# FAST FREDDIE™

Operation, Maintenance and Service Manual

Complete with Illustrated Parts Lists

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Illustrated Parts Lists

Manufactured under license from Kaneko Seisakusho, Ltd.

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How to Use This Manual

This manual, written for game operators and service technicians, describes the Fast Freddie™ game.

Chapter 1 describes new features, game setup, option switch settings, self-test procedures, and game play.

Chapter 2 contains troubleshooting procedures.
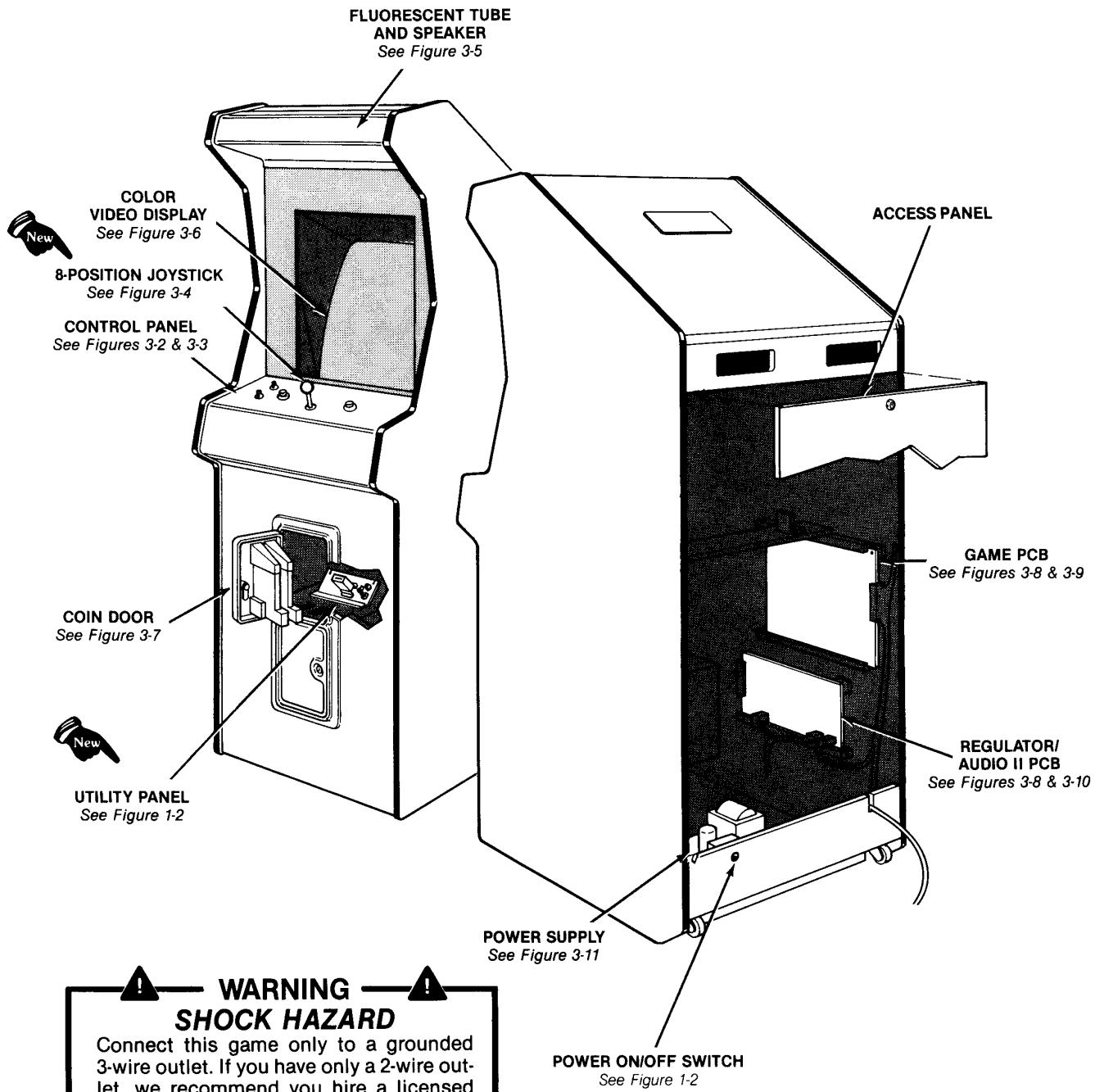
Chapter 3 details maintenance, repair, and parts information.

In addition, schematic diagrams of the game circuitry are included with this manual.

Figures 1-1 and 3-1 illustrate the game cabinet. Italicized lettering on these figures refers you to other places in the manual for information about specific cabinet parts.

Chapter *1*

FLUORESCENT TUBE
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See Figure 3-5

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8-POSITION JOYSTICK
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UTILITY PANEL
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See Figure 3-11

⚠ — WARNING — ⚠
SHOCK HAZARD
Connect this game only to a grounded
3-wire outlet. If you have only a 2-wire out-
let, 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!

POWER ON/OFF SWITCH
See Figure 1-2

Figure 1-1   Game Overview

A. New Features

The Fast Freddie™ game has three new features. Even if you are familiar with ATARI® games, you should note these important differences:

1. **Joystick Control.** This new eight-position control is made of steel and molded plastic. It has few parts, which make servicing easier. The leaf switches snap in and out for easy replacement. The rubber bellows are designed for a quick return to center.

2. **Game Cabinet.** The Fast Freddie™ cabinet has several new features. The cabinet grille is both a speaker grille and display-shield retainer. In addition, the upper part of the display shield also serves as the attraction panel.

3. **Key Loops.** The utility panel has two key loops. This provides a convenient place to store keys for the rear access panel and lower coin door.

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

c. Remove the tie-wrap that holds the coiled power cord on the inside cabinet wall. Check the power cord for any cuts or dents in the insulation. Place the square black plastic strain-relief plate in the wood slot at the bottom of the rear panel opening.

```
┌──── ⚠ — WARNING — ⚠ ────┐
│                                        │
│  To avoid electrical shock, do not touch in- │
│  ternal parts of the display with your hands │
│  or with metal objects held in your hands!   │
└────────────────────────────┘
```

d. Note the game serial number. It is printed on a label on the back of the cabinet. Verify that the same serial number is also on the Fast Freddie game PCB, Regulator/Audio II PCB, power supply, and video display. A drawing of the serial-numbered components is on the inside front cover of this manual. Please mention this number whenever you call your distributor for service.

e. Check major subassemblies, such as the power supply, control panel, and video display for secure mounting.

B. Game Inspection

Please inspect your game carefully to ensure that it 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. Remove the screws that were used as extra security to seal the rear access panel. Unlock and open this panel and the coin door; 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 reversed edge connector will damage a PCB** and will void your warranty.

    b. Check that all plug-in integrated circuits on the PCB are firmly seated in their sockets.

C. Game Installation

1. Installation Requirements

Power	150 W
Temperature	0 to 38°C (32 to 100°F)
Humidity	Not over 95% relative
Space Required	64 x 79 cm (25⅜ x 31 in.)
Game Height	174 cm (68¾ in.)

2. Voltage Selection

The power supply used in this game operates on the line voltage of almost any country in the world. The power supply may have three different voltage selection plugs: 100 VAC (violet wire color), 220 VAC (blue wire color), and 240 VAC (brown wire color).

Before plugging in your game, check your line voltage. Then check the wire color on the voltage selection plug that is plugged into your power supply. Make sure the voltage selection plug is correct for your location's line voltage (see *Figure 3-11*).

D. Switch Locations

1. On/Off Switch

The on/off switch is located on the back of the cabinet, lower left side (see *Figure 1-2*).

2. Utility Panel Switches

The utility panel includes the volume control, self-test, coin switch, and coin counter(s). The coin switch is used to credit the game, and it activates the left coin counter. These switches are located inside the upper coin door (see *Figure 1-2*).

3. Option Switches

Option switches are located on the game PCB at location B5 (see *Figure 1-2*).

KEY LOOP

UTILITY PANEL

COIN COUNTER

SELF-TEST

VOLUME CONTROL SWITCHES
(To increase, turn clockwise)

COIN

POWER ON/OFF SWITCH

GAME OPTION SWITCHES

1-8

OFF

B5

ON

A13
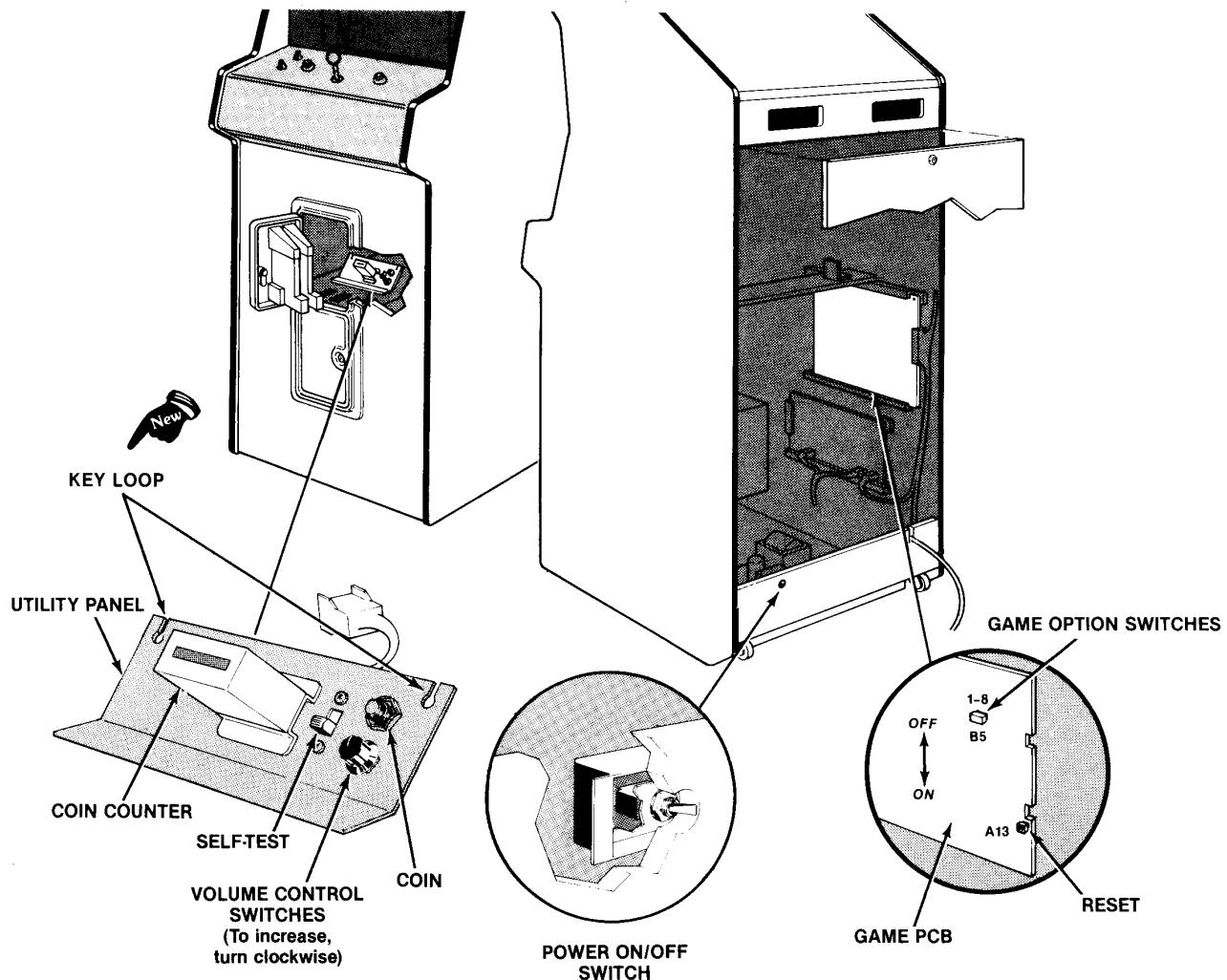
RESET

GAME PCB

Figure 1-2   Game Switch Locations

E. Option Switch Settings

Table 1-1 details game option switch settings on the game PCB. Options are preset at the factory and shown by the ◄ symbols. However, you may change the settings to suit your individual needs.

To verify option switch settings, push reset button or power the game off and then on again. Set the self-test switch to *on* and verify the settings on the self-test screen. Then set the self-test switch to *off*.

Table 1-1   Option Switch Settings

This table contains switch settings for options relating to game price, number of Fast Freddie lives, and bonus options. The switches are on the game PCB at location B5.

Settings of 8-Toggle Switch on Fast Freddie PCB (at B5)								Option	
1	2	3	4	5	6	7	8		
								Left Coin Mechanism 1 coin counter	**Right Coin Mechanism** 2 coin counters
Off	Off	Off	Off					1 coin for 1 credit	1 coin for 1 credit ◄
On	Off	Off	Off					2 coins for 1 credit	2 coins for 1 credit
Off	On	Off	Off					2 coins for 1 credit	1 coin for 3 credits
On	On	Off	Off					1 coin for 1 credit	1 coin for 2 credits
Off	Off	On	Off					1 coin for 1 credit	1 coin for 3 credits
On	Off	On	Off					1 coin for 1 credit	1 coin for 4 credits
Off	On	On	Off					1 coin for 1 credit	1 coin for 5 credits
On	On	On	Off					1 coin for 1 credit	1 coin for 6 credits
Off	Off	Off	On					1 coin for 2 credits	1 coin for 2 credits
On	Off	Off	On					1 coin for 2 credits	1 coin for 4 credits
Off	On	Off	On					1 coin for 2 credits	1 coin for 5 credits
On	On	Off	On					1 coin for 2 credits	1 coin for 10 credits
Off	Off	On	On					1 coin for 2 credits	1 coin for 11 credits
On	Off	On	On					1 coin for 2 credits	1 coin for 12 credits
Off	On	On	On					1 coin for 2 credits	1 coin for 6 credits
On	On	On	On					Free play	Free play
				Off				3 Fast Freddie lives ◄	
				On				5 Fast Freddie lives	
					Off	Off		No bonus	
					On	Off		Bonus life every 30,000 points	
					Off	On		Bonus life every 50,000 points ◄	
					On	On		Bonus life every 100,000 points	
							Off	Upright cabinet ◄	
							On	Cocktail cabinet	

◄ *Manufacturer's recommended settings*

F. Self-Test Procedure

This game will test itself and provide data to show that the game's circuitry and controls are operating properly. The data is provided on the video display and speaker. No additional equipment is necessary.

We suggest you perform the self-test procedure when you first set up the game, any time you collect money from the game, when you change game options, or when you suspect game failure.

Refer to Figure 1-2 for the location of the self-test switch and option switches. To perform the self-test, set the self-test switch to *on*. To end the self-test, set the self-test switch to *off*.

The complete self-test procedure is explained in *Chapter 2, Self-Test Procedure.* If a part of the test described in Figure 1-3 fails, refer to Chapter 2.

Figure 1-3   Self-Test Procedure

Instruction	Test Passes
1. Set the self-test switch to *on* (see Figure 1-2).	The screen shows the self-test display. The RAMs and ROMs are tested and if they are good, the screen displays *RAM OK* and *ROM OK.* If the screen is different from the self-test display, refer to *Chapter 2, Self-Test Procedure.*
2. Observe the eight colored squares.	Colors are blue, violet, green, yellow, light blue, white, red, and blue. If colors are not as described, refer to the raster-scan video display manual.
3. Activate control panel and coin switches.	The *0* changes to *1* as the switch is activated. If the test fails, refer to *Chapter 2, Self-Test Procedure.*
	Push the joystick diagonally up and to the left. For proper game operation, both the top and left switches **must** close at the same time, and the top and left *0*s should each become *1*s. Push the joystick in the three other diagonal directions (up and right, down and left, down and right), repeating the above procedure. The corresponding pair of switches should close in the same manner. If the test fails, refer to *Chapter 3, 8-Position Joystick Assembly.*
4. Simultaneously press the start 1 and KICK switches.	A game sound is produced. To go to the next sound simultaneously press the start 1 and KICK switches. Test all 10 sounds in this manner. If test fails, refer to *Chapter 2, Self-Test Procedure.*

<div align="center">

Game Sounds

SOUND 0	Beginning of round
SOUND 1	Fast Freddie gliding
SOUND 2	Fast Freddie kicking
SOUND 3	Picking up a letter
SOUND 4	Fast Freddie falling
SOUND 5	Fast Freddie gliding
SOUND 6	Airplane falling
SOUND 7	Helicopter, bird falling
SOUND 8	Genie falling
SOUND 9	Landing on platform

</div>

| Instruction	Test Passes
5. To end the self-test.	Simultaneously press the start 1 and start 2 switches. A cross-hatch pattern appears on the screen. Then set the self-test switch to *off.* The Attract Mode will now be displayed.
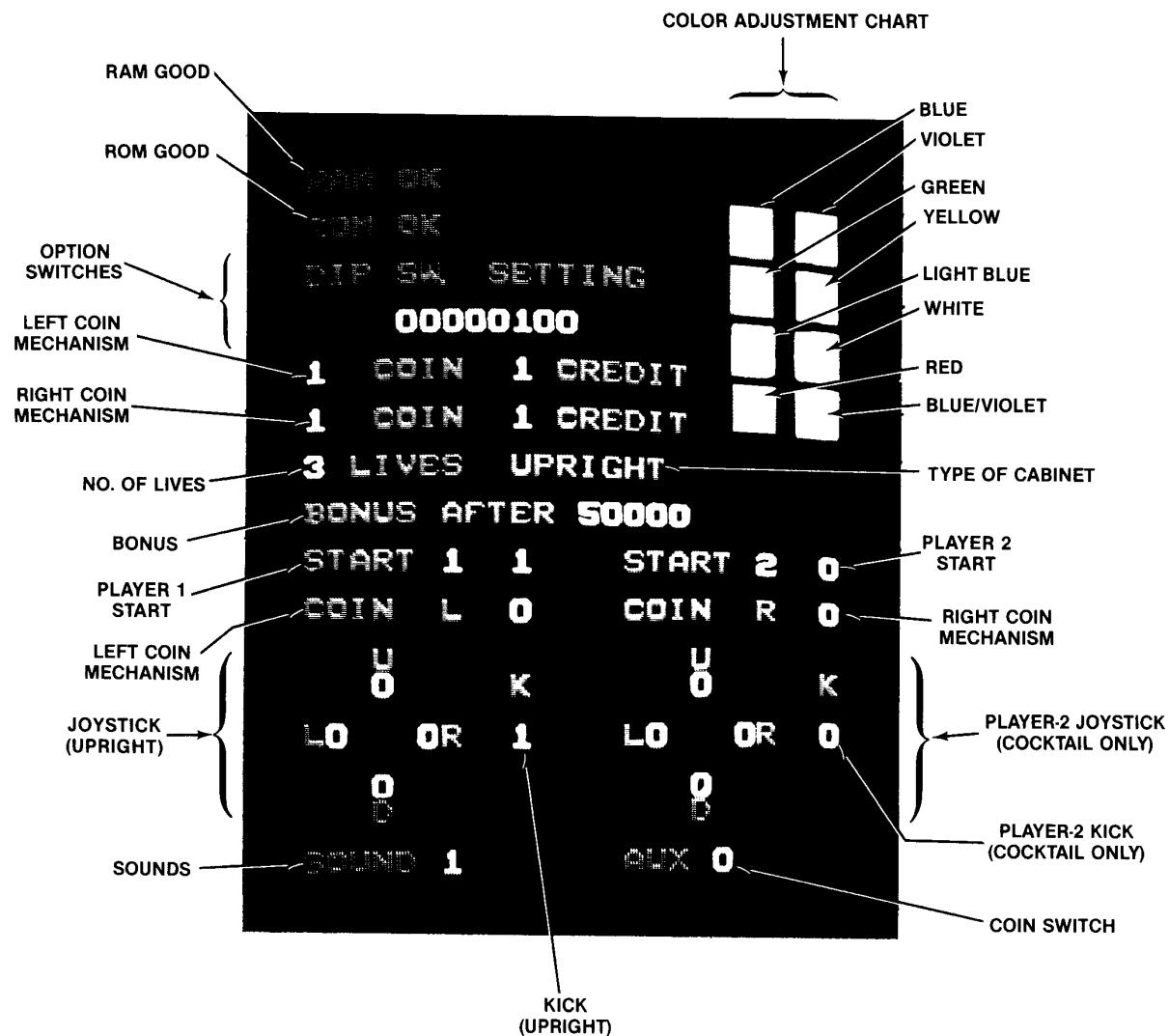
Figure 1-3   Self-Test Procedure, continued
Self-Test Display

G. Game Play

The Fast Freddie™ game is a one- or two-player game with a color raster-scan video display. The game depicts a hang-glider, Fast Freddie, gliding in the sky. Fast Freddie glides over the land and must avoid obstacles on the land and in the sky. As he glides along, he may pick up letters to spell the word *BONUS* for bonus points. He must pick up the letters in the correct order (*B* first, *O* second, etc). To end each round he must land on a landing platform.

Fast Freddie has six possible modes of operation: demonstration, attract, ready-to-play, play, high-score and self-test. Self-test is a special mode for checking the game switches and computer functions. You may enter self-test at any time. (All credits will be cancelled and the high score table will be erased.)

1. Demonstration Mode

Enter this mode by simultaneously pressing the coin switch and the self-test switch (see *Figure 2*). In this mode, you may see the more advanced rounds of game play. If Fast Freddie collides with any object in the sky, he does not crash. However, he must avoid obstacles on the ground and land on a platform to go to the next round. To end this mode, set the self-test switch to *off*.

2. Attract Mode

The attract mode begins when power is applied to the game, after a play or high-score mode, or after self-test. This mode lasts for about 35 seconds, and ends only when a credit is entered, or when in self-test. In the attract mode, the screen displays one of three possible pictures.

The first picture shows various ways a player may score points. At the top of the screen are the words *1UP, HIGH SCORE* and *2UP* (with corresponding scores). The words *FAST FREDDIE* flash on the screen and Fast Freddie is to the right of these words. The message *KICK FLYING OBJECTS AND PICK UP FLAGS* appears. Obstacles and their corresponding point value appear in the center of the screen. At the bottom of the screen is the message © *ATARI, INC. 1982*.
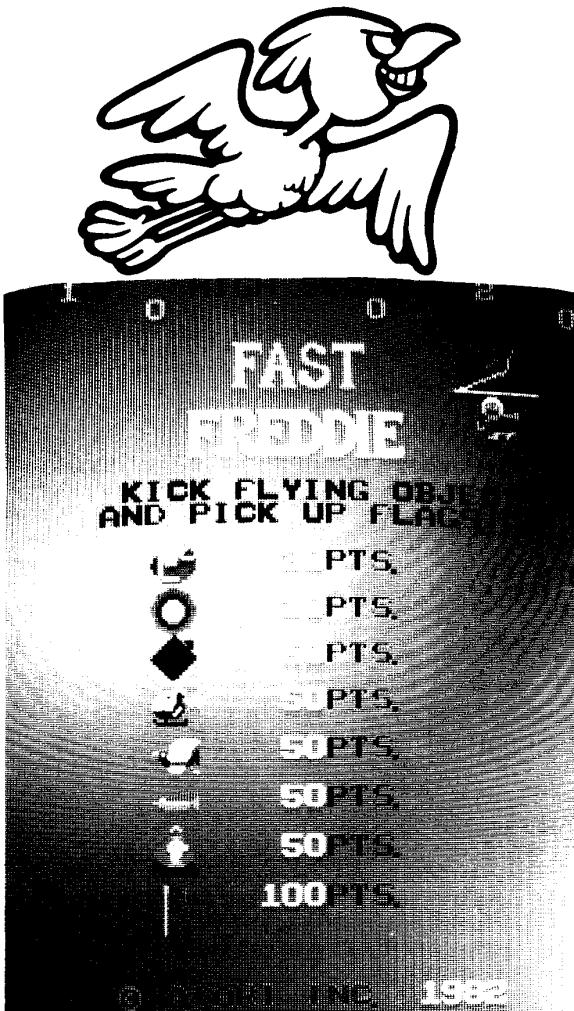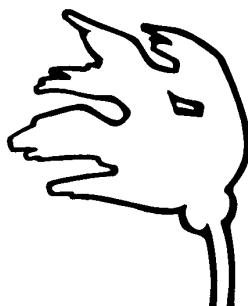

Figure 1-4   Attract Mode Screen

The second picture shows the high-score table. The words *1UP, HIGH SCORE and 2UP* (with corresponding scores) appear at the top of the screen. The 10 highest scores and their corresponding initials appear in the center of the screen. The words © *ATARI, INC. 1982* appear at the bottom of the screen.

The third picture shows one of three versions of game play. Fast Freddie glides over an alpine setting and a plane hits him and he crashes to the ground. Or he glides over the ocean and a bird sends him crashing down. Or he glides over Egypt and a genie on a flying carpet hits him and he crashes to the ground. The words *1UP, HIGH SCORE* and *2UP* (with corresponding scores) appear at the top of the screen. The words *SPELL BONUS* and *KICK* and a rectangular gauge showing the amount of kick appear at the bottom of the screen.

3. Ready-To-Play Mode

This mode begins when coins are inserted and accepted for game play. The words *1UP, HIGH SCORE* and *2UP* (with corresponding scores) appear at the top of the screen. The words *PUSH START BUTTON* and *ONLY 1PLAYER* or *1PLAYER OR 2PLAYER* and bonus life information appear in the center of the screen. The number of credits appears at the bottom right of the screen. If a game is set for two credits for one play and a player inserts only one coin, credits will not appear at the bottom of the screen until the second coin is inserted. This mode ends when a player presses a start button.

4. Play Mode

In the Play Mode, the player controls Fast Freddie with an eight-position joystick. Thus, the player causes Fast Freddie to glide in the sky and to avoid obstacles on the land and in the sky. The player may use KICK to destroy objects in the sky that are below him. Fast Freddie begins each life with about 12 seconds of KICK. A rectangular gauge at the bottom right of the screen shows the amount of kick remaining.

Fast Freddie may pick up letters worth 100 points each to spell the word *BONUS* for bonus points. The letters he picks up are displayed on a line at the bottom of the screen. However, he must pick up the letters in the correct order to get the bonus points. If he spells the word *BONUS*, any remaining letters are worth 200 points each if picked up.

Round one begins with Fast Freddie on a mountain in an alpine setting. He runs off the top of the mountain and glides in the sky. As he glides along, a

Table 1-2   Fast Freddie Game Play and Scoring

Round	Terrain	Obstacles	Points
1	Alpine (summer)	Airplanes	30
		Helicopters	50
2	Sea (blue)	Airplanes	30
		Birds	50
3	Egypt (green)	Disks	30
		Genie on Carpet	50
4	Alpine (autumn)	Airplanes	50
		Helicopters	70
5	Sea (purple)	Airplanes	50
		Birds	70
6	Egypt (red)	Disks	50
		Flying Carpet	70
7	Alpine (winter)	Airplanes	70
		Helicopters	90
8	Sea (brown)	Airplanes	70
		Birds	90
9	Egypt (blue)	Genie on Carpet	70
		Flying Carpet	90

Gliding is worth 10 points per ⅝ inch (1.6 cm).

Picking up a letter on a flag is worth 100 points. If *BONUS* is spelled out, picking up a letter is worth 200 points.

Landing platforms are worth 1,000 to 5,000 points. If *BONUS* is spelled out, platforms are worth 5,000 to 25,000 points.

flag with a letter on it appears below. He may pick up the letter and begin to spell out the word *BONUS* for extra points. As he picks up a letter it is displayed on a line at the bottom of the screen. He must pick up the letters in the order they appear in the word. If he picks up a letter out of sequence, the letters appearing on the line at the bottom of the screen will be erased.

After a period of time, airplanes appear. They will destroy Fast Freddie if they hit him. The player uses his joystick to avoid the airplanes and KICK to destroy them. Fast Freddie must be above the airplanes (and other flying objects) to destroy them. A helicopter also appears, and Fast Freddie must avoid or destroy it also.

Toward the end of the round, landing platforms appear on the ground. Fast Freddie must land on a platform to end the round. Each platform has a different point value. If the word *BONUS* is not spelled out, the platforms are worth 5,000 to 25,000 points. If the word *BONUS* is spelled out, the platforms are worth 10,000 to 50,000 points. The words *LANDING TIME:10* also appear. Fast Freddie has 10 seconds to land. If the landing is successful the next round will begin.

Fast Freddie has nine rounds of game play. The first, fourth, and seventh rounds show an alpine setting in summer, autumn, and winter. The second, fifth, and eighth rounds depict an ocean setting with different colored backgrounds. The third, sixth, and ninth rounds take place in Egypt with different colored backgrounds. Each round has different obstacles. The game ends when all of Fast Freddie's lives are used up.
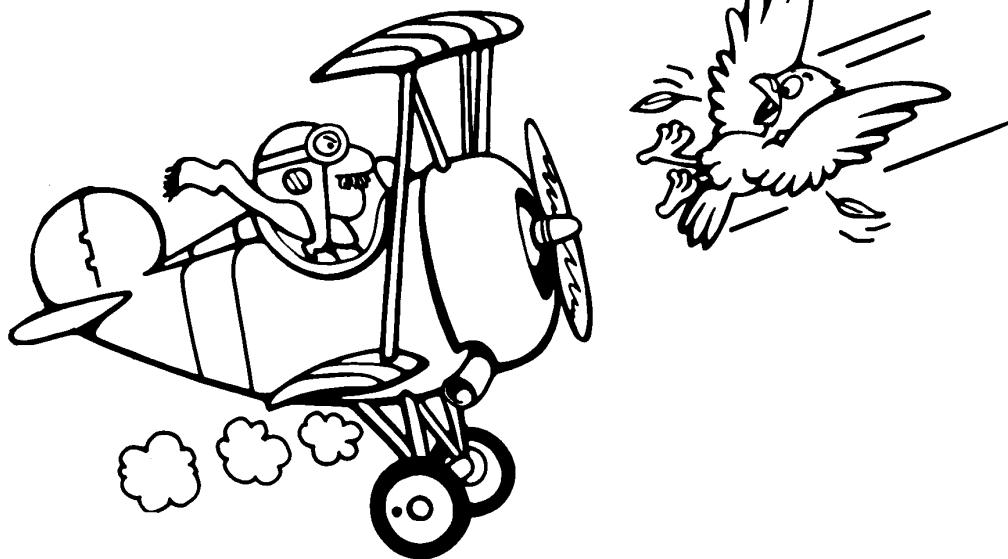
The screen displays several messages during game play. At the top of the screen are the words *1UP, HIGH SCORE* and *2UP* (with corresponding scores). At the bottom of the screen are the number of lives remaining, the bonus word or letter(s) collected, and gauge measuring the amount of kick remaining.

5. High-Score Mode
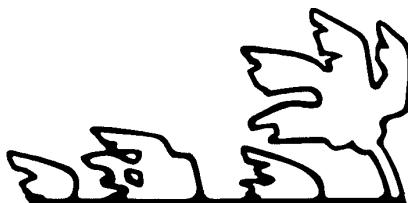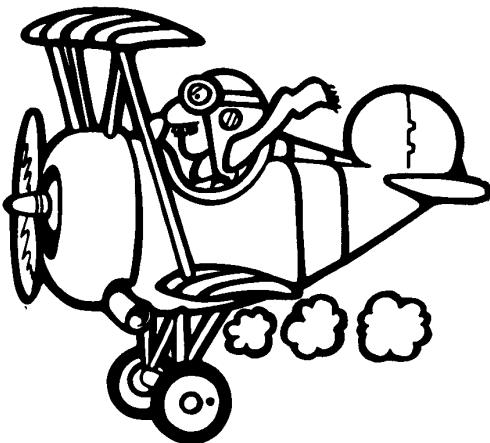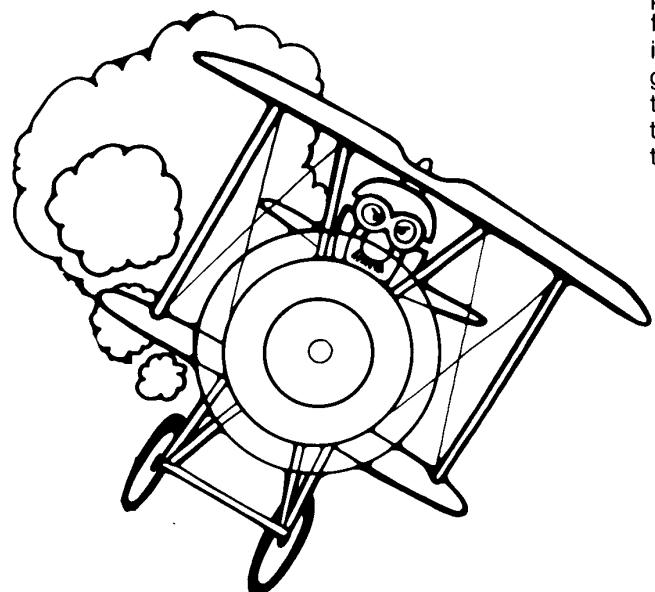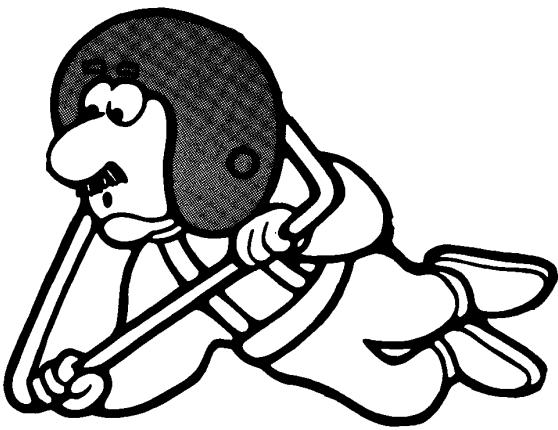
This mode begins when a player has one of the ten top scores. The message *REGISTER YOUR NAME* appears on the screen. Below these words is a line containing the characters of the alphabet, *RUB* (erase), and *END*. A player enters his initials by moving the joystick to the left or the right to locate the correct letter. He causes the letter to be transferred to the right of the word *NAME* by pushing the KICK button. When he has entered three characters, they are automatically transferred into the high-score table.

6. Hints for Game Play

- Stay in the center of the screen when possible.
- It is not necessary to spell *BONUS* to get to the end of a round.
- Avoid clouds in the ocean round.
- Kick at any flying object that is below you and within range.
- Try to land on the last landing platform for the most points.

Troubleshooting

This game tests itself when the self-test switch is set to the *on* position. If there is a failure, the game produces audiovisual aids to help you isolate the failing portion of the game. The self-test procedure included in Chapter 1 will help you decide if the game is or isn't working properly. The expanded self-test procedures in this chapter are included to help the qualified electronic technician determine why the game isn't working properly.

Chapter 2
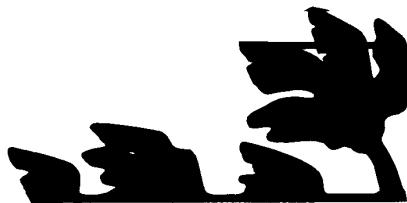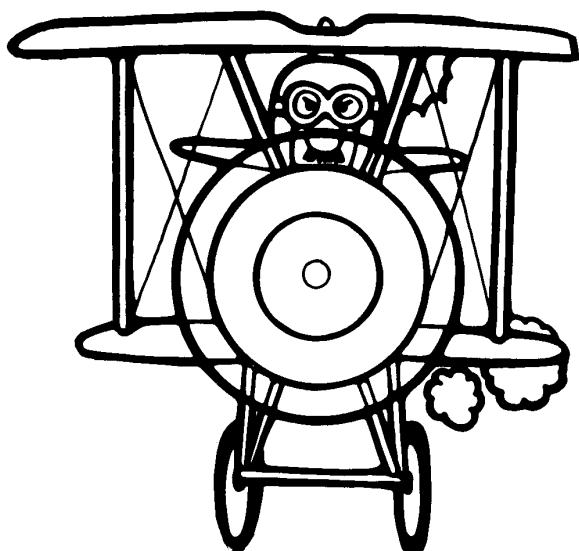
A. Comments on Troubleshooting

When troubleshooting, first determine the symptom(s) of the failure. After determining the symptom, look over the wiring diagram and determine what assemblies could cause the failure. Could it be caused by the power supply, Regulator/Audio II PCB, or the video display?

The next step is to check all harness wires and connectors to the suspected failing assembly. If you find no harness or connector problem, substitute an assembly known to be good for the suspected failing assembly. If the game functions properly, you have successfully isolated the failure. If it doesn't, repeat the procedure with another assembly.

When you have isolated the failing assembly, you must troubleshoot that assembly and make the necessary repairs. If the video display is failing, we suggest that a qualified video display technician handle the troubleshooting and repair. If the power supply or Regulator/Audio II PCB is failing, troubleshooting and repair are relatively simple, as these assemblies are not too complicated. If a game PCB is failing, troubleshooting and repair depend on your understanding of the operation of the PCB.

To effectively troubleshoot a game PCB, it is necessary for you, the technician, to become familiar with the PCB hardware. The diagrams in the schematic package (included with the game) show the functions of the circuitry. Again, while troubleshooting the PCB, first determine the symptom of the failure, then locate the suspected area on the schematic diagram.

B. Self-Test Procedure

To enter Self-Test, set the self-test switch to the *on* position. The screen displays the picture below. See *Chapter 1, Section F, Self-Test Procedure* for a complete description of this picture.

```
┌──────────────NOTE──────────────┐
│ This procedure does not test the coin │
│ door lockout coils and coin counter. If the │
│ Self-Test passes, but the lockout coils do │
│ not energize when power is applied to the │
│ game, suspect the lockout coil wiring or │
│ coin door harness. Troubleshoot using │
│ the game schematics. │
└─────────────────────────────────┘
```
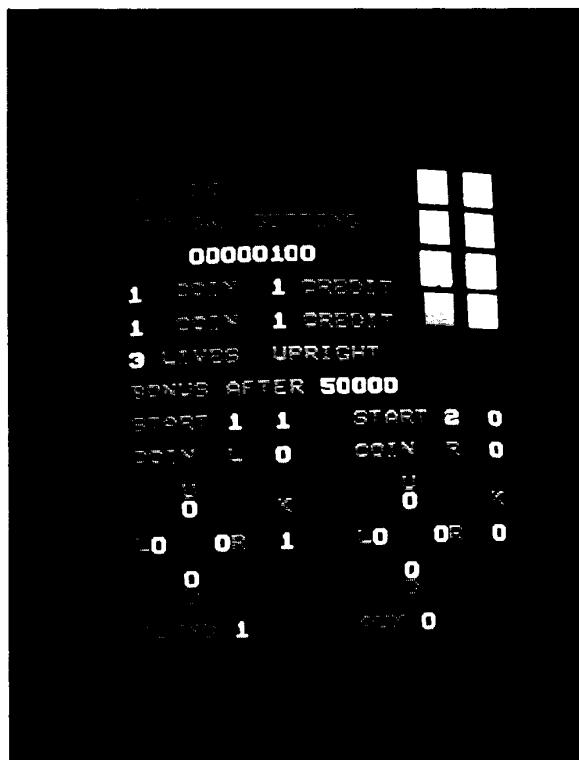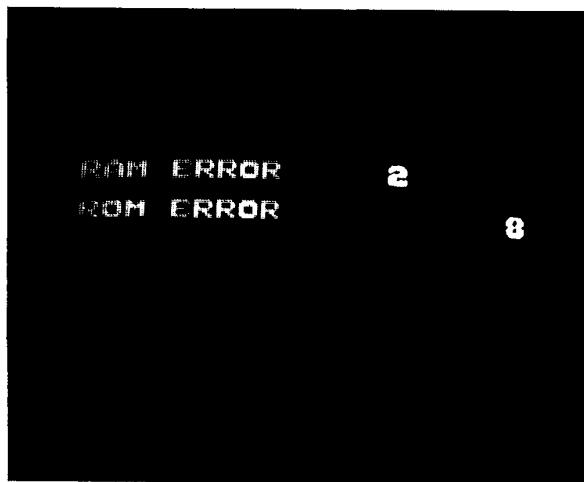

Figure 2-1   Self-Test Screen 1
Test Passes

**Figure 2-2   Self-Test Screen 1
Test Fails**

SCREEN 1

RAM failure may be indicated by a blank screen or by garbage on the screen. It may also be indicated by or the word *RAM* and a number displayed at the top of the screen. The RAM and its location are listed as follows:

Screen Display	RAM chip location on game PCB
RAM 0	E11, E12
RAM 1	J10, J11
RAM 2	D14
RAM 3	E16

ROM failure is indicated by the word *ROM* and a number displayed at the top of the screen. The bad ROM and its location are listed as follows:

Screen display	ROM chip location on game PCB
ROM 1	D16
ROM 2	D17
ROM 3	C14
ROM 4	C16
ROM 5	C17
ROM 6	A14
ROM 7	A16
ROM 8	A17

SWITCH failure is indicated by the associated *0* not changing to a *1* on the screen when the switch is activated. Troubleshoot using the information in *Chapter 3, Section B,* and game schematics.

SOUND failure is indicated by no sound. Check the volume control levels on the utility panel, or troubleshoot using the game schematics.

To go to screen 2, simultaneously press start 1 and start 2 switches.
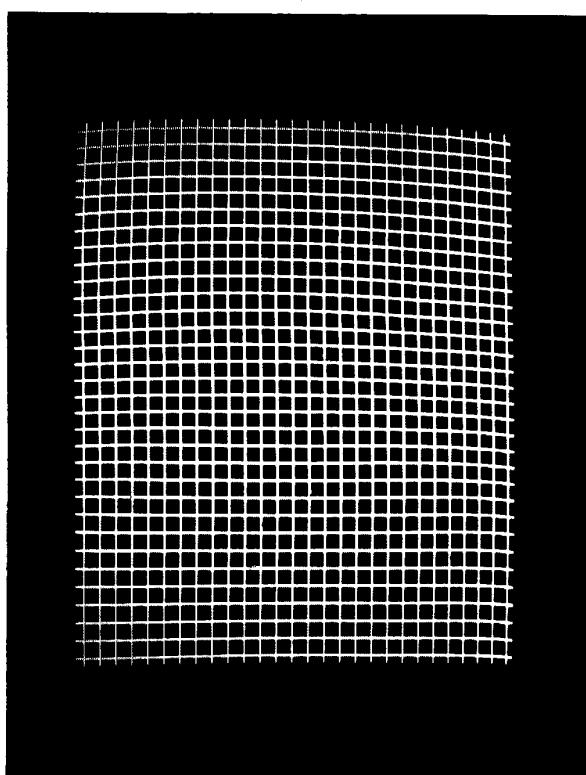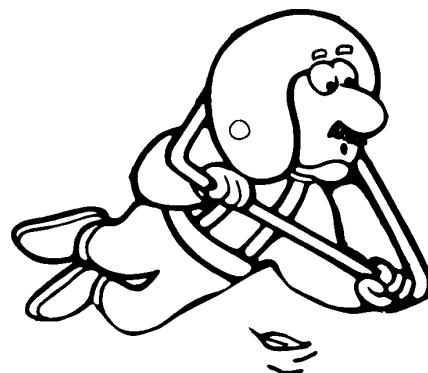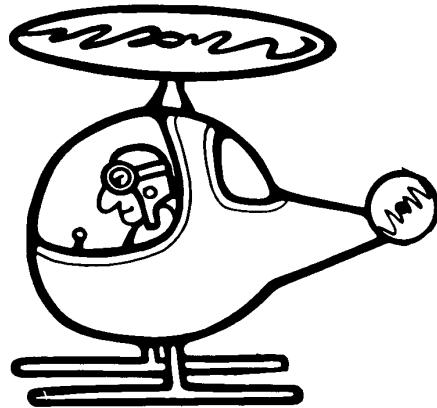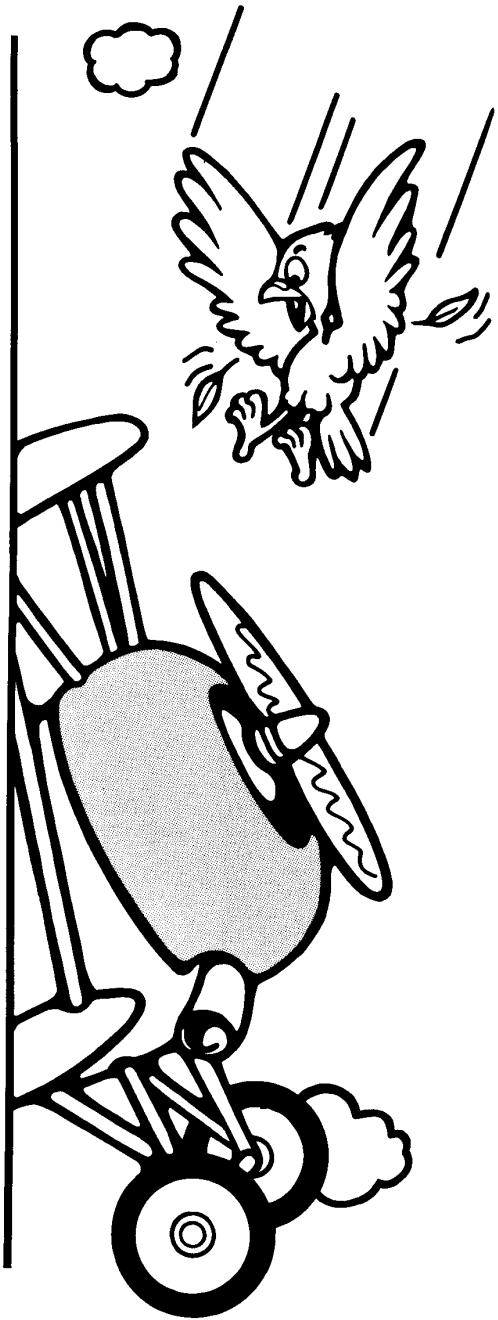
Figure 2-3   Self-Test Screen 2

SCREEN 2

A white crosshatch pattern appears on the screen (see *Figure 2-3*). Use this pattern for convergence (see the raster-scan video display manual).

Maintenance, Repair and Parts
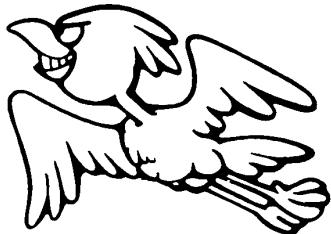
This chapter details maintenance and repair information, and provides information you need to order parts for your Fast Freddie game. Please note that **common hardware has been deleted** from most of the parts lists. This includes screws, nuts, washers, bolts, etc.

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

When ordering parts, please 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.

Atari Customer Service numbers are listed in the front of this manual for your convenience.

Chapter 3

A. Cabinet-Mounted Assemblies

038226-01
(Grille)

178034-024
(T-Molding)

037332-01
(Grille)

Fluor. Tube & Speaker—
See Figure 3-5

038689-01
(Shield)

Video Display—
see Figure 3-6

8-Position
Joystick Assy.—
See Figure 3-4

178013-001
(Latch)

037721-02
(Access Panel)

71-2110
(Lock)

78-6900402
(Tape)

Control Panel Assy.—
see Figures 3-2 & 3-3

A038004-01
(Utility Sw. Harn.)

Coin Door Assy.—
see Figure 3-7

Game PCB Assy.—
See Figures 3-8 & 3-9

038003-01
(Util. Sw. Brkt.)

A002465-01
(Coin Counter)

69-001
(Self-Test Sw.)

62-041
(Coin Sw.)

19-9032
(Vol. Control)

178070-001
(Knob)

Regulator/Audio II PCB Assy.—
See Figures 3-8 & 3-10

A038453-01
(Power Harn. Assy.)

A038718-01
(Main Harn. Assy.)

A037491-01
(Coin Box)

78-3201
(Glide)

A037454-03
(Power Cord)

Power Supply Assy.—
See Figure 3-11

178048-001
(Caster)

009992-01
(On/Off Sw. Cover)

A037470-01
(On/Off Sw.)

Figure 3-1   Cabinet-Mounted Assemblies
Ireland-Built Cabinet   A038677-01 & -02   A

Figure 3-1 Cabinet-Mounted Assemblies, continued
Ireland-Built Cabinet
Parts List

Part No.	Description
A002465-01	Coin Counter
A037454-03	Strain-Relief Power Cord *(Austria, Belgium, Chile, Denmark, Finland, France, Germany, Greece, Indonesia, Italy, Netherlands, Norway, Spain, Sweden, and Uruguay)*
A037470-01	Power On/Off Switch and Mounting Plate Assembly
A037491-01	Coin Box
A038004-01	Harness for Volume Control/Self-Test Switch/Coin Counter Assembly
A038453-01	Power Harness Assembly
A038678-01	Cabinet Assembly *(includes wood-grained side panels, glides, and PCB retainers, but not the rear access panel)*
A038678-02	Cabinet Assembly *(includes graphics on side panels, glides, and PCB retainers, but not the rear access panel)*
A038718-01	Main Harness Assembly
	The following four items are the technical information supplements to this game:
SP-208	Fast Freddie™ Schematic Package
ST-208-01	Fast Freddie Label with Self-Test Procedure and Option Switch Settings
TM-160	Service Manual for 19-Inch Electrohome Color Raster-Scan Display *Substitute TM-201 when using part no. 92-055, 19-Inch Wells Gardner Display.*
TM-208	Fast Freddie Operation, Maintenance and Service Manual
19-9032	Volume Control
62-041	SPDT Momentary-Contact Pushbutton Utility Coin Switch with Black Cap
69-001	DPDT Self-Test Switch
71-2110	Lock Mechanism *(for rear access panel)*
78-3201	Adjustable Glide
78-6900402	Vinyl Foam Single-Coated-Adhesive Tape, ¼-Inch Wide x ⅛-Inch Thick
009992-01	On/Off Switch Cover
037721-02	Rear Access Panel *(does not include lock)*
037332-01	Ventilation Grille *(located on cabinet top)*
038003-01	Utility Switch Bracket for Volume Control, Self-Test Switch, Coin Switch, and Coin Counter
038226-01	Upper Cabinet Grille
038689-01	Video Display Shield with Graphics
038691-01	Side Panel Decal *(not shown in illustration)*
178013-001	Spring Draw Latch
178034-024	¾-Inch Black Plastic T-Molding
178048-001	2-Inch Rigid Caster
178070-001	Volume Control Knob

B. The Control Panel

⚠—WARNING—⚠
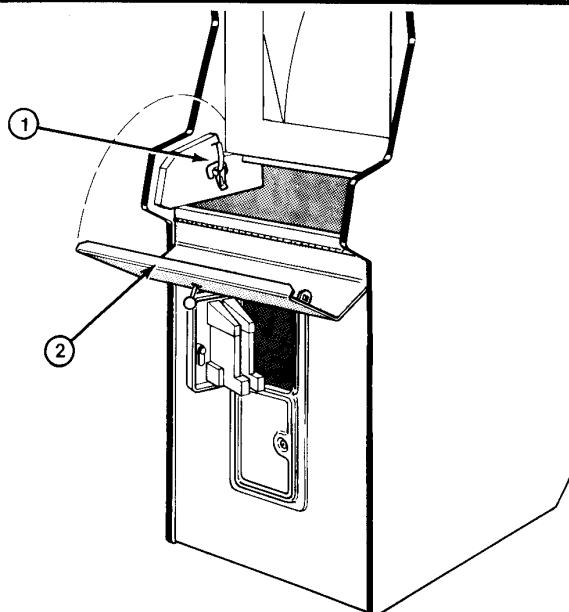
Prior to removing or repairing any switch on the control panel, **unplug the game.**

To Open the Control Panel:

1. Open the coin door. Reach up through the opening and release the spring-draw latches. They are on the cabinet side walls at each end of the control panel.

2. Lift up on the control panel at the top edge, and tilt it toward you. The control panel edge next to the display shield has foam tape applied to it. The tape cushions the shield and prevents liquids from entering the cabinet interior. Make sure this tape is in good condition.

Leaf Switch Repair:

● Adjust the leaf switches for a narrow gap. When a switch button is depressed, the resulting wiping action of the cross-bar contacts provides a self-cleaning feature. **Don't burnish the contacts.** To clean them, use electrical contact cleaner.

● To replace a leaf switch, remove the screw with a Phillips-head screwdriver.

● To replace the switch button, turn the stamped nut with a wrench in a counterclockwise direction, as seen from the inside of the control panel. The ring on the outside of the control panel should not spin, due to its design.

● Reinstall the switch. Reconnect the harness wires as shown in the *Schematic Package, Game Wiring Diagram.* Make certain the right colors go to the right tabs on the switch.

Start-Switch Replacement:

These switches have a very low failure rate. If a switch should ever be suspect, first test it using the directions that follow.

To Test Switch:

● Remove the wires from the suspected switch.

● Attach the leads of an ohmmeter to normally open and common contacts.

● Check contacts (push and release the switch button) for closed and open continuity.

● If the contacts do not operate sharply or always remain closed or open, then replace the switch.

To Replace Switch:

● Remove all wires from the faulty switch.

● Turn the switch counterclockwise while holding the black cone-shaped bushing on the outside of the control panel.

● Install a new switch using the reverse procedure.

● Reconnect the harness wires as shown.

Figure 3-2   The Control Panel

A038688-01
(Control Panel/Decal)
038267-01
(Control Panel)
038692-04
(Decal)

171021-001
8-Position Joystick Assy.—
see Figure 3-4

78-6900402
(Tape)

62-041
(Start Sw.)

⚠ — WARNING — ⚠

Players may receive an electric shock if this
control panel is not properly grounded! After
servicing any parts on the panel, check that the
ground wire is firmly attached to the metal tab
on the inside of the control panel. Only *then*
should you lock up the game.

75-010S
(Flat Washer)

75-040S
(Split-Lock Washer)

75-911S
(Hex Nut)

75-9910N0
(Nut)

036895-01
(Bezel)

178030-003
(Pushbutton Assy.)

75-5112B
(Carriage Bolt)

A038455-01
(Harness)

160013-001
(Leaf Sw./Button Holder)

**Figure 3-3   Control Panel Assembly
Ireland-Built Cabinet   A038678-01   A
Parts List**

Part No.	Description
A038455-01	Control Panel Harness Assembly
A038688-01	Control Panel with Decal
62-041	SPDT Momentary Pushbutton Start Switch
75-010S	#10 Flat Washer
75-040S	#10 Split-Lock Washer
75-5112B	#10-24 × ¾-Inch Black Carriage Bolt
75-911S	#10-24 Hex Nut
75-9910N0	#⅜-11 Steel Stamped Nut
78-6900402	Vinyl Foam Single-Coated-Adhesive Tape, ¼-Inch Wide × ⅛-Inch Thick *(24 in. required)*
038267-01	Control Panel
038692-04	Control Panel Decal
036895-01	Black Molded Switch Bezel
160013-001	Leaf Switch and Button Holder *(Leaf switch only is part no. 160012-001)*
171021-001	8-Position Joystick Assembly
178030-003	Black Pushbutton Assembly

┌─────────────────────────────────┐
│   ▲— WARNING —▲   │
│   │
│   Prior to removing or repairing the joystick, un- │
│   plug the game.   │
└─────────────────────────────────┘

To Repair the Joystick:

1. First remove the entire joystick assembly from the control panel (see *Figure 3-3*). Now locate the four screws in the plastic joystick frame and remove these screws.

2. Next remove the retaining ring from the bottom of the shaft. The assembly will come apart.

3. To replace the *bellows*, pry it up and out of the plastic frame.
   - Reassemble in reverse order.
   - Note that the inner raised ring on the bellows is longer on one side. This side goes on the top of the assembly (toward the control knob).

4. To replace a *leaf switch*, you don't need to disassemble the joystick.
   - Using your thumbs, pry apart the plastic flanges on the switch holder. With your index finger, lift the switch up so that it will clear the plastic tab located on the outside end of the switch holder.
   - Slide the switch out of its holder. Replace the switch in reverse order. Adjust the switch for a narrow gap.

Disassemble in the order indicated. (Circled numbers match the numbered instructions.)

99-080028
(Shaft)

99-080026
(Black Plastic Washer)

99-080036
(Top Plate)

99-080029
(Nylon Washer)

③ 99-080031
(Bellows)

④ 99-080025
(Leaf Switch)

99-080032
(Steel Washer)

99-080030
(Spring)

99-080037
(Sw. Plate)

99-080033
(Guard/Actuator)

99-080038
(Sw. Actuator)

① 82-AL616
(Screw)

73-3003
② (Retaining Ring)
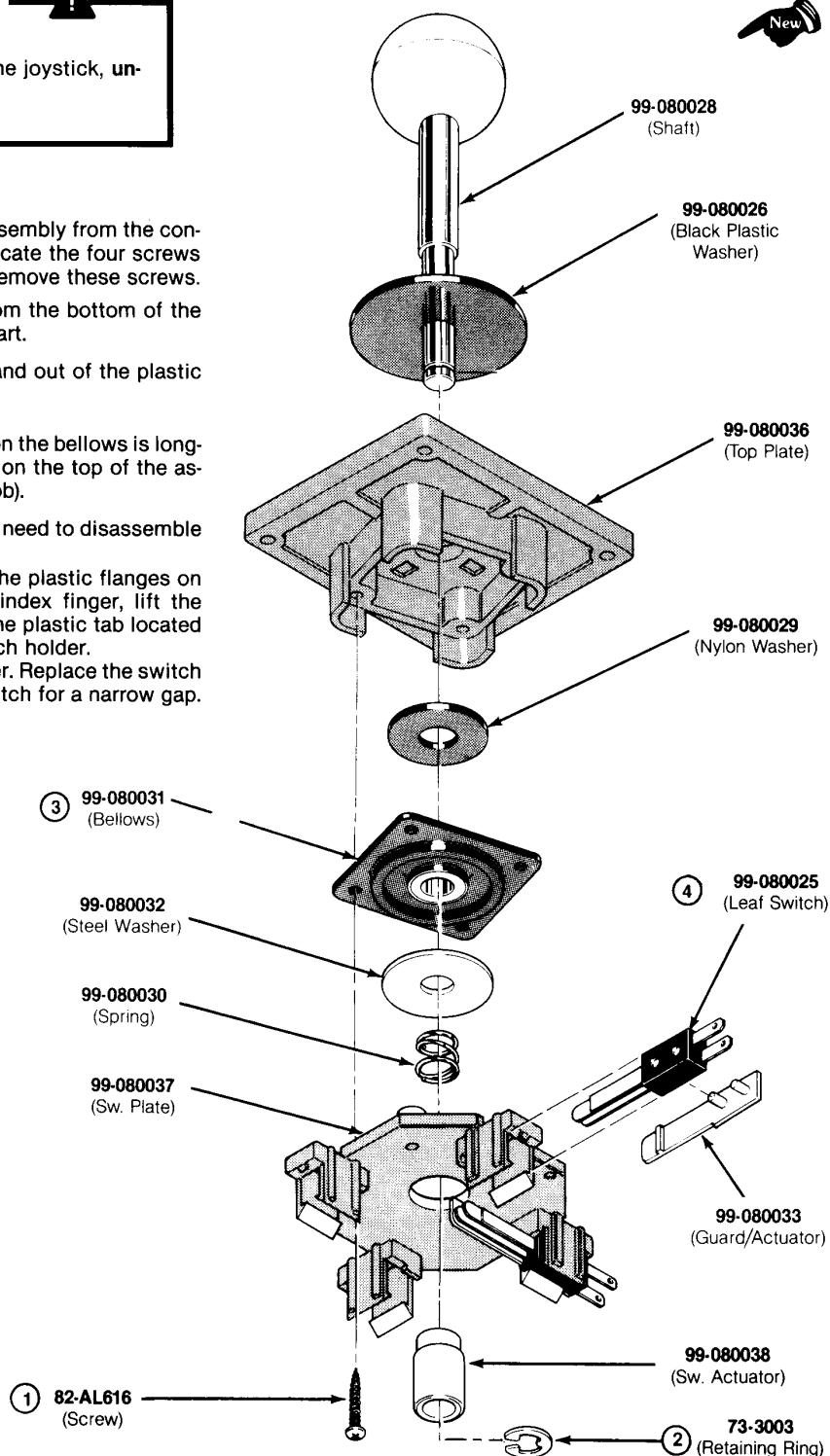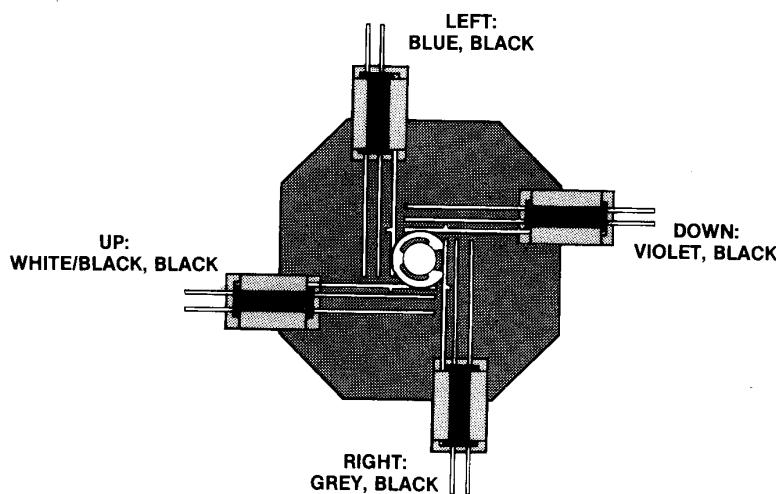
**Figure 3-4   8-Position Joysick Assembly
171021-001**

To Adjust the Joystick:

1. Make sure that each leaf switch is firmly seated in its holder. There is a small gray plastic tab on the outside end of the switch holder. The black plastic part of each leaf switch must be in front of this tab.

2. Check that all four leaf switches can be activated by watching the switch blades as you move the joystick handle up, down, left and right.

3. Test the four diagonal positions. In each diagonal position, two leaf switches should close. Switches should continue bending slightly after making contact.

4. Adjust each switch for narrow gap.
   ● Push the joystick handle away from the switch for easier servicing.
   ● Use a pair of needlenose pliers or a switch adjustment tool to bend each double set of blades in toward the center. Make the bend where the double set of blades comes out of the black plastic part of the switch.

5. Recheck the switch action. The switches must move independently for right, left, up, down and diagonal motion of the joystick.

JOYSTICK—
TOP REAR VIEW

LEFT:
BLUE, BLACK

UP:
WHITE/BLACK, BLACK

DOWN:
VIOLET, BLACK

RIGHT:
GREY, BLACK

Figure 3-4   8-Position Joystick Assembly, continued
Parts List

Part No.	Description
73-3003	Retaining Ring
82-AL616	#6 × 1-Inch Cross-Recessed Pan-Head Type BT Tapping Steel Screw
99-080025	Leaf Switch
99-080026	2-Inch Black Plastic Washer
99-080028	Metal Shaft
99-080029	Nylon Washer
99-080030	Spring
99-080031	Bellows
99-080032	Flat Steel Washer
99-080033	Plastic Guard/Actuator
99-080036	Top Plate
99-080037	Switch Mounting Plate
99-080038	Nylon Switch Actuator
171021-001	Joystick Assembly

C. Fluorescent Tube and Speaker

⚠— WARNING —⚠

Prior to removing or repairing the speaker or fluorescent tube, **unplug the game.**

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 Remove the Tube and Speaker Board:

1. From the back of the game, unlock and open the rear access panel. The tube and speaker harness has a 5-pin connector. Unplug this connector.

2. Open the control panel (see *Figure 3-2, The Control Panel*).

3. From the top front of the game, remove the five button-head screws that secure the upper cabinet grille to the cabinet. Lift the grille up and away from the cabinet. Be careful glass display shield doesn't fall forward.

4. Lift the display shield up and out of the cabinet.

5. Slide the baffle board that is underneath the fluorescent tube out the front of the cabinet.

6. Remove the screws that secure the tube and speaker board to the cabinet. Slide this board up and out of the cabinet.

To Replace Fluorescent Tube:

7. Remove the Y-lead connectors at each end of the fluorescent tube.

8. Slightly rotate the tube up or down, and carefully remove it from its clamps. Replace it with a new tube. Do not snap the tube in vigorously—*you may break it, causing an implosion!* Replace the Y-lead connectors. Reinstall the tube and speaker board, baffle board, shield, grille, and reconnect the harness. Close and lock the control panel and the rear access panel.

To Replace The Speaker:

9. Unplug the two plug-in connectors on the back of the speaker.

10. Remove the hardware that attaches the speaker to the board. Replace the speaker and reinstall the hardware and two plug-in connectors. Reinstall the tube and speaker board, baffle board, shield, grille, and reconnect the harness. Close and lock the control panel and the rear access panel.

**Disassemble in the order indicated. (Circled numbers match the numbered instructions.)**

038226-01
(Grille)

038217-01
(Baffle Board)

038689-01
(Shield)
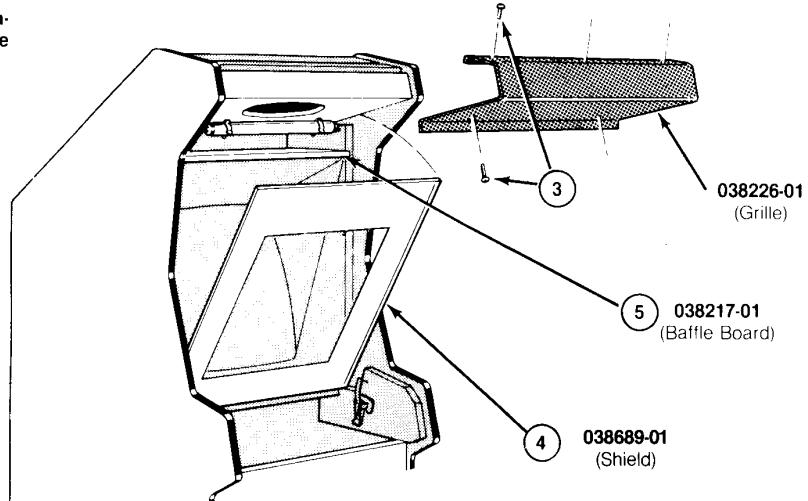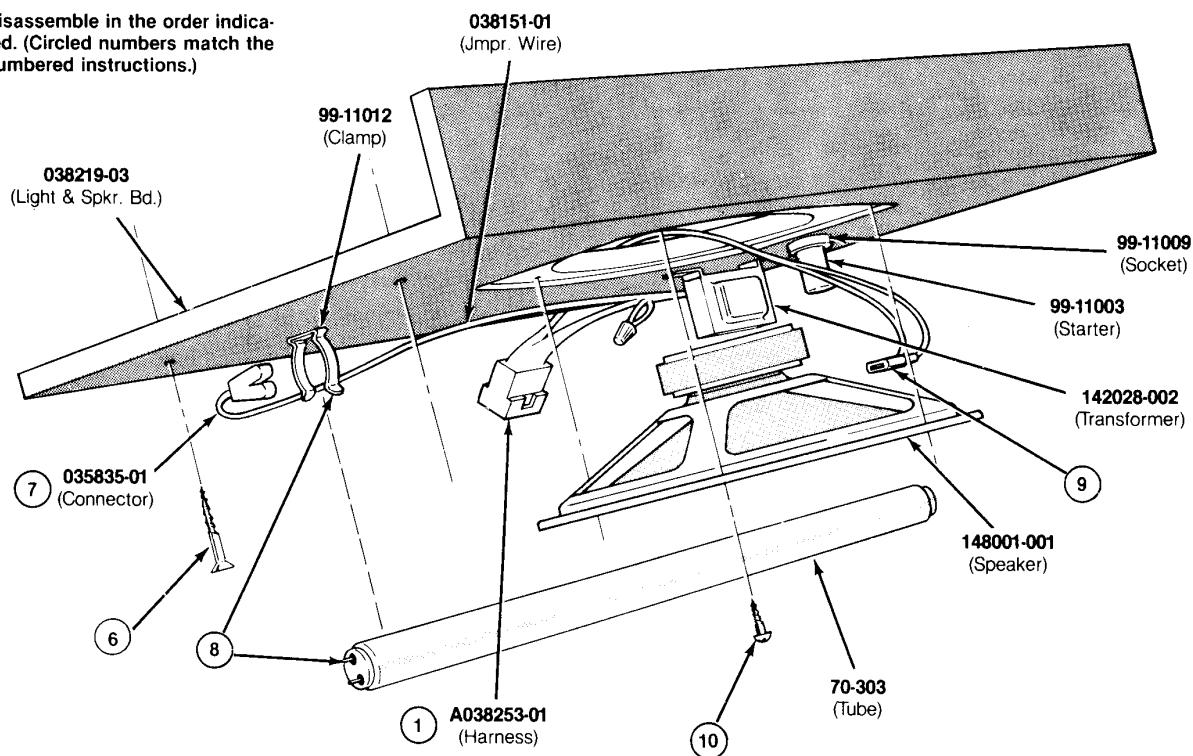
Figure 3-5   Fluorescent Tube and Speaker

Disassemble in the order indicated. (Circled numbers match the numbered instructions.)

038151-01 (Jmpr. Wire)

99-11012 (Clamp)

038219-03 (Light & Spkr. Bd.)

99-11009 (Socket)

99-11003 (Starter)

142028-002 (Transformer)

⑦ 035835-01 (Connector)

⑨

148001-001 (Speaker)

⑥

⑧

70-303 (Tube)

① A038253-01 (Harness)

⑩

NOTE
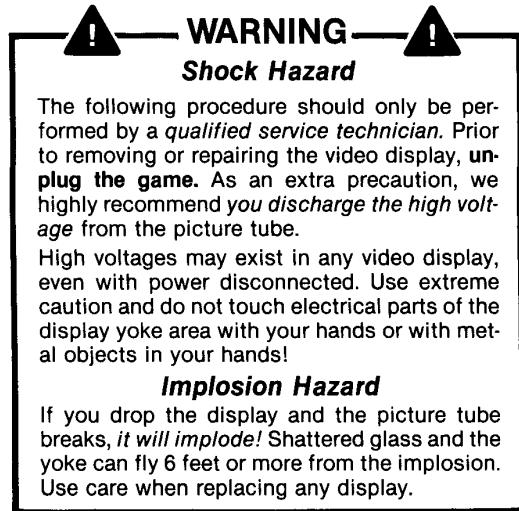
To ensure that the fluorescent tube starts, make sure the ground wire is firmly attached to the transformer.

**Figure 3-5   Fluorescent Tube and Speaker, continued
Ireland-Built Cabinet   A038228-01   A
Parts List**

Part No.	Description
A038253-01	Tube and Speaker Harness Assembly
70-303*	18-Inch, 1-Inch Diameter, 15W Cool White Fluorescent Tube
99-11003	Fluorescent Tube Starter
99-11009	Starter Socket
99-11012*	1⅛-Inch Fluorescent Tube Clamp
035835-01	12-Inch Y-Lead Connector
038151-01	Jumper Wire
038217-01	Baffle Board
038219-03	Tube and Speaker Board
038226-01	Cabinet Grille
038689-01	Display Shield
142028-002	50 Hz 118V Ballast Transformer
148001-001	6 x 9-Inch 4-Ohm 15W Oval High-Fidelity Speaker
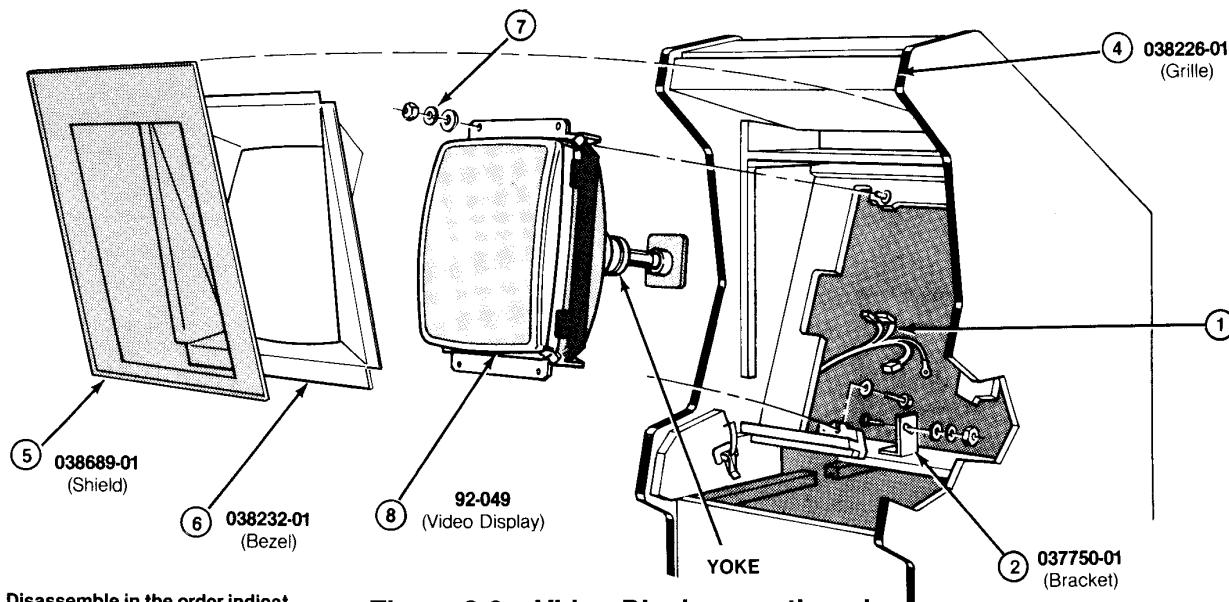
Acceptable substitutes are part numbers 70-304 (tube) and 99-11011 (clamp). They must be used together.

D. Video Display

To Remove Video Display:

1. Open the rear access panel and unplug the three display harness connectors and disconnect the green ground wire.

2. The rear of the display chassis is attached to a mounting bracket. Remove the hardware that secures the chassis to this bracket.

3. Open the control panel (see *Figure 3-2*).

4. Remove the 5 button-head screws that secure the upper cabinet grille to the cabinet (see *Figure 3-5*). Lift the grille up and away from the cabinet.

5. Lift the video display shield up and out of the cabinet.

6. Carefully remove the cardboard bezel.

7. Remove the four sets of hardware that secure the display chassis to the wood frame.

8. Carefully remove the display through the front of the cabinet. After servicing the display, reinstall in reverse order.


⑤ **038689-01**
(Shield)

⑥ **038232-01**
(Bezel)

⑧ **92-049**
(Video Display)

④ **038226-01**
(Grille)

①

② **037750-01**
(Bracket)

YOKE

Disassemble in the order indicated. (Circled numbers match the numbered instructions.)

Figure 3-6   Video Display, continued
Ireland-Built Cabinet
Parts List

Part No.	Description
92-049	19-Inch Electrohome Color Raster-Scan Video Display (*Acceptable substitute is part no. 92-055—use with TM-201*)
037750-01	Display Mounting Bracket
038226-01	Upper Cabinet Grille
038232-01	Display Bezel
038689-01	Display Shield with Graphics

E. Coin Door
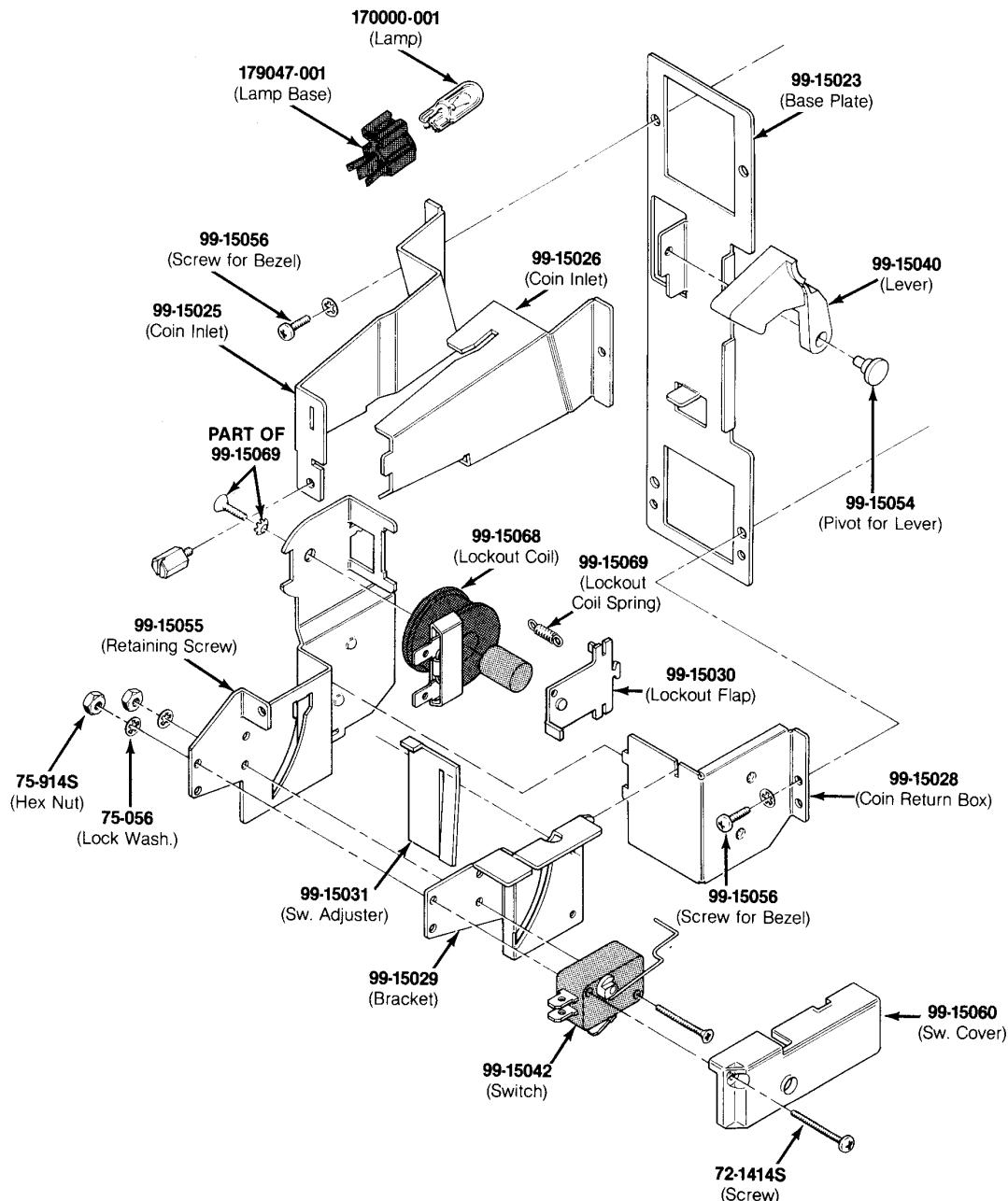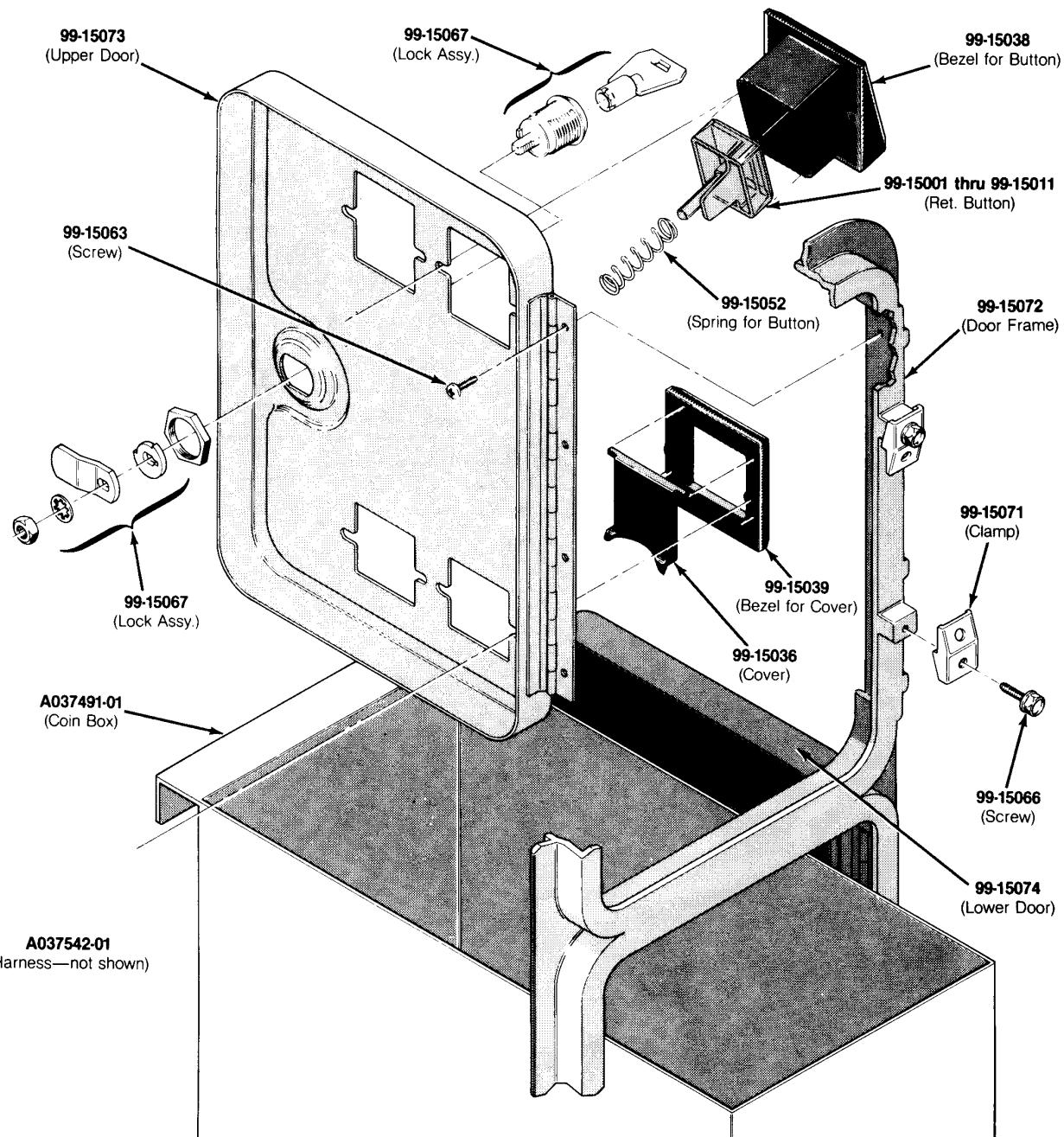
Figure 3-7   Vertically Mounted Coin Door
A037619-xx   D

99-15073
(Upper Door)

99-15067
(Lock Assy.)

99-15038
(Bezel for Button)

99-15001 thru 99-15011
(Ret. Button)

99-15063
(Screw)

99-15052
(Spring for Button)

99-15072
(Door Frame)

99-15067
(Lock Assy.)

99-15071
(Clamp)

99-15039
(Bezel for Cover)

A037491-01
(Coin Box)

99-15036
(Cover)

99-15066
(Screw)

99-15074
(Lower Door)

A037542-01
(Harness—not shown)

A037619-01 — U.S. 25¢/25¢ Coin Door	A037619-08 — German 1 DM/1 DM Coin Door	A037619-15 — French 2 Fr/1 Fr Coin Door
A037619-02 — U.S. 50¢/50¢ Coin Door	A037619-09 — German 2 DM/1 DM Coin Door	A037619-16 — Swedish 1 Kr/1 Kr Coin Door
A037619-03 — Canadian 25¢/25¢ Coin Door	A037619-10 — German 2 DM/5 DM Coin Door	A037619-17 — Spanish 25 Pts/25 Pts Coin Door
A037619-04 — British 10 P/10 P Coin Door	A037619-11 — German 1 DM/5 DM Coin Door	A037619-18 — Italian 100 L/100 L Coin Door
A037619-05 — British 10 P/50 P Coin Door	A037619-12 — 5 Fr/5 Fr Coin Door	A037619-19 — Hong Kong $1/$1 Coin Door
A037619-06 — British 20 P/50 P Coin Door	A037619-13 — Swiss 1 Fr/1 Fr Coin Door	A037619-20 — Japanese 100Y/100Y Coin Door
A037619-07 — Australian 20¢/20¢ Coin Door	A037619-14 — French 1 Fr/1 Fr Coin Door	

Figure 3-7   Vertically Mounted Coin Door, continued

Figure 3-7   Vertically Mounted Coin Door, continued
Parts List

Part No.	Description
A037491-01	Coin Box *(Not included in assembly)*
A037542-01	Harness Assembly
72-1414S	#4-40 × ⅞-Inch Cross-Recessed Pan-Head Steel Machine Screw
75-056	#6 Internal-Tooth Zinc-Plated Steel Lock Washer
75-914S	#4-40 Steel Machine Hex Nut
75-3414S	#4-40 × ⅞-Inch 82° Cross-Recessed Flat-Head Steel Machine Screw
99-15001	Coin Return Button with U.S. 25¢ Price Plate
99-15002	Coin Return Button with U.S. $1 Price Plate
99-15003	Coin Return Button with German 1 DM Price Plate
99-15004	Coin Return Button with German 2 DM Price Plate
99-15005	Coin Return Button with German 5 DM Price Plate
99-15006	Coin Return Button with Belgian 5 Fr Price Plate
99-15007	Coin Return Button with French 1 Fr Price Plate
99-15008	Coin Return Button with Japanese 100 Yen Price Plate
99-15009	Coin Return Button with British 10 Pence Price Plate
99-15010	Coin Return Button with Australian 20¢ Price Plate
99-15011	Coin Return Button with Italian 100 Lire Price Plate
99-15023	Base Plate
99-15025	Left Half of Coin Inlet
99-15026	Right Half of Coin Inlet
99-15027	Side Plate of Coin Return Box
99-15028	Base Plate of Coin Return Box
99-15029	Switch Bracket
99-15030	Flap for Lockout Coil *(U.S. 25¢)*
99-15031	Switch Adjuster
99-15036	Metal Coin Return Cover
99-15038	Bezel for Coin Return Button
99-15039	Metal Bezel for Coin Return Cover
99-15040	Coin Return Lever
99-15042	Coin Switch for U.S. 25¢
99-15052	Spring for Coin Return Button
99-15054	Pivot for Coin Return Lever
99-15055	Retaining Screw
99-15056	#4-40 × ⁵⁄₁₆-Inch Cross-Recessed Pan-Head Steel Machine Screw
99-15060	Switch Cover
99-15063	Screw for Hinge
99-15066	Screw for Clamp
99-15067	Lock Assembly
99-15068	Lockout Coil
99-15069	Spring for Lockout Coil
99-15070	Doors and Frame
99-15071	Clamp for Frame
99-15072	Door Frame
99-15073	Upper Door
99-15074	Lower Door
170000-001	6.3V Miniature Wedge-Base Incandescent Lamp
171006-035	Metal Coin Mechanism
179047-001	Lamp Base

F. Printed-Circuit Boards

⚠️— WARNING —⚠️

Prior to removing or repairing any printed-circuit board, **unplug the game.**

To Remove Printed-Circuit Boards:

1. Open the rear access panel.

2. Locate the hardware that secures the PCB to the cabinet, and remove this hardware. (Each PCB has one screw and two spacers to secure it.)

3. If you are removing the game board, unplug the edge connector. If you are removing the Regulator/Audio II PCB, disconnect the four small harness connectors on this board.

4. Carefully remove the PCB from its retainers. Be careful not to twist the boards, as this may loosen connections or components. Repair as required.

5. Reinstall the PCB, making sure that the connectors are properly plugged in. Note that they are keyed to fit only one way, so if they don't slip on easily, don't force them. **A reversed connector will probably damage your game** and void the warranty.

6. Replace the hardware that secures the PCB to the cabinet wall. Close and lock the rear access panel.

7. Check that the operation of the game is correct by performing the self-test. This is very important when you repair a PCB. Unless you are a qualified technician, **do not turn any knob on a PCB.**

Remove in the order indicated. (Circled numbers match the numbered instructions.)
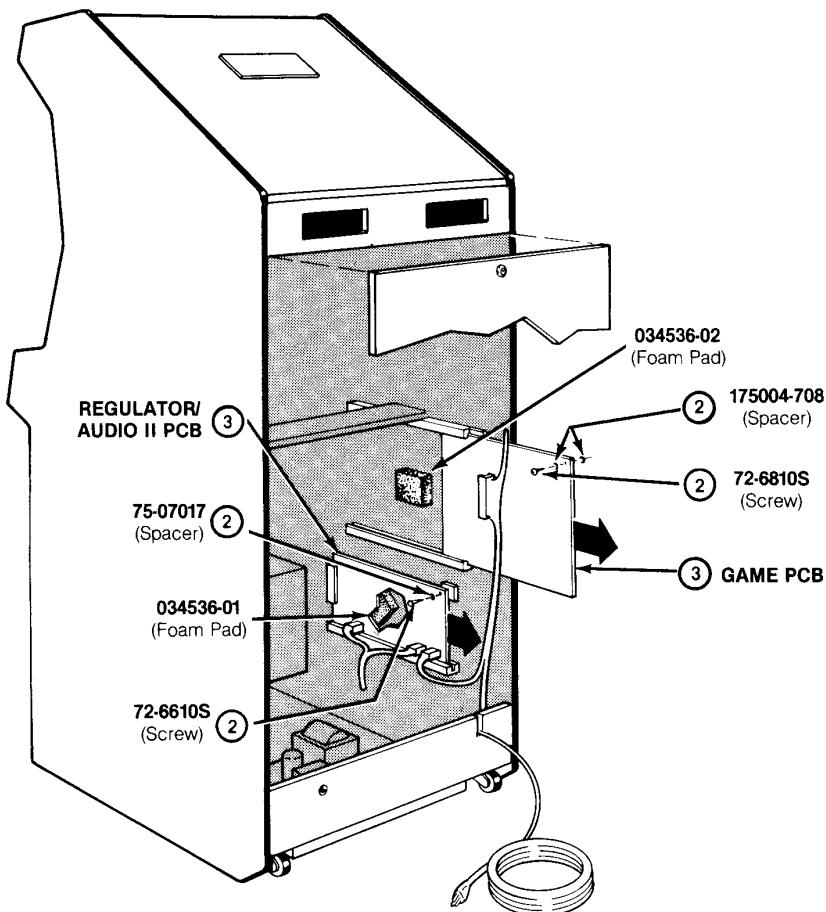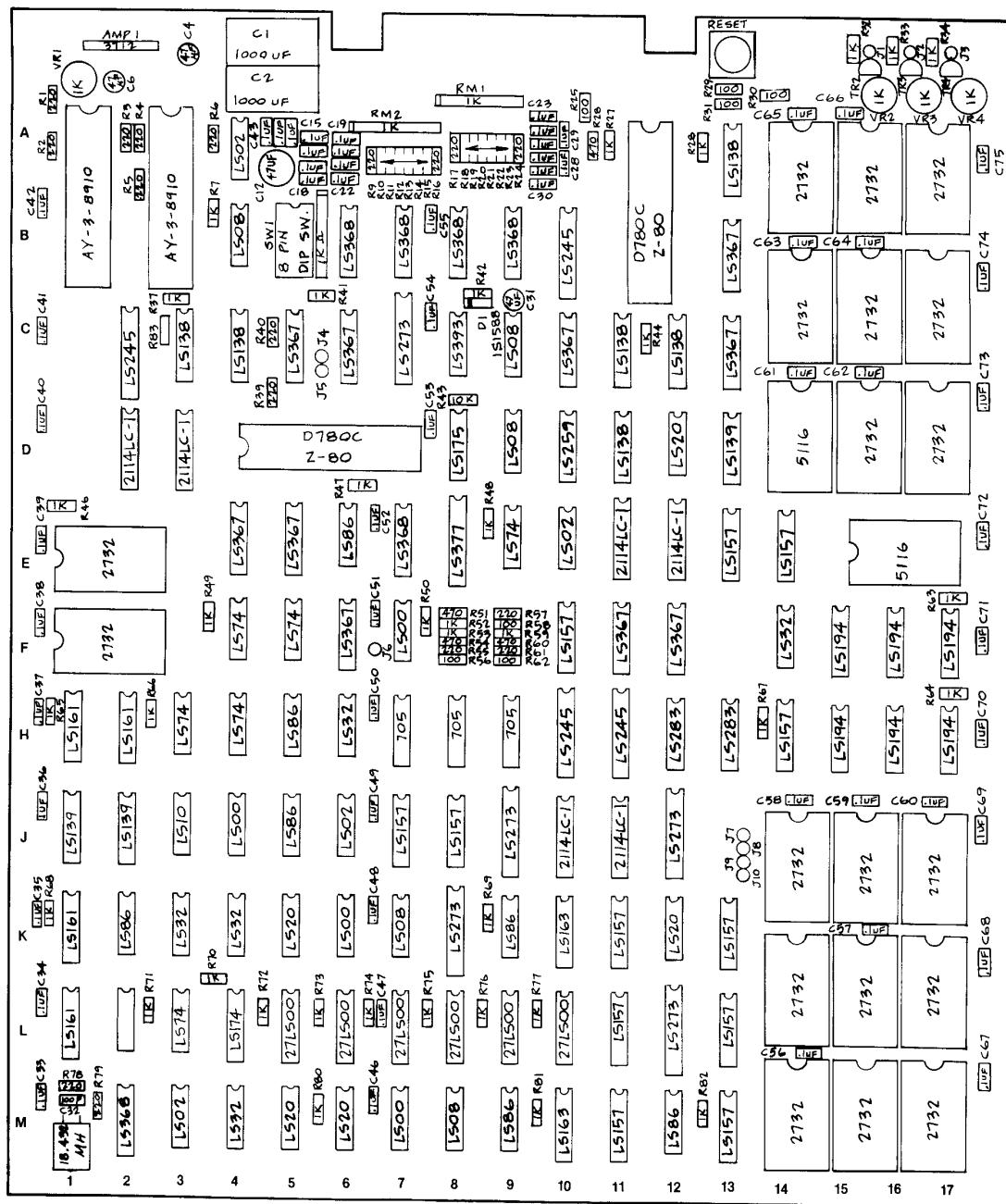
Figure 3-8   Printed-Circuit Board Removal

Figure 3-9   Fast Freddie PCB Assembly
171026-001
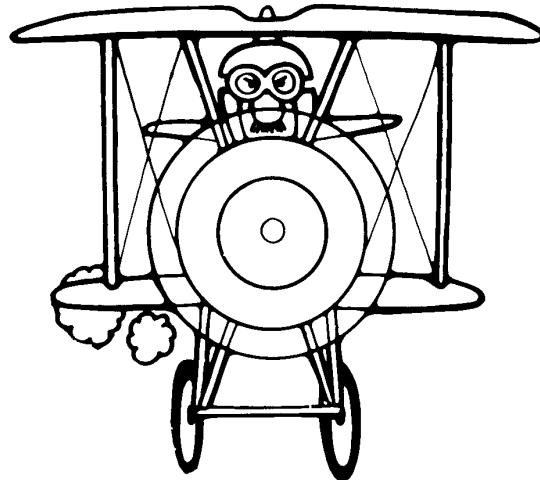
Figure 3-9   Fast Freddie PCB Assembly, continued
Parts List
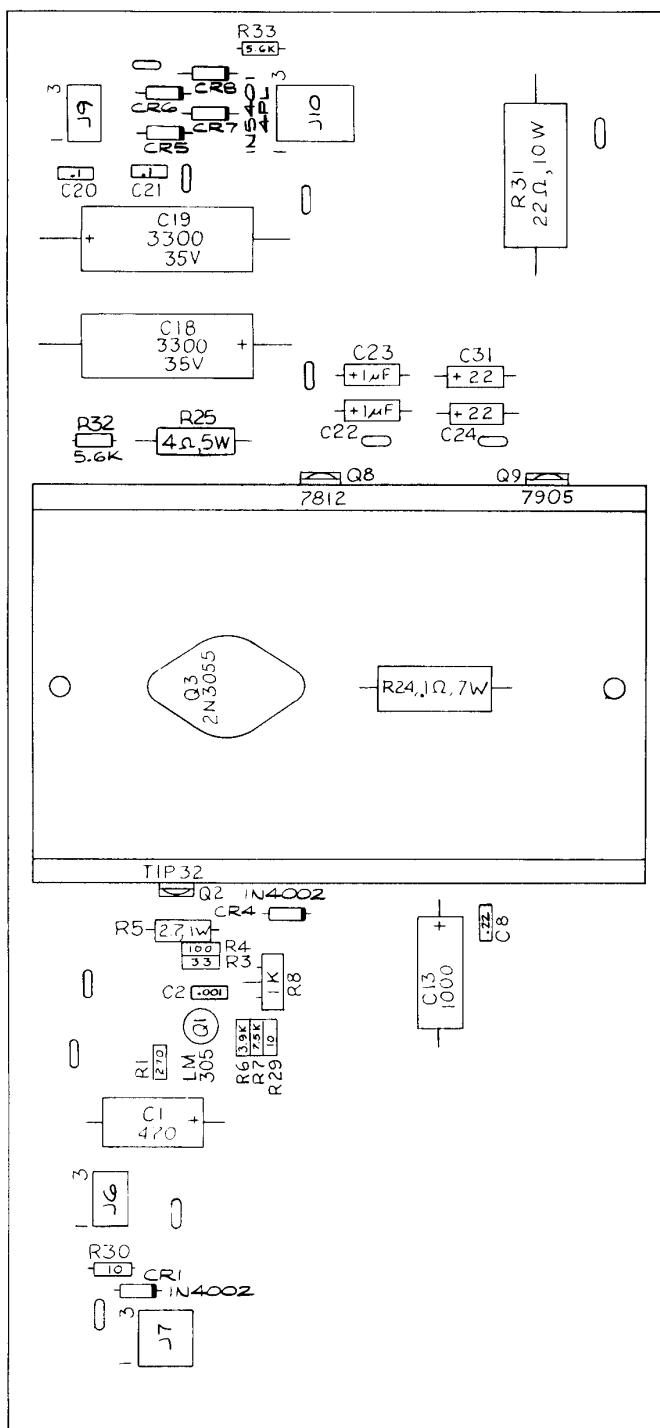
Part No.	Description (Reference Designations and Locations in Bold)
24-250108	1000 μF, ±20%, 16V (min) Axial Aluminum Electrolytic Capacitor (C1, 2)
31-1N914	75V Type-1N914 Switching Diode (D1-3)
37-7408	Type-7408 Integrated Circuit (C9)
37-74LS00	Type-74LS00 Integrated Circuit (F7, J4, K6, M7)
37-74LS02	Type-74LS02 Integrated Circuit (A4, E10, J6, M3)
37-74LS08	Type-74LS08 Integrated Circuit (B4, D9, K7, M8)
37-74LS10	Type-74LS10 Integrated Circuit (J3)
37-74LS20	Type-74LS20 Integrated Circuit (D12, K5, K12, M5, M6)
37-74LS32	Type-74LS32 Integrated Circuit (F14, H6, K3, K4, M4)
37-74LS74	Type-74LS74 Integrated Circuit (E9, F4, F5, H3, H4, L3)
37-74LS86	Type-74LS86 Integrated Circuit (E6, H5, J5, K2, K9, M9, M12)
37-74LS139	Type-74LS139 Integrated Circuit (D13, J2, J3)
37-74LS157	Type-74LS157 Integrated Circuit (E13, E14, F10, H14, J7, J8, K11, K13, L11, L13, M11, M13)
37-74LS161	Type-74LS161 Integrated Circuit (H1, H2, K1, L1)
37-74LS163	Type-74LS163 Integrated Circuit (K10, M10)
37-74LS174	Type-74LS174 Integrated Circuit (L4)
37-74LS175	Type-74LS175 Integrated Circuit (D8)
37-74LS194	Type-74LS194 Integrated Circuit (F15-17, H15-17)
37-74LS245	Type-74LS245 Integrated Circuit (B10, C2, H10, H11)
37-74LS259	Type-74LS259 Integrated Circuit (D10)
37-74LS273	Type-74LS273 Integrated Circuit (C7, J9, J12, K8, L12)
37-74LS367	Type-74LS367 Integrated Circuit (B13, C5, C6, C10, C13, E4, E5, F11, F12)
37-74LS377	Type-74LS377 Integrated Circuit (E8)
37-74LS393	Type-74LS393 Integrated Circuit (C8)
62-001	SPST Momentary Pushbutton Switch (A13)
66-118PIT	8-Station, SPST, Dual-Inline-Package Switch (B5)
79-42C16	16-Contact Medium-Insertion-Force Integrated Circuit Socket (H7-9)
79-42C24	24-Contact Medium-Insertion-Force Integrated Circuit Socket (A14, A16, A17, C14, C16, C17, D16, D17, E1, F1, J14, J16, J17, L14, L16, L17, M14, M16, M17)
79-42C40	40-Contact Medium-Insertion-Force Integrated Circuit Socket (B11-12, D5-7)
90-7036	Random-Access Memory (D2, D3, E11, E12, J10, J11)
110000-101	100 Ohm, ±5%, ¼W Resistor (R25, 29, 29-31, 56, 58, 62)
110000-102	1K Ohm, ±5%, ¼W Resistor (R52, 53, 59, All Pull-Up Resistors)
110000-103	10K Ohm, ±5%, ¼W Resistor (R43)
110000-221	220 Ohm, ±5%, ¼W Resistor (R9-24, 39, 40, 55, 57, 61, 78, 79)
110000-224	220K Ohm, ±5%, ¼W Resistor (R1-6)
110000-471	470 Ohm, ±5%, ¼W Resistor (R26, 51, 54, 60)
118001-102	1K Ohm, 8-Element, 9-Pin, Single-Inline Package Resistor Network (RM1-3)
119003-102	1K Ohm, ±20%, Horizontal Trimpot (VR1-4)
121015-104	0.1 μF, ±10%, Radial-Lead Ceramic Capacitor (C10, 11, 15-30, All Bypass Capacitors)
121020-101	100 pF, ±5%, Radial-Lead Mica Capacitor (C32)
123004-470	47 μF, ±20%, 16V (min) Aluminum ElectrolyticCapacitor (C4, 6, 31)
123004-471	470 μF, ±20%, 16V (min) Aluminum Electrolytic Capacitor (C12)
133011-001	50V, 400mW NPN Transistor (TR2-4)
136009-101	Programmable Read-Only Memory 1 (D16)

[Continued on next page]

Figure 3-9   Fast Freddie PCB Assembly, continued
Parts List

| Part No.	Description (Reference Designations and Locations in Bold)
136009-102	Programmable Read-Only Memory 2 (D17)
136009-103	Programmable Read-Only Memory 3 (C14)
136009-104	Programmable Read-Only Memory 4 (C16)
136009-105	Programmable Read-Only Memory 5 (C17)
136009-106	Programmable Read-Only Memory 6 (A14)
136009-107	Programmable Read-Only Memory 7 (A16)
136009-108	Programmable Read-Only Memory 8 (A17)
136009-109	Programmable Read-Only Memory 9 (E1)
136009-110	Programmable Read-Only Memory 10 (F1)
136009-111	Programmable Read-Only Memory 11 (M17)
136009-112	Programmable Read-Only Memory 12 (M16)
136009-113	Programmable Read-Only Memory 13 (M14)
136009-114	Programmable Read-Only Memory 14 (L17)
136009-115	Programmable Read-Only Memory 15 (L16)
136009-116	Programmable Read-Only Memory 16 (L14)
136009-117	Programmable Read-Only Memory 17 (J17)
136009-118	Programmable Read-Only Memory 18 (J16)
136009-119	Programmable Read-Only Memory 19 (J14)
136009-120	Programmable Read-Only Memory (H7)
136009-121	Programmable Read-Only Memory (H8)
136009-122	Programmable Read-Only Memory (H9)
137168-001	Type-74LS368 Integrated Circuit (B6-9, E7, F6, M2)
137169-001	Type-74LS107 Integrated Circuit (L2)
137170-001	Random-Access Memory (L5-10)
137177-001	Type-74LS138 Integrated Circuit (A13, C3, C4, C11, C12, D11)
137194-001	Z80 Microprocessor (D5-7, B11, B12)
137204-001	Type-74LS283 Integrated Circuit (H12, H13)
137222-001	Type GI AY3-8910 Sound Integrated Circuit (B1, B3)
137234-001	Audio Amplifier Integrated Circuit (AMP1)
137211-001	2Kx8 Static Random-Access Memory (D14)
137235-001	Custom Chip (E16, 17)
144000-002	18.432 MHz Crystal (M1)

Figure 3-10   Regulator/Audio II PCB Assembly
A035435-06   B

Figure 3-10   Regulator/Audio II PCB Assembly
Parts List

| Part No.	Description (Reference Designations and Locations in Bold)
19-100P1015	0.1 Ohm, ±3%, 7W Wirewound Resistor **(R24)**
19-315102	1K Ohm Vertical PCB-Mounting Cermet Trimpot **(R8)** *Acceptable substitute is part no. 119002-102.*
24-250108	1000 μF 25V Aluminum Electrolytic Fixed Axial-Lead Capacitor **(C13)**
24-250477	470 μF 25V Aluminum Electrolytic Fixed Axial-Lead Capacitor **(C1)**
24-350226	22 μF 35V Aluminum Electrolytic Fixed Axial-Lead Capacitor **(C24, 31)**
24-350338	3300 μF 35V Aluminum Electrolytic Fixed Axial-Lead Capacitor **(C18, 19)**
24-500105	1 μF 50V Aluminum Electrolytic Fixed Axial-Lead Capacitor **(C22, 23)**
29-088	0.1 μF 50V Ceramic-Disc Axial-Lead Capacitor **(C20, 21)**
31-1N4002	Type-1N4002 100V 1-Amp. Silicon Rectifier Diode **(CR1, 4)**
31-1N5401	Type-1N5401 100V 3-Amp. Silicon Rectifier Diode **(CR5-8)**
33-TIP32	Type-TIP32 PNP Power Transistor **(Q2)**
34-2N3055	Type-2N3055 NPN Silicon Transistor **(Q3)**
37-LM305	5V Linear Voltage Regulator **(Q1)**
37-7812	Type-7812 +12V Voltage Regulator **(Q8)**
37-7905	Type-7905 −5V Voltage Regulator **(Q9)**
72-1608C	#6-32 × ½-Inch Cross-Recessed Pan-Head Corrosion-Resistant Steel Machine Screw
72-6810S	#8 × ¾-Inch Phillips-Head Wood Screw *(for mounting PCB to cabinet)*
75-F60405	#6-32 × ¼-Inch Binder-Head Nylon Screw
75-99516	#6-32 Nut/Washer Assembly
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)**
034531-01	Heat Sink
034536-02	Foam Vibration Damper *(goes between PCB and cabinet wall)*
110000-100	10 Ohm, ±5%, ¼W Resistor **(R29, 30)**
110000-101	100 Ohm, ±5%, ¼W Resistor **(R4)**
110000-271	270 Ohm, ±5%, ¼W Resistor **(R1)**
110000-330	33 Ohm, ±5%, ¼W Resistor **(R3)**
110000-392	3.9K Ohm, ±5%, ¼W Resistor **(R6)**
110000-562	5.6K Ohm, ±5%, ¼W Resistor **(R32, 33)**
110000-752	7.5K Ohm, ±5%, ¼W Resistor **(R7)**
110009-027	2.7 Ohm, ±5%, 1W Resistor **(R5)**
116000-220	22 Ohm, ±5%, 10W Wirewound Resistor **(R31)**
116001-040	4 Ohm, ±5%, 5W Wirewound Resistor **(R25)**
122002-102	.001 μF 50V Ceramic-Disc Axial-Lead Capacitor **(C2)**
122004-224	.22 μF 25V (min.) Ceramic-Disc Axial-Lead Capacitor **(C8)**
175004-708	Fiber Spacer *(for mounting PCB to cabinet)*
179051-001	Test Point *(Acceptable substitute is part no. 020670-01)*

G. Power Supply Assembly

29-053
(Capacitor)

A035888-01
(Transformer)

A021084-01, -04 & -05
(Vol. Sel. Plug)

⚠ **WARNING** ⚠
Fuse cover must be
in place during game
operation.

034544-01
(Cover)

79-4411001
(Fuse Post)

78-70501SC
(Capac. Bracket)

46-2017002
(Fuse)

A035891-01
(Fuse Harness)

034482-02
(Chassis)

46-301203
(Fuse)

037639-01
(Label)

78-2708
(Hole Bushing)

79-3206
(Fuse Block)

A034630-01
(RFI Filter)

037641-01
(Label)

46-2014002
(Fuses)

79-15021001
(Term'l Block)

A035890-01
(Pwr. Harness)

3A-MDA3501
(Rectifier)

A034629-01
(A.C. Harness)

Figure 3-11   Power Supply Assembly
A037671-02   C

Figure 3-11   Power Supply Assembly, continued
Parts List
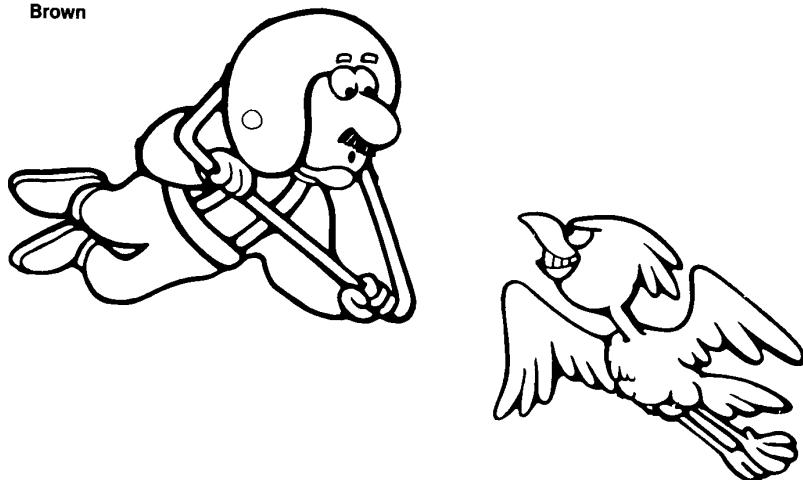
Part No.	Description (Reference Designations in Bold)
A021084-01	Voltage Plug for 100V *(violet)*
A021084-04	Voltage Plug for 220V *(blue)*
A021084-05	Voltage Plug for 240V *(brown)*
A034629-01	A.C. Harness Assembly
A034630-01	RFI Filter Assembly **(FL1)**
A035888-01	Transformer Assembly **(T1)** *Acceptable substitute is part no. A035888-02*
A035890-01	Power Harness Assembly
A035891-01	Fuse Harness Assembly
A037671-02	Power Supply Assembly
29-053	27,000 µF 15V DC Electrolytic Capacitor **(C1)**
3A-MDA3501	Bridge Rectifier, Type MDA 3501 **(CR1)**
46-2014002	4-Amp. 250V 3AG Slow-Blow Glass Cartridge-Type Fuse **(F2, F4–F6)**
46-2017002	7-Amp. 250V 3AG Slow-Blow Glass Cartridge-Type Fuse **(F1)**
46-301203	20-Amp. 32V 3AG Slow-Blow Glass Cartridge-Type Fuse **(F3)**
78-2708	Nylon Type 6/6 Hole Bushing with ⅜-Inch Inside Diameter × ⁵⁵⁄₆₄-Inch Outside Diameter × ¼-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 ¼-Inch Quick-Disconnect Terminals
79-4411001	Panel-Mounting Non-Indicating 3AG Cartridge-Type Fuse Post
034482-02	Power Supply Chassis
034544-01	Fuse Block Cover
037243-01	Metal Base Plate *(goes under the power supply—not shown in illustration)*
037639-01	Label for Fuse Value **(F1)**
037641-01	Label for Fuse Values **(F2–F6)**
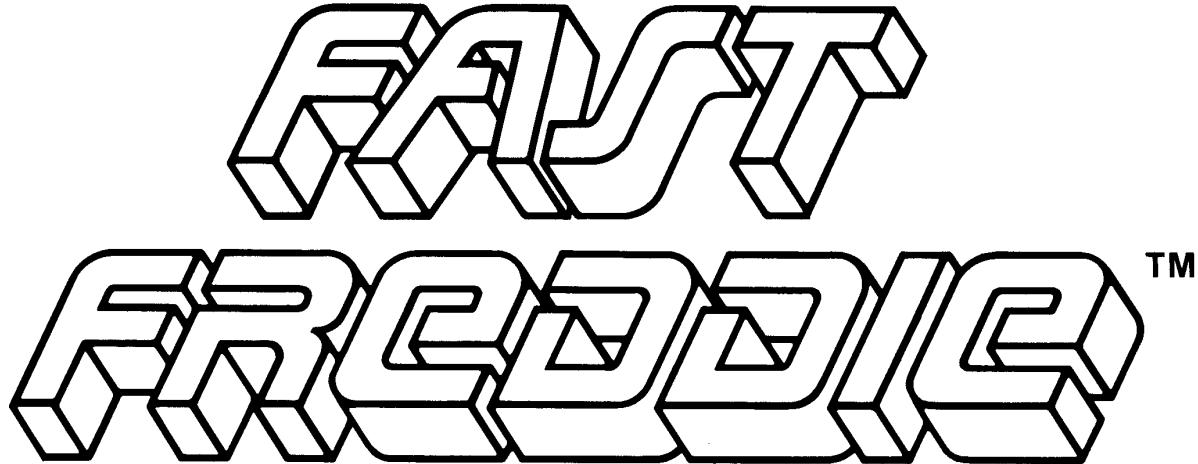
Line Voltage Range	Voltage Selection Plug Wire Color
90-110 VAC (100)	Violet
200-240 VAC (220)	Blue
220-260 VAC (240)	Brown

Schematic Package Supplement
to

FAST FREDDIE™

Operation, Maintenance and Service Manual

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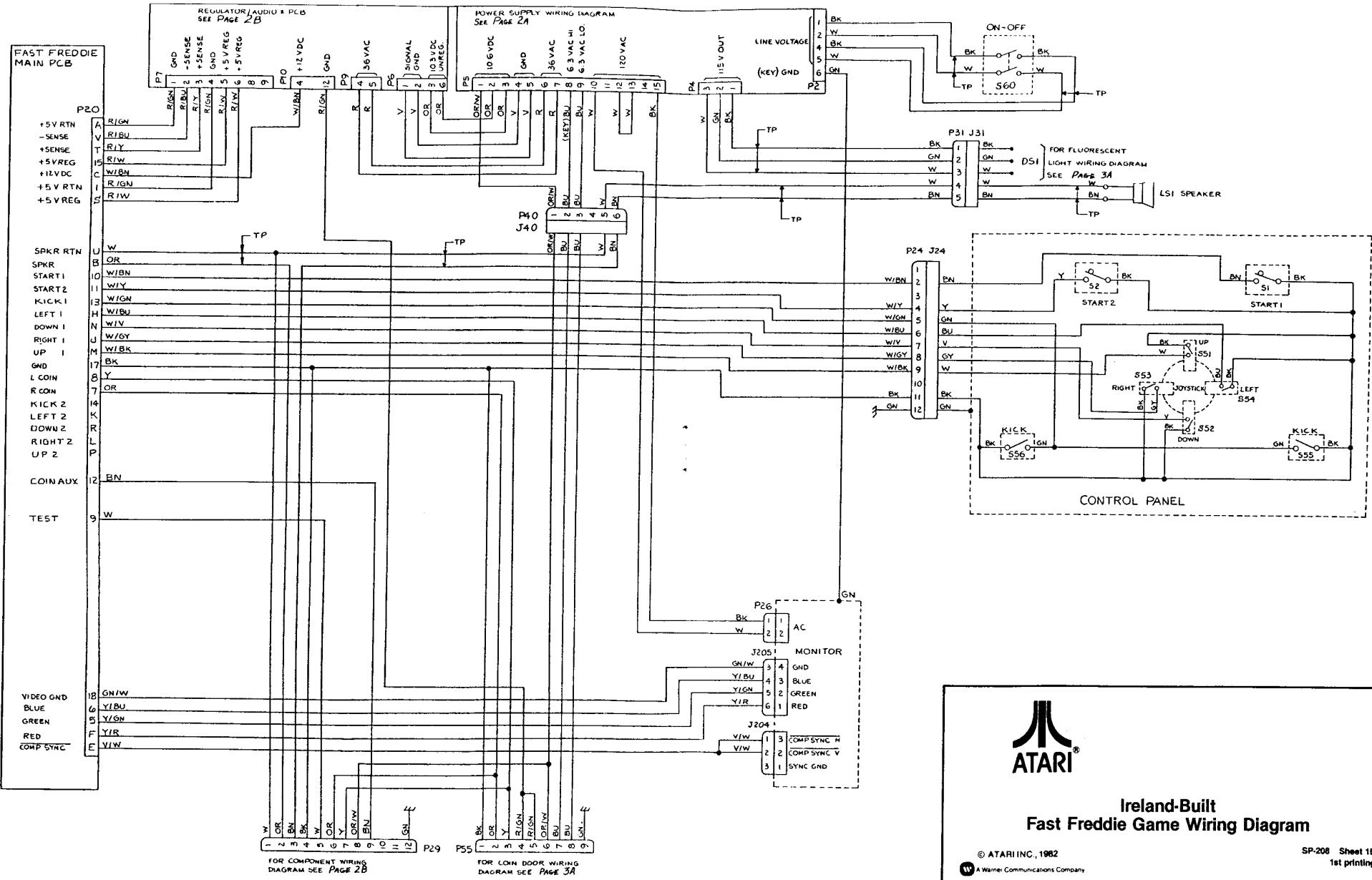
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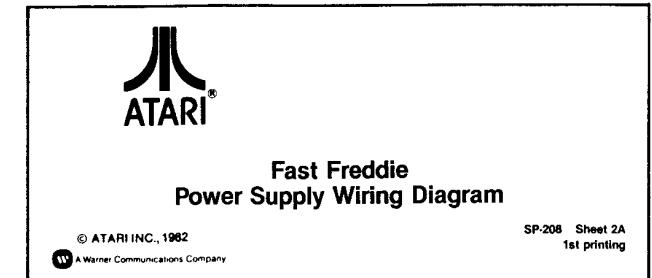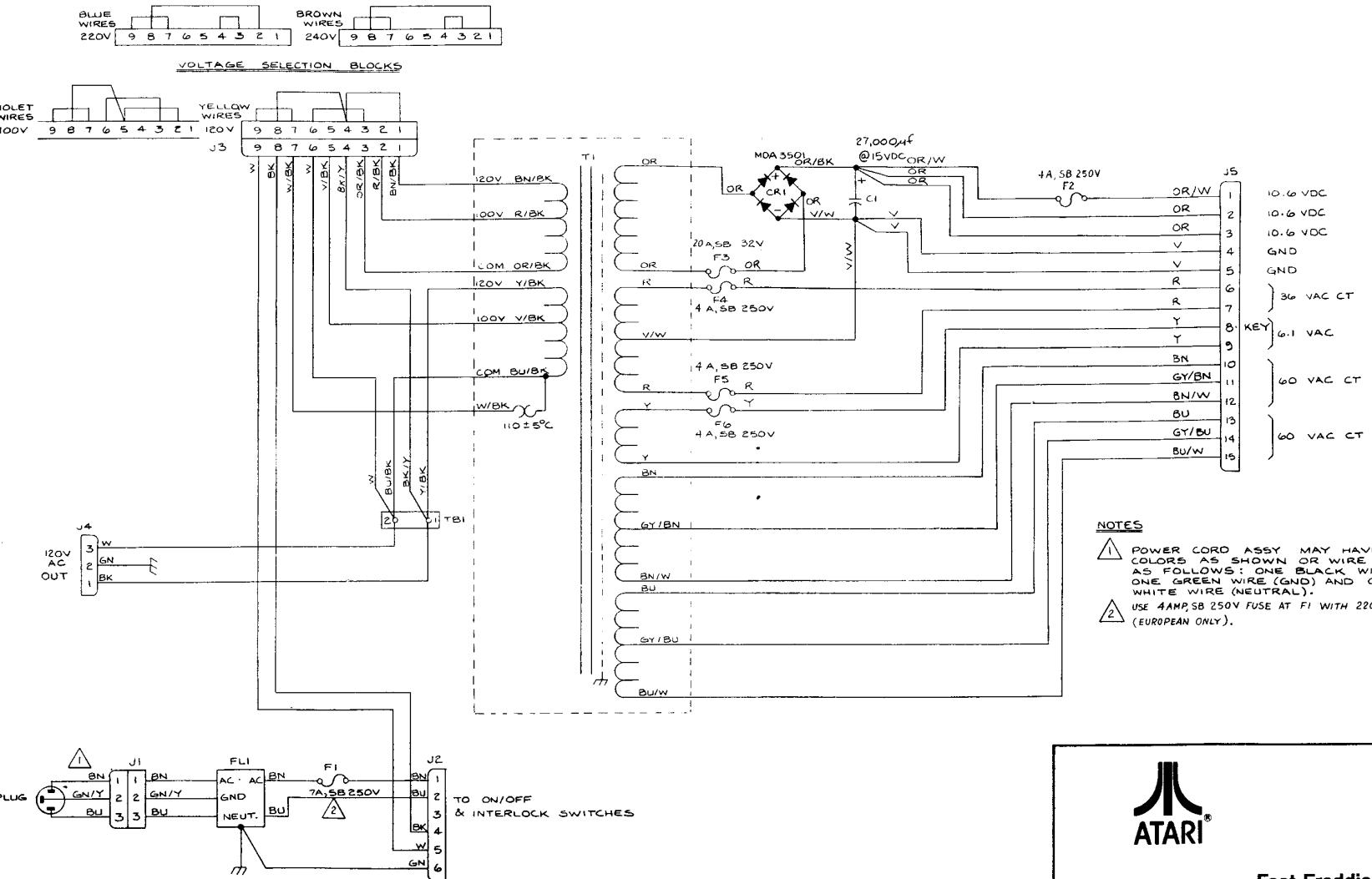
Table of Contents
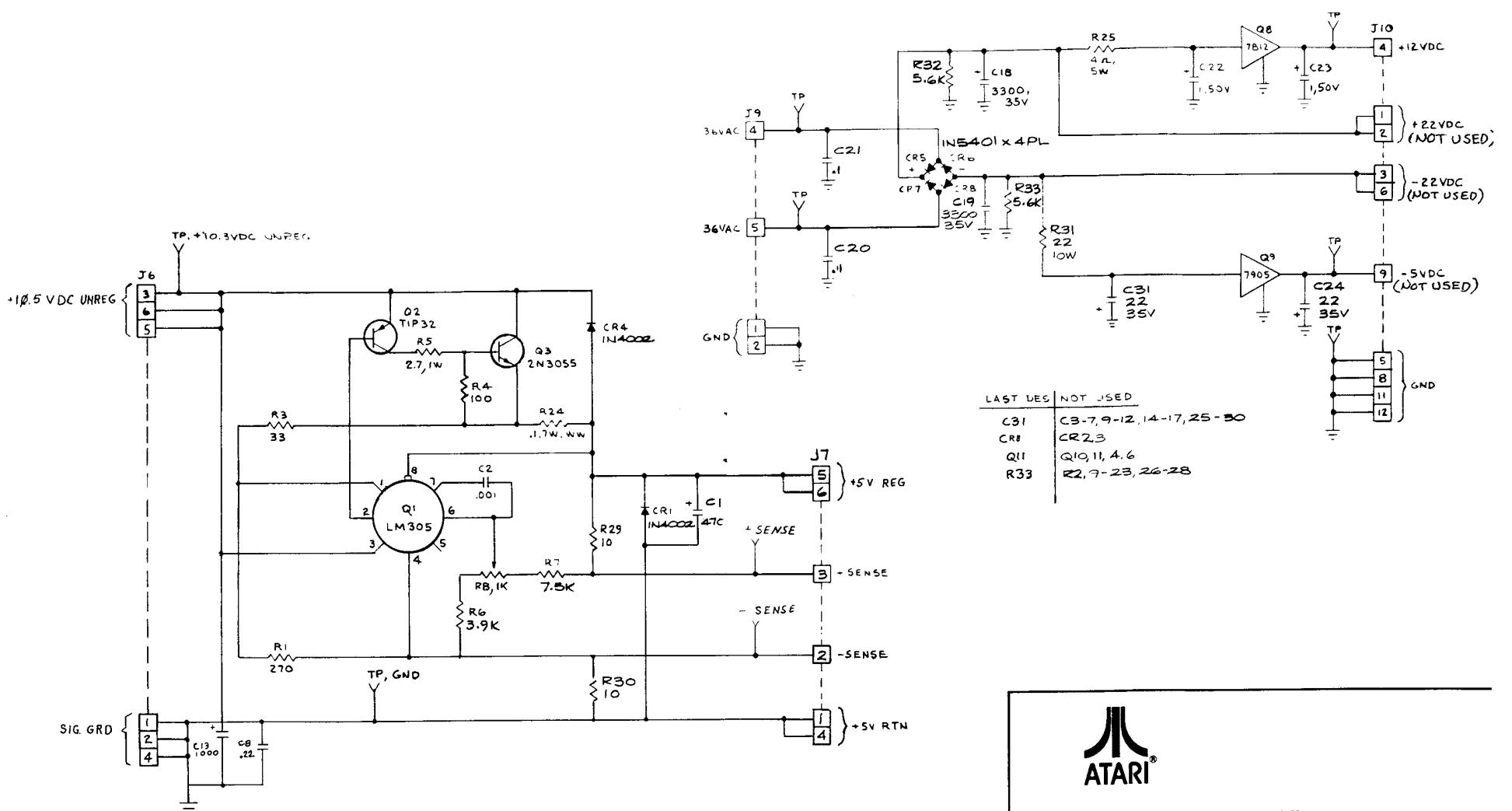
Ireland-Built
Fast Freddie Game Wiring Diagram

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A Warner Communications Company

SP-208 Sheet 1B
1st printing

VOLTAGE SELECTION BLOCKS

BLUE WIRES 220V   9 8 7 6 5 4 3 2 1
BROWN WIRES 240V   9 8 7 6 5 4 3 2 1

VIOLET WIRES 100V 9 8 7 6 5 4 3 2 1
YELLOW WIRES 120V 9 8 7 6 5 4 3 2 1
J3   9 8 7 6 5 4 3 2 1

NOTES

⚠ 1 POWER CORD ASSY MAY HAVE WIRE COLORS AS SHOWN OR WIRE COLORS AS FOLLOWS: ONE BLACK WIRE (AC), ONE GREEN WIRE (GND) AND ONE WHITE WIRE (NEUTRAL).

⚠ 2 USE 4 AMP, SB 250V FUSE AT F1 WITH 220V & 240V (EUROPEAN ONLY).

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Fast Freddie
Power Supply Wiring Diagram

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1st printing

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| LAST DES	NOT USED
C31	C3-7, 9-12, 14-17, 25-30
CR8	CR23
Q11	Q10, 11, 4, 6
R33	R2, 9-23, 26-28
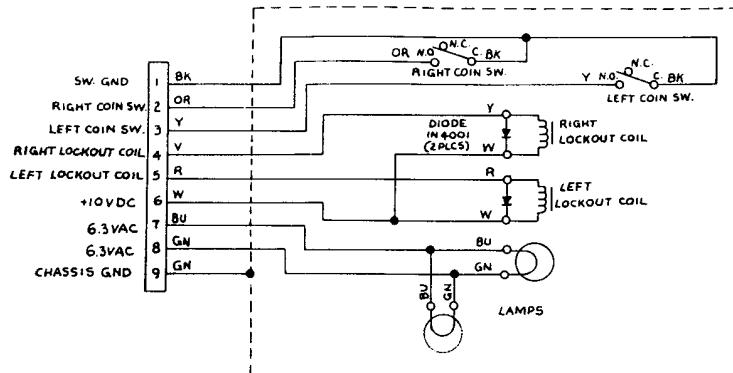
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Fast Freddie
Regulator/Audio II PCB Schematic
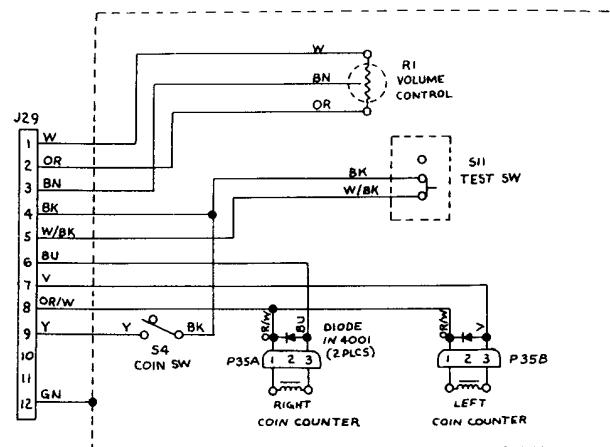
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SP-208   Sheet 2B
1st printing
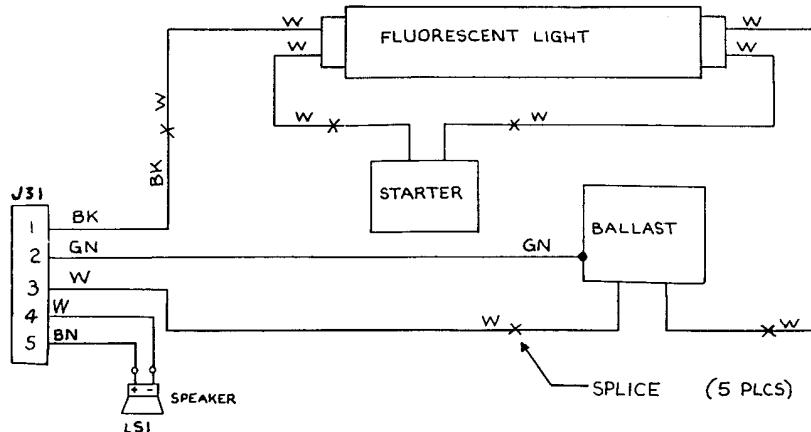
Coin Door Wiring Diagram

|		
SW. GND	1	BK
RIGHT COIN SW.	2	OR
LEFT COIN SW.	3	Y
RIGHT LOCKOUT COIL	4	V
LEFT LOCKOUT COIL	5	R
+10 VDC	6	W
6.3 VAC	7	BU
6.3 VAC	8	GN
CHASSIS GND	9	GN

Utility Panel Wiring Diagram

J29

1	W
2	OR
3	BN
4	BK
5	W/BK
6	BU
7	V
8	OR/W
9	Y
10	
11	
12	GN

Fluorescent Light and Speaker Wiring Diagram

J31

1	BK
2	GN
3	W
4	W
5	BN

SPEAKER
LS1

SPLICE   (5 PLCS)

Fast Freddie
PCB Block Diagram

SP-208   Sheet 3B
1st printing

Fast Freddie PCB Connector

Soldering Face			Parts Face
GND	A	1	GND
SP Out	B	2	No Connection
+ 12 V	C	3	+ 12 V
+ 12 V	D	4	+ 12 V
Sync	E	5	Green
Red	F	6	Blue
1 Player Left	H	7	Coin 2
1 Player Right	J	8	Coin 1
* 2 Player Left	K	9	Test
* 2 Player Right	L	10	1 Player Start
1 Player Up	M	11	2 Player Start
1 Player Down	N	12	Coin Aux. Input
* 2 Player Up	P	13	1 Player Kick
* 2 Player Down	R	14	* 2 Player Kick
+ 5 V	S	15	+ 5 V
+ 5 V	T	16	+ 5 V
GND	U	17	GND
GND	V	18	GND

* No connection in upright mode.

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Fast Freddie
Memory Map and PCB Connector
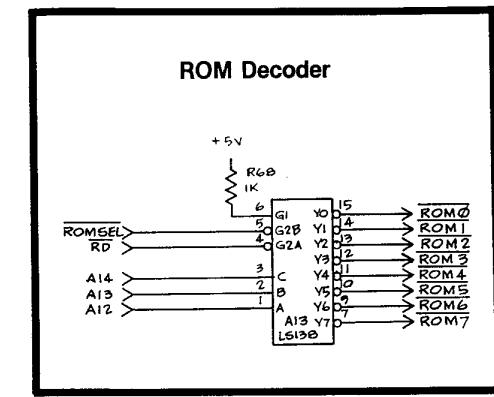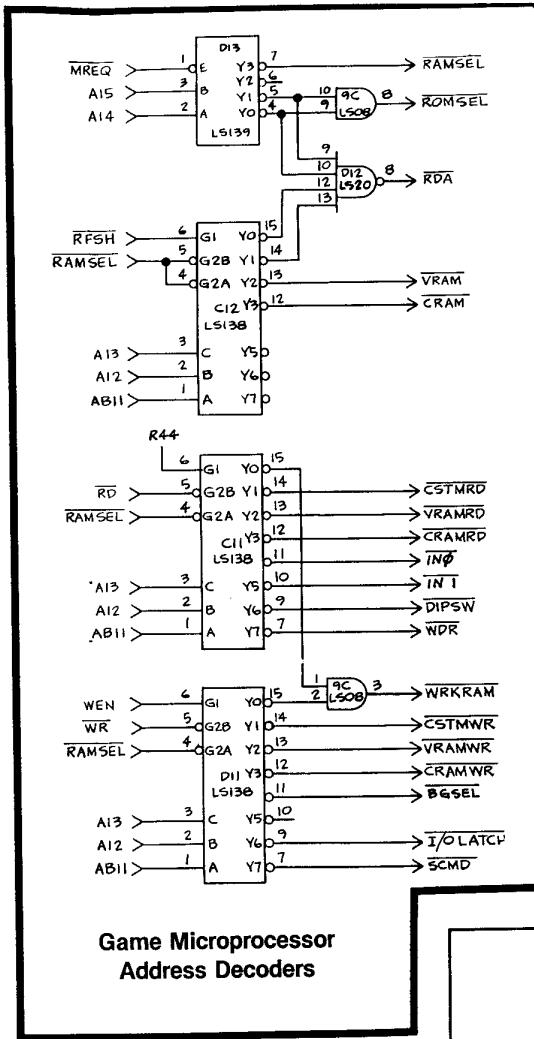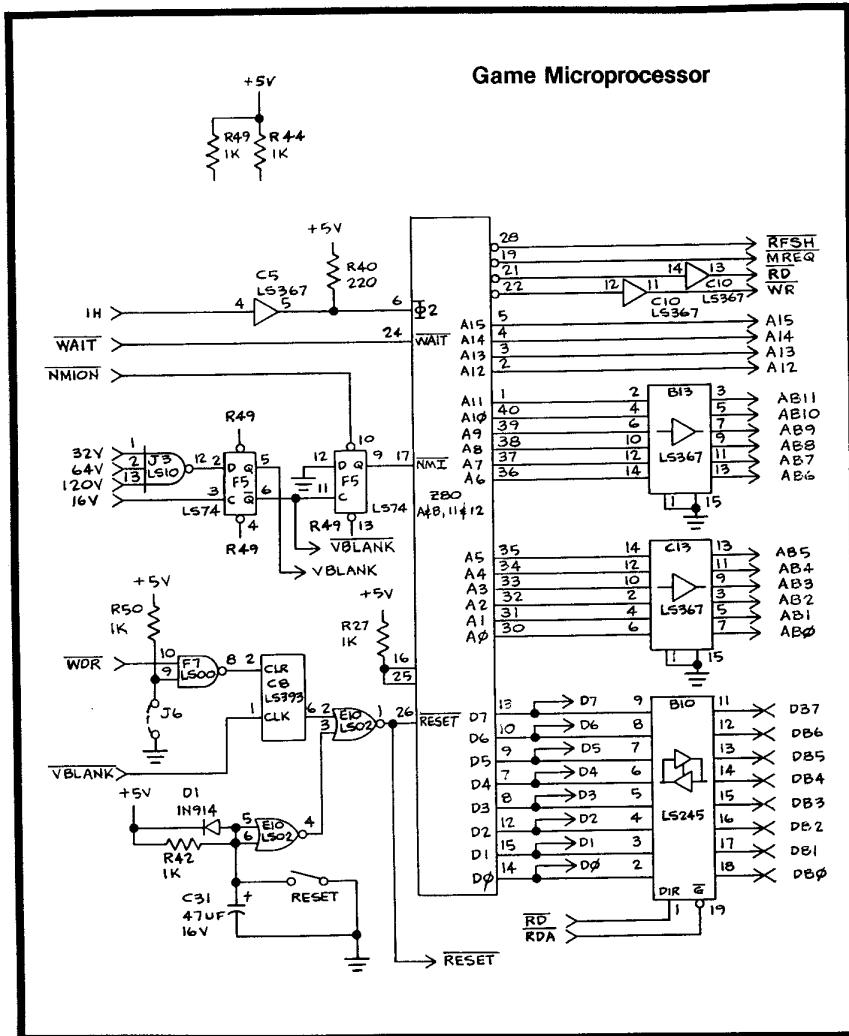
MEMORY MAP

HEXA-DECIMAL ADDRESS	R/W	D7	D6	D5	D4	D3	D2	D1	D0	FUNCTION
Game Microprocessor Memory Space										
0000–7FFF	R	D	D	D	D	D	D	D	D	Z80 32K Program ROM
C000–C7FF	R/W	D	D	D	D	D	D	D	D	2K Working RAM
C800–C8FF	R/W	D	D	D	D	D	D	D	D	Custom Chip
D000–D3FF	R/W	D	D	D	D	D	D	D	D	1K Video RAM
D800–D8FF	R/W	D	D	D	D	D	D	D	D	Control RAM
E000	W	D	D	D	D	D	D	D	D	Background Color Select
E000	R								D	Coin 2
E000	R							D		Coin 1
E000	R						D			Test
E000	R					D				1 Player Start
E000	R				D					2 Player Start
E000	R			D						Coin Aux: Input
E000	R		D							1 Player Kick
E000	R	D								2 Player Kick
E800	R								D	1 Player Left
E800	R							D		1 Player Right
E800	R						D			2 Player Left
E800	R					D				2 Player Right
E800	R				D					1 Player Up
E800	R			D						1 Player Down
E800	R		D							2 Player Up
E800	R	D								2 Player Down
F000	R	D	D	D	D	D	D	D	D	Option Switch
F000	W								D	NMI Preset
F001	W								D	Character ROM Select 1
F002	W								D	Character ROM Select 2
F003	W								D	Color ROM Select 1
F004	W								D	Color ROM Select 2
F005	W								D	Horizontal Flip
F006	W								D	Vertical Flip
F800	W	D	D	D	D	D	D	D	D	Sound Output Port ($\overline{\text{SCMD}}$)
F800	R									Soft Reset
Sound Microprocessor Memory Space										
0000–1FFF	R	D	D	D	D	D	D	D	D	4K Sound Program ROM
2000–27FF	R/W	D	D	D	D	D	D	D	D	2K Sound Working RAM
3000	R	D	D	D	D	D	D	D	D	Input Port From Game C.P.U. ($\overline{\text{SCMDRD}}$)
3000	W								D	SNMI Preset
5000	W	D	D	D	D	D	D	D	D	Programmable Sound Generator
5001	W	D	D	D	D	D	D	D	D	Programmable Sound Generator
6000	W	D	D	D	D	D	D	D	D	Programmable Sound Generator
6001	W	D	D	D	D	D	D	D	D	Programmable Sound Generator

Game Microprocessor

Game Microprocessor Address Decoders

ROM Decoder

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Program Memory

	2732	2732	2732	2732	2732	2732	2732	2732		

AB11 —21—
AB10 —19—
AB9 —22—
AB8 —23—
AB7 —1—
AB6 —2—
AB5 —3—
AB4 —4—
AB3 —5—
AB2 —6—
AB1 —7—
AB0 —8—

A11
A10
A9
A8
A7
A6
A5
A4
A3
A2
A1
A0

D16	D17	C14	C16	C17	A14	A16	A17

D7 —17—→ D7
D6 —16—→ D6
D5 —15—→ D5
D4 —14—→ D4
D3 —13—→ D3
D2 —11—→ D2
D1 —10—→ D1
D0 —9—→ D0

18 20 18 20 18 20 18 20 18 20 18 20 18 20 18 20

ROM0
ROM1
ROM2
ROM3
ROM4
ROM5
ROM6
ROM7

	6116	5116

AB10 —19—
AB9 —22—
AB8 —23—
AB7 —1—
AB6 —2—
AB5 —3—
AB4 —4—
AB3 —5—
AB2 —6—
AB1 —7—
AB0 —8—
WR —21—

A10
A9
A8
A7
A6
A5
A4
A3
A2
A1
A0
WR

D14	E16

D7 —17— D7
D6 —16— D6
D5 —15— D5
D4 —14— D4
D3 —13— D3
D2 —11— D2
D1 —10— D1
D0 —9— D0

18 20 18 20

WRKRAM
CSTMRD
CSTMWR

Sound Microprocessor

Sound Microprocessor Address Decoders

+5V
R39 220
CLK2
SNMI
ΦZ

+5V

28 19 21 22 — SMREQ, SRD, SWR
A15 5
A14 4
A13 3 — SA13
A12 2 — SA12

R49
32V
64V J4 LS10 D Q F4 D Q F4
16V
LS74   LS74
R49   R49

A11 40 — E4 LS367 — SAB11
A10 39 — SAB10
A9 38 — SAB9
A8 37 — SAB8
A7 36 — SAB7
A6 — SAB6

NMI
Z80
D4-7

A5 35 — E5 LS367 — SAB5
A4 34 — SAB4
A3 33 — SAB3
A2 32 — SAB2
A1 31 — SAB1
A0 30 — SAB0

R47
16
24
25 WAIT
26 RESET

RESET

D7 13 — SD7 9 — C2 — SDB7
D6 10 — SD6 8 — SDB6
D5 9 — SD5 7 — SDB5
D4 7 — SD4 6 — SDB4
D3 8 — SD3 5 — SDB3
D2 12 — SD2 4 — LS245 — SDB2
D1 15 — SD1 3 — SDB1
D0 14 — SD0 — SDB0

R37 DIR G
SGON

+5V
R66 R37 R47 R83
1K 1K 1K 1K

Sound Input

+5V
R41 1K

DB0 3 — D — SD0
DB1 4 — SD1
DB2 7 — C7 LS273 — SD2
DB3 8 — SD3
DB4 13 — SD4
DB5 14 — SD5
DB6 17
DB7 18 — Q

LS367 C6

SCMD
SCMD RD

LS367 C5
SD6
SD7
CLK1
CLK2

1H
2H

Address Decoders

SAB0 — A4 LS02 — SGA1
SAB1 — SGA2
SGW2 — SGA3
SGW3 — A4 — SGA4

R83
G1 Y0 15 — SROM0
SRD — G2B Y1 14 — SROM1
SMREQ — G2A Y2 13
C4 Y3 12 — SCMDRD
LS138
SA13 — C Y5
SA12 — B Y6
SAB11 — A Y7

B4 LS08 — SRAMCS

R83
G1 Y0 15
SWR — G2B Y1 14
SMREQ — G2A Y2 13
C3 Y3 12
LS138
SA13 — C Y5 — SGW1
SA12 — B Y6 — SGW2
SAB11 — A Y7 — SGW3

B4 LS08 B4 LS08 — SGON
R66

SD0 — D Q H3 LS74 — SNMI
C
R66

Sound Memory

Sound Output
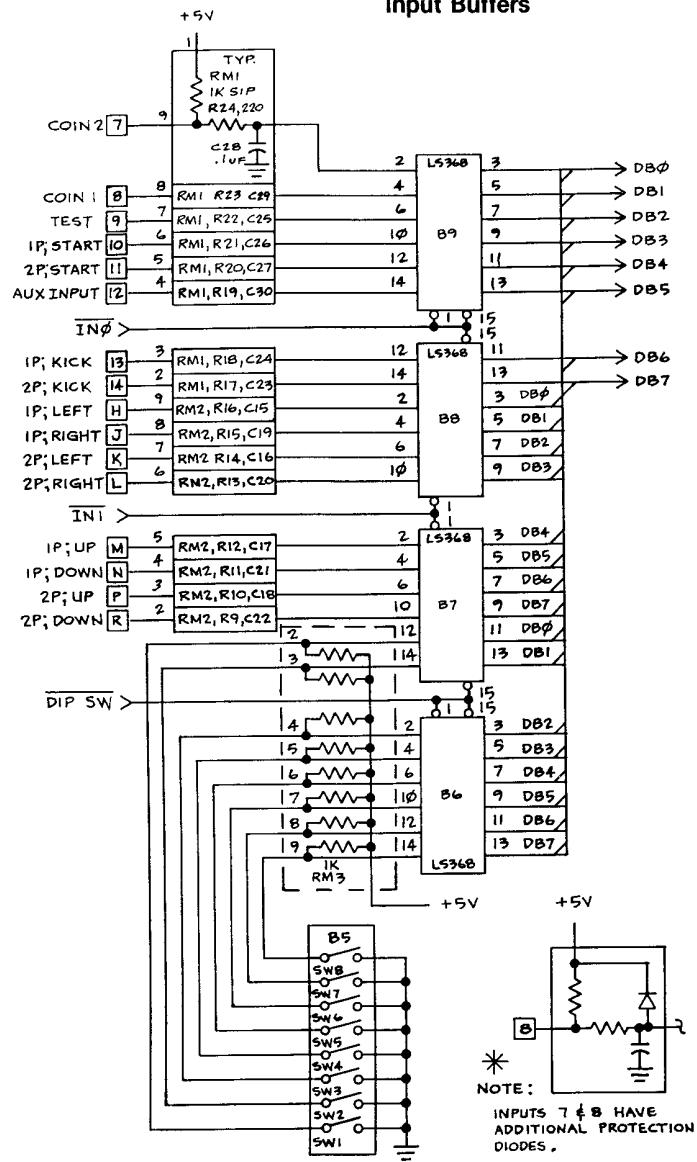
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Fast Freddie
Sound Memory and Output
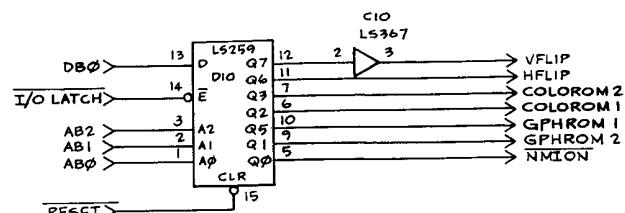
SP-206 Sheet 6A
1st printing

Input Buffers

Control Signal Latch

NOTE: INPUTS 7 & 8 HAVE ADDITIONAL PROTECTION DIODES.
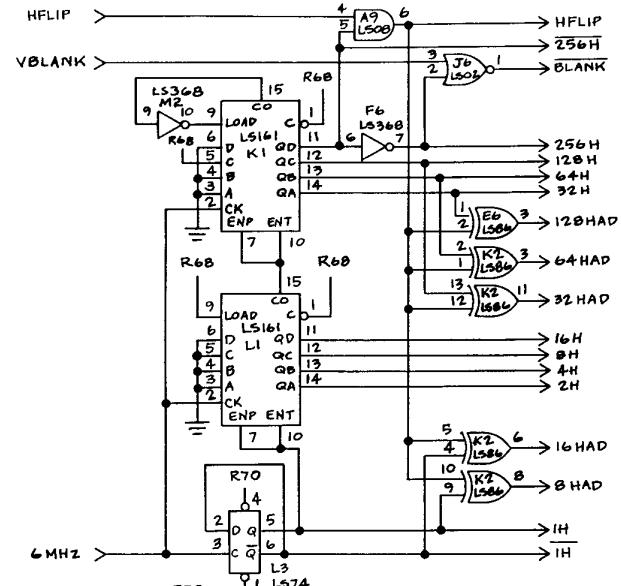
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Input Buffers and Control Signal Latch
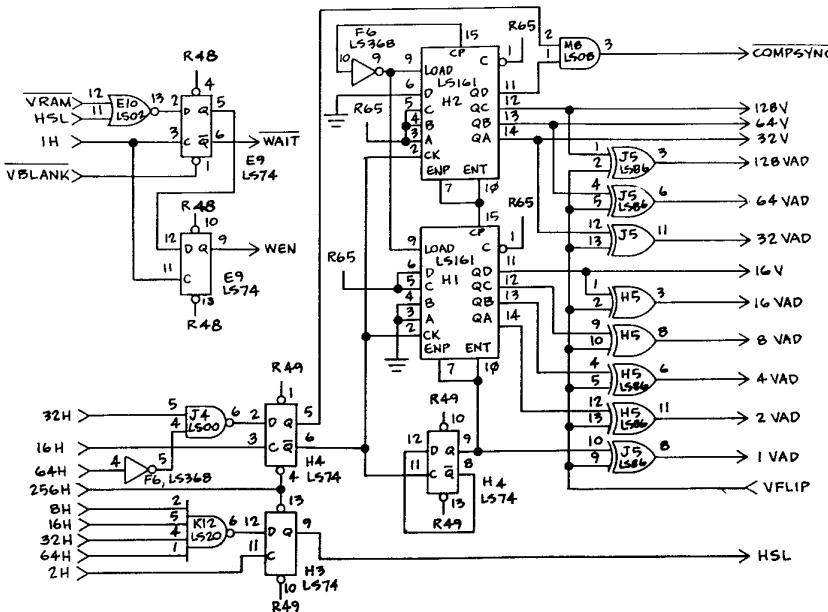
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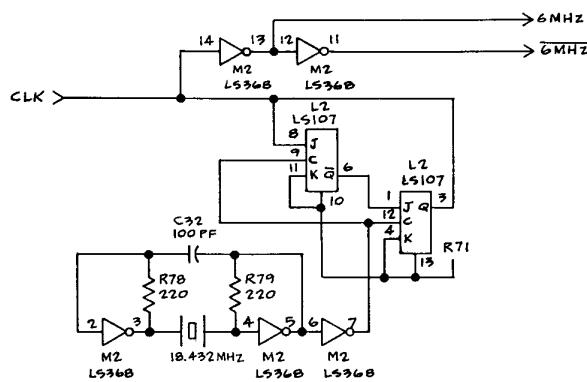
Horizontal Sync Chain
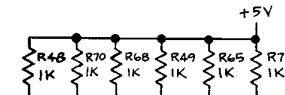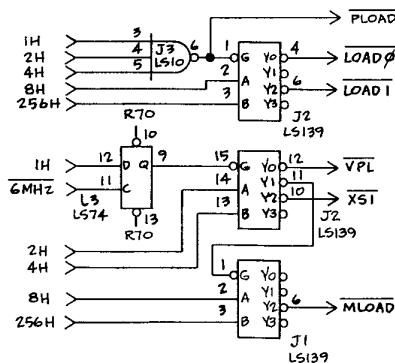
Vertical Sync Chain

Crystal Clock

Control Load Signals
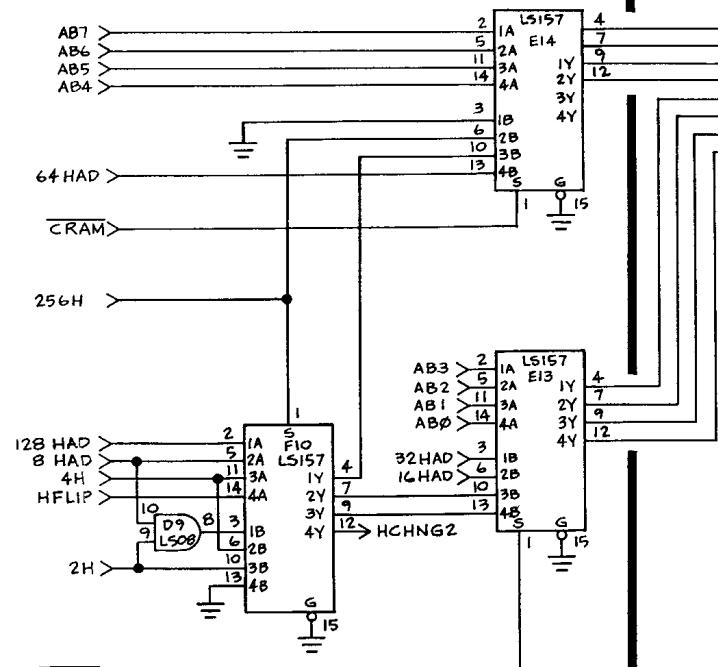
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**Fast Freddie
Crystal Clock and Timing Chains**
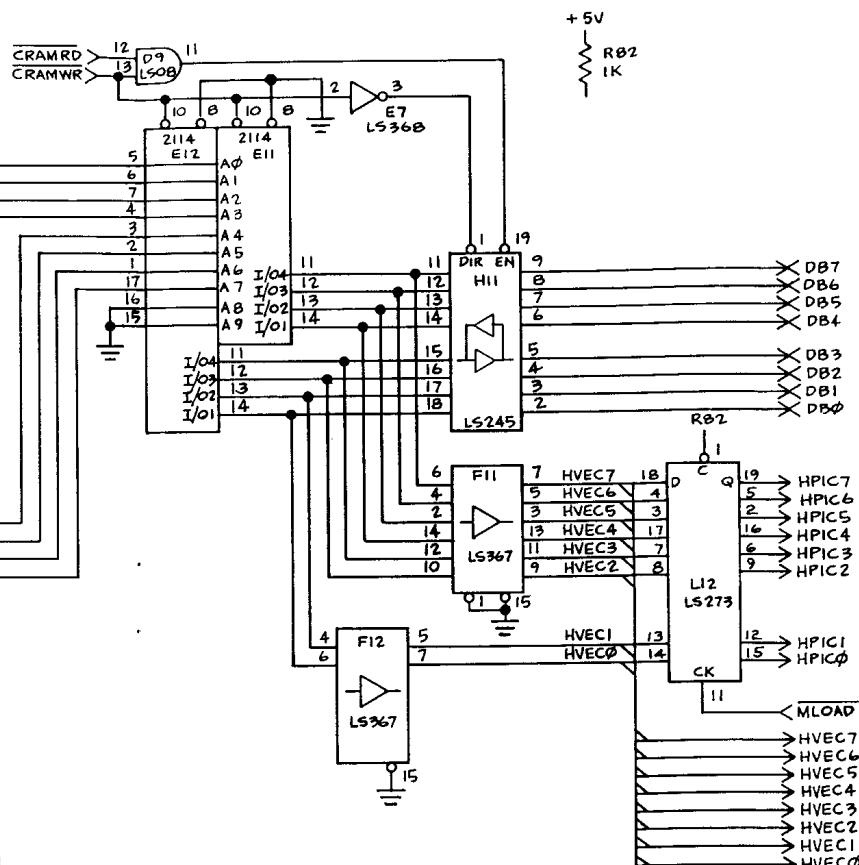
Video Control RAM Address Multiplexers

Video Control RAM

Control Signals

Motion Object Vertical-Position Adders

Video RAM Address Multiplexers

Video RAM

Graphics ROM Address Multiplexers

Graphics ROM

Fast Freddie Graphic Memory

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SP-208 Sheet 8B
1st printing

Video Summation Logic
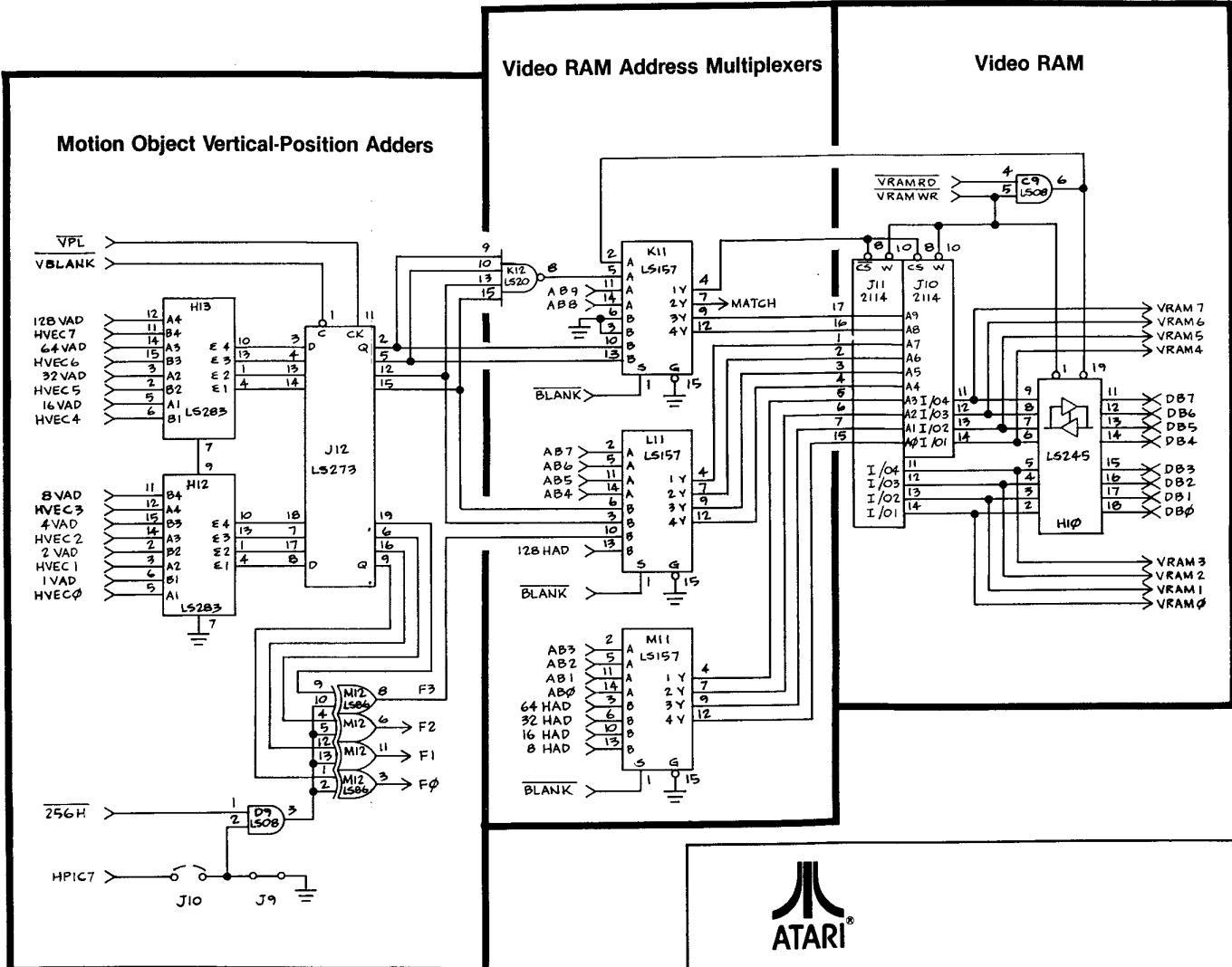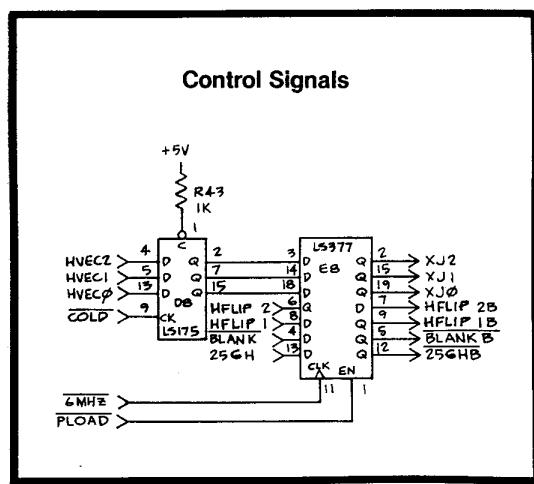
Motion Object RAM
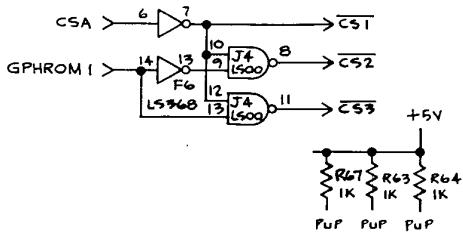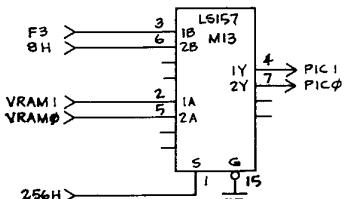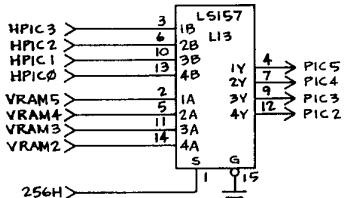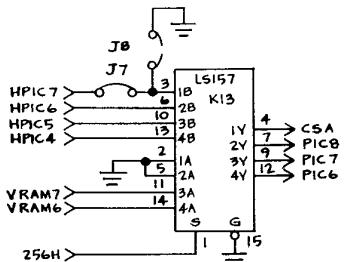
ATARI®

Fast Freddie Motion Object Memory
and Video Summation Logic

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SP-206   Sheet 9A
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Color ROM Address Latches

Color ROM Address Multiplexers

Color ROM

PCB Output Signals

Descriptions of Signal Names for Fast Freddie PCB Schematic Diagrams

A12-A15

Game Microprocessor Address Lines 12-15 are generated by the Game Microprocessor (A & B 11/12). These signals are the select input signals for Game Microprocessor Address Decoders C11, C12, D11, D13, and for ROM Decoder A13.

AB0-AB11

Game Microprocessor Buffered Address Bus is generated by the Game Microprocessor (A & B 11/12), buffered by B13 and C13, and applied to the Program Memory, Video Control RAM Address Multiplexers, and Video RAM Address Multiplexers. AB0-AB2 are applied to D10. AB11 is applied to Game Microprocessor Address Decoders C11, C12, and D11.

BG0-BG7

Background Color Signals 0-7 are generated by Color ROM Address Latch J9. These signals are multiplexed with the CR0-CR5, COLOROM1, and COLOROM2 signals by Color ROM Address Multiplexers J7 and J8.

$\overline{BGSEL}$

Background Color Select is generated by Game Microprocessor Address Decoder D11 and applied as the clock input signal to Color ROM Address Latch J9.

$\overline{BLANK}$

Composite Blanking Signal is generated by logic gate J6 of the Horizontal Timing Chain and applied as the select input for Video RAM Address Multiplexers K11, L11, M11. $\overline{BLANK}$ is also applied to E8 to produce $\overline{BLANKB}$.

BLUE

Blue Video Output Signal is generated by Color ROM H7, buffered by Q3, and applied to the video display circuitry for further amplification and processing.

CBIT0-CBIT5

Color Bits 0-5 are generated by logic gates within K6 and M7 of the Video Summation Logic. They are then applied to the D input pins of Color ROM Address Latch K8 to produce CR0-CR5.

CLK

6-MHz Clock Signal is generated at pin 3 of J-K flip-flop L2 of the Crystal Clock circuit. CLK is used to clock the D-type flip-flops within L4 of the Video Summation Logic.

CLK1

Clock 1 is generated by driver C5 of the Sound Input circuit. This signal is derived from Horizontal Timing Signal 1H and is used to clock Programmable Sound Generators B1 and B3.

CLK2

Clock 2 is generated by driver C5 of the Sound Input circuit. This signal is derived from Horizontal Timing Signal 2H and is the phase 2 clock signal for Sound Microprocessor D4-D7.

$\overline{COLD}$

Color Load is generated by J2 and applied as the clock input signal for D8.

COLOROM1-COLOROM2

Color ROM Enables 1 and 2 are generated by Control Signal Latch D10 and applied to Color ROM Address Multiplexer J7.

COLSEL

Color Select is taken from logic gate J6 of the Video Summation Logic and applied through Color ROM Address Latch K8 to the select input pins of Color ROM Address Multiplexers J7 and J8.

$\overline{COMPSYNC}$

Composite Synchronization Signal is taken from logic gate M8 in the Vertical Timing Chain and applied to the video display circuitry for further processing.

CR0-CR5

Color Signals 0-5 are generated by Color ROM Address Latch K8 from signals CBIT0-CBIT5. CR0-CR5 are applied to Color ROM Address Multiplexers J7 and J8.

$\overline{CRAM}$

Control RAM Enable is generated by Game Microprocessor Address Decoder C12 and applied as the select input to Video Control RAM Address Multiplexers E13 and E14.

$\overline{CRAMRD}$

Control RAM Read is generated by Game Microprocessor Address Decoder C11 and applied through logic gate D9 as the read enable for the Video Control RAM.

$\overline{CRAMWR}$

Control RAM Write is generated by Game Microprocessor Address Decoder D11 and applied as the write enable for the Video Control RAM.

$\overline{CS1}$-$\overline{CS3}$

Graphics ROM Chip-Select Enables 1-3 are generated from the CSA and GPHROM1 signals by logic gates E7, F6, and J4 of the Graphics ROM circuit.

CSA

Graphics ROM Chip-Select Address is generated by Graphics ROM Address Multiplexer K13 and applied to logic gate E7 to develop $\overline{CS1}$-$\overline{CS3}$.

$\overline{CSTMRD}$

Custom RAM Read is generated by Game Microprocessor Address Decoder C11 and applied as the read enable for Custom RAM D16 and D17.

$\overline{CSTMWR}$

Custom RAM Write is generated by Game Microprocessor Address Decoder D11 and applied as the write enable for the Custom RAM D15 and D17.

D0-D7

Game Microprocessor Data Bus is a bi-directional data bus between the Game Microprocessor and the Program Memory.

DB0-DB7

Game Microprocessor Buffered Data Bus is a buffered bi-directional data bus between Game Microprocessor Data-Bus Buffer B10 and C7 of the Sound Input circuit, Input Signal Buffers B6-B9, buffer H11 of the Video Control RAM, buffer H10 of the Video RAM, and Color ROM Address Latch J9. DB0 is also applied to Control Signal Latch D10.

DIPSW

Dip-Switch Read Enable is generated by Game Microprocessor Address Decoder C11 and applied as the read enable for Input Buffers B6 and B7.

GPHROM1-GPHROM2

Graphics ROM Enables 1 and 2 are generated by Control Signal Latch D10. GPHROM1 is used to develop $\overline{CS1}$-$\overline{CS3}$. GPHROM2 enables Graphics ROM J14, J17, L14, L17, M14, and M17.

GREEN

Green Video Output Signal is generated by Color ROM H8, buffered by Q2, and applied to the video display circuitry for further amplification and processing.

HFLIP

Horizontal Flip is generated by Control Signal Latch D10 and applied to logic gate A9 of the Horizontal Timing Chain to produce HFLIP1. HFLIP is also applied to Video Control RAM Address Multiplexer F10.

HFLIP1-HFLIP2

Horizontal Change Signals 1 and 2. HFLIP1 is generated by logic gate A9 of the Horizontal Timing Chain and buffered by E8 to produce HFLIP1B. HFLIP2 is generated by Video Control RAM Address Multiplexer F10 and buffered by E8 to produce HFLIP2B.

HFLIP1B-HFLIP2B

Buffered Horizontal Change Signals 1 and 2 are generated by E8 from HFLIP1 and HFLIP2. HFLIP1B is applied to logic gates K9 and M9 in the Motion Object RAM circuit to develop the input signals for Motion Object RAM L5-L10. HFLIP2B is applied to logic gate F14 of the Graphics ROM circuit to develop the S1 input signal for shift registers F15-F17 and H15-H17.

HPIC0-HPIC7

Horizontal Pictures 0-7 are generated by Video Control RAM L12 from the HVEC0-HVEC7 signals. The HPIC0-HPIC7 signals are applied to Graphic ROM Address Multiplexers K13 and L13. HPIC7 is applied through jumper J10 to logic gate D9 of the Motion Object Vertical Position Adders circuit.

HVEC0-HVEC7

Horizontal Vectors 0-7 are generated by F11 and F12 of the Video Control RAM and used by L12 to produce HPIC0-HPIC7. HVEC0-HVEC7 are also applied to H12 and H13 of the Motion Object Vertical Position Adders, and to K10 and M10 of the Motion Object RAM. HVEC0-HVEC2 are applied to D8.

IN0-IN1

Input Buffer Enables 0 and 1 are generated by Game Microprocessor Address Decoder C11 and applied to Input Buffers B7-B9.

I/O LATCH

Input/Output Latch is generated by Game Microprocessor Address Decoder D11 and applied as the enable input signal for Control Signal Latch D10.

LOAD0-LOAD1

Horizontal Load Signals 0 and 1 are generated by J2 from the Horizontal Timing Signals. $\overline{LOAD0}$ is the load input signal for K10 and M10 of the Motion Object RAM. $\overline{LOAD1}$ is gated with Horizontal Timing Signal $\overline{256HB}$ by H6 to develop the clear input signal for K10 and M10 of the Motion Object RAM.

MATCH

Match is generated by Video RAM Address Multiplexer K11. MATCH is applied to the Graphics ROM circuit where it is gated with $\overline{PLOAD}$ by J6 to produce the S0 input signal for shift registers F15-F17 and H15-H17.

MLOAD

Motion Object Load is generated by J1 and applied as the clock input signal to the D-type flip-flops within L12 of the Video Control RAM.

MREQ

Game Microprocessor Memory Request is generated by the Game Microprocessor (A & B 11/12) and applied to Game Microprocessor Address Decoder D13.

NMION

Non-Maskable Interrupt On is generated by Control Signal Latch D10 and applied to F5 to clear the non-maskable interrupt latch for the Game Microprocessor.

PIC0-PIC8

Picture Address Bits 0-8 are generated by Graphic ROM Address Multiplexers K13, L13, and M13. The PIC0-PIC8 signals are applied to Graphics ROM J14, J16, J17, L14, L16, L17, M14, M16, and M17.

PICBIT0-PICBIT2

Picture Bits 0-2 are generated by multiplexer H14 of the Graphics ROM circuit and applied to F14, M5, and M6 of the Video Summation Logic.

PLOAD

Picture Load is generated by logic gate J3 and applied as the enable signal to E8. $\overline{PLOAD}$ is also applied to logic gate J6 of the Graphics ROM circuit.

Descriptions of Signal Names for Fast Freddie PCB Schematic Diagrams
(continued)

$\overline{\text{RAMSEL}}$

RAM Select is generated by Game Microprocessor Address Decoder D13 and applied to Game Microprocessor Address Decoders C11, C12, and D11.

$\overline{\text{RD}}$

Game Microprocessor Read is generated by the Game Microprocessor (A & B 11/12) and applied through driver C10 to Game Microprocessor Address Decoder C11, Game Microprocessor ROM Decoder A13, and to Data-Bus Buffer B10.

$\overline{\text{RDA}}$

Game Microprocessor Read Enable is generated by logic gate D12 of the Game Microprocessor Address Decoder circuit. $\overline{\text{RDA}}$ is applied as the direction input signal for Data-Bus Buffer B10.

RED

Red Video Output Signal is generated by Color ROM H9, buffered by Q4, and applied to the video display circuitry for further amplification and processing.

$\overline{\text{RESET}}$

Game Reset is generated by logic gates C8, E10, and F7 of the Game Microprocessor circuit from the $\overline{\text{WDR}}$ signal and the RESET switch. $\overline{\text{RESET}}$ is applied to the Game Microprocessor (A & B 11/12), Sound Microprocessor D4-D7, Programmable Sound Generators B1 and B3, and Control Signal Latch D10.

$\overline{\text{RFSH}}$

Game Microprocessor Refresh is generated by the Game Microprocessor (A & B 11/12) and applied to Game Microprocessor Address Decoder C12.

$\overline{\text{ROM0-ROM7}}$

Program ROM Chip-Select Enables 0-7 are generated by Game Microprocessor ROM Decoder A13 and applied to the Program ROM.

$\overline{\text{ROMSEL}}$

Program ROM Select is generated by Game Microprocessor Address Decoder D13, gated by C9, and applied to Game Microprocessor ROM Decoder A13.

SA12-SA13

Sound Microprocessor Address Lines 12 and 13 are generated by Sound Microprocessor D4-D7 and applied to Sound Microprocessor Address Decoders C3 and C4.

SAB0-SAB11

Sound Microprocessor Buffered Address Bus is generated by Sound Microprocessor D4-D7, buffered by E4 and E5, and applied to the Sound Microprocessor Address Decoders and the Sound Memory.

$\overline{\text{SCMD}}$

Sound Command is generated by Game Microprocessor Address Decoder D11 and applied as the clock input for the D-type flip-flops within C7 of the Sound Input circuit.

$\overline{\text{SCMDRD}}$

Sound Command Read is generated by Sound Microprocessor Address Decoder C4 to enable drivers C5 and C6 of the Sound Input circuit.

SD0-SD7

Sound Microprocessor Data Bus is a bi-directional data bus between the Sound Microprocessor and Sound Memory D2-D3, E1-E3, F1-F3 and Sound Input buffers C5C6. SD0 is applied to Sound Microprocessor Address Decoder H3 to produce $\overline{\text{SNMI}}$.

SDB0-SDB7

Sound Microprocessor Buffered Data Bus is a buffered bi-directional data bus between Sound Microprocessor Data-Bus Buffer C2 and Programmable Sound Generators B1 and B3.

SGA1-SGA4

Programmable Sound Generator Control Lines 1-4 are generated by the logic gates within A4 of the Sound Microprocessor Address Decoder circuit and applied to Programmable Sound Generators B1 and B3.

$\overline{\text{SGON}}$

Programmable Sound Generator Write Enable is generated by logic gate B4 of the Sound Microprocessor Address Decoder circuit and applied to Sound Microprocessor Data-Bus Buffer C2.

$\overline{\text{SGW1}}$-$\overline{\text{SGW3}}$

Sound Generator Control Lines 1-3 are generated by Sound Microprocessor Address Decoder C3 and applied to logic gate B4 to produce $\overline{\text{SGON}}$. $\overline{\text{SGW2}}$ and $\overline{\text{SGW3}}$ are also applied to logic gate A4 to produce SGA1-SGA4.

SHF0-SHF5

Pixel Bits 0-5 are generated by shift registers F15-F17 and H15-H17 of the Graphics ROM circuit and applied to multiplexer H14 to produce PICBIT0-PICBIT2.

$\overline{\text{SMREQ}}$

Sound Microprocessor Memory Request is generated by Sound Microprocessor D4-D7 and applied to Sound Microprocessor Address Decoders C3 and C4.

$\overline{\text{SNMI}}$

Sound Microprocessor Non-Maskable Interrupt is generated by H3 of the Sound Microprocessor Address Decoder circuit and applied to F4 to clear the nonmaskable interrupt latch for the Sound Microprocessor.

$\overline{\text{SRAMCS}}$

Sound RAM Chip Select is generated by logic gate B4 of the Sound Microprocessor Address Decoder circuit and applied to Sound Memory D2 and D3.

$\overline{\text{SRD}}$

Sound Microprocessor Read is generated by Sound Microprocessor D4-D7 and applied to Sound Microprocessor Address Decoder C4.

SROM0-SROM1

Sound ROM Chip-Select Enables 0-1 are generated by Sound Microprocessor Address Decoder C4 and applied as the select input signals to Sound Memory E1-E3 and F1-F3.

SWR

Sound Microprocessor Write is generated by Sound Microprocessor D4-D7 and applied to Sound Microprocessor Address Decoder C3 and to Sound Memory D2-D3.

VBLANK

Vertical Blanking (active HIGH) is generated by F5 of the Game Microprocessor circuit and applied to logic gate J6 of the Horizontal Timing Chain to produce BLANK.

VBLANK

Vertical Blanking (active LOW) is generated by F5 of the Game Microprocessor circuit and applied as the clock input signal to counter C8 of the Game Microprocessor circuit. VBLANK is also applied as the clear input signal to C10 and to the D-type flip-flops within J12 of the Motion Object Vertical Position Adders circuit.

VFLIP

Vertical Flip is generated by Control Signal Latch D10 and applied through driver C10 to logic gates H5 and J5 of the Vertical Timing Chain.

VPL

Vertical Position Load is generated by J2 and applied as the clock input signal for the D-type flip-flops of J12 in the Motion Object Vertical Position Adders circuit.

VRAM

Video RAM Enable is generated by Game Microprocessor Address Decoder C12 and applied to logic gate B11.

VRAM0-VRAM7

Video RAM Output Data 0-7 is generated by Video RAM J10 and J11 and applied to Graphics ROM Address Multiplexers K13, L13, M13.

VRAMRD

Video RAM Read is generated by Game Microprocessor Address Decoder C11 and gated with VRAMWR by C9 of the Video RAM circuit to produce the read enable signal for H10 and K11.

VRAMWR

Video RAM Write is generated by Game Microprocessor Address Decoder D11 and gated with VRAMRD by C9 of the Video RAM circuit to produce the write enable signal for H10 and K11. VRAMWR is also the write enable signal for Video RAM J10 and J11.

WAIT

Game Microprocessor Wait is generated by C10 and applied as the wait input signal to the Game Microprocessor (A & B 11/12).

WDR

Watchdog Reset is generated by Game Microprocessor Address Decoder C11 and applied to logic gate F7 of the Game Microprocessor circuit.

WEN

Write Enable is generated by C10 and applied to Game Microprocessor Address Decoder D11.

WR

Game Microprocessor Write is generated by the Game Microprocessor (A & B 11/12), buffered by logic gate C10, and applied to Game Microprocessor Address Decoder D11 and to Custom RAM D15-D17.

WRKRAM

Working RAM Enable is generated by logic gate C9 of the Game Microprocessor Address Decoder circuit and applied to Custom RAM F15-F17.

1H-256H, 1H, 256HB

Horizontal Timing Signals are generated by the Horizontal Timing Chain and used throughout the game circuitry.

8HAD-128HAD

Horizontal Address Signals are generated by the Horizontal Timing Chain and applied to Video Control RAM Address Multiplexers E13, E14, F10, and to Video RAM Address Multiplexers L11 and M11.

6 MHZ, 6 MHZ

6-MHz Timing Signals are generated by the Crystal Clock circuit and used throughout the game circuitry.

16V-128V

Vertical Timing Signals are generated by the Vertical Timing Chain and applied to J3 and F5 of the Game Microprocessor circuit and to J4 and F4 of the Sound Microprocessor circuit.

1VAD-128VAD

Vertical Address Signals are generated by the Vertical Timing Chain and applied to Motion Object Vertical Position Adders H12 and H13.

Electrohome 19-Inch Color Raster-Scan Video Display Schematic Diagram

Schematic Notes

Unless otherwise specified
  Resistance: (Ω) (K→KΩ, M→MΩ), 1/4 (W) carbon resistor
  Capacitance: 1 or higher→ (pF), less than 1→ (μF)
        working voltage→ 50 (V)
        ceramic capacitor
  Inductance: (μH)
Electrolytic Cap: Capacitance Value (μF)/working voltage (V),
        NP → non-polar (or bipolar) electrolytic cap.
Refer to the parts list for additional component information.

⏚ indicates test point connection

⏚ indicates chassis ground unless otherwise specified

Hz indicates cycles per second

For **safety** purposes (and continuing reliability)
⚠ replace all components marked with safety symbol with
   identical type.
    NOTE: FR → fusible resistor
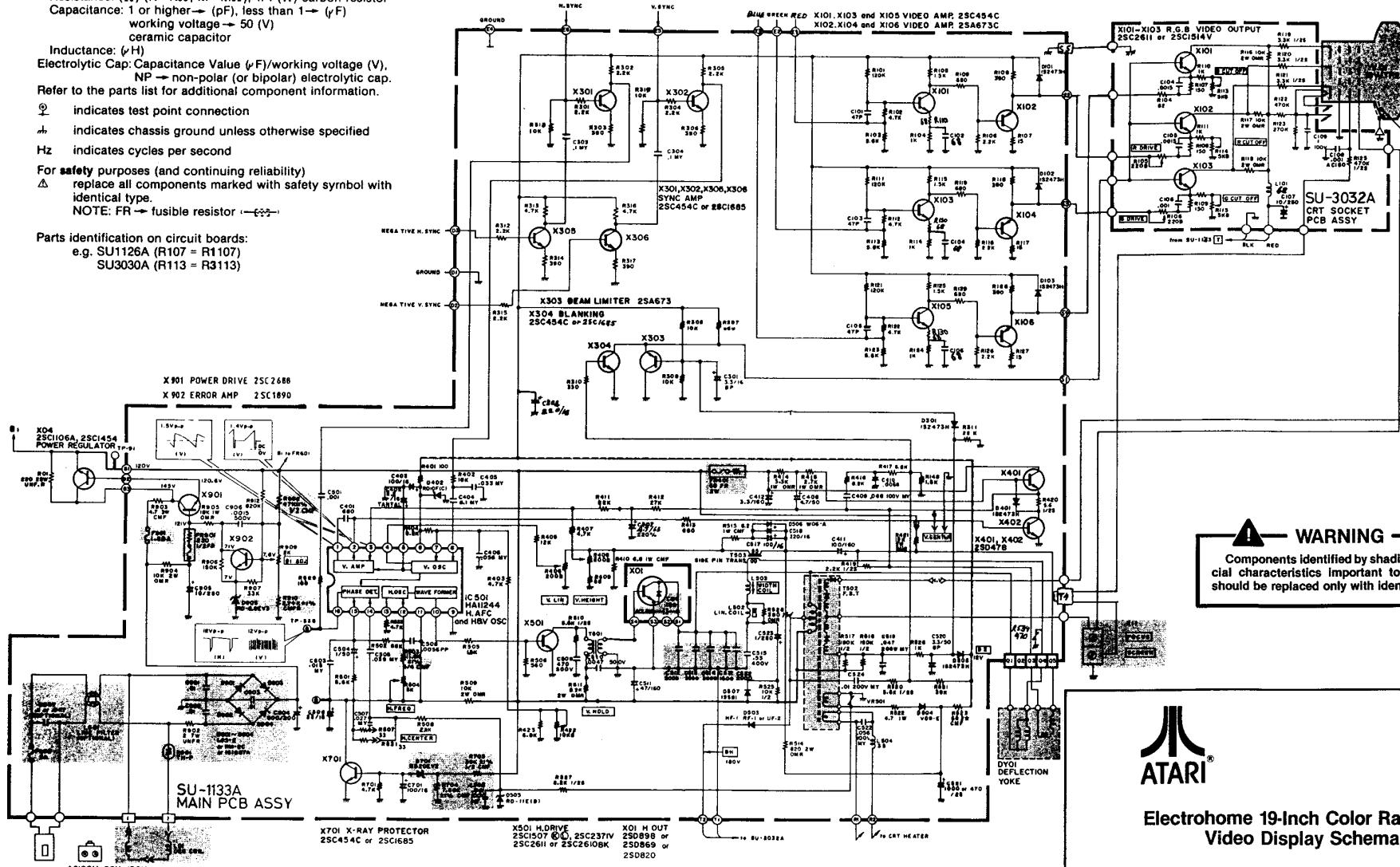
Parts identification on circuit boards:
    e.g. SU1126A (R107 = R1107)
        SU3030A (R113 = R3113)

X901 POWER DRIVE 2SC2688
X902 ERROR AMP 2SC1890

X04
2SC1106A, 2SC1454
POWER REGULATOR

SU-1133A
MAIN PCB ASSY

AC120V 60Hz/50Hz
±10%

X701 X-RAY PROTECTOR
2SC454C or 2SC1685

X501 H.DRIVE
2SC1507 (G.L), 2SC237IV
2SC2611 or 2SC2610BK

X01 H OUT
2SD898 or
2SD869 or
2SD820

X101.X103 and X105 VIDEO AMP. 2SC454C
X102.X104 and X106 VIDEO AMP. 2SA673C

X301,X302,X305,X306
SYNC AMP
2SC454C or 2SC1685

X303 BEAM LIMITER 2SA673
X304 BLANKING
2SC454C or 2SC1685

X101-X103 R,G,B VIDEO OUTPUT
2SC2611 or 2SC1514V

SU-3032A
CRT SOCKET
PCB ASSY

IC501
HA11244
H. AFC
and H&V OSC

DY01
DEFLECTION
YOKE

⚠ — **WARNING** — ⚠
Components identified by shading have spe-
cial characteristics important to safety and
should be replaced only with identical types.
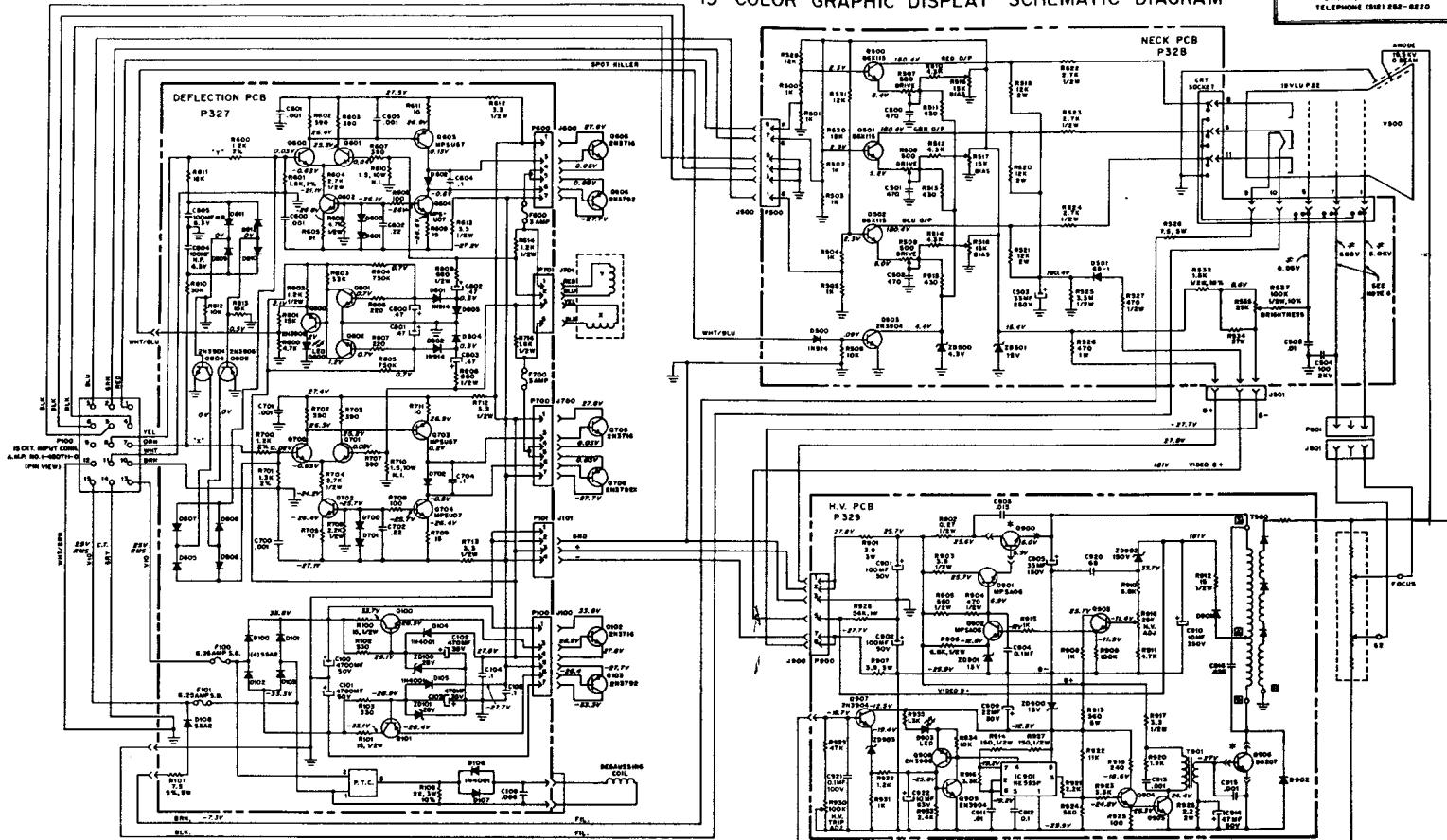
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**Electrohome 19-Inch Color Raster-Scan
Video Display Schematic**

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19" COLOR GRAPHIC DISPLAY SCHEMATIC DIAGRAM

WELLS-GARDNER ELECTRONICS CORP.
CHICAGO, ILLINOIS 60639
TELEPHONE (312) 252-8520

GENERAL NOTES:

1. RESISTANCE VALUES IN OHMS 1/4 WATT, 5% UNLESS OTHERWISE NOTED. K=1,000, M=1,000,000

2. CAPACITANCE VALUE OF 1 OR LESS IN MICROFARADS, ABOVE 1 IN PICOFARADS UNLESS OTHERWISE NOTED.

3. Q500 AND Q900 ARE NOT ON H.V.P.C.B.
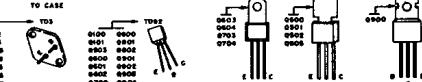
4. ALL D.C. VOLTAGES 10% MEASURED FROM POINT INDICATED TO GROUND USING A HIGH IMPEDANCE METER. VOLTAGES ARE MEASURED WITH NO SIGNAL INPUT AND CONTROLS ARE IN A NORMAL OPERATING POSITION

5. CIRCLED NUMBERS INDICATE LOCATION OF WAVE-FORM READING.

6. USE A 1,000:1 PROBE WHEN MEASURING SCREEN OR FOCUS VOLTAGE.

7. ✳ VOLTAGES VARY WITH CONTROL SETTINGS.

19K6102-5635

Wells-Gardner 19-Inch Color Raster-Scan Video Display Schematic

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1st printing