ORBIT™

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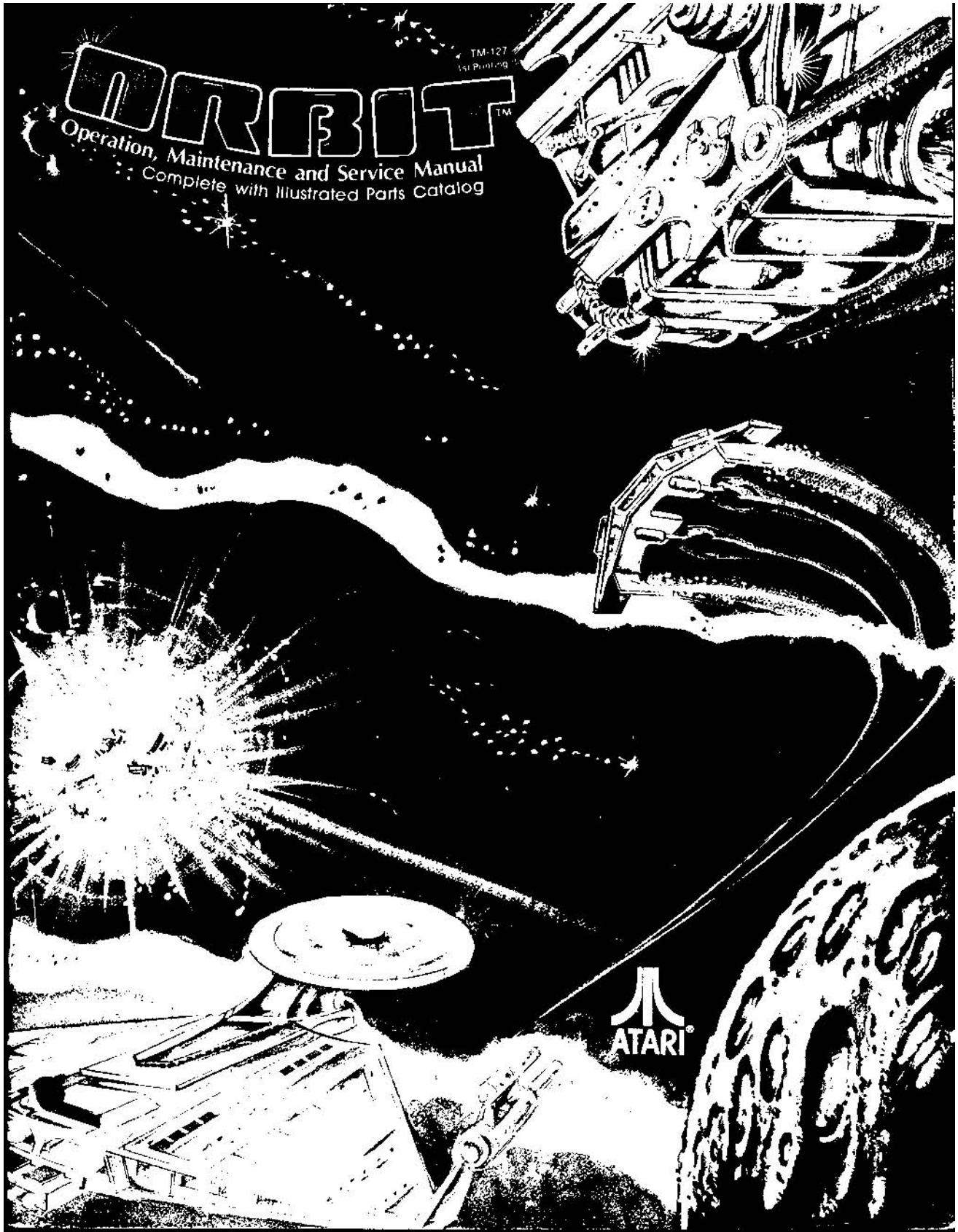1st Printing

Operation, Maintenance and Service Manual
Complete with Illustrated Parts Catalog

ATARI®

ORBIT™

Operation, Maintenance and Service Manual

Complete with Illustrated Parts Catalog

ATARI

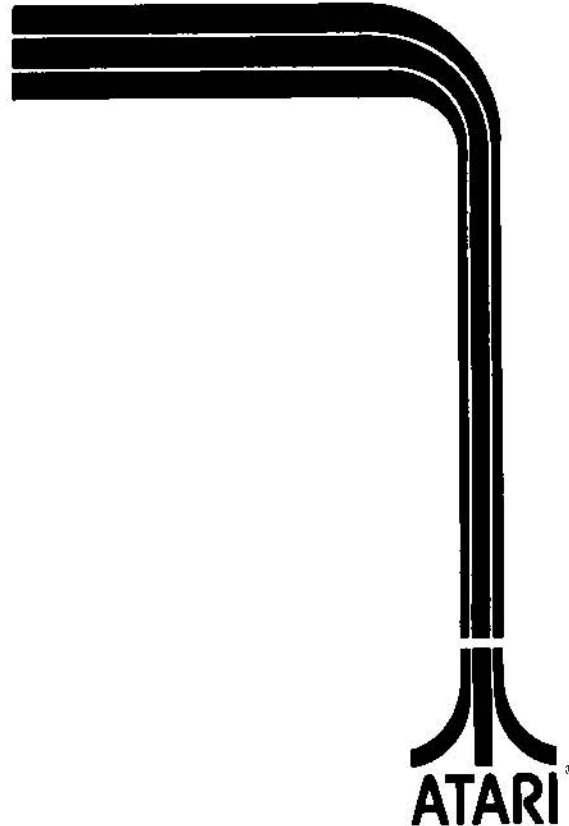A Warner Communications Company

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A. INTRODUCTION

Orbit is a two-player game developed by Atari, Inc. The game is packaged in an upright, floor-resting cabinet illustrated by brightly colored orange, red and blue graphics to further enhance potential play. A 23-inch TV monitor is mounted in the top front of the cabinet with the monitor screen tilted back from the vertical. The TV monitor viewing screen is shielded by a Plexiglas® panel that also displays colorful graphics.

Player-operated controls are mounted on a control panel directly below the TV monitor viewing screen on the front of the game cabinet as illustrated in Figure 1-1. The controls consist of a Game Select, Game Option, and Starship Control pushbutton switches.

ORBIT

GAME SELECTION

LEFT-PLAYER STARSHIP CONTROLS

RIGHT-PLAYER STARSHIP CONTROL

HYPERSPACE   HEAT RESET   GAME RESET   HYPERSPACE
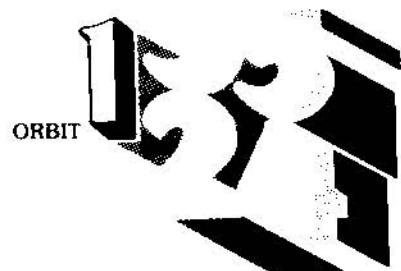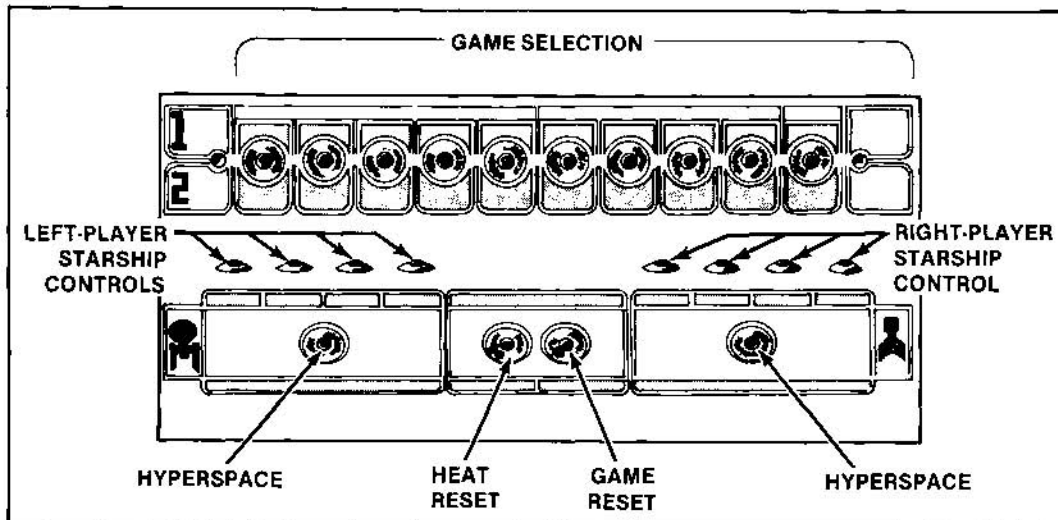
Figure 1-1   Orbit Control Panel

The coin mechanism on the front mid-portion of the game cabinet, below the control panel, initiates the play. The cash box is located behind a locked access door.

B. GAME INSPECTION

Your new Orbit game is manufactured ready to play immediately after removal from the shipping carton. Your cooperation is desired in order to supply the final touch of quality control to your game. Therefore, please follow the procedures below to ensure that your game is in perfect condition:

1. Examine all external parts of the game cabinet for dents, chips, or broken parts.

2. After determining that the game has been received in good condition, unlock and open the access door located to the right of the cabinet while facing the coin door, just under the table top. Carefully inspect the interior and verify the following:

   a. All plug-in connectors are firmly seated.

   b. Remove game PCB as instructed in steps 1-4 of Section E.

   c. All integrated circuit packages (chips, ICs) in sockets on the game printed circuit board are firmly seated.

   d. Replace game PCB as instructed in step 6 of Section E.

   e. The fuses are all seated snugly in their holders.

   f. No harness wires are disconnected.

   g. No loose foreign objects should be present, especially metal objects that could cause electrical problems.

Be sure all the major assemblies are checked. Check the game printed circuit board (PCB), the transformer (located on the power supply chassis inside the game cabinet), the speaker, and player controls. Also, be certain that the TV monitor is securely mounted.

Check the serial number located on the metallic label in the upper left-hand corner on the back of the game cabinet or the opposite side of the coin door side. The serial number also appears in the corner (common to both edge connectors) on the back of the PCB, inside the game cabinet. See the illustration on the inside front cover of this manual.

C. INSTALLATION REQUIREMENTS

Voltage Selection

Your Orbit game is shipped for operation at 110 VAC, 60 Hz.

IF YOUR LOCAL LINE VOLTAGE IS 110 VAC, perform the following steps:

1. Measure AC line voltage with an AC voltmeter as in Figure 1-3.

LINE VOLTAGE	VOLTAGE-CHANGING PLUG WIRE COLOR
95 VAC	BLACK
110 VAC	ORANGE (installed at factory)
210 VAC	GREEN
220 VAC	RED

ORANGE CONNECTOR (FACTORY-INSTALLED)

VOLTAGE SELECTION CONNECTOR

8 Amp. 125V. Fast - Blow

115 VAC out

F3 F4 F5

PCB Power

2.5 Amp. 125 V. Slow blow

ON/OFF AND INTERLOCK SWITCH

Power In

F1 F2

3 Amp. 250 V. Slow - blow

POWER SUPPLY CHASSIS
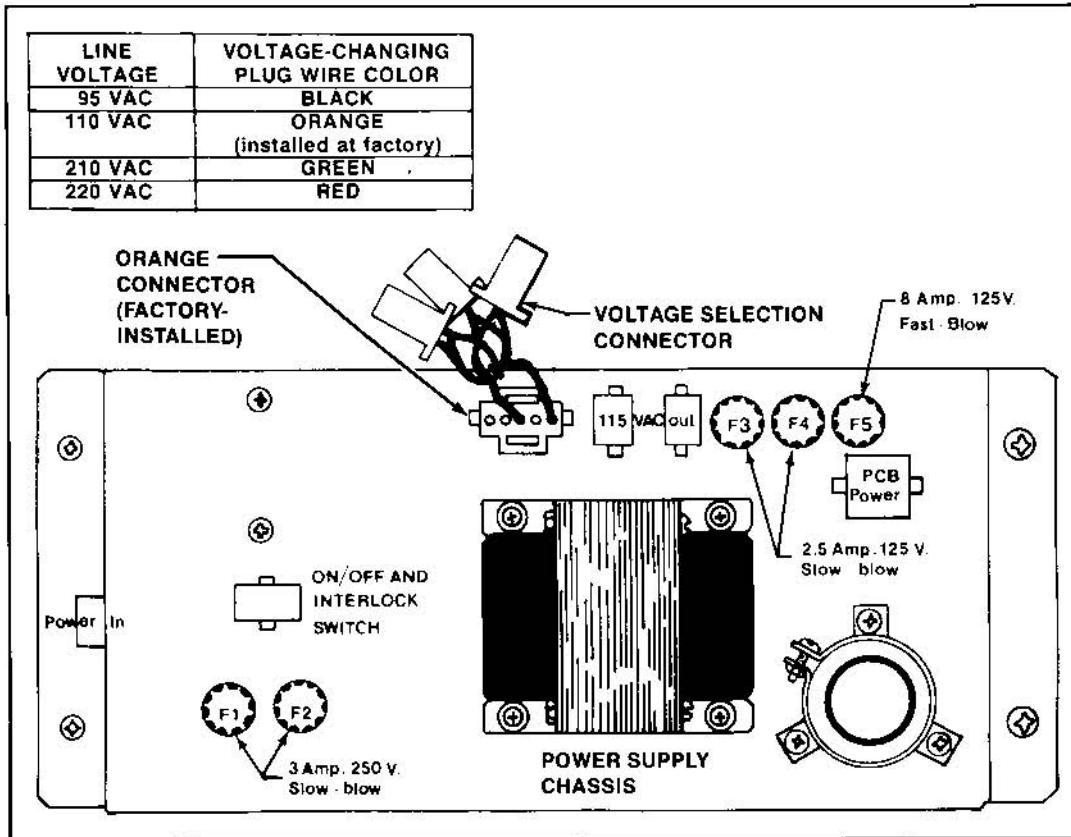
Figure 1-2   Voltage Selection Connectors

2. If AC line voltage is consistently below 100 VAC, plug in the *black* low-voltage connection, on the power supply chassis. See Figure 1-2.

3. If AC line voltage is approximately 110 VAC, plug in the *orange* connection (factory installed).

IF YOUR LOCAL LINE VOLTAGE IS NOT 110 VAC, BUT INSTEAD IS 220 VAC, perform the following steps:

1. Measure AC line voltage with an AC voltmeter as in Figure 1-3.

2. If AC line voltage is consistently below 210 VAC, plug in the *green* low-voltage connection. See Figure 1-2.

3. If AC line voltage is approximately 220 VAC, plug in the *red* connection.

Type of Power Cord

Atari has added a strain-relief cord to your Orbit game. The advantage of this type of cord is that if pulled accidentally, the strain-relief will hold the cord in place at the cabinet wall. The plastic strain relief "cushions" the impact of the shock and prevents the cord from pulling the wires out of the harness connector.

D. INTERLOCK, POWER ON/OFF SWITCH AND OTHER OPERATOR CONTROLS

To minimize the hazard of electrical shock while you are working on the inside of the game cabinet, two interlock switches have been installed. One is located behind
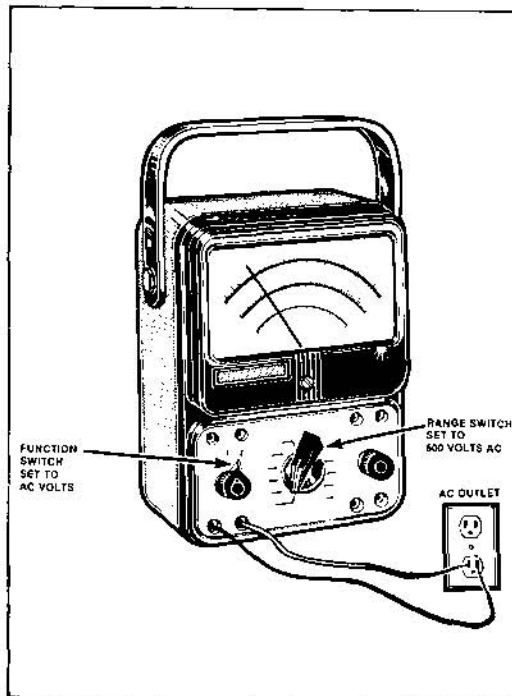
Figure 1-3   AC Line Voltage Check

the rear access door and one behind the coin door. These switches remove all the AC line power from the game circuitry while the doors remain open. To help conserve energy, a power on/off switch has been placed on the game so that it can be turned off during closed periods. This switch is located in the upper rear left-hand corner of the game cabinet, as shown in Figure 1-5.

Table 1-1   Installation Requirements

Power Requirements	
Power Supply:	110 VAC @60 Hz 200 Watts
	220 VAC @50 Hz
Temperature Range	No lower than 0 degrees Celsius
On Location and	(32 degrees Fahrenheit)
In Storage.	No higher than 49 degrees
	Celsius (120 degrees Fahrenheit)
Humidity Range	
Relative	No more than 95%
Humidy:	
Location Space Requirements	
Height:	152 centimeters (60 inches)
Width:	64 centimeters (25¼ inches)
Depth	76 centimeters (30 inches)
TV Monitor	23 inch Black and White
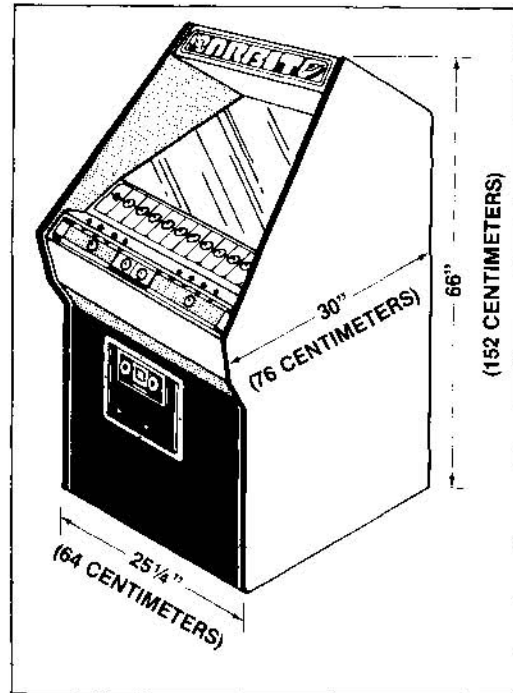
Figure 1-4   Location Set-up Requirements

Interlock Switch Checkout Procedure

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

1. Unlock and open the rear access door and the coin door.

2. Plug the AC line power cord into your local AC outlet (110 VAC or 220 VAC).

3. Set the power On/Off switch to the "On" position.

4. Close the access and coin door. Within approximately 30 seconds after closing the last door to the game cabinet the TV monitor should display a picture.

5. Slowly open either door to the game cabinet, and the TV picture should disappear when either the access door or coin door is opened to approximately one inch.

6. If the results of step 5 are satisfactory, the interlock switches are operating properly. If the picture does not disappear as described, check to see if the corresponding interlock switch is broken from its mounting or stuck in the "On" position.

7. Close and lock both doors.

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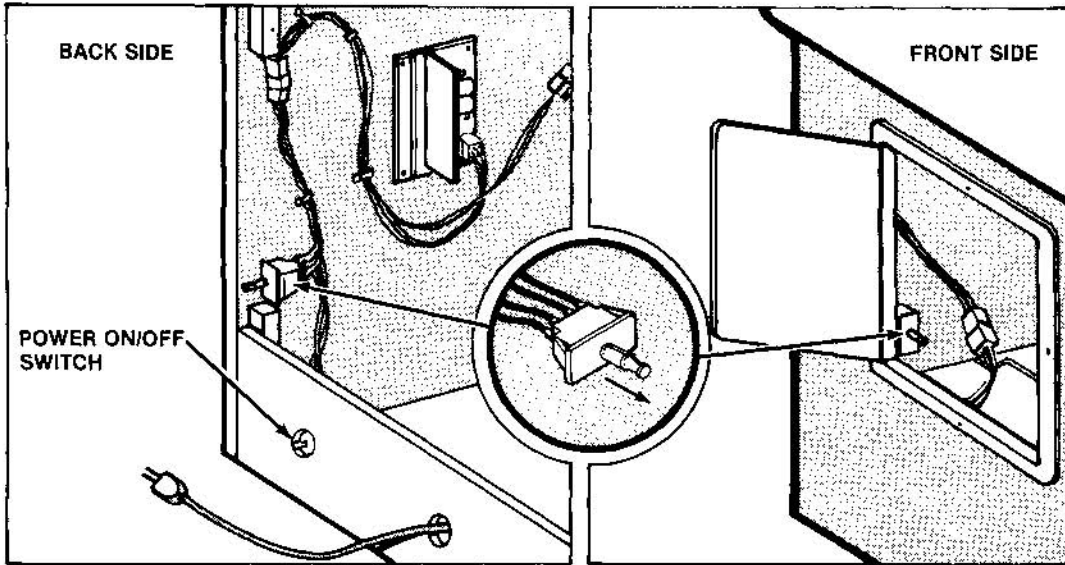
Figure 1-5   Location of Interlock and Power On/Off Switches
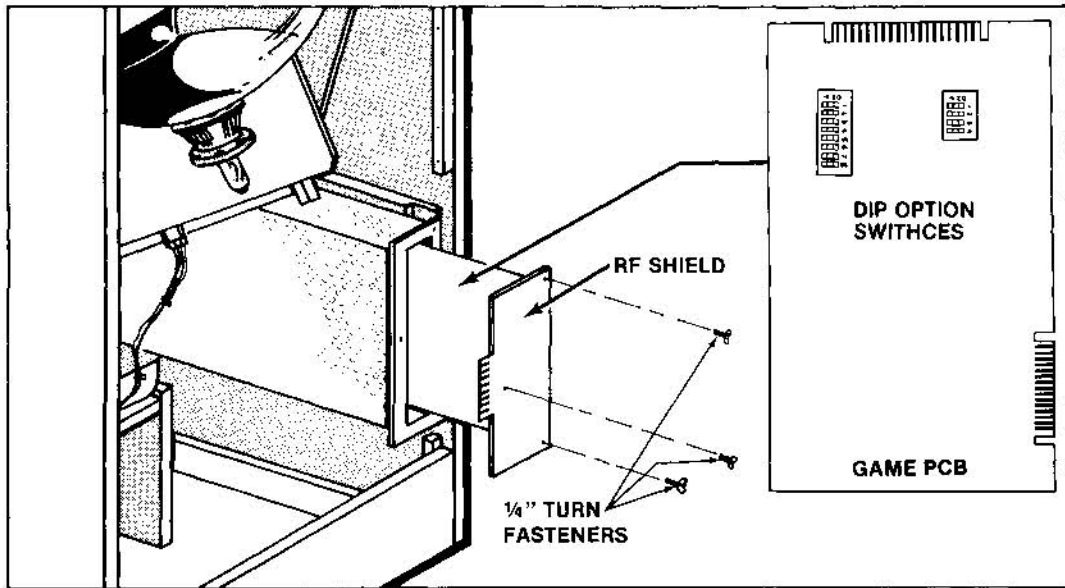
Figure 1-6   Option DIP Switches and Game PCB Location and Removal

E. OPERATOR OPTIONS

The operator options offer maximum player appeal for your game location(s). These options are listed in Table 1-2. They are preset for a certain game set-up during production. To determine how the switches have been set for your game, compare the attract mode (Chapter 2, Section B) with the information in Table 1-2.

To change the toggle positions of the switch assembly and set the desired options, the printed circuit board (PCB) must be removed according to the following procedures:

> **NOTE**
>
> This game includes a new style of easy-access PCB. The radio frequency shield has been redesigned to use only three individual quarter-turn fasteners as a direct result of field input.

1. Switch the game power on/off switch to "off" and open the access door.
2. Locate the radio frequency (RF) shield assembly immediately inside the game cabinet behind the access door (see Figure 1-6). This assembly is an aluminum box with hundreds of holes. On one end of the assembly is a small PCB with an edge connector coming from the edge of the Football game PCB.
3. Turn the three individual quarter-turn fasteners on the RF shield PCB ¼-turn to the left or counter-clockwise.

4. Carefully pull out the Orbit game PCB and the RF shield board together as a unit. These would not normally need to be separated when merely making option switch changes.
5. Set the switches for the desired options as listed in Table 1-2.
6. Replace both PCBs by following steps 1 through 4 in reverse order. Do not force or bend the game PCB. Before replacing, inspect the PCB for damage.
7. Close and lock the access door.
8. Plug in the game and verify that all options function by playing the game.

F. SELF-TEST PROCEDURE

Orbit will test itself and provide data to demonstrate that the game's circuitry and controls are working properly. This procedure uses the TV monitor and the speaker; no additional equipment is required. See Figure 1-7 for location of the Self-Test switch. To start the procedure, slide this switch to "on" as indicated in the figure. See Table 1-3 for further details and instructions on the Self-Test. We suggest that you run the Self-Test each time the coin box is opened.

G. VOLUME CONTROL

If volume is incorrect for your location, open the coin door and adjust the volume control as indicated in Figure 1-7.
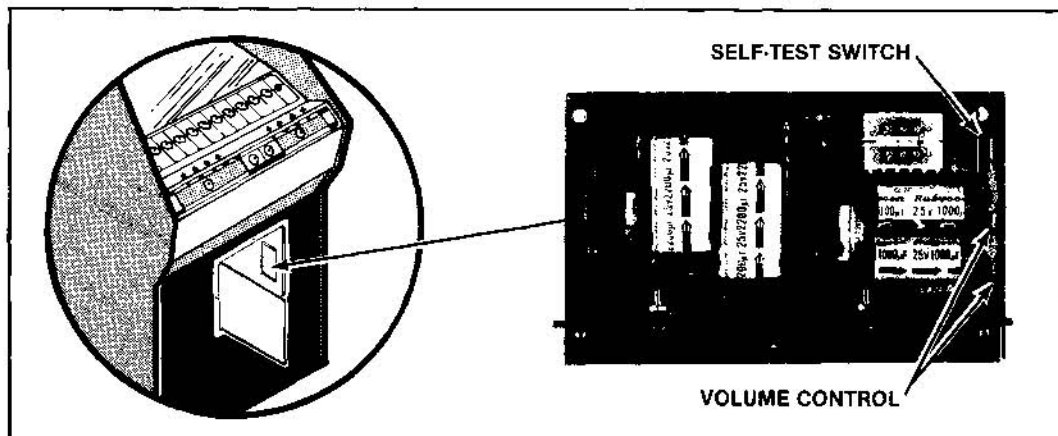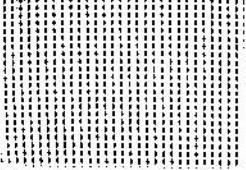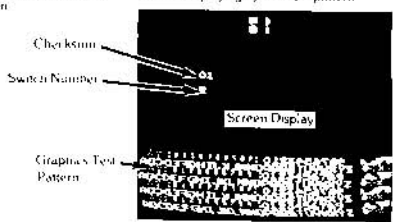
Figure 1-7   Location of Self-Test Switch and Volume Control

Table 1-2   8-Toggle DIP Option Settings

	Switch Settings on 8-Toggle DIP Switch (Located on the Game PCB)								Result
	1	2	3	4	5	6	7	8	
Game Length	ON	ON	ON						0:30 min.
	OFF	ON	ON						1:00 min.
	ON	OFF	ON						1:30 mins.
	OFF	OFF	ON						2:00 mins.
	ON	ON	OFF						2:30 mins.
	OFF	ON	OFF						3:00 mins.
	ON	OFF	OFF						3:30 mins.
	OFF	OFF	OFF						4:00 mins.
Game Instruction Language (as displayed on TV screen)				OFF	OFF				German
				OFF	ON				French
				ON	OFF				Spanish
				ON	ON				English
Free Play						ON			Coins
						OFF			Free Play

Table 1-3 Self-Test Procedure

Be sure *all* toggles on the 4-toggle DIP switch are set at OFF. Otherwise the self-test will not function as described below.

INSTRUCTION	RESULT IF TEST PASSES	RESULT IF TEST FAILS
1. **Preliminary** Remove ORBIT PCB from RF cage as explained in subsection E procedure Steps 1-4 Set volume level potentiometer located on the Dual Audio Amplifier PCB as illustrated in Figure 1-7) to one half volume	Not Applicable	Not Applicable
2. **Zero Page RAM Test** Set self test slide switch (located on the Dual Audio Amplifier PCB as illustrated in Figure 1-7) to the "ON" position	**Audio Indicator:** 2 high tones (high tone good indication) **Video Indicator:** Screen displays all H's 	Audio — Low tone indicates a bad RAM The bad RAM is isolated as follows | Low Note	Lighted LED	RAM Location
1	Heat Reset	D1
2	Hyperspace	C1	
3. **Display RAM Test** Occurs shortly after Test 2 CONDITIONS Test 3 must pass to insure a valid test elsewhere	**Audio Indicator** 8 high tones (high tone good indication) **Video Indicator** Screen flashes once more displays all H's	Audio — Any low tone of the eight tones indicates a bad display RAM device The bad RAM is isolated as follows 	Low Note	Bad RAM Device Location
---	---
1	H5
2	J4
3	H J6
4	H J4
5	K6
6	K4
7	L6
8	L4	
4. **ROM Test** Occurs shortly after Test 3 and all H's disappear from screen	**Video Indicator:** Screen displays graphics test pattern Audio Interleave Test Pattern Checksum good when "OK" is displayed in the checksum screen location	Video A bad checksum is indicated by one or more numbers appearing on the screen at the checksum output location 	Checksum Number	Possible Bad Devices
---	---
1	H3(2K × 8) or H2&L2(1K × 4 each)
2	H3(2K × 8) or H1&L1(1K × 4 each)
3	K L3(2K × 8) or M2&F2(1K × 4 each)
4	K L3(2K × 8) or M1&F1(1K × 4 each)
5	L M3(2K × 8) or N2&E2(1K × 4 each)
6	L M3(2K × 8) or N1&E1(1K&4 each)	
5. **Sound/Switch Test** Holds over from Test 4 Screen remains also as in Test 4	**Audio Indicator:** Pressing any game select or option or game reset produces a tone The number of the game switch will appear on the screen (Exception: Game reset displays an "A") Heat reset turns on the explosion and warning sounds All other switches and option game PCB switches produce a beep on a transition from on to off or vice versa **Video Indicator** Pressing any game select or option switch produces a numerical representation of that switch Pressing Game Reset displays an "A" rather than a number	Audio No beep — indicates possible bad switch No explosion or warning sound Sound generator or dual audio amplifier PCB circuitry possibly bad **Video** Switch pressed does not display corresponding number on screen Switch or logic possibly bad

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GAME PLAY

ORBIT 2

INSERT COINS
04:00 PER COIN

POWER-UP OR FREEZE MODE

Figure 2-1   Attract Mode

SELECT GAME

05:21

AFTER GAME RESET PRESSED

Figure 2-4   Ready-To-Play Mode

INSERT COINS

GAME OVER
10   09
00:00

END OF TIME

Figure 2-2   Freeze Mode

19   05:21   12
10   09

INITIATED IMMEDIATELY
AFTER PRESSING THE
SELECTED GAME (0-9)

Figure 2-5   Play Mode

INSERT COINS
SELECT GAME

04:00

AFTER COINS ACCEPTED
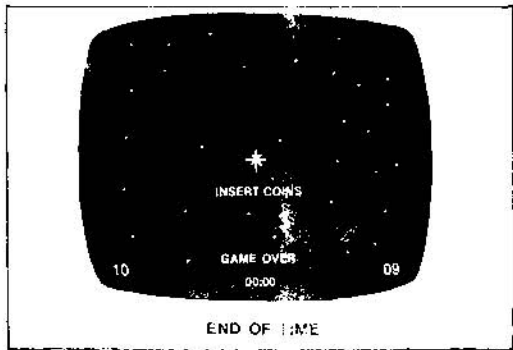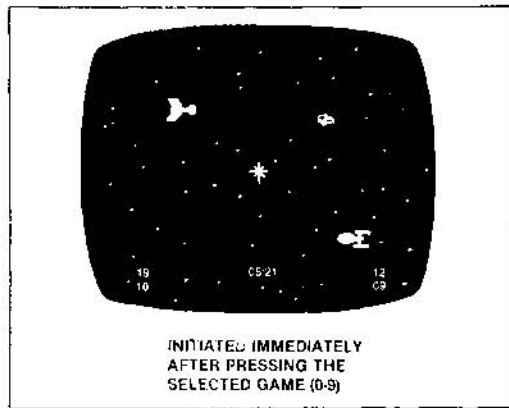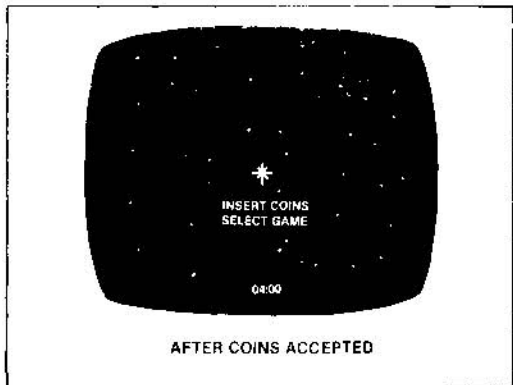
Figure 2-3   Ready-To-Play Mode

2-2   ORBIT
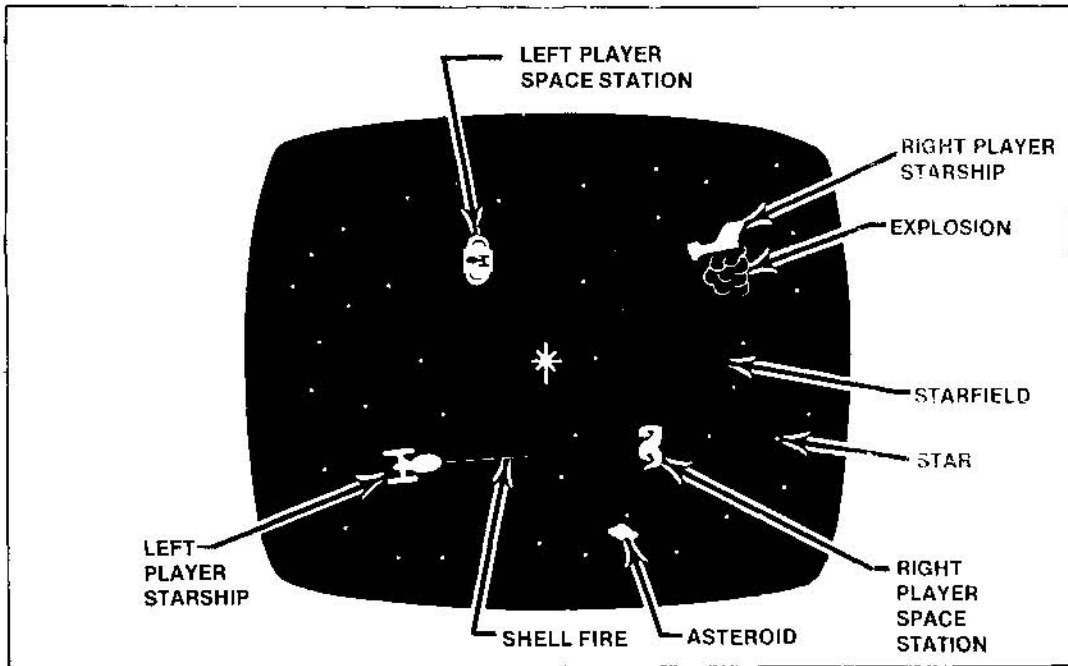
Figure 2-6 Playfield and Motion Object Display

Table 2-1 PLAYER CONTROLS

Figure 2-7 Reference Number	Control Name	Description/Function
1	Left player LEFT control	Rotates left player starship counterclockwise.
2	Left player RIGHT control	Rotates left player starship clockwise.
3	Left player Thrust control	Applies forward thrust
4	Left player FIRE control	Fires one shot each time pushbutton is pressed.
5	Left player HYPERSPACE control	Left player starship disappears and then reappears in another spot on the TV monitor screen when pushbutton is pressed. Starship is capable of firing while in hyperspace (invisible) from the position last visible.
6	Right player LEFT control	Rotates right player starship counterclockwise.
7	Right player RIGHT control	Rotates right player starship clockwise.
8	Right player Thrust control	Applies forward thrust
9	Right player FIRE control	Fires one shot each time pushbutton is pressed.
10	Right player HYPERSPACE control	Right player starship disappears and then reappears in another spot on the TV monitor screen when pushbutton is pressed. Starship is capable of firing while in hyperspace (invisible) from the position last visible.
11	GAME SELECT	Sets game mode to Ready-to-Play mode as illustrated in Figure 2-4 .
12.	HEAT RESET	Resets the game to initial play positions.

All pushbutton switch non-lighted LICON types, press for "on" condition, release for "off".

Table 2-2 GAME LEVELS

Figure 2-7 Reference Letter	Game Level	Level Options
A	**BEGINNER** Instant start/stop when pressing forward	Slow (Starship and Shells) Medium (Starship and Shells) Fast (Starship and Shells)
B	**INTERMEDIATE** Accelerates to full speed when forward push-button pressed. Partial breaking when forward pushbutton released.	Slow (Starship and Shells) Fast (Starship and Shells)
C	**EXPERT** Acceleration to full speed when forward push-button pressed.	Fast shells (Shells only) Slow (Starship and Shells) Medium (Starship and Shells) Fast (Starship and Shells)
D	**SUPER EXPERT** Same as Expert, with a strong gravity option.	
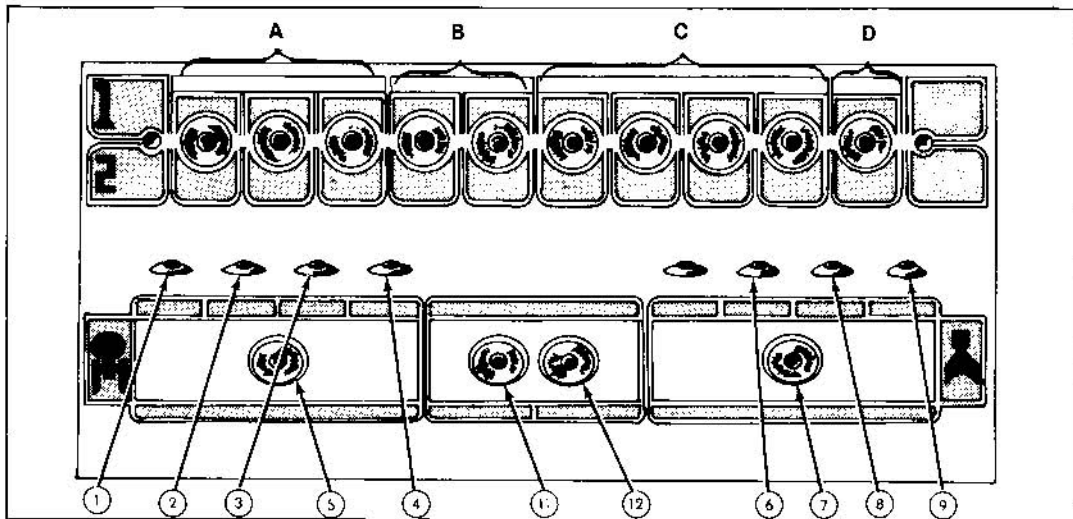
Figure 2-7   Location of Game Levels and Starship Controls

Table 2-3   GAME OPTIONS

Figure 2-8 Reference Number	Game Option	Description/Function
1	Bounce Back (See Figure 2-9)	Sets boundaries around perimeter of the TV monitor screen. Example: Starship immediately reverses direction after reaching boundary. Normally perimeter boundaries do not exist.
2	Negative Gravity (See Figure 2-9)	Sun radiates gravity outward to perimeter boundaries of the TV monitor screen. Normal sun state radiates positive gravity (positive gravity is inward toward the sun).
3	Zero Gravity	Sun does not radiate gravity.
4	Black Hole (See Figure 2-9)	Invisible sun with any selected gravity.
5	Space Stations (See Figure 2-7)	Two space stations orbit around sun. Each player is designated a specific space station on which he may land for repairs, fuel and shells. When player starship touches opponent's station it is immediate annihilation.
6	Unlimited Supplies	Unlimited fuel and ordnance (fire power).
7	Stars (See Figure 2-7)	Remove stars from playfield.
8	Strong Gravity	Unusually strong positive gravity.
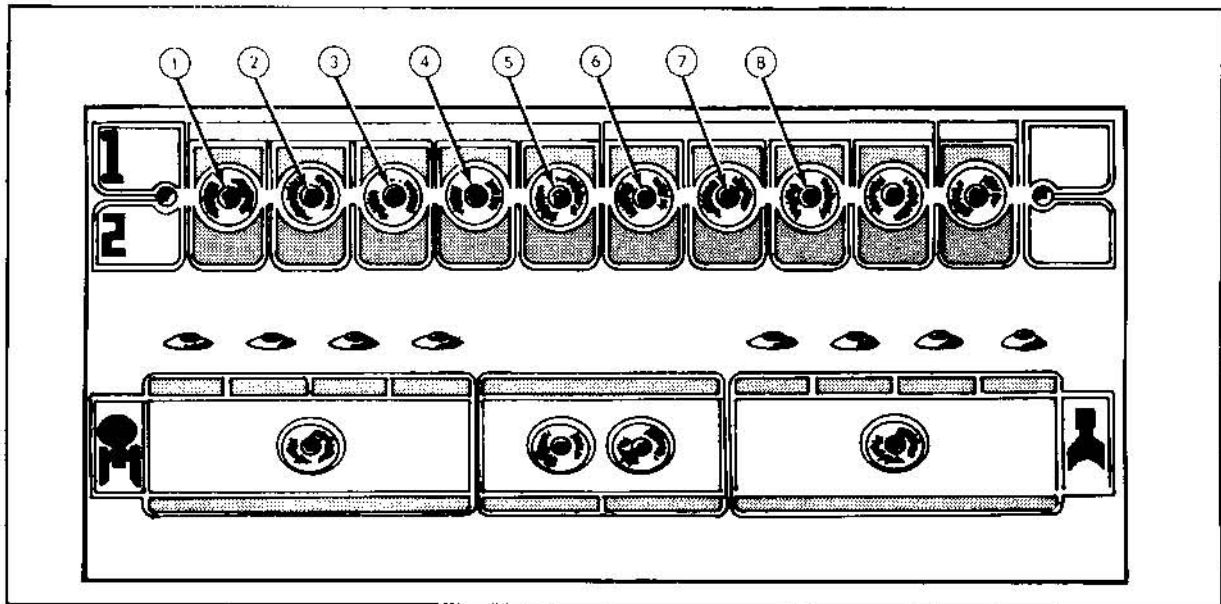
Figure 2-8   Location of Game Option Pushbuttons
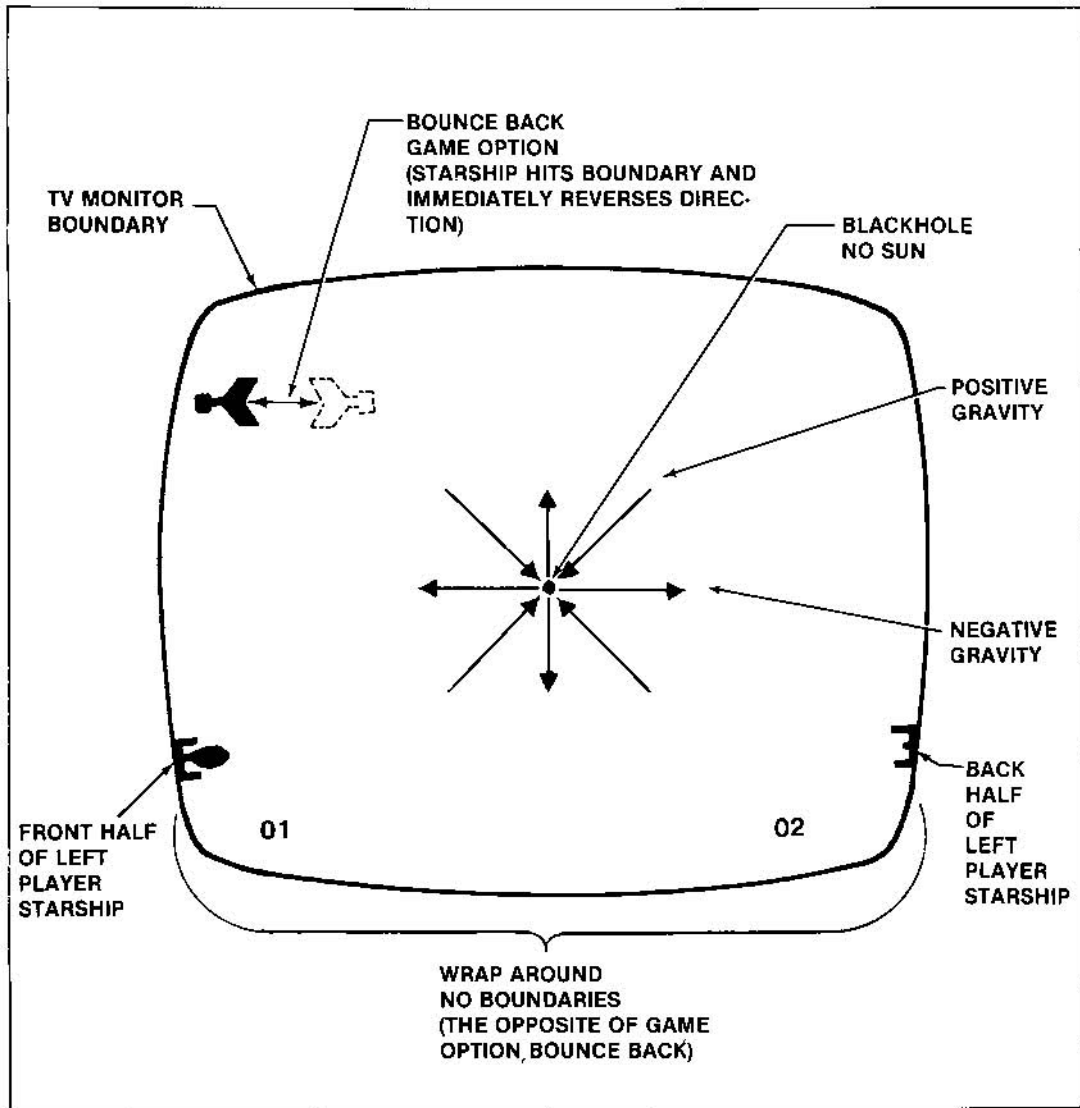
Figure 2-9   Selected Game Options
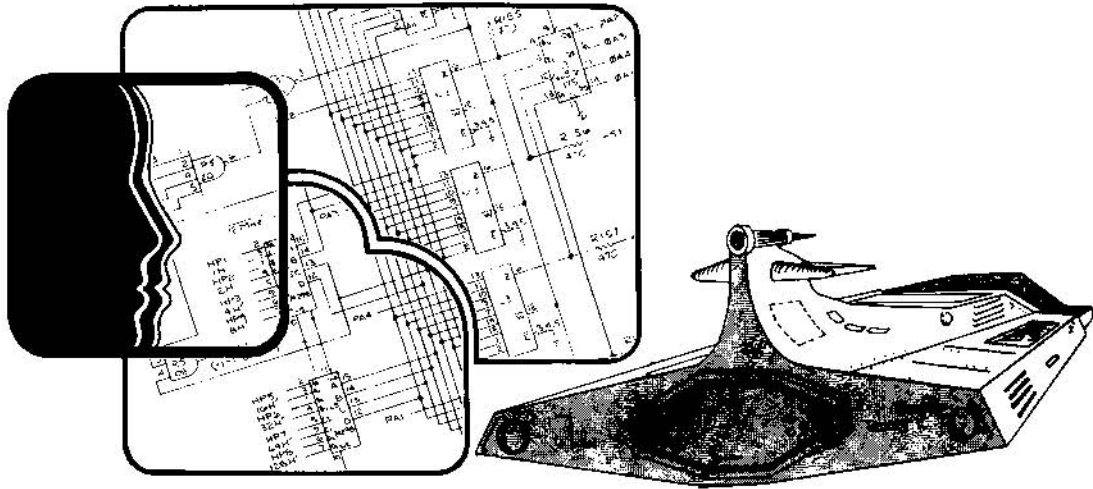
THEORY OF OPERATION

A. GENERAL INFORMATION

This chapter provides a general overview of the theory of operation of the Orbit electronics contained on the game printed circuit board (PCB). It also goes into specific detail of the various circuits to explain to an individual of moderate technical background how these circuits should perform. This detailed information has been organized with emphasis placed on troubleshooting the game PCB, circuit by circuit.

The Orbit game block diagram of Figure 3-1 illustrates the major components, including all controls remote to the game PCB. The function and direction of the information to and from these various controls is also shown.

ORBIT
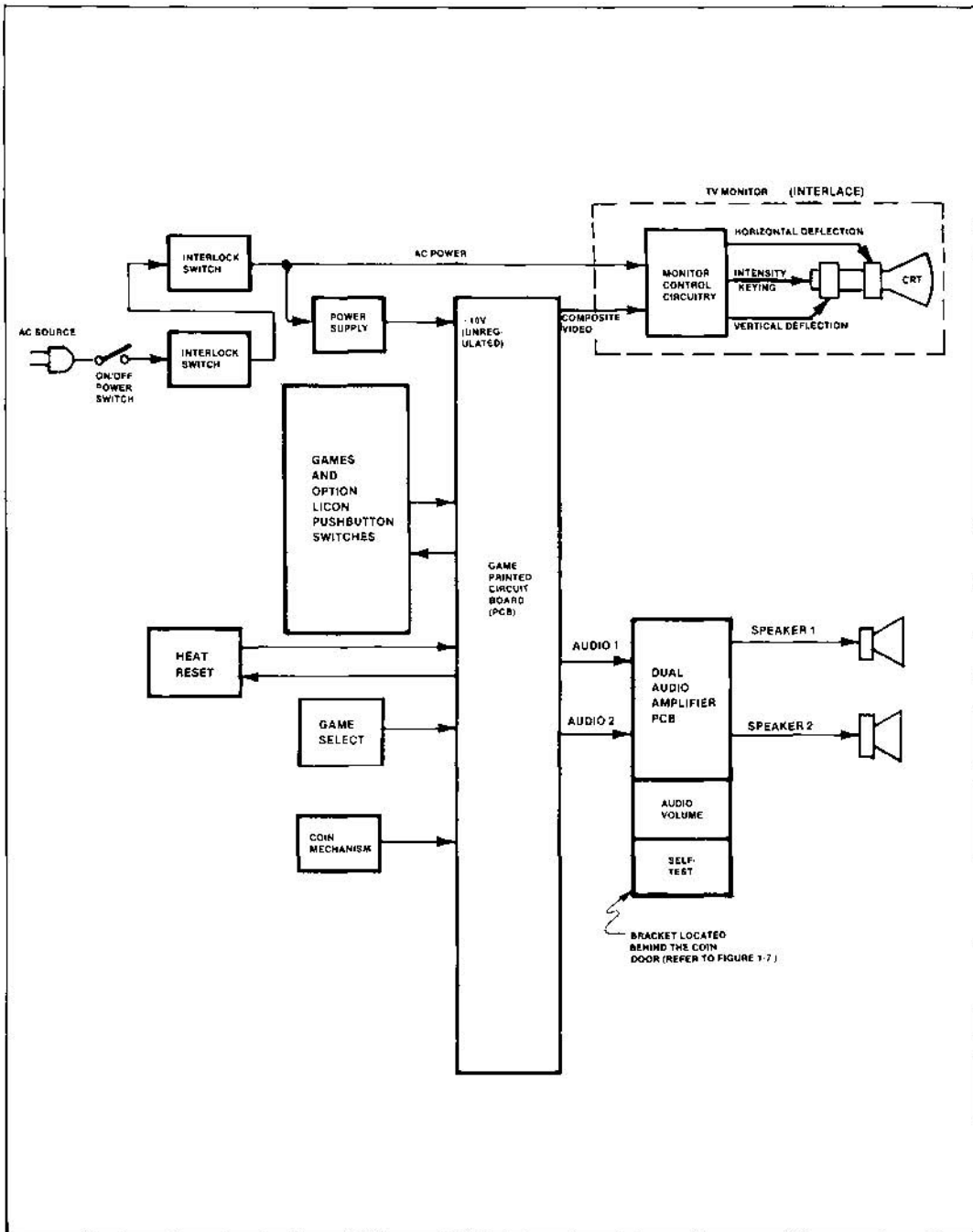
Figure 3-1   Orbit Game Block Diagram
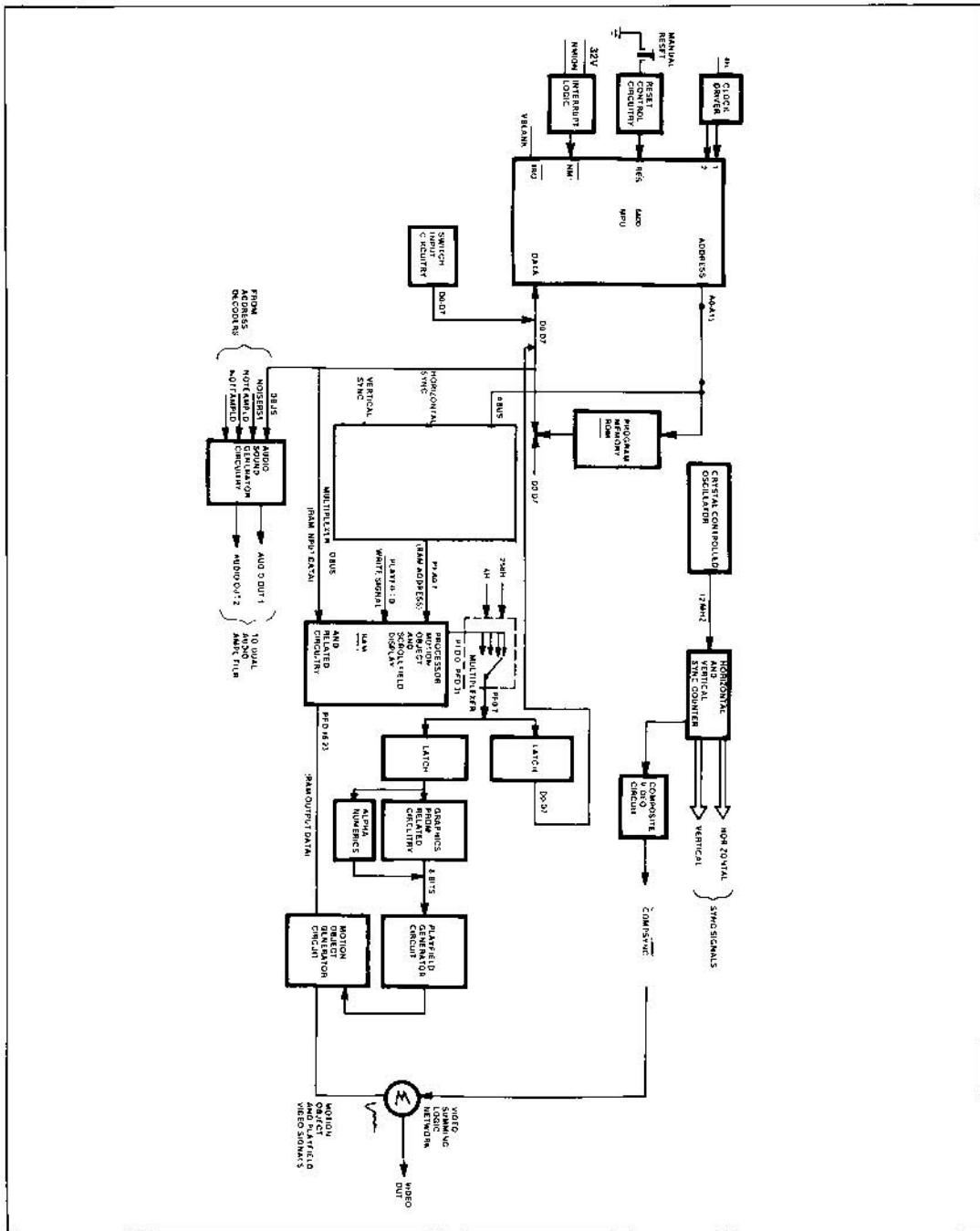
Figure 3-2   Orbit PCB Block Diagram

The Orbit PCB block diagram in Figure 3-2 illustrates the division and function of the various circuits located on the game PCB and how they are controlled by the microprocessor. Refer to Figure 3-2 as you go through the following circuit descriptions.

The functional operation of the Orbit PCB circuitry begins naturally enough with the microprocessor (or MPU) circuitry. As you go through the various circuit descriptions, you learn how the MPU receives its sequential program instructions from its ROM memory and how it carries out these instructions through the use of its display RAM memory (Section C); how it reads in the game control switches (Section G), and how it writes or outputs the results of its instructions and calculations to the game's other PCB circuitry, such as the playfield generator (Section E), the motion object generator (Section F), and the audio amplifier (Section K).

A circuit description of the standard Atari sync generator (Section D) is also included. This is the only PCB circuitry that functions independently of microprocessor control.

All reference schematic diagrams of the aforementioned circuits are found in Appendix A at the end of this manual.

B. POWER SUPPLY (See Figure 3-3)

The power supply produces all the necessary game voltage requirements as shown in Figure 3-4.

The PCB receives + 10 volts DC, unregulated, at pins B and 2 of the game PCB edge connector and from the secondary of the transformer located on the Type B power supply chassis.

The + 10 volts is rectified and filtered off-board and regulated on-board by the LM323 three-terminal regulator device to a stable + 5 volts DC. The + 5 volts DC is distributed throughout the PCB to power all logic circuits.

C. MICROPROCESSOR CIRCUITRY

The heart of the Orbit game PCB is the microprocessor circuitry. A brief description of the major components and their function within the microprocessor circuitry is provided in the following paragraphs. Note that the microprocessor circuitry components include the following: (see Figure 3-5)

1. MPU (at location C3)
2. Data Buffers (Tranceiver devices located at E4 and E6)
3. Address Buffers (Schmidt gate devices located at B4 and C2)
4. Program Memory; comprised of PROM device N2, N1, M2, M1, L2, L1, E2, E1, F2, F1, H2 and H1, for the -01 version; and ROM devices L/M3, K/L3, and H3 for the -02 version. (See Figure 3-5)
5. Working RAM devices located at C1 and D1
6. Address decoding devices (A5, A6 and miscellaneous gates)
7. Watchdog reset counter (K10 and miscellaneous gates)

MPU, ROM, and RAM (See Figure 3-6)

The microprocessor is the "master controller" behind all action that takes place in the game circuitry. In going through the following paragraphs refer to Table 3-1, MPU Input/Output Signal Descriptions. Upon initialization, the MPU (via ABUS 0-ABUS 15) addresses data permanently stored in the program ROMs or PROMs. This addressed data then travels to the MPU via its 8-bit data bus (D0 through D7). The MPU decodes this data to determine what action it is to perform next (i.e., "read coin switch 1," "attract mode", etc.). The MPU uses RAM memory to perform many of these instructions, namely to temporarily store information which it will later recall. The MPU is capable of writing (or putting data into) the RAM and then later reading (pulling data out of) the RAM, via its address bus (ABUS 0-ABUS 15) and bi-directional data bus (D0-D7).

Address Decoding (See Figure 3-7)

The MPU address decoding circuitry performs the critical function of turning on or enabling the appropriate game circuitry (i.e., RAM, ROM, latches, etc.) at the appropriate time, so that information can be transferred back and forth between this game circuitry and the MPU. A memory map defining the address decoding circuit is shown in Table 3-2 as reference.

Φ 2 Clock Driver

The basic operating frequency of the microprocessor is established by its Φ1 and Φ2 input (on pin 37 of the MPU device). The Orbit MPU runs at an operating frequency of 750 KHz. Examination of the MPU Φ2 output waveform (pin 39) with an oscilloscope should show a signal with a period of 1.33 microseconds. (The period of any periodic waveform is the measurement of the time
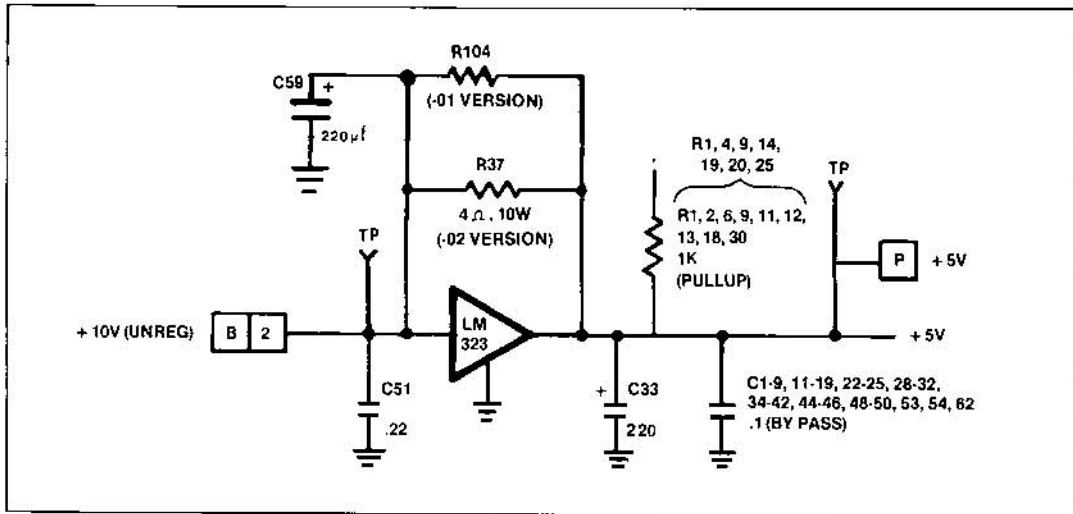
Figure 3-3   On-Board Power Supply Schematic Diagram
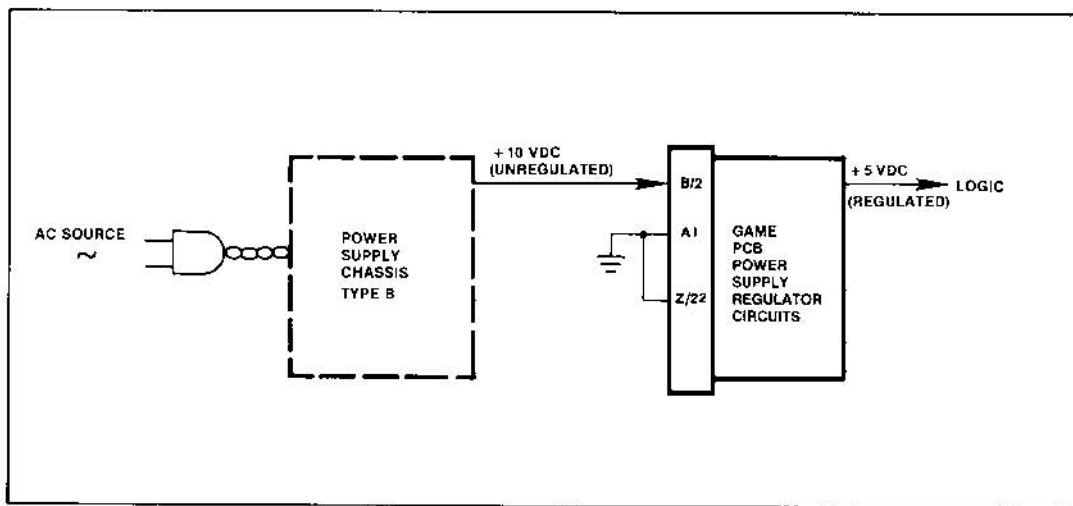
Figure 3-4   Power Supply Simplified Block Diagram

it takes to complete one full cycle.) The 750 KHz clock outputs are generated by the 4H signal. This 4H frequency is generated by the horizontal sync counter R4 to produce the Φ1 and Φ2 clock input. See Figure 3-8, Φ1 and Φ2 Clock Driver Signal.

Watchdog RESET (See Figure 3-5)

The reset counter in the microprocessor control circuitry consists of a 4-bit decade counter, K10. The Q_D output of this counter is the RESET signal to the MPU.
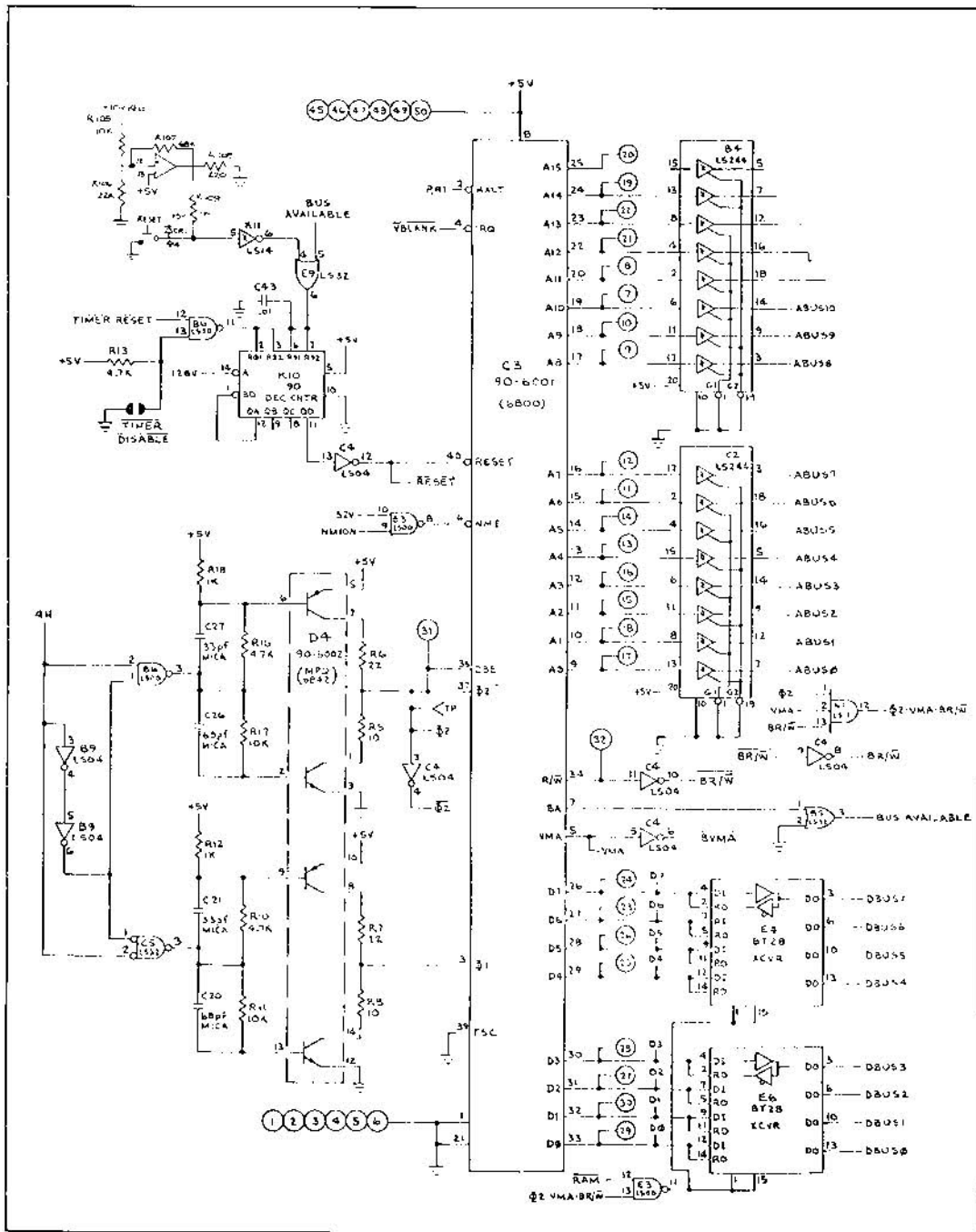
Figure 3-5   Microprocessor Schematic Diagram
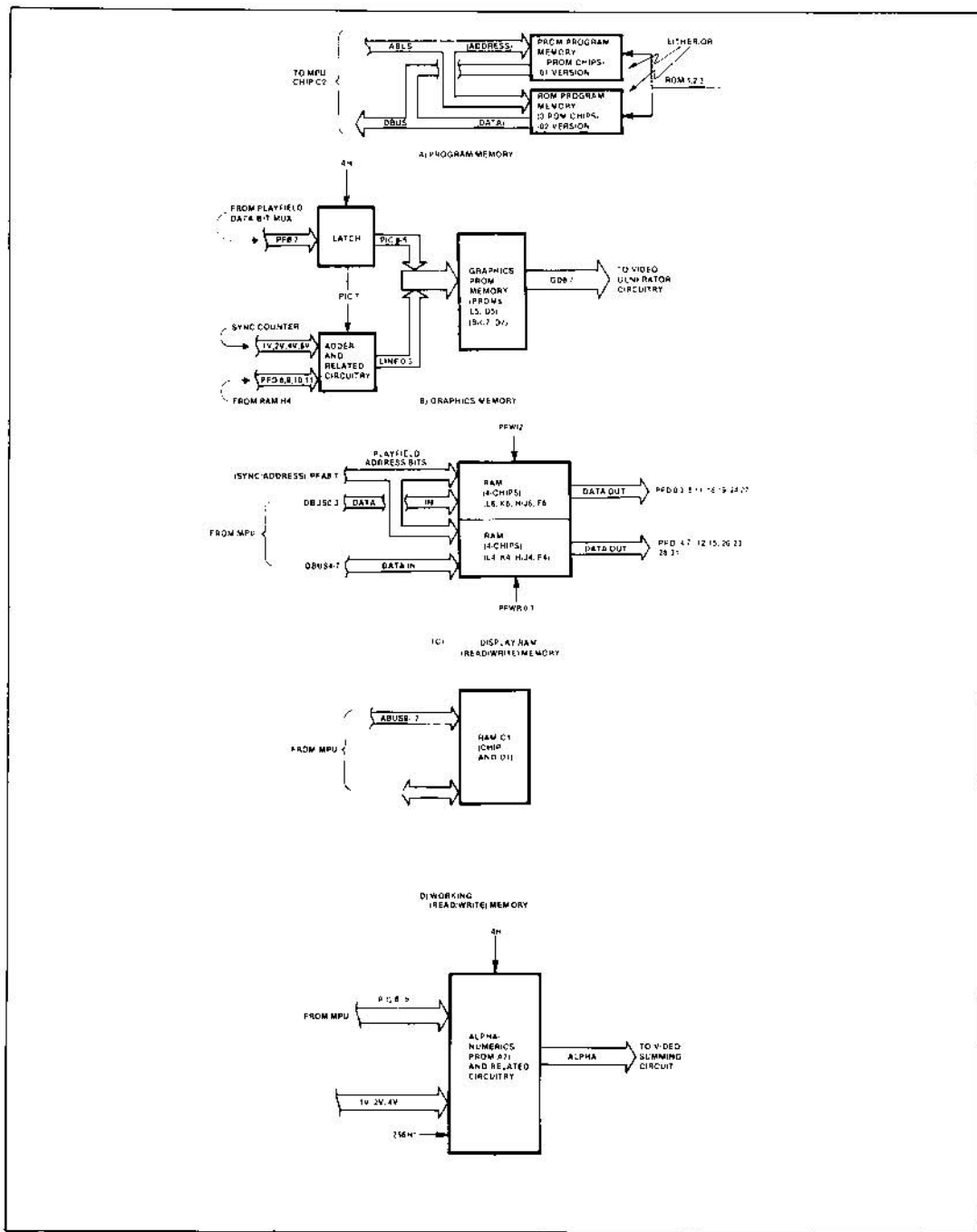
Figure 3-6 Memory Block Diagram
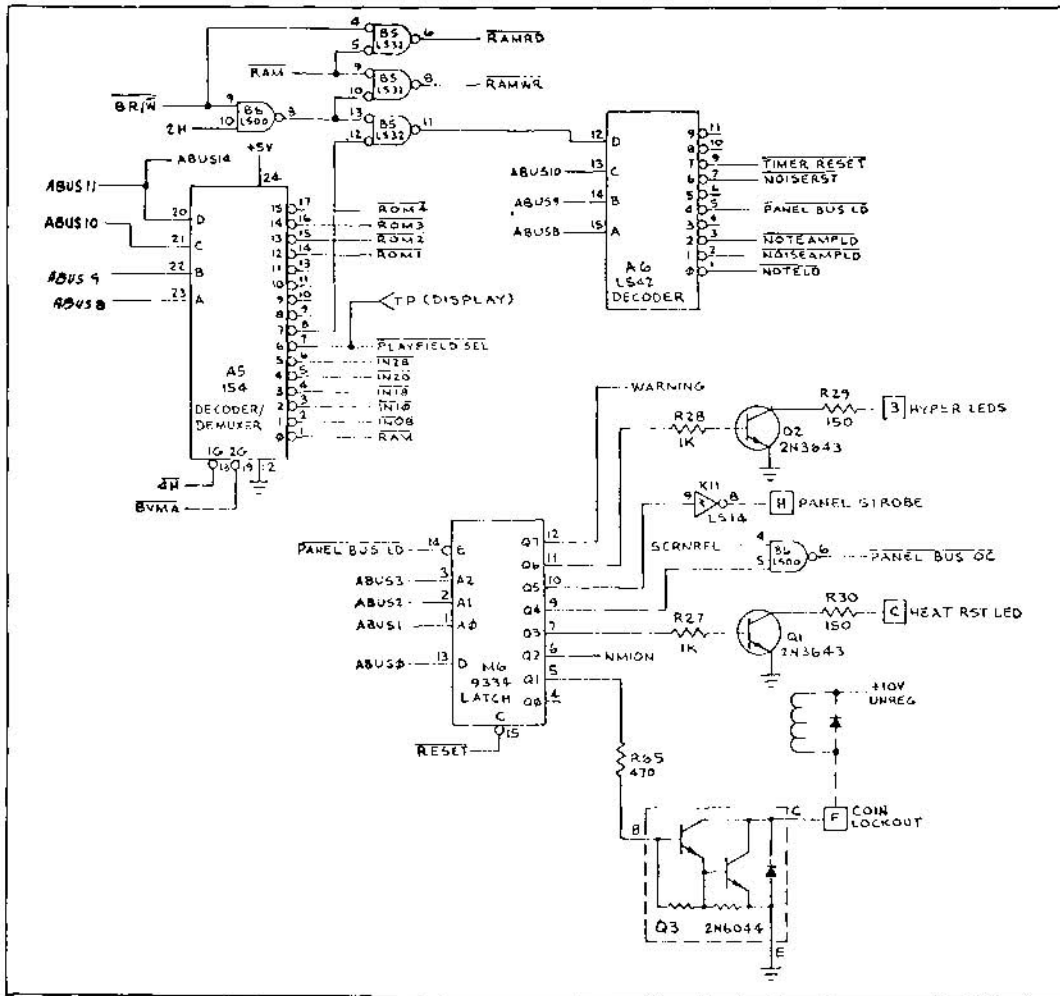
Figure 3-7   Address Decoding
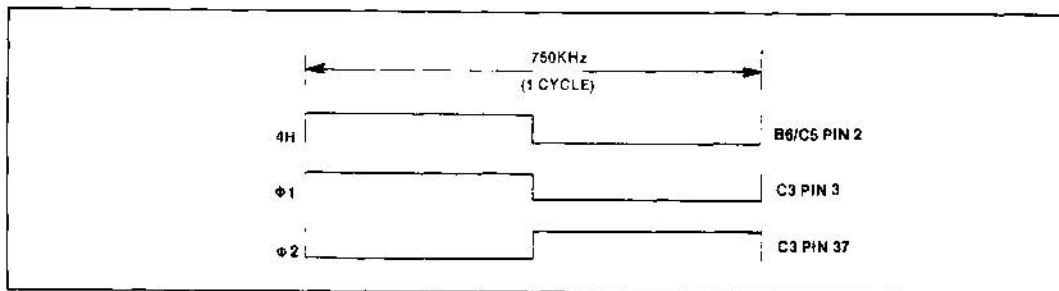
Figure 3-8   Φ1 and Φ2 Clock Driver Signal

Table 3-1 MPU Input/Output Signal Descriptions

Signal	Number of Lines	Description/Function
D0-D7	8	These eight lines are bi-directional data bus lines
A0-A15	16	These sixteen lines are unilateral MPU address lines to supporting memory (i.e., ROMs, RAMs), and I/O.
$\overline{RESET}$	1	This input line, when low, resets the MPU from either a power-down or on a QE output of the watchdog counter. During the reset sequence prior to RESET going high, the contents of the last two locations (FFFE, FFFF) in memory are loaded into the MPU program counter to point the start of a reset routine.
$\overline{IRQ}$	1	This input when low indicates an interrupt request to the MPU. After the MPU concludes its current sequence it will then proceed to the IRQ sequence.
$\overline{NMI}$	1	This input line while going low indicates a non-maskable interrupt sequence. After the MPU concludes its current sequence it will then proceed to the NMI sequence.
DBE	1	This input line when high enables the MPU tri-state bus drivers. It is driven by the $\Phi 2$ clock.
$\Phi 1, \Phi 2$	2	Two-phase, non-overlapping MPU clock inputs.
R/W	1	This output is the read and write signal line which indicates the direction of data transfers on MPU data bus

Counter K10 counts how many times the 128V signal changes states. On every high-to-low transition of 128V, the counter advances to the next count in its sequence. Meanwhile, the $\overline{TIMER\ RESET}$ signal, generated by the MPU at various times during its normal instruction sequence, is resetting the counter back to zero. If for some reason the MPU program has strayed from its intended instruction sequence and the $\overline{TIMER\ RESET}$ signal does not occur before this counter counts up to a point where the Q_D output goes high, a RESET signal is generated to the MPU. The RESET signal causes the MPU to restart its instruction sequence from the beginning of the program.

D. SYNC GENERATOR
(See Figure 3-9)

The base frequency of the sync generator is a 12.096-MHz clock, generated by a crystal-controlled oscillator consisting of crystal Y1, inverter R3 and several discrete components. The output of this oscillator is 12 MHz. Examination of this signal with an oscilloscope (at pin 4 of R3) should show the period (or cycle time) to be approximately 83 nanoseconds (.083 microseconds). See Figure 3-10.

This base frequency is then divided down by binary counters R4, R5, R6; it provides the various horizontal synchronization frequencies (1H through 256H). The final output of this horizontal counter chain is 256H (at pin 13 of R6). This signal is in effect a division of the base frequency (12.096 MHz) by 768, to give a horizontal line frequency of 15,750 Hz. The period of 256H is about 63.5 microseconds. The 256H signal, as well as other horizontal signals, are used to generate the H SYNC timing pulses at flip-flop P8. See Figure 3-10, Horizontal Sync Timing Diagram for the relative timing of these waveforms.

The H SYNC signal is used to clock two stages of vertical sync counters P7 and P8. This H SYNC signal is divided down by these counters to form the various vertical synchronization frequencies (1V through 128V). These two stages of vertical counters are used, in effect, to do a divide by 262 of the H SYNC signal. This results in the final output of these counters (128V at pin 11 of P8) to be a signal at a frequency of 60 Hz (the period is approximately 16.6 milliseconds). The various vertical frequencies address a sync PROM (P6) whose output data is latched by latch N6. The outputs of this latch are the various polarities and phases of the vertical timing frequency used to synchronize the TV monitor display. These signals all run at a frequency of 60 Hz. Figure 3-12, Vertical Sync Timing Diagram, for the relative timing of these waveforms.

Table 3-2 Atari Programmed Memory Map

MEMORY MAP

ADDRESS	DATA	FUNCTION	
0000		RAM	
0800		IN08	
		NOT USED	
		THRUST 2	
		ROT B2	
		ROT A2	
		HYPER 2	
		TRIG 2 SW	
		SLAM	
		COIN 2	
1000		IN10	
		NOT USED	
		THRUST 1	
		ROT B1	
		ROT A1	
		HYPER 1	
		TRIG 1 SW	
		TEST	
		COIN 1	
1800		IN18	
		OPTION SW	
		OPTION SW	
		OPTION SW	
		OPTION SW	
		OPTION SW	
		OPTION SW	
		OPTION SW	
		OPTION SW	
2000		IN20	
		GAME RESET	
		SW 9	
		SW 8	
		SCRNRFL	
		HEAT RST	
		DIAG TEST	
		NEXT TEST	
		VBLANK	
2800		IN28	
		SB0	
		SB1	
		SB2	
		SB3	READS SBx LINES
		SB4	
		SB5	
		SB6	
		SB7	
3000-33BF		PLAYFIELD SEL	
33C0-33FF		MOTION OBJECT PARAMETERS	
		PICTURE	
		VPOS	
		HPOS	
		NORMAL WIDTH (0), DBL (1))8‹E (1)	
		FULL OBJECT	
		TOP HALF	
		BOTTOM HALF	
3800		NOTELD	
3900		NOISEAMPLD	
3A00		NOTEAMPLD	
3C00		PANEL BUS LD (WRITES SBx LINES)	
3C00		NOT USED	
3C02		COIN LOCKOUT	OFF(0)/ON(1)
3C04		NMION	OFF(0)/ON(1)
3C06		HEAT RST LED	OFF(0)/ON(1)
3C08		PANEL BUS OC	(RD = 0)(WR = 1)
3C0A		PANEL STROBE	OFF(0)/ON(1)
3C0C		HYPER LEDS	OFF(0)/ON(1)
3C0E		WARNING SND	OFF(0)/ON(1)
3E00		NOISERST	
3F00		TIMER RESET	
6000		ROM 1	
6800		ROM 2	
7000		ROM 3	
7800		ROM 4	

Figure 3-9   Sync Generator Schematic Diagram

ORBIT   3-11
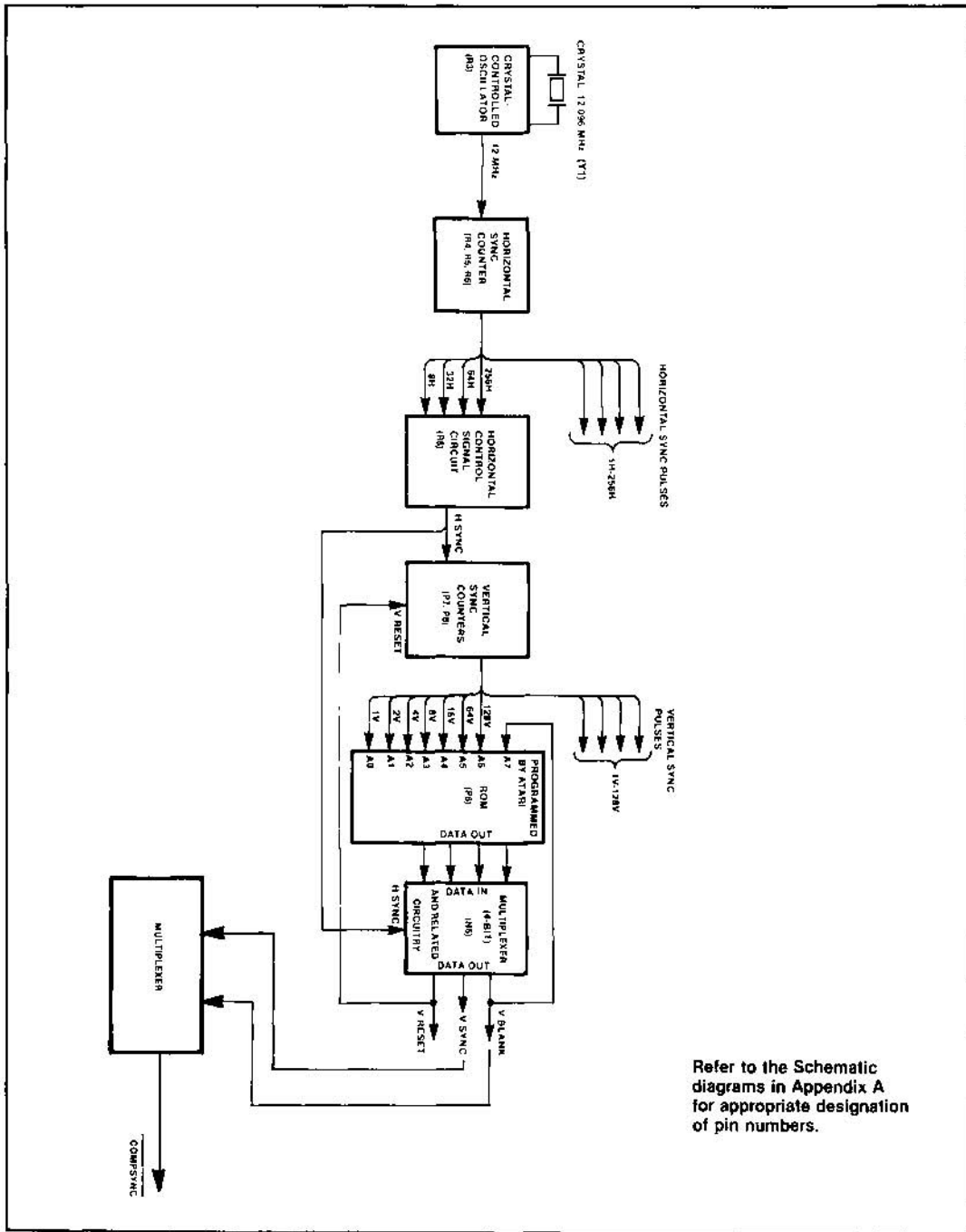
Figure 3-10 Simplified Diagram of Crystal-Controlled Oscillator and TV Sync Circuitry

Refer to the Schematic
diagrams in Appendix A
for appropriate designation
of pin numbers.
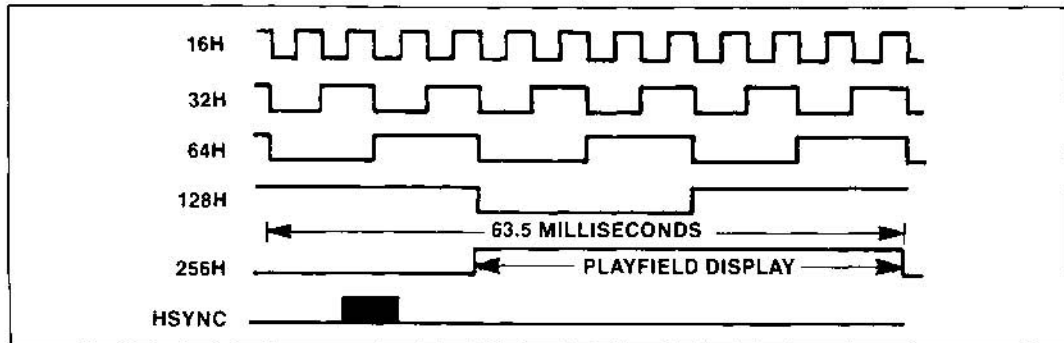
Figure 3-11 Horizontal Sync Timing Diagram

(a) EVEN FIELD IF SIGNAL = 0

(b) ODD FIELD IF SIGNAL = 1
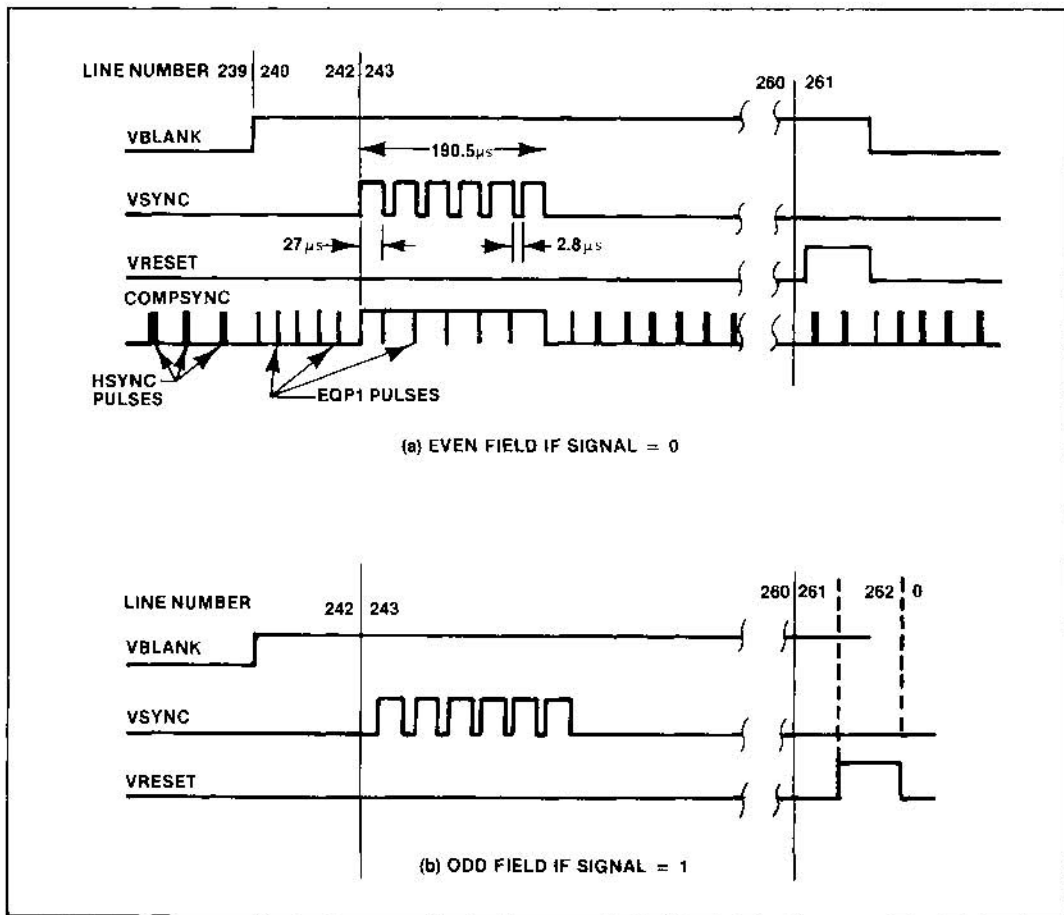
Figure 3-12 Vertical Sync Timing Diagram
(Interlaced)

The end result of the horizontal and vertical timing waveforms is to synchronize the TV monitor display. This display consists of 262 horizontal lines per frame, with each line being the time equivalent of 768 12 MHz clock pulses. Each frame is repeated 60 times per second, providing the necessary frequency of display refresh that provides a stable non-flickering display.

E. ALPHANUMERIC / PLAYFIELD GENERATOR

(See Figure 3-13)

Alpha and numeric characters are displayed as 8 line by 8 bit blocks of video at the scoreboard display area of the TV monitor screen. These alphanumeric characters are stored in PROM A7 (see Figure 3-14) which is accessed by addressing the data from the RAM (J4, K4, H/J4, F4, L6, K6, H/J6, F6). The microprocessor loads the alphanumeric character code into the RAM. These RAM data bits (PFD-xx) are then multiplexed out to the 8-bit PF0-PF7 data input to latch C6. The latch output bits then address the alphanumerics PROM A7 (at address inputs A3-A8) and address one of the 64 different pictures stored in it. The vertical signals (4V, 2V, 1V) and the vertical reflect control signal (SCRNRFL) determine which of the 8 lines of the character is currently being addressed.

The data bits GD0-GD7 from the PROM are then multiplexed by devices B8 and C8. Then converted into a serial bit structure via parallel to serial shift register D8. The output of D8 is the alphanumerics video labeled RAWVID.

This circuitry functions as follows:

1. When horizontal sync pluse 4H is low, the MPU buffered address bus (ABUS 0-ABUS 15) addresses various playfield display RAM locations, and writes appropriate picture codes into them via the MPU data bus (D0-D7).

2. When 4H is high, horizontal sync signals (8H, 16H, 32H, 64H) and vertical sync signals (8V, 16V, 32V, 64V) are now allowed to address this game display RAM and read data out of it. This data (PFD0-32)
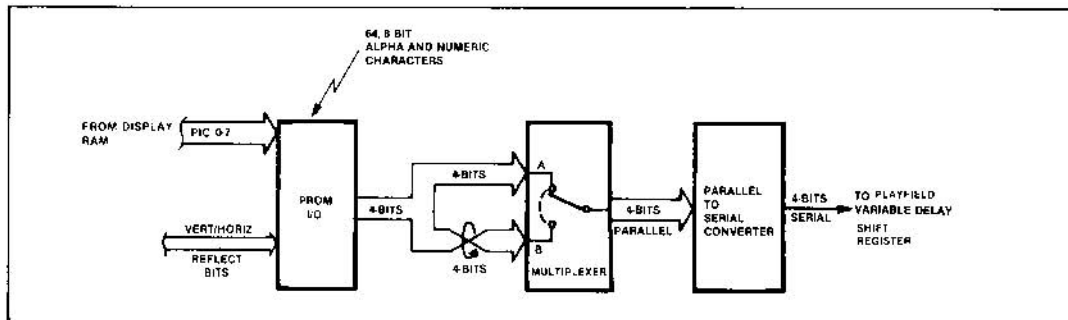
Figure 3-13   Alphanumerics Generator Block Diagram
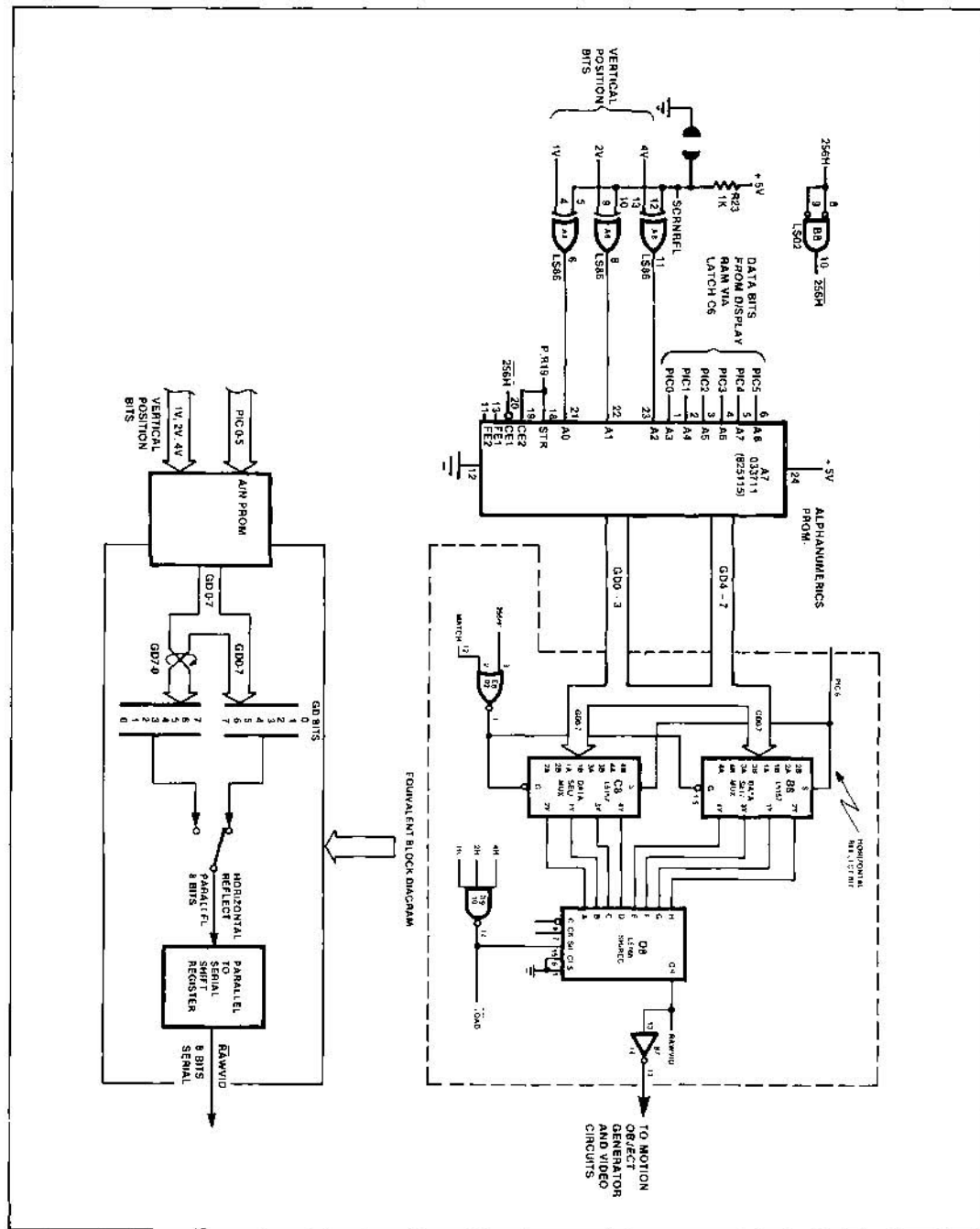
Figure 3-14 Alphanumerics Generator Simplified Schematic Diagram

being read out is then re-multiplexed into data bits PF0-PF7. These 8 data bits are then latched by latch C6 and labeled PIC 0 through PIC 7.

Since the data was read out of the RAM by the horizontal and vertical sync signals, the picture codes PIC 0-7 always correspond to the portion of the monitor display currently being scanned. Because of this, the PIC 0-7 outputs can be used to generate video information for immediate display. These PIC signals address one of 64 8 × 8 pictures stored in graphics. The output of the PROMs is then converted to serial video information by shift register D8.

F. MOTION OBJECT GENERATOR

(See Figure 3-15)

The motion object generator produces motion objects such as the starships, shells, space stations and asteriod. These motion objects are generated by some of the same circuitry found in the alphanumeric generator (see Figure 3 14), while the actual graphics are permanently stored in PROMs B/C7 and D7 (see Figure 3-17). The

RAWVID signal from the parallel to serial shift register D8 is connected to OR gate M8. This gate ORs the raw video (RAWVID) from the play ield circuitry and the data out (DO) from the RAM L8 (right player starship) which is also called the motion object video. This is then gated by AND gate M7. When 256H** is high, the M7 output is sent to the data input (Din) of the RAM L8. When 256H** is low the output of M7 (pin 8) is low. This low input to RAM L8, pin 13, loads the RAM with zeros (clears the memory) at the selected addresses.

The RAM address is selected by the microprocessor and latched at J7 via the display RAM. The playfield data from the RAM display (PF16-23) is loaded (HLD) into binary counters K7 and J8 which presets the counter to the horizontal position of the motion object. These counters then count at a 6MHz rate until the clear (HCLR) signal goes low during active video (256H). The outputs of the counters then address the RAM. This RAM will either write (WE low) the serial data at DIN (pin 13) in the addressed memory or read the serial data at DO (pin 6) in the addressed memory.

The motion objects are displayed on the playfield as determined by the logic signals at the J1 latch and the vertical magnitude comparators (H7, H8).
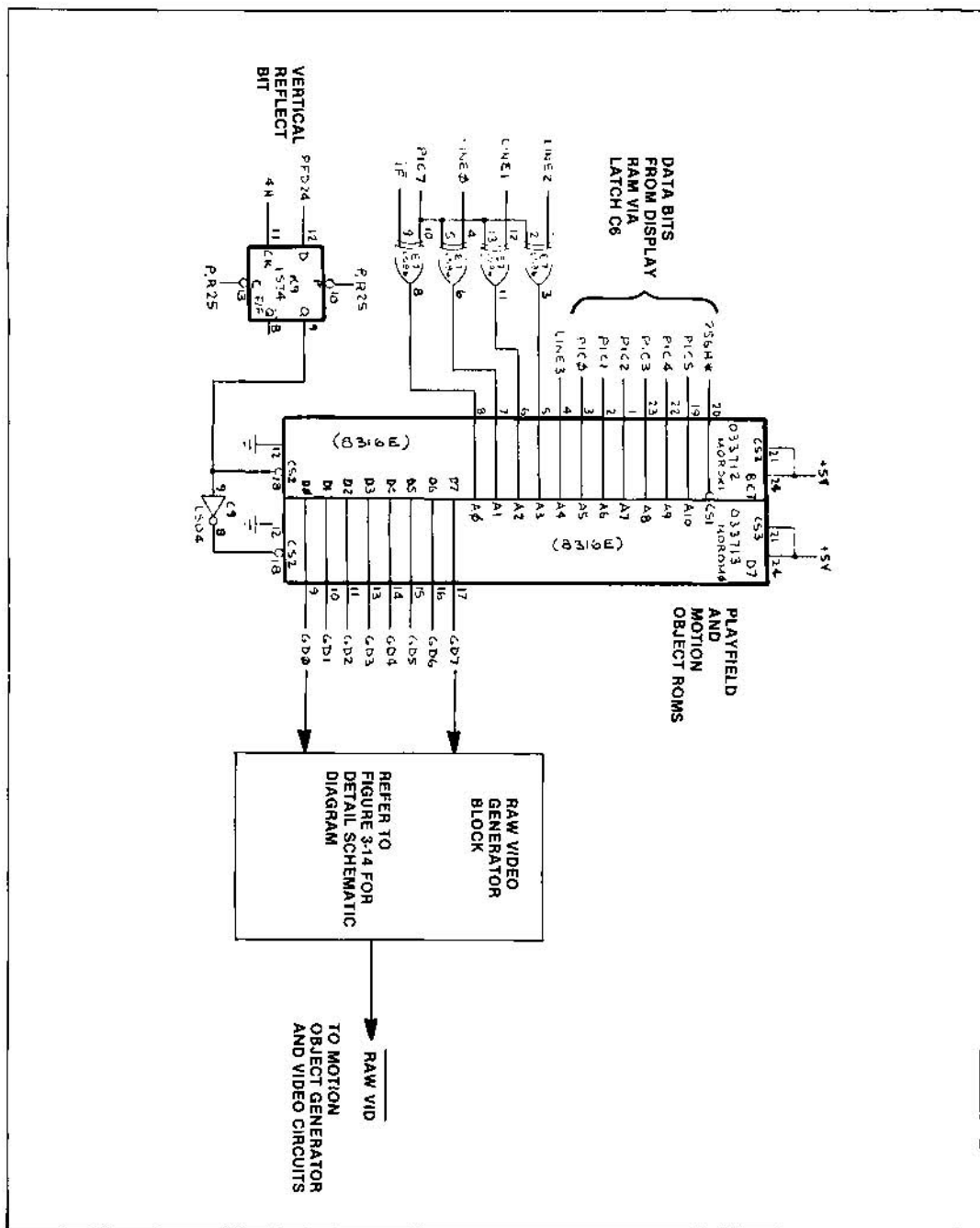
Figure 3-15   Playfield Generator Block Diagram and Simplified Schematic Diagram
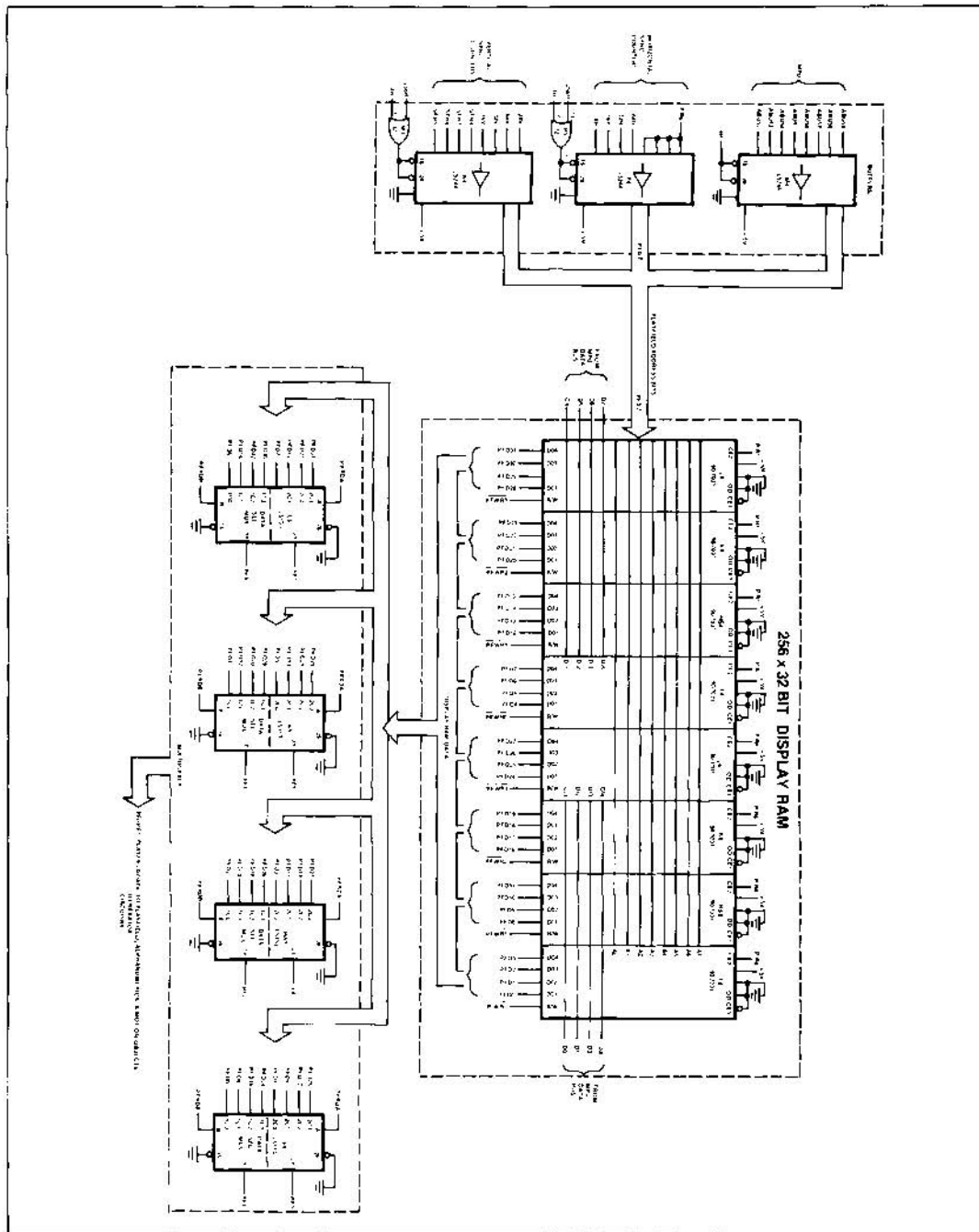
Figure 3-16   Display RAM simplified Schematic Diagram
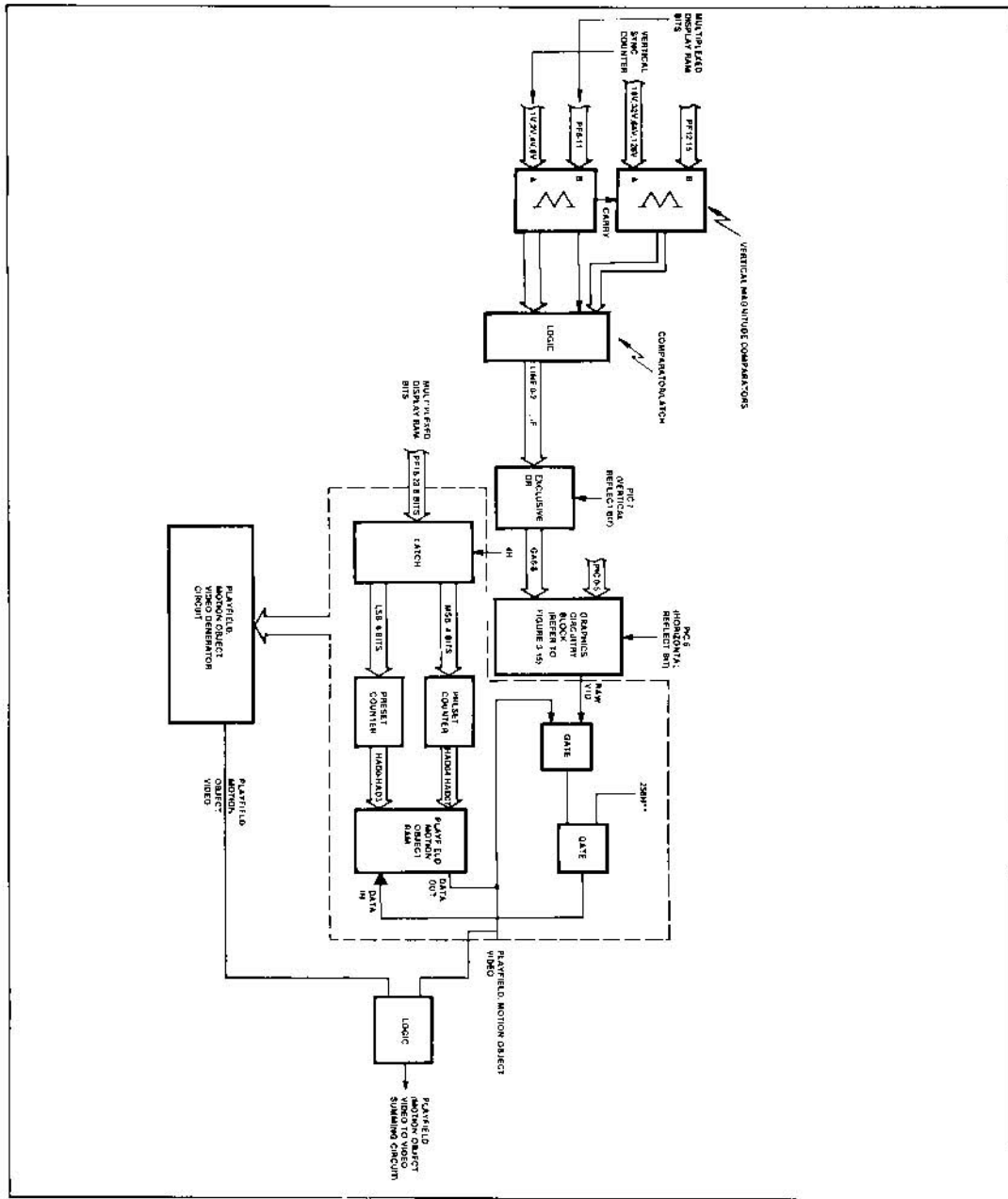
Figure 3-17   Motion Object Generator Block Diagram
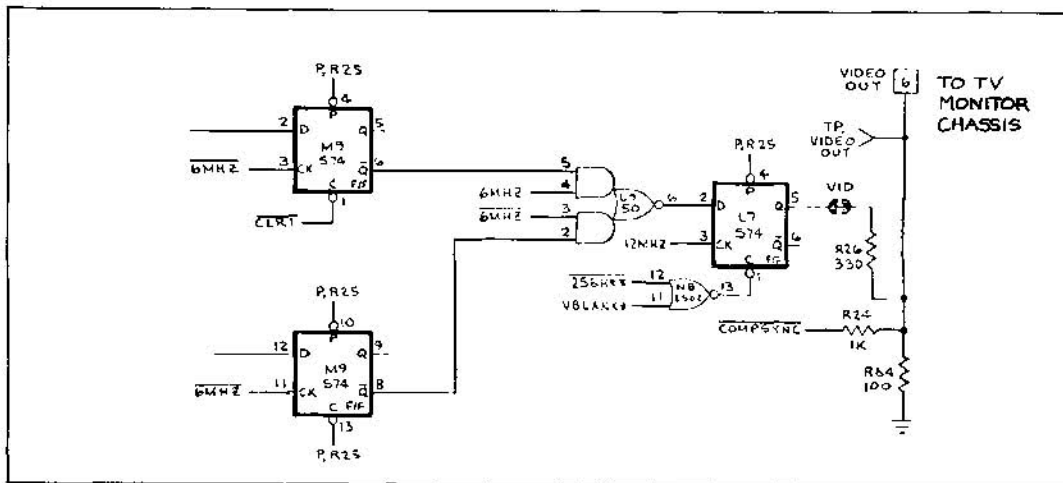
Figure 3-18   Video Circuit Simplified Schematic Diagram

G. VIDEO OUTPUT

(See Figure 3-18)

The video output circuit receives all the video signals (Comp Sync and related signals) and gates these signals summed at pin 6 of the Orbit game PCB as the composite video signal sent to the TV display monitor.

H. AUDIO GENERATOR

(See Figure 3-19)

The audio generator circuit produces the roar, explosion and various note sounds. The roar and explosion sounds are the result of the gated random noise generator comprised of shift registers A9 and A10. The volume for these sounds is automatically controlled by the data bus bits DBUS 0 - 7. These eight bits are split into DBUS 0 - 3 and DBUS 4 - 7 to produce two separate sounds later amplified by the dual amplifier PCB. The amplifier develops the stereo sound heard by the player.

Each 4-bit sound is then filtered by the active bandpass filter circuit comprised of either one-half of B12 (LM324) or the other half. The outputs of the filter circuit are individually mixed and outputted to the dual amplifier PCB.

The notes are generated by the frequency synthesizer comprised of device J11 and H11. The NOTE output signal level is then split by the gating with the output of E11 latch to develop signal outputs ANOTE 1 and ANOTE 2. These signals are then mixed: ANOTE 1 to audio output 1 and ANOTE 2 to audio output 2.
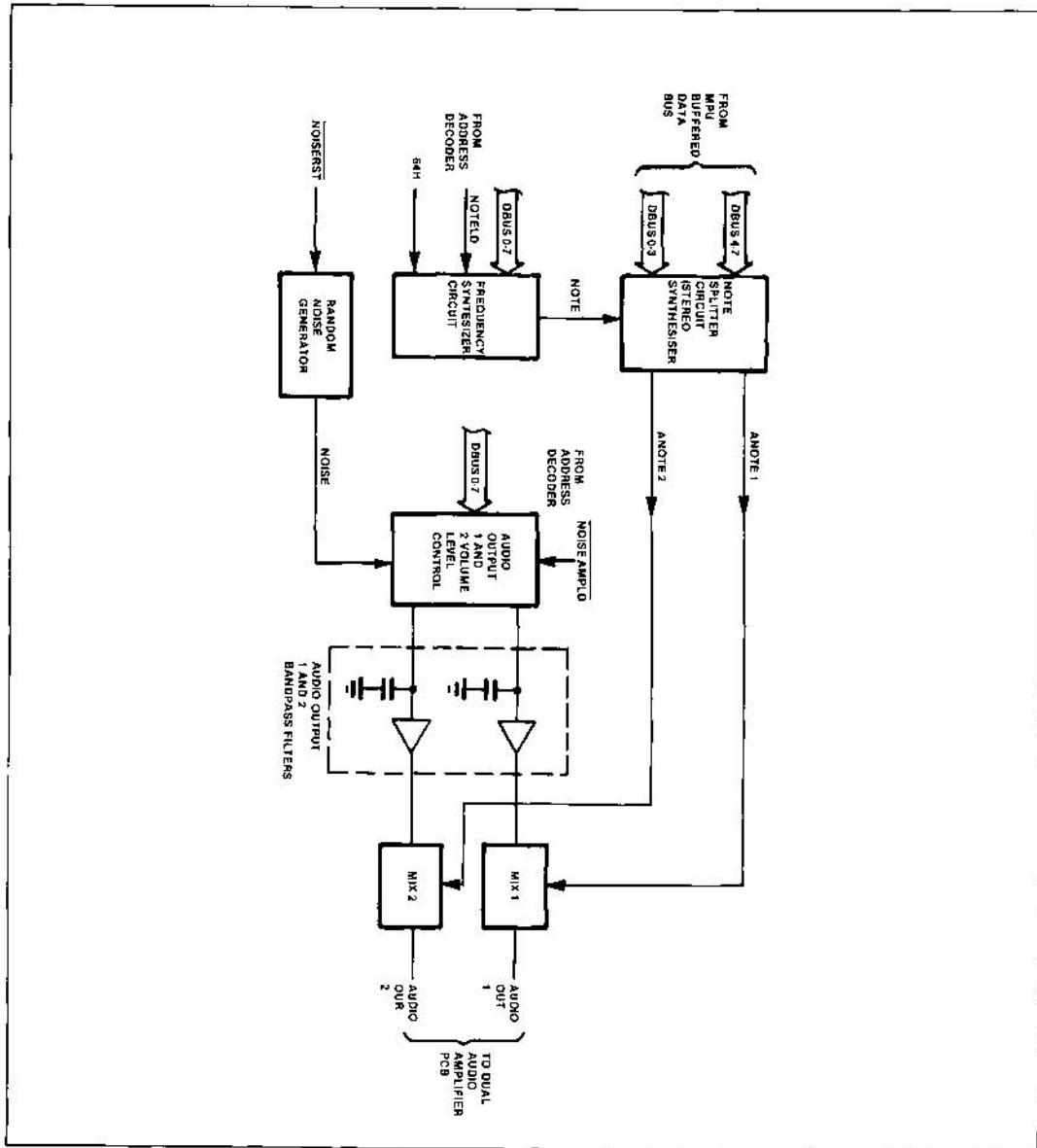
Figure 3-19   Audio Generator Simplified Schematic Diagram
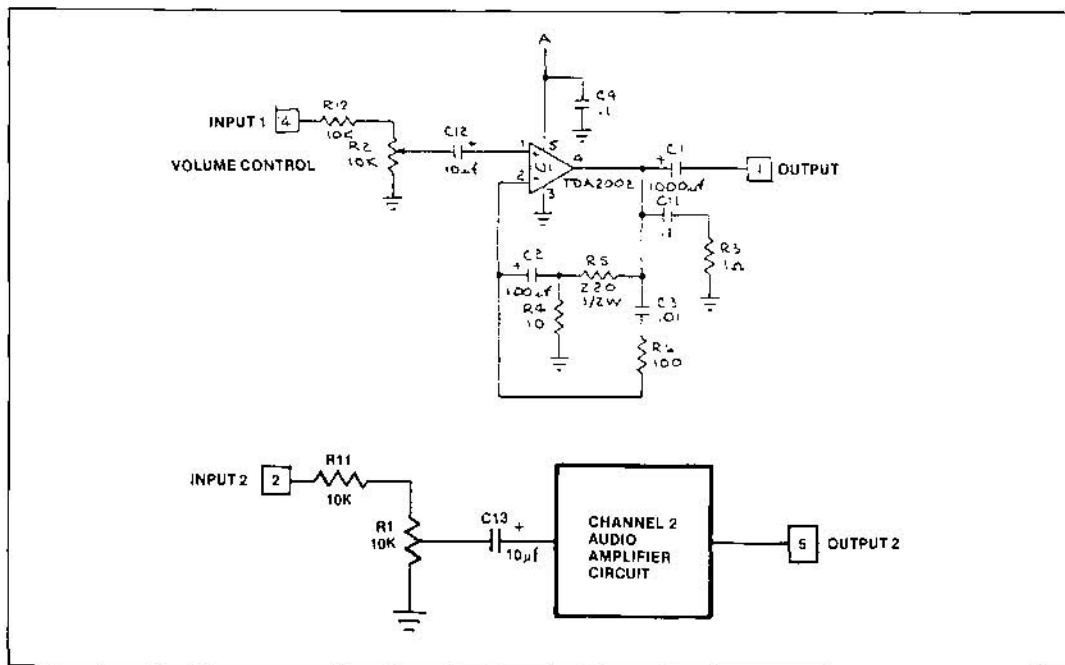
Figure 3-20 Dual Audio Amplifier Simplified Schematic Diagram

K. DUAL AUDIO AMPLIFIER

(See Figure 3-20)

This dual audio amplifier for the Orbit game is a PCB assembly which consists of two individual amplifier circuits. These two circuits reproduce the realistic cosmic stereo sounds produced by the game's sound generator.

The amplifier device of each circuit is a TDA 2002, as illustrated in Figure 3-20 each driving a speaker. The volume level is adjusted by PCB mounted potentiometers R1 and R2.

The power supplied to the circuit orginates from the power supply chassis assembly 25 VAC output.
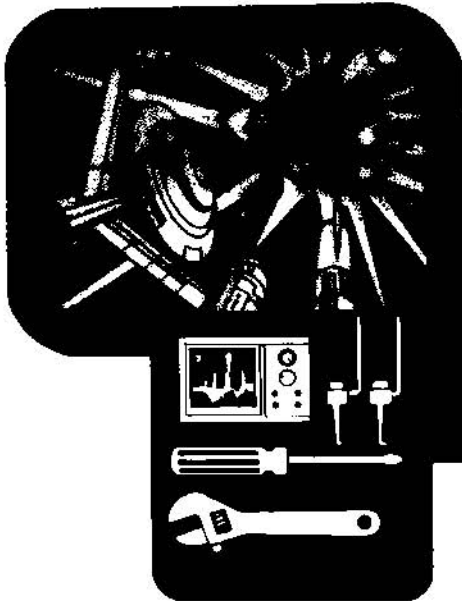
ADJUSTMENTS AND MAINTENANCE

Due to its solid-state electronic circuitry, this Atari unit should require very little maintenance and only occasional adjustment. Information given in this chapter and elsewhere in this manual is intended to cover most servicing situations that may be encountered at the game site. The procedures given are in sufficient detail to be understood by a person with moderate technical background.

ORBIT

4
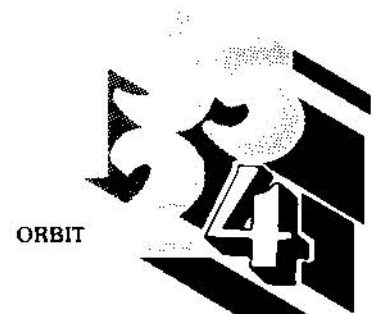
A. CLEANING

The exteriors of game cabinets and Plexiglas® panels may be cleaned with any non-abrasive household cleaner. If desired, special coin machine cleaners that leave no residue can be obtained from your distributor. Do not dry-wipe the acrylic plastic panels, because any dust can scratch the surface and result in fogging the plastic.

B. COIN MECHANISM

Components On Coin Door

Figure 4-1 shows the back side of the coin door assembly where the game's two coin mechanisms are mounted. Included is the lock-out coil assembly; the lock-out wires are connected to this assembly but are hidden behind the coin mechanisms. Powering the game causes the lock-out wires to retract far enough to allow genuine coins to reach the coin box. When AC power to the game has already been turned off, the lock-out coil is de-energized, causing the lock-out wires to move out far enough to divert coins to the return chute.

Directly below each coin mechanism is a secondary coin chute and a coin switch with a trip wire extending out to the front edge of the chute. When the trip wire is positioned correctly, a coin passing down the secondary chute and into the coin box will momentarily push the trip wire down and cause the switch contacts to close.

Also shown in the photograph is a slam switch assembly. It has been included to defeat any players who might try to obtain free game plays by violently pounding on the coin door to momentarily close the contacts on a coin switch. The slam switch contacts connect to the microcomputer system, which will ignore coin switch signals whenever the slam switch contacts are closed.

Access to Coin Mechanisms

To remove jammed coins, and for maintenance cleaning, each magnet gate assembly can be hinged open without removing it from the door, as shown in Figure 4-2. Or, if necessary, each coin mechanism can be entirely removed from the door merely by pushing down on a release lever and simultaneously tilting the mechanism back, then lifting it up and out. This is shown in Figure 4-3.

Plexiglas® is a registered trademark of Rohm & Haas Company.
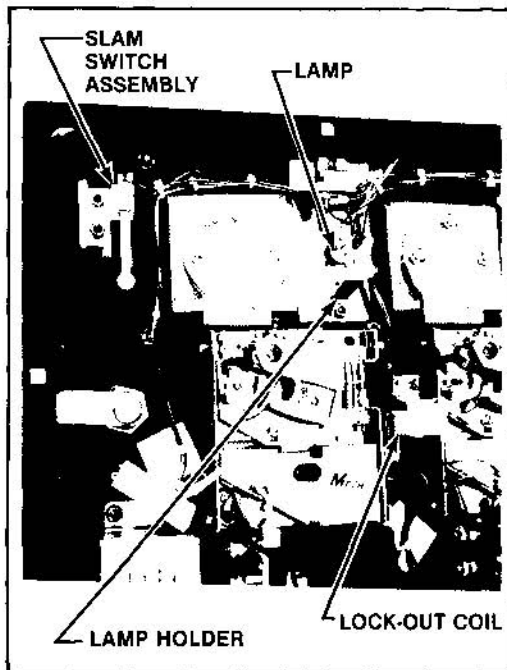
Figure 4-1   Coin Door Assembly
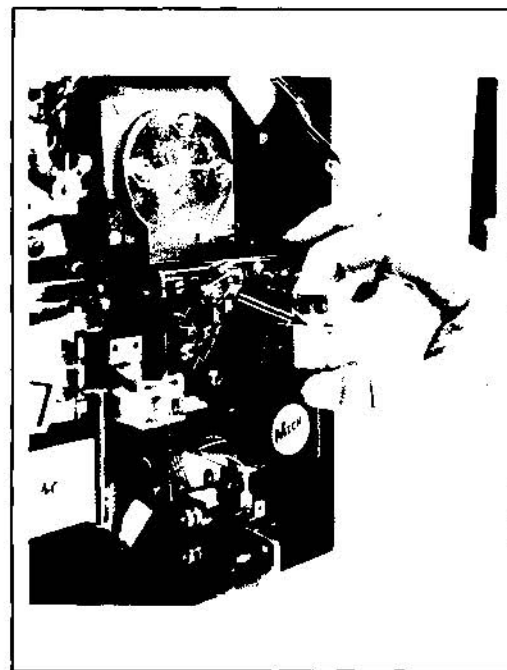
Figure 4-2   Hinging Open the Magnet Gate Assembly
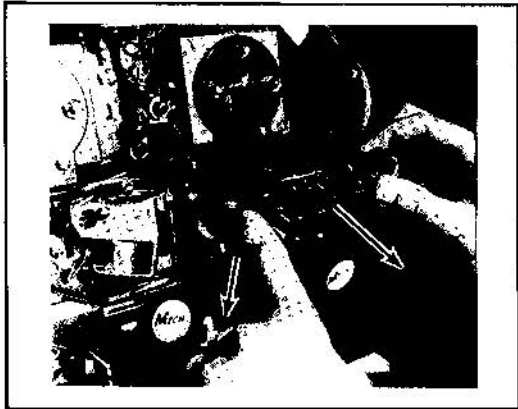
Figure 4-3   Removal of Coin Mechanism

Cleaning of Coin Paths

> **CAUTION**
>
> The use of an abrasive (such as steel wool or a wire brush) or a lubrication on a coin mechanism will result in a rapid buildup of residue.

By talking to many operators, we have found that the best method of cleaning a coin mechanism is by using hot or boiling water and a mild detergent. A toothbrush may be used for those stubborn buildups of residue. After cleaning, flush thoroughly with hot or boiling water, then blow out all water with compressed air.

Figure 4-4 shows the surfaces to clean inside the coin mechanism. These include the inside surface of the

(CLEAN BOTH SURFACES WHERE COIN ENTERS THE MECHANISM, AS WELL AS THE MAGNET)
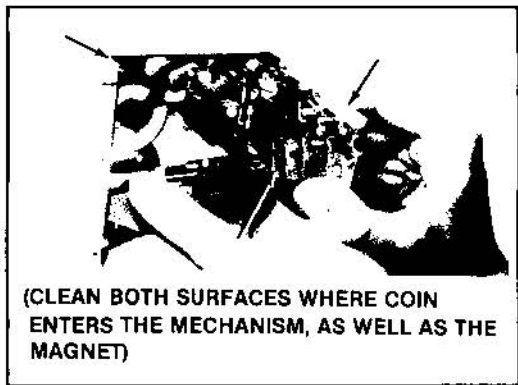
Figure 4-4   Surfaces to Clean Inside the Coin Mechanism

mainplate, and the corresponding surface of the gate assembly. There may also be metal particles clinging to the magnet itself. To remove these you can guide the point of a screwdriver or similar tool along the edge of the magnet.

If coins are not traveling as far as the coin mechanisms, you will need to clean the channel beneath the coin slot. To gain access to this channel, use a 3/8-inch wrench and remove all three nuts that secure the cover plate (refer to Figure 4-5). Removing the plate will provide access to the entire channel.

Also clean the inside surfaces of the secondary coin chutes, but when doing this be careful not to damage or bend the trip wires on the coin switches.
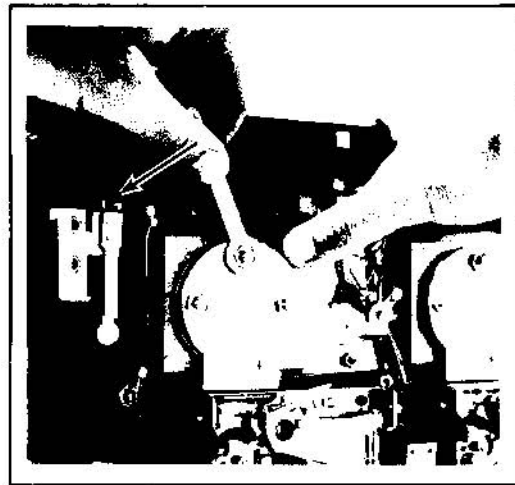
Figure 4-5   Removal of Plate Covering Rear of Coin Slot

Lubrication

Do *not* apply lubrication to the coin mechanisms. The only points that may need lubrication (and only rarely) are the shafts of the scavenger buttons (coin rejection buttons) where they pass through the coin door. Apply only one drop of light machine oil, and be positive that no oil drops down onto a coin mechanism. Figure 4-6 shows this lubrication point.

Adjustment of Coin Switch Trip Wire

In order for a coin switch to operate reliably when a coin travels down the secondary coin chute, the rest position of its trip wire should be as shown in Figure 4-7. Use extreme care when handling or touching these wires.

Figure 4-6 Close-Up View of Lubrication Point

Figure 4-7 Detail View of Coin Switch and Trip Wire

In Figure 4-7 you will note that the coin switch trip wire is oriented into the "V" of the secondary coin chute. The wire should extend to only about 1/8" beyond the chute.

A retaining clip holds the wire onto the switch actuating stud. If you should lose a retaining clip, all is not lost. Just crimp the switch actuating stud over the trip wire with a pair of pliers.

Mechanical Adjustments on Coin Mechanism

Coin mechanims are adjusted prior to shipment from the factory and normally will retain these adjustments for many months. If, due to wear or other causes, it becomes necessary to make new adjustments, remove the coin mechanism from the coin door. Then take it to a clean well-lighted area where it can be placed in a vertical position on a level surface (such as a bench top). Besides a screwdriver, you will need a set of several coins, including both new and old, worn ones. Figure 4-8 shows an exploded view of the mechanism and gives procedures for adjusting the kicker, separator, and the magnet gate. These adjustments should only be done by someone who has experience in servicing coin mechanisms and who understands their operation.

General Troubleshooting Hints

The first action is to look for jammed coins. After these have been removed, examine the coin path for presence of foreign material or loose objects (such as chewing gum, small metallic objects, paper wads, etc.). In cases where game usage is heavy, it may be necessary to clean the entire coin path periodically, in order to prevent build-up of contaminants that can hinder the movement of coins through the mechanisms. Also confirm that the trip wire on each coin switch is intact, and is properly adjusted. If troubles still persist, check the conditions and positions of the lock-out wires, and the mechanical adjustments on the coin mechanisms, before suspecting the electronics. If a coin mechanism rejects genuine coins, try to readjust it. If this is not successful, then replace it with a working mechanism.

ITEM IDENTIFICATIONS

1 Kicker and Separator Screws
2 Washers
3 Kicker
4 Separator
5 Gate Lever Spring
6 Gate Pivot Pin
7 Mainplate Assembly
8 "C" washer
9 Rail
10 Gate Assembly
12 Cradle Assembly

13 Upper Gate Pivot Spring
14 Undersize Lever Assembly
15 Magnet Gate Assembly
16 Magnet Gate Adjuster
17 Retaining Screws
18 Coverplate Assembly
19 Return Coverplate
20 Coverplate
21 Mounting Studs
22 Lower Gate Pivot Spring
23 Coin Release Lever

Kicker and separator

1. Set the acceptor with the back of the unit facing you in the test position.
2. Loosen the kicker and separator screws (1) and move the kicker (3) and the separator (4) as far to the right as they will go. Lightly tighten the screws.
3. Insert several test coins (both old and new) and note that some are returned by striking the separator.
4. Loosen the separator screw and move the separator a slight amount to the left. Lightly retighten the screw.
5. Insert the test coins again and, if some are still returned, repeat Step 4 until all the coins are accepted.
6. Loosen the kicker screw and move the kicker as far to the left as it will go. Lightly retighten the screw.
7. Insert the test coins and note that some are returned.
8. Loosen the kicker screw and move the kicker a slight amount to the right. Lightly retighten the screw.
9. Insert the test coins again and, if some are still returned, repeat Step 8 until all the coins are accepted.
10. Be sure that both screws are tight after the adjustments have been made.

Magnet gate

1. Set the acceptor with the front of the unit facing you in the test position.
2. Turn the magnet gate adjusting screw (16) out or counterclockwise until none of the coins will fit through.
3. With a coin resting in the acceptor entrance, turn the adjuster in or clockwise until the coin barely passes through the magnet gate.
4. Test this adjustment using several other coins (both old and new) and, if any fail to pass through the magnet gate, repeat Step 3 until all the coins are accepted.
5. Fix the magnet gate adjusting screw in this position with a drop of glue.

Additional Cleaning

1) Remove the transfer cradle (12) and the undersize lever (14).
2) Use a pipe cleaner or similar effective cleaning tool to clean the bushings and pivot pins.
3) Replace the transfer cradle and the undersize lever.
4) To be certain the coin mechanism is completely free of any residue, place the mechanism in boiling water for several minutes. Carefully remove it and let it air-dry completely before reinstalling in the door.

Figure 4-8   Adjustments on Coin Mechanism

C. TV MONITOR ADJUSTMENTS

The TV monitor should be adjusted only when the picture is distorted or if the contrast or brightness seems out of adjustment.

The monitor's adjustments function like those of a conventional, home television set, except that the volume adjustment has no effect. Instead, the game produces its sound in circuits separate from the TV monitor. Figure 4-9 shows the location of the adjustments on both TV monitors used by Atari. Your game contains a TV monitor manufactured to Atari specifications by either Motorola or TEC Video electronics.

When making adjustments, follow these general guidelines:

BRITE (Brightness)—Perform this adjustment before the contrast. Adjust so that the white lines covering the screen just barely disappear, when the brightness is turned up.

CONT (Contrast)—Adjust so that the images are as bright as possible against the dark background without being blurred.

HORIZ HOLD (Horizontal Hold) or HORIZ OSC (Horizontal Oscillator)—Adjust if the picture is slightly off-center horizontally, if the images appear warped, or if the picture is broken up into a series of diagonal lines. Adjust for a stable, centered picture.

VERT HOLD (Vertical Hold)—This needs adjustment only if the picture appears to be rolling up or down the screen. Adjust for a stable, centered picture.

D. FUSE REPLACEMENT

Orbit contains seven fuses, five on the power supply assembly in the lower part of the cabinet and two on the TV monitor assembly. Power supply fuses are accessible through the access door assembly. TV fuses are also ac-
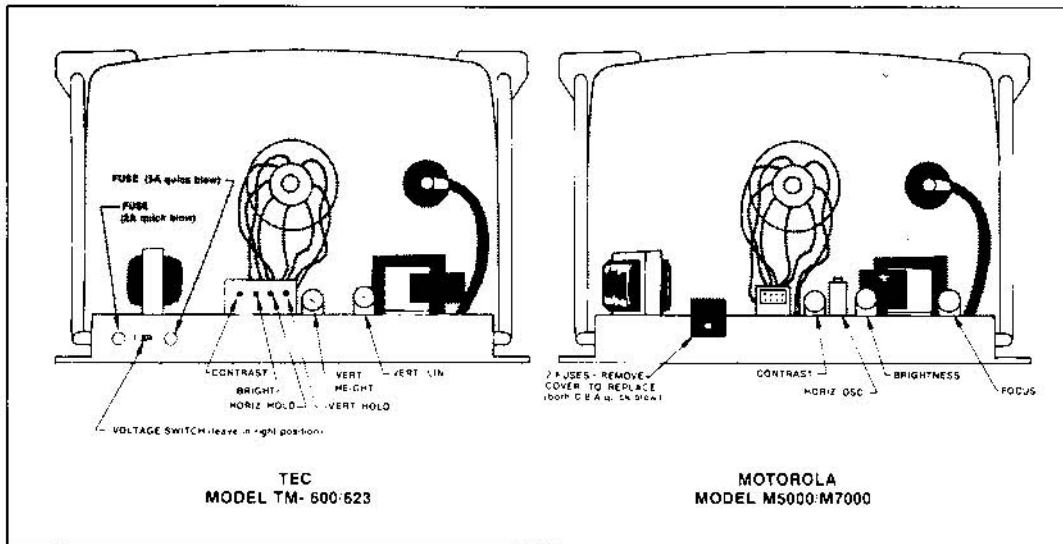
Figure 4-9   Locations of Adjustments on TV Chassis

cessible through the access door. Replace fuses only with the same type as follows:

Wells-Gardner 19V1001/22V1001 Monitors:
  3AG 1.5-amp Slo-Blo
  3AG 0.75-amp Slo-Blo

TEC TM-600/623 Monitors:
  3AG 2-amp and 0.5-amp quick-blow, 250 volts

Motorola M5000/M7000 Monitors:
  3AG 0.8-amp quick blow, 250 volts

Power Supply:
  Fuses F1 and F2—3AG 3-amp slow-blow, 250 volts
  Fuses F3 and F4—3AG 2.5-amp slow-blow, 125 volts
  Fuse F5—3AG 8-amp fast-blow, 125 volts

E. LICON SWITCH REMOVAL (See Figure 4-10)

The LED switches on the front panel have a very low failure rate. In case either switch should ever be suspect, first test it. To test the switch perform the following steps:

1. Unlock and open the coin door.
2. Remove the wires from the suspected switch.
3. Set multimeter to ohms scale.
4. Set ohms scale to R × 1, then zero the meter.
5. Connect multimeter leads to appropriate LED switch contacts. (See Figure 4-11 for designation of switch contacts and meter lead placement.)
6. Check contacts (push and release the switch button) for closed and open continuity.
7. If the contacts do not operate sharply or always remain closed or open, then replace the LED switch as outlined in Figure 4-10.

F. TV MONITOR REMOVAL (See Figure 4-11)

If the TV monitor proves to be at fault, remove the monitor as shown in Figure 4-11.
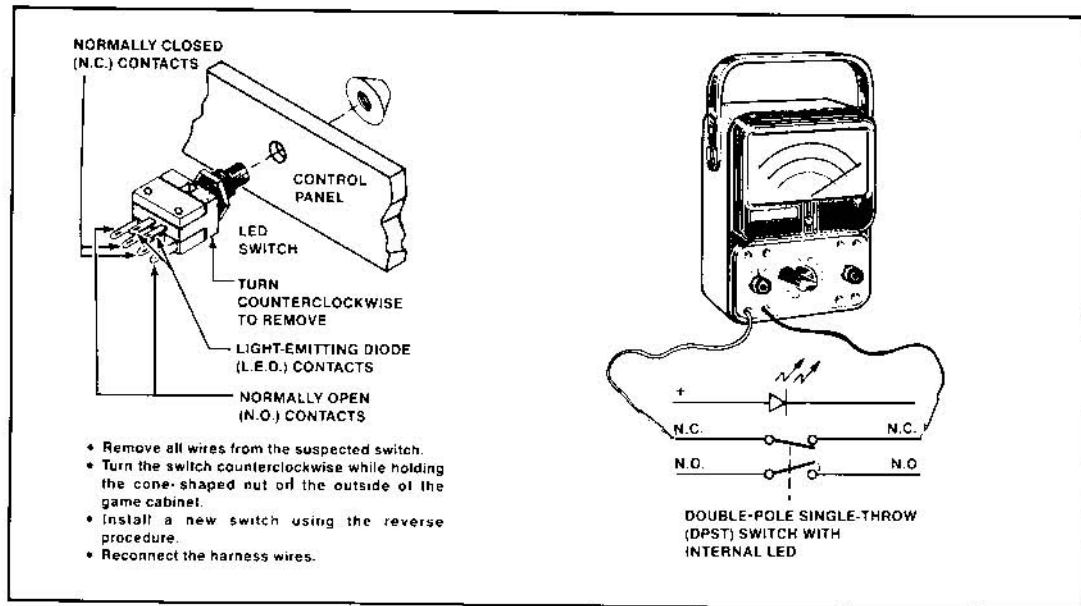
Figure 4-10 LICON Switch Removal

1. Remove control panel. Unplug connector.
2. Remove playfield Plexiglas shield.
3. Remove cardboard bezel.
4. Unplug TV monitor chassis connector and remove four carriage bolts on TV shelf assembly
5. Remove two eyebolt nuts.
6. Remove TV monitor.
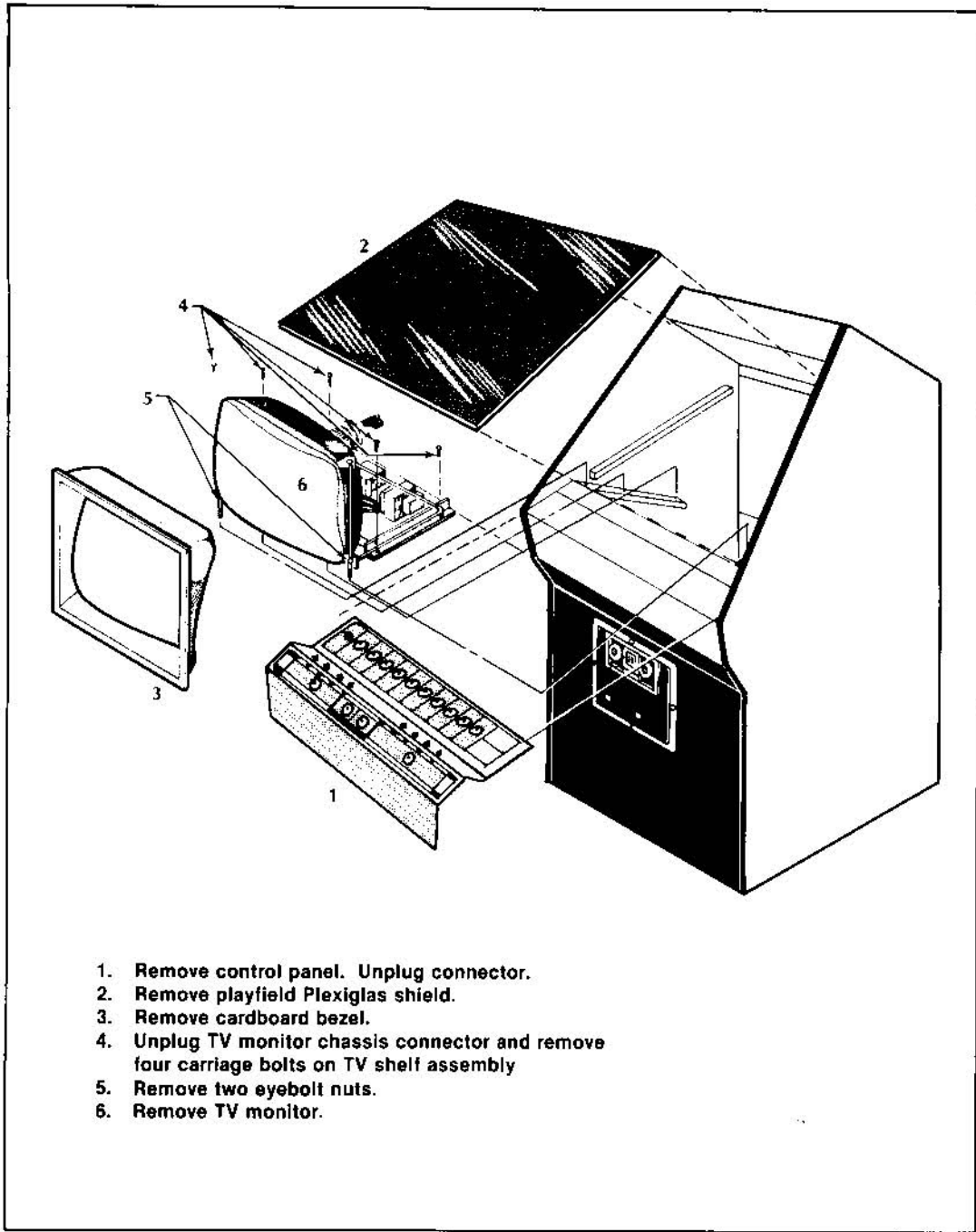
Figure 4-11   T.V. Monitor Removal
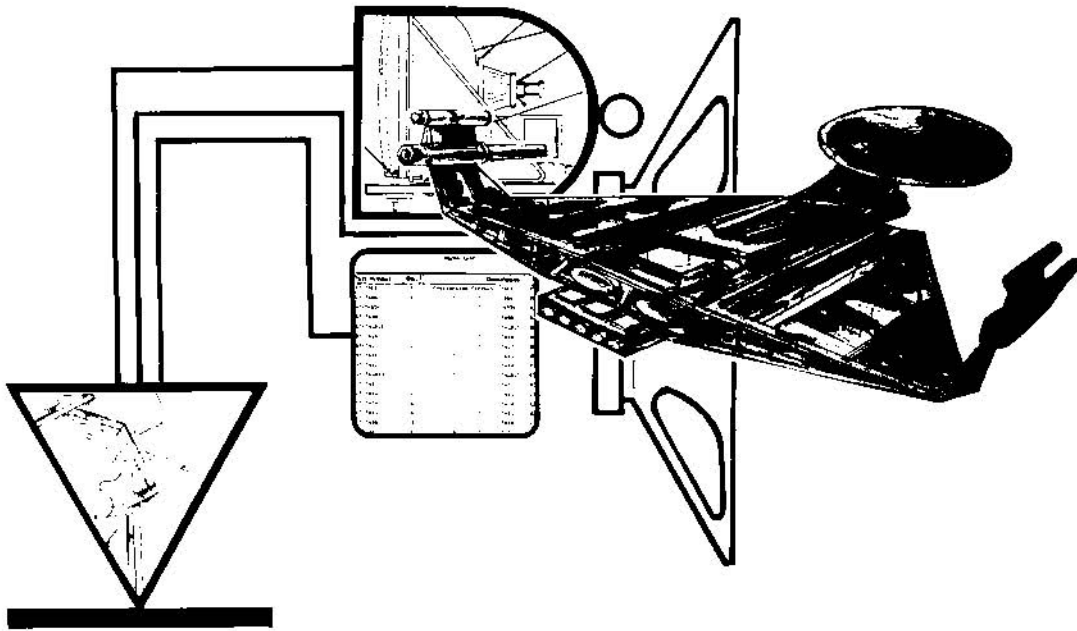
ILLUSTRATED PARTS CATALOG

The purpose of this chapter is to provide you with the necessary information for ordering replacement parts for the Orbit game.

When ordering parts from your distributor, give the part number, part name, applicable figure number of this catalog, and serial number of your Orbit 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.

SECTION Z-Z

Figure 5-1   Orbit Final Assembly A033745-01   D

5-2 ORBIT

Figure 5-1   Orbit Final Assembly A033745-01   D

Item	Part Number	Qty.	Description
1	A033744-01	1	Assy., Cabinet with Graphics
2	A033747-01	1	Assy., Control Panel
3	A008875-01	1	Assy., T.V. Shelf
4	A033750-01	1	Assy., Rear Door
5	A030867-01	1	Assy., R.F. Shield Enclosure
6	A007197-01	1	Assy., Power Supply Base
7	A009083-01	1	Assy., Coin Door
8	A007902-01	1	Assy., Cash Box
9	A033572-01	1	Assy., R.F. Shield PCB
*10	A033570-01	1	Assy., P.C. Board, Orbit (PROM version)
11	A033758-02	1	Assy., Harness and Component
12	A033016-01	1	Assy., Strain Relief Power Cord
13	A033748-01	1	Assy., Speaker Mount Panel
14	A009574-02	1	Assy., Dual Audio Amp Bd.
15			
16	007882-01	2	Cover, High Voltage
17	006870-01	1	Brkt., Coin Box
18	000869-01	2	Speaker, Grills
19	002728-01	2	Brkt., Control Panel
20	009992-01	1	On/Off Switch Cover
21	033749-01	1	Bezel with Graphics
22	008903-01	1	Shield, Plex Cover
23	033740-01	1	Panel, Cover with Graphics
24	030868-01	4	Mount, Connector
25	TM-127	1	Tech. Manual, with Illustrated Parts Catalog
26	006319-03	1	Copyright Decal
27	033095-01	2	Label, Shipping
28	005233-01	1	Seal, Rear Door
29**	TM-123	1	TEC Videoelectronics Service Manual
30			
31			
32			
33			

** The TM-125 Wells-Gardner Service Manual and the TM-124 Motorola Service
Manual are to be substituted for Item 29 if a Wells-Gardner or Motorola
monitor is used in this game.

* A substitute for Item #10 is A033570-02, 1, PCB Assy., Orbit
(ROM version)

Figure 5-1   Orbit Final Assembly
Parts List

ATARI®

Item	Part Number	Qty.	Description
34	75-99090006	6	Well Nuts, Blind Hole Fastener #10-32
35	82-8016	6	Screws, Button Hd., Socket Cap #10-32 x 1.00 Lg.
36	75-5516B	6	Carriage Bolts, ¼-20 x 1.00 Lg. Black
37	75-015S	10	Washers, Flat #¼
38	75-990505S	4	Hex Nuts, #¼-20, Nylon Locking
39	73-77015	8	Rivets, .187 x .700, Black Anodized
40	75-07021	6	#10 Nylon Black Washers
41	46-2013002	2	Fuses, 3 AMP
42	75-935	2	Nuts, Wing, #¼-20
43	75-915S	4	Nuts, Hex, #¼-20
44	75-5524	4	Carriage Bolt, ¼-20 x 1.50 Lg.
45	82-1824	10	Screws, Wood, #8 x 1½ Lg. Ft. Hd. Phil.
46	72-6812S	12	Screws, SM. Pan. Hd. Phil. #8 x 3/4" Lg.
47	72-6610S	16	Screws, SM. Pan. Hd. Phil #6 x 5/8" Lg.
48	72-6808S	5	Screws, SM. Pan. Hd. Phil. #8 x ½" Lg.
49	78-25001	1	Screw Down Tie Wrap
50	75-045S	4	Washer, Split Lock, ¼"
51			
52			
53			
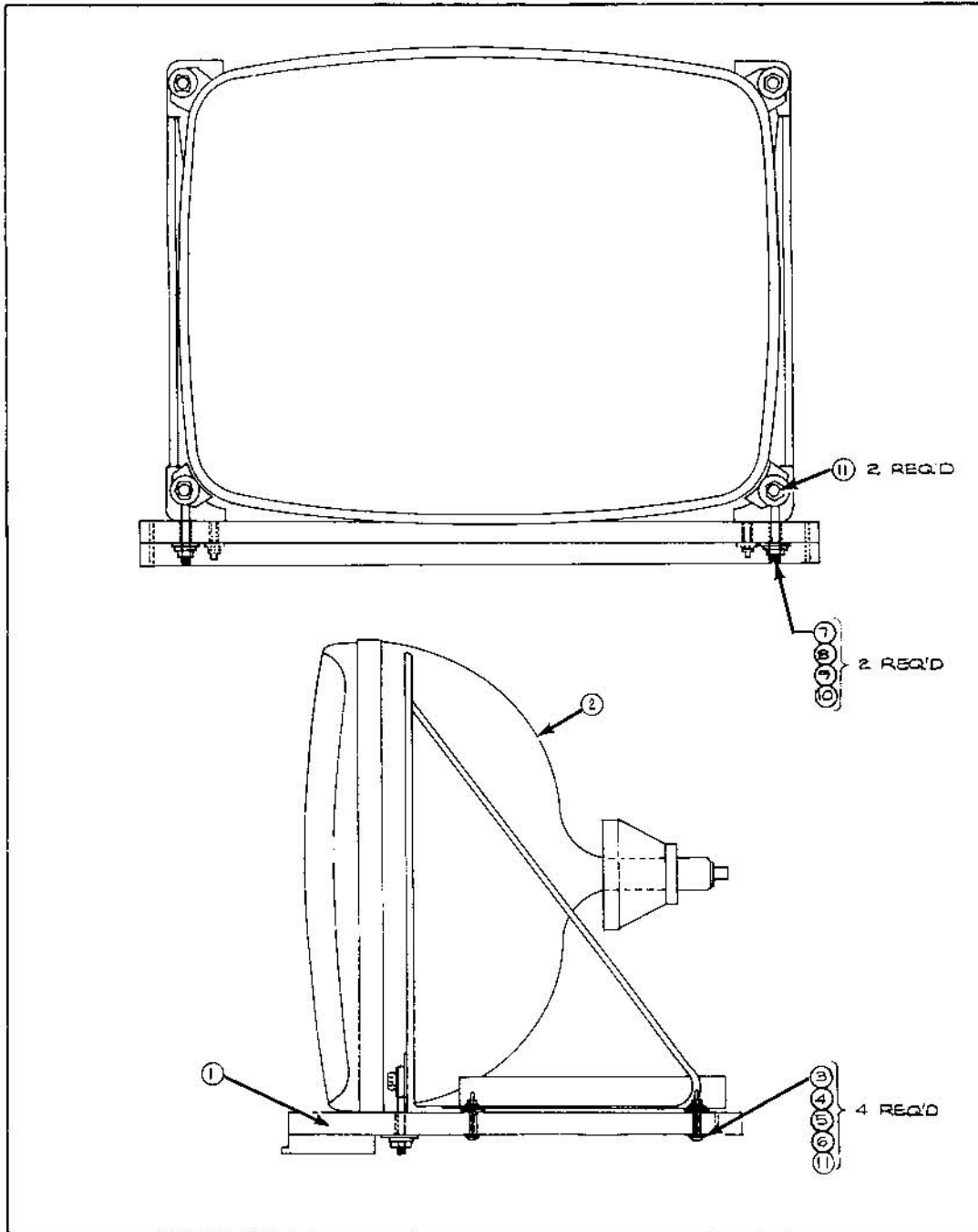
Figure 5-2 TV Monitor Assembly A008875-01   D

Figure 5-2   T.V. Monitor Assembly
Parts List

Item	Part Number	Qty.	Description
1	008897-01	1	Panel, T.V. Shelf
2	92-032	1	23" T.V. Monitor
3	75-5120	4	Carriage Bolts #10-24 x 1.25 Lg.
4	75-040	4	Lock Washer #10
5	75-911S	4	Hex Nuts, #10-24
6	75-010S	4	Flat Washers, #10
7	82-405	2	Eye Bolts, ¼-20 x 3" Lg.
8	75-07002	2	Flat Washer ¼, Fender
9	75-045	2	Lock Washers, Split ¼
10	75-915S	2	Hex Nuts, ¼-20
11	72-6012	2	Screws, Sm. #10 x 3/4" Lg.
12	75-015S	4	Flat Washer, #¼
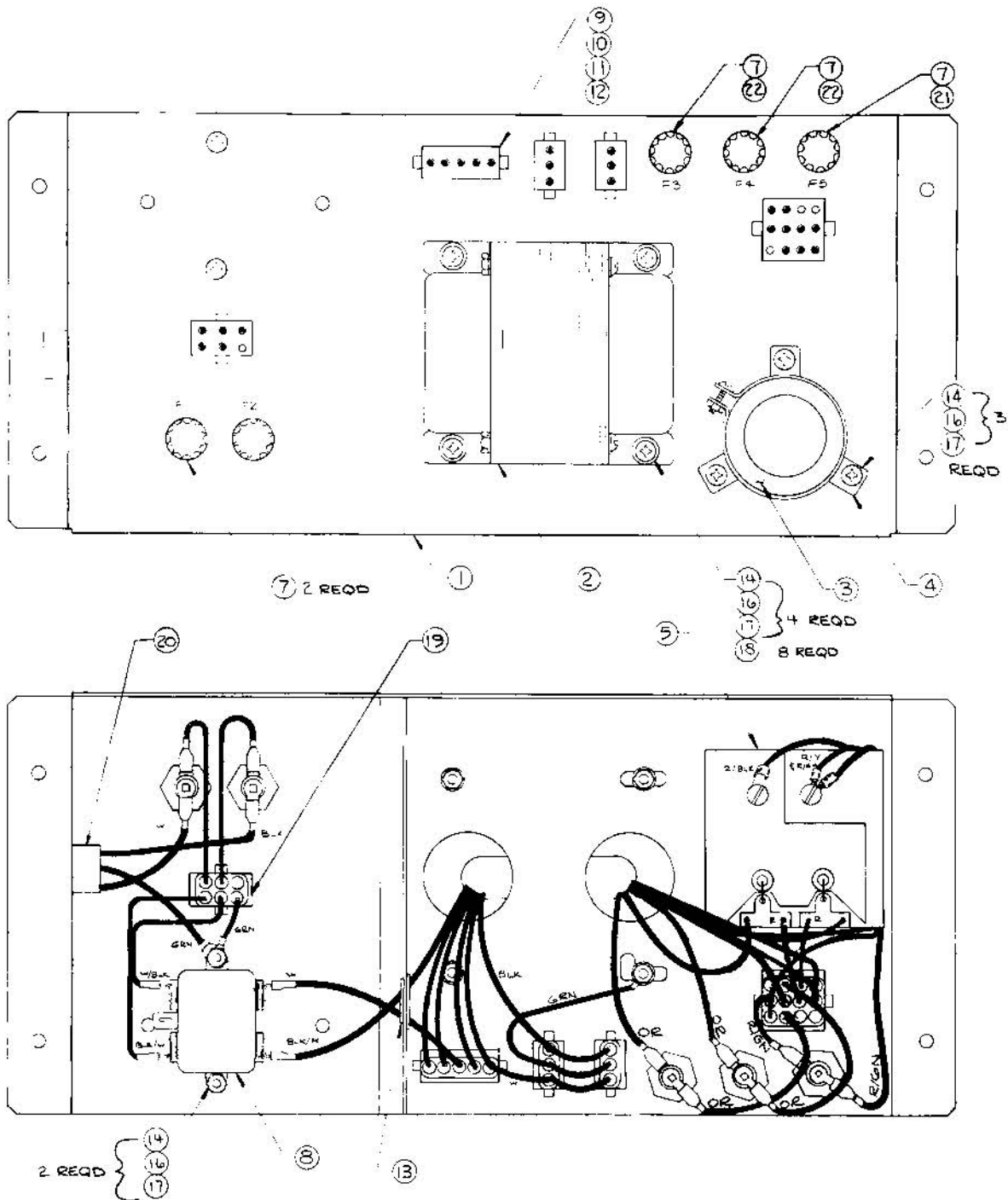
Figure 5-3 Type B Power Supply A007197-01 D

ATARI®

Figure 5-3   Type B Power Supply
Parts List

Item	Part Number	Qty.	Description
1	A009266-01	1	Power Supply Base Weldment Assembly
2	A006886-01	1	Transformer Termination Assembly "Type B"
3	29-053	1	Cap., Sprague Electrolytic 26,000 μf @ 15V
4	78-70501SC	1	Brkt., Cap. Mtg. Sprague #4586-48
5	A006555-01	1	P.C. Board Rectifier
7	79-4411004	5	Fuse Holder, Panel Mounting
8	41-2003	1	Filter, Power Line, 5 AMP
9	A006958-01	A/R	Volt Selection Block 95V
10	A006958-02	A/R	Volt Selection Block 110V
11	A006958-03	A/R	Volt Selection Block 205V
12	A006958-04	A/R	Volt Selection Block 220V
13	78-2708	1	Grommet, Plastic
14	72-1810S	9	Screw Pan Hd., #8-32 × 5/8" Lg.
16	75-048	9	Washer, Split-Lock #8
17	75-918S	9	Nut Hex #8
18	75-018S	8	Washer Flat #8
19	A007192-01	1	Power Switch Termination
20	A007444-01	1	Power In Harness
21	46-203801	1	Fuse, 8 AMP, 125V, 3 AG Fast Acting
22	46-201251	2	Fuse, 2½ AMP, 125V, Slow Acting
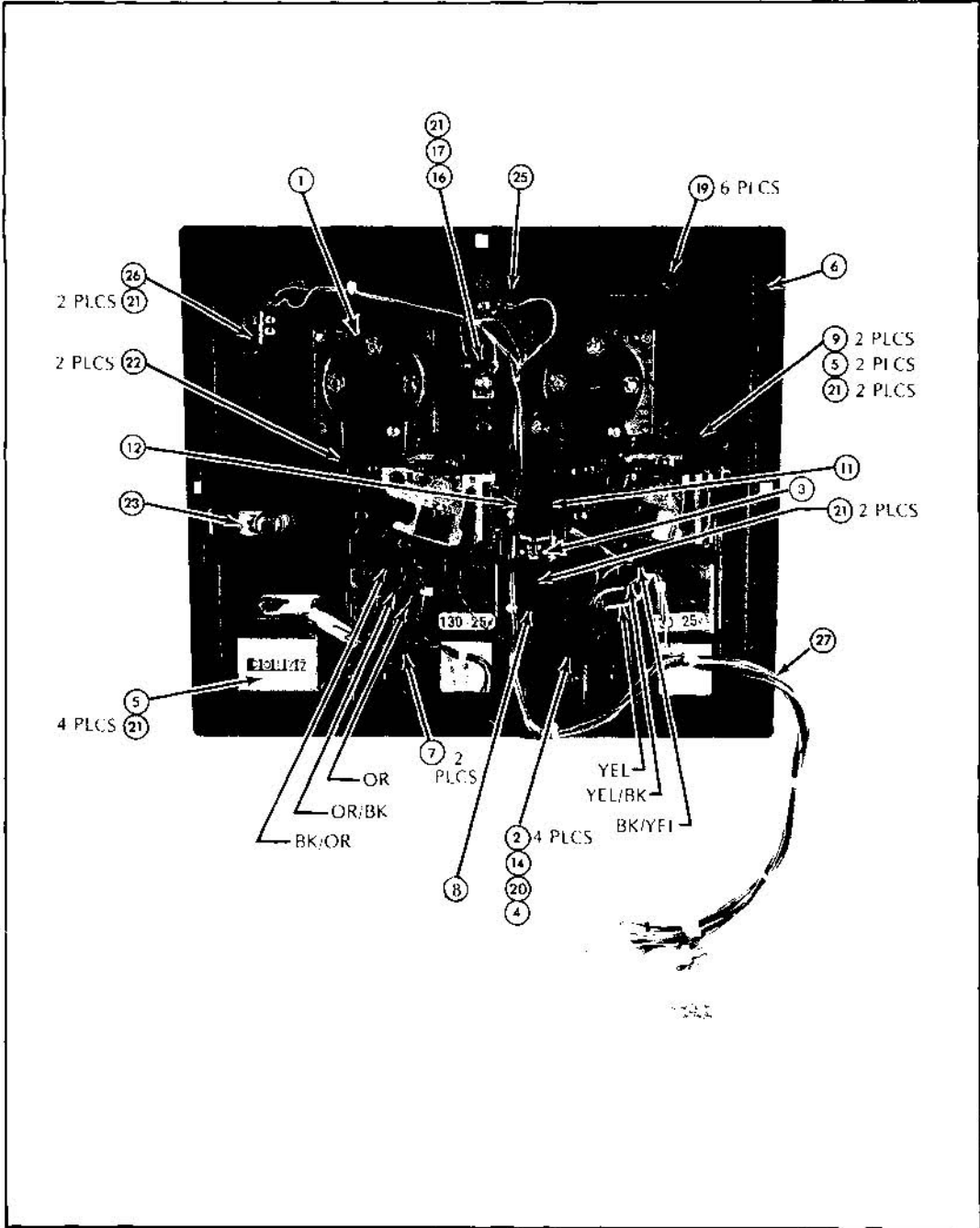
Figure 5-4 Coin Door Assembly   A009083-01   F

ATARI®

Figure 5-4   Coin Door Assembly
Parts List

Item	Part Number	Qty.	Description
1	A007637-01	1	Front Bezel Assy.—Used only on -01 Coin Door Assy.
	A007637-02	Ref.	Front Bezel Assy.—Used only on -02 Coin Door Assy.
	A007637-03	Ref.	Front Bezel Assy.—Used only on -03 Coin Door Assy.
	A007637-04	Ref.	Front Bezel Assy.—Used only on -04 Coin Door Assy.
	A007637-05	Ref.	Front Bezel Assy.—Used only on -05 Coin Door Assy.
	A007637-06	Ref.	Front Bezel Assy.—Used only on -06 Coin Door Assy.
	A007637-07	Ref.	Front Bezel Assy.—Used only on -07 Coin Door Assy. See Figure 5-5
2	75-9165	4	Nut, 6-32
3	A030362-01	1	Coin Lock-Out Assembly, See Figure 5-6
4	A007640-01	2	Coin Switch Assembly, See Figure 5-7
5	A002465-01	1	Coin Counter Assembly
6	004320-01	1	Coin Door Weldment
7	004341-01	2	Secondary Coin Chute
8	004344-01	1	Key Loop
9	004340-01	2	Spring Return
10	004337-01	2	Bracket, Wire Form
11	004338-01	1	Lock-Out, Wire Form, R.H.
12	004336-01	1	Lock-Out, Wire Form, L.H.
13	004326-01	2	Button, Scavenger
14	75-046	4	Lock Washer, #6
15	006904-01	2	Spacer
16	007359-01	1	Lamp Socket
17	70-11-47	1	Lamp
18	73-3008	2	Retaining "C" Ring, Truarc #5103-25
19	75-9914001	6	Self-Threading Nut, Tinnerman #SR188006
20	75-026S	4	Washer, #6
21	75-00516	13	Kepnut, Style 842, Stl., 6-32
22	008629-01	2	Spring
23	71-2118	1	Lock Assembly, Hudson Lock
24	71-1225CU	2	Coin Mechanism for American Quarter Only
	71-125FB	Ref.	Coin Mechanism for Belgian 5 Francs Only
	71-1205FF	Ref.	Coin Mechanism for German Mark Only
	71-1201MG	Ref.	Coin Mechanism for Swedish Krona Only
	71-1201KS	Ref.	Coin Mechanism for Japanese 100 Yen Only
	71-1210PE	Ref.	Coin Mechanism for English 10 Pence Only
	71-1220CA	Ref.	Coin Mechanism for Australian 20-Cent Piece Only
25	007753-01	1	Plate, Anti-Probe
26	A007638-01	1	Switch Assembly, Slam
27	A006921-01	1	Harness Assembly
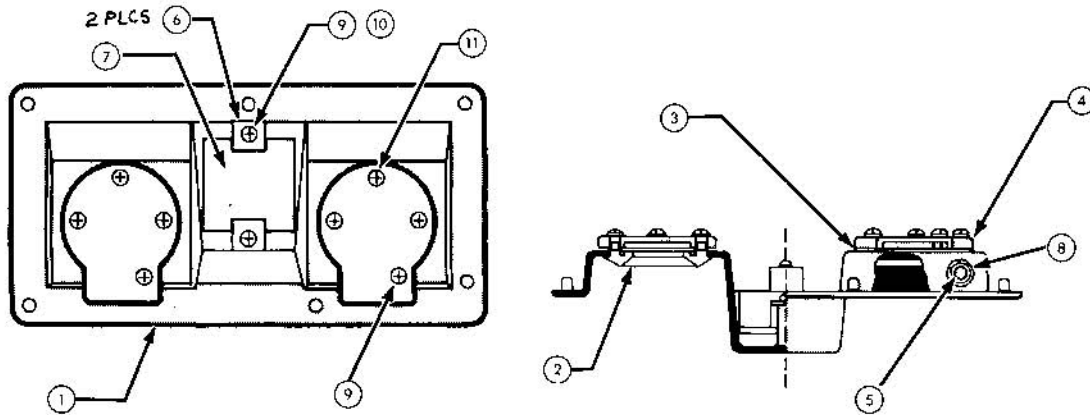
Figure 5-5   Front Bezel Assembly
A007637-01 thru -07   D

ATARI®

Parts List

Item	Part Number	Qty.	Description
1	004328-01	1	Bezel
2	See below	2	Ring
3	004331-01	2	Coin Shield
4	004332-01	2	Primary Coin Chute
5	004327-01	2	Bearing, Scavenger Button
6	004329-01	2	Clamp, Price Plate
7	See Below	1	Price Plate
8	73-3009	2	Retaining "C" Ring, Truarc #5103-37
9	72-1604S	4	Mach. Scr., 6-32 × ¼ Lg. Pan Hd., Phil
10	75-046	2	Washer, #6, Split-Lock
11	75-9914001	6	Self-Threading Nut, Tinnerman #SR188006

FRONT BEZEL ASSY VERSION	ITEM 2	ITEM 7	DENOMINATION
-01	004330-01	004343-01	25¢
-02	004330-01	004343-06	5 FR
-03	009153-01	004343-04	1 DM
-04	004330-01	004343-03	1 KR
-05	009520-01	004343-05	100 Y
-06	007752-01	004343-02	10 P
-07	007752-01	004343-07	20¢ AUST.

RELAY COIL
(PER A007639-01)
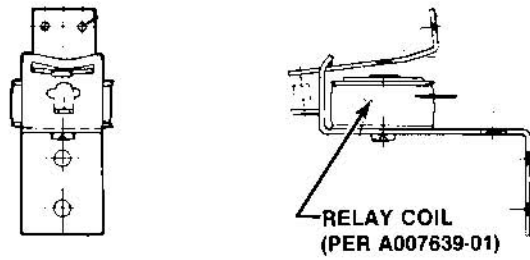
NOTES:

1. Coil data: 10 VDC ± 2, 50 Ω resistance, current 200 ma maximum.

2. Manufacturer: Coin Mech, Inc.

DETAIL OF RELAY COIL (A007639-01)
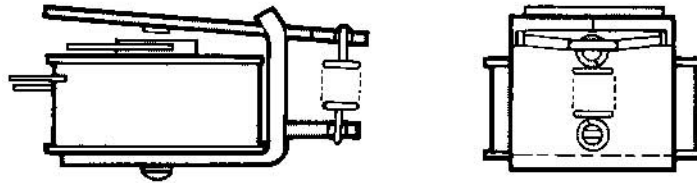
Figure 5-6   Coin Lockout Assembly
A030362-01   A
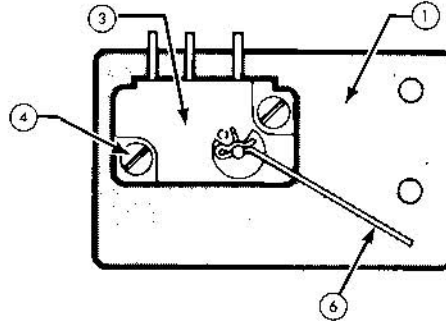
Figure 5-7   Coin Switch Assembly
A007640-01   D

Parts List

ITEM	PART NO.	DESCRIPTION	QTY
1	004342-01	Switch Mounting Plate	1
2			
3	65-441C	Switch, Omron C-5G3-3	1
4	72-HA4412	Screw MS, #4-40 x ¾ LG Roll-Tight Self-Tapping	2
5			
6	008824-01	Wireform, Cherry	1

Figure 5-8   Control Panel Assembly
            A033747-01   A
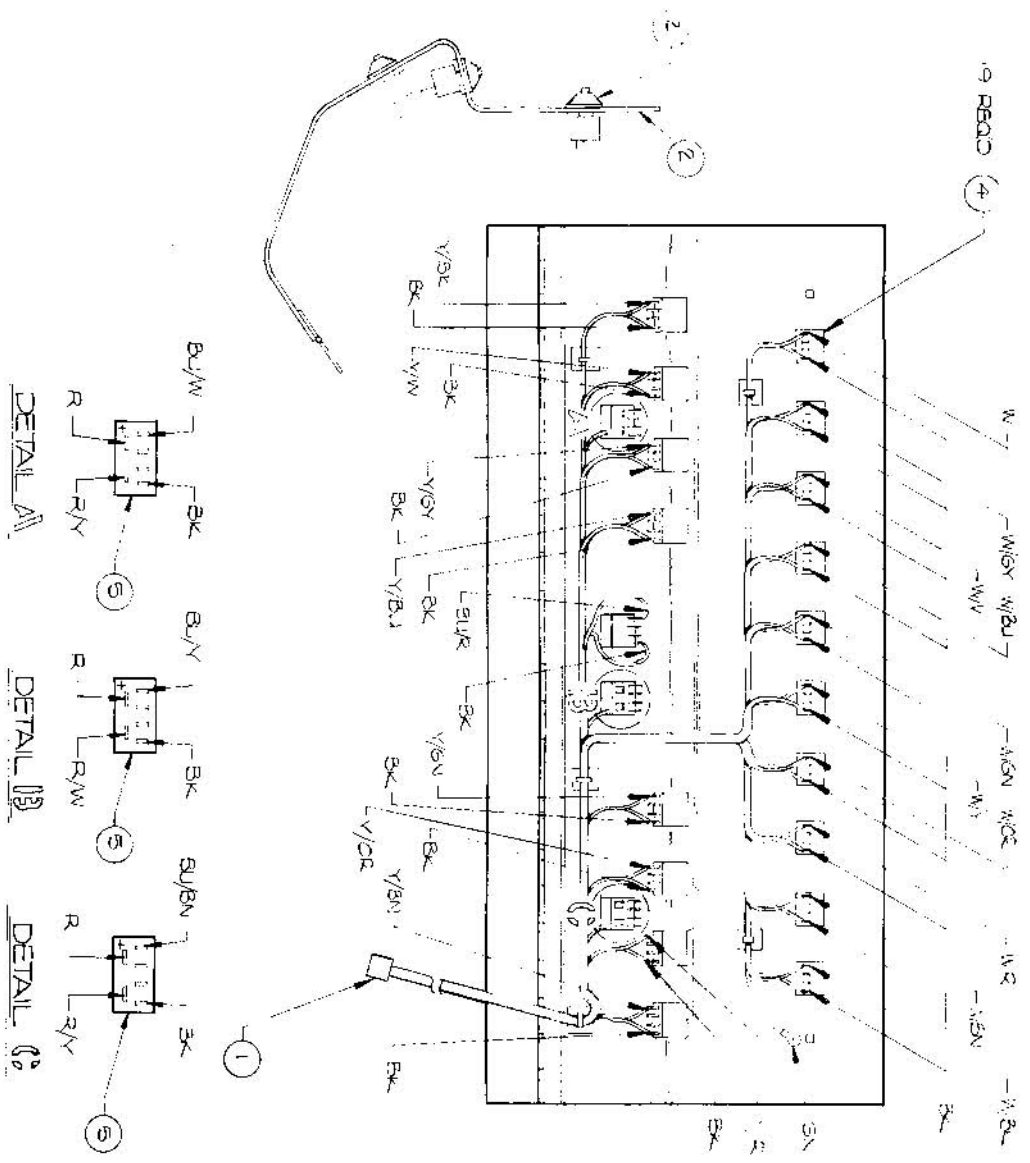
Item	Part Number	Qty.	Description
1	A033759-01	1	Assy., Control Harness
2	033742-01	1	Panel, Control with Graphics
3	033127-01	22	Busing, Switch Molded
4	62-009	19	Switch, Licon #76-7151
5	62-002	3	Switch, Licon #01-700157
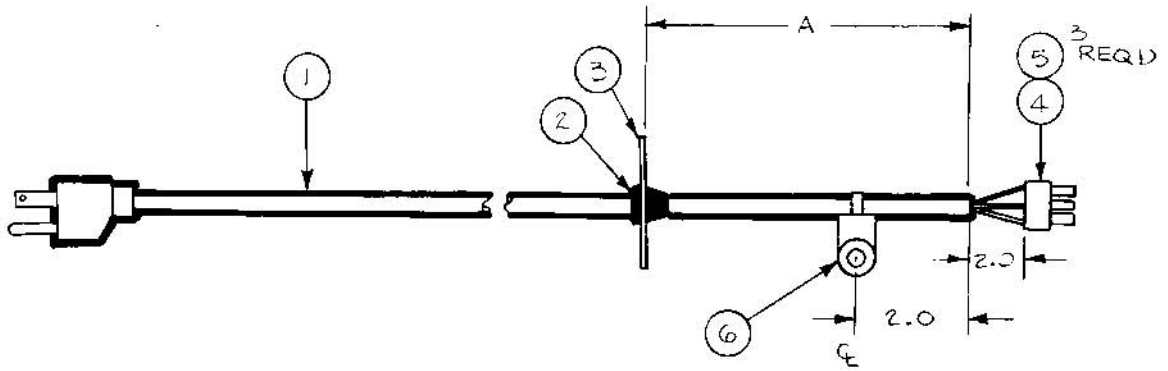
**3 POSITION AMP PLUG
AND PINS**
1 BK
2 GN
3 W

Parts List

Item	Part Number	Qty.	Description
1	54-410	1	Power Cord, 12 Foot
2	78-2112P	1	Strain Relief
3	033211-01	1	Washer, Centering
4	79-58110	1	AMP Plug, 3 Pos #1-480700-0
5	79-20123	3	AMP Pin #350547-1
6	78-25002	1	Screw-down Tie Wrap (#10 Screw)

Figure 5-9   Strain Relief Power Cord Assembly
A033016-01   B
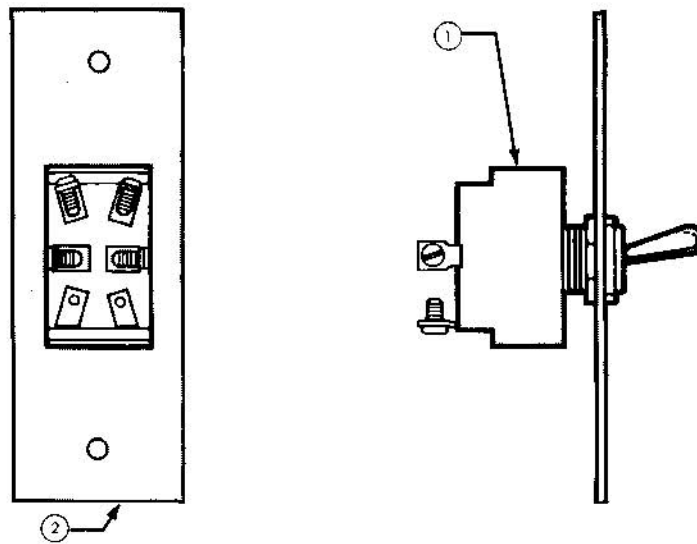
Parts List

Item	Part Number	Qty.	Description
1	61-062A	1	Toggle Switch, DPST Carling Switch #2GK54
2	006450-01	1	Mounting Plate, On-Off Switch

Figure 5-10   On/Off Switch Assembly
A006449-01

CONTACTS

PLUNGER

*To lock switch in "on"
position, pull out plunger
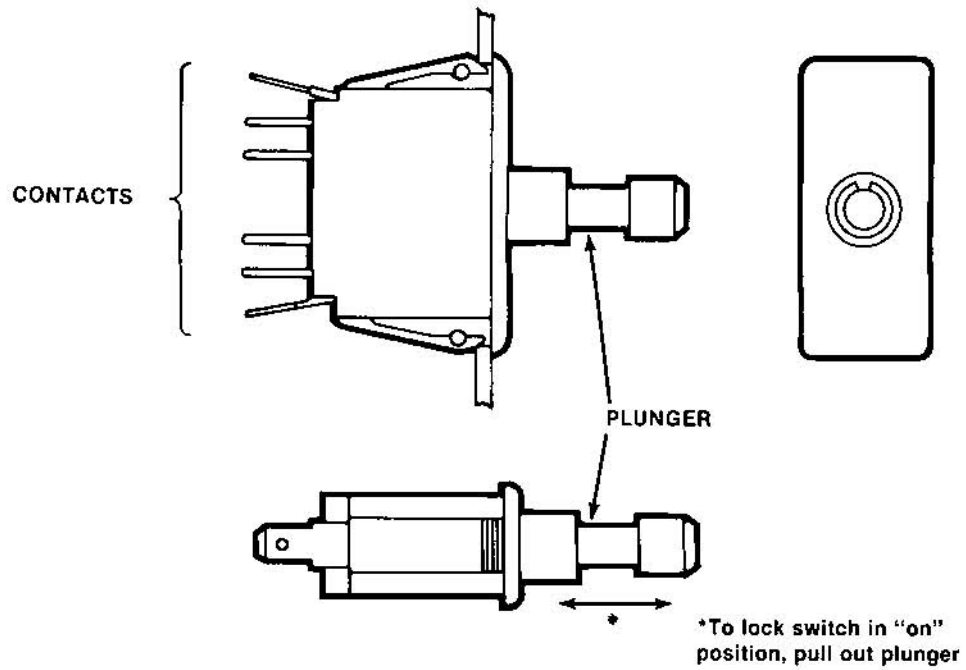
Figure 5-12   Interlock Switch Assembly
62-002

CONTACTS

PIN LAYOUT

RED LENS
PUSHBUTTON
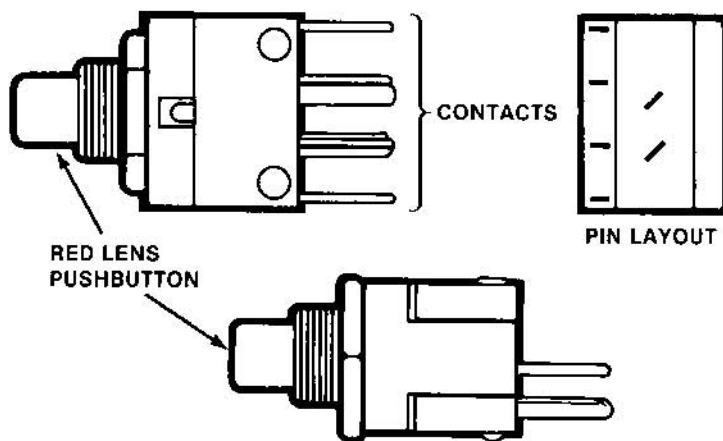
Figure 5-13   LED Pushbutton Switch Assembly (Red)
60-002
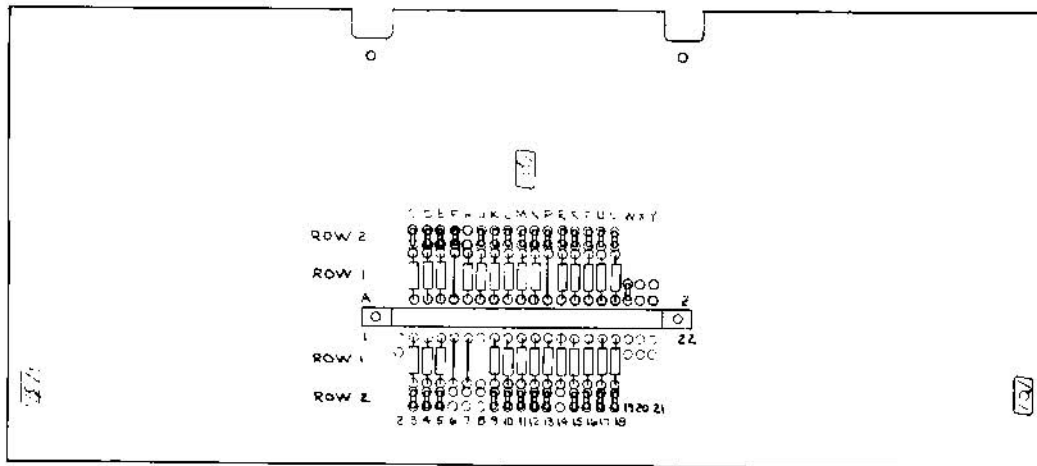
Parts List

Item	Part Number	Qty.	Description
1	030835-01	1	P.C. Board
2	2D-1016	28	Capacitor, Monolithic, .1 μf, 50V
3	41-3003	14	Inductor, 100 μh
4	52-003	13	Jumper, .600 Centers
5	75-E6106081	3	Wingscrew, #6-32 × ½ Lg.
6	75-992501	3	Fastener, ¼-Turn, #6-32, Stainless Steel
7	79-517222	1	Connector, 44-Pin, P.C. Mount

Figure 5-14   RF Shield PCB Assembly
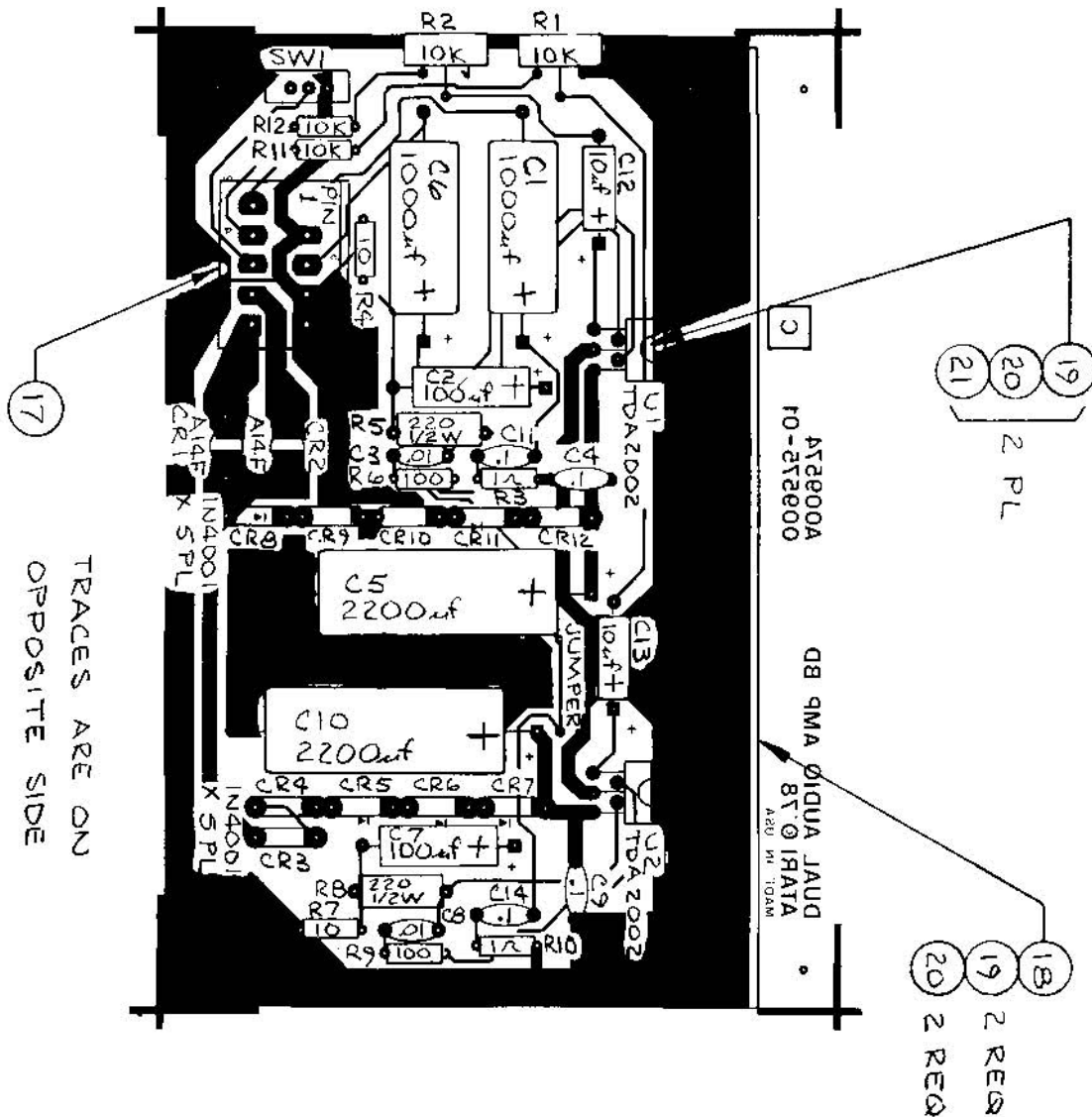
Figure 15   Dual Audio Amplifier PCB Assembly
A009574-02

Figure 15   Dual Audio Amplifier Assembly
Parts List

Item	Part Number	Qty.	Description	
1	009575-01	1	P.C. Board	
2	10-51P0	2	Res, Carbon, 5%, ¼W, 1 OHM	R3,10
3	10-5101	2	" " " " 100 "	R6,9
4	10-5100	2	" " " " 10 "	R4,7
5	11-5221	2	" " " ½W, 220 "	R5,8
6	19-316103	2	Trimpot, 10K	R1,2
7	24-250106	2	CAP, Electrolytic, 25V, 10uf	C12,13
8	24-250107	2	" " " 100uf	C2,7
9	24-250108	2	" " " 1000uf	C1,6
10	24-250228	2	" " " 2200uf	C5,C10
11	27-101103	2	" Ceramic, 100V, .01uf	C3,8
12	27-250104	4	" " 25V, .1uf	C4,9,11,14
13	31-A14F	2	Diode A14F	CR1,2
14	31-IN4001	10	Diode IN4001	CR3-12
15	37-TDA2002V	2	Audio AMP, TDA2002V	U1,2
16	69-004	1	Switch, Slide	SW1
17	78-58005	1	Connector, 10-Position	
18	030184-01	1	Heatsink	
19	72-1604C	4	Screw, P.H., Phil., #6-32 x ¼ Lg Cres	
20	75-056	4	Washer, Lock, Int Star #6	
21	78-16009	2	Silpad	
22	10-5103	2	Res, Carbon, 5%, ¼W, 10K OHM	R11,R12
23	52-003	1	Jumper, .60 Centers	

Figure 5-16 Orbit PCB Assembly
A033570-01, -02   A

Figure 5-16   Orbit PCB Assembly
Parts List
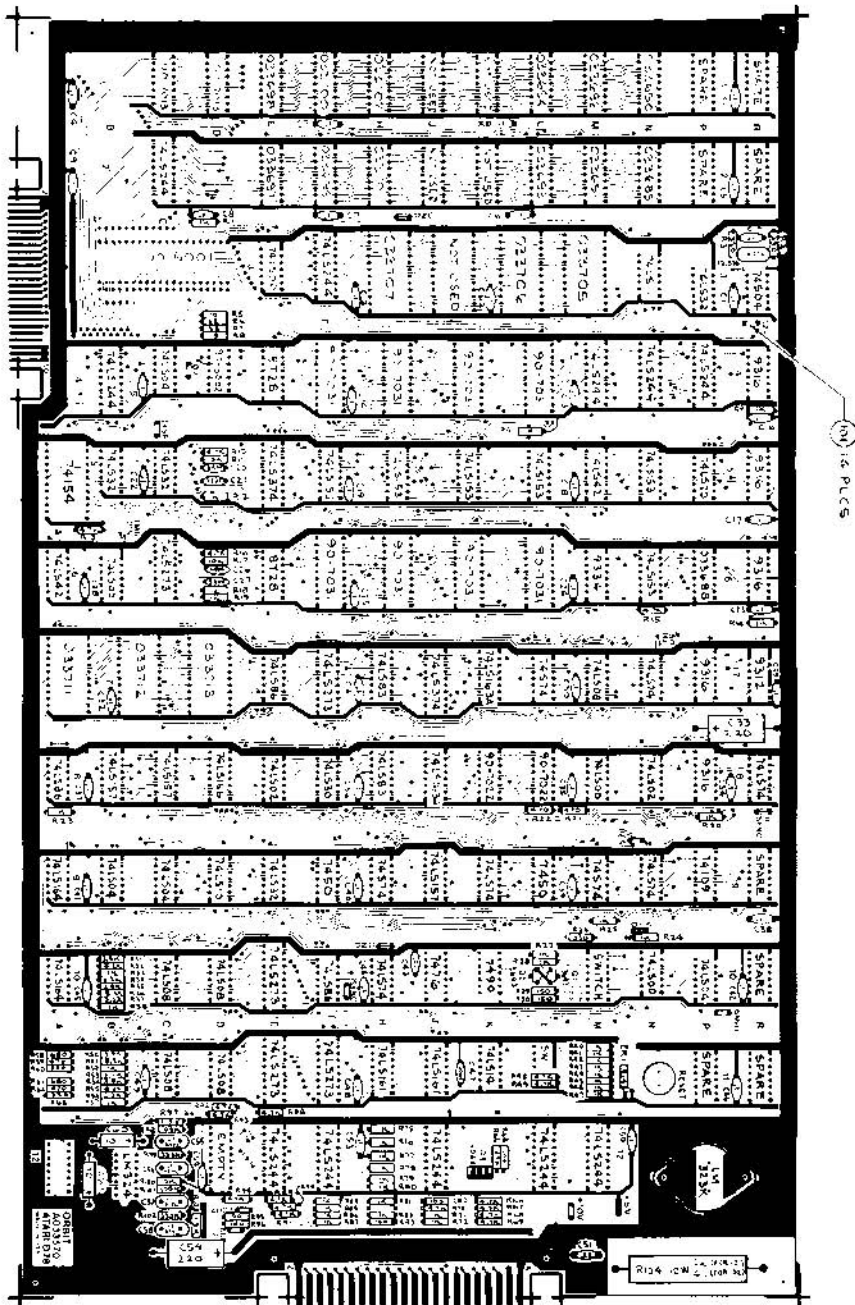Version -01

Item	Part Number	Qty.	Description
1	033571-01	1	P.C. Board
2	10-5100	2	Res., Carbon, ¼W. 5%, 10 Ohm R5,8
3	10-5101	3	" " " " 100 " R64,95,96
4	10-5102	40	" " " " 1K " R1,4,9,14,18-20, 23-25,27,28,33,38, 40-47,52,57,71,72, 75-81,83-87,109,12
5	10-5103	4	" " " " 10K " R11,17,100,105
6	10-5104	2	" " " " 100K " R98,101
7	10-5151	2	" " " " 150 " R29,30
8	10-5220	2	" " " " 22 " R6,7
9	10-5221	3	" " " " 220 " R60,63,108
10	10-5222	4	" " " " 2.2K " R34,37,53,56
11	10-5331	3	" " " " 330 " R2,3,26
12	10-5334	2	" " " " 330K " R99,102
13	10-5392	4	" " " " 3.9K " R31,35,50,54
14	10-5471	5	" " " " 470 " R21,22,59,62,65
15	10-5472	18	" " " " 4.7K " R10,13,15,16,48, 49,66-70,88-94
16	10-5682	2	" " " " 6.8K " R58,61
17	10-5822	4	" " " " 8.2K " R32,36,51,55
18	10-5152	2	" " " " 1.5K " R97,103
19	10-5223	1	" " " " 22K " R106
20	19-8D9W2P0	1	" Wirewound, 20W, 2 " R104
21	10-5683	1	" Carbon, ¼W, 5%, 68K " R107
22	21-101104	4	Cap., Mylar, 100V, .1µf C55-58
23			
24			
25	24-250106	2	Cap., Elec., 25V, 10µf C60,61
26	24-250227	2	" " " 220µf C33,59
27			
28			
29	27-250103	1	Cap., Cer. Disc, 25V, .01µf C43
30	27-250104	46	" " " " .1 µf C1-19,22-25,28-32, 34-42,44-46,48-50, 53,54,62
31	27-250224	1	" " " " .22µf C51

Figure 5-16   Orbit PCB Assembly
Parts List
Version -01

ATARI

Item	Part Number	Qty.	Description	
32				
33	28-101101	1	Cap., Mica, 100V, 100pf	C47
34	28-101330	2	" " " 33pf	C21,27
35	28-101680	2	" " " 68pf	C20,26
36				
37				
38	31-1N100	2	Diode, 1N100	CR2,3
39	31-1N914	1	" 1N914	CR1
40				
41	34-2N3643	2	Transistor, 2N3643	Q1,2
42	34-2N6044	1	" 2N6044	Q3
43				
44				
45	37-74LS00	4	Integrated Circuit, 74LS00	E3,B6,M8,N10
46	37-74LS02	2	" " 74LS02	E8,N8
47	37-74LS04	4	" " 74LS04	C4,B9,C9,P10
48	37-74S04	1	" " 74S04	R3
49	37-74LS08	5	" " 74LS08	M7,C10,D10,C11,D11
50	37-74LS10	1	" " 74LS10	D9
51	37-74LS11	1	" " 74LS11	N3
52	37-74LS14	1	" " 74LS14	K11
53	37-74LS20	1	" " 74LS20	P5
54	37-74LS30	1	" " 74LS30	F8
55	37-74LS32	4	" " 74LS32	P3,B5,C5,E9
56	37-74LS42	2	" " 74LS42	M5,A6
57	37-7450	2	" " 7450	F9,L9
58	37-74LS74	5	" " 74LS74	N7,R8,K9,N9,H10
59	37-74S74	3	" " 74S74	L7,H9,M9
60	37-7476	1	" " 7476	J10
61	37-74LS83	2	" " 74LS83	H7,H8
62	37-74LS86	3	" " 74LS86	E7,A8,F10
63	37-7490	1	" " 7490	K10
64	37-74109	1	" " 74109	P9
65	37-74LS153	6	" " 74LS153	F5,H/J5,K5,L5,N5,N6
66	37-74154	1	" " 74154	A5
67	37-74LS157	3	" " 74LS157	B8,C8,J9
68	37-74LS161	2	" " 74LS161	H11,J11
69	37-74LS163A	2	" " 74LS163A	K7,J8
70	37-74LS164	2	" " 74LS164	A9,A10
71	37-74LS166	1	" " 74LS166	D8
72	37-74LS244	11	" " 74LS244	C2,F3,B4,M4,N4,P4, F12,F12,J12,L12,M12
73	37-74LS273	5	" " 74LS273	C6,F7,E10,E11,F11
74	37-74LS374	2	" " 74LS374	E5,J7
75	37-8T28	2	" " 8T28	E4,E6
76	37-9312	1	" " 9312	R7
77	37-9316	5	" " 9316	R4,R5,R6,P7,P8
78	37-9334	1	" " 9334	M6
79	37-LM323K	1	Regulator LM323K	
80	37-LM324	1	Audio Amp LM324	B12
81				
82				
83	62-001	1	Switch, SPST, Mom (Reset)	
84	66-114PIT	1	" SPST, x4, Dip	L11

Figure 5-16   Orbit PCB Assembly
Parts List
Version -01

ATARI®

Item	Part Number	Qty.	Description	
85	66-118PIT	1	Switch, SPST, x8, Dip	M10
86				
87				
88	72-1608C	2	Screw, Pan Hd, Ph, 6-32 x ½ Lg, Cres	
89	75-016	2	Washer, Flat, #6	
90	75-056C	2	Washer, Lock, Int, Star, #6, Cres	
91	75-916C	2	Nut, Hex, #6-32, Cres	
92				
93	78-06001	1	Heatsink (LM323K)	
94	78-16005	1	Silpad (LM323K)	
95				
96	009470-01	2	Heatsink (82S17)	K8,L8
97	78-03016	AR	Cement (82S17)	
98				
99	79-42C40	1	Socket, 40-Pin, Med-Insertion	C3
100				
101	020670-01	14	Test Point	
102				
103	90-102	1	Crystal, 12.096 MHz	Y1
104				
105	90-6001	1	Microprocessor (6800)	C3
106	90-6002	1	MPU Clock Buffer (MPQ6842)	D4
107	90-7013	2	RAM (2111)	C1,D1
108	90-7022	2	RAM, Plfld 1, 0 (82S17)	K8,L8
109	90-7031	8	RAM (2101A-4)	F4,H/J4,K4,L4,F6, H/J6,K6,L6
110				
111	033688-01	1	PROM, Sync (82S129)	P6
112	033711-01	1	PROM, Alphanum (82S115)	A7
113	033712-01	1	ROM, Motion 1 (8316E)	B/C7
114	033713-01	1	ROM, Motion 0 (8316E)	D7
115				
116	033689-01	1	PROM, Prog 4 (82S137)	N2
117	033690-01	1	PROM, Prog 4 "	N1
118	033691-01	1	PROM, Prog 3 " MSB	M2
119	033692-01	1	PROM, Prog 3 "	M1
120	033693-01	1	PROM, Prog 2 "	L2
121	033694-01	1	PROM, Prog 2 "	L1
122				
123				
124	033697-01	1	PROM, Prog 4 "	E2
125	033698-01	1	PROM, Prog 4 "	E1
126	033699-01	1	PROM, Prog 3 " LSB	F2
127	033700-01	1	PROM, Prog 3 "	F1
128	033701-01	1	PROM, Prog 2 "	H2
129	033702-01	1	PROM, Prog 2 "	H1

Item	Part Number	Qty.	Description
1	033571-01	1	P.C. Board
2	10-5100	2	Res., Carbon, ¼W. 5%, 10 Ohm R5,8
3	10-5101	3	" " " " 100 " R64,95,96
4	10-5102	40	" " " " 1K " R1,4,9,14,18-20, 23-25,27,28,33,38, 40-47,52,57,71,72, 75-81,83-87,109,12
5	10-5103	4	" " " " 10K " R11,17,100,105
6	10-5104	2	" " " " 100K " R98,101
7	10-5151	2	" " " " 150 " R29,30
8	10-5220	2	" " " " 22 " R6,7
9	10-5221	3	" " " " 220 " R60,63,108
10	10-5222	4	" " " " 2.2K " R34,37,53,56
11	10-5331	3	" " " " 330 " R2,3,26
12	10-5334	2	" " " " 330K " R99,102
13	10-5392	4	" " " " 3.9K " R31,35,50,54
14	10-5471	5	" " " " 470 " R21,22,59,62,65
15	10-5472	18	" " " " 4.7K " R10,13,15,16,48, 49,66-70,88-94
16	10-5682	2	" " " " 6.8K " R58,61
17	10-5822	4	" " " " 8.2K " R32,36,51,55
18	10-5152	2	" " " " 1.5K " R97,103
19	10-5223	1	" " " " 22K " R106
20	19-8D9W2P0	1	" Wirewound, 20W, 2 " R104
21	10-5683	1	" Carbon, ¼W, 5%, 68K " R107
22	21-101104	4	Cap., Mylar, 100V, .1µf C55-58
23			
24			
25	24-250106	2	Cap., Elec., 25V, 10µf C60,61
26	24-250227	2	" " " 220µf C33,59
27			
28			
29	27-250103	1	Cap., Cer. Disc, 25V, .01µf C43
30	27-250104	46	" " " " .1 µf C1-19,22-25,28-32, 34-42,44-46,48-50, 53,54,62
31	27-250224	1	" " " " .22µf C51

Figure 5-16   Orbit PCB Assembly
Parts List
Version -02

Item	Part Number	Qty.	Description	
32				
33	28-101101	1	Cap., Mica, 100V, 100pf	C47
34	28-101330	2	" " " 33pf	C21,27
35	28-101680	2	" " " 68pf	C20,26
36				
37				
38	31-1N100	2	Diode, 1N100	CR2,3
39	31-1N914	1	" 1N914	CR1
40				
41	34-2N3643	2	Transistor, 2N3643	Q1,2
42	34-2N6044	1	" 2N6044	Q3
43				
44				
45	37-74LS00	4	Integrated Circuit, 74LS00	E3,B6,M8,N10
46	37-74LS02	2	" " 74LS02	E8,N8
47	37-74LS04	4	" " 74LS04	C4,B9,C9,F10
48	37-74S04	1	" " 74S04	R3
49	37-74LS08	5	" " 74LS08	M7,C10,D10,C11,D11
50	37-74LS10	1	" " 74LS10	D9
51	37-74LS11	1	" " 74LS11	N3
52	37-74LS14	1	" " 74LS14	K11
53	37-74LS20	1	" " 74LS20	P5
54	37-74LS30	1	" " 74LS30	F8
55	37-74LS32	4	" " 74LS32	P3,B5,C5,E9
56	37-74LS42	2	" " 74LS42	M5,A6
57	37-7450	2	" " 7450	F9,L9
58	37-74LS74	5	" " 74LS74	N7,R8,K9,N9,H10
59	37-74S74	3	" " 74S74	L7,H9,M9
60	37-7476	1	" " 7476	J10
61	37-74LS83	2	" " 74LS83	H7,H8
62	37-74LS86	3	" " 74LS86	E7,A8,F10
63	37-7490	1	" " 7490	K10
64	37-74109	1	" " 74109	P9
65	37-74LS153	6	" " 74LS153	F5,H/J5,K5,L5,N5,N6
66	37-74154	1	" " 74154	A5
67	37-74LS157	3	" " 74LS157	B8,C8,J9
68	37-74LS161	2	" " 74LS161	H11,J11
69	37-74LS163A	2	" " 74LS163A	K7,J8
70	37-74LS164	2	" " 74LS164	A9,A10
71	37-74LS166	1	" " 74LS166	D8
72	37-74LS244	11	" " 74LS244	C2,F3,B4,M4,N4,P4, E12,F12,J12,L12,M12
73	37-74LS273	5	" " 74LS273	C6,F7,E10,E11,P11
74	37-74LS374	2	" " 74LS374	E5,J7
75	37-8T28	2	" " 8T28	E4,E6
76	37-9312	1	" " 9312	R7
77	37-9316	5	" " 9316	R4,R5,R6,P7,P8
78	37-9334	1	" " 9334	M6
79	37-LM323K	1	Regulator LM323K	
80	37-LM324	1	Audio Amp LM324	B12
81				
82				
83	62-001	1	Switch, SPST, Mom (Reset)	
84	66-114PIT	1	" SPST, x4, Dip	L11

Figure 5-16   Orbit PCB Assembly
Parts List
Version -02

Item	Part Number	Qty.	Description	
85	66-118PIT	1	Switch, SPST, x8, Dip	M10
86				
87				
88	72-1608C	2	Screw, Pan Hd, Ph, 6-32 x ½ Lg, Cres	
89	75-016	2	Washer, Flat, #6	
90	75-056C	2	Washer, Lock, Int, Star, #6, Cres	
91	75-916C	2	Nut, Hex, #6-32, Cres	
92				
93	78-06001	1	Heatsink (LM323K)	
94	78-16005	1	Silpad (LM323K)	
95				
96	009470-01	2	Heatsink (82S17)	X8,L8
97	78-03016	AR	Cement (82S17)	
98				
99	79-42C40	1	Socket, 40-Pin, Med-Insertion	C3
100				
101	020670-01	14	Test Point	
102				
103	90-102	1	Crystal, 12.096 MHz	Y1
104				
105	90-6001	1	Microprocessor (6800)	C3
106	90-6002	1	MPU Clock Buffer (MPQ6842)	D4
107	90-7013	2	RAM (2111)	C1,D1
108	90-7022	2	RAM, Plfld 1, 0 (82S17)	K8,L8
109	90-7031	8	RAM (2101A-4)	F4,H/J4,K4,L4,F6, H/J6,K6,L6
110				
111	033688-01	1	PROM, Sync (82S129)	P6
112	033711-01	1	PROM, Alphanum (82S115)	A7
113	033712-01	1	ROM, Motion 1 (8316E)	B/C7
114	033713-01	1	ROM, Motion 0 (8316E)	D7
115				
116				
117				
118				
119				
120				
121				
122				
123				
124				
125				
126				
127				
128				
129				
130				
131				
132	033705-01	1	ROM, Prog 4 (8316E)	L/M3
133	033706-01	1	ROM, Prog 3 "	K/L3
134	033707-01	1	ROM, Prog 2 "	J3
135				

APPENDIX A

Reference Drawings

List of Reference Drawings

Figure 1 Orbit PCB Schematic Diagram
Sheet 1 of 6
033570-01, 02

ORBIT A-3

A-4 ORBIT
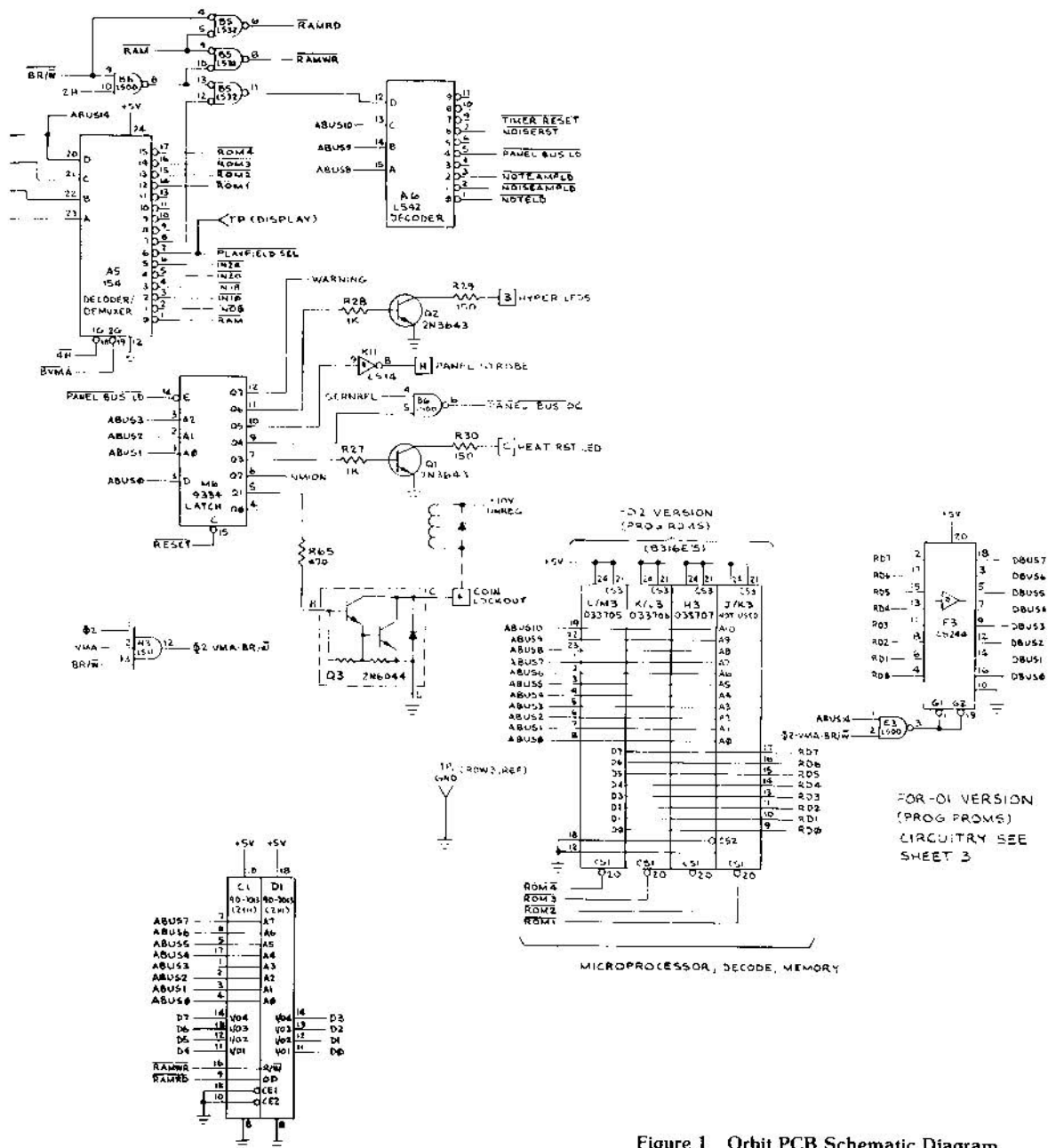
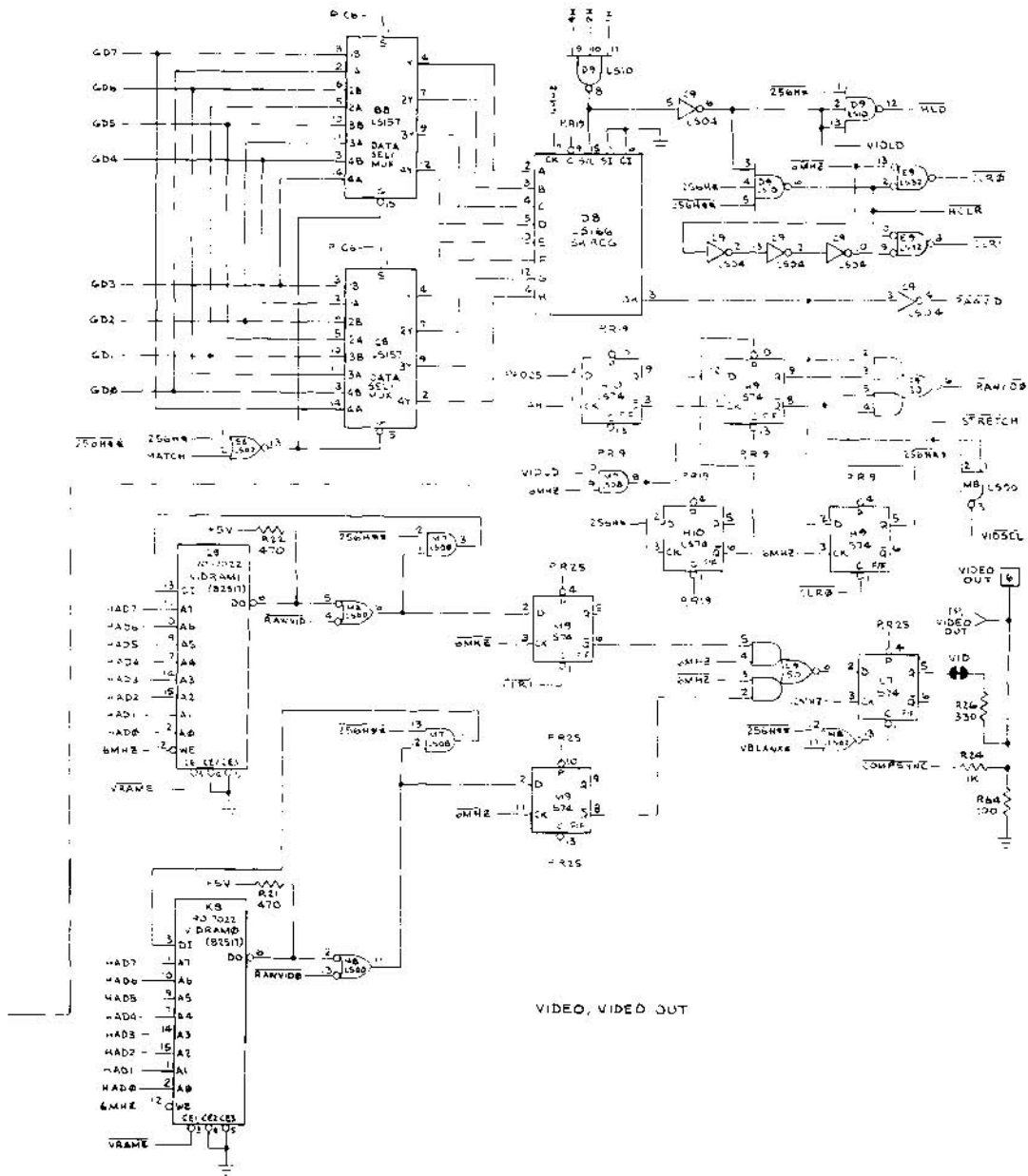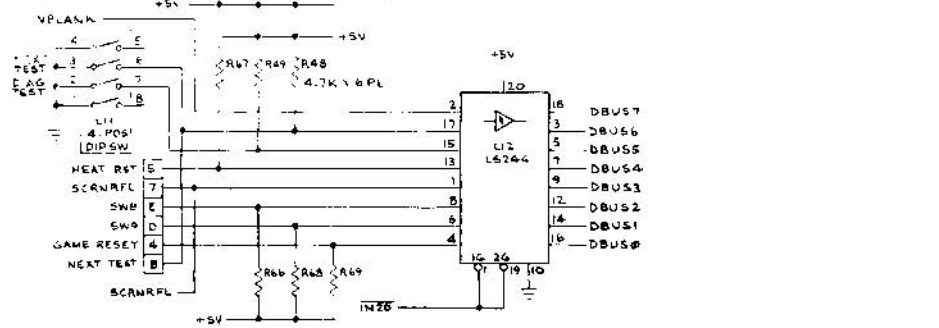Figure 1   Orbit PCB Schematic Diagram
Sheet 2 of 6
033570-01, 02

ORBIT   A-5

A-6 ORBIT
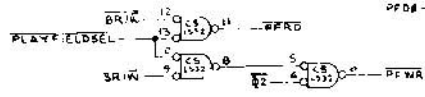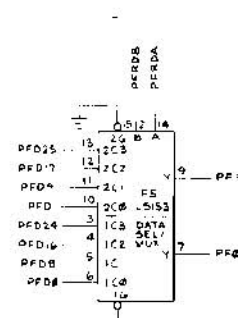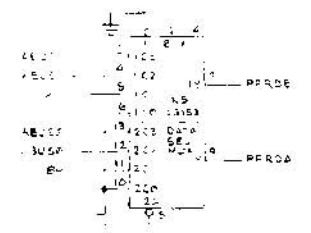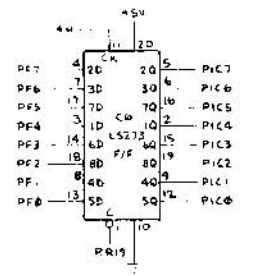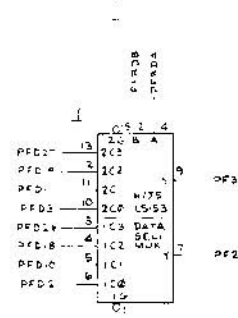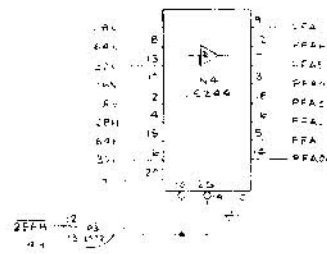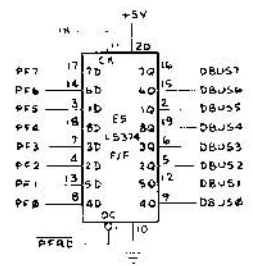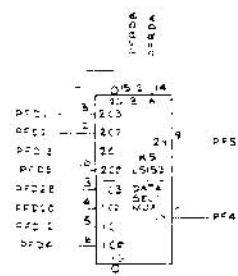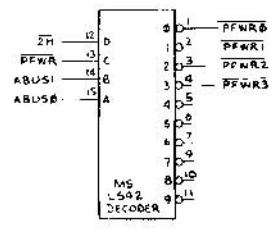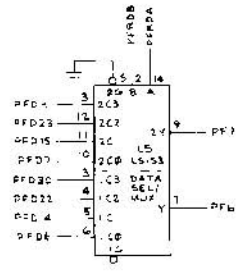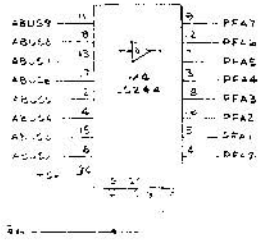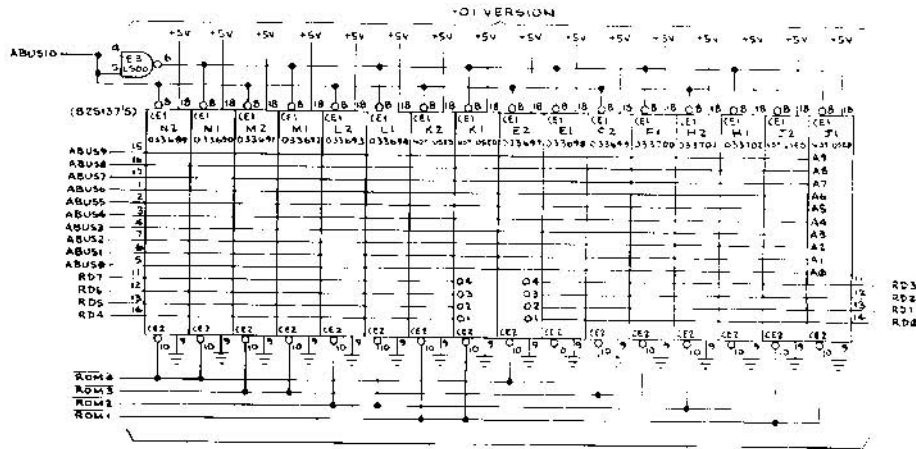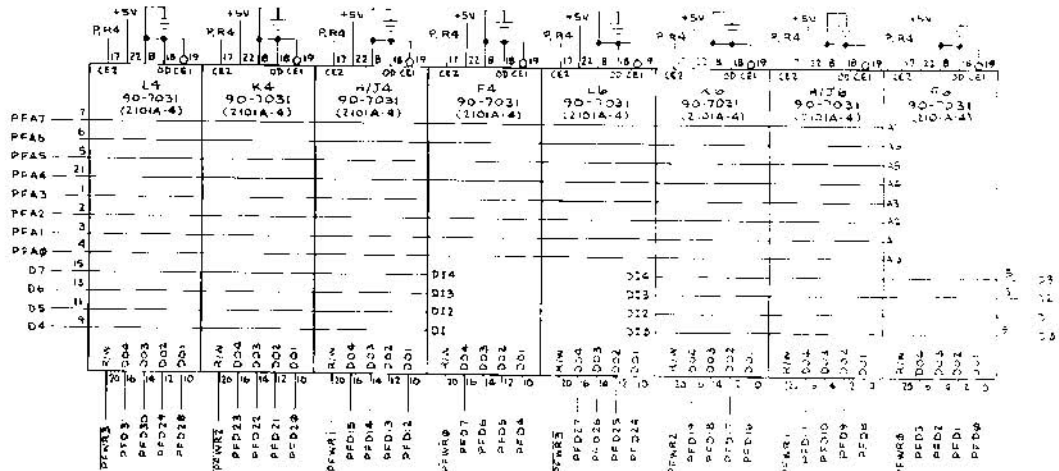
PLAYFIELD

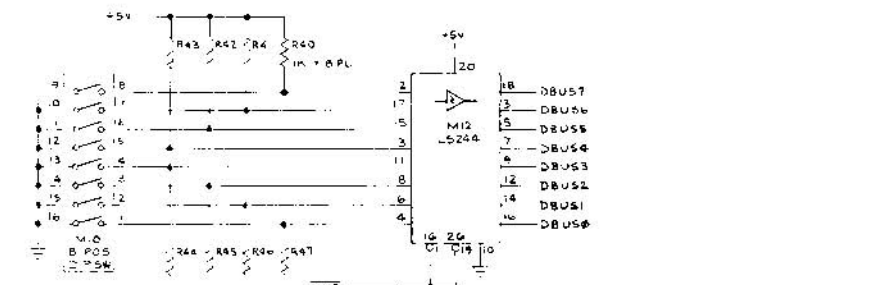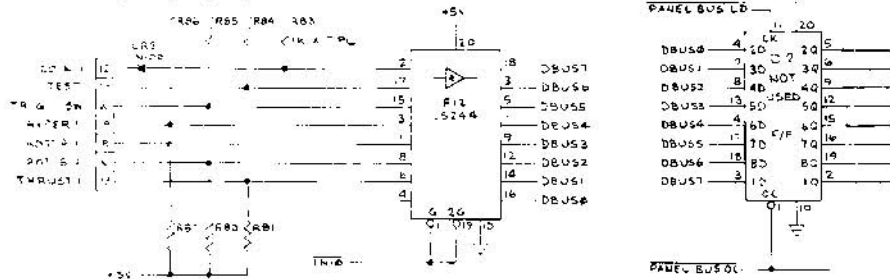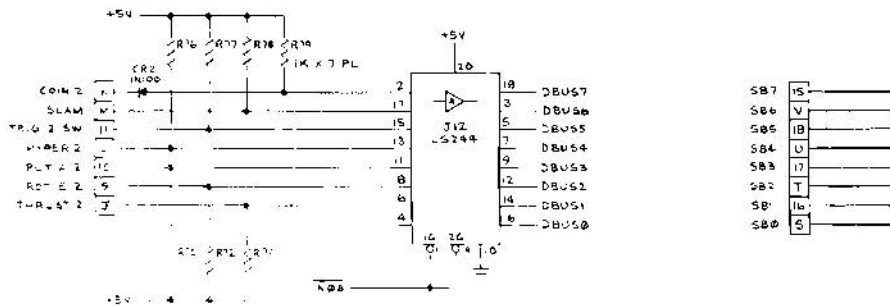Figure 1 Orbit PCB Schematic Diagram
Sheet 3 of 6
033570-01, 02

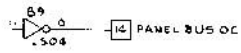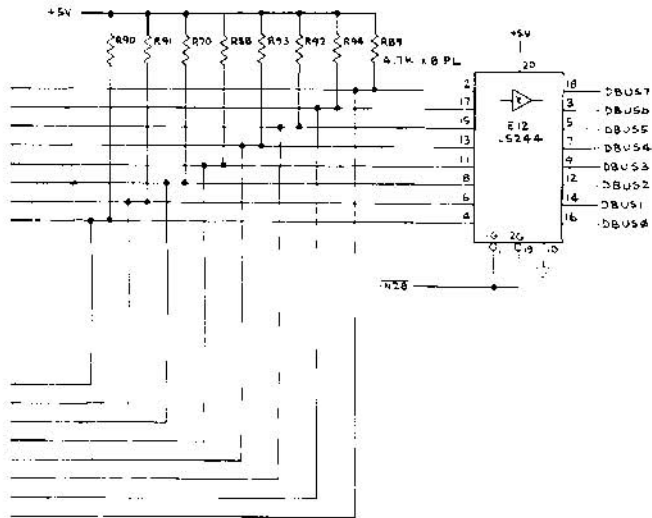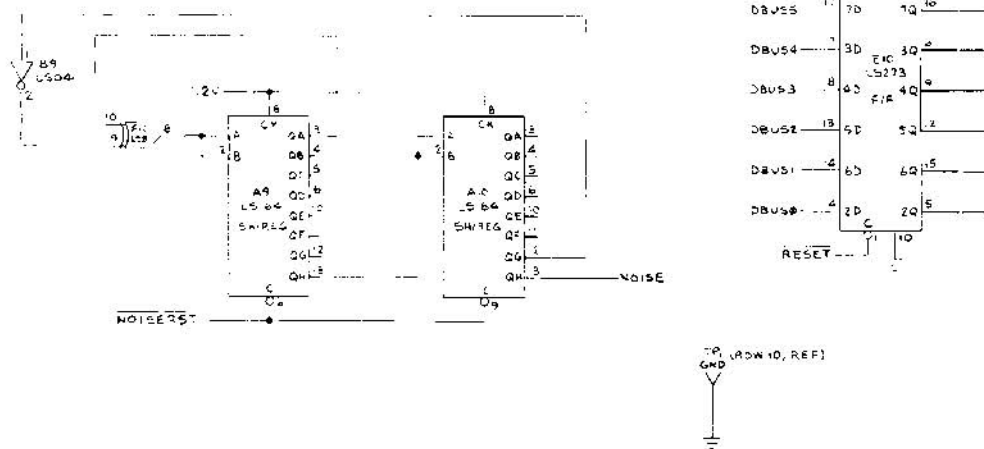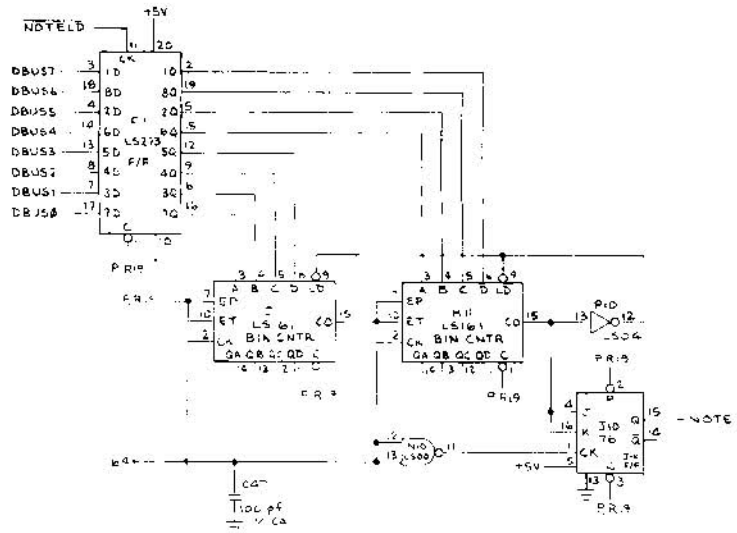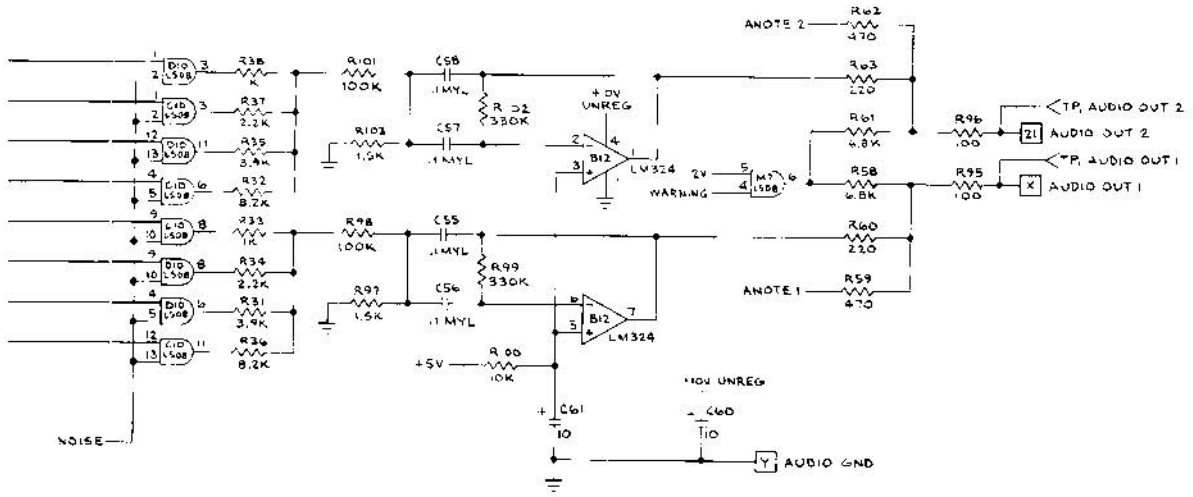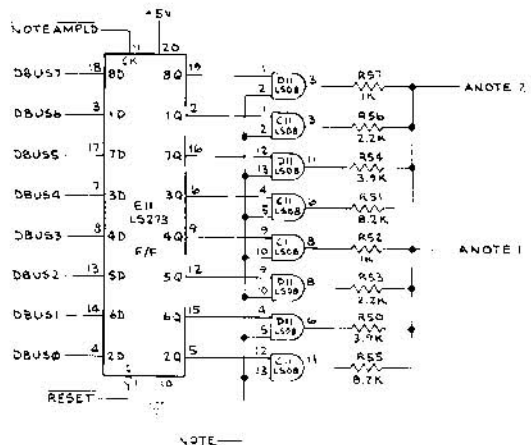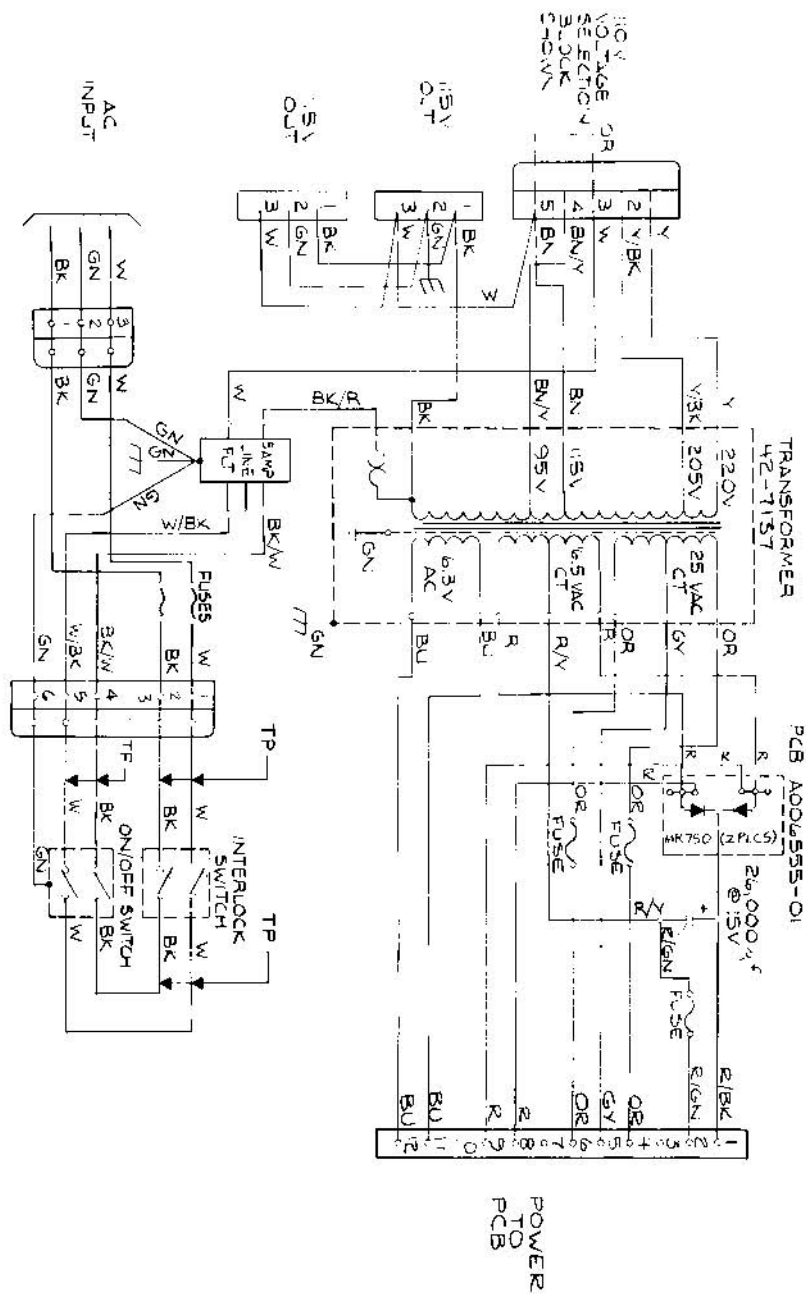ALPHA-NUMERICS, VERTICAL VIDEO

HORIZONTAL VIDEO
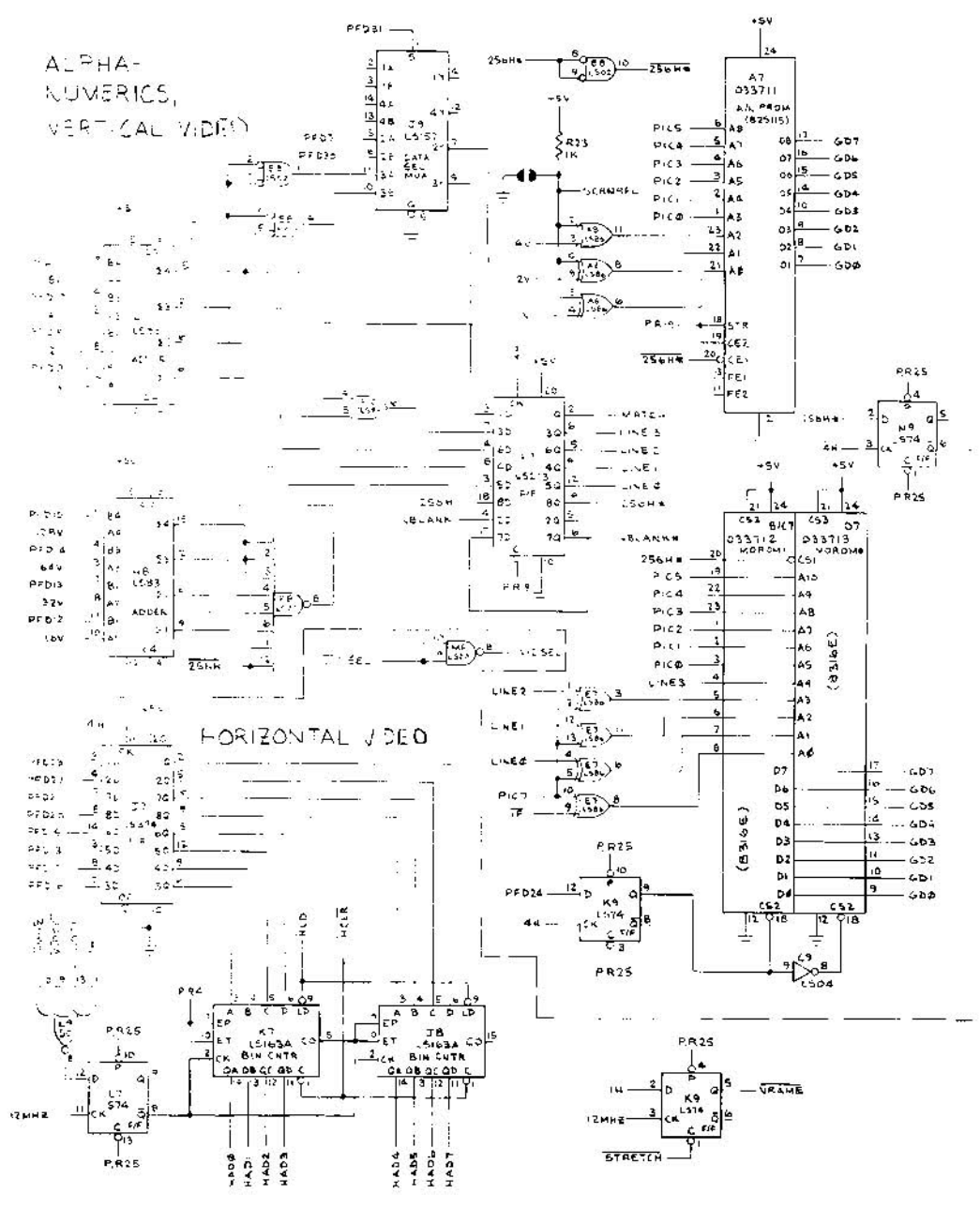
A-8 ORBIT

Figure 1   Orbit PCB Schematic Diagram
Sheet 4 of 6
033570-01, 02

ORBIT A-9

A-10 ORBIT

Figure 1   Orbit PCB Schematic Diagram
Sheet 5 of 6
033570-01, 02

ORBIT A-11

A-12 ORBIT

AUDIO, AUDIO OUT

Figure 1   Orbit PCB Schematic Diagram
Sheet 6 of 6
033570-01, 02

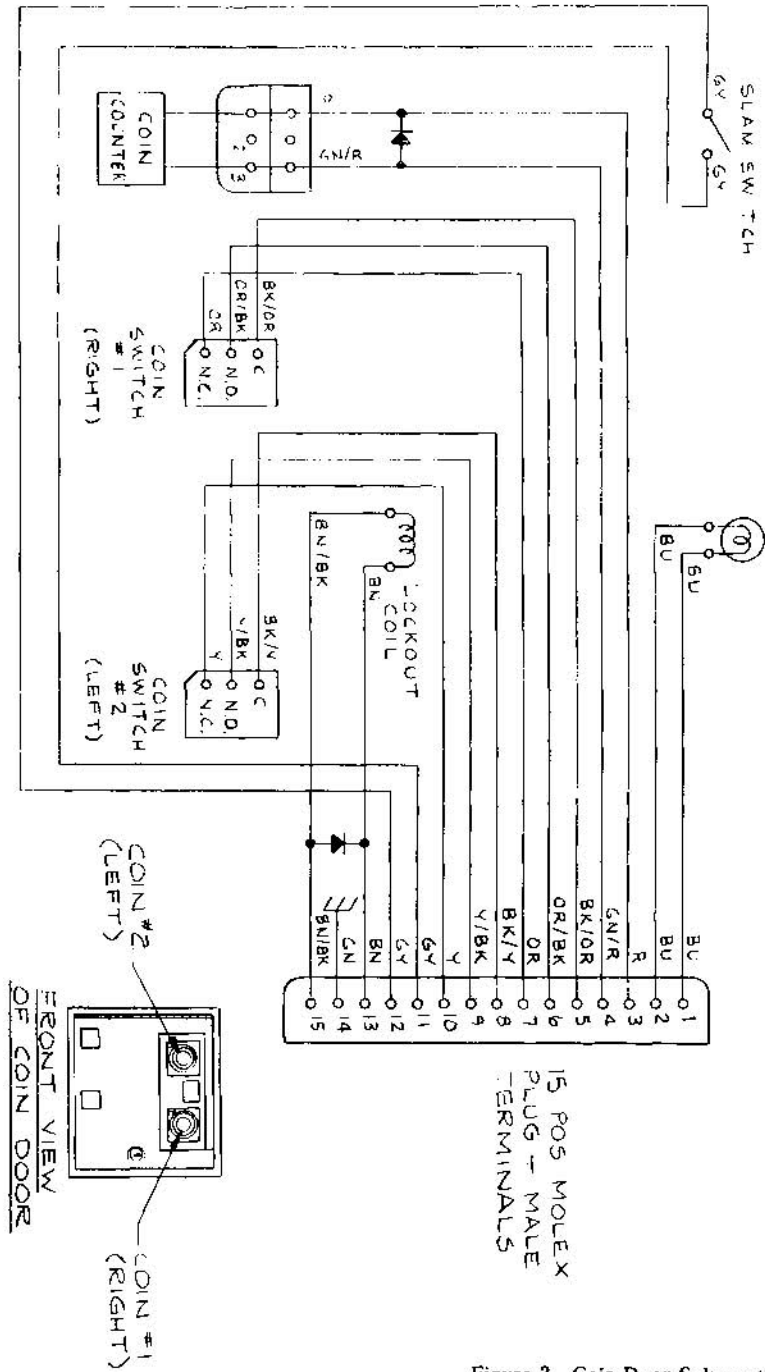ORBIT A-13

Figure 2   Type B Power Supply Schematic
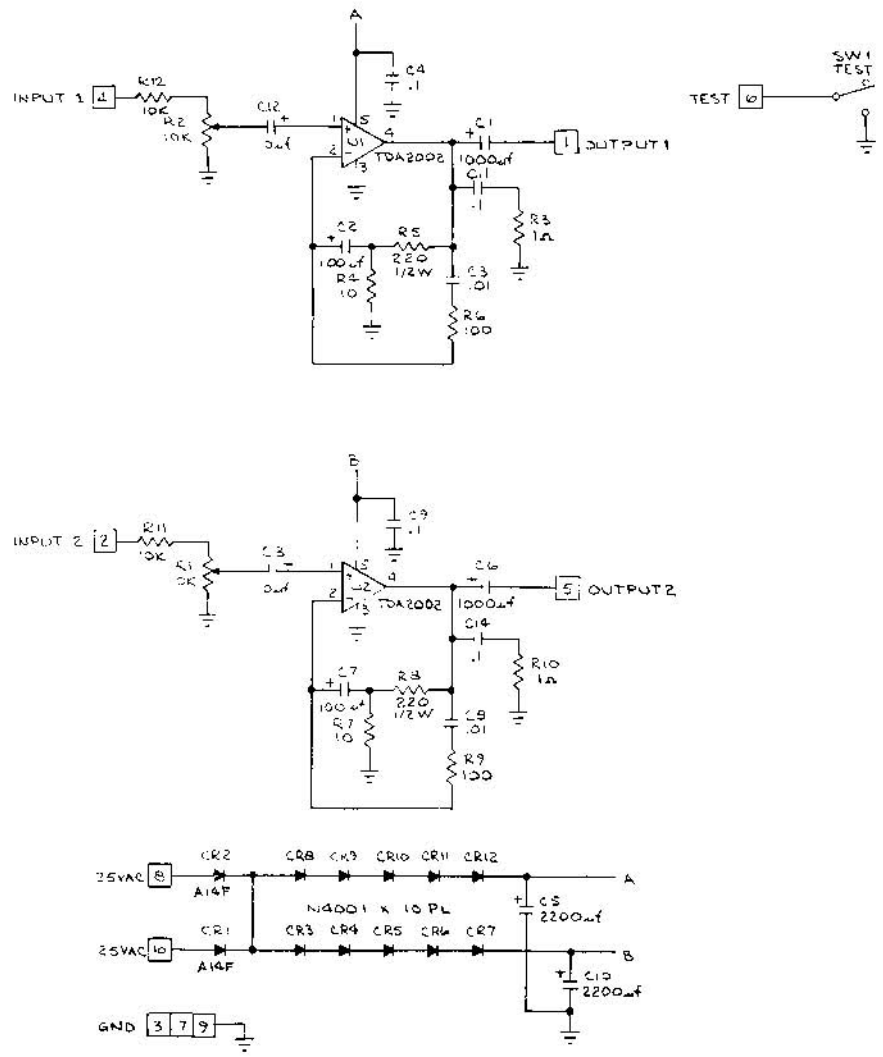
A-14 ORBIT

Figure 3   Coin Door Schematic Diagram

ORBIT A-15

Figure 4   Dual Audio Amplifier Schematic Diagram
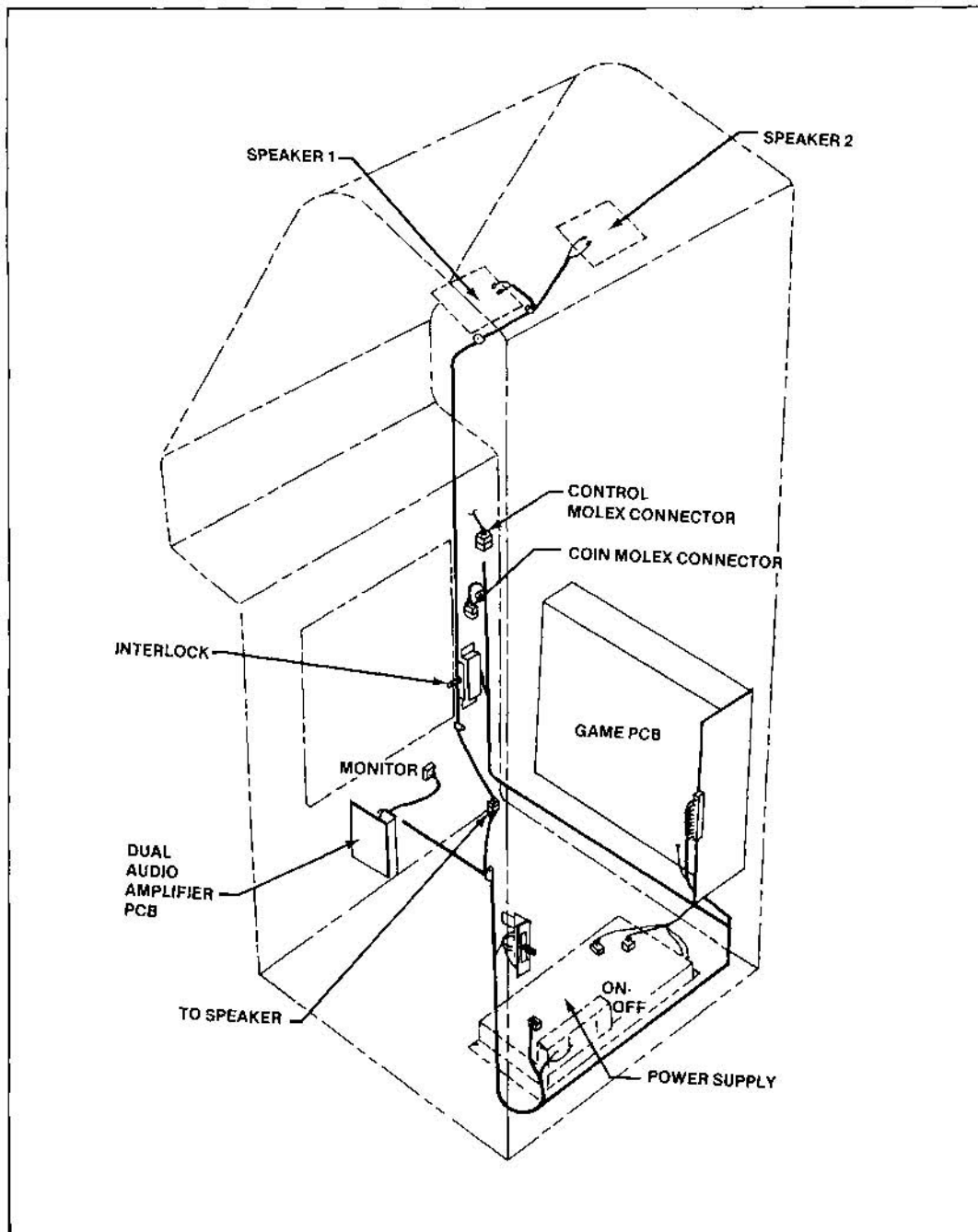
A-16

A-18 ORBIT

Figure 5 Orbit Game Harness Schematic

ORBIT A-19
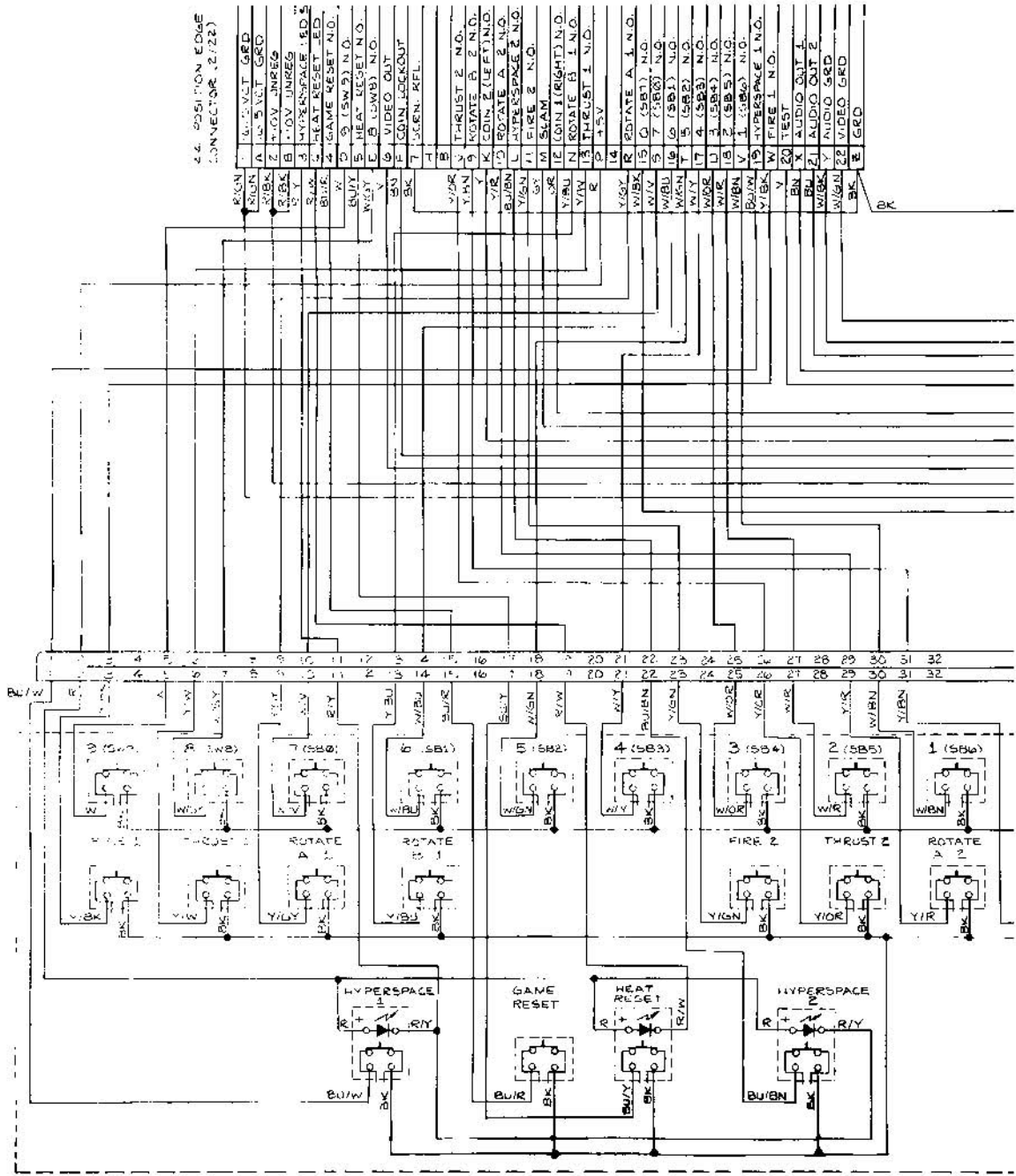
Figure 5   Orbit Game Harness Layout

A-20   ORBIT