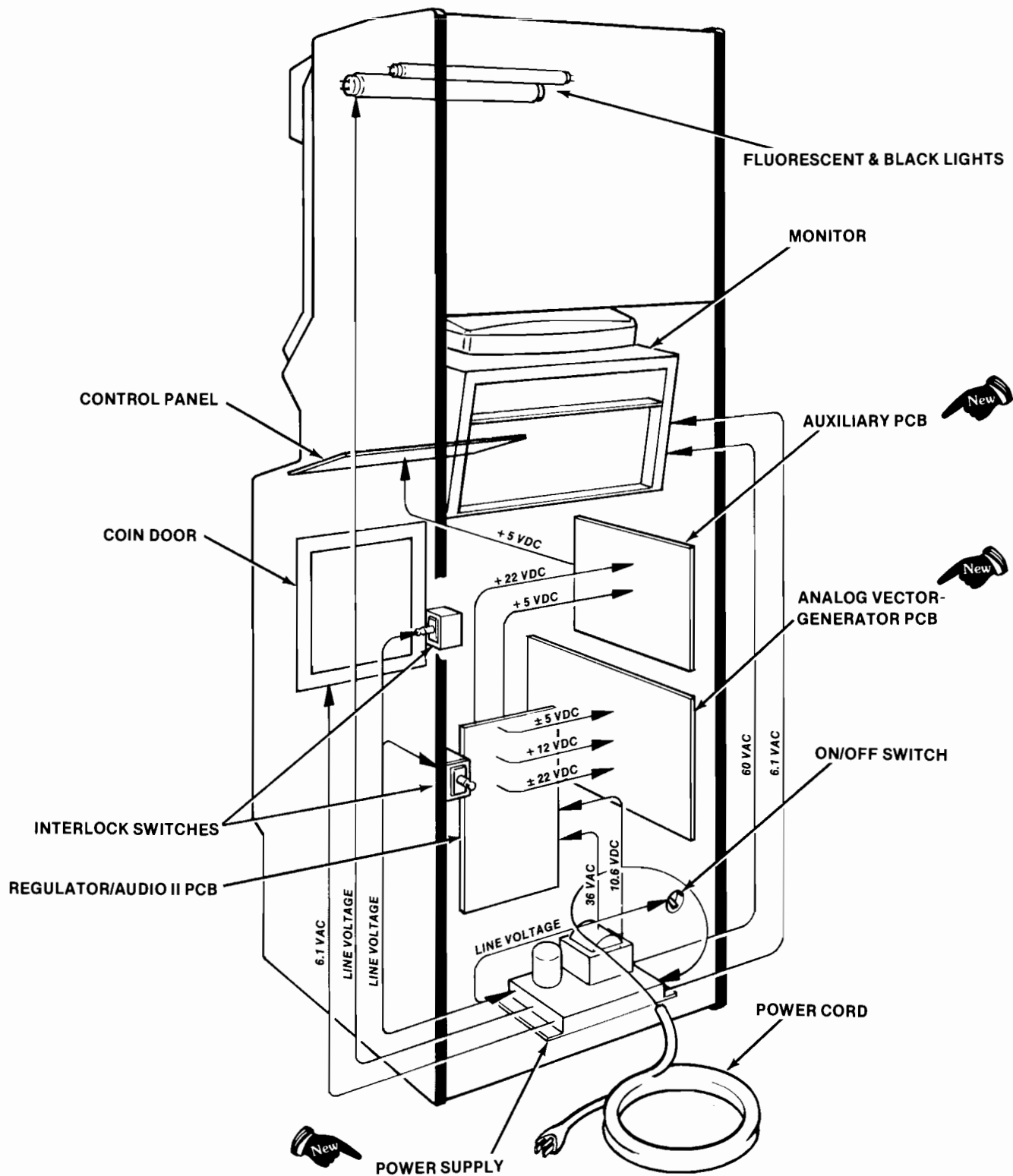


Figure 17 Power Distribution

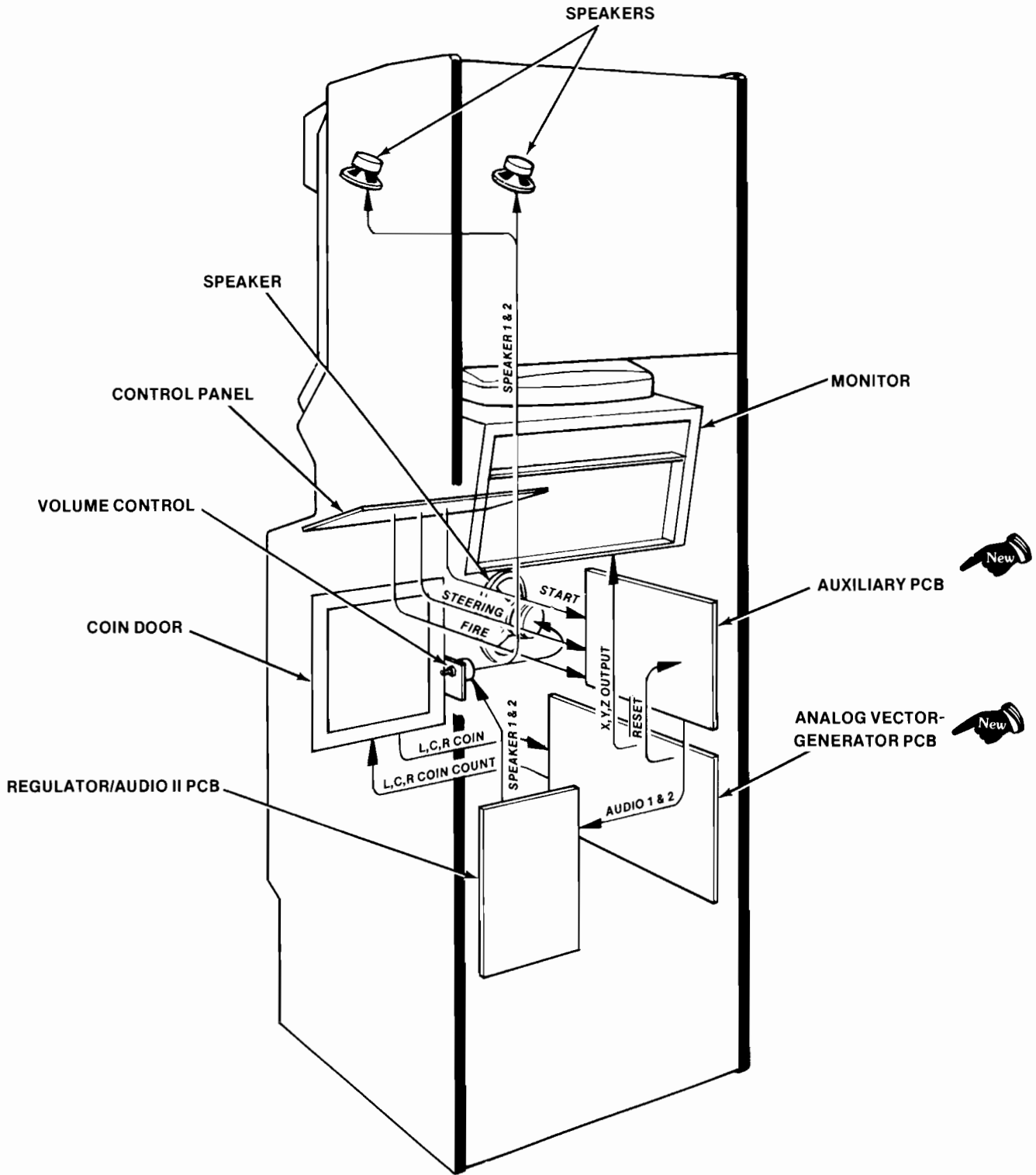
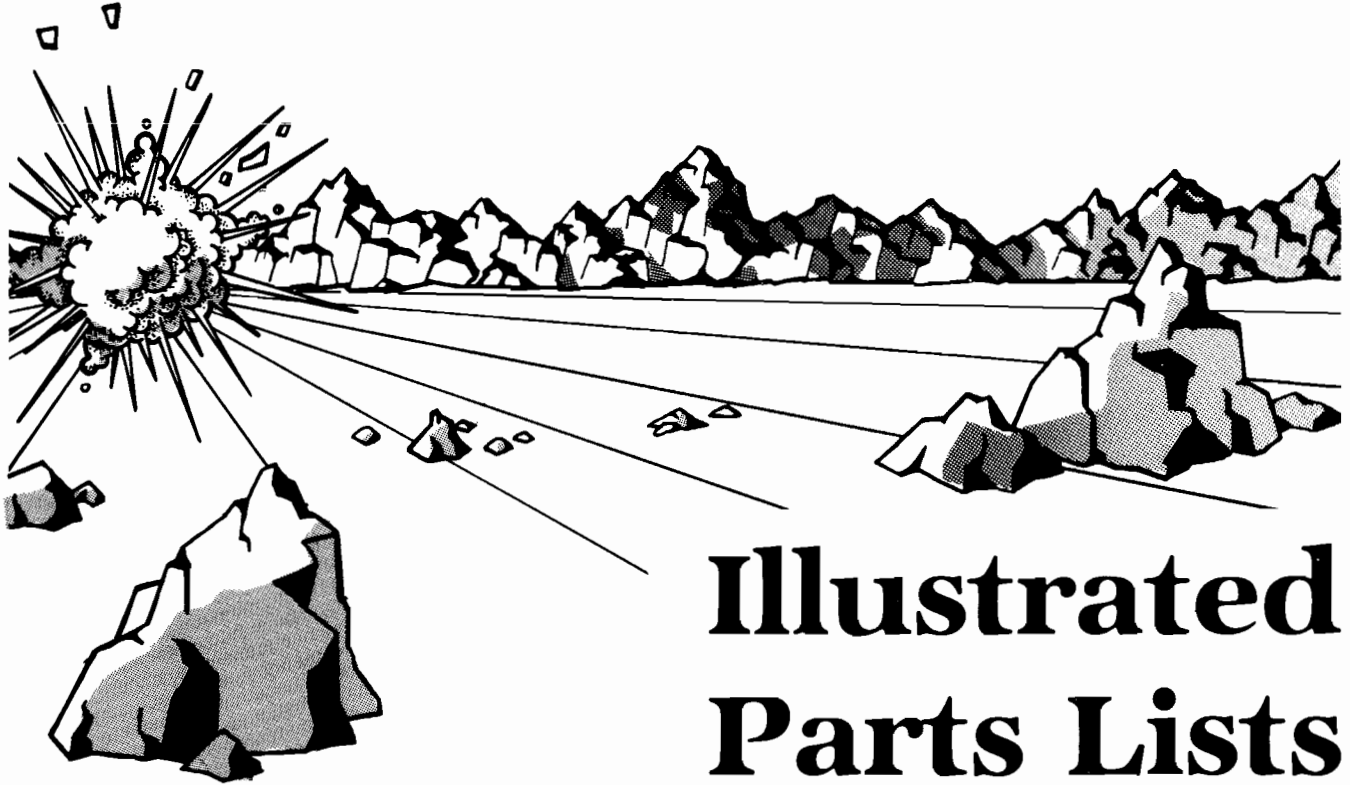


Figure 18 Signal Distribution



Illustrated Parts Lists

This chapter provides you with the necessary information for ordering replacement parts for your Battlezone™ game. Please note that, for simplicity, **common hardware has been deleted** from most of these parts lists. This includes screws, nuts, washers, bolts, etc.

The parts lists are arranged in alphanumeric order. For example, all "A-" prefix numbers come first. Following this are numbers in sequence evaluated up to the hyphen, namely 00- thru 99-, then 000598- thru approximately 190000-.

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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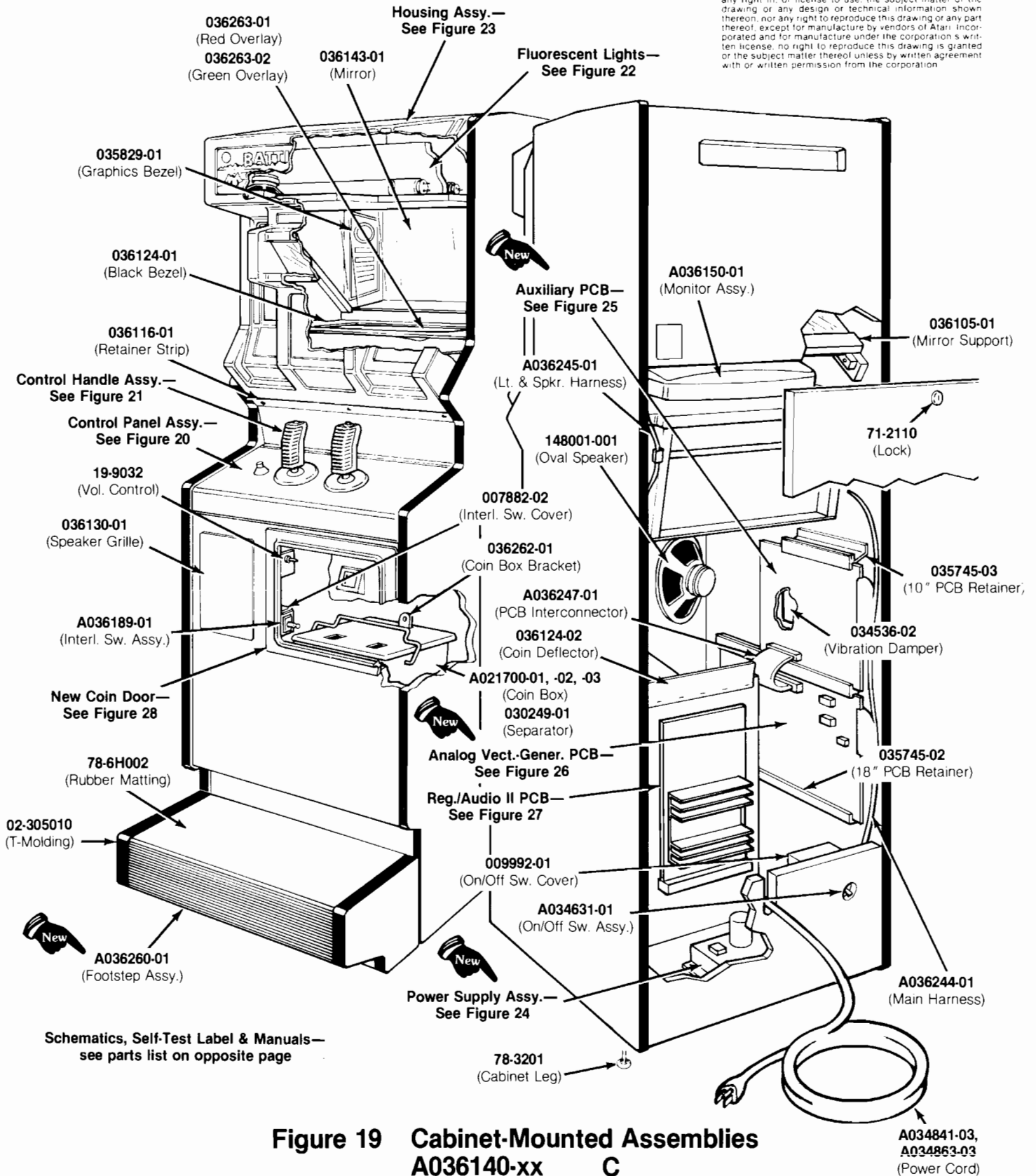



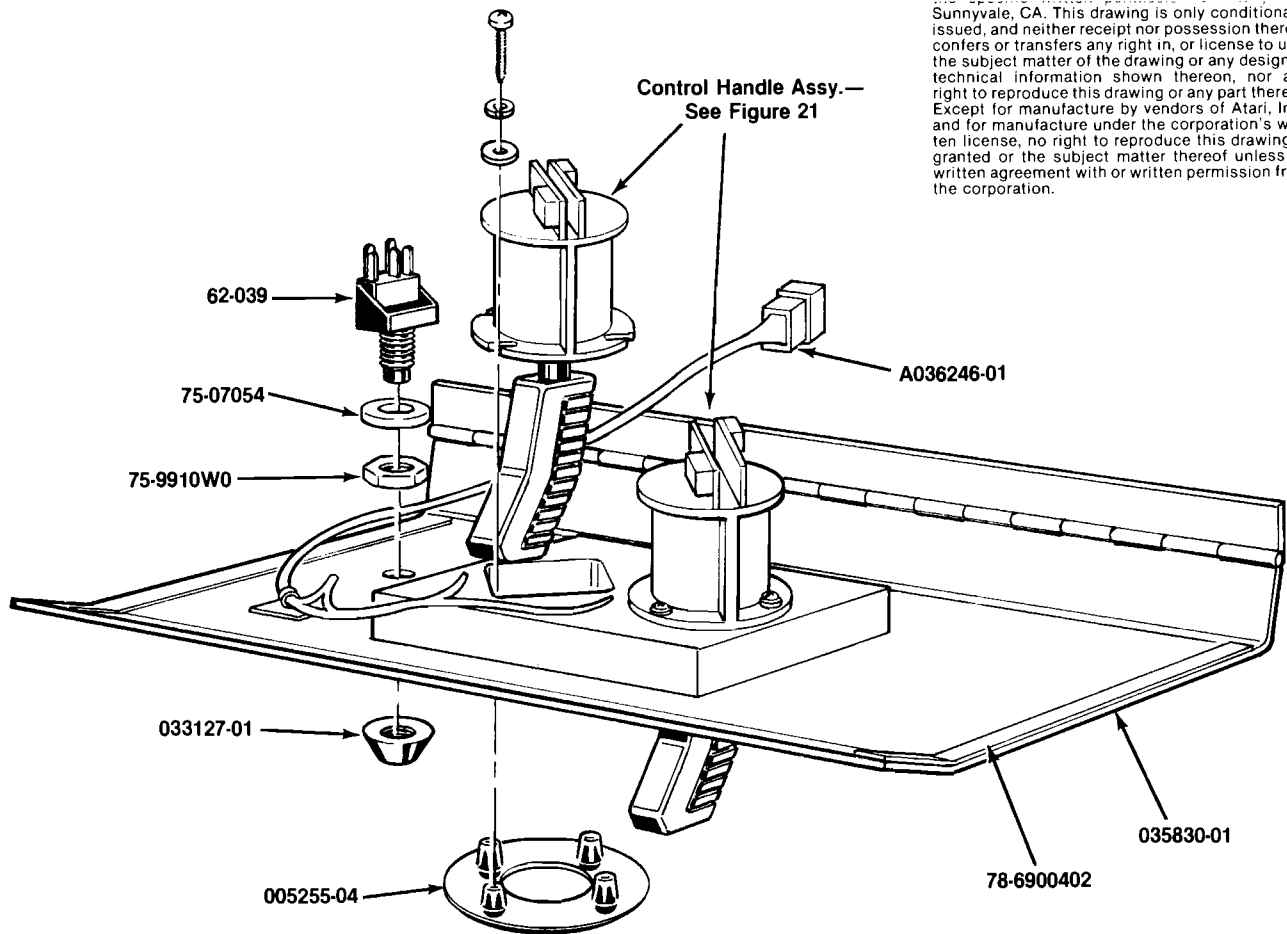
Figure 19 Cabinet-Mounted Assemblies
A036140-xx C

Figure 19 Cabinet-Mounted Assemblies Parts List

Part No.	Description
A021700-01	Coin Box Assembly <i>(for all the same coins)</i>
A021700-02	Coin Box Assembly <i>(for two different coin denominations—has one separator)</i>
A021700-03	Coin Box Assembly <i>(for three different coin denominations—has two separators)</i>
A034631-01	On/Off Switch Assembly
A034841-03	Strain Relief Power Cord <i>(domestic)</i>
A034863-03	Strain Relief Power Cord <i>(German)</i>
A036150-01	Monitor Assembly
A036189-01	Interlock Switch Assembly <i>(modified for safety)</i>
A036244-01	Main Harness Assembly <i>(also includes on/off switch, 2 interlock switches and their brackets, and volume control and its bracket)</i>
A036245-01	Fluorescent Light and Speaker Harness Assembly
A036247-01	Printed-Circuit-Board Interconnector
A036260-01	Footstep Assembly <i>(includes rubber matting)</i> 
<i>The following six items are the technical information supplements to this manual:</i>	
DP-156-01	Battlezone™ Schematic Drawings <i>(Sheet 1)</i>
DP-156-02	Battlezone Schematic Drawings <i>(Sheet 2)</i>
DP-156-03	Battlezone Schematic Drawings <i>(Sheet 3)</i>
ST-156	Label with Self-Test Procedure and Option Switch Settings
TM-151	Instruction and Service Manual for G05-802/805 Quadrascan™ X-Y Monitor
TM-156	Battlezone Operation, Maintenance and Service Manual
02-305010	¾-Inch Plastic T-Molding
19-9032	Volume Control
71-2110	Panel Cartridge Lock Mechanism <i>(for access panel)</i>
75-07017	Spacer for Mounting Printed Circuit Boards
78-3201	Cabinet-Leveling Leg
78-6H002	1/8-Inch Thick Corrugated Rubber Matting for Footstep <i>(14½ × 23 5/8 inches are required)</i>
78-24012	5-Inch Beaded Nylon Tie Wrap <i>(for PCB Edge Connectors)</i>
007882-02	Interlock Switch Cover
009992-01	On/Off Switch Cover
030249-01	Coin Box Separator
033266-01	Monitor Mounting “L” Bracket
034536-03	Foam Vibration Damper <i>(for Auxiliary and Analog Vector-Generator PCBs)</i>
035745-02	18-Inch Plastic PCB Retainer
035745-03	10-Inch Plastic PCB Retainer
035829-01	Graphics Bezel
036105-01	Mirror Support
036116-01	Housing Retainer Strip
036124-01	Black Cardboard Monitor Bezel
036124-02	Cardboard Coin Deflector
036130-01	Speaker Grille
036143-01	Mirror
036262-01	Coin Box Bracket
036263-01	Red Monitor Overlay
036263-02	Green Monitor Overlay
148001-001	6 × 9-Inch 4-Ohm 15-Watt Oval High-Fidelity Speaker

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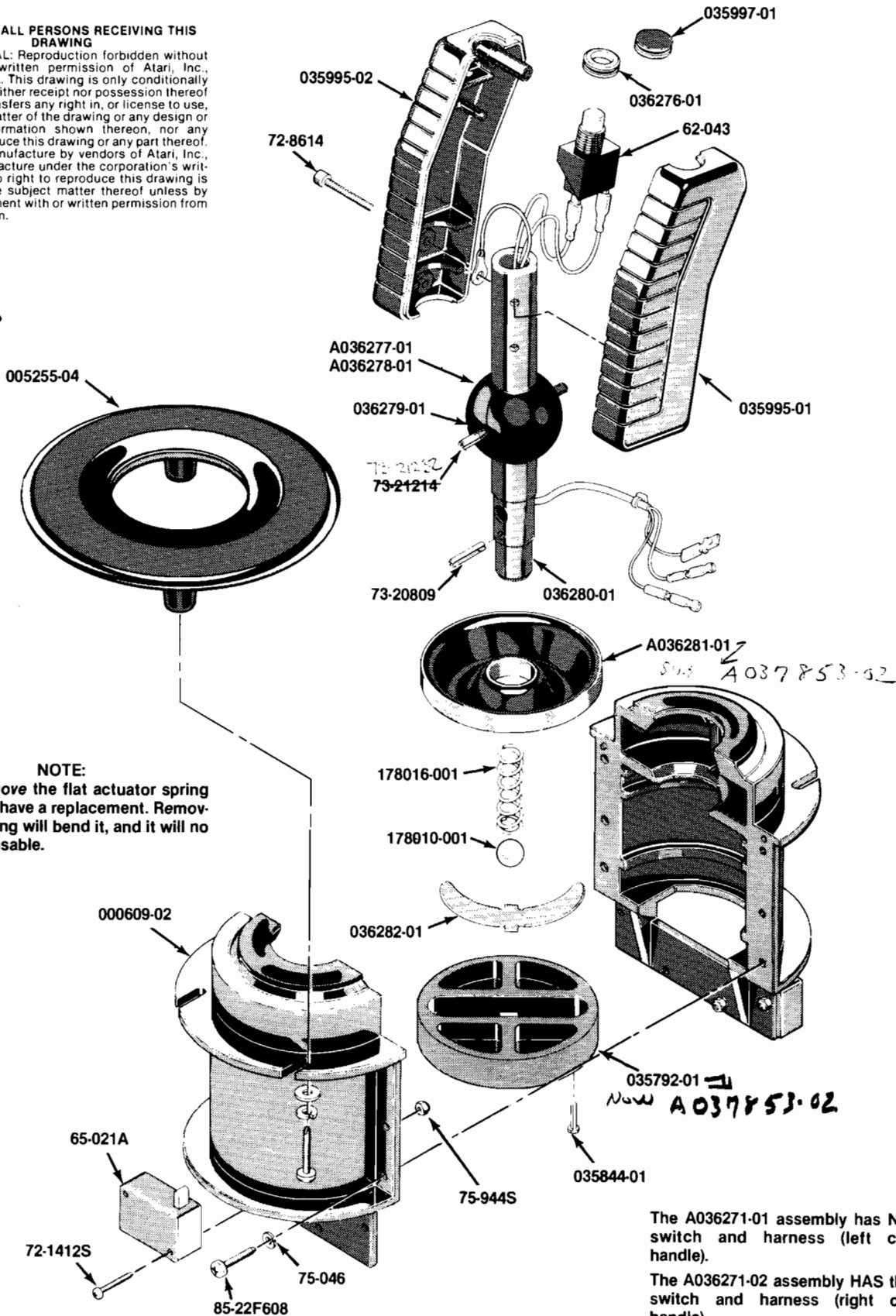
**Figure 20 Control Panel Assembly
A036139-01 B**

Parts List

<i>Part No.</i>	<i>Description</i>
A036246-01	Control-Panel Harness Assembly
62-039	SPDT Momentary-Contact Pushbutton Start Switch with Red Light-Emitting Diode
75-07054	Flat Nylon Washer, 0.470-Inch inside diameter × 0.968-Inch outside diameter × 0.075-Inch thick
75-9910W0	#15/32-32 Steel Stamped Nut
78-6900402	Vinyl Foam Single-Coated-Adhesive Tape, 1/8-Inch thick × 1/4-Inch wide
005255-04	Control-Handle Bezel
033127-01	Black Molded Switch Bushing
035830-01	Control Panel with Graphics
036102-01	Wood Support Block for Control Handles

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NOTE:
Do not remove the flat actuator spring unless you have a replacement. Removing the spring will bend it, and it will no longer be usable.

The A036271-01 assembly has NO fire switch and harness (left control handle).
The A036271-02 assembly HAS the fire switch and harness (right control handle).

**Figure 21 Control Handle Assembly
A036271-01 and -02 B**

Figure 21 Control Handle Assembly Parts List



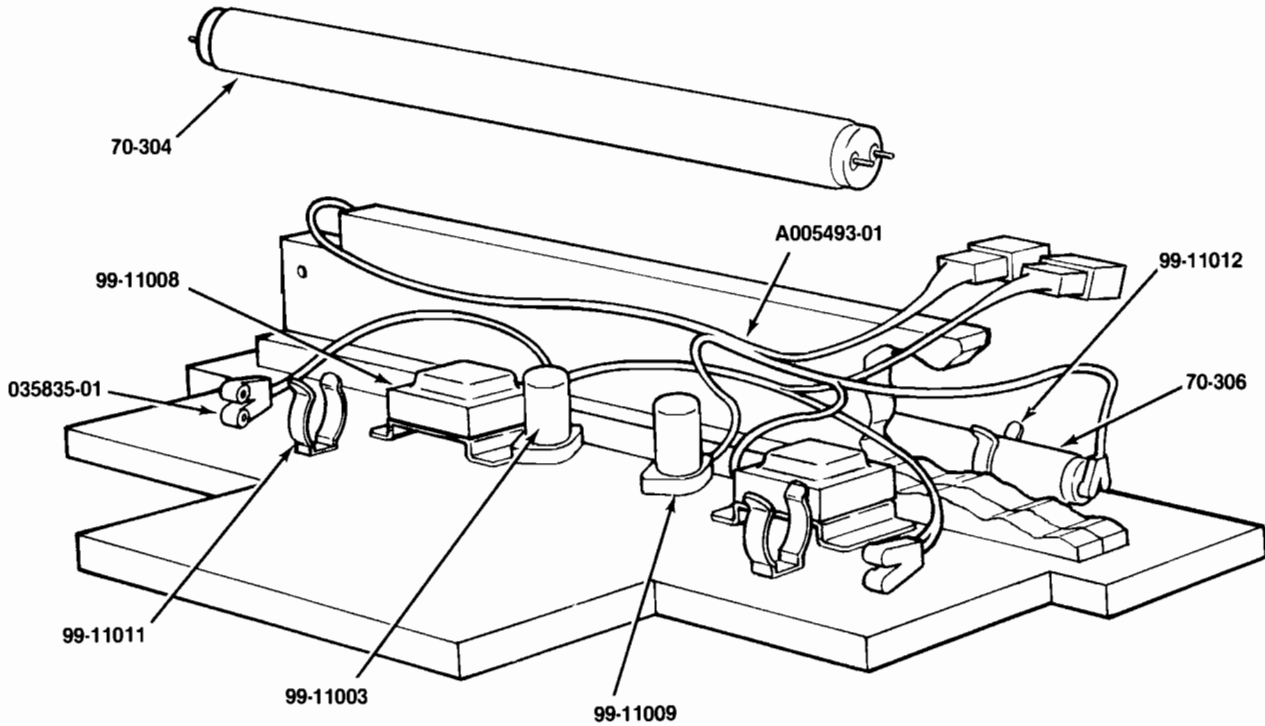
Part No.	Description
A036277-01	Shaft Assembly with Fire Switch Harness <i>(includes pivot ball, pivot shaft and 2 slotted pins)</i>
A036278-01	Shaft Assembly without Fire Switch Harness <i>(includes pivot ball, pivot shaft and 2 slotted pins)</i>
A036281-01	Centering Bellows
62-043	SPST Pushbutton Switch with Red Non-Lighting Cap <i>(used as fire switch)</i>
65-021A	Single-Pole Single-Throw Low-Force Miniature Switch
72-1412S	#4-40 × ¾-Inch Pan-Head Cross-Recessed Cadmium-Plated Steel Machine Screw
72-8614	#6-32 × 7/8-Inch Hex Socket-Head Steel Machine Screw
73-20809	1/8-Inch Diameter × 9/16-Inch Long Slotted Pin
73- 21214 21232	3/16-Inch Diameter × 7/8 ^{2"} -Inch Long Slotted Pin <i>(R) (73-21232)</i>
75-046	#6 Internal-Tooth Steel Split Lock Washer
75-944S	#4-40 Steel Self-Locking Polymer Hex Nut
78-1710	Dow Corning Heavy Silicone Compound #111 Lubricant
85-22F608	#6-32 × ½-Inch Pan-Head Cross-Recessed Self-Threading Type F Steel Machine Screw
000609-02	Control Handle Housing <i>(two of these required per control handle assembly)</i>
005255-04	Control-Handle Bezel
035792-01	Straight-Pattern Detent
035844-01	Clear Plastic Actuator Pin
035995-01	Plastic Control Handle <i>(Right Half)</i>
035995-02	Plastic Control Handle <i>(Left Half)</i>
035997-01	Plug for Left Control Handle
036276-01	Bezel for Fire Pushbutton
036279-01	Pivot Ball
036280-01	Pivot Shaft
036282-01	Flat Actuator Spring
178010-001	Nylon Actuator Ball
178016-001	Spring

*Note: The control-handle bezel is not part of this control handle assembly.
It is listed here for your convenience.*

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Wire Nuts Not Shown for Clarity



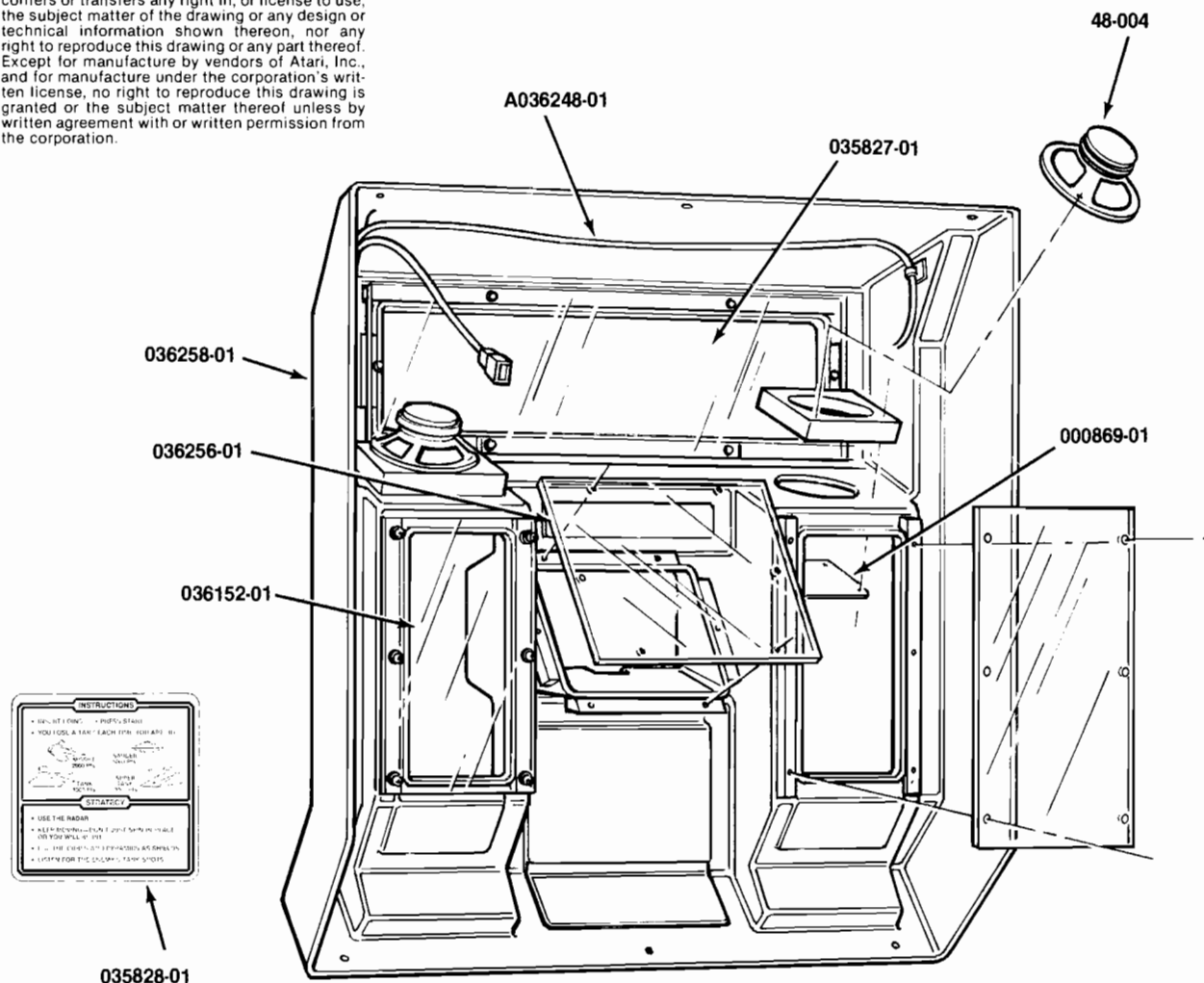
**Figure 22 Fluorescent Lights
A036146-01 A**

Parts List

<i>Part No.</i>	<i>Description</i>
A005493-01	Fluorescent Light Harness
70-304	18-Inch 15-Watt Cool White Fluorescent Tube
70-306	18-Inch 15-Watt Blacklight Fluorescent Tube
79-561816P	Wire Nut for 16- to 18-Gauge Wires
99-11003	Fluorescent Lamp Starter
99-11008	Ballast Transformer
99-11009	Starter Socket
99-11011	1½-Inch Clamp (for white tube)
99-11012	1-Inch Clamp (for blacklight tube)
035835-01	Y-Lead Connector

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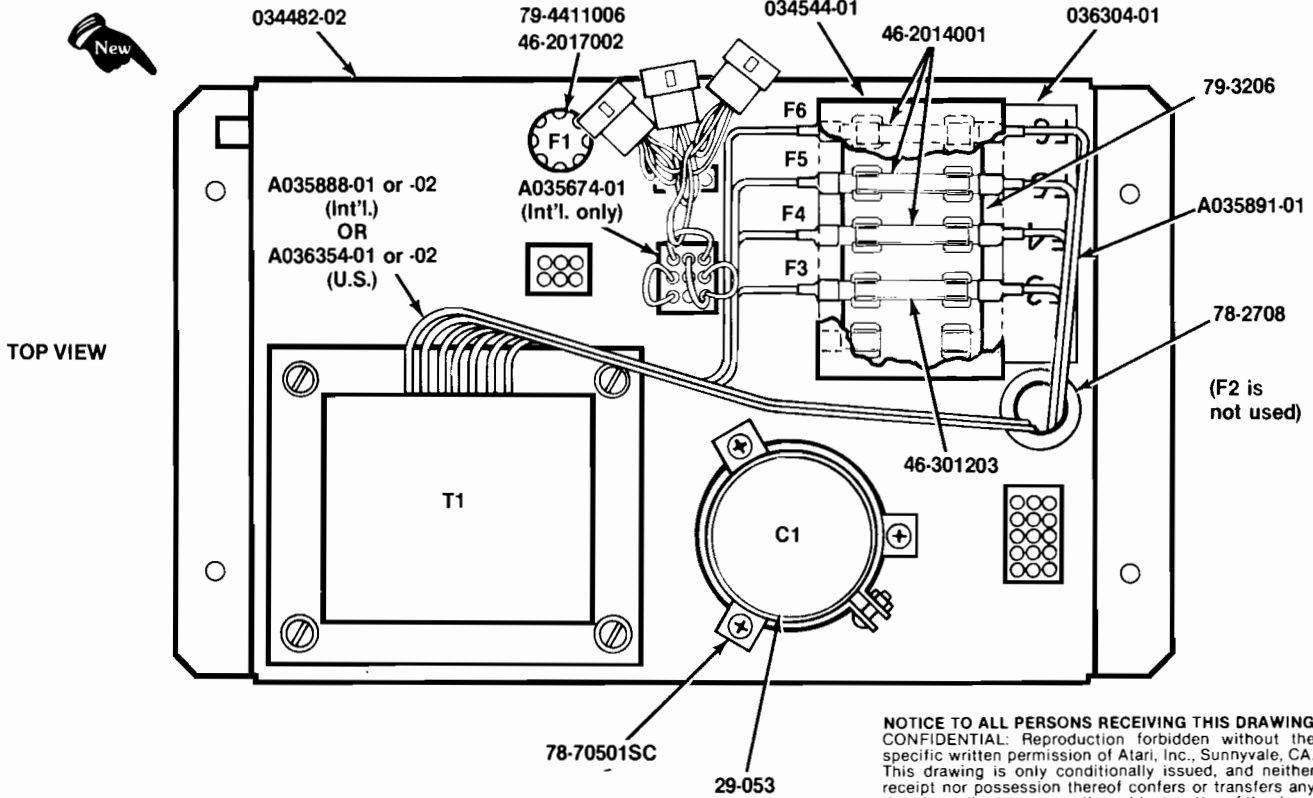
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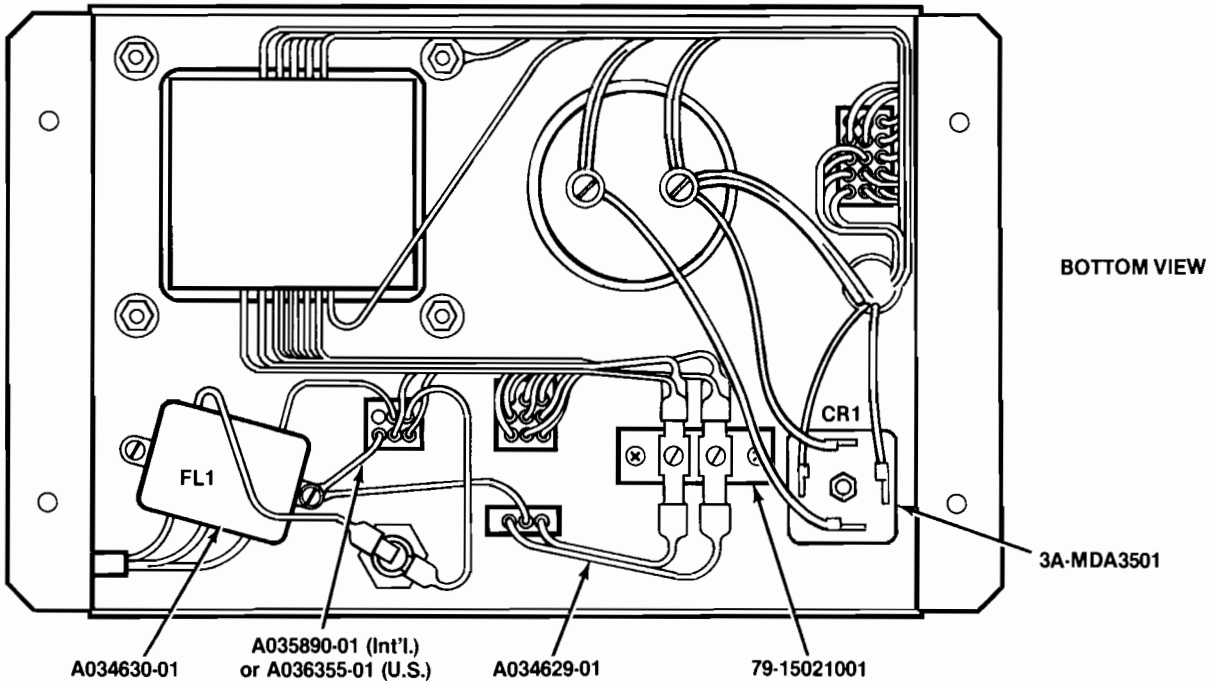
**Figure 23 Housing Assembly
A036147-01 C**

Parts List

<i>Part No.</i>	<i>Description</i>
A036248-01	Speaker Harness Assembly
48-004	5-Inch 8-Ohm 5-Watt High-Fidelity Speaker
000869-01	Speaker Grille
035827-01	Attraction Panel with Graphics
035828-01	Instructions Decal
036152-01	Side Window
036256-01	Center Viewing Window
036258-01	Housing



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**Figure 24 Power Supply Assemblies for X-Y Games
 A035892-01 (International) A / A036353-01 (U.S.) A**

Figure 24 Power Supply Assemblies for X-Y Games Parts List



Part No.	Description (Reference Designations in Bold)
A034629-01	A.C. Harness Assembly
A034630-01	RFI Filter Assembly (FL1)
A035674-01	Voltage Plug Assembly (set of four plugs—for international power supply only)
A035888-01 or -02	Transformer Assembly—international only (T1)
A035890-01	Power Harness Assembly (international only)
A035891-01	Fuse Harness Assembly
A036354-01 or -02	Transformer Assembly—U.S. only (T1)
A036355-01	Power Harness Assembly (U.S. only)
29-053	26,000 uf 15 V Electrolytic Capacitor (C1)
3A-MDA3501	Bridge Rectifier, Type MDA 3501 (CR1)
46-2014001	4-Amp. 125 V 3AG Slow-Blow Glass Cartridge-Type Fuse (F4, F5, F6)
46-2017002	7-Amp. 250 V 3AG Slow-Blow Glass Cartridge-Type Fuse (F1)
46-301203	20-Amp. 32 V 3AG Slow-Blow Glass Cartridge-Type Fuse (F3)
78-2708	Nylon Type 6/6 Hole Bushing with 5/8-Inch Inside Diameter × 55/64-Inch Outside Diameter × 1/4-Inch Thick
78-70501SC	2-Inch Diameter Capacitor Mounting Bracket
79-15021001	2-Circuit Single-Row Terminal Block
79-3206	5-Position 3AG Fuse Block with 1/4-Inch Quick-Disconnect Terminals
79-4411006	Panel-Mounting Non-Indicating 3AG Cartridge-Type Fuse Post
034482-02	Power Supply Chassis
034544-01	Fuse Block Cover
036304-01	Label for Fuse Values

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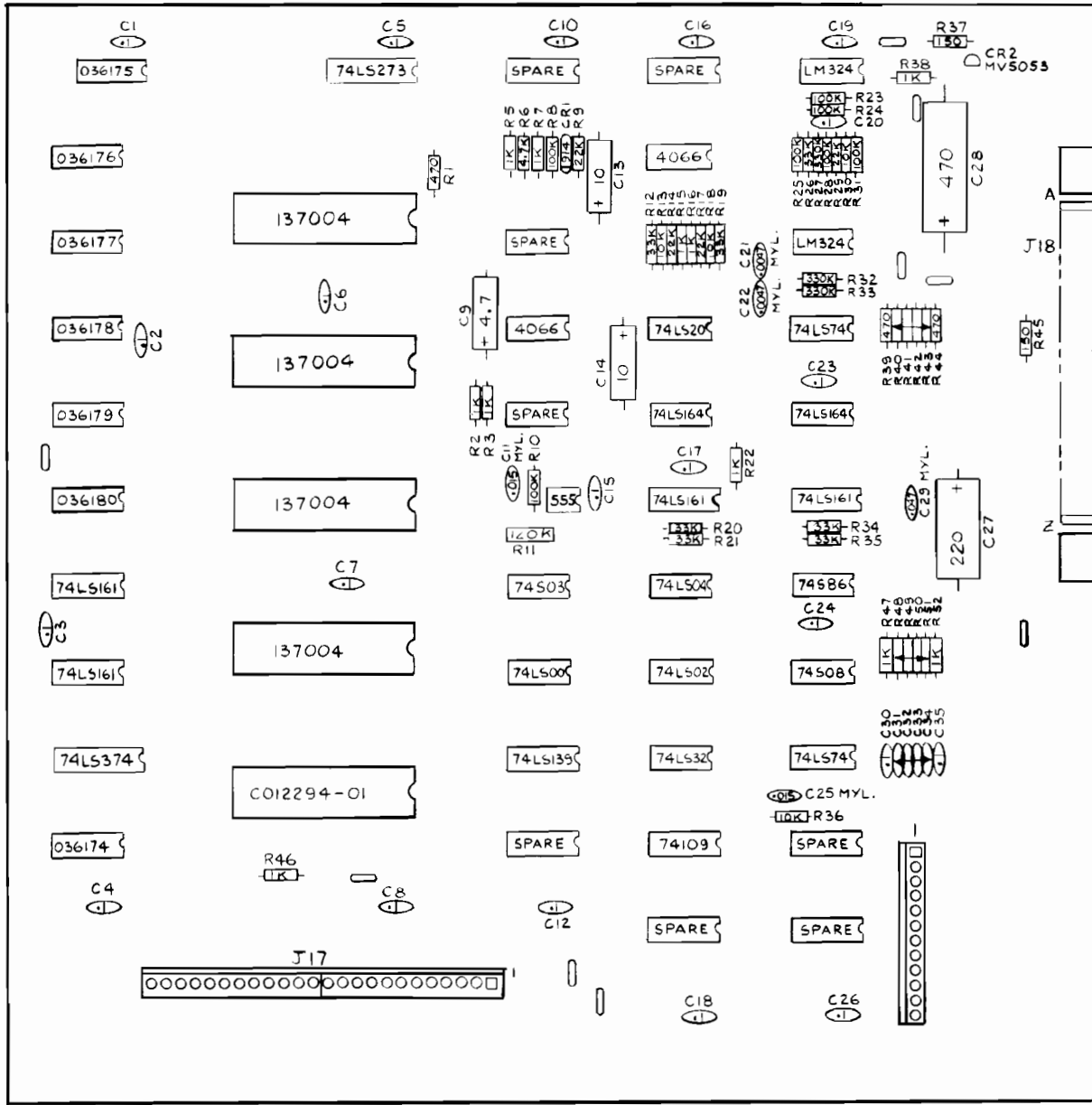


Figure 25 Battlezone™ Auxiliary PCB Assembly
 A035678-01 B

Figure 25 Battlezone™ Auxiliary PCB Assembly Parts List



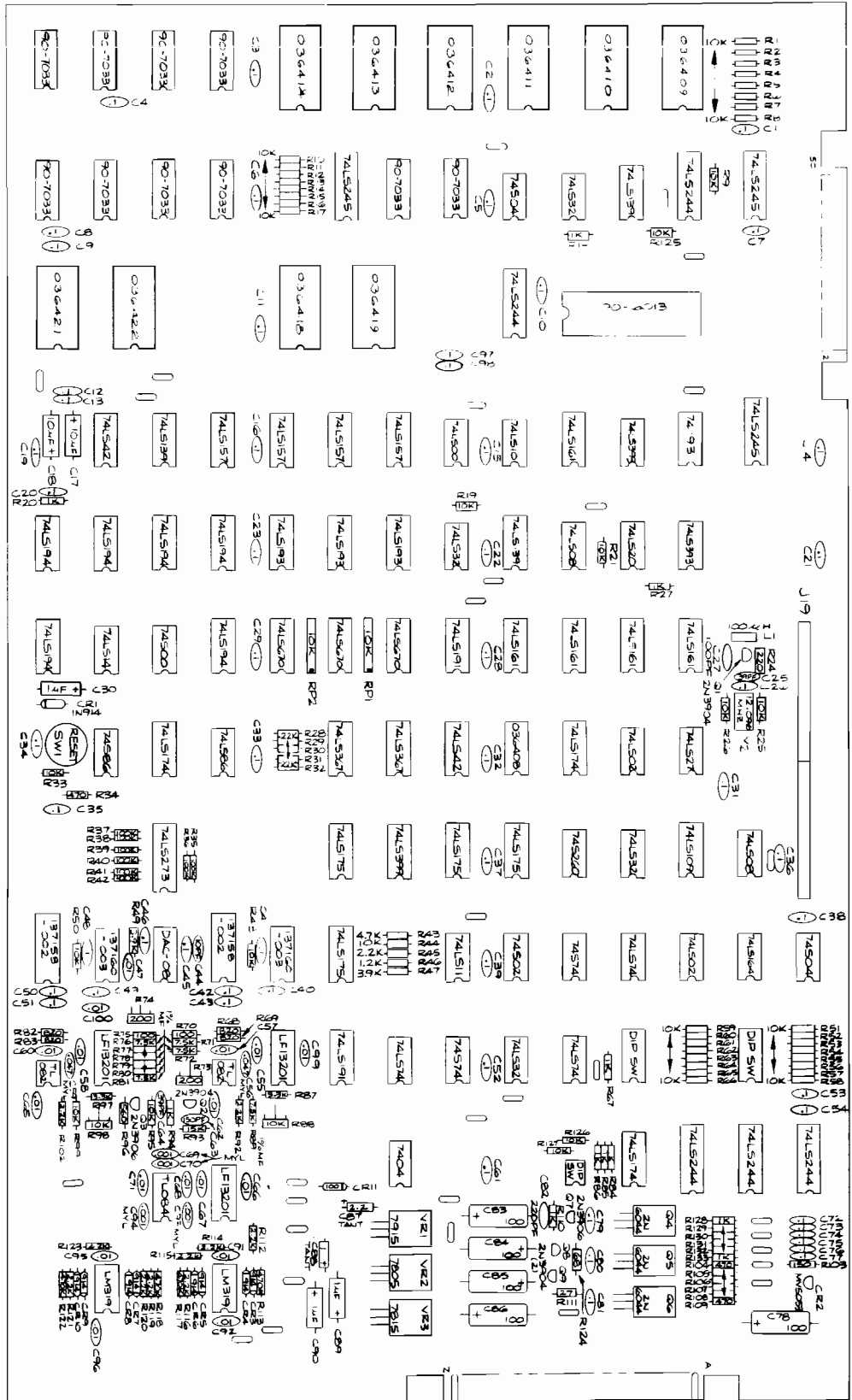
Part No.	Description (Reference Designations and Locations in Bold)
C012294-01	Audio I/O N-Channel MOS/LSI Custom Chip (B/C2)
21-101153	.015 uf, ± 10%, Radial-Lead Epoxy-Dipped 100V Mylar Capacitor (C11, C25)
21-101472	.0047 uf, ± 10%, Radial-Lead Epoxy-Dipped 100V Mylar Capacitor (C21, 22)
21-101474	.47 uf, ± 10%, Radial-Lead Epoxy-Dipped 100V Mylar Capacitor (C29)
24-250106	10 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor (C13, 14)
24-250227	220 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor (C27)
24-250477	470 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor (C28)
24-500475	4.7 uf Aluminum Electrolytic Fixed Axial-Lead 50V Capacitor (C9)
29-088	.1 uf Ceramic-Disc Radial-Lead 25V Capacitor (C1-8, 10, 12, 15-20, 23, 24, 26, 30-35)
31-1N914	75V Type-1N914 Switching Diode (CR1)
37-LM324	Type LM324 Integrated Circuit (K5, M5)
37-4066	Type 4066 Analog Switch Integrated Circuit (J3, L4)
37-555	Type 555 Timer Integrated Circuit (F3)
37-74LS00	Type 74LS00 Integrated Circuit (D3)
37-74LS02	Type 74LS02 Integrated Circuit (D4)
37-74LS04	Type 74LS04 Integrated Circuit (E4)
37-74LS20	Type 74LS20 Integrated Circuit (J4)
37-74LS32	Type 74LS32 Integrated Circuit (C4)
37-74LS74	Type 74LS74 Integrated Circuit (C5, J5)
37-74LS139	Type 74LS139 Integrated Circuit (C3)
37-74LS161	Type 74LS161 Integrated Circuit (D1, E1, F4, F5)
37-74LS164	Type 74LS164 Integrated Circuit (H4, H5)
37-74LS273	Type 74LS273 Integrated Circuit (M2)
37-74LS374	Type 74LS374 Integrated Circuit (C1)
37-74S08	Type 74S08 Integrated Circuit (D5)
37-74109	Type 74109 Integrated Circuit (B4)
38-MV5053	Type MV5053 Red Light-Emitting Diode (CR2)
79-42C16	16-Contact Medium-Insertion-Force Integrated Circuit Socket (B1, F1, H1, J1, K1, L1, M1)
79-42C40	40-Contact Medium-Insertion-Force Integrated Circuit Socket (B/C2, D/E2, F2, H/J2, K2)
020670-01	Test Point
036174-01	Programmable Read-Only Memory (B1)
036175-01	Programmable Read-Only Memory (M1)
036176-01	Programmable Read-Only Memory (L1)
036177-01	Programmable Read-Only Memory (K1)
036178-01	Programmable Read-Only Memory (J1)
036179-01	Programmable Read-Only Memory (H1)
036180-01	Programmable Read-Only Memory (F1)
110000-102	1K Ohm, ± 5%, ¼W Resistor (R2, 3, 5, 7, 15, 16, 22, 38, 46-52)
110000-103	10K Ohm, ± 5%, ¼W Resistor (R13, 18, 30, 36)
110000-124	120K Ohm, ± 5%, ¼W Resistor (R11)

[Continued on next page]

Figure 25 Battlezone™ Auxiliary PCB Assembly, continued Parts List



<i>Part No.</i>	<i>Description (Reference Designations and Locations in Bold)</i>
110000-104	100K Ohm, $\pm 5\%$, $\frac{1}{4}$ W Resistor (R8, 10, 23-25, 28, 31)
110000-151	150 Ohm, $\pm 5\%$, $\frac{1}{4}$ W Resistor (R37, 45)
110000-223	22K Ohm, $\pm 5\%$, $\frac{1}{4}$ W Resistor (R9, 14, 17, 29)
110000-333	33K Ohm, $\pm 5\%$, $\frac{1}{4}$ W Resistor (R12, 19-21, 26, 34, 35)
110000-334	330K Ohm, $\pm 5\%$, $\frac{1}{4}$ W Resistor (R27, 32, 33)
110000-471	470 Ohm, $\pm 5\%$, $\frac{1}{4}$ W Resistor (R1, 39-44)
110000-472	4.7K Ohm, $\pm 5\%$, $\frac{1}{4}$ W Resistor (R6)
137002-001	Type 74S86 Integrated Circuit (E5)
137003-001	Type 74S03 Integrated Circuit (E3)
137004-001	Transistor Array (D/E2, F2, H/J2, K2)
179014-012	12-Pin PCB Header



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Figure 26 Battlezone™ Analog Vector-Generator PCB Assembly
 A036424-02 A

Figure 26 Battlezone™ Analog Vector-Generator PCB Assembly Parts List

Memory Components (Locations Shown in Bold)



-02 P.C. Boards (ROMs)

036409-01	(N1)
036410-01	(LM1)
036411-01	(K1)
036412-01	(J1)
036413-01	(F/H1)
036414-02	(E1)
036421-01	(A3)
036422-01	(B/C3)

Figure 26 Battlezone™ Analog Vector-Generator PCB Assembly, continued Parts List

Note: The Battlezone™ Analog Vector-Generator PCB consists of the Battlezone memory chips (described on the previous page) PLUS the Universal Vector-Generator PCB. The latter is interchangeable with Battlezone and future X-Y games, but not with Lunar Lander™ or Asteroids™. All the following parts in this figure make up the Universal Vector-Generator PCB Assembly.



Part No.	Description (Reference Designations and Locations in Bold)
Universal Vector-Generator PCB Assy., A035742-01 and -02, Rev. B, consists of the following parts:	
19-007	10K Ohm, $\pm 20\%$, 1¼ W 8-Pin Dual-Inline-Package Resistor Network (RP1, RP2— <i>use only if board has 74LS170s or 74LS670s at locations E6, F6, H6</i>)
19-315103	10K Ohm Vertical PCB-Mounting Cermet Trimpot (R88, 98)
19-315201	200 Ohm Vertical PCB-Mounting Cermet Trimpot (R73, 74)
21-101102	.001 uf, $\pm 10\%$, Radial-Lead Epoxy-Dipped 100V Mylar Capacitor (C69, 70, 93, 94)
21-101103	.01 uf, $\pm 10\%$, Radial-Lead Epoxy-Dipped 100V Mylar Capacitor (For -02 PCB Assy. only: C103)
21-101473	.047 uf, $\pm 10\%$, Radial-Lead Epoxy-Dipped 100V Mylar Capacitor (C56, 59)
24-250106	10 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor (C17, 18)
24-250107	100 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor (C78, 83-86)
24-500105	1 uf Aluminum Electrolytic Fixed Axial-Lead 50V Capacitor (C30, 89, 90)
27-102182	.0018 pf, $\pm 10\%$, Radial-Lead Ceramic-Disc 1000V Capacitor (For -01 PCB Assy. only: C103; For -02 PCB Assy. only: C105)
28-101100	10 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor (C44)
28-101101	100 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor (C27)
28-101151	150 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor (C63)
28-101221	220 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor (C82)
28-101390	39 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor (C25, 64, 106)
28-101470	47 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor (C104)
29-006	1 uf, $\pm 10\%$, 35V Tantalum Capacitor (C88)
29-088	.1 uf Ceramic-Disc 25V Radial-Lead Capacitor (C1-16, 19-23, 26, 28, 29, 31-39, 45, 46, 50-54, 61, 72-77, 79-81, 97, 98). Also, for -01 PCB Assy. only: C40, 41, 48, 49. For -02 PCB Assy. only: C42, 43, 50, 51
31-1N100	100V Type-1N100 Switching Diode (CR11)
31-1N914	75V Type-1N914 Switching Diode (CR1, 3-10)
33-2N3906	Type-2N3906 PNP Switching and Amplifying Transistor (Q3, 7)
34-2N3904	Type-2N3904 NPN 60V 1-Watt Transistor (Q1, 2, 8, 9)
34-2N6044	Type-2N6044 Darlington NPN Transistor (Q4-6)
37-LM319	Type LM319 Integrated Circuit (B12, D12)
37-TL082CP	Type TL082 Integrated Circuit (A10, D10)
37-13201	Type LF13201 Integrated Circuit (B10, D11, E10)
37-347	Type TL084 Integrated Circuit (C11)
37-74LS00	Type 74LS00 Integrated Circuit (J4)
37-74LS02	Type 74LS02 Integrated Circuit (N9, M7)
37-74LS08	Type 74LS08 Integrated Circuit (L5, P8)
37-74LS10	Type 74LS10 Integrated Circuit (K4)
37-74LS14	Type 74LS14 Integrated Circuit (B6)
37-74LS20	Type 74LS20 Integrated Circuit (M5)
37-74LS27	Type 74LS27 Integrated Circuit (N7)

[Continued on next page]



Figure 26 Battlezone™ Analog Vector-Generator PCB Assembly, continued Parts List

Part No.	Description (Reference Designations and Locations in Bold)
Universal Vector-Generator PCB Assy., A035742-01 and -02, Rev. B, consists of the following parts:	
37-74LS32	Type 74LS32 Integrated Circuit (J5, K10, L2, M8)
37-74LS42	Type 74LS42 Integrated Circuit (B4, J7)
37-74LS74	Type 74LS74 Integrated Circuit (H10, L10, M9)
37-74LS86	Type 74LS86 Integrated Circuit (D7)
37-74LS109	Type 74LS109 Integrated Circuit (N8)
37-74LS139	Type 74LS139 Integrated Circuit (C4, K5, M2)
37-74LS157	Type 74LS157 Integrated Circuit (D4, E4, F4, H4)
37-74LS161	Type 74LS161 Integrated Circuit (K6, L4, L6, M6, N6)
37-74LS164	Type 74LS164 Integrated Circuit (P9)
37-74LS174	Type 74LS174 Integrated Circuit (C7, L7, M11)
37-74LS175	Type 74LS175 Integrated Circuit (F8, F9, J8, K8)
37-74LS191	Type 74LS191 Integrated Circuit (F10, J6)
37-74LS193	Type 74LS193 Integrated Circuit (E5, F5, H5)
37-74LS194	Type 74LS194 Integrated Circuit (A5, A6, B5, C5, D5, D6)
37-74LS244	Type 74LS244 Integrated Circuit (K3, N2, N11, P11, R11)
37-74LS245	Type 74LS245 Integrated Circuit (F2, P2, P4) <i>Acceptable substitute is part no. 37-8304B.</i>
37-74LS273	Type 74LS273 Integrated Circuit (C8)
37-74LS367	Type 74LS367 Integrated Circuit (F7, H7)
37-74LS393	Type 74LS393 Integrated Circuit (M4, N5)
37-74LS399	Type 74LS399 Integrated Circuit (H8)
37-74LS670	Type 74LS670 Integrated Circuit (E6, F6, H6) <i>Acceptable substitute is part no. 37-74LS170.</i>
37-74S00	Type 74S00 Integrated Circuit (C6)
37-74S02	Type 74S02 Integrated Circuit (K9)
37-74S04	Type 74S04 Integrated Circuit (K2, R9)
37-74S74	Type 74S74 Integrated Circuit (J10, L9)
37-74S260	Type 74S260 Integrated Circuit (L8)
37-7404	Type 7404 Integrated Circuit (H11)
37-74193	Type 74193 Integrated Circuit (N4)
37-7805	+ 5V Voltage Regulator (VR2)
37-7815	+ 15V Voltage Regulator (VR3)
37-7915	- 15V Voltage Regulator (VR1)
38-MV5053	Type MV5053 Light-Emitting Diode (CR2)
41-3004	100 uH, ± 10%, Hot-Molded Plastic Fixed R.F. Choke (L1)
62-001	SPST Momentary Pushbutton Switch (SW1)
66-114P1T	4-Station Single-Throw, Dual-Inline-Package Bit Switch (L11)
66-118P1T	8-Station Single-Throw, Dual-Inline-Package Bit Switch (M10, P10)
79-42C24	24-Contact Medium-Insertion-Force Integrated Circuit Socket (A3, B/C3, D3, E1, E3, F/H1, F/H3, J1, J3, K1, L/M1, N1)
79-42C40	40-Contact Medium-Insertion-Force Integrated Circuit Socket (L/M/N3)
81-4302	Nylon Snap-In Fastener
90-102	12.096 MHz, ± .005%, Crystal (Y2)
90-6013	Microprocessor (L/M/N3)
90-7033	Random-Access Memory (A1, A2, B1, B2, C1, C2, D1, D2, H2, J2)
020670-01	Test Point
036408-01	Programmable Read-Only Memory (K7)

Figure 26 Battlezone™ Analog Vector-Generator PCB Assembly, continued Parts List

Part No. Description (Reference Designations and Locations in Bold)



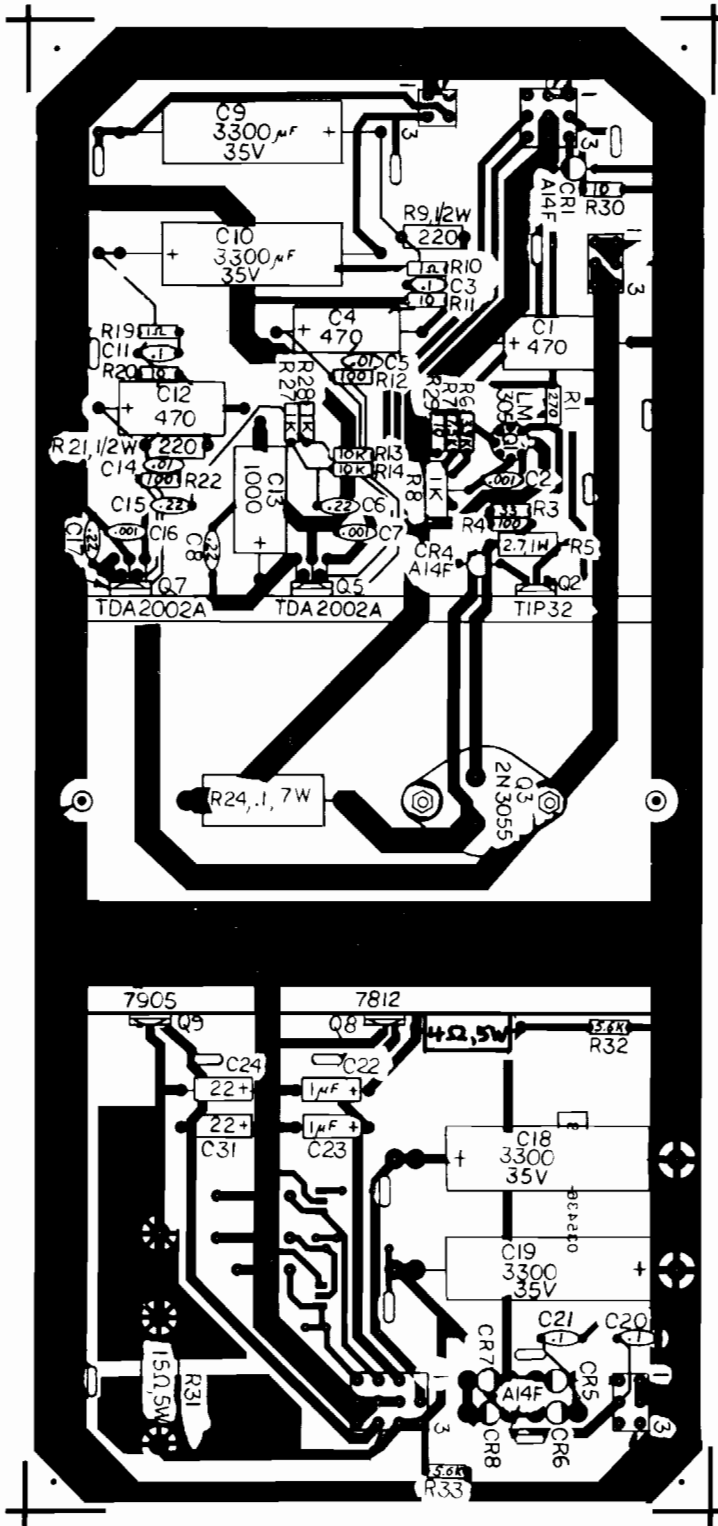
Universal Vector-Generator PCB Assy., A035742-01 and -02, Rev. B, consists of the following parts:

110000-101	100 Ohm, ± 5%, ¼ W Resistor	(R70, 75)
110000-102	1K Ohm, ± 5%, ¼ W Resistor	(R18, 20, 27, 67, 84-86, 94, 110, 128-133)
110000-103	120 Ohm, ± 5%, ¼ W Resistor	(R1-17, 19, 21, 25, 26, 33, 44, 51-66, 95, 99, 125-127. In addition, for -01 PCB Assy. only: R48, 50, 69)
110000-104	100K Ohm, ± 5%, ¼ W Resistor	(R35-42)
110000-122	1.2K Ohm, ± 5%, ¼ W Resistor	(R46)
110000-151	150 Ohm, ± 5%, ¼ W Resistor	(R103)
110000-153	15K Ohm, ± 5%, ¼ W Resistor	(R93)
110000-221	220 Ohm, ± 5%, ¼ W Resistor	(R24)
110000-222	2.2K Ohm, ± 5%, ¼ W Resistor	(R45, 92, 102, 112, 114-116, 119-121, 123)
110000-223	22K Ohm, ± 5%, ¼ W Resistor	(R28-32)
110000-270	27 Ohm, ± 5%, ¼ W Resistor	(R111)
110000-332	3.3K Ohm, ± 5%, ¼ W Resistor	(R87, 97)
110000-392	3.9K Ohm, ± 5%, ¼ W Resistor	(R47, 49)
110000-471	470 Ohm, ± 5%, ¼ W Resistor	(R34, 104-109)
110000-472	4.7K Ohm, ± 5%, ¼ W Resistor	(R43)
110000-474	470K Ohm, ± 5%, ¼ W Resistor	(R113, 117, 118, 122)
110000-561	560 Ohm, ± 5%, ¼ W Resistor	(R96)
110000-680	68 Ohm, ± 5%, ¼ W Resistor	(R124)
110000-681	680 Ohm, ± 5%, ¼ W Resistor	(For -02 PCB Assy. only: R83)
110000-821	820 Ohm, ± 5%, ¼ W Resistor	(For -02 PCB Assy. only: R68, 69, 82)
110003-752	7.5K Ohm, ± 1%, 1/8W Metal-Film Resistor	(R71, 72, 76-81, 89)
122000-225	2.2 uf, ± 10%, 35V Tantalum Capacitor	(C87)
122005-103	.01 uf Ceramic-Disc Minimum 25V Radial-Lead Capacitor	(C47, 55, 57, 58, 60, 62, 65-68, 71, 91, 92, 95, 96, 99, 100)
137002-001	Type 74S86 Integrated Circuit	(B7)
137149-001	Type 74LS11 Integrated Circuit	(J9)
137159-001	Type DAC-08 Digital-to-Analog Converter	(C9)
137158-002	Type AM6012ADC Digital-to-Analog Converter	(For -02 PCB Assy. only: A9, D9)
	OR	
137160-003	Type MC3410 Digital-to-Analog Converter	(For -01 PCB Assy. only: B9, E9)
179010-001	12-Pin PCB Header	(J19)

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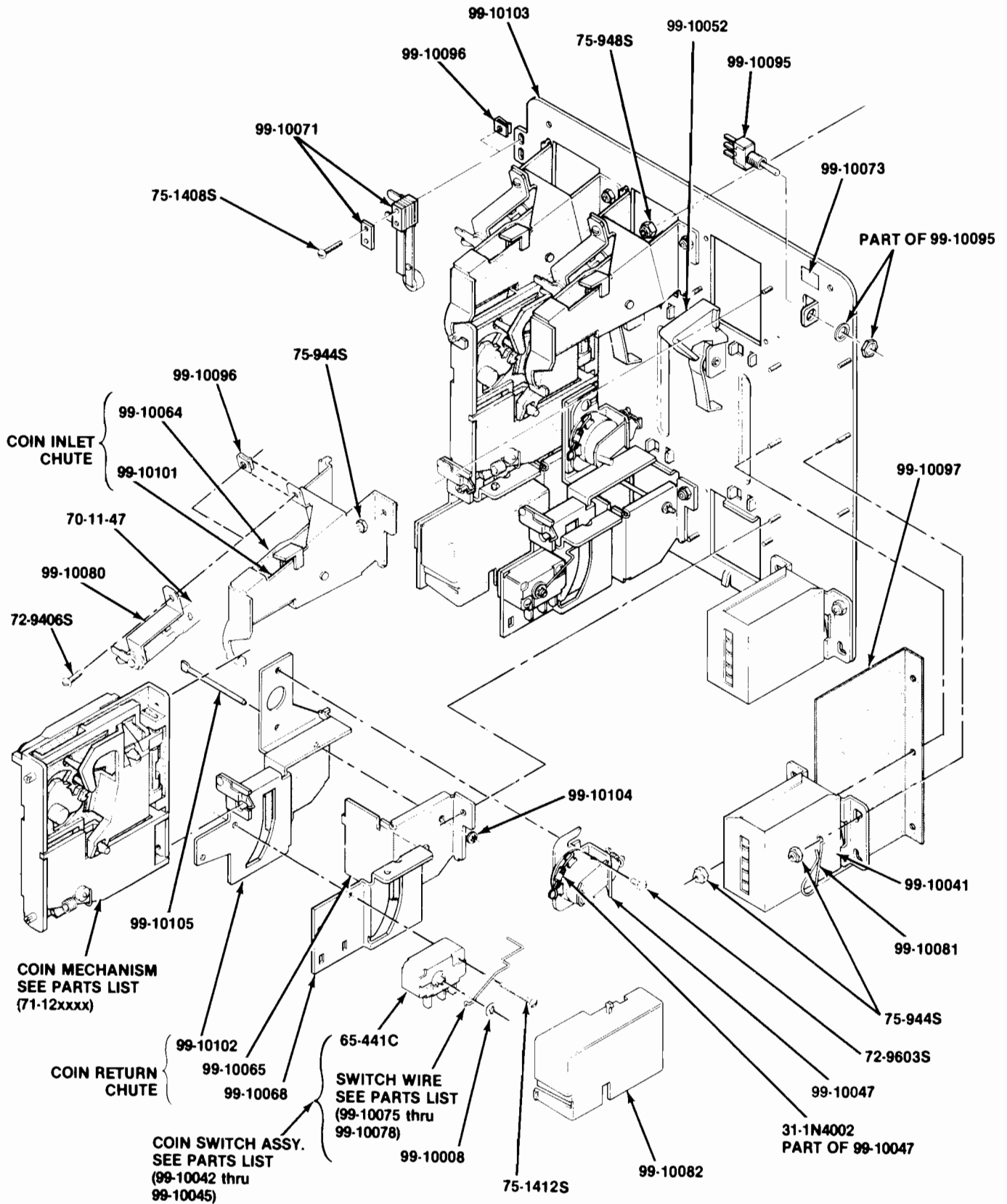
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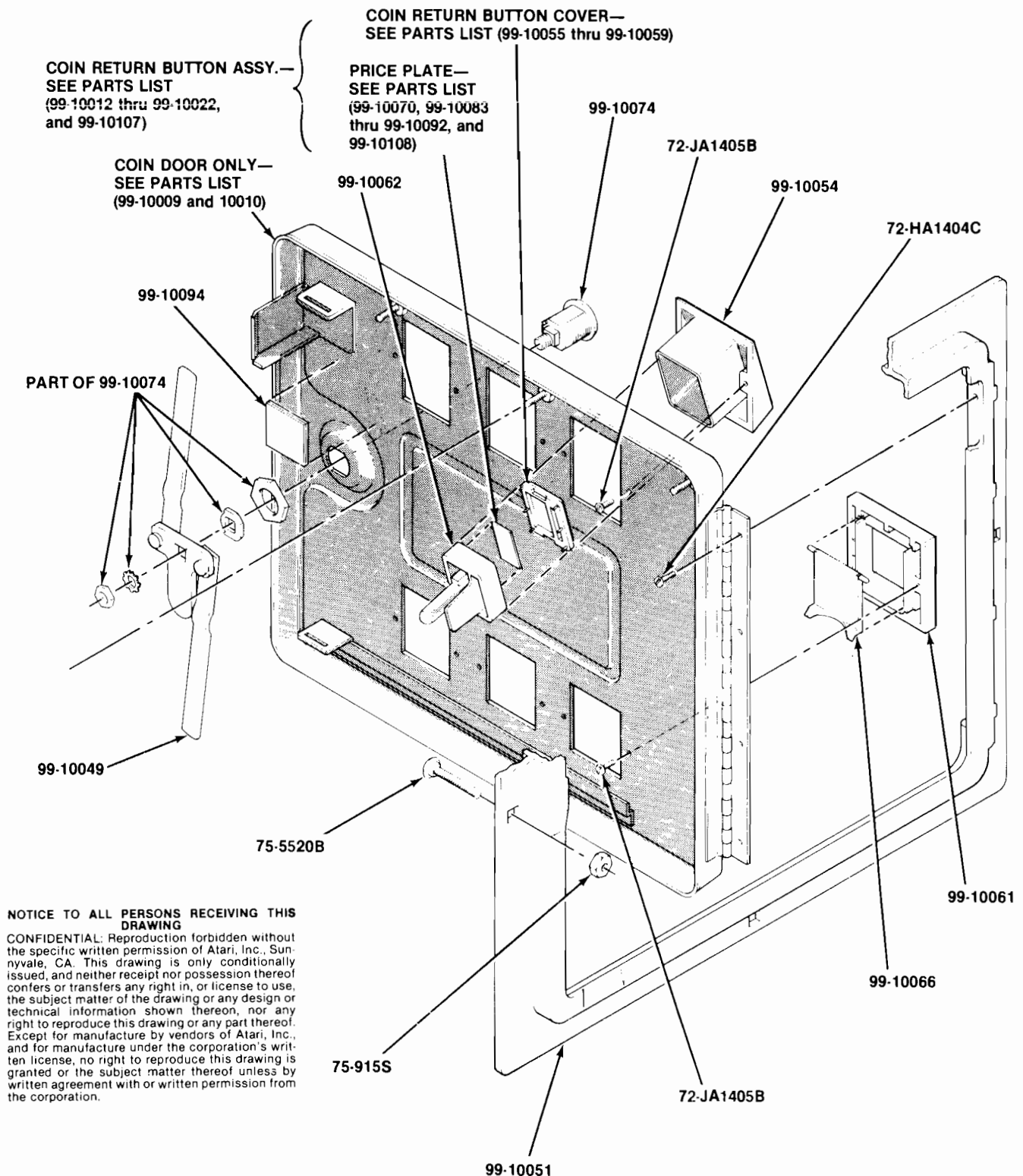
**Figure 27 Regulator/Audio II PCB Assembly
A035435-02 C**

Figure 27 Regulator/Audio II PCB Assembly Parts List

Part No.	Description (Reference Designations and Locations in Bold)
12-52P7	2.7 Ohm, $\pm 5\%$, 1W Resistor (R5)
16-54PO	4 Ohm, $\pm 5\%$, 5W Wirewound Resistor (R25)
19-100P1015	.1 Ohm, $\pm 3\%$, 7W Wirewound Resistor (R24)
19-315102	1K Ohm Vertical PCB-Mounting Cermet Trimpot (R8)
24-250108	1000 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor (C13)
24-250477	470 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor (C1, 4, 12)
24-350226	22 uf Aluminum Electrolytic Fixed Axial-Lead 35V Capacitor (C24, 31)
24-350338	3300 uf Aluminum Electrolytic Fixed Axial-Lead 35V Capacitor (C9, 10, 18, 19)
24-500105	1 uf Aluminum Electrolytic Fixed Axial-Lead 50V Capacitor (C22, 23)
29-088	.1 uf Ceramic-Disc 25V Radial-Lead Capacitor (C3, 11, 20, 21)
31-A14F	50V 2.5A Miniature Axial-Lead High-Current Rectifier (CR1, 4-8)
33-TIP32	PNP Power Transistor, Type TIP32 (Q2)
34-2N3055	NPN Silicon Transistor, Type 2N3055 (Q3)
37-LM305	5V Linear Voltage Regulator (Q1)
37-7812	+ 12V Voltage Regulator, Type 7812 (Q8)
37-7905	- 5V Voltage Regulator, Type 7905 (Q9)
72-1608C	#6-32 \times 1/2-Inch Cross-Recessed Pan-Head Corrosion-Resistant Steel Machine Screw
75-F60405	#6-32 \times 1/4-Inch Binder-Head Nylon Screw
75-99516	#6-32 Nut/Washer Assembly
78-16008	Thermally Conductive Compound (Q3)
78-16014	Thermally Conductive Silicon Insulator (Q2, 9)
79-58306	6-Position Connector Receptacle (J6, 9)
79-58308	9-Position Connector Receptacle (J7)
79-58346	12-Position Connector Receptacle (J10)
79-58354	4-Position Connector Receptacle (J8)
020670-01	Test Point
034531-01	Heat Sink
110000-010	1 Ohm, $\pm 5\%$, 1/4W Resistor (R10, 19)
110000-100	10 Ohm, $\pm 5\%$, 1/4W Resistor (R11, 20, 29, 30)
110000-101	100 Ohm, $\pm 5\%$, 1/4W Resistor (R4, 12, 22)
110000-102	1K Ohm, $\pm 5\%$, 1/4W Resistor (R27, 28)
110000-103	10K Ohm, $\pm 5\%$, 1/4W Resistor (R13, 14)
110000-271	270 Ohm, $\pm 5\%$, 1/4W Resistor (R1)
110000-330	33 Ohm, $\pm 5\%$, 1/4W Resistor (R3)
110000-392	3.9K Ohm, $\pm 5\%$, 1/4W Resistor (R6)
110000-562	5.6K Ohm, $\pm 5\%$, 1/4W Resistor (R32, 33)
110000-752	7.5K Ohm, $\pm 5\%$, 1/4W Resistor (R7)
110001-221	220 Ohm, $\pm 5\%$, 1/2W Resistor (R9, 21)
116000-220	22 Ohm, $\pm 5\%$, 10W Wirewound Resistor (R31)
122002-102	.001 uf Ceramic-Disc Minimum 25V Radial-Lead Capacitor (C2, 7, 16)
122004-224	.22 uf Ceramic-Disc 25V Capacitor (C6, 8, 15, 17)
100015-103	.01 uf Ceramic-Disc 25V Radial-Lead Capacitor (C5, C14)
137151-002	Type TDA2002A 8W Linear Audio Amplifier Integrated Circuit (Q5, 7)



**Figure 28 New Coin Door
 71-10xxxx D**



71-102201 — 25¢/25¢ Coin Door
 71-103202 — 25¢/25¢/25¢ Coin Door
 71-103203 — 25¢/25¢/\$1 Coin Door
 71-102204 — 2 DM/1 DM Coin Door
 71-103205 — 1/2/5 DM Coin Door

71-102206 — 1 DM/5 DM Coin Door
 71-102207 — 5 Fr/5 Fr Belgian Coin Door
 71-102208 — 1 Fr/1 Fr Swiss Coin Door
 71-102209 — 100Y/100Y Coin Door
 71-102210 — 10 P/10 P Coin Door

71-102211 — 20¢/20¢ Australian Coin Door
 71-102212 — 100 L/100 L Italian Coin Door
 71-102213 — 50¢/50¢ (2 x 25¢) Coin Door
 71-103214 — 50¢/50¢/50¢ Coin Door
 71-103215 — 50¢/50¢/\$1 Coin Door

Figure 28 New Coin Door
71-10xxxx D

Figure 28 New Coin Door, continued Parts List

<i>Part No.</i>	<i>Description</i>
31-1N4002	100V Silicon Rectifier 1N4002 Diode
65-441C	General-usage low-force miniature switch
70-11-47	Miniature bayonet-base incandescent lamp, type #47
71-1201ADU	U.S. \$1.00 coin mechanism
71-1201FCH	Swiss 1 Fr coin mechanism
71-1201MG	German 1 DM coin mechanism
71-1202MG	German 2 DM coin mechanism
71-1205FB	Belgian 5 Fr coin mechanism
71-1205MG	German 5 DM coin mechanism
71-1210PE	U.K. 10 P coin mechanism
71-1220CA	Australian 20¢ coin mechanism
71-1225CU	U.S. 25¢ coin mechanism
71-12100LI	Italian 100 Lire coin mechanism
71-12100YJ	Japanese Y100 coin mechanism
72-HA1404C	#4x¼" Slotted pan-head thread-rolling tri-fluted "Taptite" cadmium-plated screw
72-JA1405B	#4x5/16" Slotted pan-head thread-rolling tri-fluted "Plastite" black screw
72-9406S	#4-40x3/8" Slotted truss-head steel machine screw
72-9603S	#6-32x3/16" Slotted truss-head steel machine screw
75-915S	#¼-20 Standard pattern cadmium-plated steel hex nut
75-918S	#8-32 Standard pattern cadmium-plated steel hex nut
75-944S	#4-40 Polymer self-locking steel hex nut
75-948S	#8-32 Polymer self-locking steel hex nut
75-1408S	#4-40x½" Slotted pan-head steel machine screw
75-1412S	#4-40x¾" Slotted pan-head steel machine screw
75-5520B	#¼-20x1¼" Round-head square-neck steel bolt with black finish
99-10008	Switch wire retainer
99-10009	2-Mech coin door only
99-10010	3-Mech coin door only
99-10011	Inner panel
99-10012	U.S. 25¢ coin return button assembly
99-10013	U.S. \$1.00 coin return button assembly
99-10014	German 1 DM coin return button assembly
99-10015	German 2 DM coin return button assembly
99-10016	German 5 DM coin return button assembly
99-10017	Belgian 5 Fr coin return button assembly
99-10018	Swiss 1 Fr coin return button assembly
99-10019	Japanese Y100 coin return button assembly
99-10020	U.K. 10 P coin return button assembly
99-10021	Australian 20¢ coin return button assembly
99-10022	Italian 100 Lire coin return button assembly
99-10040	Coin inlet chute assembly
99-10041	Coin counter assembly
99-10042	Coin switch assembly for U.S. 25¢ and Belgian 5 Fr coins (silver wire)
99-10043	Coin switch assembly for German 1 DM, Swiss 1 Fr, and Japanese Y100 coins (black wire)
99-10044	Coin switch assembly for U.S. \$1.00, German 2 DM, and Italian 100 Lire coins (gold wire)

Figure 28 New Coin Door, continued Parts List

<i>Part No.</i>	<i>Description</i>
99-10045	Coin switch assembly for German 5 DM, U.K. 10 P, and Australian 20¢ coins (green wire)
99-10047	Lockout coil assembly
99-10048	Coin door harness assembly
99-10049	Locking arm assembly
99-10051	Coin door frame
99-10052	Coin return lever
99-10054	Coin button housing
99-10055	Coin return button cover for Japanese Y100 coin
99-10056	Coin return button cover for German 1 DM and Swiss 1 Fr coins
99-10057	Coin return button cover for U.S. 25¢ and Belgian 5 Fr coins
99-10058	Coin return button cover for U.S. \$1.00, German 2 DM, and Italian 100 Lire coins
99-10059	Coin return button cover for German 5 DM, U.K. 10 P, and Australian 20¢ coins
99-10061	Coin return bezel
99-10062	Coin return button
99-10063	Right half of coin inlet chute
99-10064	Left half of coin inlet chute
99-10065	Coin return box
99-10066	Coin return cover
99-10070	U.S. 25¢ price plate
99-10071	Slam switch assembly
99-10073	Test switch decal
99-10074	Lock assembly
99-10075	Black switch wire—for German 1DM, Swiss 1Fr and Japanese Y100 coins
99-10076	Silver switch wire—for U.S. 25¢ and Belgian 5Fr coins
99-10077	Gold switch wire—for U.S. \$1.00, German 2DM and Italian 100 Lire coins
99-10078	Green switch wire—for German 5DM, U.K. 10P and Australian 20¢ coins
99-10080	Miniature bayonet-base lamp socket
99-10081	Wire key holder
99-10082	Switch cover
99-10083	U.S. \$1.00 price plate
99-10084	German 1 DM price plate
99-10085	German 2 DM price plate
99-10086	German 5 DM price plate
99-10087	Belgian 5 Fr price plate
99-10088	Swiss 1 Fr price plate
99-10089	Japanese Y100 price plate
99-10090	U.K. 10 P price plate
99-10091	Australian 20¢ price plate
99-10092	Italian 100 Lire price plate
99-10094	Fish paper insulation
99-10095	Toggle switch
99-10096	“U”-type fastener
99-10097	Fish paper insulation
99-10101	Coin inlet chute sub-assembly
99-10102	Switch and lockout coil bracket sub-assembly
99-10103	Inner panel with levers sub-assembly
99-10104	Anti-penny-flip bar retainer
99-10105	Anti-penny-flip bar
99-10107	U.S. 50¢ coin return button assembly
99-10108	U.S. 50¢ price plate—for two quarters

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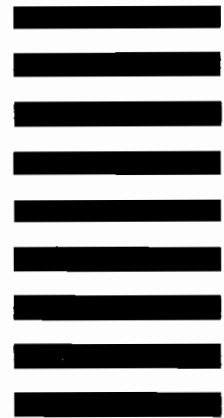


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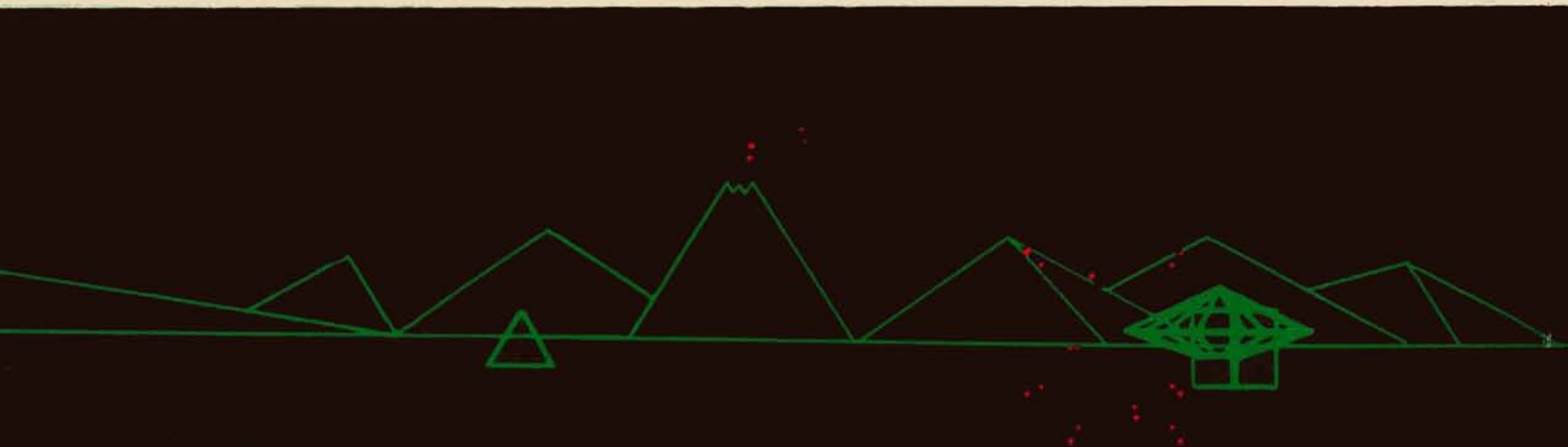
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
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